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ALTERNATIVE SOURCE DEMONSTRATION REPORT

FEDERAL CCR RULE

Flint Creek Power Plant

Primary Bottom Ash Pond

Gentry, Arkansas

Prepared for

American Electric Power
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Project CHA8495B

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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, sulfate, and total dissolved solids (TDS) in the groundwater monitoring network for the Plant Primary Bottom Ash Pond (PBAP), located at the Flint Creek Power in Gentry, Arkansas, following the second semiannual detection monitoring event of 2023. The Flint Creek Power Plant has two coal combustion residuals (CCR) storage units, including the PBAP, which was certified as having all contained CCR removed by August 2023 and is now operated as a non-CCR wastewater pond.

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 Consultants, Inc. [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 an initial sample and a resample 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 resample was not collected or analyzed.

The second semiannual detection monitoring event of 2023 at the PBAP was conducted in September (initial sampling event), and the results were compared to the calculated prediction limits. Where initial exceedances were identified, resampling was completed in December 2023. Following resampling, SSIs were identified for boron and chloride at downgradient compliance well AP-58A and for sulfate and TDS at downgradient compliance well AP-59 using intrawell analyses. 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 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 and chloride 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 and TDS at well AP-59 were 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 (2023), the PBAP is a 42.8-acre CCR surface impoundment located south of the power plant which was formerly operated as a CCR ash pond. 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 as a CCR surface impoundment, it was used primarily to manage bottom ash. The PBAP ceased receipt of CCR on November 30, 2022, and commenced closure by removal of CCR materials in accordance with the certified closure plan (American Electric Power [AEP] 2022). CCR material removal from the PBAP was completed on August 20, 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 positioned 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 the 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 (2023) are provided as **Attachment A**. These cross sections show the Boone residuum (described as a 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 2023). 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 2023).

2.3 Groundwater Monitoring Systems and Flow Conditions

The monitoring well network (**Figure 2**) includes three upgradient background wells (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 B**). Monitoring well AP-58 was found to be irreparably damaged during a sampling event in September 2022 and was replaced in November 2022 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 B**). 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 2023 initial sampling and December 2023 resampling events are provided as **Attachment C**. The groundwater flow direction is generally to the west and northwest. Hydraulic connectivity within the Uppermost Aquifer was determined by Terracon (2023) 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 and chloride at AP-58A and the SSIs for sulfate and TDS at AP-59 and the proposed alternative sources for these SSIs are described below.

3.1 Proposed Alternative Source

3.1.1 Monitoring Well AP-58A

An initial review of groundwater sampling field forms identified an alternative source for the boron and chloride 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 B**. 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 approximately 3.5 years after it was installed in February 2016. The groundwater composition for the first three samples collected from AP-58A (December 2022 through September 2023) appears similar to AP-58 during the first sampling event completed after its installation in February 2016 (October 2016). The relative concentration of anions in the December 2023 sample collected from AP-58A (one year after well installation) are nearly identical to samples collected from AP-58 one year after installation of the well but before the groundwater had equilibrated (March 2017 through June 2019, **Figure 3**). These results suggest that both AP-58 and AP-58A require(d) time after installation to equilibrate with the aquifer before the collected samples are representative of stable geochemical conditions. These findings suggest that geochemical trends at AP-58A consistent with those observed at AP-58 are expected to continue to occur over the next one to two years. Similar trends after installation have been observed for boron and chloride at AP-58 and AP-58A to date (**Figure 4**).

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 and removal of CCR from the PBAP was completed prior to the September and December 2023 sampling events associated with the second semiannual detection monitoring event of 2023. Therefore, the 2020 surface water samples are a fair basis of comparison for 2023 monitoring event groundwater conditions. The laboratory analytical report for the March 2020 surface water sampling event is provided as **Attachment D**. Reported values of boron and chloride from the PBAP samples are shown compared to the AP-58A UPL and recent samples from AP-58A (**Table 2**). Boron and chloride concentrations were greater in AP-58A groundwater samples than in both samples collected from the PBAP. This provides further support that the

PBAP is not a source of the apparent elevated concentrations of boron and chloride in AP-58A groundwater.

3.1.2 Monitoring 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 and TDS at AP-59 due to Type I (sampling causes), Type II (laboratory causes), or Type III (statistical evaluation causes) issues. Further, an initial review of site geochemistry did not identify evidence of any Type V (alternative) impacts. As described below, the SSIs observed at monitoring well AP-59 have been attributed to natural variation within the underlying geology, which is a Type IV cause. The specific source of naturally occurring sulfate at AP-59 is oxidative dissolution of pyrite within the aquifer material at the site, as described in previous ASDs prepared for sulfate at AP-59 (Geosyntec 2023a, Geosyntec 2023b, Geosyntec 2024).

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 5**). Sulfate concentrations from the most recent sampling event completed in September 2023 at AP-53 (58.9 milligrams per liter [mg/L]) and AP-54 (53.6 mg/L) are both comparable to concentrations reported for AP-59 (55.1 mg/L). Both upgradient wells and AP-59 have demonstrated considerable variability in sulfate concentrations since monitoring began in 2016 (**Figure 5**), suggest that aqueous sulfate concentrations fluctuate over time across the site and these fluctuations should not be attributed to 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, with many wells containing greater sulfate concentrations than those observed within the PBAP monitoring network.

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 6**). 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 7**), indicating that iron sulfide minerals, if present in aquifer solids, would be expected to undergo this oxidation reaction. AP-59 groundwater Eh values (a measurement of redox conditions) from recent monitoring events have been greater than average (more oxygenated), which would thermodynamically favor greater amounts of dissolution of existing pyrite in aquifer materials. The dissolution of this pyrite would contribute aqueous sulfate ions to groundwater via the mechanism described above.

Limestone lithologies present at compliance monitoring wells were evaluated to develop the geologic conceptual site model for previous ASD reports and geochemical investigations (Geosyntec 2020b; included in AEP 2021). 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 8**. 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 locations within the PBAP also supports the position that the recent elevated concentrations of sulfate at AP-59 should not be attributed to the PBAP (**Attachment D**). Reported sulfate concentrations were 39.5 mg/L (sample ID – BAP) and 16.2 mg/L (sample ID – BAP Near Stop Log) for the samples collected from the PBAP prior to CCR removal (**Table 3**). Both 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 (68.3 mg/L and 55.1 mg/L) (**Table 3**). 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.

In addition to sulfate, an SSI for TDS was identified at monitoring well AP-59. TDS concentrations at well AP-59 are displayed on **Figure 9**. TDS is the summation of all ions in a water sample, with major ions comprising the majority of TDS in most natural waters (Boyd, 2019). Sulfate comprises an average of 21% of the TDS mass at AP-59; for the December 2023 sample, 55.1 mg/L of sulfate contributed 20% of the total mass of 270 mg/L of TDS which was reported. The December 2023 sample contained 4 mg/L TDS greater than the intrawell UPL of 266 mg/L (**Table 1**), which can be accounted for by variations in the sulfate component. As shown on **Figure 9**, recent increases in sulfate concentrations coincide with recent increases in TDS levels within the well. TDS concentrations at AP-59 appear to be at least partially driven by sulfate concentrations, which are likely associated with the aquifer solids as discussed above. Therefore, the SSI identified for TDS is likely also associated with the increase in aqueous sulfate concentrations from the aquifer solids and not due to a release from the PBAP.

3.2 Sampling Requirements

The ASD described above supports the position that the identified SSIs for boron and chloride at downgradient well AP-58A are due to sampling issues, that the identified SSIs for sulfate and TDS at downgradient well AP-59 are 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 and chloride at AP-58A and for sulfate and TDS at AP-59 during the second semiannual detection monitoring event of 2023 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 E**.

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TABLES

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

Geosyntec Consultants

Analyte	Unit	Description	AP-58A		AP-59		AP-60
			9/19/2023	12/27/2023	9/19/2023	12/27/2023	9/18/2023
Boron	mg/L	Intrawell Background Value (UPL)	0.276		0.368		1.68
		Analytical Result	**1.03**	**0.65**	0.301	--	0.697
Calcium	mg/L	Intrawell Background Value (UPL)	86.8		53.9		49.9
		Analytical Result	22.6	--	51.6	--	40.6
Chloride	mg/L	Intrawell Background Value (UPL)	10.2		18.0		17.4
		Analytical Result	**26.7**	**20.3**	14.6	--	11.0
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00		0.765		0.681
		Analytical Result	0.54	--	0.42	--	0.17
pH	SU	Intrawell Background Value (UPL)	8.7		7.6		10.8
		Intrawell Background Value (LPL)	6.2		6.7		6.5
		Analytical Result	7.6	--	7.1	--	7.9
Sulfate	mg/L	Intrawell Background Value (UPL)	90.3		50.1		190
		Analytical Result	**146**	83	**68.3**	**55.1**	63.7
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	333		266		397
		Analytical Result	**370**	300	**290**	**270**	260

Notes:

1. Bold values exceed the background value.

2. Background values are shaded gray.

3. AP-58A analytical results are compared to intrawell prediction limits calculated using AP-58 background data, as insufficient data is available from AP-58A to calculate prediction limits at this time.

--: not measured

LPL: lower prediction limit

mg/L: milligrams per liter

SU: standard units

UPL: upper prediction limit

Table 2. AP-58A Relevant Parameter Comparison
Flint Creek - Primary Bottom Ash Pond

Geosyntec Consultants

Source	Sample Date	Parameter	
		Boron	Chloride
AP-58A UPL	N/A	0.276	10.2
BAP	2/25/2020	0.246	11.0
BAP Near Stop Log	2/25/2020	0.0688	7.92
AP-58A	9/19/2023	1.03	26.7
AP-58A	12/27/2023	0.65	20.3

Notes:

1. All parameters are shown in units of milligrams per liter.
2. Results greater than the AP-58A UPL are highlighted in red and results lower than the AP-58A UPL are highlighted in green.
3. AP-58A analytical results are compared to intrawell prediction limits calculated using AP-58 background data, as insufficient data is available from AP-58A to calculate prediction limits at this time.

BAP: Bottom Ash Pond
UPL: upper prediction limit

Table 3. AP-59 Relevant Parameter Comparison *Geosyntec Consultants*
Flint Creek - Primary Bottom Ash Pond

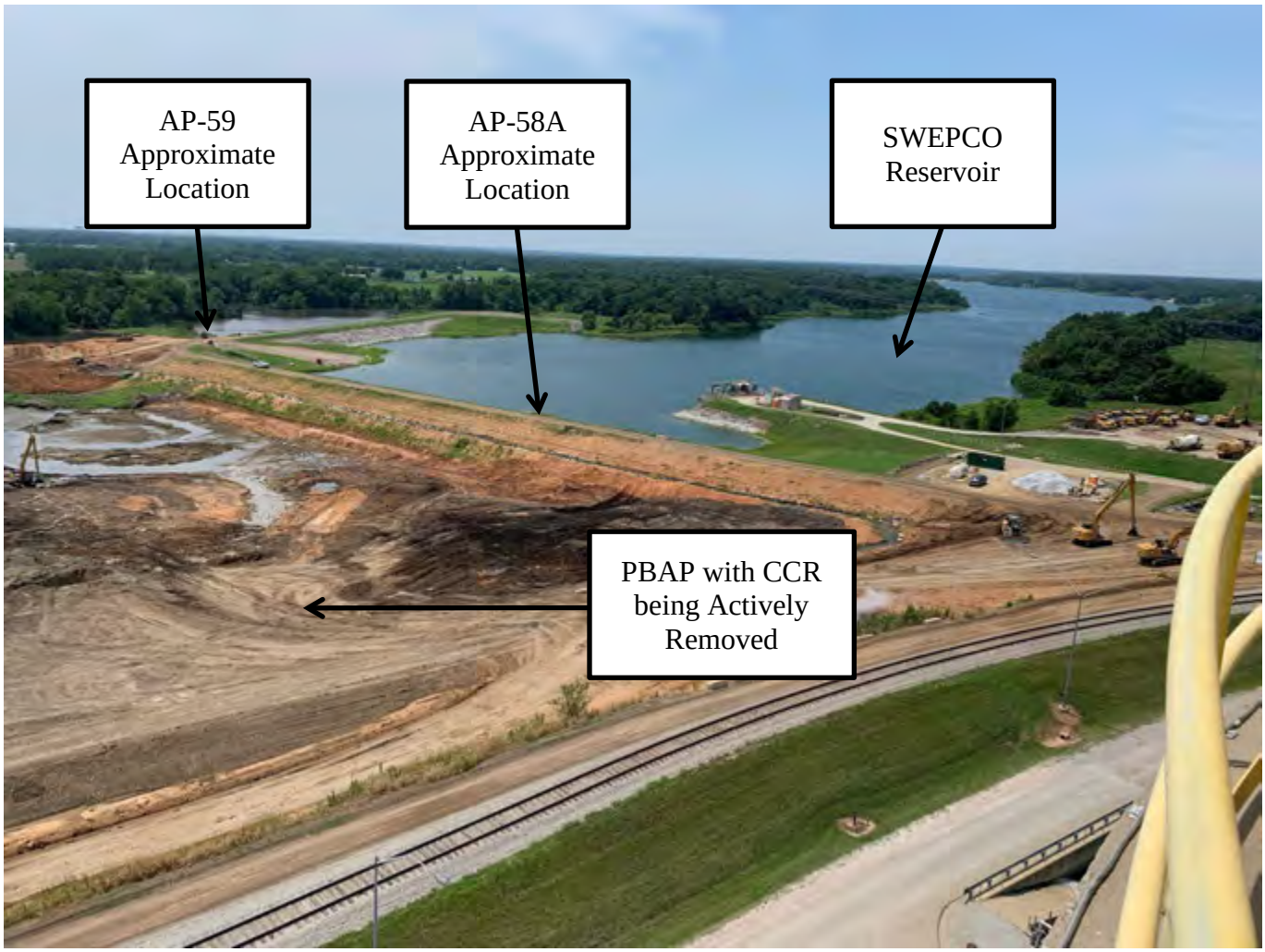
Source	Sample Date	Parameter	
		Sulfate	TDS
AP-59 UPL	N/A	50.1	266
BAP	2/25/2020	39.5	217
BAP Near Stop Log	2/25/2020	16.2	155
AP-59	9/19/2023	68.3	290
AP-59	12/27/2023	55.1	270

Notes:

1. All results are shown in milligrams per liter (mg/L).
2. Results greater than the AP-59 UPL are highlighted in red and results lower than the AP-59 UPL are highlighted in green.

BAP: Bottom Ash Pond
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

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Figure **1**

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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.
4. Aerial basemap provided by ESRI (April 2023).

200 100 0 200
Feet

Site Layout

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

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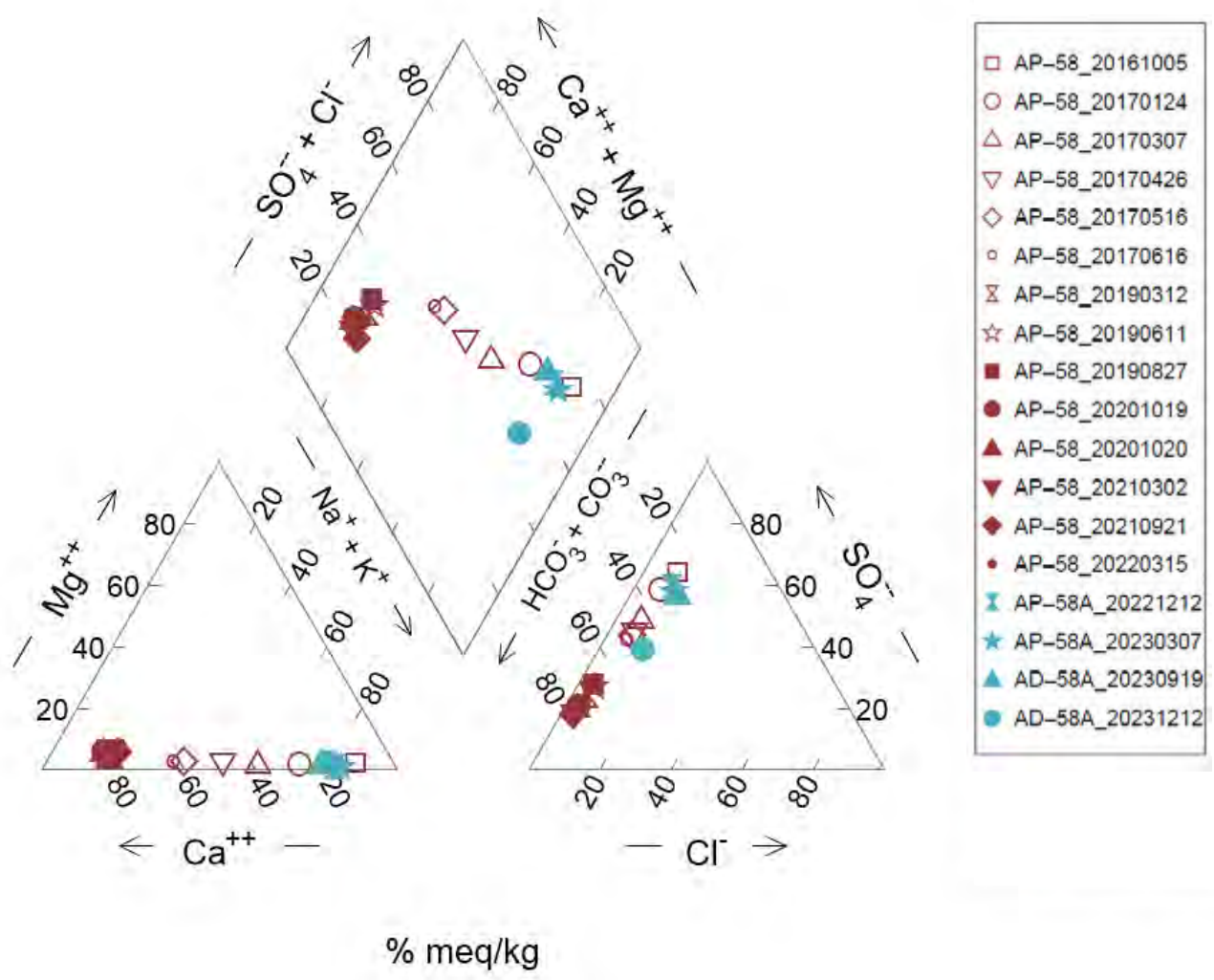
Columbus, Ohio | June 2024

Figure 2

\\annarbor-01\Data\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2022\Flint Creek PBAP Site Layout_ASD.mxd. ASoltero. 3/28/2024. CHA8423/01/08.



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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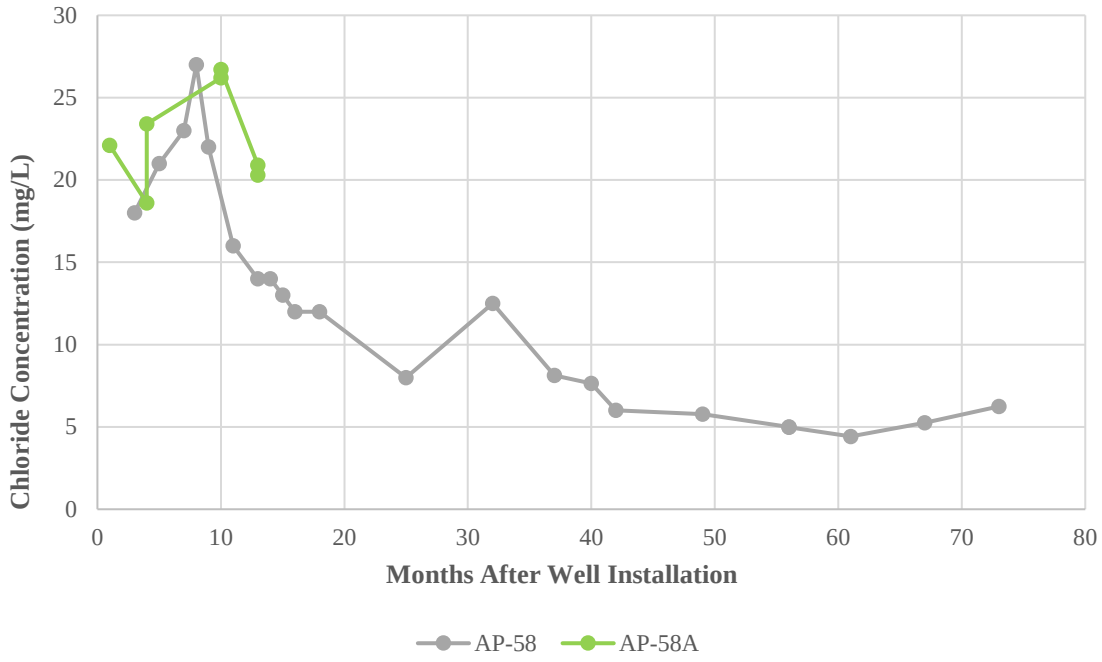

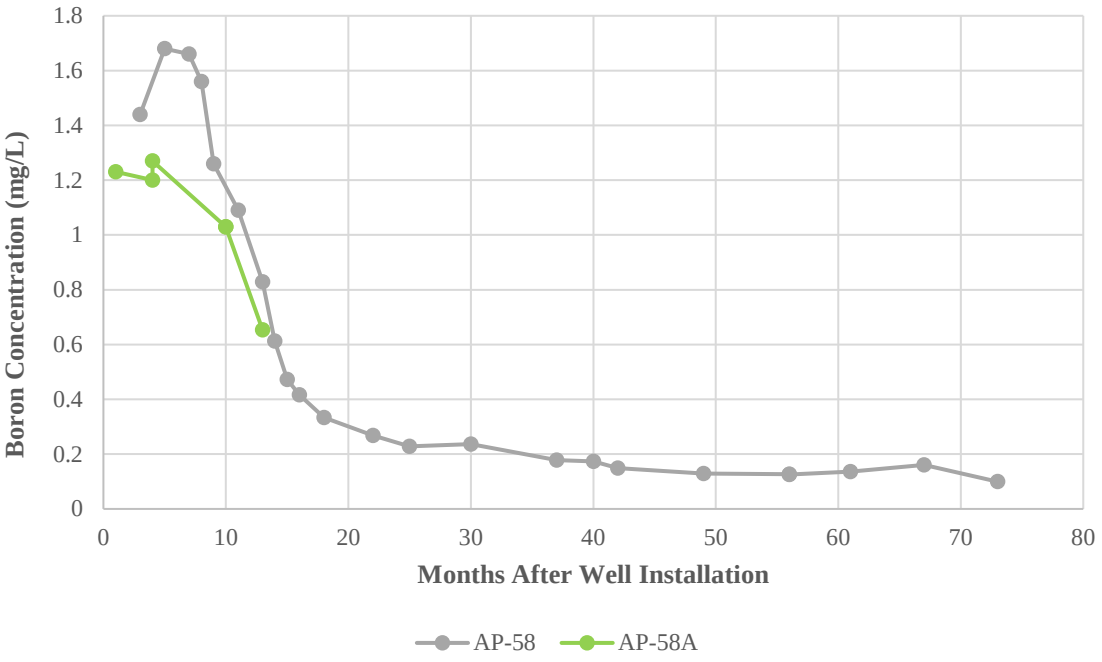

Notes:
1. Boron and chloride concentrations are shown in milligrams per liter (mg/L).
2. Monitoring well AP-58 was installed in February 2016 and ceased use in September 2022 after it sustained irreparable damage.
3. AP-58A was installed in November 2022 to replace AP-58.

AP-58 and AP-58A Boron and Chloride Comparison

Flint Creek Primary Bottom Ash Pond

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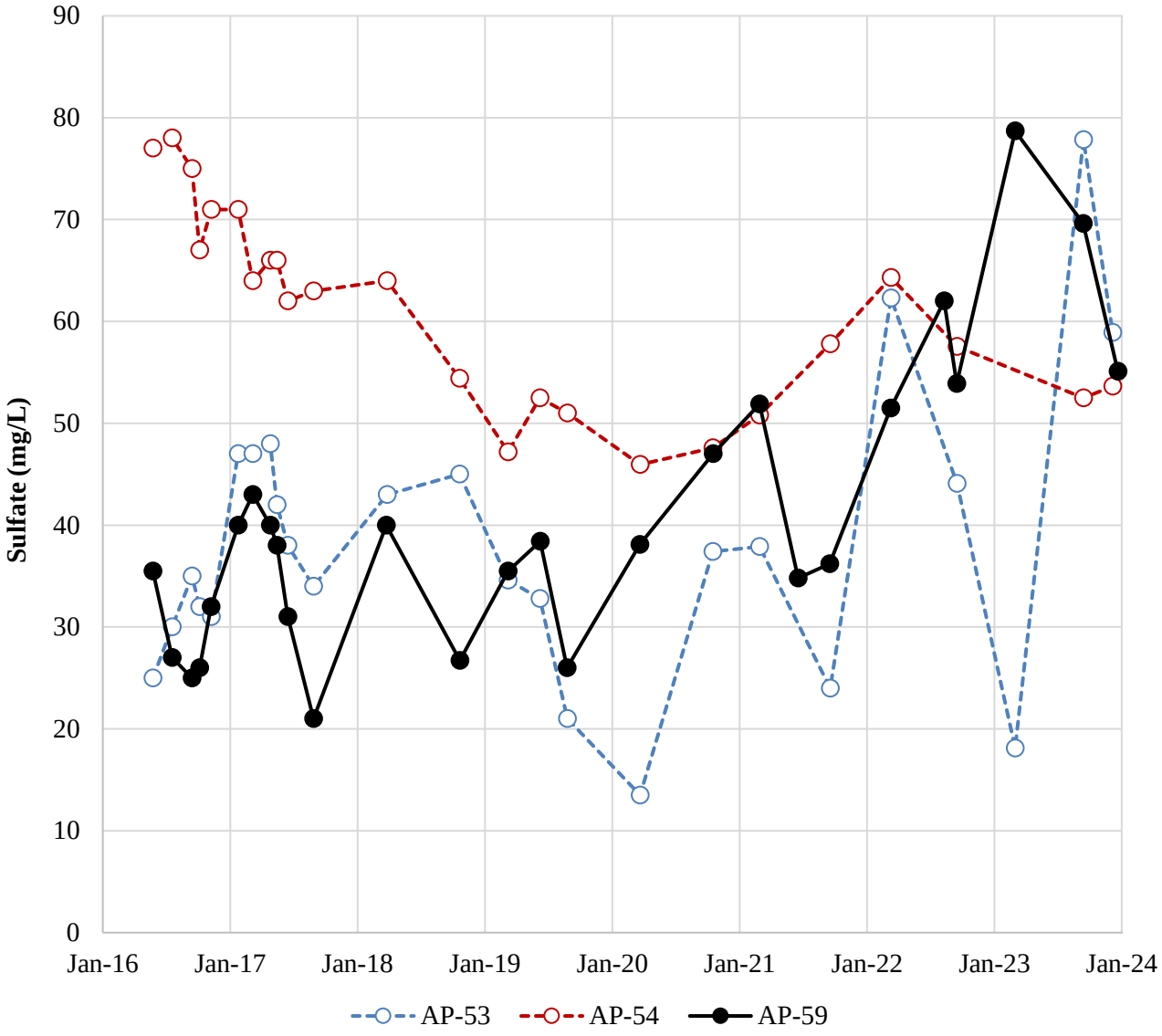
Figure **4**

Columbus, Ohio

June 2024



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

mg/L: milligrams per liter

Sulfate Comparison to Background Monitoring Wells

Flint Creek Primary Bottom Ash Pond

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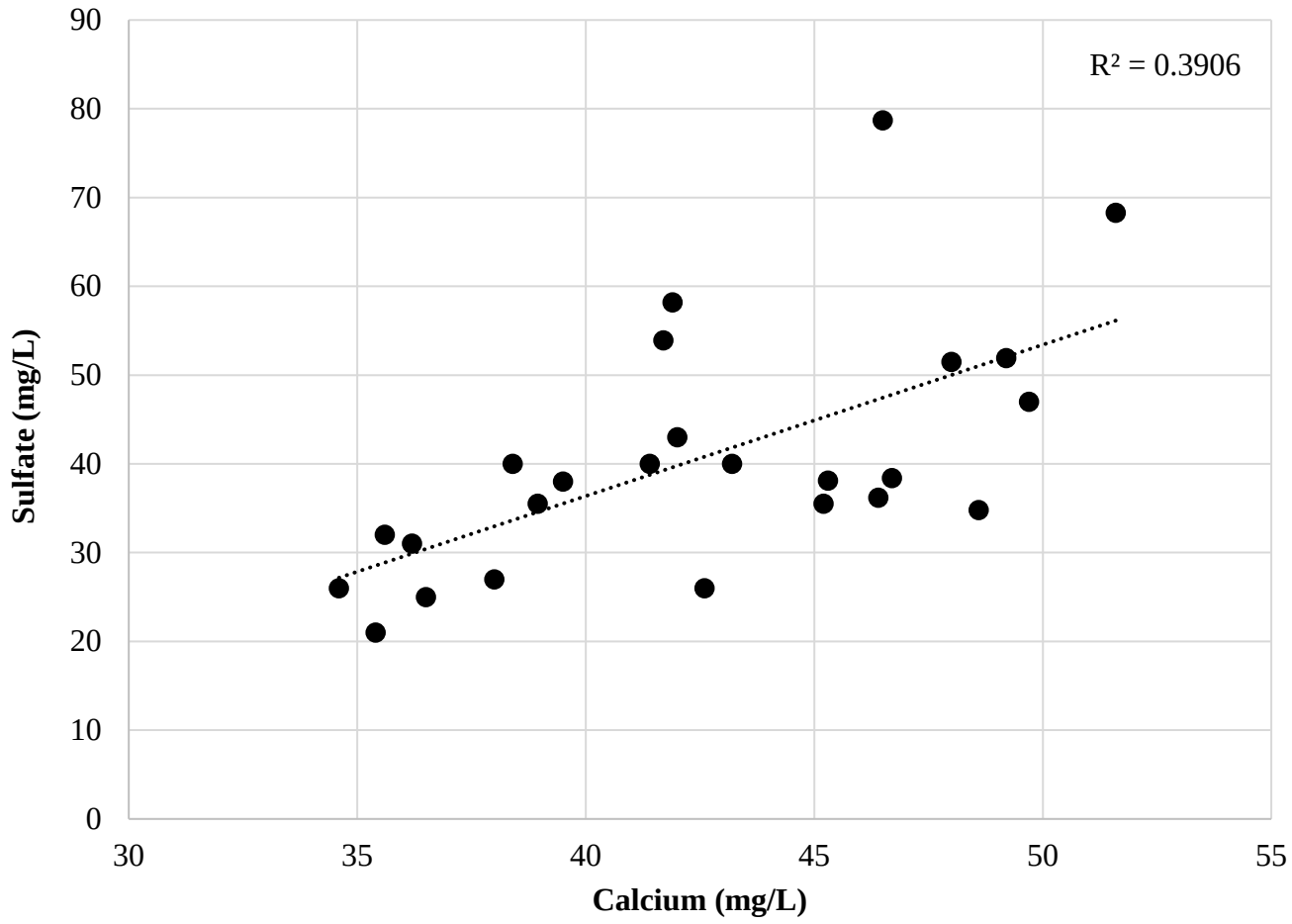
June 2024

Figure **5**



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

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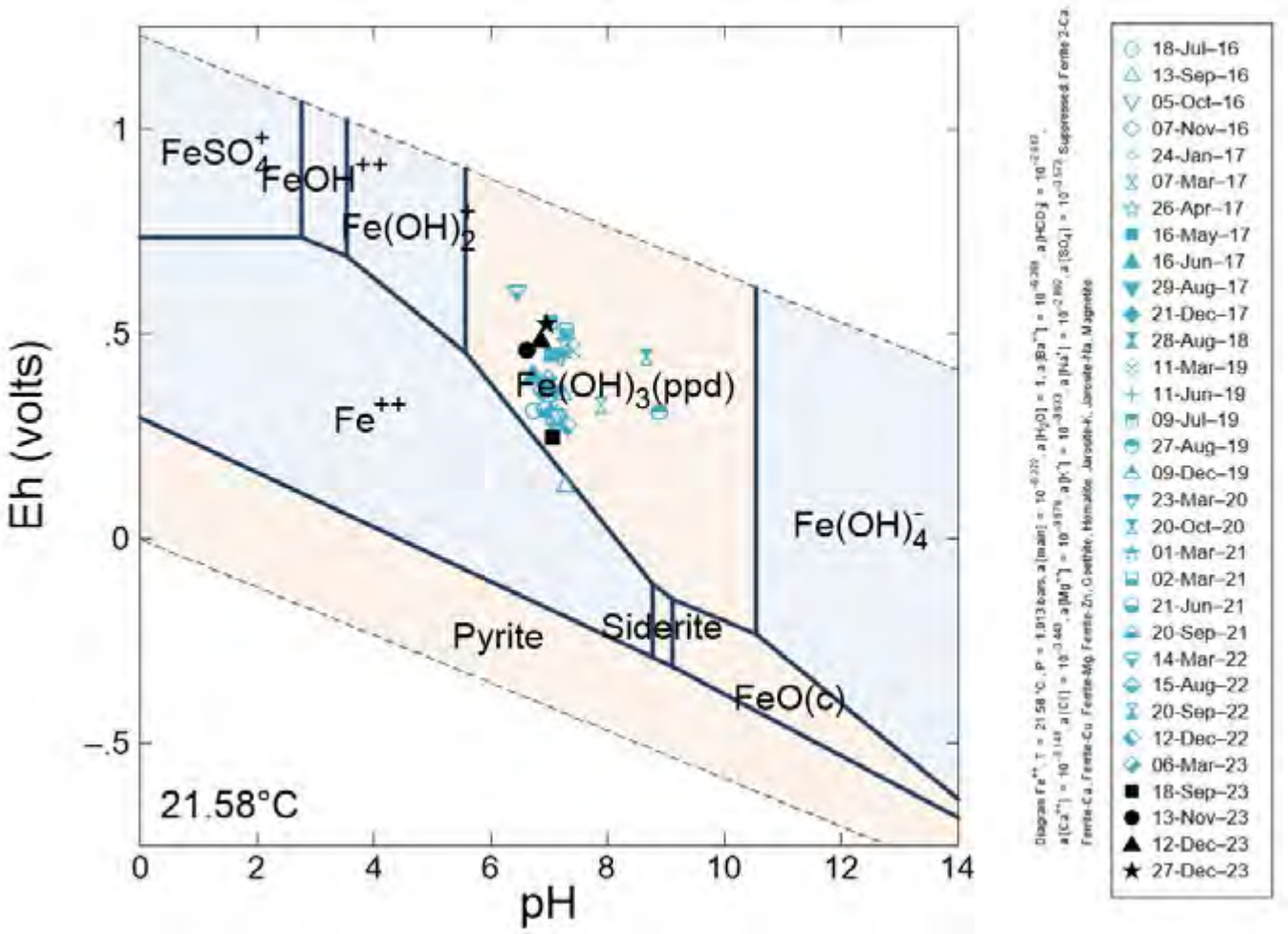
June 2024

Figure **6**



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

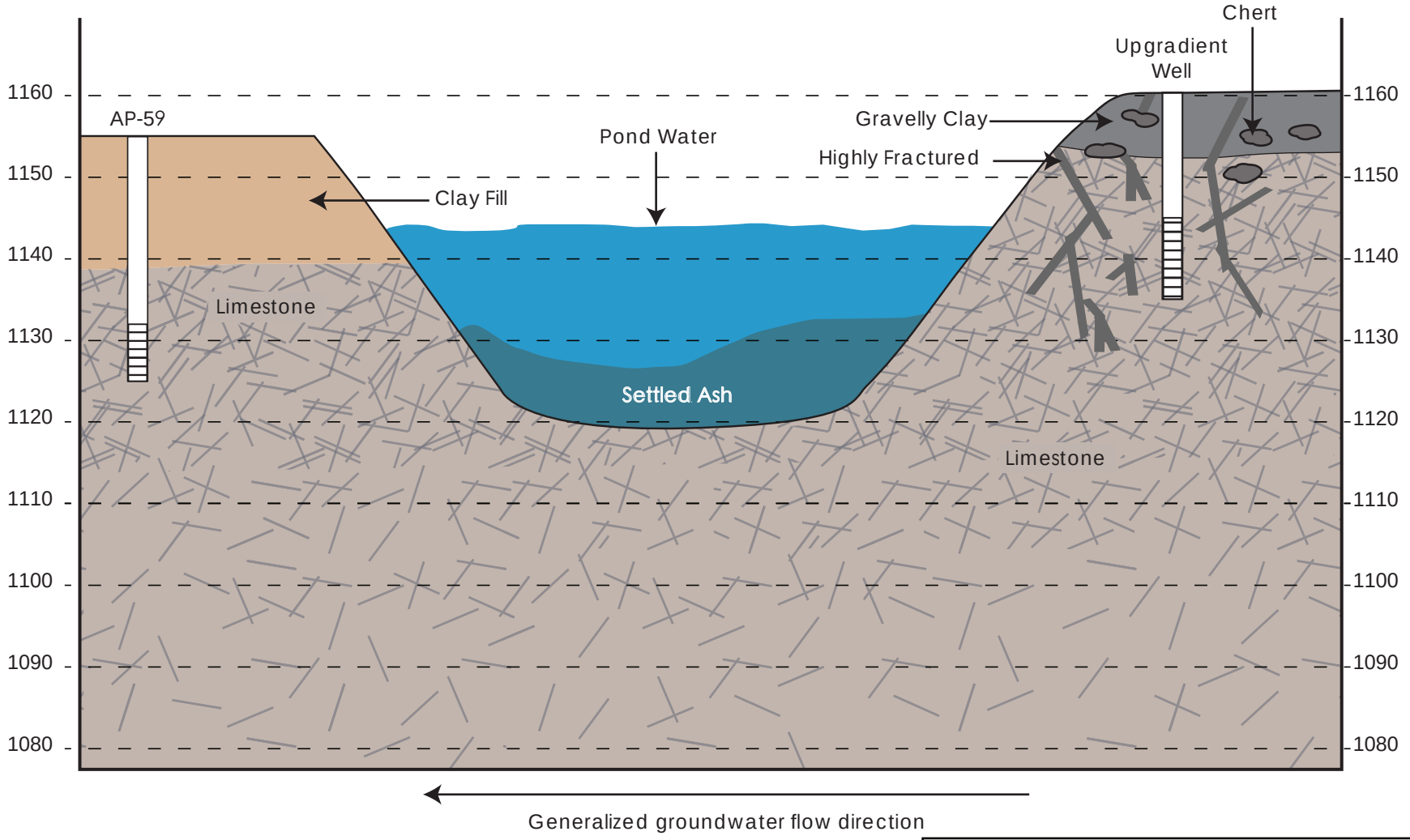
Geosyntec consultants

AMERICAN ELECTRIC POWER

Columbus, Ohio

June 2024

Figure 7



Not to Scale

Site Geology Illustration
Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

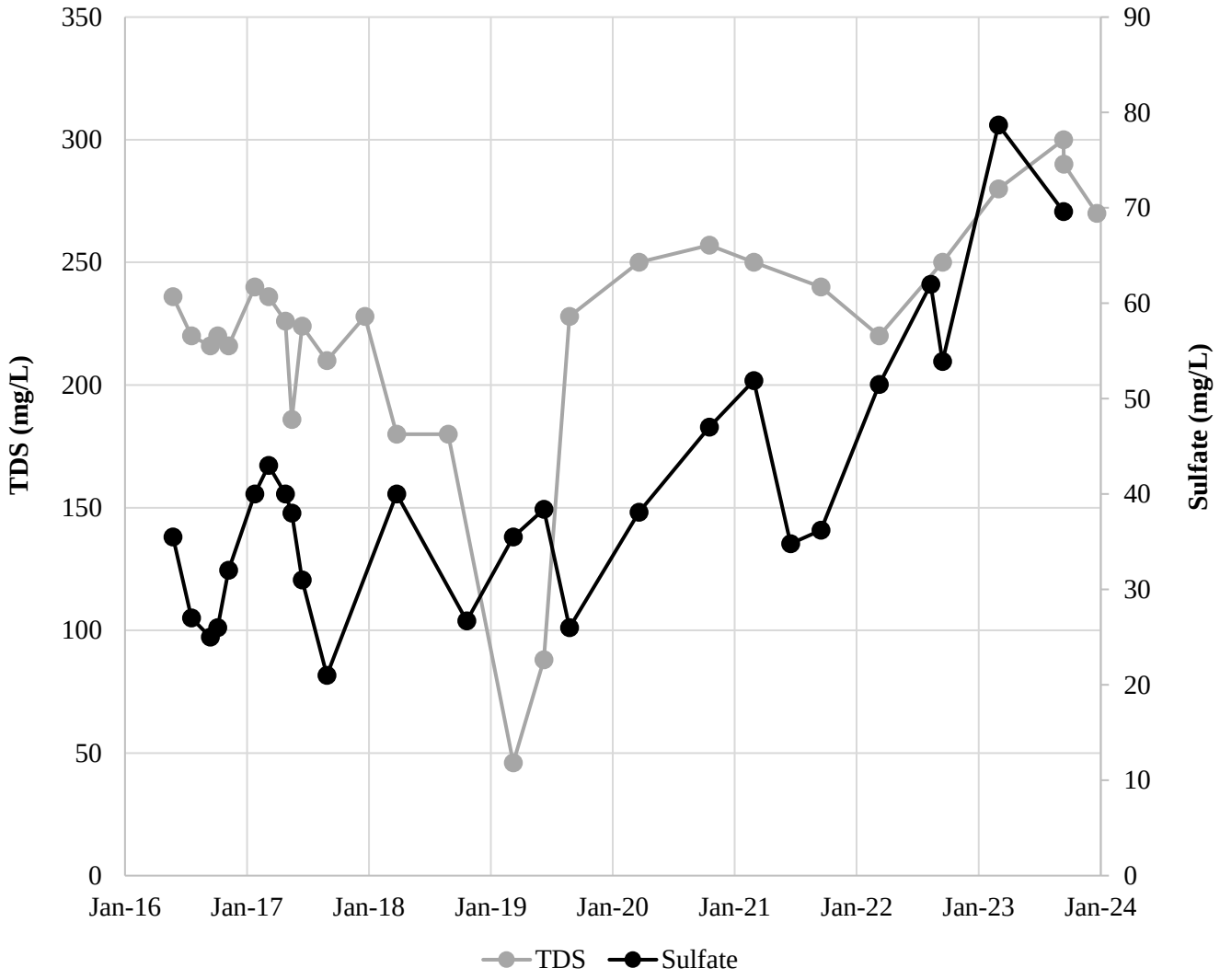
AMERICAN ELECTRIC POWER

Columbus, Ohio

June 2024

Figure **8**

FlintCreekIllustration_July2021_CHA8495.ai



Notes:
1. Total dissolved solids (TDS) and total sulfate concentrations are shown for compliance well AP-59

mg/L: milligrams per liter

AP-59 TDS and Sulfate Time Series
Flint Creek Primary Bottom Ash Pond

Geosyntec consultants

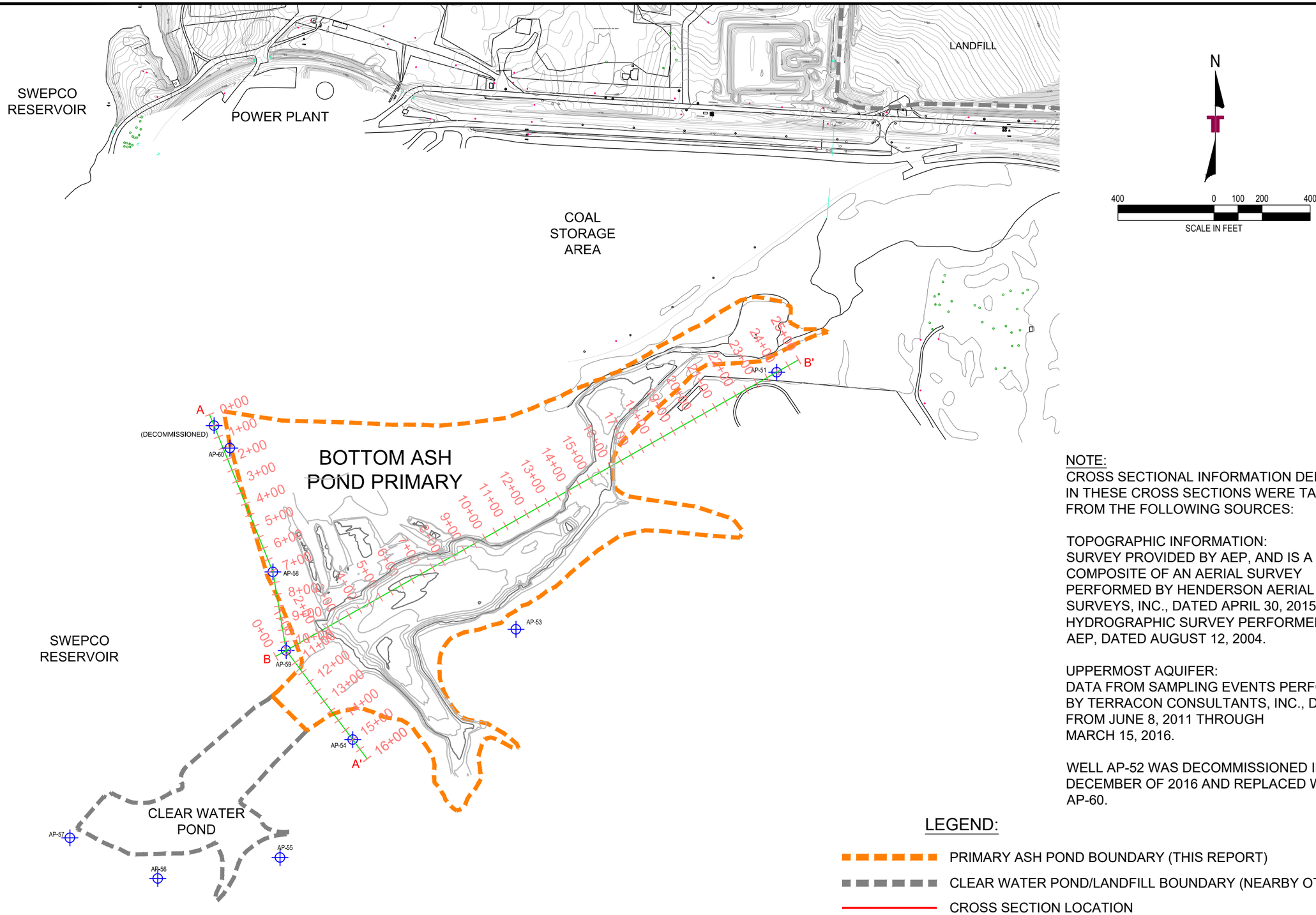
AMERICAN ELECTRIC POWER

Columbus, Ohio

June 2024

Figure **9**

ATTACHMENT A
Geologic Cross Sections



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

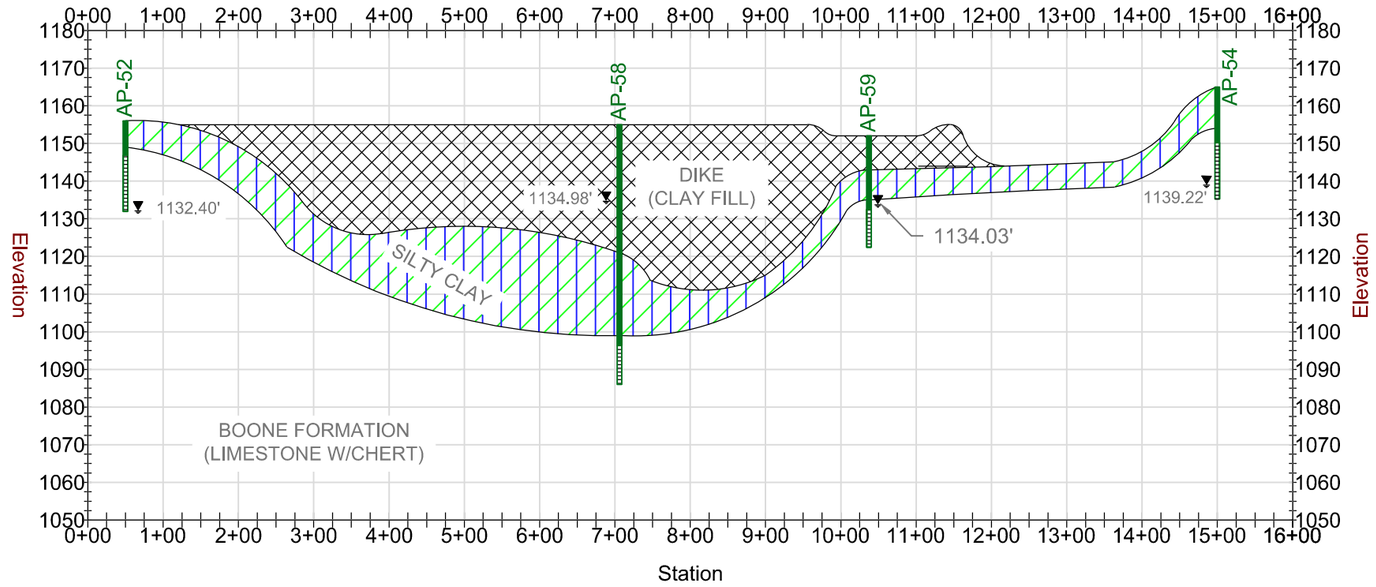
CROSS SECTION LOCATION MAP

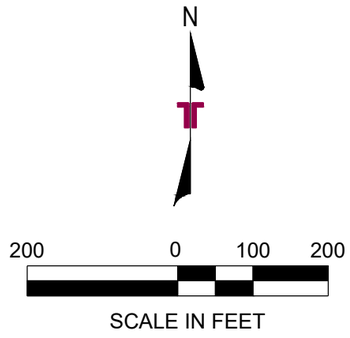
GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEK POWER PLANT BOTTPONDOM ASH
GENTRY ARKANSAS

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

REV.	DATE	BY	DESCRIPTION

ALIGN- A-A'

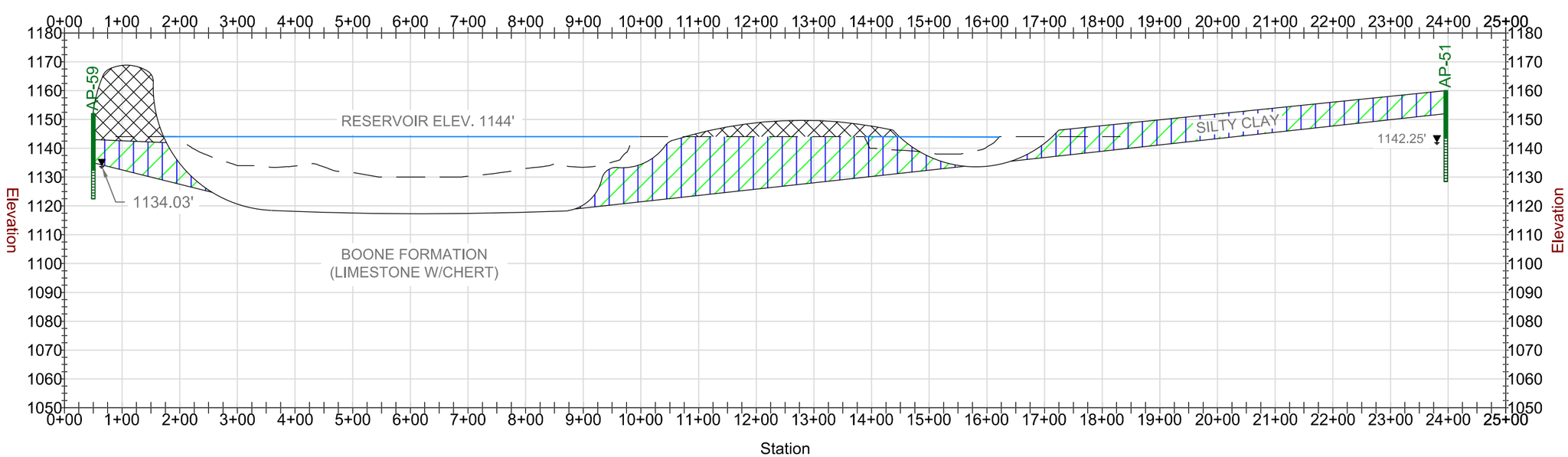




LEGEND:

- 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

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

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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-58 PAGE: 1 of 2

TOTAL DEPTH: 69 FEET BELOW GROUND SURFACE (BGS)

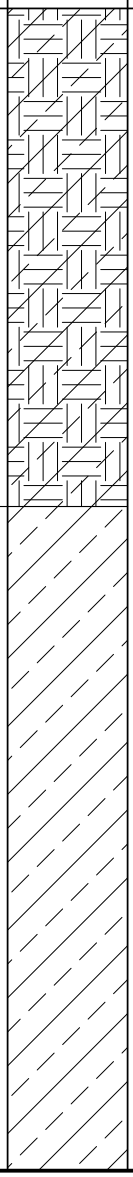
CLIENT: AMERICAN ELECTRIC POWER	PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35157182-002	DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: ADAM HOOPER	DRILLER: GARY MOYERS
DATE DRILLED: 2/16/2016	RIG TYPE: CME 75 BUGGY

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

FIELD BORING LOG

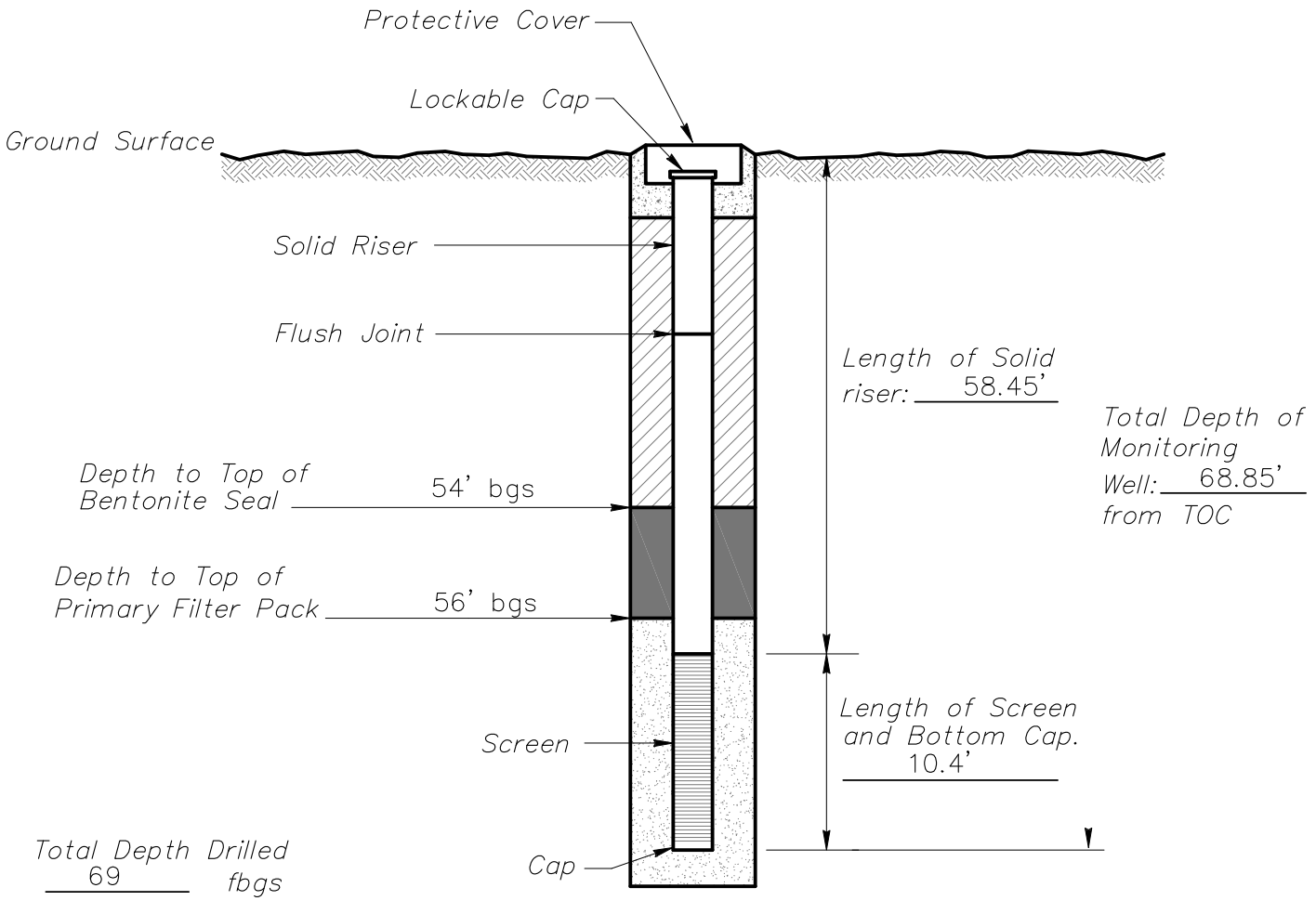
BORING NO.: AP-58 PAGE: 2 of 2

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			

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

FIELD BORING LOG

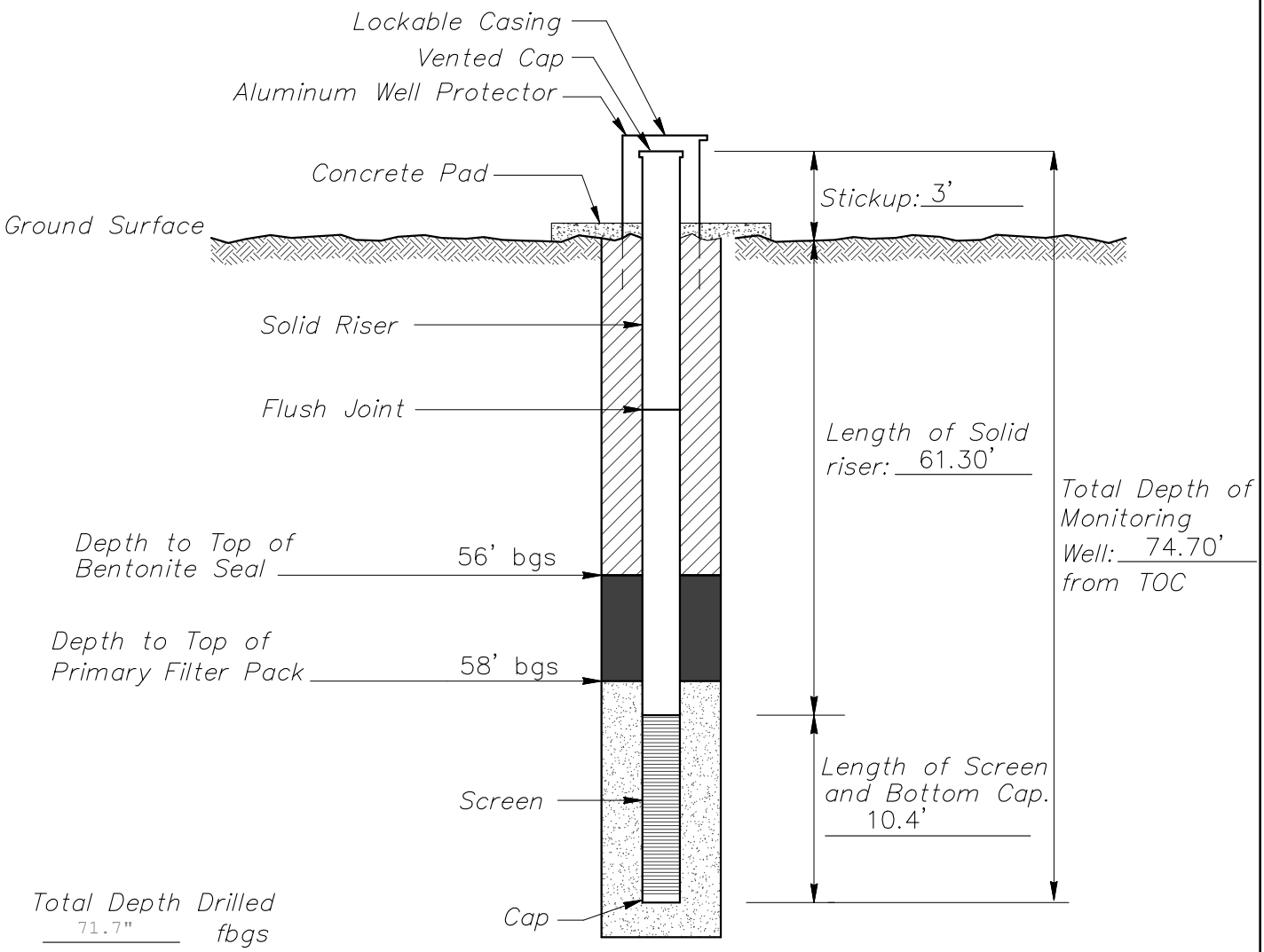
BORING NO.: AP-58A PAGE: 2 of 2

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

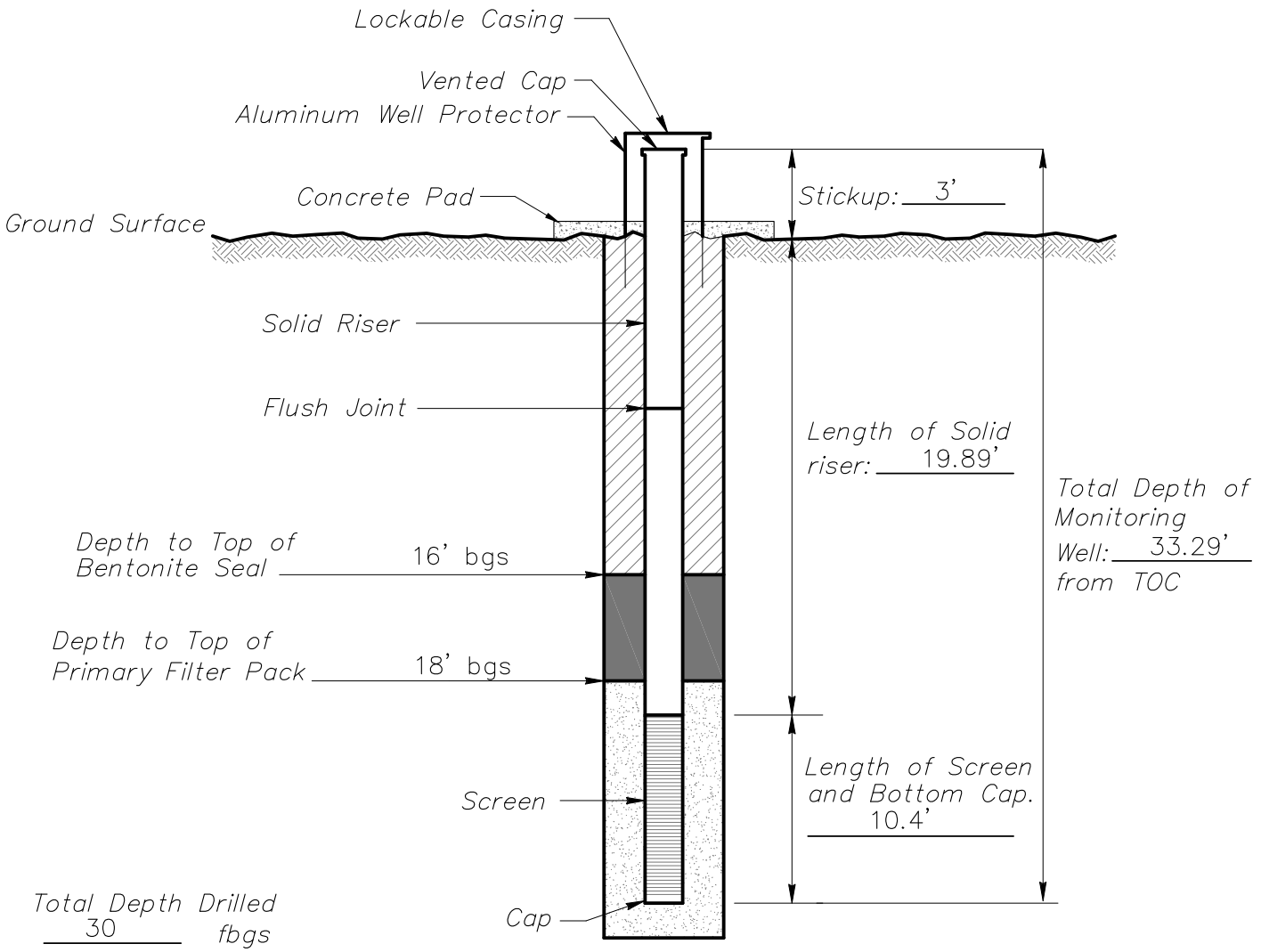
SAMPLING METHOD: 5' CONTINUOUS SAMPLER - LOGGED BY CUTTINGS

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)

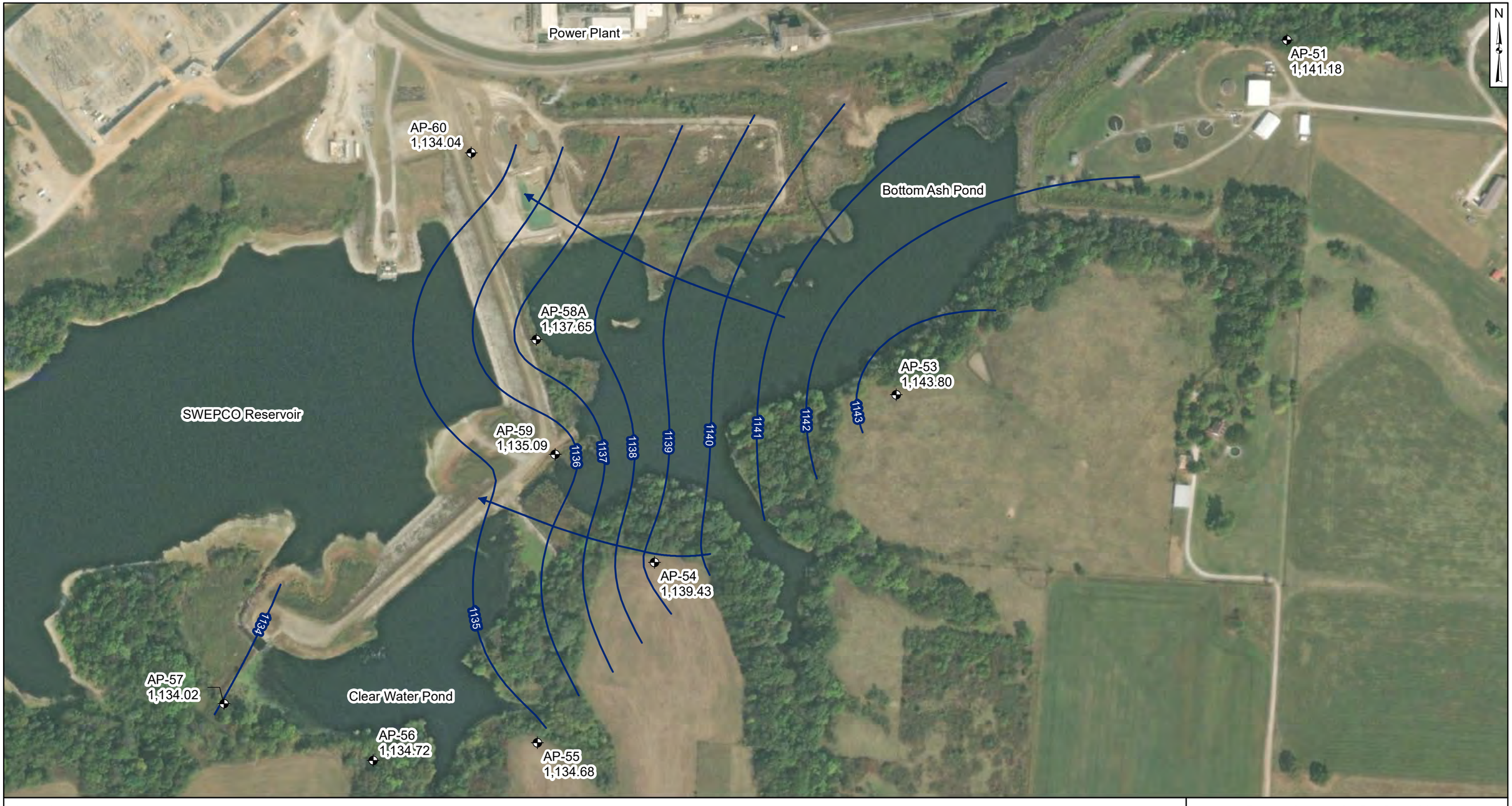
Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

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

ATTACHMENT C

Potentiometric Surface Maps, Uppermost Aquifer
September 2023 and December 2023

Map was previously provided in AEP. 2024. 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 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).

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
C-1

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2023\AEP-Flint Creek_GW_BAP_Sept2023.mxd. ASoltero. 9/29/2023. CHA8423/01/08.

Map was previously provided in AEP. 2024. 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 27, 2023, provided by AEP.
- Only wells AP-58A and AP-59 were gauged during the December 2023 verification event. Groundwater contours based on September 2023 sampling event.
- 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 - December 2023

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

Geosyntec consultants

Columbus, Ohio | 2024/01/23

Figure **C-2**

\\annarbor-01\Data\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2023\AEP-Flint Creek_GW_BAP_Dec2023_ver.mxd. ASoltero. 1/23/2024. CHA8423/01/08.

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	B, Ca, Li, Sb, As, Ba, Be, Cd, Cr, Co, Pb, Mo, Se, Tl and Na, K, Mg, Sr (250 mL bottle, pH<2, HNO3)	Ra-226, Ra-228 (Three (six every 10th*) 1L bottles, pH<2, HNO3)	TDS, F, Cl, SO4, and Br, Alkalinity (1 L + 250 mL bottles, Cool, 0-6C)	Hg (40 mL Glass vial or 250 mL PTFE lined bottle, HCL**, pH<2)	dissolved Fe and dissolved Mn (Field-filter 250 mL bottle then pH<2, HNO3)		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			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

AMERICAN ELECTRIC POWER

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 pm

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 lpn

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 lpn

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 Pointe Blvd, Suite 103
Tallahassee, Florida 32308

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

9864	Arkansas	June/28/2024
License Number	Licensing State	Date