Annual Groundwater Monitoring Report

Southwestern Electric Power Company

Flint Creek Power Plant

Primary Bottom Ash Pond CCR Management Unit

Gentry, Arkansas

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SOUTHWESTERN ELECTRIC POWER COMPANY℠

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I. Overview

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

In general, the following activities were completed:

- The CCR unit was in detection monitoring at the beginning and at the end of 2023;
- Groundwater samples were collected on March 6-7, 2023, then again on September 18-19, 2023 and analyzed for Appendix III constituents, as specified in 40 CFR 257.94 *et seq.* and AEP's *Groundwater Sampling and Analysis Plan (2016)*. Groundwater samples were collected on September 19, 2023, October 9-10, 2023, November 13-14, 2023 and December 12-13, 2023 and analyzed for Appendix IV constituents as specified in 40 CFR 257.102(c);
- Groundwater monitoring data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;
- Appendix III constituents were compared to prediction limits (intervals for pH) established from background data established previously. Statistical comparisons to background were made for samples initially collected on September 20-21, 2022 for all monitoring wells except AP-58A and for samples initially collected on December 12, 2022 for the newly installed AP-58A;
- The statistical evaluation of the data collected on September 20-21, 2022 and December 12, 2022, completed on June 20, 2023, concluded that there were potential statistically significant increases (SSIs) over background of five Appendix III constituents (boron, chloride, pH, sulfate and total dissolved solids) at monitoring well AP-58A and one Appendix III constituent (sulfate) at AP-59. Statistical analyses of data collected during the March 6-7, 2023 and September 18-19, 2023 sampling events will be completed in 2024;
- Because a potential SSI over background of an Appendix III constituent was detected at Flint Creek Plant's PBAP during the March 14-15, 2022 initial sampling, the corresponding August 15, 2022 resampling, and statistical analysis completed on November 27, 2022, an alternative source demonstration (ASD) study was conducted resulting in a February 24, 2023 ASD report. Because potential SSIs over background of Appendix III constituents were detected at the Flint Creek Plant's PBAP from the September 20-21, 2022 and December 12, 2022 initial sampling event followed by corresponding resamples collected on March 6, 2023 at monitoring wells AP-58A and AP-

59 and statistical analyses completed on June 20, 2023, an ASD study was conducted resulting in a September 18, 2023 ASD report.

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

- A map, aerial photograph or a drawing showing the CCR management unit(s), all groundwater monitoring wells and monitoring well identification numbers;
- All of the monitoring data collected, including the rate and direction of groundwater flow, plus a summary showing the number of samples collected per monitoring well, the dates the samples were collected and whether the sample was collected as part of detection monitoring or assessment monitoring programs is included in Appendix 1;
- Statistical comparison of monitoring data to determine if there have been one or more SSIs over background levels (Attached as Appendix 2, where applicable);
- A discussion of whether any alternate source demonstrations were performed, and the conclusions (Attached as Appendix 3, where applicable);
- A summary of any transition between monitoring programs, for example the date and circumstances for transitioning from detection monitoring to assessment monitoring (Notices attached as Appendix 4, where applicable);
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a statement regarding the rationale for the installation/decommission (Attached as Appendix 5, where applicable); and
- Other information required to be included in the annual report such as 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.

PBAP Monitoring Wells	
Upgradient	Downgradient
AP-51	Former AP-58/and AP-58A
AP-53	AP-59
AP-54	AP-60

III. Monitoring Wells Installed or Decommissioned

Because one monitoring well (AP-58) was decommissioned and its replacement well (AP-58A) installed in 2022, a revised groundwater monitoring network design report, *Groundwater Monitoring Network Design Report Revision 2* (2023) was placed in the facility's operating record in 2023. The revised design report, viewable on the AEP CCR web site, discusses the facility location, the hydrogeological setting, the hydrostratigraphic units, the uppermost aquifer, downgradient monitoring well locations and the upgradient monitoring well locations. There were no monitoring wells installed or decommissioned in 2023. Well AP-58A/AP58 installation/decommissioning logs are provided in Appendix 5.

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

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

V. Groundwater Quality Data Statistical Analysis

The first semiannual detection monitoring event of 2022 occurred on March 14-15, 2022. In response to a potential statistically significant increase in the concentration of sulfate and a potential statistically significant decrease in pH detected in groundwater samples at monitoring well AP-59 on March 14, 2022, resamples for these constituents were collected at the well on August 15, 2022 and statistical analyses were completed on November 27, 2022. The resampling and statistical analyses eliminated the decrease in pH as a statistical false positive but indicated a potential SSI in the concentration of sulfate. Thus, an alternative source demonstration (ASD) study was conducted resulting in a February 24, 2023 ASD report, which is provided in Appendix 3.

The second semiannual detection monitoring event of 2022 occurred on September 20-21, 2022 for all monitoring wells except AP-58A and on December 12, 2022 for the newly installed AP-58A, which was found irreparably damaged during the September 20-21, 2022 sampling event with no groundwater samples obtainable. In response to potential SSIs in the concentrations of boron, chloride, pH, sulfate, and total dissolved solids in monitoring well AP-58A, the concentration of sulfate in AP-59, and the concentration of calcium in AP-60, resamples for these constituents were collected at the corresponding wells on March 6, 2023, and statistical analyses were completed on June 20, 2023 The resampling and statistical analyses eliminated the increase in calcium at AP-60 as a statistical false positive but indicated potential SSIs for the remaining constituents. Thus, an alternative source demonstration (ASD) study was conducted resulting in a September 18, 2023 ASD report. A memorandum with the results of the statistical evaluation is provided in Appendix 2.

As required by 40 CFR 257.94, groundwater samples were collected and analyzed for all Appendix III constituents during a first semiannual sampling event on March 6-7, 2023. In response to a potential SSIs in the concentration of boron, chloride, pH, sulfate, and total dissolved solids in monitoring well AP-58A and the concentrations of sulfate and total dissolved solids in monitoring well AP-59 on March 7, 2023, resamples for these constituents were collected at the corresponding wells on September 18, 2023. Statistical analyses of data collected during the March 6-7, 2023 sampling event and the September 18, 2023 resampling will be completed in 2024.

As required by 40 CFR 257.94, groundwater samples were collected and analyzed for all Appendix III constituents during a second semiannual sampling event on September 18-19, 2023. A statistical evaluation of these results will be completed in 2024.

The PBAP CCR unit has been undergoing closure by removal of CCR with all CCR removed from the unit as of August 20, 2023. As required by 40 CFR 257.102(c), groundwater samples were collected and analyzed for all Appendix IV constituents to determine suitability for final CCR unit closure. A total of at least seven samples will be collected to obtain a suitable dataset for determination of statistical limits to compare with groundwater protection standards. Four samples were collected in 2023.

VI. Alternate Source Demonstration

Because a potential SSI over background of an Appendix III constituent was detected at Flint Creek Plant's PBAP during the March 14-15, 2022 initial sampling, the corresponding August 15, 2022 resampling, and statistical analysis completed on November 27, 2022, an alternative source demonstration (ASD) study was conducted resulting in a February 24, 2023 ASD report. The report concluded that the SSI was not due to a release from the Flint Creek PBAP, but was instead attributed to natural variation in the underlying geology. Because potential SSIs over background of Appendix III constituents were detected at the Flint Creek Plant's PBAP from the September 20-21, 2022 and December 12, 2022 initial sampling event followed by corresponding resamples collected on March 6, 2023 at monitoring wells AP-58A and AP-59 and statistical analyses completed on June 20, 2023, an ASD study was conducted resulting in a September 18, 2023 ASD report. The report concluded that the SSI was not due to a release from the Flint Creek PBAP, but was instead attributed to natural variation or sampling issues. Both reports are provided in Appendix 3.

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

No transition between monitoring requirements occurred in 2023; the CCR unit was in detection monitoring at the beginning and at the end of 2023. A statement to this effect is provided in Appendix 4. The sampling frequency of twice per year will be maintained for the Appendix III constituents (boron, calcium, chloride, fluoride, pH, sulfate and total dissolved solids).

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

VIII. Other Information Required

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

IX. Description of Any Problems Encountered in 2023 and Actions Taken

No significant problems were encountered in 2023. Through the use of low-flow purging and sampling methodology, samples representative of uppermost aquifer groundwater were obtained and the schedule was met to support this annual groundwater report preparation.

X. A Projection of Key Activities for the Upcoming Year

Key activities for 2024 include the following:

- Detection monitoring and closure verification sampling on a semiannual schedule;
- Statistical evaluation to determine any SSIs (or decreases with respect to pH) or statistically significant levels above corresponding groundwater protection standards;
- Responding to any new data received in light of CCR rule requirements;
- Preparation of the next annual groundwater report.

APPENDIX 1 - Groundwater Data Tables and Figures

Tables follow showing the groundwater monitoring data collected, the rate of groundwater flow each time groundwater was sampled, the number of samples collected per monitoring well, dates that the samples were collected, and whether each sample was collected as part of a detection monitoring or an assessment monitoring program. Figures follow showing the PE-certified groundwater monitoring network with the corresponding well identifications along with static water elevation data and groundwater flow directions each time groundwater was sampled in the form of annotated satellite images.

Table 1. Groundwater Data Summary: AP-51
Flint Creek - PBAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	0.01	4.86	4	< 0.083 U1	4.6	2	61
7/18/2016	Background	0.01	5.07	6	< 0.083 U1	5.3	4	80
9/13/2016	Background	0.01	5.84	6	< 0.083 U1	5.3	3	64
10/5/2016	Background	0.00767833 J1	5.24	7	< 0.083 U1	5.0	4	80
11/8/2016	Background	0.01	5.23	7	< 0.083 U1	5.2	4	76
1/24/2017	Background	0.00849011 J1	5.43	5	< 0.083 U1	5.1	< 0.14 U1	80
3/7/2017	Background	0.01	5.05	5	< 0.083 U1	5.0	0.5139 J1	40
4/26/2017	Background	0.01475	4.21	6	0.28 J1	5.2	6	96
5/16/2017	Background	0.01135	5.55	6	< 0.083 U1	5.1	3	60
6/16/2017	Background	0.0186	5.61	7	< 0.083 U1	5.1	3	68
8/29/2017	Detection	0.01706	5.13	6	< 0.083 U1	4.8	3	50
3/28/2018	Detection	0.01519	11.1	2	< 0.083 U1	7.8	9	96
8/28/2018	Detection	0.011	6.69	--	--	7.7	--	74
10/22/2018	Detection	--	--	9.71	< 0.083 U1	--	2.14	--
3/11/2019	Detection	0.01 J1	6.20	7.84	0.04 J1	7.6	< 0.06 U1	70
6/10/2019	Detection	< 0.04 U1	13.1	7.79	0.05 J1	7.2	2.6	106
8/28/2019	Detection	< 0.02 U1	6.79	7	< 0.083 U1	6.0	1	56
3/24/2020	Detection	< 0.02 U1	9.90	8.48	0.04 J1	5.9	2.4	107
10/19/2020	Detection	< 0.02 U1	7.73	9.86	0.02 J1	4.5	< 0.06 U1	100
3/2/2021	Detection	< 0.02 U1	8.35	10.4	0.04 J1	5.8	0.1 J1	70
9/20/2021	Detection	--	--	--	--	5.3	--	--
9/21/2021	Detection	< 0.009 U1	8.3	10.9	0.03 J1	--	0.07 J1	100
3/14/2022	Detection	--	--	--	--	5.7	--	--
3/15/2022	Detection	< 0.009 U1	8.06	11.6	0.03 J1	--	0.14 J1	110
9/20/2022	Detection	--	--	--	--	5.7	--	--
9/21/2022	Detection	< 0.009 U1	7.89	11.6	0.04 J1	--	0.99	120
3/6/2023	Detection	--	--	--	--	6.0	--	--
3/7/2023	Detection	< 0.009 U1	9.39	10.2	0.03 J1	--	1.08	70
9/18/2023	Detection	--	--	--	--	5.5	--	--
9/19/2023	Detection	< 0.007 U1	7.67	9.84	0.04 J1	--	0.4 J1	140
10/9/2023	*	--	--	--	--	5.4	--	--
10/10/2023	*	--	--	--	0.04 J1	--	--	--
11/13/2023	*	--	--	--	--	5.5	--	--
11/14/2023	*	--	--	--	0.04 J1	--	--	--
12/12/2023	*	--	--	--	--	5.5	--	--
12/13/2023	*	--	7.33	10.6	0.03 J1	--	0.2 J1	--

Table 1. Groundwater Data Summary: AP-51
Flint Creek - PBAP
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
5/24/2016	Background	< 0.93 U1	< 1.05 U1	80	0.257631 J1	0.0935902 J1	0.258389 J1	0.434643 J1	1.063	< 0.083 U1	< 0.68 U1	< 0.00013 U1	0.01938 J1	0.92212 J1	1.24502 J1	< 0.86 U1
7/18/2016	Background	< 0.93 U1	< 1.05 U1	86	0.308658 J1	< 0.07 U1	1	2.39535 J1	--	< 0.083 U1	0.839767 J1	0.003	0.01329 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1
9/13/2016	Background	< 0.93 U1	< 1.05 U1	128	0.373982 J1	< 0.07 U1	6	14	2.38	< 0.083 U1	3.72318 J1	0.005	0.00978 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1
10/5/2016	Background	< 0.93 U1	< 1.05 U1	98	0.329677 J1	< 0.07 U1	2	5	1.656	< 0.083 U1	1.49287 J1	0.008	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1
11/8/2016	Background	1.28923 J1	< 1.05 U1	105	0.453846 J1	0.226326 J1	4	9	1.387	< 0.083 U1	2.07767 J1	0.004	0.00949 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1
1/24/2017	Background	< 0.93 U1	< 1.05 U1	103	0.366323 J1	< 0.07 U1	2	4.46068 J1	1.916	< 0.083 U1	< 0.68 U1	0.003	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1
3/7/2017	Background	7	< 1.05 U1	95	0.355243 J1	0.128375 J1	2	5	1.31	< 0.083 U1	0.88397 J1	0.002	< 0.005 U1	0.586637 J1	< 0.99 U1	< 0.86 U1
4/26/2017	Background	< 0.93 U1	< 1.05 U1	62.43	0.24 J1	< 0.07 U1	1.96	4.08 J1	0.6089	0.28 J1	< 0.68 U1	0.00216	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1
5/16/2017	Background	< 0.93 U1	< 1.05 U1	101	0.42 J1	0.1 J1	1.86	6.92	2.935	< 0.083 U1	< 0.68 U1	0.00315	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1
6/16/2017	Background	< 0.93 U1	2.5 J1	88.87	0.27 J1	< 0.07 U1	0.89 J1	5.26	1.728	< 0.083 U1	< 0.68 U1	0.0024	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1
9/19/2023	*	0.036 J1	0.58	118	0.373	0.057	1.47	6.62	1.52	0.04 J1	0.96	0.00248	0.183	0.1 J1	1.24	0.07 J1
10/10/2023	*	0.011 J1	0.18	115	0.326	0.055	1.02	1.58	14.16	0.04 J1	0.13 J1	0.00197	0.068	< 0.1 U1	0.62	0.05 J1
11/14/2023	*	< 0.008 U1	0.20	123	0.347	0.061	0.57	1.55	1.56	0.04 J1	0.13 J1	0.00217	0.013	< 0.1 U1	0.95	0.06 J1
12/13/2023	*	0.017 J1	0.22	114	0.347	0.066	0.87	2.79	3.16	0.03 J1	0.30	0.00202	0.004 J1	< 0.1 U1	0.53	0.08 J1

Table 1. Groundwater Data Summary: AP-53
Flint Creek - PBAP
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	0.11	4.15	10	< 0.083 U1	4.7	25	80
7/18/2016	Background	0.109	3.49	12	< 0.083 U1	4.5	30	104
9/13/2016	Background	0.155	5.54	13	< 0.083 U1	4.7	35	104
10/5/2016	Background	0.121	3.39	13	0.205 J1	4.9	32	110
11/8/2016	Background	0.138	3.38	14	< 0.083 U1	5.0	31	118
1/24/2017	Background	0.158	3.87	14	< 0.083 U1	5.0	47	132
3/7/2017	Background	0.137	3.85	13	< 0.083 U1	5.0	47	112
4/26/2017	Background	0.124	3.89	15	< 0.083 U1	5.6	48	200
5/16/2017	Background	0.118	3.46	14	< 0.083 U1	4.5	42	90
6/16/2017	Background	0.122	3.39	14	< 0.083 U1	5.0	38	136
8/29/2017	Detection	0.114	2.82	11	< 0.083 U1	4.8	34	92
3/28/2018	Detection	0.115	3.51	12	< 0.083 U1	5.0	43	114
8/28/2018	Detection	0.124	3.37	--	--	5.6	--	120
10/22/2018	Detection	--	--	19.2	< 0.083 U1	--	45	--
3/11/2019	Detection	0.114	3.09	12.3	0.07 J1	5.2	34.6	130
6/10/2019	Detection	0.110	3.37	13.4	0.06	5.2	32.8	98
8/28/2019	Detection	0.083	3.11	8	< 0.083 U1	5.4	21	96
3/24/2020	Detection	0.055	3.20	9.40	0.05 J1	5.2	13.5	76
10/19/2020	Detection	0.139	3.81	12.3	0.05 J1	4.7	37.4	105
3/2/2021	Detection	0.091	4.06	12.5	0.07	5.4	37.9	94
9/21/2021	Detection	0.098	3.0	11.1	0.05 J1	5.1	24.0	80
3/15/2022	Detection	0.077	17.0	17.6	0.11	5.8	62.3	160
9/21/2022	Detection	0.10	5.65	13.9	0.06	5.8	44.1	110
3/7/2023	Detection	0.044 J1	4.13	14.7	0.04 J1	5.6	18.1	90
9/19/2023	Detection	0.181	16.9	16.1	0.07	6.1	77.8	200
10/9/2023	*	--	--	--	0.08	5.7	--	--
11/13/2023	*	--	--	--	0.11	5.6	--	--
12/12/2023	*	--	16.7	17.2	0.12	6.3	58.9	--

Table 1. Groundwater Data Summary: AP-53
Flint Creek - PBAP
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
5/24/2016	Background	< 0.93 U1	6	142	1	0.585577 J1	37	12	3.55	< 0.083 U1	11	0.006	0.159	2.50374 J1	< 0.99 U1	< 0.86 U1
7/18/2016	Background	< 0.93 U1	2.79903 J1	76	0.473295 J1	0.0914021 J1	7	4.26267 J1	--	< 0.083 U1	1.07393 J1	0.004	0.046	0.344001 J1	1.20159 J1	< 0.86 U1
9/13/2016	Background	< 0.93 U1	24	258	3	1	94	27	5.93	< 0.083 U1	30	0.036	0.085	6	< 0.99 U1	0.981236 J1
10/5/2016	Background	< 0.93 U1	< 1.05 U1	63	0.289207 J1	< 0.07 U1	2	3.26642 J1	0.568	0.205 J1	< 0.68 U1	0.009	0.025	< 0.29 U1	< 0.99 U1	< 0.86 U1
11/8/2016	Background	< 0.93 U1	8	122	0.980287 J1	3	26	13	2.06	< 0.083 U1	8	0.01	0.118	1.0939 J1	< 0.99 U1	< 0.86 U1
1/24/2017	Background	1.37199 J1	3.86298 J1	97	0.663471 J1	0.0732158 J1	16	9	2.16	< 0.083 U1	3.91103 J1	0.006	0.183	0.821188 J1	< 0.99 U1	< 0.86 U1
3/7/2017	Background	1.45983 J1	7	110	0.851036 J1	0.485904 J1	21	15	1.915	< 0.083 U1	8	0.007	0.14	1.44927 J1	< 0.99 U1	< 0.86 U1
4/26/2017	Background	1.23 J1	4.82 J1	102	0.61 J1	0.22 J1	15.41	7.89	1.552	< 0.083 U1	4.13 J1	0.00623	< 0.005 U1	0.96 J1	2.14 J1	< 0.86 U1
5/16/2017	Background	1.95 J1	1.53 J1	64.08	0.33 J1	< 0.07 U1	3.01	2.9 J1	1.327	< 0.083 U1	< 0.68 U1	0.00228	0.04	0.31 J1	< 0.99 U1	< 0.86 U1
6/16/2017	Background	1.15 J1	3.1 J1	71.32	0.41 J1	< 0.07 U1	5.78	3 J1	2.139	< 0.083 U1	0.87 J1	0.00357	0.043	< 0.29 U1	< 0.99 U1	< 0.86 U1
9/19/2023	*	0.012 J1	0.40	114	0.082	0.045	0.83	0.633	1.38	0.07	< 0.05 U1	0.00058	0.013	< 0.1 U1	2.67	0.08 J1
10/9/2023	*	0.014 J1	0.57	109	0.064	0.034	0.59	0.701	14.86	0.08	< 0.05 U1	0.00050	0.013	< 0.1 U1	2.95	0.08 J1
11/13/2023	*	0.015 J1	0.52	93.2	0.051	0.027	0.33	2.03	2.48	0.11	< 0.05 U1	0.00045	0.010	< 0.1 U1	2.61	0.09 J1
12/12/2023	*	0.014 J1	0.35	80.1	0.036 J1	0.015 J1	0.34	1.84	2.28	0.12	< 0.05 U1	0.00032	0.010	0.1 J1	1.12	0.09 J1

Table 1. Groundwater Data Summary: AP-54
Flint Creek - PBAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	0.249	10.4	14	< 0.083 U1	5.8	77	180
7/18/2016	Background	0.255	10	16	< 0.083 U1	5.8	78	178
9/13/2016	Background	0.266	10.6	16	< 0.083 U1	5.6	75	172
10/5/2016	Background	0.255	11.8	15	0.1943 J1	5.5	67	164
11/8/2016	Background	0.26	11.3	15	< 0.083 U1	5.7	71	168
1/24/2017	Background	0.284	11.2	14	< 0.083 U1	5.5	71	164
3/7/2017	Background	0.259	11.3	14	< 0.083 U1	5.4	64	150
4/26/2017	Background	0.256	10.8	15	< 0.083 U1	6.1	66	154
5/16/2017	Background	0.256	9.58	16	< 0.083 U1	5.1	66	136
6/16/2017	Background	0.249	7.53	15	< 0.083 U1	5.3	62	192
8/29/2017	Detection	0.259	11.3	13	< 0.083 U1	5.5	63	156
3/28/2018	Detection	0.223	5.61	13	< 0.083 U1	5.3	64	130
8/28/2018	Detection	0.240	15.5	--	--	5.9	--	168
10/22/2018	Detection	--	--	18.3	< 0.083 U1	--	54.4	--
3/11/2019	Detection	0.219	14.5	16.0	0.09 J1	6.4	47.2	160
6/10/2019	Detection	0.209	10.7	15.3	0.07	6.5	52.5	134
8/28/2019	Detection	0.213	12.2	12	< 0.083 U1	6.8	51	154
3/24/2020	Detection	0.202	7.08	13.2	0.05 J1	6.4	45.9	143
10/19/2020	Detection	0.214	8.39	12.8	0.04 J1	5.8	47.6	130
3/2/2021	Detection	0.199	9.72	12.5	0.06	5.6	50.8	127
9/21/2021	Detection	0.202	13.6	12.4	0.06	6.5	57.8	150
3/15/2022	Detection	0.168	19.7	15.1	0.07	5.7	64.3	160
9/21/2022	Detection	0.157	18.8	14.8	0.07	5.9	57.7	150
9/19/2023	Detection	0.166	15.4	13.9	0.06	6.4	52.5	140
10/9/2023	*	--	--	--	0.07	5.7	--	--
11/13/2023	*	--	--	--	0.08	5.8	--	--
12/12/2023	*	--	19.4	16.1	0.06	6.0	53.6	--

Table 1. Groundwater Data Summary: AP-54
Flint Creek - PBAP
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
5/24/2016	Background	< 0.93 U1	< 1.05 U1	35	0.177109 J1	< 0.07 U1	0.485517 J1	7	1	< 0.083 U1	< 0.68 U1	0.000736668 J1	0.02407 J1	< 0.29 U1	< 0.99 U1	1.05347 J1
7/18/2016	Background	< 0.93 U1	< 1.05 U1	58	0.294165 J1	< 0.07 U1	1	13	--	< 0.083 U1	< 0.68 U1	0.001	0.031	< 0.29 U1	< 0.99 U1	< 0.86 U1
9/13/2016	Background	< 0.93 U1	< 1.05 U1	38	0.0361596 J1	< 0.07 U1	0.470668 J1	7	3.37	< 0.083 U1	< 0.68 U1	0.000599096 J1	0.0122 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1
10/5/2016	Background	< 0.93 U1	< 1.05 U1	35	0.175329 J1	< 0.07 U1	1	6	1.59	0.1943 J1	< 0.68 U1	0.006	0.02499 J1	< 0.29 U1	1.26436 J1	< 0.86 U1
11/8/2016	Background	< 0.93 U1	1.8333 J1	227	0.250807 J1	0.164026 J1	9	19	1.722	< 0.083 U1	1.30257 J1	0.002	0.049	1.06052 J1	< 0.99 U1	< 0.86 U1
1/24/2017	Background	< 0.93 U1	4.57372 J1	109	0.660002 J1	0.132116 J1	25	24	1.107	< 0.083 U1	7	0.006	0.082	3.34504 J1	< 0.99 U1	< 0.86 U1
3/7/2017	Background	< 0.93 U1	< 1.05 U1	96	0.164735 J1	< 0.07 U1	4	12	2.125	< 0.083 U1	< 0.68 U1	0.003	0.00568 J1	0.545312 J1	< 0.99 U1	< 0.86 U1
4/26/2017	Background	< 0.93 U1	< 1.05 U1	31.04	0.1 J1	< 0.07 U1	0.42 J1	4.4 J1	0.769	< 0.083 U1	< 0.68 U1	0.00048 J1	0.017 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1
5/16/2017	Background	< 0.93 U1	< 1.05 U1	34.92	0.16 J1	< 0.07 U1	0.44 J1	5.33	1.222	< 0.083 U1	< 0.68 U1	0.00078 J1	0.02 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1
6/16/2017	Background	5.57	1.65 J1	46.98	0.28 J1	< 0.07 U1	0.53 J1	7.14	1.325	< 0.083 U1	< 0.68 U1	0.00127	0.018 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1
9/19/2023	*	0.009 J1	0.28	39.5	0.043 J1	0.092	0.76	4.42	1.3	0.06	0.11 J1	0.00020 J1	0.004 J1	< 0.1 U1	1.04	0.02 J1
10/9/2023	*	0.008 J1	0.33	41.2	0.025 J1	0.015 J1	0.50	5.32	4.68	0.07	< 0.05 U1	0.00018 J1	0.004 J1	< 0.1 U1	1.39	0.02 J1
11/13/2023	*	0.011 J1	0.47	44.6	0.028 J1	0.010 J1	0.76	1.80	1.59	0.08	0.05 J1	0.00017 J1	0.003 J1	< 0.1 U1	2.32	0.06 J1
12/12/2023	*	0.021 J1	0.24	39.9	0.243	0.008 J1	0.62	1.61	2.4	0.06	0.63	0.00021 J1	0.003 J1	0.7	0.92	0.07 J1

Table 1. Groundwater Data Summary: AP-58/AP-58A
Flint Creek - PBAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	1.44	24.9	18	0.8759 J1	7.1	213	602
7/18/2016	Background	1.68	27.4	21	0.8849 J1	8.4	229	691
9/13/2016	Background	1.66	17.5	23	0.7518 J1	8.3	238	644
10/5/2016	Background	1.56	18.9	27	0.8942 J1	8.8	231	696
11/7/2016	Background	1.26	30.5	22	0.5598 J1	7.8	186	562
1/24/2017	Background	1.09	34.4	16	< 0.083 U1	8.1	158	448
3/7/2017	Background	0.829	48.1	14	< 0.083 U1	7.0	123	420
4/26/2017	Background	0.613	59	14	0.53 J1	7.1	111	374
5/16/2017	Background	0.473	69.3	13	0.4677 J1	7.5	104	344
6/16/2017	Background	0.416	70.1	12	< 0.083 U1	6.0	101	398
8/29/2017	Detection	0.333	75.5	12	< 0.083 U1	7.8	96	344
12/21/2017	Detection	0.268	73.9	--	--	7.4	80	304
3/26/2018	Detection	0.228	77.2	8	< 0.083 U1	7.4	70	262
8/28/2018	Detection	0.237	75.9	--	--	6.9	--	300
10/23/2018	Detection	--	--	12.5	< 0.083 U1	--	75.5	--
3/12/2019	Detection	0.178	74.8	8.13	0.33	8.4	49.9	290
6/11/2019	Detection	0.173	78.3	7.64	0.36	7.6	52.2	272
8/27/2019	Detection	0.149	76.1	6	0.222 J1	7.5	53	292
3/24/2020	Detection	0.129	68.1	5.78	0.32	6.8	39.7	246
10/20/2020	Detection	0.126	67.9	4.98	0.28	6.6	34.8	249
3/1/2021	Detection	--	--	--	--	7.2	--	--
3/2/2021	Detection	0.135	62.0	4.44	0.33	--	29.3	232
9/20/2021	Detection	--	--	--	--	6.9	--	--
9/21/2021	Detection	0.162	64.6	5.26	0.34	--	31.0	240
3/14/2022	Detection	--	--	--	--	6.8	--	--
3/15/2022	Detection	0.182	67.0	6.25	0.32	--	40.9	240
12/12/2022	Detection	1.23	20.6	22.1	0.59	8.9	164	400
3/6/2023	Background	1.20	--	18.6	--	9.0	134	410 P1
3/7/2023	Detection	1.27	16.7	23.4	0.58	9.0	152	400
9/18/2023	Background	1.03	--	26.2	--	7.6	144	400
9/19/2023	Detection	1.03	22.6	26.7	0.54	7.6	146	370
10/9/2023	*	--	--	--	0.52	7.6	--	--
11/13/2023	*	--	--	--	0.50	7.5	--	--
12/12/2023	*	--	17.0	20.9	0.48	7.7	85.3	--
12/27/2023	Detection	0.653	--	20.3	--	7.6	83.4	300

Table 1. Groundwater Data Summary: AP-58/AP-58A
Flint Creek - PBAP
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
5/24/2016	Background	< 0.93 U1	5	37	0.105636 J1	< 0.07 U1	0.810009 J1	3.86496 J1	0.548	0.8759 J1	< 0.68 U1	< 0.00013 U1	0.032	62	< 0.99 U1	< 0.86 U1
7/18/2016	Background	< 0.93 U1	22	104	3	0.459763 J1	8	7	--	0.8849 J1	12	0.018	0.042	66	2.81093 J1	< 0.86 U1
9/13/2016	Background	0.971405 J1	25	39	0.162863 J1	< 0.07 U1	2	2.29869 J1	1.007	0.7518 J1	2.19582 J1	0.007	0.02274 J1	68	1.13435 J1	1.02461 J1
10/5/2016	Background	1.99545 J1	18	41	0.382276 J1	< 0.07 U1	3	2.68738 J1	0.787	0.8942 J1	1.93685 J1	0.017	< 0.005 U1	63	2.55318 J1	< 0.86 U1
11/7/2016	Background	< 0.93 U1	14	41	0.108253 J1	< 0.07 U1	1	1.28551 J1	1.65	0.5598 J1	< 0.68 U1	0.008	0.00775 J1	44	< 0.99 U1	< 0.86 U1
1/24/2017	Background	< 0.93 U1	11	56	0.0635907 J1	< 0.07 U1	2	1.8255 J1	1.896	< 0.083 U1	< 0.68 U1	0.009	0.00625 J1	39	< 0.99 U1	< 0.86 U1
3/7/2017	Background	< 0.93 U1	8	42	0.0245 J1	< 0.07 U1	1	1.05431 J1	0.938	< 0.083 U1	0.928114 J1	0.015	< 0.005 U1	26	< 0.99 U1	< 0.86 U1
4/26/2017	Background	< 0.93 U1	6.14	49.86	0.09 J1	< 0.07 U1	1.57	1.36 J1	1.163	0.53 J1	< 0.68 U1	0.01194	0.006 J1	16.9	< 0.99 U1	< 0.86 U1
5/16/2017	Background	< 0.93 U1	4.32 J1	43.08	0.03 J1	< 0.07 U1	0.75 J1	0.87 J1	0.663	0.4677 J1	< 0.68 U1	0.01188	< 0.005 U1	14.05	< 0.99 U1	< 0.86 U1
6/16/2017	Background	2.16 J1	2.71 J1	41.48	0.03 J1	< 0.07 U1	0.58 J1	0.57 J1	2.268	< 0.083 U1	< 0.68 U1	0.01182	< 0.005 U1	12.23	< 0.99 U1	< 0.86 U1
9/19/2023	*	0.416	9.01	28.1	0.008 J1	0.013 J1	0.58	0.304	0.6	0.54	0.18 J1	0.00537	0.006	36.1	0.21 J1	< 0.02 U1
10/9/2023	*	0.261	8.87	25.8	< 0.007 U1	0.013 J1	0.38	0.241	20.75	0.52	0.11 J1	0.00447	0.006	26.9	0.15 J1	< 0.02 U1
11/13/2023	*	0.195	8.94	25.9	< 0.007 U1	0.005 J1	0.31	0.251	0.58	0.50	0.09 J1	0.00497	0.005	23.9	0.12 J1	< 0.02 U1
12/12/2023	*	0.162	8.18	24.9	< 0.007 U1	0.006 J1	0.33	0.234	1.65	0.48	0.07 J1	0.00478	0.003 J1	20.8	0.13 J1	< 0.02 U1

Table 1. Groundwater Data Summary: AP-59
Flint Creek - PBAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	0.25	39.3	19	0.7409 J1	7.4	37	240
7/18/2016	Background	0.339	38	14	0.6517 J1	6.8	27	220
9/13/2016	Background	0.38	36.5	13	0.583 J1	7.3	25	216
10/5/2016	Background	0.347	34.6	14	0.7085 J1	7.1	26	220
11/7/2016	Background	0.323	35.6	15	0.5832 J1	7.2	32	216
1/24/2017	Background	0.317	38.4	13	< 0.083 U1	7.0	40	240
3/7/2017	Background	0.253	42	13	< 0.083 U1	7.9	43	236
4/26/2017	Background	0.222	41.4	15	0.61 J1	7.2	40	226
5/16/2017	Background	0.208	39.5	13	0.5762 J1	7.1	38	186
6/16/2017	Background	0.227	36.2	12	< 0.083 U1	6.7	31	224
8/29/2017	Detection	0.295	35.4	12	0.6463 J1	7.1	21	210
12/21/2017	Detection	0.279	46.8	--	--	6.9	--	228
3/26/2018	Detection	0.218	43.2	12	< 0.083 U1	7.0	40	180
8/28/2018	Detection	0.277	42.2	--	--	7.1	--	180
10/23/2018	Detection	--	--	19	0.548 J1	--	26.7	--
3/11/2019	Detection	0.221	45.2	15.0	0.59	7.4	35.5	46
6/11/2019	Detection	0.233	46.7	14.7	0.65	7.3	38.4	88
7/9/2019	Detection	--	45.3	--	--	7.0	--	--
8/27/2019	Detection	0.246	42.6	11	0.413 J1	8.9	26	228
12/9/2019	Detection	--	--	--	--	7.3	--	--
3/23/2020	Detection	0.228	45.3	12.3	0.61	7.2	38.1	250
10/20/2020	Detection	0.244	49.7	13.2	0.46	8.7	47.0	257
3/1/2021	Detection	--	49.4	--	--	7.3	--	--
3/2/2021	Detection	0.157	49.2	13.7	0.49	7.3	51.9	250
6/21/2021	Detection	--	48.6	--	--	6.9	34.8	--
9/20/2021	Detection	0.238	46.4	14.4	0.46	6.8	36.2	240
3/14/2022	Detection	0.202	48.0	16.0	0.47	6.5	51.5	220
8/15/2022	Detection	--	--	--	--	6.9	62.0	--
9/20/2022	Detection	0.336	41.7	15.4	0.48	7.1	53.9	250
3/6/2023	Detection	--	--	--	--	7.0	77.7	--
3/7/2023	Detection	0.368	46.5	17.7	0.47	7.0	78.7	280
9/18/2023	Detection	--	--	--	--	7.1	69.6	300
9/19/2023	Detection	0.301	51.6	14.6	0.42	7.1	68.3	290
10/9/2023	*	--	--	--	0.42	7.4	--	--
11/13/2023	*	--	--	--	0.47	6.6	--	--
12/12/2023	*	--	41.9	16.9	0.45	6.9	58.2	--
12/27/2023	Detection	--	--	--	--	7.0	55.1	270

Table 1. Groundwater Data Summary: AP-59
Flint Creek - PBAP
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
5/24/2016	Background	< 0.93 U1	< 1.05 U1	67	< 0.02 U1	< 0.07 U1	0.583478 J1	2.01538 J1	0.711	0.7409 J1	< 0.68 U1	0.000378518 J1	0.029	7	< 0.99 U1	1.24044 J1
7/18/2016	Background	< 0.93 U1	< 1.05 U1	72	0.0339425 J1	< 0.07 U1	3	2.54042 J1	--	0.6517 J1	1.02999 J1	0.000590098 J1	0.035	9	< 0.99 U1	1.07757 J1
9/13/2016	Background	< 0.93 U1	< 1.05 U1	82	< 0.02 U1	< 0.07 U1	< 0.23 U1	2.3351 J1	1.288	0.583 J1	< 0.68 U1	0.000162193 J1	< 0.005 U1	9	< 0.99 U1	1.01454 J1
10/5/2016	Background	< 0.93 U1	< 1.05 U1	89	< 0.02 U1	< 0.07 U1	0.300781 J1	2.72689 J1	0.725	0.7085 J1	< 0.68 U1	0.011	< 0.005 U1	8	< 0.99 U1	1.63378 J1
11/7/2016	Background	< 0.93 U1	< 1.05 U1	93	< 0.02 U1	< 0.07 U1	< 0.23 U1	3.0738 J1	1.109	0.5832 J1	< 0.68 U1	0.00039204 J1	< 0.005 U1	8	< 0.99 U1	< 0.86 U1
1/24/2017	Background	< 0.93 U1	< 1.05 U1	107	< 0.02 U1	< 0.07 U1	< 0.23 U1	3.38517 J1	0.3279	< 0.083 U1	< 0.68 U1	0.000152708 J1	< 0.005 U1	8	< 0.99 U1	1.21456 J1
3/7/2017	Background	< 0.93 U1	< 1.05 U1	96	< 0.02 U1	< 0.07 U1	0.244944 J1	3.32152 J1	0.713	< 0.083 U1	< 0.68 U1	0.006	< 0.005 U1	7	< 0.99 U1	< 0.86 U1
4/26/2017	Background	< 0.93 U1	1.58 J1	104	< 0.02 U1	< 0.07 U1	< 0.23 U1	3.36 J1	1.319	0.61 J1	< 0.68 U1	0.00026 J1	< 0.005 U1	5.33	< 0.99 U1	< 0.86 U1
5/16/2017	Background	< 0.93 U1	< 1.05 U1	93.9	< 0.02 U1	< 0.07 U1	< 0.23 U1	3 J1	0.618	0.5762 J1	< 0.68 U1	0.00033 J1	0.006 J1	5.66	< 0.99 U1	1.09 J1
6/16/2017	Background	< 0.93 U1	1.96 J1	86.79	< 0.02 U1	< 0.07 U1	< 0.23 U1	2.83 J1	2.251	< 0.083 U1	< 0.68 U1	0.00021 J1	< 0.005 U1	6.4	< 0.99 U1	< 0.86 U1
9/19/2023	*	0.029 J1	3.40	78.1	0.008 J1	0.028	0.38	2.52	1.68	0.42	0.19 J1	0.00027 J1	< 0.002 U1	5.1	0.05 J1	0.14 J1
10/9/2023	*	0.025 J1	2.97	74.0	< 0.007 U1	0.011 J1	0.26 J1	2.33	27.8	0.42	0.16 J1	0.00027 J1	< 0.002 U1	5.0	0.10 J1	0.15 J1
11/13/2023	*	0.031 J1	2.90	64.3	0.009 J1	0.017 J1	0.41	2.22	2.11	0.47	0.28	0.00028 J1	< 0.002 U1	5.9	0.12 J1	0.15 J1
12/12/2023	*	0.024 J1	2.54	56.0	< 0.007 U1	0.01 J1	0.32	1.70	2.23	0.45	0.11 J1	0.00024 J1	< 0.002 U1	5.6	< 0.04 U1	0.13 J1

Table 1. Groundwater Data Summary: AP-60
Flint Creek - PBAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
12/19/2016	Background	1.4	16.7	14	0.0946 J1	8.9	165	369
1/24/2017	Background	1.12	33.2	13	< 0.083 U1	7.8	152	356
3/7/2017	Background	1.26	25.9	12	< 0.083 U1	8.1	145	340
3/29/2017	Background	1.14	43	13	< 0.083 U1	8.4	140	368
4/26/2017	Background	1.3	25	15	0.58 J1	7.6	160	340
5/16/2017	Background	1.41	16.3	14	0.558 J1	8.6	167	302
6/16/2017	Background	1.2	29.2	15	< 0.083 U1	7.8	152	368
6/28/2017	Background	1.35	17.7	16	0.5516 J1	7.5	166	368
8/29/2017	Detection	1.13	32.3	13	0.4518 J1	7.7	146	356
12/21/2017	Detection	0.857	46.2	--	--	7.2	128	332
3/26/2018	Detection	0.645	45.5	9	< 0.083 U1	8.6	113	284
8/28/2018	Detection	1.27	31.1	--	--	7.8	--	276
10/23/2018	Detection	--	--	15.7	< 0.083 U1	--	135	--
3/11/2019	Detection	0.728	21.2	11.0	0.31	10.9	114	310
6/11/2019	Detection	0.559	3.44	9.79	0.29	10.0	108	304
7/9/2019	Detection	--	--	--	--	7.7	--	--
8/27/2019	Detection	0.756	10.7	8	0.2 J1	10.9	99	330
12/9/2019	Detection	--	--	--	--	7.6	--	--
3/23/2020	Detection	--	--	10.9	0.36	9.8	167	370
3/24/2020	Detection	1.25	27.9	--	--	--	--	--
10/20/2020	Detection	0.301	9.22	7.52	0.15	10.0	80.7	280
3/1/2021	Detection	1.19	34.6	11.2	0.46	8.4	164	350
9/20/2021	Detection	0.176	11.7	6.83	0.13	8.6	63.9	250
3/14/2022	Detection	0.151	2.20	6.69	0.14	8.6	58.5	240
9/20/2022	Detection	0.756	54.3	11.9	0.59	8.7	118	330
3/6/2023	Background	--	0.47	--	--	9.1	--	--
3/7/2023	Detection	0.870	8.43	6.82	0.17	9.1	56.8	280
9/18/2023	Detection	0.697	40.6	11.0	0.17	7.9	63.7	260
10/9/2023	*	--	--	--	0.28	8.0	--	--
11/13/2023	*	--	--	--	0.38	7.5	--	--
12/12/2023	*	--	27.1	16.1	0.42	8.0	101	--

Table 1. Groundwater Data Summary: AP-60
Flint Creek - PBAP
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
12/19/2016	Background	< 0.93 U1	9	17	0.0543046 J1	< 0.07 U1	2	1.92133 J1	1.176	0.0946 J1	0.742652 J1	0.001	< 0.005 U1	60	< 0.99 U1	< 0.86 U1
1/24/2017	Background	1.34724 J1	3.61807 J1	34	< 0.02 U1	< 0.07 U1	0.502321 J1	0.87237 J1	0.771	< 0.083 U1	< 0.68 U1	0.000637932 J1	< 0.005 U1	55	< 0.99 U1	< 0.86 U1
3/7/2017	Background	< 0.93 U1	9	15	< 0.02 U1	< 0.07 U1	0.297514 J1	0.458637 J1	1.121	< 0.083 U1	< 0.68 U1	0.003	< 0.005 U1	57	< 0.99 U1	< 0.86 U1
3/29/2017	Background	< 0.93 U1	7	41	0.023217 J1	< 0.07 U1	3	2.22346 J1	1.158	< 0.083 U1	1.84769 J1	0.002	0.00961 J1	53	< 0.99 U1	< 0.86 U1
4/26/2017	Background	< 0.93 U1	11.42	24.03	0.12 J1	< 0.07 U1	3.75	3.01 J1	0.429	0.58 J1	2.91 J1	0.00236	0.01 J1	56.38	< 0.99 U1	0.98 J1
5/16/2017	Background	1 J1	11.39	13.05	0.03 J1	< 0.07 U1	0.91 J1	0.66 J1	2.082	0.558 J1	< 0.68 U1	0.00048 J1	0.009 J1	62.09	< 0.99 U1	< 0.86 U1
6/16/2017	Background	< 0.93 U1	7.69	27.23	< 0.02 U1	< 0.07 U1	< 0.23 U1	0.42 J1	3.697	< 0.083 U1	< 0.68 U1	0.00063 J1	< 0.005 U1	54.18	< 0.99 U1	< 0.86 U1
6/28/2017	Background	< 0.93 U1	9.32	12.61	< 0.02 U1	< 0.07 U1	0.37 J1	0.37 J1	7.167	0.5516 J1	< 0.68 U1	0.00031 J1	0.006 J1	63.76	< 0.99 U1	< 0.86 U1
9/18/2023	*	0.138	2.84	47.5	< 0.007 U1	0.006 J1	0.36	0.511	1.7	0.17	0.06 J1	0.0138	< 0.002 U1	8.3	0.13 J1	0.08 J1
10/9/2023	*	0.079 J1	4.36	36.2	< 0.007 U1	0.006 J1	0.27 J1	0.352	26.46	0.28	0.13 J1	0.00598	< 0.002 U1	15.4	0.09 J1	0.03 J1
11/13/2023	*	10.1	9.66	53.0	8.70	4.73	21.3	5.66	2.66	0.38	22.8	0.0381	< 0.002 U1	34.8	36.9	5.49
12/12/2023	*	0.055 J1	4.58	27.2	< 0.007 U1	< 0.004 U1	0.25 J1	0.387	1.93	0.42	0.10 J1	0.00464	< 0.002 U1	18.6	0.07 J1	0.06 J1

Table 1. Groundwater Data Summary
Flint Creek - Primary Bottom Ash Pond

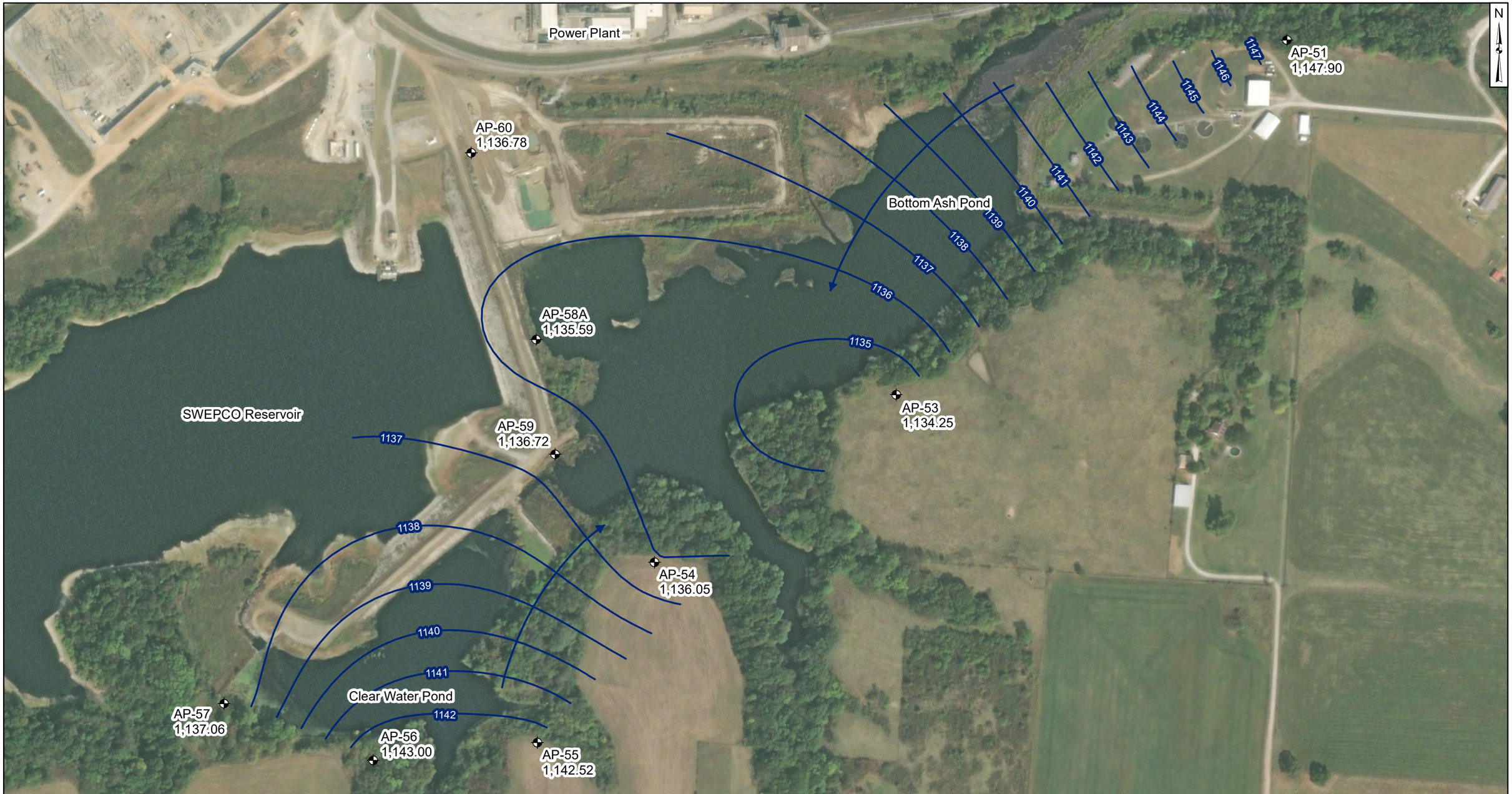
Notes:
- -: Not analyzed
*Sample was collected for Appendix IV constituents to update the background dataset prior to closure determination under 40 CFR 257.102(c).
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.
In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.
P1: The precision between duplicate results was above acceptance limits.
P2: The precision on the laboratory control sample duplicate (LCSD) was above acceptance limits.
In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.
AP-58 was found irreparably damaged during the September 2022 sampling event and was replaced by AP-58A.
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
µg/L: micrograms per liter

Table 1: Residence Time Calculation Summary
Flint Creek Primary Bottom Ash Pond

Geosyntec Consultants, Inc.

CCR Management Unit	Monitoring Well	Well Diameter (inches)	2023-03		2023-09		2023-10		2023-11		2023-12[5]	
			Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)
Primary Bottom Ash Pond	AP-51 [1]	2.0	283	0.2	72	0.8	83	0.7	89	0.7	NC	NC
	AP-53 [1]	2.0	286	0.2	215	0.3	289	0.2	335	0.2	NC	NC
	AP-54 [1]	2.0	333	0.2	399	0.2	561	0.1	612	0.1	NC	NC
	AP-58A [2],[4]	2.0	112	0.5	350	0.2	397	0.2	895	0.1	327	0.2
	AP-59 [2]	2.0	105	0.6	451	0.1	602	0.1	618	0.1	500	0.1
	AP-60 [2],[3]	2.0	75	0.8	265	0.2	330	0.2	333	0.2	NC	NC

Notes:
[1] - Background Well
[2] - Downgradient Well
[3] - AP-52 was replaced with AP-60 in December 2016
[4] - AP-58 was found damaged in September 2022 and replaced with AP-58A in December 2022
[5] - Only select wells were gauged as part of two-of-two verification sampling
NC - No calculation was performed



Legend

- Monitoring Wells
- Groundwater Contour Elevation
- Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data were collected March 6 and 7, 2023, provided by AEP.
- AP-58 was irreparably damaged and was replaced by well AP-58A.
- Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon, 2017) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- Well locations resurveyed on February 2 and 3, 2023 (Datum: AR SP North NAD27).

200 100 0 200 Feet

Potentiometric Surface Map
Uppermost Aquifer - March 2023

AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

Geosyntec consultants

Columbus, Ohio | 2023/05/16

Figure **X**

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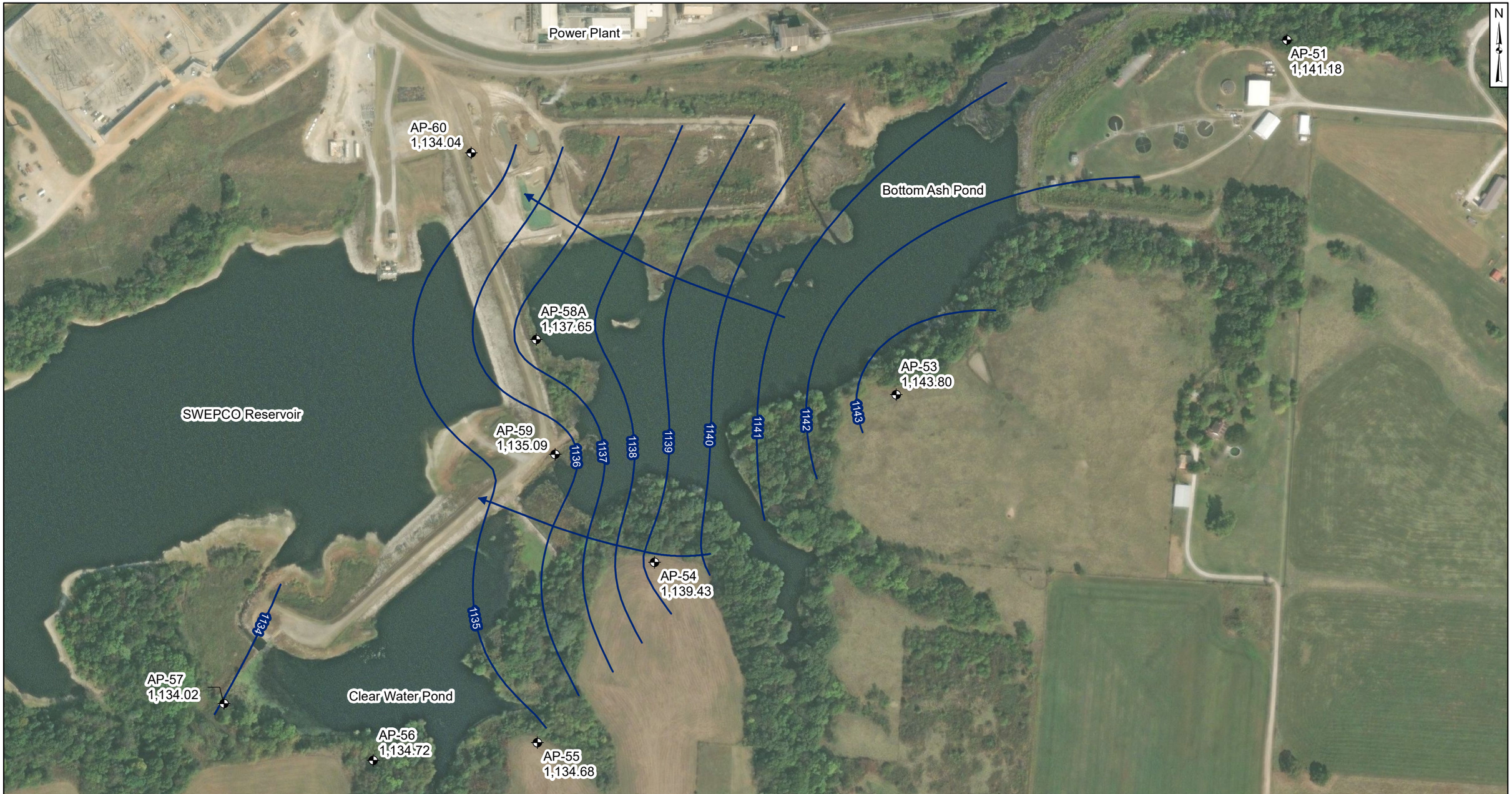

Legend

- Monitoring Wells
- Groundwater Contour Elevation
- Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data were collected September 18, 2023, provided by AEP.
- AP-58 was irreparably damaged and was replaced by well AP-58A.
- Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon, 2017) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- Well locations resurveyed on February 2 and 3, 2023 (Datum: AR SP North NAD27).

200 100 0 200 Feet

Potentiometric Surface Map
Uppermost Aquifer - September 2023

AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

Geosyntec consultants

Columbus, Ohio | 2023/09/29

Figure **X**

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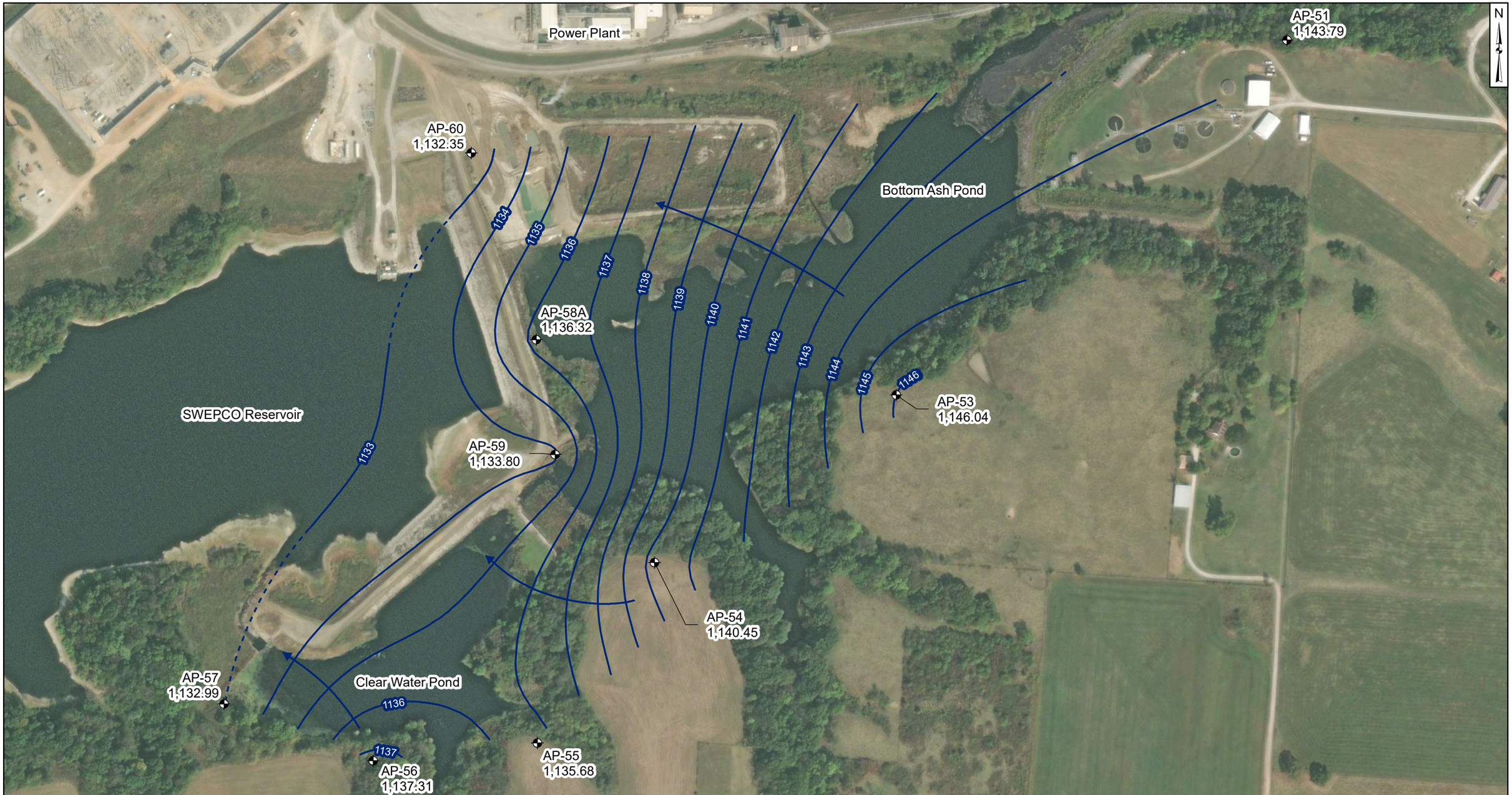

Legend

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

Notes

- Monitoring well coordinates and water level data were collected November 13, 2023, provided by AEP.
- AP-58 was irreparably damaged and was replaced by well AP-58A.
- Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon, 2017) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- Well locations resurveyed on February 2 and 3, 2023 (Datum: AR SP North NAD27).

200 100 0 200 Feet

Potentiometric Surface Map
Uppermost Aquifer - November 2023

AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

Geosyntec consultants

Columbus, Ohio | 2023/11/27

Figure **X**

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APPENDIX 2 - Statistical Analyses

The June 2023 memorandum summarizing the statistical evaluation for the September and December 2022, detection monitoring sampling event follows.

Geosyntec consultants

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Worthington, Ohio 43085
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www.geosyntec.com

Memorandum

Date:	June 16, 2023
To:	David Miller (AEP)
Copies to:	Bill Smith (AEP)
From:	Allison Kreinberg (Geosyntec)
Subject:	Evaluation of Detection Monitoring Data at Flint Creek Plant's Primary Bottom Ash Pond (PBAP)

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257 Subpart D, "CCR rule"), the second semiannual detection monitoring event of 2022 at the Primary Bottom Ash Pond (PBAP), an existing CCR unit at the Flint Creek Power Plant located in Gentry, Arkansas, was completed on September 20, 2022. Downgradient well AP-58 was found irreparably damaged during the September 2022 sampling event and was replaced by AP-58A, which was sampled on December 12, 2022. Based on the results of the initial event, verification sampling was completed on March 6, 2023.

Background values for the PBAP were previously calculated in January 2018 and March 2020. After a minimum of four detection monitoring events, the results of those events were compared to the existing background and the dataset was updated as appropriate. Revised upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Details on the calculation of these revised background values are described in Geosyntec's *Statistical Analysis Summary* report, dated January 10, 2022.

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

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

- Boron concentrations exceeded the intrawell UPL of 0.276 milligrams per liter (mg/L) in both the initial (1.23 mg/L) and second (1.20 mg/L) samples collected at AP-58A. Therefore, an SSI over background is concluded for boron at AP-58A.

- Chloride concentrations exceeded the intrawell UPL of 10.2 mg/L in both the initial (22.1 mg/L) and second (18.6 mg/L) samples collected at AP-58A. Therefore, an SSI over background is concluded for chloride at AP-58A.

- pH exceeded the intrawell UPL of 8.7 SU in both the initial (8.9) and second (9.0) samples collected at AP-58A. Therefore, an SSI over background is concluded for pH at AP-58A.

- Sulfate concentrations exceeded the intrawell UPL of 90.3 mg/L in both the initial (164 mg/L) and second (134 mg/L) samples collected at AP-58A. Sulfate concentrations also exceeded the intrawell UPL of 50.1 mg/L in both the initial (53.9 mg/L) and second (77.7 mg/L) samples collected at AP-59. Therefore, SSIs over background are concluded for sulfate at AP-58A and AP-59.

- Total dissolved solid (TDS) concentrations exceeded the intrawell UPL of 333 mg/L in both the initial (400 mg/L) and second (410 mg/L) samples collected at AP-58A. Therefore, an SSI over background is concluded for TDS at AP-58A.

In response to the exceedances noted, above, the Flint Creek PBAP CCR unit will either transition to assessment monitoring or an alternative source demonstration (ASD) for sulfate, boron, chloride, pH, and TDS will be conducted in accordance with 40 CFR 257.94(e)(2). If the ASD is successful, the Flint Creek PBAP will remain in detection monitoring.

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

Table 1: Detection Monitoring Data Evalation
Flint Creek - Primary Bottom Ash Pond

Geosyntec Consultants

Analyte	Unit	Description	AP-58A		AP-59		AP-60	
			12/12/2022	3/6/2023	9/20/2022	3/6/2023	9/20/2022	3/6/2023
Boron	mg/L	Intrawell Background Value (UPL)	0.276		0.368		1.68	
		Analytical Result	**1.23**	**1.20**	0.336	--	0.756	--
Calcium	mg/L	Intrawell Background Value (UPL)	86.8		53.9		49.9	
		Analytical Result	20.6	--	41.7	--	**54.3**	0.47
Chloride	mg/L	Intrawell Background Value (UPL)	10.2		18.0		17.4	
		Analytical Result	**22.1**	**18.6**	15.4	--	11.9	--
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00		0.765		0.681	
		Analytical Result	0.59	--	0.48	--	0.59	--
pH	SU	Intrawell Background Value (UPL)	8.7		7.6		10.8	
		Intrawell Background Value (LPL)	6.2		6.7		6.5	
		Analytical Result	**8.9**	**9.0**	7.1	--	8.7	--
Sulfate	mg/L	Intrawell Background Value (UPL)	90.3		50.1		190	
		Analytical Result	**164**	**134**	**53.9**	**77.7**	118	--
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	333		266		397	
		Analytical Result	**400**	**410**	250	--	330	--

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
Bold values exceed the background value.
Background values are shaded gray.
--: Not measured

ATTACHMENT A

Certification by a Qualified Professional Engineer

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the January 10, 2022 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Flint Creek PBAP 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

15296	Arkansas	06.20.2023
License Number	Licensing State	Date

APPENDIX 3 – Alternative Source Demonstrations

The February 2023 and September 2023 ASD reports follows.

ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

Flint Creek Power Plant
Primary Bottom Ash Pond
Gentry, Arkansas

Submitted to

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

500 W. Wilson Bridge Rd, Suite 250
Worthington, Ohio 43085

February 2023

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LIST OF ACRONYMS AND ABBREVIATIONS

ASD	Alternative Source Demonstration
bgs	Below Ground Surface
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
EPRI	Electric Power Research Institute
LPL	Lower Prediction Limit
PBAP	Primary Bottom Ash Pond
SSI	Statistically Significant Increase
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency

SECTION 1

INTRODUCTION AND SUMMARY

This Alternative Source Demonstration (ASD) report has been prepared to address a statistically significant increase (SSI) for sulfate in the groundwater monitoring network for the Primary Bottom Ash Pond (PBAP) at the Flint Creek Power Plant in Gentry, Arkansas, following the first semiannual detection monitoring event of 2022. The Flint Creek Power Plant has two coal combustion residuals (CCR) storage units, including the PBAP.

Background concentrations for the PBAP were initially calculated in January 2018 with data from ten monitoring events (Geosyntec, 2018a). Upper prediction limits (UPLs) were calculated for each parameter listed in 40 CFR Part 257 Appendix III (Appendix III parameter) to represent background values. A lower prediction limit (LPL) was also calculated for pH. Prediction limits were calculated based on a one-of-two retesting procedure in accordance with the Unified Guidance (United States Environmental Protection Agency [USEPA], 2009) and the statistical analysis plan developed for the site. With this procedure, an SSI is concluded only if both samples in a series of two exceed the UPL or, in the case of pH, are below the LPL. In practice, if the initial result did not exceed the UPL or fall below the LPL, a second sample was not collected or analyzed. The background values have been periodic evaluated and updated, as appropriate, in accordance with the most recent statistical analysis plan after completion of four or five detection additional monitoring events (Geosyntec, 2020a; 2022).

The first semiannual detection monitoring event of 2022 was performed in March 2022 (initial sampling event), and the results were compared to the calculated prediction limits. Where initial exceedances were identified, verification resampling was completed in August 2022. Following verification resampling, an SSI was identified for sulfate at downgradient compliance well AP-59 at the PBAP using intrawell analysis. No other SSIs were identified. A summary of the Appendix III analytical results for the downgradient compliance wells and the calculated prediction limits to which they were compared is provided in **Table 1**.

1.1 CCR Rule Requirements

United States Environmental Protection Agency (USEPA) regulations regarding detection monitoring programs for CCR landfills and surface impoundments provide owners and operators with the option to make an 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. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels to*

> *include obtaining a certification from a qualified professional engineer… verifying the accuracy of the information in the report.*

Pursuant to 40 CFR 257.94(e)(2), Geosyntec Consultants, Inc. (Geosyntec) has prepared this ASD report to document that the SSI identified for sulfate at monitoring well AP-59 is from a source other than impacts derived from the PBAP.

1.2 Demonstration of Alternative Sources

An evaluation was completed to assess possible alternative sources to which the identified SSI could be attributed. Alternative sources were identified amongst five types, based on methodology provided by the Electric Power Research Institute (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 SSI identified for sulfate at well AP-59 was based on Type IV causes (natural variation) and not by a direct release from the PBAP.

SECTION 2

SUMMARY OF SITE CONDITIONS

Descriptions of the Flint Creek PBAP design and construction, regional geology and site hydrogeology, and groundwater monitoring network and flow conditions are presented below.

2.1 PBAP Design and Construction

As described by Terracon (2017), the PBAP is a 42.8-acre CCR surface impoundment located south of the Power Plant (**Attachment A**). It was constructed from 1974 to 1978 with an approximately 820-feet long cross-valley dam consisting of compacted clayey soil. While it was operational, it was used primarily for management of bottom ash. The PBAP ceased receipt of CCR and non-CCR waste streams on November 30, 2022 and commenced closure by removal of CCR materials in accordance with the certified closure plan (AEP, 2022a).

2.2 Regional Geology/Site Hydrogeology

As described by Terracon (2017), the PBAP is located in an area of the Ozark Plateaus Province that has undergone regional-scale uplift followed by significant incision by rivers, resulting in hilly topography. It is underlain by the Mississippian-aged Boone Formation, which consists primarily of limestone and chert. Locally, the stratigraphy consists of a 30 to 50-foot thick weathered residuum of the Boone Formation, consisting of heavily-weathered limestone with chert nodules and iron-rich clay, and an underlying massive cherty limestone of the Boone Formation.

The Boone Formation is underlain by the Mississippian-aged St. Joe Member, which is a light-grey crystalline limestone which has not experienced significant physical or chemical weathering and is distinct from the Boone Formation due to its lack of chert and clay.

The Boone residuum, the underlying Boone Formation cherty limestone, and the underlying St. Joe Member collectively comprise a single hydrostatic unit known as the Boone-St. Joe Aquifer. This aquifer is underlain by the Chattanooga Shale, a black, fissile shale which acts as a barrier to vertical flow from the aquifer unit above.

Geologic cross sections near the PBAP presented by Terracon (2017) are provided as **Attachment B**. These cross sections show the Boone residuum (described as silty clay on the cross sections) and cherty limestone Boone Formation underlying the clayey berm of the PBAP.

Three distinct zones of groundwater flow have been identified within the Boone-St. Joe Aquifer at the site: Uppermost, Intermediate, and Deep (AEP, 2022b). Perched groundwater is occasionally present within upper unconsolidated soils but is not continuous throughout the site and does not constitute an aquifer unit. All monitoring wells in the PBAP monitoring well network monitor the uppermost aquifer, which is defined as the upper portion of the Boone Formation (Terracon, 2017).

2.3 Groundwater Monitoring Network and Flow Conditions

The current monitoring well network includes three background wells which are upgradient of the PBAP (AP-51, AP-53, and AP-54) and three downgradient compliance wells (AP-58a [monitoring well AP-58 was found to be irreparably damaged during the September 2022 sampling event and was replaced by AP-58a] , AP-59, and AP-60). The location of these wells is shown in **Attachment A.**

Monitoring well AP-59 is screened entirely within competent limestone, as shown on the cross sections in **Attachment B** and on the boring log and well construction diagram provided as **Attachment C**. One thin fracture/void was noted at 22 feet below ground surface (bgs) within the screened interval of the well.

The potentiometric map showing groundwater flow contours for the Uppermost Aquifer during the March 2022 sampling event is provided as **Attachment A**. Groundwater flow direction is generally to the northwest. Hydraulic connectivity within the Uppermost Aquifer was determined by Terracon (2017) to be related to multiple factors including lithology, rock type, layer thickness, and degree of bedrock fracture. Seasonal variability in the groundwater flow direction and hydraulic gradient has not been observed since the monitoring well network was installed.

SECTION 3

ALTERNATIVE SOURCE DEMONSTRATION

The method used to assess possible alternative sources of the SSI for sulfate at AP-59 and the proposed alternative source are described below.

3.1 Proposed Alternative Source

An initial review of groundwater sampling field forms, site geochemistry, site historical data, and laboratory and statistical analyses did not identify alternative sources for sulfate due to Type I (sampling), Type II (laboratory), or Type III (statistical evaluation) issues. Further, an initial review of site geochemistry did not identify evidence of any Type V (anthropogenic) impacts. As described below, the SSI observed at monitoring well AP-59 has been attributed to natural variation within the underlying geology, which is a Type IV cause.

Sulfate concentrations at background wells AP-53 and AP-54, which are located upgradient of the PBAP and AP-59, have historically been greater than those observed at AP-59, including a peak value of 78 mg/L at AP-54 in July 2016 (**Figure 1**). Further, sulfate concentrations at upgradient monitoring well AP-53 generally appear to fluctuate in a similar pattern as sulfate at AP-59, suggesting that natural variation of sulfate within the aquifer groundwater may be influencing values both upgradient and downgradient of the PBAP.

Regional groundwater quality of the Boone-St. Joe Limestone Aquifer in Benton County, Arkansas (the county in which the PBAP is located) has previously been studied (Ogden, 1979). A total of 253 groundwater samples from wells in Benton County screened within the Boone-St. Joe Aquifer were sampled and analyzed as part of the study. These samples revealed variability in sulfate concentrations. Ogden (1979) reported sulfate concentrations up to 124.50 mg/L in select wells in the county. One source of sulfate in these wells was hypothesized to be the chemical weathering of iron-sulfide minerals such as pyrite within the Boone and St. Joe Limestones.

Ogden (1979) identified a strong correlation between sulfate and calcium concentrations in groundwater. This relationship was also observed in AP-59 groundwater data since monitoring began in 2016 (**Figure 2**). Ogden hypothesized that this relationship is likely a product of iron-sulfide mineral oxidation. Oxidation of pyrite within the Boone-St. Joe Aquifer would yield sulfuric acid as a reaction product, the dissociation of which would result in an increase in aqueous sulfate and hydrogen ions which would in turn cause dissolution of calcite comprising the limestone aquifer. Oxidation-reduction (redox) conditions of AP-59 groundwater favor the thermodynamic stability of iron oxyhydroxides (**Figure 3**), indicating that iron sulfide minerals, if present as aquifer solids, would be expected to undergo this oxidation reaction.

The limestone lithology present at AP-59 was evaluated to develop the geologic conceptual site model for previous ASD reports and geochemical investigations (Geosyntec, 2020b; included in AEP, 2022b). Limestone at downgradient well locations was determined to be unpassivated and

capable of buffering incoming acidic waters via dissolution of calcite (Geosyntec 2018b, Geosyntec 2019, Geosyntec 2021a, Geosyntec 2021b). This illustrated conceptual site model is shown on **Figure 4**. If iron sulfide oxidation reactions were occurring in the limestone near AP-59, increases in aqueous sulfate and calcium would be expected. Increases in calcium are occasionally observed at AP-59, as documented in previous ASD reports for this well (Geosyntec, 2021b).

Sulfate concentrations measured in surface water samples collected in March 2020 from various locations within the PBAP and nearby SWEPCO Reservoir (shown on **Attachment A**) also support the position that the recent elevated concentrations of sulfate at AP-59 should not be attributed to the PBAP. The laboratory analytical report for this surface water sampling is provided as **Attachment D**. Two surface water samples from the PBAP contained reported sulfate concentrations of 39.5 milligrams per liter (mg/L) (sample ID – BAP) and 16.2 mg/L (sample ID – BAP Near Stop Log), and a sample collected from SWEPCO Reservoir (referred to as SWEPCO Lake in the laboratory report) contained a reported sulfate concentration of 35.0 mg/L. All three of these samples contain sulfate concentrations lower than the UPL for sulfate at AP-59 (50.1 mg/L) and the two samples from the recent detection monitoring event for the PBAP which triggered the SSI (51.5 mg/L and 62.0 mg/L). Operations involving the PBAP did not change significantly between the collection of surface water samples in March 2020 and initiation of pre-closure activities, including ongoing CCR removal, in spring of 2022. Thus, the 2020 surface water samples are a fair basis of comparison for March 2022 groundwater conditions. Lower concentrations of sulfate in the PBAP water than in groundwater at downgradient compliance well AP-59 indicates that the PBAP is not anticipated to act as a source for the recent elevated sulfate concentrations in groundwater.

3.2 Sampling Requirements

The ASD described above supports the position that the identified SSI for sulfate is a product of natural variation and not due to a release from the Flint Creek PBAP. Therefore, the unit will remain in the detection monitoring program. Groundwater at the unit will continue to be sampled for Appendix III parameters on a semiannual basis.

SECTION 4

CONCLUSIONS AND RECOMMENDATIONS

The preceding information serves as the ASD prepared in accordance with 40 CFR 257.94(e)(2) and supports the position that the SSI for sulfate identified at AP-59 during the first semiannual detection monitoring event of 2022 was not due to a release from the Flint Creek PBAP. The identified SSI should instead be attributed to natural variation in the underlying geology. Therefore, no further action is warranted, and the Flint Creek PBAP will remain in the detection monitoring program. Certification of this ASD by a qualified professional engineer is provided in **Attachment E**.

SECTION 5

REFERENCES

AEP, 2021. Annual Groundwater Monitoring Report, Flint Creek Power Plant, Primary Bottom Ash Pond CCR Management Unit. January.

AEP, 2022a. Notification of Intent to Close a CCR Unit. Flint Creek Plant – Primary Bottom Ash Pond. November.

AEP, 2022b. Second Quarter 2022 Groundwater Analysis Report. Southwestern Electric Power Company. Flint Creek Power Station. Class 3N Landfill. Gentry, Arkansas. September.

EPRI, 2017. Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Sites. 3002010920. October.

Geosyntec Consultants. 2018a. Statistical Analysis Summary. Primary Bottom Ash Pond – Flint Creek Plant. January.

Geosyntec Consultants, 2018b. Alternative Source Demonstration Report, Federal CCR Rule. Primary Bottom Ash Pond – Flint Creek Plant. April.

Geosyntec Consultants, 2019. Alternative Source Demonstration Report, Federal CCR Rule. Primary Bottom Ash Pond – Flint Creek Plant. November.

Geosyntec Consultants, 2020a. Statistical Analysis Summary. Primary Bottom Ash Pond – Flint Creek Plant. Revision 1. June.

Geosyntec Consultants, 2020b. Flint Creek PBAP Geochemical Investigation Results. December.

Geosyntec Consultants, 2021a. Alternative Source Demonstration Report, Federal CCR Rule. Primary Bottom Ash Pond – Flint Creek Plant. August.

Geosyntec Consultants, 2021b. Alternative Source Demonstration Report, Federal CCR Rule. Primary Bottom Ash Pond – Flint Creek Plant. November.

Geosyntec Consultants. 2022. Statistical Analysis Summary. Primary Bottom Ash Pond – Flint Creek Plant. January.

Ogden, A.E., 1979. Hydrogeologic and Geochemical Investigation of the Boone-St. Joe Limestone Aquifer in Benton County, Arkansas. Arkansas Water Resources Center. Publication No. PUB-0068.

Terracon, 2017. Report 1 – Groundwater Monitoring Network for CCR Compliance. SWEPCO – Flint Creek Primary Bottom Ash Pond. October.

United States Environmental Protection Agency, 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance. EPA 530/R-09-007.

TABLES

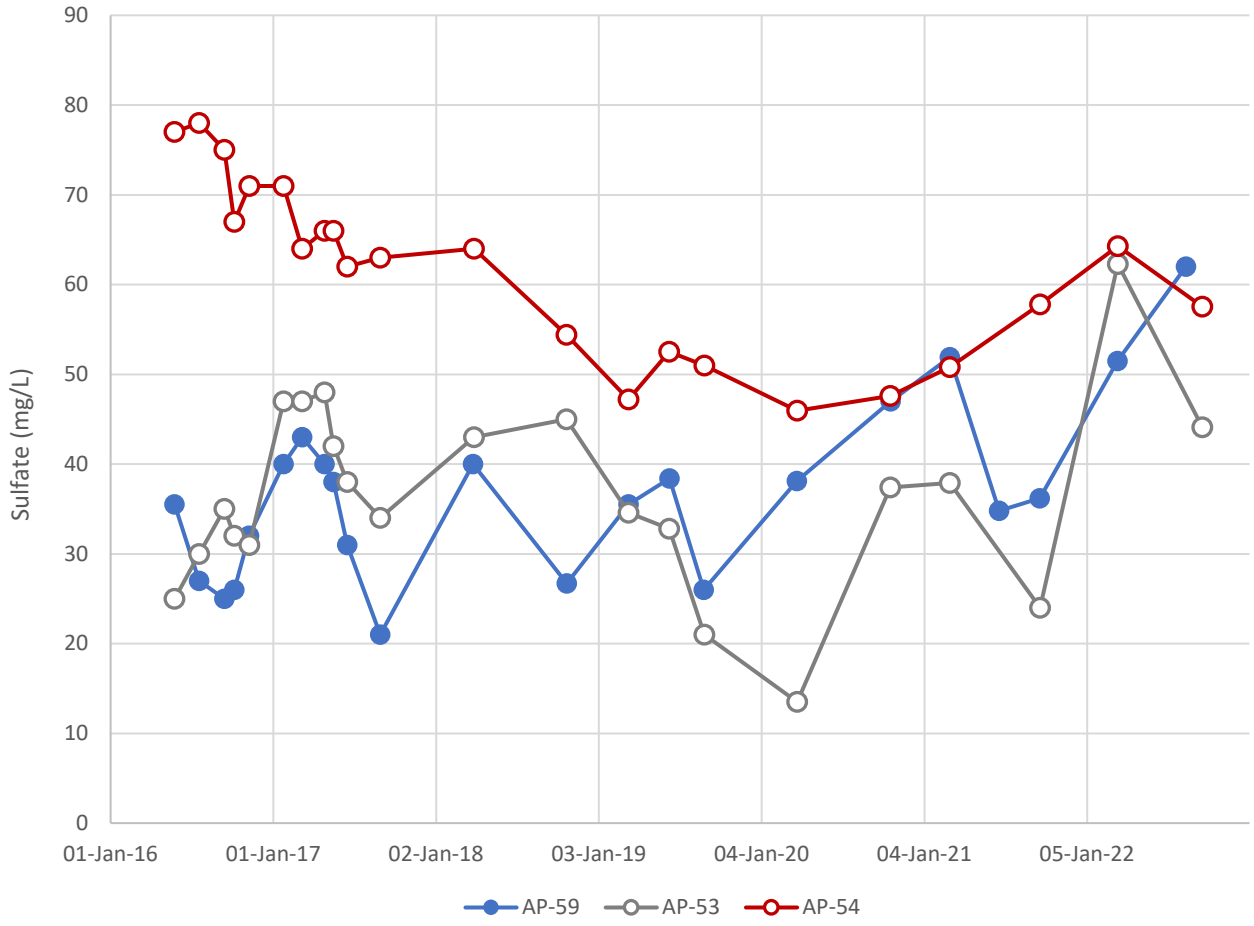
Table 1: Detection Monitoring Data Evalation
Flint Creek - Primary Bottom Ash Pond

Geosyntec Consultants

Analyte	Unit	Description	AP-58	AP-59		AP-60
			3/15/2022	3/14/2022	8/15/2022	3/14/2022
Boron	mg/L	Intrawell Background Value (UPL)	0.276	0.368		1.68
		Analytical Result	0.182	0.202	--	0.151
Calcium	mg/L	Intrawell Background Value (UPL)	86.8	53.9		49.9
		Analytical Result	67.0	48.0	--	2.20
Chloride	mg/L	Intrawell Background Value (UPL)	10.2	18.0		17.4
		Analytical Result	6.25	16.0	--	6.69
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00	0.765		0.681
		Analytical Result	0.32	0.47	--	0.14
pH	SU	Intrawell Background Value (UPL)	8.7	7.6		10.8
		Intrawell Background Value (LPL)	6.2	6.7		6.5
		Analytical Result	6.8	**6.5**	6.9	8.6
Sulfate	mg/L	Intrawell Background Value (UPL)	90.3	50.1		190
		Analytical Result	40.9	**51.5**	**62.0**	58.5
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	333	266		397
		Analytical Result	240	220	--	240

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
Bold values exceed the background value.
Background values are shaded gray.
--: Not measured

FIGURES



Notes: Total sulfate concentrations are shown for compliance well AP-59 and upgradient background wells AP-53 and AP-54.

Sulfate Comparison to Background Monitoring Wells

Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

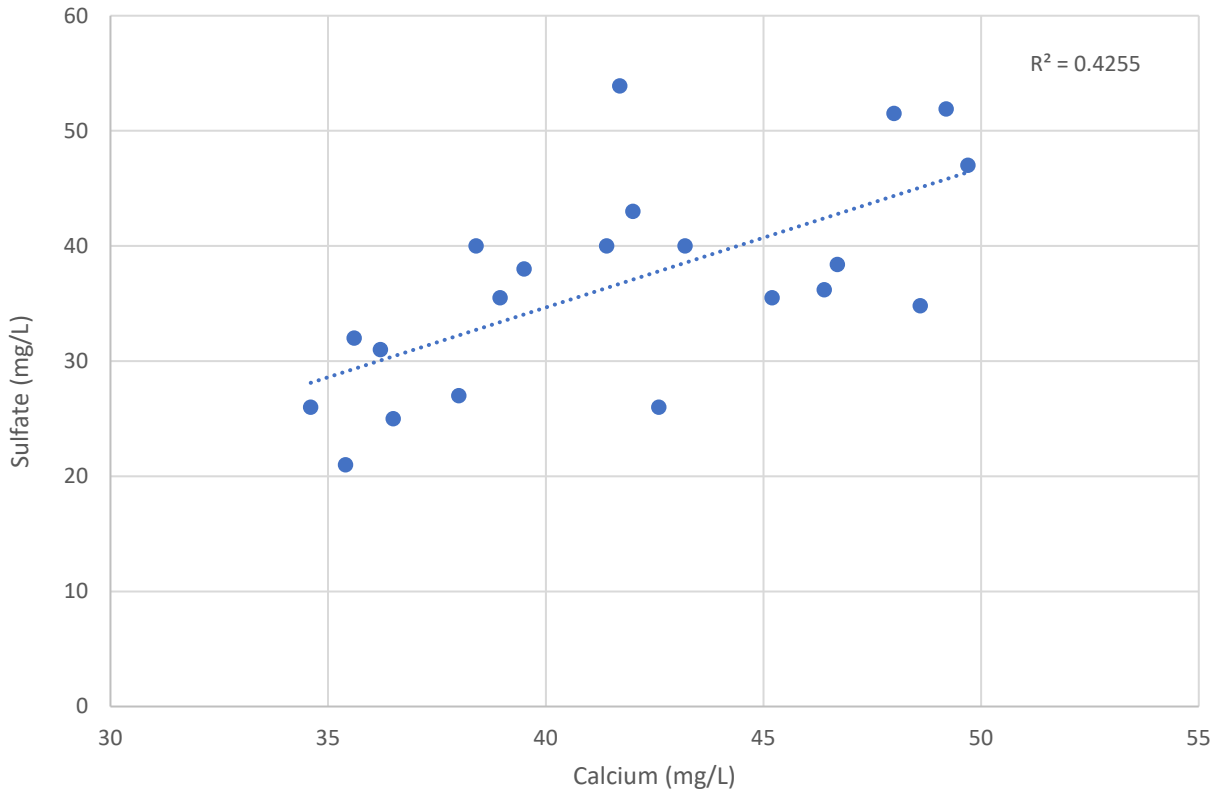
AMERICAN ELECTRIC POWER

Figure **1**

Columbus, Ohio

February 2023

internal info: path, date revised, author



Notes: Total calcium and sulfate concentrations from individual sampling events are displayed.

AP-59 Calcium vs. Sulfate Scatter Plot
Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

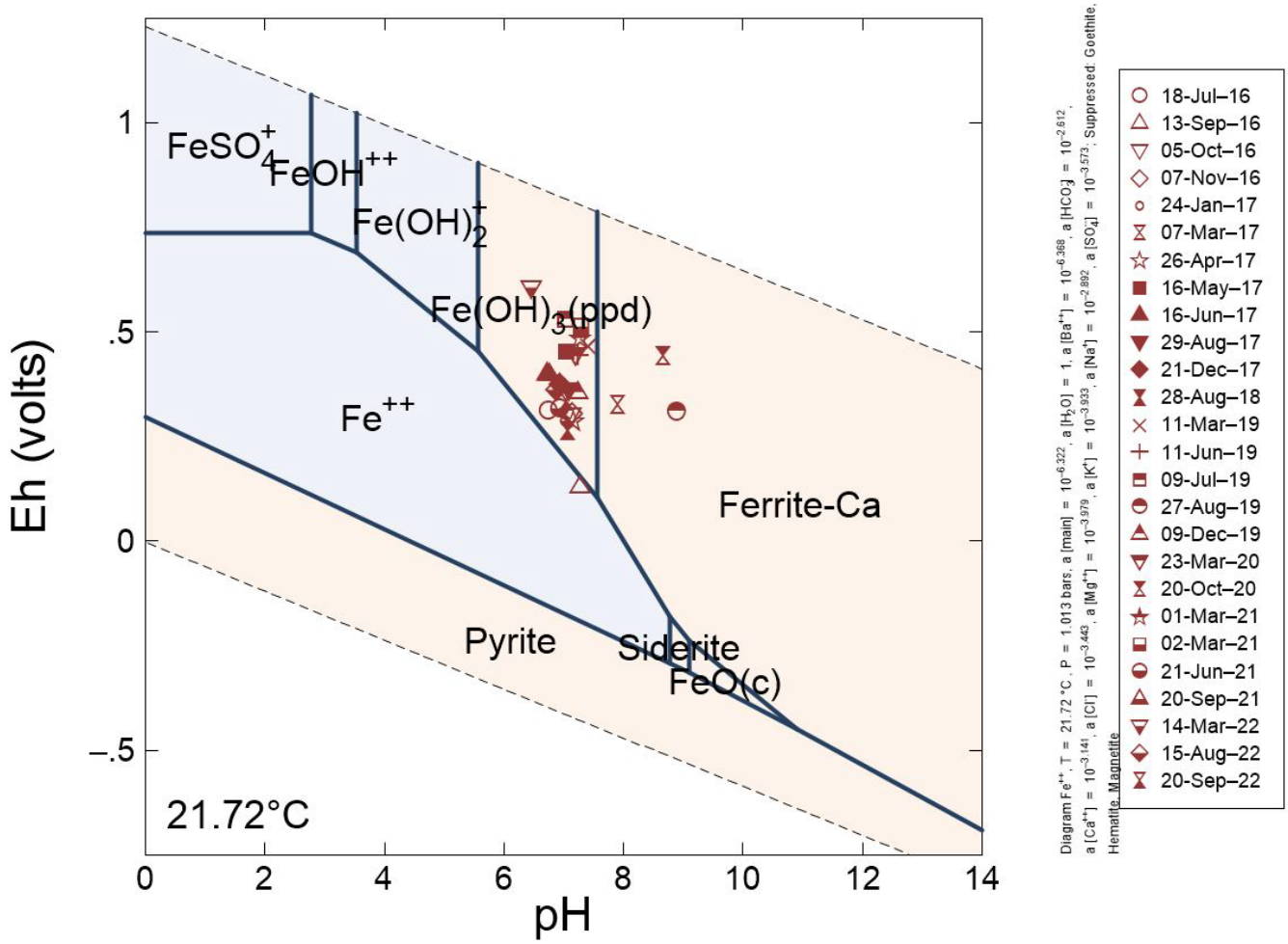
AMERICAN ELECTRIC POWER

Figure **2**

Columbus, Ohio

February 2023

internal info: path, date revised, author



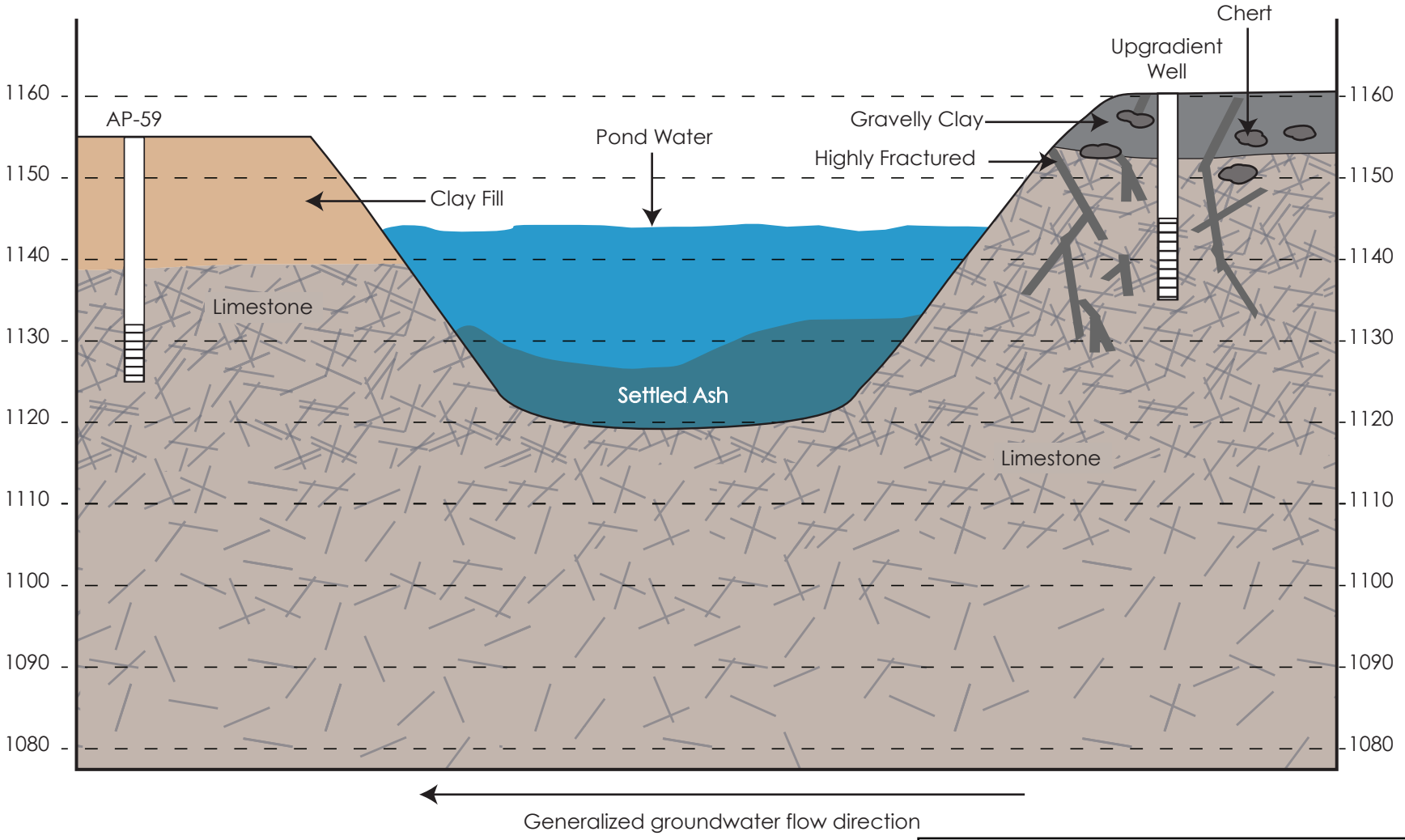
Notes: Average groundwater temperature and concentrations of major cations and anions at AP-59 since monitoring began in 2016 were used to establish baseline conditions for the diagram. Eh and pH values for sampling dates at AP-59 are shown on the diagram. Crystalline iron oxyhydroxide phases hematite, goethite, and magnetite are less likely to form and are suppressed in the diagram to show the stability field of amorphous iron oxyhydroxide $Fe(OH)_3(ppd)$.

AP-59 Iron Eh-pH Diagram
Flint Creek Primary Bottom Ash Pond

Geosyntec consultants | AMERICAN ELECTRIC POWER

Columbus, Ohio | February 2023

Figure **3**



Not to Scale

Site Geology Illustration
Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

AMERICAN ELECTRIC POWER

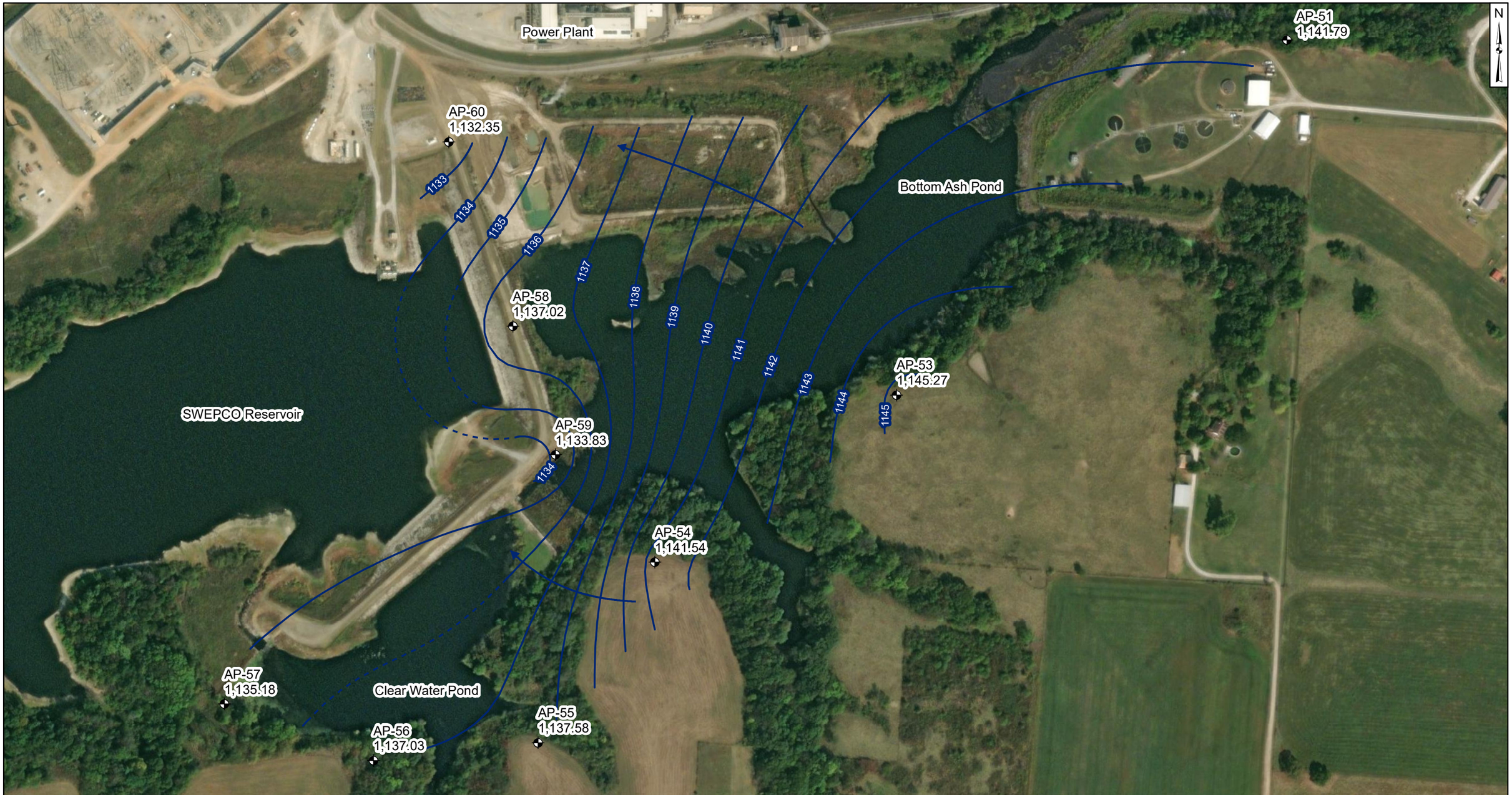
Columbus, Ohio

February 2023

Figure **4**

FlintCreekIllustration_July2021_CHA8495.ai

ATTACHMENT A
Potentiometric Surface Map,
Uppermost Aquifer - March 2022



Legend

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

Notes

- Monitoring well coordinates and water level data were collected March 14, 2022 and provided by AEP.
- Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon, 2017) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- Aerial imagery provided by ESRI, 2022

200 100 0 200 Feet

Potentiometric Surface Map
Uppermost Aquifer - March 2022

AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

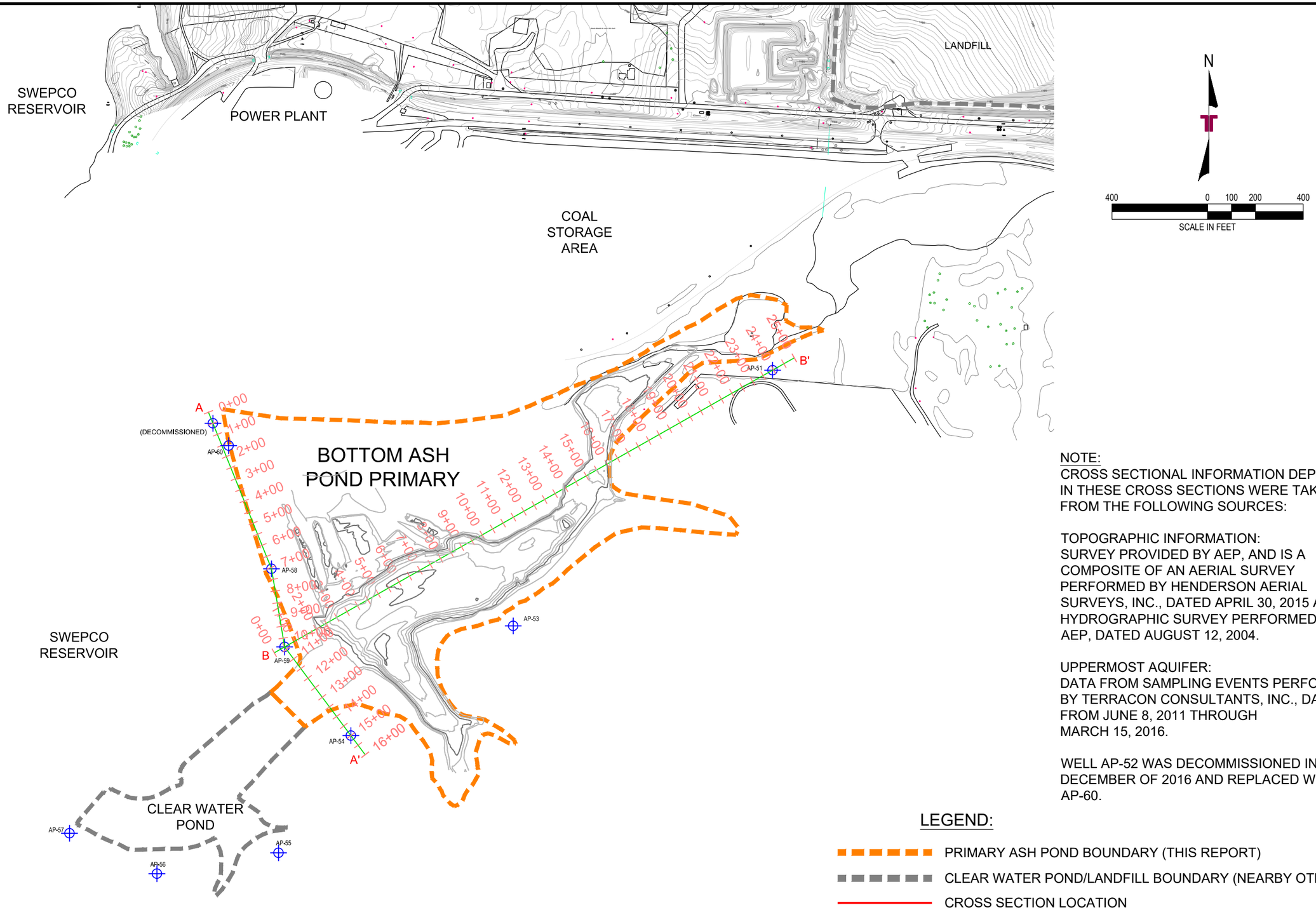
Geosyntec consultants

Columbus, Ohio | 2022/11/14

Figure **X**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2022\AEP-Flint Creek_GW_BAP_Mar2022.mxd. ASoltero. 11/14/2022. CHA8423/01/08.

ATTACHMENT B
Geologic Cross Sections



N

400 0 100 200 400

SCALE IN FEET

NOTE:
CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WERE TAKEN FROM THE FOLLOWING SOURCES:

TOPOGRAPHIC INFORMATION:
SURVEY PROVIDED BY AEP, AND IS A COMPOSITE OF AN AERIAL SURVEY PERFORMED BY HENDERSON AERIAL SURVEYS, INC., DATED APRIL 30, 2015 AND A HYDROGRAPHIC SURVEY PERFORMED BY AEP, DATED AUGUST 12, 2004.

UPPERMOST AQUIFER:
DATA FROM SAMPLING EVENTS PERFORMED BY TERRACON CONSULTANTS, INC., DATING FROM JUNE 8, 2011 THROUGH MARCH 15, 2016.

WELL AP-52 WAS DECOMMISSIONED IN DECEMBER OF 2016 AND REPLACED WITH AP-60.

LEGEND:

- PRIMARY ASH POND BOUNDARY (THIS REPORT)
- CLEAR WATER POND/LANDFILL BOUNDARY (NEARBY OTHERS)
- CROSS SECTION LOCATION
- MONITORING WELL

SHEET 1

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DOM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.:	216-001-35157124
ACAD NO.	001
SHEET NO.:	1 OF 2

CROSS SECTION LOCATION MAP

GROUNDWATER MONITORING NETWORK EVALUATION

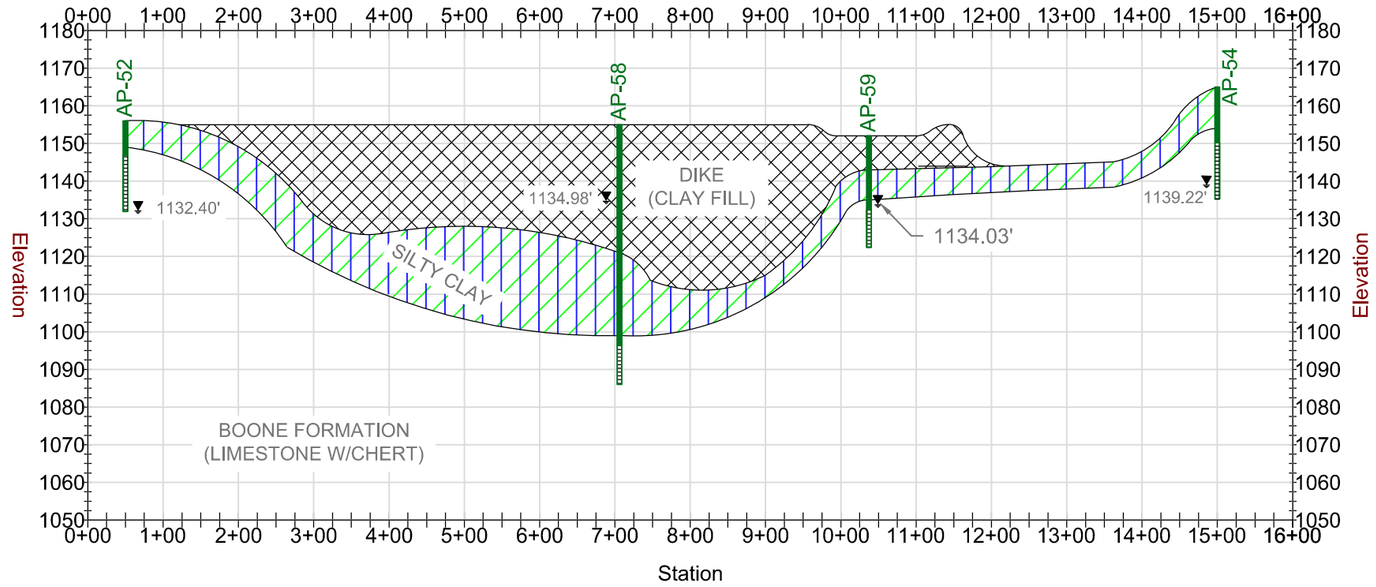
AMERICAN ELECTRIC POWER

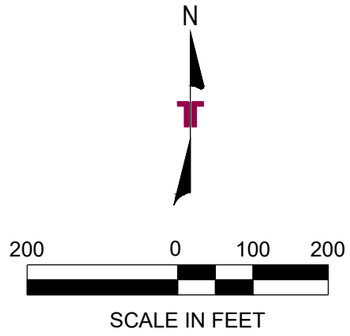
SWEPCO FLINT CREEK POWER PLANT BOTTPONDOM ASH
GENTRY ARKANSAS

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH BRYANT, AR 72022
PH. (501) 847-9292 FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

ALIGN- A-A'

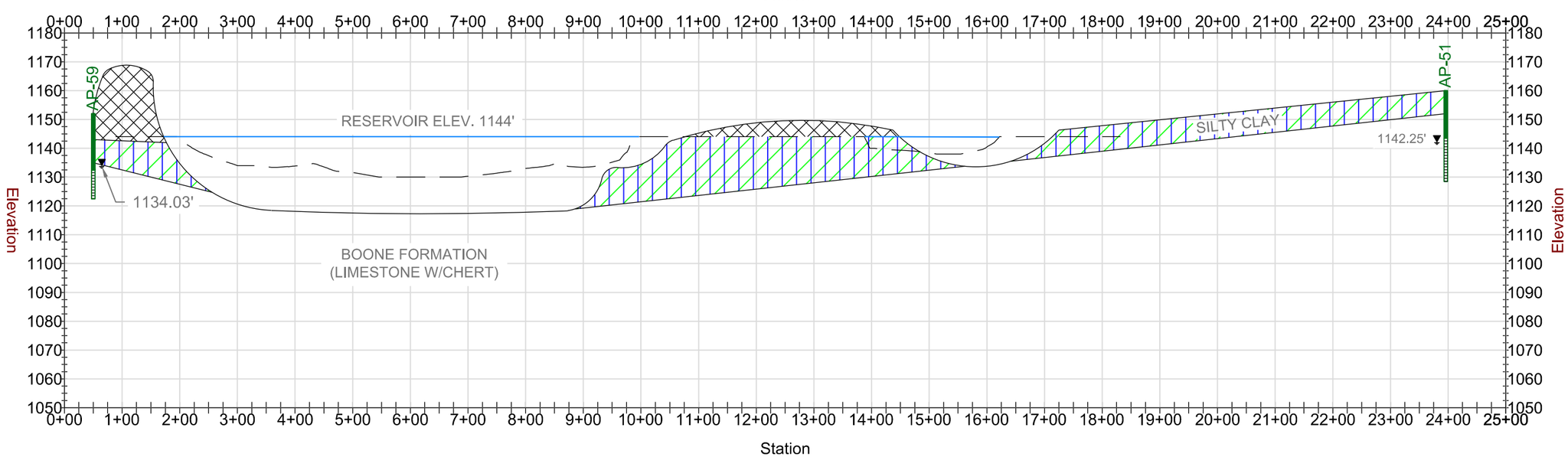




LEGEND:

- DIKE (CLAY FILL)
- SILTY CLAY

ALIGN- B-B'



SHEET 2

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DOM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.	216-001-35157124
ACAD NO.	001
SHEET NO.:	2 OF 2

CROSS SECTION A-A' & B-B'

GROUNDWATER MONITORING NETWORK EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEK POWER PLANT BOTTPONDOM ASH
GENTRY ARKANSAS

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH
BRYANT, AR 72022
PH. (501) 847-9292
FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

ATTACHMENT C
AP-59 Boring Log and Well Construction Diagram

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: AP-59 PAGE: 1 of 1

TOTAL DEPTH: 30 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35157182-001	DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: ADAM HOOPER	DRILLER: GARY MOYERS
DATE DRILLED: 2/3/2016	RIG TYPE: CME 75 BUGGY

DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY

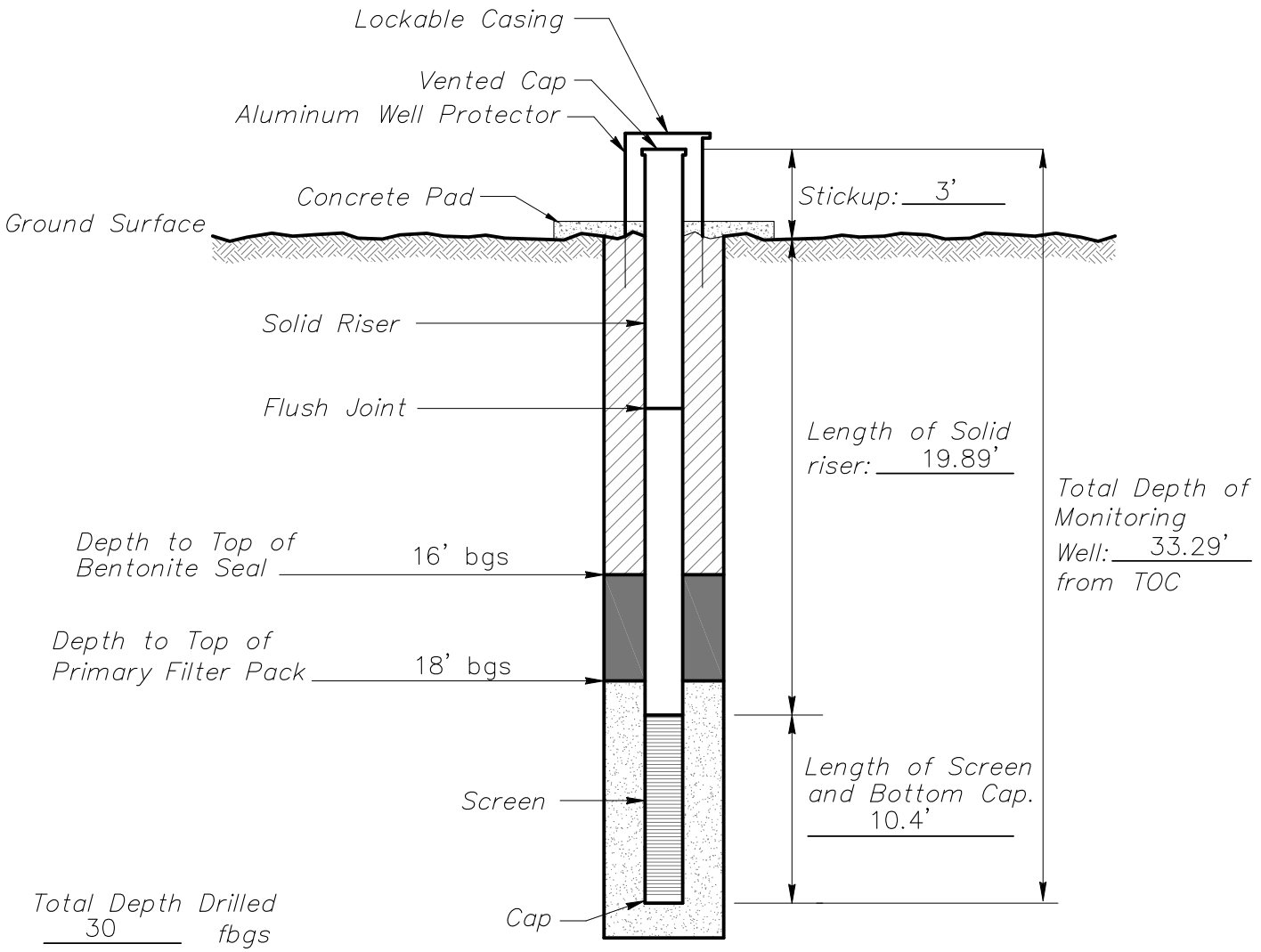
SAMPLING METHOD: 5' CONTINUOUS SAMPLER - LOGGED BY CUTTINGS

N: N/A E: N/A G.S. ELEV. N/A

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
0	0'-8.5' SILTY CLAY - FILL red and brown		
5			
10	8.5'-14.5' LIMESTONE and SILTY CLAY hard while drilling		
15	14.5'-17' SILTY CLAY red		Moisture at top of rock at 17' bgs
20	17'-30' LIMESTONE light gray, crystalline, thin fracture/void at 22' bgs		Water at 22' bgs 17' - 30' Logged by cuttings
25			
30	Total Depth of Boring at 30' bgs		

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION Well Number AP-59
Job Number 35157182 Installation Date 2/4/2016 Location AEP-FLINT CREEK -GENTRY, AR.
Datum Elevation NA Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010
Riser Diameter & Material 2" PVC Borehole Diameter 8"
Granular Backfill Material 16-30 SAND Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor ANDERSON ENGINEERING



Portland/Bentonite Grout

Bentonite Pellet Plug

Granular Backfill

(Not to Scale)

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216-001-35157182
WELL NUMBER: AP-59
DRAWING NUMBER: 005 CHECKED BY: MR

ATTACHMENT D

Surface Water Samples

Laboratory Analytical Report

Chain of Custody Record

Program: Coal Combustion Residuals (CCR)

Dolan Chemical Laboratory (DCL)
4001 Bixby Road
Groveport, Ohio 43125
Contacts: Michael Ohlinger (614-836-4184)
Dave Conover (614-836-4219)

Project Name: CCR
Contact Name:
Contact Phone:
Sampler(s): Ivaunna Neigler, Nicole Morrall

Analysis Turnaround Time (in Calendar Days)
◉ Routine (28 days for Monitoring Wells)

Site Contact:

Date:

For Lab Use Only:
COC/Order #:

Shipping confirmation sent to recipients below:
nmorrall@aep.com
ipneigler@aep.com
cmhubbell@aep.com

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Sampler(s) Initials	250 mL bottle, pH<2, HNO3: B, Ca, Li, Sb, As, Ba, Be, Cd, Cr, Co, Pb, Mo, Se, Tl and Na, K, Mg, Sr	Three (six every 10th*) 1L bottles, pH<2, HNO3: Ra-226, Ra-228	1 L + 250 mL bottles, Cool, 0-6C: TDS, F, Cl, SO4, and Br, Alkalinity	40 mL Glass vial or 250 mL PTFE lined bottle, HCL**, pH<2: Hg	Field-filter 250 mL bottle then pH<2, HNO3: dissolved Fe and dissolved Mn		Contains extra parameters	Sample Specific Notes:
Low Volume Waste Outlet Combined	2/25/20	13:03	G	GW	2	NM	X		X					<4°C
Bottom Ash Pond	2/25/20	13:14	G	W	2	NM	X		X					<4°C
BAP near Stop Log	2/25/20	13:29	G	W	2	NM	X		X					<4°C
SWEPCO Lake	2/25/20	13:23	G	W	2	NM	X		X					<4°C
Field Blank	2/25/20	13:44	G	W	1	NM APN			X					<4°C
Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____; F = filter in field							4	4	1	2	F 4			

** Six 1L Bottles must be collected for Radium for every 10th sample.*

*** HCl must be Trace Metal Grade for Mercury analysis when samples cannot be delivered to the laboratory within 48 hours of sampling.*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:
Nicole Morrall	AEP	2/25/20 14:00		
Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Date/Time:

Form REP-703
Rev. 1, 11/2013

Dolan Chemical Laboratory
4001 Bixby Road
Groveport, OH 43125
T: 614-836-4221, Audinet 210-4221
F: 614-836-4168, Audinet 210-4168
http://aepenv/labs

Water Analysis

Location: Flint Creek PS ***Report Date: 3/20/2020***

Low Volume Waste Outlet Combined

Sample Number: 200633-001 **Date Collected: 02/25/2020 13:03** **Date Received: 2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.07	ug/L	J	0.1	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Arsenic, As	0.78	ug/L		0.1	0.03	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Barium, Ba	119	ug/L		0.2	0.05	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	< 0.01	ug/L	U	0.05	0.01	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	0.460	ug/L		0.2	0.04	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.127	ug/L		0.05	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.2	ug/L	J	0.2	0.05	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	2.63	ug/L		2	0.4	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Selenium, Se	0.4	ug/L		0.2	0.03	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Boron, B	0.076	mg/L		0.05	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	35.1	mg/L		0.3	0.1	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.000381	mg/L		0.0002	0.00005	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	2.83	mg/L		0.1	0.02	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Potassium, K	4.69	mg/L		1	0.2	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Sodium, Na	11.4	mg/L		0.5	0.1	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.175	mg/L		0.01	0.002	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	102	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	7.92	mg/L		0.04	0.01	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.08	mg/L		0.06	0.01	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	183	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	17.8	mg/L		0.4	0.06	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0

pH = 6.30 2/25/2020 13:03 ipn

Location: Flint Creek PS ***Report Date: 3/20/2020***

Bottom Ash Pond

Sample Number: 200633-002 **Date Collected: 02/25/2020 13:15** **Date Received: 2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.11	ug/L		0.1	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Arsenic, As	1.03	ug/L		0.1	0.03	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Barium, Ba	199	ug/L		0.2	0.05	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	0.03	ug/L	J	0.05	0.01	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	2.98	ug/L		0.2	0.04	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.193	ug/L		0.05	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.275	ug/L		0.2	0.05	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	5.81	ug/L		2	0.4	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Selenium, Se	1.8	ug/L		0.2	0.03	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Boron, B	0.246	mg/L		0.05	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	40.5	mg/L		0.3	0.1	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.00111	mg/L		0.0002	0.00005	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	3.14	mg/L		0.1	0.02	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Potassium, K	5.61	mg/L		1	0.2	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Sodium, Na	22.7	mg/L		0.5	0.1	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.498	mg/L		0.01	0.002	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	116	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	11.0	mg/L		0.04	0.01	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.18	mg/L		0.06	0.01	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	217	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	39.5	mg/L		0.4	0.06	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0

pH = 8.70 2/25/2020 13:14 ipn

Location: Flint Creek PS *Report Date: 3/20/2020*

BAP Near Stop Log

Sample Number: 200633-003 **Date Collected: 02/25/2020 13:29** **Date Received: 2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.07	ug/L	J	0.1	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Arsenic, As	0.71	ug/L		0.1	0.03	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Barium, Ba	79.5	ug/L		0.2	0.05	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	< 0.01	ug/L	U	0.05	0.01	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	0.1	ug/L	J	0.2	0.04	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.056	ug/L		0.05	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.06	ug/L	J	0.2	0.05	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	1	ug/L	J	2	0.4	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Selenium, Se	0.3	ug/L		0.2	0.03	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Boron, B	0.068	mg/L		0.05	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	34.4	mg/L		0.3	0.1	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.000205	mg/L		0.0002	0.00005	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	2.75	mg/L		0.1	0.02	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Potassium, K	4.87	mg/L		1	0.2	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Sodium, Na	11.7	mg/L		0.5	0.1	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.147	mg/L		0.01	0.002	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	101	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	7.92	mg/L		0.04	0.01	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.08	mg/L		0.06	0.01	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	155	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	16.2	mg/L		0.4	0.06	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0

pH = 7.23 2/25/2020 13:29 lpn

pH = 8.31 2/25/2020 13:23 ipn

Location: Flint Creek PS **Report Date: 3/20/2020**

Swepco Lake SWEPCO Lake

Sample Number: 200633-004 **Date Collected: 02/25/2020 13:23** **Date Received: 2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.08	ug/L	J	0.1	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Arsenic, As	0.70	ug/L		0.1	0.03	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Barium, Ba	113	ug/L		0.2	0.05	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	0.01	ug/L	J	0.05	0.01	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	0.619	ug/L		0.2	0.04	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.144	ug/L		0.05	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.1	ug/L	J	0.2	0.05	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	2	ug/L	J	2	0.4	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Selenium, Se	0.7	ug/L		0.2	0.03	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Boron, B	0.102	mg/L		0.05	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	38.0	mg/L		0.3	0.1	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.000527	mg/L		0.0002	0.00005	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	3.04	mg/L		0.1	0.02	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Potassium, K	4.94	mg/L		1	0.2	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Sodium, Na	20.7	mg/L		0.5	0.1	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.224	mg/L		0.01	0.002	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	99.8	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	11.7	mg/L		0.04	0.01	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.12	mg/L		0.06	0.01	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	206	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	35.0	mg/L		0.4	0.06	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0

Field Blank

Sample Number: 200633-005 **Date Collected: 02/25/2020 13:44** **Date Received: 2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Alkalinity, as CaCO3	< 5	mg/L	U	20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	< 0.01	mg/L	U	0.04	0.01	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0
Fluoride, F	< 0.01	mg/L	U	0.06	0.01	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	< 20	mg/L	U	50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	< 0.06	mg/L	U	0.4	0.06	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0

U: Analyte was analyzed and not detected at or above adjusted Method Detection Limit
J: Analyte was positively identified, though the quantitation was below Reporting Limit.

Michael Ohlinger, Chemist
Email msohlinger@aep.com *Tel.*
Fax 614-836-4168 *Audinet 8-210-*

ATTACHMENT E
Certification by a Qualified Professional Engineer

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

I certify that the above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Flint Creek Primary Bottom Ash Pond 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

Arkansas Firm Certificate of
Authorization No. 52
Exp. 12/31/2024

9846	Arkansas	February 24, 2023
License Number	Licensing State	Date

Geosyntec consultants

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AMERICAN ELECTRIC POWER

BOUNDLESS ENERGY™

ALTERNATIVE SOURCE DEMONSTRATION REPORT

FEDERAL CCR RULE

Flint Creek Power Plant

Primary Bottom Ash Pond

Gentry, Arkansas

Prepared for

American Electric Power
1 Riverside Plaza
Columbus, Ohio 43215-2372

Prepared by

Geosyntec Consultants, Inc.
500 West Wilson Bridge Road, Suite 250
Worthington, Ohio 43085

Project CHA8495B

September 2023

Geosyntec consultants

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ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	alternative source demonstration
bgs	below ground surface
CCR	coal combustion residuals
CFR	Code of Federal Regulations
EPRI	Electric Power Research Institute
LPL	lower prediction limit
mg/L	milligrams per liter
PBAP	Primary Bottom Ash Pond
redox	oxidation-reduction
SSI	statistically significant increase
TDS	total dissolved solids
UPL	upper prediction limit
USEPA	United States Environmental Protection Agency

1. INTRODUCTION AND SUMMARY

This alternative source demonstration (ASD) report has been prepared to address statistically significant increases (SSIs) for boron, chloride, pH, sulfate, and total dissolved solids (TDS) in the groundwater monitoring network at the Flint Creek Power Plant Primary Bottom Ash Pond (PBAP) in Gentry, Arkansas, following the second semiannual detection monitoring event of 2022. The Flint Creek Power Plant has two coal combustion residuals (CCR) storage units, including the PBAP.

Background groundwater values for the PBAP were originally calculated in January 2018 and have been updated intermittently in accordance with the *Statistical Analysis Plan* prepared for the Flint Creek Plant (Geosyntec 2020a). For the most recent update in January 2022, revised upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values (Geosyntec 2022a). Prediction limits were calculated based on a one-of-two retesting procedure in accordance with the Unified Guidance (United States Environmental Protection Agency [USEPA] 2009) and the statistical analysis plan developed for the site. With this procedure, an SSI is concluded only if both samples in a series of two have reported results above the UPL or, in the case of pH, below the lower prediction limit (LPL). In practice, if the initial result was not above the UPL or was not below the LPL, a second sample was not collected or analyzed.

The second semiannual detection monitoring event of 2022 at the PBAP was performed in September (initial sampling event), and the results were compared to the calculated prediction limits. The initial sampling event for AP-58A was completed in December 2022 following well installation and development. Where initial exceedances were identified, verification resampling was completed in March 2023. Following verification resampling, SSIs were identified for boron, chloride, pH, sulfate, and TDS at downgradient compliance well AP-58A using intrawell analyses. An additional SSI was identified for sulfate at downgradient compliance well AP-59 using intrawell analysis. No other SSIs were identified. A summary of the Appendix III analytical results for the downgradient compliance wells and the calculated prediction limits to which they were compared is provided in **Table 1**.

1.1 CCR Rule Requirements

USEPA regulations regarding detection monitoring programs for CCR landfills and surface impoundments provide owners and operators with the option to make an ASD when an SSI is identified:

> *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. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels to include obtaining a certification from a qualified professional engineer* . . . verifying the accuracy of the information in the report. (Code of Federal Regulations [CFR] Title 40, Section 257.94(e)(2)).

Pursuant to 40 CFR 257.94(e)(2), Geosyntec Consultants, Inc. (Geosyntec) has prepared this ASD report to document that the identified SSIs at AP-58A and AP-59 should not be attributed to a release from the PBAP.

1.2 Demonstration of Alternative Sources

An evaluation was completed to assess alternative sources to which the identified SSI could be attributed. Alternative sources were identified from among five types, based on methodology provided by the Electric Power Research Institute (EPRI, 2017):

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

A demonstration was conducted to show that the SSIs identified for boron, chloride, pH, sulfate, and TDS at well AP-58A were based on a Type I cause (sampling issues) and not by a direct release from the PBAP. A demonstration was conducted to show that the SSI identified for sulfate at well AP-59 was based on Type IV causes (natural variation) and not by a direct release from the PBAP.

2. SUMMARY OF SITE CONDITIONS

Descriptions of the Flint Creek PBAP design and construction, regional geology and site hydrogeology, and groundwater monitoring systems and flow conditions are presented below.

2.1 PBAP Design and Construction

As described by Terracon (2017), the PBAP is a 42.8-acre CCR surface impoundment located south of the power plant. It was constructed from 1974 to 1978 with an approximately 820-foot long cross-valley dam consisting of compacted clayey soil. While it was operational, it was used primarily to manage bottom ash. The PBAP ceased receipt of CCR and non-CCR waste streams on November 30, 2022, and commenced closure by removal of CCR materials in accordance with the certified closure plan (American Electric Power [AEP] 2022a). CCR material removal from the PBAP was completed on August 19, 2023. A photograph showing the condition of the PBAP shortly before completion of CCR removal is provided in **Figure 1**.

2.2 Regional Geology / Site Hydrogeology

As described by Terracon (2017), the PBAP is in an area of the Ozark Plateaus Province that has undergone regional-scale uplift followed by significant incision by rivers, resulting in hilly topography. It is underlain by the Mississippian-aged Boone Formation, which consists primarily of limestone and chert. Locally, the stratigraphy consists of a 30- to 50-foot-thick weathered residuum of the Boone Formation, consisting of heavily-weathered limestone with chert nodules and iron-rich clay, and an underlying massive cherty limestone of the Boone Formation.

The Boone Formation is underlain by the Mississippian-aged St. Joe Member, which is a light-grey crystalline limestone that has not experienced significant physical or chemical weathering and is distinct from the Boone Formation due to its lack of chert and clay.

The Boone residuum, the underlying Boone Formation cherty limestone, and the underlying St. Joe Member collectively comprise a single hydrostatic unit known as the Boone–St. Joe Aquifer. This aquifer is underlain by the Chattanooga Shale, a black, fissile shale that acts as a barrier to vertical flow from the aquifer unit above.

Geologic cross sections near the PBAP presented by Terracon (2017) are provided as **Attachment A**. These cross sections show the Boone residuum (described as silty clay on the cross sections) and cherty limestone Boone Formation underlying the clayey berm of the PBAP.

Three distinct zones of groundwater flow have been identified within the Boone–St. Joe Aquifer at the site: Uppermost, Intermediate, and Deep (AEP 2022b). Perched groundwater is occasionally present within upper unconsolidated soils but is not continuous throughout the site and does not constitute an aquifer unit. All monitoring wells in the PBAP monitoring well network monitor the uppermost aquifer, which is defined as the upper portion of the Boone Formation (Terracon, 2017).

2.3 Groundwater Monitoring Systems and Flow Conditions

The current monitoring well network (**Figure 2**) includes three background wells that are upgradient of the PBAP (AP-51, AP-53, and AP-54) and three downgradient compliance wells (AP-58A, AP-59, and AP-60).

Monitoring well AP-59 is screened entirely within competent limestone, as was monitoring well AP-58 (see cross sections in **Attachment A** and on the boring log and well construction diagrams provided in **Attachment C**). Monitoring well AP-58 was found to be irreparably damaged during the September 2022 sampling event and was replaced in November by AP-58A. Following the discovery of damage to the AP-58 well casing, the well was plugged and monitoring well AP-58A was installed approximately 10 feet south of AP-58's location and screened at the same interval (AP-58 was screened from 58.45 to 68.45 feet below ground surface [bgs], and AP-58A is screened from 61.30 to 71.30 feet bgs) (**Attachment C**). One thin fracture/void was noted at 22 feet bgs within the screened interval of AP-59. No structural features were noted within the screened intervals of AP-58 or AP-58A.

Potentiometric maps showing groundwater flow contours for the Uppermost Aquifer during the September 2022 and December 2022 sampling events are provided as **Attachment B**. The groundwater flow direction is generally to the northwest. Hydraulic connectivity within the Uppermost Aquifer was determined by Terracon (2017) to be related to multiple factors including lithology, rock type, layer thickness, and degree of bedrock fracture. Seasonal variability in the groundwater flow direction and hydraulic gradient has not been observed since the monitoring well network was installed.

3. ALTERNATIVE SOURCE DEMONSTRATION

The methods used to assess possible alternative sources of the SSIs for boron, chloride, pH, sulfate, and TDS at AP-58A and the SSI for sulfate at AP-59 and the proposed alternative sources for these SSIs are described below.

3.1 Proposed Alternative Source

3.1.1 Well AP-58A

An initial review of groundwater sampling field forms identified an alternative source for the boron, chloride, pH, sulfate, and TDS SSIs at AP-58A due to Type I (sampling) issues. As discussed in Section 2.3, well AP-58A was installed in November 2022 after it was discovered in September 2022 that well AP-58 was irreparably damaged. Boring logs and well construction diagrams for both AP-58 and AP-58A are provided in **Attachment C**. As indicated in the well installation report (**Attachment D**), well AP-58A is located approximately 10 feet south of previous well AP-58 and screened at approximately the same elevation. Thus, groundwater collected from AP-58A should reflect conditions previously observed at former well AP-58.

A Piper diagram, which represents the relative concentrations of major cations and anions in the groundwater, was created to visualize groundwater geochemistry at both AP-58 and AP-58A (**Figure 3**). The diagram indicates that groundwater samples from AP-58 did not begin to show consistency within major ion chemistry until around August 2019 (as indicated by the solid red symbols on the Piper diagram), at which point the monitoring well had equilibrated with the aquifer for approximately 3.5 years since it was installed in February 2016. The groundwater composition for the first two samples collected from AP-58A appears similar to AP-58 during the first sampling event completed after its installation in February 2016. These results suggest that both AP-58 and AP-58A require time after installation to equilibrate with the aquifer before the collected samples are representative of stable geochemical conditions. Well AP-58A was installed on November 21, 2022, developed 15 days later on December 6, 2022, and sampled for the first time six days after development on December 12, 2022. Thus, the December 2022 sampling event at AP-58A was completed 21 days after it was installed.

A comparison of concentrations of relevant parameters from various PBAP samples to both groundwater concentrations at AP-58A and the established intrawell UPLs supports the position that the SSIs observed at AP-58A should not be attributed to the PBAP. Two surface water samples with sample IDs of ‘BAP’ and ‘BAP – Near Stop Log’ were collected from the PBAP in March 2020. The PBAP was dewatered during the timeframe of interest and did not contain freestanding water. Therefore, the 2020 surface water samples are a fair basis of comparison for 2022 monitoring event groundwater conditions. The laboratory analytical report for this surface water sampling event is provided as **Attachment E**. Reported values of boron, chloride, sulfate, TDS, and pH from the PBAP samples are shown compared to the AP-58A UPL and both samples from the newly installed AP-58A (**Table 2**). Values of all parameters that contained SSIs at AP-58A were greater in AP-58A groundwater samples than in both samples collected from the PBAP. That concentrations of all parameters of interest were lower in samples from the PBAP water than in samples collected at AP-58A indicates that the PBAP is not a source of the apparent elevated concentrations of boron, chloride, sulfate, TDS, and pH in groundwater from new AP-58A.

3.1.2 Well AP-59

An initial review of groundwater sampling field forms, site geochemistry, site historical data, and laboratory and statistical analyses did not identify alternative sources for sulfate at AP-59 due to Type I (sampling), Type II (laboratory), or Type III (statistical evaluation) issues. Further, an initial review of site geochemistry did not identify evidence of any Type V (anthropogenic) impacts. As described below, the SSI observed at monitoring well AP-59 has been attributed to natural variation within the underlying geology, which is a Type IV cause.

Sulfate concentrations at background wells AP-53 and AP-54, which are located upgradient of the PBAP and AP-59, have historically been similar to or greater than those observed at AP-59 (**Figure 4**). Although sulfate concentrations from the most recent sampling event at AP-53 and AP-54 are lower than the reported concentration from the most recent event at AP-59, both upgradient wells have demonstrated considerable variability in sulfate concentrations since monitoring began in 2016 (**Figure 4**). Historical sulfate values at upgradient monitoring wells indicate that aqueous sulfate concentrations fluctuate over time in some locations upgradient of the PBAP and are comparable to the concentrations that have been observed at compliance well AP-59. Further, the highest concentration at AP-59 that has been reported (77.7 milligrams per liter [mg/L]) falls within the range of historical values for background wells (maximum of 78 mg/L at AP-54 in July 2016).

Regional groundwater quality of the Boone–St. Joe Limestone Aquifer in Benton County, Arkansas (the county in which the PBAP is located) has previously been studied (Ogden 1979). A total of 253 groundwater samples from wells in Benton County screened within the Boone–St. Joe Aquifer were sampled and analyzed as part of the study. These samples revealed variability in sulfate concentrations. Ogden (1979) reported sulfate concentrations up to 124.50 mg/L in select wells in the county.

Ogden (1979) identified a positive correlation between sulfate and calcium concentrations in groundwater. This relationship was also observed in AP-59 groundwater data since monitoring began in 2016 (**Figure 5**). Ogden hypothesized that this relationship is likely a product of iron-sulfide mineral oxidation. Oxidation of pyrite within the Boone–St. Joe Aquifer would yield sulfuric acid as a reaction product, the dissociation of which would result in an increase in aqueous sulfate and hydrogen ions (decrease in groundwater pH) which would in turn cause dissolution of the calcite that makes up the limestone aquifer. Oxidation-reduction (redox) conditions of AP-59 groundwater favor the thermodynamic stability of iron oxyhydroxides (**Figure 6**), indicating that iron sulfide minerals, if present as aquifer solids, would be expected to undergo this oxidation reaction.

The limestone lithology present at AP-59 was evaluated to develop the geologic conceptual site model for previous ASD reports and geochemical investigations (Geosyntec 2020b; included in AEP 2022b). Limestone at downgradient well locations was determined to be unpassivated and capable of buffering incoming acidic waters via dissolution of calcite (Geosyntec 2018, Geosyntec 2019, Geosyntec 2021a, Geosyntec 2021b, Geosyntec 2022b). This illustrated conceptual site model is shown on **Figure 7**. If iron sulfide oxidation reactions were occurring in the limestone near AP-59, increases in aqueous sulfate and calcium would be expected. Increases in calcium are occasionally observed at AP-59, as documented in previous ASD reports for this well (Geosyntec, 2021b).

A comparison of sulfate concentrations measured in surface water samples collected in March 2020 from various locations within the PBAP and nearby SWEPCO Reservoir also supports the position that the recent elevated concentrations of sulfate at AP-59 should not be attributed to the PBAP (**Attachment E**). Reported sulfate concentrations of 39.5 milligrams per liter (mg/L) (sample ID – BAP) and 16.2 mg/L (sample ID – BAP Near Stop Log) for the samples collected from the PBAP, and a sample collected from SWEPCO Reservoir (referred to as SWEPCO Lake in the laboratory report), contained a reported sulfate concentration of 35.0 mg/L. All three of these samples contain sulfate concentrations lower than the UPL for sulfate at AP-59 (50.1 mg/L) and the two samples from the recent detection monitoring event for the PBAP that triggered the SSI (53.9 mg/L and 77.7 mg/L). Lower concentrations of sulfate in the PBAP water than in groundwater at downgradient compliance well AP-59 indicate that the PBAP is not anticipated to act as a source for the recent elevated sulfate concentrations in groundwater.

3.2 Sampling Requirements

The ASD described above supports the position that the identified SSIs at downgradient wells AP-58A are due to sampling issues, that the identified SSI for sulfate at AP-59 is a product of natural variation within the uppermost aquifer, and that none of the identified SSIs are due to a release from the Flint Creek PBAP. Therefore, the unit will remain in the detection monitoring program. Groundwater at the unit will continue to be sampled for Appendix III parameters.

4. CONCLUSIONS AND RECOMMENDATIONS

The preceding information serves as the ASD prepared in accordance with 40 CFR 257.94(e)(2) and supports the position that the SSIs for boron, chloride, pH, sulfate, and TDS at AP-58A and for sulfate at AP-59 during the second semiannual detection monitoring event of 2022 should be attributed to natural variation or sampling issues and not to a release from the Flint Creek PBAP. Therefore, no further action is warranted, and the Flint Creek PBAP will remain in the detection monitoring program. Certification of this ASD by a qualified professional engineer is provided in **Attachment F**.

5. REFERENCES

AEP. 2022a. *Notification of Intent to Close a CCR Unit. Flint Creek Plant – Primary Bottom Ash Pond*. American Electric Power. November.

AEP. 2022b. *Second Quarter 2022 Groundwater Analysis Report. Southwestern Electric Power Company. Flint Creek Power Station. Class 3N Landfill. Gentry, Arkansas*. American Electric Power. September.

AEP. 2023. *Annual Groundwater Monitoring Report. Southwestern Electric Power Company. Flint Creek Power Plant. Primary Bottom Ash Pond CCR Management Unit.* American Electric Power. January.

EPRI. 2017. *Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Sites*. 3002010920. Electric Power Research Institute. October.

Geosyntec. 2018. *Alternative Source Demonstration Report, Federal CCR Rule. Primary Bottom Ash Pond – Flint Creek Plant*. Geosyntec Consultants, Inc. April.

Geosyntec. 2019. *Alternative Source Demonstration Report, Federal CCR Rule. Primary Bottom Ash Pond – Flint Creek Plant*. Geosyntec Consultants, Inc. November.

Geosyntec. 2020a. *Statistical Analysis Plan*. Geosyntec Consultants, Inc. October.

Geosyntec. 2020b. *Flint Creek PBAP Geochemical Investigation Results*. Geosyntec Consultants, Inc. December.

Geosyntec. 2021a. *Alternative Source Demonstration Report, Federal CCR Rule. Primary Bottom Ash Pond – Flint Creek Plant*. Geosyntec Consultants, Inc. August.

Geosyntec. 2021b. *Alternative Source Demonstration Report, Federal CCR Rule. Primary Bottom Ash Pond – Flint Creek Plant*. Geosyntec Consultants, Inc. November.

Geosyntec. 2022a. *Statistical Analysis Summary. Primary Bottom Ash Pond – Flint Creek Plant*. Geosyntec Consultants, Inc. January.

Geosyntec. 2022b. *Alternative Source Demonstration Report, Federal CCR Rule. Primary Bottom Ash Pond – Flint Creek Plant*. Geosyntec Consultants, Inc. February.

Ogden, A.E. 1979. *Hydrogeologic and Geochemical Investigation of the Boone-St. Joe Limestone Aquifer in Benton County, Arkansas*. Arkansas Water Resources Center. Publication No. PUB-0068.

Terracon. 2017. *Report 1 – Groundwater Monitoring Network for CCR Compliance. SWEPCO – Flint Creek Primary Bottom Ash Pond*. October.

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

TABLES

Table 1: Detection Monitoring Data Evaluation
Flint Creek - Primary Bottom Ash Pond

Geosyntec Consultants

Analyte	Unit	Description	AP-58A		AP-59		AP-60	
			12/12/2022	3/6/2023	9/20/2022	3/6/2023	9/20/2022	3/6/2023
Boron	mg/L	Intrawell Background Value (UPL)	0.276		0.368		1.68	
		Analytical Result	**1.23**	**1.20**	0.336	--	0.756	--
Calcium	mg/L	Intrawell Background Value (UPL)	86.8		53.9		49.9	
		Analytical Result	20.6	--	41.7	--	**54.3**	0.47
Chloride	mg/L	Intrawell Background Value (UPL)	10.2		18.0		17.4	
		Analytical Result	**22.1**	**18.6**	15.4	--	11.9	--
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00		0.765		0.681	
		Analytical Result	0.59	--	0.48	--	0.59	--
pH	SU	Intrawell Background Value (UPL)	8.7		7.6		10.8	
		Intrawell Background Value (LPL)	6.2		6.7		6.5	
		Analytical Result	**8.9**	**9.0**	7.1	--	8.7	--
Sulfate	mg/L	Intrawell Background Value (UPL)	90.3		50.1		190	
		Analytical Result	**164**	**134**	**53.9**	**77.7**	118	--
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	333		266		397	
		Analytical Result	**400**	**410**	250	--	330	--

Notes:
Bold values exceed the background value.
Background values are shaded gray.
The UPLs shown for AP-58A were calculated using AP-58 data, as AP-58A was installed to replace AP-58 following damage to the well.
LPL: lower prediction limit
mg/L: milligrams per liter
SU: standard units
UPL: Upper prediction limit
--: Not measured

Table 2: Relevant Parameter Comparison
Flint Creek - Primary Bottom Ash Pond

Geosyntec Consultants

Source	Sample Date	Parameter				
		Boron	Chloride	Sulfate	TDS	pH
AP-58A UPL	N/A	0.276	10.2	90.3	333	8.7
BAP	2/25/2020	0.246	11.0	39.5	217	8.7
BAP Near Stop Log	2/25/2020	0.0688	7.92	16.2	155	7.2
AP-58A	12/22/2022	1.23	22.1	164	400	8.9
AP-58A	3/6/2023	1.20	18.6	134	410	9.0

Notes:
All parameters are shown in units of milligrams per liter, except for pH, which is shown in standard units.
1. Results greater than the AP-58A UPL are highlighted in red and results lower than the AP-58A UPL are highlighted in green. Equal results are highlighted yellow.
BAP: Bottom Ash Pond
N/A: not applicable
TDS: total dissolved solids
UPL: upper prediction limit

FIGURES

Notes:

1. Photograph taken looking southwest on July 25, 2023 prior to the completion of CCR removal.
2. AP-58A is located on the center dike shown in the photograph.

PBAP Site Photograph

Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

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Figure **1**

Columbus, Ohio

September 2023

internal info: path, date revised, author

Legend

- Monitoring Wells

Notes

1. Monitoring well coordinates were collected December 12, 2022; data provided by AEP.
2. AP-58 had irreparable damage and was replaced by well AP-58A.
3. Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon 2017) provided by AEP.

200 100 0 200 Feet

Site Layout

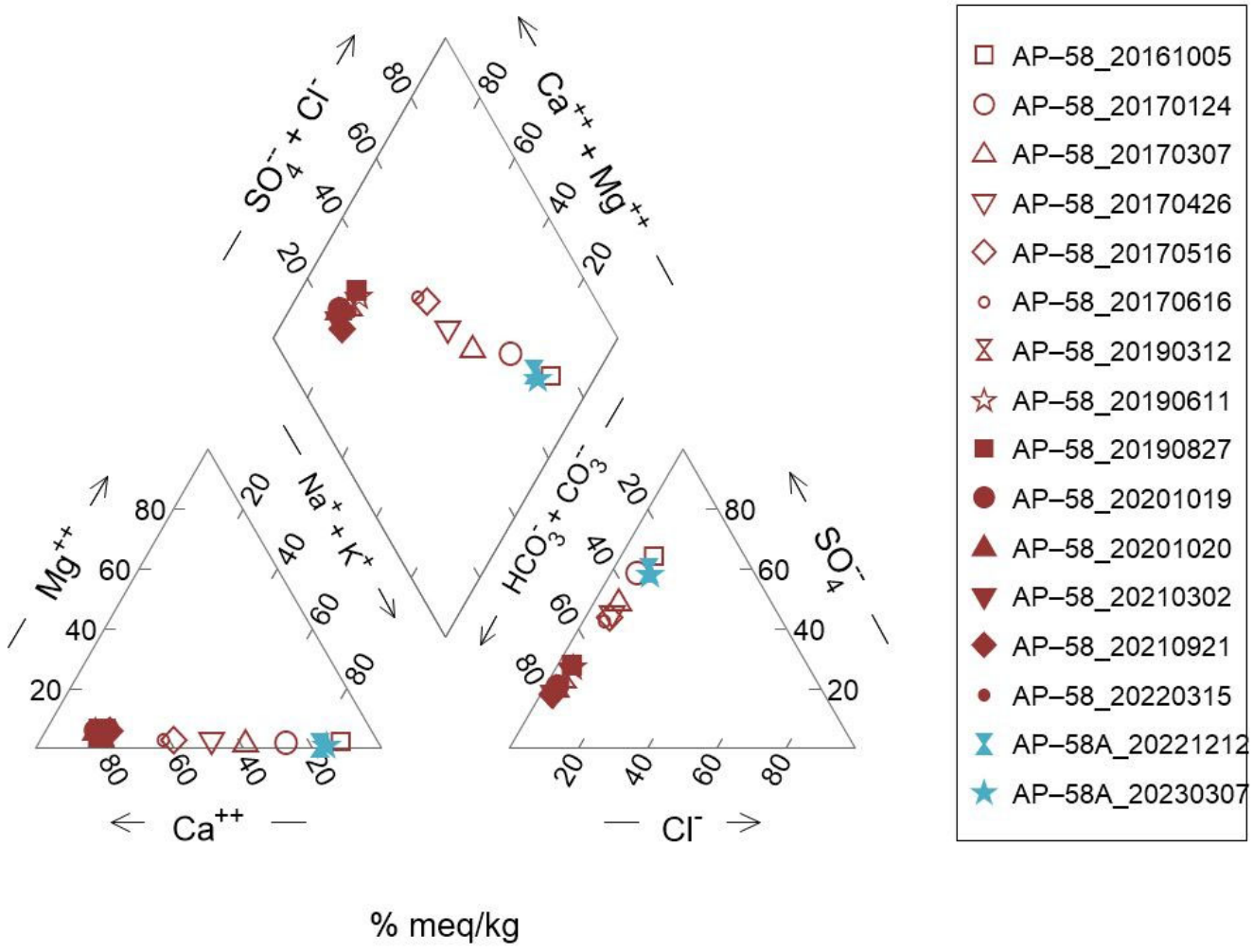
AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

Geosyntec consultants

Columbus, Ohio | 2023/09/11

Figure **2**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2022\Flint Creek PBAP Site Layout_ASD.mxd. hduff. 9/11/2023. CHA8423/01/08.



% meq/kg

Notes:
1. Samples from AP-58 and AP-58A that were analyzed for all major ions are shown on the Piper diagram in units of percentage of milliequivalents per kilogram (% meq/kg) for major cations (bottom left triangle) and major anions (bottom right triangle).

Piper Diagram
Flint Creek Primary Bottom Ash Pond

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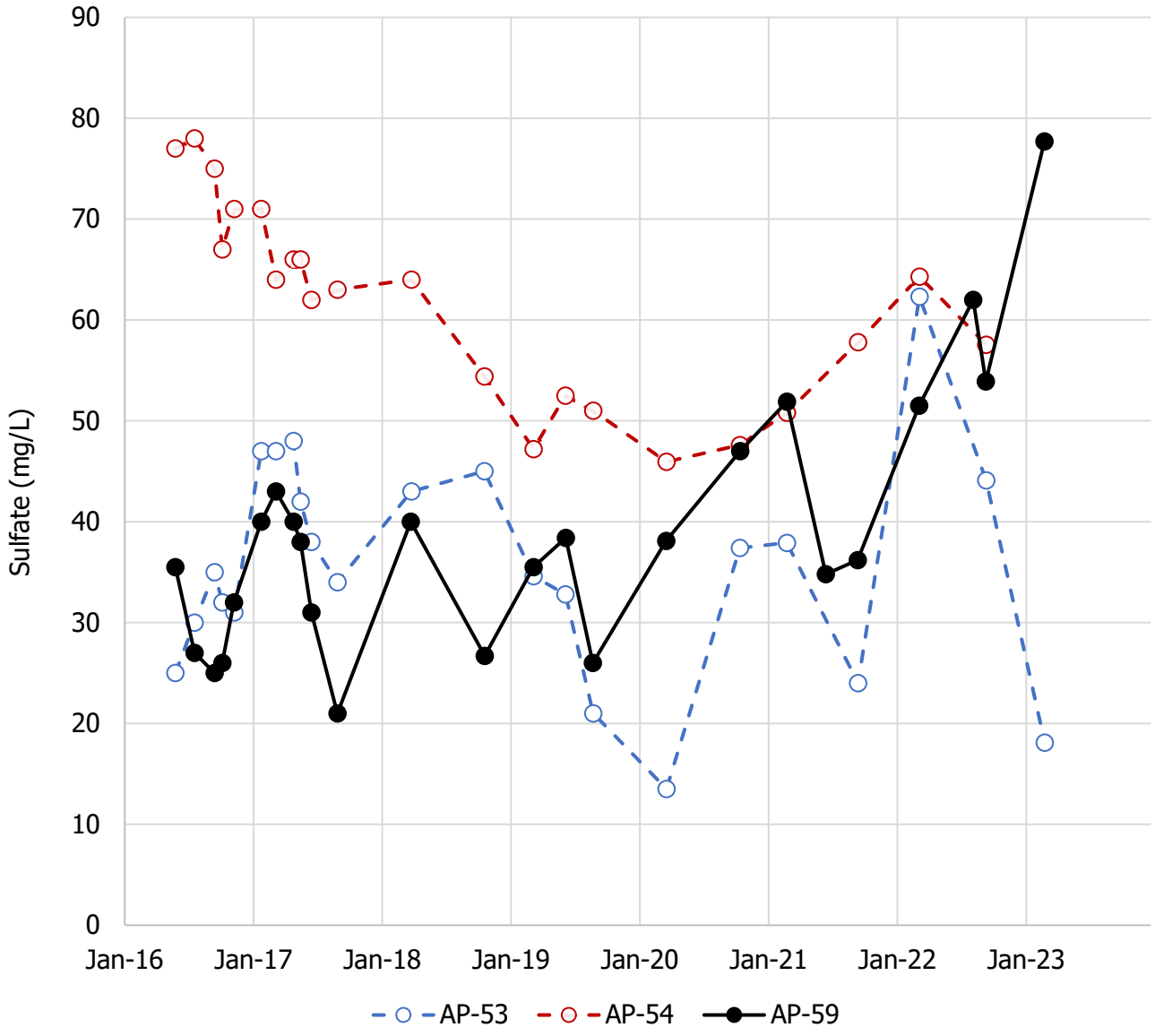
Columbus, Ohio | September 2023

Figure **3**

internal info: path, date revised, author



Notes:
1. Total sulfate concentrations are shown for compliance well AP-59 and upgradient background wells AP-53 and AP-54.
2. AP-54 could not be sampled in March 2023 due to insufficient volume in the well.

mg/L: milligrams per liter

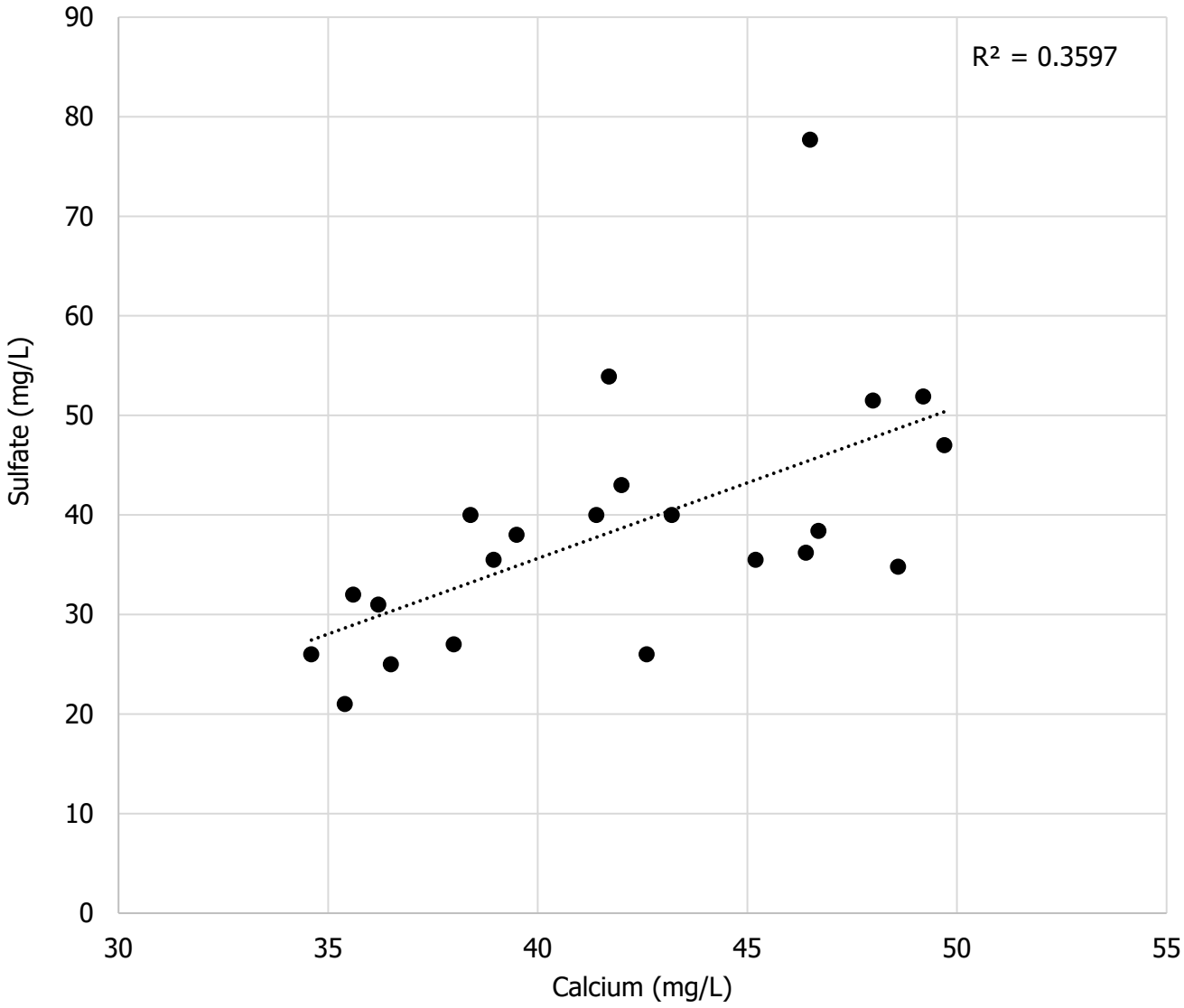
Sulfate Comparison to Background Monitoring Wells
Flint Creek Primary Bottom Ash Pond

Geosyntec consultants | AMERICAN ELECTRIC POWER

Columbus, Ohio | September 2023

Figure **4**

internal info: path, date revised, author



Notes:
1. Total calcium and sulfate concentrations from individual sampling events are displayed.

mg/L: milligrams per liter

AP-59 Calcium vs. Sulfate Scatter Plot
Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

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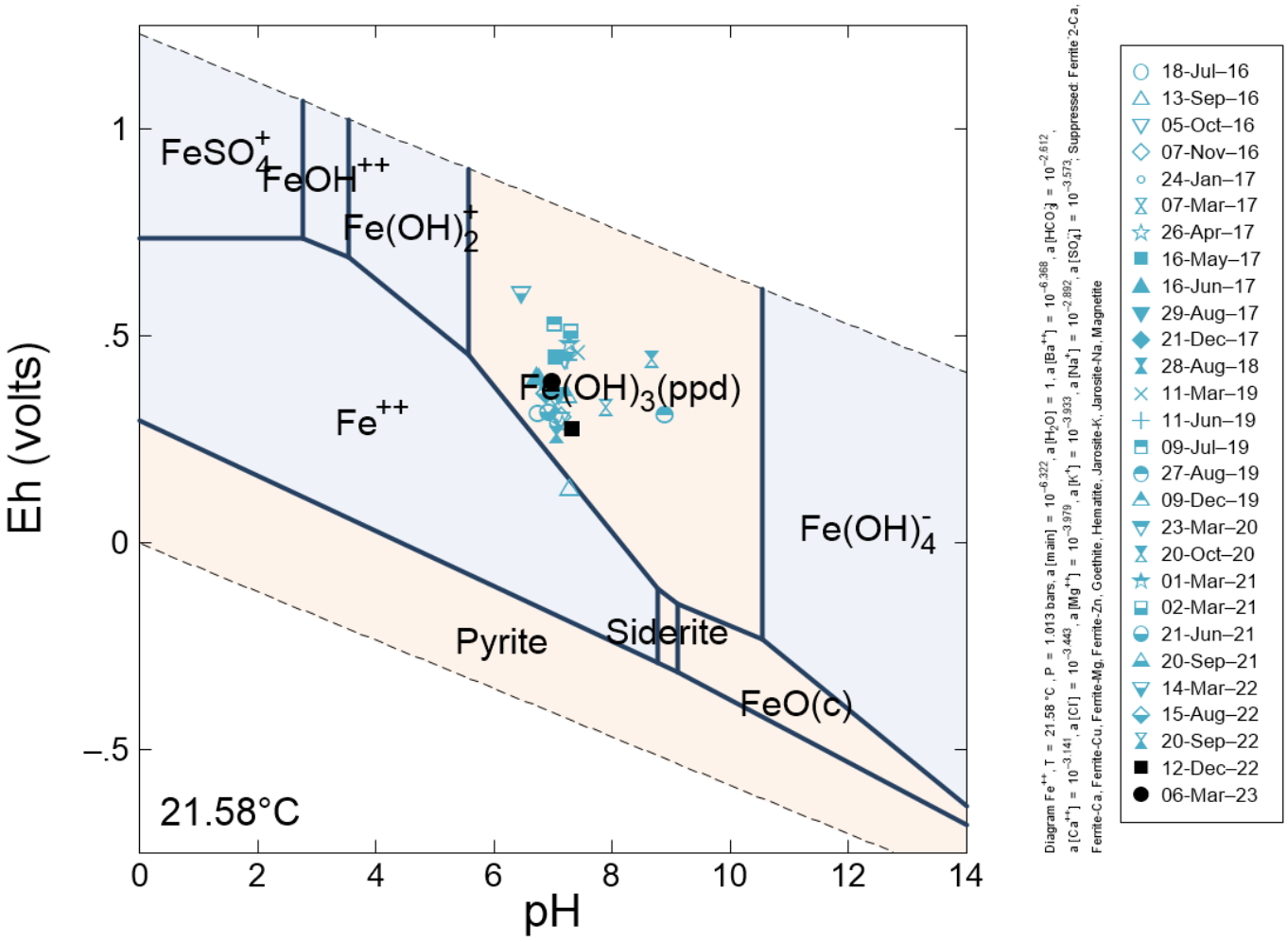
Figure **5**

Columbus, Ohio

September 2023

internal info: path, date revised, author



Notes:
1.Average groundwater temperature and concentrations of major cations and anions at AP-59 since monitoring began in 2016 were used to establish baseline conditions for the diagram.
2. Eh and pH values for sampling dates at AP-59 are shown on the diagram.
3. Crystalline iron oxyhydroxide phases hematite, goethite, magnetite, and ferrite are less likely to form and are suppressed in the diagram to show the stability field of amorphous iron oxyhydroxide $Fe(OH)_3$(ppd).

AP-59 Iron Eh-pH Diagram
Flint Creek Primary Bottom Ash Pond

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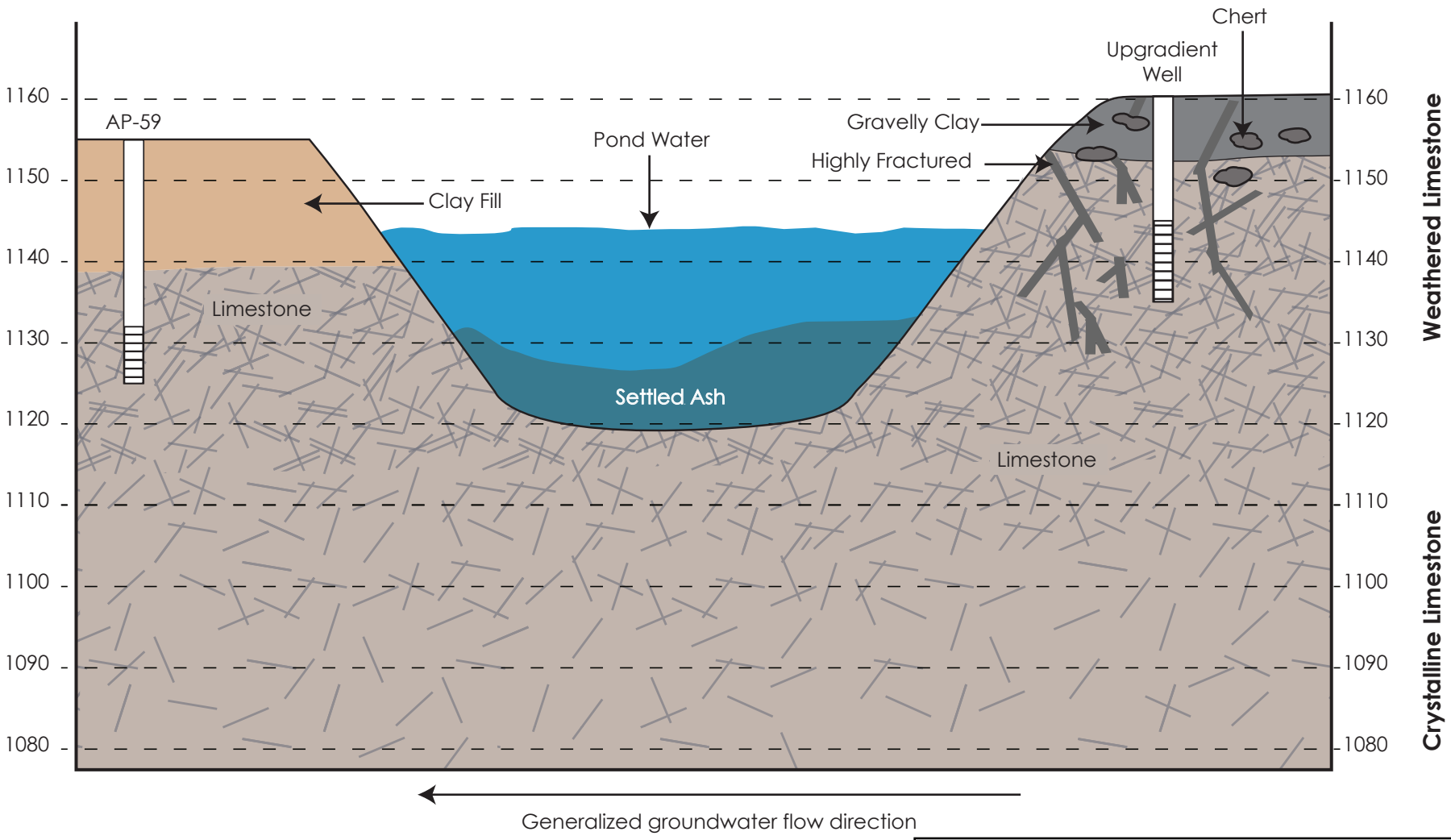
Columbus, Ohio | September 2023

Figure 6



Not to Scale

Site Geology Illustration
Flint Creek Primary Bottom Ash Pond

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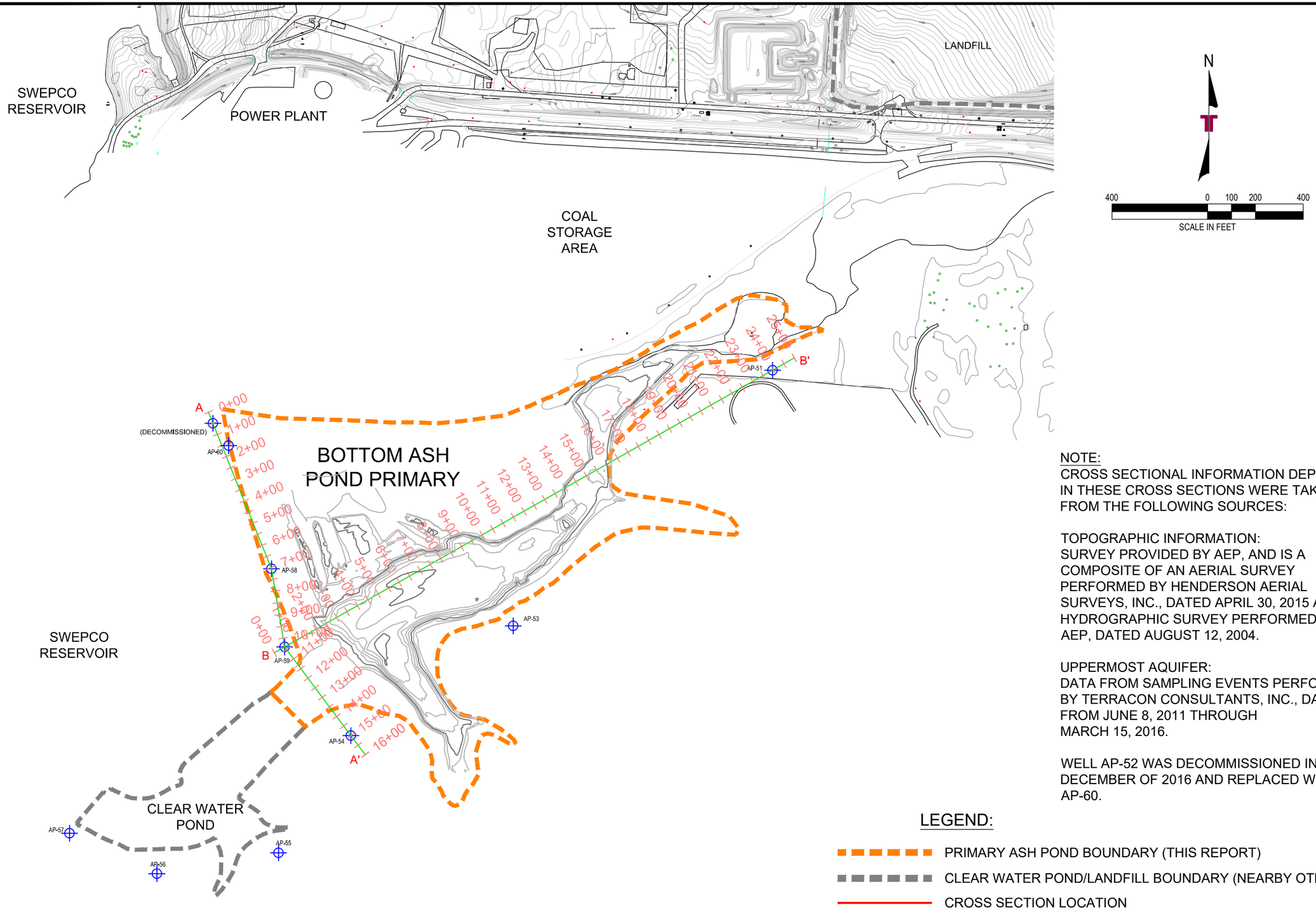
Columbus, Ohio

September 2023

Figure 7

FlintCreekIllustration_July2021_CHA8495.ai

ATTACHMENT A
Geologic Cross Sections



N

400 0 100 200 400

SCALE IN FEET

NOTE:
CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WERE TAKEN FROM THE FOLLOWING SOURCES:

TOPOGRAPHIC INFORMATION:
SURVEY PROVIDED BY AEP, AND IS A COMPOSITE OF AN AERIAL SURVEY PERFORMED BY HENDERSON AERIAL SURVEYS, INC., DATED APRIL 30, 2015 AND A HYDROGRAPHIC SURVEY PERFORMED BY AEP, DATED AUGUST 12, 2004.

UPPERMOST AQUIFER:
DATA FROM SAMPLING EVENTS PERFORMED BY TERRACON CONSULTANTS, INC., DATING FROM JUNE 8, 2011 THROUGH MARCH 15, 2016.

WELL AP-52 WAS DECOMMISSIONED IN DECEMBER OF 2016 AND REPLACED WITH AP-60.

LEGEND:

- PRIMARY ASH POND BOUNDARY (THIS REPORT)
- CLEAR WATER POND/LANDFILL BOUNDARY (NEARBY OTHERS)
- CROSS SECTION LOCATION
- MONITORING WELL

SHEET 1

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DOM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.:	216-001-35157124
ACAD NO.	001
SHEET NO.:	1 OF 2

CROSS SECTION LOCATION MAP

GROUNDWATER MONITORING NETWORK EVALUATION

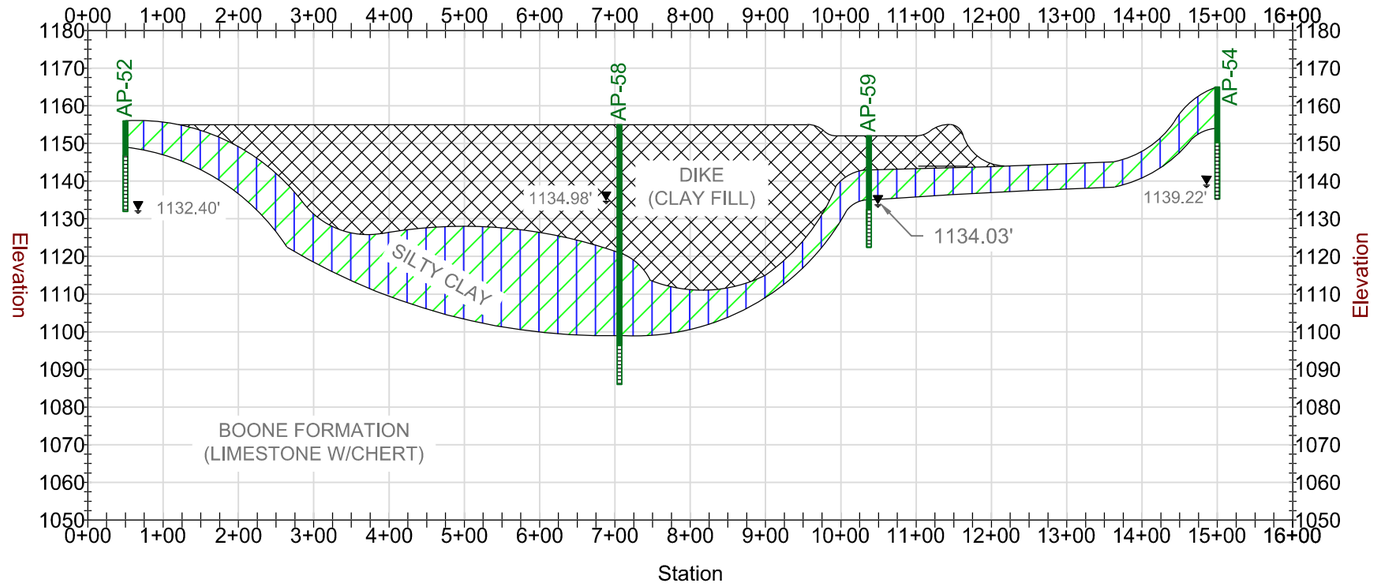
AMERICAN ELECTRIC POWER

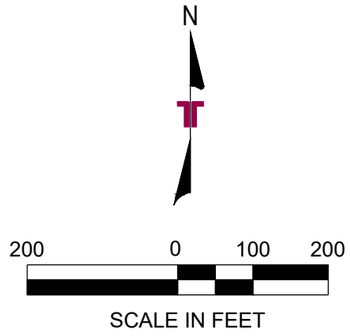
SWEPCO FLINT CREEK POWER PLANT BOTTPONDOM ASH
GENTRY ARKANSAS

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH BRYANT, AR 72022
PH. (501) 847-9292 FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

ALIGN- A-A'

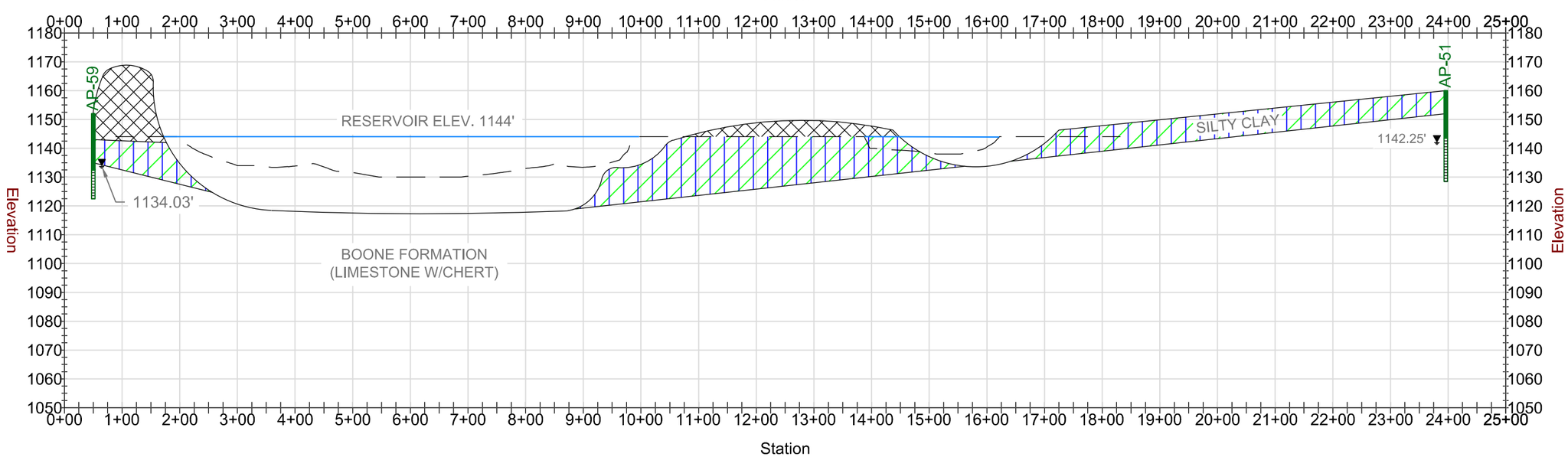




LEGEND:

- DIKE (CLAY FILL)
- SILTY CLAY

ALIGN- B-B'



SHEET 2

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DOM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.	216-001-35157124
ACAD NO.	001
SHEET NO.:	2 OF 2

CROSS SECTION A-A' & B-B'

GROUNDWATER MONITORING NETWORK EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEK POWER PLANT BOTTPONDOM ASH
GENTRY ARKANSAS

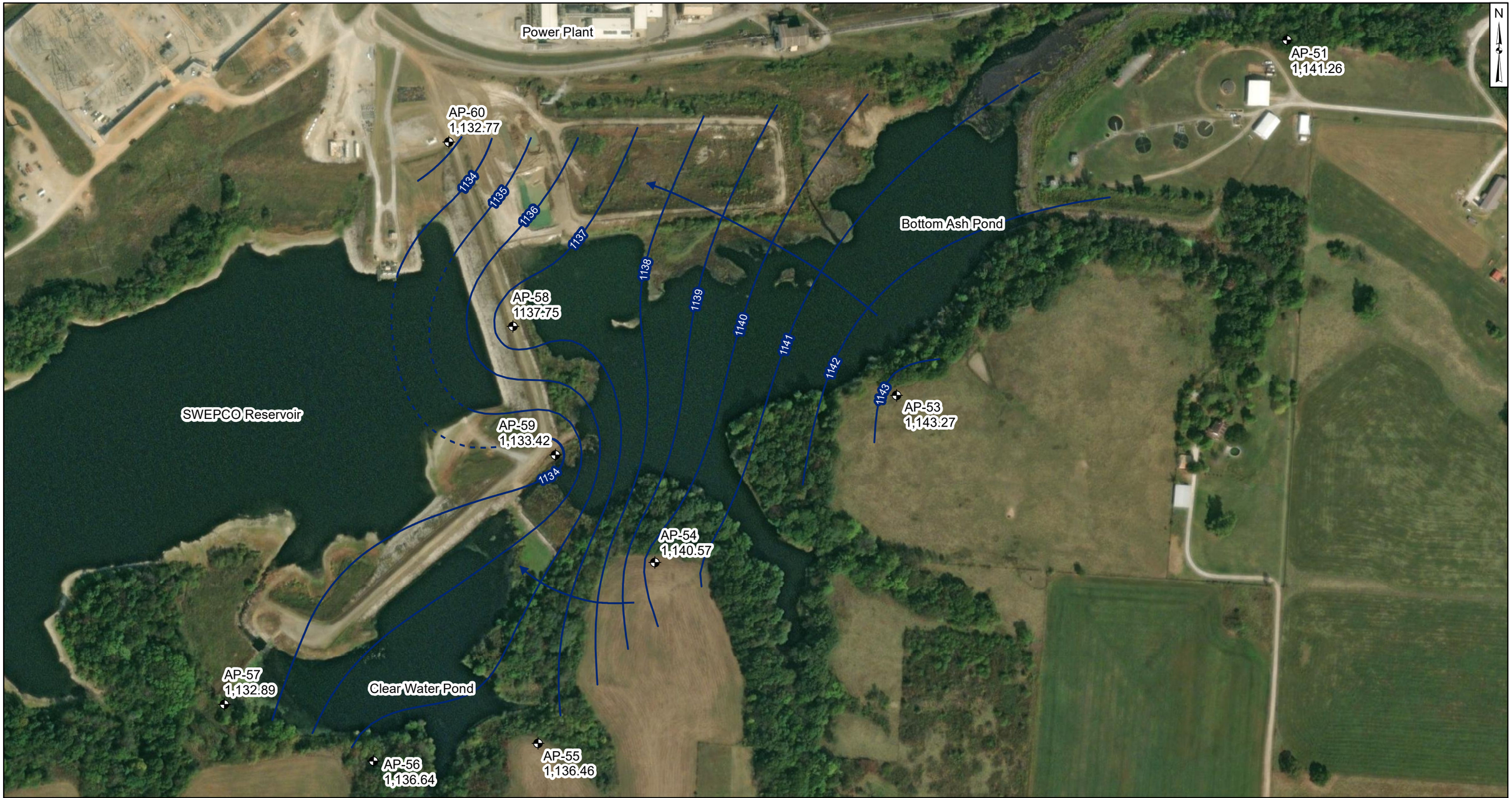
Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH
BRYANT, AR 72022
PH. (501) 847-9292
FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

ATTACHMENT B

Potentiometric Surface Maps, Uppermost Aquifer
September 2022 and December 2022

Map was previously provided in AEP. 2023. *Annual Groundwater Monitoring Report. Southwestern Electric Power Company, Flint Creek Power Plant, Primary Bottom Ash CCR Management Unit.* American Electric Power. January.



Legend

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

Notes

- Monitoring well coordinates and water level data were collected September 20, 2022 provided by AEP.
- Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon, 2017) provided by AEP.
- Groundwater elevation units are feet above mean sea level.

200 100 0 200 Feet

Potentiometric Surface Map
Uppermost Aquifer - September 2022

AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

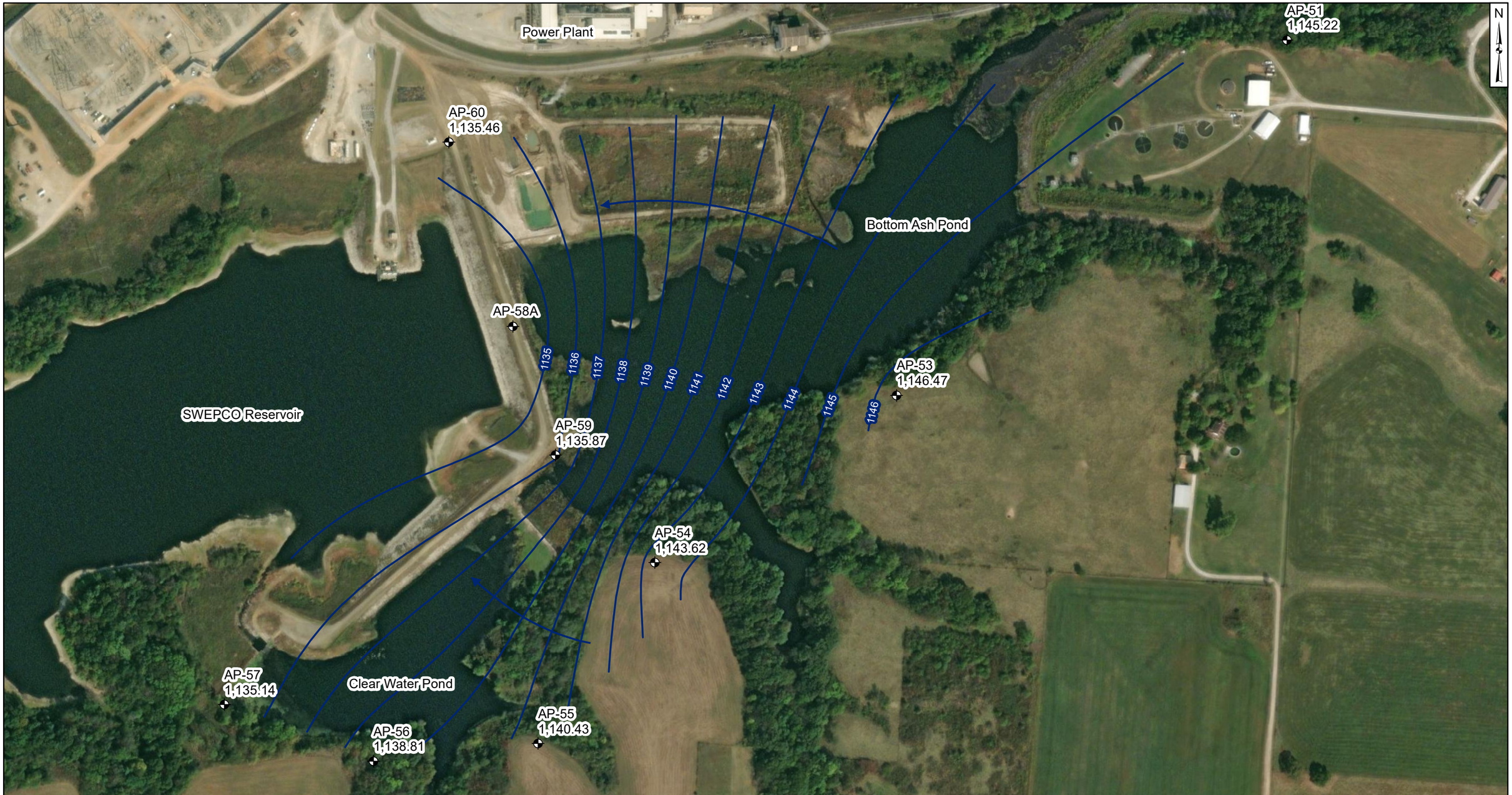
Geosyntec consultants

Columbus, Ohio | 2023/01/26

Figure **3**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2022\AEP-Flint Creek_GW_BAP_Sept2022.mxd. HDuff. 1/26/2023. CHA8423/01/08.

Map was previously provided in AEP. 2023. *Annual Groundwater Monitoring Report - Southwestern Electric Power Company, Flint Creek Power Plant, Primary Bottom Ash CCR Management Unit.* American Electric Power. January.



Legend

- Monitoring Wells
- Groundwater Contour Elevation
- Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data were collected December 12, 2022 provided by AEP.
- AP-58 was found irreparably damaged in September 2022 and was replaced by well AP-58A.
- AP-58A survey and associated water level data not yet available. The approximate well location is shown.
- Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon, 2017) provided by AEP.
- Groundwater elevation units are feet above mean sea level.

200 100 0 200 Feet

Potentiometric Surface Map
Uppermost Aquifer - December 2022

AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

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Columbus, Ohio | 2023/01/26

Figure **4**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2022\AEP-Flint Creek_GW_BAP_Dec2022.mxd. HDuff. 1/26/2023. CHA8423/01/08.

ATTACHMENT C
AP-58, AP-58A, and AP-59 Boring Logs and Well Construction Diagrams

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PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: AP-58 PAGE: 1 of 2

TOTAL DEPTH: 69 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35157182-002	DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: ADAM HOOPER	DRILLER: GARY MOYERS
DATE DRILLED: 2/16/2016	RIG TYPE: CME 75 BUGGY

DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY

SAMPLING METHOD: 5' CONTINUOUS SAMPLER - LOGGED BY CUTTINGS

N: N/A E: N/A G.S. ELEV. N/A

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
			Flush - mounted boring
0	0'-15' SILTY CLAY - FILL brown and red, poor sample return		
15	15'-56' SILTY CLAY red, moist zones at 30' - 40' and 45' - 50'		
20			
25			
30			

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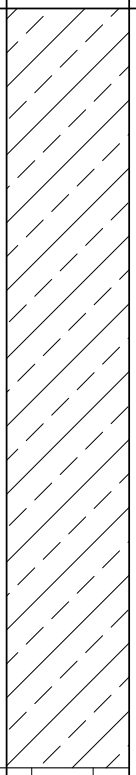
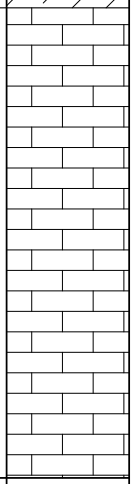
FIELD BORING LOG

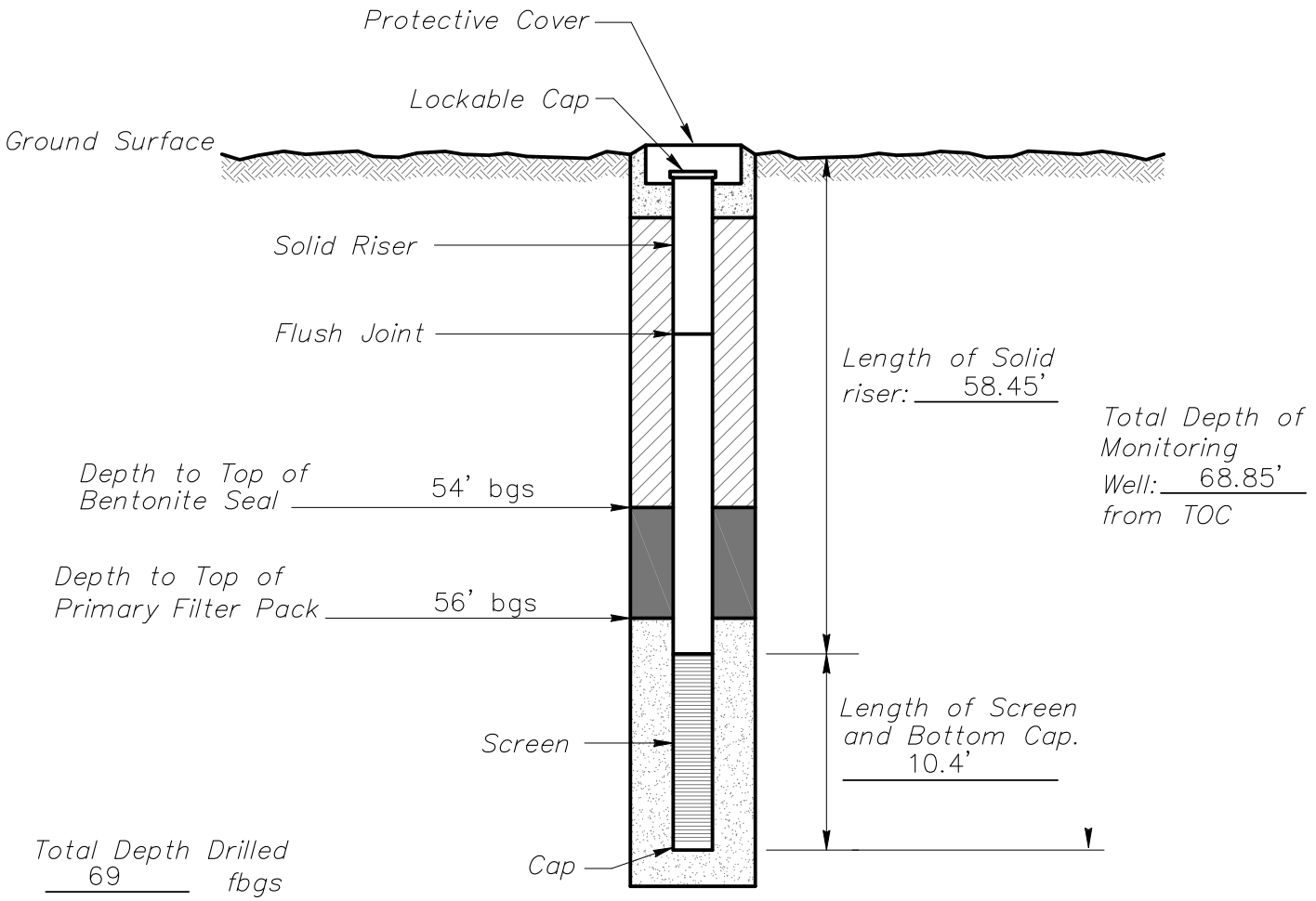
BORING NO.: AP-58 PAGE: 2 of 2

TOTAL DEPTH: 69 FEET BELOW GROUND SURFACE (BGS)

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
40	15'-56' SILTY CLAY red, moist zones at 30' - 40' and 45' - 50'		
45			
50			
55			56' - 59' bgs logged by cuttings
60	56'-69' LIMESTONE gray, crystalline		
65			
70	Total Depth of Boring at 69' bgs		
75			

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION Well Number AP–58
Job Number 35157182 Installation Date 2/16/2016 Location AEP–FLINT CREEK –GENTRY, AR.
Datum Elevation NA Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010
Riser Diameter & Material 2" PVC Borehole Diameter 8"
Granular Backfill Material 16–30 SAND Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor ANDERSON ENGINEERING



Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35157182
WELL NUMBER: AP–58
DRAWING NUMBER: 006 CHECKED BY: MR

Terracon
25809 Interstate 30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: AP-58A PAGE: 1 of 2

TOTAL DEPTH: 71.7' FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35237104-001	DRILLING CO.: SUNBELT
LOGGED BY: JOSH RAY	DRILLER: NEAL FARRAR AR License #C001451
DATE DRILLED: 11/21/2022	RIG TYPE: CME 75 BUGGY

DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY

SAMPLING METHOD: 5' CONTINUOUS SAMPLER / AIR ROTARY

N: 707805.248 E: 1255854.857 G.S. ELEV. 1155.71

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
0	0'-15' SILTY CLAY - FILL brown and red, poor sample return		
15	15'-55' SILTY CLAY red, moist zones at 40'		
30			

Terracon
25809 Interstate 30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

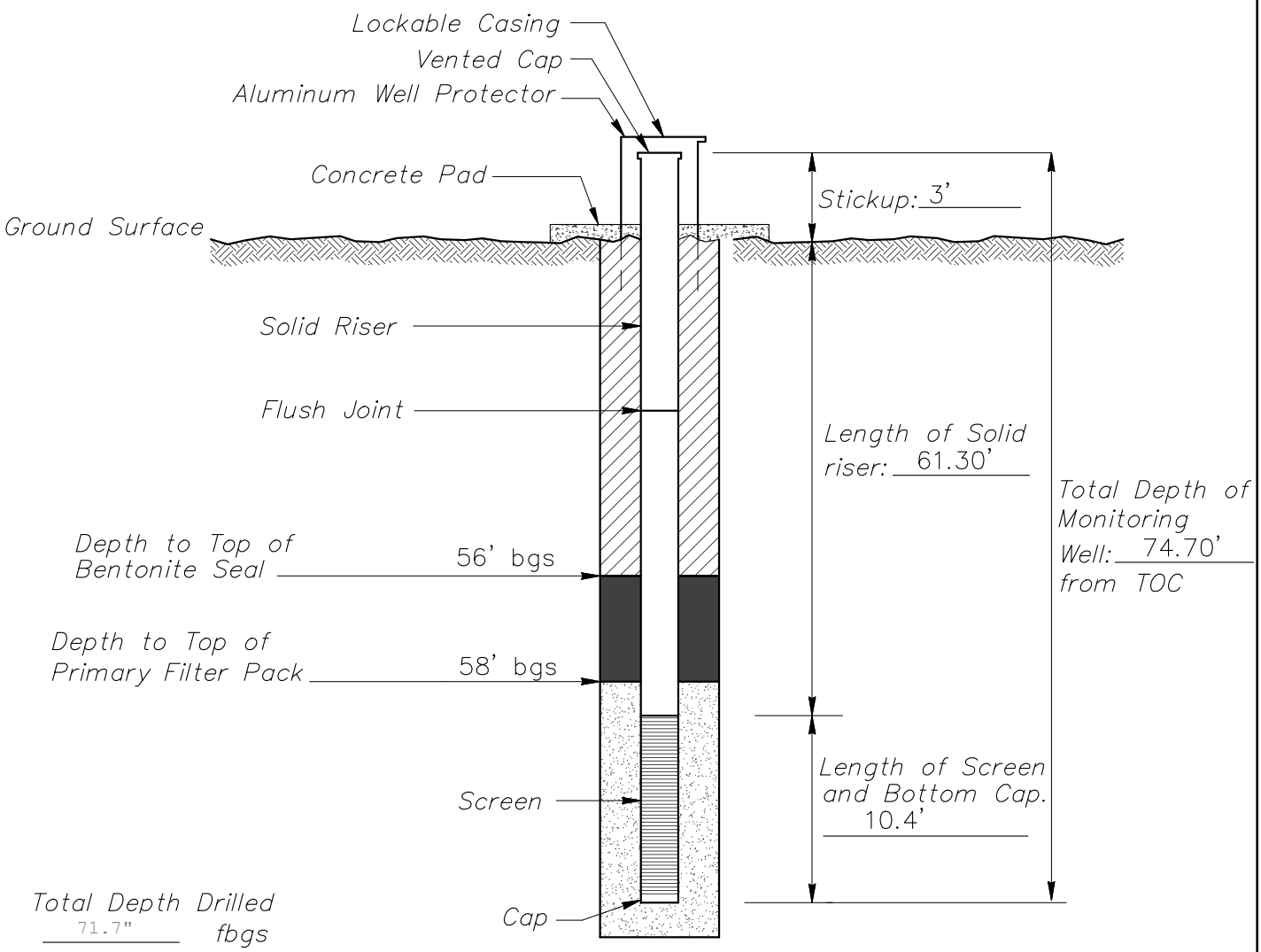
BORING NO.: AP-58A PAGE: 2 of 2

TOTAL DEPTH: 71.7' FEET BELOW GROUND SURFACE (BGS

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
	15'-55' SILTY CLAY red, moist zones at 40'		
40			
45			
50			Groundwater encountered above bedrock, and rose to static level of 20.90' below TOC
55	55'-70' LIMESTONE gray, crystalline		55' - 70' bgs logged by cuttings, wet
60			
65			
70	Total Depth of Boring at 71.7' bgs		
75			

MONITORING WELL INSTALLATION RECORD

Job Name: FLINT CREEK – CCR WELL INSTALLATION
Well Number: AP–58A
Job Number: 35237104
Installation Date: 11/21/2022
Location: AEP–FLINT CREEK–GENTRY, AR.
Datum Elevation: 1158.57' NGVD29 Vertical Datum
Surface Elevation: 1155.71' NGVD29 Vertical Datum
Datum for Water Level Measurement: T.O.C.
Screen Diameter & Material: 2" PVC
Slot Size: 0.010"
Riser Diameter & Material: 2" PVC
Borehole Diameter: 8"
Granular Backfill Material: 16–30 SAND
Terracon Representative: JOSH RAY
Drilling Method: HOLLOW STEM AUGER AND AIR ROTARY
Drilling Contractor: SUNBELT



Portland/Bentonite Grout

Bentonite Pellet Plug

Granular Backfill

(Not to Scale)

Terracon

MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216–001–35237104
WELL NUMBER: AP–58A
DRAWING NUMBER: 002
CHECKED BY: MR

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: AP-59 PAGE: 1 of 1

TOTAL DEPTH: 30 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35157182-001	DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: ADAM HOOPER	DRILLER: GARY MOYERS
DATE DRILLED: 2/3/2016	RIG TYPE: CME 75 BUGGY

DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY

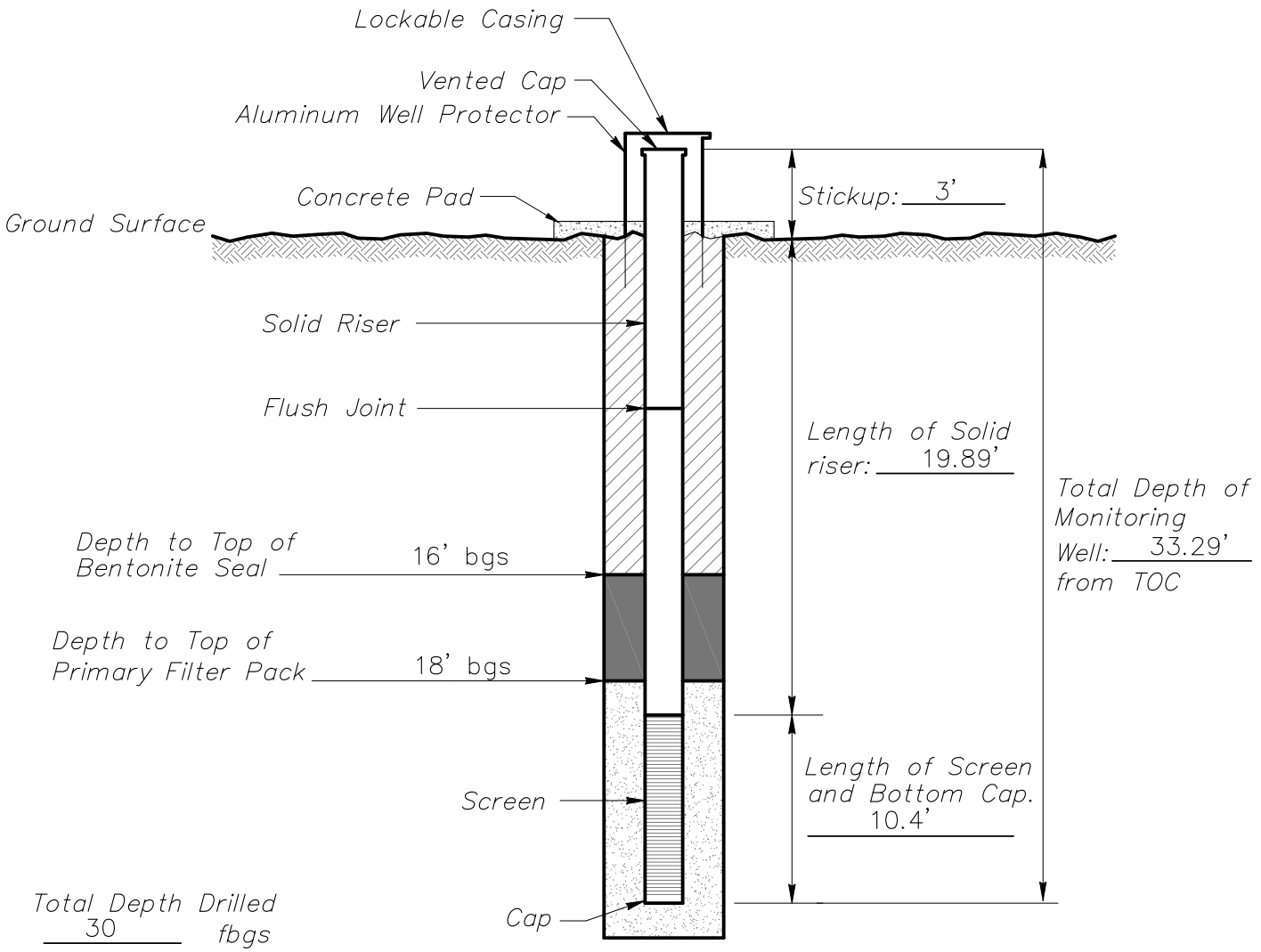
SAMPLING METHOD: 5' CONTINUOUS SAMPLER - LOGGED BY CUTTINGS

N: N/A E: N/A G.S. ELEV. N/A

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
0	0'-8.5' SILTY CLAY - FILL red and brown		
5			
10	8.5'-14.5' LIMESTONE and SILTY CLAY hard while drilling		
15	14.5'-17' SILTY CLAY red		Moisture at top of rock at 17' bgs
20	17'-30' LIMESTONE light gray, crystalline, thin fracture/void at 22' bgs		Water at 22' bgs 17' - 30' Logged by cuttings
25			
30	Total Depth of Boring at 30' bgs		

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION Well Number AP-59
Job Number 35157182 Installation Date 2/4/2016 Location AEP-FLINT CREEK -GENTRY, AR.
Datum Elevation NA Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010
Riser Diameter & Material 2" PVC Borehole Diameter 8"
Granular Backfill Material 16-30 SAND Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor ANDERSON ENGINEERING



Portland/Bentonite Grout

Bentonite Pellet Plug

Granular Backfill

(Not to Scale)

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216-001-35157182
WELL NUMBER: AP-59
DRAWING NUMBER: 005 CHECKED BY: MR

ATTACHMENT D
AP-58A Well Replacement Report

September 11, 2023

American Electric Power
ATTN: Scott Carney, Plant Environmental Coordinator
21797 SWEPCO Plant Road
Gentry, AR 72734

Subject: **Installation of Replacement Well AP-58A**
Flint Creek Primary Bottom Ash Pond
Gentry, Arkansas
Terracon Project 35227269

Dear Mr. Carney:

Terracon Consultants Inc. (Terracon) is pleased to present the report of plugging one monitoring well (AP-58) and replacing the well with AP-58A at the above referenced facility.

PROJECT BACKGROUND

A monitoring well (AP-58) associated with the Flint Creek Primary Bottom Ash Pond (PBAP) became damaged below ground surface and could not be repaired, and at your request, the well was plugged and abandoned and replaced with well AP-58A. The new well (AP-58A) was installed approximately 10 feet south of the original well and screened at the same interval as the original well. The following sections discuss the activities associated with the well plugging and well replacement.

PLUG AP-58

Monitoring well AP-58 was plugged and abandoned by the following methods:

- The stickup protective cover, concrete pad and bollard posts were removed;
- An attempt was made to pull and remove the PVC casing:
- The boring was overdrilled to 1 foot beyond its total depth (70 feet) using hollow stem augers; and,
- The boring was then plugged and abandoned by filling with a portland/bentonite grout with a tremie pipe from total depth to within 1 foot of the ground surface. The upper 1 foot of ground surface was filled with soil to match the existing grade.

INSTALLATION OF AP-58A

The replacement well for AP-58 was designated as AP-58A and installed on November 21, 2022. The well was installed by an Arkansas licensed monitoring well contractor under the supervision

of a Terracon geologist. The boring was initially advanced with hollow stem augers and soil samples collected by a continuous sampler until bedrock was encountered, at which time the boring was advanced with air rotary and logged by cuttings. The soil boring was advanced to a depth of approximately 70 feet below ground surface (bgs).

The replacement well was constructed in accordance with *ASTM D 5092-90 Design and Installation of Ground Water Monitoring Wells in Aquifers*. The monitoring well was constructed as follows:

- 10-foot section of 2-inch diameter Schedule 40 PVC flush threaded pipe with 0.010 inch slotted screen;
- 2-inch diameter Schedule 40 PVC flush threaded riser approximately 3 feet above ground
- surface;
- Sand filter pack (16/30) from bottom of well to approximately two to three feet above the screened interval;
- Two foot bentonite seal was installed above the filter pack and allowed to hydrate;
- The remaining annulus was filled with a portland/bentonite grout to near surface; and
- A lockable cap was installed over the top of the PVC casing. Surface completion consisted of a 3-foot X 3-foot cement surface pad with an aluminum protective casing, including protective bollard posts.

The location of the replacement well AP-58A is presented in Figure 1. A boring log for AP-58A and a Monitoring Well Installation Record are attached.

The well was subsequently developed on December 6, 2022 by removing six well casing volumes until the groundwater turbidity had stabilized. A Groundwater Monitoring Well Development Record is attached.

If you have any questions or comments regarding this report, please feel free to contact us at (501) 847-9292 at your convenience.

Sincerely,
Terracon Consultants, Inc.

Merrick Rotenberry, P.G.
Project Manager

Quin Baber
Environmental Department Manager

Attachments: Figure 1
Soil Boring Log
Monitoring Well Installation Record
Groundwater Monitoring Development Record

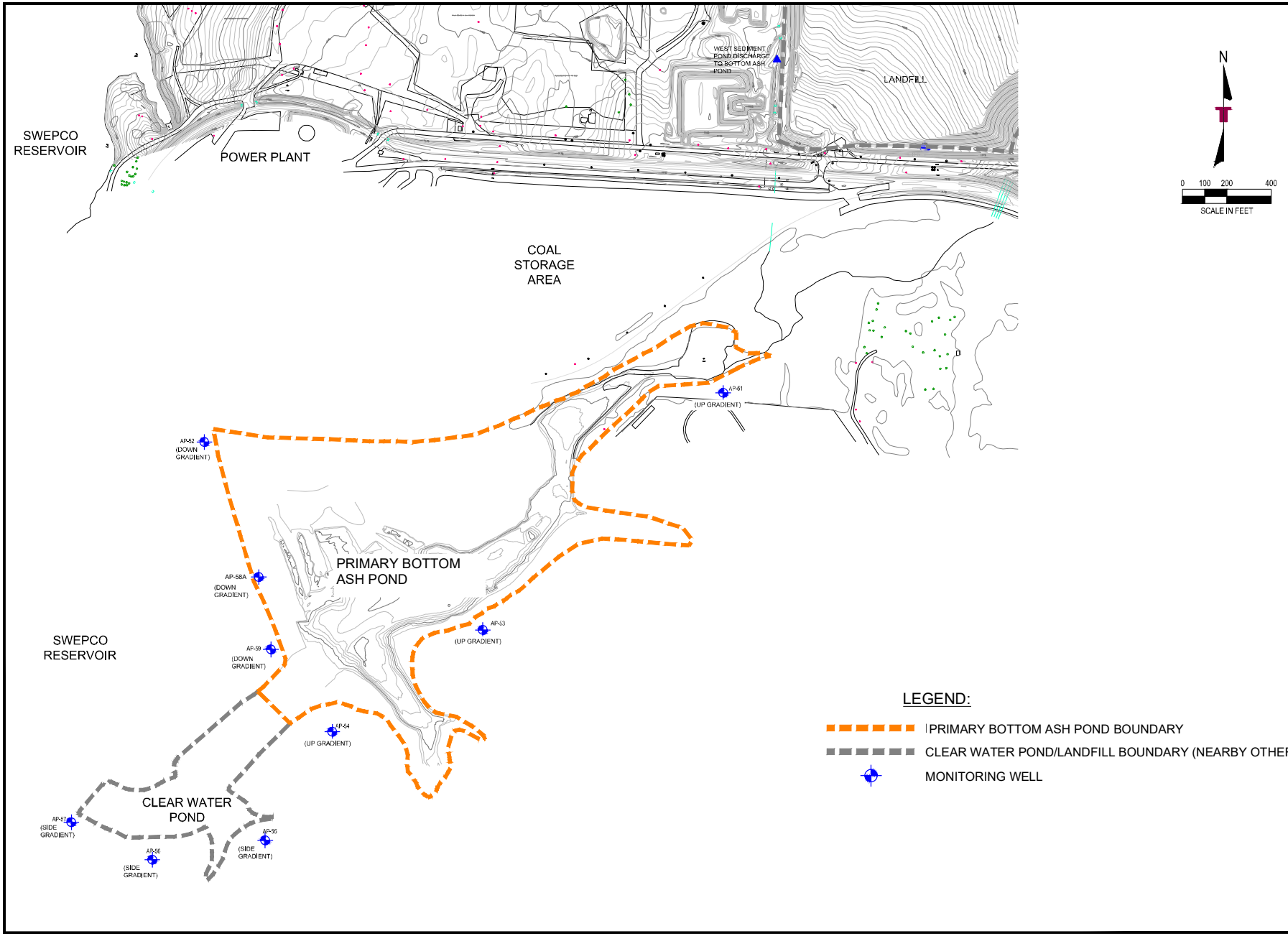


FIGURE 3

DESIGNED BY:	TLB
DRAWN BY:	TLB
APP'D. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	5-25-2016
JOB NO.	216401-25157124
ACAD NO.	063
SHEET NO.	3 OF 11

CCR UNIT AND WELL LOCATIONS

LOCATION RESTRICTION EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND

GENTRY ARKANSAS

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH BRYANT, AR 72022
PH. (501) 847-9282 FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

Terracon
25809 Interstate 30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: AP-58A PAGE: 1 of 2

TOTAL DEPTH: 71.7' FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35237104-001	DRILLING CO.: SUNBELT
LOGGED BY: JOSH RAY	DRILLER: NEAL FARRAR AR License #C001451
DATE DRILLED: 11/21/2022	RIG TYPE: CME 75 BUGGY

DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY

SAMPLING METHOD: 5' CONTINUOUS SAMPLER / AIR ROTARY

N: 707805.248 E: 1255854.857 G.S. ELEV. 1155.71

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
0	0'-15' SILTY CLAY - FILL brown and red, poor sample return		
15	15'-55' SILTY CLAY red, moist zones at 40'		
30			

Terracon
25809 Interstate 30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

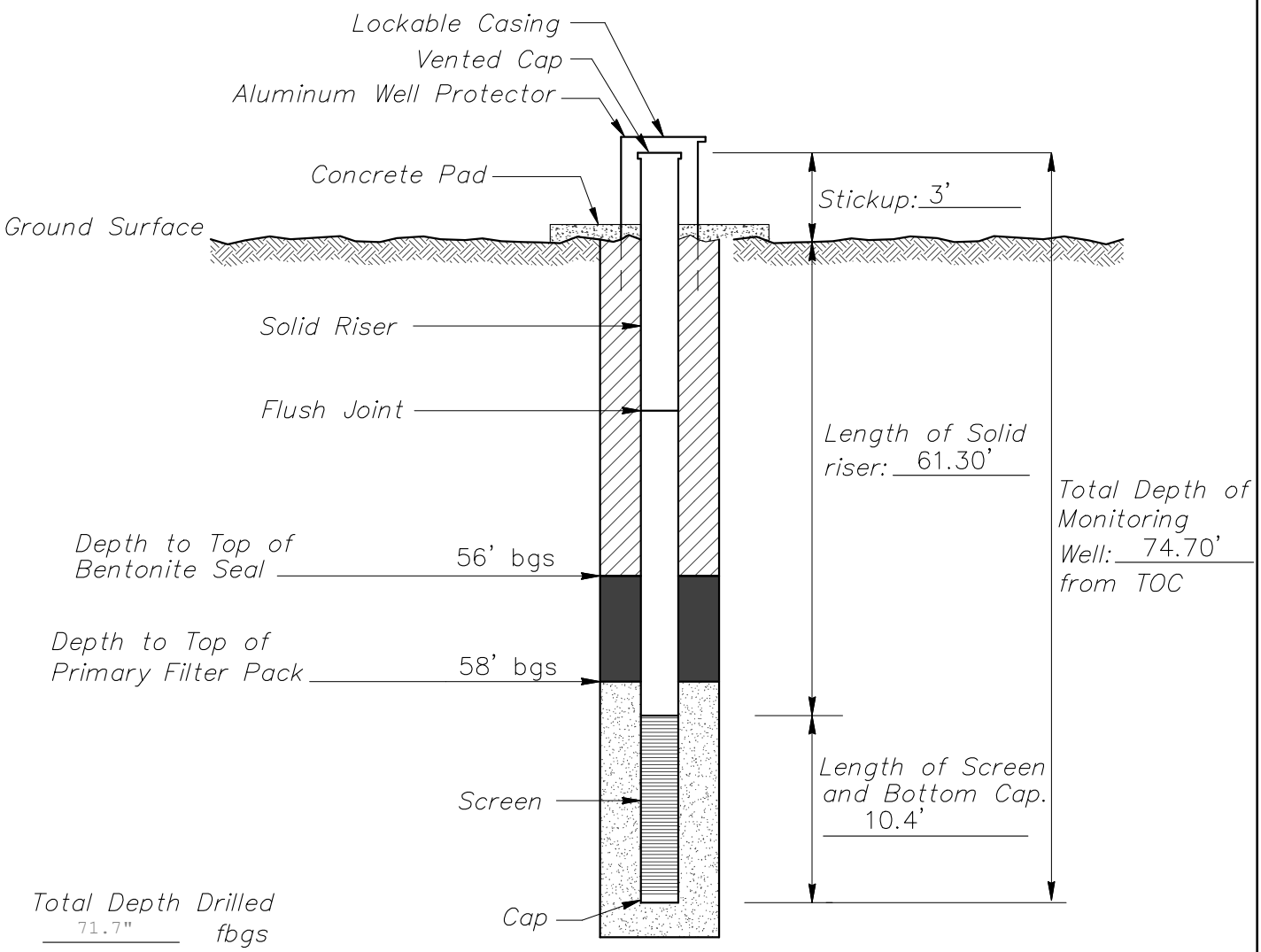
BORING NO.: AP-58A PAGE: 2 of 2

TOTAL DEPTH: 71.7' FEET BELOW GROUND SURFACE (BGS

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
	15'-55' SILTY CLAY red, moist zones at 40'		
40			
45			
50			Groundwater encountered above bedrock, and rose to static level of 20.90' below TOC
55	55'-70' LIMESTONE gray, crystalline		55' - 70' bgs logged by cuttings, wet
60			
65			
70	Total Depth of Boring at 71.7' bgs		
75			

MONITORING WELL INSTALLATION RECORD

Job Name: FLINT CREEK – CCR WELL INSTALLATION
Well Number: AP–58A
Job Number: 35237104
Installation Date: 11/21/2022
Location: AEP–FLINT CREEK–GENTRY, AR.
Datum Elevation: 1158.57' NGVD29 Vertical Datum
Surface Elevation: 1155.71' NGVD29 Vertical Datum
Datum for Water Level Measurement: T.O.C.
Screen Diameter & Material: 2" PVC
Slot Size: 0.010"
Riser Diameter & Material: 2" PVC
Borehole Diameter: 8"
Granular Backfill Material: 16–30 SAND
Terracon Representative: JOSH RAY
Drilling Method: HOLLOW STEM AUGER AND AIR ROTARY
Drilling Contractor: SUNBELT



Portland/Bentonite Grout

Bentonite Pellet Plug

Granular Backfill

(Not to Scale)

Terracon

MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216–001–35237104
WELL NUMBER: AP–58A
DRAWING NUMBER: 002
CHECKED BY: MR

GROUNDWATER MONITORING WELL DEVELOPMENT RECORDS

Terracon

OVERVIEW

PROJECT NUMBER: 35227269 DATE: 12/6/2022

SAMPLING LOCATION: AP-58A WEATHER: Cloudy 60 F

DATUM FOR WATER DEPTH MEASUREMENT: T.O.C. WELL DIAMETER (in): 2

WELL PHYSICAL CONDITION

WELL LOCKED? ☑ Yes ☐ No CASING CONDITION: ☑ Ok ☐ Needs Attention

WELL NUMBER LABELED? ☑ Yes ☐ No WELL PAINT CONDITION: ☑ Ok ☐ Needs Attention

GENERAL WELL INTERIOR/EXTERIOR CONDITIONS:

WATER CALCULATIONS

WATER DEPTH (feet): 20.90 TOTAL DEPTH OF WELL (feet): 74.70

VOLUME OF WATER *V = 3.0408 X [TD-WD(ft)] x [Diameter(in)]^2 in Gallons:* 8.76

WELL PURGING

INITIAL APPEARANCE: Clear at First INITIAL ODOR: None

PURGING DATE: 12/6/2022 PURGING METHOD: Pumped with a submersible

TIME START PURGING: 1450 TIME END PURGING: 1525

VOLUME PURGED [Gallons]: 53.00 WELL PURGED DRY? ☐ Yes ☑ No

FIELD MEASUREMENTS

TIME	**VOLUME** [GAL]	**WATER LEVEL** [feet]	**TURBIDITY** [NTU]
1454	9.00		>1000
1500	18.00		>1000
1507	27.00		33.2
1512	36.00		19.9
1517	45.00		16.8
1522	23.00		9.2

FIELD SAMPLE PRESERVATION:		**CONTAINER HANDLING:**	

COMMENTS

ATTACHMENT E
Surface Water Samples
Laboratory Analytical Report

Chain of Custody Record

Program: Coal Combustion Residuals (CCR)

Dolan Chemical Laboratory (DCL)
4001 Bixby Road
Groveport, Ohio 43125
Contacts: Michael Ohlinger (614-836-4184)
Dave Conover (614-836-4219)

Project Name: CCR
Contact Name:
Contact Phone:
Sampler(s): Ivaunna Neigler, Nicole Morrall

Analysis Turnaround Time (in Calendar Days)
◉ Routine (28 days for Monitoring Wells)

Site Contact:

Date:

For Lab Use Only:
COC/Order #:

Shipping confirmation sent to recipients below:
nmorrall@aep.com
ipneigler@aep.com
cmhubbell@aep.com

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Sampler(s) Initials	250 mL bottle, pH<2, HNO3: B, Ca, Li, Sb, As, Ba, Be, Cd, Cr, Co, Pb, Mo, Se, Tl and Na, K, Mg, Sr	Three (six every 10th*) 1L bottles, pH<2, HNO3: Ra-226, Ra-228	1 L + 250 mL bottles, Cool, 0-6C: TDS, F, Cl, SO4, and Br, Alkalinity	40 mL Glass vial or 250 mL PTFE lined bottle, HCL**, pH<2: Hg	Field-filter 250 mL bottle then pH<2, HNO3: dissolved Fe and dissolved Mn		Contains extra parameters	Sample Specific Notes:
Low Volume Waste Outlet Combined	2/25/20	13:03	G	GW	2	NM	X		X					<4°C
Bottom Ash Pond	2/25/20	13:14	G	W	2	NM	X		X					<4°C
BAP near Stop Log	2/25/20	13:29	G	W	2	NM	X		X					<4°C
SWEPCO Lake	2/25/20	13:23	G	W	2	NM	X		X					<4°C
Field Blank	2/25/20	13:44	G	W	1	NM APN			X					<4°C
Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____; F = filter in field							4	4	1	2	F 4			

** Six 1L Bottles must be collected for Radium for every 10th sample.*

*** HCl must be Trace Metal Grade for Mercury analysis when samples cannot be delivered to the laboratory within 48 hours of sampling.*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:
Nicole Morrall	AEP	2/25/20 14:00		
Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Date/Time:

Form REP-703
Rev. 1, 11/2013

Dolan Chemical Laboratory
4001 Bixby Road
Groveport, OH 43125
T: 614-836-4221, Audinet 210-4221
F: 614-836-4168, Audinet 210-4168
http://aepenv/labs

Water Analysis

Location: Flint Creek PS ***Report Date: 3/20/2020***

Low Volume Waste Outlet Combined

Sample Number: 200633-001 **Date Collected: 02/25/2020 13:03** **Date Received: 2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.07	ug/L	J	0.1	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Arsenic, As	0.78	ug/L		0.1	0.03	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Barium, Ba	119	ug/L		0.2	0.05	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	< 0.01	ug/L	U	0.05	0.01	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	0.460	ug/L		0.2	0.04	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.127	ug/L		0.05	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.2	ug/L	J	0.2	0.05	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	2.63	ug/L		2	0.4	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Selenium, Se	0.4	ug/L		0.2	0.03	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Boron, B	0.076	mg/L		0.05	0.02	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	35.1	mg/L		0.3	0.1	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.000381	mg/L		0.0002	0.00005	JDB	03/02/2020 13:13	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	2.83	mg/L		0.1	0.02	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Potassium, K	4.69	mg/L		1	0.2	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Sodium, Na	11.4	mg/L		0.5	0.1	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.175	mg/L		0.01	0.002	DAM	03/02/2020 12:20	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	102	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	7.92	mg/L		0.04	0.01	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.08	mg/L		0.06	0.01	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	183	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	17.8	mg/L		0.4	0.06	CRJ	02/27/2020 14:18	EPA 300.1-1997, Rev. 1.0

pH = 6.30 2/25/2020 13:03 ipn

Location: Flint Creek PS ***Report Date: 3/20/2020***

Bottom Ash Pond

Sample Number: 200633-002 **Date Collected: 02/25/2020 13:15** **Date Received: 2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.11	ug/L		0.1	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Arsenic, As	1.03	ug/L		0.1	0.03	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Barium, Ba	199	ug/L		0.2	0.05	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	0.03	ug/L	J	0.05	0.01	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	2.98	ug/L		0.2	0.04	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.193	ug/L		0.05	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.275	ug/L		0.2	0.05	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	5.81	ug/L		2	0.4	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Selenium, Se	1.8	ug/L		0.2	0.03	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Boron, B	0.246	mg/L		0.05	0.02	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	40.5	mg/L		0.3	0.1	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.00111	mg/L		0.0002	0.00005	JDB	03/02/2020 13:18	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	3.14	mg/L		0.1	0.02	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Potassium, K	5.61	mg/L		1	0.2	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Sodium, Na	22.7	mg/L		0.5	0.1	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.498	mg/L		0.01	0.002	DAM	03/02/2020 12:24	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	116	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	11.0	mg/L		0.04	0.01	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.18	mg/L		0.06	0.01	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	217	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	39.5	mg/L		0.4	0.06	CRJ	02/27/2020 13:18	EPA 300.1-1997, Rev. 1.0

pH = 8.70 2/25/2020 13:14 ipn

Location: Flint Creek PS *Report Date: 3/20/2020*

BAP Near Stop Log

Sample Number: 200633-003 **Date Collected: 02/25/2020 13:29** **Date Received: 2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.07	ug/L	J	0.1	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Arsenic, As	0.71	ug/L		0.1	0.03	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Barium, Ba	79.5	ug/L		0.2	0.05	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	< 0.01	ug/L	U	0.05	0.01	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	0.1	ug/L	J	0.2	0.04	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.056	ug/L		0.05	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.06	ug/L	J	0.2	0.05	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	1	ug/L	J	2	0.4	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Selenium, Se	0.3	ug/L		0.2	0.03	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Boron, B	0.068	mg/L		0.05	0.02	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	34.4	mg/L		0.3	0.1	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.000205	mg/L		0.0002	0.00005	JDB	03/02/2020 13:22	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	2.75	mg/L		0.1	0.02	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Potassium, K	4.87	mg/L		1	0.2	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Sodium, Na	11.7	mg/L		0.5	0.1	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.147	mg/L		0.01	0.002	DAM	03/02/2020 12:27	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	101	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	7.92	mg/L		0.04	0.01	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.08	mg/L		0.06	0.01	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	155	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	16.2	mg/L		0.4	0.06	CRJ	02/27/2020 13:44	EPA 300.1-1997, Rev. 1.0

pH = 7.23 2/25/2020 13:29 lpn

pH = 8.31 2/25/2020 13:23 ipn

Location: Flint Creek PS **Report Date: 3/20/2020**

Swepco Lake SWEPCO Lake

Sample Number: 200633-004 **Date Collected: 02/25/2020 13:23** **Date Received: 2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.08	ug/L	J	0.1	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Arsenic, As	0.70	ug/L		0.1	0.03	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Barium, Ba	113	ug/L		0.2	0.05	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.02	ug/L	U	0.1	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	0.01	ug/L	J	0.05	0.01	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	0.619	ug/L		0.2	0.04	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.144	ug/L		0.05	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.1	ug/L	J	0.2	0.05	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Molybdenum, Mo	2	ug/L	J	2	0.4	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Selenium, Se	0.7	ug/L		0.2	0.03	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.1	ug/L	U	0.5	0.1	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Boron, B	0.102	mg/L		0.05	0.02	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	38.0	mg/L		0.3	0.1	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Lithium, Li	0.000527	mg/L		0.0002	0.00005	JDB	03/02/2020 13:25	EPA 200.8-1994, Rev. 5.4
Magnesium, Mg	3.04	mg/L		0.1	0.02	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Potassium, K	4.94	mg/L		1	0.2	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Sodium, Na	20.7	mg/L		0.5	0.1	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.224	mg/L		0.01	0.002	DAM	03/02/2020 12:40	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	99.8	mg/L		20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	11.7	mg/L		0.04	0.01	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.12	mg/L		0.06	0.01	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	206	mg/L		50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	35.0	mg/L		0.4	0.06	CRJ	02/27/2020 15:34	EPA 300.1-1997, Rev. 1.0

Field Blank

Sample Number: 200633-005 **Date Collected: 02/25/2020 13:44** **Date Received: 2/26/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Alkalinity, as CaCO3	< 5	mg/L	U	20	5	MGK	03/04/2020 12:10	SM 2320B-2011
Bromide, Br	< 0.04	mg/L	U	0.2	0.04	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0
Chloride, Cl	< 0.01	mg/L	U	0.04	0.01	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0
Fluoride, F	< 0.01	mg/L	U	0.06	0.01	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	< 20	mg/L	U	50	20	SDW	02/28/2020	SM 2540C-2011
Sulfate, SO4	< 0.06	mg/L	U	0.4	0.06	CRJ	02/27/2020 15:09	EPA 300.1-1997, Rev. 1.0

U: Analyte was analyzed and not detected at or above adjusted Method Detection Limit
J: Analyte was positively identified, though the quantitation was below Reporting Limit.

Michael Ohlinger, Chemist
Email msohlinger@aep.com *Tel.*
Fax 614-836-4168 *Audinet 8-210-*

ATTACHMENT F
Certification by a Qualified Professional Engineer

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

I certify that the above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Flint Creek Primary Bottom Ash Pond 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

Signature

Geosyntec Consultants
2039 Centre Pointe Blvd, Suite 103
Tallahassee, Florida 32308

Arkansas Firm Certificate of
Authorization No. 52
Exp. 12/31/2024

9864	Arkansas	September 18, 2023
License Number	Licensing State	Date

APPENDIX 4 - Notices for Monitoring Program Transitions

No transition between monitoring requirements occurred in 2023; the CCR unit was in detection monitoring at the beginning and at the end of the year. Notices for monitoring program transitions are not applicable at this time.

APPENDIX 5 - Well Installation/Decommissioning Logs

Monitoring well AP-58 was found irreparably damaged during the September 20-21, 2022 sampling event. This well was properly decommissioned and its replacement well (AP-58A) installed in December 2022. Well AP-58A/AP58 installation/decommissioning logs are provided in the following AP-58A/AP-58 well installation/decommissioning report.

September 11, 2023

American Electric Power
ATTN: Scott Carney, Plant Environmental Coordinator
21797 SWEPCO Plant Road
Gentry, AR 72734

Subject: **Installation of Replacement Well AP-58A**
Flint Creek Primary Bottom Ash Pond
Gentry, Arkansas
Terracon Project 35227269

Dear Mr. Carney:

Terracon Consultants Inc. (Terracon) is pleased to present the report of plugging one monitoring well (AP-58) and replacing the well with AP-58A at the above referenced facility.

PROJECT BACKGROUND

A monitoring well (AP-58) associated with the Flint Creek Primary Bottom Ash Pond (PBAP) became damaged below ground surface and could not be repaired, and at your request, the well was plugged and abandoned and replaced with well AP-58A. The new well (AP-58A) was installed approximately 10 feet south of the original well and screened at the same interval as the original well. The following sections discuss the activities associated with the well plugging and well replacement.

PLUG AP-58

Monitoring well AP-58 was plugged and abandoned by the following methods:

- The stickup protective cover, concrete pad and bollard posts were removed;
- An attempt was made to pull and remove the PVC casing:
- The boring was overdrilled to 1 foot beyond its total depth (70 feet) using hollow stem augers; and,
- The boring was then plugged and abandoned by filling with a portland/bentonite grout with a tremie pipe from total depth to within 1 foot of the ground surface. The upper 1 foot of ground surface was filled with soil to match the existing grade.

INSTALLATION OF AP-58A

The replacement well for AP-58 was designated as AP-58A and installed on November 21, 2022. The well was installed by an Arkansas licensed monitoring well contractor under the supervision

of a Terracon geologist. The boring was initially advanced with hollow stem augers and soil samples collected by a continuous sampler until bedrock was encountered, at which time the boring was advanced with air rotary and logged by cuttings. The soil boring was advanced to a depth of approximately 70 feet below ground surface (bgs).

The replacement well was constructed in accordance with *ASTM D 5092-90 Design and Installation of Ground Water Monitoring Wells in Aquifers*. The monitoring well was constructed as follows:

- 10-foot section of 2-inch diameter Schedule 40 PVC flush threaded pipe with 0.010 inch slotted screen;
- 2-inch diameter Schedule 40 PVC flush threaded riser approximately 3 feet above ground
- surface;
- Sand filter pack (16/30) from bottom of well to approximately two to three feet above the screened interval;
- Two foot bentonite seal was installed above the filter pack and allowed to hydrate;
- The remaining annulus was filled with a portland/bentonite grout to near surface; and
- A lockable cap was installed over the top of the PVC casing. Surface completion consisted of a 3-foot X 3-foot cement surface pad with an aluminum protective casing, including protective bollard posts.

The location of the replacement well AP-58A is presented in Figure 1. A boring log for AP-58A and a Monitoring Well Installation Record are attached.

The well was subsequently developed on December 6, 2022 by removing six well casing volumes until the groundwater turbidity had stabilized. A Groundwater Monitoring Well Development Record is attached.

If you have any questions or comments regarding this report, please feel free to contact us at (501) 847-9292 at your convenience.

Sincerely,
Terracon Consultants, Inc.

Merrick Rotenberry, P.G.
Project Manager

Quin Baber
Environmental Department Manager

Attachments: Figure 1
Soil Boring Log
Monitoring Well Installation Record
Groundwater Monitoring Development Record

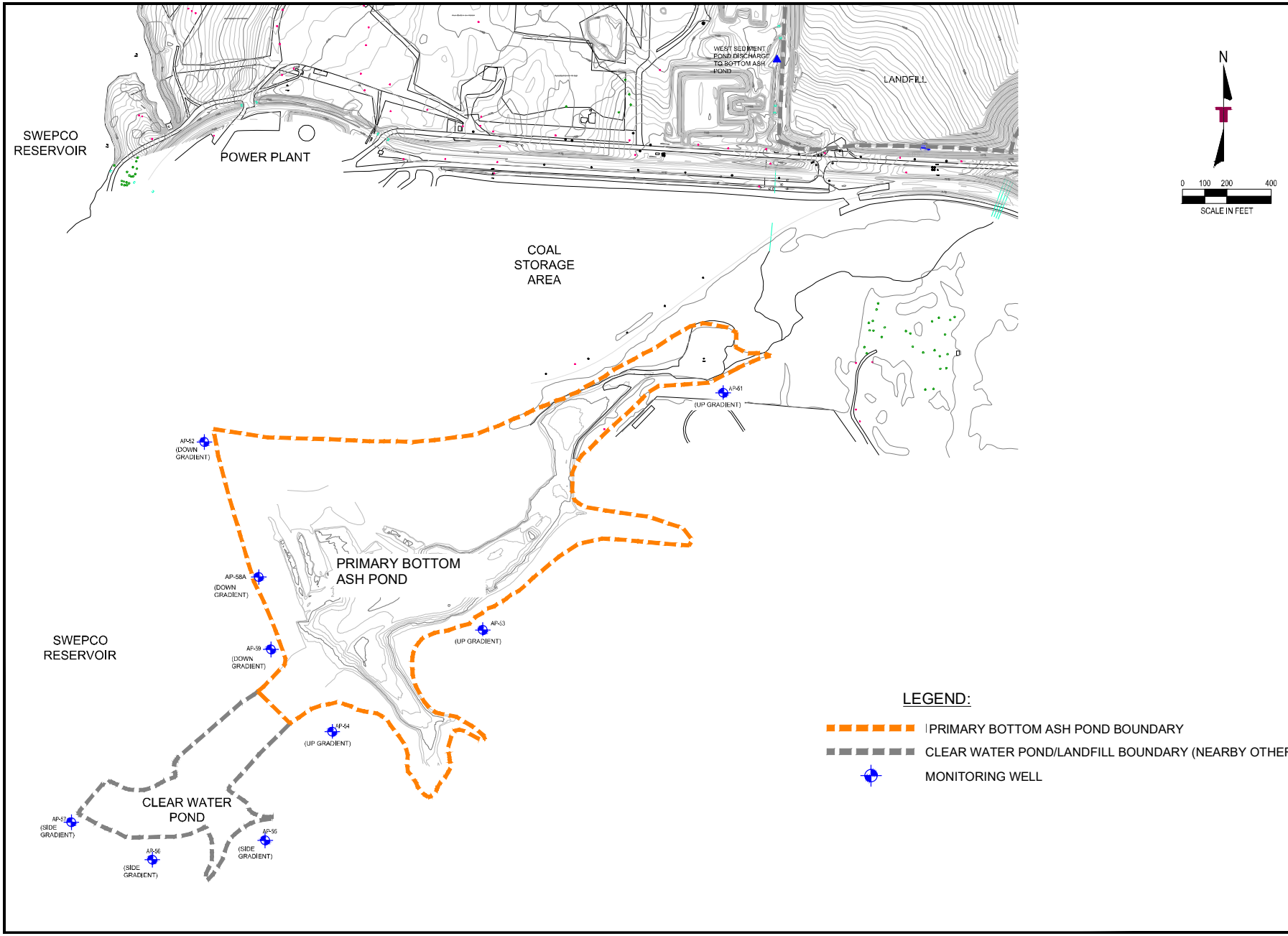


FIGURE 3

DESIGNED BY:	TLB
DRAWN BY:	TLB
APP'VD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	5-25-2016
JOB NO.	216401-25151724
ACAD NO.	063
SHEET NO.	3 OF 11

CCR UNIT AND WELL LOCATIONS

LOCATION RESTRICTION EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND

GENTRY ARKANSAS

Terracon
Consulting Engineers and Scientists
25909 I-30 SOUTH BRYANT, AR 72022
PH. (501) 847-9282 FAX. (501) 847-9210

REV.:	DATE	BY	DESCRIPTION

Terracon
25809 Interstate 30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: AP-58A PAGE: 1 of 2

TOTAL DEPTH: 71.7' FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35237104-001	DRILLING CO.: SUNBELT
LOGGED BY: JOSH RAY	DRILLER: NEAL FARRAR AR License #C001451
DATE DRILLED: 11/21/2022	RIG TYPE: CME 75 BUGGY

DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY

SAMPLING METHOD: 5' CONTINUOUS SAMPLER / AIR ROTARY

N: 707805.248 E: 1255854.857 G.S. ELEV. 1155.71

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
0	0'-15' SILTY CLAY - FILL brown and red, poor sample return		
15	15'-55' SILTY CLAY red, moist zones at 40'		
30			

Terracon
25809 Interstate 30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

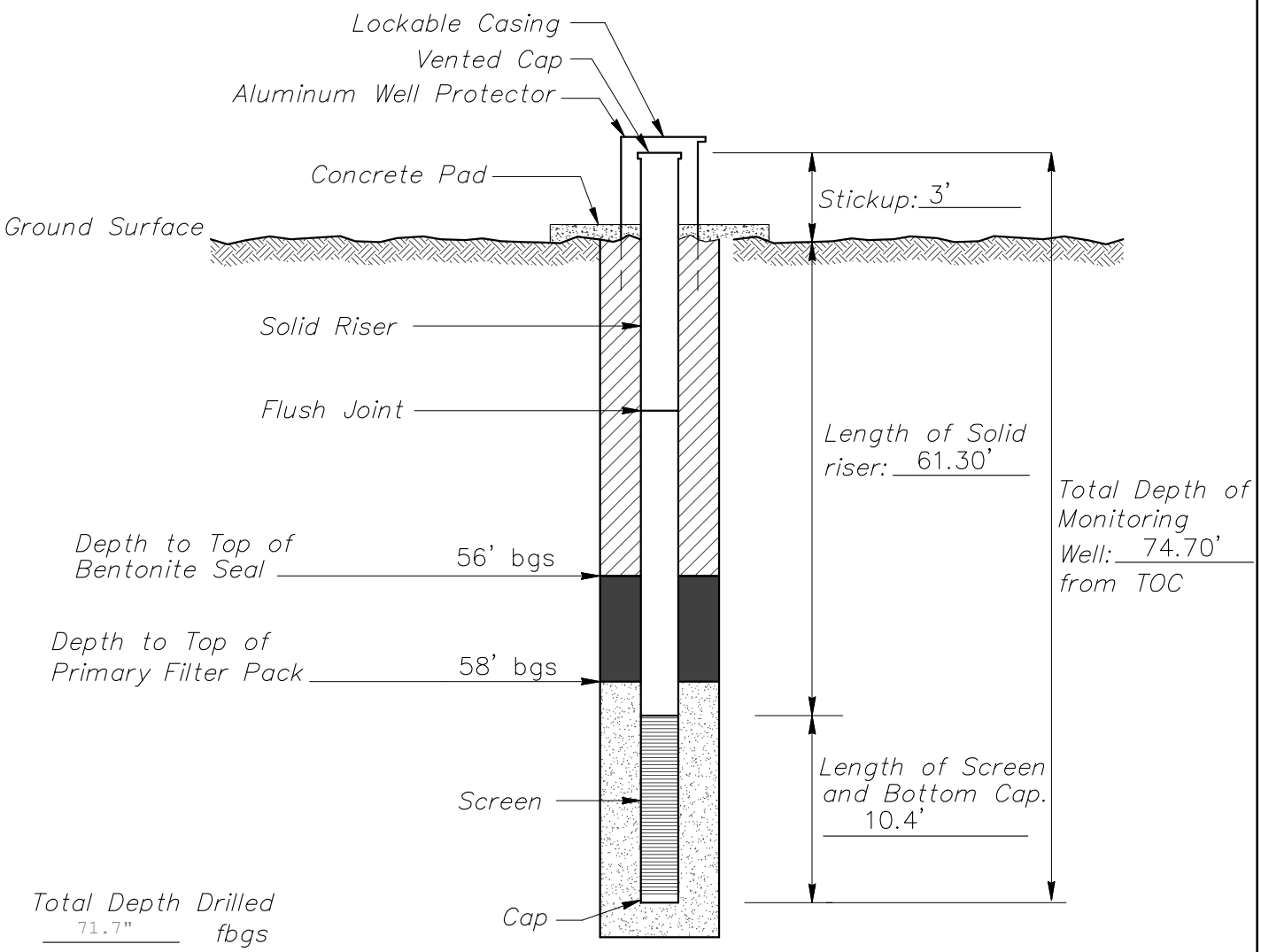
BORING NO.: AP-58A PAGE: 2 of 2

TOTAL DEPTH: 71.7' FEET BELOW GROUND SURFACE (BGS

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
	15'-55' SILTY CLAY red, moist zones at 40'		
40			
45			
50			Groundwater encountered above bedrock, and rose to static level of 20.90' below TOC
55	55'-70' LIMESTONE gray, crystalline		55' - 70' bgs logged by cuttings, wet
60			
65			
70	Total Depth of Boring at 71.7' bgs		
75			

MONITORING WELL INSTALLATION RECORD

Job Name: FLINT CREEK – CCR WELL INSTALLATION
Well Number: AP–58A
Job Number: 35237104
Installation Date: 11/21/2022
Location: AEP–FLINT CREEK–GENTRY, AR.
Datum Elevation: 1158.57' NGVD29 Vertical Datum
Surface Elevation: 1155.71' NGVD29 Vertical Datum
Datum for Water Level Measurement: T.O.C.
Screen Diameter & Material: 2" PVC
Slot Size: 0.010"
Riser Diameter & Material: 2" PVC
Borehole Diameter: 8"
Granular Backfill Material: 16–30 SAND
Terracon Representative: JOSH RAY
Drilling Method: HOLLOW STEM AUGER AND AIR ROTARY
Drilling Contractor: SUNBELT



Portland/Bentonite Grout

Bentonite Pellet Plug

Granular Backfill

(Not to Scale)

Terracon

MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216–001–35237104
WELL NUMBER: AP–58A
DRAWING NUMBER: 002
CHECKED BY: MR

GROUNDWATER MONITORING WELL DEVELOPMENT RECORDS

Terracon

OVERVIEW

PROJECT NUMBER: 35227269 DATE: 12/6/2022

SAMPLING LOCATION: AP-58A WEATHER: Cloudy 60 F

DATUM FOR WATER DEPTH MEASUREMENT: T.O.C. WELL DIAMETER (in): 2

WELL PHYSICAL CONDITION

WELL LOCKED? ☑ Yes ☐ No CASING CONDITION: ☑ Ok ☐ Needs Attention

WELL NUMBER LABELED? ☑ Yes ☐ No WELL PAINT CONDITION: ☑ Ok ☐ Needs Attention

GENERAL WELL INTERIOR/EXTERIOR CONDITIONS:

WATER CALCULATIONS

WATER DEPTH (feet): 20.90 TOTAL DEPTH OF WELL (feet): 74.70

VOLUME OF WATER *V = 3.0408 X [TD-WD(ft)] x [Diameter(in)]^2 in Gallons:* 8.76

WELL PURGING

INITIAL APPEARANCE: Clear at First INITIAL ODOR: None

PURGING DATE: 12/6/2022 PURGING METHOD: Pumped with a submersible

TIME START PURGING: 1450 TIME END PURGING: 1525

VOLUME PURGED [Gallons]: 53.00 WELL PURGED DRY? ☐ Yes ☑ No

FIELD MEASUREMENTS

TIME	**VOLUME** [GAL]	**WATER LEVEL** [feet]	**TURBIDITY** [NTU]
1454	9.00		>1000
1500	18.00		>1000
1507	27.00		33.2
1512	36.00		19.9
1517	45.00		16.8
1522	23.00		9.2

FIELD SAMPLE PRESERVATION:		**CONTAINER HANDLING:**	

COMMENTS