APPENDIX H –
HYDROGEOLOGIC INVESTIGATIONS

APPENDIX H.1

TECHNICAL EVALUATION OF HYDROGEOLOGY

Appendix H.1 – Technical Evaluation of Hydrogeology

TDEC Commissioner's Order:
Environmental Assessment Report
Cumberland Fossil Plant
Cumberland City, Tennessee

August 14, 2023

Prepared for:

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APPENDIX H.1 – TECHNICAL EVALUATION OF HYDROGEOLOGY

REVISION LOG

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0	Submittal to TDEC	April 29, 2022
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Sign-off Sheet

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Abbreviations

amsl	Above Mean Sea Level
CARA	Corrective Action/Risk Assessment
CCR	Coal Combustion Residuals
CCR Parameters	Constituents listed in Appendices III and IV of 40 CFR 257 and five inorganic constituents included in Appendix I of Tennessee Rule 0400-11-01-.04
CCR Rule	Title 40, Code of Federal Regulations, Part 257
CFR	Code of Federal Regulations
cm/sec	Centimeters Per Second
CUF Plant	Cumberland Fossil Plant
DO	Dissolved Oxygen
EAR	Environmental Assessment Report
EI	Environmental Investigation
EIP	Environmental Investigation Plan
ENV	Environmental
EnvStds	Environmental Standards, Inc.
GSL	Groundwater Screening Level
mg/L	Milligrams per Liter
NTU	Nephelometric Turbidity Unit
ORP	Oxidation / Reduction Potential
%	Percent
PLM	Polarized Light Microscopy
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan
SAP	Sampling and Analysis Plan
SAR	Sampling and Analysis Report
SPLP	Synthetic Precipitation Leaching Procedure
Stantec	Stantec Consulting Services Inc.
TDEC	Tennessee Department of Environment and Conservation
TDEC Order	TDEC Commissioner’s Order OGC15-0177
TDEC permitted landfill	Dry Ash Stack and Gypsum Storage Area
TDS	Total Dissolved Solids
TI	Technical Instructions
TOC	Total Organic Carbon
TVA	Tennessee Valley Authority
µS/cm	Microsiemens per Centimeter

1.0 INTRODUCTION

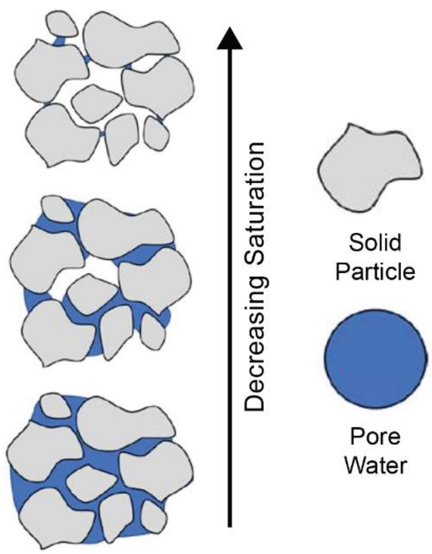
Stantec Consulting Services Inc (Stantec), on behalf of the Tennessee Valley Authority (TVA), has prepared this technical evaluation appendix to summarize historical and recent evaluations of hydrogeological and analytical results for groundwater and geochemical data at TVA's Cumberland Fossil Plant (CUF Plant) in Cumberland City, Tennessee. This technical appendix also provides a characterization of the extent of contamination and preliminary explanation for the observed occurrences of coal combustion residuals (CCR) constituents in groundwater to support information provided in the Environmental Assessment Report (EAR) and to fulfill the requirements for the Tennessee Department of Environment and Conservation (TDEC) -issued Commissioner's Order No. OGC15-0177 (TDEC Order) Program (TDEC 2015). Further evaluation of the need for corrective actions and the associated extent of groundwater contamination will be provided in the Corrective Action/Risk Assessment (CARA) Plan. For purposes of this document, the following hydrogeological terms as they are defined below are used throughout this document.

- Pore water – subsurface water that occurs in pore spaces in CCR material
- Groundwater – subsurface water that occurs in pore spaces in unconsolidated or geologic materials (e.g., soil, bedrock)
- Aquifer – a geologic formation capable of yielding useable quantities of groundwater
- Confined aquifer – an aquifer present between two aquitards when the water level in a well is observed to be above the top of the aquifer due to the confining pressure (see graphic below)
- Aquitard – a geologic formation comprised of less permeable geologic materials that transmit groundwater more slowly than an aquifer
- Saturated – Unconsolidated or geologic materials (e.g., soil, bedrock) or CCR material where all of the pore space is filled with water. The use of the term "saturated" in reference to the moisture content of CCR material does not imply that the pore water is readily separable from the CCR material.
- Moisture content – the measure of the amount of water contained within unconsolidated or geologic materials (e.g., soil, bedrock) or CCR material. Moisture content of saturated material can be variable because the characteristics of the material determine the amount of pore space available for water to fill.
- Phreatic surface – the surface of pore water at which pressure is atmospheric and below which CCR material may be saturated with pore water. Pore water levels are measured at locations where temporary wells or piezometers were installed within CCR material. The measured pore water levels are used to infer pore water levels between the wells and piezometers to develop the phreatic surface.

- Piezometric surface – the groundwater surface defined by the level to which groundwater will rise in a well completed in a confined aquifer
- Uppermost aquifer – the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within a facility's property boundary.

In a confined aquifer, measured groundwater levels rise above the top of the aquifer. The difference between the measured groundwater levels within the aquifer and the top of the aquifer is call the pressure head. A figure showing pressure head for a confined aquifer and associated bounding aquitards is provided below. For confined aquifers, groundwater is not encountered in the interval shown as pressure head above the top of the aquifer because it is bounded by an upper aquitard, which also physically separates the groundwater from the geologic unit located above the upper aquitard.

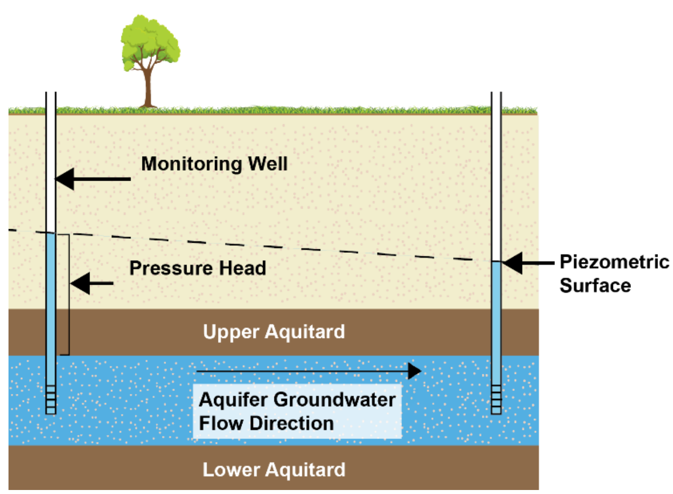
Pore Water



Benson, C., *Water Flow in Coal Combustion Products and Drainage of Free Water*, Report No. 3002021963, Electric Power Research Institute, Palo Alto, CA.

This figure depicts how subsurface water occurs in the pore spaces in CCR material (referred to as "pore water" in this EAR), and how saturation varies within the CCR material. The phreatic surface is the surface of pore water at which pressure is atmospheric and below which CCR material may be saturated with pore water.

Confined Aquifer



Groundwater is subsurface water that occurs in pore spaces in soil or bedrock. Groundwater level measurements are used to estimate directions of groundwater movement. Groundwater generally flows much more slowly than water in a surface stream or river.

2.0 GROUNDWATER AND HYDROGEOLOGICAL INVESTIGATIONS

The purpose of the groundwater and hydrogeological investigations was to further characterize and evaluate subsurface conditions in proximity to four CCR management units at the CUF Plant, including the Stilling Pond (including Retention Pond), Dry Ash Stack, Gypsum Storage Area, and Bottom Ash Pond. For this investigation, TVA reviewed information from previous studies and assessments, completed field sampling programs, and conducted evaluations related to geology, hydrogeology, groundwater quality, and CCR material characteristics as part of the TDEC Order Environmental Investigation (EI).

The following sections summarize the previous studies and present overall hydrogeological investigation and evaluation findings related to the CUF Plant CCR management units based on data obtained during previous studies and the EI.

2.1 PREVIOUS STUDIES AND ASSESSMENTS

This section provides a summary of prior studies that have been conducted at the CUF Plant and provide useable information related to geology, hydrogeology, groundwater quality, and CCR material characteristics. No previous studies of the geochemical interaction of geological materials, groundwater or pore water are known to have been conducted. In addition to the studies summarized below, information from other hydrogeological and geotechnical studies that met the data quality objectives of the Environmental Investigation Plan (EIP, TVA 2018a) is incorporated into the evaluation presented in this appendix.

Exploratory drilling at the CUF Plant began in 1958 to evaluate the suitability for the foundation for a proposed power plant. Faulting, highly fractured bedrock and jointing across the study area were observed in cores of bedrock (Kellberg 1958).

In 1991, TVA initiated a field exploration program to support an application to TDEC for a landfill permit. The permit application consisted of a review of existing data from available soil borings to evaluate if the area that was being used for CCR management was a suitable location for the continued management of fly ash, bottom ash and gypsum (Law 1992). To supplement the available data, additional field exploration and testing activities were conducted in 1992 and 1993 to characterize the hydrogeology of the proposed landfill site (Law 1992 and TVA 1998). Based on the results of the investigations and the associated landfill permit application, TDEC issued Solid Waste Disposal Permit #IDL 81-102-0082 to continue managing CCR material in the CCR management units known today as the Dry Ash Stack and Gypsum Storage Area (collectively the TDEC permitted landfill).

In 1993, TVA began a groundwater detection monitoring program to satisfy requirements of the TDEC Solid Waste Disposal Permit #IDL 81-102-0082, which after a permit modification in 1996 became current permit number #IDL 81-102-0086 (TVA 1998). As part of this program, groundwater samples were collected, and water elevations were measured at compliance monitoring wells and background monitoring well locations surrounding the TDEC permitted landfill. Surface water samples were collected at Rye Spring and from Wells Creek at locations upstream and downstream of the CUF Plant CCR management units to enable hydrogeologic interpretation of the groundwater quality results. Samples were collected from Rye Spring until 2016, when the property owner rescinded access. Exhibit H.1-1 shows the locations of Wells Creek and Rye Spring.

In 2009, TDEC placed the TDEC permitted landfill into a groundwater assessment monitoring program, which required quarterly groundwater sample collection (TVA 2009).

In 2010-2011, TVA began a voluntary monitoring program at its surface impoundments. A field assessment was conducted to evaluate the suitability of existing monitoring wells to serve as part of a voluntary groundwater monitoring system and evaluate the proposed locations of additional wells required to achieve the objective of one upgradient and three downgradient wells (TVA 2011a). For the Stilling Pond (including Retention Pond), one existing monitoring well and two new monitoring wells were included in the groundwater monitoring system as downgradient wells. The above noted sampling locations in Rye Spring and Wells Creek were included in lieu of upgradient wells. Samples were collected from this monitoring system between 2011 and 2016.

In 2015-2016, a hydrogeological investigation was implemented south of Wells Creek to support an application to TDEC for a permit for a new solid waste landfill to provide storage for fly ash, bottom ash, and synthetic gypsum produced at the CUF Plant (TVA 2018c). The investigation consisted of drilling several test borings, piezometers and observation wells. Additional monitoring wells and one piezometer were installed between 2017 and 2018, and groundwater sampling activities were conducted.

In 2016, activities were conducted to develop a monitoring well system that met criteria of Title 40, Code of Federal Regulations (40 CFR) Part 257 (CCR Rule), including the installation of new wells and the closure of wells no longer in use. Other activities included well redevelopment, downhole video logging of wells, dedicated sampling pump installations, and field survey of wells remaining in-service. Twelve monitoring wells were installed, and 10 wells were closed (Stantec 2017). Groundwater monitoring under the CCR Rule started in 2016.

In 2012, 2013 and 2016, TVA conducted chemical characterization studies of the CCR material produced by operations at the CUF Plant (AECOM 2016). CCR material samples were collected and tested for physical and chemical characteristics, including leachability and total metals. The collected samples included dry fly ash, bottom ash, gypsum used to manufacture wallboard, and unused gypsum fines. The historical studies did not include the collection of CCR management unit pore water.

In 2018, TVA included historical information in Appendix M of the EIP regarding previously existing, abandoned, or closed piezometers and wells along with historical monitored surface water locations. Available construction and abandonment information for the borings, piezometers, and monitoring wells from previous studies and assessments was provided in Appendix N of the EIP. Historical groundwater quality data from these previous studies were provided in Tables 1A through 1C of Appendix M in the EIP and included groundwater elevations and chemical and physical parameters. Historical surface water data collected at Rye Spring were provided in Tables 1A through 1C of Appendix M in the EIP.

2.2 CURRENT AND ONGOING GROUNDWATER MONITORING

Current and ongoing compliance groundwater monitoring at the CUF Plant CCR management units consists of two programs:

- **CCR Rule Monitoring Program**: Monitoring at the Stilling Pond (including Retention Pond), Dry Ash Stack, Gypsum Storage Area, and Bottom Ash Pond is conducted per the CCR Rule. In accordance with the CCR Rule, TVA established two groundwater monitoring systems. One system was certified for the Stilling Pond (including Retention Pond). A second multiunit groundwater monitoring system was certified for the other CCR management units (AECOM 2017, a and b). Baseline sampling, detection monitoring and assessment monitoring phases were implemented from 2016 to the present. Groundwater elevation and analytical data have been and continue to be provided to TDEC and posted to TVA's CCR Rule Compliance Data and Information public website.

  Based on groundwater analytical results, TVA prepared *Assessment of Corrective Measures Reports* for each groundwater monitoring system (TVA 2019) in accordance with the CCR Rule. Subsequently, the remedy selection process began to select a remedy that meets the requirements of the CCR Rule. TVA will continue to produce semiannual remedy selection reports describing the progress made toward the selection and design of remedies and annual groundwater monitoring and corrective action reports describing groundwater analytical results from continued groundwater assessment monitoring.

- **TDEC Permitted Landfill Monitoring Program**. From 1993 to the present, TVA has conducted groundwater monitoring at the TDEC permitted landfill under Solid Waste Disposal Permit No. IDL 81-102-0086. The sampling has been conducted in accordance with the Groundwater Quality Assessment Plans (TVA 2011b, 2017, and 2018b). Groundwater analytical data reports have been and continue to be provided to TDEC as part of this program.

Exhibit H.1-1 shows the current groundwater monitoring well and piezometer networks. Appendix E.3 provides a list of the wells and their associated monitoring program.

2.3 HYDROGEOLOGY

The objectives of the TDEC Order hydrogeological and groundwater investigations were to characterize the hydrogeology and groundwater quality and evaluate groundwater flow conditions in the vicinity of the CUF Plant CCR management units.

TVA performed well installation and groundwater sample collection activities in accordance with the *EIP*, *Groundwater Investigation and Hydrogeological Investigation Sampling and Analysis Plans (SAPs)* (Stantec 2018b and c), *Hydrogeological Investigation SAP Addendum – CUF-1006* (Stantec 2021), *QAPP* and TVA's TIs. Well installation and sample location selection, sample collection methodology, sample analyses, and quality assurance/quality control completed for the investigations are provided in the *Hydrogeological Investigation SAR* (Appendix H.2), *the Hydrogeological Investigation SAR Addendum –*

CUF-1006 (Appendix H.3), and the *Groundwater Investigation SARs* for the six sampling events (Appendices H.4 through H.9).

As reported in the *Groundwater and Hydrogeological Investigation SARs*, the data collected during these investigations were deemed usable for reporting and evaluation in this EAR because they met the objectives of the *EIP*. An analysis of results and discussion of the dataset from these investigations along with data collected under other *TDEC Order SAPs* and data collected under other TDEC permitted landfill and CCR Rule compliance programs is presented in the sections below.

2.3.1 Scope of Work

The scope of work for the EI hydrogeological and groundwater investigations included drilling soil borings and installing permanent wells at six planned locations, collecting soil samples from the screened interval of three proposed background well locations and conducting six groundwater sampling events. Encountered field conditions resulted in modifications to the original plan defined in the SAP. These changes are discussed in Section 2.4.2.

The groundwater sampling events included gauging groundwater pressures and pore water levels in permanent and temporary monitoring wells installed as part of the EI and other existing monitoring wells and piezometers near the CCR management units. The groundwater and soil samples were analyzed for the CCR-related constituents listed in Appendices III and IV of the CCR Rule, except soil samples were not analyzed for total dissolved solids. In addition, five inorganic constituents listed in Appendix I of Tennessee Rule 0400-11-01-.04 and not included in the CCR Rule Appendices III and IV were analyzed to maintain continuity with the TDEC compliance programs. These additional TDEC Appendix I constituents included copper, nickel, silver, vanadium, and zinc. The combined federal CCR Appendices III and IV constituents and TDEC Appendix I inorganic constituents are hereafter referred to as CCR Parameters. For geochemical evaluation, groundwater samples were analyzed for major cations/anions not included in the CCR Parameters. The additional geochemical parameters included bicarbonate, carbonate, magnesium, potassium, and sodium. Table H.1-1 provides a summary of the boring and well locations associated with the hydrogeological investigation and the rationale for each well location. The locations of the EI wells and other program well locations are shown on Exhibit H.1-1.

2.3.2 Well Installation

The hydrogeological investigation well installation activities were conducted between November 29, 2018 and July 19, 2019, and between March 11, 2021 and August 31, 2021, and consisted of hollow stem auger drilling, well installation, well development, slug testing, pump installation, and well surveys. Stantec performed field activities based on guidance and specifications listed in TVA's TIs, the *SAPs* and the *QAPP*.

Two of three proposed background permanent wells (CUF-1000 and CUF-1001) were installed in unconsolidated materials to provide groundwater samples that have not been affected by the CCR management units and to be representative of background conditions. Monitoring well CUF-1000 was repeatedly dry and is not considered a viable well; therefore, it was removed from this analysis. While CUF-1001 is an upgradient well, it does not appear to be representative of background conditions based on the statistical evaluation of reported analytical results as discussed in Section 2.5. The third proposed background permanent well (CUF-1004) was planned at a location south of the CCR management units; however, none of the three borings advanced at this location was completed as a well because groundwater was not encountered in the unconsolidated materials. Soil samples were collected from the screened intervals of each of the background well borings for analysis of CCR Parameters. The results are provided in the *Background Soil Investigation SAR* (Appendix F.1).

Wells CUF-1002 and CUF-1003 were proposed as downgradient wells to investigate groundwater in unconsolidated materials above bedrock between the CCR management units and the CUF Plant but, based on the evaluation of measured groundwater elevations, they are considered to be upgradient of the CCR management units (see Exhibit H.1-2). Certain CCR constituents were detected in these wells at statistically significant concentrations above groundwater screening levels (GSLs); therefore, analytical results of groundwater samples collected from these wells are not considered to be representative of background groundwater quality.

Well CUF-1005 was installed in unconsolidated materials on the east side of the Gypsum Storage Area. Based on the reported analytical results for samples collected from this well, TVA conducted supplemental analysis using polarized light microscopy (PLM) of retained cores from the original borehole. The results of the PLM analyses indicated a 2.8-foot-thick zone that consisted of 78% to 85% CCR material within the CUF-1005 screened interval. The zone containing CCR material was identified from 21.5 to 24.3 feet below ground surface. Information from the *CCR Material Quantity Investigation SAR* (Appendix G.5) was used to confirm that the screened interval was located in CCR material within the Gypsum Storage Area; therefore, the analytical results of samples collected from well CUF-1005 are representative of pore water, not groundwater. The laboratory report containing the results of the PLM analyses is provided in Attachment H.1-A. Exhibit D.2 (Appendix D) shows a cross-section of the Gypsum Storage Area, including the location of the screen for well CUF-1005.

Because the analytical results of samples collected from well CUF-1005 are representative of pore water, they are not included in the groundwater quality evaluation below. On March 18, 2021, TVA installed additional well CUF-1006 in unconsolidated materials above bedrock approximately 75 feet east of CUF-1005 and outside of the CCR management unit. Exhibit H.1-1 shows the well location. Analytical results of groundwater samples collected from well CUF-1006 are included in the statistical evaluation of groundwater data presented below. Groundwater elevation data from the EI sampling events are summarized in Table H.1-2.

2.3.3 Well Construction

Permanent monitoring wells were installed by qualified drill crews working under the direction of a Stantec Professional Geologist and a licensed Tennessee driller. Wells were constructed of four-inch diameter Schedule 40 polyvinyl chloride (PVC) pre-packed well screen (0.010-inch slots) and riser. The screen and riser consisted of flush-joint, threaded PVC pipe. The screen length was selected based on the results of the boring log and the target stratum and was either five or 10 feet in length. Well construction details are included in the *Hydrogeological Investigation SAR.* Table H.1-3 shows the well construction summary for wells CUF-1000 through CUF-1006 (except for CUF-1004, which was not installed) and other previously existing wells shown on Exhibit H.1-1.

2.3.4 Well Development

Each new permanent well was developed using a combination of bailing, surging, and pumping after a minimum of 24 hours following well installation. A summary of initial and final water quality measurements collected during well development is presented in Table B.2 in Appendix B of the *Hydrogeological Investigation SAR* (Appendix H.2) and Table B.3 in Appendix B of the *Hydrogeological Investigation SAR Addendum – CUF-1006* (Appendix H.3).

2.3.5 Aquifer Testing

2.3.5.1 Pressure Testing

Upon completion of coring in borings that terminated in bedrock as part of the exploratory drilling field program discussed in the *Exploratory Drilling SAR* (Appendix G.2), Stantec performed pressure testing to estimate hydraulic conductivity of shallow bedrock at depths ranging from 0.7 to 54 feet below the bedrock contact (44.0 to 147.7 feet below ground surface) in the temporary wells and geotechnical borings discussed in the *Exploratory Drilling SAR* (Appendix G.2). The bedrock was tested by isolating interval lengths of between five- to 10-foot in the borehole with inflatable rubber packers. Potable water was pumped into each interval at constant pressure, typically for five minutes, with the volume of water lost into the bedrock formation measured using a flow meter. Tests were repeated within each interval over a range of pressures, typically in five pounds per square inch increments.

Estimated hydraulic conductivity values were calculated from the field data based on the rate of flow into the formation at each location. Table H.1-4 provides the equation used and a summary of the estimated bedrock hydraulic conductivities in each tested interval. The bedrock hydraulic conductivity results ranged from 9.8×10^{-6} cm/sec to 5.6×10^{-4} cm/sec. The geometric mean of the hydraulic conductivities is 3.1×10^{-5} cm/sec.

2.3.5.2 Slug Testing

After development of the wells installed as part of the hydrogeological investigation, Stantec performed slug tests in five of the six permanent wells (wells CUF-1001, CUF-1002, CUF-1003, CUF-1005, and CUF-1006) to estimate the hydraulic conductivity of the unconsolidated geologic materials within the screened interval of each well. A pressure transducer with a data recorder was used to collect water level information from the wells. Well CUF-1000 could not be tested because it was repeatedly dry and had an insufficient water column to conduct the tests. A slug test was performed on CUF-1005, but it was determined that the well was screened in CCR material; therefore, the test results were not included in the characterization of natural geological materials.

The field data were analyzed using AQTESOLV™ Version 4.50 Professional software to estimate the hydraulic conductivity of the saturated unconsolidated materials in the screened interval of each tested monitoring well. Calculated hydraulic conductivities are summarized in Table B.3 in Appendix B of the *Hydrogeological Investigation SAR* (Appendix H.2) and Table B.4 in Appendix B of the *Hydrogeological Investigation SAR Addendum – CUF-1006* (Appendix H.3), and the software output packages are provided in Appendix E of the *Hydrogeological Investigation SAR* and Appendix E of the *Hydrogeological*

Investigation SAR Addendum – CUF-1006 (Appendix H.3). The hydraulic conductivity in the four EI permanent wells CUF-1001, CUF-1002, CUF-1003, and CUF-1006 ranged from 5.66 x 10^{-5} cm/sec to 4.45 x 10^{-2} cm/sec.

A summary of the EI slug test results combined with other hydraulic conductivity results obtained during previous plant investigations is provided in Table H.1-5. The geometric mean of the hydraulic conductivities of the wells listed in Table H.1-5 is 6.56 x 10^{-3} cm/sec.

2.3.6 Groundwater Sampling

Groundwater samples were collected during six events on the following dates in 2019 and 2020:

- Event 1 – May 6-10, 2019
- Event 2 – July 8-10, 2019
- Event 3 – September 9-11, 2019
- Event 4 – October 28-30, 2019
- Event 5 – January 6-8, 2020
- Event 6 – March 9-11, 2020.

Additional groundwater samples were collected from CUF-1006 during six events to complete the scope of the Groundwater Investigation SAP on the following dates in 2021 and 2022:

- Event 1 – July 22, 2021 / August 6, 2021 (resampled August 6 because, except for radium, July 22 samples were received out of temperature requirements for analysis)
- Event 2 – August 20, 2021
- Event 3 – October 12, 2021
- Event 4 – January 27, 2022
- Event 5 – March 8, 2022
- Event 6 – April 18, 2022.

TVA performed investigation sample and data collection activities in accordance with the *Groundwater Investigation SAP*, TVA's TIs and the *QAPP*. Permanent wells were purged using dedicated bladder pumps equipped with dedicated tubing and low-flow purging and sampling techniques. Details of each sampling event, except for CUF-1006, are provided in the *Groundwater Investigation SARs*, Events #1 through #6 (Appendices H.3 through H.8).

2.3.7 Hydrogeologic Assessment Results

Several soil boring and well installation projects at and in the vicinity of the CUF Plant CCR management units yielded information about the geology, hydrogeologic properties of the geologic formations, groundwater elevations, groundwater flow direction and groundwater quality. This section provides an evaluation of the hydrogeological setting of CUF Plant CCR management units.

2.3.7.1 Well Construction and Presence of CCR Material

Because of the results of PLM testing of solid material samples collected from the boring for well CUF-1005, a review of boring logs and additional PLM testing was conducted for previously existing monitoring wells installed at similar locations between the dikes constructed at elevations 380 feet above mean sea level (amsl) and 395 feet amsl. The PLM investigation was conducted as part of compliance with the CCR Rule. Laboratory reports are provided in Attachment H.1-A.

Based on comments on boring logs or the results of PLM analysis of soil samples, a few previously existing monitoring wells were installed in borings that were drilled through CCR material, including wells 93-1, 93-3, and CUF-212. In addition, based on the description of soils and notes about water levels on the boring log for well CUF-209, it is likely that CCR material was encountered in the boring for this well. While the screened interval of these monitoring wells is not within the CCR material, the presence of CCR material directly above the well screens and construction of the wells without an outer casing to isolate the CCR material creates uncertainty about the representativeness of groundwater samples collected from these wells. The results of the boring log review and PLM testing may lead to a re-evaluation of the certified groundwater monitoring systems for compliance with the CCR Rule and TDEC permitted landfill groundwater monitoring programs.

2.3.7.2 Geology and Lithology

Chapter 2.4 of the EAR provides a discussion of the regional geologic setting for the CUF Plant, including the Wells Creek Structure which is the result of a meteor impact that occurred about 200 million years ago. Discussions in the following sections are limited to the central basin of the structure, called the Wells Creek Basin, because that is where the CCR management units are located.

The meteor impact caused bedrock formations that exist at a depth of approximately 2,500 feet below ground in the area surrounding the crater to be brought to ground surface in the center of the crater. Parts of the CCR management units are located above these geologic formations that have been uplifted. Exhibit H.1-3 is a geologic map of the CUF Plant that shows the locations of these uplifted geological materials. Away from the center of the basin, the orientation of geological formations ranges from nearly vertical to flat-lying. The inner rim of the basin rises above the elevation of the central basin. Steele Ridge, which passes through the CUF Plant, is formed by the inner rim of the meteor crater. Exhibit H.1-4 is a geologic map that includes an east-west oriented cross-section passing through the center of the crater to the south of the CUF Plant. The cross-section shows that the center of the crater consists of Knox Dolomite, with a succession of increasingly younger formations on each side of the center of the crater, dipping away from the center.

The lithologies at the CUF Plant primarily consist of residuum and alluvium overlying bedrock. A discussion of CCR material is provided in Appendix G.1. Exhibit H.1-5 shows a three-dimensional representation of the extent of CCR material at the CUF Plant.

Residuum is the material that remains after bedrock has weathered to a point that it is no longer considered rock. Residuum commonly consists of clay or silt but can have layers of coarser materials such as sand and gravel. Alluvium refers to natural materials that are deposited by moving water. The alluvium can be further differentiated into silts and clays and sands and gravels. Bedrock formations primarily consist of limestone, dolomite, or shale.

According to the TVA *Groundwater Quality Assessment Plan* (TVA 2017) located in Appendix Q of the EIP, floodplain alluvium beneath the CCR management units is generally found at elevations below approximately 360 feet amsl. Shallow alluvial deposits typically consist of clays and silts grading downward to coarser sands and gravels. The alluvium averages less than 25 feet in thickness beneath the CCR management units but may be as great as 45 feet thick in the abandoned channel of Wells Creek. Alluvium is underlain at some locations by a layer of residual soils primarily consisting of clay and silt. Representative cross-sections, showing the underlying lithologic units and CCR material are provided in Appendix D. Exhibit D-1 is a transect location map for the cross sections. Exhibit D-2 depicts the profiles across the Dry Ash Stack and Gypsum Storage Area. Exhibit D-3 depicts profiles across the Stilling Pond (including Retention Pond) and Bottom Ash Pond.

Silty and clayey residuum soils typically are the first geologic material encountered above approximately 360 feet amsl. The thickness of residuum ranges from little to none along some nearby ridges on the west side of Wells Creek where bedrock is exposed at the surface to up to approximately 200 feet to the southwest of Wells Creek. The alluvium and residuum are collectively referred to as unconsolidated materials. Exhibit H.1-6 shows the areal extent of the fine-grained unconsolidated materials. Exhibit H.1-7 shows the extent of the coarse-grained alluvial deposits.

Ordovician age carbonate rocks of the Knox Group, Stones River Group, and Hermitage-Fernvale Formations comprise bedrock beneath most of the CCR management units (see Exhibits H.1-4, D-2, and D-3). An exception is the northern part of the Dry Ash Stack and the Stilling Pond (including Retention Pond) where younger Silurian-Mississippian age rocks consisting of shales and limestones are present east and west of the former Wells Creek channel. Cross sections included in Appendix D show inferred contacts between the bedrock formations located below the CCR management units. Available information used to infer the contacts included historical reports and characterization of bedrock cores obtained during the EI. Exhibit H.1-8 shows the bedrock surface.

Additional characterization of the geology of the CUF Plant included an evaluation of available information about the presence of fractures or the potential for solutioning of bedrock (i.e., formation of karst features). Some observed fractures were open and other fractures were filled with calcite or clay. These occurred in the Stilling Pond (including Retention Pond) and Dry Ash Stack. Fractures observed in rock cores from the Gypsum Storage Area were filled with calcite. Law (1992) also noted that many fractures were recemented. In some borings, intervals of clay were encountered within the bedrock ranging in thickness from one to 13.2 feet thick. These occurred in borings installed through the Stilling Pond (including Retention Pond) and Dry Ash Stack.

Based on observations of bedrock cores obtained during the EI, only one void approximately 0.5 feet thick was noted in boring CUF-B13 installed through the Stilling Pond (including Retention Pond). Most of the descriptions of rock cores indicated that no voids, soil filled features, or solution features were observed. The conclusion of the geotechnical evaluation was that voids are localized and not interconnected. See Appendix G.1 for additional exploratory drilling details. In addition, historical reports noted that no open voids or cavities were detected in borings that included coring of bedrock (Law 1992). Law (1992) concluded that the risk of sinkhole formation was not significant.

A reconnaissance of a former quarry located offsite and south of the Gypsum Storage Area was conducted on October 3, 2019. The quarry was flooded, but the exposed Knox Dolomite along the quarry rim above the water line was visible. Due to safety concerns, the reconnaissance staff could not get closer than approximately 20 to 30 feet from the rock outcrop. No obvious solution features were noted. Fractures were observed, but it is unknown if the fractures were naturally occurring or due to blasting performed during the quarry operations.

Surface geophysics, consisting of electrical resistivity imaging/induced polarization and multichannel analysis of surface waves, were conducted during the 2019 exploratory drilling activities to characterize the unconsolidated materials in the vicinity of the mapped preconstruction channels of Wells Creek. The surveys were conducted along the western perimeter of the Stilling Pond (including Retention Pond) and the southwest perimeter of the Dry Ash Stack. The electrical resistivity imaging survey indicated a slightly undulating interface between the unconsolidated materials and bedrock. No large-scale dissolution features were evident in the bedrock in the electrical resistivity imaging survey. Details of the surveys are provided in the *Exploratory Drilling SAR* (Appendix G.2).

Downhole geophysics was conducted during the 2019 exploratory drilling activities. The logging consisted of: Natural Gamma, Fluid Temperature, Fluid Resistivity, Caliper, Optical Televiewer (93-1D only), Heat Pulse Flow Meter, and Idronaut. The encountered bedrock consisted of limestone and some shale under the Dry Ash Stack, and limestone and dolomite under the Gypsum Storage Area. Based on the borehole logging, the mean strike of the bedding planes is west-northwest/east-southeast. Also, two predominant fracture sets were identified, although fractures were also identified in other directions. The mean strike of the primary fracture set was east-west and the secondary set was northeast-southwest. Details of the investigation activities are included in the *Exploratory Drilling SAR* (Appendix G.2). Open fractures in brecciated bedrock from a meteor impact would be expected to be random and not aligned in fracture sets as identified from the geophysical testing. The presence of fracture sets indicates that the fractures that resulted from the meteor impact have been recemented and the observed fracture sets were created by other forces.

2.3.7.3 Uppermost Aquifer

Hydrostratigraphic units are geological formations that have been defined to characterize the hydrogeology of the CUF Plant to understand where and how groundwater is flowing. Groundwater flows from higher groundwater elevations to lower elevations. In saturated geological formations that have higher permeability than adjacent formations, groundwater flows in a mostly horizontal direction. In saturated geological formations that have lower permeability than adjacent formations, groundwater flows in a more vertical direction. The more permeable geological formations capable of yielding useable quantities of groundwater are called aquifers. Aquifers are targeted for development as water sources by property owners. The less permeable geological formations are called aquitards.

Hydraulic characteristics of hydrostratigraphic units are used to classify aquifers. An aquifer located between two aquitards is called a confined aquifer. Groundwater can flow through aquitards into underlying aquifers, but the rate of flow is commonly much slower than the rate of flow within the aquifer. Aquifers can be considered confined even if they are not completely covered by an aquitard. For example, the Memphis aquifer in western Tennessee is a confined aquifer, yet it is known that the aquitard above the Memphis aquifer is thin or absent in some areas (Parks and Carmichael 1990).

As shown in the graphical representation in Section 1.0, in a confined aquifer, measured groundwater levels rise above the top of the aquifer. The difference between the measured groundwater levels within the aquifer and the top of the aquifer is called the pressure head. For confined aquifers, groundwater is not encountered in the interval shown as pressure head above the top of the aquifer because it is bounded by an upper aquitard, which also physically separates the groundwater from the geologic unit located above the upper aquitard.

In state and federal regulations, the term uppermost aquifer is used. This is the aquifer nearest the natural ground surface, as well as lower aquifers that are hydraulically interconnected with this aquifer within a facility’s property boundary that are capable of yielding usable quantities of groundwater. Regulations are designed to protect the groundwater in the uppermost aquifer because it could be used by property owners as a source of water. The term uppermost aquifer is used in this report.

Based on the geology and hydraulic conductivities measured in the vicinity of the CCR management units, the alluvial sands and gravels above bedrock shown on Exhibits D-2 and D-3 in Appendix D of the EAR are considered to be the uppermost aquifer. Groundwater elevations within bedrock were similar to those measured in the sands and gravels suggesting that these geological formations are hydraulically connected. Where the sands and gravels are absent in the eastern part of the CCR management unit area, the underlying bedrock has been defined as the uppermost aquifer. The uppermost aquifer is overlain by less permeable clays and silts that are defined as an aquitard; therefore, the uppermost aquifer is a confined aquifer. Other observed lithologies (e.g., clays and silts) typically have not produced usable amounts of water but are monitored at certain locations for spatial distribution where the sands and gravels are laterally absent. Groundwater in the confined aquifer is not in contact with the CCR material inside the CCR management unit where the aquitard is present because the aquitard physically separates them.

Exhibit H.1-9 shows the distribution and thickness of the clays and silts that comprise the aquitard above the uppermost aquifer. Based on visual field descriptions of unconsolidated materials on borings logs, five locations might not have clay or silt above the uppermost aquifer. These locations are shown on Exhibit H.1-9. The following bullets present information about the visual field descriptions provided on logs for other borings installed near these locations. Also, an evaluation of the changes in water levels, above and below the aquitard, to fluctuations in surface stream water levels, pumping from the uppermost aquifer, and pumping from within the Dry Ash Stack are provided in Section 2.3.7.5.

- B-5 – located in the former Stilling Pond (including Retention Pond): This boring was located within the former Wells Creek channel as part of the post-EI repurposing activities. CCR material was removed from the vicinity of this location as part of those activities. Nearby borings on two sides of B-5 and also located within the former Wells Creek channel had clay and silt thicknesses of approximately 6.8 feet (B-6; TPZ-34) and 7.5 feet (B-4; TPZ-33). These borings were also installed as part of the post-EI repurposing activities.
- STN-48 - located outside of and adjacent to the former Stilling Pond (including Retention Pond): This boring was drilled through a perimeter dike in the southwest portion of the unit. No CCR material was reported in the boring. The logs for nearby borings STN-102, STN-47, and P-2A, located west, south and southeast of STN-48, respectively, included descriptions of intervals of clay that ranged from 11.5 to 21 feet thick. No sand was described in the borings near STN-48.
- GCCUF-F-2A and GCCUF-F-2B in the Dry Ash Stack: These two borings were located in close proximity to one another and the former Wells Creek Channel. A boring located between these two locations (STN-17) indicated a thickness of approximately 27.4 feet of clays and silts. Logs of other nearby borings located within the former Wells Creek Channel had thicknesses of approximately 3.5 feet (CUF-B-17) to 9.7 feet (HBA2) of clays and silts.
- STN-24 in the Gypsum Storage Area: This boring is located along the southern edge of the Gypsum Storage Area. Nearby borings on two sides of STN-24 had approximate thicknesses of 12.6 feet (STN-23) and 10.4 feet (STN-25) of clays and silts.

2.3.7.4 Groundwater Flow

This section provides a discussion of how groundwater flows at the CUF Plant. Groundwater flow occurs because gravity moves groundwater from areas of higher groundwater elevations to areas of lower elevations along flow paths that are generally perpendicular to groundwater elevation contours. Physiographic and hydrogeological features affect how groundwater flows. Hydrogeological barriers (i.e., rivers and surface streams) and divides (i.e., ridges that form watershed boundaries) bound the extent of groundwater flow. Groundwater flows toward, but not across, hydrogeological barriers and away from hydrogeological divides.

Exhibit H.1-10 shows the physiographic setting of the CUF Plant within the Wells Creek Basin. The key characteristic of the setting is that the plant is situated in a low-lying basin along Wells Creek and the Cumberland River surrounded by the higher elevation inner rim of the meteor crater. Groundwater within the basin moves toward Wells Creek.

Physiographic features that affect groundwater flow in the vicinity of the CUF Plant include the Cumberland River to the north, Steele Ridge through the plant, and Wells Creek to the south and west of the CCR management units (see Exhibit H.1-2). Groundwater in the vicinity of the CUF Plant on the southwest side of Steele Ridge flows toward Wells Creek, except for a small area in the vicinity of the Stilling Pond (including Retention Pond) that flows to the Cumberland River. Groundwater northeast of Steele Ridge flows to the Cumberland River. These physiographic features bound the flow of groundwater to the south, west, and north of the plant past Wells Creek, the Cumberland River, and to the northeast past Steele Ridge.

Groundwater levels in the uppermost aquifer were measured in 24 wells and used for groundwater elevation contour map development. Groundwater level measurements were also obtained from 12 piezometers installed for other programs. Surface water elevation measurements for the Cumberland River were continuously recorded as part of TVA's plant operations. The automated reading recorded closest to noon on the gauging date was used for comparison to manually gauged groundwater levels. The groundwater level measurements were converted to elevations. Table H.1-6 provides elevation data for Event #2 in July 2019. Table H.1-7 provides elevation data from the Groundwater Investigation. Exhibit H.1-2 provides a representative groundwater elevation contour map for Event #2 in July 2019. Groundwater elevation contour maps for other sampling events can be found in Appendices H.3 and H.5 through H.8.

Exhibit H.1-3 shows three faults beneath the CCR management units. The westernmost fault is roughly aligned with the original course of Wells Creek. This is a common observation within the Wells Creek Basin (see Exhibit 2-7) where many surface streams have formed over the location of mapped faults that radiate away from the center of the basin. This suggests that the surface streams formed where they did because of the faults. The faults may have resulted in less resistant areas that were more easily eroded by flowing water in surface streams. Erosion of the less resistant materials created the stream valleys to which groundwater moves. Where surface streams formed over faults, groundwater flow is toward the faults, not along them.

The middle and eastern faults transect Steele Ridge, which is a groundwater divide and has higher elevations of groundwater than occur on either side of the ridge. Groundwater in this area is influenced by ground surface topography of the ridge, not the formation of surface streams over the faults. This suggests that groundwater does not flow toward or along these faults as preferential flow paths. If the faults were preferential flow paths, then one would expect groundwater elevations to be at lower levels than areas on either side of the fault, which is not the case.

During the EI, groundwater levels were measured within the uppermost aquifer, the overlying clays and silts, and the underlying bedrock prior to the six groundwater sampling events to evaluate the direction and rate of groundwater flow in the uppermost aquifer. Surface water elevations were measured at the Cumberland River because the elevations of surface streams affect groundwater flow.

The available data indicated that groundwater flows downward through the clays and silts of the aquitard into the alluvial sands and gravels or bedrock that comprise the uppermost aquifer. Groundwater elevations within bedrock were similar to those measured in the sands and gravels suggesting that these geological formations are hydraulically connected. Groundwater flow within the uppermost aquifer beneath the central and southern part of the CCR management units is generally horizontal to the west and southwest towards Wells Creek. In the northern part of the CCR management units, groundwater flow is to the northwest toward Wells Creek and the north toward the Cumberland River. There may be limited reversal of ground water flow (sometimes called mounding) near the Stilling Pond (including Retention Pond), but it does not extend past the groundwater divide.

Horizontal groundwater flow rates were calculated using hydraulic head elevation data acquired during the six EI groundwater sampling events and a mean hydraulic conductivity derived from the results of slug testing data (Table H.1-5). Flow direction and hydraulic gradient were estimated using the triangulation method and groundwater elevations for each event. The flow rate was calculated using typical effective porosity percentages based on soil type, constant hydraulic conductivity values based on geometric mean calculations from slug testing, and the groundwater elevation inputs specific to each gauging event. Table H.1-8 provides a summary of the calculations used to estimate the average horizontal flow rate for each groundwater sampling event. Calculations were made for the Stilling Pond (including Retention Pond) and collectively for the Dry Ash Stack, Gypsum Storage Area, and Bottom Ash Pond for consistency with reporting for the CCR Rule program.

For the Stilling Pond (including Retention Pond), the values used to calculate groundwater flow rates follow:

- Geometric mean of hydraulic conductivity of 6.56 x 10^{-3} cm/sec
- Average horizontal hydraulic gradient ranging from 0.00695 feet/foot (Event #5) to 0.0092 feet/foot (Event #4)
- Effective porosity of 19% for the Stilling Pond. The reference for the effective porosity of the sand uses specific yield as a proxy for effective porosity of unconsolidated materials (Johnson, A.I. Revised 1966, page D18).

The average groundwater flow rate for the Stilling Pond (including Retention Pond) ranged from 248 feet/year (Event #5) to 329 feet/year (Event #4). Table H.1-8 provides a summary of the calculations used to estimate the average flow rate for each groundwater sampling event. These calculated groundwater flow rates, and those presented below, are generally much slower than water flow in surface streams or rivers. Flow rates in surface streams or rivers generally are measured in feet per second (United States Geological Survey 1999).

For the Dry Ash Stack, Gypsum Storage Area, and Bottom Ash Pond, the values used to calculate groundwater flow rates follow:

- Geometric mean of hydraulic conductivity of 6.56 x 10^{-3} cm/sec
- Average horizontal hydraulic gradient ranging from 0.00905 feet/foot (Event #2) to 0.0163 feet/foot (Event #3)
- Effective porosity of 16% for the Multi-Unit (Johnson, A.I. Revised 1966, page D18).

The average groundwater flow rate for the Dry Ash Stack, Gypsum Storage Area and Bottom Ash Pond ranged from 384 feet/year (Event #2) to 693 feet/year (Event #3). Table H.1-8 provides a summary of the calculations used to estimate the average flow rate for each groundwater sampling event.

The effects on groundwater levels due to decanting, pumping of temporary wells screened within CCR material and the alluvial sand and gravel, and other construction activities in the Stilling Pond (including

Retention Pond) are illustrated on Exhibits D-2 and D-3. As is expected, the decreases in groundwater levels are greater in closer proximity to the construction activities and pumping wells and in the more permeable sands and gravels. The effects of the construction activities were much less pronounced in the clay and silt aquitard. Farther from the construction activities, the effects on groundwater levels were more modest for the Dry Ash Stack and even less so for the Gypsum Storage Area. Some of the diminished observed effect in the unconsolidated materials is based on the absence of the more permeable sand and gravel layer beneath parts of the CCR management units, especially the Gypsum Storage Area. These projects may have both short-term (i.e., temporary) and long-term effects on the pore water in the CCR management units. TVA is continuing to monitor the groundwater levels, as they relate to current conditions and potential future conditions. Additional evaluation of the effects of pumping on groundwater and pore water levels is provided in the next section.

2.3.7.5 Groundwater/Surface Stream/Pore Water Relationships

TVA measured pore water levels within the temporary wells monthly for six months. In addition, the wells were gauged during bi-monthly groundwater sampling events. This information was combined with available information from other instruments to develop maps of the phreatic surfaces for the Dry Ash Stack and Gypsum Storage Area at the time of gauging. The phreatic surface is the surface of pore water at which pressure is atmospheric and below which CCR material may be saturated with pore water. The use of the term “saturated” in reference to the moisture content of CCR material does not imply that the pore water is readily separable from the CCR material. Saturated CCR material can have a range of moisture contents based on the characteristics of the material. In addition, some of the other instruments that measure pore water, groundwater, and surface stream levels have been automated to provide time-series data, which has been plotted to evaluate the relationships of the elevations of pore water, groundwater, and surface streams. Discussion of these relationships is provided below.

Within the Dry Ash Stack and Gypsum Storage Area CCR management units, the phreatic surface was at a higher elevation than the groundwater levels within the uppermost aquifer. During the EI, the phreatic surfaces were generally at an elevation near the underdrain layers, which were constructed over the sluiced ash within the units in 1996, prior to stacking of CCR material in the Dry Ash Stack and gypsum in the Gypsum Storage Area.

In the central part of the Gypsum Storage Area, the phreatic surface was at an elevation near the constructed underdrain layer but was below the elevation of the underdrain layer near the perimeter. The underdrain layer includes a piping system designed to drain pore water to a perimeter ditch. Water has been observed flowing from some of these pipes into the ditch. Further, the proposed temporary wells that were to be installed at the top of the underdrain layer were not installed because the gypsum was unsaturated. Available data suggest that pore water flows laterally through the underdrain layers to the perimeter ditch. Section A-A’ on Exhibit D-2 in Appendix D depicts the relationship between the phreatic and piezometric surfaces for this unit.

In the central part of the Dry Ash Stack, the phreatic surface was at an elevation up to a few feet above the top of the underdrain layer during certain gauging events but was approximately at the elevation of the underdrain layer near the perimeter. During other gauging events, the highest pore water levels were near the top of the underdrain layer. The underdrain layer was designed to daylight to a perimeter ditch or be intercepted by a subsurface collection system (along a portion of the west perimeter). The underdrain layer in this CCR management unit may not be as effective as the one in the Gypsum Storage Area, but proximity of the phreatic surface to the underdrain layer suggests that some pore water above the level of the perimeter ditch drains to the perimeter ditch. Section B-B' on Exhibit D-2 in Appendix D depicts the relationship between the phreatic and piezometric surfaces for this unit.

Generally, the available groundwater level data indicated that pore water levels were up to 20 feet higher than groundwater levels in the uppermost aquifer. This suggests that the low permeability of the perimeter dikes and the clays and silts that comprise the aquitard at the base of the units impedes lateral and vertical flow of pore water.

In addition, groundwater, pore water, and surface stream level fluctuations were compared to each other to evaluate the correlations of changes in water levels between the three media. The surface stream level of the Cumberland River was used as a proxy for Wells Creek because initially the latter did not have a gauging station established during the EI groundwater sampling events. A gauging station has since been installed in Wells Creek. A comparison of Well Creek stage elevations to the Cumberland River stages elevations indicated that Wells Creek is affected by the seasonal fluctuations of the Cumberland River because of the damming of the Cumberland River, and the Cumberland River stage is a reasonable proxy for Wells Creek stage.

Exhibit H.1-11 is a site map that shows the locations of certain pore water and groundwater monitoring locations included in this evaluation for the Stilling Pond (including the Retention Pond), Dry Ash Stack, Bottom Ash Pond, and Gypsum Storage Area. Exhibit H.1-12 provides hydrographs for the Cumberland River stage and piezometers and wells that illustrate representative groundwater level fluctuations within the uppermost aquifer. Exhibit H.1-13 provides hydrographs for the Cumberland River stage and piezometers that illustrate representative pore water levels within the CCR management units. Hydrographs for other locations are provided in Attachment H.1-B. Following are observations regarding correlation of fluctuations in water levels between the Cumberland River, groundwater, and pore water.

- **Stilling Pond (including the Retention Pond)**: The hydrograph for piezometer CUF-TPZ-34B, which measures groundwater levels within the uppermost aquifer, began after decanting of the pool for this CCR management unit and before the deep well pumping from the uppermost aquifer because this piezometer was installed as part of the repurposing activities. This location exhibited a maximum of approximately 27 feet of groundwater drawdown below the Cumberland River stage during the deep well extraction event. The groundwater level recovered periodically during subsequent intermittent pumping. The hydrograph does not show a strong correlation with river levels. This hydrograph is included to provide a representative response to pumping from the uppermost aquifer for comparison to other hydrographs discussed below.

  This CCR management unit did not have piezometers that provided representative pore water level measurements.

- **Dry Ash Stack**: The hydrographs for piezometers or wells CUF-DAS INT-2-5, CUF-PZ-F2A-1, CUF-DAS-A-2-4, CUF-209, and CUF-211, which measure groundwater levels within the uppermost aquifer, had groundwater levels above the river stage before the groundwater extraction in the Stilling Pond (including the Retention Pond) area and showed a subdued response to river stage. During the groundwater extraction activities, piezometers CUF-DAS-A-2-4 and CUF-DAS-INT-2-5 had groundwater elevations that were approximately 16 feet below the river stage, indicating a strong response to pumping from the uppermost aquifer. Piezometer CUF-PZ-F2A-1 and well CUF-211 showed a subdued response to the pumping. Groundwater elevations at well CUF-209 remained above the Cumberland River stage throughout most of the extraction activities and showed relatively little response to river stage fluctuations. The hydrograph for piezometer CUF-B16C began after the sustained deep well pumping from the uppermost aquifer began because that is when it was automated. This location had groundwater elevations below the Cumberland River stage, indicating a response to pumping from the uppermost aquifer similar to piezometers CUF-DAS-A-2-4 and CUF-DAS-INT-2-5.

The hydrographs for piezometers CUF-DAS INT-2-2, CUF-PZ-F2A-2, and CUF-DAS-A-2-1, which measure pore water levels within the CCR management unit, had pore water levels above the river stage before and after pumping from the uppermost aquifer and showed little, if any, response to river stage or pumping from the uppermost aquifer. The minor fluctuations observed in the graphs could be due to direct infiltration of precipitation. Minor fluctuations in the graph for piezometer CUF-DAS-A-2-2 during pumping from the uppermost aquifer could also have been due to pumping of pore water from within the Stilling Pond (including Retention Pond). The hydrograph for piezometer CUF-B16A began after the sustained deep well pumping from the uppermost aquifer began because that is when it was automated. This location had pore water elevations above the Cumberland River stage and showed no response to pumping from the uppermost aquifer. These hydrographs indicate that the aquitard is providing separation between the uppermost aquifer and the CCR management unit.

- **Gypsum Storage Area**: The hydrograph for piezometer CUF-PZ-H2C-1, which measures groundwater levels within the uppermost aquifer, had a similar elevation and pattern to the Cumberland River level hydrograph. The does not appear to be a response to the pumping from the uppermost aquifer.

  The hydrographs for piezometers CUF-PZ-H2C-4, CUF-GSA-INT-1-5, and CUF-PZ-N2A-5, which measure pore water levels within the CCR management unit, had pore water levels above the river stage before and after pumping from the uppermost aquifer area and showed little, if any, response to river stage or pumping from the uppermost aquifer. The minor fluctuations in the graphs could be due to direct infiltration of precipitation. These hydrographs indicate that the aquitard is providing separation between the uppermost aquifer and the CCR management unit.

- **Bottom Ash Pond**: This CCR management unit did not have piezometers that provided representative groundwater level measurements within the uppermost aquifer.

  The hydrograph for piezometer CUF-PZ-BAPHP-4D-4, which measures pore water levels within the CCR management unit, did not show fluctuations that correlated with the Cumberland River stage or pumping from the uppermost aquifer. The location has shown a decrease in the level of pore water of approximately 10 feet over the time period shown on the hydrograph.

Further, an evaluation of piezometers installed in boring locations CUF-PZ-F2A and CUF-PZ-F2B was conducted for instruments that monitor pore water levels within the CCR management unit and groundwater levels withing the uppermost aquifer. The evaluation provides observations of responses to the Cumberland River stage, pumping from the uppermost aquifer, and pumping from within the Dry Ash Stack near these two locations. Exhibit H.1-14 shows hydrographs for the Cumberland River and piezometers installed at each boring location within the uppermost aquifer (CUF-PZ-F2A1 and CUF-PZ-F2B1) and the Dry Ash Stack CCR management unit (CUF-PZ-F2A2 and CUF-PZ-F2B3). The piezometers installed within the Dry Ash Stack showed a subdued correlation with fluctuations in river levels. This could be due to direct infiltration of precipitation. These piezometers showed a response to pumping from within the CCR management unit that began in December 2020 and ceased in August 2021 but did not show a response to pumping from the uppermost aquifer that began in August 2021.

Piezometers monitored within the uppermost aquifer showed fluctuations that correlated with Cumberland River stage and pumping from within the uppermost aquifer. These piezometers did not show correlation with the initiation or cessation of pumping from within the Dry Ash Stack. The differences in fluctuations between piezometers installed within the CCR management unit and the uppermost aquifer indicate that the intervening aquitard is providing separation between these locations. A low permeability layer must be present between the CCR management unit and the uppermost aquifer at these locations to explain the differences in fluctuations.

The descriptions on boring logs for these two locations are inherently subjective. Water level measurements from the piezometers are objective. Based on the weight of evidence including the preponderance of boring logs that include descriptions of clays and silts above the uppermost aquifer, including in the vicinity of these two locations, and the differences in the response of water levels within the CCR management unit and the uppermost aquifer, it is concluded that the aquitard is present in the vicinity of borings CUF-PZ-F2A and CUF-PZ-F2B.

Pore water and groundwater levels are expected to decrease as CCR management units are closed or repurposed. As discussed above, pore water and groundwater levels decreased due to decanting, pumping, and other construction activities in the Stilling Pond (including Retention Pond). Observed decreases caused by decanting the Stilling Pond (including Retention Pond), are expected to persist.

Pore water levels within the CCR management units and groundwater levels within the uppermost aquifer responded differently to hydraulic stresses. Pore water levels dropped in response to pumping from within the Dry Ash Stack, but the pumping did not appear to affect groundwater levels within the uppermost aquifer. In addition, fluctuations in water levels in surface streams and responses to pumping from within the uppermost aquifer were observed in monitoring wells and piezometers that monitor the uppermost aquifer, but pore water levels did not respond or only showed limited responses to these stresses. These results demonstrate that the aquitard provides separation between the CCR management units and the uppermost aquifer for hydraulic stresses.

2.4 GROUNDWATER QUALITY

This section provides a discussion of the analytical results for groundwater samples collected from monitoring wells installed as part of the EI and previously installed wells monitored as part of the TDEC permitted landfill and CCR Rule monitoring programs. The groundwater quality evaluation is based on a statistical evaluation of constituents listed in Appendix I of TDEC Rule 0400-11-01-.04 (TDEC Appendix I) and Appendices III and IV of the CCR Rule. The analytical results were compared to GSLs approved by TDEC (see Appendix A.2). The results of the statistical evaluation are shown in a color-coded format where green indicates no statistically significant concentration greater than or equal to the GSL for constituents other than pH and no statistically significant difference outside the GSL range for pH, and red indicates a statistically significant concentration greater than or equal to the GSL for constituents other than pH or a statistically significant difference outside the GSL range for pH. The statistical methods applied to determine the green and red categories are discussed in the statistical evaluation of groundwater analytical data provided in Appendix E.3 and the results are summarized below. Table H.1-9 provides the analytical results of groundwater samples used in the statistical evaluation. Table H.1-10 provides a summary of groundwater quality parameters used for the statistical analyses. Table H.1-11 lists the approved GSLs. Table H.1-12 shows the results of the statistical evaluation with the color-coded format described above.

The dataset compiled for statistical analysis included available analytical data for groundwater samples collected between July 2008 and August 2022, although the specific start date and frequency of sampling may vary between wells based on date of well installation and the applicable monitoring program. Only wells installed for the TDEC permitted landfill groundwater monitoring systems prior to 2016 (93-1, 93-1D, 93-2R, 93-3, and 93-4) were sampled prior to November 2016. Wells installed for the CCR Rule monitoring program (CUF-201, CUF-202, CUF-205, CUF-206, CUF-207, CUF-208, CUF-209, CUF-211, and CUF-212) were sampled between November 2016 and August 2022. Three groundwater monitoring wells installed for the EI (CUF-1001, CUF-1002 and CUF-1003) were sampled during 10 events between May 2019 and August 2022 to complete the scope in the approved *Groundwater Investigation SAP* and additional sampling conducted in conjunction with sampling events for the CCR Rule and TDEC permitted landfill monitoring programs. Well CUF-1006 was sampled 7 times between August 2021 and August 2022.

As noted in Appendix E.3, the historical data prior to November 2016 were excluded from the evaluation of statistically significant concentrations above the GSLs because of higher variability of the older data and a noticeable change in concentrations for certain constituent-wells pairs. The November 2016 date correlates with modifications that were made to the monitoring program at the CUF Plant in 2016 to improve the quality of the groundwater monitoring program.

The statistical evaluation included screening for outliers, which are abnormally high or low values that may represent anomalous data or data errors. There were no outliers removed from further statistical analysis based on this evaluation. Appendix E.3 provides additional information regarding the outlier evaluation and methods used to compare results to the GSLs.

The statistical evaluation identified 49 CCR Rule Appendix III well-constituent pairs with statistically significantly concentrations above a GSL or outside the GSL range for pH. These included boron, chloride, pH, sulfate, and TDS. Nine well-constituent pairs for the TDEC Appendix I or CCR Rule Appendix IV constituents had a statistically significant concentration above a GSL. Arsenic (93-1 and CUF-206), cobalt (93-1, CUF-211, CUF-212, and CUF-1006), lithium (93-3), and molybdenum (CUF-209 and CUF-1006) were the only Appendix IV constituents with a statistically significant concentration above an approved level. Table H.1-12 provides a summary of the statistical evaluation. Exhibits H.1-15 and H.1-16 provide the results of the statistical evaluations for CCR Rule Appendix IV and TDEC Appendix I constituents with at least one detection above the GSL for the Dry Ash Stack and Gypsum Storage Area/Stilling Pond (including Retention Pond), respectively. A detailed explanation of the interpretation of the graphs inset on these exhibits is provided in Appendix E.3.

For the well-constituent pairs identified with statistically significantly concentrations greater than or equal to a GSL or outside the GSL range for pH, linear regression analysis identified 31 statistically significant decreasing trends and 23 statistically significant increasing trends. Table H.1-13 provides a summary of the trend evaluation.

2.4.1 Piper Diagrams

Another approach to characterize the groundwater analytical results included the use of Piper diagrams, which are graphical representations of the major ion chemistry of groundwater. Available groundwater data were used to develop the diagrams, which were used to visually evaluate similarities and differences in the general chemistry characteristics of the groundwater samples and assess whether the results potentially indicated influences from the various sources of groundwater. A Piper diagram from the March 2020 EI wells groundwater sampling event is depicted in Exhibit H.1-17, which is considered to be representative of the major ion distribution of the groundwater near the CUF Plant CCR management units over the sampling time period. Piper diagrams for the remaining five events conducted between May 2019 and January 2020 are provided in Attachment H.1-C.

The groundwater-type of the background wells was observed to be a calcium-bicarbonate type. Groundwater near the Gypsum Storage Area and Dry Ash Stack was generally classified as a calcium-sulfate type to a mixed calcium-sulfate-chloride type. Groundwater samples collected from the Stilling Pond (including Retention Pond) were generally a calcium-sulfate-chloride type. Additional information regarding groundwater geochemistry is provided in Section 2.4.4.

2.4.2 Evaluation of Well CUF-209 Analytical Data

Exhibit H.1-18 provides a graph of certain CCR constituents detected in groundwater samples collected from well CUF-209. The exhibit also includes a timeline of certain operational events that occurred in the vicinity of well CUF-209 just prior to and following the beginning of the increase in concentrations of molybdenum. This well was installed in 2016 and sampled beginning in November 2016 through August 2022. From the initial sampling event until July 2019, the concentration of molybdenum was less than 50 µg/L. Around July 2019, the reported concentrations of molybdenum began to increase and peaked around July 2020 at a reported concentration of 1,430 µg/L. Since July 2020, the concentrations of molybdenum have decreased to 277 µg/L. Two other constituents included in the exhibit (boron and sulfate) show similar trends. These trends suggest that a short-term event, possibly a temporary interconnection of the CCR management unit with the uppermost aquifer during drilling for the EI, caused the increase in concentrations.

The following lines of evidence are consistent with EI drilling as the cause:

- In accordance with the *Exploratory Drilling SAP*, EI borings, including borings for the temporary wells, were drilled through the CCR material and foundation soils into bedrock in late 2018 and early 2019.
- Stiff diagrams, which are a graphical tool used to identify similarities and differences of water quality by comparing the overall shapes of the diagrams to one another, were plotted for pore water from the temporary wells and groundwater from well CUF-209. The diagrams were made by plotting equalized concentrations of major cations and anions with positively charged constituents plotted left of a vertical line and negatively charged constituents on plotted on the right of the vertical line. Stiff diagrams are evaluated by comparing the shapes to one another. Exhibit H.1-19 shows the Stiff diagrams. The diagram for pore water from well CUF-TW08 has a similar shape to the diagram for groundwater from well CUF-209. The diagrams for the other temporary monitoring wells have different shapes.
- Well CUF-TW08 is the closest temporary well to well CUF-209 (approximately 800 feet away) and is generally upgradient with respect to the groundwater flow direction. No known operational changes that would be expected to have the potential to cause an interconnection of the CCR management unit with the uppermost aquifer were identified.
- Calculated groundwater flow rates ranged from approximately 400 to 700 feet per year in the vicinity of the Dry Ash Stack, as noted in Section 2.3.7.4.
- The borings drilled through the foundation soils were backfilled with bentonite to the base of the CCR management unit prior to installing the temporary wells. This would have sealed the apparent temporary interconnection.

The calculated travel times using an average hydraulic conductivity are too low for the constituents to have reached well CUF-209 within approximately six months; however, the range of hydraulic conductivity estimates based on slug tests conducted at the CUF Plant varied by two orders of magnitude. The mean used for the above groundwater flow rates was approximately one order of magnitude less than the highest estimates for the uppermost aquifer; therefore, groundwater flow rates could be ten times higher than the rates given above, which would be high enough for the constituents to have reached well CUF-209 within six months. Furthermore, the head difference between pore water and groundwater would have resulted in a higher hydraulic gradient than used for the groundwater flow rate calculations until the boring was sealed.

Based on these lines of evidence, a temporary interconnection due to drilling during the EI is a plausible explanation for the cause of the observed trends in groundwater quality at well CUF-209.

There are no other known operational changes that would be expected to have caused the observed short-term trends in concentrations of boron, sulfate, and molybdenum.

2.4.3 Evaluation of Well CUF-1003 Analytical Data

Exhibit H.1-20 provides a graph of certain CCR constituents detected in groundwater samples collected from well CUF-1003. This well was installed in December 2018 and sampled beginning in May 2019 through August 2022. Beginning in September 2019, boron, chloride, molybdenum, and sulfate began to show a sharp decrease in reported analytical concentrations. After March 2020, the concentrations began to stabilize. There has been a relatively small increase in the concentrations in 2022; however, overall, the trends show an asymptotic decrease in concentrations over the sampling time period. These results indicate that a condition in the hydrogeological system changed to produce the dramatic decreases in a suite of constituents. One operational change that occurred in the vicinity of well CUF-1003 in September 2018 was the closure of the metal cleaning pond which included decanting water from the pond. This was approximately one year prior to the beginning of the downward trend in constituent concentrations.

The following lines of evidence are consistent with closure of the metal cleaning pond as the cause:

- Based on measured groundwater levels, well CUF-1003 is upgradient of the Gypsum Storage Area which suggests that it is not the source of the detected CCR constituents
- In the area between the Gypsum Storage Area and Steele Ridge, the groundwater flow direction is inferred to be from the metal cleaning pond to the southeast toward well CUF-1003 (see Exhibit H.1-2)
- The groundwater flow rate in the vicinity of well CUF-1003 and the metal cleaning pond was calculated to be approximately 565 feet per year based on the following information:
    - The elevation of the metal cleaning pond was approximately 385 feet amsl
    - Water levels in well CUF-1003 averaged approximately 382 feet amsl over the six EI sampling events
    - The distance from the eastern edge of the metal cleaning pond to well CUF-1003 was approximately 450 feet
    - The estimated hydraulic conductivity measured in well CUF-1003 was 1.31×10^{-2} cm/sec
    - An effective porosity of 16% was used for the above calculations.
- No other operational changes (e.g., capping, CCR material removal, pore water extraction) were made to the Gypsum Storage Area that would be expected to cause the observed trends in CCR constituents.

The groundwater quality data indicate that either the groundwater flow direction in the vicinity of well CUF-1003 has changed or the source of CCR constituents has been controlled. Groundwater level measurements in well CUF-1003 were first recorded in May 2019 only a few months before the downward trends in concentrations began; therefore, data are not available to establish long-term flow patterns prior to the beginning of the downward trends. Based on available groundwater level measurements, the metal cleaning pond could have been an upgradient source for well CUF-1003, but the Gypsum Storage Area does not appear to be an upgradient source. Further, based on the calculated groundwater flow rate of 565 feet per year, it would have taken approximately 290 days for groundwater to flow 450 feet from the eastern edge of the metal cleaning pond to well CUF-1003. Considering that the metal cleaning pond was closed approximately one year prior to the beginning of the downward trends, which would have controlled the source of the constituents, and uncertainties associated with estimates of hydraulic conductivities calculated from slug test data, 290 days after closure of the metal cleaning pond is a reasonable timeframe to begin detecting changes in groundwater quality in well CUF-1003.

Based on these lines of evidence, closure of the metal cleaning pond is a plausible explanation for the cause of the observed trends in groundwater quality at well CUF-1003.

2.4.4 Geochemistry of Soils-Groundwater Interaction

Groundwater quality is affected by numerous geochemical processes during groundwater flow through geological materials. The distinct difference between the chemical characteristics of pore water within the CCR material, presented in Appendix G.1, and the characteristics of groundwater quality downgradient of the CCR management units at the CUF Plant is difficult to explain without the aid of geochemistry. It is well documented in the literature that certain CCR constituents that are detected in pore water (typically at higher concentrations than in groundwater) can be affected by geochemical processes that occur between constituents dissolved in groundwater and geological materials through which it flows. The effects of these geochemical processes, which often result in the attenuation of CCR constituents (i.e., reduced concentrations) can explain observed differences between the characteristics of pore water and groundwater. The extent of the interactions between dissolved constituents in groundwater and geological materials ranges from limited interaction for constituents such as boron, chloride and sulfate, to strong interactions for constituents such as arsenic and cobalt.

Descriptions of the geochemical interactions between geological materials and constituents dissolved in groundwater are provided in many textbooks (e.g., Appelo and Postma 1996). Geochemical reactions or processes that can affect CCR constituents include:

- Adsorption/desorption on the surfaces of metal hydroxides – an interaction whereby constituents adsorb to metal hydroxide soil minerals; the process is reversible and controlled by the pH and redox of groundwater

- Cation exchange with clay minerals – a process where constituents adsorb to clay minerals, subject to competition and relative concentrations of constituents; cation exchange reactions are reversible

- Mineral precipitation or dissolution – a process where dissolved constituents in groundwater combine to form a soil mineral; minerals are also subject to dissolution (i.e., reaction is reversible) under certain conditions of groundwater pH and oxidation/reduction potential (redox).

Observations of groundwater and pore water chemistry can indicate the extent to which geochemical processes chemically change groundwater and influence groundwater quality at the CUF Plant. Boron, chloride, and sulfate commonly occur in high concentrations in pore water and are minimally attenuated by geochemical processes. Thus, they can be used to infer locations in the groundwater monitoring program where there is an influence from pore water. This is because boron and chloride are considered non-reactive because neither constituent is subject to geochemical reactions that would materially change concentrations in groundwater during flow through geological materials. Sulfate is considered a low-reactive constituent because there are geochemical conditions in some CCR influenced groundwater where the concentration of sulfate can be reduced by mineral precipitation.

In contrast, those CCR constituents most likely to be influenced by interactions between geological materials and groundwater (e.g., arsenic, lithium, and molybdenum) typically show concentrations in groundwater monitoring wells that are much different than those observed in pore water, indicating that groundwater is being chemically changed relative to pore water by some physical or geochemical process (or a combination of both) occurring as it flows through geological materials. Groundwater quality measured at a given groundwater monitoring location is a result not only of the interactions between its constituents and the geological materials through which it flows, but also of flow from upgradient sources (including background). Thus, the area upgradient of a groundwater monitoring well can be thought of as an interacting geochemical and hydrogeologic system, including:

- Materials that contribute chemical mass to groundwater
- The physical properties of the geological materials that govern direction and rate of groundwater flow
- Minerals in the geologic materials that can interact with constituents being transported by groundwater
- The pH and redox conditions of groundwater.

This geochemical and hydrogeological system, which includes natural and anthropogenic sources and interactions with natural geologic materials, is referred to as the upgradient system.

Understanding the geochemistry of geological materials is important in interpreting the processes influencing current conditions of groundwater chemistry at the CUF Plant and evaluating effects of activities, such as capping or groundwater remediation, on the evolution of groundwater quality. Further evaluation of the geochemical processes acting in the upgradient system at the CUF Plant to influence groundwater quality will be included in the CARA Plan during assessments of remedies, where needed.

2.4.4.1 Summary

Downgradient of the CCR management units, four TDEC Appendix I or CCR Rule Appendix IV CCR constituents had statistically significant concentrations in onsite groundwater above a GSL in seven compliance wells, including arsenic (93-1, CUF-206), cobalt (93-1, CUF-211, and CUF-212, and CUF-1006), lithium (93-3), and molybdenum (CUF-209 and CUF-1006). Five wells had only one constituent with a statistically significant concentration above a GSL, and two wells had two constituents with a statistically significant concentration above a GSL. These constituents and onsite groundwater from these wells will be further evaluated in the CARA Plan.

3.0 SUMMARY

The objectives of the TDEC Order hydrogeological and groundwater investigations were to characterize the hydrogeology and groundwater quality and evaluate groundwater flow conditions in the vicinity of the CUF Plant CCR management units. The key findings of the CUF Plant hydrogeological and groundwater investigations are summarized below:

- TVA evaluated analytical results for groundwater in support of the EAR based on data collected under three groundwater monitoring programs (some of which overlap), including the EI, CCR Rule, and TDEC permitted landfill monitoring programs. Monitoring well locations and CCR constituents that will require further evaluation in the CARA Plan are provided below.

Summary of Findings Requiring Further Evaluation in the CARA Plan	
CCR Management Unit	**Groundwater**
Gypsum Storage Area	Lithium (Well 93-3*) Cobalt (Well CUF-212* and CUF-1006) Molybdenum (Well CUF-1006)
Dry Ash Stack	Molybdenum (Well CUF-209) Arsenic (Well CUF-93-1*) Cobalt (Wells CUF-93-1* and CUF-211)
Bottom Ash Pond	Included in Gypsum Storage Area and Dry Ash Stack findings
Stilling Pond (Including Retention Pond)	Arsenic (Well CUF-206)

* Monitoring wells installed in borings drilled through CCR material.

- Drainage improvements, closure activities, or potential corrective actions are expected to reduce concentrations of CCR constituents to below GSLs in groundwater at downgradient monitoring locations

- Pore water within the CCR material has specific chemical characteristics that are different from the characteristics of groundwater downgradient of the CCR management units. Certain CCR constituents that have been detected in pore water are affected by geochemical processes during groundwater flow through geological materials. The effect of these geochemical processes, which can result in the attenuation of CCR constituents and reduced dissolved groundwater concentrations, can explain the observed differences between the characteristics of pore water and groundwater quality.

- The pore water levels reported herein may not represent steady-state conditions. Within the Dry Ash Stack and Gypsum Storage Area CCR management units, some pore water flows laterally through the underdrain layers to the ash pond or to perimeter ditches. This may limit the elevation to which the phreatic surface rises to approximately the elevation of the underdrain layer. Below the underdrain layers, the low permeability of the perimeter dikes limits lateral flow, and the clays and silts that comprise the aquitard at the base of the units impede vertical flow of pore water. The use of the term flow, or other terms such as “saturated” in reference to the moisture content of CCR material does not imply that the pore water is readily separable from the CCR material.

- The alluvial sands and gravels are considered to be the uppermost aquifer where they are present. Bedrock is considered to be the uppermost aquifer where sands and gravels are absent. The sands and gravels and bedrock are interpreted to be hydraulically connected. The uppermost aquifer is considered to be under confined conditions and is typically overlain by clays and silts that act as an aquitard. Available water level data, including the effect of river stage and pumping from the uppermost aquifer, indicate that the aquitard provides a hydraulic separation between the uppermost aquifer and the CCR material.

- The groundwater flow direction within the uppermost aquifer beneath the CCR management units is generally to the west and southwest towards Wells Creek. In the northwestern part of the CCR management units, groundwater flow is to the northwest toward Wells Creek and north toward the Cumberland River. Groundwater flow in the vicinity of the CCR management units is bounded to the north by the Cumberland River and to the south and west by Wells Creek. There is a groundwater flow divide in the area of the CUF Plant that separates flow to the Cumberland River to the northeast from flow to the southwest toward Wells Creek.

TVA will continue to monitor the trends of arsenic, cobalt, lithium, and molybdenum and conduct further evaluation in the CARA Plan to determine if corrective actions are needed. The influence of geochemical processes on groundwater quality will be further evaluated in the CARA Plan as part of the assessment of remedies, where needed.

4.0 REFERENCES

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TABLES

Table H.1-1 - Summary of Environmental Investigation Boring and Monitoring Well Locations
Cumberland Fossil Plant

Boring ID	Well ID	Location	Rationale
CUF-1000ALT CUF-1000ALTA	NC CUF-1000	West/southwest of the CCR Management units and Wells Creek; in flood plain alluvial deposits	To collect groundwater data from a background location
CUF-1001ALT CUF-1001ALT2	NC CUF-1001	Between the CCR Management units and the main plant, northeast of the CCR units; adjacent to a gravel road	To collect groundwater data from a background location
CUF-1002ALT2	CUF-1002	Between the CCR Management units and the main plant, adjacent to the Dry Ash Stack; in a parking area	To collect groundwater data between the CCR Management units and the Cumberland River
CUF-1003 CUF-1003A CUF-1003B	NC NC CUF-1003	Between the CCR Management units and the main plant, adjacent to the Gypsum Storage Area and a laydown area	To collect groundwater data between the CCR Management units and the Cumberland River
CUF-1004ALT CUF-1004ALT2 CUF-1004ALT2A	NC NC NC	Proposed south of the CCR Management units and Wells Creek; in Knox Dolomite	To collect groundwater data from a background location (well not installed because groundwater was not encountered)
CUF-1005	CUF-1005	Adjacent to the eastern limit of the Gypsum Storage Area; adjacent to a gravel road and unnamed pond	To collect groundwater data near the eastern boundary of the CCR Management units

Notes:

CCR	Coal Combustion Residual
CUF	Cumberland Fossil Plant
ID	Identification
NC	Not completed as a monitoring well

1. Monitoring well CUF-1001 was initially installed in boring CUF-1001ALT, but it yielded insufficient groundwater and the well was subsequently installed in soil boring CUF-1001ALT2.

2. Monitoring well CUF-1005 was determined to be installed in CCR material after installation, and a replacement well was proposed to collect groundwater near the eastern boundary of the CCR management units.

Table H.1-2 – Groundwater Level Measurements, Groundwater Sampling CUF-1006
Cumberland Fossil Plant

UNID	Well / Piezometer ID	Date Measured	Depth to Groundwater	Top of Casing Elevation	Groundwater Elevation	Piezometer Ground Surface Elevation	Screened Interval	Screened Formation
			ft btoc	ft msl	ft msl	ft msl	ft btoc	
CUF-00-GW-43-031	CUF-1006	12-Jul-21	19.44	387.58	368.14	378.84	25.3 - 35.1	Silty Clay
		16-Aug-21	19.66	387.58	367.92	378.84	25.3 - 35.1	
		11-Oct-21	19.33	387.58	368.25	378.84	25.3 - 35.1	
		17-Jan-22	18.09	387.58	369.49	378.84	25.3 - 35.1	
		1-Mar-22	18.07	387.58	369.51	378.84	25.3 - 35.1	
		11-Apr-22	18.06	387.58	369.52	378.84	25.3 - 35.1	

Notes:

btoc	below top of casing
ft	feet
ID	identification
msl	mean sea level
UNID	Unique Numerical Identification

1. Top of casing elevations, screen intervals, and screened formations were obtained from the TVA Well Inventory Log provided by TVA.

Table H.1-3 - Summary of Monitoring Well Construction Specifications
Cumberland Fossil Plant

	Top of Casing		Bottom of Well			Screened Interval					
Well ID	Stickup	Elevation	Depth	Depth	Elevation	Depth Top	Depth Bottom	Depth Top	Depth Bottom	Elevation Top	Elevation Bottom
	ft ags	ft NGVD29	ft bgs	ft btoc	ft NGVD29	ft bgs	ft bgs	ft btoc	ft btoc	ft NGVD29	ft NGVD29
93-1	2.3	397.17	60.0	62.3	334.9	50.0	60.0	52.3	62.3	344.9	334.9
93-2R	2.6	397.88	70.2	72.8	325.1	59.7	69.4	62.3	72.0	335.6	325.9
93-3	2.3	397.50	52.8	55.1	342.4	42.7	52.7	45.0	55.0	352.5	342.5
93-4	2.7	397.34	33.9	36.6	360.7	24.5	33.9	27.2	36.6	370.1	360.7
96-9	-0.1	392.59	31.5	31.4	361.2	16.2	31.0	16.1	30.9	376.5	361.7
B103	1.6	395.97	84.1	85.7	310.3	72.4	82.4	74.0	84.0	322.0	312.0
B110	2.6	398.27	49.9	52.5	345.8	45.7	49.9	48.3	52.5	350.0	345.8
CUF-101	-0.2	385.68	17.9	17.7	368.0	2.2	17.4	2.0	17.2	383.7	368.5
CUF-102	-0.3	402.93	14.8	14.5	388.4	4.1	14.1	3.8	13.8	399.1	389.1
CUF-120	3.8	393.19	10.9	14.7	378.5	5.5	10.5	9.3	14.3	383.9	378.9
CUF-201	3.7	400.41	24.4	28.1	372.3	13.9	24.0	17.6	27.7	382.8	372.7
CUF-202	3.8	383.28	16.1	19.9	363.4	10.5	15.8	14.3	19.6	369.0	363.7
CUF-205	3.7	384.51	23.8	27.5	357.0	13.2	23.4	16.9	27.1	367.6	357.4
CUF-206	3.8	398.67	89.8	93.6	305.1	78.9	89.1	82.7	92.9	316.0	305.8
CUF-207	3.8	398.19	81.9	85.7	312.5	71.2	81.3	75.0	85.1	323.2	313.1
CUF-208	3.8	398.38	54.8	58.6	339.8	44.1	54.2	47.9	58.0	350.5	340.4
CUF-209	3.7	398.23	60.1	63.8	334.4	49.4	59.6	53.1	63.3	345.1	334.9
CUF-210	3.7	398.20	65.3	69.0	329.2	59.8	64.8	63.5	68.5	334.7	329.7
CUF-211	3.8	398.76	64.8	68.6	330.2	53.9	64.1	57.7	67.9	341.1	330.9
CUF-212	3.7	398.71	69.5	73.2	325.5	58.9	69.1	62.6	72.8	336.1	325.9
CUF-213	3.8	399.05	42.0	45.7	353.4	36.3	41.5	40.0	45.2	359.1	353.9

Table H.1-3 - Summary of Monitoring Well Construction Specifications
Cumberland Fossil Plant

Well ID	Top of Casing		Bottom of Well			Screened Interval					
	Stickup	Elevation	Depth	Depth	Elevation	Depth Top	Depth Bottom	Depth Top	Depth Bottom	Elevation Top	Elevation Bottom
	ft ags	ft NGVD29	ft bgs	ft btoc	ft NGVD29	ft bgs	ft bgs	ft btoc	ft btoc	ft NGVD29	ft NGVD29
CUF-1000	3.7	395.29	21.8	25.5	369.8	10.8	21.4	14.5	25.1	380.8	370.2
CUF-1001	3.5	393.75	17.5	21.0	372.8	12.3	17.1	15.8	20.6	378.0	373.2
CUF-1002	3.4	389.26	17.0	20.4	368.9	11.7	16.6	15.1	20.0	374.2	369.3
CUF-1003	3.4	396.39	14.5	17.9	378.5	9.2	14.1	12.6	17.5	383.8	378.9
CUF-1005	3.5	399.58	25.7	29.2	370.4	14.7	25.3	18.2	28.8	381.4	370.8
CUF-1006	3.5	378.84	26.8	30.3	348.5	16.6	26.4	20.1	29.9	358.7	348.9

Notes:

ags	above ground surface
bgs	below ground surface
btoc	below top of casing
ft	feet
ID	identification
n/a	Not applicable
NGVD29	National Geodetic Vertical Datum of 1929
R	Replacement Well

1. Well information based on data provided by TVA and Stantec (e.g., well logs, well inspection report); however, there may be discrepancies between sources for certain information.
2. Coordinates and elevations for Wells Creek and Rye Springs are estimates from Google Earth and have not been professionally surveyed.
3. Stick-up height based on difference between surveyed values for Top of Casing Elevation and Ground Surface Elevation.

Table H.1-4 - Summary of Hydraulic Conductivity Estimates Derived from Pressure Testing in Rock
Cumberland Fossil Plant

Boring ID	Ground Surface Elevation (ft)	Test Depth Interval (ft)		Test Interval Elevation (ft)		Test Length (ft)	Flow Rate (gal/min)	Total Head (ft)	Hydraulic Conductivity (cm/sec)
CUF-TW01	426.7	72.0	79.8	354.7	346.9	7.8	4.6	89.9	2.9E-04
CUF-TW01	426.7	80.0	90.4	346.7	336.3	10.4	3.0	101.7	1.4E-04
CUF-TW03	424.4	82.0	89.4	342.4	335.0	7.4	0.5	105.2	2.8E-05
CUF-TW03	424.4	89.4	99.4	335.0	325.0	10.0	3.5	111.5	1.5E-04
CUF-TW05	422.5	77.5	85.5	345.0	337.0	8.0	0.2	100.7	1.1E-05
CUF-TW05	422.5	85.5	95.7	337.0	326.8	10.2	1.7	109.8	7.2E-05
CUF-TW07	438.3	127.5	132.5	310.8	305.8	5.0	0.9	144.1	5.0E-05
CUF-TW07	438.3	130.5	135.5	307.8	302.8	5.1	0.5	149.2	2.6E-05
CUF-TW07	438.3	135.5	145.5	302.8	292.8	10.0	1.4	156.6	4.2E-05
CUF-TW08	435.7	129.0	138.4	306.7	297.3	9.4	0.3	149.7	1.0E-05
CUF-TW08	435.7	138.5	148.5	297.2	287.2	10.0	1.0	162.0	2.9E-05
CUF-TW09	442.1	139.7	147.7	302.4	294.4	8.0	3.7	160.2	1.3E-04
CUF-TW09	442.1	139.7	147.7	302.4	294.4	8.0	3.6	160.2	1.3E-04
CUF-TW09	442.1	147.7	157.7	294.4	284.4	10.0	1.3	166.7	3.7E-05
CUF-B11	390.1	86.5	94.0	303.6	296.1	7.5	0.0	105.6	NC
CUF-B11	390.1	94.0	104.0	296.1	286.1	10.0	0.3	114.3	1.2E-05
CUF-B12	387.4	52.6	57.6	334.8	329.8	5.0	0.2	72.2	2.2E-05
CUF-B12	387.4	55.0	60.0	332.4	327.4	5.0	0.2	74.6	2.1E-05
CUF-B12	387.4	60.0	70.0	327.4	317.4	10.0	0.2	82.1	1.2E-05
CUF-B13	394.7	72.0	80.5	322.7	314.2	8.5	0.7	93.9	4.0E-05
CUF-B14	440.8	127.5	134.6	313.3	306.2	7.1	5.9	150.1	2.4E-04
CUF-B14	440.8	135.0	145.1	305.8	295.7	10.1	1.8	156.8	5.4E-05
CUF-B16	439.7	127.5	134.5	312.2	305.2	7.0	0.8	150.5	3.3E-05
CUF-B16	439.7	134.5	144.5	305.2	295.2	10.0	1.2	157.2	3.6E-05
CUF-B17	443.4	111.5	118.5	331.9	324.9	7.0	0.0	131.0	NC
CUF-B17	443.4	118.5	128.5	324.9	314.9	10.0	0.3	139.5	1.0E-05
CUF-B18	395.0	44.0	52.0	351.0	343.0	8.0	6.5	65.5	5.6E-04
CUF-B18	395.0	52.0	62.0	343.0	333.0	10.0	0.1	76.5	6.2E-06
CUF-B18	395.0	62.0	71.7	333.0	323.3	9.7	0.4	86.4	2.2E-05
CUF-B18	395.0	72.0	81.3	323.0	313.7	9.3	0.4	96.2	2.1E-05
CUF-B18	395.0	82.0	91.4	313.0	303.6	9.4	0.0	104.4	NC
CUF-B19	394.8	46.0	54.8	348.8	340.0	8.8	0.5	67.1	3.9E-05
CUF-B19	394.8	54.5	64.5	340.3	330.3	10.0	0.1	76.5	6.2E-06
CUF-B19	394.8	64.5	74.5	330.3	320.3	10.0	0.1	86.5	5.5E-06
CUF-B19	394.8	74.5	84.5	320.3	310.3	10.0	0.2	96.5	9.8E-06
CUF-B19	394.8	84.4	94.4	310.4	300.4	10.0	0.2	105.5	9.0E-06
CUF-B19	394.8	94.5	104.5	300.3	290.3	10.0	0.0	116.5	NC
CUF-B19	394.8	104.5	114.5	290.3	280.3	10.0	0.1	126.3	3.7E-06
CUF-B19	394.8	114.5	119.5	280.3	275.3	5.0	0.6	134.0	3.6E-05
								Geometric Mean (cm / sec)	**3.1E-05**

See notes on last page.

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Table H.1-4 - Summary of Hydraulic Conductivity Estimates Derived from Pressure Testing in Rock
Cumberland Fossil Plant

Notes:

cm / sec	centimeter per second
ft	feet
gal / min	gallon per minute
ID	identification
NC	Not calculated. No flow observed.
psi	pounds per square inch

Hydraulic Conductivity Calculation:

$$K = \frac{CQ}{2\pi LH} * \ln(L/r)$$

K	hydraulic conductivity (cm/sec)
Q	flow rate (gal/min)
L	test length (ft)
H	total head (ft)
r	borehole radius (0.1250) (ft)
C	conversion factor (0.0679) (cm-min-ft^3)/(ft-sec-gal)

Total Head Calculation:

$$H = P * C_{pressure} + \left(\frac{D_{top} - D_{bottom}}{2} + H_{gauge}\right)$$

H	total head (ft)
P	pressure (psi)
$C_{pressure}$	conversion factor (psi to head ft)
D_{top}	top test depth (ft)
D_{bottom}	bottom test depth (ft)
H_{gauge}	gauge height (ft)

Preene, M (2019). Design and interpretation of packer permeability tests for geotechnical purposes. Quarterly Journal Of Engineering Geology, 52, 2, May, 182–200.

Table H.1-5 - Summary of Hydraulic Conductivity Results from Slug Test Data
Cumberland Fossil Plant

Monitoring Well ID	Slug Test Hydraulic Conductivity (cm/sec)	Slug Test Hydraulic Conductivity (ft/day)
93-2R [(1)]	4.28E-02	121.32
CUF-205 [(2)]	2.78E-03	7.88
CUF-206 [(2)]	6.22E-02	176.43
CUF-207 [(2)]	5.35E-03	15.17
CUF-208 [(2)]	4.59E-04	1.30
CUF-209 [(2)]	3.86E-04	1.09
CUF-211 [(2)]	3.15E-03	8.92
CUF-212 [(2)]	1.83E-03	5.17
CUF-1001 [(3)]	4.12E-02	116.80
CUF-1002 [(3)]	4.45E-02	126.10
CUF-1003 [(3)]	1.31E-02	37.00
Geometric Mean	**6.56E-03**	**1.86E+01**

Notes:

cm/s - centimeters per second

ft/day - feet per day

ID - identification

1) Cumberland Fossil Plant Groundwater Assessment No. WR98-1-46-110 Tennessee Valley Authority August, 1998
   [Well 93-2R]
2) Terracon, 2018. Aquifer Testing and Equipment Blank Results. TVA CCR Rule – Cumberland Fossil Plant (CUF). Terracon Consultants, Inc. December 12, 2018.
3) Hydrogeological Investigation SAR (Appendix H.2)
4) Slug test data for background wells CUF-201 and CUF-202 are not included in the sitewide average because they are located west of Wells Creek, which is considered to be a boundary to groundwater flow.

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Table H.1-6 – Groundwater Level Measurements, Groundwater Sampling Event #2 (July 8, 2019)
Cumberland Fossil Plant

UNID	Well / Piezometer ID	Date Measured	Depth to Groundwater	Top of Casing Elevation	Groundwater Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
			ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft btoc	
CUF-00-GW-43-001	93-1	8-Jul-19	34.89	397.17	362.28	n/a	n/a	n/a	52.3 - 62.3	Alluvial Silts and Clays / Alluvial Sands and Gravels
CUF-00-GW-43-002	93-2R	8-Jul-19	37.59	397.88	360.29	n/a	n/a	n/a	62.3 - 72.0	Alluvial Sands and Gravels
CUF-00-GW-43-003	93-3	8-Jul-19	29.55	397.50	367.95	n/a	n/a	n/a	45.0 - 55.0	Alluvial Silts and Clays
CUF-00-GW-43-004	93-4	8-Jul-19	NM	397.34	NM	n/a	n/a	n/a	27.2 - 36.6	Bedrock: Limestone
CUF-00-GW-43-005	96-9	8-Jul-19	19.58	392.59	373.01	n/a	n/a	n/a	16.1 - 30.9	Bedrock: Fernvale and Hermitage Limestones
CUF-00-GW-43-006	B103	8-Jul-19	32.10	395.97	363.87	n/a	n/a	n/a	74.0 - 84.0	Alluvial Silts and Clays
CUF-00-GW-43-007	B110	8-Jul-19	45.18	398.27	353.09	n/a	n/a	n/a	48.3 - 52.5	Alluvial Silts and Clays
CUF-00-GW-43-008	CUF-101	8-Jul-19	2.87	385.68	382.81	n/a	n/a	n/a	2.0 - 17.2	Clay
CUF-00-GW-43-009	CUF-102	8-Jul-19	12.44	402.93	390.49	n/a	n/a	n/a	3.8 - 13.8	Bedrock: Limestone
CUF-00-GW-43-010	CUF-120	8-Jul-19	7.18	393.19	386.01	n/a	n/a	n/a	9.3 - 14.3	Bedrock
CUF-00-GW-43-011	CUF-201	8-Jul-19	12.20	400.41	388.21	n/a	n/a	n/a	17.6 - 27.7	Alluvial Sands and Gravels
CUF-00-GW-43-012	CUF-202	8-Jul-19	6.85	383.28	376.43	n/a	n/a	n/a	14.3 - 19.6	Alluvial Sands and Gravels
CUF-00-GW-43-014	CUF-205	8-Jul-19	19.66	384.51	364.85	n/a	n/a	n/a	16.9 - 27.1	Alluvial Sands and Gravels
CUF-00-GW-43-015	CUF-206	8-Jul-19	34.15	398.67	364.52	n/a	n/a	n/a	82.7 - 92.9	Alluvial Sands and Gravels
CUF-00-GW-43-016	CUF-207	8-Jul-19	34.61	398.19	363.58	n/a	n/a	n/a	75.0 - 85.1	Alluvial Sands and Gravels
CUF-00-GW-43-017	CUF-208	8-Jul-19	36.57	398.38	361.81	n/a	n/a	n/a	47.9 - 58.0	Alluvial Sands and Gravels
CUF-00-GW-43-018	CUF-209	8-Jul-19	34.91	398.23	363.32	n/a	n/a	n/a	53.1 - 63.3	Alluvial Sands and Gravels
CUF-00-GW-43-019	CUF-210	8-Jul-19	27.58	398.20	370.62	n/a	n/a	n/a	63.5 - 68.5	Alluvial Sands and Gravels
CUF-00-GW-43-020	CUF-211	8-Jul-19	36.60	398.76	362.16	n/a	n/a	n/a	57.7 - 67.9	Alluvial Sands and Gravels
CUF-00-GW-43-021	CUF-212	8-Jul-19	38.62	398.71	360.09	n/a	n/a	n/a	62.6 - 72.8	Alluvial Sands and Gravels
CUF-00-GW-43-022	CUF-213	8-Jul-19	22.14	399.05	376.91	n/a	n/a	n/a	40.0 - 45.2	Alluvial Sands and Gravels
CUF-00-GW-43-026	CUF-1000	8-Jul-19	25.45*	395.29	Dry*	n/a	n/a	n/a	14.5 - 25.1	Clay and Clayey Sand
CUF-00-GW-43-027	CUF-1001	8-Jul-19	15.64	393.75	378.11	n/a	n/a	n/a	15.8 - 20.6	Clayey Gravel and Clay
CUF-00-GW-43-028	CUF-1002	8-Jul-19	11.63	389.26	377.63	n/a	n/a	n/a	15.1 - 20.0	Clay and Gravel/Clay
CUF-00-GW-43-029	CUF-1003	8-Jul-19	15.29	396.39	381.10	n/a	n/a	n/a	12.6 - 17.5	Gravel/Cobbles and Clay
CUF-00-GW-43-030	CUF-1005	8-Jul-19	10.78	399.58	388.80	n/a	n/a	n/a	18.2 - 28.8	Sand, Clayey Gravel, Clay
Piezometers										
n/a	CUF-B14C	n/a	NM	n/a	NM	440.8	319.8	121.0	n/a	Alluvial Clay and Granular
n/a	CUF-B15B	8-Jul-19	69.6	n/a	368.7	438.3	327.8	110.5	n/a	Alluvial Granular
n/a	CUF-B16C	8-Jul-19	70.4	n/a	369.4	439.7	324.7	115.0	n/a	Alluvial Granular
n/a	CUF-B17B	8-Jul-19	71.2	n/a	372.1	443.4	336.4	107.0	n/a	Alluvial Granular
n/a	CUF_PZ49	8-Jul-19	15.8	n/a	363.4	379.2	322.2	57.0	n/a	Alluvial Granular
n/a	CUF_PZ53A	8-Jul-19	13.7	n/a	362.3	376.0	311.0	65.0	n/a	Alluvial Granular
n/a	CUF_PZ58A	n/a	NM	n/a	NM	394.8	349.3	45.5	n/a	Alluvial Granular
n/a	CUF_R_2B_VWPZ2	8-Jul-19	34.2	n/a	361.1	395.3	320.0	75.3	n/a	Alluvial Granular
n/a	CUF_S_2A_VWPZ1	8-Jul-19	33.8	n/a	361.5	395.3	299.7	95.6	n/a	Alluvial Granular
n/a	CUF_F_2B_VWPZ1	8-Jul-19	52.1	n/a	360.0	412.1	322.1	90.0	n/a	Alluvial Granular
n/a	CUF_DAS_A_1_VWPZ3	8-Jul-19	19.6	n/a	368.4	388.0	293.0	95.0	n/a	Alluvial Granular
n/a	CUF_DAS_A_2_VWPZ4	8-Jul-19	43.8	n/a	369.1	412.9	308.4	104.5	n/a	Alluvial Granular
n/a	CUF_DAS_INT_2_VWPZ5	8-Jul-19	65.3	n/a	369.2	434.5	313.5	121.0	n/a	Alluvial Granular
n/a	CUF_H_2B_VWPZ1	8-Jul-19	50.6	n/a	360.1	410.7	322.7	88.0	n/a	Alluvial Granular
Surface Water Gauge										
Cumberland River gauge	n/a	8-Jul-19	n/a	n/a	360.26	n/a	n/a	n/a	n/a	n/a

See notes on last page.

Table H.1-6 – Groundwater Level Measurements, Groundwater Sampling Event #2 (July 8, 2019)
Cumberland Fossil Plant

Notes:

*	<0.1 ft of water was present in the sump/end cap of the well and is not indicative of groundwater, the well is considered dry
bgs	below ground surface
btoc	below top of casing
ft	feet
ID	identification
msl	mean sea level
n/a	not applicable
NM	not measured
SAR	sampling and analysis report
UNID	Unique Numerical Identification

1. Top of casing elevations, screen intervals, and screened formations were obtained from the TVA Well Inventory Log provided by TVA.
2. Cumberland River data point is the closest reading to noon Central Daylight Time recorded by the automated staff gauge provided by TVA.
3. Ground surface elevation, groundwater elevations and piezometer data were obtained from geotechnical instrumentation database. Vibrating wire sensor formation information were obtained from boring logs. Data used were based on average of readings on the measur
4. Depth to groundwater and groundwater elevations in piezometers are calculated values. Accuracy of piezometer data is to 0.1 ft.
5. A groundwater level was not measured in well 93-4 because the meter was obstructed by the pump. Groundwater levels were not measured in select peizometers as noted above because the sensors were not recording data.

Table H.1-7 - Cumberland River and Groundwater Elevation Comparison
May 2019-March 2020
Cumberland Fossil Plant

	Groundwater Elevation by Date (ft asml)					
Well ID	**5/6/2019**	**7/8/2019**	**9/9/2019**	**10/28/2019**	**1/6/2020**	**3/9/2020**
93-1	361.54	362.28	358.15	357.45	362.94	361.58
93-2R	359.47	360.29	355.45	354.79	360.17	359.34
93-3	367.8	367.95	365.73	366.62	368.6	367.86
93-4	NM	NM	NM	NM	369.9	368.13
96-9	373.15	373.01	372.48	372.63	373.82	373.83
B103	363.46	363.87	361.14	360.41	364.42	363.77
B110	374.76	353.09	374.12	374.09	374.87	374.72
CUF-101	384.8	382.81	382.98	385.32	385.48	384.98
CUF-102	391.77	390.49	390.47	392.44	394.42	393.07
CUF-120	385.93	386.01	386.16	386.35	386.37	386.15
CUF-201	389.05	388.21	387.86	388.08	389.24	389.17
CUF-202	378.21	376.43	376.41	378.12	378.78	378.51
CUF-205	366.82	364.85	363.27	364.78	370.35	368.7
CUF-206	363.2	364.52	361.07	359.64	364.06	363.41
CUF-207	363.16	363.58	360.58	359.71	363.94	363.26
CUF-208	361.02	361.81	357.88	356.75	361.74	361.41
CUF-209	363.12	363.32	360.9	360.51	364.14	363.25
CUF-210	370.26	370.62	368.49	368.18	370.45	370.53
CUF-211	361.44	362.16	357.99	357.29	362.9	361.43
CUF-212	359.26	360.09	355.22	354.53	360.94	359.15
CUF-213	377.19	376.91	375.84	377.03	377.9	NM
CUF-1000	374.8	Dry*	Dry*	Dry*	381.11	379.24
CUF-1001	377.67	378.11	378.21	378.24	378.58	378.11
CUF-1002	377.76	377.63	377.69	377.78	377.78	377.72
CUF-1003	381.43	381.1	384.91	381.63	382.32	381.98
CUF-1005	389.62	388.8	388.51	388.46	389.89	389.71
Cumberland River	359.41	360.26	355.59	354.52	361.23	359.29

Notes:

ft asml	feet above mean sea level
ID	identification
NM	not measured

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Table H.1-8 - Rate and Direction of Groundwater Flow Summary
Cumberland Fossil Plant

Stilling Pond (including Retention Pond)

Sampling Event	Event 1	Event 2	Event 3	Event 4	Event 5	Event 6
Groundwater Elevation Measurement Date	5/6/2019	7/8/2019	9/9/2019	10/28/2019	6-Jan-20	3/9/2020
Horizontal Gradient (ft/ft)	7.43E-03	7.59E-03	9.10E-03	9.20E-03	6.95E-03	7.13E-03
Hydraulic Conductivity (cm/sec)	6.56E-03	6.56E-03	6.56E-03	6.56E-03	6.56E-03	6.56E-03
Effective Porosity	19%	19%	19%	19%	19%	19%
Flow Direction	W-NW	W-NW	W-NW	W-NW	W-NW	W-NW
Flow Rate (ft/yr)	265	271	325	329	248	255

Multi-Unit (Dry Ash Stack and Gypsum Storage Area)

Sampling Event	Event 1	Event 2	Event 3	Event 4	Event 5	Event 6
Groundwater Elevation Measurement Date	5/6/2019	7/8/2019	9/9/2019	10/28/2019	1/6/2020	3/9/2020
Horizontal Gradient (ft/ft)	1.03E-02	9.05E-03	1.63E-02	1.11E-02	1.04E-02	1.07E-02
Hydraulic Conductivity (cm/sec)	6.56E-03	6.56E-03	6.56E-03	6.56E-03	6.56E-03	6.56E-03
Effective Porosity	16%	16%	16%	16%	16%	16%
Flow Direction	W-SW	W-SW	W-SW	W-SW	W-SW	W-SW
Flow Rate (ft/yr)	439	384	693	471	440	452

Notes:

cm/sec - centimeter per second

ft/ft - feet per foot

ft/yr - feet per year

% - percent

W-SW - West-Southwest

W-NW - West-Northwest

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-1									
Sample Date		16-Jul-08	21-Jan-09	4-Mar-09	14-Apr-09	22-Jul-09	7-Oct-09	14-Jan-10	7-Apr-10	22-Jul-10	27-Oct-10
Sample ID		CUF-93-1-0708	CUF-93-1-0109	CUF-93-1-0309	CUF-93-1-0409	CUF-93-1-0709	CUF-93-1-1009	CUF-93-1-0110	CUF-93-1-0410	CUF-93-1-0710	CUF-93-1-1010
Parent Sample ID											
Sample Depth		60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Total Metals											
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<1	<1.0	-	<1	<1	<1	<1	3.5	<1	<1
Arsenic	ug/L	17	13	15	6.6	14	9.1	8.4	6.6	9.6	3.2
Barium	ug/L	220	230	-	400	310	330	310	280	300	320
Beryllium	ug/L	<2	6.8	<1	<1	<2	<2	<2	<2	<2	<2
Boron	ug/L	560	650	-	-	620	600	1,100	510	680	640
Cadmium	ug/L	0.94	1.5	-	<0.5	0.88	0.63	<0.5	0.62	<0.5	<0.5
Calcium	ug/L	220,000	240,000	-	-	240,000	290,000	260,000	260,000	290,000	280,000
Chromium	ug/L	5.3	1.0	-	1.1	3	4.2	<2	<2	2.3	<2
Cobalt	ug/L	7.3	7.9	-	6.1	6	5.6	6.9	5.4	8.7	1.4
Copper	ug/L	8.1	7.8	-	1.5	4.9	18	<4	<2	<2	<2
Iron	ug/L	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	3.3	1.6	-	<1	2.6	1.6	<1	<1	<1	<1
Lithium	ug/L	-	-	-	-	-	-	-	-	-	-
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.2	<0.20	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Molybdenum	ug/L	5.3	17	-	-	9.3	<5	<5	<5	<5	7.5
Nickel	ug/L	13	12	-	9.6	15	10	8.2	10	25	7.5
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<2	<2	-	6	6.2	8.6	5.2	1.5	68	1.4
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	1.1	0.76	-	<0.5	<1	2.4	<1	3.3	<1	<1
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<1	<1.0	-	<1	<1	<1	<1	<1	<1	<1
Vanadium	ug/L	-	-	-	<2	-	-	-	-	-	<2
Zinc	ug/L	29	60	-	28	55	27	10	15	<10	14
Radiological Parameters											
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	-	-	-	-	-	-	-	-	-	-
Anions											
Chloride	mg/L	270	300	-	-	330	350	370	350	390	430
Fluoride	mg/L	<0.10	<0.10	-	0.1	0.14	<0.10	<0.1	<0.10	<0.1	0.13
Sulfate	mg/L	130	150	-	-	160	160	160	160	200	200
General Chemistry											
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	1,200	1,000	-	-	1,400	1,500	1,200	1,400	1,700	1,700

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-1										
Sample Date		19-Jan-11	5-Apr-11	27-Jul-11	4-Oct-11	10-Jan-12	18-Apr-12	19-Jul-12	17-Oct-12	15-Jan-13	3-Apr-13	2-Jul-13
Sample ID		CUF-93-1-0111	CUF-93-1-0411	CUF-93-1-0711	CUF-93-1-1011	CUF-93-1-0112	CUF-93-1-0412	CUF-93-1-0712	CUF-93-1-1012	CUF-93-1-0113	CUF-93-1-0413	CUF-93-1-0713
Parent Sample ID												
Sample Depth		60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Total Metals												
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Arsenic	ug/L	7.7	9.2	6.8	13	3	2.8	1.8	11	28 J	7.5	5.5
Barium	ug/L	280	230	260	240	170	230	240	300	210	250	190
Beryllium	ug/L	2 UJ	2 UJ	<2	<2	<2	<2	<2	<2	<2	<2	<2
Boron	ug/L	740	590	760	530	530	-	-	560	-	480	-
Cadmium	ug/L	1.9	<0.5	<0.5	0.62	0.55	0.65	2.0	<0.5	0.53	0.52	<0.5
Calcium	ug/L	320,000	260,000	290,000	300,000	330,000	-	-	320,000	-	300,000	-
Chromium	ug/L	<2	2.4	4.7	16	11	6.3	5.1	<2	<2	4.6	<2
Cobalt	ug/L	7.3	2.8	2.4	7.8	2	1.0	2.8	10	8.9	3.6	<1
Copper	ug/L	2.3	2.3 U*	<2	3.3	5	4.8	8.0	3	2.7	3.9	<2
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<1	<1	<1	1.4	<1	<1	<1	<1	<1	<1	<1
Lithium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.2	<0.2	<0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Molybdenum	ug/L	5 UJ	14	15	11	21	-	-	7.8 J	-	8.7	-
Nickel	ug/L	2.1	28 J	16	20	22	11	17	12	21	11	9.1
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	3	3.9 J	8.4	8.2	<1	1.0	<1	<1	<1	<5	5.0
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<1	<1	<1	<1	<1	<1	<1	1 UR	<1	<1	<1
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Vanadium	ug/L	4.7	4	<2	4.8	7.8	<2	2.2	<2	4.4 U*	2.8	<2
Zinc	ug/L	16	<10	<10	14	<10	12	17	<10	12	<10	<10
Radiological Parameters												
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Anions												
Chloride	mg/L	440	430	450	250	540	-	-	510	-	490	-
Fluoride	mg/L	0.14	<0.10	0.15	<0.1	<0.1	0.12	0.19	<0.10	<0.10	<0.10	<0.1
Sulfate	mg/L	230 J	190	240	120	170	-	-	250	-	220	-
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	1,400	1,400	1,900	1,600	1,200	-	-	2,000	-	1,200	-

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-1									
Sample Date		9-Oct-13	22-Jan-14	9-Apr-14	22-Jul-14	9-Oct-14	14-Jan-15	14-Apr-15	21-Jul-15	21-Oct-15	26-Jan-16
Sample ID		CUF-93-1-1013	CUF-93-1-0114	CUF-93-1-0414	CUF-93-1-0714	CUF-93-1-1014	CUF-93-1-0115	CUF-93-1-0415	CUF-93-1-0715	CUF-93-1-1015	CUF-93-1-0116
Parent Sample ID											
Sample Depth		60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Total Metals											
Aluminum	ug/L	<500	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<1.0	<2	<2	<2	<1	<2	<2	<2	<2	<2
Arsenic	ug/L	2.6	9.68	<2	4.17	6	<2	<2	<2	<2	<2
Barium	ug/L	294	303	182	189 J	250	230	199	193	279	172
Beryllium	ug/L	<2.0	<2	<2	<2	<2	<2	<2	<2	<2	<2
Boron	ug/L	436	-	-	-	-	-	-	-	-	-
Cadmium	ug/L	<1.0	1.21	<1	<1	<0.5	<1	<1	<1	<1	<1
Calcium	ug/L	336,000	-	-	-	-	-	-	-	-	-
Chromium	ug/L	2.6	7.6	<2	<2	<2	2.9	<2	<2	<2	<2
Cobalt	ug/L	5.5	12.4	2.06	<2	2.1	<2	<2	<2	5.63	3.23
Copper	ug/L	3.2	4.98	<2	<2	2.6	<5	<5	<5	<5	<5
Iron	ug/L	2,080	-	-	-	-	-	-	-	-	-
Lead	ug/L	<1.0	<2	<2	<2	<1	<2	<2	<2	<2	<2
Lithium	ug/L	-	-	-	-	-	-	-	-	-	-
Magnesium	ug/L	34,500	-	-	-	-	-	-	-	-	-
Manganese	ug/L	6,640	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.20	0.2 UJ	0.2 UJ	0.2 UJ	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Molybdenum	ug/L	3.4	-	-	-	-	-	-	-	-	-
Nickel	ug/L	7.6	9.75	3.6	5.84	11	4.4	3.01	3.24	5.35	3.86
Potassium	ug/L	5,670	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<2.0	<2	<2	<2	<1	<2	<2	<2	<2	<2
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.50	<2	<2	<2	<1	<2	<2	<2	<2	<2
Sodium	ug/L	58,300	-	-	-	-	-	-	-	-	-
Strontium	ug/L	1,630	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<1.0	<2	<2	<2	<1	<2	<2	<2	<1	<1
Vanadium	ug/L	<2.0	-	-	2.31	2.9	<5	<5	<5	<5	<5
Zinc	ug/L	<20.0	<25	<25	<25	16	<25	<25	<25	<25	<25
Radiological Parameters											
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	-	-	-	-	-	-	-	-	-	-
Anions											
Chloride	mg/L	-	-	-	-	-	-	-	-	-	-
Fluoride	mg/L	-	0.109	0.244	<0.500	<0.1	<0.10	<0.1	<0.1	<0.100	<0.1
Sulfate	mg/L	-	-	-	-	-	-	-	-	-	-
General Chemistry											
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	1,670	-	-	-	-	-	-	-	-	-

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-1											
Sample Date		13-Apr-16	13-Apr-16	20-Jul-16	18-Oct-16	24-Jan-17	5-Apr-17	5-Apr-17	11-Jul-17	17-Oct-17	17-Oct-17	24-Jan-18	4-Apr-18
Sample ID		CUF-93-1-0416	CUF-93-1-0416-DUP	CUF-93-1-0716	CUF-93-1-1016	93-1	93-1	93-1 DUP	93-1	93-1	93-1 DUP	93-1-0118	93-1-0418
Parent Sample ID			CUF-93-1-0416					CUF-93-1-0417			CUF-93-1-1017		
Sample Depth		60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft
Sample Type		Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Total Metals													
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<2	<2	<2	<2	<2.00	<2	<2	<2	<2	<2	<2	<2
Arsenic	ug/L	2.86	3.41	2.93	13.6	12	14.3	14.3	12	13.7	14.2	12.9	12.5
Barium	ug/L	246	237	276	190	<200	177	174	148	156	152	163	162
Beryllium	ug/L	<2	<2	<2	<2	<4	<1	<1	<1	<1	<1	<1	<1
Boron	ug/L	-	-	-	1,040	937 J	1,170	1,230	823	767	865	883	870
Cadmium	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Calcium	ug/L	-	-	-	518,000	456,000	436,000	426,000	442,000	463,000	458,000	507,000	488,000
Chromium	ug/L	<2	2.33	<2	<2	2.00 UJ	<2	<2	<2	<2	<2	<2	<2
Cobalt	ug/L	4.65	4.03	10.4	16	23.1 J	21.1	21.9	18	22	22.2	17.8	17.7
Copper	ug/L	<5	<5	<5	<5	<2.00	<2	<2	<2	<2	<2	<2	<2
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<2	<2	<2	<2	<1	<1	<1	<1	<1	<1	<1	<1
Lithium	ug/L	-	-	-	<15	5.00 UJ	<5	<5	<5	<5	<5	<5	11.4
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.2	<0.2	<0.2	<0.2	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Molybdenum	ug/L	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Nickel	ug/L	4.29	4.25	5.79	5.13	5.85 J	4.6	4.77	4.93	4.95	4.77	4.82	5.32
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<2	<2	<2	<2	5 UJ	<5	<5	<5	<5	<5	<5	<5
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<2	<2	<2	<2	<1.00	<1	<1	<1	<1	<1	<1	<1
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1	<1	<1
Vanadium	ug/L	<5	<5	<5	<5	<50	<1	<1	1.75 U*	<1	<1	<1	<1
Zinc	ug/L	<25	<25	<25	<25	11.1	8.3	8.18	9.44	10.4	11.7	8.31	9.61
Radiological Parameters													
Radium-226	pCi/L	-	-	-	-	0.413 +/-(0.137)	0.522 +/-(0.155)	0.391 +/-(0.133)	0.436 +/-(0.119)	0.546 +/-(0.128)J	0.437 +/-(0.113)J	0.433 +/-(0.120)	0.380 +/-(0.108)
Radium-228	pCi/L	-	-	-	-	0.601 +/-(0.285)	0.138 +/-(0.210)U	0.391 +/-(0.258)	0.263 +/-(0.222)U	0.561 +/-(0.257)J	0.198 +/-(0.231)UJ	0.915 +/-(0.323)U*	0.485 +/-(0.251)
Radium-226+228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Anions													
Chloride	mg/L	-	-	-	-	694	702	692	728	712	712	746	690
Fluoride	mg/L	<0.1	<0.1	<0.100	<0.100	<0.500	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250
Sulfate	mg/L	-	-	-	482	395	390	381	437	413	422	470	481
General Chemistry													
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	7.57	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	-	-	-	2,770	2,090	2,020	2,000	2,740	2,300	2,270	2,330	2,080

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-1									
Sample Date		23-Jul-18	10-Oct-18	22-Jan-19	9-Apr-19	30-Jul-19	30-Jul-19	15-Oct-19	28-Jan-20	8-Apr-20	28-Jul-20
Sample ID		CUF-93-1-0718	93-1-1018	93-1-0119	CUF-93-1	CUF-93-1	CUF-93-1-DUP	CUF-93-1-1019	CUF-93-1-0120	CUF-93-1-0420	CUF-93-1-0720
Parent Sample ID							CUF-93-1-0719				
Sample Depth		60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Total Metals											
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<2.00	<2	<1.12	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378
Arsenic	ug/L	11.7	12	12.5	14.5	12.9	12.1	13.2	12.1	12.7	14.5
Barium	ug/L	148	143	147	135	134	133	144	134	124	132
Beryllium	ug/L	<1.00	<1	<0.057	<0.155	<0.182	<0.182	<0.182	<0.182	0.182 UJ	<0.182
Boron	ug/L	768	815	888 J	1,000	905	904	854	928	945	805 J
Cadmium	ug/L	<1.00	<1	0.179 J	<0.125	<0.125	<0.125	0.129 J	<0.217	0.227 U*	<0.217
Calcium	ug/L	490,000	446,000	466,000	487,000	542,000	540,000	482,000	525,000	516,000	531,000
Chromium	ug/L	<2.00	<2	2.53 U*	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	16.7	16.9	20.1	19	17.1	16.4	19.6 J	19.7	19.7	22.1
Copper	ug/L	<2.00	<2	<1.3	0.837 J	<0.627	<0.627	0.887 J	1.02 J	0.773 J	0.774 U*
Iron	ug/L	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<1.00	<1	0.31 J	<0.128	<0.128	<0.128	0.251 J	0.400 J	0.322 U*	<0.128
Lithium	ug/L	<5.00	12.5	3.03 J	<3.14	<3.39	<3.39	3.69 J	11.4 U*	3.39 UJ	<3.39
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.200	0.200 UJ	<0.101	<0.101	0.101 UJ	0.101 UJ	<0.101	0.101 UJ	<0.101	0.130 UJ
Molybdenum	ug/L	<5.00	<5	2.83 J	3.3 J	3.78 J	3.56 J	3.46 J	2.60 J	2.94 U*	3.32 J
Nickel	ug/L	4.15	4.24	5.35	5.05	4.62 U*	4.58 U*	5.47	5.63	5.13	5.31
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<5.00	<5	<0.813	<2.62	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<1.00	<1	<0.121	<0.121	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<1.00	<1	0.163 J	0.174 J	0.612 J	0.342 J	0.356 J	0.360 J	0.393 U*	0.303 J
Vanadium	ug/L	<1.00	<1	2.13 U*	<0.899	<0.991	<0.991	<0.991	1.20	<0.991	<0.991
Zinc	ug/L	7.80	11.1	15.5	13.7	11.3	11.1	21.5 U*	15.9	15.8	13.5 U*
Radiological Parameters											
Radium-226	pCi/L	0.629 +/-(0.141)	0.322 +/-(0.135)U*	0.375 +/-(0.115)	0.313 +/-(0.101)	0.652 +/-(0.528)U	0.118 +/-(0.494)U	0.649 +/-(0.585)U	1.63 +/-(0.847)	0.181 +/-(0.466)U	0.342 +/-(0.362)U
Radium-228	pCi/L	0.304 +/-(0.213)U	0.460 +/-(0.255)	0.397 +/-(0.326)U	0.344 +/-(0.242)U	0.0316 +/-(0.243)U	0.217 +/-(0.247)U	0.377 +/-(0.451)U	0.315 +/-(0.454)U	0.113 +/-(0.270)U	0.530 +/-(0.452)U
Radium-226+228	pCi/L	-	-	-	-	0.683 +/-(0.581)U	0.336 +/-(0.553)U	1.03 +/-(0.739)U	1.95 +/-(0.961)J	0.294 +/-(0.539)U	0.871 +/-(0.579)U
Anions											
Chloride	mg/L	733	737	665	689	719	711	682	697	700	761
Fluoride	mg/L	<0.250	<0.250	0.351	0.0892 J	<0.132	<0.132	0.0886 J	0.0831 J	0.157 U*	0.129 J
Sulfate	mg/L	466	469	481	486	430	432	482	439	525	570
General Chemistry											
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	2,270	2,140	2,180	2,150	2,840	2,940	2,550	2,010	2,260	2,380

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-1								
Sample Date		5-Oct-20	5-Oct-20	20-Jan-21	13-Apr-21	14-Jul-21	13-Oct-21	19-Jan-22	12-Apr-22	12-Jul-22
Sample ID		CUF-93-1-1020	CUF-93-1-DUP-1020	CUF-GW-93-1-01202021	CUF-GW-93-1-04132021	CUF-GW-93-1-07142021	CUF-GW-CUF-93-1-10132021	CUF-GW-93-1-01192022	CUF-GW-93-1-04122022	CUF-GW-93-1-07122022
Parent Sample ID			CUF-93-1-1020							
Sample Depth		60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft
Sample Type		Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Total Metals										
Aluminum	ug/L	-	-	-	-	-	-	-	-	-
Antimony	ug/L	0.658 J	0.588 J	0.439 J	0.667 J	0.862 J	0.519 J	0.420 J	0.564 J	<0.506
Arsenic	ug/L	13.1	14.2	14.0	13.7	14.7	14.1	13.3	13.5	12.9
Barium	ug/L	129	128	126	117	113	109	102	107	101
Beryllium	ug/L	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.274	<0.274
Boron	ug/L	1,040	942	983	898	913	1,010	931	1,170	908 J
Cadmium	ug/L	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217
Calcium	ug/L	535,000	541,000	571,000	549,000	546,000	550,000	537,000	547,000	591,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	21.6	22.8	23.2	22.6	21.0	21.5	21.1	22.9	24.7
Copper	ug/L	<0.627	<0.627	0.725 J	<0.627	<0.627	<0.627	<0.627	<1.14	<1.14
Iron	ug/L	-	-	-	-	-	-	-	-	-
Lead	ug/L	3.18 J	0.308 J	<0.128	0.137 J	0.149 J	<0.128	<0.128	0.253 J	<0.167
Lithium	ug/L	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	1.58 J	2.02 J
Magnesium	ug/L	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	0.130 UJ
Molybdenum	ug/L	3.22 J	3.07 J	2.93 J	3.26 J	3.53 J	3.13 J	3.14 J	3.21 J	3.33 J
Nickel	ug/L	5.78	5.87	5.94	5.42	5.30	4.95	5.25	5.91	5.93
Potassium	ug/L	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<0.739	<0.739
Silicon	ug/L	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.223	<0.223
Sodium	ug/L	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-
Thallium	ug/L	0.171 U*	0.284 U*	<0.148	0.166 J	0.205 J	0.180 J	0.172 J	<0.472	<0.472
Vanadium	ug/L	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.776	<0.776
Zinc	ug/L	14.2	14.0	14.2	13.9	12.9	11.2 U*	12.2	17.3	13.8
Radiological Parameters										
Radium-226	pCi/L	0.310 +/-(0.471)U	0.448 +/-(0.413)U	1.49 +/-(0.731)	0.332 +/-(0.411)U	-0.0758 +/-(0.410)U	1.80 +/-(0.907)	0.734 +/-(0.517)	0.784 +/-(0.460)	0.750 +/-(0.623)U
Radium-228	pCi/L	0.368 +/-(0.388)U	0.222 +/-(0.277)U	0.527 +/-(0.492)U	0.521 +/-(0.519)U	-0.158 +/-(0.233)U	0.564 +/-(0.441)U	0.337 +/-(0.430)U	0.146 +/-(0.376)U	0.695 +/-(0.558)U
Radium-226+228	pCi/L	0.678 +/-(0.610)U	0.670 +/-(0.497)U	2.01 +/-(0.881)J	0.852 +/-(0.662)U	0.000 +/-(0.471)U	2.36 +/-(1.01)J	1.07 +/-(0.673)J	0.931 +/-(0.594)J	1.45 +/-(0.836)U
Anions										
Chloride	mg/L	694	707	790	701	747	745	727	714	642
Fluoride	mg/L	0.0711 J	0.0817 J	0.135 J	0.0689 J	0.114 U*	0.173 J	0.137 U*	0.132 U*	0.171
Sulfate	mg/L	451	538	634	553	647	651	642	661	615
General Chemistry										
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	1,950	1,980	2,120 J	2,350	2,510	2,220	2,150	2,210	2,440

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-1D									
Sample Date		31-Jul-19	15-Oct-19	28-Jan-20	28-Jan-20	8-Apr-20	28-Jul-20	5-Oct-20	20-Jan-21	20-Jan-21	13-Apr-21
Sample ID		CUF-93-1D	CUF-93-1D-1019	CUF-93-1D-0120	CUF-93-1D-DUP-0120	CUF-93-1D-0420	CUF-93-1D-0720	CUF-93-1D-1020	CUF-GW-93-1D-01202021	CUF-GW-FD-01202021	CUF-GW-93-1D-04132021
Parent Sample ID					CUF-93-1D-0120					CUF-GW-93-1D-01202021	
Sample Depth		91 ft	91 ft	91 ft	91 ft	91 ft	91 ft	91 ft	91 ft	91 ft	91 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	CCR Program	State Compliance	State Compliance	State Compliance
Total Metals											
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378
Arsenic	ug/L	3.30	4.43	4.01	3.74	4.28	5.68	4.58	5.31	5.58	4.01
Barium	ug/L	89.3	80.0	73.9	76.3	61.6	64.2	58.4	55.6	54.8	54.7
Beryllium	ug/L	<0.182	<0.182	0.360 J	<0.182	0.182 UJ	<0.182	<0.182	<0.182	<0.182	<0.182
Boron	ug/L	4,980	4,620	4,610	5,000	4,850	4,010 J	5,090	5,230	5,310	5,080
Cadmium	ug/L	<0.125	<0.125	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217
Calcium	ug/L	263,000	245,000	268,000	283,000	257,000	279,000	286,000	288,000	290,000	276,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	0.386 J	1.52	3.86	3.86	5.79	6.58	8.13	9.48	9.71	10.3
Copper	ug/L	<0.627	<0.627	<0.627	<0.627	<0.627	0.796 U*	<0.627	<0.627	<0.627	<0.627
Iron	ug/L	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<0.128	<0.128	0.177 J	0.141 J	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128
Lithium	ug/L	10.0	9.29	17.1 U*	15.6 U*	12.3 J	12.1	11.5	9.67	10.0	10.2
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	0.101 UJ	<0.101	<0.101	<0.101	<0.101	0.130 UJ	<0.130	<0.130	<0.130	<0.130
Molybdenum	ug/L	11.0	7.48	4.27 J	4.27 J	3.77 J	3.94 J	3.32 J	3.46 J	3.53 J	3.92 J
Nickel	ug/L	<0.336	0.380 J	1.36	0.369 J	<0.336	0.463 J	<0.336	<0.336	<0.336	<0.336
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	0.165 J	<0.148	0.282 J	<0.148	<0.148	<0.148	<0.148	<0.148	<0.148	<0.148
Vanadium	ug/L	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991
Zinc	ug/L	5.26	9.20 U*	<3.22	<3.22	<3.22	<6.44	<3.22	4.59 J	<3.22	<3.22
Radiological Parameters											
Radium-226	pCi/L	0.483 +/-(0.567)U	0.292 +/-(0.527)U	1.81 +/-(0.928)J	0.276 +/-(0.499)UJ	0.180 +/-(0.445)U	0.535 +/-(0.603)U	0.251 +/-(0.351)U	0.427 +/-(0.514)U	0.750 +/-(0.684)U	0.184 +/-(0.318)U
Radium-228	pCi/L	0.272 +/-(0.308)U	0.347 +/-(0.330)U	0.179 +/-(0.332)U	0.141 +/-(0.360)U	-0.443 +/-(0.363)U	0.182 +/-(0.273)U	0.291 +/-(0.446)U	-0.0637 +/-(0.399)U	0.421 +/-(0.470)U	0.742 +/-(0.447)U*
Radium-226+228	pCi/L	0.755 +/-(0.646)U	0.638 +/-(0.621)U	1.99 +/-(0.985)J	0.416 +/-(0.615)UJ	0.180 +/-(0.574)U	0.717 +/-(0.662)U	0.542 +/-(0.568)U	0.427 +/-(0.651)U	1.17 +/-(0.830)U	0.925 +/-(0.548)U*
Anions											
Chloride	mg/L	148	149	158	156	156	160	166	162	163	159
Fluoride	mg/L	0.274	0.432 J	0.270	0.260	0.301	0.217	0.235	0.264	0.268	0.161
Sulfate	mg/L	423	487	459	472	493	556	538	827	904	544
General Chemistry											
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	1,190	1,210	1,240	1,250	1,250	1,300	1,300	1,330	1,250 J	1,360

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-1D								CUF-93-2R		
Sample Date		14-Jul-21	14-Jul-21	13-Oct-21	19-Jan-22	19-Jan-22	12-Apr-22	12-Apr-22	12-Jul-22	16-Jul-08	21-Jan-09	21-Jan-09
Sample ID		CUF-GW-93-1D-07142021	CUF-GW-FD01-07142021	CUF-GW-CUF-93-1D-10132021	CUF-GW-93-1D-01192022	CUF-GW-FD-01192022	CUF-GW-93-1D-04122022	CUF-GW-FD-04122022	CUF-GW-93-1D-07122022	CUF-93-2R-0708	CUF-93-2R-0109	CUF-93-2R-0109-DUP
Parent Sample ID			CUF-GW-93-1D-07142021			CUF-GW-93-1D-01192022		CUF-GW-93-1D-04122022				CUF-93-2R-0109
Sample Depth		91 ft	91 ft	91 ft	91 ft	91 ft	91 ft	91 ft	91 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Total Metals												
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<0.378	<0.378	<0.378	<0.378	<0.378	<0.506	<0.506	<0.506	<1	<1	<1
Arsenic	ug/L	4.21	4.32	5.13	4.73	4.84	5.14	4.92	2.91	16	8.7	9.9
Barium	ug/L	55.5	55.2	68.3	67.4	69.1	66.3	67.4	60.7	64	60	61
Beryllium	ug/L	<0.182	<0.182	<0.182	<0.182	<0.182	<0.274	<0.274	<0.274	<2	<2	<2
Boron	ug/L	4,890	4,810	6,580	5,150	5,100	5,860	5,970	4,630	14,000	15,000	15,000
Cadmium	ug/L	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	3.1	2.9	2.9
Calcium	ug/L	289,000	284,000	305,000	290,000	297,000	285,000	291,000	310,000	860,000	940,000	940,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	0.7	5.9	5.8
Cobalt	ug/L	13.1	13.1	5.73	1.70	1.70	1.16	1.18	3.94	4.6	5.2	5.2
Copper	ug/L	<0.627	<0.627	<0.627	<0.627	<0.627	<1.14	<1.14	<1.14	7.4	6.4	24
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<0.128	<0.128	<0.128	<0.128	<0.128	<0.167	<0.167	<0.167	1.5	<1	<1
Lithium	ug/L	15.2	15.0	5.67	5.02	5.07	4.39 J	4.77 J	4.52 J	-	-	-
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	0.130 UJ	<0.2	<0.20	<0.2
Molybdenum	ug/L	2.24 J	2.07 J	4.52 J	3.11 J	3.38 J	3.41 J	3.37 J	4.95 J	<5	<5	<5
Nickel	ug/L	0.431 J	0.387 J	<0.336	<0.336	<0.336	<0.517	<0.517	<0.517	52	-	-
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<1.51	<1.51	<1.51	<1.51	<1.51	<0.739	<0.739	<0.739	<2	<2	<2
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.177	<0.177	<0.177	<0.223	<0.223	<0.223	<0.5	<0.5	<0.5
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<0.148	<0.148	<0.148	<0.148	<0.148	<0.472	<0.472	<0.472	<1	<1	<1
Vanadium	ug/L	<0.991	<0.991	<0.991	<0.991	<0.991	<0.776	<0.776	<0.776	-	-	-
Zinc	ug/L	<3.22	<3.22	<3.22	<3.22	<3.22	<2.88	<2.88	<2.88	14	64	160
Radiological Parameters												
Radium-226	pCi/L	0.0920 +/-(0.282)U	-0.0671 +/-(0.257)U	0.0400 +/-(0.463)U	0.867 +/-(0.580)	0.560 +/-(0.437)	0.336 +/-(0.319)U	-0.0215 +/-(0.166)U	0.269 +/-(0.513)U	-	-	-
Radium-228	pCi/L	-0.123 +/-(0.201)U	0.196 +/-(0.296)U	0.435 +/-(0.390)U	0.0362 +/-(0.525)UJ	0.956 +/-(0.624)J	0.746 +/-(0.551)U	0.407 +/-(0.312)U	0.242 +/-(0.448)U	-	-	-
Radium-226+228	pCi/L	0.0920 +/-(0.346)U	0.196 +/-(0.392)U	0.475 +/-(0.606)U	0.903 +/-(0.782)J	1.52 +/-(0.761)J	1.08 +/-(0.637)U	0.407 +/-(0.353)U	0.511 +/-(0.681)U	-	-	-
Anions												
Chloride	mg/L	167	173	175	172	185	180	192	175	1,000	1,100	1,100
Fluoride	mg/L	0.210	0.255	0.184	0.170 U*	0.186 U*	0.130 U*	0.145 U*	0.162	0.16	0.11	0.13
Sulfate	mg/L	621	594	716	614	602	541	578	519	1,200	1,200	1,200
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	1,370	1,390	1,550	1,420	1,400	1,350	1,360	1,370	4,500	3,900	3,900

See notes on last page.

Stantec

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-2R											
Sample Date		13-Apr-09	22-Jul-09	22-Jul-09	7-Oct-09	14-Jan-10	7-Apr-10	7-Apr-10	22-Jul-10	27-Oct-10	19-Jan-11	5-Apr-11	5-Apr-11
Sample ID		CUF-93-2R-0409	CUF-93-2R-0709	CUF-93-2R-0709-DUP	CUF-93-2R-1009	CUF-93-2R-0110	CUF-93-2R-0410	CUF-93-2R-0410-DUP	CUF-93-2R-0710	CUF-93-2R-1010	CUF-93-2R-0111	CUF-93-2R-0411	CUF-93-2R-0411-DUP
Parent Sample ID				CUF-93-2R-0709				CUF-93-2R-0410					CUF-93-2R-0411
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Total Metals													
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Arsenic	ug/L	6.4	20	25	11	12	<1	<10	6.4	1.4	3.4	9.6	14
Barium	ug/L	57	53	53	63	54	54	53	47	56	54	41 J	51 J
Beryllium	ug/L	<1	<2	<2	<2	<2	<2	<2	<2	<2	<2	2 UJ	2 UJ
Boron	ug/L	-	14,000	14,000	15,000	13,000	12,000	12,000	13,000	16,000	16,000	14,000	13,000
Cadmium	ug/L	1.8	1.3	1.3	<2.5	1.7	1.1	1.3	1.5	1.5	1.3	1.7	1.7
Calcium	ug/L	-	860,000	870,000	960,000	890,000	890,000	860,000	860,000	920,000	960,000	910,000	890,000
Chromium	ug/L	2	3.6	3.9	<10	<2	9.3	3.4	<2	3.3	<2	<2	<2
Cobalt	ug/L	2.9	3.5	3.6	<5	9	7.2	6.5	2.1	2.6	1.1	3.6	4.1
Copper	ug/L	<1	<2	<2	<10	6	<2	<2	<2	<2	<2	<2	<2
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Lithium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<1	<0.2
Molybdenum	ug/L	-	<5	<5	<5	<5	<5	<5	<5	<5	5 UJ	8.7	<5
Nickel	ug/L	33	48	48	24	24	17	29	26	24	<1	65 J	83 J
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	29	42	48	30	14	<10	<10	30	3.5	<1	21 J	5 UJ
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.5	<1	<1	<5	<1	<1	<1	<1	<1	<1	1.2 J	<1
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Vanadium	ug/L	7.5	-	-	-	-	-	-	-	4.4	<2	8.4	10
Zinc	ug/L	<10	<10	<10	<50	<10	<10	<10	<10	<10	<10	<10	<10
Radiological Parameters													
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Anions													
Chloride	mg/L	-	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,200	1,100	1,200	1,200
Fluoride	mg/L	<0.1	0.11	0.11	<0.10	<0.1	<0.10	<0.10	0.12	<0.10	0.11	0.13	0.11
Sulfate	mg/L	-	1,300	1,300	1,300	1,400	1,300	1,300	1,300	1,400	1,300 J	1,300	1,300
General Chemistry													
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	-	4,400	4,300	4,800	3,900	4,200	4,500	4,700	4,700	3,900	4,300	4,600

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-2R											
Sample Date		26-Jul-11	26-Jul-11	4-Oct-11	10-Jan-12	10-Jan-12	18-Apr-12	18-Apr-12	19-Jul-12	17-Oct-12	14-Jan-13	14-Jan-13	3-Apr-13
Sample ID		CUF-93-2R-0711	CUF-93-2R-0711-DUP	CUF-93-2R-1011	CUF-93-2R-0112	CUF-93-2R-0112-DUP	CUF-93-2R-0412	CUF-93-2R-0412-DUP	CUF-93-2R-0712	CUF-93-2R-1012	CUF-93-2R-0113	CUF-93-2R-0113 DUP	CUF-93-2R-0413
Parent Sample ID			CUF-93-2R-0711			CUF-93-2R-0112		CUF-93-2R-0412				CUF-93-2R-0113	
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Total Metals													
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1
Arsenic	ug/L	5.1	6.3	8.2	4.8	6	5.8	6.2	3.2	6.3	58 J	68 J	11
Barium	ug/L	50	50	51	53	50	57	52	48	47	48	46	48
Beryllium	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Boron	ug/L	14,000	14,000	14,000	14,000	14,000	-	-	-	14,000	-	-	13,000
Cadmium	ug/L	2.2	2.3	3	2.8	2.1	2.9	3.6	1.8	2.2	1.9	1.9	1.8
Calcium	ug/L	940,000	910,000	890,000	990,000	990,000	-	-	-	910,000	-	-	930,000
Chromium	ug/L	<2	<2	16	<2	<2	5.2	3.3	2.5	3.8	4.1	2.9	5.2
Cobalt	ug/L	1.8	1.8	3.9	3.1	3.4	2.0	2.3	3.5	4.1	5.1	4.8	5.4
Copper	ug/L	<2	<2	<2	<2	<2	<4	<2	5.8	<2	<2	<2	<2
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1
Lithium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.20	<0.20	<0.2	<0.4	<0.2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2
Molybdenum	ug/L	13	12	8.1	7.2	<5	-	-	-	5 UJ	-	-	<5
Nickel	ug/L	13	14	41	23	27	25	22	35	29	32	33	28
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	24	27	30	<1	<1	1.5	1.7	<1	1.2	<1	1.8	15
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	1.1	<1	<1	1.2	<1	<2	<1	<1	1 UR	<1	<1	<1
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1
Vanadium	ug/L	<2	<2	3.2	6.7	7.9	7.7	7.5	5.8	3.2	5.6 U*	8.5 U*	8.7
Zinc	ug/L	<10	<10	<10	<10	<10	<20	<10	<10	<10	<10	<10	<10
Radiological Parameters													
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Anions													
Chloride	mg/L	1,200	1,200	1,200	1,200	1,200	-	-	-	1,200	-	-	1,200
Fluoride	mg/L	<0.10	<0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.24	<0.10	<0.10	0.13
Sulfate	mg/L	1,200	1,300	1,300	1,300	1,300	-	-	-	1,300	-	-	1,300
General Chemistry													
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	4,300	4,600	4,800	4,000	4,000	-	-	-	5,100	-	-	2,800

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-2R											
Sample Date		1-Jul-13	8-Oct-13	8-Oct-13	22-Jan-14	8-Apr-14	8-Apr-14	21-Jul-14	8-Oct-14	8-Oct-14	14-Jan-15	14-Apr-15	21-Jul-15
Sample ID		CUF-93-2R-0713	CUF-93-2R-1013	CUF-93-2R-1013-DUP	CUF-93-2R-0114	CUF-93-2R-0414	CUF-93-2R-0414-DUP	CUF-93-2R-0714	CUF-93-2R-1014	CUF-93-2R-1014-DUP	CUF-93-2R-0115	CUF-93-2R-0415	CUF-93-2R-0715
Parent Sample ID				CUF-93-2R-1013			CUF-93-2R-0414			CUF-93-2R-1014			
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Total Metals													
Aluminum	ug/L	-	<5,000	<5,000	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<1	<1.0	<1.0	<2	<2	<2	<2	<1	<1	<2	<2	<2
Arsenic	ug/L	9.6	<4.0	<4.0	2.35	<2	<2	7.57	7.4	8	<2	<2	<2
Barium	ug/L	48	46.7	47.0	<100	<100	<100	47.7	50	48	48	44.6	42.7
Beryllium	ug/L	<2	<4.0	<4.0	<2	<2	<2	<2	<2	<2	<2	<2	<2
Boron	ug/L	-	13,000	13,700	-	-	-	-	-	-	-	-	-
Cadmium	ug/L	1.5	2.2	2.1	2.87	2.33	2.25	2.48	2.4	2.1	1.9	1.66	1.52
Calcium	ug/L	-	991,000	984,000	-	-	-	-	-	-	-	-	-
Chromium	ug/L	<2	<20.0	<20.0	<2	<2	<2	<2	3.8	<2	<2	<2	<2
Cobalt	ug/L	2.1	<4.0	<4.0	2.03	2.49	2.49	2.09	2.9	3	<2	2.09	2.02
Copper	ug/L	<2	<20.0	<20.0	<2	<2	<2	<2	<2	<2	<5	<5	<5
Iron	ug/L	-	<5,000	<5,000	-	-	-	-	-	-	-	-	-
Lead	ug/L	<1	<1.0	<1.0	<2	<2	<2	<2	<1	<1	<2	<2	<2
Lithium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	ug/L	-	78,700	74,700	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	12,900	13,400	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.2	<0.20	<0.20	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	<0.2	-	<0.2	<0.2	<0.2
Molybdenum	ug/L	-	<1.0	<1.0	-	-	-	-	-	-	-	-	-
Nickel	ug/L	23	<20.0	<20.0	5.75	5.53	5.34	5.48	26	27	4.8	4.50	5.32
Potassium	ug/L	-	31,400	33,300	-	-	-	-	-	-	-	-	-
Selenium	ug/L	20	<20.0	<20.0	<2	<2	<2	<2	<1	<1	<2	<2	<2
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<1	<0.50	<0.50	<2	<2	<2	<2	2.8	<1	<2	<2	<2
Sodium	ug/L	-	53,900	53,600	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	1,390	1,410	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<1	<1.0	<1.0	<2	<2	<2	<2	<1	<1	<2	<2	<2
Vanadium	ug/L	2.0	<20.0	<20.0	<2	<2	<2	2.9	4.4	5.3	<5	<5	<5
Zinc	ug/L	<10	<200	<200	<25	<25	<25	<25	16	<10	<25	<25	<25
Radiological Parameters													
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Anions													
Chloride	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	mg/L	<0.1	-	-	<0.100	0.119	<0.100	<1.00	<0.1	<0.1	0.15	<0.1	<0.1
Sulfate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
General Chemistry													
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	-	4,400	4,350	-	-	-	-	-	-	-	-	-

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-2R											
Sample Date		21-Oct-15	21-Oct-15	25-Jan-16	13-Apr-16	19-Jul-16	19-Jul-16	19-Oct-16	7-Nov-16	7-Nov-16	24-Jan-17	7-Feb-17	7-Feb-17
Sample ID		CUF-93-2R-1015	CUF-93-2R-1015-DUP	CUF-93-2R-0116	CUF-93-2R-0416	CUF-93-2R-0716	CUF-93-2R-0716-DUP	CUF-93-2R-1016	CUF-GW-002-11072016	CUF-GW-903-11072016	CUF-GW-002-01242017	CUF-GW-002-02072017	CUF-GW-903-02072017
Parent Sample ID			CUF-93-2R-1015				CUF-93-2R-0716			CUF-GW-002-11072016			CUF-GW-002-02072017
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals													
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<2	<2	<2	<2	<2	<2	<2	0.257 U*	0.174 U*	<0.443	0.719 U*	0.797 U*
Arsenic	ug/L	<2	<2	<2	<2	<2	<2	<2	1.54	1.34	3.02 J	2.3 J	2.26 J
Barium	ug/L	46.4	46.2	43.3	46	48.2	48.9	45.6	42.7	38	38.6	37.6	36.4
Beryllium	ug/L	<2	<2	<2	<2	<2	<2	<2	<0.102	<0.102	<0.131	0.131 UJ	0.131 UJ
Boron	ug/L	-	-	-	-	-	-	21,300	17,500	17,500	23,000 J	19,900	19,500
Cadmium	ug/L	2.16	2.17	2.16	1.84	2.6	2.53	1.56	1.4	1.24	0.496 J	0.702 J	0.935 J
Calcium	ug/L	-	-	-	-	-	-	1.04 1.04e+006	999,000	893,000	900,000	912,000 J	877,000 J
Chromium	ug/L	<2	<2	<2	<2	<2	<2	<2	<0.339	<0.339	<0.378	0.4 J	0.45 J
Cobalt	ug/L	<2	<2	2.03	<2	<2	<2	<2	2.02	1.79	1.86	1.9 J	1.87 J
Copper	ug/L	<5	<5	<5	<5	<5	<5	<5	-	-	-	-	-
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<2	<2	<2	<2	<2	<2	<2	0.163 J	0.09 J	<0.318	<0.318	<0.318
Lithium	ug/L	-	-	-	-	-	-	15.7	3.84 U*	3.11 U*	4.92 U*	4.16 U*	3.23 U*
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.0521	<0.0521	<0.0521	<0.0521	<0.0521
Molybdenum	ug/L	-	-	-	-	-	-	<5	1.37 J	0.985 J	1.05 J	1.13 J	0.848 J
Nickel	ug/L	5.17	4.87	5.50	5.43	5.34	5.46	5.53	-	-	-	-	-
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<2	<2	<2	<2	<2	<2	<2	0.362 U*	0.482 U*	<1.27	<12.7	<12.7
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<2	<2	<2	<2	<2	<2	<2	-	-	-	-	-
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<1	<1	<1	<1	<1	<1	<2	0.155 J	0.118 J	0.115 J	0.119 J	0.123 U*
Vanadium	ug/L	<5	<5	<5	<5	<5	<5	<5	-	-	-	-	-
Zinc	ug/L	<25	<25	<25	<25	<25	<25	<25	-	-	-	-	-
Radiological Parameters													
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	-	-	-	-	-	-	-	0.953 +/-(0.58)U	0.984 +/-(0.39)J	0.425 +/-(0.40)J	0.529 +/-(0.42)J	1.03 +/-(0.48)J
Anions													
Chloride	mg/L	-	-	-	-	-	-	-	626 J	1,100 J	1,020	1,000	1,060
Fluoride	mg/L	<0.100	0.132	<0.1	<0.1	<0.100	<0.100	<0.100	<0.121	<0.121	<0.0733	<0.0733	<0.0733
Sulfate	mg/L	-	-	-	-	-	-	1,330	1,170	1,190	1,310	1,280	1,360
General Chemistry													
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	7.01	-	-	-	-	-
Total Dissolved Solids	mg/L	-	-	-	-	-	-	4,690	4,100	4,200	4,390	3,770	3,830

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-2R										
Sample Date		8-Mar-17	5-Apr-17	3-May-17	31-May-17	12-Jul-17	12-Jul-17	27-Jul-17	17-Aug-17	30-Aug-17	3-Oct-17	17-Oct-17
Sample ID		CUF-GW-002-03082017	CUF-GW-002-04052017	CUF-GW-002-05032017	CUF-GW-002-05312017	CUF-GW-002-07122017	CUF-GW-903-07122017	CUF-GW-002-07272017	CUF-GW-002-08172017	CUF-GW-002-08302017	CUF-GW-002-10032017	93-2R
Parent Sample ID							CUF-GW-002-07122017					
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance
Total Metals												
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	0.584 U*	<0.443	<0.443	<0.443	<0.443	<0.443	<0.443	<0.443	0.738 U*	-	<2
Arsenic	ug/L	1.91	1.64	2.43	2.83	1.45	1.51	1.92	1.78	1.59	-	1.75
Barium	ug/L	39.9	42	39.6	37.6	39.6	40.7	36.4	41.1	36.4	-	41
Beryllium	ug/L	<0.131	0.622 J	<0.131	<0.131	<0.131	<0.131	<0.131	<0.131	<0.131	-	<1
Boron	ug/L	20,600 J	29,600	17,100	14,900	19,400	20,200	11,900	13,700	17,600	18,600	12,300
Cadmium	ug/L	0.378 J	0.379 J	0.565 U*	0.471 J	0.5 J	0.537 J	0.13 J	0.541 J	0.344 J	-	3.16
Calcium	ug/L	908,000	1.23 1.23e+006	1.06 1.06e+006	944,000	945,000	970,000	993,000	889,000	936,000	931,000	954,000
Chromium	ug/L	<0.378	<0.378	<0.378	<0.378	0.507 J	<0.378	<0.378	0.468 U*	0.455 U*	-	<2
Cobalt	ug/L	1.78	1.51	1.5	1.58	1.91	1.92	2.35	2.05	1.94	-	2.2
Copper	ug/L	-	-	-	-	-	-	-	-	-	-	<2
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<0.318	<0.318	<0.318	<0.318	1.03	<0.318	<0.318	<0.318	<0.318	-	<1
Lithium	ug/L	4.15 U*	2.65 U*	8.07 U*	3.33 J	3.6 J	3.51 J	3.79 J	4.01 J	5.15 U*	-	<5
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	-	<0.200
Molybdenum	ug/L	1.08 J	1.29 J	1.01 J	0.91 J	1.06 J	0.868 J	0.833 U*	0.653 J	1.06 J	-	<5
Nickel	ug/L	-	-	-	-	-	-	-	-	-	-	4.33
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	1.27 UJ	<1.27	<1.27	<1.27	<1.27	<1.27	<1.27	<1.27	<1.27	-	<5
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	-	-	-	<1.00	<1.00	-	-	-	-	<1
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	0.138 U*	<0.0531	0.139 U*	0.142 J	0.141 J	0.135 J	0.11 J	0.126 J	0.164 J	-	<1
Vanadium	ug/L	-	-	-	-	<1.00	<1.00	-	-	-	-	<1
Zinc	ug/L	-	-	-	-	<5.00	<5.00	-	-	-	-	12.5
Radiological Parameters												
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-	0.189 +/-(0.0790)J
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-	0.331 +/-(0.229)U
Radium-226+228	pCi/L	+/-(0.52)U	+/-(0.43)U	+/-(0.49)U	+/-(1.8)UR	+/-(0.47)UJ	0.822 +/-(0.55)J	1.13 +/-(0.52)J	0.448 +/-(0.35)J	+/-(0.63)U	-	-
Anions												
Chloride	mg/L	977	1,010	1,080	1,090	1,140	1,100	1,160	1,100	1,140	1,100	1,130
Fluoride	mg/L	<0.147	<0.0733	0.0853 J	<0.147	0.0928 J	0.112 J	0.0785 J	<0.0658	<0.0658	0.171 J	<0.250
Sulfate	mg/L	1,310	1,400	1,350	1,360	1,350	1,290	1,320	1,270	1,410	1,500	1,330
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	3,980	4,620	4,130	4,990	4,460	4,480	3,970	4,200	3,980	3,970	4,280

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-2R										
Sample Date		30-Jan-18	4-Apr-18	31-May-18	21-Jun-18	12-Jul-18	2-Aug-18	22-Aug-18	22-Jan-19	22-Jan-19	7-Feb-19	9-Apr-19
Sample ID		CUF-93-2R-0118	93-2R-0418	CUF-GW-002-05312018	CUF-GW-002-06212018	CUF-GW-002-07122018	CUF-GW-002-08022018	CUF-GW-002-08222018	93-2R-0119	93-2R-DUP-0119	CUF-GW-002-02072019	CUF-93-2R
Parent Sample ID										93-2R-0119		
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	State Compliance	CCR Program	State Compliance
Total Metals												
Aluminum	ug/L	-	-	-	-	0.0123	-	-	-	-	19.7 J	-
Antimony	ug/L	<2	<2	<1.12	<1.12	<1.12	<1.12	<1.12	<1.12	<1.12	<0.378	<0.378
Arsenic	ug/L	1.08	2.33	2.06	1.96	2.21	1.49	2.1	1.24	1.43	1.81	1.58
Barium	ug/L	41.4	40.5	38.8	43.2	42.5	42.2	40.8	37.8	38	44.8	38.9
Beryllium	ug/L	<4.0	<1	<0.057	<0.057	<0.057	<0.057	<0.057	<0.057	<0.057	<0.155	<0.155
Boron	ug/L	23,400	16,500	12,100	14,600	13,600	17,600	18,700	17,200	16,900	9,480	18,200
Cadmium	ug/L	<1	<1	0.431 J	0.538 J	0.316 J	0.765 J	0.455 J	0.459 J	0.546 J	0.378 J	0.161 J
Calcium	ug/L	961,000	952,000	970,000	987,000	949,000	877,000	890,000	863,000	866,000	956,000	899,000
Chromium	ug/L	<2	<2	<0.631	1.74 U*	1.75 U*	1.78 U*	2.04 U*	1.09 U*	2.01 U*	<1.53	<1.53
Cobalt	ug/L	1.66	1.67	1.75	1.98	2.4	1.51	2.3	1.69	1.6	1.9	1.96
Copper	ug/L	<2	<2	-	-	<2	-	-	<1.3	<1.3	0.79 J	1.23 J
Iron	ug/L	-	-	-	-	2,040	-	-	-	-	2,330	-
Lead	ug/L	<1	<1	0.094 UJ	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.128	<0.128
Lithium	ug/L	<5	<5	4.48 U*	4.31 J	2.59 J	4.27 J	3.11 J	2.87 J	<2.56	<3.14	3.64 J
Magnesium	ug/L	-	-	-	-	68,900	-	-	-	-	64,700	-
Manganese	ug/L	-	-	-	-	12,800	-	-	-	-	11,000	-
Mercury	ug/L	<0.2	<0.200	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.101	<0.101	<0.101	<0.101
Molybdenum	ug/L	<5.00	<5	1.09 J	0.896 J	0.934 J	1.08 J	1.19 J	1.25 J	1.25 J	0.973 J	1.41 J
Nickel	ug/L	6.73	4.65	-	-	3.84	-	-	4.37	4.21	2.94	4.78
Potassium	ug/L	-	-	-	-	32,100	-	-	-	-	36,500	-
Selenium	ug/L	<5	<5	<0.813	<0.813	<0.813	<0.813	<0.813	<0.813	<0.813	<2.62	<2.62
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<1	<1	-	-	-	-	-	<0.121	<0.121	-	<0.121
Sodium	ug/L	-	-	-	-	57,400	-	-	-	-	58,300	-
Strontium	ug/L	-	-	-	-	1,330	-	-	-	-	1,540	-
Thallium	ug/L	<1	<1	0.136 J	0.138 J	0.128 J	0.14 J	0.152 J	0.153 J	0.139 J	0.137 J	0.138 J
Vanadium	ug/L	<1	<1	-	-	-	-	-	0.962 U*	1.58 U*	-	<0.899
Zinc	ug/L	<5	10.6	-	-	-	-	-	<2.42	2.51 J	-	3.29 J
Radiological Parameters												
Radium-226	pCi/L	0.195 +/-(0.102)	0.108 +/-(0.0592)	-	-	-	-	-	0.109 +/-(0.0655)J	0.216 +/-(0.0824)J	0.161 +/-(0.0812)J	0.0928 +/-(0.0693)U
Radium-228	pCi/L	1.52 +/-(0.476)	0.163 +/-(0.199)U	-	-	-	-	-	0.307 +/-(0.283)U	0.619 +/-(0.303)	0.748 +/-(0.311)	0.270 +/-(0.210)U
Radium-226+228	pCi/L	-	-	0.340 +/-(0.256)U*	1.12 +/-(0.441)J	1.28 +/-(0.365)J	1.03 +/-(0.293)	0.841 +/-(0.330)U*	-	-	0.908 +/-(0.321)J	-
Anions												
Chloride	mg/L	858	1,140	1,160	1,140	910	877	1,020	982	945	1,150	877
Fluoride	mg/L	<0.5	<0.250	<0.0658	0.106 J	<0.132	<0.132	0.125 J	0.348	0.520	<0.0658	<0.0658
Sulfate	mg/L	1,390	1,480	1,520	1,500	1,120	1,150	1,410	1,280	1,300	1,290	1,210
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	89.1	-	-	-	-	84.0	-
Alkalinity, Carbonate	mg/L	-	-	-	-	<5	-	-	-	-	<5.00	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	3,630	4,140	4,100	4,010	4,210	5,080	4,330	3,800	3,760	3,150	3,960

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location							CUF-93-2R					
Sample Date		9-May-19	31-Jul-19	31-Jul-19	9-Oct-19	28-Jan-20	10-Mar-20	7-Apr-20	28-Jul-20	28-Jul-20	11-Sep-20	5-Oct-20
Sample ID		CUF-GW-002-05092019	CUF-GW-002-07312019	CUF-GW-903-07312019	CUF-GW-002-10092019	CUF-GW-002-01282020	CUF-GW-002-03102020	CUF-93-2R-0420	CUF-GW-002-07282020	CUF-GW-903-07282020	CUF-GW-002-09112020	CUF-93-2R-1020
Parent Sample ID				CUF-GW-002-07312019						CUF-GW-002-07282020		
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	14.1 J	45.2	45.5	<12.5	73.0	104	-	39.8	36.6	135	-
Antimony	ug/L	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378
Arsenic	ug/L	1.63	1.48	1.46	1.27	1.15	1.11	1.52	1.29	1.37	1.14	0.897 J
Barium	ug/L	40.4	43.0	40.6	40.6	37.6	38.9	38.6	36.4	36.1	38.7	38.3
Beryllium	ug/L	<0.155	<0.182	<0.182	<0.182	<0.182	<0.182	0.345 J	<0.182	<0.182	<0.182	<0.182
Boron	ug/L	17,300	18,400	18,200	17,100	17,800	18,300	20,200	19,000	19,200	21,000	25,200
Cadmium	ug/L	0.538 J	0.780 J	0.789 J	0.337 J	0.857 J	0.847 J	1.04	0.398 J	0.374 J	1.37	0.811 J
Calcium	ug/L	946,000	854,000	846,000	870,000	922,000	924,000	946,000	898,000	908,000	894,000	887,000
Chromium	ug/L	<1.53	2.81 U*	1.58 U*	<1.53	<1.53	<1.53	<1.53	<1.53	2.92	<1.53	<1.53
Cobalt	ug/L	2.16	2.18	2.10	1.69	1.23	1.39	1.64	1.44	1.43	1.39	1.21
Copper	ug/L	1.21 J	1.65 J	1.39 J	<0.627	<0.627	1.06 J	<0.627	<0.627	0.725 J	<0.627	<0.627
Iron	ug/L	1,700	1,560	1,540	1,290	998	1,130	-	1,280	1,310	1,210	-
Lead	ug/L	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	0.470 J	<0.128	<0.128	0.138 J	<0.128
Lithium	ug/L	6.2 U*	4.14 U*	4.66 U*	<3.39	<3.39	<3.39	4.07 J	<3.39	<3.39	<3.39	<3.39
Magnesium	ug/L	46,000	46,700	46,100	39,100	34,600	39,000	-	41,100	41,200	26,500	-
Manganese	ug/L	15,200	14,900	14,800	16,600	16,600	16,700	-	14,000	14,100	19,400	-
Mercury	ug/L	<0.101	<0.101	<0.101	<0.101	0.121 U*	0.101 UJ	<0.101	<0.130	<0.130	<0.130	<0.130
Molybdenum	ug/L	1.32 J	2.02 J	1.31 J	1.55 J	1.35 J	1.48 J	1.64 J	1.42 J	1.46 J	1.59 J	1.85 J
Nickel	ug/L	5.22	5.97	5.09 U*	4.74	4.53	4.71	4.04	4.23	4.43	5.66	5.37
Potassium	ug/L	39,200	39,100	38,600	41,100	38,700	39,100	-	40,200	40,600	41,300	-
Selenium	ug/L	<2.62	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	<0.177	<0.177	<0.177	<0.177	<0.177	0.188 J	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	51,000	52,400	51,000	50,900	45,100	50,500	-	49,200	49,000	44,400	-
Strontium	ug/L	1,660	1,530	1,480	1,490	1,530	1,490	-	1,560	1,550	1,660	-
Thallium	ug/L	0.176 J	0.175 J	0.207 J	0.194 J	<0.148	0.176 J	1.05	0.160 J	0.195 J	0.168 U*	0.174 U*
Vanadium	ug/L	-	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991
Zinc	ug/L	-	7.54 U*	8.24 U*	<3.22	<3.22	6.56	3.78 J	3.39 J	3.98 J	4.28 U*	<3.22
Radiological Parameters												
Radium-226	pCi/L	0.145 +/-(0.159)U	0.875 +/-(0.526)J	0.00272 +/-(0.159)UJ	0.204 +/-(0.261)U	0.446 +/-(0.313)	1.66 +/-(0.864)	0.925 +/-(0.476)	1.17 +/-(0.638)	1.75 +/-(0.754)	0.690 +/-(0.454)	0.370 +/-(0.471)U
Radium-228	pCi/L	-0.0861 +/-(0.783)U	0.0969 +/-(0.477)U	0.203 +/-(0.466)U	-0.106 +/-(0.337)U	0.109 +/-(0.343)UJ	0.0662 +/-(0.240)U	0.709 +/-(0.556)U	0.00757 +/-(0.250)U	0.651 +/-(0.498)U	-0.132 +/-(0.339)U	-0.0711 +/-(0.361)U
Radium-226+228	pCi/L	0.145 +/-(0.799)U	0.972 +/-(0.710)J	0.206 +/-(0.492)UJ	0.204 +/-(0.426)U	0.555 +/-(0.465)J	1.73 +/-(0.896)J	1.63 +/-(0.732)J	1.17 +/-(0.686)J	2.40 +/-(0.904)J	0.690 +/-(0.567)J	0.370 +/-(0.593)U
Anions												
Chloride	mg/L	973	935	934	867	838	1,060 J	724	924	904	769	741
Fluoride	mg/L	0.0961 J	0.111 J	0.122 J	0.124 J	0.0689 J	0.0860 J	0.110 U*	0.0658 UJ	0.0658 UJ	0.0682 J	<0.0658
Sulfate	mg/L	1,330	1,330	1,330	1,330	1,240	1,640 J	1,130	1,390	1,350	1,380 J	1,410
General Chemistry												
Alkalinity, Bicarbonate	mg/L	79.6	76.5	75.8	84.8	78.0	71.2	-	74.3	77.3	79.6	-
Alkalinity, Carbonate	mg/L	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	-	<5.00	<5.00	<5.00	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	4,330	4,480	4,440	3,740	3,120	3,410	3,130	3,060	3,170	3,120	3,080

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-2R										
Sample Date		20-Jan-21	20-Jan-21	3-Mar-21	14-Apr-21	16-Jul-21	18-Aug-21	18-Aug-21	13-Oct-21	19-Jan-22	7-Mar-22	13-Apr-22
Sample ID		CUF-GW-93-2R-01202021	CUF-GW-FD01-01202021	CUF-GW-93-2R-03032021	CUF-GW-93-2R-04142021	CUF-GW-93-2R-07162021	CUF-GW-93-2R-08182021	CUF-GW-FD02-08182021	CUF-GW-CUF-93-2R-10132021	CUF-GW-93-2R-01192022	CUF-GW-93-2R-03072022	CUF-GW-93-2R-04132022
Parent Sample ID			CUF-GW-93-2R-01202021					CUF-GW-93-2R-08182021				
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	State Compliance
Total Metals												
Aluminum	ug/L	78.3	73.5	103	-	80.6	17.6 J	15.9 J	-	36.9	<15.5	-
Antimony	ug/L	<0.378	<0.378	<0.378	<0.378	0.903 J	1.17 J	1.17 J	<0.378	<0.378	<0.506	<0.506
Arsenic	ug/L	0.933 J	0.698 J	0.838 J	0.884 J	0.917 J	0.615 J	0.570 J	0.628 J	0.450 J	0.561 J	0.556 J
Barium	ug/L	35.7	36.6	36.4	35.7	37.1	36.4	36.1	36.7	37.3	34.3	33.7
Beryllium	ug/L	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.274	<0.274
Boron	ug/L	22,600 J	20,100 J	22,000	23,100	23,400	23,100	22,700	24,800	25,600	25,400	28,100
Cadmium	ug/L	1.05	1.07	0.544 J	0.378 J	0.845 J	0.999 J	1.03	0.680 J	1.18	0.689 J	0.533 J
Calcium	ug/L	881,000	884,000	872,000	891,000	868,000	823,000	822,000	845,000	860,000	828,000	803,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	1.10	1.08	1.11	1.00	1.21	1.06	1.08	0.879	0.838	0.855	0.734
Copper	ug/L	<0.627	<0.627	<0.627	<0.627	0.869 J	<0.627	<0.627	0.793 J	<0.627	<1.14	<1.14
Iron	ug/L	664	662	1,050	-	779	609	608	-	218	261	-
Lead	ug/L	<0.128	<0.128	<0.128	<0.128	0.222 J	<0.128	<0.128	<0.128	<0.128	<0.167	<0.167
Lithium	ug/L	<3.39	<3.39	<3.39	<3.39	5.69	4.88 J	4.69 J	<3.39	<3.39	1.77 J	1.74 J
Magnesium	ug/L	18,000	18,200	17,700	-	19,100	16,700	16,800	-	10,100	10,200	-
Manganese	ug/L	20,400	20,700	20,400	-	18,100	20,300	20,300	-	19,900	18,700	-
Mercury	ug/L	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130
Molybdenum	ug/L	1.85 J	1.83 J	1.89 J	2.05 J	1.79 J	1.97 J	1.90 J	2.49 J	2.41 J	2.45 J	2.40 J
Nickel	ug/L	5.76	5.76	5.78	5.54	5.13	5.50	5.92	6.25	6.09	5.92	5.63
Potassium	ug/L	47,900	48,400	49,200	-	46,800	48,400	48,500	-	52,200	53,800	-
Selenium	ug/L	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<0.739	<0.739
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.223	<0.223
Sodium	ug/L	41,700	42,100	42,300	-	42,500	40,500	40,500	-	37,200	36,400	-
Strontium	ug/L	1,610	1,630	1,590	-	1,670	1,620	1,620	-	1,640	1,630	-
Thallium	ug/L	<0.148	<0.148	0.200 J	0.215 J	0.223 U*	0.175 J	0.201 J	0.237 J	0.313 J	<0.472	0.599 J
Vanadium	ug/L	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.776	<0.776
Zinc	ug/L	<3.22	<3.22	<3.22	<3.22	3.87 J	5.08	4.35 J	4.82 J	<3.22	<2.88	<2.88
Radiological Parameters												
Radium-226	pCi/L	0.448 +/-(0.286)	0.192 +/-(0.247)U	0.0308 +/-(0.174)U	1.90 +/-(0.960)	1.27 +/-(0.553)	0.121 +/-(0.212)U	0.0587 +/-(0.221)U	1.60 +/-(0.817)	1.03 +/-(0.563)	0.733 +/-(0.541)	0.535 +/-(0.365)
Radium-228	pCi/L	-0.0823 +/-(0.424)U	0.0372 +/-(0.389)U	0.577 +/-(0.566)U	-0.115 +/-(0.251)U	-0.0220 +/-(0.372)U	0.293 +/-(0.450)U	0.711 +/-(0.445)	0.107 +/-(0.280)U	0.563 +/-(0.404)U	-0.332 +/-(0.412)U	0.424 +/-(0.321)U
Radium-226+228	pCi/L	0.448 +/-(0.511)J	0.229 +/-(0.461)U	0.608 +/-(0.592)U	1.90 +/-(0.992)J	1.27 +/-(0.666)J	0.414 +/-(0.497)U	0.769 +/-(0.497)J	1.70 +/-(0.863)J	1.59 +/-(0.693)J	0.733 +/-(0.680)J	0.959 +/-(0.486)J
Anions												
Chloride	mg/L	798	832	690	656	670	638	631	496	427	498	466
Fluoride	mg/L	0.145 U*	0.137 U*	<0.0650	<0.0650	0.152 U*	<0.0650	<0.0650	0.0823 J	0.102 J	0.126 J	0.263 U*
Sulfate	mg/L	1,660	1,810	1,490	1,500	1,440	1,470	1,460	1,550	1,730	1,800	1,660
General Chemistry												
Alkalinity, Bicarbonate	mg/L	84.9	96.2	82.5	-	78.0	78.3	77.9	-	55.2	51.7	-
Alkalinity, Carbonate	mg/L	<5.00	<5.00	<5.00	-	<5.00	<5.00	<5.00	-	<5.00	<5.00	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	3,350	3,280	3,540	3,010	3,330	3,220	3,480	3,290	3,200	3,170	3,030

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-2R				CUF-93-3						
Sample Date		14-Jul-22	14-Jul-22	25-Aug-22	25-Aug-22	16-Jul-08	16-Jul-08	21-Jan-09	14-Apr-09	22-Jul-09	7-Oct-09	7-Oct-09
Sample ID		CUF-GW-93-2R-07142022	CUF-GW-FD02-07142022	CUF-GW-93-2R-08252022	CUF-GW-FD03-08252022	CUF-93-3-0708	CUF-93-3-0708-DUP	CUF-93-3-0109	CUF-93-3-0409	CUF-93-3-0709	CUF-93-3-1009	CUF-93-3-1009-DUP
Parent Sample ID			CUF-GW-93-2R-07142022		CUF-GW-93-2R-08252022		CUF-93-3-0708					CUF-93-3-1009
Sample Depth		71 ft	71 ft	71 ft	71 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft
Sample Type		Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Total Metals												
Aluminum	ug/L	23.5 J	18.0 J	15.8 U*	<15.5	-	-	-	-	-	-	-
Antimony	ug/L	<0.506	<0.506	<0.506	<0.506	<1	<1	<10	<1	<1	<1	<1
Arsenic	ug/L	0.826 J	0.812 J	0.762 J	0.759 J	3.4	2.6	<10	2	6.7	2.2	2.3
Barium	ug/L	37.4	38.3	32.2	32.6	150	150	170	150	170	160	150
Beryllium	ug/L	<0.274	<0.274	<0.274	<0.274	<2	<2	<2	<1	<2	<2	<2
Boron	ug/L	23,100	22,600	22,400	23,300	5,400	5,500	5,900	-	5,500	6,200	6,200
Cadmium	ug/L	0.872 J	0.957 J	0.989 J	1.01	<0.5	<0.5	<5	<0.5	<0.5	<0.5	<0.5
Calcium	ug/L	865,000	913,000	812,000	843,000	170,000	170,000	190,000	-	170,000	190,000	190,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	2.4	1.3	10	6.8	14	5.9	5.5
Cobalt	ug/L	0.909	0.966	0.887	0.925	<1	<1	<10	2.7	1.6	<1	<1
Copper	ug/L	<1.14	<1.14	<1.14	<1.14	1.8	2.1	<10	2.1	3.6	<2	<2
Iron	ug/L	705	703	580	612	-	-	-	-	-	-	-
Lead	ug/L	<0.167	<0.167	<0.167	<0.167	<1	<1	<5	1.9	3	1.4	1.3
Lithium	ug/L	1.69 J	1.59 J	1.51 J	1.71 J	-	-	-	-	-	-	-
Magnesium	ug/L	13,900	14,200	12,800	13,200	-	-	-	-	-	-	-
Manganese	ug/L	17,800	18,000	16,100	17,100	-	-	-	-	-	-	-
Mercury	ug/L	<0.130	<0.130	<0.130	<0.130	<0.2	<0.2	<0.20	<0.2	<0.2	<0.2	<0.2
Molybdenum	ug/L	2.00 J	2.08 J	1.64 J	1.78 J	33	33	36	-	42	30	31
Nickel	ug/L	5.14	5.26	5.04	5.38	9.1	9	18	9.4	160	6.3	6
Potassium	ug/L	55,800	56,700	51,700	54,100	-	-	-	-	-	-	-
Selenium	ug/L	<0.739	<0.739	<0.739	<0.739	<2	<2	<2	4.5	<1	1.8	1.4
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.223	<0.223	<0.223	<0.223	<0.5	<0.5	<5	<0.5	<1	<1	<1
Sodium	ug/L	40,800	42,200	38,000	39,700	-	-	-	-	-	-	-
Strontium	ug/L	1,710	1,740	1,610	1,720	-	-	-	-	-	-	-
Thallium	ug/L	<0.472	<0.472	<0.472	<0.472	<1	<1	<5	<1	<1	<1	<1
Vanadium	ug/L	<0.776	<0.776	<0.776	<0.776	-	-	-	10	-	-	-
Zinc	ug/L	4.06 J	<2.88	<2.88	3.02 J	10	<10	<100	19	29	16	14
Radiological Parameters												
Radium-226	pCi/L	1.03 +/-(0.788)	0.517 +/-(0.563)U	0.120 +/-(0.329)U	0.279 +/-(0.330)U	-	-	-	-	-	-	-
Radium-228	pCi/L	0.141 +/-(0.561)U	0.636 +/-(0.592)U	0.467 +/-(0.497)U	0.769 +/-(0.557)U	-	-	-	-	-	-	-
Radium-226+228	pCi/L	1.17 +/-(0.967)J	1.15 +/-(0.817)U	0.587 +/-(0.596)U	1.05 +/-(0.648)U	-	-	-	-	-	-	-
Anions												
Chloride	mg/L	550	550	538	547	37	36	52	-	55	42	44
Fluoride	mg/L	0.146 U*	0.413 J	0.181 U*	0.202 U*	0.33	0.32	0.3	0.23	0.41	0.41	0.41
Sulfate	mg/L	1,520	1,520	1,470	1,510	200	200	180	-	190	200	200
General Chemistry												
Alkalinity, Bicarbonate	mg/L	57.9	57.2	55.9	55.7	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	<5.00	<5.00	<5.00	<5.00	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	3,250	3,340	3,420	3,530	780	770	760	-	820	810	830

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-3										
Sample Date		14-Jan-10	7-Apr-10	22-Jul-10	22-Jul-10	27-Oct-10	19-Jan-11	5-Apr-11	26-Jul-11	4-Oct-11	10-Jan-12	18-Apr-12
Sample ID		CUF-93-3-0110	CUF-93-3-0410	CUF-93-3-0710	CUF-93-3-0710-DUP	CUF-93-3-1010	CUF-93-3-0111	CUF-93-3-0411	CUF-93-3-0711	CUF-93-3-1011	CUF-93-3-0112	CUF-93-3-0412
Parent Sample ID					CUF-93-3-0710							
Sample Depth		53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Total Metals												
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<1	1.9	<1	<1	<1	<1	<1	<1	<1	<1	<1
Arsenic	ug/L	2.6	<10	1.2	1.4	2.4	<1	3.4	<1	1.3	<1	1.4
Barium	ug/L	180	140	150	160	180	140	180	140	140	150	150
Beryllium	ug/L	<1	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Boron	ug/L	6,500	5,700	5,900	5,800	5,800	6,000	5,800	6,000	5,800	6,200	-
Cadmium	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Calcium	ug/L	180,000	180,000	180,000	180,000	180,000	190,000	180,000	180,000	180,000	200,000	-
Chromium	ug/L	12	11	9.3	8.3	1.2	<2	14	<2	<2	<2	<2
Cobalt	ug/L	4.4	2.7	<1	<1	<1	<1	1.5	<1	<1	<1	<1
Copper	ug/L	4.1	2.1	2.2	<2	2	<2	4.9 U*	<2	<2	<2	<2
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	3.7	1.8	2.4	2	2.7	<1	4.2	<1	<1	<1	<1
Lithium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20	<0.2	<0.2	<0.2
Molybdenum	ug/L	36	28	31	32	29	24 J	34	31	26	32	-
Nickel	ug/L	11	16	9.2	9	9	<1	20 J	1.3	3.2	3.8	3.0
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	1.9	<10	<1	1.2	1.4	3	1 UJ	<1	<1	<1	<1
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Vanadium	ug/L	15	-	-	-	11	<2	19	<2	<2	2.2	3.2
Zinc	ug/L	19	25	16	14	16	<10	20	<10	<10	<10	<10
Radiological Parameters												
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Anions												
Chloride	mg/L	37	38	44	50	40	46	57	46	47.0	50	-
Fluoride	mg/L	0.51	0.41	0.41	0.36	0.37	0.44	0.32	0.46	0.39	0.45	0.38
Sulfate	mg/L	190	200	200	200	210	190 J	190	190	190	180	-
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	800	800	830	810	800	770	840	830	830	830	-

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-3											
Sample Date		19-Jul-12	17-Oct-12	17-Oct-12	14-Jan-13	3-Apr-13	1-Jul-13	1-Jul-13	8-Oct-13	22-Jan-14	8-Apr-14	21-Jul-14	21-Jul-14
Sample ID		CUF-93-3-0712	CUF-93-3-1012	CUF-93-3-1012 DUP	CUF-93-3-0113	CUF-93-3-0413	CUF-93-3-0713	CUF-93-3-0713-DUP	CUF-93-3-1013	CUF-93-3-0114	CUF-93-3-0414	CUF-93-3-0714	CUF-93-3-0714-DUP
Parent Sample ID				CUF-93-3-1012				CUF-93-3-0713					CUF-93-3-0714
Sample Depth		53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Total Metals													
Aluminum	ug/L	-	-	-	-	-	-	-	<2,500	-	-	-	-
Antimony	ug/L	<1	<1	<1	<1	<1	<1	<1	<1.0	<2	<2	<2	<2
Arsenic	ug/L	<1	<1	<1	12 J	2	1.2	<1	<4.0	<2	<2	<2	<2
Barium	ug/L	160	160	160	160	160	160	150	164	161	139	152	150
Beryllium	ug/L	<2	<2	<2	<2	<2	<2	<2	<4.0	<2	<2	<2	<2
Boron	ug/L	-	6,200	6,100	-	5,800	-	-	5,510	-	-	-	-
Cadmium	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0	<1	<1	<1	<1
Calcium	ug/L	-	190,000	190,000	-	190,000	-	-	195,000	-	-	-	-
Chromium	ug/L	<2	<2	<2	<2	<2	<2	<2	<10.0	<2	2.4	<2	<2
Cobalt	ug/L	<1	<1	<1	<1	<1	<1	<1	<4.0	<2	<2	<2	<2
Copper	ug/L	<2	<2	<2	<2	<2	<2	<2	<10.0	<2	<2	<2	<2
Iron	ug/L	-	-	-	-	-	-	-	2,600	-	-	-	-
Lead	ug/L	<1	<1	<1	<1	<1	<1	<1	<1.0	<2	<2	<2	<2
Lithium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	ug/L	-	-	-	-	-	-	-	25,400	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	1,800	-	-	-	-
Mercury	ug/L	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<1	<0.20	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ
Molybdenum	ug/L	-	32	31	-	24	-	-	22.9	-	-	-	-
Nickel	ug/L	5.1	3.7	3.8	4.5	4.3	3.1	2.5	<10.0	<2	2.47	<2	<2
Potassium	ug/L	-	-	-	-	-	-	-	2,510	-	-	-	-
Selenium	ug/L	<1	<1	<1	<1	2.7	<1	<1	<10.0	<2	<2	<2	<2
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<1	1 UR	1 UR	<1	<1	<1	<1	<0.50	<2	<2	<2	<2
Sodium	ug/L	-	-	-	-	-	-	-	54,100	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	896	-	-	-	-
Thallium	ug/L	<1	<1	<1	<1	<1	<1	<1	<1.0	<2	<2	<2	<2
Vanadium	ug/L	<2	<2	<2	3.6 U*	4.2	<2	<2	<10.0	-	-	3.23	3.3
Zinc	ug/L	<10	<10	<10	<10	<10	<10	<10	<100	<25	<25	<25	<25
Radiological Parameters													
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Anions													
Chloride	mg/L	-	53	53	-	62	-	-	-	-	-	-	-
Fluoride	mg/L	0.44	0.44	0.42	0.39	0.41	0.35	0.36	-	0.459	0.510	0.381	0.383
Sulfate	mg/L	-	180	160	-	160	-	-	-	-	-	-	-
General Chemistry													
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	-	850	860	-	1,700	-	-	818	-	-	-	-

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-3											
Sample Date		9-Oct-14	14-Jan-15	14-Jan-15	14-Apr-15	21-Jul-15	21-Jul-15	21-Oct-15	25-Jan-16	13-Apr-16	19-Jul-16	19-Oct-16	19-Oct-16
Sample ID		CUF-93-3-1014	CUF-93-3-0115	CUF-93-3-0115-DUP	CUF-93-3-0415	CUF-93-3-0715	CUF-93-3-0715-DUP	CUF-93-3-1015	CUF-93-3-0116	CUF-93-3-0416	CUF-93-3-0716	CUF-93-3-1016	CUF-93-3-1016-DUP
Parent Sample ID				CUF-93-3-0115			CUF-93-3-0715						CUF-93-3-1016
Sample Depth		53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Total Metals													
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<1	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Arsenic	ug/L	2.1	<2	<2	<2	<2	<2	<2	<2	<2	2.83	<2	<2
Barium	ug/L	160	160	160	153	158	158	158	151	167	173	194	189
Beryllium	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Boron	ug/L	-	-	-	-	-	-	-	-	-	-	7,050	7,090
Cadmium	ug/L	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Calcium	ug/L	-	-	-	-	-	-	-	-	-	-	242,000	238,000
Chromium	ug/L	38	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Cobalt	ug/L	2.5	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Copper	ug/L	2.4	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	1.4	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Lithium	ug/L	-	-	-	-	-	-	-	-	-	-	69.6	72.7
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Molybdenum	ug/L	-	-	-	-	-	-	-	-	-	-	18.7	18.4
Nickel	ug/L	39	<2	<2	4.13	<2	<2	<2	<2	<2	<2	<2	<2
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<1	<2	<2	<2	<2	<2	<10	<2	<2	<2	<2	<2
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<1	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<1	<2	<2	<2	<2	<2	<1	<1	<1	<1	<2	<2
Vanadium	ug/L	7.7	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Zinc	ug/L	16	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Radiological Parameters													
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Anions													
Chloride	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	mg/L	0.39	0.48	0.49	0.355	0.418	0.382	0.45	0.387	0.398	0.431	0.325	0.386
Sulfate	mg/L	-	-	-	-	-	-	-	-	-	-	114	133
General Chemistry													
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	7.55	7.51
Total Dissolved Solids	mg/L	-	-	-	-	-	-	-	-	-	-	922	924

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-3										
Sample Date		24-Jan-17	5-Apr-17	11-Jul-17	11-Jul-17	3-Oct-17	17-Oct-17	24-Jan-18	24-Jan-18	4-Apr-18	1-Jun-18	21-Jun-18
Sample ID		93-3	93-3	93-3	93-3 DUP	CUF-GW-003-10032017	93-3	93-3-0118	93-3-DUP-0118	93-3-0418	CUF-GW-003-06012018	CUF-GW-003-06212018
Parent Sample ID					CUF-93-3-0717				CUF-93-3-0118			
Sample Depth		53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	CCR Program	State Compliance	State Compliance	State Compliance	State Compliance	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<2.00	<2	<2	<2	-	<2	<2	<2	<2	<1.12	<1.12
Arsenic	ug/L	<1	<1	<1	<1	-	<1	<1	1.3	<1	0.389 J	0.582 U*
Barium	ug/L	<200	155	163	156	-	148	167	174	173	179	182
Beryllium	ug/L	<4	<1	<1	<1	-	<1	<1	<1	<1	<0.057	<0.057
Boron	ug/L	7,650	11,000	7,120	7,240	6,440	5,990	6,040	6,120	6,870	6,190	6,680
Cadmium	ug/L	<1	<1	<1	<1	-	<1	<1	<1	<1	<0.125	<0.125
Calcium	ug/L	203,000	194,000	212,000	205,000	216,000	203,000	212,000	213,000	220,000	220,000	226,000
Chromium	ug/L	<2.00	<2	<2	<2	-	<2	<2	<2	<2	<0.631	1.68 U*
Cobalt	ug/L	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.075	0.13 J
Copper	ug/L	<2.00	<2	<2	<2	-	<2	<2	<2	<2	-	-
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<1	<1	<1	<1	-	<1	<1	<1	<1	<0.094	0.101 J
Lithium	ug/L	72.1	79.4	76.7	75.7	-	68	68.7	71.7	70.7	61.7	79.3
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.200	<0.200	<0.200	<0.200	-	<0.200	<0.200	<0.200	<0.200	<0.0653	<0.0653
Molybdenum	ug/L	16	17	17.2	16.6	-	17.8	20	20	21.5	22	20.3
Nickel	ug/L	<1	<1	<1	<1	-	<1	<1	<1	<1	-	-
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<5	<5	<5	<5	-	<5	<5	<5	<5	<0.813	<0.813
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<1.00	<1	<1	<1	-	<1	<1	<1	<1	-	-
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<1	<1	<1	<1	-	<1	<1	<1	<1	<0.063	<0.063
Vanadium	ug/L	<50	<1	2.43 U*	3.26 U*	-	<1	1.26	1.34	1.76	-	-
Zinc	ug/L	<5	<5	<5	<5	-	<5	<5	<5	<5	-	-
Radiological Parameters												
Radium-226	pCi/L	0.429 +/-(0.134)	0.347 +/-(0.131)	0.220 +/-(0.0872)U*	0.376 +/-(0.110)J	-	0.297 +/-(0.0939)J	0.320 +/-(0.105)	0.360 +/-(0.103)	0.303 +/-(0.0992)	-	-
Radium-228	pCi/L	0.130 +/-(0.196)U	0.317 +/-(0.301)U	0.175 +/-(0.179)U	0.373 +/-(0.211)	-	0.210 +/-(0.223)U	0.533 +/-(0.300)U*	0.512 +/-(0.328)U*	0.257 +/-(0.228)U	-	-
Radium-226+228	pCi/L	-	-	-	-	-	-	-	-	-	0.866 +/-(0.326)J	1.05 +/-(0.298)J
Anions												
Chloride	mg/L	100	96.8	105	105	95.5	96.2	106	105	110	104	101
Fluoride	mg/L	0.340	0.407	0.458	0.475	0.221	0.490	0.398	0.374	0.367	0.416	0.444
Sulfate	mg/L	124	139	144	145	82.0	126	138	135	133	131	129
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	875	870	859	941	918	893	936	911	942	949	968

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-3										
Sample Date		13-Jul-18	2-Aug-18	21-Aug-18	17-Jan-19	17-Jan-19	7-Feb-19	10-Apr-19	7-May-19	6-Aug-19	9-Oct-19	28-Jan-20
Sample ID		CUF-GW-003-07132018	CUF-GW-003-08022018	CUF-GW-003-08212018	CUF-GW-003-01172019	CUF-GW-903-01172019	CUF-GW-003-02072019	CUF-93-3	CUF-GW-003-05072019	CUF-GW-003-08062019	CUF-GW-003-10092019	CUF-GW-003-01282020
Parent Sample ID						CUF-GW-003-01172019						
Sample Depth		53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	<0.03	-	-	<11.8	<11.8	<12.5	-	<12.5	<12.5	<12.5	<12.5
Antimony	ug/L	<1.12	<1.12	<1.12	<1.12	<1.12	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378
Arsenic	ug/L	0.551 J	0.342 J	0.499 J	0.539 J	0.497 J	<0.323	0.508 J	0.38 J	0.499 J	0.410 J	0.356 J
Barium	ug/L	182	161	158	187	189	186	172	162	175	198	177
Beryllium	ug/L	<0.057	<0.057	<0.057	<0.057	<0.057	<0.155	<0.155	<0.155	<0.182	<0.182	<0.182
Boron	ug/L	5,840	6,610	5,050	6,360	6,530	6,440	6,600	6,170	6,710	5,850	5,210
Cadmium	ug/L	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125	<0.217
Calcium	ug/L	229,000	226,000	192,000	220,000	222,000	216,000	213,000	211,000 J	210,000	228,000	228,000
Chromium	ug/L	1.04 U*	<0.631	1.77 U*	2.13 U*	3.67 U*	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	0.164 J	<0.075	0.192 J	0.171 J	0.274 J	0.132 J	0.195 J	0.223 J	0.211 J	0.151 J	<0.134
Copper	ug/L	<2	-	-	<1.3	<1.3	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627
Iron	ug/L	2,420	-	-	3,300 J	10,900 J	2,970	-	3,180	2,770	2,390	2,510
Lead	ug/L	<0.094	0.097 J	<0.094	<0.094	<0.094	<0.128	0.14 J	<0.128	<0.128	<0.128	<0.128
Lithium	ug/L	59.6	58	58	77.4	80.2	72.2	72.4	75.7	69.9	83.0	81.2
Magnesium	ug/L	30,800	-	-	28,700	29,200	30,100	-	32,400 J	30,700	30,300	28,700
Manganese	ug/L	2,500	-	-	2,080	2,130	2,130	-	1,940	1,870	2,630	2,180
Mercury	ug/L	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.101	<0.101	<0.101	<0.101	<0.101	0.101 UJ
Molybdenum	ug/L	21.3	24.7	17.5	20.1	20.7	19.1	20.4	18.7	18.0	19.5	19.4
Nickel	ug/L	0.587	-	-	0.83 J	1.21	0.331 J	0.445 J	0.453 J	0.424 U*	0.387 J	0.577 J
Potassium	ug/L	1,920	-	-	2,220	2,250	2,250	-	2,240 J	2,440	2,120	2,170
Selenium	ug/L	<0.813	<0.813	<0.813	<0.813	<0.813	<2.62	<2.62	<2.62	<1.51	<1.51	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	-	-	-	-	-	<0.121	-	<0.177	<0.177	<0.177
Sodium	ug/L	60,200	-	-	58,500	58,200	61,000	-	62,500	62,500	65,000	61,100
Strontium	ug/L	873	-	-	936	922	1,050	-	994 J	1,100	1,130	1,090
Thallium	ug/L	<0.063	<0.063	<0.063	<0.063	<0.063	<0.128	<0.128	<0.128	<0.148	<0.148	<0.148
Vanadium	ug/L	-	-	-	-	-	-	1.63	-	2.34 U*	1.85	1.09
Zinc	ug/L	-	-	-	-	-	-	<3.22	-	<3.22	<3.22	<3.22
Radiological Parameters												
Radium-226	pCi/L	-	-	-	0.611 +/-(0.159)	0.696 +/-(0.172)	0.508 +/-(0.142)J	0.375 +/-(0.110)	0.545 +/-(0.135)	0.403 +/-(0.429)U	0.675 +/-(0.460)	0.367 +/-(0.542)U
Radium-228	pCi/L	-	-	-	0.287 +/-(0.238)U	-0.0227 +/-(0.190)U	0.222 +/-(0.245)U	0.304 +/-(0.222)U	0.587 +/-(0.327)	0.00704 +/-(0.263)U	0.509 +/-(0.477)U	0.489 +/-(0.369)UJ
Radium-226+228	pCi/L	0.902 +/-(0.253)J	0.590 +/-(0.260)U*	1.14 +/-(0.275)J	0.898 +/-(0.286)J	0.696 +/-(0.256)J	0.730 +/-(0.283)J	-	1.13 +/-(0.354)	0.410 +/-(0.503)U	1.18 +/-(0.663)J	0.855 +/-(0.656)UJ
Anions												
Chloride	mg/L	109	82.9	104	108	109	112	109	113	117	111	122
Fluoride	mg/L	0.387	0.241	0.335	0.466	0.475	0.438	0.356	0.385	0.337	0.352	0.399
Sulfate	mg/L	135	108	144	133	136	128	116	129	132	108	118
General Chemistry												
Alkalinity, Bicarbonate	mg/L	548	-	-	477	509	532	-	551	493	554	496
Alkalinity, Carbonate	mg/L	<5	-	-	<5.00	<5.00	<5.00	-	<5.00	<5.00	<5.00	<5.00
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	920	1,000	890	916	911	907	920	982	917	948	965

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-3										
Sample Date		11-Mar-20	7-Apr-20	28-Jul-20	11-Sep-20	6-Oct-20	19-Jan-21	3-Mar-21	14-Apr-21	16-Jul-21	18-Aug-21	14-Oct-21
Sample ID		CUF-GW-003-03112020	CUF-93-3-0420	CUF-GW-003-07282020	CUF-GW-003-09112020	CUF-93-3-1020	CUF-GW-93-3-01192021	CUF-GW-93-3-03032021	CUF-GW-93-3-04142021	CUF-GW-93-3-07162021	CUF-GW-93-3-08182021	CUF-GW-CUF-93-3-10142021
Parent Sample ID												
Sample Depth		53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	State Compliance
Total Metals												
Aluminum	ug/L	<12.5	-	<12.5	<12.5	-	<12.5	<12.5	-	<12.5	<12.5	-
Antimony	ug/L	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378
Arsenic	ug/L	<0.313	0.378 J	0.488 J	0.329 J	0.594 J	0.357 J	0.498 J	0.375 J	<0.313	<0.313	1.49
Barium	ug/L	201	206	187	183	168	205	185	190	187	203	176
Beryllium	ug/L	<0.182	<0.182	0.185 J	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182
Boron	ug/L	6,630	6,700	5,890	6,450	6,580	6,250 J	6,530	6,670	6,090	6,870	5,940
Cadmium	ug/L	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217
Calcium	ug/L	245,000	263,000	241,000	232,000	223,000	258,000	233,000	251,000	239,000	231,000	233,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	<0.134	0.141 J	<0.134	<0.134	<0.134	<0.134	<0.134	<0.134	<0.134	<0.134	<0.134
Copper	ug/L	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627
Iron	ug/L	2,820	-	2,440	3,030	-	2,210	2,770	-	2,780	2,880	-
Lead	ug/L	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	0.227 J
Lithium	ug/L	75.3	55.0	62.4	82.5	90.7	63.2	67.0	61.4	61.5	59.7	69.6
Magnesium	ug/L	31,100	-	29,600	30,600	-	29,300	29,400	-	29,200	31,700	-
Manganese	ug/L	2,570	-	2,440	1,980	-	2,880	2,210	-	2,780	3,220	-
Mercury	ug/L	0.101 UJ	<0.101	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130
Molybdenum	ug/L	18.9	22.7	22.2	16.7	21.1	22.2	21.0	24.2	22.5	24.5	24.5
Nickel	ug/L	0.362 J	0.566 J	0.516 J	<0.336	<0.336	0.476 J	0.409 J	0.348 J	0.443 J	0.570 J	<0.336
Potassium	ug/L	2,020	-	2,340	2,070	-	2,340	2,130	-	1,960	1,920	-
Selenium	ug/L	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	66,300	-	59,800	62,600	-	61,700	65,400	-	63,200	65,000	-
Strontium	ug/L	1,060	-	1,150	1,180	-	1,200	1,130	-	1,090	1,060	-
Thallium	ug/L	<0.148	<0.148	0.247 J	<0.148	0.391 U*	<0.148	<0.148	<0.148	<0.148	<0.148	<0.148
Vanadium	ug/L	1.04	1.58	1.28	<0.991	<0.991	1.89 U*	1.28	1.23	1.23	1.35	1.28
Zinc	ug/L	<3.22	<3.22	<3.22	<3.22	<3.22	<3.22	<3.22	<3.22	32.3	<3.22	<3.22
Radiological Parameters												
Radium-226	pCi/L	1.63 +/-(0.814)	0.349 +/-(0.279)	0.531 +/-(0.492)U	0.439 +/-(0.390)U	0.352 +/-(0.438)U	0.493 +/-(0.484)U	0.717 +/-(0.653)U	0.976 +/-(0.695)	0.670 +/-(0.469)	0.570 +/-(0.567)U	1.26 +/-(0.757)
Radium-228	pCi/L	0.338 +/-(0.299)U	0.798 +/-(0.417)	0.384 +/-(0.270)	0.255 +/-(0.407)U	0.223 +/-(0.260)U	0.685 +/-(0.615)U	0.971 +/-(0.659)	0.0828 +/-(0.233)U	0.444 +/-(0.390)U	0.223 +/-(0.481)U	0.424 +/-(0.451)U
Radium-226+228	pCi/L	1.97 +/-(0.867)J	1.15 +/-(0.502)	0.915 +/-(0.562)J	0.694 +/-(0.564)U	0.575 +/-(0.510)U	1.18 +/-(0.782)U	1.69 +/-(0.928)J	1.06 +/-(0.732)J	1.11 +/-(0.610)J	0.793 +/-(0.743)U	1.68 +/-(0.881)J
Anions												
Chloride	mg/L	122	117	144	125	125	143	130	134	136	141	140
Fluoride	mg/L	0.375	0.370	0.386	0.343	0.261 J	0.423	0.338	0.300	0.370	0.425	0.398
Sulfate	mg/L	116	98.1	123	116 J	134	117	119	115	122	116	117
General Chemistry												
Alkalinity, Bicarbonate	mg/L	476	-	518	483	-	546	522	-	525	540	-
Alkalinity, Carbonate	mg/L	<5.00	-	<5.00	<5.00	-	<5.00	<5.00	-	<5.00	<5.00	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	942	937	935	942	907	795	1,010	983	978	972	1,010

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-3					CUF-93-4				
Sample Date		21-Jan-22	3-Mar-22	13-Apr-22	13-Jul-22	24-Aug-22	16-Jul-08	21-Jan-09	14-Apr-09	22-Jul-09	7-Oct-09
Sample ID		CUF-GW-93-3-01212022	CUF-GW-93-3-03032022	CUF-GW-93-3-04132022	CUF-GW-93-3-07132022	CUF-GW-93-3-08242022	CUF-93-4-0708	CUF-93-4-0109	CUF-93-4-0409	CUF-93-4-0709	CUF-93-4-1009
Parent Sample ID											
Sample Depth		53 ft	53 ft	53 ft	53 ft	53 ft	34 ft	34 ft	34 ft	34 ft	34 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Total Metals											
Aluminum	ug/L	21.0 J	<15.5	-	<15.5	<15.5	-	-	-	-	-
Antimony	ug/L	0.663 J	<0.506	0.538 J	<0.506	<0.506	<1	<5	<1	<1	<1
Arsenic	ug/L	0.764 J	0.627 J	1.01	0.892 J	<0.282	4	7.3	2.6	10	7.9
Barium	ug/L	187	194	177	224	203 J	67	67	81	70	94
Beryllium	ug/L	<0.182	<0.274	<0.274	<0.274	<0.274	<2	<2	<1	<2	<2
Boron	ug/L	6,570	5,750	7,210	6,130	5,940	1,200	2,100	-	<200	4,000
Cadmium	ug/L	<0.217	<0.217	<0.217	<0.217	<0.217	0.85	3.6	<0.5	<0.5	1.2
Calcium	ug/L	222,000	239,000	230,000	265,000	251,000	380,000	420,000	-	100,000	540,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	5.9	6.1	1.7	32	3.6
Cobalt	ug/L	<0.134	<0.261	<0.261	<0.261	<0.261	1.8	<5	<1	<1	1.9
Copper	ug/L	<0.627	<1.14	<1.14	<1.14	<1.14	5	13	1.7	<2	4.9
Iron	ug/L	3,340	2,970	-	2,440	2,450	-	-	-	-	-
Lead	ug/L	<0.128	<0.167	<0.167	<0.167	<0.167	1.9	<5	<1	<1	1.1
Lithium	ug/L	82.2	70.4	76.5	56.8	51.8	-	-	-	-	-
Magnesium	ug/L	32,900	31,100	-	30,000	30,200	-	-	-	-	-
Manganese	ug/L	1,830	2,540	-	2,860	3,230	-	-	-	-	-
Mercury	ug/L	<0.130	<0.130	<0.130	<0.130	<0.130	<0.2	<0.20	<0.2	<0.2	<0.2
Molybdenum	ug/L	26.0	19.0	19.7	24.4	11.7	<5	<5	-	<5	<5
Nickel	ug/L	0.621 J	<0.517	<0.517	0.678 J	0.640 U*	13	-	15	21	14
Potassium	ug/L	2,430	2,370	-	2,490	2,030	-	-	-	-	-
Selenium	ug/L	<1.51	<0.739	<0.739	<0.739	<0.739	<2	<2	12	11	11
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.223	<0.223	<0.223	<0.223	1.4	<2.5	<0.5	<1	<1
Sodium	ug/L	65,200	64,200	-	61,900	62,000	-	-	-	-	-
Strontium	ug/L	1,150	1,160	-	1,160	1,070 J	-	-	-	-	-
Thallium	ug/L	<0.148	<0.472	<0.472	<0.472	<0.472	<1	<5	<1	<1	<1
Vanadium	ug/L	2.42	1.59	1.51	2.50	1.71	-	-	4.2	-	-
Zinc	ug/L	<3.22	<2.88	<2.88	3.21 J	<2.88	11	<50	10	24	13
Radiological Parameters											
Radium-226	pCi/L	0.525 +/-(0.430)U	0.996 +/-(0.635)	0.274 +/-(0.287)U	0.578 +/-(0.590)U	0.571 +/-(0.433)	-	-	-	-	-
Radium-228	pCi/L	0.496 +/-(0.432)U	0.790 +/-(0.526)U*	0.144 +/-(0.384)U	0.368 +/-(0.392)U	0.198 +/-(0.350)U	-	-	-	-	-
Radium-226+228	pCi/L	1.02 +/-(0.610)U	1.79 +/-(0.825)J	0.418 +/-(0.479)U	0.946 +/-(0.708)U	0.769 +/-(0.557)J	-	-	-	-	-
Anions											
Chloride	mg/L	144	158	143	163	149	280	300	-	350	360
Fluoride	mg/L	0.367	0.427	0.390 U*	0.272	0.387	<0.10	<0.1	<0.1	<0.10	<0.10
Sulfate	mg/L	118	126	110	109	101	290	350	-	470	650
General Chemistry											
Alkalinity, Bicarbonate	mg/L	517	546	-	557	538 J	-	-	-	-	-
Alkalinity, Carbonate	mg/L	<5.00	<5.00	-	<5.00	2.60 UJ	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	959	978	994	1,000	1,010	1,700	1,400	-	2,100	2,300

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location							CUF-93-4					
Sample Date		14-Jan-10	7-Apr-10	22-Jul-10	27-Oct-10	19-Jan-11	5-Apr-11	27-Jul-11	4-Oct-11	10-Jan-12	18-Apr-12	19-Jul-12
Sample ID		CUF-93-4-0110	CUF-93-4-0410	CUF-93-4-0710	CUF-93-4-1010	CUF-93-4-0111	CUF-93-4-0411	CUF-93-4-0711	CUF-93-4-1011	CUF-93-4-0112	CUF-93-4-0412	CUF-93-4-0712
Parent Sample ID												
Sample Depth		34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Total Metals												
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<1	2	<1	<1	<1	<1	<1	<1	<1	<1	<1
Arsenic	ug/L	5.5	<10	2.9	5	2.1	5	2	4	2.4	2.3	<1
Barium	ug/L	95	91	86	100	100	78	77	79	110	88	78
Beryllium	ug/L	<2	<2	<2	<2	<2	2 UJ	<2	<2	<2	<2	<2
Boron	ug/L	5,600	5,200	4,500	6,200	6,900	6,300	3,900	3,800	8,100	-	-
Cadmium	ug/L	<0.5	3.2	<0.5	1.6	3.2	1.1	<0.5	<0.5	<0.5	<0.5	<0.5
Calcium	ug/L	560,000	540,000	510,000	570,000	600,000	560,000	500,000	500,000	660,000	-	-
Chromium	ug/L	<2	3.7	<2	<2	<2	<2	<2	<2	2.3	<2	<2
Cobalt	ug/L	1.1	1.9	<1	<1	<1	<1	<1	<1	<1	<1	<1
Copper	ug/L	<4	12	3.7	7.1	2.5	7.5 U*	<2	<2	2.2	2.7	2.1
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Lithium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20	<0.2	<0.2	<0.2	<0.2
Molybdenum	ug/L	<5	<5	<5	<5	5 UJ	8.4	9.8	<5	<5	-	-
Nickel	ug/L	14	37	14	13	<1	39 J	7.2	13	19	13	19
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	6.1	<10	8.5	3.7	2	1 UJ	7.7	6.9	<1	1.3	<1
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Vanadium	ug/L	-	-	-	<2	<2	2.9	<2	<2	5.5	3.6	2.7
Zinc	ug/L	<10	38	36	13	13	<10	<10	<10	<10	<10	<10
Radiological Parameters												
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Anions												
Chloride	mg/L	390	390	380	400	420	420	360	220	440	-	-
Fluoride	mg/L	<0.1	<0.10	0.1	<0.10	<0.10	<0.10	<0.10	<0.1	<0.1	<0.1	<0.1
Sulfate	mg/L	840	810	750	900	970	850	620	390	1,100	-	-
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	2,400	2,400	2,700	2,800	2,500	2,500	2,500	2,500	2,800	-	-

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-4										
Sample Date		17-Oct-12	15-Jan-13	3-Apr-13	2-Jul-13	9-Oct-13	22-Jan-14	9-Apr-14	22-Jul-14	9-Oct-14	14-Jan-15	14-Apr-15
Sample ID		CUF-93-4-1012	CUF-93-4-0113	CUF-93-4-0413	CUF-93-4-0713	CUF-93-4-1013	CUF-93-4-0114	CUF-93-4-0414	CUF-93-4-0714	CUF-93-4-1014	CUF-93-4-0115	CUF-93-4-0415
Parent Sample ID												
Sample Depth		34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Total Metals												
Aluminum	ug/L	-	-	-	-	<2,500	-	-	-	-	-	-
Antimony	ug/L	<1	<1	<1	<1	<1.0	<2	<2	<2	<1	<2	<2
Arsenic	ug/L	<1	34 J	6.2	5.9	<4.0	2.04	<2	3.46	2.9	<2	<2
Barium	ug/L	78	84	78	74	67.0	92.6	<100	58	58	55	58.3
Beryllium	ug/L	<2	<2	<2	<2	<4.0	<2	<2	<2	<2	<2	<2
Boron	ug/L	6,000	-	7,200	-	8,780	-	-	-	-	-	-
Cadmium	ug/L	<0.5	1.3	<0.5	<0.5	<1.0	<1	<1	<1	<0.5	2	<1
Calcium	ug/L	550,000	-	620,000	-	654,000	-	-	-	-	-	-
Chromium	ug/L	<2	<2	3.2	<2	<10.0	<2	<2	<2	<2	<2	<2
Cobalt	ug/L	<1	1.2	<1	<1	<4.0	<2	<2	<2	1.3	<2	<2
Copper	ug/L	2	8.9	3.6	2.2	<10.0	<2	2.35	<2	2	<5	<5
Iron	ug/L	-	-	-	-	<2,500	-	-	-	-	-	-
Lead	ug/L	<1	<1	<1	<1	<1.0	<2	<2	<2	<1	<2	<2
Lithium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Magnesium	ug/L	-	-	-	-	37,300	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	284	-	-	-	-	-	-
Mercury	ug/L	<0.2	<0.2	<0.2	<0.2	<0.20	0.2 UJ	0.2 UJ	0.2 UJ	<0.2	<0.2	<0.2
Molybdenum	ug/L	5 UJ	-	<5	-	<1.0	-	-	-	-	-	-
Nickel	ug/L	18	19	17	15	<10.0	7.38	3.78	2.9	17	4	6.12
Potassium	ug/L	-	-	-	-	8,010	-	-	-	-	-	-
Selenium	ug/L	<1	<1	5.7	6.4	<10.0	<2	<2	<2	<1	<2	<2
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	1 UR	<1	<1	<1	<0.50	<2	<2	<2	<1	<2	<2
Sodium	ug/L	-	-	-	-	137,000	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	1,480	-	-	-	-	-	-
Thallium	ug/L	<1	<1	<1	<1	<1.0	<2	<2	<2	<1	<2	<2
Vanadium	ug/L	2	4.9 U*	7	<2	<10.0	-	<2	2.25	3.2	<5	<5
Zinc	ug/L	<10	14	<10	<10	<100	<25	<25	<25	<10	<25	<25
Radiological Parameters												
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Anions												
Chloride	mg/L	470	-	430	-	-	-	-	-	-	-	-
Fluoride	mg/L	0.23	<0.10	0.18	<0.1	-	0.131	<0.100	<0.500	<0.1	0.16	<0.1
Sulfate	mg/L	1,100	-	1,100	-	-	-	-	-	-	-	-
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	2,900	-	1,700	-	3,000	-	-	-	-	-	-

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-4										
Sample Date		21-Jul-15	21-Oct-15	26-Jan-16	13-Apr-16	20-Jul-16	18-Oct-16	24-Jan-17	5-Apr-17	11-Jul-17	17-Oct-17	24-Jan-18
Sample ID		CUF-93-4-0715	CUF-93-4-1015	CUF-93-4-0116	CUF-93-4-0416	CUF-93-4-0716	CUF-93-4-1016	93-4	93-4	93-4	93-4	93-4-0118
Parent Sample ID												
Sample Depth		34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Total Metals												
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<2	<2	<2	<2	<2	<2	<2.00	<2	<2	<2	<2
Arsenic	ug/L	<2	<2	<2	<2	<2	<2	<1	<1	<1	<1	<1
Barium	ug/L	52.5	46.4	52.1	61.1	51.7	51.8	<200	51	45.6	45.6	46.3
Beryllium	ug/L	<2	<2	<2	<2	<2	<2	<4	<1	<1	<1	<1
Boron	ug/L	-	-	-	-	-	11,900	11,400	13,400	12,300	11,900	12,000
Cadmium	ug/L	<1	<1	<1	<1	1.26	<1	<1	<1	<1	<1	<1
Calcium	ug/L	-	-	-	-	-	670,000	590,000	571,000	554,000	583,000	636,000
Chromium	ug/L	<2	<2	<2	<2	<2	<2	<2.00	<2	<2	<2	<2
Cobalt	ug/L	<2	<2	<2	<2	<2	<2	0.785	0.74	<0.5	0.681	0.556
Copper	ug/L	<5	<5	<5	<5	5.03	<5	<2.00	<2	<2	<2	<2
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<2	<2	<2	<2	<2	<2	<1	<1	<1	<1	<1
Lithium	ug/L	-	-	-	-	-	18.4	10.4	8.49	13	6.69	6.26
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.200	<0.200	<0.200	<0.200	<0.200
Molybdenum	ug/L	-	-	-	-	-	<5	<5	<5	<5	<5	<5
Nickel	ug/L	2.51	2.85	8.07	6.36	5.2	10.4	10.2	7.42	5.31	6.6	5.24
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<2	<2	<2	<2	<2	<2	<5	<5	<5	<5	<5
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<2	<2	<2	<2	<2	<2	<1.00	<1	<1	<1	<1
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<2	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1
Vanadium	ug/L	<5	<5	<5	<5	<5	<5	<50	<1	1.95 U*	<1	<10
Zinc	ug/L	<25	<25	<25	<25	<25	<25	<5	<5	<5	<5	<5
Radiological Parameters												
Radium-226	pCi/L	-	-	-	-	-	-	0.310 +/-(0.113)	0.192 +/-(0.0985)	0.212 +/-(0.0844)U*	0.249 +/-(0.0856)J	0.268 +/-(0.0937)
Radium-228	pCi/L	-	-	-	-	-	-	0.143 +/-(0.184)U	0.128 +/-(0.278)U	-0.0608 +/-(0.223)U	0.176 +/-(0.217)U	1.10 +/-(0.373)U*
Radium-226+228	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Anions												
Chloride	mg/L	-	-	-	-	-	-	388	373	366	363	384
Fluoride	mg/L	<0.1	<0.100	<0.1	<0.1	<0.100	<0.100	<0.500	<0.250	<0.250	<0.250	<0.250
Sulfate	mg/L	-	-	-	-	-	1,210	1,040	1,220	1,290	1,250	1,320
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	5.56	-	-	-	-	-
Total Dissolved Solids	mg/L	-	-	-	-	-	2,740	2,710	2,770	2,980	2,860	2,820

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-93-4					CUF-201					
Sample Date		4-Apr-18	23-Jul-18	10-Oct-18	22-Jan-19	8-Apr-20	9-Nov-16	23-Jan-17	7-Feb-17	7-Mar-17	4-Apr-17	2-May-17
Sample ID		93-4-0418	CUF-93-4-0718	93-4-1018	93-4-0119	CUF-93-4-0420	CUF-GW-011-11092016	CUF-GW-011-01232017	CUF-GW-011-02072017	CUF-GW-011-03072017	CUF-GW-011-04042017	CUF-GW-011-05022017
Parent Sample ID												
Sample Depth		34 ft	34 ft	34 ft	34 ft	34 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<2	<2.00	<2	<1.12	0.656 J	0.352 U*	<0.443	0.656 U*	0.443 U*	<0.443	<0.443
Arsenic	ug/L	<1	<1.00	<1	0.491 J	0.383 U*	4.6	0.343 U*	2.31	1.21	1.06	1.05
Barium	ug/L	47.1	41.9	38.4	38.9	39.5	33.1	25.7	25.8	24.6	23.7	25.5
Beryllium	ug/L	<1	<1.00	<1	<0.057	0.182 UJ	<0.102	<0.131	<0.131	<0.131	<0.131	<0.131
Boron	ug/L	12,000	11,900	10,700	12,100	11,400	8.59 J	31.7 U*	10.4 J	14.1 U*	16.1 U*	<7.81
Cadmium	ug/L	<1	<1.00	<1	<0.125	<0.217	<0.152	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781
Calcium	ug/L	637,000	580,000	495,000	502,000	524,000	27,000	25,000	25,000	24,400	28,800	24,300
Chromium	ug/L	<2	<2.00	<2	1.95 U*	<1.53	<0.339	<0.378	<0.378	<0.378	<0.378	<0.378
Cobalt	ug/L	<0.5	<0.50	<0.5	0.441 J	0.251 U*	1.15	0.491 J	1.01	0.473 J	0.172 J	0.413 U*
Copper	ug/L	<2	<2.00	<2	1.43 J	0.737 J	-	-	-	-	-	-
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<1	<1.00	<1	<0.094	0.325 U*	<0.0675	<0.318	<0.318	<0.318	<0.318	<0.318
Lithium	ug/L	12.2	5.91	13.5	7.42	11.8 J	1.93 U*	2.67 U*	<2.12	<2.12	<2.12	2.23 J
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.200	<0.200	0.200 UJ	<0.101	<0.101	<0.0521	<0.0521	<0.0521	<0.0653	<0.0653	<0.0653
Molybdenum	ug/L	<5	<5.00	<5	<0.474	<0.610	3.29 J	2.32 J	2.43 J	2.25 J	1.74 J	1.67 J
Nickel	ug/L	4.69	6.22	3.69	5.2	1.51	-	-	-	-	-	-
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<5	<5.00	<5	<0.813	<1.51	<0.348	<1.27	1.27 UJ	<1.27	<1.27	<1.27
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<1	<1.00	<1	<0.121	<0.177	-	-	-	-	-	-
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<1	<1.00	<1	0.154 J	0.150 U*	<0.036	<0.0531	<0.0531	<0.0531	<0.0531	<0.0531
Vanadium	ug/L	<1.25	1.01	1.51	1.77 U*	<0.991	-	-	-	-	-	-
Zinc	ug/L	<5	<5.00	<5	5.02	<3.22	-	-	-	-	-	-
Radiological Parameters												
Radium-226	pCi/L	0.227 +/-(0.0861)	0.340 +/-(0.104)	0.391 +/-(0.153)U*	0.162 +/-(0.0731)	0.246 +/-(0.447)U	-	-	-	-	-	-
Radium-228	pCi/L	0.241 +/-(0.230)U	0.290 +/-(0.231)U	0.270 +/-(0.243)U	0.228 +/-(0.280)U	0.363 +/-(0.361)U	-	-	-	-	-	-
Radium-226+228	pCi/L	-	-	-	-	0.609 +/-(0.575)U	+/-(0.26)U	+/-(0.71)UJ	1.11 +/-(0.57)J	+/-(0.33)U	+/-(0.37)U	+/-(0.56)U
Anions												
Chloride	mg/L	363	342	334	315	277	1.33	1.65	1.44	1.13 U*	1.67	1.65
Fluoride	mg/L	<0.250	<0.250	<0.250	0.293	0.141 U*	0.150	0.141 U*	0.150	0.137 U*	0.149	0.156
Sulfate	mg/L	1,290	1,230	1,180	1,130	1,020	1.12	1.93 U*	1.52	1.08 J	1.97	1.90
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	2,780	2,700	2,540	2,470	2,320	119	103	110	91.0	75.0	87.0

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-201										
Sample Date		30-May-17	11-Jul-17	26-Jul-17	16-Aug-17	29-Aug-17	2-Oct-17	18-Oct-17	25-Jan-18	5-Apr-18	5-Apr-18	30-May-18
Sample ID		CUF-GW-011-05302017	CUF-GW-011-07112017	CUF-GW-011-07262017	CUF-GW-011-08162017	CUF-GW-011-08292017	CUF-GW-011-10022017	CUF-201	CUF-201-0118	CUF-201-0418	CUF-201-0418-DUP	CUF-GW-011-05302018
Parent Sample ID											CUF-201-0418	
Sample Depth		26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	State Compliance	State Compliance	State Compliance	CCR Program
Total Metals												
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<0.443	<0.443	0.632 U*	<0.443	1.27 U*	-	<2	<2	<2	<2	<1.12
Arsenic	ug/L	4.04	4.64	4.58	5.03	5.14	-	5.88	<1	2.23	2.23	1.41
Barium	ug/L	25.4	29.8	26.5	31.8	28.5	-	28.1	21.1	26.6	26.6	20.8
Beryllium	ug/L	<0.131	<0.131	<0.131	<0.131	<0.131	-	<1	<1	<1	<1	<0.057
Boron	ug/L	<7.81	8.94 U*	9.33 J	28.8 U*	10.5 J	9.5 J	<80	<80	<80	<80	<30.3
Cadmium	ug/L	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781	-	<1	<1	<1	<1	<0.125
Calcium	ug/L	24,100	25,900	24,600	26,000	25,800	24,700	25,500	25,300	26,300	25,700	23,400
Chromium	ug/L	<0.378	<0.378	<0.378	<0.378	<0.378	-	<2	<2	<2	<2	<0.631
Cobalt	ug/L	0.808	0.757	0.801	0.72	0.7	-	0.716	<0.5	<0.5	<0.5	0.423 J
Copper	ug/L	-	-	-	-	-	-	<2	<2	<2	<2	-
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<0.318	<0.318	<0.318	<0.318	<0.318	-	<1	<1	<1	<1	<0.094
Lithium	ug/L	<2.12	<2.12	<2.12	<2.12	3.49 U*	-	<5	<5	<5	<5	3.73 U*
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	-	<0.200	<0.200	<0.200	<0.200	<0.0653
Molybdenum	ug/L	2.33 J	2.45 J	2.58 J	2.57 J	2.71 J	-	<5	<5	<5	<5	1.64 U*
Nickel	ug/L	-	-	-	-	-	-	<1	<1	<1	<1	-
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<1.27	1.27 UJ	<1.27	<1.27	<1.27	-	<5	<5	<5	<5	<0.813
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	<1.00	-	-	-	-	<1	<1	<1	<1	-
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<0.0531	<0.0531	0.073 J	<0.0531	<0.0531	-	<1	<1	<1	<1	<0.063
Vanadium	ug/L	-	<1.00	-	-	-	-	<1	<1	1.02	1.3	-
Zinc	ug/L	-	<5.00	-	-	-	-	<5	<5	<5	<5	-
Radiological Parameters												
Radium-226	pCi/L	-	-	-	-	-	-	0.0859 +/-(0.0575)J	0.0272 +/-(0.0502)U	0.0246 +/-(0.0392)U	0.00972 +/-()U	-
Radium-228	pCi/L	-	-	-	-	-	-	0.202 +/-(0.221)U	1.02 +/-(0.383)U*	0.116 +/-(0.211)U	0.0655 +/-()U	-
Radium-226+228	pCi/L	+/-(0.71)U	+/-(0.39)U	+/-(0.51)U	+/-(0.58)U	0.636 +/-(0.51)U*	-	-	-	-	-	0.0547 +/-(0.277)U
Anions												
Chloride	mg/L	1.52	1.46	1.44	1.44	1.54	1.56	1.55	1.30	2.10	2.13	1.50
Fluoride	mg/L	0.147	0.185	0.150	0.147	0.155	0.130	0.222	0.146	<0.100	<0.100	0.140
Sulfate	mg/L	1.37	1.58	1.34	1.06	1.26	1.11	1.02	1.39	1.52	1.74	1.55
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	105	104	104	104	91.0	91.0	99.0	125	94.0	107	98.0

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-201										
Sample Date		19-Jun-18	10-Jul-18	31-Jul-18	20-Aug-18	20-Aug-18	17-Jan-19	24-Jan-19	5-Feb-19	10-Apr-19	7-May-19	29-Jul-19
Sample ID		CUF-GW-011-06192018	CUF-GW-011-07102018	CUF-GW-011-07312018	CUF-GW-011-08202018	CUF-GW-903-08202018	CUF-GW-011-01172019	201-0119	CUF-GW-011-02052019	CUF-201	CUF-GW-011-05072019	CUF-GW-011-07292019
Parent Sample ID						CUF-GW-011-08202018						
Sample Depth		26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	State Compliance	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	-	-	-	-	-	16.5 J	-	<12.5	-	12.5 J	<12.5
Antimony	ug/L	1.28 J	<1.12	<1.12	<1.12	<1.12	<1.12	<1.12	<0.378	<0.378	<0.378	<0.378
Arsenic	ug/L	3.94	4.91	4.42	4.55	4.42	0.809 J	0.842 J	0.645 J	0.608 J	0.613 J	5.02
Barium	ug/L	20.5	23.3	26.3	25.6	24.9	20	18.2	18.1	17.1	15.8	24.2
Beryllium	ug/L	<0.057	<0.057	<0.057	<0.057	<0.057	<0.057	<0.057	<0.155	<0.155	<0.155	<0.182
Boron	ug/L	<30.3	<30.3	33 U*	<30.3	<30.3	<30.3	<30.3	<30.3	36.8 J	31.7 U*	<38.6
Cadmium	ug/L	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
Calcium	ug/L	25,900	25,300	25,500	25,000	24,600	25,200	22,600	23,700	24,700	24,400 J	23,900
Chromium	ug/L	1.87 U*	1.09 U*	1.36 U*	1.15 U*	1.25 U*	1.84 U*	1.24 U*	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	0.639	0.675	0.65	0.546	0.54	<0.075	0.168 J	0.109 J	<0.075	0.247 J	0.569
Copper	ug/L	-	-	-	-	-	<1.3	<1.3	7.67	<0.627	<0.627	<0.627
Iron	ug/L	-	-	-	-	-	387 J	-	302	-	258	4,470
Lead	ug/L	<0.094	<0.094	<0.094	<0.094	<0.094	0.121 J	<0.094	0.266 J	<0.128	<0.128	<0.128
Lithium	ug/L	<2.56	<2.56	<2.56	<2.56	<2.56	<2.56	<2.56	4.76 U*	<3.14	4.55 J	<3.39
Magnesium	ug/L	-	-	-	-	-	3,380	-	3,410	-	3,570 J	3,650
Manganese	ug/L	-	-	-	-	-	16.7	-	79	-	133	216
Mercury	ug/L	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.101	<0.101	<0.101	<0.101	<0.101
Molybdenum	ug/L	1.48 J	1.94 J	2.41 J	2.26 J	2.25 J	1.57 J	1.38 J	1.49 J	0.943 J	1.11 J	2.05 J
Nickel	ug/L	-	-	-	-	-	0.395 J	0.456 J	2.25	<0.312	0.437 J	0.555 U*
Potassium	ug/L	-	-	-	-	-	630	-	720	-	570 J	476 J
Selenium	ug/L	<0.813	<0.813	<0.813	<0.813	<0.813	<0.813	<0.813	<2.62	<2.62	<2.62	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	-	-	-	-	-	<0.121	-	<0.121	-	<0.177
Sodium	ug/L	-	-	-	-	-	3,100	-	3,550	-	3,100	3,270
Strontium	ug/L	-	-	-	-	-	51	-	61.3	-	52 J	62.0
Thallium	ug/L	<0.063	<0.063	<0.063	<0.063	<0.063	<0.063	<0.063	<0.128	<0.128	<0.128	<0.148
Vanadium	ug/L	-	-	-	-	-	-	1.05 U*	-	<0.899	-	<0.991
Zinc	ug/L	-	-	-	-	-	-	<2.42	-	<3.22	-	<3.22
Radiological Parameters												
Radium-226	pCi/L	-	-	-	-	-	0.0155 +/-(0.0588)U	0.0660 +/-(0.0537)U	0.0502 +/-(0.0534)U	0.00644 +/-(0.0467)U	-0.0350 +/-(0.0285)U	0.404 +/-(0.499)U
Radium-228	pCi/L	-	-	-	-	-	0.0892 +/-(0.249)U	-0.507 +/-(0.209)U	0.245 +/-(0.257)U	0.0617 +/-(0.289)U	-0.455 +/-(0.359)U	0.122 +/-(0.387)U
Radium-226+228	pCi/L	0.218 +/-(0.262)U	0.260 +/-(0.231)U*	0.602 +/-(0.247)U*	0.343 +/-(0.261)U*	0.511 +/-(0.263)U*	0.105 +/-(0.256)U	-	0.295 +/-(0.262)U	-	0.000 +/-(0.360)U	0.526 +/-(0.632)U
Anions												
Chloride	mg/L	1.06 J	0.984 J	1.41	1.65	1.56	1.57	1.76	1.62	1.73	1.78	1.29
Fluoride	mg/L	0.114	0.130	0.0940 J	0.0978 J	0.103	0.149	0.145	0.134	0.107	0.113	0.0889 J
Sulfate	mg/L	1.26 J	1.14	1.47	1.68	1.54	1.70	1.15	1.03	1.96 U*	2.16	1.28
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	78.8	-	90.9	-	89.6	83.6
Alkalinity, Carbonate	mg/L	-	-	-	-	-	<5.00	-	<5.00	-	<5.00	<5.00
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	105	99.0	114	101	101	79.0	103	67.0	78.0	98.0	73.0

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-201										
Sample Date		8-Oct-19	28-Jan-20	10-Mar-20	9-Apr-20	28-Jul-20	10-Sep-20	6-Oct-20	19-Jan-21	2-Mar-21	14-Apr-21	15-Jul-21
Sample ID		CUF-GW-011-10082019	CUF-GW-011-01282020	CUF-GW-011-03102020	CUF-201-0420	CUF-GW-011-07282020	CUF-GW-011-09102020	CUF-201-1020	CUF-GW-CUF-201-01192021	CUF-GW-CUF-201-03022021	CUF-GW-201-04142021	CUF-GW-CUF-201-07152021
Parent Sample ID												
Sample Depth		26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program
Total Metals												
Aluminum	ug/L	<12.5	<12.5	<12.5	-	<12.5	<12.5	-	<12.5	16.5 J	-	<12.5
Antimony	ug/L	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	0.450 J	<0.378	<0.378	<0.378
Arsenic	ug/L	5.95	0.517 J	0.539 J	0.349 J	5.36	6.37	7.01	0.735 J	0.825 J	0.401 J	6.47
Barium	ug/L	29.1	17.0	17.6	15.3	23.9	25.5	28.4	15.6	16.4	15.1	23.7
Beryllium	ug/L	<0.182	<0.182	0.258 J	0.182 UJ	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182
Boron	ug/L	46.0 U*	<38.6	<38.6	<38.6	<38.6	<38.6	44.9 U*	<38.6	<38.6	<38.6	<38.6
Cadmium	ug/L	<0.125	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217
Calcium	ug/L	25,900	23,200	24,700	24,100	24,200	25,800	25,100	24,200	24,700	24,900	25,500
Chromium	ug/L	2.05 U*	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	0.453 J	<0.134	<0.134	<0.134	0.422 J	0.383 J	0.492 J	<0.134	<0.134	<0.134	0.454 J
Copper	ug/L	<0.627	<0.627	0.755 J	<0.627	1.70 J	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627
Iron	ug/L	6,020	137	73.6	-	5,020	5,610	-	301	395	-	6,000
Lead	ug/L	<0.128	<0.128	0.165 J	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128
Lithium	ug/L	<3.39	<3.39	<3.39	3.39 UJ	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39
Magnesium	ug/L	3,780	3,090	3,440	-	3,660	3,510	-	3,300	3,370	-	3,440
Manganese	ug/L	258	7.73	5.86 U*	-	220	214	-	6.57	13.0	-	219
Mercury	ug/L	<0.101	0.101 UJ	<0.101	<0.101	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130
Molybdenum	ug/L	2.54 J	1.31 J	1.28 J	1.06 J	2.39 J	2.27 J	2.56 J	1.45 J	1.47 J	1.10 J	2.55 J
Nickel	ug/L	<0.336	0.371 J	<0.336	0.527 J	1.06	0.424 J	0.436 J	<0.336	<0.336	<0.336	0.526 J
Potassium	ug/L	580	551	499 J	-	549	496 J	-	535	526	-	555
Selenium	ug/L	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	4,120	2,860	2,790	-	3,240	3,150	-	2,810	2,880	-	3,200
Strontium	ug/L	69.2	57.8	56.6	-	66.8	67.5	-	57.8	57.0	-	68.8
Thallium	ug/L	<0.148	<0.148	0.184 J	<0.148	<0.148	<0.148	0.160 U*	<0.148	<0.148	<0.148	0.455 U*
Vanadium	ug/L	1.23 U*	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991
Zinc	ug/L	3.97 U*	<3.22	<3.22	<3.22	3.75 U*	4.38 U*	<3.22	<3.22	3.40 J	<3.22	<3.22
Radiological Parameters												
Radium-226	pCi/L	0.223 +/-(0.369)U	0.0348 +/-(0.313)U	0.109 +/-(0.334)U	0.478 +/-(0.566)U	0.0939 +/-(0.371)U	0.0671 +/-(0.370)U	-0.205 +/-(0.247)U	-0.000185 +/-(0.285)U	0.317 +/-(0.540)U	-0.249 +/-(0.234)U	0.177 +/-(0.298)U
Radium-228	pCi/L	-0.0225 +/-(0.397)U	0.0471 +/-(0.284)UJ	0.373 +/-(0.316)U	-0.0559 +/-(0.544)U	0.0985 +/-(0.318)U	0.187 +/-(0.258)U	-0.00323 +/-(0.374)U	-0.215 +/-(0.391)U	0.206 +/-(0.301)U	0.273 +/-(0.285)U	0.0395 +/-(0.364)U
Radium-226+228	pCi/L	0.223 +/-(0.542)U	0.0818 +/-(0.422)UJ	0.482 +/-(0.460)U	0.478 +/-(0.785)U	0.192 +/-(0.489)U	0.254 +/-(0.451)U	0.000 +/-(0.448)U	0.000 +/-(0.484)U	0.522 +/-(0.618)U	0.273 +/-(0.369)U	0.217 +/-(0.470)U
Anions												
Chloride	mg/L	1.44	1.70	1.72	1.90	1.54	1.46	1.23 J	1.79	1.65	1.69	1.79
Fluoride	mg/L	0.104	0.122	<0.0263	0.141	0.100 J	0.126	0.0955 J	0.159 U*	0.129	0.105	0.112 U*
Sulfate	mg/L	1.28 U*	1.56 J	1.73	1.75 J	1.28	1.33 J	0.739 J	1.69 J	1.47	1.27	1.35
General Chemistry												
Alkalinity, Bicarbonate	mg/L	93.7	76.7	72.4	-	83.1	83.9	-	82.4	91.7	-	86.1
Alkalinity, Carbonate	mg/L	<5.00	<5.00	<5.00	-	<5.00	<5.00	-	<5.00	<5.00	-	<5.00
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	80.0	91.0	100	91.0	87.0	98.0	84.0	80.0	106 J	113	106

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-201							CUF-202		
Sample Date		17-Aug-21	14-Oct-21	19-Jan-22	2-Mar-22	14-Apr-22	12-Jul-22	23-Aug-22	9-Nov-16	24-Jan-17	6-Feb-17
Sample ID		CUF-GW-CUF-201-08172021	CUF-GW-CUF-201-10142021	CUF-GW-CUF-201-01192022	CUF-GW-CUF-201-03022022	CUF-GW-CUF-201-04142022	CUF-GW-CUF-201-07122022	CUF-GW-CUF-201-08232022	CUF-GW-012-11092016	CUF-GW-012-01242017	CUF-GW-012-02062017
Parent Sample ID											
Sample Depth		26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	18 ft	18 ft	18 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	State Compliance	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals											
Aluminum	ug/L	<12.5	-	<12.5	<15.5	-	<15.5	<15.5	-	-	-
Antimony	ug/L	<0.378	<0.378	0.466 J	<0.506	<0.506	<0.506	<0.506	0.84 U*	<0.443	0.607 U*
Arsenic	ug/L	5.49	6.73	0.673 J	0.794 J	0.321 J	6.29	6.06	0.443 J	0.22 UJ	<0.22
Barium	ug/L	26.8	26.5	16.0	16.2	15.1	22.6	23.6 J	37.8	25.7	24.7
Beryllium	ug/L	<0.182	<0.182	<0.182	<0.274	<0.274	<0.274	<0.274	<0.102	<0.131	<0.131
Boron	ug/L	<38.6	<38.6	<38.6	<60.1	<60.1	<60.1	<60.1	20.2	25.5 U*	25.4 J
Cadmium	ug/L	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.152	<0.0781	<0.0781
Calcium	ug/L	23,400	25,200	22,500	23,900	24,900	25,300	23,800	61,100	61,900	62,200
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<0.339	<0.378	<0.378
Cobalt	ug/L	0.377 J	0.374 J	<0.134	<0.261	<0.261	0.417 J	0.355 J	3.59	0.114 J	0.096 J
Copper	ug/L	<0.627	<0.627	<0.627	<1.14	<1.14	<1.14	<1.14	-	-	-
Iron	ug/L	6,330	-	331	283	-	5,390	6,130	-	-	-
Lead	ug/L	<0.128	<0.128	<0.128	<0.167	<0.167	<0.167	<0.167	<0.0675	<0.318	<0.318
Lithium	ug/L	<3.39	<3.39	<3.39	<0.831	<0.831	<0.831	<0.831	3.06 U*	4.07 U*	3.06 U*
Magnesium	ug/L	3,450	-	3,420	3,370	-	3,640	3,520	-	-	-
Manganese	ug/L	209	-	4.39 J	10.3	-	195	210	-	-	-
Mercury	ug/L	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.0521	<0.0521	<0.0521
Molybdenum	ug/L	2.22 J	2.25 J	1.47 J	1.42 J	1.22 J	2.05 J	1.83 J	7.28	4.54 J	4.49 J
Nickel	ug/L	0.544 J	0.380 J	<0.336	<0.517	<0.517	<0.517	1.56 U*	-	-	-
Potassium	ug/L	539	-	510	559	-	572	563	-	-	-
Selenium	ug/L	<1.51	<1.51	<1.51	<0.739	<0.739	<0.739	<0.739	<0.348	<1.27	1.27 UJ
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.177	<0.223	<0.223	0.223 UR	<0.223	-	-	-
Sodium	ug/L	3,240	-	2,880	2,940	-	3,130	3,280	-	-	-
Strontium	ug/L	67.2	-	56.8	60.8	-	68.9	61.6 J	-	-	-
Thallium	ug/L	<0.148	<0.148	0.171 U*	<0.472	<0.472	<0.472	<0.472	0.91 J	0.152 J	0.2 U*
Vanadium	ug/L	<0.991	<0.991	<0.991	<0.776	<0.776	<0.776	<0.776	-	-	-
Zinc	ug/L	<3.22	<3.22	<3.22	<2.88	<2.88	<2.88	<2.88	-	-	-
Radiological Parameters											
Radium-226	pCi/L	0.273 +/-(0.492)U	0.155 +/-(0.365)U	0.129 +/-(0.257)U	-0.100 +/-(0.334)U	-0.0216 +/-(0.198)U	-0.174 +/-(0.350)U	0.268 +/-(0.395)U	-	-	-
Radium-228	pCi/L	0.444 +/-(0.591)U	0.494 +/-(0.502)U	-0.226 +/-(0.282)U	0.863 +/-(0.652)U	-0.371 +/-(0.336)U	0.309 +/-(0.531)U	0.327 +/-(0.465)U	-	-	-
Radium-226+228	pCi/L	0.717 +/-(0.769)U	0.649 +/-(0.620)U	0.129 +/-(0.382)U	0.863 +/-(0.732)U	0.000 +/-(0.390)U	0.309 +/-(0.635)U	0.596 +/-(0.610)U	+/-(0.30)U	+/-(0.54)UJ	+/-(0.56)U
Anions											
Chloride	mg/L	1.47	1.64 J	1.59	1.71	1.74	1.64	1.54	1.45	1.55	1.33
Fluoride	mg/L	0.180	0.150	0.106 U*	0.126	0.110 U*	0.104	0.0951 U*	0.196	0.191 U*	0.212
Sulfate	mg/L	1.18	1.31	1.61	1.85	2.22	1.85	1.30 U*	15.6	17.0	17.6
General Chemistry											
Alkalinity, Bicarbonate	mg/L	83.6	-	79.6	84.4	-	83.5	84.6 J	-	-	-
Alkalinity, Carbonate	mg/L	<5.00	-	<5.00	<5.00	-	<5.00	5.00 UJ	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	96.0	129	95.0	93.0	101	95.0	115	230	221	214

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-202										
Sample Date		7-Mar-17	4-Apr-17	2-May-17	30-May-17	11-Jul-17	26-Jul-17	17-Aug-17	29-Aug-17	2-Oct-17	18-Oct-17	25-Jan-18
Sample ID		CUF-GW-012-03072017	CUF-GW-012-04042017	CUF-GW-012-05022017	CUF-GW-012-05302017	CUF-GW-012-07112017	CUF-GW-012-07262017	CUF-GW-012-08172017	CUF-GW-012-08292017	CUF-GW-012-10022017	CUF-202	CUF-202-0118
Parent Sample ID												
Sample Depth		18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	State Compliance
Total Metals												
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	0.704 U*	<0.443	<0.443	0.508 U*	<0.443	0.609 U*	0.618 U*	1.7 U*	-	<2	<2
Arsenic	ug/L	<0.22	<0.22	0.358 J	0.459 J	<0.22	0.242 J	0.392 U*	0.488 U*	-	<1	<1
Barium	ug/L	24.5	24.5	24.5	25.7	30.9	30.2	36.4	33.3	-	22.1	22.8
Beryllium	ug/L	<0.131	<0.131	<0.131	<0.131	<0.131	<0.131	<0.131	<0.131	-	<1	<1
Boron	ug/L	22.9 U*	31.8 U*	18.8 J	17.4 J	17.9 U*	25.8 J	33.7 U*	38.6 J	19.1 J	<80	<80
Cadmium	ug/L	<0.0781	<0.0781	<0.0781	0.645 J	0.25 J	0.305 J	0.19 J	0.23 J	-	<1	<1
Calcium	ug/L	63,700	75,500	67,800	60,800	60,200	62,500	62,500	63,500	60,700	61,600	65,100
Chromium	ug/L	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	0.44 U*	-	<2	<2
Cobalt	ug/L	<0.0947	0.111 J	<0.0947	0.185 J	0.231 J	0.369 J	0.426 J	0.5	-	<0.5	<0.5
Copper	ug/L	-	-	-	-	-	-	-	-	-	<2	<2
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	-	<1	<1
Lithium	ug/L	3.34 U*	2.36 U*	3.48 J	2.41 J	2.25 J	2.47 J	3.12 J	7.08 U*	-	<5	<5
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	-	<0.200	<0.200
Molybdenum	ug/L	4.41 J	4.83 J	5.68	8.71	7.66	7.95	7.96	8.63	-	7.3	<5
Nickel	ug/L	-	-	-	-	-	-	-	-	-	1.22	<1
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<1.27	<1.27	<1.27	<1.27	1.27 UJ	<1.27	<1.27	<1.27	-	<5	<5
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	-	-	-	<1.00	-	-	-	-	<1	<1
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	0.169 U*	<0.0531	0.203 U*	1.25	0.858 J	1.09	0.942 J	1.09	-	<1	<1
Vanadium	ug/L	-	-	-	-	<1.00	-	-	-	-	<1	<1
Zinc	ug/L	-	-	-	-	<5.00	-	-	-	-	<5	<5
Radiological Parameters												
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	0.104 +/-(0.0579)J	0.0368 +/-(0.0491)U
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-0.0802 +/-(0.197)U	0.509 +/-(0.285)U*
Radium-226+228	pCi/L	+/-(0.35)U	+/-(0.44)U	+/-(0.45)U	+/-(0.74)UR	+/-(0.54)U	+/-(0.41)U	+/-(0.32)U	1.03 +/-(0.60)U*	-	-	-
Anions												
Chloride	mg/L	1.22 U*	1.43	1.36	1.29	1.43	1.44	1.52	1.54	1.74	1.67	1.35
Fluoride	mg/L	0.218 U*	0.203	0.215	0.195	0.265	0.215	0.216	0.216	0.184	0.311	0.170
Sulfate	mg/L	14.7	16.6	16.1	15.1	16.6	15.8	16.2	17.1	14.6	15.2	16.4
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	212	189	203	221	217	222	220	202	209	217	231

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-202										
Sample Date		5-Apr-18	30-May-18	19-Jun-18	10-Jul-18	31-Jul-18	21-Aug-18	17-Jan-19	24-Jan-19	5-Feb-19	10-Apr-19	7-May-19
Sample ID		CUF-202-0418	CUF-GW-012-05302018	CUF-GW-012-06192018	CUF-GW-012-07102018	CUF-GW-012-07312018	CUF-GW-012-08212018	CUF-GW-012-01172019	202-0119	CUF-GW-012-02052019	CUF-202	CUF-GW-012-05072019
Parent Sample ID												
Sample Depth		18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	State Compliance	CCR Program
Total Metals												
Aluminum	ug/L	-	-	-	-	-	-	<11.8	-	<12.5	-	<12.5
Antimony	ug/L	<2	<1.12	<1.12	<1.12	<1.12	<1.12	<1.12	<1.12	<0.378	<0.378	<0.378
Arsenic	ug/L	<1	<0.323	0.499 U*	0.371 J	0.328 J	0.425 J	<0.323	<0.323	<0.323	<0.323	<0.323
Barium	ug/L	20.6	19.9	12.2	15.5	21.5	19.8	16.8	15.9	15.4	16.3	15.8
Beryllium	ug/L	<1	<0.057	<0.057	<0.057	<0.057	<0.057	<0.057	<0.057	<0.155	<0.155	<0.155
Boron	ug/L	<80	<30.3	<30.3	<30.3	32.7 U*	<30.3	<30.3	<30.3	<30.3	42 J	35.6 U*
Cadmium	ug/L	<1	<0.125	0.125 J	0.215 J	0.247 J	0.164 J	<0.125	<0.125	<0.125	<0.125	<0.125
Calcium	ug/L	63,300	60,100	66,900	60,700	63,900	58,300	60,100	61,400	59,500	64,000	63,200 J
Chromium	ug/L	<2	<0.631	1.71 U*	0.947 U*	1.71 U*	1.58 U*	1.85 U*	1.83 U*	<1.53	<1.53	<1.53
Cobalt	ug/L	<0.5	0.078 J	0.103 J	0.176 J	0.154 J	0.114 J	0.119 J	<0.075	<0.075	<0.075	0.089 J
Copper	ug/L	<2	-	-	-	-	-	<1.3	<1.3	<0.627	<0.627	<0.627
Iron	ug/L	-	-	-	-	-	-	14.8 J	-	<14.1	-	<14.1
Lead	ug/L	<1	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.128	<0.128	<0.128
Lithium	ug/L	<5	4.74 U*	3.02 J	2.8 J	3.54 J	2.99 J	2.67 J	<2.56	4.77 U*	<3.14	3.58 J
Magnesium	ug/L	-	-	-	-	-	-	6,560	-	6,530	-	7,310 J
Manganese	ug/L	-	-	-	-	-	-	67.4	-	15.8	-	54
Mercury	ug/L	<0.200	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.101	<0.101	<0.101	<0.101
Molybdenum	ug/L	<5	5.06 U*	8.93	7.22	7.58	6.24	2.73 J	2.74 J	3.08 J	3.3 J	3.41 J
Nickel	ug/L	<1	-	-	-	-	-	0.407 J	<0.312	<0.312	1.22	<0.312
Potassium	ug/L	-	-	-	-	-	-	1,100	-	1,090	-	1,070 J
Selenium	ug/L	<5	<0.813	<0.813	<0.813	<0.813	<0.813	<0.813	<0.813	<2.62	<2.62	<2.62
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<1	-	-	-	-	-	-	<0.121	-	<0.121	-
Sodium	ug/L	-	-	-	-	-	-	1,930	-	1,940	-	2,030
Strontium	ug/L	-	-	-	-	-	-	90.6	-	103	-	98.5 J
Thallium	ug/L	<1	<0.063	0.83 J	1.13	1.02	0.941 J	0.16 J	0.148 J	<0.128	<0.128	0.13 J
Vanadium	ug/L	1.19	-	-	-	-	-	-	1.45 U*	-	0.945 J	-
Zinc	ug/L	<5	-	-	-	-	-	-	<2.42	-	<3.22	-
Radiological Parameters												
Radium-226	pCi/L	0.0417 +/-(0.0489)U	-	-	-	-	-	0.199 +/-(0.0934)	0.0333 +/-(0.0398)U	0.00938 +/-(0.0369)U	0.00517 +/-(0.0405)U	0.0671 +/-(0.0556)U
Radium-228	pCi/L	-0.0752 +/-(0.192)U	-	-	-	-	-	0.00853 +/-(0.187)U	0.129 +/-(0.238)U	0.306 +/-(0.225)U	0.455 +/-(0.279)	0.0861 +/-(0.447)U
Radium-226+228	pCi/L	-	0.281 +/-(0.319)U	0.210 +/-(0.267)U	0.280 +/-(0.208)U*	0.531 +/-(0.223)U*	0.369 +/-(0.222)U*	0.207 +/-(0.209)J	-	0.316 +/-(0.228)U	-	0.153 +/-(0.450)U
Anions												
Chloride	mg/L	1.53	1.28	0.978 J	0.819 J	1.42	1.52	1.30	1.42	1.31	1.43	1.41
Fluoride	mg/L	0.178	0.222	0.184	0.164	0.178	0.161	0.201	0.201	0.201	0.175	0.167
Sulfate	mg/L	17.2	15.6	12.5 J	11.9	16.8	17.3	17.1	15.9	17.7	17.0	17.4
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	210	-	176	-	175
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	<5.00	-	<5.00	-	<5.00
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	212	219	223	218	229	211	207	198	197	185	214

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-202										
Sample Date		30-Jul-19	8-Oct-19	28-Jan-20	10-Mar-20	9-Apr-20	28-Jul-20	9-Sep-20	6-Oct-20	19-Jan-21	2-Mar-21	14-Apr-21
Sample ID		CUF-GW-012-07302019	CUF-GW-012-10082019	CUF-GW-012-01282020	CUF-GW-012-03102020	CUF-202-0420	CUF-GW-012-07282020	CUF-GW-012-09092020	CUF-202-1020	CUF-GW-CUF-202-01192021	CUF-GW-CUF-202-03022021	CUF-GW-202-04142021
Parent Sample ID												
Sample Depth		18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance
Total Metals												
Aluminum	ug/L	<12.5	<12.5	<12.5	<12.5	-	<12.5	<12.5	-	<12.5	<12.5	-
Antimony	ug/L	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	0.420 J	<0.378	<0.378	<0.378
Arsenic	ug/L	<0.323	0.345 J	<0.313	<0.313	<0.313	<0.313	<0.313	<0.313	<0.313	0.469 J	<0.313
Barium	ug/L	20.6	29.3	14.8	15.9	15.1	6.95 J	13.8	14.2	10.4	13.5	12.0
Beryllium	ug/L	<0.182	<0.182	<0.182	<0.182	0.182 UJ	<0.182	<0.182	<0.182	<0.182	0.216 J	<0.182
Boron	ug/L	<38.6	52.2 U*	<38.6	<38.6	<38.6	<38.6	78.0 J	48.6 U*	63.5 U*	61.8 U*	<38.6
Cadmium	ug/L	0.131 J	0.172 J	<0.217	<0.217	<0.217	<0.217	0.236 J	<0.217	<0.217	<0.217	<0.217
Calcium	ug/L	60,800	64,800	63,500	62,700	62,700	60,700	62,500	64,600	63,500	64,900	63,800
Chromium	ug/L	1.96 U*	1.90 U*	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	0.307 J	0.232 J	<0.134	<0.134	<0.134	<0.134	0.253 J	0.154 J	<0.134	0.183 J	<0.134
Copper	ug/L	<0.627	1.57 J	<0.627	<0.627	<0.627	<0.627	<0.627	19.9	<0.627	1.50 J	<0.627
Iron	ug/L	<19.5	<19.5	<19.5	<19.5	-	<19.5	<19.5	-	<19.5	<19.5	-
Lead	ug/L	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	0.145 J	<0.128
Lithium	ug/L	4.16 U*	<3.39	<3.39	<3.39	3.39 UJ	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39
Magnesium	ug/L	7,470	7,420	7,200	6,860	-	7,380	6,890	-	6,750	6,820	-
Manganese	ug/L	1,510	1,540	54.8	40.7	-	1,440	1,830	-	13.8	4.71 J	-
Mercury	ug/L	<0.101	<0.101	0.101 UJ	<0.101	<0.101	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130
Molybdenum	ug/L	6.38	6.55	2.71 J	2.80 J	2.61 J	7.67	7.02	5.68	2.73 J	2.87 J	2.81 J
Nickel	ug/L	1.03 U*	0.898 J	<0.336	<0.336	<0.336	0.876 J	0.871 J	1.23	<0.336	0.457 J	<0.336
Potassium	ug/L	1,120	1,210	1,110	975	-	1,100	1,130	-	1,090	1,070	-
Selenium	ug/L	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	1,960	2,140	2,040	1,890	-	1,960	1,870	-	1,920	2,210	-
Strontium	ug/L	108	115	109	105	-	116	118	-	109	111	-
Thallium	ug/L	0.978 J	1.21	<0.148	0.172 J	<0.148	0.672 J	1.10 U*	0.945 U*	0.361 J	0.519 J	0.158 J
Vanadium	ug/L	<0.991	1.24 U*	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991
Zinc	ug/L	4.14 J	4.61 U*	<3.22	<3.22	<3.22	3.55 U*	<3.22	<3.22	<3.22	<3.22	<3.22
Radiological Parameters												
Radium-226	pCi/L	0.0452 +/-(0.378)U	0.0774 +/-(0.370)U	0.301 +/-(0.303)U	0.263 +/-(0.506)U	-0.0532 +/-(0.421)U	-0.256 +/-(0.373)U	-0.0668 +/-(0.291)U	0.0975 +/-(0.474)U	0.00644 +/-(0.264)U	0.194 +/-(0.513)U	0.136 +/-(0.440)U
Radium-228	pCi/L	-0.16 +/-(0.205)U	0.0379 +/-(0.244)U	0.0128 +/-(0.423)U	-0.0440 +/-(0.331)U	0.114 +/-(0.393)U	0.290 +/-(0.380)U	-0.288 +/-(0.248)U	-0.128 +/-(0.448)U	0.548 +/-(0.618)U	0.0865 +/-(0.258)U	-0.0960 +/-(0.302)U
Radium-226+228	pCi/L	0.0452 +/-(0.430)U	0.115 +/-(0.444)U	0.313 +/-(0.520)U	0.263 +/-(0.604)U	0.114 +/-(0.576)U	0.290 +/-(0.533)U	0.000 +/-(0.383)U	0.0975 +/-(0.653)U	0.555 +/-(0.672)U	0.281 +/-(0.575)U	0.136 +/-(0.534)U
Anions												
Chloride	mg/L	1.43	1.39	1.38	1.37	1.28	1.43	1.36	1.40	1.87	1.39	1.39
Fluoride	mg/L	0.150	0.137	0.181	0.118	0.188	0.125 J	0.164	0.170	0.223 U*	0.157	0.143
Sulfate	mg/L	17.1	16.8	16.5	17.3	16.0	17.1	17.0	16.6	19.0 J	18.4	17.8
General Chemistry												
Alkalinity, Bicarbonate	mg/L	179	181	168	160	-	172	177	-	177	173	-
Alkalinity, Carbonate	mg/L	<5.00	<5.00	<5.00	<5.00	-	<5.00	<5.00	-	<5.00	<5.00	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	191	206	210	219	216	200	219	201	203	194 J	205

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-202							
Sample Date		15-Jul-21	17-Aug-21	14-Oct-21	18-Jan-22	2-Mar-22	14-Apr-22	12-Jul-22	23-Aug-22
Sample ID		CUF-GW-CUF-202-07152021	CUF-GW-CUF-202-08172021	CUF-GW-CUF-202-10142021	CUF-GW-CUF-202-01182022	CUF-GW-CUF-202-03022022	CUF-GW-CUF-202-04142022	CUF-GW-CUF-202-07122022	CUF-GW-CUF-202-08232022
Parent Sample ID									
Sample Depth		18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program
Total Metals									
Aluminum	ug/L	<12.5	<12.5	-	<12.5	<15.5	-	<15.5	<15.5
Antimony	ug/L	<0.378	<0.378	0.406 J	0.412 J	<0.506	<0.506	<0.506	<0.506
Arsenic	ug/L	0.319 J	<0.313	<0.313	<0.313	<0.282	<0.282	<0.282	<0.282
Barium	ug/L	7.78 J	6.95 J	11.1	8.92 J	9.29 J	10.0	5.23 J	5.79 J
Beryllium	ug/L	0.200 J	<0.182	<0.182	0.186 J	<0.274	<0.274	<0.274	<0.274
Boron	ug/L	<38.6	<38.6	50.4 J	61.3 U*	<60.1	<60.1	<60.1	75.1 J
Cadmium	ug/L	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217
Calcium	ug/L	62,700	58,600	64,900	59,100	60,000	63,000	64,600	60,800
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	0.260 J	<0.134	<0.134	<0.134	<0.261	<0.261	<0.261	<0.261
Copper	ug/L	<0.627	<0.627	<0.627	<0.627	<1.14	<1.14	<1.14	<1.14
Iron	ug/L	43.4 J	<19.5	-	<19.5	28.3 J	-	<27.7	<27.7
Lead	ug/L	0.134 J	<0.128	<0.128	<0.128	<0.167	<0.167	<0.167	<0.167
Lithium	ug/L	<3.39	<3.39	<3.39	<3.39	1.80 J	1.63 J	1.84 J	1.98 J
Magnesium	ug/L	6,790	7,110	-	7,080	6,790	-	7,210	7,110
Manganese	ug/L	1,180	1,400	-	10.0	8.14	-	428	1,270
Mercury	ug/L	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130
Molybdenum	ug/L	7.99	6.38	5.10	2.90 J	2.65 J	2.56 J	9.66	6.06
Nickel	ug/L	1.23	0.909 J	0.345 J	<0.336	<0.517	<0.517	0.869 J	1.86 U*
Potassium	ug/L	1,090	1,150	-	1,020	1,050	-	1,130	1,170
Selenium	ug/L	<1.51	<1.51	<1.51	<1.51	<0.739	<0.739	<0.739	<0.739
Silicon	ug/L	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.177	<0.177	<0.223	<0.223	<0.223	<0.223
Sodium	ug/L	1,880	1,880	-	1,980	1,900	-	1,980	2,020
Strontium	ug/L	117	114	-	108	111	-	105	109 J
Thallium	ug/L	1.06 U*	0.692 J	0.689 U*	0.334 J	<0.472	<0.472	0.549 J	0.606 J
Vanadium	ug/L	<0.991	<0.991	<0.991	<0.991	<0.776	<0.776	<0.776	<0.776
Zinc	ug/L	4.09 J	<3.22	<3.22	<3.22	<2.88	<2.88	4.70 J	<2.88
Radiological Parameters									
Radium-226	pCi/L	-0.203 +/-(0.177)U	-0.0399 +/-(0.404)U	0.291 +/-(0.502)U	0.125 +/-(0.326)U	0.142 +/-(0.414)U	0.00233 +/-(0.211)U	0.221 +/-(0.425)U	-0.149 +/-(0.355)U
Radium-228	pCi/L	0.0257 +/-(0.341)U	0.135 +/-(0.265)U	0.0947 +/-(0.448)U	0.0729 +/-(0.290)U	0.867 +/-(0.556)	0.0207 +/-(0.265)U	1.14 +/-(0.530)U*	0.529 +/-(0.492)U
Radium-226+228	pCi/L	0.0257 +/-(0.384)U	0.135 +/-(0.483)U	0.386 +/-(0.673)U	0.197 +/-(0.436)U	1.01 +/-(0.693)J	0.0231 +/-(0.338)U	1.36 +/-(0.679)U*	0.529 +/-(0.607)U
Anions									
Chloride	mg/L	1.57	1.67	1.51 J	1.47	1.41	1.43	1.48	1.44
Fluoride	mg/L	0.156 U*	0.208	0.188	0.152	0.193	0.189 U*	0.149	0.215 U*
Sulfate	mg/L	19.5	19.5	18.0	19.0	21.7	20.6	20.0	19.4
General Chemistry									
Alkalinity, Bicarbonate	mg/L	181	185	-	169	159	-	177	172 J
Alkalinity, Carbonate	mg/L	<5.00	<5.00	-	<5.00	<5.00	-	<5.00	5.00 UJ
pH (lab)	SU	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	208	212	220	212	212	209	202	232

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-205										
Sample Date		9-Nov-16	26-Jan-17	8-Feb-17	8-Mar-17	4-Apr-17	3-May-17	31-May-17	11-Jul-17	26-Jul-17	17-Aug-17	30-Aug-17
Sample ID		CUF-GW-014-11092016	CUF-GW-014-01262017	CUF-GW-014-02082017	CUF-GW-014-03082017	CUF-GW-014-04042017	CUF-GW-014-05032017	CUF-GW-014-05312017	CUF-GW-014-07112017	CUF-GW-014-07262017	CUF-GW-014-08172017	CUF-GW-014-08302017
Parent Sample ID												
Sample Depth		25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	0.509 U*	<0.443	0.514 U*	0.868 U*	<0.443	0.452 J	0.45 J	<0.443	<0.443	<0.443	1.29 U*
Arsenic	ug/L	0.398 J	0.659 J	0.248 J	0.468 J	0.305 J	0.558 J	0.738 U*	0.35 J	0.29 J	0.514 U*	0.67 U*
Barium	ug/L	80	76.5	66.7	76.7	79	76.3	74.5	85.2	70.8	85.5	78.7
Beryllium	ug/L	<0.102	0.131 UJ	0.131 UJ	<0.131	<0.131	<0.131	<0.131	<0.131	<0.131	<0.131	<0.131
Boron	ug/L	142	178 U*	213 J	158	213	153	135	139 J	124	149 U*	151
Cadmium	ug/L	0.183 J	0.168 J	0.183 J	0.181 J	<0.0781	0.085 U*	0.354 J	0.215 J	0.226 J	0.223 J	0.211 J
Calcium	ug/L	138,000	125,000 J	122,000 J	132,000	155,000	140,000	127,000	134,000	140,000	135,000	137,000
Chromium	ug/L	<0.339	0.378 UJ	0.378 UJ	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	0.426 U*
Cobalt	ug/L	0.968	0.373 U*	0.524 U*	0.458 J	0.337 J	0.246 U*	0.468 J	0.573	0.561	0.633	0.568
Copper	ug/L	-	-	-	-	-	-	-	-	-	-	-
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<0.0675	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	0.379 J	<0.318
Lithium	ug/L	2 U*	2.78 U*	2.12 UJ	3.01 U*	<2.12	2.47 U*	<2.12	<2.12	<2.12	<2.12	3.41 U*
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.0521	<0.0521	0.0521 UJ	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653
Molybdenum	ug/L	1.08 J	0.953 J	0.844 U*	0.862 J	0.795 J	0.735 J	0.828 J	0.938 J	1.04 J	0.882 J	0.999 J
Nickel	ug/L	-	-	-	-	-	-	-	-	-	-	-
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<0.348	<1.27	1.27 UJ	<1.27	<1.27	<1.27	<1.27	1.27 UJ	<1.27	<1.27	<1.27
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	-	-	-	-	-	-	-	-	-	-
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<0.036	<0.0531	<0.0531	<0.0531	<0.0531	<0.0531	<0.0531	<0.0531	<0.0531	<0.0531	<0.0531
Vanadium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Zinc	ug/L	-	-	-	-	-	-	-	-	-	-	-
Radiological Parameters												
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	0.618 +/-(0.35)J	+/-(0.40)U	0.551 +/-(0.53)J	+/-(0.41)U	+/-(0.41)U	+/-(0.48)U	+/-(0.79)UR	+/-(0.57)U	0.905 +/-(0.45)U*	0.690 +/-(0.39)J	+/-(0.57)U
Anions												
Chloride	mg/L	3.69	5.87	5.72	4.25	6.36	6.16	5.80	6.25	6.18	6.33	6.43
Fluoride	mg/L	0.100	0.105 U*	0.131	0.106 U*	0.117	0.122	0.102	0.134	0.113	0.0983 J	0.116
Sulfate	mg/L	154	132	128	149	149	145	148	153	148	155	160
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	513	435	465	475	466	477	496	455	479	464	448

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-205											
Sample Date		3-Oct-17	30-May-18	30-May-18	19-Jun-18	19-Jun-18	11-Jul-18	1-Aug-18	1-Aug-18	21-Aug-18	5-Feb-19	8-May-19	30-Jul-19
Sample ID		CUF-GW-014-10032017	CUF-GW-014-05302018	CUF-GW-903-05302018	CUF-GW-014-06192018	CUF-GW-903-06192018	CUF-GW-014-07112018	CUF-GW-014-08012018	CUF-GW-903-08012018	CUF-GW-014-08212018	CUF-GW-014-02052019	CUF-GW-014-05082019	CUF-GW-014-07302019
Parent Sample ID				CUF-GW-014-05302018		CUF-GW-014-06192018			CUF-GW-014-08012018				
Sample Depth		25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals													
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	<12.5	<12.5	<12.5
Antimony	ug/L	-	<1.12	<1.12	<1.12	<1.12	<1.12	<1.12	<1.12	<1.12	<0.378	<0.378	<0.378
Arsenic	ug/L	-	0.386 J	0.524 J	0.639 U*	0.675 U*	0.57 J	0.667 J	0.619 J	0.617 J	0.402 J	0.41 J	0.376 J
Barium	ug/L	-	77.2	76.6	79.6	81.4	82.3	90.1	90.3	91	75.4	77.2	91.0
Beryllium	ug/L	-	0.057 U*	<0.057	<0.057	<0.057	<0.057	<0.057	<0.057	<0.057	<0.155	<0.155	<0.182
Boron	ug/L	152	158	156	137	146	130	146	144	122	147	174 U*	132
Cadmium	ug/L	-	0.224 J	0.139 J	0.317 J	0.34 J	0.212 J	0.211 J	0.217 J	0.222 J	<0.125	0.202 J	0.211 J
Calcium	ug/L	130,000	130,000	133,000	133,000	138,000	127,000	131,000	134,000	132,000	123,000	134,000 J	135,000
Chromium	ug/L	-	<0.631	<0.631	1.74 U*	1.77 U*	1.13 U*	1.41 U*	1.14 U*	1.52 U*	<1.53	<1.53	1.74 U*
Cobalt	ug/L	-	0.469 J	0.496 J	0.512	0.575	0.572	1.31	1.45	1.56	0.46 J	0.586	0.797
Copper	ug/L	-	-	-	-	-	-	-	-	-	<0.627	0.682 J	0.804 J
Iron	ug/L	-	-	-	-	-	-	-	-	-	<14.1	<14.1	<19.5
Lead	ug/L	-	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.128	<0.128	<0.128
Lithium	ug/L	-	3.82 U*	3.87 U*	<2.56	<2.56	<2.56	<2.56	<2.56	<2.56	3.49 U*	<3.14	<3.39
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	10,800	12,200 J	12,800
Manganese	ug/L	-	-	-	-	-	-	-	-	-	331	448	717
Mercury	ug/L	-	<0.0653	<0.0653	<0.0653	<0.0653	0.0653 UJ	<0.0653	<0.0653	<0.0653	<0.101	<0.101	<0.101
Molybdenum	ug/L	-	0.827 U*	0.996 J	0.956 J	1.03 J	0.955 J	1.07 J	1.17 J	1.22 J	0.844 J	0.773 J	0.704 J
Nickel	ug/L	-	-	-	-	-	-	-	-	-	4.17	5.37	8.16
Potassium	ug/L	-	-	-	-	-	-	-	-	-	2,580	2,650 J	2,560
Selenium	ug/L	-	<0.813	<0.813	<0.813	<0.813	<0.813	<0.813	<0.813	<0.813	<2.62	<2.62	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	-	-	-	-	-	-	-	-	-	-	<0.177
Sodium	ug/L	-	-	-	-	-	-	-	-	-	2,830	3,020	3,010
Strontium	ug/L	-	-	-	-	-	-	-	-	-	338	324 J	349
Thallium	ug/L	-	<0.063	<0.063	<0.063	<0.063	<0.063	<0.063	<0.063	<0.063	<0.128	<0.128	<0.148
Vanadium	ug/L	-	-	-	-	-	-	-	-	-	-	-	1.37
Zinc	ug/L	-	-	-	-	-	-	-	-	-	-	-	5.30
Radiological Parameters													
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	0.195 +/-(0.0803)	0.214 +/-(0.0852)	0.652 +/-(0.575)U
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-0.123 +/-(0.235)U	0.176 +/-(0.260)U	0.0968 +/-(0.323)U
Radium-226+228	pCi/L	-	0.337 +/-(0.281)J	0.451 +/-(0.260)J	0.558 +/-(0.310)U	0.305 +/-(0.272)J	0.414 +/-(0.234)U*	0.925 +/-(0.291)U*	0.474 +/-(0.228)U*	1.11 +/-(0.297)J	0.195 +/-(0.248)J	0.390 +/-(0.274)J	0.748 +/-(0.660)U
Anions													
Chloride	mg/L	6.33	5.13	5.11	3.59 J	5.46 J	4.03	5.62	5.61	5.75	4.33	4.38	4.67
Fluoride	mg/L	0.0857 J	0.122	0.122	0.119	0.122	0.0898 J	0.107	0.0999 J	0.0591 J	0.117	0.106	0.0848 U*
Sulfate	mg/L	156	152	151	135 J	162	155	163	162	168	150	155	168
General Chemistry													
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	222	233	221
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	<5.00	<5.00	<5.00
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	485	476	473	477	457	510	510	486	500	453	471	467

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-205										
Sample Date		8-Oct-19	28-Jan-20	11-Mar-20	29-Jul-20	10-Sep-20	20-Jan-21	4-Mar-21	20-Jul-21	18-Aug-21	26-Jan-22	8-Mar-22
Sample ID		CUF-GW-014-10082019	CUF-GW-014-01282020	CUF-GW-014-03112020	CUF-GW-014-07292020	CUF-GW-014-09102020	CUF-GW-CUF-205-01202021	CUF-GW-CUF-205-03042021	CUF-GW-CUF-205-07202021	CUF-GW-CUF-205-08182021	CUF-GW-CUF-205-01262022	CUF-GW-CUF-205-03082022
Parent Sample ID												
Sample Depth		25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	<12.5	<12.5	<12.5	<12.5	<12.5	<12.5	<12.5	<12.5	<12.5	<12.5	<15.5
Antimony	ug/L	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.506
Arsenic	ug/L	0.806 J	0.408 J	0.520 J	0.372 J	<0.313	0.434 J	0.380 J	<0.313	<0.313	<0.313	0.463 J
Barium	ug/L	94.5	81.5	83.4	83.6	93.6	98.1	91.3	96.3	96.8	57.5	62.4
Beryllium	ug/L	0.257 U*	<0.182	0.378 U*	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.274
Boron	ug/L	154	121	159 U*	145 U*	150 U*	153 U*	171 U*	177 U*	171 U*	149	120
Cadmium	ug/L	0.302 J	0.218 J	<0.217	<0.217	<0.217	0.218 J	<0.217	0.258 J	0.218 J	<0.217	0.268 J
Calcium	ug/L	141,000	133,000	135,000	140,000	146,000	158,000	148,000	154,000	144,000	120,000	106,000
Chromium	ug/L	2.20 U*	<1.53	<1.53	1.55 J	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	0.736	0.708	0.363 J	0.527	0.443 J	0.960	0.247 J	0.572	0.689	0.470 J	1.78
Copper	ug/L	0.970 J	<0.627	0.684 J	0.720 J	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627	<1.14
Iron	ug/L	<19.5	<19.5	<19.5	<19.5	<19.5	<19.5	<19.5	<19.5	30.7 J	<19.5	<27.7
Lead	ug/L	<0.128	<0.128	0.171 U*	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.167
Lithium	ug/L	3.69 J	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	1.22 J
Magnesium	ug/L	12,400	11,700	11,600	12,100	12,400	13,200	11,800	12,600	13,400	9,960	8,580
Manganese	ug/L	632	622	204	541	527	912	238	515	516	337	1,390
Mercury	ug/L	<0.101	0.101 UJ	0.101 UJ	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130
Molybdenum	ug/L	0.958 J	1.06 J	0.886 J	0.896 J	0.849 J	1.08 J	<0.610	0.691 J	<0.610	1.23 J	1.35 J
Nickel	ug/L	5.98	5.81	3.26	6.88	6.71	8.30	3.74	7.45	7.31	2.99	12.0
Potassium	ug/L	2,760	2,620	2,400	2,640	2,530	2,900	2,770	2,620	2,780	2,750	2,870
Selenium	ug/L	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<0.739
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.223
Sodium	ug/L	3,410	2,990	2,930	2,900	2,860	3,100	3,060	3,080	3,100	3,060	2,860
Strontium	ug/L	377	342	347	377	418	408	504	414	397	379	482
Thallium	ug/L	0.291 U*	0.156 J	0.273 J	<0.148	<0.148	<0.148	<0.148	0.167 J	<0.148	<0.148	<0.472
Vanadium	ug/L	1.85 U*	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.776
Zinc	ug/L	5.85 U*	3.46 J	7.54 U*	4.55 U*	4.03 U*	3.92 J	<3.22	4.29 J	6.87	<3.22	4.95 U*
Radiological Parameters												
Radium-226	pCi/L	0.537 +/-(0.444)U	0.291 +/-(0.274)U	0.368 +/-(0.502)U	0.513 +/-(0.475)U	0.285 +/-(0.392)U	0.582 +/-(0.593)U	0.575 +/-(0.625)U	0.664 +/-(0.409)	1.01 +/-(0.722)	0.0662 +/-(0.222)U	1.19 +/-(0.714)
Radium-228	pCi/L	-0.178 +/-(0.264)U	0.180 +/-(0.475)U	0.730 +/-(0.443)	0.0857 +/-(0.215)U	0.147 +/-(0.254)U	0.294 +/-(0.330)U	0.244 +/-(0.474)U	0.0345 +/-(0.325)U	-0.201 +/-(0.477)U	0.192 +/-(0.302)U	0.0953 +/-(0.333)U
Radium-226+228	pCi/L	0.537 +/-(0.517)U	0.471 +/-(0.548)U	1.10 +/-(0.670)J	0.598 +/-(0.521)U	0.432 +/-(0.468)U	0.876 +/-(0.678)U	0.819 +/-(0.785)U	0.699 +/-(0.522)J	1.01 +/-(0.866)J	0.258 +/-(0.375)U	1.28 +/-(0.788)J
Anions												
Chloride	mg/L	4.49	4.23	3.95	4.45	4.10	4.78	6.11	6.98	6.45	4.52	5.11
Fluoride	mg/L	0.0746 J	0.107	0.184	0.0636 J	0.0860 J	0.124 U*	0.0862 J	0.120 U*	0.0767 J	0.133	0.128 U*
Sulfate	mg/L	168	160	162	180	179 J	236 J	184	308	214	129	150
General Chemistry												
Alkalinity, Bicarbonate	mg/L	226	210	213	214	207	225	187	222	220	198	171
Alkalinity, Carbonate	mg/L	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	457	482	503	535	508	559	483	578	577	400	374

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-206										
Sample Date		9-Nov-16	26-Jan-17	8-Feb-17	9-Mar-17	5-Apr-17	4-May-17	1-Jun-17	13-Jul-17	28-Jul-17	18-Aug-17	31-Aug-17
Sample ID		CUF-GW-015-11092016	CUF-GW-015-01262017	CUF-GW-015-02082017	CUF-GW-015-03092017	CUF-GW-015-04052017	CUF-GW-015-05042017	CUF-GW-015-06012017	CUF-GW-015-07132017	CUF-GW-015-07282017	CUF-GW-015-08182017	CUF-GW-015-08312017
Parent Sample ID												
Sample Depth		77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	0.249 U*	<0.443	0.525 U*	2.97 U*	<0.443	<0.443	<0.443	<0.443	<0.443	<0.443	0.562 U*
Arsenic	ug/L	10.2	10.2	10.4 J	10	10.3	10	9.62	9.96	10.5	9.94	10.4
Barium	ug/L	91.6	98.4	82.1	90.8	91.8	95.4	89.1	93.4	83.7	97.6	87.4
Beryllium	ug/L	<0.102	0.131 UJ	0.131 UJ	<0.131	0.524 J	<0.131	<0.131	<0.131	<0.131	<0.131	<0.131
Boron	ug/L	21,000	24,700 J	21,100	21,000	24,200	19,000	19,400	19,500	18,500	21,600	21,200
Cadmium	ug/L	<0.152	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781
Calcium	ug/L	581,000	579,000 J	579,000 J	593,000	699,000	622,000	564,000	578,000	591,000	538,000	576,000
Chromium	ug/L	<0.339	0.58 J	0.378 UJ	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	0.381 U*	0.527 U*
Cobalt	ug/L	0.464 J	0.56 J	0.457 U*	0.471 J	0.453 J	0.469 U*	0.546	0.508	0.594	0.55	0.56
Copper	ug/L	-	-	-	-	-	-	-	-	-	-	-
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<0.0675	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318
Lithium	ug/L	1.99 U*	2.55 U*	2.12 UJ	<2.12	2.42 U*	<2.12	<2.12	<2.12	<2.12	<2.12	2.24 U*
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.0521	<0.0521	0.0521 UJ	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653
Molybdenum	ug/L	<0.873	0.907 J	0.633 U*	0.669 J	1.29 J	1.43 J	0.856 J	0.802 J	0.742 J	0.805 J	0.812 J
Nickel	ug/L	-	-	-	-	-	-	-	-	-	-	-
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	0.961 U*	<1.27	1.27 UJ	<1.27	<1.27	<1.27	<1.27	<1.27	<1.27	<1.27	<1.27
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	-	-	-	-	-	-	-	-	-	-
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<0.036	<0.0531	<0.0531	<0.0531	<0.0531	0.057 U*	0.164 J	<0.0531	<0.0531	<0.0531	<0.0531
Vanadium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Zinc	ug/L	-	-	-	-	-	-	-	-	-	-	-
Radiological Parameters												
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	1.81 +/-(0.47)	1.83 +/-(0.56)	1.78 +/-(0.59)J	1.59 +/-(0.56)J	1.49 +/-(0.72)J	1.50 +/-(0.65)J	1.08 +/-(0.65)U*	1.51 +/-(0.65)J	1.42 +/-(0.65)J	1.21 +/-(0.77)J	1.14 +/-(0.61)J
Anions												
Chloride	mg/L	647	623	645	578	677	643	641	668	669	635	703
Fluoride	mg/L	<0.121	0.0789 U*	<0.0733	<0.147	<0.0733	<0.0733	<0.0733	0.104 J	0.0734 J	0.0662 J	0.0699 J
Sulfate	mg/L	942	993	1,030	977	1,090	1,020	1,060	1,070	1,040	978	1,080
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	3,190	2,640	2,840	2,750	2,900	2,840	3,210	2,940	2,840	2,820	2,980

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-206											
Sample Date		4-Oct-17	29-May-18	20-Jun-18	11-Jul-18	11-Jul-18	1-Aug-18	21-Aug-18	5-Feb-19	5-Feb-19	8-May-19	8-May-19	30-Jul-19
Sample ID		CUF-GW-015-10042017	CUF-GW-015-05292018	CUF-GW-015-06202018	CUF-GW-015-07112018	CUF-GW-903-07112018	CUF-GW-015-08012018	CUF-GW-015-08212018	CUF-GW-015-02052019	CUF-GW-903-02052019	CUF-GW-015-05082019	CUF-GW-903-05082019	CUF-GW-015-07302019
Parent Sample ID						CUF-GW-015-07112018				CUF-GW-015-02052019		CUF-GW-015-05082019	
Sample Depth		77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals													
Aluminum	ug/L	-	-	-	-	-	-	-	48.9	48.1	20.2 J	22.6 J	16.4 J
Antimony	ug/L	-	<1.12	<1.12	<1.12	<1.12	<1.12	<1.12	<0.378	<0.378	<0.378	<0.378	<0.378
Arsenic	ug/L	-	9.93	10.4	13.1	11.7	12.1	9.65	12.8	13	12	12.2	11.7
Barium	ug/L	-	98.5	101	103	93.6	98.3	93.1	87.7	87.4	86.7	92.8	105
Beryllium	ug/L	-	<0.057	<0.057	<0.057	<0.057	<0.057	<0.057	<0.155	<0.155	<0.155	<0.155	0.189 J
Boron	ug/L	20,400	20,600	21,400	19,600	19,400	20,200	12,500	19,800	20,800	18,500	19,600	21,400
Cadmium	ug/L	-	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
Calcium	ug/L	566,000	551,000	592,000	566,000	526,000	548,000	530,000	495,000	502,000	512,000 J	529,000 J	539,000
Chromium	ug/L	-	<0.631	1.66 U*	1.47 U*	1.22 U*	1.45 U*	2.1 U*	<1.53	<1.53	<1.53	<1.53	1.59 U*
Cobalt	ug/L	-	0.493 J	0.644	0.614	0.562	0.647	0.59	0.633	0.667	0.776	0.839	0.899
Copper	ug/L	-	-	-	-	-	-	-	<0.627	<0.627	<0.627	<0.627	1.05 J
Iron	ug/L	-	-	-	-	-	-	-	100,000	102,000	109,000	113,000	105,000
Lead	ug/L	-	<0.094	<0.094	<0.094	<0.094	<0.094	<0.094	<0.128	<0.128	<0.128	<0.128	<0.128
Lithium	ug/L	-	<2.56	<2.56	2.57 J	<2.56	<2.56	7.19	3.66 U*	3.87 U*	<3.14	<3.14	<3.39
Magnesium	ug/L	-	-	-	-	-	-	-	76,200	77,700	83,000 J	85,800 J	96,500
Manganese	ug/L	-	-	-	-	-	-	-	15,600	15,800	15,600	16,200	18,300
Mercury	ug/L	-	<0.0653	<0.0653	0.0653 UJ	0.0653 UJ	<0.0653	<0.0653	<0.101	<0.101	<0.101	<0.101	<0.101
Molybdenum	ug/L	-	0.951 U*	0.787 J	0.786 J	0.792 J	0.796 J	0.797 J	0.91 J	0.927 J	0.914 J	0.865 J	0.838 J
Nickel	ug/L	-	-	-	-	-	-	-	0.719 J	0.834 J	0.828 J	0.841 J	1.03 U*
Potassium	ug/L	-	-	-	-	-	-	-	4,010	4,070	4,110 J	4,230 J	4,250
Selenium	ug/L	-	<0.813	<0.813	<0.813	<0.813	<0.813	<0.813	<2.62	<2.62	<2.62	<2.62	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	-	-	-	-	-	-	-	-	-	-	<0.177
Sodium	ug/L	-	-	-	-	-	-	-	26,600	27,500	28,100	29,000	31,600
Strontium	ug/L	-	-	-	-	-	-	-	1,380	1,390	1,280 J	1,310 J	1,450
Thallium	ug/L	-	<0.063	<0.063	<0.063	<0.063	<0.063	<0.063	<0.128	<0.128	<0.128	<0.128	0.149 J
Vanadium	ug/L	-	-	-	-	-	-	-	-	-	-	-	<0.991
Zinc	ug/L	-	-	-	-	-	-	-	-	-	-	-	6.33
Radiological Parameters													
Radium-226	pCi/L	-	-	-	-	-	-	-	0.729 +/-(0.163)	0.619 +/-(0.149)	0.597 +/-(0.151)J	0.390 +/-(0.128)J	0.462 +/-(0.482)U
Radium-228	pCi/L	-	-	-	-	-	-	-	0.674 +/-(0.296)	0.659 +/-(0.309)	0.481 +/-(0.319)U	0.858 +/-(0.359)	0.826 +/-(0.499)
Radium-226+228	pCi/L	-	1.41 +/-(0.375)J	1.18 +/-(0.369)J	0.927 +/-(0.254)J	1.14 +/-(0.269)	1.49 +/-(0.313)J	1.71 +/-(0.303)	1.40 +/-(0.338)	1.28 +/-(0.343)	1.08 +/-(0.353)J	1.25 +/-(0.381)J	1.29 +/-(0.694)J
Anions													
Chloride	mg/L	697	663	557	480	517	659	640	617	614	593	623	589
Fluoride	mg/L	<0.132	<0.0658	<0.132	<0.132	<0.132	<0.0658	<0.0658	<0.0658	<0.0658	0.109 J	0.100 J	0.117 U*
Sulfate	mg/L	887	1,060	888	765	816	1,030	1,040	958	954	922	978	908
General Chemistry													
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	82.8	101	93.5	85.6	129
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	<5.00	<5.00	<5.00	<5.00	<5.00
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	2,870	2,800	2,850	2,900	2,810	3,240	3,010	2,510	2,560	2,830	2,950	2,880

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-206										
Sample Date		8-Oct-19	29-Jan-20	29-Jan-20	11-Mar-20	29-Jul-20	11-Sep-20	19-Jan-21	4-Mar-21	8-Jun-21	25-Aug-21	24-Jan-22
Sample ID		CUF-GW-015-10082019	CUF-GW-015-01292020	CUF-GW-903B-01292020	CUF-GW-015-03112020	CUF-GW-015-07292020	CUF-GW-015-09112020	CUF-GW-CUF-206-01192021	CUF-GW-CUF-206-03042021	CUF-GW-CUF-206-06082021	CUF-GW-CUF-206-08252021	CUF-GW-CUF-206-01242022
Parent Sample ID				CUF-GW-015-01292020								
Sample Depth		77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	14.3 J	18.7 J	18.4 J	22.3 J	23.0 J	26.8 J	12.9 U*	<12.5	<12.5	<12.5	26.2 J
Antimony	ug/L	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378
Arsenic	ug/L	9.27	14.5	13.7	14.0	10.4	12.4	13.0	10.3	10.5	23.9	17.6
Barium	ug/L	96.4	94.1	93.4	103	94.9	99.6	93.0	178	168	46.5	53.7
Beryllium	ug/L	<0.182	<0.182	<0.182	0.352 U*	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182
Boron	ug/L	19,600	19,200	17,900	18,700	22,100	20,900	20,800	11,400	10,400	15,500	8,650
Cadmium	ug/L	<0.125	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217
Calcium	ug/L	569,000	597,000	564,000	562,000	579,000	588,000	577,000	382,000	369,000	493,000	338,000
Chromium	ug/L	1.85 U*	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	0.761	0.472 J	0.409 J	0.600	0.342 J	0.402 J	0.358 J	0.150 J	0.252 J	6.00	2.80
Copper	ug/L	0.666 J	<0.627	<0.627	<0.627	1.91 J	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627
Iron	ug/L	103,000	105,000	102,000	111,000	103,000	107,000	107,000	99,700	98,000	62,600	48,000
Lead	ug/L	<0.128	<0.128	<0.128	0.229 U*	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128
Lithium	ug/L	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39
Magnesium	ug/L	97,000	85,800	81,400	82,100	89,300	88,200	82,500	46,000	44,000	65,200	38,100
Manganese	ug/L	20,600	16,800	15,900	17,400	18,900	19,500	16,700	11,300	10,300	15,400	9,290
Mercury	ug/L	<0.101	<0.101	<0.101	0.101 UJ	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130
Molybdenum	ug/L	0.769 J	0.917 J	0.960 J	1.19 J	0.857 J	0.916 J	0.906 J	0.826 J	0.896 J	0.798 J	0.905 J
Nickel	ug/L	0.540 J	<0.336	<0.336	0.586 J	<0.336	0.464 J	<0.336	<0.336	<0.336	25.2	13.0
Potassium	ug/L	4,370	4,210	3,990	3,710	4,090	4,050	4,160	2,680	2,650	3,470	2,680
Selenium	ug/L	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	32,100	31,400	29,700	31,300	31,000	30,200	29,800	25,100	23,100	26,600	17,500
Strontium	ug/L	1,560	1,460	1,410	1,390	1,520	1,580	1,470	1,030	1,010	1,250	849
Thallium	ug/L	<0.148	<0.148	<0.148	0.451 J	<0.148	<0.148	<0.148	<0.148	0.536 J	<0.148	<0.148
Vanadium	ug/L	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991
Zinc	ug/L	3.98 U*	<3.22	<3.22	<3.22	<3.22	3.25 U*	<3.22	<3.22	<3.22	3.72 J	<3.22
Radiological Parameters												
Radium-226	pCi/L	0.493 +/-(0.327)	0.550 +/-(0.424)U	1.31 +/-(0.686)	1.92 +/-(0.817)	1.87 +/-(0.854)	0.834 +/-(0.464)	1.01 +/-(0.578)	0.835 +/-(0.649)U	0.138 +/-(0.409)U	0.995 +/-(0.731)	0.953 +/-(0.510)
Radium-228	pCi/L	0.578 +/-(0.381)	0.647 +/-(0.551)U	0.557 +/-(0.554)U	0.725 +/-(0.432)	1.33 +/-(0.665)	0.534 +/-(0.491)U	0.399 +/-(0.350)U	0.387 +/-(0.363)U	-0.0437 +/-(0.349)U	0.439 +/-(0.421)U	0.819 +/-(0.440)
Radium-226+228	pCi/L	1.07 +/-(0.502)	1.20 +/-(0.695)U	1.87 +/-(0.882)J	2.65 +/-(0.925)	3.20 +/-(1.08)	1.37 +/-(0.676)J	1.41 +/-(0.675)J	1.22 +/-(0.744)U	0.138 +/-(0.538)U	1.43 +/-(0.844)J	1.77 +/-(0.674)
Anions												
Chloride	mg/L	636	615	602	631	601	633	821	387	369	479	322
Fluoride	mg/L	0.114 J	<0.0658	<0.0658	0.378	0.0658 UJ	<0.0658	0.135 U*	<0.0650	<0.0650	0.109 J	0.0800 J
Sulfate	mg/L	1,020	910	889	978	887	934 J	1,400 J	525	511	767	503
General Chemistry												
Alkalinity, Bicarbonate	mg/L	140	141	144	69.8	178	161	82.0	138	131	115	159
Alkalinity, Carbonate	mg/L	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	2,810	2,670	2,470	2,590	2,540	2,270	2,430	1,550	1,600	2,230	1,400

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-206			CUF-207							
Sample Date		9-Mar-22	15-Jul-22	31-Aug-22	8-Nov-16	26-Jan-17	8-Feb-17	9-Mar-17	5-Apr-17	4-May-17	1-Jun-17	13-Jul-17
Sample ID		CUF-GW-CUF-206-03092022	CUF-GW-CUF-206-07152022	CUF-GW-CUF-206-08312022	CUF-GW-016-11082016	CUF-GW-016-01262017	CUF-GW-016-02082017	CUF-GW-016-03092017	CUF-GW-016-04052017	CUF-GW-016-05042017	CUF-GW-016-06012017	CUF-GW-016-07132017
Parent Sample ID												
Sample Depth		77.2 ft	77.2 ft	77.2 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	<15.5	<15.5	<15.5	-	-	-	-	-	-	-	-
Antimony	ug/L	<0.506	<0.506	<0.506	0.185 U*	0.46 U*	0.671 U*	2.39 U*	<0.443	<0.443	<0.443	<0.443
Arsenic	ug/L	17.3	14.2	13.5	0.783 J	1.51	0.877 J	1.03 U*	0.849 J	1.44	1.45	0.736 J
Barium	ug/L	65.3	83.8	70.1	50.6	55.6	44.4	49.8	52.2	52.9	53.6	55.2
Beryllium	ug/L	<0.274	<0.274	<0.274	<0.102	0.131 UJ	0.131 UJ	<0.131	0.698 J	<0.131	<0.131	<0.131
Boron	ug/L	7,710	5,230	5,580	27,400	32,400 J	26,700 J	27,700	32,600	23,800	25,900	25,200
Cadmium	ug/L	<0.217	<0.217	<0.217	<0.152	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781
Calcium	ug/L	257,000	245,000	227,000	488,000	493,000 J	472,000 J	476,000	588,000	469,000	488,000	504,000
Chromium	ug/L	<1.53	<1.53	<1.53	<0.339	0.378 UJ	0.378 UJ	<0.378	<0.378	<0.378	<0.378	<0.378
Cobalt	ug/L	1.92	<1.31	0.711	0.311 J	0.308 J	0.242 U*	0.346 J	0.261 J	0.247 U*	0.284 J	0.291 J
Copper	ug/L	<1.14	<1.14	<1.14	-	-	-	-	-	-	-	-
Iron	ug/L	49,900	55,300	48,700	-	-	-	-	-	-	-	-
Lead	ug/L	<0.167	<0.167	<0.167	<0.0675	<0.318	<0.318	<0.318	<0.318	0.403 J	<0.318	<0.318
Lithium	ug/L	<0.831	<0.831	<0.831	1.53 U*	2.6 U*	2.12 UJ	<2.12	7.36 U*	<2.12	<2.12	<2.12
Magnesium	ug/L	32,100	26,900	24,700	-	-	-	-	-	-	-	-
Manganese	ug/L	7,180	5,560	5,720	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.130	<0.130	<0.130	<0.0521	<0.0521	0.0521 UJ	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653
Molybdenum	ug/L	0.985 J	1.09 J	0.628 J	22.4	21.6	20.3 J	20.1	21.8	20.8	21	21
Nickel	ug/L	9.32	2.61 J	4.34 U*	-	-	-	-	-	-	-	-
Potassium	ug/L	2,290	2,060	1,910	-	-	-	-	-	-	-	-
Selenium	ug/L	<0.739	<0.739	<0.739	0.531 U*	1.98 J	1.27 UJ	<1.27	<1.27	<1.27	<1.27	<1.27
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.223	<0.223	<0.223	-	-	-	-	-	-	-	-
Sodium	ug/L	17,600	16,000	14,800	-	-	-	-	-	-	-	-
Strontium	ug/L	833	736	647	-	-	-	-	-	-	-	-
Thallium	ug/L	<0.472	<0.472	<0.472	<0.036	<0.0531	<0.0531	<0.0531	<0.0531	<0.0531	<0.0531	<0.0531
Vanadium	ug/L	<0.776	<0.776	<0.776	-	-	-	-	-	-	-	-
Zinc	ug/L	<2.88	<2.88	3.90 J	-	-	-	-	-	-	-	-
Radiological Parameters												
Radium-226	pCi/L	0.949 +/-(0.631)	0.378 +/-(0.336)U	0.879 +/-(0.559)	-	-	-	-	-	-	-	-
Radium-228	pCi/L	0.131 +/-(0.277)U	1.06 +/-(0.614)U*	0.235 +/-(0.501)U	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	1.08 +/-(0.689)J	1.44 +/-(0.700)U*	1.11 +/-(0.750)J	0.834 +/-(0.55)U	0.789 +/-(0.63)J	1.27 +/-(0.52)J	1.46 +/-(0.49)J	+/-(0.58)U	+/-(0.68)J	+/-(0.96)U*	+/-(0.73)U
Anions												
Chloride	mg/L	316	201	211	684	600	594	628	619	571	594	616
Fluoride	mg/L	0.0744 U*	0.0874 U*	0.138 U*	<0.121	0.168 U*	0.157 J	0.110 U*	0.197 J	0.160 J	0.151 J	0.210 J
Sulfate	mg/L	372	311	324	1,040	1,090	1,060	1,170	1,120	1,010	1,110	1,100
General Chemistry												
Alkalinity, Bicarbonate	mg/L	142	132	134 J	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	<5.00	<5.00	2.60 UJ	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	1,170	986	1,020 J	2,840	2,860	2,450	2,750	2,880	2,880	3,030	2,850

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location							CUF-207					
Sample Date		28-Jul-17	22-Aug-17	31-Aug-17	4-Oct-17	31-May-18	20-Jun-18	11-Jul-18	1-Aug-18	22-Aug-18	6-Feb-19	8-May-19
Sample ID		CUF-GW-016-07282017	CUF-GW-016-08222017	CUF-GW-016-08312017	CUF-GW-016-10042017	CUF-GW-016-05312018	CUF-GW-016-06202018	CUF-GW-016-07112018	CUF-GW-016-08012018	CUF-GW-016-08222018	CUF-GW-016-02062019	CUF-GW-016-05082019
Parent Sample ID												
Sample Depth		69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	<12.5	<12.5
Antimony	ug/L	<0.443	0.696 U*	0.651 U*	-	<1.12	<1.12	<1.12	<1.12	<1.12	<0.378	<0.378
Arsenic	ug/L	0.799 J	1.01 U*	1.14 U*	-	0.673 J	1.19 U*	0.973 J	1.17	1.25	0.741 J	0.911 J
Barium	ug/L	51.9	55.6	51.4	-	55.8	59	56.1	57	51	54.2	56
Beryllium	ug/L	<0.131	<0.131	<0.131	-	<0.057	<0.057	<0.057	<0.057	<0.057	<0.155	<0.155
Boron	ug/L	24,900	26,600	27,600	26,600	25,600	27,300	25,800	26,000	24,300	28,500	29,100
Cadmium	ug/L	<0.0781	<0.0781	<0.0781	-	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
Calcium	ug/L	501,000	452,000	494,000	475,000	468,000	494,000	448,000	462,000	446,000	451,000	479,000 J
Chromium	ug/L	<0.378	0.544 U*	0.547 U*	-	<0.631	1.68 U*	0.919 U*	1.28 U*	2.06 U*	<1.53	2.39 U*
Cobalt	ug/L	0.377 J	1.82	0.297 J	-	0.289 J	0.385 J	0.356 J	0.368 J	0.339 U*	0.396 U*	0.575
Copper	ug/L	-	-	-	-	-	-	-	-	-	<0.627	<0.627
Iron	ug/L	-	-	-	-	-	-	-	-	-	56,700	63,000
Lead	ug/L	<0.318	<0.318	<0.318	-	<0.094	<0.094	<0.094	<0.094	<0.094	<0.128	<0.128
Lithium	ug/L	<2.12	2.45 J	2.23 U*	-	<2.56	<2.56	<2.56	<2.56	<2.56	4.42 U*	3.65 J
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	150,000	165,000 J
Manganese	ug/L	-	-	-	-	-	-	-	-	-	17,400	18,100
Mercury	ug/L	<0.0653	<0.0653	<0.0653	-	<0.0653	<0.0653	0.0653 UJ	<0.0653	<0.0653	0.101 UJ	<0.101
Molybdenum	ug/L	21.2	19.7	21.1	-	21.1	20.5	18.7	19.4	20.2	20.6	19.4
Nickel	ug/L	-	-	-	-	-	-	-	-	-	0.456 J	0.702 J
Potassium	ug/L	-	-	-	-	-	-	-	-	-	8,500	8,580 J
Selenium	ug/L	<1.27	<1.27	<1.27	-	<0.813	<0.813	<0.813	<0.813	<0.813	<2.62	<2.62
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	-	-	-	-	-	-	-	-	-	-
Sodium	ug/L	-	-	-	-	-	-	-	-	-	33,100	35,600
Strontium	ug/L	-	-	-	-	-	-	-	-	-	1,470	1,350 J
Thallium	ug/L	<0.0531	<0.0531	<0.0531	-	<0.063	<0.063	<0.063	<0.063	<0.063	<0.128	<0.128
Vanadium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Zinc	ug/L	-	-	-	-	-	-	-	-	-	-	-
Radiological Parameters												
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	0.454 +/-(0.129)	0.325 +/-(0.118)
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	0.521 +/-(0.290)	0.751 +/-(0.383)
Radium-226+228	pCi/L	+/-(0.71)J	+/-(0.87)U	1.34 +/-(0.71)J	-	1.11 +/-(0.307)U*	0.689 +/-(0.300)J	0.891 +/-(0.265)	0.972 +/-(0.312)U*	0.928 +/-(0.317)U*	0.976 +/-(0.317)	1.08 +/-(0.401)
Anions												
Chloride	mg/L	616	646	652	659	626	478	475	608	613	591	618
Fluoride	mg/L	0.145 J	<0.0658	0.149 J	0.134 J	0.201 J	0.202 J	0.142 J	0.120 J	0.503	0.199 J	0.186 J
Sulfate	mg/L	1,050	1,160	1,100	955	1,110	867	844	1,070	1,110	1,000	1,050
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	250	251
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	<5.00	<5.00
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	2,560	2,890	3,060	2,830	3,020	2,760	2,710	2,870	2,850	2,990	2,770

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location							CUF-207					
Sample Date		30-Jul-19	8-Oct-19	8-Oct-19	28-Jan-20	11-Mar-20	28-Jul-20	10-Sep-20	10-Sep-20	20-Jan-21	4-Mar-21	22-Jun-21
Sample ID		CUF-GW-016-07302019	CUF-GW-016-10082019	CUF-GW-903-10082019	CUF-GW-016-01282020	CUF-GW-016-03112020	CUF-GW-016-07282020	CUF-GW-016-09102020	CUF-GW-903-09102020	CUF-GW-CUF-207-01202021	CUF-GW-CUF-207-03042021	CUF-GW-CUF-207-06222021
Parent Sample ID				CUF-GW-016-10082019					CUF-GW-016-09102020			
Sample Depth		69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	<12.5	<12.5	<12.5	<12.5	18.6 J	46.5	24.0 J	21.8 J	14.7 U*	<12.5	22.5 J
Antimony	ug/L	<0.378	<0.378	<0.378	0.410 J	<0.378	0.394 U*	<0.378	<0.378	<0.378	<0.378	<0.378
Arsenic	ug/L	0.806 J	0.926 J	1.00	0.890 J	0.793 J	0.617 J	0.576 J	0.670 J	0.682 J	1.76	2.89
Barium	ug/L	66.5	64.0	62.8	61.0	67.7	62.3	65.7	64.1	65.0	60.4	55.3
Beryllium	ug/L	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182
Boron	ug/L	28,600	26,500	26,300	26,800	29,400	30,400	30,300	29,800	30,300	29,100	26,100
Cadmium	ug/L	<0.125	<0.125	<0.125	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217
Calcium	ug/L	504,000	513,000	509,000	553,000	563,000	546,000	554,000	540,000	581,000	553,000	560,000
Chromium	ug/L	<1.53	2.09 U*	2.02 U*	<1.53	<1.53	2.98	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	0.605	0.457 J	0.485 J	0.252 J	0.262 J	0.180 J	0.225 J	0.200 J	0.241 J	0.281 J	0.475 U*
Copper	ug/L	0.902 J	<0.627	<0.627	<0.627	<0.627	0.727 J	<0.627	<0.627	<0.627	<0.627	1.57 U*
Iron	ug/L	61,500	62,600	61,100	60,500	66,600	61,900	63,700	62,100	65,700	67,900	73,200
Lead	ug/L	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	0.205 U*
Lithium	ug/L	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39
Magnesium	ug/L	180,000	172,000	170,000	162,000	176,000	161,000	154,000	150,000	157,000	153,000	159,000
Manganese	ug/L	18,400	19,100	18,800	18,800	21,400	20,200	20,400	20,000	20,100	20,600	21,600
Mercury	ug/L	<0.101	<0.101	<0.101	0.101 UJ	0.101 UJ	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130
Molybdenum	ug/L	19.7	19.8	19.7	19.2	20.3	18.6	19.1	18.6	18.2	15.2	11.1
Nickel	ug/L	0.488 U*	0.336 UJ	3.47 J	<0.336	<0.336	<0.336	<0.336	<0.336	<0.336	<0.336	0.500 J
Potassium	ug/L	9,140	9,040	9,000	8,960	8,230	8,720	8,530	8,310	9,310	7,920	7,520
Selenium	ug/L	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	38,600	38,400	37,700	37,900	39,800	38,700	36,500	35,400	38,300	36,400	33,200
Strontium	ug/L	1,580	1,680	1,650	1,590	1,580	1,680	1,760	1,700	1,670	1,570	1,590
Thallium	ug/L	<0.148	<0.148	<0.148	<0.148	<0.148	<0.148	<0.148	<0.148	0.176 J	<0.148	0.437 U*
Vanadium	ug/L	<0.991	1.07 U*	1.07 U*	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991
Zinc	ug/L	<3.22	3.53 U*	3.77 U*	<3.22	3.34 U*	3.45 U*	<3.22	<3.22	4.50 J	<3.22	<3.22
Radiological Parameters												
Radium-226	pCi/L	0.0234 +/-(0.388)U	0.494 +/-(0.485)U	0.314 +/-(0.340)U	0.494 +/-(0.356)	1.17 +/-(0.678)	0.772 +/-(0.570)	0.490 +/-(0.440)UJ	1.42 +/-(0.648)J	0.628 +/-(0.521)U	1.79 +/-(0.885)	1.43 +/-(0.782)
Radium-228	pCi/L	0.960 +/-(0.506)	1.05 +/-(0.482)	0.770 +/-(0.428)	0.928 +/-(0.603)	0.938 +/-(0.431)	0.423 +/-(0.318)U	0.431 +/-(0.319)U	0.844 +/-(0.497)	1.08 +/-(0.662)	0.956 +/-(0.676)U	0.589 +/-(0.369)
Radium-226+228	pCi/L	0.984 +/-(0.637)J	1.54 +/-(0.684)J	1.08 +/-(0.546)J	1.42 +/-(0.700)	2.10 +/-(0.803)	1.19 +/-(0.653)J	0.921 +/-(0.544)UJ	2.26 +/-(0.816)J	1.70 +/-(0.843)J	2.75 +/-(1.11)J	2.02 +/-(0.865)
Anions												
Chloride	mg/L	599	629	617	646	646	694	702	623	700	642	635
Fluoride	mg/L	0.172 J	0.162 J	0.169 J	0.128 J	0.445	0.0658 UJ	0.126 J	0.127 J	0.178 U*	0.134 J	0.162 J
Sulfate	mg/L	1,030	1,100	1,080	1,060	1,090	1,070	1,140 J	996 J	1,140 J	1,040	1,090
General Chemistry												
Alkalinity, Bicarbonate	mg/L	228	242	241	234	185	252	226	242	195	180	129 J
Alkalinity, Carbonate	mg/L	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	5.00 UJ
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	3,000	2,960	2,830	2,700	2,840	2,750	2,700	2,760	2,640	3,070	2,540

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-207					CUF-208					
Sample Date		25-Aug-21	24-Jan-22	9-Mar-22	15-Jul-22	30-Aug-22	8-Nov-16	26-Jan-17	8-Feb-17	9-Mar-17	5-Apr-17	4-May-17
Sample ID		CUF-GW-CUF-207-08252021	CUF-GW-CUF-207-01242022	CUF-GW-CUF-207-03092022	CUF-GW-CUF-207-07152022	CUF-GW-CUF-207-08302022	CUF-GW-017-11082016	CUF-GW-017-01262017	CUF-GW-017-02082017	CUF-GW-017-03092017	CUF-GW-017-04052017	CUF-GW-017-05042017
Parent Sample ID												
Sample Depth		69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	22.8 J	42.1	24.7 J	<15.5	<15.5	-	-	-	-	-	-
Antimony	ug/L	<0.378	<0.378	<0.506	<0.506	<0.506	0.138 U*	<0.443	0.697 U*	3.04 U*	<0.443	<0.443
Arsenic	ug/L	2.75	2.41	2.96	2.49	2.28	2.45	2.16	2.9	3.49 U*	2.8	3.45
Barium	ug/L	43.9	35.2	37.7	42.8	37.4	39	37.9	30.9	33.8	35.4	34.8
Beryllium	ug/L	<0.182	<0.182	<0.274	<0.274	<0.274	<0.102	0.131 UJ	<0.131	<0.131	0.45 J	<0.131
Boron	ug/L	20,800	12,000	10,400	7,830	8,930	16,900	19,000 J	16,500	16,900	18,800	15,000
Cadmium	ug/L	<0.217	<0.217	<0.217	<0.217	<0.217	<0.152	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781
Calcium	ug/L	462,000	245,000	198,000	184,000	180,000	777,000	743,000	735,000	760,000	903,000	816,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	<0.339	<0.378	<0.378	<0.378	<0.378	<0.378
Cobalt	ug/L	0.446 J	0.646	0.349 J	<1.31	<0.261	8.27	6.99	6.72	5.87	5.56	4.91
Copper	ug/L	<0.627	<0.627	<1.14	<1.14	<1.14	-	-	-	-	-	-
Iron	ug/L	67,400	37,600	31,700	29,100	27,900	-	-	-	-	-	-
Lead	ug/L	0.159 J	<0.128	<0.167	<0.167	<0.167	<0.0675	<0.318	<0.318	<0.318	<0.318	<0.318
Lithium	ug/L	<3.39	<3.39	<0.831	<0.831	<0.831	1.88 U*	2.84 U*	<2.12	<2.12	3.88 U*	<2.12
Magnesium	ug/L	139,000	68,900	58,600	52,400	51,400	-	-	-	-	-	-
Manganese	ug/L	19,900	11,100	8,960	8,560	8,640	-	-	-	-	-	-
Mercury	ug/L	<0.130	<0.130	<0.130	<0.130	<0.130	<0.0521	<0.0521	0.0521 UJ	<0.0653	<0.0653	<0.0653
Molybdenum	ug/L	8.28	5.28	6.76	7.33	6.64	6.85	4.47 J	4.94 J	3.83 J	6.08	4.93 J
Nickel	ug/L	0.336 J	<0.336	<0.517	<2.59	<0.517	-	-	-	-	-	-
Potassium	ug/L	5,740	3,640	3,320	3,120	3,010	-	-	-	-	-	-
Selenium	ug/L	<1.51	<1.51	<0.739	<0.739	<0.739	<0.348	<1.27	<1.27	<1.27	<1.27	<1.27
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.223	<0.223	<0.223	-	-	-	-	-	-
Sodium	ug/L	30,900	16,300	15,400	13,500	13,100	-	-	-	-	-	-
Strontium	ug/L	1,260	621	604	523	482	-	-	-	-	-	-
Thallium	ug/L	<0.148	<0.148	<0.472	<0.472	<0.472	<0.036	<0.0531	<0.0531	<0.0531	<0.0531	<0.0531
Vanadium	ug/L	<0.991	<0.991	<0.776	<0.776	<0.776	-	-	-	-	-	-
Zinc	ug/L	<3.22	<3.22	<2.88	<2.88	<2.88	-	-	-	-	-	-
Radiological Parameters												
Radium-226	pCi/L	1.11 +/-(0.717)	0.265 +/-(0.431)U	0.432 +/-(0.439)U	0.358 +/-(0.470)U	0.565 +/-(0.565)U	-	-	-	-	-	-
Radium-228	pCi/L	1.04 +/-(0.517)	0.231 +/-(0.342)U	0.508 +/-(0.425)U	0.429 +/-(0.565)U	0.328 +/-(0.563)U	-	-	-	-	-	-
Radium-226+228	pCi/L	2.15 +/-(0.884)	0.496 +/-(0.550)U	0.940 +/-(0.611)U	0.787 +/-(0.735)U	0.894 +/-(0.797)U	0.360 +/-(0.52)U	+/-(0.36)U	+/-(0.54)U	+/-(0.35)UJ	+/-(0.57)U	+/-(0.59)U
Anions												
Chloride	mg/L	477	250	215	172	178	1,080	668	687	701	681	709
Fluoride	mg/L	0.130 J	0.115	0.112 U*	0.0746 J	0.0795 U*	<0.121	0.0796 U*	<0.0733	<0.0733	<0.0733	0.0764 J
Sulfate	mg/L	946	459	356	301	318	1,100	1,220	1,210	1,290	1,220	1,280
General Chemistry												
Alkalinity, Bicarbonate	mg/L	153	161	157	153	156 J	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	<5.00	<5.00	<5.00	<5.00	2.60 UJ	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	2,450	1,190	993	922	927 J	3,380	3,100	3,310	3,310	2,910	3,260

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-208										
Sample Date		1-Jun-17	13-Jul-17	28-Jul-17	22-Aug-17	31-Aug-17	4-Oct-17	31-May-18	20-Jun-18	12-Jul-18	1-Aug-18	22-Aug-18
Sample ID		CUF-GW-017-06012017	CUF-GW-017-07132017	CUF-GW-017-07282017	CUF-GW-017-08222017	CUF-GW-017-08312017	CUF-GW-017-10042017	CUF-GW-017-05312018	CUF-GW-017-06202018	CUF-GW-017-07122018	CUF-GW-017-08012018	CUF-GW-017-08222018
Parent Sample ID												
Sample Depth		52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<0.443	<0.443	<0.443	0.639 U*	0.614 U*	-	<1.12	<1.12	<1.12	<1.12	<1.12
Arsenic	ug/L	3.23	2.75	3.02	3.35	3.42	-	3.11	3.1	3.14	3.66	3.58
Barium	ug/L	32.9	31.8	29.9	38.4	33.3	-	32.4	33.5	32.4	35.4	30.4
Beryllium	ug/L	<0.131	<0.131	<0.131	<0.131	<0.131	-	<0.057	<0.057	<0.057	<0.057	<0.057
Boron	ug/L	15,300	13,500	15,500	12,400	15,600	15,300	12,200	11,800	10,400	10,200	10,100
Cadmium	ug/L	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781	-	<0.125	<0.125	<0.125	<0.125	<0.125
Calcium	ug/L	750,000	712,000	792,000	797,000	789,000	731,000	715,000	706,000	672,000	682,000	598,000
Chromium	ug/L	<0.378	<0.378	<0.378	0.556 U*	0.482 U*	-	<0.631	1.58 U*	1.33 U*	1.38 U*	1.95 U*
Cobalt	ug/L	5.41	5.53	6.8	6.24	6.59	-	4.65	4.97	5.48	5.23	4.71
Copper	ug/L	-	-	-	-	-	-	-	-	-	-	-
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<0.318	<0.318	<0.318	<0.318	<0.318	-	<0.094	<0.094	<0.094	<0.094	<0.094
Lithium	ug/L	<2.12	<2.12	<2.12	2.58 J	2.27 U*	-	2.8 U*	<2.56	<2.56	<2.56	<2.56
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	-	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653
Molybdenum	ug/L	5.29	3.54 J	4.38 J	3.78 J	4.78 J	-	2.55 J	2.32 J	2.22 J	2.34 J	3 J
Nickel	ug/L	-	-	-	-	-	-	-	-	-	-	-
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<1.27	<1.27	<1.27	<1.27	<1.27	-	<0.813	<0.813	<0.813	<0.813	<0.813
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	-	-	-	-	-	-	-	-	-	-
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<0.0531	<0.0531	<0.0531	<0.0531	<0.0531	-	<0.063	<0.063	<0.063	<0.063	<0.063
Vanadium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Zinc	ug/L	-	-	-	-	-	-	-	-	-	-	-
Radiological Parameters												
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	0.726 +/-(0.75)U*	+/-(0.67)U	+/-(0.53)U	0.806 +/-(0.44)J	0.982 +/-(0.60)J	-	0.478 +/-(0.307)U*	0.465 +/-(0.280)U*	0.552 +/-(0.275)U*	0.351 +/-(0.253)U*	0.407 +/-(0.238)U*
Anions												
Chloride	mg/L	675	694	697	710	725	734	675	527	529	639	577
Fluoride	mg/L	<0.0733	0.0865 J	0.0786 J	<0.0658	0.0673 J	0.179 J	0.0786 J	<0.132	<0.132	<0.0658	0.525
Sulfate	mg/L	1,250	1,240	1,200	1,240	1,230	1,310	1,110	877	851	991	887
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	3,840	3,470	3,260	3,430	3,460	3,440	3,210	3,130	3,020	3,110	2,970

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-208										
Sample Date		6-Feb-19	8-May-19	30-Jul-19	9-Oct-19	29-Jan-20	11-Mar-20	29-Jul-20	11-Sep-20	20-Jan-21	4-Mar-21	22-Jun-21
Sample ID		CUF-GW-017-02062019	CUF-GW-017-05082019	CUF-GW-017-07302019	CUF-GW-017-10092019	CUF-GW-017-01292020	CUF-GW-017-03112020	CUF-GW-017-07292020	CUF-GW-017-09112020	CUF-GW-CUF-208-01202021	CUF-GW-CUF-208-03042021	CUF-GW-CUF-208-06222021
Parent Sample ID												
Sample Depth		52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	12.8 J	<12.5	<12.5	16.7 J	<12.5	<12.5	<12.5	<12.5	83.3	<12.5	<12.5
Antimony	ug/L	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378
Arsenic	ug/L	2.99	2.96	3.03	3.26	2.60	2.38	3.82	4.42	6.98	4.43	5.03
Barium	ug/L	30.8	31	37.0	34.5	32.7	37.8	31.0	35.3	45.6	33.9	34.4
Beryllium	ug/L	<0.155	<0.155	0.266 J	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182
Boron	ug/L	10,000	8,870	6,300	6,690	5,310	6,050	6,640	5,450	8,550 J	6,530	6,960
Cadmium	ug/L	<0.125	<0.125	<0.125	<0.125	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217
Calcium	ug/L	569,000	613,000 J	612,000	610,000	584,000	579,000	608,000	573,000	488,000	632,000	600,000
Chromium	ug/L	<1.53	1.55 U*	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	6.62	6.22	6.36	5.11	5.42	6.99	4.96	6.34	10.1	5.53	7.51
Copper	ug/L	<0.627	0.721 J	1.08 J	<0.627	<0.627	<0.627	0.657 J	<0.627	<0.627	<0.627	0.994 U*
Iron	ug/L	3,080	3,380	3,120	2,650	2,180	2,520	2,590	3,510	9,850	3,970	5,470
Lead	ug/L	<0.128	<0.128	0.133 J	<0.128	<0.128	<0.128	0.245 J	<0.128	<0.128	<0.128	<0.128
Lithium	ug/L	4.75 U*	3.64 J	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39
Magnesium	ug/L	50,500	56,300 J	57,400	53,600	46,700	47,100	51,400	45,500	37,300	49,600	46,500
Manganese	ug/L	4,500	4,840	4,750	4,830	4,350	4,980	4,630	4,490	5,440	5,310	4,860
Mercury	ug/L	0.101 UJ	<0.101	<0.101	<0.101	<0.101	0.101 UJ	<0.130	<0.130	<0.130	<0.130	<0.130
Molybdenum	ug/L	4.79 J	2.66 J	2.96 J	1.86 J	3.55 J	4.96 J	1.89 J	3.38 J	39.9	6.37	13.3
Nickel	ug/L	2.85	2.99	3.23 U*	2.56	2.69	3.03	2.92	2.75	3.69	2.78	3.04
Potassium	ug/L	1,250	1,300 J	1,290	1,390	1,220	1,090	1,350	1,110	1,220	1,260	1,300
Selenium	ug/L	<2.62	<2.62	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	-	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	58,100	60,600	67,500	66,500	70,400	74,000	66,800	70,100	136,000	69,900	81,200
Strontium	ug/L	561	535 J	565	529	528	539	554	577	1,030	583	716
Thallium	ug/L	<0.128	<0.128	0.179 J	<0.148	<0.148	<0.148	0.407 J	<0.148	<0.148	<0.148	<0.148
Vanadium	ug/L	-	-	<0.991	1.06	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991
Zinc	ug/L	-	-	6.44	<3.22	<3.22	7.04 U*	3.57 U*	6.92 U*	<3.22	<3.22	<3.22
Radiological Parameters												
Radium-226	pCi/L	0.0454 +/-(0.0568)U	0.104 +/-(0.0716)	-0.165 +/-(0.214)U	0.359 +/-(0.419)U	0.441 +/-(0.357)U	0.0124 +/-(0.306)U	0.226 +/-(0.470)U	0.225 +/-(0.369)U	0.105 +/-(0.345)U	0.632 +/-(0.616)U	0.0367 +/-(0.389)U
Radium-228	pCi/L	0.0551 +/-(0.219)U	0.212 +/-(0.256)U	0.0394 +/-(0.446)U	-0.366 +/-(0.465)U	1.04 +/-(0.614)	0.375 +/-(0.407)U	0.138 +/-(0.381)U	0.191 +/-(0.526)U	0.719 +/-(0.526)U	0.545 +/-(0.390)	-0.0836 +/-(0.318)U
Radium-226+228	pCi/L	0.101 +/-(0.226)U	0.317 +/-(0.266)J	0.0394 +/-(0.494)U	0.359 +/-(0.626)U	1.48 +/-(0.710)J	0.388 +/-(0.509)U	0.364 +/-(0.605)U	0.416 +/-(0.643)U	0.824 +/-(0.629)U	1.18 +/-(0.729)J	0.0367 +/-(0.502)U
Anions												
Chloride	mg/L	599	590	585	577	578	567	601	575	596	588	558
Fluoride	mg/L	0.0857 U*	<0.0658	0.0959 U*	0.104 J	0.0679 J	0.407	0.0263 UJ	<0.0658	0.105 U*	0.0715 J	0.122 J
Sulfate	mg/L	890	899	851	812	768	784	790	758 J	906	822	769
General Chemistry												
Alkalinity, Bicarbonate	mg/L	238	245	237	255	251	253	251	265	299	247	280
Alkalinity, Carbonate	mg/L	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	2,770	2,990	3,040	2,850	2,240	2,330	2,320	2,310	2,200	2,690	2,220

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-208					CUF-209					
Sample Date		25-Aug-21	25-Jan-22	9-Mar-22	14-Jul-22	25-Aug-22	8-Nov-16	25-Jan-17	8-Feb-17	9-Mar-17	5-Apr-17	4-May-17
Sample ID		CUF-GW-CUF-208-08252021	CUF-GW-CUF-208-01252022	CUF-GW-CUF-208-03092022	CUF-GW-CUF-208-07142022	CUF-GW-CUF-208-08252022	CUF-GW-018-11082016	CUF-GW-018-01252017	CUF-GW-018-02082017	CUF-GW-018-03092017	CUF-GW-018-04052017	CUF-GW-018-05042017
Parent Sample ID												
Sample Depth		52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	12.7 J	15.3 J	<15.5	42.0	<15.5	-	-	-	-	-	-
Antimony	ug/L	<0.378	0.483 J	<0.506	0.560 J	<0.506	0.163 U*	0.57 U*	0.745 U*	2.79 U*	<0.443	<0.443
Arsenic	ug/L	2.37	2.47	2.75	4.54	4.70	7.76	10.5	12.1 J	12.7	12.4	9.14
Barium	ug/L	40.5	36.3	40.5	41.0	35.3	54.9	57.8	79	78.3	74.3	104
Beryllium	ug/L	<0.182	<0.182	<0.274	<0.274	<0.274	<0.102	0.131 UJ	0.131 UJ	<0.131	0.149 J	<0.131
Boron	ug/L	6,730	5,450	4,860	10,900	10,500	2,820	4,340	5,890 J	5,540	7,640	4,140
Cadmium	ug/L	<0.217	<0.217	<0.217	<0.217	<0.217	<0.152	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781
Calcium	ug/L	594,000	538,000	483,000	648,000	605,000	207,000	247,000 J	281,000 J	289,000	351,000	256,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	<0.339	0.378 UJ	0.378 UJ	<0.378	<0.378	<0.378
Cobalt	ug/L	5.06	3.90	4.55	6.17	6.17	3.04	3.23 J	3.4 J	3.23	2.48	2.23
Copper	ug/L	<0.627	<0.627	<1.14	<1.14	<1.14	-	-	-	-	-	-
Iron	ug/L	1,750	1,780	1,320	3,170	3,600	-	-	-	-	-	-
Lead	ug/L	<0.128	<0.128	<0.167	0.205 U*	<0.167	<0.0675	<0.318	<0.318	<0.318	<0.318	<0.318
Lithium	ug/L	<3.39	<3.39	<0.831	1.04 J	<0.831	1.49 U*	2.86 U*	2.12 UJ	<2.12	3.41 U*	<2.12
Magnesium	ug/L	50,000	40,600	39,300	52,700	49,200	-	-	-	-	-	-
Manganese	ug/L	3,720	2,820	2,960	5,420	5,170	-	-	-	-	-	-
Mercury	ug/L	<0.130	<0.130	<0.130	<0.130	<0.130	<0.0521	<0.0521	0.0521 UJ	<0.0653	<0.0653	<0.0653
Molybdenum	ug/L	10.2	10.8	11.4	102	46.8	49.2	39.9	36.9	39.1	37.8	29.9
Nickel	ug/L	3.97	3.36	5.08	<5.17	3.29 U*	-	-	-	-	-	-
Potassium	ug/L	1,090	1,100	971	1,810	1,600	-	-	-	-	-	-
Selenium	ug/L	<1.51	<1.51	<0.739	<0.739	<0.739	0.348 U*	<1.27	1.27 UJ	<1.27	<1.27	<1.27
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.223	<0.223	<0.223	-	-	-	-	-	-
Sodium	ug/L	75,800	82,200	91,100	81,600	76,100	-	-	-	-	-	-
Strontium	ug/L	604	612	695	697	647	-	-	-	-	-	-
Thallium	ug/L	<0.148	<0.148	<0.472	<0.472	<0.472	<0.036	<0.0531	<0.0531	0.066 U*	<0.0531	<0.0531
Vanadium	ug/L	<0.991	<0.991	<0.776	<0.776	<0.776	-	-	-	-	-	-
Zinc	ug/L	3.45 J	3.63 J	5.09 U*	3.70 U*	<2.88	-	-	-	-	-	-
Radiological Parameters												
Radium-226	pCi/L	0.343 +/-(0.548)U	-0.0940 +/-(0.242)U	0.464 +/-(0.446)U	0.213 +/-(0.394)U	0.151 +/-(0.303)U	-	-	-	-	-	-
Radium-228	pCi/L	-0.191 +/-(0.254)U	0.0860 +/-(0.272)U	0.386 +/-(0.378)U	0.967 +/-(0.689)U	0.0584 +/-(0.410)U	-	-	-	-	-	-
Radium-226+228	pCi/L	0.343 +/-(0.604)U	0.0860 +/-(0.364)U	0.850 +/-(0.585)U	1.18 +/-(0.793)U	0.209 +/-(0.510)U	0.576 +/-(0.34)U	+/-(0.45)U	+/-(0.56)U	+/-(0.50)UJ	+/-(0.48)U	+/-(0.60)U
Anions												
Chloride	mg/L	579	517	533	479	489	116	95.9	118	105	106	112
Fluoride	mg/L	0.123 J	0.119 J	0.124 U*	0.0416 J	0.162 U*	0.126 J	0.157 U*	0.178	0.0919 U*	0.234	0.199
Sulfate	mg/L	792	714	585	959	1,140	164	105	163	113	127	146
General Chemistry												
Alkalinity, Bicarbonate	mg/L	275	284	296	213	195	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	<5.00	<5.00	<5.00	<5.00	<5.00	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	2,470	2,040	2,100	2,700	2,660	770	613	778	619	659	717

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location							CUF-209					
Sample Date		1-Jun-17	12-Jul-17	28-Jul-17	18-Aug-17	31-Aug-17	4-Oct-17	31-May-18	20-Jun-18	12-Jul-18	1-Aug-18	22-Aug-18
Sample ID		CUF-GW-018-06012017	CUF-GW-018-07122017	CUF-GW-018-07282017	CUF-GW-018-08182017	CUF-GW-018-08312017	CUF-GW-018-10042017	CUF-GW-018-05312018	CUF-GW-018-06202018	CUF-GW-018-07122018	CUF-GW-018-08012018	CUF-GW-018-08222018
Parent Sample ID												
Sample Depth		62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<0.443	<0.443	<0.443	<0.443	0.583 U*	-	<1.12	<1.12	<1.12	<1.12	<1.12
Arsenic	ug/L	8.62	11.3	6.98	8.67	9.94	-	10.5	9.47	11.8	10.2	11.3
Barium	ug/L	111	92.8	180	103	67.4	-	68.6	63.4	87.8	62	58.8
Beryllium	ug/L	<0.131	<0.131	<0.131	<0.131	<0.131	-	<0.057	<0.057	<0.057	<0.057	<0.057
Boron	ug/L	3,580	5,270	7,640	6,810	6,190	6,570	7,480	7,080	4,430	6,920	1,890
Cadmium	ug/L	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781	-	<0.125	<0.125	<0.125	<0.125	<0.125
Calcium	ug/L	209,000	313,000	366,000	313,000	309,000	315,000	361,000	356,000	257,000	346,000	146,000
Chromium	ug/L	<0.378	<0.378	<0.378	<0.378	0.551 U*	-	<0.631	1.55 U*	1.58 U*	1.4 U*	1.93 U*
Cobalt	ug/L	2.41	3.15	2.86	2.88	2.67	-	2.47	2.42	2.2	2.34	0.97 U*
Copper	ug/L	-	-	-	-	-	-	-	-	-	-	-
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<0.318	<0.318	<0.318	<0.318	<0.318	-	<0.094	<0.094	<0.094	<0.094	<0.094
Lithium	ug/L	<2.12	<2.12	<2.12	<2.12	<2.12	-	<2.56	<2.56	<2.56	<2.56	<2.56
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	-	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653
Molybdenum	ug/L	29	35.3	44.6	31.6	26.7	-	15	15.6	15.2	15.2	10.9
Nickel	ug/L	-	-	-	-	-	-	-	-	-	-	-
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<1.27	<1.27	<1.27	<1.27	<1.27	-	<0.813	<0.813	<0.813	<0.813	<0.813
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	-	-	-	-	-	-	-	-	-	-
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<0.0531	<0.0531	<0.0531	<0.0531	<0.0531	-	<0.063	<0.063	<0.063	<0.063	<0.063
Vanadium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Zinc	ug/L	-	-	-	-	-	-	-	-	-	-	-
Radiological Parameters												
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	0.561 +/-(0.49)U*	0.619 +/-(0.52)J	1.19 +/-(0.63)J	+/-(0.56)U	1.11 +/-(0.66)J	-	0.381 +/-(0.263)U*	0.445 +/-(0.310)J	0.712 +/-(0.341)U*	0.918 +/-(0.352)U*	0.401 +/-(0.237)U*
Anions												
Chloride	mg/L	121	118	198	139	137	264	135	156	118	314	153
Fluoride	mg/L	0.174	0.201	0.159	0.153	0.205	0.111	0.228	0.212	0.167	0.145	0.379
Sulfate	mg/L	159	155	329	175	135	460	134	187	121	558	176
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	809	764	1,110	880	847	1,390	789	852	814	1,610	866

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-209										
Sample Date		23-Jan-19	6-Feb-19	9-Apr-19	9-Apr-19	8-May-19	31-Jul-19	9-Oct-19	29-Jan-20	10-Mar-20	8-Apr-20	29-Jul-20
Sample ID		209-0119	CUF-GW-018-02062019	CUF-209	CUF-209-DUP	CUF-GW-018-05082019	CUF-GW-018-07312019	CUF-GW-018-10092019	CUF-GW-018-01292020	CUF-GW-018-03102020	CUF-209-0420	CUF-GW-018-07292020
Parent Sample ID					CUF-209_04092019							
Sample Depth		62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	CCR Program	State Compliance	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program
Total Metals												
Aluminum	ug/L	-	61.8	-	-	<12.5	12.7 J	45.3	<12.5	16.3 J	-	22.2 J
Antimony	ug/L	<1.12	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	0.389 U*	<0.378	<0.378	<0.378
Arsenic	ug/L	11.5	9.28	10.5	10.2	5.85	5.73	3.73	2.50	2.58	2.25 U*	1.98
Barium	ug/L	72.3	60.9	82.5	79.1	89.7	121	85.4	57.4	56.2	52.5	46.2
Beryllium	ug/L	<0.057	<0.155	<0.155	<0.155	<0.155	<0.182	<0.182	<0.182	<0.182	0.182 UJ	<0.182
Boron	ug/L	2,800	2,830	5,110	5,280	8,470	18,200	21,300	25,700	29,000	32,300	30,400
Cadmium	ug/L	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125	0.143 J	0.832 J	<0.217	<0.217	<0.217
Calcium	ug/L	201,000	175,000	182,000	183,000	215,000 J	398,000	485,000	585,000	618,000	606,000	652,000
Chromium	ug/L	2.31 U*	<1.53	<1.53	<1.53	<1.53	1.68 U*	1.73 U*	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	0.91	1.46	1.53	1.61	2.7	3.29	2.27	1.33	1.47	1.33 U*	1.08
Copper	ug/L	<1.3	<0.627	<0.627	<0.627	<0.627	4.11	<0.627	<0.627	0.919 J	<0.627	<0.627
Iron	ug/L	-	4,750	-	-	5,280	3,860	2,840	1,750	2,060	-	1,650
Lead	ug/L	<0.094	0.15 J	0.142 J	<0.128	<0.128	0.245 J	<0.128	<0.128	<0.128	<0.128	<0.128
Lithium	ug/L	<2.56	4.32 U*	<3.14	<3.14	3.81 J	4.77 U*	3.94 J	<3.39	3.53 J	3.39 UJ	3.89 J
Magnesium	ug/L	-	14,300	-	-	21,000 J	40,200	43,900	42,100	48,700	-	48,100
Manganese	ug/L	-	5,870	-	-	9,860	16,200	16,100	15,600	15,800	-	13,700
Mercury	ug/L	<0.101	0.101 UJ	<0.101	<0.101	<0.101	<0.101	<0.101	0.101 UJ	<0.101	<0.101	<0.130
Molybdenum	ug/L	7.94	10.6	13	12.3	13.9	186	324	827	946	891	1,430
Nickel	ug/L	0.378 J	0.721 J	0.627 J	0.599 J	1.45	2.54 U*	2.10	1.45	1.66	1.27	1.25 U*
Potassium	ug/L	-	1,080	-	-	1,380 J	3,110	6,220	12,400	13,300	-	20,600
Selenium	ug/L	<0.813	<2.62	<2.62	<2.62	<2.62	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.121	-	<0.121	<0.121	-	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	-	78,600	-	-	249,000	223,000	221,000	159,000	183,000	-	150,000
Strontium	ug/L	-	365	-	-	1,350 J	2,460	2,440	2,210	2,180	-	2,110
Thallium	ug/L	<0.063	<0.128	<0.128	<0.128	<0.128	<0.148	<0.148	<0.148	<0.148	<0.148	<0.148
Vanadium	ug/L	1.34 U*	-	<0.899	0.978 J	-	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991
Zinc	ug/L	<2.42	-	<3.22	<3.22	-	6.56 U*	3.59 U*	<3.22	3.88 J	<3.22	5.14 U*
Radiological Parameters												
Radium-226	pCi/L	0.261 +/-(0.0945)	0.112 +/-(0.0707)	0.136 +/-(0.0798)J	0.305 +/-(0.102)J	0.239 +/-(0.0906)	0.881 +/-(0.501)	0.629 +/-(0.586)U	0.677 +/-(0.426)	0.135 +/-(0.375)U	1.41 +/-(0.767)	0.235 +/-(0.278)U
Radium-228	pCi/L	0.0662 +/-(0.286)U	0.347 +/-(0.257)U	0.494 +/-(0.257)	0.493 +/-(0.306)	0.388 +/-(0.264)U	0.264 +/-(0.266)U	0.323 +/-(0.421)U	0.360 +/-(0.358)UJ	0.159 +/-(0.256)U	0.528 +/-(0.383)U	0.332 +/-(0.316)U
Radium-226+228	pCi/L	-	0.459 +/-(0.267)J	-	-	0.627 +/-(0.279)J	1.14 +/-(0.567)J	0.952 +/-(0.721)U	1.04 +/-(0.557)J	0.294 +/-(0.454)U	1.94 +/-(0.858)J	0.567 +/-(0.421)U
Anions												
Chloride	mg/L	180	154	191	190	199	253	273	266	264	273	277
Fluoride	mg/L	0.208	0.169	0.169	0.175	0.183	0.179 J	0.236 J	0.201 J	0.438	0.290	0.128 J
Sulfate	mg/L	233	171	377	386	615	1,100	1,290	1,330	1,570	1,540	1,620
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	329	-	-	243	193	180	147	136	-	144
Alkalinity, Carbonate	mg/L	-	<5.00	-	-	<5.00	<5.00	<5.00	<5.00	<5.00	-	<5.00
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	981	824	1,220	1,210	1,570	2,120	2,510	2,680	2,880	2,920	2,370

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-209										
Sample Date		14-Sep-20	5-Oct-20	20-Jan-21	4-Mar-21	13-Apr-21	19-Jul-21	19-Aug-21	13-Oct-21	13-Oct-21	20-Jan-22	4-Mar-22
Sample ID		CUF-GW-018-09142020	CUF-209-1020	CUF-GW-CUF-209-01202021	CUF-GW-CUF-209-03042021	CUF-GW-209-04132021	CUF-GW-CUF-209-07192021	CUF-GW-CUF-209-08192021	CUF-GW-CUF-209-10132021	CUF-GW-FD-10132021	CUF-GW-CUF-209-01202022	CUF-GW-CUF-209-03042022
Parent Sample ID										CUF-GW-CUF-209-10132021		
Sample Depth		62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	State Compliance	State Compliance	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	22.0 J	-	14.0 U*	<12.5	-	<12.5	12.5 J	-	-	40.1	<15.5
Antimony	ug/L	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.506
Arsenic	ug/L	2.21	1.73	2.43	1.85	2.48	2.17	2.16	2.03	1.86	2.33	2.26
Barium	ug/L	42.0	45.8	39.1	39.0	41.7	39.4	38.5	40.0	37.3	38.3	39.3
Beryllium	ug/L	<0.182	<0.182	<0.182	<0.182	0.194 J	<0.182	<0.182	<0.182	<0.182	<0.182	<0.274
Boron	ug/L	28,500	29,300	28,700	27,000	26,300	24,800	24,000	22,300	21,800	21,700	23,100
Cadmium	ug/L	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217
Calcium	ug/L	606,000	595,000	574,000	560,000	554,000	528,000	544,000	538,000	503,000	515,000	509,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	1.04	1.13	1.34	1.17	1.82	1.45	1.48	1.32	1.21	1.69	1.19
Copper	ug/L	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627	2.30	<0.627	<0.627	<0.627	<1.14
Iron	ug/L	1,610	-	1,710	1,820	-	2,190	2,060	-	-	2,210	2,110
Lead	ug/L	<0.128	<0.128	<0.128	<0.128	0.156 J	<0.128	0.130 J	0.194 J	<0.128	<0.128	<0.167
Lithium	ug/L	3.61 J	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	0.931 J
Magnesium	ug/L	43,600	-	42,300	40,400	-	39,000	39,900	-	-	41,300	43,100
Manganese	ug/L	13,200	-	12,800	13,200	-	13,800	13,300	-	-	13,500	13,100
Mercury	ug/L	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130
Molybdenum	ug/L	1,210	1,250	858	762	617	540	487	520	500	394	462
Nickel	ug/L	1.24	1.26	1.39	1.25	2.02	1.28	2.15	1.09	0.999 J	2.08	1.25
Potassium	ug/L	18,500	-	17,000	15,400	-	13,300	13,300	-	-	12,700	13,200
Selenium	ug/L	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<0.739
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	0.933 J	<0.177	<0.177	<0.223
Sodium	ug/L	137,000	-	131,000	125,000	-	111,000	105,000	-	-	96,400	98,100
Strontium	ug/L	2,010	-	1,870	1,820	-	1,810	1,760	-	-	1,660	1,790 J
Thallium	ug/L	<0.148	<0.148	0.539 J	<0.148	0.489 J	<0.148	0.336 J	0.174 J	<0.148	<0.148	<0.472
Vanadium	ug/L	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.776
Zinc	ug/L	<3.22	<3.22	<3.22	<3.22	<3.22	<3.22	13.7 U*	<3.22	<3.22	<3.22	<2.88
Radiological Parameters												
Radium-226	pCi/L	0.324 +/-(0.478)U	0.453 +/-(0.439)U	0.212 +/-(0.324)U	0.361 +/-(0.522)U	0.496 +/-(0.398)U	0.218 +/-(0.340)U	0.870 +/-(0.641)	0.623 +/-(0.611)U	1.53 +/-(0.834)	0.122 +/-(0.420)U	0.431 +/-(0.530)U
Radium-228	pCi/L	0.0968 +/-(0.214)U	0.511 +/-(0.377)U	-0.309 +/-(0.360)U	0.151 +/-(0.531)U	0.400 +/-(0.461)U	0.329 +/-(0.301)U	0.307 +/-(0.329)U	-0.267 +/-(0.286)UJ	0.806 +/-(0.485)J	0.731 +/-(0.537)U	0.253 +/-(0.361)UJ
Radium-226+228	pCi/L	0.421 +/-(0.524)U	0.964 +/-(0.579)U	0.212 +/-(0.485)U	0.512 +/-(0.745)U	0.896 +/-(0.609)U	0.548 +/-(0.454)U	1.18 +/-(0.720)J	0.623 +/-(0.675)UJ	2.34 +/-(0.965)J	0.853 +/-(0.681)U	0.684 +/-(0.641)UJ
Anions												
Chloride	mg/L	251	231	246	224	220	196	198	182	196	172	195
Fluoride	mg/L	0.163 J	0.147 J	0.229 U*	0.209 J	0.143 J	0.244 J	0.425	0.206 J	0.205 J	0.181	0.294
Sulfate	mg/L	1,440 J	1,400	1,570 J	1,310	1,340	1,250	1,580 J	1,270	1,300	1,280	1,500
General Chemistry												
Alkalinity, Bicarbonate	mg/L	143	-	156	154	-	362	159 J	-	-	151	145
Alkalinity, Carbonate	mg/L	<5.00	-	<5.00	<5.00	-	<5.00	5.00 UR	-	-	<5.00	<5.00
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	2,890	2,560	2,630	2,490	2,750	2,630	2,470	2,330	2,390	2,300	2,360

See notes on last page.

Stantec

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-209			CUF-211					
Sample Date		12-Apr-22	13-Jul-22	24-Aug-22	7-Nov-16	25-Jan-17	8-Feb-17	8-Mar-17	5-Apr-17	5-Apr-17
Sample ID		CUF-GW-CUF-209-04122022	CUF-GW-CUF-209-07132022	CUF-GW-CUF-209-08242022	CUF-GW-020-11072016	CUF-GW-020-01252017	CUF-GW-020-02082017	CUF-GW-020-03082017	CUF-GW-020-04052017	CUF-GW-903-04052017
Parent Sample ID										CUF-GW-020-04052017
Sample Depth		62 ft	62 ft	62 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample
Program	Units	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals										
Aluminum	ug/L	-	<15.5	<15.5	-	-	-	-	-	-
Antimony	ug/L	2.99	<0.506	<0.506	0.129 U*	0.618 U*	0.49 U*	0.571 U*	<0.443	<0.443
Arsenic	ug/L	2.02	2.00	1.68	9.96	8.64	9.65 J	8.99	11.5	11.1
Barium	ug/L	39.5	42.0	33.2 J	183	193	163	179	195	191
Beryllium	ug/L	<0.274	<0.274	<0.274	<0.102	0.131 UJ	0.131 UJ	<0.131	0.148 J	<0.131
Boron	ug/L	23,300	19,800	18,200	5,090	6,290	5,670 J	5,440 J	8,190	8,060
Cadmium	ug/L	<0.217	<0.217	<0.217	0.243 J	0.279 J	0.342 J	0.372 J	0.276 J	0.224 J
Calcium	ug/L	514,000	569,000	453,000	214,000	209,000 J	202,000 J	206,000	255,000	252,000
Chromium	ug/L	<1.53	<1.53	<1.53	<0.339	0.378 UJ	0.378 UJ	<0.378	<0.378	<0.378
Cobalt	ug/L	1.21	1.48	1.04	6.68	7.2 J	6.39 J	7.05	6.29	6.23
Copper	ug/L	<1.14	<1.14	<1.14	-	-	-	-	-	-
Iron	ug/L	-	2,060	1,880	-	-	-	-	-	-
Lead	ug/L	<0.167	<0.167	<0.167	<0.0675	<0.318	<0.318	<0.318	<0.318	<0.318
Lithium	ug/L	1.80 J	1.45 J	1.32 J	4.31 U*	6.05 U*	4.81 U*	5.25 U*	4.03 U*	4.25 U*
Magnesium	ug/L	-	43,100	36,200	-	-	-	-	-	-
Manganese	ug/L	-	14,100	12,000	-	-	-	-	-	-
Mercury	ug/L	<0.130	<0.130	<0.130	<0.0521	<0.0521	0.0521 UJ	<0.0653	<0.0653	<0.0653
Molybdenum	ug/L	409	330	277	5.33	6.06 U*	5.84 J	6.96	6.89	6.82
Nickel	ug/L	1.13	1.31	3.30 U*	-	-	-	-	-	-
Potassium	ug/L	-	13,300	11,000	-	-	-	-	-	-
Selenium	ug/L	<0.739	<0.739	<0.739	<0.348	<1.27	1.27 UJ	1.27 UJ	<1.27	<1.27
Silicon	ug/L	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.223	0.223 UR	<0.223	-	-	-	-	-	-
Sodium	ug/L	-	98,700	85,200	-	-	-	-	-	-
Strontium	ug/L	-	1,810	1,560 J	-	-	-	-	-	-
Thallium	ug/L	<0.472	<0.472	<0.472	0.04 J	<0.0531	<0.0531	0.074 U*	<0.0531	<0.0531
Vanadium	ug/L	<0.776	<0.776	<0.776	-	-	-	-	-	-
Zinc	ug/L	<2.88	<2.88	2.93 J	-	-	-	-	-	-
Radiological Parameters										
Radium-226	pCi/L	0.808 +/-(0.461)	0.0581 +/-(0.443)U	0.0586 +/-(0.224)U	-	-	-	-	-	-
Radium-228	pCi/L	0.477 +/-(0.380)U	0.722 +/-(0.461)U*	0.00756 +/-(0.412)U	-	-	-	-	-	-
Radium-226+228	pCi/L	1.29 +/-(0.597)J	0.780 +/-(0.639)U*	0.0662 +/-(0.469)U	1.35 +/-(0.58)U*	1.36 +/-(0.49)	1.34 +/-(0.53)J	+/-(0.58)U	0.921 +/-(0.59)J	1.72 +/-(0.77)
Anions										
Chloride	mg/L	183	183	171	179	174	154	158	169	166
Fluoride	mg/L	0.359 U*	0.177 J	0.263 U*	0.0869 J	0.108 U*	0.110	0.0701 U*	0.139	0.141
Sulfate	mg/L	1,300	1,290	1,130	204	211	188	211	217	216
General Chemistry										
Alkalinity, Bicarbonate	mg/L	-	144	150 J	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	<5.00	2.60 UJ	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	2,390	2,400	2,360	949	908	925	916	1,040	893

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-211											
Sample Date		3-May-17	3-May-17	31-May-17	12-Jul-17	27-Jul-17	27-Jul-17	18-Aug-17	30-Aug-17	30-Aug-17	3-Oct-17	31-May-18	20-Jun-18
Sample ID		CUF-GW-020-05032017	CUF-GW-903-05032017	CUF-GW-020-05312017	CUF-GW-020-07122017	CUF-GW-020-07272017	CUF-GW-903-07272017	CUF-GW-020-08182017	CUF-GW-020-08302017	CUF-GW-903-08302017	CUF-GW-020-10032017	CUF-GW-020-05312018	CUF-GW-020-06202018
Parent Sample ID			CUF-GW-020-05032017				CUF-GW-020-07272017			CUF-GW-020-08302017			
Sample Depth		67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft
Sample Type		Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals													
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<0.443	<0.443	<0.443	<0.443	<0.443	<0.443	<0.443	0.91 U*	0.641 U*	-	<1.12	<1.12
Arsenic	ug/L	9.73	9.44	9.63	9.71	10.8	10.1	9.98	9.86	10.1	-	9.02	9.92
Barium	ug/L	193	196	175	191	178	175	202	169	178	-	172	198
Beryllium	ug/L	<0.131	<0.131	<0.131	<0.131	<0.131	<0.131	<0.131	<0.131	<0.131	-	<0.057	<0.057
Boron	ug/L	5,400	5,350	5,470	5,080	4,640	4,840	5,760	5,650	5,840	4,740	5,570	5,450
Cadmium	ug/L	0.304 U*	0.331 U*	0.35 J	0.353 J	0.323 J	0.203 J	0.43 J	0.358 J	0.355 J	-	2.08	2.25
Calcium	ug/L	226,000	224,000	208,000	222,000	215,000	221,000	217,000	207,000	219,000	206,000	229,000	223,000
Chromium	ug/L	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	0.399 U*	0.672 U*	0.472 U*	-	<0.631	1.78 U*
Cobalt	ug/L	5.62	5.73	6.07	6.67	6.99	6.86	6.83	6.45	6.83	-	6.32	6.17
Copper	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	-	<0.094	<0.094
Lithium	ug/L	8.89 U*	8.59 U*	4.31 J	4.17 J	4.44 J	4.4 J	4.49 J	6.27 U*	5.6 U*	-	5.57 U*	4.93 J
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	-	<0.0653	<0.0653
Molybdenum	ug/L	6.36	6.98	6.76	6.73	6.81	6.72	7.13	7.2	7.53	-	7.95	8.48
Nickel	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<1.27	<1.27	<1.27	<1.27	<1.27	<1.27	<1.27	<1.27	<1.27	-	<0.813	<0.813
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<0.0531	<0.0531	<0.0531	<0.0531	0.067 J	<0.0531	0.07 J	0.077 J	0.07 J	-	<0.063	0.063 J
Vanadium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Radiological Parameters													
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	1.27 +/-(0.69)J	1.78 +/-(0.69)	0.373 +/-(0.66)J	1.37 +/-(0.67)J	2.51 +/-(0.75)J	+/-(0.67)UJ	1.15 +/-(0.51)	1.16 +/-(0.72)J	1.13 +/-(0.59)J	-	1.24 +/-(0.338)U*	0.788 +/-(0.378)J
Anions													
Chloride	mg/L	170	171	172	181	184	188	189	187	190	184	198	217
Fluoride	mg/L	0.125	0.134	0.116	0.104	0.118	0.123	0.109	0.110	0.111	0.0707 J	0.164	0.177
Sulfate	mg/L	227	220	222	226	228	233	226	234	240	175	235	263
General Chemistry													
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	910	915	1,070	972	995	994	965	935	942	941	997	1,030

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-211									
Sample Date		12-Jul-18	2-Aug-18	22-Aug-18	23-Jan-19	7-Feb-19	9-Apr-19	8-May-19	31-Jul-19	9-Oct-19	29-Jan-20
Sample ID		CUF-GW-020-07122018	CUF-GW-020-08022018	CUF-GW-020-08222018	211-0119	CUF-GW-020-02072019	CUF-211	CUF-GW-020-05082019	CUF-GW-020-07312019	CUF-GW-020-10092019	CUF-GW-020-01292020
Parent Sample ID											
Sample Depth		67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals											
Aluminum	ug/L	-	-	-	-	111	-	13.9 J	63.8	47.0	39.1
Antimony	ug/L	<1.12	<1.12	<1.12	<1.12	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378
Arsenic	ug/L	11.5	9.97	12.1	8.34	9.74	11.4	9.21	10.7	9.59	10.7
Barium	ug/L	200	203	185	164	185	174	166	192	189	178
Beryllium	ug/L	<0.057	<0.057	<0.057	<0.057	<0.155	<0.155	<0.155	<0.182	<0.182	<0.182
Boron	ug/L	5,370	5,880	5,620	5,100	5,170	5,570	5,070	5,350	4,840	4,680
Cadmium	ug/L	1.1	0.883 J	0.862 J	1.75	2.29	1.69	1.79	7.14	8.15	2.55
Calcium	ug/L	229,000	218,000	215,000	215,000	214,000	221,000	212,000 J	222,000	227,000	235,000
Chromium	ug/L	1.43 U*	1.73 U*	1.83 U*	1.75 U*	<1.53	<1.53	<1.53	2.45 U*	<1.53	<1.53
Cobalt	ug/L	7.64	5.7	7.77	5.89	6.17	6.42	7.14	7.36	6.56	5.73
Copper	ug/L	-	-	-	<1.3	0.64 J	<0.627	<0.627	1.10 J	<0.627	<0.627
Iron	ug/L	-	-	-	-	36,100	-	37,000	35,900	36,200	33,400
Lead	ug/L	<0.094	<0.094	<0.094	<0.094	0.189 J	<0.128	<0.128	0.175 J	<0.128	<0.128
Lithium	ug/L	3.29 J	5.72	4.26 J	4.23 J	<3.14	4.36 J	5.44	6.32 U*	4.16 J	4.48 J
Magnesium	ug/L	-	-	-	-	8,920	-	9,790 J	10,200	9,860	8,730
Manganese	ug/L	-	-	-	-	11,600	-	11,100	11,200	11,700	12,300
Mercury	ug/L	<0.0653	<0.0653	<0.0653	<0.101	<0.101	<0.101	<0.101	<0.101	<0.101	0.101 UJ
Molybdenum	ug/L	8.9	8.63	8.55	8.08	8.22	9.37	8.48	8.36	9.20	9.56
Nickel	ug/L	-	-	-	3.3	3.56	3.49	3.85	4.54 U*	3.50	3.31
Potassium	ug/L	-	-	-	-	13,200	-	13,400 J	13,500	13,700	13,300
Selenium	ug/L	<0.813	<0.813	<0.813	<0.813	<2.62	<2.62	<2.62	<1.51	<1.51	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	-	-	<0.121	-	<0.121	-	<0.177	<0.177	<0.177
Sodium	ug/L	-	-	-	-	53,500	-	57,300	59,900	61,200	55,400
Strontium	ug/L	-	-	-	-	538	-	509 J	567	545	575
Thallium	ug/L	<0.063	<0.063	<0.063	<0.063	<0.128	<0.128	<0.128	<0.148	<0.148	<0.148
Vanadium	ug/L	-	-	-	1.16 U*	-	<0.899	-	<0.991	<0.991	<0.991
Zinc	ug/L	-	-	-	3.81 J	-	12.7	-	10.3 U*	5.68 U*	4.06 J
Radiological Parameters											
Radium-226	pCi/L	-	-	-	0.499 +/-(0.134)	0.383 +/-(0.122)J	0.446 +/-(0.123)	0.409 +/-(0.115)	0.929 +/-(0.528)	0.457 +/-(0.464)U	0.662 +/-(0.557)U
Radium-228	pCi/L	-	-	-	0.415 +/-(0.303)U	0.435 +/-(0.242)	0.562 +/-(0.333)	0.333 +/-(0.278)U	0.365 +/-(0.407)U	0.228 +/-(0.401)U	0.624 +/-(0.354)J
Radium-226+228	pCi/L	1.11 +/-(0.323)J	1.19 +/-(0.284)	1.05 +/-(0.277)J	-	0.819 +/-(0.271)J	-	0.743 +/-(0.301)J	1.29 +/-(0.666)J	0.685 +/-(0.614)U	1.29 +/-(0.660)J
Anions											
Chloride	mg/L	203	183	200	212	205	203	209	211	225	220
Fluoride	mg/L	0.113 J	0.0768 J	0.173	0.233	0.149	0.116	0.110	0.0919 J	0.213 J	0.111
Sulfate	mg/L	231	214	244	224	231	220	229	226	233	214
General Chemistry											
Alkalinity, Bicarbonate	mg/L	-	-	-	-	264	-	253	238	261	268
Alkalinity, Carbonate	mg/L	-	-	-	-	<5.00	-	<5.00	<5.00	<5.00	<5.00
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	1,050	1,160	1,140	979	949	992	1,080	1,170	1,150	1,000

See notes on last page.

Stantec

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-211									
Sample Date		10-Mar-20	10-Mar-20	7-Apr-20	28-Jul-20	14-Sep-20	5-Oct-20	19-Jan-21	4-Mar-21	13-Apr-21	13-Apr-21
Sample ID		CUF-GW-020-03102020	CUF-GW-903-03102020	CUF-211-0420	CUF-GW-020-07282020	CUF-GW-020-09142020	CUF-211-1020	CUF-GW-CUF-211-01192021	CUF-GW-CUF-211-03042021	CUF-GW-211-04132021	CUF-GW-FD-04132021
Parent Sample ID			CUF-GW-020-03102020								CUF-GW-211-04132021
Sample Depth		67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft
Sample Type		Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample
Program	Units	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	State Compliance
Total Metals											
Aluminum	ug/L	22.7 J	22.7 J	-	21.7 J	21.8 J	-	<12.5	<12.5	-	-
Antimony	ug/L	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378
Arsenic	ug/L	10.2	10.4	9.79	10.4	11.5	10.2	10.3	10.4	9.90	9.33
Barium	ug/L	180	184	174	172	186	178	161	173	182	183
Beryllium	ug/L	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182
Boron	ug/L	5,360	5,940	6,190	5,540	5,850	5,630	6,130 J	5,810	5,100	4,990
Cadmium	ug/L	1.18	1.33	1.84	0.911 J	1.64	1.55	0.961 J	2.53	1.10	1.16
Calcium	ug/L	234,000	241,000	244,000	248,000	270,000	257,000	233,000	243,000	280,000	278,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	6.60	6.95	6.43	7.16	7.25	6.36	6.35	6.92	8.63	8.62
Copper	ug/L	1.12 J	0.644 J	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627
Iron	ug/L	37,400	38,100	-	37,700	39,700	-	35,600	37,900	-	-
Lead	ug/L	0.488 J	<0.128	0.230 J	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128
Lithium	ug/L	4.70 J	4.67 J	4.32 J	4.02 J	4.79 J	4.02 J	3.66 J	4.37 J	3.55 J	3.69 J
Magnesium	ug/L	9,520	9,850	-	10,100	10,400	-	9,420	9,570	-	-
Manganese	ug/L	12,400	13,000	-	11,900	14,000	-	11,700	12,500	-	-
Mercury	ug/L	0.101 UJ	0.101 UJ	<0.101	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130
Molybdenum	ug/L	9.66	10.2	9.53	9.59	12.8	13.4	9.39	9.10	8.86	8.94
Nickel	ug/L	3.73	3.63	3.43	3.74	4.27	3.73	3.56	3.31	4.38	4.07
Potassium	ug/L	12,200	12,600	-	14,200	15,200	-	12,600	12,600	-	-
Selenium	ug/L	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	61,600	63,500	-	62,500	66,500	-	60,200	62,400	-	-
Strontium	ug/L	556	579	-	623	696	-	576	593	-	-
Thallium	ug/L	<0.148	<0.148	0.439 J	<0.148	<0.148	<0.148	<0.148	0.482 J	0.198 J	<0.148
Vanadium	ug/L	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991
Zinc	ug/L	4.97 J	5.15	4.37 J	5.57	4.84 J	3.91 J	<3.22	<3.22	<3.22	<3.22
Radiological Parameters											
Radium-226	pCi/L	1.38 +/-(0.817)	1.73 +/-(0.806)	0.670 +/-(0.366)	1.03 +/-(0.593)	1.34 +/-(0.714)	0.421 +/-(0.534)U	1.13 +/-(0.684)	1.61 +/-(0.900)	0.961 +/-(0.524)	0.620 +/-(0.500)U
Radium-228	pCi/L	0.338 +/-(0.324)U	0.508 +/-(0.472)U	0.693 +/-(0.425)	0.0772 +/-(0.219)U	0.00550 +/-(0.283)U	0.482 +/-(0.438)U	0.405 +/-(0.537)U	0.136 +/-(0.385)U	0.462 +/-(0.521)U	1.81 +/-(0.813)U*
Radium-226+228	pCi/L	1.72 +/-(0.879)J	2.24 +/-(0.935)J	1.36 +/-(0.561)	1.10 +/-(0.632)J	1.34 +/-(0.768)J	0.903 +/-(0.690)U	1.53 +/-(0.870)J	1.74 +/-(0.979)J	1.42 +/-(0.739)J	2.43 +/-(0.954)U*
Anions											
Chloride	mg/L	238 J	252	239	262	269	274	341	222	278	287
Fluoride	mg/L	0.0852 J	0.180	0.136 U*	0.0766 J	0.0915 J	0.0980 J	0.125 U*	0.101	0.0829 J	0.0814 J
Sulfate	mg/L	245 J	264	243	245	261 J	260	376	241	246	253
General Chemistry											
Alkalinity, Bicarbonate	mg/L	229	219	-	261	240	-	244	241	-	-
Alkalinity, Carbonate	mg/L	<5.00	<5.00	-	<5.00	<5.00	-	<5.00	<5.00	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	1,040	1,070	1,000	1,110	1,110	1,650	1,220	1,060	1,110	1,200

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-211							
Sample Date		20-Jul-21	19-Aug-21	13-Oct-21	18-Jan-22	8-Mar-22	13-Apr-22	13-Jul-22	23-Aug-22
Sample ID		CUF-GW-CUF-211-07202021	CUF-GW-CUF-211-08192021	CUF-GW-CUF-211-10132021	CUF-GW-CUF-211-01182022	CUF-GW-CUF-211-03082022	CUF-GW-CUF-211-04132022	CUF-GW-CUF-211-07132022	CUF-GW-CUF-211-08232022
Parent Sample ID									
Sample Depth		67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program
Total Metals									
Aluminum	ug/L	<12.5	<12.5	-	33.3	<15.5	-	<15.5	24.3 U*
Antimony	ug/L	<0.378	<0.378	<0.378	0.392 J	<0.506	<0.506	<0.506	<0.506
Arsenic	ug/L	10.1	9.72	8.89	9.37	8.03	8.41	9.25	7.24
Barium	ug/L	218	178	183	132	113	102	104	112 J
Beryllium	ug/L	<0.182	<0.182	<0.182	<0.182	<0.274	<0.274	<0.274	<0.274
Boron	ug/L	5,220	5,520	5,260	4,700	5,650	2,940	5,770	5,080
Cadmium	ug/L	1.10	0.448 J	1.03	2.63	0.800 J	0.915 J	7.27	2.21
Calcium	ug/L	325,000	330,000	335,000	347,000	348,000	342,000	373,000	360,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	13.5	14.9	16.9	19.2	17.7	17.4	13.7	12.4
Copper	ug/L	<0.627	<0.627	<0.627	<0.627	<1.14	<1.14	<1.14	<1.14
Iron	ug/L	37,000	31,600	-	27,600	25,200	-	32,900	34,800
Lead	ug/L	<0.128	<0.128	<0.128	<0.128	<0.167	<0.167	<0.167	<0.167
Lithium	ug/L	<3.39	<3.39	<3.39	<3.39	1.80 J	1.62 J	2.29 J	1.55 J
Magnesium	ug/L	11,300	11,100	-	12,200	11,700	-	12,300	11,800
Manganese	ug/L	18,500	17,000	-	19,500	18,600	-	19,100	20,800
Mercury	ug/L	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130
Molybdenum	ug/L	6.49	9.26	6.18	4.35 J	3.48 J	3.99 J	4.27 J	3.29 J
Nickel	ug/L	3.95	4.36	4.49	5.01	4.47	4.74	4.16	3.74 U*
Potassium	ug/L	16,700	18,500	-	18,600	19,700	-	22,800	23,200
Selenium	ug/L	<1.51	<1.51	<1.51	<1.51	<0.739	<0.739	<0.739	<0.739
Silicon	ug/L	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.177	<0.177	<0.223	<0.223	0.223 UR	<0.223
Sodium	ug/L	79,400	83,500	-	89,700	90,200	-	101,000	101,000
Strontium	ug/L	850	834	-	887	886	-	921	927 J
Thallium	ug/L	<0.148	<0.148	<0.148	0.310 J	<0.472	<0.472	<0.472	<0.472
Vanadium	ug/L	<0.991	<0.991	<0.991	<0.991	<0.776	<0.776	<0.776	<0.776
Zinc	ug/L	3.75 J	4.98 U*	8.26 U*	11.3	9.64 U*	10.0 U*	10.6	6.85
Radiological Parameters									
Radium-226	pCi/L	0.776 +/-(0.486)	0.472 +/-(0.474)U	0.545 +/-(0.522)U	0.794 +/-(0.495)	0.387 +/-(0.546)U	0.240 +/-(0.320)U	1.19 +/-(0.742)	0.394 +/-(0.406)U
Radium-228	pCi/L	0.447 +/-(0.365)U	0.377 +/-(0.453)U	0.702 +/-(0.576)U	0.560 +/-(0.421)U	0.358 +/-(0.371)U	0.722 +/-(0.403)	0.576 +/-(0.476)U	0.433 +/-(0.487)U
Radium-226+228	pCi/L	1.22 +/-(0.608)J	0.849 +/-(0.655)U	1.25 +/-(0.778)U	1.35 +/-(0.650)J	0.745 +/-(0.660)U	0.963 +/-(0.515)J	1.77 +/-(0.881)J	0.827 +/-(0.634)U
Anions									
Chloride	mg/L	411 J	379	346	386	458	402	391	430
Fluoride	mg/L	0.173 U*	0.125 U*	0.135 J	0.0916 U*	0.0942 U*	0.0929 U*	0.107 J	1.18 U*
Sulfate	mg/L	327 J	336 J	328	469	555	473	515	444
General Chemistry									
Alkalinity, Bicarbonate	mg/L	246	258 J	-	261	222	-	236	192 J
Alkalinity, Carbonate	mg/L	<5.00	5.00 UR	-	<5.00	<5.00	-	<5.00	5.00 UJ
pH (lab)	SU	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	1,390	1,420	1,430	1,540	1,530	1,620	1,690	1,540

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-212											
Sample Date		7-Nov-16	24-Jan-17	24-Jan-17	7-Feb-17	8-Mar-17	8-Mar-17	5-Apr-17	3-May-17	31-May-17	31-May-17	12-Jul-17	27-Jul-17
Sample ID		CUF-GW-021-11072016	CUF-GW-021-01242017	CUF-GW-903-01242017	CUF-GW-021-02072017	CUF-GW-021-03082017	CUF-GW-903-03082017	CUF-GW-021-04052017	CUF-GW-021-05032017	CUF-GW-021-05312017	CUF-GW-903-05312017	CUF-GW-021-07122017	CUF-GW-021-07272017
Parent Sample ID				CUF-GW-021-01242017			CUF-GW-021-03082017				CUF-GW-021-05312017		
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals													
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	0.33 U*	<0.443	<0.443	0.818 U*	0.464 U*	0.515 U*	<0.443	<0.443	<0.443	<0.443	<0.443	<0.443
Arsenic	ug/L	7.09	8.37 J	7.67 J	6.96	6.81	7.01	7.86	6.82	7.32	7.62	7.32	6.53
Barium	ug/L	58.1	48.3	46.4	43	46.7	46.8	46.7	41.4	39.4	43.1	43.9	36.4
Beryllium	ug/L	<0.102	<0.131	<0.131	<0.131	<0.131	<0.131	0.759 J	<0.131	<0.131	<0.131	<0.131	<0.131
Boron	ug/L	36,800	47,100 J	46,200 J	42,300 J	39,800	41,100	52,400	35,100	36,800	38,700	54,200	37,400
Cadmium	ug/L	<0.152	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781	<0.0781
Calcium	ug/L	780,000	766,000	740,000	761,000	791,000	790,000	1.02 1.02e+006	845,000	763,000	793,000	828,000	855,000
Chromium	ug/L	<0.339	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378
Cobalt	ug/L	3	10.8	10.8	12	13.7	13.9	14.3	10.8	11.5	11.7	16.4	18.7
Copper	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	0.21 J	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318	<0.318
Lithium	ug/L	1.94 U*	3.07 U*	3.12 U*	2.74 U*	2.9 U*	3.12 U*	<2.12	2.53 U*	2.16 J	<2.12	<2.12	<2.12
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.0521	<0.0521	<0.0521	<0.0521	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653
Molybdenum	ug/L	94.9	41.2	40.4	34.7	35.7	35.5	32.7	25.4	28.3	28.4	25.4	22.5
Nickel	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	0.586 U*	<1.27	1.27 UJ	1.27 UJ	1.27 UJ	1.27 UJ	<1.27	<1.27	<1.27	<1.27	<1.27	<1.27
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<0.036	<0.0531	<0.0531	<0.0531	<0.0531	<0.0531	<0.0531	<0.0531	0.063 J	0.062 J	<0.0531	<0.0531
Vanadium	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Radiological Parameters													
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-	-	-
Radium-226+228	pCi/L	0.653 +/-(0.54)U	1.35 +/-(0.57)J	1.20 +/-(0.57)J	0.723 +/-(0.40)J	+/-(0.42)U	+/-(0.46)U	+/-(0.48)U	+/-(0.44)U	0.711 +/-(0.55)J	1.05 +/-(0.74)J	+/-(0.74)J	0.619 +/-(0.52)J
Anions													
Chloride	mg/L	687	674	707	716	731	729	755	685	632	635	638	647
Fluoride	mg/L	0.157 J	0.130 U*	0.106 U*	0.127 J	0.153 U*	0.168 U*	0.0959 J	0.121 J	0.111 J	0.113 J	0.147 J	0.109 J
Sulfate	mg/L	1,310	1,370	1,440	1,430	1,300	1,280	1,460	1,470	1,500	1,500	1,510	1,480
General Chemistry													
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	3,790	3,720	3,760	3,450	3,700	3,690	4,110	3,470	3,950	3,930	3,510	3,400

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-212										
Sample Date		17-Aug-17	17-Aug-17	30-Aug-17	3-Oct-17	3-Oct-17	1-Jun-18	21-Jun-18	12-Jul-18	2-Aug-18	22-Aug-18	23-Jan-19
Sample ID		CUF-GW-021-08172017	CUF-GW-903-08172017	CUF-GW-021-08302017	CUF-GW-021-10032017	CUF-GW-903-10032017	CUF-GW-021-06012018	CUF-GW-021-06212018	CUF-GW-021-07122018	CUF-GW-021-08022018	CUF-GW-021-08222018	212-0119
Parent Sample ID			CUF-GW-021-08172017			CUF-GW-021-10032017						
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance
Total Metals												
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<0.443	<0.443	0.962 U*	-	-	<1.12	<1.12	<1.12	<1.12	<1.12	<1.12
Arsenic	ug/L	5.76	5.87	5.34	-	-	5.41	4.85	5.27	4.23	5.68	5.38
Barium	ug/L	42.4	42	38.3	-	-	36.9	37.4	35.6	28.7	33.8	32.8
Beryllium	ug/L	<0.131	<0.131	<0.131	-	-	<0.057	<0.057	<0.057	<0.057	<0.057	<0.057
Boron	ug/L	39,800	39,800	36,800	36,900	38,000	37,600	41,100	37,800	34,900	38,000	37,100
Cadmium	ug/L	<0.0781	<0.0781	<0.0781	-	-	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
Calcium	ug/L	738,000	739,000	795,000	750,000	773,000	725,000	751,000	747,000	717,000	692,000	710,000
Chromium	ug/L	0.393 U*	<0.378	0.445 U*	-	-	<0.631	1.5 U*	1.28 U*	<0.631	1.73 U*	1.77 U*
Cobalt	ug/L	17.1	17.2	17.9	-	-	16.9	22.8	27.2	18.1	27	22.8
Copper	ug/L	-	-	-	-	-	-	-	-	-	-	<1.3
Iron	ug/L	-	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<0.318	<0.318	<0.318	-	-	0.154 J	<0.094	<0.094	<0.094	<0.094	<0.094
Lithium	ug/L	2.26 J	2.35 J	3 U*	-	-	2.87 U*	3.04 J	<2.56	<2.56	<2.56	<2.56
Magnesium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.0653	<0.0653	<0.0653	-	-	<0.0653	<0.0653	<0.0653	<0.0653	<0.0653	<0.101
Molybdenum	ug/L	23.4	22.9	23	-	-	15.7	14	14.5	13.5	14.6	14.6
Nickel	ug/L	-	-	-	-	-	-	-	-	-	-	11.2
Potassium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Selenium	ug/L	<1.27	<1.27	<1.27	-	-	<0.813	<0.813	<0.813	<0.813	<0.813	<0.813
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	-	-	-	-	-	-	-	-	-	<0.121
Sodium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<0.0531	<0.0531	<0.0531	-	-	0.083 J	0.157 J	0.152 J	0.159 J	0.141 J	0.126 J
Vanadium	ug/L	-	-	-	-	-	-	-	-	-	-	1.4 U*
Zinc	ug/L	-	-	-	-	-	-	-	-	-	-	<2.42
Radiological Parameters												
Radium-226	pCi/L	-	-	-	-	-	-	-	-	-	-	0.109 +/-(0.0630)
Radium-228	pCi/L	-	-	-	-	-	-	-	-	-	-	0.208 +/-(0.285)U
Radium-226+228	pCi/L	1.21 +/-(0.47)J	+/-(0.34)UJ	+/-(0.65)J	-	-	0.875 +/-(0.296)J	0.644 +/-(0.266)J	1.24 +/-(0.391)J	0.821 +/-(0.317)U*	0.681 +/-(0.286)U*	-
Anions												
Chloride	mg/L	604	612	654	669	676	559	548	529	457	494	560
Fluoride	mg/L	0.117 J	0.171 J	0.0944 J	<0.132	<0.132	0.137 J	0.151	<0.263	<0.132	0.137 J	0.220 J
Sulfate	mg/L	1,410	1,420	1,520	1,250	1,260	1,490	1,420	1,200	1,420	1,470	1,430
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	3,430	3,450	3,340	3,600	3,310	3,350	3,610	3,330	3,890	1,730	3,080

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location							CUF-212					
Sample Date		7-Feb-19	9-Apr-19	9-May-19	31-Jul-19	9-Oct-19	28-Jan-20	11-Mar-20	7-Apr-20	7-Apr-20	28-Jul-20	14-Sep-20
Sample ID		CUF-GW-021-02072019	CUF-212	CUF-GW-021-05092019	CUF-GW-021-07312019	CUF-GW-021-10092019	CUF-GW-021-01282020	CUF-GW-021-03112020	CUF-212-0420	CUF-212-DUP-0420	CUF-GW-021-07282020	CUF-GW-021-09142020
Parent Sample ID										CUF-212-0420		
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	State Compliance	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	34.1	-	<12.5	19.1 J	<12.5	<12.5	<12.5	-	-	<12.5	20.1 J
Antimony	ug/L	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378
Arsenic	ug/L	5.03	6.1	5.23	4.70	4.31	4.33	3.49	3.20	3.09	3.57	3.89
Barium	ug/L	36.1	30.8	54.8	33.9	32.9	29.9	32.8	31.1	31.0	31.0	30.3
Beryllium	ug/L	<0.155	<0.155	<0.155	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182
Boron	ug/L	40,000	38,300	42,800	38,700	33,000	34,800	36,600	40,100	41,000	37,800	37,500
Cadmium	ug/L	<0.125	<0.125	<0.125	<0.125	<0.125	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217
Calcium	ug/L	735,000	691,000	761,000	706,000	679,000	737,000	751,000	722,000	722,000	731,000	720,000
Chromium	ug/L	<1.53	<1.53	<1.53	1.83 U*	1.88 U*	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	21.9	19.9	24.7	22.6	21.0	20.3	24.9	22.8	22.6	24.5	22.2
Copper	ug/L	<0.627	0.921 J	1.59 J	1.34 J	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627
Iron	ug/L	10,200	-	10,100	9,110	9,520	8,670	9,210	-	-	10,500	9,780
Lead	ug/L	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128
Lithium	ug/L	<3.14	<3.14	5.17 U*	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39
Magnesium	ug/L	44,500	-	45,200	46,500	42,200	38,400	43,000	-	-	41,900	40,600
Manganese	ug/L	11,500	-	10,300	9,090	9,550	9,910	10,200	-	-	10,100	10,200
Mercury	ug/L	<0.101	<0.101	<0.101	<0.101	<0.101	<0.101	0.101 UJ	<0.101	<0.101	<0.130	<0.130
Molybdenum	ug/L	15.3	15.6	14.7	17.4	15.8	18.2	20.2	16.4	17.1	20.7	21.1
Nickel	ug/L	10.5	10	13	12.9	11.4	11.5	12.6	12.5	12.2	14.8	12.6
Potassium	ug/L	38,100	-	36,600	38,100	35,500	35,200	36,800	-	-	35,900	34,300
Selenium	ug/L	<2.62	<2.62	<2.62	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	-	<0.121	-	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	46,400	-	46,600	47,200	45,900	41,500	46,800	-	-	46,700	43,900
Strontium	ug/L	1,900	-	2,030	1,890	1,700	1,810	1,790	-	-	1,880	1,940
Thallium	ug/L	0.146 J	0.13 J	0.143 J	0.201 J	0.184 J	<0.148	0.175 J	0.292 J	0.289 J	0.196 J	0.259 J
Vanadium	ug/L	-	0.978 J	-	1.03	1.05	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991
Zinc	ug/L	-	<3.22	-	7.55 U*	<3.22	<3.22	4.51 U*	<3.22	<3.22	<3.22	3.31 J
Radiological Parameters												
Radium-226	pCi/L	0.193 +/-(0.0866)J	0.168 +/-(0.0757)	0.206 +/-(0.0884)	0.492 +/-(0.407)U	0.728 +/-(0.537)U	0.878 +/-(0.576)	0.895 +/-(0.625)	0.679 +/-(0.363)	0.373 +/-(0.400)U	0.560 +/-(0.415)	0.420 +/-(0.489)U
Radium-228	pCi/L	0.116 +/-(0.221)U	0.760 +/-(0.356)	0.594 +/-(0.443)U	-0.402 +/-(0.404)U	0.156 +/-(0.334)U	0.163 +/-(0.530)UJ	0.0589 +/-(0.459)U	0.215 +/-(0.421)U	0.569 +/-(0.440)U	0.137 +/-(0.378)U	0.512 +/-(0.438)U
Radium-226+228	pCi/L	0.309 +/-(0.237)J	-	0.800 +/-(0.452)J	0.492 +/-(0.573)U	0.884 +/-(0.632)U	1.04 +/-(0.783)J	0.954 +/-(0.775)J	0.894 +/-(0.556)J	0.942 +/-(0.595)U	0.697 +/-(0.561)J	0.932 +/-(0.657)U
Anions												
Chloride	mg/L	547	498	521	470	442	446	427	418	426	411	381
Fluoride	mg/L	<0.0658	0.0718 J	0.114 J	0.136 J	0.124 J	<0.0658	<0.0658	0.112 U*	0.115 U*	0.0658 UJ	<0.0658
Sulfate	mg/L	1,480	1,370	1,510	1,460	1,520	1,390	1,500	1,410	1,410	1,460	1,390 J
General Chemistry												
Alkalinity, Bicarbonate	mg/L	54.0	-	33.8	33.9	40.3	38.5	32.3	-	-	38.2	36.1
Alkalinity, Carbonate	mg/L	<5.00	-	<5.00	<5.00	<5.00	<5.00	<5.00	-	-	<5.00	<5.00
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	2,750	3,220	3,300	3,430	3,270	2,970	3,080	3,190 J	3,090 J	3,000	2,440

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-212										
Sample Date		6-Oct-20	19-Jan-21	3-Mar-21	3-Mar-21	14-Apr-21	19-Jul-21	19-Jul-21	19-Aug-21	14-Oct-21	19-Jan-22	19-Jan-22
Sample ID		CUF-212-1020	CUF-GW-CUF-212-01192021	CUF-GW-CUF-212-03032021	CUF-GW-FD02-03032021	CUF-GW-212-04142021	CUF-GW-CUF-212-07192021	CUF-GW-FD02-07192021	CUF-GW-CUF-212-08192021	CUF-GW-CUF-212-10142021	CUF-GW-CUF-212-01192022	CUF-GW-FD02-01192022
Parent Sample ID					CUF-GW-CUF-212-03032021			CUF-GW-CUF-212-07192021				CUF-GW-CUF-212-01192022
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program
Total Metals												
Aluminum	ug/L	-	<12.5	<12.5	<12.5	-	<12.5	12.6 J	15.1 J	-	12.6 J	13.0 J
Antimony	ug/L	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378
Arsenic	ug/L	3.92	3.45	4.08	4.20	3.62	3.98	4.20	3.73	3.37	2.99	3.48
Barium	ug/L	31.5	29.5	32.6	31.4	29.4	31.4	30.3	28.1	28.5	28.4	28.3
Beryllium	ug/L	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182
Boron	ug/L	38,500	37,000 J	36,100	35,400	36,300	38,300	36,100	39,600	35,600	36,100	37,000
Cadmium	ug/L	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217
Calcium	ug/L	721,000	724,000	719,000	729,000	701,000	714,000	699,000	726,000	692,000	659,000	676,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	19.9	23.3	23.7	24.0	26.1	21.1	21.0	23.1	23.8	27.2	27.4
Copper	ug/L	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627	<0.627
Iron	ug/L	-	8,170	10,300	9,660	-	8,810	8,530	8,510	-	9,770	9,840
Lead	ug/L	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128
Lithium	ug/L	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39
Magnesium	ug/L	-	40,500	40,000	40,100	-	39,200	38,800	40,300	-	40,700	40,500
Manganese	ug/L	-	10,500	12,000	11,900	-	9,830	9,860	9,830	-	11,200	11,500
Mercury	ug/L	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130
Molybdenum	ug/L	22.2	21.0	18.2	18.5	20.2	21.0	21.0	21.7	21.5	18.6	18.9
Nickel	ug/L	11.5	13.2	12.9	13.2	14.4	11.0	11.1	13.1	12.7	14.2	15.1
Potassium	ug/L	-	36,200	33,400	33,300	-	36,200	35,300	34,900	-	31,900	32,200
Selenium	ug/L	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	-	43,600	48,100	49,000	-	41,000	40,300	42,600	-	47,100	46,800
Strontium	ug/L	-	1,830	1,780	1,810	-	1,930	1,910	1,890	-	1,670	1,700
Thallium	ug/L	0.179 U*	<0.148	0.159 J	0.184 J	0.237 J	0.238 J	0.517 J	0.165 J	0.201 U*	0.218 J	0.207 J
Vanadium	ug/L	<0.991	1.60 U*	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991
Zinc	ug/L	<3.22	<3.22	<3.22	<3.22	<3.22	3.37 J	4.04 J	5.16 U*	<3.22	<3.22	<3.22
Radiological Parameters												
Radium-226	pCi/L	0.327 +/-(0.371)U	0.564 +/-(0.516)U	0.882 +/-(0.696)U	0.447 +/-(0.561)U	0.208 +/-(0.521)U	0.377 +/-(0.317)U	-0.0456 +/-(0.221)U	0.196 +/-(0.426)U	0.751 +/-(0.532)	0.231 +/-(0.280)U	0.316 +/-(0.410)U
Radium-228	pCi/L	-0.0266 +/-(0.370)U	0.170 +/-(0.487)U	0.407 +/-(0.442)U	0.0529 +/-(0.482)U	0.569 +/-(0.458)U	0.361 +/-(0.423)U	0.473 +/-(0.425)U	0.313 +/-(0.328)U	-0.0744 +/-(0.399)U	0.206 +/-(0.363)UJ	0.885 +/-(0.479)J
Radium-226+228	pCi/L	0.327 +/-(0.524)U	0.734 +/-(0.709)U	1.29 +/-(0.824)U	0.500 +/-(0.740)U	0.777 +/-(0.694)U	0.738 +/-(0.529)U	0.473 +/-(0.479)U	0.509 +/-(0.538)U	0.751 +/-(0.665)J	0.437 +/-(0.459)UJ	1.20 +/-(0.631)J
Anions												
Chloride	mg/L	406	438	436	446	403	377	428	352	381	357	370
Fluoride	mg/L	<0.0658	0.0995 U*	<0.0650	<0.0650	<0.0650	0.0853 U*	0.0891 U*	0.125 U*	0.0792 J	0.111 J	0.350 J
Sulfate	mg/L	1,410	2,020	1,500	1,840	1,520	1,580	1,630	1,550 J	1,590	1,550	1,500
General Chemistry												
Alkalinity, Bicarbonate	mg/L	-	35.7	34.5	32.2	-	30.7 J	39.9 J	28.3 J	-	28.1 J	40.0 J
Alkalinity, Carbonate	mg/L	-	<5.00	<5.00	<5.00	-	5.00 UR	<5.00	5.00 UR	-	<5.00	5.00 UR
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	2,780	3,900	3,130	2,970	2,930	2,980	3,020	3,000	2,970	2,840	2,870

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-212					CUF-1001			
Sample Date		4-Mar-22	4-Mar-22	13-Apr-22	13-Jul-22	25-Aug-22	8-May-19	8-Jul-19	8-Jul-19	10-Sep-19
Sample ID		CUF-GW-CUF-212-03042022	CUF-GW-FD02-03042022	CUF-GW-CUF-212-04132022	CUF-GW-CUF-212-07132022	CUF-GW-CUF-212-08252022	CUF-GW-027-20190508	CUF-GW-027-20190708	CUF-GW-DUP01-20190708	CUF-GW-027-20190910
Parent Sample ID			CUF-GW-CUF-212-03042022						CUF-GW-027-20190708	
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	19 ft	19 ft	19 ft	19 ft
Sample Type		Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	EIP	EIP	EIP	EIP
Total Metals										
Aluminum	ug/L	<15.5	<15.5	-	96.8	65.9 U*	-	-	-	-
Antimony	ug/L	<0.506	<0.506	<0.506	2.51	1.06 J	<0.378	<0.378	<0.378	<0.378
Arsenic	ug/L	2.88	3.27	4.13	2.57	3.12	0.520 U*	2.72	2.72	2.83
Barium	ug/L	28.4	30.0	28.5	27.5	26.8	62.3	62.2	64.2	82.3
Beryllium	ug/L	<0.274	<0.274	<0.274	<0.274	<0.274	<0.155	<0.155	<0.155	0.228 U*
Boron	ug/L	35,800	36,100	35,400	28,800	32,200	3,210	3,430	3,650	3,960
Cadmium	ug/L	<0.217	<0.217	<0.217	<0.217	<0.217	<0.125	<0.125	<0.125	<0.125
Calcium	ug/L	645,000	670,000	664,000	566,000	620,000	228,000	234,000	242,000	243,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	1.56 U*	<1.53	2.29 U*	2.78 U*
Cobalt	ug/L	23.9	24.6	23.3	12.8	22.0	3.96	0.529	0.517	0.737
Copper	ug/L	<1.14	<1.14	<1.14	<1.14	<1.14	<0.627	<0.627	0.635 U*	1.08 U*
Iron	ug/L	8,260	8,430	-	3,590	6,960	-	-	-	-
Lead	ug/L	<0.167	0.318 J	<0.167	0.198 J	0.247 J	<0.128	<0.128	<0.128	<0.128
Lithium	ug/L	<0.831	0.890 J	1.46 J	1.24 J	1.62 J	4.01 J	5.15 U*	5.75 U*	8.05 U*
Magnesium	ug/L	39,400	40,800	-	34,900	36,500	25,200	24,400	25,400	24,100
Manganese	ug/L	9,670	10,000	-	6,280	8,280	-	-	-	-
Mercury	ug/L	<0.130	<0.130	<0.130	<0.130	<0.130	<0.101	<0.101	<0.101	<0.101
Molybdenum	ug/L	25.5	26.8	20.7	25.4	24.4	225	80.0	81.6	63.9
Nickel	ug/L	13.4	14.1	13.4	13.8	15.0	3.96	0.574 U*	0.638 U*	0.481 J
Potassium	ug/L	33,200	34,300	-	29,300	31,900	8,240	6,590	6,830	5,570
Selenium	ug/L	<0.739	<0.739	<0.739	<0.739	<0.739	<2.62	<2.62	<2.62	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.223	<0.223	<0.223	<0.223	<0.223	<0.121	<0.121	<0.121	<0.177
Sodium	ug/L	43,000	44,400	-	35,400	38,700	15,400	15,500	16,100	17,700
Strontium	ug/L	1,760 J	1,840 J	-	1,500	1,640	-	-	-	-
Thallium	ug/L	<0.472	<0.472	<0.472	<0.472	0.714 J	<0.128	<0.128	<0.128	<0.148
Vanadium	ug/L	<0.776	<0.776	<0.776	<0.776	<0.776	1.34 U*	1.07 U*	1.65 U*	1.57 U*
Zinc	ug/L	<2.88	<2.88	<2.88	22.5	15.0	<3.22	<3.22	<3.22	4.07 U*
Radiological Parameters										
Radium-226	pCi/L	0.302 +/-(0.453)U	0.617 +/-(0.643)U	0.366 +/-(0.355)U	0.201 +/-(0.512)U	0.462 +/-(0.498)U	0.123 +/-(0.0796)	0.106 +/-(0.162)U	0.0722 +/-(0.164)UJ	0.811 +/-(0.678)U
Radium-228	pCi/L	0.227 +/-(0.333)UJ	0.430 +/-(0.377)UJ	0.227 +/-(0.409)U	0.910 +/-(0.477)U*	0.00777 +/-(0.424)U	0.184 +/-(0.252)U	0.223 +/-(0.672)U	0.824 +/-(0.823)UJ	0.0586 +/-(0.298)U
Radium-226+228	pCi/L	0.530 +/-(0.562)UJ	1.05 +/-(0.745)UJ	0.592 +/-(0.541)U	1.11 +/-(0.700)U*	0.470 +/-(0.653)U	0.307 +/-(0.264)J	0.329 +/-(0.691)U	0.896 +/-(0.839)UJ	0.870 +/-(0.741)U
Anions										
Chloride	mg/L	406	381	386	334	313	40.6	54.7	53.6	64.6
Fluoride	mg/L	0.0840 J	0.0807 J	0.126 U*	0.133 J	0.224 U*	0.169	0.140	0.140	0.147
Sulfate	mg/L	1,660	1,640	1,510	1,300	1,240	456	388	379	466
General Chemistry										
Alkalinity, Bicarbonate	mg/L	30.4	31.1	-	36.5	29.8 J	295	252	251	257
Alkalinity, Carbonate	mg/L	<5.00	<5.00	-	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
pH (lab)	SU	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	2,830	2,810	3,240	2,630	2,730	975	938	952	1,040

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-1001								
Sample Date		29-Oct-19	29-Oct-19	7-Jan-20	7-Jan-20	10-Mar-20	10-Mar-20	2-Mar-21	2-Mar-21	13-Jul-21
Sample ID		CUF-GW-027-20191029	CUF-GW-DUP01-20191029	CUF-GW-027-20200107	CUF-GW-DUP01-20200107	CUF-GW-027-20200310	CUF-GW-DUP01-20200310	CUF-GW-CUF-1001-03022021	CUF-GW-FD01-03022021	CUF-GW-CUF-1001-07132021
Parent Sample ID			CUF-GW-027-20191029		CUF-GW-027-20200107		CUF-GW-027-20200310		CUF-GW-CUF-1001-03022021	
Sample Depth		19 ft	19 ft	19 ft	19 ft	19 ft	19 ft	19 ft	19 ft	19 ft
Sample Type		Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample
Program	Units	EIP	EIP	EIP	EIP	EIP	EIP	EIP	EIP	CCR Program
Total Metals										
Aluminum	ug/L	-	-	-	-	-	-	<12.5	<12.5	<12.5
Antimony	ug/L	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378
Arsenic	ug/L	2.59	2.66	2.13	2.14	0.945 J	0.977 J	0.745 J	0.746 J	1.08
Barium	ug/L	62.3	63.6	56.6	60.1	49.5	49.2	36.5	36.3	43.2
Beryllium	ug/L	<0.182	<0.182	0.182 J	<0.182	<0.182	<0.182	<0.182	<0.182	<0.182
Boron	ug/L	2,930	3,110	4,080	4,110	3,310	3,590	2,870	2,770	2,880
Cadmium	ug/L	<0.125	<0.125	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217
Calcium	ug/L	245,000	255,000	268,000	278,000	276,000	272,000	262,000	257,000	269,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	0.687	0.671	1.51	1.48	1.63	1.49	0.656	0.686	1.37
Copper	ug/L	<0.627	<0.627	1.01 J	0.768 J	0.888 U*	1.05 U*	<0.627	<0.627	<0.627
Iron	ug/L	-	-	-	-	-	-	556	566	1,620
Lead	ug/L	0.147 J	<0.128	<0.128	<0.128	<0.128	0.139 U*	<0.128	<0.128	<0.128
Lithium	ug/L	11.4	9.85	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39
Magnesium	ug/L	23,900	24,800	27,600	28,500	25,500	24,900	24,000	23,600	23,700
Manganese	ug/L	-	-	-	-	-	-	819	847	2,140
Mercury	ug/L	0.101 UJ	0.101 UJ	<0.101	<0.101	<0.101	<0.101	<0.130	<0.130	<0.130
Molybdenum	ug/L	81.8	82.0	184	189	177	179	152	150	149
Nickel	ug/L	0.582 U*	0.405 U*	2.61 U*	2.70 U*	2.72	2.52	2.11 U*	2.14 U*	1.55 U*
Potassium	ug/L	5,670	5,870	6,850	7,090	5,610	5,530	6,480	6,330	5,750
Selenium	ug/L	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51
Silicon	ug/L	-	-	-	-	-	-	5,560	5,500	5,620
Silver	ug/L	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	16,300	16,700	15,800	16,400	16,700	16,300	14,000	13,500	20,900
Strontium	ug/L	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<0.148	<0.148	<0.148	<0.148	<0.148	<0.148	<0.148	<0.148	<0.148
Vanadium	ug/L	1.66	1.01	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991	<0.991
Zinc	ug/L	<3.22	6.33 U*	<3.22	<3.22	<3.22	<3.22	<3.22	<3.22	<3.22
Radiological Parameters										
Radium-226	pCi/L	0.370 +/-(0.495)U	0.377 +/-(0.292)U	0.337 +/-(0.542)U	-0.0986 +/-(0.392)U	0.932 +/-(0.699)	0.563 +/-(0.594)U	0.471 +/-(0.549)U	0.181 +/-(0.337)U	0.403 +/-(0.341)U
Radium-228	pCi/L	0.535 +/-(0.373)J	-0.156 +/-(0.404)UJ	0.0990 +/-(0.365)U	0.0746 +/-(0.470)U	0.438 +/-(0.378)U	-0.0684 +/-(0.282)U	-0.0825 +/-(0.318)U	0.216 +/-(0.440)U	0.185 +/-(0.286)U
Radium-226+228	pCi/L	0.905 +/-(0.620)J	0.377 +/-(0.498)UJ	0.436 +/-(0.654)U	0.0746 +/-(0.612)U	1.37 +/-(0.794)J	0.563 +/-(0.658)U	0.471 +/-(0.634)U	0.397 +/-(0.555)U	0.588 +/-(0.445)U
Anions										
Chloride	mg/L	67.2	69.0	53.3	52.4	54.2	55.3	35.8	35.4	50.5
Fluoride	mg/L	0.158	0.154	0.129	0.124	0.176	0.185	0.154	0.155	0.105
Sulfate	mg/L	465	400	514	517	479	485	438	451	526
General Chemistry										
Alkalinity, Bicarbonate	mg/L	250	258	224	226	214	223	228	232	230
Alkalinity, Carbonate	mg/L	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
pH (lab)	SU	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	1,070	1,050	1,060	1,070	1,050	1,040	703 J	920 J	1,090

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-1001			CUF-1002							
Sample Date		8-Mar-22	23-Aug-22	23-Aug-22	9-May-19	9-Jul-19	11-Sep-19	11-Sep-19	29-Oct-19	8-Jan-20	11-Mar-20	14-Jul-21
Sample ID		CUF-GW-CUF-1001-03082022	CUF-GW-CUF-1001-08232022	CUF-GW-FD02-08232022	CUF-GW-028-20190509	CUF-GW-028-20190709	CUF-GW-028-20190911	CUF-GW-DUP01-20190911	CUF-GW-028-20191029	CUF-GW-028-20200108	CUF-GW-028-20200311	CUF-GW-1002-07142021
Parent Sample ID				CUF-GW-CUF-1001-08232022				CUF-GW-028-20190911				
Sample Depth		19 ft	19 ft	19 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	EIP	EIP	EIP	EIP	EIP	EIP	EIP	State Compliance
Total Metals												
Aluminum	ug/L	<15.5	<15.5	<15.5	-	-	-	-	-	-	-	-
Antimony	ug/L	<0.506	<0.506	<0.506	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378	<0.378
Arsenic	ug/L	0.531 J	0.872 J	0.890 J	3.05	6.27	6.30	7.08	6.92	2.54	0.684 J	1.10
Barium	ug/L	33.6	42.5	39.8	75.2	54.7	59.8	63.4	49.6	53.9	54.7	106
Beryllium	ug/L	<0.274	<0.274	<0.274	<0.155	<0.155	0.212 U*	0.925 U*	<0.182	<0.182	<0.182	<0.182
Boron	ug/L	2,570	2,450	2,340	258 U*	414	341 U*	374 U*	226	328	351 U*	300
Cadmium	ug/L	<0.217	<0.217	<0.217	<0.125	<0.125	<0.125	0.247 J	<0.125	<0.217	<0.217	<0.217
Calcium	ug/L	261,000	270,000	256,000	240,000	224,000	212,000	222,000	214,000	223,000	233,000	203,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	2.71 U*	3.28 U*	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	0.711	1.22	1.18	1.32	0.779	0.598	0.870	0.450 J	0.147 J	0.135 J	<0.134
Copper	ug/L	<1.14	<1.14	<1.14	<0.627	<0.627	0.919 U*	1.15 U*	<0.627	<0.627	<0.627	<0.627
Iron	ug/L	442	1,170	1,120	-	-	-	-	-	-	-	-
Lead	ug/L	<0.167	<0.167	<0.167	0.136 U*	<0.128	<0.128	0.245 J	<0.128	<0.128	<0.128	<0.128
Lithium	ug/L	1.18 J	1.08 J	1.33 J	<3.14	4.52 U*	6.08 U*	8.37 U*	9.07	<3.39	<3.39	<3.39
Magnesium	ug/L	23,400	24,400	23,200	33,700	31,700	30,600	32,100	29,700	33,300	29,800	-
Manganese	ug/L	1,200	3,340	3,190	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.130	<0.130	<0.130	<0.101	0.101 UJ	<0.101	<0.101	0.101 UJ	<0.101	0.101 UJ	<0.130
Molybdenum	ug/L	100	120	114	1.83 J	2.02 J	2.61 J	2.92 J	2.73 U*	2.47 U*	1.09 J	0.888 J
Nickel	ug/L	1.33	2.00	2.06	2.35	1.86 U*	1.02	1.18	0.583 U*	1.54 U*	<0.336	<0.336
Potassium	ug/L	5,320	5,470	5,190	1,760	1,620	1,710	1,810	1,640	1,620	1,450	-
Selenium	ug/L	0.893 J	1.61 J	1.53 J	<2.62	<2.62	<1.51	<1.51	<1.51	<1.51	<1.51	<1.51
Silicon	ug/L	5,980	6,030	5,760	-	-	-	-	-	-	-	-
Silver	ug/L	<0.223	<0.223	<0.223	<0.121	<0.121	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	33,900	29,300	28,200	35,300	24,100	23,500	24,800	66,000	48,400	33,200	-
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<0.472	<0.472	<0.472	<0.128	<0.128	<0.148	0.427 U*	<0.148	<0.148	0.345 J	<0.148
Vanadium	ug/L	<0.776	<0.776	<0.776	1.19 U*	0.926 U*	1.66 U*	1.82 U*	1.73	<0.991	<0.991	<0.991
Zinc	ug/L	<2.88	<2.88	<2.88	9.13	<3.22	4.46 U*	3.46 U*	4.62 U*	<3.22	<3.22	<3.22
Radiological Parameters												
Radium-226	pCi/L	0.0380 +/-(0.208)U	0.236 +/-(0.431)U	0.186 +/-(0.278)U	0.125 +/-(0.0837)	-0.0415 +/-(0.0652)U	0.458 +/-(0.581)U	0.0334 +/-(0.410)U	0.393 +/-(0.498)U	0.602 +/-(0.580)U	0.957 +/-(0.686)	0.206 +/-(0.276)U
Radium-228	pCi/L	0.290 +/-(0.320)U	0.329 +/-(0.493)U	0.700 +/-(0.519)U	-0.198 +/-(0.292)U	-0.0443 +/-(0.231)U	0.246 +/-(0.286)U	0.472 +/-(0.349)U	0.383 +/-(0.304)U	0.245 +/-(0.322)U	-0.164 +/-(0.349)U	0.265 +/-(0.287)U
Radium-226+228	pCi/L	0.328 +/-(0.381)U	0.565 +/-(0.655)U	0.886 +/-(0.589)U	0.125 +/-(0.304)J	0.000 +/-(0.240)U	0.703 +/-(0.648)U	0.505 +/-(0.538)U	0.775 +/-(0.584)U	0.847 +/-(0.663)U	0.957 +/-(0.770)J	0.471 +/-(0.398)U
Anions												
Chloride	mg/L	53.5	56.6	55.0	43.2	33.0	25.2	25.6	29.4	32.3	35.9	22.8
Fluoride	mg/L	0.165 U*	0.177	0.183	0.313	0.329	0.323	0.325	0.349	0.276	0.403	0.329
Sulfate	mg/L	543	496	476	367	343	345	334	385	337	295	263
General Chemistry												
Alkalinity, Bicarbonate	mg/L	246	178 J	179 J	374	335	357	346	359	361	359	-
Alkalinity, Carbonate	mg/L	<5.00	5.00 UJ	5.00 UJ	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	-
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	1,060	1,160	1,140	957	897	900	907	935	947	853	848

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-1002				CUF-1003					
Sample Date		14-Oct-21	19-Jan-22	12-Apr-22	13-Jul-22	8-May-19	9-Jul-19	10-Sep-19	30-Oct-19	7-Jan-20	10-Mar-20
Sample ID		CUF-GW-CUF-1002-10142021	CUF-GW-CUF-1002-01192022	CUF-GW-CUF-1002-04122022	CUF-GW-CUF-1002-07132022	CUF-GW-029-20190508	CUF-GW-029-20190709	CUF-GW-029-20190910	CUF-GW-029-20191030	CUF-GW-029-20200107	CUF-GW-029-20200310
Parent Sample ID											
Sample Depth		18 ft	18 ft	18 ft	18 ft	16.8 ft	16.8 ft	16.8 ft	16.8 ft	16.8 ft	16.8 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	EIP	EIP	EIP	EIP	EIP	EIP
Total Metals											
Aluminum	ug/L	-	-	-	-	-	-	-	-	-	-
Antimony	ug/L	<0.378	<0.378	<0.506	<0.506	<0.378	0.584 J	<0.378	<0.378	<0.378	<0.378
Arsenic	ug/L	0.488 J	0.912 J	0.779 J	0.378 J	0.335 U*	0.719 J	0.608 U*	0.408 J	1.25	<0.313
Barium	ug/L	87.3	89.2	80.5	87.0	42.3	40.3	42.1	35.8	31.5	24.6
Beryllium	ug/L	<0.182	<0.182	<0.274	<0.274	<0.155	0.342 U*	0.192 U*	0.481 U*	<0.182	<0.182
Boron	ug/L	353	315	364	346	24,900	22,400	23,200	12,000	12,700	7,460
Cadmium	ug/L	<0.217	<0.217	<0.217	<0.217	0.299 J	0.188 J	0.174 J	0.308 J	0.295 J	<0.217
Calcium	ug/L	204,000	196,000	202,000	214,000	674,000	633,000	591,000	585,000	543,000	487,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	3.19 U*	2.73 U*	2.87 U*	<1.53	<1.53	<1.53
Cobalt	ug/L	<0.134	<0.134	<0.261	<0.261	4.29	1.99	1.46	0.807	0.756	0.665
Copper	ug/L	<0.627	<0.627	<1.14	<1.14	3.04	1.40 U*	1.52 U*	<0.627	1.14 J	1.11 U*
Iron	ug/L	-	-	-	-	-	-	-	-	-	-
Lead	ug/L	<0.128	0.154 J	<0.167	<0.167	<0.128	0.128 J	<0.128	<0.128	<0.128	<0.128
Lithium	ug/L	<3.39	<3.39	0.855 J	<0.831	5.65	8.10 U*	7.50 U*	5.84 U*	<3.39	<3.39
Magnesium	ug/L	-	-	-	-	70,700	70,300	63,700	65,300	50,200	39,000
Manganese	ug/L	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	<0.130	<0.130	<0.130	<0.130	<0.101	0.101 UJ	<0.101	<0.101	<0.101	<0.101
Molybdenum	ug/L	1.57 J	2.13 J	0.936 J	1.52 J	561	597	579	373	265	181
Nickel	ug/L	<0.336	<0.336	<0.517	<0.517	6.03	1.66 U*	1.36	1.07 U*	2.04 U*	1.34
Potassium	ug/L	-	-	-	-	29,100	35,000	34,100	32,500	18,400	13,200
Selenium	ug/L	<1.51	<1.51	<0.739	<0.739	<2.62	<2.62	<1.51	<1.51	<1.51	<1.51
Silicon	ug/L	-	-	-	-	-	-	-	-	-	-
Silver	ug/L	<0.177	<0.177	<0.223	<0.223	<0.121	<0.121	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	-	-	-	-	45,400	45,500	48,700	27,800	174,000	184,000
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<0.148	<0.148	<0.472	<0.472	0.284 J	0.479 U*	0.416 J	0.557 U*	0.216 J	<0.148
Vanadium	ug/L	<0.991	<0.991	<0.776	<0.776	2.43 U*	2.67 U*	2.70 U*	3.34	<0.991	<0.991
Zinc	ug/L	<3.22	<3.22	<2.88	<2.88	7.99	3.63 J	3.60 U*	4.35 U*	<3.22	3.66 J
Radiological Parameters											
Radium-226	pCi/L	-0.0941 +/-(0.421)U	0.281 +/-(0.454)U	0.321 +/-(0.338)U	0.647 +/-(0.550)U	0.217 +/-(0.0944)	0.0881 +/-(0.0655)	0.698 +/-(0.585)U	0.294 +/-(0.240)U	0.229 +/-(0.483)U	0.560 +/-(0.599)U
Radium-228	pCi/L	-0.153 +/-(0.510)U	0.772 +/-(0.501)	0.309 +/-(0.353)U	0.341 +/-(0.344)U	0.331 +/-(0.313)U	0.329 +/-(0.243)U	0.197 +/-(0.291)U	0.482 +/-(0.404)U	0.137 +/-(0.330)U	0.417 +/-(0.400)U
Radium-226+228	pCi/L	0.000 +/-(0.662)U	1.05 +/-(0.677)J	0.630 +/-(0.489)U	0.989 +/-(0.648)U	0.548 +/-(0.327)J	0.417 +/-(0.252)J	0.895 +/-(0.653)U	0.776 +/-(0.470)U	0.367 +/-(0.585)U	0.977 +/-(0.721)U
Anions											
Chloride	mg/L	23.2	26.0	57.3	23.2	305	285	258	163	214	116
Fluoride	mg/L	0.414	0.410	0.739	0.311	0.125 J	0.249 J	0.202 J	0.158 J	0.142 J	0.163 J
Sulfate	mg/L	311	251	476	255	1,740	1,720	1,490	1,500	1,400	1,330
General Chemistry											
Alkalinity, Bicarbonate	mg/L	-	-	-	-	113	94.6	132	164	135	163
Alkalinity, Carbonate	mg/L	-	-	-	-	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	825	779	759	851	3,210	2,980	2,680	2,510	2,550	2,190

See notes on last page.

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Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-1003					CUF-1006				
Sample Date		2-Mar-21	14-Jul-21	14-Jul-21	7-Mar-22	24-Aug-22	22-Jul-21	6-Aug-21	20-Aug-21	12-Oct-21	12-Oct-21
Sample ID		CUF-GW-CUF-1003-03022021	CUF-GW-CUF-1003-07142021	CUF-GW-FD02-07142021	CUF-GW-CUF-1003-03072022	CUF-GW-CUF-1003-08242022	CUF-GW-CUF-1006-07222021	CUF-GW-CUF-1006-08062021	CUF-GW-CUF-1006-08202021	CUF-GW-CUF-1006-10122021	CUF-GW-FD02-10122021
Parent Sample ID				CUF-GW-CUF-1003-07142021							CUF-GW-CUF-1006-10122021
Sample Depth		16.8 ft	16.8 ft	16.8 ft	16.8 ft	16.8 ft	30 ft	30 ft	30 ft	30 ft	30 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample
Program	Units	EIP	CCR Program	EIP	CCR Program	CCR Program	EIP	EIP	CCR Program	EIP	EIP
Total Metals											
Aluminum	ug/L	21.4 U*	<12.5	<12.5	<15.5	<15.5	-	19.8 J	23.9 J	25.8 J	23.5 J
Antimony	ug/L	0.476 J	0.682 J	0.664 J	<0.506	<0.506	-	3.56	3.54	0.818 J	1.01 J
Arsenic	ug/L	<0.313	<0.313	<0.313	0.329 J	<0.282	-	0.449 J	0.520 J	3.18	3.21
Barium	ug/L	22.6	23.1	23.2	22.7	16.4	-	49.6	45.0	65.8	63.5
Beryllium	ug/L	<0.182	<0.182	<0.182	<0.274	<0.274	-	<0.182	<0.182	<0.182	<0.182
Boron	ug/L	7,320	6,050	5,920	8,480	8,370	-	11,100	11,300	8,950	8,710
Cadmium	ug/L	<0.217	<0.217	<0.217	<0.217	<0.217	-	0.605 J	0.513 J	<0.217	<0.217
Calcium	ug/L	392,000	368,000	361,000	372,000	344,000	-	552,000	612,000	509,000	497,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	-	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	<0.134	0.180 J	0.205 J	<0.261	<0.261	-	4.40	3.60	7.22	7.16
Copper	ug/L	0.640 J	1.64 J	1.46 J	<1.14	<1.14	-	1.02 J	1.14 J	<0.627	0.642 J
Iron	ug/L	<19.5	<19.5	<19.5	<27.7	<27.7	-	347	358	6,940	6,900
Lead	ug/L	<0.128	<0.128	<0.128	<0.167	<0.167	-	0.157 J	<0.128	<0.128	0.189 J
Lithium	ug/L	<3.39	<3.39	<3.39	1.81 J	1.31 J	-	<3.39	<3.39	<3.39	<3.39
Magnesium	ug/L	31,300	28,700	28,600	33,600	31,600	-	16,400	16,700	16,800	16,500
Manganese	ug/L	71.0	234	228	39.3	294	-	16,400	18,500	17,100	16,800
Mercury	ug/L	<0.130	<0.130	<0.130	<0.130	<0.130	-	<0.130	<0.130	<0.130	<0.130
Molybdenum	ug/L	99.6	74.3	73.2	121	116	-	204	217	267	260
Nickel	ug/L	<0.336	<0.336	0.342 U*	<0.517	0.520 J	-	4.95 U*	4.32	3.23	3.36
Potassium	ug/L	9,880	8,100	8,050	10,600	10,000	-	3,350	3,710	3,960	3,870
Selenium	ug/L	<1.51	<1.51	<1.51	<0.739	<0.739	-	<1.51	<1.51	<1.51	<1.51
Silicon	ug/L	3,790	4,220	4,260	4,160	4,460	-	4,850	5,130	5,210	4,910
Silver	ug/L	<0.177	<0.177	<0.177	<0.223	<0.223	-	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	137,000	166,000	163,000	152,000	151,000	-	52,700	49,900	55,000	55,100
Strontium	ug/L	-	-	-	-	-	-	-	-	-	-
Thallium	ug/L	<0.148	<0.148	0.228 J	<0.472	<0.472	-	<0.148	<0.148	<0.148	0.427 J
Vanadium	ug/L	<0.991	<0.991	<0.991	0.932 J	<0.776	-	<0.991	<0.991	<0.991	<0.991
Zinc	ug/L	<3.22	<3.22	<3.22	<2.88	<2.88	-	4.99 J	7.21	5.93	6.32
Radiological Parameters											
Radium-226	pCi/L	-0.236 +/-(0.343)U	0.194 +/-(0.341)U	-0.125 +/-(0.284)U	-0.0487 +/-(0.220)U	0.0681 +/-(0.251)U	0.413 +/-(0.497)U	-	0.181 +/-(0.423)U	0.196 +/-(0.418)U	0.661 +/-(0.514)U*
Radium-228	pCi/L	0.0480 +/-(0.401)U	0.0620 +/-(0.256)U	0.0785 +/-(0.422)U	-0.0147 +/-(0.208)U	0.141 +/-(0.429)U	0.283 +/-(0.280)U	-	0.384 +/-(0.542)U	-0.0703 +/-(0.596)U	0.547 +/-(0.500)U
Radium-226+228	pCi/L	0.0480 +/-(0.527)U	0.256 +/-(0.426)U	0.0785 +/-(0.509)U	0.000 +/-(0.303)U	0.209 +/-(0.497)U	0.697 +/-(0.571)U	-	0.565 +/-(0.687)U	0.196 +/-(0.727)U	1.21 +/-(0.717)U*
Anions											
Chloride	mg/L	103	101	99.1	135	160	-	490	541	456	456
Fluoride	mg/L	0.152	0.109	0.106	0.180 U*	0.305	-	0.139 J	0.342	0.196 J	0.192 J
Sulfate	mg/L	932	991	1,030	1,260	1,250	-	914	954	903	942
General Chemistry											
Alkalinity, Bicarbonate	mg/L	185	169	179	143	133 J	-	138	143 J	147	146
Alkalinity, Carbonate	mg/L	<5.00	<5.00	<5.00	<5.00	2.60 UJ	-	<5.00	5.00 UR	<5.00	<5.00
pH (lab)	SU	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	1,780	1,800	1,760	2,010	2,270	-	2,200	2,400	2,250	2,190

See notes on last page.

Table H.1-9 - Groundwater Analytical Results
Cumberland Fossil Plant

Sample Location		CUF-1006					
Sample Date		27-Jan-22	27-Jan-22	8-Mar-22	18-Apr-22	18-Apr-22	25-Aug-22
Sample ID		CUF-GW-CUF-1006-01272022	CUF-GW-FD02-01272022	CUF-GW-CUF-1006-03082022	CUF-GW-CUF-1006-04182022	CUF-GW-FD02-04182022	CUF-GW-CUF-1006-08252022
Parent Sample ID			CUF-GW-CUF-1006-01272022			CUF-GW-CUF-1006-04182022	
Sample Depth		30 ft	30 ft	30 ft	30 ft	30 ft	30 ft
Sample Type		Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Total Metals							
Aluminum	ug/L	23.8 J	24.2 J	<15.5	<15.5	<15.5	<15.5
Antimony	ug/L	<0.378	<0.378	<0.506	<0.506	<0.506	<0.506
Arsenic	ug/L	3.68	3.87	3.49	5.85	5.38	6.94
Barium	ug/L	45.9 J	45.6 J	158	151	148	98.8
Beryllium	ug/L	<0.182	<0.182	<0.274	<0.274	<0.274	<0.274
Boron	ug/L	11,900	11,300	6,390	8,910	8,950	5,760
Cadmium	ug/L	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217
Calcium	ug/L	621,000	617,000	480,000	576,000	573,000	487,000
Chromium	ug/L	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	4.77	4.77	10.6	9.18	9.23	11.2
Copper	ug/L	<0.627	<0.627	<1.14	<1.14	<1.14	<1.14
Iron	ug/L	4,210	4,200	15,100	21,300	21,100	34,200
Lead	ug/L	<0.128	<0.128	<0.167	<0.167	<0.167	<0.167
Lithium	ug/L	<3.39	<3.39	<0.831	<0.831	<0.831	<0.831
Magnesium	ug/L	15,100	14,900	18,200	20,200	20,300	19,400
Manganese	ug/L	18,100	18,000	21,100	18,800	19,100	23,100
Mercury	ug/L	<0.130	<0.130	<0.130	<0.130	<0.130	<0.130
Molybdenum	ug/L	256	255	122	182	182	104
Nickel	ug/L	2.09	2.18	2.98	2.69	2.76	2.81
Potassium	ug/L	4,040	4,020	3,610	3,210	3,190	3,320
Selenium	ug/L	<1.51	<1.51	<0.739	<0.739	<0.739	<0.739
Silicon	ug/L	5,310	5,150	5,180	5,630	5,490	4,980
Silver	ug/L	0.177 UJ	0.177 UJ	<0.223	<0.223	<0.223	<0.223
Sodium	ug/L	46,800	46,200	57,100	55,400	56,000	59,800
Strontium	ug/L	-	-	-	-	-	-
Thallium	ug/L	<0.148	<0.148	<0.472	<0.472	<0.472	<0.472
Vanadium	ug/L	<0.991	<0.991	<0.776	<0.776	<0.776	<0.776
Zinc	ug/L	<3.22	<3.22	<2.88	<2.88	<2.88	<2.88
Radiological Parameters							
Radium-226	pCi/L	0.0586 +/-(0.156)U	0.301 +/-(0.297)U	0.262 +/-(0.269)U	0.286 +/-(0.373)U	0.400 +/-(0.423)U	-0.0623 +/-(0.449)U
Radium-228	pCi/L	0.0519 +/-(0.386)U	0.136 +/-(0.451)U	0.475 +/-(0.369)U	0.847 +/-(0.557)J	0.262 +/-(0.355)UJ	0.0605 +/-(0.376)U
Radium-226+228	pCi/L	0.110 +/-(0.416)U	0.438 +/-(0.540)U	0.737 +/-(0.456)U	1.13 +/-(0.671)J	0.662 +/-(0.552)UJ	0.0605 +/-(0.585)U
Anions							
Chloride	mg/L	602	571	648	516	538	561
Fluoride	mg/L	0.211 J	0.196 J	0.220 J	0.316 U*	0.231 U*	0.316 U*
Sulfate	mg/L	813	777	509	727	812	635
General Chemistry							
Alkalinity, Bicarbonate	mg/L	165	164	234	164	165	153
Alkalinity, Carbonate	mg/L	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
pH (lab)	SU	-	-	-	-	-	-
Total Dissolved Solids	mg/L	2,190	2,140	1,910	2,360	2,240	2,150

Notes:
Please note that units have been converted automatically in this table, and significant figures may not have been maintained.

15.2	measured concentration did not exceed the indicated standard
<0.03	analyte was not detected at a concentration greater than the Method Detection Limit
-	Parameter not analyzed / not available.
ft	feet
ID	Identification
J	quantitation is approximate due to limitations identified during data validation
U*	result should be considered “not detected” because it was detected in an associated field or laboratory blank at a similar level
UJ	This compound was not detected, but the reporting or detection limit should be considered estimated due to a bias identified during data validation.
UR	Unreliable reporting or detection limit; compound may or may not be present in sample.
mg/L	milligrams per Liter
pCi/L	picocuries per Liter
SU	standard unit
ug/L	micrograms per Liter

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-1										
Sample Date		16-Jul-08	21-Jan-09	4-Mar-09	14-Apr-09	22-Jul-09	7-Oct-09	14-Jan-10	7-Apr-10	22-Jul-10	27-Oct-10	19-Jan-11
Sample ID		CUF-93-1-0708	CUF-93-1-0109	CUF-93-1-0309	CUF-93-1-0409	CUF-93-1-0709	CUF-93-1-1009	CUF-93-1-0110	CUF-93-1-0410	CUF-93-1-0710	CUF-93-1-1010	CUF-93-1-0111
Parent Sample ID												
Sample Depth		60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Field Parameters												
Dissolved Oxygen	%	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen	mg/L	2.7	2.4	1.8	4.6	2.2	2.3	1.4	1.4	1.9	3.3	3.3
ORP	mV	80	112	118	138	210	209	173	279	169	276	233
pH (field)	SU	6.8	6.8	7.4	7.2	6.7	6.9	6.9	6.8	6.8	7.2	6.9
Specific Cond. (Field)	uS/cm	1,530	1,633	1,670	1,670	1,755	1,834	1,835	1,800	1,948	1,998	2,127
Temperature, Water (C)	DEG C	20.2	12.9	17.4	16.9	19.3	16.8	15.6	18.8	22.1	16.4	14.1
Turbidity, field	NTU	-	-	-	-	-	-	-	-	-	-	-

See notes on last page.

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Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-1										
Sample Date		5-Apr-11	27-Jul-11	4-Oct-11	10-Jan-12	18-Apr-12	19-Jul-12	17-Oct-12	3-Apr-13	2-Jul-13	9-Oct-13	22-Jan-14
Sample ID		CUF-93-1-0411	CUF-93-1-0711	CUF-93-1-1011	CUF-93-1-0112	CUF-93-1-0412	CUF-93-1-0712	CUF-93-1-1012	CUF-93-1-0413	CUF-93-1-0713	CUF-93-1-1013	CUF-93-1-0114
Parent Sample ID												
Sample Depth		60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Field Parameters												
Dissolved Oxygen	%	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen	mg/L	4.5	2.6	2.4	4.4	3.9	1.6	1.5	2.6	2.9	2	3.1
ORP	mV	272	207	171	151	375	219	176	264	288	187	164
pH (field)	SU	10.9	7.1	6.7	9.3	7.8	7.2	6.8	7.8	9.2	7.2	6.8
Specific Cond. (Field)	uS/cm	300	2,016	2,042	1,977	2,062	2,172	2,294	2,211	1,992	2,451	2,584
Temperature, Water (C)	DEG C	14.4	20.5	20.8	16.9	16.7	21.1	17.8	14.5	18.8	16.8	14.5
Turbidity, field	NTU	-	-	42.1	80.1	12.1	39.6	7.3	17.5	24.2	10.1	23.7

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-1										
Sample Date		22-Jul-14	14-Jan-15	14-Apr-15	21-Jul-15	21-Oct-15	26-Jan-16	13-Apr-16	20-Jul-16	18-Oct-16	11-Jul-17	17-Oct-17
Sample ID		CUF-93-1-0714	CUF-93-1-0115	CUF-93-1-0415	CUF-93-1-0715	CUF-93-1-1015	CUF-93-1-0116	CUF-93-1-0416	CUF-93-1-0716	CUF-93-1-1016	93-1	93-1
Parent Sample ID												
Sample Depth		60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Field Parameters												
Dissolved Oxygen	%	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen	mg/L	2.8	3.5	3.7	3.4	2.3	3.8	3.2	3.3	1.7	0.91	0.4
ORP	mV	327	321	191	228	165	136	308	155	157	161	159
pH (field)	SU	8.9	7.9	10.5	7.4	7.5	7.3	8.7	6.8	6.4	-	6.8
Specific Cond. (Field)	uS/cm	2,282	2,635	2,359	2,363	2,823	2,857	2,718	2,791	3,167	3,335	3,239
Temperature, Water (C)	DEG C	20.2	13.1	16.7	22.1	15.9	14.8	16.1	20.9	27.9	27.32	17.6
Turbidity, field	NTU	19.1	28.4	36.8	33.9	15.2	17.6	24.9	9.7	10.8	9.7	8.3

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-1										
Sample Date		24-Jan-18	4-Apr-18	23-Jul-18	22-Jan-19	9-Apr-19	30-Jul-19	15-Oct-19	28-Jan-20	28-Jul-20	5-Oct-20	20-Jan-21
Sample ID		93-1-0118	93-1-0418	CUF-93-1-0718	93-1-0119	CUF-93-1	CUF-93-1	CUF-93-1-1019	CUF-93-1-0120	CUF-93-1-0720	CUF-93-1-1020	CUF-GW-93-1-01202021
Parent Sample ID												
Sample Depth		60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	60 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	CCR Program	State Compliance
Field Parameters												
Dissolved Oxygen	%	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen	mg/L	0.8	0	0.2	0.3	0	0.3	0.2	0.1	0.2	0.24	0.50
ORP	mV	204	198	176	182	179	172	158	172	149	177	192
pH (field)	SU	6.7	6.5	6.5	6.5	6.4	6.6	6.5	6.5	6.4	6.28	6.1
Specific Cond. (Field)	uS/cm	3,255	3,191	3,270	3,262	3,338	3,312	3,290	3,226	3,298	3,316	3,291
Temperature, Water (C)	DEG C	14.4	14.8	23.2	13.7	19.1	22.7	21.5	14	25.1	18.7	13.0
Turbidity, field	NTU	9.2	9.5	9	9.6	9.1	9.5	10.7	8.9	4.9	5.0	4.2

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-1						CUF-93-1D			
Sample Date		13-Apr-21	14-Jul-21	13-Oct-21	19-Jan-22	12-Apr-22	12-Jul-22	31-Jul-19	15-Oct-19	28-Jan-20	28-Jul-20
Sample ID		CUF-GW-93-1-04132021	CUF-GW-93-1-07142021	CUF-GW-CUF-93-1-10132021	CUF-GW-93-1-01192022	CUF-GW-93-1-04122022	CUF-GW-93-1-07122022	CUF-93-1D	CUF-93-1D-1019	CUF-93-1D-0120	CUF-93-1D-0720
Parent Sample ID											
Sample Depth		60 ft	60 ft	60 ft	60 ft	60 ft	60 ft	91 ft	91 ft	91 ft	91 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Field Parameters											
Dissolved Oxygen	%	3.6	3.0	3.3	4.5	2.0	7.4	-	-	-	-
Dissolved Oxygen	mg/L	0.32	0.24	0.29	0.44	0.18	0.51	0.2	0	0.4	0.2
ORP	mV	169	157	145	161	148	134	54	70	52	7
pH (field)	SU	6.38	6.28	6.48	6.40	6.39	6.29	7.2	7.1	6.8	6.8
Specific Cond. (Field)	uS/cm	3,310	3,360	3,366	3,350	3,377	3,441	1,758	1,804	1,781	1,881
Temperature, Water (C)	DEG C	19.84	25.22	22.00	15.46	21.65	32.52	24.7	18.7	11.5	26.1
Turbidity, field	NTU	5.9	4.8	4.7	4.4	7.9	11.0	9.7	7.8	3.2	0.0

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-1D							
Sample Date		5-Oct-20	20-Jan-21	13-Apr-21	14-Jul-21	13-Oct-21	19-Jan-22	12-Apr-22	12-Jul-22
Sample ID		CUF-93-1D-1020	CUF-GW-93-1D-01202021	CUF-GW-93-1D-04132021	CUF-GW-93-1D-07142021	CUF-GW-CUF-93-1D-10132021	CUF-GW-93-1D-01192022	CUF-GW-93-1D-04122022	CUF-GW-93-1D-07122022
Parent Sample ID									
Sample Depth		91 ft	91 ft	91 ft	91 ft	91 ft	91 ft	91 ft	91 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Field Parameters									
Dissolved Oxygen	%	-	-	3.8	2.1	2.2	4.9	3.0	6.1
Dissolved Oxygen	mg/L	0.50	1.2	0.36	0.18	0.19	0.45	0.26	0.48
ORP	mV	105	118	85	94	38.0	90	59	74
pH (field)	SU	6.68	6.5	6.81	6.72	6.87	6.75	6.70	6.61
Specific Cond. (Field)	uS/cm	1,898	1,868	1,850	1,959	2,111	1,987	1,955	1,943
Temperature, Water (C)	DEG C	16.55	11	16.48	21.23	22.10	14.00	21.12	26.30
Turbidity, field	NTU	0.5	1.6	1.9	2.0	2.5	1.5	2.8	0.00

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-2R										
Sample Date		16-Jul-08	21-Jan-09	13-Apr-09	22-Jul-09	7-Oct-09	14-Jan-10	7-Apr-10	22-Jul-10	27-Oct-10	19-Jan-11	5-Apr-11
Sample ID		CUF-93-2R-0708	CUF-93-2R-0109	CUF-93-2R-0409	CUF-93-2R-0709	CUF-93-2R-1009	CUF-93-2R-0110	CUF-93-2R-0410	CUF-93-2R-0710	CUF-93-2R-1010	CUF-93-2R-0111	CUF-93-2R-0411
Parent Sample ID												
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Field Parameters												
Dissolved Oxygen	%	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen	mg/L	0.2	0.2	0.2	0.2	0.4	0.3	0.2	0.1	0.3	0.2	0.2
ORP	mV	81	254	5	176	208	230	224	101	250	221	275
pH (field)	SU	6.3	6.5	6.6	6.3	6.5	6.4	6.4	6.3	6.3	6.3	6.5
Specific Cond. (Field)	uS/cm	4,755	4,902	4,878	4,920	5,075	4,972	4,868	4,886	5,125	4,997	5,032
Temperature, Water (C)	DEG C	21.7	18.9	21.2	21.2	20.6	18.8	21.2	23.5	20.4	18.6	19.2
Turbidity, field	NTU	-	-	-	-	-	-	-	-	-	-	-

See notes on last page.

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Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-2R										
Sample Date		26-Jul-11	4-Oct-11	10-Jan-12	18-Apr-12	19-Jul-12	17-Oct-12	3-Apr-13	1-Jul-13	8-Oct-13	22-Jan-14	8-Apr-14
Sample ID		CUF-93-2R-0711	CUF-93-2R-1011	CUF-93-2R-0112	CUF-93-2R-0412	CUF-93-2R-0712	CUF-93-2R-1012	CUF-93-2R-0413	CUF-93-2R-0713	CUF-93-2R-1013	CUF-93-2R-0114	CUF-93-2R-0414
Parent Sample ID												
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Field Parameters												
Dissolved Oxygen	%	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen	mg/L	0.1	0.1	0.3	7.4	0.2	0.2	0.2	0.2	0.1	0.2	0.1
ORP	mV	137	108	316	217	254	244	248	217	150	240	220
pH (field)	SU	6.3	6.3	6.3	6.3	6.2	6.3	6.5	6.4	6.4	6.3	6.3
Specific Cond. (Field)	uS/cm	5,125	5,137	5,260	5,339	5,370	5,318	5,395	5,380	5,275	5,406	5,366
Temperature, Water (C)	DEG C	25.6	22.2	19.3	20.4	22.2	20.4	17.6	21.7	19.3	11.7	19.2
Turbidity, field	NTU	-	20.1	12.2	11.7	8.7	6.7	4.5	6.3	6.2	6.9	8

See notes on last page.

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Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-2R										
Sample Date		21-Jul-14	14-Jan-15	14-Apr-15	21-Jul-15	21-Oct-15	25-Jan-16	13-Apr-16	19-Jul-16	19-Oct-16	7-Nov-16	24-Jan-17
Sample ID		CUF-93-2R-0714	CUF-93-2R-0115	CUF-93-2R-0415	CUF-93-2R-0715	CUF-93-2R-1015	CUF-93-2R-0116	CUF-93-2R-0416	CUF-93-2R-0716	CUF-93-2R-1016	CUF-GW-002-11072016	CUF-GW-002-01242017
Parent Sample ID												
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	-	-	-	-	-	-	-	-	-	10.1	2.2
Dissolved Oxygen	mg/L	0.2	0.1	0.1	0.1	0.1	0.1	0.9	0.9	1.2	0.96	0.21
ORP	mV	214	197	195	188	153	151	162	207	230	25.5	-5.6
pH (field)	SU	6.2	6.3	6.5	6.2	6.5	6.3	6.6	6.2	6.4	6.44	6.44
Specific Cond. (Field)	uS/cm	5,337	5,353	5,256	5,241	5,213	5,226	5,239	5,082	5,062	5,050	4,760
Temperature, Water (C)	DEG C	24.8	17.6	19.3	21.9	20.4	19.1	19.6	22.1	21.5	18.5	17.5
Turbidity, field	NTU	19.9	4.8	4.8	5.2	4.9	5	1.2	4.8	5.3	3.64	1.28

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-2R										
Sample Date		7-Feb-17	8-Mar-17	5-Apr-17	3-May-17	31-May-17	12-Jul-17	27-Jul-17	17-Aug-17	30-Aug-17	3-Oct-17	17-Oct-17
Sample ID		CUF-GW-002-02072017	CUF-GW-002-03082017	CUF-GW-002-04052017	CUF-GW-002-05032017	CUF-GW-002-05312017	CUF-GW-002-07122017	CUF-GW-002-07272017	CUF-GW-002-08172017	CUF-GW-002-08302017	CUF-GW-002-10032017	93-2R
Parent Sample ID												
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance
Field Parameters												
Dissolved Oxygen	%	3.1	4.2	4.1	3.8	5.2	1.8	3.9	3.2	3.9	2.8	-
Dissolved Oxygen	mg/L	0.28	0.40	0.41	0.37	0.46	0.17	0.35	0.28	0.36	0.25	0.5
ORP	mV	8.0	16.1	34.3	23.9	125.6	16.1	12.6	9.8	62.7	44.9	251
pH (field)	SU	6.50	6.60	6.59	6.62	6.64	6.48	6.46	6.48	6.49	6.48	6.7
Specific Cond. (Field)	uS/cm	4,830	4,850	4,770	4,730	4,900	5,110	5,030	5,020	5,000	4,080	5,260
Temperature, Water (C)	DEG C	17.9	17.9	18.6	18.9	19.3	18.7	21.3	21.1	18.7	19.5	19.2
Turbidity, field	NTU	4.18	2.89	3.14	2.25	1.24	3.78	1.49	3.81	2.73	4.52	1

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-2R										
Sample Date		30-Jan-18	4-Apr-18	31-May-18	21-Jun-18	12-Jul-18	22-Aug-18	12-Sep-18	3-Oct-18	22-Jan-19	7-Feb-19	9-Apr-19
Sample ID		CUF-93-2R-0118	93-2R-0418	CUF-GW-002-05312018	CUF-GW-002-06212018	CUF-GW-002-07122018	CUF-GW-002-08222018	CUF-GW-002-09122018	CUF-GW-002-10032018	93-2R-0119	CUF-GW-002-02072019	CUF-93-2R
Parent Sample ID												
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	State Compliance
Field Parameters												
Dissolved Oxygen	%	-	-	7.4	3.9	2.5	2.7	2.1	3.7	-	3.1	-
Dissolved Oxygen	mg/L	1.1	0	0.70	0.39	0.23	0.23	0.19	0.34	0.6	0.30	0.3
ORP	mV	296	207	51.4	23.7	85.4	107.4	169.7	85.2	256	37.8	213
pH (field)	SU	6.5	6.4	6.46	6.33	6.63	6.71	6.45	6.49	6.5	6.50	6.4
Specific Cond. (Field)	uS/cm	4,697	5,107	5,159	4,865	4,470	4,860	5,020	4,980	4,915	4,210	5,239
Temperature, Water (C)	DEG C	13.2	15.3	18.8	18.2	19.0	18.7	18.5	18.9	14.3	17.7	21.6
Turbidity, field	NTU	0	0	1.21	2.36	0.81	3.62	2.21	0.56	1.9	1.18	0

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location							CUF-93-2R					
Sample Date		9-May-19	31-Jul-19	9-Oct-19	28-Jan-20	10-Mar-20	28-Jul-20	11-Sep-20	5-Oct-20	20-Jan-21	3-Mar-21	14-Apr-21
Sample ID		CUF-GW-002-05092019	CUF-GW-002-07312019	CUF-GW-002-10092019	CUF-GW-002-01282020	CUF-GW-002-03102020	CUF-GW-002-07282020	CUF-GW-002-09112020	CUF-93-2R-1020	CUF-GW-93-2R-01202021	CUF-GW-93-2R-03032021	CUF-GW-93-2R-04142021
Parent Sample ID												
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance
Field Parameters												
Dissolved Oxygen	%	3.7	3.5	2.6	4.5	2.9	2.6	8.6	-	2.7	2.7	6.6
Dissolved Oxygen	mg/L	0.35	0.30	0.25	0.43	0.28	0.24	0.84	0.37	0.27	0.26	0.98
ORP	mV	119.2	31.7	13.7	-13.3	37.4	71.1	12.1	229	44.7	46.2	178
pH (field)	SU	6.40	6.54	6.53	6.48	6.55	6.47	6.62	6.3	6.58	6.51	6.39
Specific Cond. (Field)	uS/cm	4,820	4,210	4,620	4,040	3,790	4,370	4,260	4,242	2,760	4,110	4,037
Temperature, Water (C)	DEG C	17.7	18.8	18.6	16.9	17.2	18.7	19.0	19.5	16.8	17.3	16.09
Turbidity, field	NTU	1.32	3.77	0.80	4.86	4.16	1.32	3.86	0.0	4.56	2.62	0.3

See notes on last page.

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Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-2R							
Sample Date		16-Jul-21	18-Aug-21	13-Oct-21	19-Jan-22	7-Mar-22	13-Apr-22	14-Jul-22	25-Aug-22
Sample ID		CUF-GW-93-2R-07162021	CUF-GW-93-2R-08182021	CUF-GW-CUF-93-2R-10132021	CUF-GW-93-2R-01192022	CUF-GW-93-2R-03072022	CUF-GW-93-2R-04132022	CUF-GW-93-2R-07142022	CUF-GW-93-2R-08252022
Parent Sample ID									
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program
Field Parameters									
Dissolved Oxygen	%	16.9	3.8	2.0	1.2	1.7	2.1	4.1	1.4
Dissolved Oxygen	mg/L	1.52	0.36	0.18	0.12	0.17	0.19	0.37	0.14
ORP	mV	43.3	228.0	220	163.6	80.2	195	-55.7	79.1
pH (field)	SU	8.19	6.52	6.50	6.58	6.33	6.53	6.75	6.55
Specific Cond. (Field)	uS/cm	3,110	3,940	3,850	3,540	3,560	3,713	3,330	3,400
Temperature, Water (C)	DEG C	18.7	18.5	22.37	17.2	16.9	18.25	18.3	18.3
Turbidity, field	NTU	7.42	1.05	0.6	2.88	0.71	0.6	2.26	4.90

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location							CUF-93-3					
Sample Date		16-Jul-08	21-Jan-09	14-Apr-09	22-Jul-09	7-Oct-09	14-Jan-10	7-Apr-10	22-Jul-10	27-Oct-10	19-Jan-11	5-Apr-11
Sample ID		CUF-93-3-0708	CUF-93-3-0109	CUF-93-3-0409	CUF-93-3-0709	CUF-93-3-1009	CUF-93-3-0110	CUF-93-3-0410	CUF-93-3-0710	CUF-93-3-1010	CUF-93-3-0111	CUF-93-3-0411
Parent Sample ID												
Sample Depth		53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Field Parameters												
Dissolved Oxygen	%	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen	mg/L	0.2	0.2	0.3	0.2	0.3	0.3	0.2	0.1	0.2	0.2	0.1
ORP	mV	-53	15	-9	50	96	104	45	-38	11	60	20
pH (field)	SU	6.8	6.9	7	6.7	6.9	6.8	6.9	6.7	6.7	6.8	6.7
Specific Cond. (Field)	uS/cm	1,145	1,173	1,167	1,183	1,181	1,190	1,150	1,167	1,168	1,168	1,175
Temperature, Water (C)	DEG C	19.6	16.6	17.7	20.8	18.7	17	20	22.2	20	15.7	17.9
Turbidity, field	NTU	-	-	-	-	-	-	-	-	-	-	-

See notes on last page.

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Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-3										
Sample Date		7-Jun-11	26-Jul-11	4-Oct-11	10-Jan-12	18-Apr-12	19-Jul-12	17-Oct-12	3-Apr-13	1-Jul-13	8-Oct-13	22-Jan-14
Sample ID		CUF-93-3-0611	CUF-93-3-0711	CUF-93-3-1011	CUF-93-3-0112	CUF-93-3-0412	CUF-93-3-0712	CUF-93-3-1012	CUF-93-3-0413	CUF-93-3-0713	CUF-93-3-1013	CUF-93-3-0114
Parent Sample ID												
Sample Depth		53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Field Parameters												
Dissolved Oxygen	%	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen	mg/L	0.3	0.3	0.2	0.2	5.9	0.2	0.2	0.9	0.1	0.3	0.2
ORP	mV	73	53	9	45	75	110	98	120	89	40	128
pH (field)	SU	6.7	6.7	6.8	6.8	6.8	6.7	6.8	6.8	6.8	7	6.8
Specific Cond. (Field)	uS/cm	1,208	1,208	1,181	1,209	1,245	1,287	1,270	1,276	1,280	1,315	1,281
Temperature, Water (C)	DEG C	22.3	27.5	17.3	16.2	18.8	23.4	18.7	15.1	19.7	17.4	11.6
Turbidity, field	NTU	-	-	3.6	2.2	0.9	0	1.3	1.5	3.5	1.8	4.1

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-3										
Sample Date		8-Apr-14	21-Jul-14	14-Jan-15	14-Apr-15	21-Jul-15	21-Oct-15	25-Jan-16	13-Apr-16	19-Jul-16	19-Oct-16	11-Jul-17
Sample ID		CUF-93-3-0414	CUF-93-3-0714	CUF-93-3-0115	CUF-93-3-0415	CUF-93-3-0715	CUF-93-3-1015	CUF-93-3-0116	CUF-93-3-0416	CUF-93-3-0716	CUF-93-3-1016	93-3
Parent Sample ID												
Sample Depth		53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Field Parameters												
Dissolved Oxygen	%	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen	mg/L	0.3	0.1	0.1	0.2	0.3	0.2	0.1	0.9	1.5	1.3	0.4
ORP	mV	104	75	75	101	98	10	31	48	116	97	123
pH (field)	SU	6.7	6.7	6.8	6.7	6.6	7	6.7	7	6.7	6.7	-
Specific Cond. (Field)	uS/cm	1,249	1,259	1,273	1,272	1,339	1,315	1,306	1,329	1,361	1,486	1,440
Temperature, Water (C)	DEG C	17.6	22	12	17.6	25.7	19.8	15.9	16.8	25.4	23.4	26.9
Turbidity, field	NTU	8.8	20	5	2.2	3.6	5	4.4	0.8	1.4	1.7	2.5

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-3										
Sample Date		3-Oct-17	17-Oct-17	24-Jan-18	4-Apr-18	1-Jun-18	21-Jun-18	13-Jul-18	2-Aug-18	21-Aug-18	12-Sep-18	4-Oct-18
Sample ID		CUF-GW-003-10032017	93-3	93-3-0118	93-3-0418	CUF-GW-003-06012018	CUF-GW-003-06212018	CUF-GW-003-07132018	CUF-93-3-0818	CUF-GW-003-08212018	CUF-GW-003-09122018	CUF-GW-003-10042018
Parent Sample ID												
Sample Depth		53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	State Compliance	State Compliance	State Compliance	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	5.7	-	-	-	5.2	2.9	3.6	-	4.7	3.6	5.2
Dissolved Oxygen	mg/L	0.47	0.41	0.7	0	0.48	0.27	0.35	0.35	0.43	0.34	0.47
ORP	mV	-46.0	115	155	144	86.1	-74.5	49.9	49.9	0.4	126.2	56.6
pH (field)	SU	6.79	7.03	6.9	6.7	6.73	6.70	6.75	6.75	6.83	6.72	6.64
Specific Cond. (Field)	uS/cm	1,310	1,460	1,474	1,519	1,481	1,371	1,340	1.34	1,440	1,490	1,480
Temperature, Water (C)	DEG C	21.3	19.9	14.1	15	18.6	18.1	18.4	-	18.2	18.0	18.5
Turbidity, field	NTU	0.24	0.5	1.5	0	1.69	0.85	1.31	1.31	0.78	0.91	1.76

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-3										
Sample Date		17-Jan-19	7-Feb-19	10-Apr-19	7-May-19	6-Aug-19	9-Oct-19	28-Jan-20	11-Mar-20	28-Jul-20	11-Sep-20	6-Oct-20
Sample ID		CUF-GW-003-01172019	CUF-GW-003-02072019	CUF-93-3	CUF-GW-003-05072019	CUF-GW-003-08062019	CUF-GW-003-10092019	CUF-GW-003-01282020	CUF-GW-003-03112020	CUF-GW-003-07282020	CUF-GW-003-09112020	CUF-93-3-1020
Parent Sample ID												
Sample Depth		53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	3.8	3.6	-	3.6	4.0	3.9	7.5	4.7	6.7	8.9	-
Dissolved Oxygen	mg/L	0.36	0.37	0	0.34	0.36	0.37	0.73	0.44	0.61	1.17	0.0
ORP	mV	-53.3	-38.0	136	-11.8	-67.4	-80.9	-66.4	-63.7	-56.8	-53.0	100
pH (field)	SU	6.82	6.73	6.7	6.68	6.61	6.79	6.77	6.79	6.67	6.39	6.7
Specific Cond. (Field)	uS/cm	1,340	1,250	1,575	1,500	1,420	1,560	1,480	1,410	1,620	1,520	1,509
Temperature, Water (C)	DEG C	16.4	17.3	15.2	18.0	18.0	18.7	16.3	16.6	19.4	20.2	16.2
Turbidity, field	NTU	1.65	2.53	0.1	0.76	1.05	1.64	0.93	0.91	2.05	1.80	0.0

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-3										
Sample Date		19-Jan-21	3-Mar-21	14-Apr-21	16-Jul-21	18-Aug-21	14-Oct-21	21-Jan-22	3-Mar-22	13-Apr-22	13-Jul-22	24-Aug-22
Sample ID		CUF-GW-93-3-01192021	CUF-GW-93-3-03032021	CUF-GW-93-3-04142021	CUF-GW-93-3-07162021	CUF-GW-93-3-08182021	CUF-GW-CUF-93-3-10142021	CUF-GW-93-3-01212022	CUF-GW-93-3-03032022	CUF-GW-93-3-04132022	CUF-GW-93-3-07132022	CUF-GW-93-3-08242022
Parent Sample ID												
Sample Depth		53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft	53 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	7.2	3.5	4.1	1.9	2.6	3.1	16.9	3.4	2.7	0.1	3.5
Dissolved Oxygen	mg/L	0.57	0.34	0.38	0.17	0.23	0.30	1.72	0.32	0.24	0.01	0.31
ORP	mV	-86.3	-73.5	958	-75.3	-75.6	90	-87.9	-47.3	21	-44.1	-61.9
pH (field)	SU	6.83	6.75	6.68	7.30	6.73	6.78	6.82	6.71	6.74	6.68	6.74
Specific Cond. (Field)	uS/cm	1,500	1,580	1,591	1,430	1,620	1,615	1,460	1,530	1,621	1,480	1,500
Temperature, Water (C)	DEG C	16.1	16.7	16.76	20.3	20.8	20.52	14.6	17.7	21.03	20.0	20.7
Turbidity, field	NTU	1.71	0.90	0.5	3.20	0.61	1.7	3.80	0.60	1.9	3.05	3.09

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-4								
Sample Date		16-Jul-08	21-Jan-09	14-Apr-09	22-Jul-09	7-Oct-09	14-Jan-10	7-Apr-10	22-Jul-10	27-Oct-10
Sample ID		CUF-93-4-0708	CUF-93-4-0109	CUF-93-4-0409	CUF-93-4-0709	CUF-93-4-1009	CUF-93-4-0110	CUF-93-4-0410	CUF-93-4-0710	CUF-93-4-1010
Parent Sample ID										
Sample Depth		34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Field Parameters										
Dissolved Oxygen	%	-	-	-	-	-	-	-	-	-
Dissolved Oxygen	mg/L	3.5	3.8	5.9	3.3	6.8	3.4	3.5	3.2	5.4
ORP	mV	114	133	165	228	415	329	323	247	328
pH (field)	SU	6.8	6.8	7	6.6	6.9	6.8	6.7	6.6	6.7
Specific Cond. (Field)	uS/cm	1,870	2,044	2,259	2,257	2,482	2,914	2,819	2,657	2,942
Temperature, Water (C)	DEG C	19.4	15.2	16.2	18.8	16.7	15.7	19.1	20.1	15.8
Turbidity, field	NTU	-	-	-	-	-	-	-	-	-

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-4										
Sample Date		**19-Jan-11**	**5-Apr-11**	**27-Jul-11**	**4-Oct-11**	**10-Jan-12**	**18-Apr-12**	**19-Jul-12**	**17-Oct-12**	**3-Apr-13**	**2-Jul-13**	**9-Oct-13**
Sample ID		**CUF-93-4-0111**	**CUF-93-4-0411**	**CUF-93-4-0711**	**CUF-93-4-1011**	**CUF-93-4-0112**	**CUF-93-4-0412**	**CUF-93-4-0712**	**CUF-93-4-1012**	**CUF-93-4-0413**	**CUF-93-4-0713**	**CUF-93-4-1013**
Parent Sample ID												
Sample Depth		**34 ft**	**34 ft**	**34 ft**	**34 ft**	**34 ft**	**34 ft**	**34 ft**	**34 ft**	**34 ft**	**34 ft**	**34 ft**
Sample Type		**Normal Environmental Sample**	**Normal Environmental Sample**	**Normal Environmental Sample**	**Normal Environmental Sample**	**Normal Environmental Sample**	**Normal Environmental Sample**	**Normal Environmental Sample**	**Normal Environmental Sample**	**Normal Environmental Sample**	**Normal Environmental Sample**	**Normal Environmental Sample**
Program	**Units**	**State Compliance**	**State Compliance**	**State Compliance**	**State Compliance**	**State Compliance**	**State Compliance**	**State Compliance**	**State Compliance**	**State Compliance**	**State Compliance**	**State Compliance**
Field Parameters												
Dissolved Oxygen	%	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen	mg/L	4.7	6.7	3.2	2.8	3.7	3.2	2.7	3.9	3.4	2.2	3
ORP	mV	265	340	223	212	189	427	410	468	479	329	328
pH (field)	SU	6.5	6.9	6.9	6.6	7.4	6.8	6.5	6.8	6.9	6.6	6.9
Specific Cond. (Field)	uS/cm	2,922	2,800	2,586	2,615	3,350	3,341	3,168	3,108	3,336	3,499	3,509
Temperature, Water (C)	DEG C	13.9	14.6	20.8	20.7	16.7	15.9	20.4	17.3	10.7	18.3	15.7
Turbidity, field	NTU	-	-	-	37.8	32.8	5.4	19	17.7	15.9	12.2	14.2

See notes on last page.

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Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-4										
Sample Date		22-Jan-14	9-Apr-14	22-Jul-14	14-Jan-15	14-Apr-15	21-Jul-15	21-Oct-15	26-Jan-16	13-Apr-16	20-Jul-16	18-Oct-16
Sample ID		CUF-93-4-0114	CUF-93-4-0414	CUF-93-4-0714	CUF-93-4-0115	CUF-93-4-0415	CUF-93-4-0715	CUF-93-4-1015	CUF-93-4-0116	CUF-93-4-0416	CUF-93-4-0716	CUF-93-4-1016
Parent Sample ID												
Sample Depth		34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance
Field Parameters												
Dissolved Oxygen	%	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen	mg/L	3	2.3	2.3	5.1	2.5	2	3.6	3.9	3.7	4.5	1.9
ORP	mV	288	349	349	327	336	386	299	350	323	275	153
pH (field)	SU	6.7	6.7	6.4	6.7	6.7	6.4	6.9	6.3	7	6.6	6.5
Specific Cond. (Field)	uS/cm	3,609	3,672	3,702	3,667	3,526	3,409	3,549	3,300	3,440	3,495	3,470
Temperature, Water (C)	DEG C	14.3	14.5	19	12.8	16.1	20.7	14.8	14.2	13	19.4	23.7
Turbidity, field	NTU	20.3	13.6	14.7	5.4	5.2	5.1	5.4	5.2	5.5	11.4	2.1

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-93-4							CUF-201			
Sample Date		11-Jul-17	17-Oct-17	24-Jan-18	4-Apr-18	23-Jul-18	10-Oct-18	22-Jan-19	9-Nov-16	23-Jan-17	7-Feb-17	7-Mar-17
Sample ID		93-4	93-4	93-4-0118	93-4-0418	CUF-93-4-0718	93-4-1018	93-4-0119	CUF-GW-011-11092016	CUF-GW-011-01232017	CUF-GW-011-02072017	CUF-GW-011-03072017
Parent Sample ID												
Sample Depth		34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	34 ft	26 ft	26 ft	26 ft	26 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	-	-	-	-	-	-	-	3.2	2.9	5.2	4.2
Dissolved Oxygen	mg/L	0.9	1.1	1.1	2.6	1.9	4	0.5	0.30	0.29	0.53	0.42
ORP	mV	491	432	560	365	414	639	597	-127.7	-11.7	8.1	24.2
pH (field)	SU	-	6.8	6.5	6.5	6.5	6.5	6.5	7.12	6.83	6.94	6.93
Specific Cond. (Field)	uS/cm	3,444	3,466	3,428	3,287	3,319	3,212	3,122	191	170	171	167
Temperature, Water (C)	DEG C	20.9	14	12.6	11.6	22.1	26.5	13.3	18.8	13.9	14.9	14.7
Turbidity, field	NTU	0.4	0.8	0	0	7.8	9.8	1.3	0.18	8.55	14.6	9.73

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-201										
Sample Date		4-Apr-17	2-May-17	30-May-17	11-Jul-17	26-Jul-17	16-Aug-17	29-Aug-17	2-Oct-17	18-Oct-17	25-Jan-18	5-Apr-18
Sample ID		CUF-GW-011-04042017	CUF-GW-011-05022017	CUF-GW-011-05302017	CUF-GW-011-07112017	CUF-GW-011-07262017	CUF-GW-011-08162017	CUF-GW-011-08292017	CUF-GW-011-10022017	CUF-201	CUF-201-0118	CUF-201-0418
Parent Sample ID												
Sample Depth		26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	State Compliance	State Compliance
Field Parameters												
Dissolved Oxygen	%	11.6	18.9	10.9	8.5	7.8	3.2	3.9	8.4	-	-	-
Dissolved Oxygen	mg/L	1.13	1.71	1.02	0.77	0.67	0.28	0.36	0.75	0.3	2.3	0.8
ORP	mV	75.0	90.7	-4.2	-93.5	-122.5	-130.7	-100.1	-102.4	76	413	212
pH (field)	SU	6.93	6.69	6.82	7.06	7.32	7.36	7.10	7.25	7.4	7.1	7.1
Specific Cond. (Field)	uS/cm	162	162	178	185	180	180	185	165	185	149	152
Temperature, Water (C)	DEG C	17.5	20.5	19.7	21.6	23.8	22.6	20.8	20.8	15.2	4.3	13.2
Turbidity, field	NTU	4.94	4.90	2.38	1.87	0.74	0.78	1.43	1.33	0	2.3	9.2

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location							CUF-201					
Sample Date		30-May-18	19-Jun-18	10-Jul-18	31-Jul-18	20-Aug-18	10-Sep-18	17-Jan-19	24-Jan-19	5-Feb-19	10-Apr-19	7-May-19
Sample ID		CUF-GW-011-05302018	CUF-GW-011-06192018	CUF-GW-011-07102018	CUF-GW-011-07312018	CUF-GW-011-08202018	CUF-GW-011-09102018	CUF-GW-011-01172019	201-0119	CUF-GW-011-02052019	CUF-201	CUF-GW-011-05072019
Parent Sample ID												
Sample Depth		26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	State Compliance	CCR Program	State Compliance	CCR Program
Field Parameters												
Dissolved Oxygen	%	2.6	2.7	2.6	4.4	5.8	1.9	17.7	-	53.2	-	4.9
Dissolved Oxygen	mg/L	0.25	0.25	0.25	0.56	0.54	0.18	1.80	0	5.82	1.6	0.48
ORP	mV	56.8	-60.0	-43.5	-1.8	-82.1	196.2	16.7	374	128.3	352	111.4
pH (field)	SU	7.12	7.12	7.01	7.01	7.08	6.80	7.22	7	6.65	6.8	6.76
Specific Cond. (Field)	uS/cm	159.1	157.6	157.8	181	182	185	140	160	276	156	160
Temperature, Water (C)	DEG C	16.7	18.4	18.3	18.9	20.7	18.2	14.9	10.6	15.2	21	17.3
Turbidity, field	NTU	7.39	1.46	0.81	0.95	1.00	0.90	4.91	6.1	3.71	1.57	1.70

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-201										
Sample Date		29-Jul-19	8-Oct-19	28-Jan-20	10-Mar-20	28-Jul-20	10-Sep-20	6-Oct-20	19-Jan-21	2-Mar-21	14-Apr-21	15-Jul-21
Sample ID		CUF-GW-011-07292019	CUF-GW-011-10082019	CUF-GW-011-01282020	CUF-GW-011-03102020	CUF-GW-011-07282020	CUF-GW-011-09102020	CUF-201-1020	CUF-GW-CUF-201-01192021	CUF-GW-CUF-201-03022021	CUF-GW-201-04142021	CUF-GW-CUF-201-07152021
Parent Sample ID												
Sample Depth		26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program
Field Parameters												
Dissolved Oxygen	%	7.1	6.1	30.3	27.5	5.6	8.3	-	18.7	21.5	12.0	5.8
Dissolved Oxygen	mg/L	0.62	0.58	3.27	2.81	0.50	0.77	0.0	1.91	2.26	1.20	0.52
ORP	mV	-102.8	-137.8	11.6	89.1	-99.4	-144.0	55	97.7	77.4	368	-124.6
pH (field)	SU	6.80	7.25	6.96	6.83	6.79	7.09	7.2	7.12	7.29	6.94	7.25
Specific Cond. (Field)	uS/cm	166	188	155	143	182	182	187	160	159	155	170
Temperature, Water (C)	DEG C	21.6	18.0	12.4	14.7	20.3	20.3	20.6	14.6	12.8	14.32	21.7
Turbidity, field	NTU	1.58	1.22	2.04	0.73	1.17	0.74	0.0	4.67	4.35	0.3	2.70

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-201							CUF-202		
Sample Date		17-Aug-21	14-Oct-21	19-Jan-22	2-Mar-22	14-Apr-22	12-Jul-22	23-Aug-22	9-Nov-16	24-Jan-17	6-Feb-17
Sample ID		CUF-GW-CUF-201-08172021	CUF-GW-CUF-201-10142021	CUF-GW-CUF-201-01192022	CUF-GW-CUF-201-03022022	CUF-GW-CUF-201-04142022	CUF-GW-CUF-201-07122022	CUF-GW-CUF-201-08232022	CUF-GW-012-11092016	CUF-GW-012-01242017	CUF-GW-012-02062017
Parent Sample ID											
Sample Depth		26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	26 ft	18 ft	18 ft	18 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	State Compliance	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters											
Dissolved Oxygen	%	3.9	3.0	19.1	20.7	19.0	4.7	5.2	3.2	29.4	35.2
Dissolved Oxygen	mg/L	0.36	0.26	1.96	2.05	1.95	0.40	0.44	0.30	3.19	3.65
ORP	mV	-141.4	33	206.0	99.5	313	-141.5	-128.8	-28.8	134.8	51.6
pH (field)	SU	7.37	7.30	7.23	6.67	6.95	10.03	7.26	7.36	7.33	7.14
Specific Cond. (Field)	uS/cm	184	188	154	160	155	158	168	376	350	366
Temperature, Water (C)	DEG C	19.5	21.23	13.6	15.7	13.50	22.4	22.1	17.9	11.3	13.1
Turbidity, field	NTU	0.32	1.2	3.95	1.68	1.0	0.92	0.58	0.04	0.00	0.23

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-202										
Sample Date		7-Mar-17	4-Apr-17	2-May-17	30-May-17	11-Jul-17	26-Jul-17	17-Aug-17	29-Aug-17	2-Oct-17	18-Oct-17	25-Jan-18
Sample ID		CUF-GW-012-03072017	CUF-GW-012-04042017	CUF-GW-012-05022017	CUF-GW-012-05302017	CUF-GW-012-07112017	CUF-GW-012-07262017	CUF-GW-012-08172017	CUF-GW-012-08292017	CUF-GW-012-10022017	CUF-202	CUF-202-0118
Parent Sample ID												
Sample Depth		18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	State Compliance
Field Parameters												
Dissolved Oxygen	%	34.4	27.5	6.9	13.8	6.8	10.8	6.0	17.8	22.3	-	-
Dissolved Oxygen	mg/L	3.65	2.58	0.69	1.16	0.63	0.94	0.52	1.58	2.02	0.6	4.8
ORP	mV	48.0	81.7	63.7	93.7	70.1	67.2	85.2	99.0	140.0	235	462
pH (field)	SU	7.31	7.42	7.25	7.18	7.41	7.54	7.41	7.32	7.52	7.6	7.4
Specific Cond. (Field)	uS/cm	356	362	352	369	373	353	354	368	327	365	338
Temperature, Water (C)	DEG C	13.1	18.7	17.5	23.0	20.7	23.2	22.5	20.8	20.6	15.3	8.4
Turbidity, field	NTU	0.76	0.63	0.48	0.10	0.45	0.38	0.48	0.87	0.00	0	0

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-202										
Sample Date		5-Apr-18	30-May-18	19-Jun-18	10-Jul-18	31-Jul-18	21-Aug-18	10-Sep-18	2-Oct-18	17-Jan-19	24-Jan-19	5-Feb-19
Sample ID		CUF-202-0418	CUF-GW-012-05302018	CUF-GW-012-06192018	CUF-GW-012-07102018	CUF-GW-012-07312018	CUF-GW-012-08212018	CUF-GW-012-09102018	CUF-GW-012-10022018	CUF-GW-012-01172019	202-0119	CUF-GW-012-02052019
Parent Sample ID												
Sample Depth		18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	State Compliance	CCR Program
Field Parameters												
Dissolved Oxygen	%	-	19.3	2.9	6.6	3.9	3.8	3.8	4.5	41.4	-	49.5
Dissolved Oxygen	mg/L	5.07	1.72	0.26	0.59	0.36	0.36	0.34	0.40	4.44	4.3	5.21
ORP	mV	316	142.8	158.4	74.3	96.0	135.3	142.3	118.0	98.3	486	111.6
pH (field)	SU	7.57	7.47	7.42	7.43	7.43	7.33	7.32	7.22	7.53	7.4	7.59
Specific Cond. (Field)	uS/cm	338	143.2	337.9	328.4	365	366	368	369	309	345	285
Temperature, Water (C)	DEG C	12.26	19.2	18.5	22.5	19.8	19.5	20.3	21.5	11.9	8	12.7
Turbidity, field	NTU	0	0.60	0.44	0.46	0.30	0.52	0.30	0.56	0.98	0.6	0.94

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-202										
Sample Date		10-Apr-19	7-May-19	30-Jul-19	8-Oct-19	28-Jan-20	10-Mar-20	28-Jul-20	9-Sep-20	6-Oct-20	19-Jan-21	2-Mar-21
Sample ID		CUF-202	CUF-GW-012-05072019	CUF-GW-012-07302019	CUF-GW-012-10082019	CUF-GW-012-01282020	CUF-GW-012-03102020	CUF-GW-012-07282020	CUF-GW-012-09092020	CUF-202-1020	CUF-GW-CUF-202-01192021	CUF-GW-CUF-202-03022021
Parent Sample ID												
Sample Depth		18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	-	17.3	7.0	5.0	45.0	51.2	16.1	8.1	-	41.1	42.0
Dissolved Oxygen	mg/L	4.8	1.67	0.64	0.49	5.11	5.42	1.47	0.70	0.0	4.57	4.71
ORP	mV	288	88.2	169.5	15.6	188.2	79.7	68.7	-85.2	240	183.3	117.3
pH (field)	SU	7.3	7.23	7.23	7.45	7.60	7.46	7.36	7.39	7.3	7.14	7.61
Specific Cond. (Field)	uS/cm	352	363	334	372	323	313	371	375	371	359	355
Temperature, Water (C)	DEG C	16.1	17.2	20.1	19.0	9.5	12.6	22.1	22.8	20.3	10.8	10.5
Turbidity, field	NTU	0	0.69	0.39	0.36	0.78	0.31	0.40	1.12	0.0	1.49	0.24

See notes on last page.

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Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-202								
Sample Date		14-Apr-21	15-Jul-21	17-Aug-21	14-Oct-21	18-Jan-22	2-Mar-22	14-Apr-22	12-Jul-22	23-Aug-22
Sample ID		CUF-GW-202-04142021	CUF-GW-CUF-202-07152021	CUF-GW-CUF-202-08172021	CUF-GW-CUF-202-10142021	CUF-GW-CUF-202-01182022	CUF-GW-CUF-202-03022022	CUF-GW-CUF-202-04142022	CUF-GW-CUF-202-07122022	CUF-GW-CUF-202-08232022
Parent Sample ID										
Sample Depth		18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program
Field Parameters										
Dissolved Oxygen	%	25.6	3.3	6.7	3.2	44.2	56.0	44.1	3.9	4.0
Dissolved Oxygen	mg/L	2.64	0.31	0.62	0.23	4.90	5.68	4.67	0.34	0.37
ORP	mV	321	33.1	206.8	221	173.8	118.1	384	45.4	136.8
pH (field)	SU	7.31	7.12	7.44	7.32	7.60	7.35	7.45	9.69	7.38
Specific Cond. (Field)	uS/cm	349	328	368	378	351	346	352	319	337
Temperature, Water (C)	DEG C	13.16	21.4	21.0	23.72	11.1	14.1	11.95	21.2	20.1
Turbidity, field	NTU	0.0	2.90	0.15	1.0	0.26	0.16	0.4	0.26	0.24

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-205										
Sample Date		9-Nov-16	26-Jan-17	8-Feb-17	8-Mar-17	4-Apr-17	3-May-17	31-May-17	11-Jul-17	26-Jul-17	17-Aug-17	30-Aug-17
Sample ID		CUF-GW-014-11092016	CUF-GW-014-01262017	CUF-GW-014-02082017	CUF-GW-014-03082017	CUF-GW-014-04042017	CUF-GW-014-05032017	CUF-GW-014-05312017	CUF-GW-014-07112017	CUF-GW-014-07262017	CUF-GW-014-08172017	CUF-GW-014-08302017
Parent Sample ID												
Sample Depth		25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	7.3	4.5	3.7	5.0	4.8	4.1	18.2	3.1	3.6	4.8	4.7
Dissolved Oxygen	mg/L	0.75	0.46	0.37	0.51	0.45	0.42	1.70	0.29	0.32	0.41	0.42
ORP	mV	68.0	7.9	-11.5	78.3	90.6	88.0	148.7	77.8	51.5	91.8	114.9
pH (field)	SU	6.96	6.86	6.96	7.03	6.90	6.95	6.88	6.90	6.99	6.97	6.98
Specific Cond. (Field)	uS/cm	750	680	690	710	720	700	720	730	690	700	750
Temperature, Water (C)	DEG C	18.8	14.3	15.0	15.2	18.8	16.3	18.7	19.7	22.2	23.9	20.8
Turbidity, field	NTU	0.00	0.06	0.32	0.70	0.54	0.47	0.17	0.56	0.60	0.24	0.98

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-205										
Sample Date		3-Oct-17	30-May-18	19-Jun-18	11-Jul-18	1-Aug-18	21-Aug-18	12-Sep-18	2-Oct-18	5-Feb-19	8-May-19	30-Jul-19
Sample ID		CUF-GW-014-10032017	CUF-GW-014-05302018	CUF-GW-014-06192018	CUF-GW-014-07112018	CUF-GW-014-08012018	CUF-GW-014-08212018	CUF-GW-014-09122018	CUF-GW-014-10022018	CUF-GW-014-02052019	CUF-GW-014-05082019	CUF-GW-014-07302019
Parent Sample ID												
Sample Depth		25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	4.4	70.2	19.9	3.4	8.3	3.1	3.5	5.8	6.8	5.3	3.8
Dissolved Oxygen	mg/L	0.37	6.91	1.92	0.34	0.72	0.28	0.33	0.52	0.65	0.51	0.36
ORP	mV	139.6	186.0	193.0	145.0	149.3	134.9	219.8	142.5	112.0	149.1	154.6
pH (field)	SU	6.99	6.91	6.96	6.88	6.81	6.98	6.72	6.87	7.16	6.72	6.85
Specific Cond. (Field)	uS/cm	630	698	652	675	730	750	730	710	580	710	680
Temperature, Water (C)	DEG C	21.3	18.5	18.5	18.2	17.9	18.2	18.3	20.5	17.4	16.4	18.6
Turbidity, field	NTU	0.16	0.51	0.24	0.74	2.59	1.73	1.83	0.32	0.49	0.90	0.84

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location							CUF-205					
Sample Date		8-Oct-19	28-Jan-20	11-Mar-20	29-Jul-20	10-Sep-20	20-Jan-21	4-Mar-21	20-Jul-21	18-Aug-21	26-Jan-22	8-Mar-22
Sample ID		CUF-GW-014-10082019	CUF-GW-014-01282020	CUF-GW-014-03112020	CUF-GW-014-07292020	CUF-GW-014-09102020	CUF-GW-CUF-205-01202021	CUF-GW-CUF-205-03042021	CUF-GW-CUF-205-07202021	CUF-GW-CUF-205-08182021	CUF-GW-CUF-205-01262022	CUF-GW-CUF-205-03082022
Parent Sample ID												
Sample Depth		25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft	25 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	5.2	12.6	4.3	5.8	3.5	3.3	13.5	2.7	2.8	30.3	47.3
Dissolved Oxygen	mg/L	0.49	1.26	0.42	0.52	0.32	0.34	1.31	0.24	0.26	3.08	4.73
ORP	mV	107.9	144.5	107.3	215.8	23.2	31	69.4	66.2	268.3	144.9	78.5
pH (field)	SU	6.93	7.08	6.83	6.91	6.90	6.98	6.88	7.19	6.92	7.10	7.04
Specific Cond. (Field)	uS/cm	740	640	630	750	770	810	760	720	820	610	568
Temperature, Water (C)	DEG C	19.3	15.9	15.2	20.2	19.3	16.6	16.2	18.3	18.9	15.8	15.4
Turbidity, field	NTU	0.72	1.04	0.30	0.95	1.37	1.64	0.65	1.41	1.54	2.59	4.93

See notes on last page.

Stantec

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-206										
Sample Date		9-Nov-16	26-Jan-17	8-Feb-17	9-Mar-17	5-Apr-17	4-May-17	1-Jun-17	13-Jul-17	28-Jul-17	18-Aug-17	31-Aug-17
Sample ID		CUF-GW-015-11092016	CUF-GW-015-01262017	CUF-GW-015-02082017	CUF-GW-015-03092017	CUF-GW-015-04052017	CUF-GW-015-05042017	CUF-GW-015-06012017	CUF-GW-015-07132017	CUF-GW-015-07282017	CUF-GW-015-08182017	CUF-GW-015-08312017
Parent Sample ID												
Sample Depth		77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	3.1	2.5	1.4	2.8	2.0	2.6	15.6	1.0	1.5	1.7	2.5
Dissolved Oxygen	mg/L	0.31	0.25	0.14	0.28	0.20	0.27	1.42	0.10	0.14	0.17	0.25
ORP	mV	-116.0	-107.4	-104.2	-108.2	-94.0	-83.7	-4.4	-100.5	-108.3	-104.8	-93.6
pH (field)	SU	6.58	6.52	6.63	6.65	6.64	6.71	6.65	6.57	6.53	6.61	6.61
Specific Cond. (Field)	uS/cm	3,740	3,640	3,630	3,630	3,580	3,470	3,420	3,680	3,560	3,540	3,640
Temperature, Water (C)	DEG C	15.9	14.2	15.2	16.9	16.2	15.9	16.7	16.9	18.3	17.5	16.8
Turbidity, field	NTU	0.75	1.36	1.24	1.28	1.17	0.66	0.68	1.24	2.68	3.23	3.78

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		**CUF-206**										
Sample Date		**4-Oct-17**	**29-May-18**	**20-Jun-18**	**11-Jul-18**	**1-Aug-18**	**21-Aug-18**	**11-Sep-18**	**3-Oct-18**	**5-Feb-19**	**8-May-19**	**30-Jul-19**
Sample ID		**CUF-GW-015-10042017**	**CUF-GW-015-05292018**	**CUF-GW-015-06202018**	**CUF-GW-015-07112018**	**CUF-GW-015-08012018**	**CUF-GW-015-08212018**	**CUF-GW-015-09112018**	**CUF-GW-015-10032018**	**CUF-GW-015-02052019**	**CUF-GW-015-05082019**	**CUF-GW-015-07302019**
Parent Sample ID												
Sample Depth		**77.2 ft**	**77.2 ft**	**77.2 ft**	**77.2 ft**	**77.2 ft**	**77.2 ft**	**77.2 ft**	**77.2 ft**	**77.2 ft**	**77.2 ft**	**77.2 ft**
Sample Type		**Normal Environmental Sample**	**Normal Environmental Sample**	**Normal Environmental Sample**	**Normal Environmental Sample**	**Normal Environmental Sample**	**Normal Environmental Sample**	**Normal Environmental Sample**	**Normal Environmental Sample**	**Normal Environmental Sample**	**Normal Environmental Sample**	**Normal Environmental Sample**
Program	**Units**	**CCR Program**	**CCR Program**	**CCR Program**	**CCR Program**	**CCR Program**	**CCR Program**	**CCR Program**	**CCR Program**	**CCR Program**	**CCR Program**	**CCR Program**
Field Parameters												
Dissolved Oxygen	%	2.4	1.8	1.5	2.1	2.7	2.6	1.1	1.4	1.2	2.5	2.5
Dissolved Oxygen	mg/L	0.28	0.15	0.13	0.19	0.25	0.28	0.11	0.16	0.10	0.26	0.24
ORP	mV	-102.7	-85.7	-108.1	-61.2	-67.8	-62.3	181.4	-71.6	-129.5	-81.9	-110.8
pH (field)	SU	6.65	6.52	6.60	6.66	6.61	6.65	6.53	6.50	6.88	6.51	6.55
Specific Cond. (Field)	uS/cm	2,940	3,658	3,460	3,237	3,610	3,540	3,670	3,690	2,870	3,580	3,280
Temperature, Water (C)	DEG C	17.8	16.5	16.8	17.2	16.6	16.8	16.6	17.0	15.8	16.4	17.1
Turbidity, field	NTU	3.86	2.36	0.64	0.89	0.78	1.35	0.80	1.31	4.60	1.76	4.15

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-206										
Sample Date		8-Oct-19	29-Jan-20	11-Mar-20	29-Jul-20	11-Sep-20	19-Jan-21	4-Mar-21	8-Jun-21	25-Aug-21	24-Jan-22	9-Mar-22
Sample ID		CUF-GW-015-10082019	CUF-GW-015-01292020	CUF-GW-015-03112020	CUF-GW-015-07292020	CUF-GW-015-09112020	CUF-GW-CUF-206-01192021	CUF-GW-CUF-206-03042021	CUF-GW-CUF-206-06082021	CUF-GW-CUF-206-08252021	CUF-GW-CUF-206-01242022	CUF-GW-CUF-206-03092022
Parent Sample ID												
Sample Depth		77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft	77.2 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	2.9	8.6	2.5	3.2	6.1	1.4	2.6	22.1	1.1	4.0	2.0
Dissolved Oxygen	mg/L	0.27	0.87	0.25	0.30	0.55	0.13	0.26	2.13	0.11	0.38	0.20
ORP	mV	-108.7	-65.4	-119.7	-102.4	-119.7	-115.7	-112.1	-116.6	-121.0	-115.0	-80.9
pH (field)	SU	6.61	6.68	6.62	6.57	6.70	6.45	6.51	6.52	7.02	6.78	6.67
Specific Cond. (Field)	uS/cm	3,670	3,090	2,910	3,540	3,610	3,450	2,570	2,370	2,940	2,000	1,830
Temperature, Water (C)	DEG C	17.1	15.2	15.6	18.0	16.8	15.8	16.0	16.4	17.1	15.9	16.1
Turbidity, field	NTU	1.61	2.11	0.98	3.99	1.61	1.92	0.63	2.41	3.89	3.89	1.83

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-206		CUF-207								
Sample Date		15-Jul-22	31-Aug-22	8-Nov-16	26-Jan-17	8-Feb-17	9-Mar-17	5-Apr-17	4-May-17	1-Jun-17	13-Jul-17	28-Jul-17
Sample ID		CUF-GW-CUF-206-07152022	CUF-GW-CUF-206-08312022	CUF-GW-016-11082016	CUF-GW-016-01262017	CUF-GW-016-02082017	CUF-GW-016-03092017	CUF-GW-016-04052017	CUF-GW-016-05042017	CUF-GW-016-06012017	CUF-GW-016-07132017	CUF-GW-016-07282017
Parent Sample ID												
Sample Depth		77.2 ft	77.2 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	4.4	1.5	3.2	2.4	1.4	2.1	1.8	4.3	11.1	2.8	1.4
Dissolved Oxygen	mg/L	0.43	0.15	0.30	0.24	0.14	0.22	0.18	0.43	1.10	0.27	0.14
ORP	mV	-125.4	-110.7	-118.0	-116.7	-108.6	-109.7	-103.0	-91.4	-21.8	-108.7	-116.7
pH (field)	SU	6.61	6.76	6.75	6.69	6.79	6.82	6.81	6.88	6.87	6.70	6.72
Specific Cond. (Field)	uS/cm	1,300	1,380	3,920	3,710	3,690	3,680	3,640	3,530	3,480	3,730	3,570
Temperature, Water (C)	DEG C	16.9	16.8	16.7	14.4	15.5	16.6	16.8	16.2	17.3	17.2	18.1
Turbidity, field	NTU	2.48	3.30	3.03	3.55	1.46	1.69	1.40	0.68	0.58	1.63	2.21

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-207										
Sample Date		22-Aug-17	31-Aug-17	4-Oct-17	31-May-18	20-Jun-18	11-Jul-18	1-Aug-18	22-Aug-18	11-Sep-18	3-Oct-18	6-Feb-19
Sample ID		CUF-GW-016-08222017	CUF-GW-016-08312017	CUF-GW-016-10042017	CUF-GW-016-05312018	CUF-GW-016-06202018	CUF-GW-016-07112018	CUF-GW-016-08012018	CUF-GW-016-08222018	CUF-GW-016-09112018	CUF-GW-016-10032018	CUF-GW-016-02062019
Parent Sample ID												
Sample Depth		69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	2.3	9.5	3.5	3.8	2.5	4.6	2.5	2.4	1.1	3.4	2.2
Dissolved Oxygen	mg/L	0.21	0.92	0.32	0.36	0.26	0.41	0.23	0.25	0.11	0.32	0.11
ORP	mV	-116.1	-103.8	-96.6	-69.2	-126.3	-74.2	-78.7	-17.1	169.7	-86.7	-120.5
pH (field)	SU	6.83	6.77	6.79	6.74	6.78	6.82	6.85	6.74	6.73	6.73	6.65
Specific Cond. (Field)	uS/cm	3,550	3,670	3,030	3,652	3,417	3,195	3,540	3,590	3,620	3,640	3,030
Temperature, Water (C)	DEG C	18.6	17.0	17.8	17.7	17.2	17.4	17.5	17.3	17.5	17.6	16.2
Turbidity, field	NTU	0.80	1.77	0.20	0.37	0.48	0.98	0.61	0.91	1.64	0.67	0.64

See notes on last page.

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Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-207					
Sample Date		8-May-19	30-Jul-19	8-Oct-19	28-Jan-20	11-Mar-20	28-Jul-20
Sample ID		CUF-GW-016-05082019	CUF-GW-016-07302019	CUF-GW-016-10082019	CUF-GW-016-01282020	CUF-GW-016-03112020	CUF-GW-016-07282020
Parent Sample ID							
Sample Depth		69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters							
Dissolved Oxygen	%	2.6	1.7	1.4	12.1	2.2	3.4
Dissolved Oxygen	mg/L	0.25	0.16	0.14	1.20	0.21	0.33
ORP	mV	-82.2	-119.2	-131.4	77.7	-117.1	-118.9
pH (field)	SU	6.66	6.70	6.76	6.86	6.77	6.76
Specific Cond. (Field)	uS/cm	3,790	3,400	3,840	3,370	3,120	3,750
Temperature, Water (C)	DEG C	17.0	17.5	17.2	15.8	16.1	17.6
Turbidity, field	NTU	0.61	4.77	0.90	1.42	0.48	2.80

Sample Location		CUF-207				
Sample Date		10-Sep-20	20-Jan-21	4-Mar-21	25-Aug-21	24-Jan-22
Sample ID		CUF-GW-016-09102020	CUF-GW-CUF-207-01202021	CUF-GW-CUF-207-03042021	CUF-GW-CUF-207-08252021	CUF-GW-CUF-207-01242022
Parent Sample ID						
Sample Depth		69.9 ft	69.9 ft	69.9 ft	69.9 ft	69.9 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters						
Dissolved Oxygen	%	1.4	1.7	2.3	0.9	3.7
Dissolved Oxygen	mg/L	0.14	0.17	0.27	0.09	0.35
ORP	mV	-56.3	-116.6	-124.2	-134.6	-99.4
pH (field)	SU	5.19	6.68	6.33	7.16	6.78
Specific Cond. (Field)	uS/cm	3,830	3,770	3,950	3,220	1,790
Temperature, Water (C)	DEG C	17.5	16.1	16.7	17.2	16.8
Turbidity, field	NTU	2.01	0.61	2.03	4.70	4.09

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-207			CUF-208							
Sample Date		9-Mar-22	15-Jul-22	30-Aug-22	8-Nov-16	26-Jan-17	8-Feb-17	9-Mar-17	5-Apr-17	4-May-17	1-Jun-17	13-Jul-17
Sample ID		CUF-GW-CUF-207-03092022	CUF-GW-CUF-207-07152022	CUF-GW-CUF-207-08302022	CUF-GW-017-11082016	CUF-GW-017-01262017	CUF-GW-017-02082017	CUF-GW-017-03092017	CUF-GW-017-04052017	CUF-GW-017-05042017	CUF-GW-017-06012017	CUF-GW-017-07132017
Parent Sample ID												
Sample Depth		69.9 ft	69.9 ft	69.9 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	3.4	1.2	1.4	6.3	4.5	4.7	4.2	5.3	9.1	15.4	7.4
Dissolved Oxygen	mg/L	0.33	0.12	0.13	0.61	0.46	0.41	0.40	0.49	0.90	1.41	0.69
ORP	mV	-82.9	-111.9	-191.2	-21.4	-24.6	-14.9	-20.8	-6.1	-5.7	98.8	-19.0
pH (field)	SU	6.39	6.71	6.88	6.73	6.66	6.78	6.81	6.81	6.85	6.81	6.65
Specific Cond. (Field)	uS/cm	1,510	1,280	1,240	4,060	3,930	3,920	3,930	3,860	3,820	3,780	4,020
Temperature, Water (C)	DEG C	16.1	18.0	17.9	17.3	13.8	16.3	17.8	18.6	17.2	19.7	20.4
Turbidity, field	NTU	0.87	1.39	1.49	0.00	0.26	0.40	0.52	0.74	0.54	0.28	0.71

See notes on last page.

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Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-208										
Sample Date		28-Jul-17	22-Aug-17	31-Aug-17	4-Oct-17	31-May-18	20-Jun-18	12-Jul-18	1-Aug-18	22-Aug-18	11-Sep-18	3-Oct-18
Sample ID		CUF-GW-017-07282017	CUF-GW-017-08222017	CUF-GW-017-08312017	CUF-GW-017-10042017	CUF-GW-017-05312018	CUF-GW-017-06202018	CUF-GW-017-07122018	CUF-GW-017-08012018	CUF-GW-017-08222018	CUF-GW-017-09112018	CUF-GW-017-10032018
Parent Sample ID												
Sample Depth		52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	11.9	16.7	12.2	18.9	3.6	5.0	12.2	6.0	6.0	3.3	3.9
Dissolved Oxygen	mg/L	1.00	1.44	1.11	1.58	0.34	0.45	1.07	0.56	0.55	0.32	0.36
ORP	mV	-26.3	-18.5	-7.1	-26.2	84.0	-15.6	166.2	38.1	86.0	188.2	57.5
pH (field)	SU	6.67	6.74	6.77	6.78	6.71	6.70	6.65	6.72	6.77	6.70	6.71
Specific Cond. (Field)	uS/cm	3,790	3,790	3,910	3,340	3,789	3,500	3,279	3,550	3,510	3,560	3,670
Temperature, Water (C)	DEG C	24.1	24.0	19.3	24.5	19.2	20.6	21.4	19.5	18.9	18.7	18.9
Turbidity, field	NTU	1.70	0.79	1.42	1.43	0.41	0.49	1.39	0.27	1.43	1.61	0.97

See notes on last page.

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Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-208										
Sample Date		6-Feb-19	8-May-19	30-Jul-19	9-Oct-19	29-Jan-20	11-Mar-20	29-Jul-20	11-Sep-20	20-Jan-21	4-Mar-21	25-Aug-21
Sample ID		CUF-GW-017-02062019	CUF-GW-017-05082019	CUF-GW-017-07302019	CUF-GW-017-10092019	CUF-GW-017-01292020	CUF-GW-017-03112020	CUF-GW-017-07292020	CUF-GW-017-09112020	CUF-GW-CUF-208-01202021	CUF-GW-CUF-208-03042021	CUF-GW-CUF-208-08252021
Parent Sample ID												
Sample Depth		52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft	52.8 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	4.6	5.5	6.8	5.8	7.9	7.2	8.8	9.5	4.5	5.4	13.6
Dissolved Oxygen	mg/L	0.44	0.49	0.61	0.56	0.83	0.71	0.78	0.83	0.46	0.53	1.17
ORP	mV	-14.8	9.4	-23.1	-46.6	-15.2	-11.8	-0.5	19.3	-74.8	-26.1	8.5
pH (field)	SU	6.74	6.61	6.67	6.69	6.78	6.76	6.62	5.73	6.72	6.31	7.07
Specific Cond. (Field)	uS/cm	2,840	3,590	3,130	3,390	2,750	2,810	3,360	3,210	2,520	3,420	3,200
Temperature, Water (C)	DEG C	16.6	20.0	21.4	18.4	14.4	15.8	20.8	20.6	15.1	17.1	22.9
Turbidity, field	NTU	3.30	1.99	1.13	1.16	0.42	0.35	2.25	0.95	4.01	0.83	4.94

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-208				CUF-209						
Sample Date		25-Jan-22	9-Mar-22	14-Jul-22	25-Aug-22	8-Nov-16	25-Jan-17	8-Feb-17	9-Mar-17	5-Apr-17	4-May-17	1-Jun-17
Sample ID		CUF-GW-CUF-208-01252022	CUF-GW-CUF-208-03092022	CUF-GW-CUF-208-07142022	CUF-GW-CUF-208-08252022	CUF-GW-018-11082016	CUF-GW-018-01252017	CUF-GW-018-02082017	CUF-GW-018-03092017	CUF-GW-018-04052017	CUF-GW-018-05042017	CUF-GW-018-06012017
Parent Sample ID												
Sample Depth		52.8 ft	52.8 ft	52.8 ft	52.8 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	8.5	6.1	5.6	2.7	3.7	4.9	4.3	4.5	5.0	3.8	9.0
Dissolved Oxygen	mg/L	0.87	0.61	0.49	0.23	0.36	0.48	0.41	0.42	0.44	0.37	0.86
ORP	mV	11.8	29.3	-27.9	-3.2	-104.7	-122.6	-95.0	-104.5	-95.7	-15.8	-2.1
pH (field)	SU	6.78	6.71	6.82	6.80	7.06	7.11	7.12	7.20	7.13	7.08	7.12
Specific Cond. (Field)	uS/cm	2,790	2,730	2,890	2,710	1,380	1,890	1,850	1,890	1,870	1,670	1,390
Temperature, Water (C)	DEG C	13.6	14.8	21.4	21.3	17.4	17.6	15.6	17.3	20.9	17.4	20.2
Turbidity, field	NTU	4.66	4.20	5.70	0.89	1.39	0.54	0.46	1.09	1.13	0.75	0.23

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-209										
Sample Date		12-Jul-17	28-Jul-17	18-Aug-17	31-Aug-17	4-Oct-17	31-May-18	20-Jun-18	12-Jul-18	1-Aug-18	22-Aug-18	11-Sep-18
Sample ID		CUF-GW-018-07122017	CUF-GW-018-07282017	CUF-GW-018-08182017	CUF-GW-018-08312017	CUF-GW-018-10042017	CUF-GW-018-05312018	CUF-GW-018-06202018	CUF-GW-018-07122018	CUF-GW-018-08012018	CUF-GW-018-08222018	CUF-GW-018-09112018
Parent Sample ID												
Sample Depth		62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	4.6	8.1	8.0	18.0	9.7	3.5	6.7	4.9	10.6	3.2	2.5
Dissolved Oxygen	mg/L	0.42	0.72	0.67	1.63	0.91	0.32	0.59	0.43	0.92	0.31	0.23
ORP	mV	-93.6	-79.1	-87.3	-82.7	-73.1	-58.7	-90.2	-48.2	34.8	-13.2	118.7
pH (field)	SU	7.05	6.93	7.05	7.05	7.07	7.10	7.04	7.09	7.04	7.11	7.02
Specific Cond. (Field)	uS/cm	1,920	1,990	1,880	1,920	1,660	2,164	1,952	1,789	2,020	1,230	1,500
Temperature, Water (C)	DEG C	20.6	22.7	23.1	19.6	20.8	19.8	21.0	20.9	20.9	18.2	18.2
Turbidity, field	NTU	0.92	0.95	1.00	1.44	0.47	0.22	0.24	0.26	0.31	1.16	0.72

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-209										
Sample Date		3-Oct-18	23-Jan-19	6-Feb-19	9-Apr-19	8-May-19	31-Jul-19	9-Oct-19	29-Jan-20	10-Mar-20	29-Jul-20	14-Sep-20
Sample ID		CUF-GW-018-10032018	209-0119	CUF-GW-018-02062019	CUF-209	CUF-GW-018-05082019	CUF-GW-018-07312019	CUF-GW-018-10092019	CUF-GW-018-01292020	CUF-GW-018-03102020	CUF-GW-018-07292020	CUF-GW-018-09142020
Parent Sample ID												
Sample Depth		62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	State Compliance	CCR Program	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	4.1	-	3.9	-	5.0	8.8	6.8	8.4	6.1	9.8	9.9
Dissolved Oxygen	mg/L	0.38	0.6	0.35	0	0.45	0.79	0.64	0.85	0.59	0.88	0.84
ORP	mV	-40.1	136	-81.3	94	-53.3	-54.0	-68.0	-36.2	-52.6	123.5	-19.7
pH (field)	SU	7.06	7.1	6.97	6.8	6.69	6.67	6.79	6.88	6.89	6.87	7.88
Specific Cond. (Field)	uS/cm	1,670	2,189	1,400	2,070	2,250	2,580	3,150	3,110	3,010	3,340	3,280
Temperature, Water (C)	DEG C	18.9	14.6	16.8	16.6	20.1	20.6	19.3	14.6	16.7	21.5	21.5
Turbidity, field	NTU	0.62	0.9	4.02	0	0.45	1.36	0.61	0.24	0.16	0.48	0.70

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-209										
Sample Date		5-Oct-20	20-Jan-21	4-Mar-21	13-Apr-21	19-Jul-21	19-Aug-21	13-Oct-21	20-Jan-22	4-Mar-22	12-Apr-22	13-Jul-22
Sample ID		CUF-209-1020	CUF-GW-CUF-209-01202021	CUF-GW-CUF-209-03042021	CUF-GW-209-04132021	CUF-GW-CUF-209-07192021	CUF-GW-CUF-209-08192021	CUF-GW-CUF-209-10132021	CUF-GW-CUF-209-01202022	CUF-GW-CUF-209-03042022	CUF-GW-CUF-209-04122022	CUF-GW-CUF-209-07132022
Parent Sample ID												
Sample Depth		62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft	62 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	State Compliance	CCR Program
Field Parameters												
Dissolved Oxygen	%	-	9.5	7.7	3.2	5.2	7.8	4.9	5.8	7.2	4.5	7.2
Dissolved Oxygen	mg/L	0.22	0.91	0.77	0.30	0.48	0.69	0.46	0.63	0.67	0.42	0.64
ORP	mV	181	-29.6	-43.2	90	-44.0	-8.8	41.0	-61.8	-2.2	37	-24.0
pH (field)	SU	6.65	6.76	6.81	6.73	6.72	6.85	6.86	7.00	6.75	6.79	6.78
Specific Cond. (Field)	uS/cm	3,215	3,110	3,060	2,954	2,470	2,790	2,764	2,560	2,630	2,731	2,470
Temperature, Water (C)	DEG C	15.7	13.9	16.2	15.90	20.7	20.1	18.01	11.6	18.5	16.95	21.5
Turbidity, field	NTU	0.0	0.54	0.31	0.5	2.49	0.42	0.7	3.47	0.19	1.4	0.15

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-209	CUF-211								
Sample Date		24-Aug-22	7-Nov-16	25-Jan-17	8-Feb-17	8-Mar-17	5-Apr-17	3-May-17	31-May-17	12-Jul-17	27-Jul-17
Sample ID		CUF-GW-CUF-209-08242022	CUF-GW-020-11072016	CUF-GW-020-01252017	CUF-GW-020-02082017	CUF-GW-020-03082017	CUF-GW-020-04052017	CUF-GW-020-05032017	CUF-GW-020-05312017	CUF-GW-020-07122017	CUF-GW-020-07272017
Parent Sample ID											
Sample Depth		62 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters											
Dissolved Oxygen	%	4.6	43.2	3.1	4.0	5.0	3.9	16.9	4.7	1.2	1.8
Dissolved Oxygen	mg/L	0.38	3.91	0.30	0.40	0.49	0.39	1.45	0.44	0.11	0.18
ORP	mV	-15.0	-68.7	-98.7	-80.2	-81.1	-63.1	-60.1	23.2	-79.4	-83.4
pH (field)	SU	6.84	6.63	6.63	6.65	6.68	6.60	6.70	6.69	6.60	6.64
Specific Cond. (Field)	uS/cm	2,340	1,520	1,490	1,490	1,480	1,500	1,470	1,490	1,540	1,460
Temperature, Water (C)	DEG C	21.9	18.7	17.2	16.8	17.9	18.6	18.5	19.0	18.8	20.1
Turbidity, field	NTU	2.53	1.82	0.17	0.55	0.88	1.02	0.43	0.41	0.80	1.31

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-211										
Sample Date		18-Aug-17	30-Aug-17	3-Oct-17	31-May-18	20-Jun-18	12-Jul-18	22-Aug-18	12-Sep-18	3-Oct-18	23-Jan-19	7-Feb-19
Sample ID		CUF-GW-020-08182017	CUF-GW-020-08302017	CUF-GW-020-10032017	CUF-GW-020-05312018	CUF-GW-020-06202018	CUF-GW-020-07122018	CUF-GW-020-08222018	CUF-GW-020-09122018	CUF-GW-020-10032018	211-0119	CUF-GW-020-02072019
Parent Sample ID												
Sample Depth		67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program
Field Parameters												
Dissolved Oxygen	%	1.8	3.0	2.2	43.2	5.2	2.7	3.1	2.5	4.8	-	2.9
Dissolved Oxygen	mg/L	0.17	0.28	0.22	4.19	0.45	0.26	0.35	0.24	0.46	0.59	0.25
ORP	mV	-73.0	-68.9	-70.6	-61.4	-83.6	-25.8	7.4	170.0	-38.7	131	-88.5
pH (field)	SU	6.59	6.64	6.68	6.67	6.64	6.65	6.79	6.53	6.65	6.69	6.58
Specific Cond. (Field)	uS/cm	1,470	1,570	1,320	1,577	1,478	1,400	1,570	1,600	1,620	1,616	1,310
Temperature, Water (C)	DEG C	19.0	18.6	19.6	19.3	18.7	18.9	19.0	18.6	19.0	14.85	17.7
Turbidity, field	NTU	0.84	1.39	4.54	4.39	0.44	1.01	0.94	1.04	0.47	2.8	4.53

See notes on last page.

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Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-211										
Sample Date		9-Apr-19	8-May-19	31-Jul-19	9-Oct-19	29-Jan-20	10-Mar-20	28-Jul-20	14-Sep-20	5-Oct-20	19-Jan-21	4-Mar-21
Sample ID		CUF-211	CUF-GW-020-05082019	CUF-GW-020-07312019	CUF-GW-020-10092019	CUF-GW-020-01292020	CUF-GW-020-03102020	CUF-GW-020-07282020	CUF-GW-020-09142020	CUF-211-1020	CUF-GW-CUF-211-01192021	CUF-GW-CUF-211-03042021
Parent Sample ID												
Sample Depth		67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	-	3.4	2.3	2.2	5.5	3.1	4.2	3.7	-	1.6	3.2
Dissolved Oxygen	mg/L	0	0.32	0.21	0.21	0.56	0.28	0.38	0.34	0.3	0.17	0.31
ORP	mV	134	-47.9	-88.5	-105.4	-42.5	-95.8	-50.8	-36.5	134	-91.5	-94.1
pH (field)	SU	6.5	6.46	6.58	6.64	6.62	6.67	6.56	7.37	6.4	6.62	6.35
Specific Cond. (Field)	uS/cm	1,633	1,640	1,490	1,670	1,610	1,530	1,750	1,830	1,822	1,270	1,720
Temperature, Water (C)	DEG C	20.5	18.8	19.2	18.7	16.8	17.5	19.4	18.6	19.2	17.4	17.6
Turbidity, field	NTU	0.2	1.10	4.97	3.34	4.76	0.73	0.78	0.58	0.0	1.19	1.02

See notes on last page.

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Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-211								
Sample Date		13-Apr-21	20-Jul-21	19-Aug-21	13-Oct-21	18-Jan-22	8-Mar-22	13-Apr-22	13-Jul-22	23-Aug-22
Sample ID		CUF-GW-211-04132021	CUF-GW-CUF-211-07202021	CUF-GW-CUF-211-08192021	CUF-GW-CUF-211-10132021	CUF-GW-CUF-211-01182022	CUF-GW-CUF-211-03082022	CUF-GW-CUF-211-04132022	CUF-GW-CUF-211-07132022	CUF-GW-CUF-211-08232022
Parent Sample ID										
Sample Depth		67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft	67 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	State Compliance	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program
Field Parameters										
Dissolved Oxygen	%	2.9	1.3	2.9	2.6	13.4	3.6	3.3	6.7	0.9
Dissolved Oxygen	mg/L	0.27	0.13	0.27	0.75	1.27	0.34	0.31	0.62	0.09
ORP	mV	130	-60.4	-36.0	150	-74.6	-23.8	149	-52.1	-29.6
pH (field)	SU	6.51	8.03	6.53	6.45	6.45	6.37	6.29	6.34	6.32
Specific Cond. (Field)	uS/cm	1,906	1,930	2,220	2,254	2,290	2,310	2,427	2,200	2,290
Temperature, Water (C)	DEG C	19.85	18.4	18.5	21.92	17.2	17.1	17.65	18.3	18.6
Turbidity, field	NTU	0.5	4.34	0.78	2.1	3.75	0.56	0.30	2.60	4.98

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-212										
Sample Date		7-Nov-16	24-Jan-17	7-Feb-17	8-Mar-17	5-Apr-17	3-May-17	31-May-17	12-Jul-17	27-Jul-17	17-Aug-17	30-Aug-17
Sample ID		CUF-GW-021-11072016	CUF-GW-021-01242017	CUF-GW-021-02072017	CUF-GW-021-03082017	CUF-GW-021-04052017	CUF-GW-021-05032017	CUF-GW-021-05312017	CUF-GW-021-07122017	CUF-GW-021-07272017	CUF-GW-021-08172017	CUF-GW-021-08302017
Parent Sample ID												
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters												
Dissolved Oxygen	%	21.8	2.5	3.7	3.7	5.6	4.5	6.3	2.2	2.2	2.6	2.8
Dissolved Oxygen	mg/L	1.94	0.23	0.34	0.35	0.53	0.44	0.58	0.21	0.19	0.23	0.26
ORP	mV	-100.4	-122.1	-92.5	-89.1	-66.5	-60.0	22.4	-84.3	-65.4	-70.5	79.4
pH (field)	SU	7.33	7.08	7.17	7.18	7.11	7.16	7.16	6.97	6.93	7.00	6.80
Specific Cond. (Field)	uS/cm	4,210	4,010	4,080	4,230	4,180	3,870	3,880	3,990	3,790	3,770	3,990
Temperature, Water (C)	DEG C	19.3	17.8	17.7	18.1	18.7	19.1	18.9	19.0	19.6	19.5	19.0
Turbidity, field	NTU	3.76	0.41	1.05	0.99	1.07	1.33	1.13	1.22	1.09	1.58	1.67

See notes on last page.

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Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-212										
Sample Date		3-Oct-17	1-Jun-18	21-Jun-18	12-Jul-18	22-Aug-18	12-Sep-18	4-Oct-18	23-Jan-19	7-Feb-19	9-Apr-19	9-May-19
Sample ID		CUF-GW-021-10032017	CUF-GW-021-06012018	CUF-GW-021-06212018	CUF-GW-021-07122018	CUF-GW-021-08222018	CUF-GW-021-09122018	CUF-GW-021-10042018	212-0119	CUF-GW-021-02072019	CUF-212	CUF-GW-021-05092019
Parent Sample ID												
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program	State Compliance	CCR Program
Field Parameters												
Dissolved Oxygen	%	3.4	11.1	77.5	2.4	2.8	2.5	1.7	-	3.3	-	3.8
Dissolved Oxygen	mg/L	0.25	1.01	7.25	0.22	0.25	0.24	0.15	0.5	0.32	0	0.34
ORP	mV	-27.8	204.2	-16.7	26.8	88.1	90.2	30.4	172	-12.4	131	-4.4
pH (field)	SU	6.77	6.63	6.50	6.57	6.69	6.57	6.64	6.6	6.56	6.5	6.47
Specific Cond. (Field)	uS/cm	3,330	3,769	3,537	3,280	3,590	3,710	3,780	3,763	3,050	3,752	3,700
Temperature, Water (C)	DEG C	19.3	18.3	18.5	19.1	18.9	18.7	19.4	15.3	17.9	22.7	18.0
Turbidity, field	NTU	2.04	4.54	2.06	0.69	0.98	0.96	0.33	2.5	2.81	0	1.16

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-212										
Sample Date		31-Jul-19	9-Oct-19	28-Jan-20	11-Mar-20	28-Jul-20	14-Sep-20	6-Oct-20	19-Jan-21	3-Mar-21	14-Apr-21	19-Jul-21
Sample ID		CUF-GW-021-07312019	CUF-GW-021-10092019	CUF-GW-021-01282020	CUF-GW-021-03112020	CUF-GW-021-07282020	CUF-GW-021-09142020	CUF-212-1020	CUF-GW-CUF-212-01192021	CUF-GW-CUF-212-03032021	CUF-GW-212-04142021	CUF-GW-CUF-212-07192021
Parent Sample ID												
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	CCR Program	State Compliance	CCR Program
Field Parameters												
Dissolved Oxygen	%	4.5	2.9	5.4	3.4	3.5	2.3	-	2.2	1.7	1.6	2.2
Dissolved Oxygen	mg/L	0.41	0.27	0.52	0.32	0.32	0.24	0.2	0.2	0.16	1.11	0.21
ORP	mV	-22.8	-48.4	-35.4	2.4	11.0	-176.7	130	-34.8	-22.3	150	-25.4
pH (field)	SU	6.47	6.54	6.49	6.50	6.51	6.90	6.3	6.47	6.45	6.24	7.15
Specific Cond. (Field)	uS/cm	3,230	3,600	3,280	2,990	3,390	3,460	3,483	2,180	3,560	3,433	2,850
Temperature, Water (C)	DEG C	19.4	19.1	17.2	17.4	19.4	18.7	15.4	17.1	17.8	16.58	18.6
Turbidity, field	NTU	4.69	1.27	1.11	0.86	1.81	1.15	0.0	1.46	1.55	0.1	4.64

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-212							CUF-1001		
Sample Date		19-Aug-21	14-Oct-21	19-Jan-22	4-Mar-22	13-Apr-22	13-Jul-22	25-Aug-22	8-May-19	8-Jul-19	10-Sep-19
Sample ID		CUF-GW-CUF-212-08192021	CUF-GW-CUF-212-10142021	CUF-GW-CUF-212-01192022	CUF-GW-CUF-212-03042022	CUF-GW-CUF-212-04132022	CUF-GW-CUF-212-07132022	CUF-GW-CUF-212-08252022	CUF-GW-027-20190508	CUF-GW-027-20190708	CUF-GW-027-20190910
Parent Sample ID											
Sample Depth		71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	71 ft	19 ft	19 ft	19 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	CCR Program	State Compliance	CCR Program	CCR Program	State Compliance	CCR Program	CCR Program	EIP	EIP	EIP
Field Parameters											
Dissolved Oxygen	%	2.7	3.9	3.8	2.9	3.4	0.01	0.8	4.9	2.4	3.0
Dissolved Oxygen	mg/L	0.24	0.35	0.35	0.27	0.30	0.00	0.07	0.47	0.22	0.28
ORP	mV	36.9	144	-42.4	23.8	118	-26.5	59.6	-71.1	-173.8	-144.6
pH (field)	SU	6.45	6.36	6.38	6.30	6.37	6.96	6.37	7.15	7.24	6.91
Specific Cond. (Field)	uS/cm	3,310	3,361	3,170	3,150	3,328	2,360	2,850	1,285	1,223	1,435
Temperature, Water (C)	DEG C	18.6	19.64	17.1	17.8	19.22	23.2	19.0	17.5	19.6	21.8
Turbidity, field	NTU	1.90	0.4	3.90	0.20	0.80	8.44	4.86	0.49	0.78	0.35

See notes on last page.

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Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-1001							CUF-1002			
Sample Date		29-Oct-19	7-Jan-20	10-Mar-20	2-Mar-21	13-Jul-21	8-Mar-22	23-Aug-22	9-May-19	9-Jul-19	11-Sep-19	29-Oct-19
Sample ID		CUF-GW-027-20191029	CUF-GW-027-20200107	CUF-GW-027-20200310	CUF-GW-CUF-1001-03022021	CUF-GW-CUF-1001-07132021	CUF-GW-CUF-1001-03082022	CUF-GW-CUF-1001-08232022	CUF-GW-028-20190509	CUF-GW-028-20190709	CUF-GW-028-20190911	CUF-GW-028-20191029
Parent Sample ID												
Sample Depth		19 ft	19 ft	19 ft	19 ft	19 ft	19 ft	19 ft	18 ft	18 ft	18 ft	18 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	EIP	EIP	EIP	EIP	CCR Program	CCR Program	CCR Program	EIP	EIP	EIP	EIP
Field Parameters												
Dissolved Oxygen	%	2.7	20.2	33.6	10.4	1.5	17.6	2.3	2.9	2.9	3.4	1.0
Dissolved Oxygen	mg/L	0.24	1.89	3.29	1.03	0.14	1.74	0.20	0.28	0.26	0.29	0.09
ORP	mV	-122.0	1.8	124.1	-7.3	-57.9	22.0	143.3	34.6	-81.2	-163.1	-142.9
pH (field)	SU	6.03 J	7.19	7.21	6.92	8.33	7.28	6.89	6.71	6.83	6.97	6.00 J
Specific Cond. (Field)	uS/cm	1,344	1,387	1,287	1,340	1,250	1,290	1,350	1,273	1,256	1,288	1,378
Temperature, Water (C)	DEG C	20.2	17.6	16.6	16.3	18.4	16.0	20.7	16.4	19.2	21.6	21.4
Turbidity, field	NTU	1.02	2.95	2.81	0.8	1.86	0.31	0.74	8.35	4.13	2.44	3.66

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-1002							CUF-1003		
Sample Date		8-Jan-20	11-Mar-20	14-Jul-21	14-Oct-21	19-Jan-22	12-Apr-22	13-Jul-22	8-May-19	9-Jul-19	10-Sep-19
Sample ID		CUF-GW-028-20200108	CUF-GW-028-20200311	CUF-GW-1002-07142021	CUF-GW-CUF-1002-10142021	CUF-GW-CUF-1002-01192022	CUF-GW-CUF-1002-04122022	CUF-GW-CUF-1002-07132022	CUF-GW-029-20190508	CUF-GW-029-20190709	CUF-GW-029-20190910
Parent Sample ID											
Sample Depth		18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	18 ft	16.8 ft	16.8 ft	16.8 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	EIP	EIP	State Compliance	State Compliance	State Compliance	State Compliance	State Compliance	EIP	EIP	EIP
Field Parameters											
Dissolved Oxygen	%	1.9	1.4	2.5	2.1	0.22	1.0	5.7	30.4	3.6	5.0
Dissolved Oxygen	mg/L	0.17	0.15	0.21	0.17	0.04	0.10	0.47	2.83	0.33	0.42
ORP	mV	-77.7	-13.4	-15	-12	10	-45	43	121.9	103.5	-15.9
pH (field)	SU	6.89	6.96	6.90	7.01	7.05	6.98	6.92	6.48	6.44	7.17
Specific Cond. (Field)	uS/cm	1,336	1,185	1,177	1,177	1,116	1,119	1,175	3,412	3,187	3,121
Temperature, Water (C)	DEG C	17.9	15.4	25.28	24.65	14.09	16.04	20.11	19.0	20.7	23.4
Turbidity, field	NTU	6.86	6.65	1.7	1.4	4.5	2.3	0.00	1.10	1.86	0.62

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-1003						
Sample Date		30-Oct-19	7-Jan-20	10-Mar-20	2-Mar-21	14-Jul-21	7-Mar-22	24-Aug-22
Sample ID		CUF-GW-029-20191030	CUF-GW-029-20200107	CUF-GW-029-20200310	CUF-GW-CUF-1003-03022021	CUF-GW-CUF-1003-07142021	CUF-GW-CUF-1003-03072022	CUF-GW-CUF-1003-08242022
Parent Sample ID								
Sample Depth		16.8 ft	16.8 ft	16.8 ft	16.8 ft	16.8 ft	16.8 ft	16.8 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	EIP	EIP	EIP	EIP	CCR Program	CCR Program	CCR Program
Field Parameters								
Dissolved Oxygen	%	5.1	27.3	14.2	47.5	17.4	49.6	36.6
Dissolved Oxygen	mg/L	0.46	2.64	1.44	4.52	1.59	5.12	3.11
ORP	mV	118.0 J	192.4	139.7	103.9	93.8	143.8	205.9
pH (field)	SU	7.24 J	6.88	7.07	7.01	6.78	7.09	6.90
Specific Cond. (Field)	uS/cm	2,539	2,954	2,290	2,270	2,140	2,120	2,180
Temperature, Water (C)	DEG C	20.2	16.0	15.1	13.8	20.4	13.8	22.9
Turbidity, field	NTU	0.85	0.24	0.59	0.36	1.70	0.31	0.26

See notes on last page.

Table H.1-10 - Groundwater Quality Parameters
Cumberland Fossil Plant

Sample Location		CUF-1006					
Sample Date		22-Jul-21	12-Oct-21	27-Jan-22	8-Mar-22	18-Apr-22	25-Aug-22
Sample ID		CUF-GW-CUF-1006-07222021	CUF-GW-CUF-1006-10122021	CUF-GW-CUF-1006-01272022	CUF-GW-CUF-1006-03082022	CUF-GW-CUF-1006-04182022	CUF-GW-CUF-1006-08252022
Parent Sample ID							
Sample Depth		30 ft	30 ft	30 ft	30 ft	30 ft	30 ft
Sample Type		Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Program	Units	EIP	EIP	CCR Program	CCR Program	CCR Program	CCR Program
Field Parameters							
Dissolved Oxygen	%	14.2	6.9	4.3	6.8	1.4	2.6
Dissolved Oxygen	mg/L	1.28	0.64	0.45	0.72	0.14	0.25
ORP	mV	147.7	-39.8	-74.6	-37.9	-79.0	-94.2
pH (field)	SU	6.73	6.61	6.90	6.98	6.88	6.81
Specific Cond. (Field)	uS/cm	2.72	2.87	2.91	2.48	3.090	2.56
Temperature, Water (C)	DEG C	20.4	18.6	12.7	13.1	15.4	20.3
Turbidity, field	NTU	3.62	1.54	4.99	1.11	8.91	4.09

Notes:

Please note that units have been converted automatically in this table, and significant figures may not have been maintained.

-	Parameter not analyzed / not available.
%	percent
Cond.	conductance
DEG C	degrees Celsius
ft	feet below top of casing
ID	identification
J	quantitation is approximate due to limitations identified during data validation
mg/L	milligrams per Liter
mV	milliVolts
NTU	Nephelometric Turbidity Unit
ORP	Oxidation Reduction Potential, measured using a silver reference electrode which has a standard potential of 200 mV
SU	Standard Units
uS/cm	microSiemens per centimeter

Table H.1-11 - Screening Levels for Groundwater
Cumberland Fossil Plant

CCR Parameters	Groundwater Screening Levels	
	(µg/L)	Source
CCR Rule Appendix III Constituents :		
Boron	4,000	RSL
Calcium	--	--
Chloride	250,000	SMCL
Fluoride	4,000	MCL
pH	6.5-8.5 S.U.	SMCL
Sulfate	250,000	SMCL
Total Dissolved Solids	500,000	SMCL
CCR Rule Appendix IV Constituents :		
Antimony	6	MCL
Arsenic	10	MCL
Barium	2,000	MCL
Beryllium	4	MCL
Cadmium	5	MCL
Chromium (total)	100	MCL
Cobalt	6	CCR Rule GWPS
Fluoride	4,000	MCL
Lead	15	CCR Rule GWPS
Lithium	40	CCR Rule GWPS
Mercury	2	MCL
Molybdenum	100	CCR Rule GWPS
Radium-226 & 228	5 pCi/L	MCL
Selenium	50	MCL
Thallium	2	MCL
TDEC Appendix I Constituents :		
Copper	1,300	MCLG
Nickel	100	TN MCL
Silver	100	TN MCL
Vanadium	86	RSL
Zinc	5,000	SMCL

Notes:

CCR - coal combustion residuals

CCR Rule - Coal Combustion Residuals rule, USEPA Title 40, Code of Federal Regulations, Part 257

GWPS - groundwater protection standards

MCL - USEPA maximum contaminant level

MCLG - Maximum contaminant level goal

pCi/L - picocuries per liter

RSL - USEPA regional screening level

SMCL - USEPA secondary maximum contaminant level

S.U. - standard units

TN MCL - maximum contaminant level promulgated by State of Tennessee

TDEC - Tennessee Department of Environmental and Conservation

µg/L - micrograms per liter

USEPA - United States Environmental Protection Agency

Table H.1-12 - Summary of Statistically Significant Concentrations/Values Compared to Groundwater Screening Levels
Cumberland Fossil Plant

Parameter	Background			Upgradient	Dry Ash Stack					Gypsum Storage Area					Stilling Pond (Including Retention Pond)			
	CUF-1001	CUF-201	CUF-202	93-4	93-1	93-1D	CUF-1002	CUF-209	CUF-211	93-2R	93-3	CUF-1003	CUF-1006	CUF-212	CUF-205	CUF-206	CUF-207	CUF-208
CCR Rule Appendix III Parameters																		
Boron	Green	Green	Green	Red	Green	Red	Green	Red	Red	Red	Red	Green	Red	Red	Green	Red	Red	Green
Chloride	Green	Green	Green	Red	Red	Green	Green	Green	Red	Red	Green	Green	Red	Red	Green	Red	Red	Red
Fluoride[1]	Green	Green	Green	Green*	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
pH	Green	Green	Green	Green	Red	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Sulfate	Red	Green	Green	Red	Red	Red	Red	Red	Red	Red	Green	Red	Red	Red	Green	Red	Red	Red
Total Dissolved Solids	Red	Green	Green	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Green	Red	Red	Red
CCR Rule Appendix IV Parameters																		
Antimony	Green*	Green*	Green*	Green*	Green	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*
Arsenic	Green	Green	Green	Green*	Red	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	Green
Barium	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Beryllium	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*
Cadmium	Green*	Green*	Green	Green*	Green*	Green*	Green*	Green*	Green	Green	Green*	Green	Green*	Green*	Green	Green*	Green*	Green*
Chromium	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*
Cobalt	Green	Green	Green	Green	Red	Green	Green	Green	Red	Green	Green	Green	Red	Red	Green	Green	Green	Green
Lead	Green*	Green*	Green*	Green*	Green	Green*	Green*	Green	Green	Green	Green	Green*	Green*	Green	Green*	Green*	Green*	Green*
Lithium	Green	Green*	Green	Green	Green	Green	Green*	Green	Green	Green	Red	Green*	Green*	Green	Green*	Green*	Green*	Green*
Mercury	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*
Molybdenum	Green	Green	Green	Green*	Green	Green	Green	Red	Green	Green	Green	Green	Red	Green	Green	Green	Green	Green
Rad226+228	Green*	Green*	Green	Green	Green	Green*	Green*	Green	Green	Green	Green	Green*	Green*	Green	Green	Green	Green	Green*
Selenium	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*
Thallium	Green*	Green*	Green	Green*	Green	Green*	Green*	Green	Green	Green	Green*	Green*	Green*	Green	Green*	Green	Green*	Green*
TDEC Appendix I Parameters																		
Copper	Green*	Green*	Green*	Green*	Green	Green*	Green*	Green*	Green*	Green	Green*	Green	Green*	Green*	Green	Green*	Green*	Green*
Nickel	Green	Green	Green	Green	Green	Green	Green*	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Silver	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*
Vanadium	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green*	Green	Green*	Green*	Green*	Green*	Green*	Green*	Green*
Zinc	Green*	Green*	Green*	Green*	Green	Green*	Green*	Green*	Green	Green	Green*	Green*	Green*	Green	Green	Green*	Green*	Green*

Green	No statistically significant concentration greater than or equal to the GSL for constituents other than pH and no statistically significant difference greater than or equal to the upper GSL or less than or equal to the lower GSL for pH.
Green*	Limited dataset (sample size <5 or <4 detected values), but none of the available results are greater than or equal to the GSL or greater than or equal to the upper GSL or less than or equal to the lower GSL for pH.
Red	Statistically significant concentration greater than or equal to the GSL for constituents other than pH or a statistically significant difference greater than or equal to the upper GSL or less than or equal to the lower GSL for pH.

Notes:

CCR Rule - Title 40, Code of Federal Regulations, Part 257

GWPS - Groundwater protection standard

TDEC - Tennessee Department of Environment and Conservation

The dataset compiled for statistical analysis includes available analytical data for groundwater samples collected between November 2016 and August 2022.

Bold colors are used to represent CCR Rule Appendix IV Parameter and TDEC Appendix I Parameter results while subdued colors represent CCR Rule Appendix III Parameter results.

See Appendix E.3 for full description of statistical methods applied.

[1]Fluoride is both a CCR Rule Appendix III and CCR Rule Appendix IV constituent. In this table, fluoride has been grouped with the Appendix III constituents to avoid duplication of results.

Table H.1-13 - Linear Regression Results
Cumberland Fossil Plant

Well	Constituent Type	Constituent	p-value	Trend summary[1]
CUF-1001	CCR Rule Appendix III Parameters	Boron	0.0129	Decreasing
		pH (field)	0.4579	No trend detected
		Sulfate	0.0711	No trend detected
		Total dissolved solids	0.547	No trend detected
	CCR Rule Appendix IV Parameters	Molybdenum	0.7833	No trend detected
CUF-201	CCR Rule Appendix III Parameters	pH (field)	0.0449	Increasing
CUF-202	CCR Rule Appendix III Parameters	pH (field)	0.0712	No trend detected
CUF-93-4	CCR Rule Appendix III Parameters	Boron	0.1985	No trend detected
		Chloride	0.0001	Decreasing
		pH (field)	0.1603	No trend detected
		Sulfate	0.2493	No trend detected
		Total dissolved solids	0.003	Decreasing
CUF-93-1	CCR Rule Appendix III Parameters	Chloride	0.7843	No trend detected
		pH (field)	0.0013	Decreasing
		Sulfate	<0.0001	Increasing
		Total dissolved solids	0.8656	No trend detected
	CCR Rule Appendix IV Parameters	Arsenic	0.0606	No trend detected
		Cobalt	0.0135	Increasing
CUF-93-1D	CCR Rule Appendix III Parameters	Boron	0.1271	No trend detected
		pH (field)	0.0204	Decreasing
		Sulfate	0.1263	No trend detected
		Total dissolved solids	0.001	Increasing
	CCR Rule Appendix IV Parameters	Cobalt	0.6575	No trend detected
CUF-1002	CCR Rule Appendix III Parameters	pH (field)	0.1766	No trend detected
		Sulfate	0.4562	No trend detected
		Total dissolved solids	0.0012	Decreasing
CUF-209	CCR Rule Appendix III Parameters	Boron	<0.0001	Increasing
		Chloride	0.0013	Increasing
		Sulfate	<0.0001	Increasing
		Total dissolved solids	<0.0001	Increasing
	CCR Rule Appendix IV Parameters	Arsenic	<0.0001	Decreasing
		Molybdenum	<0.0001	Increasing
CUF-211	CCR Rule Appendix III Parameters	Boron	0.1132	No trend detected
		Chloride	<0.0001	Increasing
		pH (field)	0.4819	No trend detected
		Sulfate	<0.0001	Increasing
		Total dissolved solids	<0.0001	Increasing
	CCR Rule Appendix IV Parameters	Arsenic	0.0987	No trend detected
		Cadmium	0.0306	Increasing
		Cobalt	<0.0001	Increasing
CUF-93-2R	CCR Rule Appendix III Parameters	Boron	0.0003	Increasing
		Chloride	<0.0001	Decreasing
		pH (field)	0.2535	No trend detected
		Sulfate	0.0001	Increasing
		Total dissolved solids	<0.0001	Decreasing
CUF-93-3	CCR Rule Appendix III Parameters	Boron	0.0775	No trend detected
		pH (field)	0.8146	No trend detected
		Total dissolved solids	0.0005	Increasing
	CCR Rule Appendix IV Parameters	Lithium	0.3313	No trend detected

Table H.1-13 - Linear Regression Results
Cumberland Fossil Plant

CUF-1003	CCR Rule Appendix III Parameters	Boron	0.0154	Decreasing
		Chloride	0.0312	Decreasing
		pH (field)	0.4966	No trend detected
		Sulfate	0.018	Decreasing
		Total dissolved solids	0.014	Decreasing
	CCR Rule Appendix IV Parameters	Molybdenum	0.0034	Decreasing
CUF-1006	CCR Rule Appendix III Parameters	Boron	0.0591	No trend detected
		Chloride	0.3115	No trend detected
		Sulfate	0.032	Decreasing
		total dissolved solids	0.4587	No trend detected
	CCR Rule Appendix IV Parameters	Cobalt	0.0172	Increasing
		Molybdenum	0.0865	No trend detected
CUF-212	CCR Rule Appendix III Parameters	Boron	0.001	Decreasing
		Chloride	<0.0001	Decreasing
		pH (field)	<0.0001	Decreasing
		Sulfate	0.0654	No trend detected
		Total dissolved solids	0.0001	Decreasing
	CCR Rule Appendix IV Parameters	Cobalt	<0.0001	Increasing
CUF-205	CCR Rule Appendix III Parameters	Sulfate	0.002	Increasing
		Total dissolved solids	0.3975	No trend detected
CUF-206	CCR Rule Appendix III Parameters	Boron	<0.0001	Decreasing
		Chloride	<0.0001	Decreasing
		pH (field)	0.1607	No trend detected
		Sulfate	<0.0001	Decreasing
		Total dissolved solids	<0.0001	Decreasing
	CCR Rule Appendix IV Parameters	Arsenic	0.0001	Increasing
		Cobalt	0.0213	Increasing
CUF-207	CCR Rule Appendix III Parameters	Boron	0.0004	Decreasing
		Chloride	0.0006	Decreasing
		pH (field)	0.2246	No trend detected
		Sulfate	0.0001	Decreasing
		Total dissolved solids	<0.0001	Decreasing
CUF-208	CCR Rule Appendix III Parameters	Boron	<0.0001	Decreasing
		Chloride	<0.0001	Decreasing
		pH (field)	0.4703	No trend detected
		Sulfate	<0.0001	Decreasing
		Total dissolved solids	<0.0001	Decreasing
	CCR Rule Appendix IV Parameters	Cobalt	0.6779	No trend detected
		Molybdenum	0.002	Increasing

Notes
CCR Rule - Title 40, Code of Federal Regulations, Part 257
1. Trend evaluated using linear regression. Regression considered significant when $p<0.05$.

EXHIBITS

Exhibit No.

H.1-1

Title

Well and Piezometer Network

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location — 175568209

Stewart County, Tennessee

Prepared by MB on 2022-10-13
Technical Review by MD on 2022-10-13

0 400 800 1,200 1,600 Feet

1:4,800 (At original document size of 22x34)

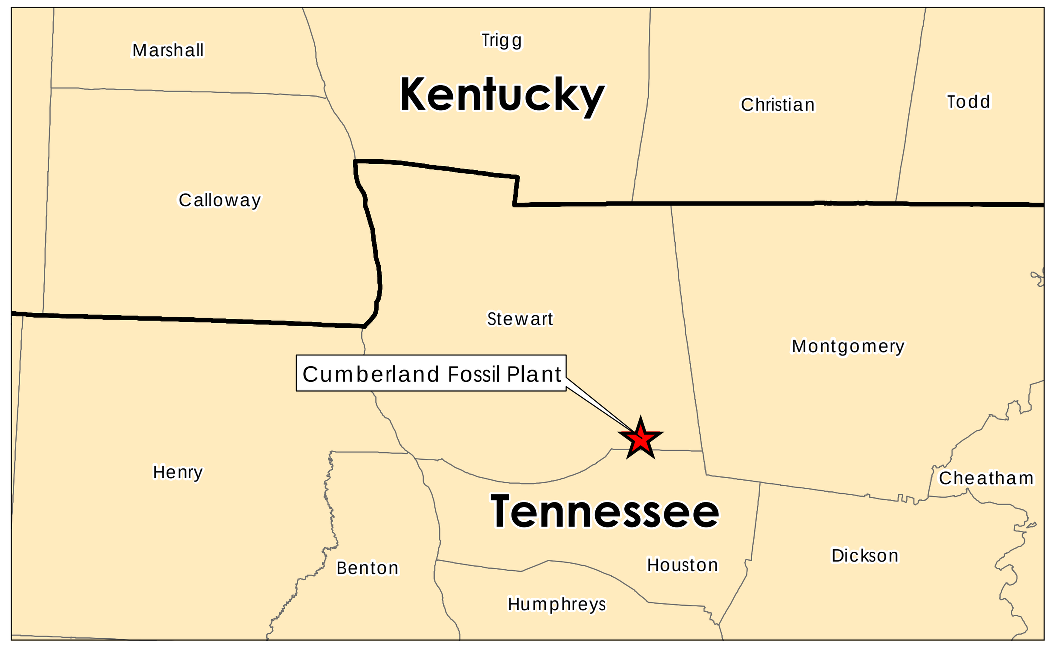
Legend

- CCR Program Well
- CCR/State Program Well
- EIP Program Well
- State Program Well
- Other Program Well
- Piezometer
- Temporary Well
- Cumberland River Gauging Station
- Reported Spring
- 2021 Imagery Boundary
- 2022 Imagery Boundary
- CCR Unit Area (Approximate)

CCR: Coal combustion residuals

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (5/21/2021 and 5/12/2022)



Stantec

TVA

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Exhibit No.

H.1-2

Title

Groundwater Elevation Contour Map, Event #2 (July 8, 2019)

Client/Project

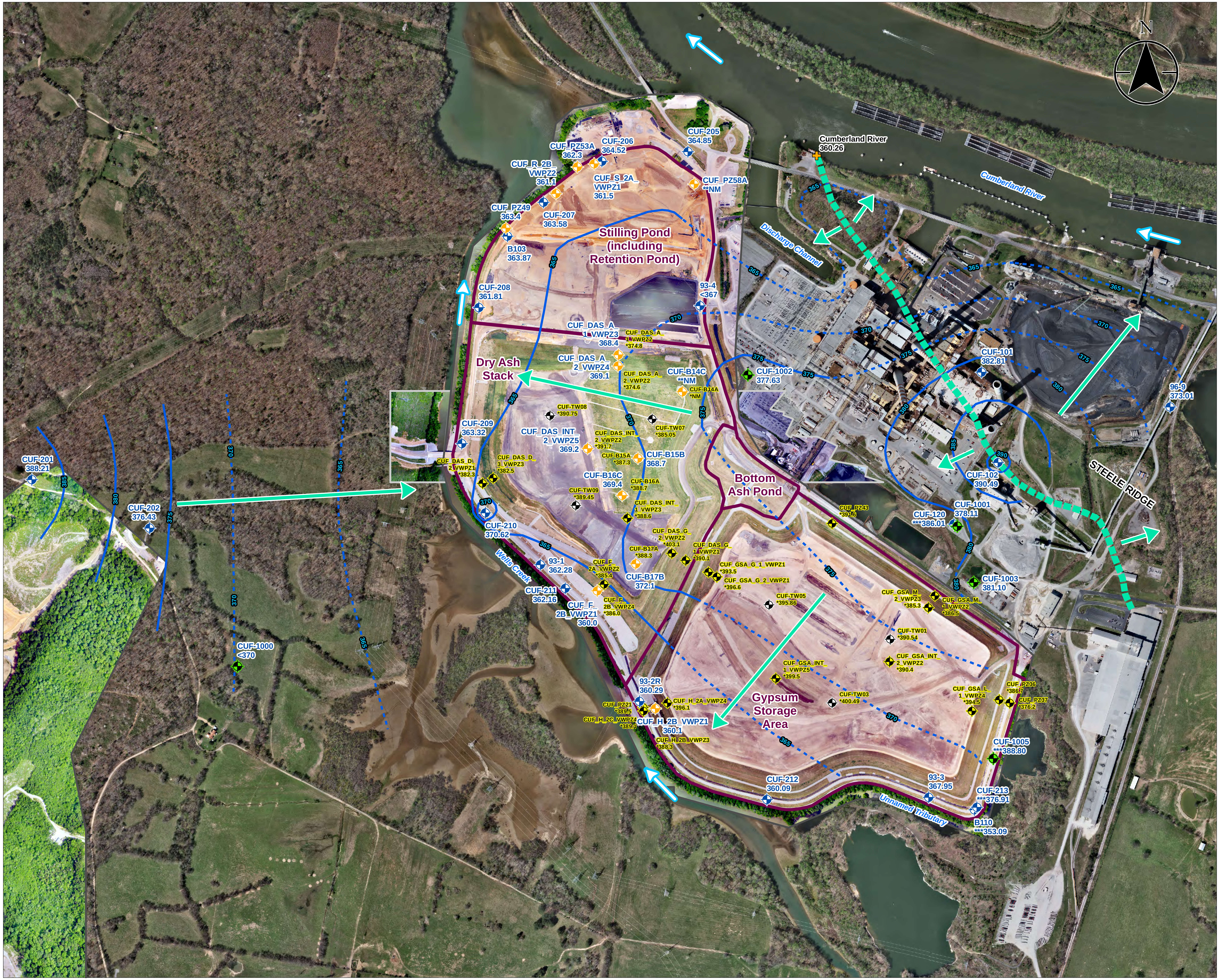
Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location: Stewart County, Tennessee

175568209
Prepared by MB on 2023-05-23
Technical Review by MD on 2023-05-23

0 400 800 1,200 1,600 Feet

1:4,800 (At original document size of 22x34)



Legend

- Groundwater Investigation Monitoring Well — groundwater elevation in feet above mean sea level (ft amsl)
- Other Monitoring Well — groundwater elevation in ft amsl
- Piezometer — groundwater elevation in ft amsl
- Piezometer in CCR — pore water elevation in ft amsl; value not used for contouring
- Temporary well in CCR — pore water elevation in ft amsl; value not used for contouring
- Cumberland River Gauging Station — surface water elevation in ft amsl
- Inferred Groundwater Flow
- Interpolated Groundwater Contour (5 ft interval; elevations are in ft amsl)
- Groundwater Contour (5 ft interval; elevations are in ft amsl)
- Groundwater Divide
- Surface Stream Flow
- 2021 Imagery Boundary
- 2022 Imagery Boundary
- CCR Unit Area (Approximate)

CCR: Coal combustion residuals

The groundwater elevations and flow are focused on data from wells that monitor the uppermost aquifer, but also rely on data collected from wells or piezometers installed in the CCR management units or other hydrogeological units to support the evaluations.

< Groundwater elevations are rounded to nearest foot to constrain potential elevation when depth to groundwater could not be measured.

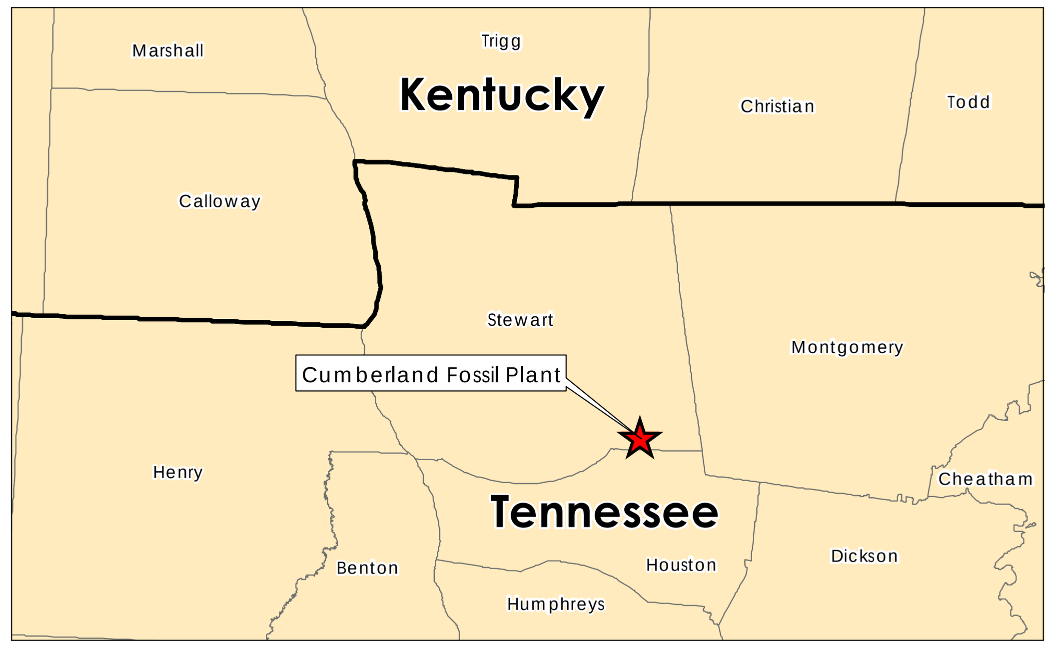
*Location monitoring pore water and is not used to develop groundwater contours.

**Piezometers were not collecting groundwater measurements during this monitoring event.

***Groundwater elevation displayed but not used as input for contouring due to factors such as well construction or being screened in a different hydrogeologic unit.

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (5/21/2021 and 5/12/2022)
3. Groundwater contours were created using Surfer Version 16.1.350 (December 13, 2018) and manual adjustment
4. For PZ's with multiple instruments in CCR material, the reading with the highest pore water elevation is displayed, unless that reading is suspected of being erroneous.
5. Groundwater contours for the Gypsum Storage Area are inferred from perimeter monitoring wells.



Stantec

TVA

Exhibit No.

H.1-3

Title

Geologic Map

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

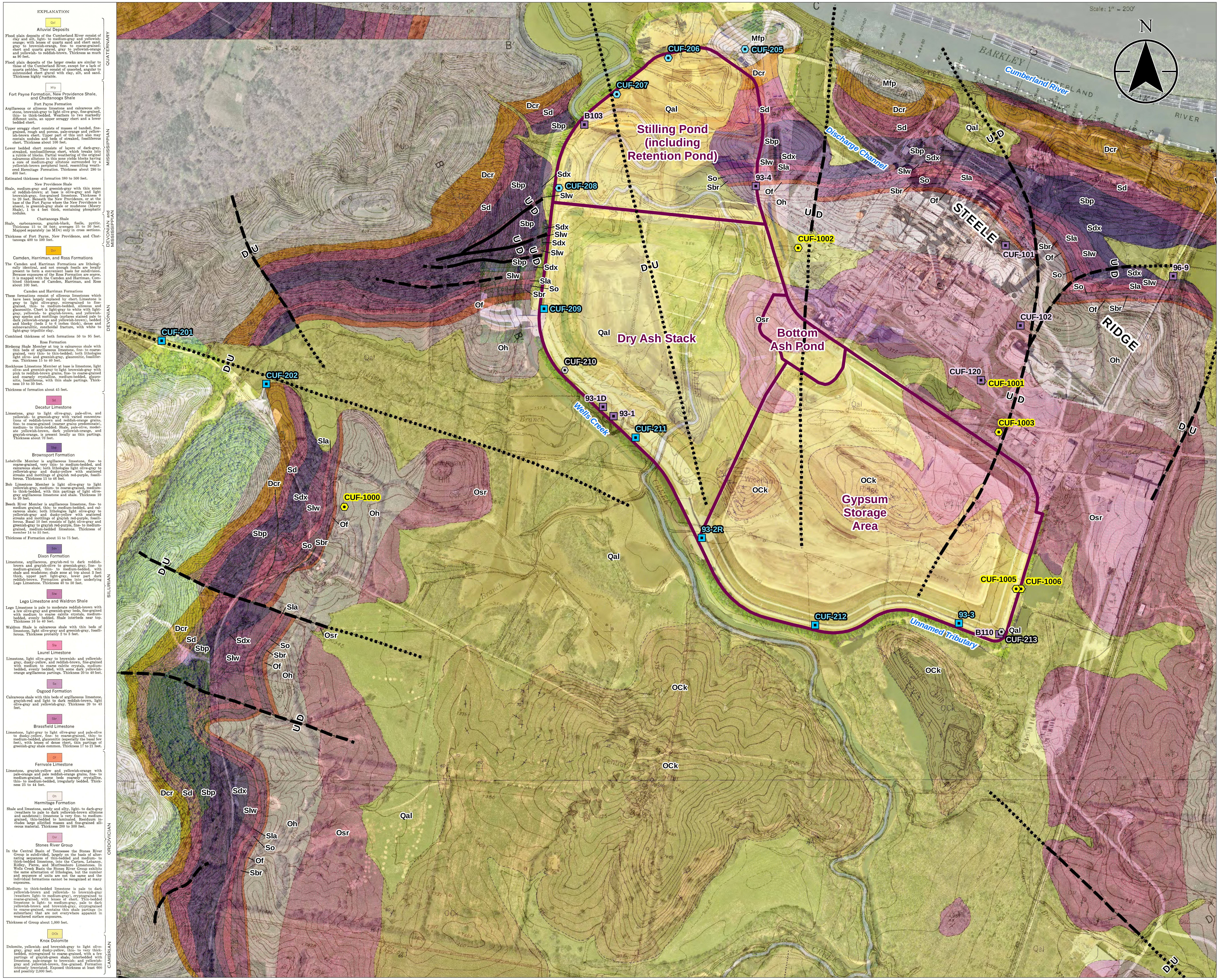
Project Location

Stewart County, Tennessee

175568209
Prepared by MB on 2023-05-23
Technical Review by VS on 2023-05-23

0 450 900 1,350 1,800 Feet

1:5,400 (At original document size of 22x34)



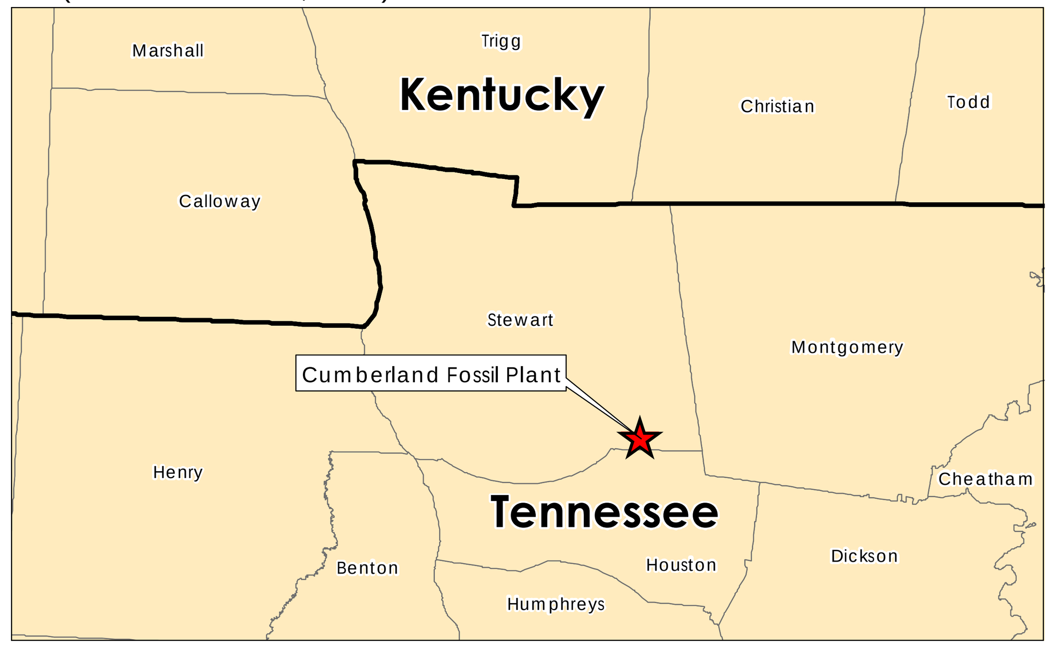
Legend

- CCR Program Well
- CCR/State Program Well
- EIP Program Well
- State Program Well
- Other Program Well
- CCR Unit Area (Approximate)
- Fault
- Fault, dashed where approximate
- Fault, dotted where concealed

U upthrown side, D downthrown side

Notes

1. Coordinate System: NAD 1927 StatePlane Tennessee FIPS 4100
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (5/21/2021 and 5/12/2022)
3. Geologic map corresponds to *The Geologic Map of Wells Creek Basin* (Tiedemann et al, 1968).



Stantec TVA

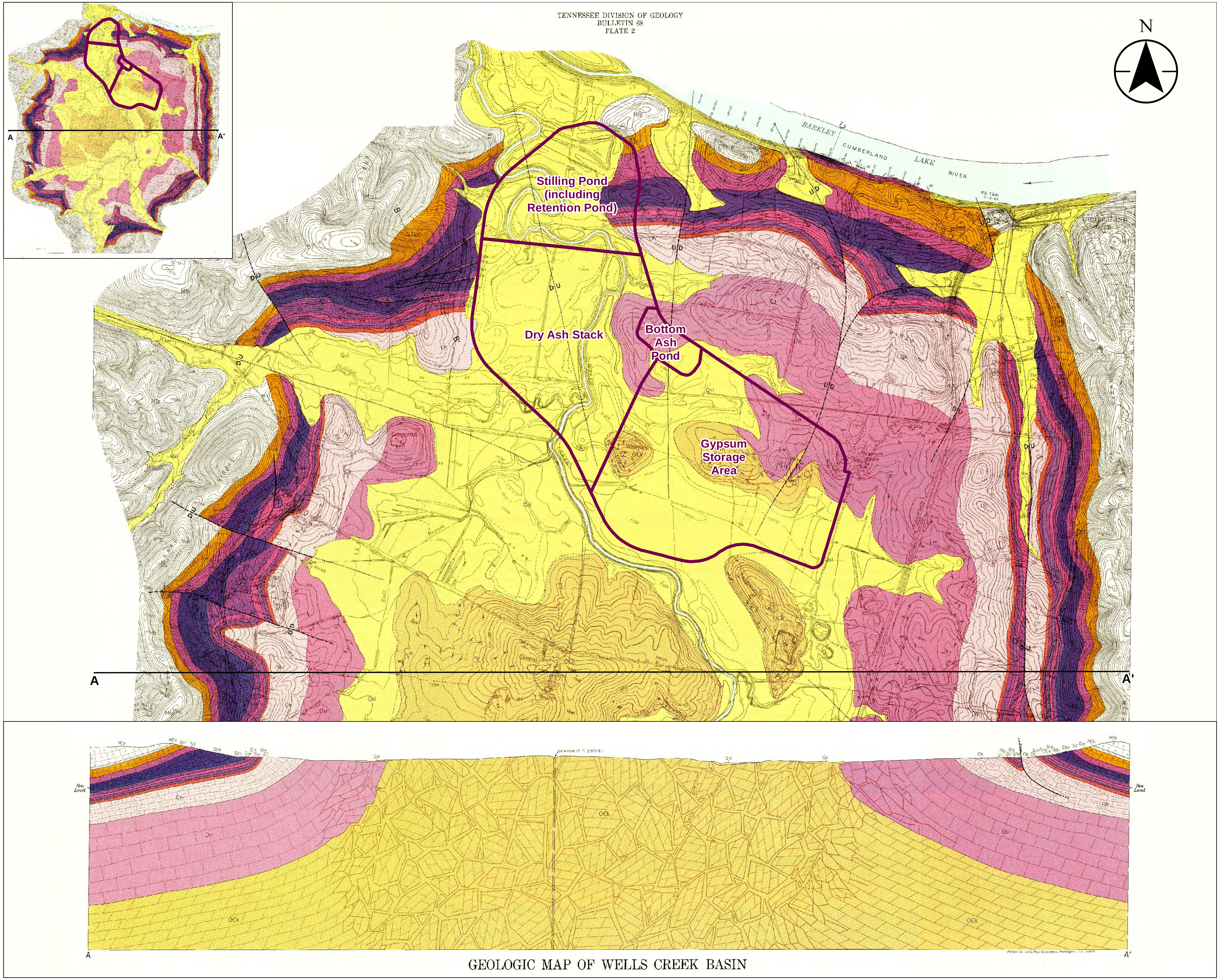


Exhibit No.

H.1-4

Title

Geologic Map
Cross Section A-A'

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location

Stewart County, Tennessee

175568209
Prepared by MB on 2022-12-12
Technical Review by VS on 2022-12-12

0 600 1,200 1,800 2,400 Feet

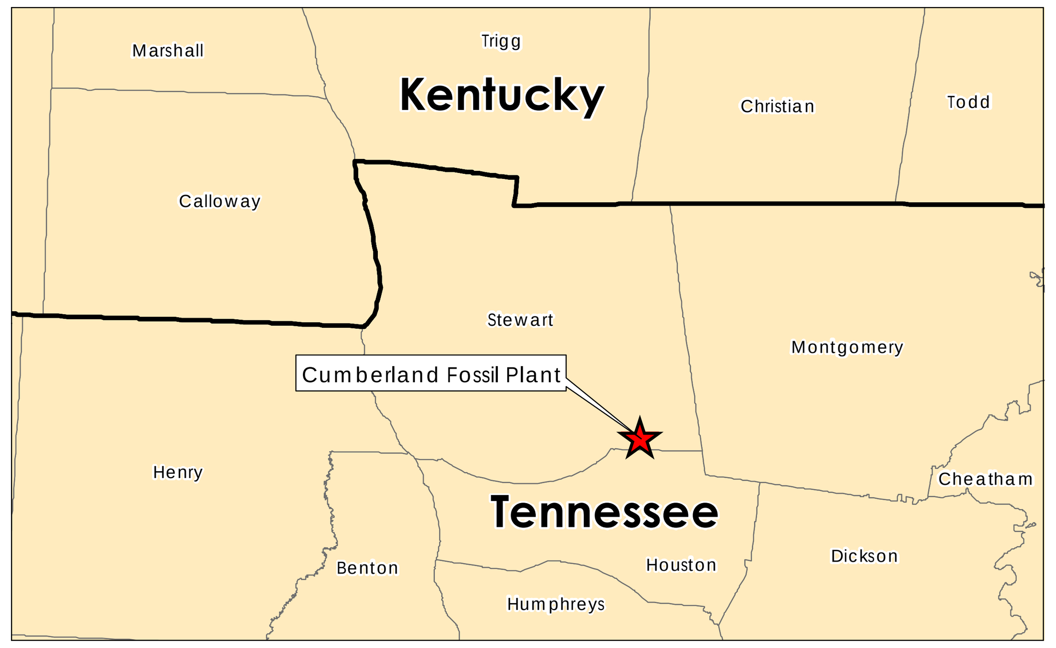
1:7,200 (At original document size of 22x34)

Legend

- Bulletin 68 Cross Section A-A'
- CCR Unit Area (Approximate)
- Qal — Alluvial Deposits
- Mfp — Fort Payne Formation, New Providence Shale, and Chattanooga Shale
- Dcr — Camden, Harriman, and Ross Formations
- Sd — Decatur Limestone
- Sbp — Brownsport Formation
- Sdx — Dixon Formation
- Slw — Lego Limestone and Waldron Shale
- Sla — Laurel Limestone
- So — Osgood Formation
- Sbr — Brassfield Limestone
- Of — Fernvale Limestone
- Oh — Hermitage Formation
- Osr — Stones River Group
- OCk — Knox Dolomite
- Contact, dahsed where approximate
- Fault, dashed where approximate, dotted where concealed; U upthrown side, D downthrown side
- Fault, arrow indicates relative movement (shown in cross section only)
- Strike and dip of beds
  - 45 Normal
  - 60 Overturned
  - Vertical
  - Horizontal

Notes

1. Coordinate System: NAD 1927 StatePlane Tennessee FIPS 4100
2. Geologic map corresponds to *The Geologic Map of Wells Creek Basin* (Tiedemann et al, 1968).



Stantec TVA

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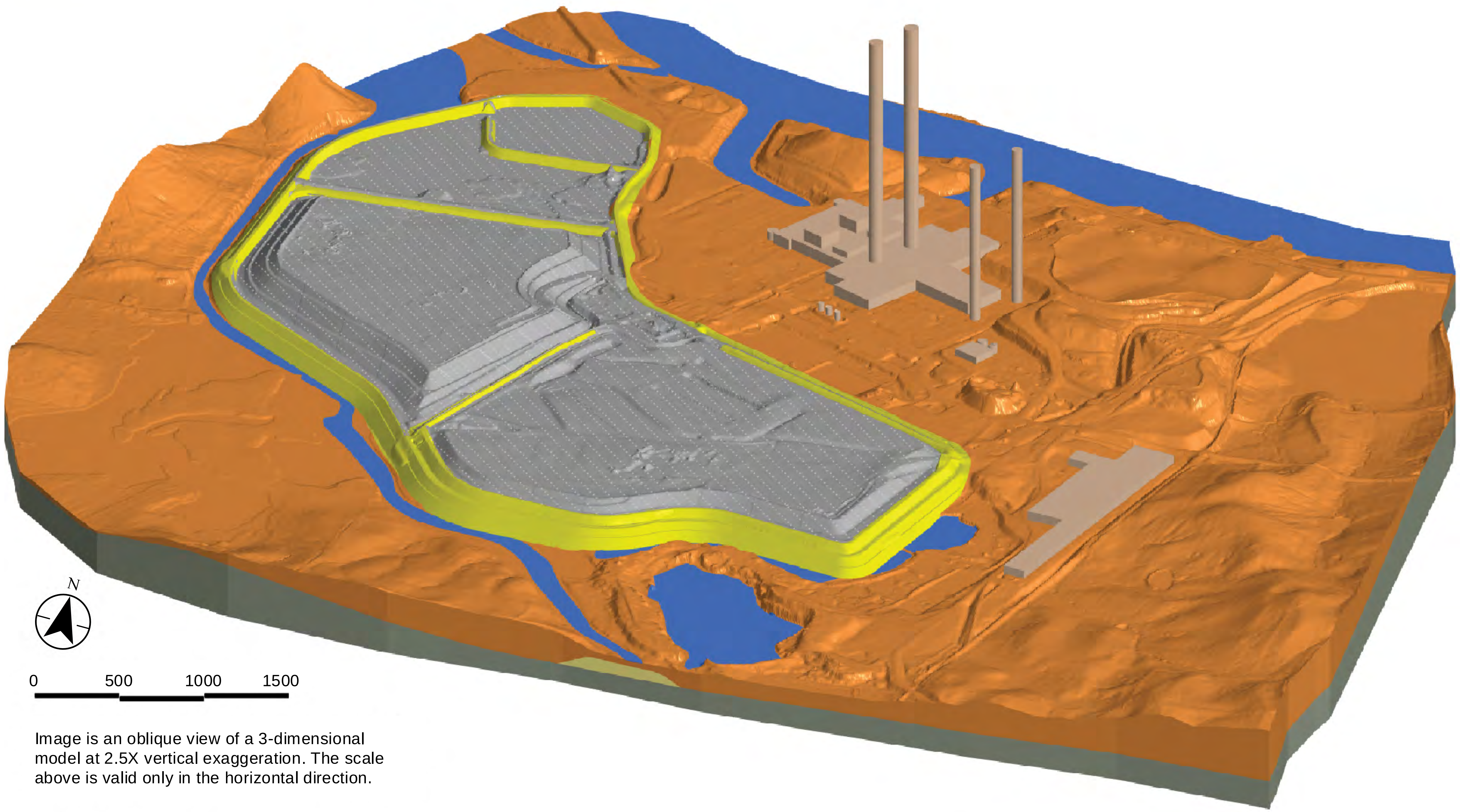

Image is an oblique view of a 3-dimensional model at 2.5X vertical exaggeration. The scale above is valid only in the horizontal direction.

DRAFT

Exhibit No.
H.1-5

TVA Restricted Information – Deliberative and Pre-Decisional Privileged

Title
Lithologic Model (Oblique View Looking North)

Client/Project 175568209
Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Clinton, Tennessee
Stewart County, Tennessee

Prepared by DMB on 2021-10-14
TR by JG on 2021-10-14
IR Review by TR on 2021-10-14

Legend

- Building Structure
- CCR Material
- Clay Dike
- Unconsolidated Materials (Primarily Silt and Clay)
- Unconsolidated Materials (Primarily Sand and Gravel)
- Waterbody
- Bedrock

CCR: Coal combustion residuals

Stantec

TVA

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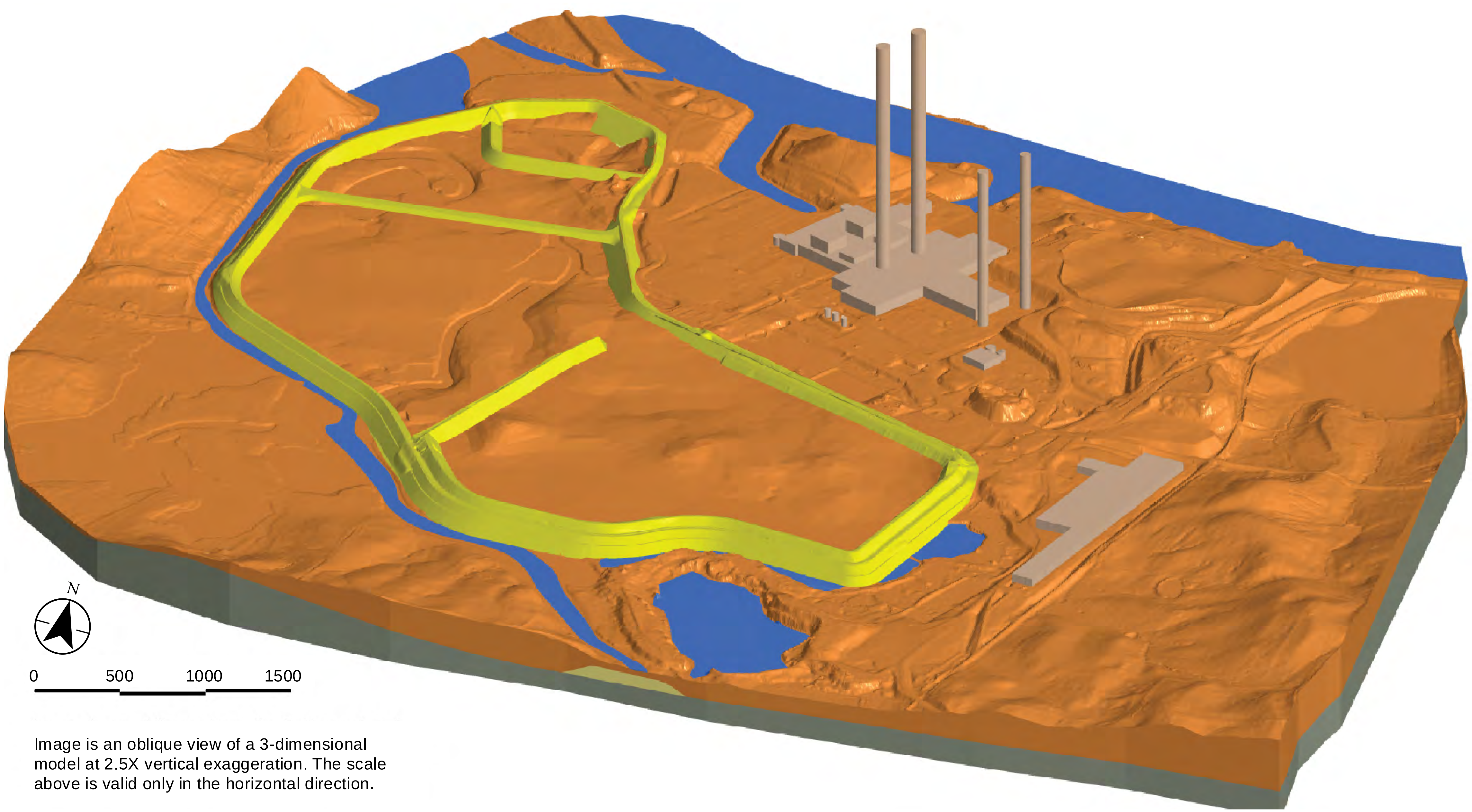

Image is an oblique view of a 3-dimensional model at 2.5X vertical exaggeration. The scale above is valid only in the horizontal direction.

Exhibit No.

H.1-6

Title

Lithologic Model - Top of Alluvial Deposits, Primarily Silt and Clay Layer (Oblique View Looking North)

Client/Project 175568209

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Clinton, Tennessee

Stewart County, Tennessee

Prepared by DMB on 2021-10-14
TR by JG on 2021-10-14
IR Review by TR on 2021-10-14

Legend

- Building Structure
- Clay Dike
- Unconsolidated Materials (Primarily Silt and Clay)
- Unconsolidated Materials (Primarily Sand and Gravel)
- Waterbody
- Bedrock

Stantec

TVA

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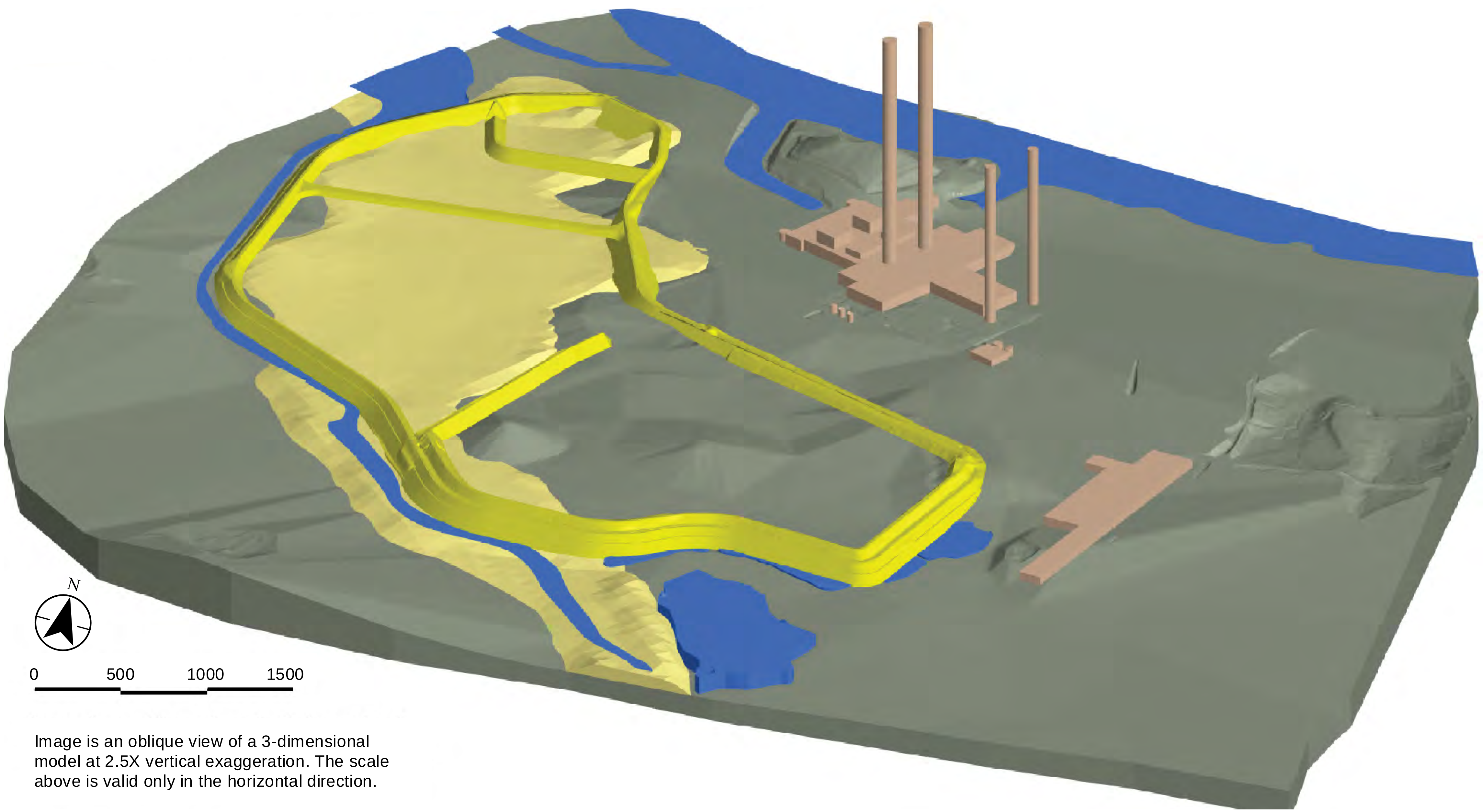

Image is an oblique view of a 3-dimensional model at 2.5X vertical exaggeration. The scale above is valid only in the horizontal direction.

Exhibit No.

H.1-7

Title

Lithologic Model - Top of Alluvial Deposits, Primarily Sand and Gravel Layer (Oblique View Looking North)

Client/Project 175568209

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Clinton, Tennessee

Stewart County, Tennessee

Prepared by DMB on 2021-10-14
TR by JG on 2021-10-14
IR Review by TR on 2021-10-14

Legend

- Building Structure
- Clay Dike
- Unconsolidated Materials (Primarily Sand and Gravel)
- Waterbody
- Bedrock

Stantec

TVA

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Exhibit No.

H.1-8

Title

Lithologic Model - Top of Bedrock (Oblique View Looking North)

Client/Project 175568209

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Clinton, Tennessee

Stewart County, Tennessee

Prepared by DMB on 2021-10-14
TR by JG on 2021-10-14
IR Review by TR on 2021-10-14

Legend

- Building Structure
- Clay Dike
- Waterbody
- Bedrock

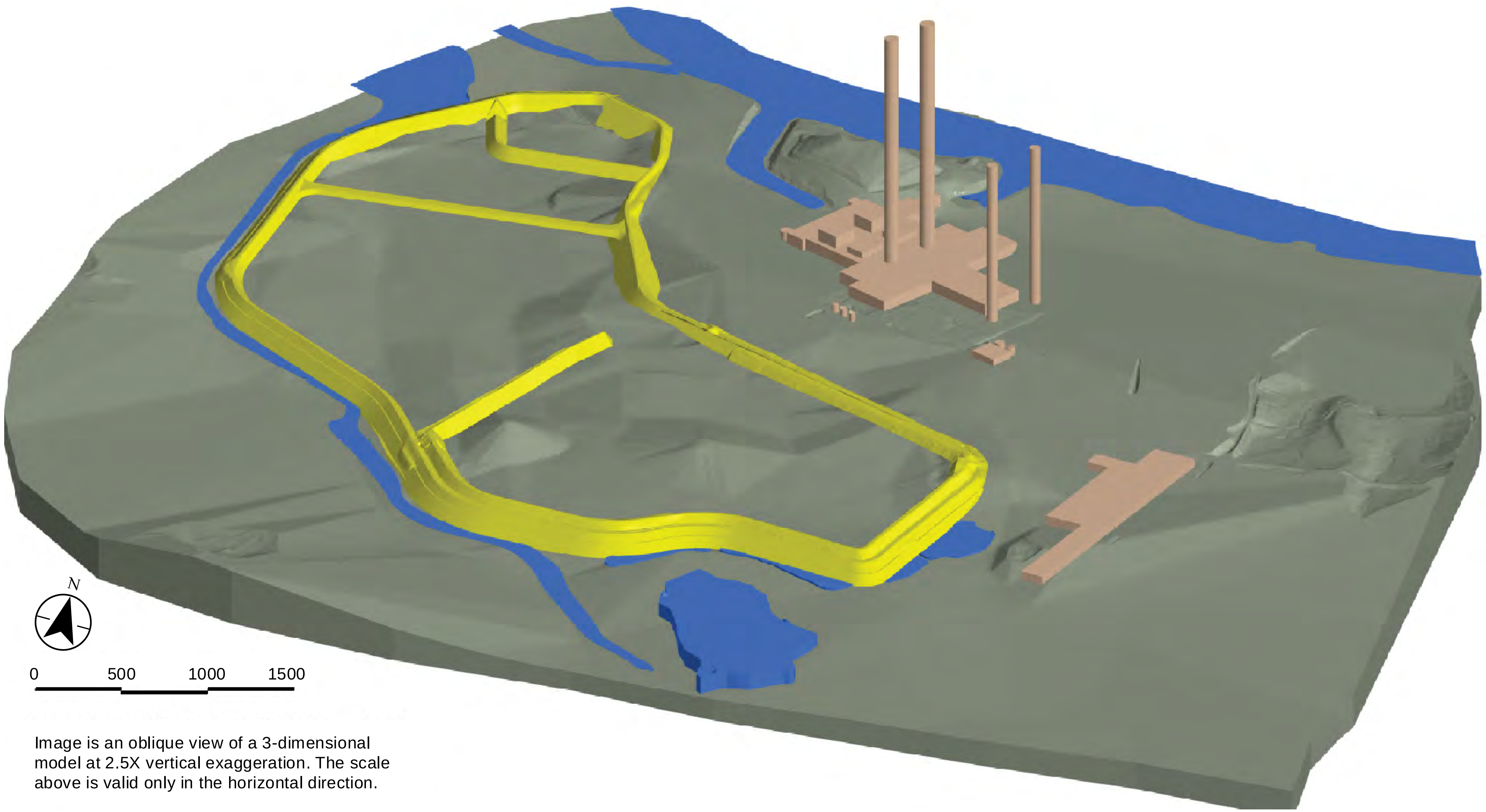

Image is an oblique view of a 3-dimensional model at 2.5X vertical exaggeration. The scale above is valid only in the horizontal direction.

Stantec

TVA

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Exhibit No.

H.1-9

Title

Thickness of Silt and Clay Above Uppermost Aquifer

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location

Stewart County, Tennessee

Prepared by LB on 2022-12-13
Reviewed by MD/JG on 2022-12-xx

N

0 500 1,000 Feet

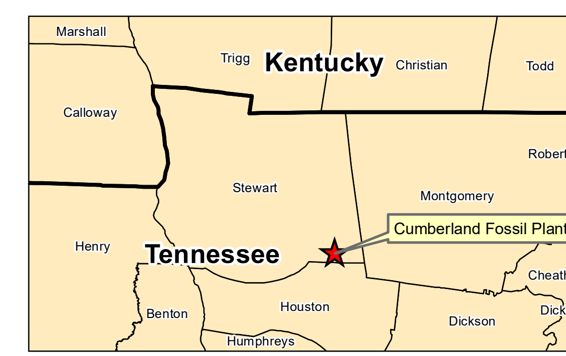
(At original document size of 11x17)
1:8,400

Legend

- Boring Location with Logged Clay
- Boring Location with Logged Clay Thickness of 0 Feet
- CCR Managment Units (approximate)

Approximate Thickness Range (feet)

- <10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- >50



Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. The isopach map was developed using the Leapfrog lithologic model and is based on the differential elevation of two surfaces: pre-construction ground surface and the top of the uppermost aquifer (either coarse alluvium or top of bedrock where coarse alluvium is absent). The boring locations with logged clay thickness are posted as confirmatory data points.
3. *Clay thickness not incorporated in isopach map.

Stantec

TVA

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Exhibit No.

H.1-10

Title

Lithologic Model - Physiographic Setting (Oblique View Looking Northeast)

Client/Project 175568209

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Clinton, Tennessee
Stewart County, Tennessee

Prepared by DMB on 2021-10-14
TR by JG on 2021-10-14
IR Review by TR on 2021-10-14

Stantec

TVA

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Exhibit No.
H.1-11

Title
CUF Instrumentation - Used for Surface Water/Pore Water/Groundwater Hydrograph Comparison

Client/Project
Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location
Stewart County, Tennessee

175568209
Prepared by MB on 2023-01-23
Technical Review by MD on 2023-01-23

0 400 800 1,200 1,600 Feet

1:4,800 (At original document size of 22x34)

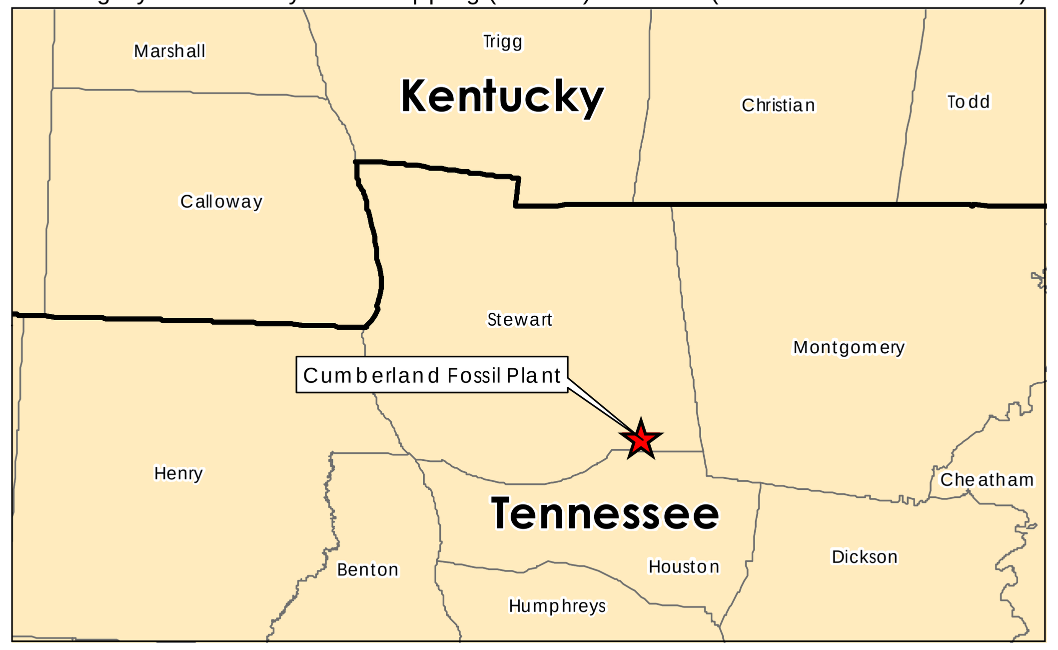
Legend

- Monitoring Well
- Piezometer
- Cumberland River Gauging Station
- 2021 Imagery Boundary
- 2022 Imagery Boundary
- CCR Unit Area (Approximate)

CCR: Coal combustion residuals

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (5/21/2021 and 5/12/2022)



Stantec TVA

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Figure No.

H.1-12

Title

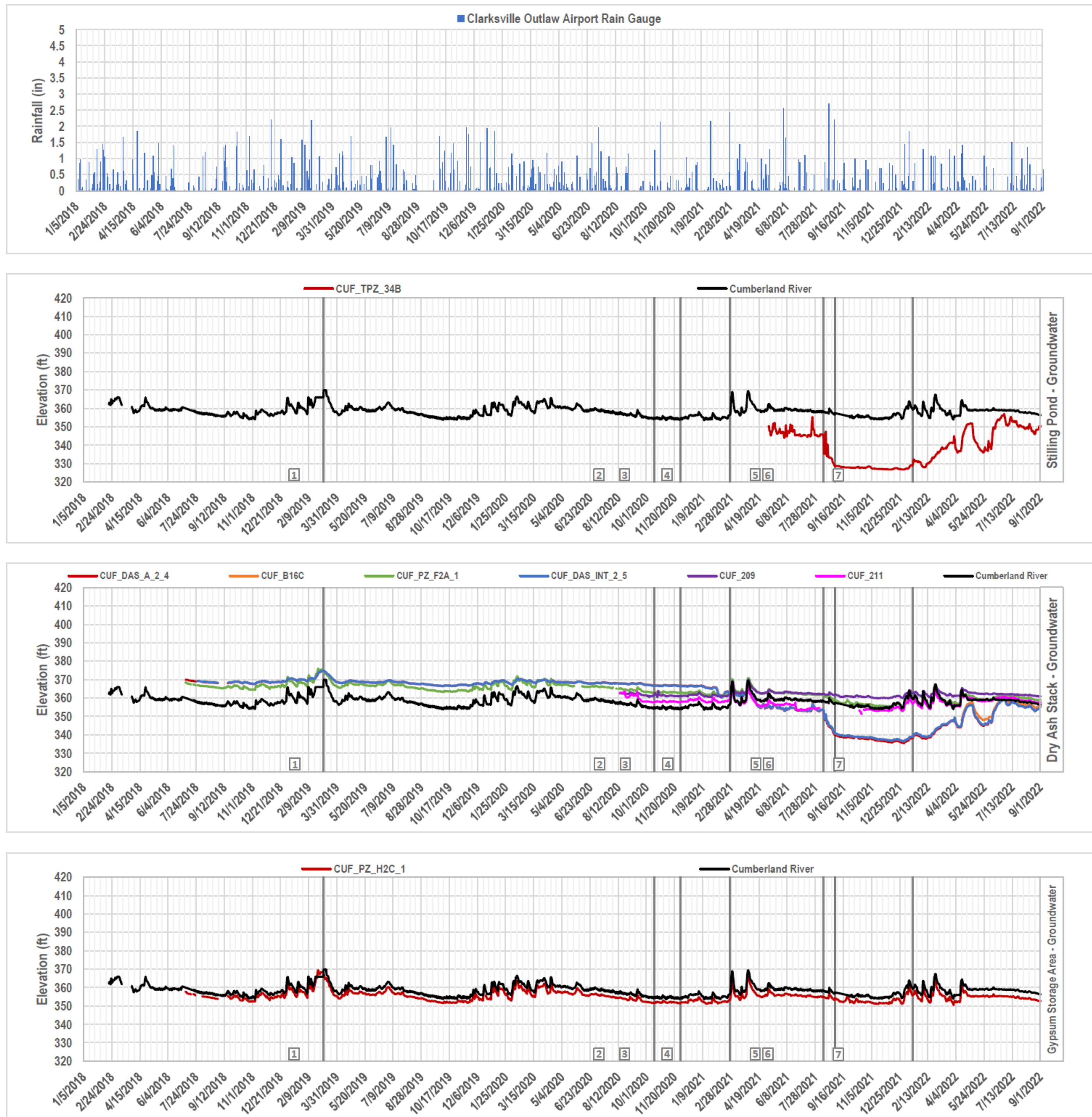
Surface Water/Groundwater Hydrograph Comparison

Client/Project 175568209

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Clinton, Tennessee
Stewart County, Tennessee

Prepared by KB on 2022-12-13
TR by MD on 2022-12-13



Timeline:
1 - MAP Wellpoints Operational 2 - DASPAR Buttress Complete 3 - MAP Drawdown Start 4 - MAP Drawdown End
5 - Deep Wells - High Pumping 6 - Deep Wells - Medium Pumping 7 - Deep Wells - Intermittent Pumping

Stantec

TVA

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Figure No.

H.1-13

Title

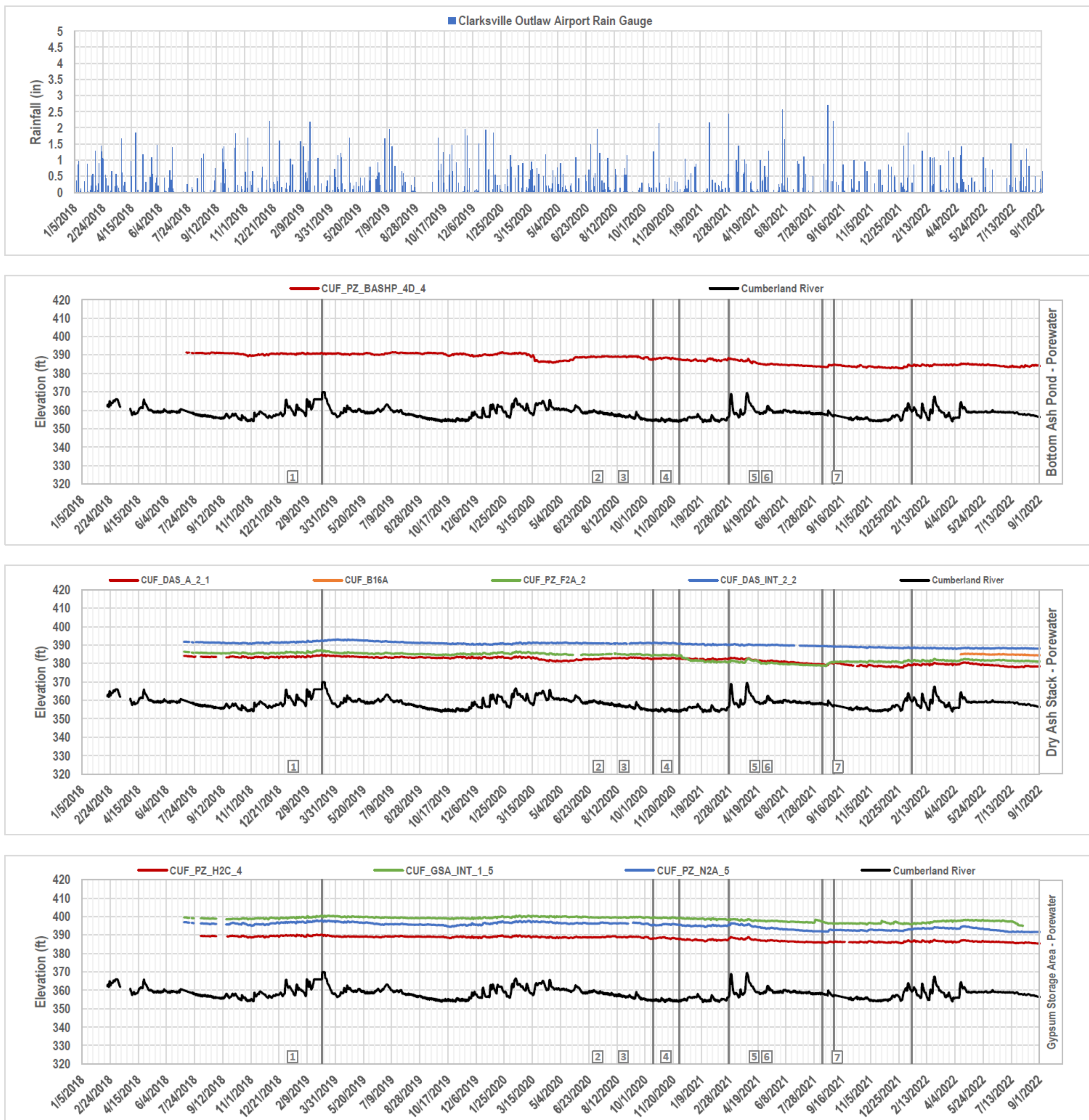
Surface Water/Pore Water Hydrograph Comparison

Client/Project 175568209

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

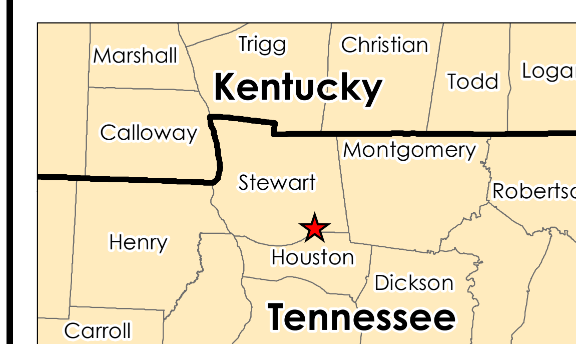
Clinton, Tennessee
Stewart County, Tennessee

Prepared by KB on 2022-12-13
TR by MD on 2022-12-13



Timeline:

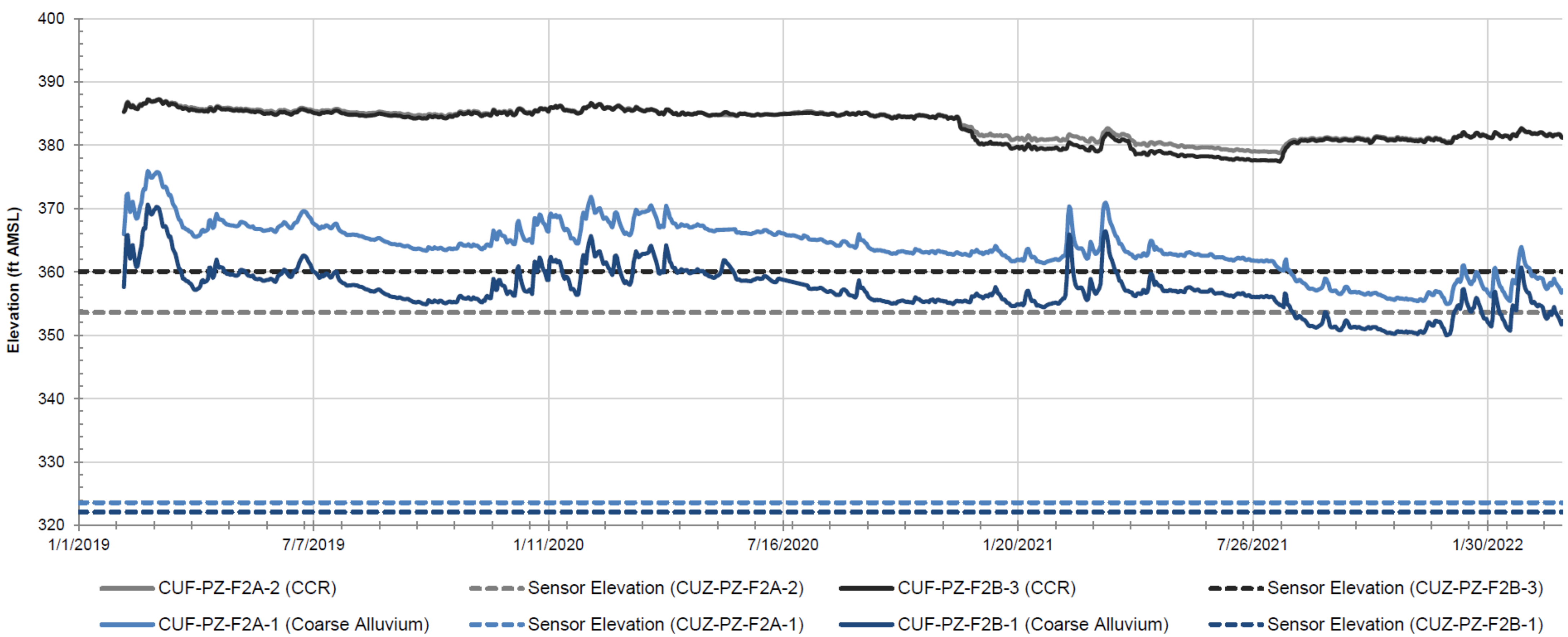
1 - MAP Wellpoints Operational 2 - DASPAR Buttress Complete 3 - MAP Drawdown Start 4 - MAP Drawdown End
5 - Deep Wells - High Pumping 6 - Deep Wells - Medium Pumping 7 - Deep Wells - Intermittent Pumping



Stantec

TVA

\\us0243-ppfss01\workgroup\1756\active\175668209\technical_production\collateral_material\exhibits_cuf_ear



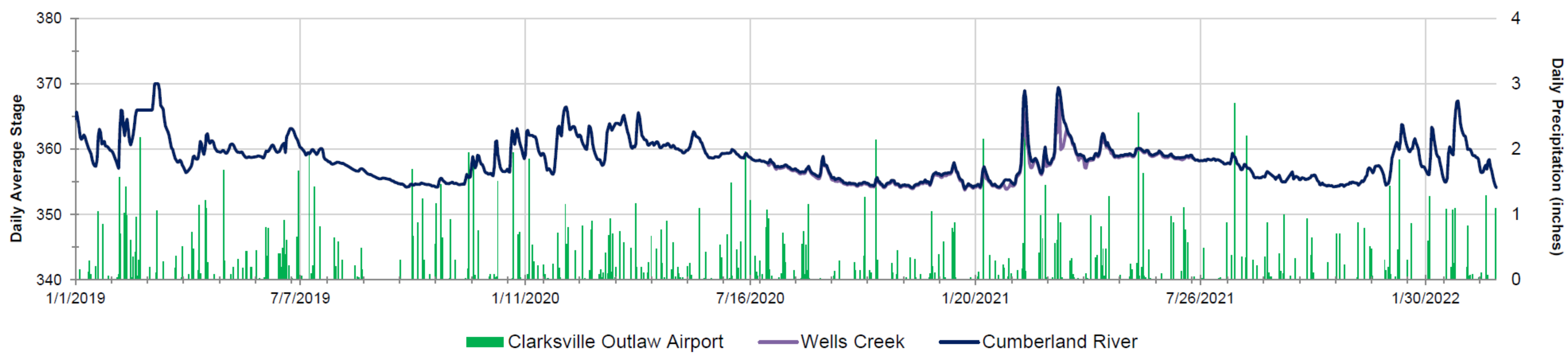


Figure No.

H.1-14

Title

Surface Water/Pore Water/Groundwater Hydrograph Comparison (CUF_PZ_F2A and CUF_PZ_F2B)

Client/Project 175568209

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Clinton, Tennessee
Stewart County, Tennessee

Prepared by KB on 2022-12-13
TR by MD on 2022-12-13

Stantec

TVA

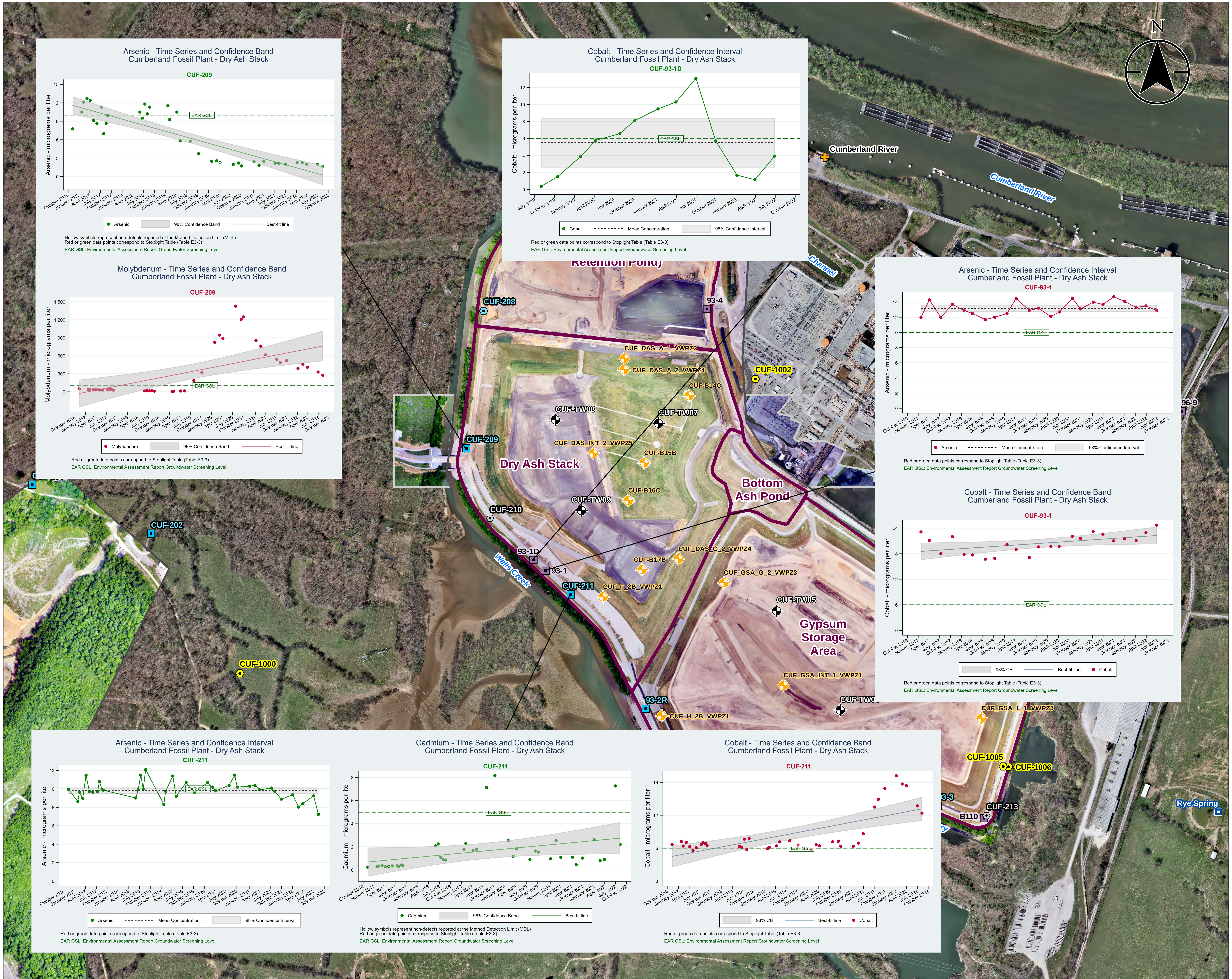


Exhibit No.

H.1-15

Title

Summary of Statistical Evaluation of Groundwater Analytical Results for CCR Rule Appendix IV and TDEC Appendix I Constituents - Dry Ash Stack

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location

175568209

Stewart County, Tennessee

Prepared by MB on 2022-12-15
Technical Review by MD on 2022-12-15

0 400 800 1,200 1,600 Feet

1:4,800 (At original document size of 22x34)

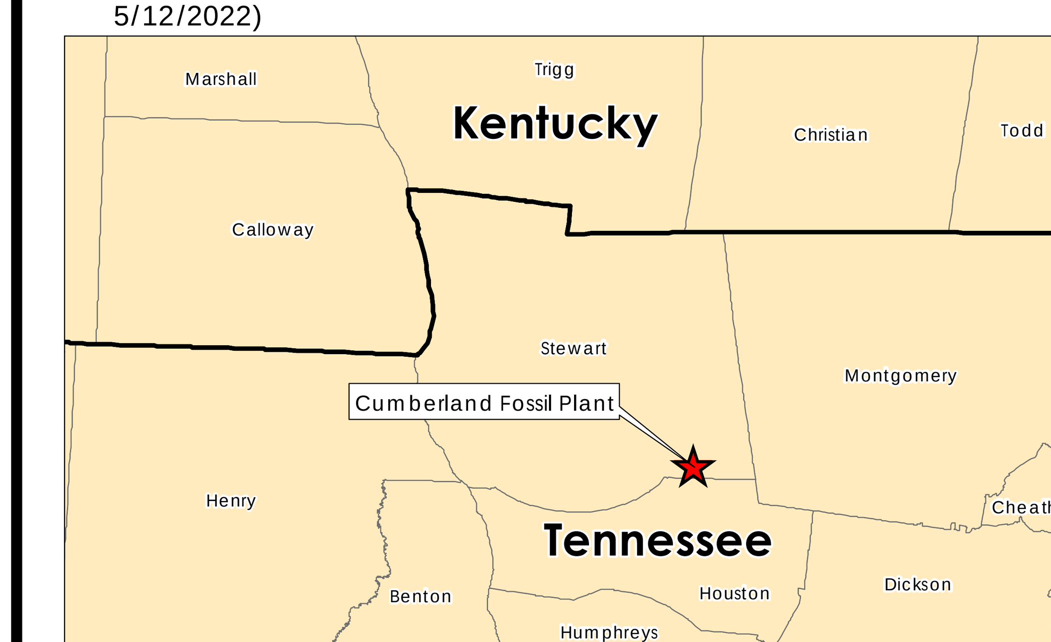
Legend

- CCR Program Well
- CCR/State Program Well
- EIP Program Well
- State Program Well
- Other Program Well
- Piezometer
- Temporary Well
- Cumberland River Gauging Station
- Reported Spring
- 2021 Imagery Boundary
- 2022 Imagery Boundary
- CCR Unit Area (Approximate)

CCR: Coal combustion residuals

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (5/21/2021 and 5/12/2022)



Stantec TVA

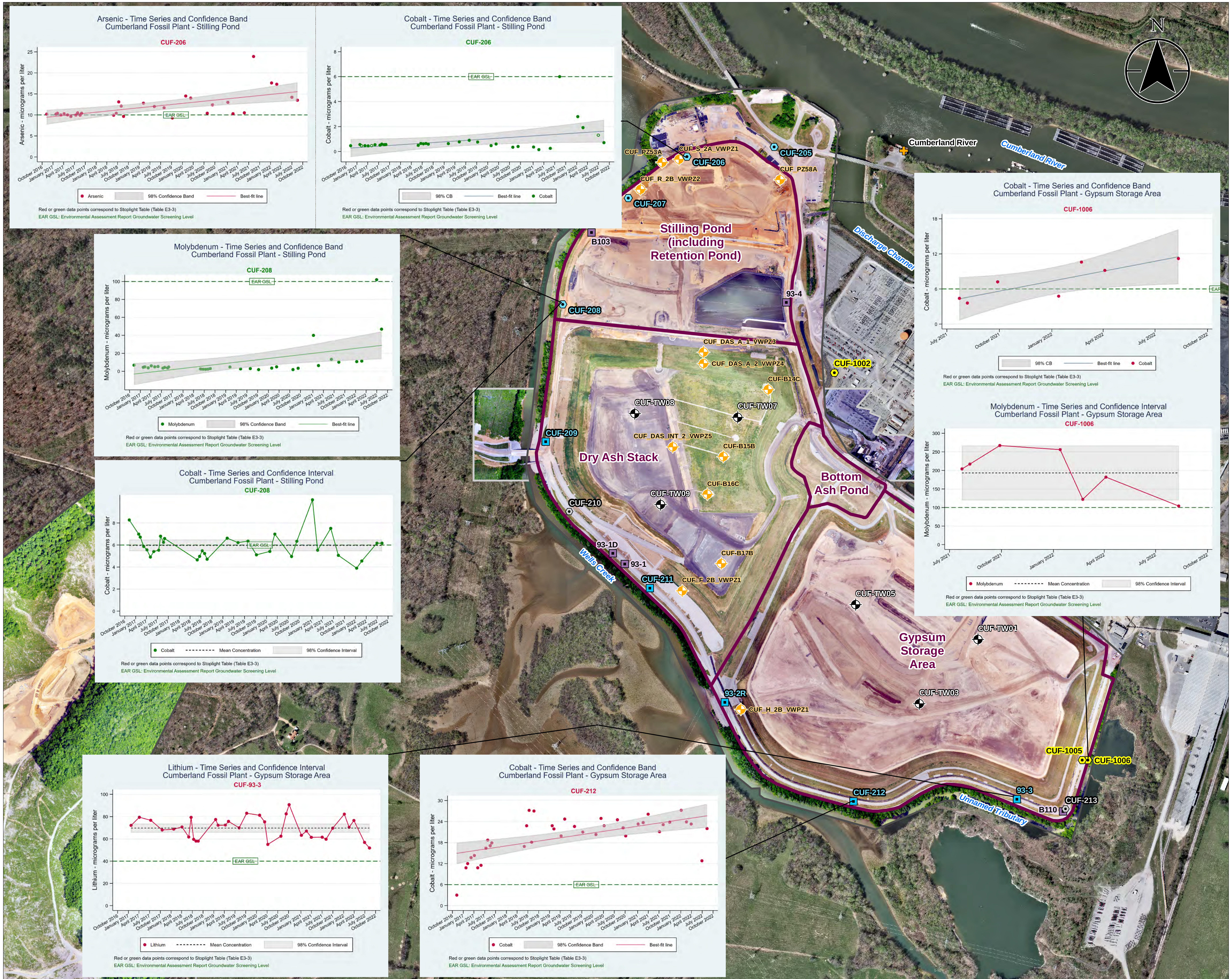


Exhibit No.

H.1-16

Title

Summary of Statistical Evaluation of Groundwater Analytical Results for CCR Rule Appendix IV and TDEC Appendix I Constituents - Stilling Pond (Including Retention Pond) and Gypsum Storage Area

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location: Stewart County, Tennessee — 175568209

Prepared by MB on 2022-12-22
Technical Review by MD on 2022-12-22

0 400 800 1,200 1,600 Feet

1:4,800 (At original document size of 22x34)

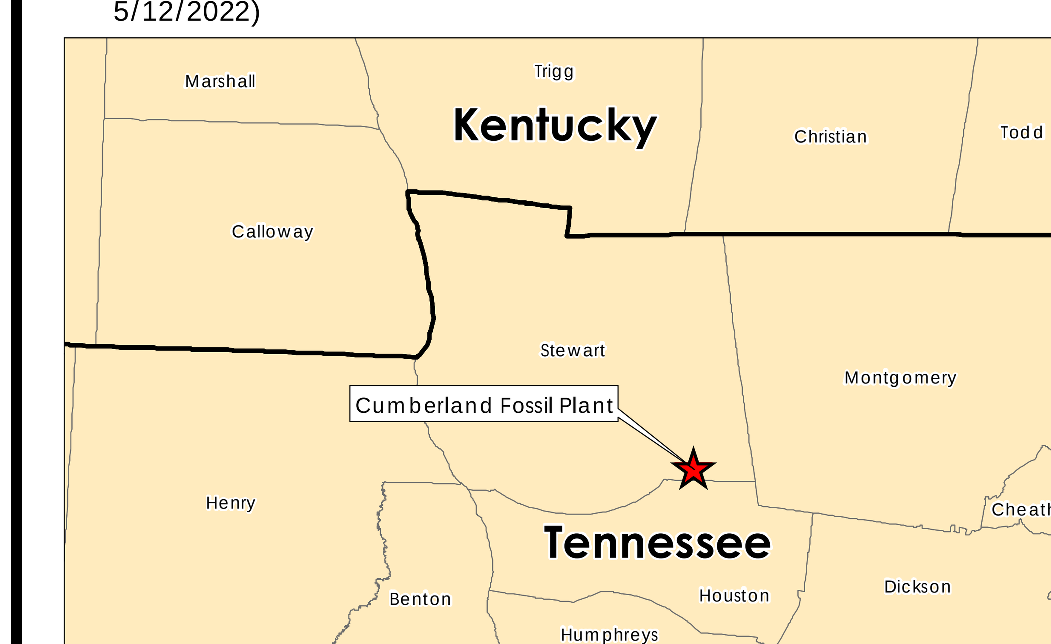
Legend

- CCR Program Well
- CCR/State Program Well
- EIP Program Well
- State Program Well
- Other Program Well
- Piezometer
- Temporary Well
- Cumberland River Gauging Station
- 2021 Imagery Boundary
- 2022 Imagery Boundary
- CCR Unit Area (Approximate)

CCR: Coal combustion residuals

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (5/21/2021 and 5/12/2022)



Stantec TVA

Exhibit No.
H.1-17

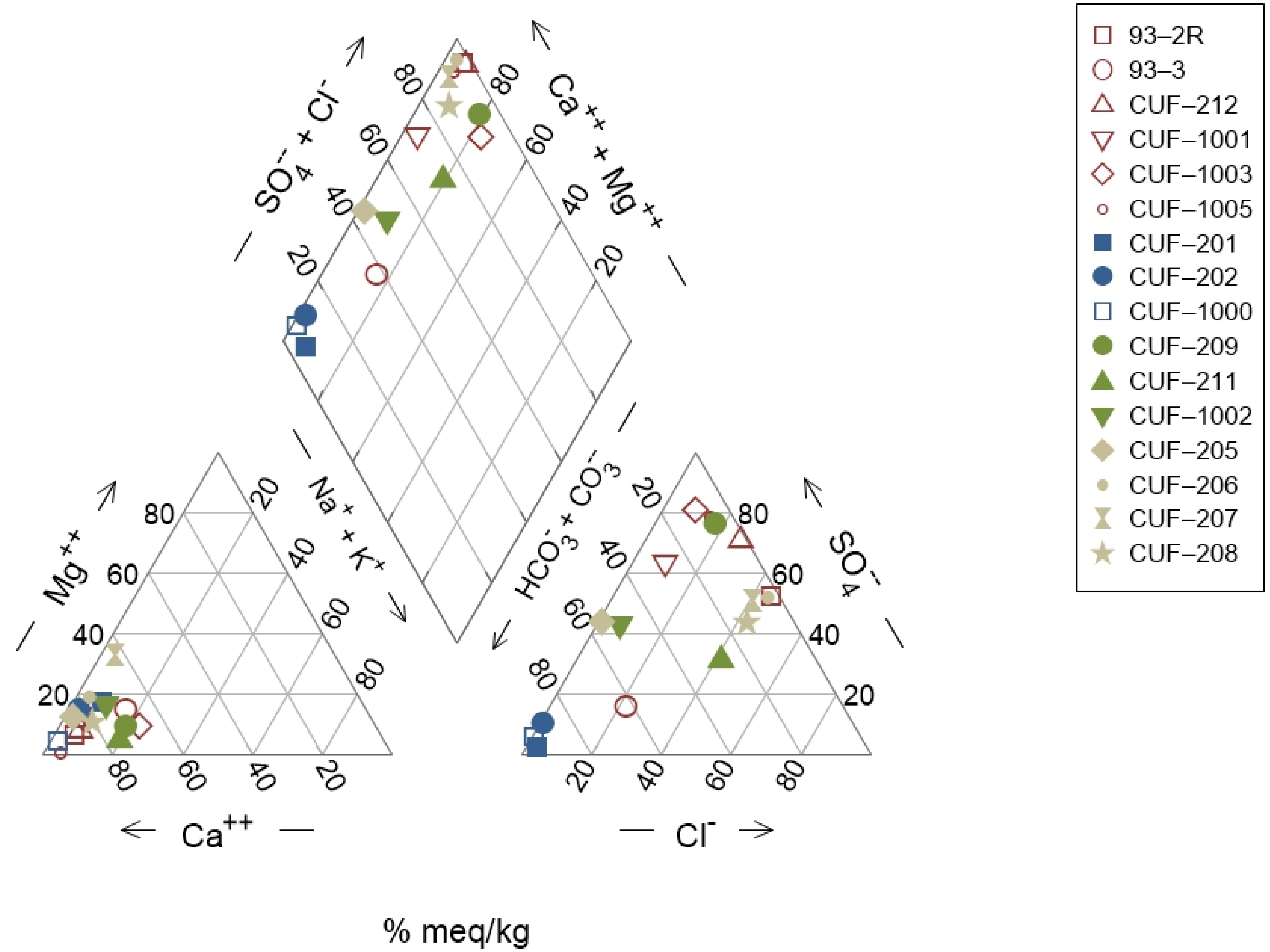
Title
Piper Diagram - March 2020

Client/Project 175568209
Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Clinton, Tennessee
Stewart County, Tennessee

Prepared by AB on 2021-08-12
ITR by RB on TBD
IQR by TBD on TBD

CUF March 2020



Legend

Notes

1. % meq/kg - Percent milliequivalent per kilogram
2. Ca^{++} - Calcium
3. Cl^- - Chloride
4. CO_3^{--} - Carbonate
5. HCO_3^- - Bicarbonate
6. K^+ - Potassium
7. Mg^{++} - Magnesium
8. Na^+ - Sodium
9. SO_4^{--} - Sulfate

Stantec

TVA

U:\TVA-EIP\175568209_CUF_Phase2\gis\mxd\EAR\CUF_EAR_A.14_StillingPondMineralogy11X17.mxd Revised: 2021-08-12 By: lblackman

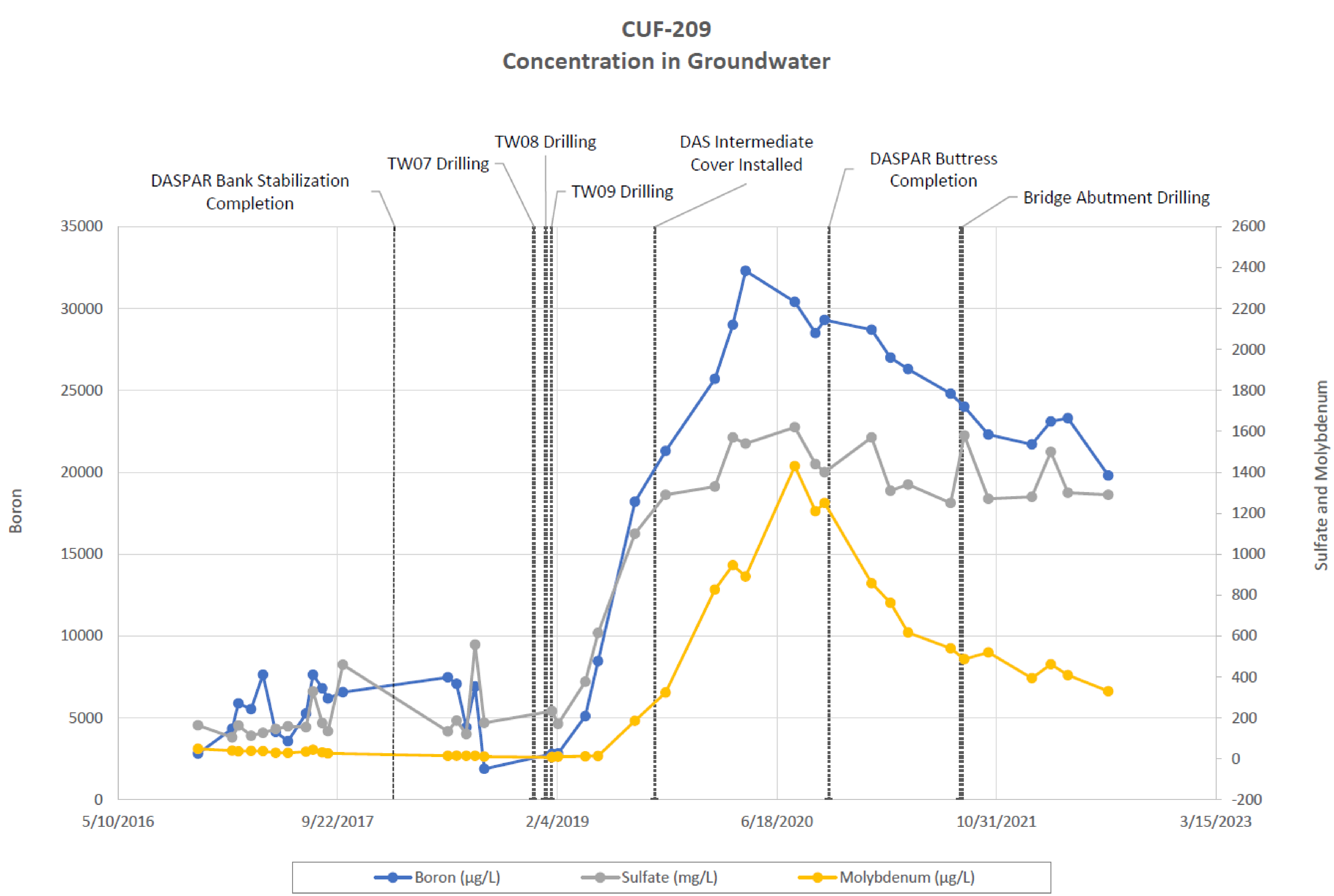


Figure No.
H.1-18

Title
CUF-209 Concentration in Groundwater

Client/Project 175568209
Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Clinton, Tennessee
Stewart County, Tennessee

Prepared by DMB on 2023-07-06
TR by LP on 2023-07-06
IR Review by TR on 2023-07-06

Legend
DAS - Dry Ash Stack
DASPAR - Dry Ash Stack Perimeter Access Road
mg/L – milligram per Liter
ug/L – microgram per Liter

Stantec

TVA

U:\TVA-EIP\175568209_CUF_Phase2\gis\mxd\EAR\H_Graph_Exhibits\CUF_EAR_H.1.18_CUF-209ConcentrationinGW.mxd Revised: 2023-08-01 By: mbough

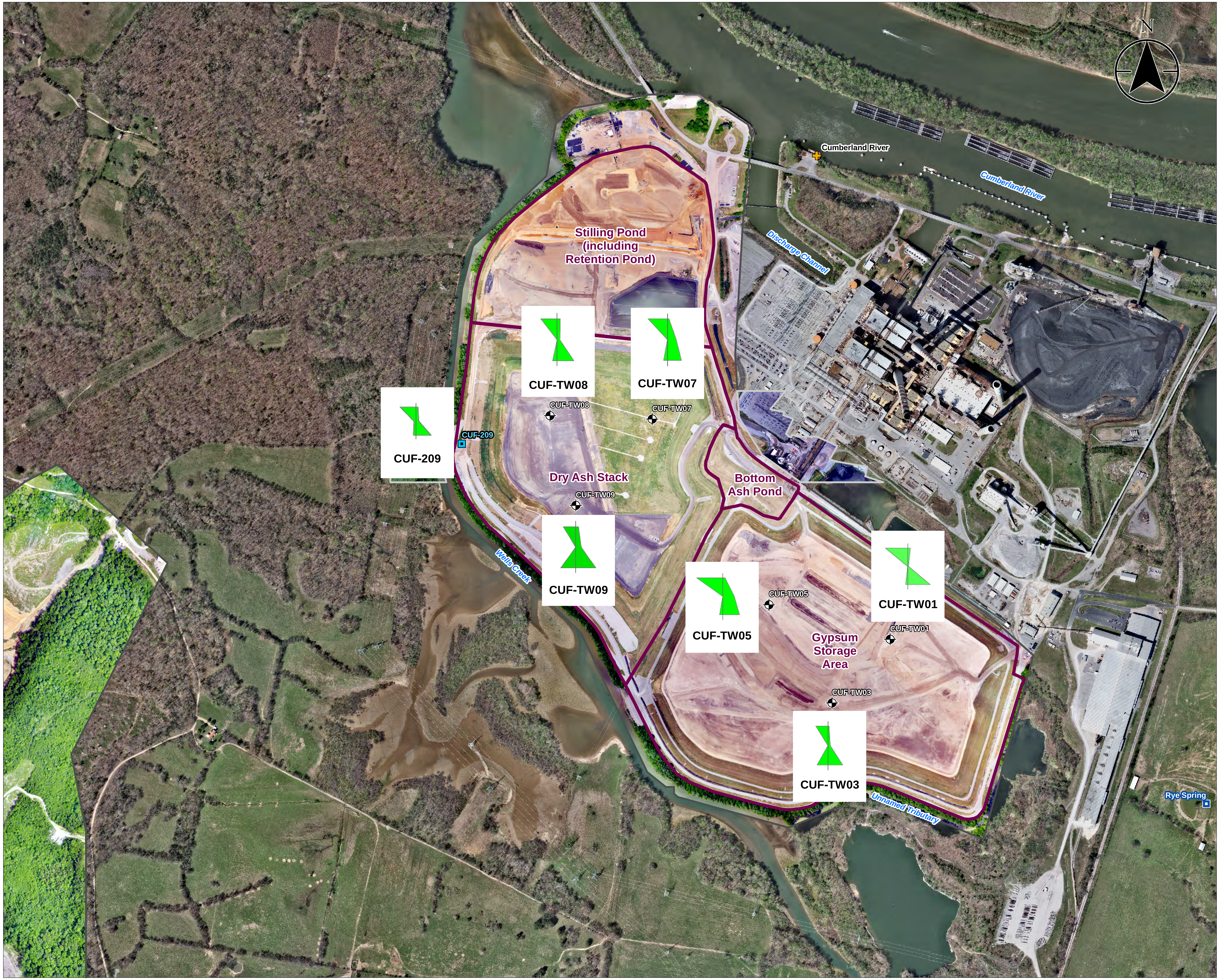


Exhibit No.

H.1-19

Title

Stiff Diagram Comparison of Groundwater at Well CUF-209 with Pore Water

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location

Stewart County, Tennessee

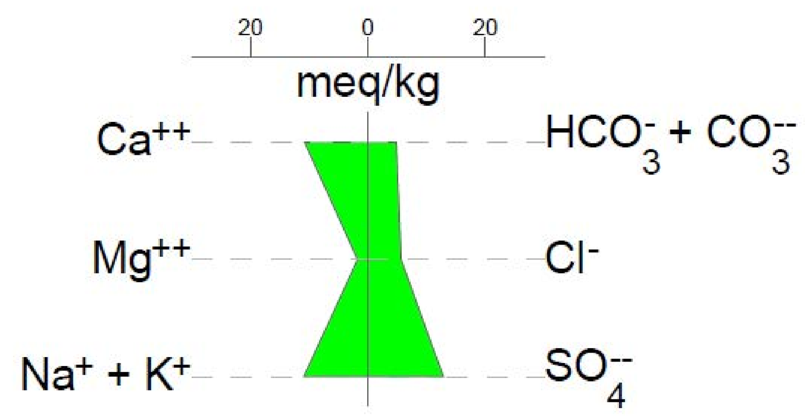
175568209
Prepared by MB on 2023-08-01
Technical Review by MD on 2023-08-01

0 400 800 1,200 1,600 Feet

1:4,800 (At original document size of 22x34)

Legend

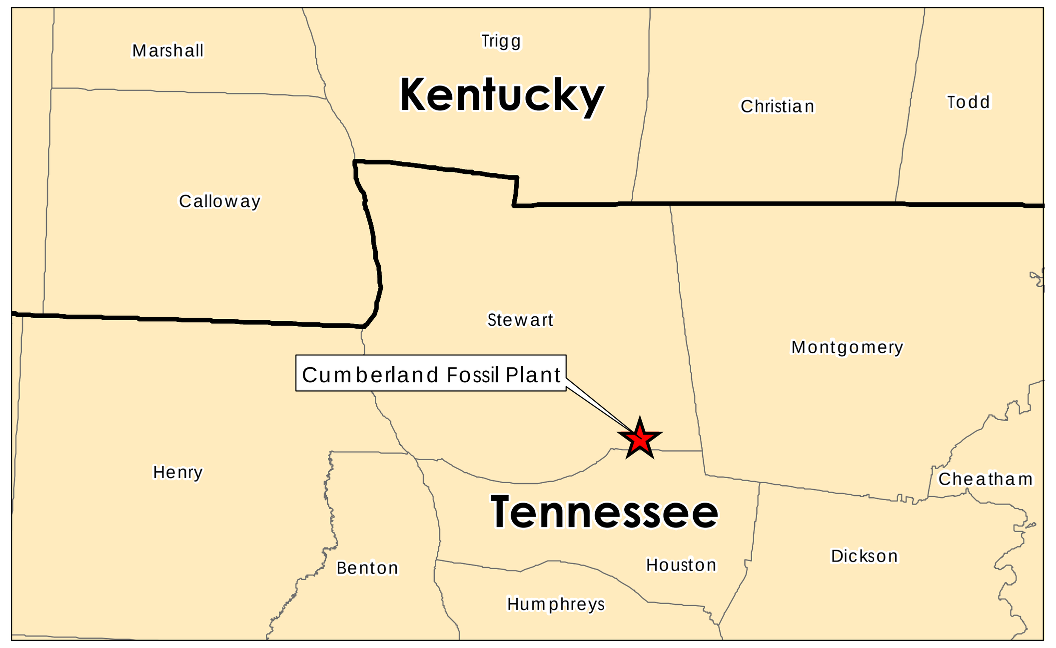
- CCR/State Program Well
- Temporary Well
- Cumberland River Gauging Station
- Reported Spring
- 2021 Imagery Boundary
- 2022 Imagery Boundary
- CCR Unit Area (Approximate)



CCR: Coal combustion residuals
meq/kg: milliequivalents per kilogram
Ca^{++}: Calcium
Cl^{-}: Chloride
CO_3^{--}: Carbonate
HCO_3^{-}: Bicarbonate
K^{+}: Potassium
Mg^{++}: Magnesium
Na^{+}: Sodium
SO_4^{--}: Sulfate

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (5/21/2021 and 5/12/2022)



Stantec TVA

U:\TVA-EIP\175568209_CUF_Phase2\gis\mxd\EAR\H.1-19_CUF_StiffDiagramComparisonCUF-209wPoreWater.mxd Revised: 2023-08-01 By: mbough

Figure No.
H.1-20

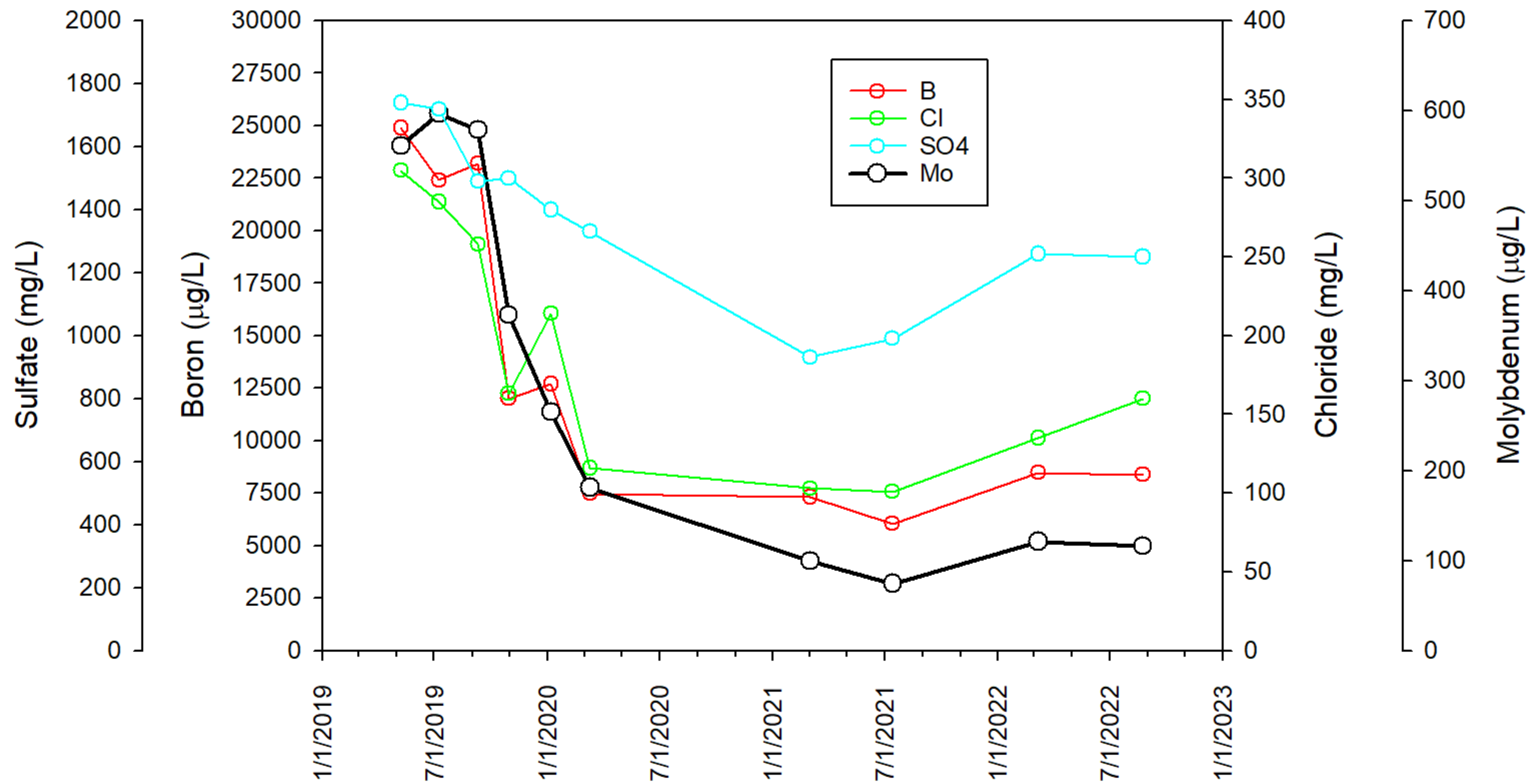
Title
Concentrations of Boron, Chloride, Sulfate, & Molybdenum in Groundwater at CUF-1003

Client/Project 175568209
Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Clinton, Tennessee
Stewart County, Tennessee

Prepared by LMB on 2021-10-14
TR by BL on 2021-10-14
IR Review by TR on 2021-10-14

Legend
ug/L – microgram per Liter
mg/L – milligram per Liter
B – boron
Cl – chloride
SO4 – sulfate
Mo - molybdenum



Stantec

TVA

ATTACHMENT H.1-A
POLARIZED LIGHT MICROSCOPY
ANALYTICAL DATA

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

November 10, 2020

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1059256-0 REV1

Dear Mr. Thomas,

A revised report has been issued to include second revision of chain of custody received.

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received five samples on September 14, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The samples were logged into RJ Lee Group project number AOH1059256-0 and assigned RJLG sample numbers as indicated in Appendix A.

The samples were received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, revised COC's and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A
Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1059256-0
Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Stone McCoy Stantec 601 Grassmere Park Suite 22 Nashville, TN 37211 United States Main: 615-885-1144	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10521699	CUF-93-3-SB01-4.50/7.5-09102020	09/14/2020 8:54 AM EDT
10521700	CUF-93-3-SB01-9.0/10.5-09102020	09/14/2020 8:54 AM EDT
10521701	CUF-93-3-SB01-18.0/19.5-09102020	09/14/2020 8:54 AM EDT
10521702	CUF-93-3-SB01-42.0/49.5-09102020	09/14/2020 8:54 AM EDT
10521703	CUF-93-3-SB01-50.4/51.4-09102020	09/14/2020 8:54 AM EDT
10521704	QC_CUF-93-3-SB01-9.0/10.5-09102020	09/14/2020 8:54 AM EDT

	Received From: Stone McCoy	*Method of Shipment:* *Federal Express*	
	Company: Stantec		**Date:** 09/14/2020
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*	
	Company: RJ Lee Group, Inc.		**Date:** 09/14/2020

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

350 Hochberg Road, Monroeville, PA 15146
Phone: (724) 325-1776 | Fax: (724) 733-1799

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	9/14/2020	Log in Date:	9/14/2020
Time Received:	8:54 AM	By:	Monica Carse	COC# :	GEOCUF0910CC2020_1C
Project:	AOH1059256-0	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	3967 2771 1625				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?	✓		
Were there any discrepancies among samples and COC?		✓	
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

N/A

Analyst Signature: M. Carse 09-14-2020

Manager Signature: [signature] 09/14/2020

A0H1059256-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA

Tennessee Valley Authority

COOLER No.:	1	of	1
COC No:	GEOCUF0910CC2020_1C		
1 of 1 Pages			
Task Desc:	CUF_Geochemical_2020_08		

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

Required Ship to Lab:	
Lab Name:	RJ Lee Group, Inc.
Lab Address:	350 Hochberg Road Monroeville, PA 15146
Lab Manager Contact Information	
Lab PM:	Monica Carse
Phone/Fax:	724-325-1776
Lab Email:	MCarse@rjleegroup.com

Required Project Information:	
Site ID #:	CUMBERLAND FOSSIL PLANT
Project #:	
Site Address	Plant 815 Cumberland City Road
City	Cumberland City; State, Zip: TN, 37050
Site PM Name:	Paul Thomas
Phone/Fax:	(423) 751-2926
Site PM Email:	pithomas0@tva.gov

Required Sampler Information	
Sampler:	C. Burton and S. McCoy
Sampling Company:	Stantec
Address	601 Grassmere Park Suite 22
Nashville, TN	Phone No: 615-885-1144
Sampling Team Number:	1
Send EDD/Hard Copy to:	tva_deliverables@envstd.com

Analysis Turnaround Time

☐ CALENDAR DAYS ☒ WORKING DAYS

TAT if different from Below ________

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☒ 10 Business Days (Standard)

Filtered: N — Preserve: None — Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Depth Unit: Feet — Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-93-3-SB01-4.5/7.5-09102020	CUF-93-3-SB01	4.5	7.5	BS	G	N	9/10/2020	1545	1	NA	X
2	* CUF-93-3-SB01-9.0/10.5-09102020	CUF-93-3-SB01	9.0	10.5	BS	G	N	9/10/2020	1603	1	NA	X
3	CUF-93-3-SB01-18.0/19.5-09102020	CUF-93-3-SB01	18.0	19.5	BS	G	N	9/10/2020	1616	1	NA	X
4	CUF-93-3-SB01-42.0/49.5-09102020	CUF-93-3-SB01	42.0	49.5	BS	G	N	9/10/2020	1622	1	NA	X
5	CUF-93-3-SB01-50.4/51.4-09102020	CUF-93-3-SB01	50.4	51.4	BS	G	N	9/10/2020	1510	2	NA	X
6												
7												
8												
9												
10												
11												
12												
13												

SM 9/10/2020

SM 9/10/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Stone McCoy /SM/ Stantec [signature]	9/11/2020	11:00	RJ Lee Group M Carse	09-14-20	8:54a

Sample Receipt Conditions			
Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☒ No	☐ Yes ☒ No	☒ Yes ☐ No	☐ Yes ☒ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE	
Fedex	Cate Burton	Catherine S Burton
	Stone McCoy	[signature]

Form TVA 30067A

A0H1059256-0

Rev_1 ME 9/18/2020

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1	of	1
COC No:	~~GEOCUF0910GG2020_1C~~ GEOCUF09102020_1C ME 9/18/2020		
1 of 1 Pages			
Task Desc:	CUF_Geochemical_2020_08		

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	C. Burton and S. McCoy
Lab Address:	350 Hochberg Road	Project #:		Sampling Company:	Stantec
	Monroeville, PA 15146	Site Address	Plant 815 Cumberland City Road	Address	601 Grassmere Park Suite 22
		City	Cumberland City State, Zip: TN 37050	Nashville, TN	Phone No: 615-885-1144
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM:	Monica Carse	Phone/Fax:	(423) 751-2926	Sampling Team Number:	1
Phone/Fax:	724-325-1776	Site PM Email:	pdthomas0@tva.gov	Send EDD/Hard Copy to:	tva_deliverables@envstd.com
Lab Email:	MCarse@rjleegroup.com				

Analysis Turnaround Time

☐ CALENDAR DAYS ☐ WORKING DAYS

TAT if different from Below ________

- ☐ 24 Hours
- ☐ 3 Business Days
- ☐ 5 Business Days
- ☐ 10 Business Days (Standard)

Filtered: N | Preserve: None | Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE (ME 9/18/2020)	SAMPLE LOCATION	Sample Depth: Start Depth (Depth Unit: Feet)	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	~~CUF-93-3-SB01-4.50/7.5-09102020~~ CUF-93-3-SB01-4.5/7.5-09102020	CUF-93-3-SB01	4.5	7.5	BS	G	N	9/10/2020	1545	1	NA	X
2	* CUF-93-3-SB01-9.0/10.5-09102020	CUF-93-3-SB01	9.0	10.5	BS	G	N	9/10/2020	1603	1	NA	x
3	CUF-93-3-SB01-18.0/19.5-09102020	CUF-93-3-SB01	18.0	19.5	BS	G	N	9/10/2020	1616	1	NA	x
4	CUF-93-3-SB01-42.0/49.5-09102020	CUF-93-3-SB01	42.0	49.5	BS	G	N	9/10/2020	1622	1	NA	x
5	CUF-93-3-SB01-50.4/51.4-09102020	CUF-93-3-SB01	50.4	51.4	BS	G	N	9/10/2020	1510	2	NA	x
6												
7												
8												
9												
10												
11												
12												
13												

SM 9/10/2020

SM 9/10/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Stone McCoy /SM/ Stantec [signature]	9/11/2020	11:00	RJ Lee Group M Carse	09-14-20	8:54am

Sample Receipt Conditions

Temperature in °C	Sample on ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE	
Fedex	Cate Burton	Catherine S Burton
	Stone McCoy	[signature]

Form TVA 30067A

Revised COC_1 Received 09-18-2020 1:38 pm MC

A0H1059256-0

REV_2 ME 10/16/2020

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1	of	1
COC No:	~~GEOCUF0910CC2020_1C~~		
1 of 1 Pages	[redacted]		
Task Desc:	CUF_Geochemical_2020_08		

GEOCUF09102020_1C
ME 9/18/2020

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	C. Burton and S. McCoy
Lab Address:	350 Hochberg Road	Project #:		Sampling Company:	Stantec
	Monroeville, PA 15146	Site Address	Plant 815 Cumberland City Road	Address	601 Grassmere Park Suite 22
		City	Cumberland City State, Zip: TN 37050	Nashville, TN	Phone No: 615-885-1144
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM:	Monica Carse	Phone/Fax:	(423) 751-2926	Sampling Team Number:	1
Phone/Fax:	724-325-1776	Site PM Email:	pdthomas0@tva.gov	Send EDD/Hard Copy to:	tva_deliverables@envstd.com
Lab Email:	MCarse@rjleegroup.com				

Analysis Turnaround Time

☐ CALENDAR DAYS ☐ WORKING DAYS

TAT if different from Below ________

- ☐ 24 Hours
- ☐ 3 Business Days
- ☐ 5 Business Days
- ☐ 10 Business Days (Standard)

Filtered: N
Preserve: None
Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE (ME 9/18/2020)	SAMPLE LOCATION	Sample Depth: Depth Unit Feet — Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-93-3-SB01-4.5/7.5-09102020 ~~CUF-93-3-SB01-4.50/7.5-09102020~~	CUF-93-3-SB01	4.5	7.5	~~BS~~	G	N	9/10/2020	1545	1	NA	X
2	* CUF-93-3-SB01-9.0/10.5-09102020	CUF-93-3-SB01	9.0	10.5	~~BS~~	G	N	9/10/2020	1603	1	NA	X
3	CUF-93-3-SB01-18.0/19.5-09102020	CUF-93-3-SB01	18.0	19.5	~~BS~~	G	N	9/10/2020	1616	1	NA	X
4	CUF-93-3-SB01-42.0/49.5-09102020	CUF-93-3-SB01	42.0	49.5	~~BS~~	G	N	9/10/2020	1622	1	NA	X
5	CUF-93-3-SB01-50.4/51.4-09102020	CUF-93-3-SB01	50.4	51.4	~~BS~~	G	N	9/10/2020	1510	2	NA	X
6					SS ME 10/16/2020							
7					SS ME 10/16/2020							
8					SS ME 10/16/2020							
9					SS ME 10/16/2020							
10					SS ME 10/16/2020							
11												
12												
13												

SM 9/10/2020

SM 9/10/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Stone McCoy /SM/ Stantec	9/11/2020	11:00	RJ Lee Group M Carse	09-14-20	8:54am

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☐ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE	
Fedex	Cate Burton	Catherine S Burton
	Stone McCoy	[signature]

Revised COC_2 Received 10-16-2020 4:51pm MC

Form TVA 30067A

Appendix B
Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 09/18/2020
Sample Received Date: 09/14/2020
RJLG Project: AOH1059256-0
Customer COC: GEOCUF09102020_1C REV_1
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-93-3-SB01-18.0/19.5-09102020	10521701	09/18/2020	09/10/2020	3%	Clay Mica Misc. Silicates Opaques Quartz Coal	Light Brown Sediment
CUF-93-3-SB01-4.5/7.5-09102020	10521699	09/18/2020	09/10/2020	2%	Clay Mica Misc. Silicates Opaques Quartz Coal	Red-Brown Sediment
CUF-93-3-SB01-42.0/49.5-09102020	10521702	09/18/2020	09/10/2020	1%	Clay Mica Misc. Silicates Opaques Quartz Coal	Gray Sediment
CUF-93-3-SB01-50.4/51.4-09102020	10521703	09/18/2020	09/10/2020	2%	Carbonate Misc. Silicates Opaques Quartz	Light Brown Sediment

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-93-3-SB01-9.0/10.5-09102020	10521700	09/18/2020	09/10/2020	ND	Clay Mica Misc. Silicates Opaques Quartz Coal	Brown Sediment
QC_CUF-93-3-SB01-9.0/10.5-09102020	10521704	09/18/2020	09/10/2020	ND	NA	Brownish Yellow Sediment

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

October 2, 2020

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1059434-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received 10 samples on September 21, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The samples were logged into RJ Lee Group project number AOH1059434-0 and assigned RJLG sample numbers as indicated in Appendix A.

The samples were received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, revised COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A
Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1059434-0
Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Carolyn Sexton Stantec 3052 Beaumont Centre Circle Lexington , KY 40513 United States Email: carolyn.sexton@stantec.com Mobile: 615-594-7508	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10522490	CUF-GC-1005-SS09-09142020	09/21/2020 8:43 AM EDT
10522491	CUF-GC-1005-SS10-09142020	09/21/2020 8:43 AM EDT
10522492	CUF-GC-1005-SS11-09142020	09/21/2020 8:43 AM EDT
10522493	CUF-GC-1005-SS12-09142020	09/21/2020 8:43 AM EDT
10522494	CUF-GC-1005-SS13-09142020	09/21/2020 8:43 AM EDT
10522495	CUF-GC-1005-SS15a-09142020	09/21/2020 8:43 AM EDT
10522496	CUF-GC-1005-SS15b-09142020	09/21/2020 8:43 AM EDT
10522497	CUF-GC-1005-SS16-09142020	09/21/2020 8:43 AM EDT
10522498	CUF-GC-1005-SS17a-09142020	09/21/2020 8:43 AM EDT
10522499	CUF-GC-1005-903-09142020	09/21/2020 8:43 AM EDT
10522500	QC_CUF-GC-1005-SS09-09142020	09/21/2020 8:43 AM EDT

	Received From: Carolyn Sexton	*Method of Shipment:* *Federal Express*	
	Company: Stantec		**Date:** 09/21/2020
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*	
	Company: RJ Lee Group, Inc.		**Date:** 09/21/2020

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

RJ Lee Group
Sample Receipt and Log in Check List

Client:	**Tennessee Valley Authority**	**Date Received:**	**9/21/2020**	**Log in Date:**	**9/28/2020**
Time Received:	**8:43 AM**	**By:**	**Monica Carse**	**COC# :**	**GEOCUF09142020_1C REV_1**
Project:	**AOH1059434-0**	**# Coolers Received**	**1**	**Means of Shipment:**	**FedEx**
Air Bill:	**3969 8591 9023**				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		Samples Received in a Box
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?	✓		
Were there any discrepancies among samples and COC?	X		11 samples listed on COC-received 10
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

N/A

Analyst Signature: M. Carse 09-28-2020

Manager Signature: [signature] 09/28/2020

A0H1059434-0

CS 09/28/2020 Rev 1

TVA Environmental Investigations

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

CS 09/28/2020
GEOCUF09142020-1C

COOLER No.:	1	of	1
COC No:	~~CUF_GC_20200914_1C~~		
1 of 1 Pages			
Task Desc:	~~CUF_GeoChem~~		

CUF-Geochemical-2020-08 CS 09/28/2020

Required Ship to Lab:	
Lab Name:	RJ Lee Group, Inc.
Lab Address:	350 Hochberg Road, Monroeville, PA 15146
Lab Manager Contact Information	
Lab PM:	Monica Carse
Phone/Fax:	724.325.1776
Lab Email:	MCarse@rjleegroup.com

Required Project Information:	
Site ID #:	Cumberland Fossil Plant
Project #:	175568209
Site Address	815 Cumberland City Rd
City	Cumblerand City; State, Zip: TN 37050
Site PM Name:	Chris Daly
Phone/Fax:	630-576-9093
Site PM Email:	chris.daly@stantec.com

Required Sampler Information	
Sampler:	Carolyn Sexton
Sampling Company:	Stantec
Address	3052 Beaumont Centre Circle
City/State	Lexington, KY; Phone: 615-594-7508
Sampling Team Number:	N/A
Send EDD/Hard Copy to:	tva_deliverables@enysd.com

Analysis Turnaround Time

CALENDAR DAYS - WORKING DAYS

TAT if different from Below ________

- 24 Hours
- 3 Business Days
- 5 Business Days
- ☒ 10 Business Days

Filtered: N

Preserve: None

Analysis: GEOCHEM-SLM-~~[illegible]~~ CS 09/28/2020

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/ Lab Sample I.D.	MS/MSD	GEOCHEM-SLM
1	CUF-GC-1005-SS09-09142020	CUF-1005	12.0	13.5	BS	G	N	09/14/2020	1239	1	N/A		X
2	CUF-GC-1005-SS10-09142020	CUF-1005	13.5	15.0	BS	G	N	09/14/2020	1243	1	N/A		X
3	CUF-GC-1005-SS11-09142020	CUF-1005	15.0	16.5	BS	G	N	09/14/2020	1247	1	N/A		X
4	CUF-GC-1005-SS12-09142020	CUF-1005	16.5	18.0	BS	G	N	09/14/2020	1250	1	N/A		X
5	CUF-GC-1005-SS13-09142020	CUF-1005	18.0	19.5	BS	G	N	09/14/2020	1254	1	N/A		X
6	CUF-GC-1005-SS15a-09142020	CUF-1005	21.0	21.5	BS	G	N	09/14/2020	1258	1	N/A		X
7	CUF-GC-1005-SS15b-09142020	CUF-1005	21.5	22.5	BS	G	N	09/14/2020	1301	1	N/A		X
8	CUF-GC-1005-SS16-09142020	CUF-1005	22.5	25.0	BS	G	N	09/14/2020	1303	1	N/A		X
9	CUF-GC-1005-SS17a-09142020	CUF-1005	24.0	24.3	BS	G	N	09/14/2020	1307	1	N/A		X
10	~~CUF-GC-1005-SS17b~~	~~CUF-1005~~	~~24.3~~	~~25.2~~	~~BS~~	~~G~~	~~N~~	~~09/14/20~~	~~1309~~	~~1~~	~~N/A~~		~~X~~
	CUF-GC-1005-903-09142020	CUF-1005	NA	NA	BS	G	Dup FD	09/14/2020	NA	1	NA		X

CS 09/28/2020 (written beside rows 10 and 11 on the right, on the Dup row and across the date/time cells)

CS 09/28/2020 (written diagonally in the analysis grid)

Additional Comments/Special Instructions:

Additional volume collected should be used for laboratory duplicate analysis.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Carolyn Sexton	09/14/2020	1445	M. Carse / RJ Lee Group	09-21-2020	9:43 AM
CS 09/14/2020					

Sample Receipt Conditions			
Yes / ~~No~~	~~Yes~~ / No	Yes / No	Yes / ~~No~~
Yes / No	Yes / No	Yes / No	Yes / No
Yes / No	Yes / No	Yes / No	Yes / No
Yes / No	Yes / No	Yes / No	Yes / No
Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?

SHIPPING METHOD:	SAMPLER NAME AND SIGNATURE
Fedex	Carolyn Sexton
CS 09/14/2020	CS 09/14/2020

Revised COC Rec'd 09-28-2020 9:18am

Form TVA 30087A

Appendix B
Mineral Identification Report

Mineral Identification

RJ LeeGroup, Inc.

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 10/01/2020
Sample Received Date: 09/21/2020
RJLG Project: AOH1059434-0
Customer COC: GEOCUF09142020_1C REV_1
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-GC-1005-903-09142020	10522499	10/01/2020	09/14/2020	93%	Carbonate Clay Quartz	Greyish Brown Sediment
CUF-GC-1005-SS09-09142020	10522490	10/01/2020	09/14/2020	ND	Carbonate Clay Misc. Silicates Opaques Quartz Coal	Light Brown Sediment
CUF-GC-1005-SS10-09142020	10522491	10/01/2020	09/14/2020	1%	Carbonate Clay Misc. Silicates Opaques Quartz Coal	Brown Sediment
CUF-GC-1005-SS11-09142020	10522492	10/01/2020	09/14/2020	ND	Carbonate Clay Misc. Silicates Opaques Quartz Coal	Light Brown Sediment

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-GC-1005-SS12-09142020	10522493	10/01/2020	09/14/2020	1%	Carbonate Clay Misc. Silicates Opaques Quartz Coal	Brown Sediment
CUF-GC-1005-SS13-09142020	10522494	10/01/2020	09/14/2020	2%	Carbonate Clay Misc. Silicates Opaques Quartz Coal	Light Brown Sediment
CUF-GC-1005-SS15a-09142020	10522495	10/01/2020	09/14/2020	7%	Carbonate Clay Misc. Silicates Opaques Quartz Coal	Light Brown Sediment
CUF-GC-1005-SS15b-09142020	10522496	10/01/2020	09/14/2020	78%	Carbonate Clay Misc. Silicates Opaques Quartz Coal	Gray Sediment
CUF-GC-1005-SS16-09142020	10522497	10/01/2020	09/14/2020	78%	Carbonate Clay Opaques Quartz Coal	Gray Sediment

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-GC-1005-SS17a-09142020	10522498	10/01/2020	09/14/2020	85%	Carbonate Clay Misc. Silicates Opaques Quartz Coal	Gray Sediment
QC_CUF-GC-1005-SS09-09142020	10522500	10/01/2020	09/14/2020	ND	NA	Yellow Sediment

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

November 18, 2020

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1059499-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received seven samples on October 2, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The samples were logged into RJ Lee Group project number AOH1059499-0 and assigned RJLG sample numbers as indicated in Appendix A.

The samples were received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, revised COC's and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A

Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1059499-0
Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Catherine Burton, PG Stantec 3052 Beaumont Centre Cir Lexington, KY 40513 United States Main: 859 608-0372	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10522712	CUF-93-3-SB02-0.0/4.5-09152020	10/02/2020 9:20 AM EDT
10522713	CUF-93-3-SB02-4.5/10.5-09152020	10/02/2020 9:20 AM EDT
10522714	CUF-93-3-SB02-10.5/15.0-09152020	10/02/2020 9:20 AM EDT
10522715	CUF-93-3-SB02-15.0/19.5-09152020	10/02/2020 9:20 AM EDT
10522716	CUF-93-3-SB02-22.5/24.0-09152020	10/02/2020 9:20 AM EDT
10522717	CUF-93-3-SB02-40.5/45.0-09152020	10/02/2020 9:20 AM EDT
10522718	CUF-93-3-SB02-45.0/51.0-09152020	10/02/2020 9:20 AM EDT
10522719	QC_CUF-93-3-SB02-22.5/24.0-09152020	10/02/2020 9:20 AM EDT

	Received From: Catherine Burton, PG	*Method of Shipment:* *Federal Express*	
	Company: Stantec		**Date:** 10/02/2020
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*	
	Company: RJ Lee Group, Inc.		**Date:** 10/02/2020

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	10/2/2020	Log in Date:	10/2/2020
Time Received:	9:20 AM	By:	Monica Carse	COC# :	GEOCUF09152020_1C
Project:	AOH1059499-0	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	3973 7858 4025				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?	✓		
Were there any discrepancies among samples and COC?		✓	
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

N/A

Analyst Signature: M. Carse 10-02-2020

Manager Signature: [signature] 10-02-2020

A0H1059499-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

1 of 1

COOLER No.:	1 of 1
COC No:	GEOCUF09152020_1C
1 of	Pages
Task Desc:	CUF_Geochemical_2020_09

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	Catherine Burton
Lab Address:	350 Hochberg Road	Project #:	182503563	Sampling Company:	Stantec
	Monroeville, PA 15146	Site Address	Plant 815 Cumberland City Road	Address	3052 Beaumont Centre Circle
		City	Cumberland City; State, Zip: TN, 37050	City/State	Lexington, KY; Phone No: 859-338-2791
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM:	Monica Carse	Phone/Fax:	(423) 751-2926	Sampling Team Number:	1
Phone/Fax:	724-325-1776	Site PM Email:	ptthomas0@tva.gov	Send EDD/Hard Copy to:	hs_deliverables@envstd.com
Lab Email:	MCarse@rjleegroup.com				

Analysis Turnaround Time

- [ ] CALENDAR DAYS
- [x] WORKING DAYS

TAT if different from Below ______

- [ ] 24 Hours
- [ ] 3 Business Days
- [ ] 5 Business Days
- [x] 10 Business Days (Standard)

Filtered: N; Preserve: None; Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	cuf-93-3-sb02-0.0/4.5-09152020	93-3-sb02	0.0	4.5	so	G	N	9/15/2020	1440	1		X
2	cuf-93-3-sb02-4.5/10.5-09152020	93-3-sb02	4.5	10.5	so	g	n	9/15/2020	1531	1		X
3	cuf-93-3-sb02-10.5/15.0-09152020	93-3-sb02	10.5	15.0	So	g	n	9/15/2020	1539	1		X
4	cuf-93-3-sb02-15.0/19.5-09152020	93-3-sb02	15.0	19.5	So	g	n	9/15/2020	1549	1		X
5	cuf-93-3-sb02-22.5/24.0-09152020	93-3-sb02	22.5	24.0	So	g	n	9/15/2020	1536	1		X
6	cuf-93-3-sb02-40.5/45.0-09152020	93-3-sb02	40.5	45.0	So	g	n	9/15/2020	1602	1		X
7	cuf-93-3-sb02-45.0/51.0-09152020	93-3-sb02	45.0	51.0	So	g	n	9/15/2020	1607	1		X
8												
9												
10												
11												
12												
13												

CB 9/21/20

CB 9/21/2020

CB 9/21/2020

CB 9/21/2020

Depth Unit / Select Unit

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec Catherine Burton	9/21/20	1611	M.Carse RJLG	10-02-2020	9:20 am

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
No	No	Yes	No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
FedEx	Catherine Burton Catherine Burton

Form TVA 30087A

A0H1059499-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

REV_1 ME 10/16/2020

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

1 of 1

COOLER No.:	of
COC No:	GEOCUF09152020_1C
1 of 1	Pages
Task Desc:	CUF_Geochemical_2020_09

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	Catherine Burton
Lab Address:	350 Hochberg Road	Project #:	182503663	Sampling Company:	Stantec
	Monroeville, PA 15146	Site Address	Plant 815 Cumberland City Road	Address	3052 Beaumont Centre Circle
		City	Cumberland City; State, Zip: TN, 37050	City/State	Lexington, KY; Phone No: 859-338-2791
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM	Monica Carse	Phone/Fax:	(423) 751-2926	Sampling Team Number:	1
Phone/Fax:	724-325-1775	Site PM Email:	[illegible]	Send EDD/Hard Copy to:	[illegible]
Lab Email:	[illegible]				

Analysis Turnaround Time

☐ CALENDAR DAYS ☐ WORKING DAYS

TAT if different from Below ____

☐ 24 hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

CUF-93-3-SB02 ME 10/16/2020

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Sample Depth: Start Depth	Sample Depth: End Depth	MATRIX CODE	GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	~~cuf-93-3-sb02-0.0/4.5-09152020~~	~~93-3-sb02~~	0.0	4.5	SS	G	N	9/15/2020	1440	1		X
2	~~cuf-93-3-sb02-4.5/10.5-09152020~~	~~93-3-sb02~~	4.5	10.5	SS	G	N	9/15/2020	1531	1		X
3	~~cuf-93-3-sb02-10.5/15.0-09152020~~	~~93-3-sb02~~	10.5	15.0	SS	G	N	9/15/2020	1539	1		X
4	~~cuf-93-3-sb02-15.0/19.5-09152020~~	~~93-3-sb02~~	15.0	19.5	SS	G	N	9/15/2020	1549	1		X
5	~~cuf-93-3-sb02-22.5/24.0-09152020~~	~~93-3-sb02~~	22.5	24.0	SS	G	N	9/15/2020	1536	1		X
6	~~cuf-93-3-sb02-40.5/45.0-09152020~~	~~93-3-sb02~~	40.5	45.0	SS	G	N	9/15/2020	1602	1		X
7	~~cuf-93-3-sb02-45.0/51.0-09152020~~	~~93-3-sb02~~	45.0	51.0	SS	G	N	9/15/2020	1607	1		X
8	CUF-93-3-SB02-0.0/4.5-09152020 ME 10/16/2020											
9	CUF-93-3-SB02-4.5/10.0-09152020 ME 10/16/2020											
10	CUF-93-3-SB02-10.5/15.0-09152020 ME 10/16/2020											
11	CUF-93-3-SB02-15.0/19.5-09152020 ME 10/16/2020											
12	CUF-93-3-SB02-22.5/24.0-09152020 ME 10/16/2020											
13	CUF-93-3-SB02-40.5/45.0-09152020 ME 10/16/2020											

ALL CAPITALIZATION AND MATRIX CODE EDITS TO THE UPPER LEFT CORRECTED BY ME 10/16/2020

CB 9/16/2020

Additional Comments: CUF-93-3-SB02-45.0/51.0-09152020 ME 10/16/2020

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec Catherine Burton	9/16	1611	M Carse RJLG	10-02-2020	9:20 am

Sample Receipt Conditions: Temperature in °C; Sample on Ice?; Sample Intact?; Trip Blank?

SHIPPING METHOD: (Select Appropriate) FedEx

SAMPLER NAME AND SIGNATURE: Catherine Burton Catherine Burton

Revised COC Rec'd 10-16-2020 @ 4:51 pm MC

A0H1059499-0

REV2 (11/17/2020, abe)

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

REV_1 ME 10/16/2020

TVA Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

1 of 1

COOLER No.:	of
COC No:	GEOCUF09152020_1C
1 of 1	Pages
Task Desc:	CUF_Geochemical_2020_09

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	Catherine Burton
Lab Address:	350 Hochberg Road	Project #:	182503663	Sampling Company:	Stantec
	Monroeville, PA 15146	Site Address	Plant 815 Cumberland City Road	Address	3052 Beaumont Centre Circle
		City	Cumberland City State, Zip: TN, 37050	City/State	Lexington, KY Phone No: 859-335-2791
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM:	Monica Carse	Phone/Fax:	(423) 751-2926	Sampling Team Number:	1
Phone/Fax:	724-325-1776	Site PM Email:	[illegible]	Send EDD/Hard Copy to:	[illegible]
Lab Email:	[illegible]				

Analysis Turnaround Time

☐ CALENDAR DAYS ☐ WORKING DAYS

TAT if different from Below ______

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☒ 10 Business Days (Standard)

CUF-93-3-SB02 ME 10/16/2020

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Sample Depth: Depth Unit / Start Depth	Select Unit / End Depth	MATRIX CODE	GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	~~cuf-93-3-sb02-0.0/4.5-09152020~~	~~93-3-sb02~~	0.0	4.5	SS	G	N	9/15/2020	1440	1		X
2	~~cuf-93-3-sb02-4.5/10.5-09152020~~	~~93-3-sb02~~	4.5	10.5	SS	G	N	9/15/2020	1531	1		X
3	~~cuf-93-3-sb02-10.5/15.0-09152020~~	~~93-3-sb02~~	10.5	15.0	SS	G	N	9/15/2020	1539	1		X
4	~~cuf-93-3-sb02-15.0/19.5-09152020~~	~~93-3-sb02~~	15.0	19.5	SS	G	N	9/15/2020	1549	1		X
5	~~cuf-93-3-sb02-22.5/24.0-09152020~~	~~93-3-sb02~~	22.5	24.0	SS	G	N	9/15/2020	1536	1		X
6	~~cuf-93-3-sb02-40.5/45.0-09152020~~	~~93-3-sb02~~	40.5	45.0	SS	G	N	9/15/2020	1602	1		X
7	~~cuf-93-3-sb02-45.0/51.0-09152020~~	~~93-3-sb02~~	45.0	51.0	SS	G	N	9/15/2020	1607	1		X
8	CUF-93-3-SB02-0.0/4.5-09152020 ME 10/16/2020											
9	CUF-93-3-SB02-4.5/~~10.0~~ 10.5 (11/17/2020, abe) -09152020 ME 10/16/2020											
10	CUF-93-3-SB02-10.5/15.0-09152020 ME 10/16/2020											
11	CUF-93-3-SB02-15.0/19.5-09152020 ME 10/16/2020											
12	CUF-93-3-SB02-22.5/24.0-09152020 ME 10/16/2020											
13	CUF-93-3-SB02-40.5/45.0-09152020 ME 10/16/2020											

Additional Comments: CUF-93-3-SB02-45.0/51.0-09152020 ME 10/16/2020

Additional volume collected should be used for MS/MSDs.

ALL CAPITALIZATION AND MATRIX CODE EDITS TO THE UPPER LEFT CORRECTED BY ME 10/16/2020

CB 9/24/2020

CB 9/24/2020

CB 9/24/2020

1/20/20

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec Catherine Burton	9/24/20	1611	M Carse RJLG	10-02-2020	9:20 am

Sample Receipt Conditions: Temperature in °C / Sample on Ice? / Sample Intact? / Trip Blank?

SHIPPING METHOD: (Select Appropriate) FedEx

SAMPLER NAME AND SIGNATURE: Catherine Burton Catherine Burton

Revised 2 COC Received 11-17-2020 @ 11:20am - MC

Form TVA 30007A

Appendix B

Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 11/17/2020
Sample Received Date: 10/02/2020
RJLG Project: AOH1059499-0
Customer COC: GEOCUF09152020_1C
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-93-3-SB02-0.0/4.5-09152020	10522712	10/08/2020	10/15/2020	ND	Carbonate Clay Opaques Quartz	Tan Sediment.
CUF-93-3-SB02-10.5/15.0-09152020	10522714	10/08/2020	10/15/2020	ND	Clay Opaques Quartz	Tan Sediment.
CUF-93-3-SB02-15.0/19.5-09152020	10522715	10/08/2020	10/15/2020	ND	Clay Opaques Quartz	Tan Sediment.
CUF-93-3-SB02-22.5/24.0-09152020	10522716	10/08/2020	10/15/2020	55%	Opaques Quartz	Beige Sediment.
CUF-93-3-SB02-4.5/10.5-09152020	10522713	10/08/2020	10/15/2020	ND	Carbonate Clay Opaques Quartz	Tan Sediment.
CUF-93-3-SB02-40.5/45.0-09152020	10522717	10/09/2020	10/15/2020	5%	Opaques Quartz	Beige Sediment.
CUF-93-3-SB02-45.0/51.0-09152020	10522718	10/09/2020	10/15/2020	2%	Opaques Quartz	Beige Sediment.

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
QC_CUF-93-3-SB02-22.5/24.0-09152020	10522719	10/09/2020	10/15/2020	70%	NA	Beige Sediment.

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

October 22, 2020

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1059500-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received one sample on October 2, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The sample was logged into RJ Lee Group project number AOH1059500-0 and assigned an RJLG sample number as indicated in Appendix A.

The sample was received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, revised COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A
Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1059500-0
Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Catherine Burton, PG Stantec 3052 Beaumont Centre Cir Lexington, KY 40513 United States Main: 859 608-0372	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10522720	CUF-93-S-SB03-10.8/12.3-09162020	10/02/2020 9:20 AM EDT

	Received From: Catherine Burton, PG	*Method of Shipment:* *Federal Express*
	Company: Stantec	**Date:** 10/02/2020
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*
	Company: RJ Lee Group, Inc.	**Date:** 10/02/2020

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	**Date Received:**	10/2/2020	**Log in Date:**	10/2/2020
Time Received:	9:20 AM	**By:**	Monica Carse	**COC# :**	GEOCUF09162020_1C
Project:	AOH1059500-0	**# Coolers Received**	1	**Means of Shipment:**	FedEx
Air Bill:	3973 7858 4025				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?	✓		
Were there any discrepancies among samples and COC?		✓	
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

N/A

Analyst Signature: M. Carse 10-02-2020

Manager Signature: [signature] 10-02-2020

A0H1059500-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

Tennessee Valley Authority

1 of 1

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	of
COC No:	GEOCUF09162020_1C
of	Pages
Task Desc:	CUF_Geochemical_2020_09

Required Ship to Lab:

Lab Name:	RJ Lee Group, Inc.
Lab Address:	350 Hochberg Road, Monroeville, PA 15146

Lab Manager Contact Information

Lab PM:	Monica Carse
Phone/Fax:	724-325-1776
Lab Email:	MCarse@rjleegroup.com

Required Project Information:

Site ID #:	CUMBERLAND FOSSIL PLANT
Project #:	182603563
Site Address	Plant 815 Cumberland City Road
City	Cumberland City, State, Zip: TN, 37050
Site PM Name:	Paul Thomas
Phone/Fax:	(423) 751-2926
Site PM Email:	pdthomas0@tva.gov

Required Sampler Information

Sampler:	Catherine Burton
Sampling Company:	Stantec
Address	3052 Beaumont Centre Circle
City/State	Lexington, KY; Phone No: 859-338-2791
Sampling Team Number:	1
Send EDD/Hard Copy to:	tva_deliverables@envstd.com

Analysis Turnaround Time

- ☐ CALENDAR DAYS ☑ WORKING DAYS
- TAT if different from Below ______
- ☐ 24 Hours
- ☐ 3 Business Days
- ☐ 5 Business Days
- ☑ 10 Business Days (Standard)

Filtered: N; Preserve: None; Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	cuf-93-3-sb03-10.8/12.3-09162020	93-3-sb03	10.8	12.3	so	G	N	9/16/2020	1319	1		X
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

CB 9/21/2020 (×4)

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec [signature]	9/21/20	1611	M. Carse / RJLG	10-02-2020	9:20 am

Sample Receipt Conditions: Temperature in °C: ☑ No; Sample on Ice?: ☑ No; Sample Intact?: ☑ Yes; Trip Blank?: ☑ No

SHIPPING METHOD: (Select Appropriate): FedEx

SAMPLER NAME AND SIGNATURE: Catherine Burton [signature]

Form TVA 30067A

A0H1059500-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

REV_1 ME 10/16/2020

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

1 of 1

COOLER No.:	1 of 1
COC No:	GEOCUF09162020_1C
	1 of 5 Pages
Task Desc:	CUF_Geochemical_2020_09

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	Catherine Burton
Lab Address:	350 Hochberg Road, Monroeville, PA 15146	Project #:	182603563	Sampling Company:	Stantec
		Site Address	Plant 815 Cumberland City Road	Address	3052 Beaumont Centre Circle
		City	Cumberland City; State, Zip: TN, 37050	City/State	Lexington, KY; Phone No: 859-338-2791
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM:	Monica Carse	Phone/Fax:	(423) 751-2926	Sampling Team Number:	1
Phone/Fax:	724-325-1776	Site PM Email:	prthomas0@tva.gov	Send EDD/Hard Copy to:	tva_deliverables@envstd.com
Lab Email:	MCarse@rjleegroup.com				

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ______

☐ 24 Hours

☐ 3 Business Days

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE T	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	~~CUF-93-3-SB03-10.8/12.3-09162020~~ CUF-93-3-SB03-10.8/12.3-09162020 ME 10/16/2020	~~93-3-SB03~~ CUF-93-3-SB03 ME 10/16/2020	10.8	12.3	~~SO~~ SS ME 10/16/2020	G	N	9/16/2020	1319	1		X
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

Filtered: N; Preserve: None; Analysis: PLM

CB 9/21/2020

CB 9/21/2020

CB 9/21/2020

CB 9/21/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
Catherine Burton/Stantec [signature]	9/16/20	1611	M. Carse / RJLG	10-02-2020	9:20 am	☑ No	☑ No	☑ Yes	☑ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
FedEx	Catherine Burton [signature]

Form TVA 30067A

Appendix B

Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 10/21/2020
Sample Received Date: 10/02/2020
RJLG Project: AOH1059500-0
Customer COC: GEOCUF09162020_1C
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-93-3-SB03-10.8/12.3-09162020	10522720	10/07/2020	09/16/2020	ND	Clay Opaques Quartz	Tan Sediment.

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

October 22, 2020

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1059503-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received two samples on October 2, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The samples were logged into RJ Lee Group project number AOH1059503-0 and assigned RJLG sample numbers as indicated in Appendix A.

The samples were received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, revised COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A
Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1059503-0
Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Catherine Burton, PG Stantec 3052 Beaumont Centre Cir Lexington, KY 40513 United States Main: 859 608-0372	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10522726	CUF-93-3-SB03-21.5/25.5-09172020	10/02/2020 9:20 AM EDT
10522727	CUF-93-3-SB03-36.0/39.0-09172020	10/02/2020 9:20 AM EDT

	Received From: Catherine Burton, PG	*Method of Shipment:* *Federal Express*
	Company: Stantec	**Date:** 10/02/2020
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*
	Company: RJ Lee Group, Inc.	**Date:** 10/02/2020

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	10/2/2020	Log in Date:	10/2/2020
Time Received:	9:20 AM	By:	Monica Carse	COC# :	GEOCUF09172020_1C
Project:	AOH1059503-0	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	3973 7858 4025				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?	✓		
Were there any discrepancies among samples and COC?		✓	
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

N/A

Analyst Signature: M. Carse 10-02-2020

Manager Signature: [signature] 10-02-2020

AOH1059503-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	of
COC No:	GEOCUF09172020_1C
of	Pages
Task Desc:	CUF_Geochemical_2020_09

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	Catherine Burton
Lab Address:	350 Hochberg Road	Project #:	182503563	Sampling Company:	Stantec
	Monroeville, PA 15146	Site Address	Plant 815 Cumberland City Road	Address	3052 Beaumont Centre Circle
		City	Cumberland City State, Zip: TN, 37050	City/State	Lexington, KY Phone No: 859-338-2791
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM:	Monica Carse	Phone/Fax:	(423) 751-2926	Sampling Team Number:	1
Phone/Fax:	724-325-1776	Site PM Email:	pthomas0@tva.gov	Send EDD/Hard Copy to:	ts_deliverables@stantec.com
Lab Email:	MCarse@rjleegroup.com				

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ______

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

Filtered: N — Preserve: None — Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	cuf-93-3-sb03-21.5/25.5-09172020	93-3-sb03	21.5	25.5	so	G	N	9/17/2020	1021	1		X
2	cuf-93-3-sb03-36.0/39.0-09172020	93-3-sb03	36.0	39.0	so	G	N	9/17/2020	1116	1		X
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

CB 9/21/2020

CB 9/21/2020

CB 9/21/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Sample Receipt Conditions			
Catherine Burton/Stantec Catherine Burton	9/21/20	1611	M. Carse RJLG	10-02-2020	9:30 am	☑ No	☑ No	☑ Yes	☑ No
						☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
						☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
						☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
						Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
FedEx	Catherine Burton Catherine Burton

Form TVA 30067A

AOH1059503-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

REV_1 ME 10/16/2020

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	of
COC No:	GEOCUF09172020_1C
of	Pages
Task Desc:	CUF_Geochemical_2020_09

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	Catherine Burton
Lab Address:	350 Hochberg Road	Project #:	182503563	Sampling Company:	Stantec
	Monroeville, PA 15146	Site Address	Plant 815 Cumberland City Road	Address	3052 Beaumont Centre Circle
		City	Cumberland City; State, Zip: TN, 37050	City/State	Lexington, KY; Phone No: 859-338-2791
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM:	Monica Carse	Phone/Fax:	(423) 751-2926	Sampling Team Number:	1
Phone/Fax:	724-325-1776	Site PM Email:	[illegible]	Send EDD/Hard Copy to:	[illegible]
Lab Email:	MCarse@rjleegroup.com				

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ______

- ☐ 24 Hours
- ☐ 3 Business Days
- ☐ 5 Business Days
- ☑ 10 Business Days (Standard)

Filtered: N; Preserve: None; Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	~~cuf-93-3-sb03-21.5/25.5-09172020~~	~~93-3-sb03~~	21.5	25.5	~~so~~	G	N	9/17/2020	1021	1		X
2	~~cuf-93-3-sb03-36.0/39.0-09172020~~	~~93-3-sb03~~	36.0	39.0	~~so~~	G	N	9/17/2020	1116	1		X
3	CUF-93-3-SB03-21.5/25.5-09172020 ME 10/16/2020											
4												
5	CUF-93-3-SB03-36.0/39.0-09172020 ME 10/16/2020											
6		CUF-93-3-SB03 ME 10/16/2020										
7		CUF-93-3-SB03 ME 10/16/2020										
8												
9					SS ME 10/16/2020							
10					SS ME 10/16/2020							
11												
12												
13												

CB 9/21/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec — Catherine Burton	9/21/20	1611	M. Carse RJLG	10-02-2020	9:20 am

Sample Receipt Conditions: Temperature in °C: ☑ No; Sample on Ice?: ☑ No; Sample Intact?: ☑ Yes; Trip Blank?: ☑ No

SHIPPING METHOD: (Select Appropriate) FedEx

SAMPLER NAME AND SIGNATURE: Catherine Burton — Catherine Burton

Form TVA 30067A

Appendix B
Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 10/21/2020
Sample Received Date: 10/02/2020
RJLG Project: AOH1059503-0
Customer COC: GEOCUF09172020_1C
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-93-3-SB03-21.5/25.5-09 172020	10522726	10/07/2020	09/17/2020	ND	Carbonate Clay Opaques Quartz	Beige Sediment.
CUF-93-3-SB03-36.0/39.0-09 172020	10522727	10/07/2020	09/17/2020	ND	Carbonate Clay Opaques Quartz	Beige Sediment.

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

October 22, 2020

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1059505-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received two samples on October 2, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The samples were logged into RJ Lee Group project number AOH1059505-0-0 and assigned RJLG sample numbers as indicated in Appendix A.

The samples were received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, revised COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A
Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1059505-0
Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Catherine Burton, PG Stantec 3052 Beaumont Centre Cir Lexington, KY 40513 United States Main: 859 608-0372	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10522729	CUF-211-SB03-26.1/30.0-09022020	10/02/2020 9:20 AM EDT
10522730	CUF-211-SB03-39.0/48.0-09022020	10/02/2020 9:20 AM EDT

	Received From: Catherine Burton, PG	*Method of Shipment:* *Federal Express*
	Company: Stantec	**Date:** 10/02/2020
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*
	Company: RJ Lee Group, Inc.	**Date:** 10/02/2020

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	10/2/2020	Log in Date:	10/2/2020
Time Received:	9:20 AM	By:	Monica Carse	COC# :	GEOCUF09022020_1C
Project:	AOH1059505-0	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	3973 7858 4025				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?	✓		
Were there any discrepancies among samples and COC?		✓	
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

N/A

Analyst Signature: M. Carse 10-02-2020

Manager Signature: [signature] 10-02-2020

A0H1059505-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

Tennessee Valley Authority

1 of 1

COOLER No.:	1	of	1
COC No:	GEOCUF09022020_1C		
1 of 1 Pages			
Task Desc:	CUF_Geochemical_2020_09		

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

Required Ship to Lab:

Lab Name:	RJ Lee Group, Inc.
Lab Address:	350 Hochberg Road Monroeville, PA 15146

Lab Manager Contact Information

Lab PM:	Monica Carse
Phone/Fax:	724-325-1776
Lab Email:	MCarse@rjleegroup.com

Required Project Information:

Site ID #:	CUMBERLAND FOSSIL PLANT
Project #:	
Site Address	Plant 815 Cumberland City Road
City	Cumberland City; State, Zip: TN, 37050
Site PM Name:	Paul Thomas
Phone/Fax:	(423) 751-2926
Site PM Email:	prthomas0@tva.gov

Required Sampler Information

Sampler:	Catherine Burton
Sampling Company:	Stantec
Address	3052 Beaumont Centre Circle
City/State	Lexington, KY; Phone No: 859-338-2791
Sampling Team Number:	1
Send EDD/Hard Copy to:	tva_deliverables@envstd.com

Analysis Turnaround Time

- ☐ CALENDAR DAYS ☑ WORKING DAYS
- TAT if different from Below ______
- ☐ 24 Hours
- ☐ 3 Business Days
- ☐ 5 Business Days
- ☑ 10 Business Days (Standard)

Filtered: N; Preserve: None; Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	cuf-211-sb03-26.1/30.0-09022020	211-sb03	26.1	30	so	G	N	9/2/2020	1837	1		X
2	cuf-211-sb03-39.0/48.0-09022020	211-sb03	39	48	so	g	N	9/2/2020	1857	1		X
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

Sample Depth: Depth Unit / Select Unit

CB 9/2/2020

CB 9/2/2020

CB 9/2/2020

CB 9/2/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec Catherine Burton	9/3/20	1011	M.Carse / RJLG	10-02 2020	9:20 am

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
FedEx	Catherine Burton Catherine Burton

Form TVA 30067A

AoH1059505-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

REV_1 ME 10/16/2020

COOLER No.:	1 of 1
COC No:	GEOCUF09022020_1C
1 of 1 Pages	
Task Desc:	CUF_Geochemical_2020_09

TVA Tennessee Valley Authority

1 of 1

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

Required Ship to Lab:	
Lab Name:	RJ Lee Group, Inc.
Lab Address:	350 Hochberg Road Monroeville, PA 15146
Lab Manager Contact Information	
Lab PM:	Monica Carse
Phone/Fax:	724-325-1776
Lab Email:	MCarse@rjleegroup.com

Required Project Information:	
Site ID #:	CUMBERLAND FOSSIL PLANT
Project #:	
Site Address	Plant 815 Cumberland City Road
City	Cumberland City; State, Zip: TN, 37050
Site PM Name:	Paul Thomas
Phone/Fax:	(423) 751-2926
Site PM Email:	prthomas0@tva.gov

Required Sampler Information		
Sampler:	Catherine Burton	
Sampling Company:	Stantec	
Address	3052 Beaumont Centre Circle	
City/State	Lexington, KY	Phone No: 859-338-2791
Sampling Team Number:	1	
Send EDD/Hard Copy to:	tva_deliverables@envstd.com	

Analysis Turnaround Time

- ☐ CALENDAR DAYS ☑ WORKING DAYS
- TAT if different from Below ______
- ☐ 24 Hours
- ☐ 3 Business Days
- ☐ 5 Business Days
- ☑ 10 Business Days (Standard)

Filtered: N — Preserve: None — Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit)	End Depth (Select Unit)	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	~~cuf-211-sb03-26.1/30.0-09022020~~	~~211-sb03~~	26.1	~~30~~	~~so~~	G	N	9/2/2020	1837	1		X
2	~~cuf-211-sb03-39.0/48.0-09022020~~	~~211-sb03~~	~~39~~	~~48~~	~~so~~	~~g~~	N	9/2/2020	1857	1		X
3	CUF-211-SB03-26.1/30.0-09022020 ME 10/16/2020					G ME 10/16/2020						
4	CUF-211-SB03-39.0/48.0-09022020 ME 10/16/2020											
5												
6		CUF-211-SB03 ME 10/16/2020										
7		CUF-211-SB03 ME 10/16/2020										
8				30.0 ME 10/16/2020								
9												
10			39.0	48.0 ME 10/16/2020								
11					SS ME 10/16/2020							
12					SS ME 10/16/2020							
13												

CB 9/2/2020

CB 9/2/2020

CB 9/2/2020

CB 9/2/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec Catherine Burton	[illegible]	[illegible]	M. Carse / RJLG	10-02 2020	am 9:20

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No

SHIPPING METHOD: (Select Appropriate) FedEx

SAMPLER NAME AND SIGNATURE: Catherine Burton Catherine Burton

Form TVA 30067A

Appendix B

Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 10/21/2020
Sample Received Date: 10/02/2020
RJLG Project: AOH1059505-0
Customer COC: GEOCUF09022020_1C
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-211-SB03-26.1/30.0-09 022020	10522729	10/07/2020	09/02/2020	2%	Carbonate Clay Opaques Quartz	Tan Sediment.
CUF-211-SB03-39.0/48.0-09 022020	10522730	10/07/2020	09/02/2020	1%	Carbonate Clay Opaques Quartz	Tan Sediment.

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

October 12, 2020

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1059514-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received four samples on October 5, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The samples were logged into RJ Lee Group project number AOH1059514-0 and assigned RJLG sample numbers as indicated in Appendix A.

The samples were received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A

Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1059514-0
Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Stone McCoy Stantec 601 Grassmere Park Suite 22 Nashville, TN 37211 United States Main: 615-885-1144	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10522777	CUF-212-SB01-0.0/5.0-09302020	10/05/2020 8:28 AM EDT
10522778	CUF-212-SB01-5.0/10.0-09302020	10/05/2020 8:28 AM EDT
10522779	CUF-212-SB01-10.0/15.0-09302020	10/05/2020 8:28 AM EDT
10522780	CUF-212-SB01-15.0/18.5-09302020	10/05/2020 8:28 AM EDT
10522781	QC_CUF-212-SB01-10.0/15.0-09302020	10/05/2020 8:28 AM EDT

	Received From: Stone McCoy	*Method of Shipment: Federal Express*	
	Company: Stantec		**Date:** 10/05/2020
	Received By: Linda Marquis	*Package Condition Upon Receipt: Sealed*	
	Company: RJ Lee Group, Inc.		**Date:** 10/05/2020

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	10/5/2020	Log in Date:	10/5/2020
Time Received:	8:28 AM	By:	Linda Marquis	COC# :	GEOCUF09302020_1C
Project:	AOH105914-0	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	3974 4203 7039				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?	✓		
Were there any discrepancies among samples and COC?		✓	
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

N/A

Analyst Signature: Linda Marquis 10-052020

Manager Signature: [signature] 10-05-2020

A0H1059514-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1 of 1
COC No:	GEOCUF09302020_1C
1 of 1 Pages	
Task Desc:	CUF_Geochemical_2020_10

Required Ship to Lab:

- Lab Name: RJ Lee Group, Inc.
- Lab Address: 350 Hochberg Road, Monroeville, PA 15146

Lab Manager Contact Information

- Lab PM: Monica Carse
- Phone/Fax: 724-325-1776
- Lab Email: MCarse@rjleegroup.com

Required Project Information:

- Site ID #: CUMBERLAND FOSSIL PLANT
- Project #:
- Site Address: Plant 815 Cumberland City Road
- City: Cumberland City State, Zip: TN, 37050
- Site PM Name: Paul Thomas
- Phone/Fax: (423) 751-2926
- Site PM Email: prthomas0@tva.gov

Required Sampler Information

- Sampler: C. Burton
- Sampling Company: Stantec
- Address: 3052 Beaumont Centre Circle
- City/State: Lexington, KY Phone No: 859-338-2791
- Sampling Team Number: 1
- Send EDD/Hard Copy to: tva_deliverables@envstd.com

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ______

- ☐ 24 Hours
- ☐ 3 Business Days
- ☐ 5 Business Days
- ☑ 10 Business Days (Standard)

Filtered: N | Preserve: None | Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: Feet)	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-212-SB01-0.0/5.0-09302020	CUF-212-SB01	0.0	5.0	SS	G	N	9/30/2020	1500	1	NA	X
2	CUF-212-SB01-5.0/10.0-09302020	CUF-212-SB01	5.0	10.0	SS	G	N	9/30/2020	1510	1	NA	x
3	CUF-212-SB01-10.0/15.0-09302020	CUF-212-SB01	10.0	15.0	SS	G	N	9/30/2020	1519	1	NA	x
4	CUF-212-SB01-15.0/18.5.0-09302020	CUF-212-SB01	15.0	18.5	SS	G	N	9/30/2020	1525	1	NA	x
5												
6												
7												
8												
9												
10												
11												
12												
13												

SM 10-2-2020

SM 10-2-2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Stone McCoy /SM/ Stantec [signature]	10/2/2020	12:30	Linda Mauger RJ Lee Group	10-05-2020	8:28 AM

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)

Fedex

SAMPLER NAME AND SIGNATURE

Cate Burton [signature]

Stone McCoy

Form TVA 30067A

Appendix B

Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 10/05/2020
Sample Received Date: 10/05/2020
RJLG Project: AOH1059514-0
Customer COC: GEOCUF09302020_1C
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-212-SB01-0.0/5.0-09302020	10522777	10/07/2020	09/30/2020	ND	Clay Opaques Quartz	Tan Sediment.
CUF-212-SB01-10.0/15.0-09302020	10522779	10/08/2020	09/30/2020	ND	Carbonate Clay Opaques Quartz	Tan Sediment.
CUF-212-SB01-15.0/18.5-09302020	10522780	10/08/2020	09/30/2020	ND	Carbonate Clay Opaques Quartz	Tan Sediment.
CUF-212-SB01-5.0/10.0-09302020	10522778	10/08/2020	09/30/2020	ND	Clay Opaques Quartz	Tan Sediment.
QC_CUF-212-SB01-10.0/15.0-09302020	10522781	10/08/2020	09/30/2020	ND	Carbonate Clay Mica Misc. Silicates Opaques Quartz	Light Brown Sediment

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

October 22, 2020

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1059625-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received two samples on October 13, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The samples were logged into RJ Lee Group project number AOH1059625-0-0 and assigned RJLG sample numbers as indicated in Appendix A.

The samples were received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, revised COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A
Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1059625-0
Project Name/Case #: Cumberland Fossil Plant

Received From:	**Relinquished To:**
Catherine Burton, PG Stantec 3052 Beaumont Centre Cir Lexington, KY 40513 United States Main: 859 608-0372	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10523276	CUF-212-SB02-51.0/54.0-10052020	10/13/2020 8:55 AM EDT
10523277	CUF-212-SB02-61.5/72.0-10052020	10/13/2020 8:55 AM EDT
10523278	QC_CUF-212-SB02-51.0/54.0-10052020	10/13/2020 8:55 AM EDT

	Received From: Catherine Burton, PG	*Method of Shipment:* *Federal Express*
	Company: Stantec	**Date:** 10/13/2020
	Received By: Linda Marquis	*Package Condition Upon Receipt:* *Sealed*
	Company: RJ Lee Group, Inc.	**Date:** 10/13/2020

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	10/13/2020	Log in Date:	10/13/2020
Time Received:	8:55 AM	By:	Linda Marquis	COC# :	GEOCUF10052020_1C
Project:	AOH1059625-0	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	3976 7518 1540				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	NA		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?	✓		
Were there any discrepancies among samples and COC?		✓	
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

NA

Analyst Signature: Linda Marquis 10-13-2020

Manager Signature: [signature] 10-13-2020

A0H105962500

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA

Tennessee Valley Authority

COOLER No.:	1	of	1
COC No:	GEOCUF10052020_1C		
1 of 1 Pages			
Task Desc:	CUF_Geochemical_2020_10		

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	C. Burton
Lab Address:	350 Hochberg Road	Project #:		Sampling Company:	Stantec
	Monroeville, PA 15146	Site Address	Plant 815 Cumberland City Road	Address	
		City	Cumberland City State, Zip: TN, 37050		Phone No:
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM:	Monica Carse	Phone/Fax:	(423) 751-2926	Sampling Team Number:	1
Phone/Fax:	724-325-1776	Site PM Email:	prthomas0@tva.gov	Send EDD/Hard Copy to:	tva_deliverables@envstd.com
Lab Email:	MCarse@rjleegroup.com				

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ______

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

Filtered: N — Preserve: None — Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Sample Depth (Depth Unit: Feet) Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-212-SB02-51.0/54.0-10052020	CUF-212-SB02	51.0	54.0	SS	G	N	10/5/2020	1510	1	NA	X
2	CUF-212-SB02-61.5/72.0-10052020	CUF-212-SB02	61.5	72.0	SS	G	N	10/5/2020	1559	1	NA	x
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

10/09/2020 CSS

10/09/2020 CSS

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Stone McCoy /SM/ Stantec	10/9/20		Linda Mauman RJ / KSlee Unay	10/13/2020	8:55AM

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Cate Burton Catherine Burton
	Stone McCoy

Form TVA 30067A

A0H10596250

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

REV_1 ME 10/16/2020

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1 of 1
COC No:	GEOCUF10052020_1C
Pages	1 of 1
Task Desc:	CUF_Geochemical_2020_10

Required Ship to Lab:
- Lab Name: RJ Lee Group, Inc.
- Lab Address: 350 Hochberg Road, Monroeville, PA 15146

Lab Manager Contact Information
- Lab PM: Monica Carse
- Phone/Fax: 724-325-1776
- Lab Email: MCarse@rjleegroup.com

Required Project Information:
- Site ID #: CUMBERLAND FOSSIL PLANT
- Project #:
- Site Address: Plant 815 Cumberland City Road
- City: Cumberland City State, Zip: TN, 37050
- Site PM Name: Paul Thomas
- Phone/Fax: (423) 751-2926
- Site PM Email: prthomas0@tva.gov

Required Sampler Information
- Sampler: C. Burton
- Sampling Company: Stantec
- Address: 3052 Beaumont Centre Circle, Lexington, KY
- Phone No: 859-336-2791 ME 10/16/2020
- Sampling Team Number: 1
- Send EDD/Hard Copy to: tva_deliverables@envstd.com

Analysis Turnaround Time
- ☐ CALENDAR DAYS ☑ WORKING DAYS
- TAT if different from Below
- ☐ 24 Hours
- ☐ 3 Business Days
- ☐ 5 Business Days
- ☑ 10 Business Days (Standard)

Filtered: N — Preserve: None — Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: Feet)	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-212-SB02-51.0/54.0-10052020	CUF-212-SB02	51.0	54.0	SS	G	N	10/5/2020	1510	1	NA	X
2	CUF-212-SB02-61.5/72.0-10052020	CUF-212-SB02	61.5	72.0	SS	G	N	10/5/2020	1559	1	NA	x
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

10/09/2020 CSB

10/09/2020 CSB

11:26 ME 10/16/2020

Additional Comments/Special Instructions:
Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Stone McCoy /SM/ Stantec	10/9/20		Linda Maman / KS Lee Group	10/13/2020	8:55 AM

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No

SHIPPING METHOD: (Select Appropriate)
Fedex

SAMPLER NAME AND SIGNATURE
- Cate Burton — Catherine Burton
- Stone McCoy

Form TVA 30087A

Appendix B

Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 10/22/2020
Sample Received Date: 10/13/2020
RJLG Project: AOH1059625-0
Customer COC: GEOCUF10052020_1C
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-212-SB02-51.0/54.0-10052020	10523276	10/19/2020	10/05/2020	ND	Clay Opaques Quartz	Tan Sediment.
CUF-212-SB02-61.5/72.0-10052020	10523277	10/19/2020	10/05/2020	ND	Clay Opaques Quartz	Tan Sediment.
QC_CUF-212-SB02-51.0/54.0-10052020	10523278	10/19/2020	10/05/2020	ND	Carbonate Clay Mica Misc. Silicates Opaques Quartz	Light Brown Sediment

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

October 22, 2020

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1059649-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received two samples on October 13, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The samples were logged into RJ Lee Group project number AOH1059649-0-0 and assigned RJLG sample numbers as indicated in Appendix A.

The samples were received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, revised COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A
Chain of Custody Forms

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

Effective Date: October 2019
Form A FOR.002.5

Chain of Custody

RJ Lee Group Work Order #: AOH1059649-0
Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Catherine Burton, PG Stantec 3052 Beaumont Centre Cir Lexington, KY 40513 United States Main: 859 608-0372	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10523352	CUF-212-SB03-27.0/31.5-10072020	10/13/2020 8:55 AM EDT
10523353	CUF-212-SB03-49.5/59.7-10072020	10/13/2020 8:55 AM EDT
10523354	QC_CUF-212-SB03-27.0/31.5-10072020	10/13/2020 8:55 AM EDT

	Received From: Catherine Burton, PG	*Method of Shipment:* *Federal Express*
	Company: Stantec	**Date:** 10/13/2020
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*
	Company: RJ Lee Group, Inc.	**Date:** 10/13/2020

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	10/13/2020	Log in Date:	10/13/2020
Time Received:	8:55 AM	By:	Monica Carse	COC# :	GEOCUF10072020_1C
Project:	AOH1059649-0	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	3976 7518 1540				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?	✓		
Were there any discrepancies among samples and COC?		✓	
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

N/A

Analyst Signature: M. Carse 10-14-2020

Manager Signature: [signature] 10-14-2020

AoH 1059649-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1 of 1
COC No:	GEOCUF10072020_1C
1 of 1 Pages	
Task Desc:	CUF_Geochemical_2020_10

Required Ship to Lab:	
Lab Name:	RJ Lee Group, Inc.
Lab Address:	350 Hochberg Road
	Monroeville, PA 15146
Lab Manager Contact Information	
Lab PM:	Monica Carse
Phone/Fax:	724-325-1776
Lab Email:	MCarse@rjleegroup.com

Required Project Information:			
Site ID #:	CUMBERLAND FOSSIL PLANT		
Project #:			
Site Address	Plant 815 Cumberland City Road		
City	Cumberland City	State, Zip:	TN, 37050
Site PM Name:	Paul Thomas		
Phone/Fax:	(423) 751-2926		
Site PM Email:	prthomas0@tva.gov		

Required Sampler Information			
Sampler:	Catherine Burton		
Sampling Company:	Stantec		
Address	3052 Beaumont Centre Circle		
City/State	Lexington, KY	Phone No:	859-338-2791
Sampling Team Number:	1		
Send EDD/Hard Copy to:	tva_deliverables@envstd.com		

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ________

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

Filtered: N — Preserve: None — Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: Feet)	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-212-SB03-27.0/31.5-10072020	CUF-212-SB03	27.0	31.5	SS	G	N	10/7/2020	1441	1	NA	X
2	CUF-212-SB03-49.5/59.7-10072020	CUF-212-SB03	49.5	59.7	SS	G	N	10/7/2020	1549	1	NA	X
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

10/09/2020 CSB

10/09/2020 CSB

10/09/2020 CSB

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Sample Receipt Conditions			
Catherine Burton/Stantec Catherine Burton	10/09/2020	1005	Jonc McCoy	10/9/20	1006	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
			M. Carse RJ Lee Group	10/13/2020	9:55 am	☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
						☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
						☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
						Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
~~Fedex~~ 10/09/2020 CSB FedEx	Catherine Burton Catherine Burton
CSB 10/09/2020	

Form TVA 30087A

AO# 1659649-0

Rev1

(abe, 10/22/2020)

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1 of 1
COC No:	GEOCUF10072020_1C
	1 of 1 Pages
Task Desc:	CUF_Geochemical_2020_10

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	Catherine Burton
Lab Address:	350 Hochberg Road	Project #:		Sampling Company:	Stantec
	Monroeville, PA 15146	Site Address	Plant 815 Cumberland City Road	Address	3052 Beaumont Centre Circle
		City	Cumberland City State, Zip: TN, 37050	City/State	Lexington, KY Phone No: 859-338-2791
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM:	Monica Carse	Phone/Fax:	(423) 751-2928	Sampling Team Number:	1
Phone/Fax:	724-325-1776	Site PM Email:	prthomas0@tva.gov	Send EDD/Hard Copy to:	tva_deliverables@emysid.com
Lab Email:	MCarse@rjleegroup.com				

Analysis Turnaround Time: ☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ______

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

Filtered: N; Preserve: None; Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Feet)	End Depth (Feet)	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-212-SB03-27.0/31.5-10072020	CUF-212-SB03	27.0	31.5	SS	G	N	10/7/2020	1441	1	NA	X
2	CUF-212-SB03-49.5/59.7-10072020	CUF-212-SB03	49.5	59.7	SS	G	N	10/7/2020	1549	1	NA	X
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

10/09/2020 CSB

10/09/2020 CSB

10/09/2020 CSB

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec Catherine Burton	10/09/2020	1005	Stone McCoy	10/9/20	1006
Stone McCoy	10/9/2020	13:21	M. Carse RJ Lee Group	10/13/2020	8:55 am
(abe, 10/22/2020)					

Sample Receipt Conditions: Temperature in °C; Sample on Ice? ☐ Yes ☑ No; Sample Intact? ☑ Yes ☐ No; Trip Blank? ☐ Yes ☑ No

SHIPPING METHOD: (Select Appropriate) ~~Fedex~~ 10/09/2020 CSB FedEX CSB 10/09/2020

SAMPLER NAME AND SIGNATURE: Catherine Burton Catherine Burton

Form TVA 30067A

Revised COC Rec'd 10-22-2020 8:47am MC

Appendix B

Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 10/22/2020
Sample Received Date: 10/13/2020
RJLG Project: AOH1059649-0
Customer COC: GEOCUF10072020_1C
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-212-SB03-27.0/31.5-10072020	10523352	10/19/2020	10/07/2020	1%	Clay Opaques Quartz	Tan Sediment.
CUF-212-SB03-49.5/59.7-10072020	10523353	10/19/2020	10/07/2020	1%	Clay Opaques Quartz	Tan Sediment.
QC_CUF-212-SB03-27.0/31.5-10072020	10523354	10/19/2020	10/07/2020	ND	NA	Light Brown Sediment

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

November 24, 2020

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1060059-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received six samples on October 5, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The samples were logged into RJ Lee Group project number AOH1060059-0 and assigned RJLG sample numbers as indicated in Appendix A.

The samples were received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, Revised COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A

Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1060059-0

Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Stone McCoy Stantec 601 Grassmere Park Suite 22 Nashville, TN 37211 United States Main: 615-885-1144	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10525041	CUF-212-SB02-0.0/5.0-10012020	10/05/2020 8:28 AM EDT
10525042	CUF-212-SB02-5.0/10.0-10012020	10/05/2020 8:28 AM EDT
10525043	CUF-212-SB02-10.0/15.0-10012020	10/05/2020 8:28 AM EDT
10525044	CUF-212-SB02-15.0/18.2-10012020	10/05/2020 8:28 AM EDT
10525045	CUF-212-SB01-51.8/54.0-10012020	10/05/2020 8:28 AM EDT
10525046	CUF-212-SB01-61.5/72.0-10012020	10/05/2020 8:28 AM EDT
10525047	QC_CUF-212-SB02-0.0/5.0-10012020	10/05/2020 8:28 AM EDT

	Received From: Stone McCoy	*Method of Shipment:* *Federal Express*	
	Company: Stantec		**Date:** 10/05/2020
	Received By: Linda Marquis	*Package Condition Upon Receipt:* *Sealed*	
	Company: RJ Lee Group, Inc.		**Date:** 10/05/2020

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

350 Hochberg Road, Monroeville, PA 15146
Phone: (724) 325-1776 | Fax: (724) 733-1799

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	10/5/2020	Log in Date:	11/18/2020
Time Received:	8:28 AM	By:	Linda Marquis	COC# :	GEOCUF10202020_1C REV2
Project:	AOH1060059-0	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	3974 4203 7039				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?		X	See Below
Were there any discrepancies among samples and COC?	X		See Below
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

There were inconsistencies between the dates in the sample ID's on the COC and those written on the jars.
A revised COC was issued on 11-17-2020.

Analyst Signature: M. Carso 11-18-2020

Manager Signature: [signature] 11-18-2020

AGH1060059-0

REV-2 (11/17/2020, abe)

REV_1 ME 10/16/2020

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.: 1 of 1
COC No: GEOCUF10012020_1C
1 of 1 Pages
Task Desc: CUF_Geochemical_2020_10

Required Ship to Lab:
Lab Name: RJ Lee Group, Inc.
Lab Address: 350 Hochberg Road, Monroeville, PA 15146
Lab Manager Contact Information
Lab PM: Monica Carse
Phone/Fax: 724-325-1776
Lab Email: MCarse@rjleegroup.com

Required Project Information:
Site ID #: CUMBERLAND FOSSIL PLANT
Project #:
Site Address: Plant 815 Cumberland City Road
City: Cumberland City State, Zip: TN, 37050
Site PM Name: Paul Thomas
Phone/Fax: (423) 751-2926
Site PM Email: prthomas0@tva.gov

Required Sampler Information
Sampler: C. Burton
Sampling Company: Stantec
Address: 3052 Beaumont Centre Circle
City/State: Lexington, KY Phone No: 859-338-2791
Sampling Team Number: 1
Send EDD/Hard Copy to: tva_deliverables@envstd.com

Analysis Turnaround Time
☐ CALENDAR DAYS ☑ WORKING DAYS
TAT if different from Below
☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

Filtered: N
Preserve: None
Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Feet)	End Depth (Feet)	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	~~CUF-212-SB02-0.0/5.0-09302020~~	CUF-212-SB02	0.0	5.0	SS	G	N	10/1/2020	1420	1	NA	X
2	~~CUF-212-SB02-5.0/10.0-09302020~~	CUF-212-SB02	5.0	10.0	SS	G	N	10/1/2020	1431	1	NA	X
3	~~CUF-212-SB02-10.0/15.0-09302020~~	CUF-212-SB02	10.0	15.0	SS	G	N	10/1/2020	1442	1	NA	X
4	~~CUF-212-SB02-15.0/18.2-09302020~~	CUF-212-SB02	15.0	18.2	SS	G	N	10/1/2020	1503	1	NA	X
5	CUF-212-SB01-51.8/54.0-10012020	CUF-212-SB01	51.8	54.0	SS	G	N	10/1/2020	1544	1	NA	X
6	CUF-212-SB01-61.5/72.0-10012020	CUF-212-SB01	61.5	72.0	SS	G	N	10/1/2020	1609	1	NA	X
7	CUF-212-SB02-0.0/~~0.5~~ 5.0 (11/17/2020, abe) -10012020 ME 10/16/2020											
8	CUF-212-SB02-5.0/10.0-10012020 ME 10/16/2020											
9	CUF-212-SB02-10.0/15.0-10012020 ME 10/16/2020											
10	CUF-212-SB02-15.0/18.2-10012020 ME 10/16/2020											
11												
12												
13												

SM 10-2-2020

SM 10-2-2020

Additional Comments/Special Instructions:
Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
Stone McCoy /SM/ Stantec [signature]	10/2/2020	1230	Linda Mawae / RJ Lee Group	10-05-2020	8:28AM	☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No

SHIPPING METHOD: (Select Appropriate) Fedex

SAMPLER NAME AND SIGNATURE
Cate Burton [signature]
Stone McCoy

Form TVA 30067A

COC REV 2 Rec'd 11-17-2020 @ 11:26am MC

Appendix B

Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 11/24/2020
Sample Received Date: 10/05/2020
RJLG Project: AOH1060059-0
Customer COC: GEOCUF10012020_1C
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-212-SB01-51.8/54.0-10012020	10525045	11/19/2020	10/01/2020	ND	Clay Opaques Quartz	Tan Sediment.
CUF-212-SB01-61.5/72.0-10012020	10525046	11/19/2020	10/01/2020	1%	Clay Opaques Quartz	Tan Sediment.
CUF-212-SB02-0.0/5.0-10012020	10525041	11/19/2020	10/01/2020	ND	Clay Opaques Quartz	Orange Sediment.
CUF-212-SB02-10.0/15.0-10012020	10525043	11/19/2020	10/01/2020	ND	Clay Opaques Quartz	Tan Sediment.
CUF-212-SB02-15.0/18.2-10012020	10525044	11/19/2020	10/01/2020	1%	Clay Opaques Quartz	Tan Sediment.
CUF-212-SB02-5.0/10.0-10012020	10525042	11/19/2020	10/01/2020	ND	Carbonate Clay Opaques Quartz	Tan Sediment.
QC_CUF-212-SB02-0.0/5.0-10012020	10525047	11/19/2020	10/01/2020	ND	NA	Yellowish Red Sediment

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

January 7, 2021

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1060292-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received one sample on December 10, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The sample was logged into RJ Lee Group project number AOH1060292-0 and assigned an RJLG sample number as indicated in Appendix A.

The sample was received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, revised COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A
Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1060292-0

Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Catherine Burton, PG Stantec 3052 Beaumont Centre Cir Lexington, KY 40513 United States Main: 859 608-0372	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10526559	CUF-212-SB02-25.5/26.4-10222020	12/10/2020 9:20 AM EST

	Received From: Catherine Burton, PG	*Method of Shipment:* *Federal Express*
	Company: Stantec	**Date:** 12/10/2020
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*
	Company: RJ Lee Group, Inc.	**Date:** 12/10/2020

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	12/10/2020	Log in Date:	12/10/2020
Time Received:	9:20 AM	By:	Monica Carse	COC#:	GEOCUF10222020_1C
Project:	AOH1060292-0	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	7811 3892 9378				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?	✓		
Were there any discrepancies among samples and COC?		✓	
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

N/A

Analyst Signature: M. Carse 12-11-2020

Manager Signature: [signature] 12-11-2020

AOH1060292-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1 of 1
COC No:	GEOCUF10222020_1C
	1 of 1 Pages
Task Desc:	CUF_Geochemical_2020_10

Required Ship to Lab:

Lab Name:	RJ Lee Group, Inc.
Lab Address:	350 Hochberg Road Monroeville, PA 15146

Lab Manager Contact Information

Lab PM:	Monica Carse
Phone/Fax:	724-325-1776
Lab Email:	MCarse@rjleegroup.com

Required Project Information:

Site ID #:	CUMBERLAND FOSSIL PLANT
Project #:	182603563
Site Address	Plant 815 Cumberland City Road
City	Cumberland City State, Zip: TN, 37050
Site PM Name:	Paul Thomas
Phone/Fax:	(423) 751-2926
Site PM Email:	prthomas0@tva.gov

Required Sampler Information

Sampler:	Catherine Burton
Sampling Company:	Stantec
Address	3052 Beaumont Centre Circle
City/State	Lexington, KY Phone No: 859-338-2791
Sampling Team Number:	1
Send EDD/Hard Copy to:	tva_deliverables@envstd.com

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ________

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

Filtered: N | Preserve: None | Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Sample Depth: Depth Unit / Start Depth	Select Unit / End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-212-SB02-25.5/26.4-10222020	212-SB02	25.5	26.4	SS	G	N	10/22/2020	1033	1	For informational use only per M. Dagon	X
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

CB 12/08/2020

CB 12/08/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec [signature]			CB 12/08/2020		
CB 12/08/2020					

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☑ Yes ☑ No CB 12/08/2020	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Catherine Burton [signature]
12/08/2020	

Rec'd By: M. Carse RJ Lee Group 12-10-2020 9:20am

Form TVA 30067A

A0H1060292-0

Rev 1, 12/18/2020, csb

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1 of 1
COC No:	GEOCUF10222020_1C
1 of 1 Pages	
Task Desc:	CUF_Geochemical_2020_10

Required Ship to Lab:

Lab Name:	RJ Lee Group, Inc.
Lab Address:	350 Hochberg Road Monroeville, PA 15146

Lab Manager Contact Information

Lab PM:	Monica Carse
Phone/Fax:	724-325-1776
Lab Email:	MCarse@rjleegroup.com

Required Project Information:

Site ID #:	CUMBERLAND FOSSIL PLANT
Project #:	182603563
Site Address	Plant 815 Cumberland City Road
City	Cumberland City State, Zip: TN, 37050
Site PM Name:	Paul Thomas
Phone/Fax:	(423) 751-2926
Site PM Email:	prthomas0@tva.gov

Required Sampler Information

Sampler:	Catherine Burton
Sampling Company:	Stantec
Address	3052 Beaumont Centre Circle
City/State	Lexington, KY Phone No: 859-338-2791
Sampling Team Number:	1
Send EDD/Hard Copy to:	tva_deliverables@envstd.com

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ________

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	Filtered N / Preserve None / Analysis PLM
1	CUF-212-SB02-25.5/26.4-10222020	CUF-212-SB02	25.5	26.4	SS	G	N	10/22/2020	1033	1	For informational use only per M. Dagon	X
2		(12/18/2020, csb)										
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

Depth Unit / Select Unit

CB 12/08/2020

CB 12/08/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec Catherine Burton (12/18/2020, csb)	12/09/2020	1248	CB 12/08/2020		

CB 12/08/2020

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☑ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

MC 12/10/2020

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Catherine Burton Catherine Burton

12/08/2020

Rec'd By: M. Carse RJ Lee Group 12-10-2020 9:20am

Form TVA 30067A

Appendix B

Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 12/17/2020
Sample Received Date: 12/10/2020
RJLG Project: AOH1060292-0
Customer COC: GEOCUF10222020_1C
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-212-SB02-25.5/26.4-10 222020	10526559	12/17/2020	10/22/2020	71%	Carbonate Clay Opaques Coal	Dark gray sediment

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

January 7, 2021

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1060294-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received one sample on December 10, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The sample was logged into RJ Lee Group project number AOH1060294-0 and assigned an RJLG sample number as indicated in Appendix A.

The sample was received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, revised COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A
Chain of Custody Forms

Effective Date: October 2019
Form A FOR.002.5

Chain of Custody

RJ Lee Group Work Order #: AOH1060294-0
Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Catherine Burton, PG Stantec 3052 Beaumont Centre Cir Lexington, KY 40513 United States Main: 859 608-0372	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10526561	CUF-211-SB01-1.5/4.5-11032020	12/10/2020 9:20 AM EST

	Received From: Catherine Burton, PG	*Method of Shipment:* *Federal Express*
	Company: Stantec	**Date:** 12/10/2020
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*
	Company: RJ Lee Group, Inc.	**Date:** 12/10/2020

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	12/10/2020	Log in Date:	12/10/2020
Time Received:	9:20 AM	By:	Monica Carse	COC# :	GEOCUF11032020_1C
Project:	AOH1060294-0	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	7811 3892 9378				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?	✓		
Were there any discrepancies among samples and COC?		✓	
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

N/A

Analyst Signature: M. Carse 12-11-2020

Manager Signature: [signature] 12-11-2020

A0H1060294-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1 of 1
COC No:	GEOCUF11032020_1C
1 of 1 Pages	
Task Desc:	CUF_Geochemical_2020_11

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	Catherine Burton
Lab Address:	350 Hochberg Road	Project #:	182603563	Sampling Company:	Stantec
	Monroeville, PA 15146	Site Address	Plant 815 Cumberland City Road	Address	3052 Beaumont Centre Circle
		City	Cumberland City State, Zip: TN, 37050	City/State	Lexington, KY Phone No: 859-338-2791
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM:	Monica Carse	Phone/Fax:	(423) 751-2926	Sampling Team Number:	1
Phone/Fax:	724-325-1776	Site PM Email:	prthomas0@tva.gov	Send EDD/Hard Copy to:	tva_deliverables@envstd.com
Lab Email:	MCarse@rjleegroup.com				

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ________

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Sample Depth: Start Depth (Depth Unit)	Sample Depth: End Depth (Select Unit)	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	Filtered: N / Preserve: None / Analysis: PLM
1	CUF-211-SB01-1.5/4.5-11032020	211-SB01	1.5	4.5	SS	G	N	11/3/2020	1531	1	NA	X
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

CB 12/08/2020

CB 12/08/2020

CB 12/08/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec Catherine Burton			CB 12/08/2020		
			CB 12/08/2020		

Sample Receipt Conditions			
☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Catherine Burton Catherine Burton
CB 12/08/2020	

Rec'd By: M. Carse RJ Lee Group 12-10-2020 9:20 am

Form TVA 30067A

A0H1060294-0

Rev 1, 12/18/2020, csb

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1	of	1
COC No:	GEOCUF11032020_1C		
1 of 1 Pages			
Task Desc:	CUF_Geochemical_2020_11		

Required Ship to Lab:

Lab Name:	RJ Lee Group, Inc.
Lab Address:	350 Hochberg Road Monroeville, PA 15146

Lab Manager Contact Information

Lab PM:	Monica Carse
Phone/Fax:	724-325-1776
Lab Email:	MCarse@rjleegroup.com

Required Project Information:

Site ID #:	CUMBERLAND FOSSIL PLANT
Project #:	182603563
Site Address	Plant 815 Cumberland City Road
City	Cumberland City State, Zip: TN, 37050
Site PM Name:	Paul Thomas
Phone/Fax:	(423) 751-2926
Site PM Email:	prthomas0@tva.gov

Required Sampler Information

Sampler:	Catherine Burton
Sampling Company:	Stantec
Address	3052 Beaumont Centre Circle
City/State	Lexington, KY Phone No: 859-338-2791
Sampling Team Number:	1
Send EDD/Hard Copy to:	tva_deliverables@envstd.com

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ________

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

Filtered: N | Preserve: None | Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit)	End Depth (Select Unit)	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-211-SB01-1.5/4.5-11032020	CUF-211-SB01	1.5	4.5	SS	G	N	11/3/2020	1531	1	NA	X
2		(12/18/2020, csb)										
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

CB 12/08/2020

CB 12/08/2020

CB 12/08/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec Catherine Burton (12/18/2020, csb)	12/09/2020	1248	CB 12/08/2020		
CB 12/08/2020					

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Catherine Burton Catherine Burton
CB 12/08/2020	

Rec'd By: M. Carse RJ Lee Group 12-10-2020 9:20 am

Form TVA 30067A

Appendix B

Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 12/17/2020
Sample Received Date: 12/10/2020
RJLG Project: AOH1060294-0
Customer COC: GEOCUF11032020_1C
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-211-SB01-1.5/4.5-1103 2020	10526561	12/17/2020	11/03/2020	ND	Carbonate Clay Mica Organic Particulate Coal	Brown-orange sediment

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

January 7, 2021

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1060296-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received five samples on December 10, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The samples were logged into RJ Lee Group project number AOH1060296-0 and assigned RJLG sample numbers as indicated in Appendix A.

The samples were received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, revised COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A

Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1060296-0

Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Catherine Burton, PG Stantec 3052 Beaumont Centre Cir Lexington, KY 40513 United States Main: 859 608-0372	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10526571	CUF-211-SB01-10.5/15.0-11062020	12/10/2020 9:20 AM EST
10526572	CUF-211-SB01-15.0/19.5-11062020	12/10/2020 9:20 AM EST
10526573	CUF-211-SB01-22.5/24.0-11062020	12/10/2020 9:20 AM EST
10526574	CUF-211-SB01-33.0/34.5-11062020	12/10/2020 9:20 AM EST
10526575	CUF-211-SB01-58.5/60.0-11062020	12/10/2020 9:20 AM EST
10526576	QC_CUF-211-SB01-33.0/34.5-11062020	12/10/2020 9:20 AM EST

	Received From: Catherine Burton, PG	*Method of Shipment:* *Federal Express*		
	Company: Stantec		**Date:** 12/10/2020	
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*		
	Company: RJ Lee Group, Inc.		**Date:** 12/10/2020	

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

350 Hochberg Road, Monroeville, PA 15146
Phone: (724) 325-1776 | Fax: (724) 733-1799

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	12/10/2020	Log in Date:	12/10/2020
Time Received:	9:20 AM	By:	Monica Carse	COC#:	GEOCUF11062020_1C
Project:	AOH1060296-0	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	7811 3892 9378				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?	✓		
Were there any discrepancies among samples and COC?		✓	
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

N/A

Analyst Signature: M. Carse 12-11-2020

Manager Signature: [signature] 12-11-2020

AOH1060296-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1	of	1
COC No:	GEOCUF11062020_1C		
1 of 1 Pages			
Task Desc:	CUF_Geochemical_2020_11		

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	Catherine Burton
Lab Address:	350 Hochberg Road	Project #:	182603563	Sampling Company:	Stantec
	Monroeville, PA 15146	Site Address	Plant 815 Cumberland City Road	Address	3052 Beaumont Centre Circle
		City	Cumberland City State, Zip: TN, 37050	City/State	Lexington, KY Phone No: 859-338-2791
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM:	Monica Carse	Phone/Fax:	(423) 751-2926	Sampling Team Number:	1
Phone/Fax:	724-325-1776	Site PM Email:	prthomas0@tva.gov	Send EDD/Hard Copy to:	tva_deliverables@envstd.com
Lab Email:	MCarse@rjleegroup.com				

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ________

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

Filtered: N | Preserve: None | Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit)	End Depth (Select Unit)	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-211-SB01-10.5/15.0-11062020	211-SB01	10.5	15.0	SS	G	N	11/6/2020	1949	1	NA	X
2	CUF-211-SB01-15.0/19.5-11062020	211-SB01	15.0	19.5	SS	G	N	11/6/2020	2008	1	NA	X
3	CUF-211-SB01-22.5/24.0-11062020	211-SB01	22.5	24.0	SS	G	N	11/6/2020	2031	1	NA	X
4	CUF-211-SB01-33.0/34.5-11062020	211-SB01	33.0	34.5	SS	G	N	11/6/2020	2049	1	NA	X
5	CUF-211-SB01-58.5/60.0-11062020	211-SB01	58.5	60.0	SS	G	N	11/6/2020	2106	1	NA	X
6												
7												
8												
9												
10												
11												
12												
13												

CB 12/08/2020

CB 12/08/2020

CB 12/08/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec Catherine Burton			CB 12/08/2020		
CB 12/08/2020					

Sample Receipt Conditions	Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
Row 1	☑ No	☑ No	☑ Yes	☑ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Catherine Burton Catherine Burton
CB 12/08/2020	

Rec'd By: M. Carse RJLeeGroup 12-10-2020 9:20 am

Form TVA 30067A

AOH1060296-0

Rev 1, 12/18/2020, csb

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1 of 1
COC No:	GEOCUF11062020_1C
	1 of 1 Pages
Task Desc:	CUF_Geochemical_2020_11

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	Catherine Burton
Lab Address:	350 Hochberg Road	Project #:	182603563	Sampling Company:	Stantec
	Monroeville, PA 15146	Site Address	Plant 815 Cumberland City Road	Address	3052 Beaumont Centre Circle
		City	Cumberland City; State, Zip: TN, 37050	City/State	Lexington, KY; Phone No: 859-338-2791
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM:	Monica Carse	Phone/Fax:	(423) 751-2926	Sampling Team Number:	1
Phone/Fax:	724-325-1776	Site PM Email:	prthomas0@tva.gov	Send EDD/Hard Copy to:	tva_deliverables@envstd.com
Lab Email:	MCarse@rjleegroup.com				

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ________

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

Filtered: N | Preserve: None | Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-211-SB01-10.5/15.0-11062020	CUF-211-SB01	10.5	15.0	SS	G	N	11/6/2020	1949	1	NA	X
2	CUF-211-SB01-15.0/19.5-11062020	CUF-211-SB01	15.0	19.5	SS	G	N	11/6/2020	2008	1	NA	X
3	CUF-211-SB01-22.5/24.0-11062020	CUF-211-SB01	22.5	24.0	SS	G	N	11/6/2020	2031	1	NA	X
4	CUF-211-SB01-33.0/34.5-11062020	CUF-211-SB01	33.0	34.5	SS	G	N	11/6/2020	2049	1	NA	X
5	CUF-211-SB01-58.5/60.0-11062020	CUF-211-SB01	58.5	60.0	SS	G	N	11/6/2020	2106	1	NA	X
6		(12/18/2020, csb)										
7												
8												
9												
10												
11												
12												
13												

CB 12/08/2020

CB 12/08/2020

CB 12/08/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec Catherine Burton (12/18/2020, csb)	12/09/2020	1248	CB 12/08/2020		

CB 12/08/2020

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Catherine Burton Catherine Burton

CB 12/08/2020

Rec'd By: M. Carse RJLeeGroup 12-10-2020 9:20 am

Form TVA 30067A

Appendix B

Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 12/17/2020
Sample Received Date: 12/10/2020
RJLG Project: AOH1060296-0
Customer COC: GEOCUF11062020_1C
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-211-SB01-10.5/15.0-11 062020	10526571	12/16/2020	11/06/2020	ND	Clay Mica Opaques Organic Particulate Quartz	Brown sediment
CUF-211-SB01-15.0/19.5-11 062020	10526572	12/17/2020	11/06/2020	1%	Amphibole Carbonate Clay Coal	Brown sediment
CUF-211-SB01-22.5/24.0-11 062020	10526573	12/16/2020	11/06/2020	ND	Clay Mica Opaques Organic Particulate Quartz	Dark brown sediment
CUF-211-SB01-33.0/34.5-11 062020	10526574	12/16/2020	11/06/2020	ND	Carbonate Clay Mica Organic Particulate Quartz	Brown sediment

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-211-SB01-58.5/60.0-11 062020	10526575	12/16/2020	11/06/2020	6%	Clay Mica Opaques Organic Particulate Coal	Dark gray sediment
QC_CUF-211-SB01-33.0/34.5 -11062020	10526576	12/16/2020	11/06/2020	ND	NA	Brown Sediment

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

January 7, 2021

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1060303-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received four samples on December 10, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The samples were logged into RJ Lee Group project number AOH1060303-0 and assigned RJLG sample numbers as indicated in Appendix A.

The samples were received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, revised COC's and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A
Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1060303-0
Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Catherine Burton, PG Stantec 3052 Beaumont Centre Cir Lexington, KY 40513 United States Main: 859 608-0372	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10526638	CUF-211-SB01-4.5/10.5-11042020	12/10/2020 9:20 AM EST
10526639	CUF-211-SB01-30.0/34.5-11042020	12/10/2020 9:20 AM EST
10526640	CUF-211-SB01-63.0/67.5-11042020	12/10/2020 9:20 AM EST
10526641	CUF-211-SB01-67.5/73.5-11042020	12/10/2020 9:20 AM EST

	Received From: Catherine Burton, PG	*Method of Shipment:* *Federal Express*
	Company: Stantec	**Date:** 12/10/2020
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*
	Company: RJ Lee Group, Inc.	**Date:** 12/10/2020

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	12/10/2020	Log In Date:	12/10/2020
Time Received:	9:20 AM	By:	Monica Carse	COC#:	GEOCUF11042020_1C
Project:	AOH1060303-0	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	7811 3892 9378				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?		X	See Below
Were there any discrepancies among samples and COC?	X		See Below
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

We did not receive a sample identified as CUF-211-SB01-1.5/4.5-11042020. We did receive a sample identified as CUF-211-SB01-4.5/10.5-11042020 which was not listed on the COC. Catherine Burton verified the sample ID and a revised COC was received.

Analyst Signature: M Carse 12-11-2020

Manager Signature: [signature] 12-11-2020

A0H1060303-0

Rev 1, 12/10/2020 csb

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1 of 1
COC No:	GEOCUF11042020_1C
1 of 1 Pages	
Task Desc:	CUF_Geochemical_2020_11

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	Catherine Burton
Lab Address:	350 Hochberg Road	Project #:	182603563	Sampling Company:	Stantec
	Monroeville, PA 15146	Site Address	Plant 815 Cumberland City Road	Address	3052 Beaumont Centre Circle
		City	Cumberland City State, Zip: TN 37050	City/State	Lexington, KY Phone No: 859-338-2791
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM:	Monica Carse	Phone/Fax:	(423) 751-2926	Sampling Team Number:	1
Phone/Fax:	724-325-1776	Site PM Email:	prthomas0@tva.gov	Send EDD/Hard Copy to:	tva_deliverables@envstd.com
Lab Email:	MCarse@rjleegroup.com				

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ________

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

Filtered: N | Preserve: None | Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	~~CUF-211-SB01-1.5/4.5-11042020~~ CUF-211-SB01-4.5/10.5-11042020 (12/10/2020, csb)	211-SB01	~~1.5~~ 4.5	~~4.5~~ 10.5	SS	G	N	11/4/2020	1240	1	NA	X
2	CUF-211-SB01-30.0/34.5-11042020	211-SB01	30.0	34.5	SS	G	N	11/4/2020	1451	1	NA	X
3	CUF-211-SB01-63.0/67.5-11042020	211-SB01	63.0	67.5	SS	G	N	11/4/2020	1532	1	NA	X
4	CUF-211-SB01-67.5/73.5-11042020	211-SB01	67.5	73.5	SS	G	N	11/4/2020	1609	1	NA	X
5												
6												
7												
8												
9												
10												
11												
12												
13												

CB 12/08/2020

CB 12/08/2020

CB 12/08/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec Catherine Burton			CB 12/08/2020		

CB 12/08/2020

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Catherine Burton Catherine Burton

Rec'd By; M. Carse RJLee Group 12-10-2020 9:20 am

Form TVA 30087A

A0H1060303-0

~~Rev 1, 12/10/2020 csb~~
Rev 2, 12/18/2020, csb

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1 of 1
COC No:	GEOCUF11042020_1C
1 of 1 Pages	
Task Desc:	CUF_Geochemical_2020_11

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	Catherine Burton
Lab Address:	350 Hochberg Road	Project #:	182603563	Sampling Company:	Stantec
	Monroeville, PA 15146	Site Address	Plant 815 Cumberland City Road	Address	3052 Beaumont Centre Circle
		City	Cumberland City State, Zip: TN 37050	City/State	Lexington, KY Phone No: 859-338-2791
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM:	Monica Carse	Phone/Fax:	(423) 751-2926	Sampling Team Number:	1
Phone/Fax:	724-325-1776	Site PM Email:	prthomas0@tva.gov	Send EDD/Hard Copy to:	tva_deliverables@envstd.com
Lab Email:	MCarse@rjleegroup.com				

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ________

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

Filtered: N — Preserve: None — Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit)	End Depth (Select Unit)	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-211-SB01-4.5/10.5-11042020 (12/10/2020, csb) ~~CUF-211-SB01-1.5/4.5-11042020~~	CUF-211-SB01	4.5 ~~1.5~~	10.5 ~~4.5~~	SS	G	N	11/4/2020	1240	1	NA	X
2	CUF-211-SB01-30.0/34.5-11042020	CUF-211-SB01	30.0	34.5	SS	G	N	11/4/2020	1451	1	NA	X
3	CUF-211-SB01-63.0/67.5-11042020	CUF-211-SB01	63.0	67.5	SS	G	N	11/4/2020	1532	1	NA	X
4	CUF-211-SB01-67.5/73.5-11042020	CUF-211-SB01 (12/18/2020, csb)	67.5	73.5	SS	G	N	11/4/2020	1609	1	NA	X
5												
6												
7												
8												
9												
10												
11												
12												
13												

CB 12/08/2020

CB 12/08/2020

CB 12/08/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec Catherine Burton	(12/18/2020, csb) 12/09/2020	1248	CB 12/08/2020		

CB 12/08/2020

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Catherine Burton Catherine Burton

Rec'd By: M. Carse RJLee Group 12-10-2020 9:20 am

Form TVA 30087A

Appendix B
Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 12/17/2020
Sample Received Date: 12/10/2020
RJLG Project: AOH1060303-0
Customer COC: GEOCUF11042020_1C REV 1
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-211-SB01-30.0/34.5-11042020	10526639	12/15/2020	11/04/2020	ND	Carbonate Clay Opaques Quartz	Brown sediment
CUF-211-SB01-4.5/10.5-11042020	10526638	12/15/2020	11/04/2020	ND	Carbonate Clay Opaques Organic Particulate Quartz	Red brown sediment
CUF-211-SB01-63.0/67.5-11042020	10526640	12/15/2020	11/04/2020	1%	Carbonate Clay Opaques Organic Particulate Quartz Coal	Brown sediment
CUF-211-SB01-67.5/73.5-11042020	10526641	12/15/2020	11/04/2020	3%	Carbonate Clay Opaques Organic Particulate Quartz Coal	Dark brown sediment

Disclaimer Notes

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* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

January 7, 2021

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1060310-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received six samples on December 10, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The samples were logged into RJ Lee Group project number AOH1060310-0 and assigned RJLG sample numbers as indicated in Appendix A.

The samples were received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, revised COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A

Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1060310-0

Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Catherine Burton, PG Stantec 3052 Beaumont Centre Cir Lexington, KY 40513 United States Main: 859 608-0372	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10526732	CUF-211-SB02-0.0/5.0-11092020	12/10/2020 9:20 AM EST
10526733	CUF-211-SB02-6.0/10.0-11092020	12/10/2020 9:20 AM EST
10526734	CUF-211-SB02-10.0/15.0-11092020	12/10/2020 9:20 AM EST
10526735	CUF-211-SB02-15.0/20.0-11092020	12/10/2020 9:20 AM EST
10526736	CUF-211-SB02-57.0/61.5-11092020	12/10/2020 9:20 AM EST
10526737	CUF-211-SB02-61.5/66.0-11092020	12/10/2020 9:20 AM EST

	Received From: Catherine Burton, PG	*Method of Shipment:* *Federal Express*	
	Company: Stantec		**Date:** 12/10/2020
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*	
	Company: RJ Lee Group, Inc.		**Date:** 12/10/2020

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

350 Hochberg Road, Monroeville, PA 15146
Phone: (724) 325-1776 | Fax: (724) 733-1799

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	12/10/2020	Log in Date:	12/10/2020
Time Received:	9:20 AM	By:	Monica Carse	COC#:	GEOCUF11092020_1C
Project:	AOH1060310-0	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	7811 3892 9378				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?	✓		
Were there any discrepancies among samples and COC?		✓	
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

N/A

Analyst Signature: M. Carse 12-11-2020

Manager Signature: [signature] 12-11-2020

A0H1060310-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1	of	1
COC No:	GEOCUF11092020_1C		
1 of 1 Pages			
Task Desc:	CUF_Geochemical_2020_11		

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	Catherine Burton
Lab Address:	350 Hochberg Road	Project #:	182603563	Sampling Company:	Stantec
	Monroeville, PA 15146	Site Address	Plant 815 Cumberland City Road	Address	3052 Beaumont Centre Circle
		City	Cumberland City State, Zip: TN, 37050	City/State	Lexington, KY Phone No: 40513
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM:	Monica Carse	Phone/Fax:	(423) 751-2926	Sampling Team Number:	1
Phone/Fax:	724-325-1776	Site PM Email:	prthomas0@tva.gov	Send EDD/Hard Copy to:	tva_deliverables@envstd.com
Lab Email:	MCarse@rjleegroup.com				

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ______

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

Filtered: N | Preserve: None | Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-211-SB02-0.0/5.0-11092020	211-SB02	0.0	5.0	SS	G	N	11/9/2020	1245	1	NA	X
2	CUF-211-SB02-6.0/10.0-11092020	211-SB02	6.0	10.0	SS	G	N	11/9/2020	1232	1	NA	X
3	CUF-211-SB02-10.0/15.0-11092020	211-SB02	10.0	15.0	SS	G	N	11/9/2020	1206	1	NA	X
4	CUF-211-SB02-15.0/20.0-11092020	211-SB02	15.0	20.0	SS	G	N	11/9/2020	1155	1	NA	X
5	CUF-211-SB02-57.0/61.5-11092020	211-SB02	57.0	61.5	SS	G	N	11/9/2020	1425	1	NA	X
6	CUF-211-SB02-61.5/66.0-11092020	211-SB02	61.5	66.0	SS	G	N	11/9/2020	1450	1	NA	X
7												
8												
9												
10												
11												
12												
13												

(Sample Depth: Depth Unit / Select Unit)

CB 12/08/2020

CB 12/08/2020

CB 12/08/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec			CB 12/08/2020		

CB 12/08/2020

Sample Receipt Conditions	Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
Row 1	☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
Row 2	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Row 3	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Row 4	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Catherine Burton

CB 12/08/2020

Rec'd By - M. Carse RJLeeGroup 12-10-2020 9:20am

Form TVA 30067A

A0H1060310-0

Rev 1, 12/18/2020, csb

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1	of	1
COC No:	GEOCUF11092020_1C		
1 of 1 Pages			
Task Desc:	CUF_Geochemical_2020_11		

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	Catherine Burton
Lab Address:	350 Hochberg Road	Project #:	182603563	Sampling Company:	Stantec
	Monroeville, PA 15146	Site Address	Plant 815 Cumberland City Road	Address	3052 Beaumont Centre Circle
		City	Cumberland City State, Zip: TN, 37050	City/State	Lexington, KY Phone No: 40513
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM:	Monica Carse	Phone/Fax:	(423) 751-2926	Sampling Team Number:	1
Phone/Fax:	724-325-1776	Site PM Email:	prthomas0@tva.gov	Send EDD/Hard Copy to:	tva_deliverables@envstd.com
Lab Email:	MCarse@rjleegroup.com				

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ______

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

Filtered: N — Preserve: None — Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-211-SB02-0.0/5.0-11092020	CUF-211-SB02	0.0	5.0	SS	G	N	11/9/2020	1245	1	NA	X
2	CUF-211-SB02-6.0/10.0-11092020	CUF-211-SB02	6.0	10.0	SS	G	N	11/9/2020	1232	1	NA	X
3	CUF-211-SB02-10.0/15.0-11092020	CUF-211-SB02	10.0	15.0	SS	G	N	11/9/2020	1206	1	NA	X
4	CUF-211-SB02-15.0/20.0-11092020	CUF-211-SB02	15.0	20.0	SS	G	N	11/9/2020	1155	1	NA	X
5	CUF-211-SB02-57.0/61.5-11092020	CUF-211-SB02	57.0	61.5	SS	G	N	11/9/2020	1425	1	NA	X
6	CUF-211-SB02-61.5/66.0-11092020	CUF-211-SB02 (12/18/2020, csb)	61.5	66.0	SS	G	N	11/9/2020	1450	1	NA	X
7												
8												
9												
10												
11												
12												
13												

Sample Depth: Depth Unit / Select Unit

CB 12/08/2020

CB 12/08/2020

CB 12/08/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec (12/18/2020, csb)	12/09/2020	1248	CB 12/08/2020		

CB 12/08/2020

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Catherine Burton

CB 12/08/2020

Rec'd By - M. Carse RJLeeGroup 12-10-2020 9:20am

Form TVA 30067A

Appendix B

Mineral Identification Report

Mineral Identification

RJ LeeGroup, Inc.

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 01/07/2021
Sample Received Date: 12/10/2020
RJLG Project: AOH1060310-0
Customer COC: GEOCUF11092020_1C
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-211-SB02-0.0/5.0-11092020	10526732	12/16/2020	11/09/2020	ND	Carbonate Clay Mica Opaques Organic Particulate	Orange brown sediment
CUF-211-SB02-10.0/15.0-11092020	10526734	12/15/2020	11/09/2020	ND	Clay Opaques Organic Particulate Quartz	Brown sediment
CUF-211-SB02-15.0/20.0-11092020	10526735	12/16/2020	11/09/2020	7%	Carbonate Clay Mica Organic Particulate Coal	Brown sediment
CUF-211-SB02-57.0/61.5-11092020	10526736	12/16/2020	11/09/2020	5%	Carbonate Clay Mica Organic Particulate Coal	Brown sediment

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-211-SB02-6.0/10.0-110 92020	10526733	12/16/2020	11/09/2020	1%	Carbonate Clay Mica Organic Particulate Coal	Red brown sediment
CUF-211-SB02-61.5/66.0-11 092020	10526737	12/16/2020	11/09/2020	ND	Carbonate Clay Mica Organic Particulate Coal	Brown sediment

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

January 7, 2021

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1060313-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received one sample on December 10, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The sample was logged into RJ Lee Group project number AOH1060313-0 and assigned an RJLG sample number as indicated in Appendix A.

The sample was received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, revised COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A

Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1060313-0
Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Catherine Burton, PG Stantec 3052 Beaumont Centre Cir Lexington, KY 40513 United States Main: 859 608-0372	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10526742	CUF-211-SB02-30.0/34.5-11102020	12/10/2020 9:20 AM EST

	Received From: Catherine Burton, PG	*Method of Shipment:* *Federal Express*
	Company: Stantec	**Date:** 12/10/2020
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*
	Company: RJ Lee Group, Inc.	**Date:** 12/10/2020

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	12/10/2020	Log in Date:	12/10/2020
Time Received:	9:20 AM	By:	Monica Carse	COC# :	GEOCUF11102020_1C
Project:	AOH1060313-0	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	7811 3892 9378				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?	✓		
Were there any discrepancies among samples and COC?		✓	
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

N/A

Analyst Signature: M. Carse 12-11-2020

Manager Signature: [signature] 12-11-2020

A0H1060313-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1	of	1
COC No:	GEOCUF11102020_1C		
1 of 1 Pages			
Task Desc:	CUF_Geochemical_2020_11		

Required Ship to Lab:

Lab Name:	RJ Lee Group, Inc.
Lab Address:	350 Hochberg Road, Monroeville, PA 15146

Lab Manager Contact Information

Lab PM:	Monica Carse
Phone/Fax:	724-325-1776
Lab Email:	MCarse@rjleegroup.com

Required Project Information:

Site ID #:	CUMBERLAND FOSSIL PLANT
Project #:	182603563
Site Address	Plant 815 Cumberland City Road
City	Cumberland City State, Zip: TN, 37050
Site PM Name:	Paul Thomas
Phone/Fax:	(423) 751-2926
Site PM Email:	prthomas0@tva.gov

Required Sampler Information

Sampler:	Catherine Burton
Sampling Company:	Stantec
Address	3052 Beaumont Centre Circle
City/State	Lexington, KY Phone No: 40513
Sampling Team Number:	1
Send EDD/Hard Copy to:	tva_deliverables@envstd.com

Analysis Turnaround Time

- [ ] CALENDAR DAYS
- [x] WORKING DAYS

TAT if different from Below ________

- [ ] 24 Hours
- [ ] 3 Business Days
- [ ] 5 Business Days
- [x] 10 Business Days (Standard)

Filtered: N — Preserve: None — Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Sample Depth: Start Depth (Depth Unit)	End Depth (Select Unit)	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-211-SB02-30.0/34.5-11102020	211-SB02	30.0	34.5	SS	C	N	11/10/2020	1240	1	NA	X
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

CB 12/08/2020

CB 12/08/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec Catherine Burton	CB 12/08/2020				
CB 12/08/2020					

Sample Receipt Conditions

	Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
1	No	No	Yes	No
2				
3				
4				

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Catherine Burton Catherine Burton

CB 12/08/2020

Rec'd By: M. Carse RJLee Group 12-10-2020 9:20 am

Form TVA 30087A

A0H1060313-0

Rev 1, 12/18/2020, csb

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1	of	1
COC No:	GEOCUF11102020_1C		
1 of 1 Pages			
Task Desc:	CUF_Geochemical_2020_11		

Required Ship to Lab:

Lab Name:	RJ Lee Group, Inc.
Lab Address:	350 Hochberg Road Monroeville, PA 15146

Lab Manager Contact Information

Lab PM:	Monica Carse
Phone/Fax:	724-325-1776
Lab Email:	MCarse@rjleegroup.com

Required Project Information:

Site ID #:	CUMBERLAND FOSSIL PLANT
Project #:	182603563
Site Address	Plant 815 Cumberland City Road
City	Cumberland City; State, Zip: TN, 37050
Site PM Name:	Paul Thomas
Phone/Fax:	(423) 751-2926
Site PM Email:	prthomas0@tva.gov

Required Sampler Information

Sampler:	Catherine Burton
Sampling Company:	Stantec
Address	3052 Beaumont Centre Circle
City/State	Lexington, KY; Phone No: 40513
Sampling Team Number:	1
Send EDD/Hard Copy to:	tva_deliverables@envstd.com

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ________

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Sample Depth, Depth Unit)	End Depth (Select Unit)	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	Filtered N / Preserve None / Analysis PLM
1	CUF-211-SB02-30.0/34.5-11102020	CUF-211-SB02 (12/18/2020, csb)	30.0	34.5	SS	~~C~~ G (12/18/2020, csb)	N	11/10/2020	1240	1	NA	X
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

CB 12/08/2020

CB 12/08/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/Stantec Catherine Burton	(12/18/2020, csb) 12/09/2020	1248	CB 12/08/2020		

CB 12/08/2020

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Catherine Burton Catherine Burton

CB 12/08/2020

Rec'd By: M. Carse RJLee Group 12-10-2020 9:20 am

Form TVA 30087A

Appendix B

Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 01/07/2021
Sample Received Date: 12/10/2020
RJLG Project: AOH1060313-0
Customer COC: GEOCUF11102020_1C
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-211-SB02-30.0/34.5-11 102020	10526742	12/17/2020	11/10/2020	5%	Carbonate Clay Opaques Coal	Brown sediment

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

January 7, 2021

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1060315-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received eight samples on December 10, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The samples were logged into RJ Lee Group project number AOH1060315-0 and assigned RJLG sample numbers as indicated in Appendix A.

The samples were received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, revised COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A
Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1060315-0
Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Catherine Burton, PG Stantec 3052 Beaumont Centre Cir Lexington, KY 40513 United States Main: 859 608-0372	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10526746	CUF-209-SB01-1.5/5.0-11302020	12/10/2020 9:20 AM EST
10526747	CUF-209-SB01-5.0/10.5-11302020	12/10/2020 9:20 AM EST
10526748	CUF-209-SB01-10.5/15.0-11302020	12/10/2020 9:20 AM EST
10526749	CUF-209-SB01-15.0/20.0-11302020	12/10/2020 9:20 AM EST
10526750	CUF-209-SB02-1.5/5.0-11302020	12/10/2020 9:20 AM EST
10526751	CUF-209-SB02-5.0/10.0-11302020	12/10/2020 9:20 AM EST
10526752	CUF-209-SB02-10.0/15.0-11302020	12/10/2020 9:20 AM EST
10526753	CUF-209-SB02-15.0/20.0-11302020	12/10/2020 9:20 AM EST
10526754	QC_CUF-209-SB01-10.5/15.0-11302020	12/10/2020 9:20 AM EST

	Received From: Catherine Burton, PG	*Method of Shipment:* *Federal Express*	
	Company: Stantec		**Date:** 12/10/2020
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*	
	Company: RJ Lee Group, Inc.		**Date:** 12/10/2020

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	12/10/2020	Log in Date:	12/11/2020
Time Received:	9:20 AM	By:	Monica Carse	COC#:	GEOCUF11302020_1C
Project:	AOH1060315-0	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	7811 3892 9378				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?	✓		
Were there any discrepancies among samples and COC?		✓	
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

N/A

Analyst Signature: M. Carse 12-11-2020

Manager Signature: [signature] 12-11-2020

A0H1060315-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1 of 1
COC No:	GEOCUF11302020_1C
	1 of 1 Pages
Task Desc:	CUF_Geochemical_2020_11

Required Ship to Lab:

Lab Name:	RJ Lee Group, Inc.
Lab Address:	350 Hochberg Road Monroeville, PA 15146

Lab Manager Contact Information

Lab PM:	Monica Carse
Phone/Fax:	724-325-1776
Lab Email:	MCarse@rjleegroup.com

Required Project Information:

Site ID #:	CUMBERLAND FOSSIL PLANT
Project #:	
Site Address	Plant 815 Cumberland City Road
City	Cumberland City; State, Zip: TN, 37050
Site PM Name:	Paul Thomas
Phone/Fax:	(423) 751-2926
Site PM Email:	prthomas0@tva.gov

Required Sampler Information

Sampler:	Catherine Burton
Sampling Company:	Stantec
Address	3052 Beaumont Centre Circle
City, State	Lexington, KY; Phone No: 859-338-2791
Sampling Team Number:	1
Send EDD/Hard Copy to:	tva_deliverables@envstd.com

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ________

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

Filtered: N; Preserve: None; Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Depth Unit: Feet — Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-209-SB01-1.5/5.0-11302020	CUF-209-SB01	1.5	5.0	SS	G	N	11/30/2020	1347	1	NA	X
2	CUF-209-SB01-5.0/10.5-11302020	CUF-209-SB01	5.0	10.5	SS	G	N	11/30/2020	1358	1	NA	X
3	CUF-209-SB01-10.5/15.0-11302020	CUF-209-SB01	10.5	15.0	SS	G	N	11/30/2020	1412	1	NA	X
4	CUF-209-SB01-15.0/20.0-11302020	CUF-209-SB01	15.0	20.0	SS	G	N	11/30/2020	1423	1	NA	X
5	CUF-209-SB02-1.5/5.0-11302020	CUF-209-SB02	1.5	5.0	SS	G	N	11/30/2020	1500	1	NA	X
6	CUF-209-SB02-5.0/10.0-11302020	CUF-209-SB02	5.0	10.0	SS	G	N	11/30/2020	1512	1	NA	X
7	CUF-209-SB02-10.0/15.0-11302020	CUF-209-SB02	10.0	15.0	SS	G	N	11/30/2020	1524	1	NA	X
8	CUF-209-SB02-15.0/20.0-11302020	CUF-209-SB02	15.0	20.0	SS	G	N	11/30/2020	1537	1	NA	X
9												
10												
11												
12												
13												

CB 12/08/2020

CB 12/08/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/ Stantec (signature)			CB 12/08/2020		
			CB 12/08/2020		

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Cate Burton (signature)
	Stone McCoy (signature)

Rec'd By: M. Carse RJ Lee Group 12-10-2020 9:20 am

Form TVA 30067A

A0H1060315-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1	of	1
COC No:	GEOCUF11302020_1C		
1 of 1 Pages			
Task Desc:	CUF_Geochemical_2020_11		

Required Ship to Lab:

- Lab Name: RJ Lee Group, Inc.
- Lab Address: 350 Hochberg Road, Monroeville, PA 15146

Lab Manager Contact Information

- Lab PM: Monica Carse
- Phone/Fax: 724-325-1776
- Lab Email: MCarse@rjleegroup.com

Required Project Information:

- Site ID #: CUMBERLAND FOSSIL PLANT
- Project #:
- Site Address: Plant 815 Cumberland City Road
- City: Cumberland City State, Zip: TN, 37050
- Site PM Name: Paul Thomas
- Phone/Fax: (423) 751-2926
- Site PM Email: prthomas0@tva.gov

Required Sampler Information

- Sampler: Catherine Burton
- Sampling Company: Stantec
- Address: 3052 Beaumont Centre Circle
- City, State: Lexington, KY Phone No: 859-338-2791
- Sampling Team Number: 1
- Send EDD/Hard Copy to: tva_deliverables@envstd.com

Analysis Turnaround Time

- [ ] CALENDAR DAYS
- [x] WORKING DAYS

TAT if different from Below ________

- [ ] 24 Hours
- [ ] 3 Business Days
- [ ] 5 Business Days
- [x] 10 Business Days (Standard)

Filtered: N
Preserve: None
Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Sample Depth Unit: Feet — Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-209-SB01-1.5/5.0-11302020	CUF-209-SB01	1.5	5.0	SS	G	N	11/30/2020	1347	1	NA	X
2	CUF-209-SB01-5.0/10.5-11302020	CUF-209-SB01	5.0	10.5	SS	G	N	11/30/2020	1358	1	NA	X
3	CUF-209-SB01-10.5/15.0-11302020	CUF-209-SB01	10.5	15.0	SS	G	N	11/30/2020	1412	1	NA	X
4	CUF-209-SB01-15.0/20.0-11302020	CUF-209-SB01	15.0	20.0	SS	G	N	11/30/2020	1423	1	NA	X
5	CUF-209-SB02-1.5/5.0-11302020	CUF-209-SB02	1.5	5.0	SS	G	N	11/30/2020	1500	1	NA	X
6	CUF-209-SB02-5.0/10.0-11302020	CUF-209-SB02	5.0	10.0	SS	G	N	11/30/2020	1512	1	NA	X
7	CUF-209-SB02-10.0/15.0-11302020	CUF-209-SB02	10.0	15.0	SS	G	N	11/30/2020	1524	1	NA	X
8	CUF-209-SB02-15.0/20.0-11302020	CUF-209-SB02	15.0	20.0	SS	G	N	11/30/2020	1537	1	NA	X
9												
10												
11												
12												
13												

CB 12/08/2020

CB 12/08/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Catherine Burton/ Stantec Catherine Burton	(12/18/2020, csb) 12/09/2020	1248	CB 12/08/2020		

CB 12/08/2020

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
No	No	Yes	No

SHIPPING METHOD: (Select Appropriate)

Fedex

SAMPLER NAME AND SIGNATURE

- Cate Burton — Catherine Burton
- Stone McCoy — SM

Rec'd By: M. Carse RJLee Group 12-10-2020 9:20 am

Form TVA 30067A

Appendix B
Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 01/07/2021
Sample Received Date: 12/10/2020
RJLG Project: AOH1060315-0
Customer COC: GEOCUF11302020_1C
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-209-SB01-1.5/5.0-11302020	10526746	12/16/2020	11/30/2020	2%	Clay Mica Opaques Quartz Coal	Brown sediment
CUF-209-SB01-10.5/15.0-11302020	10526748	12/16/2020	11/30/2020	1%	Carbonate Clay Organic Particulate Quartz Coal	Brown sediment
CUF-209-SB01-15.0/20.0-11302020	10526749	12/16/2020	11/30/2020	ND	Carbonate Clay Mica Opaques Organic Particulate	Brown sediment
CUF-209-SB01-5.0/10.5-11302020	10526747	12/16/2020	11/30/2020	ND	Carbonate Clay Mica Organic Particulate	Brown sediment

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-209-SB02-1.5/5.0-11302020	10526750	12/16/2020	11/30/2020	ND	Clay Mica Opaques Organic Particulate	Reddish brown sediment
CUF-209-SB02-10.0/15.0-11302020	10526752	12/16/2020	11/30/2020	1%	Clay Feldspar Mica Coal	Brown sediment
CUF-209-SB02-15.0/20.0-11302020	10526753	12/16/2020	11/30/2020	ND	Clay Organic Particulate Quartz Coal	Brown sediment
CUF-209-SB02-5.0/10.0-11302020	10526751	12/16/2020	11/30/2020	1%	Carbonate Clay Mica Organic Particulate Coal	Brown sediment
QC_CUF-209-SB01-10.5/15.0-11302020	10526754	12/16/2020	11/30/2020	1%	NA	Brown Sediment

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

January 7, 2021

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1060326-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received two samples on December 10, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The samples were logged into RJ Lee Group project number AOH1060326-0 and assigned RJLG sample numbers as indicated in Appendix A.

The samples were received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, revised COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A

Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1060326-0
Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Catherine Burton, PG Stantec 3052 Beaumont Centre Cir Lexington, KY 40513 United States Main: 859 608-0372	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10526793	CUF-209-SB01-24.0/27.0-12012020	12/10/2020 9:20 AM EST
10526794	CUF-209-SB01-33.0/34.5-12012020	12/10/2020 9:20 AM EST

	Received From: Catherine Burton, PG	*Method of Shipment:* *Federal Express*
	Company: Stantec	**Date:** 12/10/2020
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*
	Company: RJ Lee Group, Inc.	**Date:** 12/10/2020

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	12/10/2020	Log in Date:	12/11/2020
Time Received:	9:20 AM	By:	Monica Carse	COC#:	GEOCUF12012020_1C
Project:	AOH1060326-0	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	7811 3892 9378				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?	✓		
Were there any discrepancies among samples and COC?		✓	
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

N/A

Analyst Signature: M. Carse 12-11-2020

Manager Signature: [signature] 12-11-2020

A0H1060326-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1	of	1
COC No:	GEOCUF12012020_1C		
1 of 1 Pages			
Task Desc:	CUF_Geochemical_2020_12		

Required Ship to Lab:

Lab Name:	RJ Lee Group, Inc.
Lab Address:	350 Hochberg Road, Monroeville, PA 15146

Lab Manager Contact Information

Lab PM:	Monica Carse
Phone/Fax:	724-325-1776
Lab Email:	MCarse@rjleegroup.com

Required Project Information:

Site ID #:	CUMBERLAND FOSSIL PLANT
Project #:	
Site Address	Plant 815 Cumberland City Road
City	Cumberland City; State, Zip: TN, 37050
Site PM Name:	Paul Thomas
Phone/Fax:	(423) 751-2926
Site PM Email:	prthomas0@tva.gov

Required Sampler Information

Sampler:	Catherine Burton
Sampling Company:	Stantec
Address	3052 Beaumont Centre Circle
City, State	Lexington, KY; Phone No: 859-338-2791
Sampling Team Number:	1
Send EDD/Hard Copy to:	tva_deliverables@envstd.com

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ________

- ☐ 24 Hours
- ☐ 3 Business Days
- ☐ 5 Business Days
- ☑ 10 Business Days (Standard)

Filtered: N; Preserve: None; Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: Feet)	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-209-SB01-24.0/27.0-12012020	CUF-209-SB01	24.0	27.0	SS	G	N	12/1/2020	1055	1	NA	X
2	CUF-209-SB01-33.0/34.5-12012020	CUF-209-SB01	33.0	34.5	SS	G	N	12/1/2020	1108	1	NA	X
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

CB 12/08/2020

CB 12/08/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	TIME	DATE	TIME
Catherine Burton/ Stantec *Catherine Burton*	CB 12/08/2020		
CB 12/08/2020			

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Catherine Burton *Catherine Burton* 12/1/20
CB 12/08/2020	Stone McCoy *[signature]*
	CB 12/08/2020

Rec'd By: M. Carse RJ Lee Group 12-10-2020 9:20am

Form TVA 30067A

AOH1060326-0

Rev 1, 12/18/2020, csb

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1	of	1
COC No:	GEOCUF12012020_1C		
1 of 1 Pages			
Task Desc:	CUF_Geochemical_2020_12		

Required Ship to Lab:

Lab Name:	RJ Lee Group, Inc.
Lab Address:	350 Hochberg Road Monroeville, PA 15146

Lab Manager Contact Information

Lab PM:	Monica Carse
Phone/Fax:	724-325-1776
Lab Email:	MCarse@rjleegroup.com

Required Project Information:

Site ID #:	CUMBERLAND FOSSIL PLANT
Project #:	
Site Address	Plant 815 Cumberland City Road
City	Cumberland City · State, Zip: TN, 37050
Site PM Name:	Paul Thomas
Phone/Fax:	(423) 751-2926
Site PM Email:	prthomas0@tva.gov

Required Sampler Information

Sampler:	Catherine Burton
Sampling Company:	Stantec
Address	3052 Beaumont Centre Circle
City, State	Lexington, KY · Phone No: 859-338-2791
Sampling Team Number:	1
Send EDD/Hard Copy to:	tva_deliverables@envstd.com

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ________

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

Filtered: N · Preserve: None · Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: Feet)	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-209-SB01-24.0/27.0-12012020	CUF-209-SB01	24.0	27.0	SS	G	N	12/1/2020	1055	1	NA	X
2	CUF-209-SB01-33.0/34.5-12012020	CUF-209-SB01	33.0	34.5	SS	G	N	12/1/2020	1108	1	NA	X
3												
4												
5												
6												
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9												
10												
11												
12												
13												

CB 12/08/2020

CB 12/08/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	TIME	DATE	TIME
Catherine Burton/ Stantec · Catherine Burton (12/18/2020, csb) 12/09/2020 1248	CB 12/08/2020		
CB 12/08/2020			

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	CatherineBurton · Catherine Burton 12/1/20
CB 12/08/2020	Stone McCoy · [signature] CB 12/08/2020

Rec'd By: M. Carse RJ Lee Group 12-10-2020 9:20 am

Form TVA 30067A

Appendix B

Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 01/07/2021
Sample Received Date: 12/10/2020
RJLG Project: AOH1060326-0
Customer COC: GEOCUF12012020_1C
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-209-SB01-24.0/27.0-12 012020	10526793	12/17/2020	12/01/2020	ND	Carbonate Clay	Brown sediment
CUF-209-SB01-33.0/34.5-12 012020	10526794	12/17/2020	12/01/2020	ND	Amphibole Carbonate Clay Opaques	Brown sediment

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

January 7, 2021

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: TVA Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1060327-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received five samples on December 10, 2020 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant. The samples were logged into RJ Lee Group project number AOH1060327-0 and assigned RJLG sample numbers as indicated in Appendix A.

The samples were received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, revised COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A
Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1060327-0
Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Catherine Burton, PG Stantec 3052 Beaumont Centre Cir Lexington, KY 40513 United States Main: 859 608-0372	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10526795	CUF-209-SB02-20.0/21.6-12022020	12/10/2020 9:20 AM EST
10526796	CUF-209-SB02-33.0/34.5-12022020	12/10/2020 9:20 AM EST
10526797	CUF-209-SB02-39.0/42.0-12022020	12/10/2020 9:20 AM EST
10526798	CUF-209-SB02-49.5/54.0-12022020	12/10/2020 9:20 AM EST
10526799	CUF-209-SB02-54.0/58.5-12022020	12/10/2020 9:20 AM EST
10526800	QC_CUF-209-SB02-39.0/42.0-12022020	12/10/2020 9:20 AM EST

	Received From: Catherine Burton, PG	*Method of Shipment:* *Federal Express*	
	Company: Stantec		**Date:** 12/10/2020
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*	
	Company: RJ Lee Group, Inc.		**Date:** 12/10/2020

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

350 Hochberg Road, Monroeville, PA 15146
Phone: (724) 325-1776 | Fax: (724) 733-1799

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	12/10/2020	LoginDate:	12/11/2020
Time Received:	9:20 AM	By:	Monica Carse	COC#:	GEOCUF12022020 1C
Project:	AOH1060327-0	# Coolers Received	1	MeansofShipment	FedEx
Air Bill:	7811 3892 9378				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?	✓		
Were there any discrepancies among samples and COC?		✓	
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

N/A

Analyst Signature: M. Carse 12-11-2020

Manager Signature: [signature] 12-11-2020

AOH1060327-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1	of	1
COC No:	GEOCUF12022020_1C		
1 of 1 Pages			
Task Desc:	CUF_Geochemical_2020_12		

Required Ship to Lab:
Lab Name: RJ Lee Group, Inc.
Lab Address: 350 Hochberg Road, Monroeville, PA 15146

Lab Manager Contact Information
Lab PM: Monica Carse
Phone/Fax: 724-325-1776
Lab Email: MCarse@rjleegroup.com

Required Project Information:
Site ID #: CUMBERLAND FOSSIL PLANT
Project #:
Site Address: Plant 815 Cumberland City Road
City: Cumberland City State, Zip: TN, 37050
Site PM Name: Paul Thomas
Phone/Fax: (423) 751-2926
Site PM Email: prthomas0@tva.gov

Required Sampler Information
Sampler: Catherine Burton
Sampling Company: Stantec
Address: 3052 Beaumont Centre Circle
City, State: Lexington, KY Phone No: 859-338-2791
Sampling Team Number: 1
Send EDD/Hard Copy to: tva_deliverables@envstd.com

Analysis Turnaround Time
☐ CALENDAR DAYS ☑ WORKING DAYS
TAT if different from Below ________
☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

Filtered: N | Preserve: None | Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: Feet)	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-209-SB02-20.0/21.6-12022020	CUF-209-SB02	20.0	21.6	SS	G	N	12/2/2020	1540	1	NA	X
2	CUF-209-SB02-33.0/34.5-12022020	CUF-209-SB02	33.0	34.5	SS	G	N	12/2/2020	1550	1	NA	X
3	CUF-209-SB02-39.0/42.0-12022020	CUF-209-SB02	39.0	42.0	SS	G	N	12/2/2020	1315	1	NA	X
4	CUF-209-SB02-49.5/54.0-12022020	CUF-209-SB02	49.5	54.0	SS	G	N	12/2/2020	1358	1	NA	X
5	CUF-209-SB02-54.0/58.5-12022020	CUF-209-SB02	54.0	58.5	SS	G	N	12/2/2020	1440	1	NA	X
6												
7												
8												
9												
10												
11												
12												
13												

CB 12/08/2020
CB 12/08/2020

Additional Comments/Special Instructions:
Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION		TIME		DATE	TIME
Catherine Burton/Stantec	Catherine Burton	CB 12/08/2020			
	CB 12/08/2020				

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Cate Burton Catherine Burton
CB 12/08/2020	Stone McCoy [signature]
	CB 12/08/2020

Rec'd By: M. Carse RJLee Group 12-10-2020 9:20 am

Form TVA 30067A

AOH1060327-0

Rev 1, 12/18/2020, csb

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1	of	1
COC No:	GEOCUF12022020_1C		
1 of 1 Pages			
Task Desc:	CUF_Geochemical_2020_12		

Required Ship to Lab:

Lab Name:	RJ Lee Group, Inc.
Lab Address:	350 Hochberg Road, Monroeville, PA 15146

Lab Manager Contact Information

Lab PM:	Monica Carse
Phone/Fax:	724-325-1776
Lab Email:	MCarse@rjleegroup.com

Required Project Information:

Site ID #:	CUMBERLAND FOSSIL PLANT
Project #:	
Site Address	Plant 815 Cumberland City Road
City	Cumberland City; State, Zip: TN, 37050
Site PM Name:	Paul Thomas
Phone/Fax:	(423) 751-2926
Site PM Email:	prthomas0@tva.gov

Required Sampler Information

Sampler:	Catherine Burton
Sampling Company:	Stantec
Address	3052 Beaumont Centre Circle
City, State	Lexington, KY; Phone No: 859-338-2791
Sampling Team Number:	1
Send EDD/Hard Copy to:	tva_deliverables@envstd.com

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below ________

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☑ 10 Business Days (Standard)

Filtered: N; Preserve: None; Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Sample Depth Depth Unit: Feet — Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-209-SB02-20.0/21.6-12022020	CUF-209-SB02	20.0	21.6	SS	G	N	12/2/2020	1540	1	NA	X
2	CUF-209-SB02-33.0/34.5-12022020	CUF-209-SB02	33.0	34.5	SS	G	N	12/2/2020	1550	1	NA	X
3	CUF-209-SB02-39.0/42.0-12022020	CUF-209-SB02	39.0	42.0	SS	G	N	12/2/2020	1315	1	NA	X
4	CUF-209-SB02-49.5/54.0-12022020	CUF-209-SB02	49.5	54.0	SS	G	N	12/2/2020	1358	1	NA	X
5	CUF-209-SB02-54.0/58.5-12022020	CUF-209-SB02	54.0	58.5	SS	G	N	12/2/2020	1440	1	NA	X
6												
7												
8												
9												
10												
11												
12												
13												

CB 12/08/2020

CB 12/08/2020

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	TIME		DATE	TIME
Catherine Burton/Stantec Catherine Burton	(12/18/2020, csb) 12/09/2020 1248 CB 12/08/2020			

CB 12/08/2020

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☑ No	☐ Yes ☑ No	☑ Yes ☐ No	☐ Yes ☑ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Cate Burton Catherine Burton
CB 12/08/2020	Stone McCoy
	CB 12/08/2020

Rec'd By: M. Carse RJLee Group 12-10-2020 9:20 am

Form TVA 30067A

Appendix B

Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 01/07/2021
Sample Received Date: 12/10/2020
RJLG Project: AOH1060327-0
Customer COC: GEOCUF12022020_1C
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-209-SB02-20.0/21.6-12 022020	10526795	12/15/2020	12/02/2020	ND	Carbonate Clay Quartz	Brown sediment
CUF-209-SB02-33.0/34.5-12 022020	10526796	12/15/2020	12/02/2020	1%	Clay Feldspar Opaques Organic Particulate Quartz Coal	Brown sediment
CUF-209-SB02-39.0/42.0-12 022020	10526797	12/15/2020	12/02/2020	ND	Carbonate Clay Feldspar Opaques Organic Particulate Quartz	Dark brown sediment
CUF-209-SB02-49.5/54.0-12 022020	10526798	12/15/2020	12/02/2020	ND	Clay Diatoms Opaques Quartz	Brown sediment

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-209-SB02-54.0/58.5-12 022020	10526799	12/17/2020	12/02/2020	ND	Carbonate Clay Opaques Organic Particulate	Brown sediment
QC_CUF-209-SB02-39.0/42.0 -12022020	10526800	12/15/2020	12/02/2020	ND	NA	Brown Sediment

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

March 16, 2021

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: Cumberland Fossil Plant PLM – Analytical Report
RJ Lee Group Project Number AOH1061249-0

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received 21 samples on March 12, 2021 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant Project 175568209. The samples were logged into RJ Lee Group project number AOH1061249-0 and assigned RJLG sample numbers as indicated in Appendix A.

The samples were received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A
Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1061249-0

Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
John Myer Stantec 601 Grassmere Park Road Suite 22 Nashville, TN 37211 United States Main: 615-885-1144	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10533986	CUF-SO-CUF1006-0.0/1.5-20210311	03/12/2021 9:24 AM EST
10533987	CUF-SO-CUF1006-1.5/3.0-20210311	03/12/2021 9:24 AM EST
10533988	CUF-SO-CUF1006-3.0/4.5-20210311	03/12/2021 9:24 AM EST
10533989	CUF-SO-CUF1006-4.5/6.0-20210311	03/12/2021 9:24 AM EST
10533990	CUF-SO-CUF1006-7.5/9.0-20210311	03/12/2021 9:24 AM EST
10533991	CUF-SO-CUF1006-9.0/10.5-20210311	03/12/2021 9:24 AM EST
10533992	CUF-SO-CUF1006-10.5/11.4-20210311	03/12/2021 9:24 AM EST
10533993	CUF-SO-CUF1006-11.4/12.0-20210311	03/12/2021 9:24 AM EST
10533994	CUF-SO-CUF1006-12.0/13.5-20210311	03/12/2021 9:24 AM EST
10533995	CUF-SO-CUF1006-13.5/14.2-20210311	03/12/2021 9:24 AM EST
10533996	CUF-SO-CUF1006-14.2/15.0-20210311	03/12/2021 9:24 AM EST
10533997	CUF-SO-CUF1006-15.0/16.5-20210311	03/12/2021 9:24 AM EST
10533998	CUF-SO-CUF1006-16.5/18.0-20210311	03/12/2021 9:24 AM EST
10533999	CUF-SO-CUF1006-18.0/19.5-20210311	03/12/2021 9:24 AM EST
10534000	CUF-SO-DUP01-20210311	03/12/2021 9:24 AM EST
10534001	CUF-SO-CUF1006-19.5/21.0-20210311	03/12/2021 9:24 AM EST
10534002	CUF-SO-CUF1006-21.0/22.5-20210311	03/12/2021 9:24 AM EST
10534003	CUF-SO-CUF1006-22.5/24.0-20210311	03/12/2021 9:24 AM EST
10534004	CUF-SO-CUF1006-24.0/25.5-20210311	03/12/2021 9:24 AM EST
10534005	CUF-SO-CUF1006-25.5/27.0-20210311	03/12/2021 9:24 AM EST
10534006	CUF-SO-CUF1006-27.0/27.8-20210311	03/12/2021 9:24 AM EST
10534007	QC01_CUF-SO-CUF1006-13.5/14.2-20210311	03/12/2021 9:24 AM EST
10534008	QC02_CUF-SO-CUF1006-25.5/27.0-20210311	03/12/2021 9:24 AM EST

	Received From: John Myer	*Method of Shipment:* *Federal Express*	
	Company: Stantec		**Date:** 03/12/2021
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*	
	Company: RJ Lee Group, Inc.		**Date:** 03/12/2021

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

350 Hochberg Road, Monroeville, PA 15146
Phone: (724) 325-1776 | Fax: (724) 733-1799

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	3/12/2021	Log in Date:	3/12/2021
Time Received:	9:24 AM	By:	Monica Carse	COC# :	CUF_PLM_20210311_1C
Project:	AOH1061249-0	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	7846 5061 9545				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?	✓		
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?	✓		
Were there any discrepancies among samples and COC?		✓	
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

N/A

Analyst Signature: M. Carse 03-12-21

Manager Signature: [signature] 03-15-21

AOH1061249-0

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1	of	1
COC No:	CUF_PLM_20210311_1C		
1 of 1 Pages			
Task Desc:	CUF_PLM_2021_03		

Program: TDEC Order

Required Ship to Lab:	
Lab Name:	RJ Lee Group, Inc.
Lab Address:	350 Hochberg Road Monroeville, PA 15146
Lab Manager Contact Information	
Lab PM:	Monica Carse
Phone/Fax:	724-325-1776
Lab Email:	MCarse@rjleegroup.com

Required Project Information:	
Site ID #:	CUMBERLAND FOSSIL PLANT
Project #:	175568209
Site Address	Plant 815 Cumberland City Road
City	Cumberland City; State, Zip: TN, 37050
Site PM Name:	Paul Thomas
Phone/Fax:	(423) 751-2926
Site PM Email:	prthomas0@tva.gov

Required Sampler Information	
Sampler:	Briggs Evans/John Myer
Sampling Company:	Stantec
Address	601 Grassmere Park, Suite 22
City/State	Nashville, TN; Phone No: 6158851144
Sampling Team Number:	1
Send EDD/Hard Copy to:	tva_deliverables@envstd.com

Analysis Turnaround Time

- [ ] CALENDAR DAYS
- [x] WORKING DAYS

TAT if different from Below ______

- [x] 24 Hours
- [ ] 3 Business Days
- [ ] 5 Business Days
- [ ] 10 Business Days (Standard)

Filtered: N; Preserve: None; Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Sample Depth (Depth Unit: Feet) Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-SO-CUF1006-0.0/1.5-20210311	CUF-1006	0.0	1.5	SO	G	N	3/11/2021	1332	1	N/A	X
2	CUF-SO-CUF1006-1.5/3.0-20210311	CUF-1006	1.5	3.0	SO	G	N	3/11/2021	1340	1	N/A	X
3	CUF-SO-CUF1006-3.0/4.5-20210311	CUF-1006	3.0	4.5	SO	G	N	3/11/2021	1353	1	N/A	X
4	CUF-SO-CUF1006-4.5/6.0-20210311	CUF-1006	4.5	6.0	SO	G	N	3/11/2021	1400	1	N/A	X
5	CUF-SO-CUF1006-7.5/9.0-20210311	CUF-1006	7.5	9.0	SO	G	N	3/11/2021	1411	1	N/A	X
6	CUF-SO-CUF1006-9.0/10.5-20210311	CUF-1006	9.0	10.5	SO	G	N	3/11/2021	1418	1	N/A	X
7	CUF-SO-CUF1006-10.5/11.4-20210311	CUF-1006	10.5	11.4	SO	G	N	3/11/2021	1428	1	N/A	X
8	CUF-SO-CUF1006-11.4/12.0-20210311	CUF-1006	11.4	12.0	SO	G	N	3/11/2021	1430	1	N/A	X
9	CUF-SO-CUF1006-12.0/13.5-20210311	CUF-1006	12.0	13.5	SO	G	N	3/11/2021	1438	1	N/A	X
10	CUF-SO-CUF1006-13.5/14.2-20210311	CUF-1006	13.5	14.2	SO	G	N	3/11/2021	1442	1	N/A	X
11	CUF-SO-CUF1006-14.2/15.0-20210311	CUF-1006	14.2	15.0	SO	G	N	3/11/2021	1444	1	N/A	X
12	CUF-SO-CUF1006-15.0/16.5-20210311	CUF-1006	15.0	16.5	SO	G	N	3/11/2021	1458	1	N/A	X
13	CUF-SO-CUF1006-16.5/18.0-20210311	CUF-1006	16.5	18.0	SO	G	N	3/11/2021	1504	1	N/A	X
14	CUF-SO-CUF1006-18.0/19.5-20210311	CUF-1006	18.0	19.5	SO	G	N	3/11/2021	1510	1	N/A	X
15	CUF-SO-DUP01-20210311	CUF-1006	N/A	N/A	SO	G	FD	3/11/2021	N/A	1	N/A	X
16	CUF-SO-CUF1006-19.5/21.0-20210311	CUF-1006	19.5	21.0	SO	G	N	3/11/2021	1520	1	N/A	X
17	CUF-SO-CUF1006-21.0/22.5-20210311	CUF-1006	21.0	22.5	SO	G	N	3/11/2021	1530	1	N/A	X
18	CUF-SO-CUF1006-22.5/24.0-20210311	CUF-1006	22.5	24.0	SO	G	N	3/11/2021	1540	1	N/A	X
19	CUF-SO-CUF1006-24.0/25.5-20210311	CUF-1006	24.0	25.5	SO	G	N	3/11/2021	1548	1	N/A	X
20	CUF-SO-CUF1006-25.5/27.0-20210311	CUF-1006	25.5	27.0	SO	G	N	3/11/2021	1557	1	N/A	X
21	CUF-SO-CUF1006-27.0/27.8-20210311	CUF-1006	27.0	27.8	SO	G	N	3/11/2021	1607	1	N/A	X

DOM 3/12/21

Additional Comments/Special Instructions:

Additional volume collected should be used for MS/MSDs.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Briggs Evans / Stantec [signature]	3/11/2021	18:00	M. Carse / RJ Lee Group	03-12-21	9:24 am

Sample Receipt Conditions	Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
1	No	No	Yes	No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Briggs Evans [signature]
	John Myer [signature]

Form TVA 30067A

Appendix B

Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas		**Report Date:**	03/16/2021
TVA Bull Run Fossil Plant		**Sample Received Date:**	03/12/2021
1265 Edgemoor Road		**RJLG Project:**	AOH1061249-0
Clinton, TN 37716	United States	**Customer COC:**	CUF_PLM_20210311_1C
Email: prthomas0@tva.gov		**Purchase Order:**	
Main: 423-751-2926		**Analytical Method:**	Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-SO-CUF1006-0.0/1.5-20 210311	10533986	03/15/2021	03/11/2021	2%	Carbonate Clay Misc. Silicates Opaques Organic Particulate Quartz Coal	Brown sediment
CUF-SO-CUF1006-1.5/3.0-20 210311	10533987	03/15/2021	03/11/2021	ND	Carbonate Clay Feldspar Misc. Silicates Opaques Quartz	Brown sediment
CUF-SO-CUF1006-10.5/11.4- 20210311	10533992	03/15/2021	03/11/2021	ND	Carbonate Clay Feldspar Opaques Quartz	Brown sediment

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-SO-CUF1006-11.4/12.0-20210311	10533993	03/15/2021	03/11/2021	ND	Carbonate Clay Feldspar Opaques Quartz	Light brown sediment
CUF-SO-CUF1006-12.0/13.5-20210311	10533994	03/15/2021	03/11/2021	1%	Carbonate Clay Feldspar Misc. Silicates Opaques Quartz	Light brown sediment
CUF-SO-CUF1006-13.5/14.2-20210311	10533995	03/15/2021	03/11/2021	ND	Carbonate Clay Feldspar Opaques Quartz	Brown sediment
CUF-SO-CUF1006-14.2/15.0-20210311	10533996	03/15/2021	03/11/2021	1%	Opaques Quartz	Tan Sediment.
CUF-SO-CUF1006-15.0/16.5-20210311	10533997	03/15/2021	03/11/2021	1%	Opaques Quartz	Tan Sediment.
CUF-SO-CUF1006-16.5/18.0-20210311	10533998	03/15/2021	03/11/2021	2%	Opaques Quartz	Beige Sediment.
CUF-SO-CUF1006-18.0/19.5-20210311	10533999	03/15/2021	03/11/2021	2%	Opaques Quartz	Beige Sediment.
CUF-SO-CUF1006-19.5/21.0-20210311	10534001	03/15/2021	03/11/2021	ND	Opaques Quartz	Tan Sediment.
CUF-SO-CUF1006-21.0/22.5-20210311	10534002	03/15/2021	03/11/2021	1%	Opaques Quartz	Tan Sediment.
CUF-SO-CUF1006-22.5/24.0-20210311	10534003	03/15/2021	03/11/2021	2%	Opaques Quartz	Tan Sediment.
CUF-SO-CUF1006-24.0/25.5-20210311	10534004	03/15/2021	03/11/2021	1%	Opaques Quartz	Tan Sediment.

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-SO-CUF1006-25.5/27.0-20210311	10534005	03/15/2021	03/11/2021	ND	Opaques Quartz	Tan Sediment.
CUF-SO-CUF1006-27.0/27.8-20210311	10534006	03/15/2021	03/11/2021	ND	Opaques Quartz	Tan Sediment.
CUF-SO-CUF1006-3.0/4.5-20210311	10533988	03/15/2021	03/11/2021	ND	Carbonate Clay Feldspar Opaques Quartz	Brown sediment
CUF-SO-CUF1006-4.5/6.0-20210311	10533989	03/15/2021	03/11/2021	ND	Carbonate Clay Feldspar Misc. Silicates Opaques Quartz	Brown sediment
CUF-SO-CUF1006-7.5/9.0-20210311	10533990	03/15/2021	03/11/2021	1%	Carbonate Clay Feldspar Misc. Silicates Opaques Quartz	Light brown/gray sediment
CUF-SO-CUF1006-9.0/10.5-20210311	10533991	03/15/2021	03/11/2021	1%	Carbonate Clay Feldspar Opaques Organic Particulate Quartz	Brown sediment
CUF-SO-DUP01-20210311	10534000	03/15/2021	03/11/2021	2%	Opaques Quartz	Beige Sediment.
QC01_CUF-SO-CUF1006-13.5/14.2-20210311	10534007	03/16/2021	03/11/2021	ND	NA	Brown sediment

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
QC02_CUF-SO-CUF1006-25.5/27.0-20210311	10534008	03/16/2021	03/11/2021	ND	NA	Brown sediment

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

March 23, 2021

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1061249-1

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received 21 samples on March 16, 2021 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant Project 182603589. The samples were logged into RJ Lee Group project number AOH1061249-1 and assigned RJLG sample numbers as indicated in Appendix A.

The samples were received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A
Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1061249-1
Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Briggs Evans Stantec 601 Grassmere Park Road Suite 22 Nashville, TN 37211 United States Main: 615-885-1144	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10534298	CUF-209-SB03-0.0/1.5-03092021	03/16/2021 10:08 AM EDT
10534299	CUF-209-SB03-3.0/4.5-03092021	03/16/2021 10:08 AM EDT
10534300	CUF-209-SB03-4.5/6.0-03092021	03/16/2021 10:08 AM EDT
10534301	CUF-209-SB03-6.0/7.5-03092021	03/16/2021 10:08 AM EDT
10534302	CUF-209-SB03-7.5/9.0-03092021	03/16/2021 10:08 AM EDT
10534303	CUF-209-SB03-9.0/10.5-03092021	03/16/2021 10:08 AM EDT
10534304	CUF-209-SB03-10.5/12.0-03092021	03/16/2021 10:08 AM EDT
10534305	CUF-209-SB03-12.0/13.5-03092021	03/16/2021 10:08 AM EDT
10534306	CUF-209-SB03-13.5/15.0-03092021	03/16/2021 10:08 AM EDT
10534307	CUF-209-SB03-15.0/16.5-03092021	03/16/2021 10:08 AM EDT
10534308	CUF-209-SB03-16.5/18.0-03092021	03/16/2021 10:08 AM EDT
10534309	CUF-209-SB03-18.0/19.5-03092021	03/16/2021 10:08 AM EDT
10534310	CUF-209-SB03-19.5/21.0-03092021	03/16/2021 10:08 AM EDT
10534311	CUF-209-SB03-FD-03092021	03/16/2021 10:08 AM EDT
10534312	CUF-209-SB03-21.0/22.5-03092021	03/16/2021 10:08 AM EDT
10534313	CUF-209-SB03-22.5/24.0-03092021	03/16/2021 10:08 AM EDT
10534314	CUF-209-SB03-24.0/25.5-03092021	03/16/2021 10:08 AM EDT
10534315	CUF-209-SB03-25.5/27.0-03092021	03/16/2021 10:08 AM EDT
10534316	CUF-209-SB03-27.0/28.5-03092021	03/16/2021 10:08 AM EDT
10534317	CUF-209-SB03-28.5/30.0-03092021	03/16/2021 10:08 AM EDT
10534318	CUF-209-SB03-31.5/31.8-03092021	03/16/2021 10:08 AM EDT
10534319	QC01_CUF-209-SB03-13.5/15.0-03092021	03/16/2021 10:08 AM EDT
10534320	QC02_CUF-209-SB03-27.0/28.5-03092021	03/16/2021 10:08 AM EDT

	Received From: Briggs Evans	*Method of Shipment:* *Federal Express*	
	Company: Stantec		**Date:** 03/16/2021
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*	
	Company: RJ Lee Group, Inc.		**Date:** 03/16/2021

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

	Relinquished	*Method of Shipment:*	
	Company:		**Date:**
	Received By:	*Package Condition Upon Receipt:*	
	Company:		**Date:**

350 Hochberg Road, Monroeville, PA 15146
Phone: (724) 325-1776 | Fax: (724) 733-1799

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	3/16/2021	Log in Date:	3/18/2021
Time Received:	10:08 AM	By:	Monica Carse	COC# :	GEOCUF03092021_1C
Project:	AOH1061249-1	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	7731 6228 0260				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/	A	
Were all samples intact?	✓		
Were all samples accurately labeled?		X	See Below
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?		X	See Below
Were there any discrepancies among samples and COC?	X		See Below
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

See e-mail attached to COC for sample discrepancy.

Analyst Signature: M. Carse 03-18-21

Manager Signature: [signature] 03/19/21

AOH1061249-1

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1	of	1
COC No:	GEOCUF03092021_1C		
1 of 1 Pages			
Task Desc:	CUF_Geochemical_2021_03		

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	Briggs Evans/John Myer
Lab Address:	350 Hochberg Road	Project #:	182603589	Sampling Company:	Stantec
	Monroeville, PA 15146	Site Address	Plant 815 Cumberland City Road	Address	601 Grassmere Park, Suite 22
		City	Cumberland City State, Zip: TN, 37050	City/State	Nashville, TN Phone No: 6158851144
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM:	Monica Carse	Phone/Fax:	(423) 751-2926	Sampling Team Number:	1
Phone/Fax:	724-325-1776	Site PM Email:	prthomas0@tva.gov	Send EDD/Hard Copy to:	tva_deliverables@envstd.com
Lab Email:	MCarse@rjleegroup.com				

Analysis Turnaround Time

☐ CALENDAR DAYS ☐ WORKING DAYS

TAT if different from Below 48hr

☐ 24 Hours
☐ 3 Business Days
☐ 5 Business Days
☐ 10 Business Days (Standard)

Filtered: N — ABE 3-15-2021
Preserve: None — ABE 03-15-2021
Analysis: PLM — ABE 03/15/2021

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Sample Depth: Start Depth	Sample Depth: End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-209-SB03-0.0/1.5-03092021	CUF-209-SB03	0.0	1.5	SS	G	N	3/9/2021	0944	1	N/A	X
2	CUF-209-SB03-3.0/4.5-03092021	CUF-209-SB03	3.0	4.5	SS	G	N	3/9/2021	1000	1	N/A	X
3	CUF-209-SB03-4.5/6.0-03092021	CUF-209-SB03	4.5	6.0	SS	G	N	3/9/2021	1007	1	N/A	X
4	CUF-209-SB03-6.0/7.5-03092021	CUF-209-SB03	6.0	7.5	SS	G	N	3/9/2021	1018	1	N/A	X
5	CUF-209-SB03-7.5/9.0-03092021	CUF-209-SB03	7.5	9.0	SS	G	N	3/9/2021	1026	1	N/A	X
6	CUF-209-SB03-9.0/10.5-03092021	CUF-209-SB03	9.0	10.5	SS	G	N	3/9/2021	1032	1	N/A	X
7	CUF-209-SB03-10.5/12.0-03092021	CUF-209-SB03	10.5	12.0	SS	G	N	3/9/2021	1039	1	N/A	X
8	CUF-209-SB03-12.0/13.5-03092021	CUF-209-SB03	12.0	13.5	SS	G	N	3/9/2021	1047	1	N/A	X
9	CUF-209-SB03-13.5/15.0-03092021	CUF-209-SB03	13.5	15.0	SS	G	N	3/9/2021	1057	1	N/A	X
10	CUF-209-SB03-15.0/16.5-03092021	CUF-209-SB03	15.0	16.5	SS	G	N	3/9/2021	1104	1	N/A	X
11	CUF-209-SB03-16.5/18.0-03092021	CUF-209-SB03	16.5	18.0	SS	G	N	3/9/2021	1115	1	N/A	X
12	CUF-209-SB03-18.0/19.5-03092021	CUF-209-SB03	18.0	19.5	SS	G	N	3/9/2021	1121	1	N/A	X
13	CUF-209-SB03-19.5/21.0-03092021	CUF-209-SB03	19.5	21.0	SS	G	N	3/9/2021	1129	1	N/A	X
14	CUF-209-SB03-FD-03092021	CUF-209-SB03	NA	NA	SS	G	FD	3/9/2021	NA	1	N/A	X
15	CUF-209-SB03-21.0/22.5-03092021	CUF-209-SB03	21.0	22.5	SS	G	N	3/9/2021	1137	1	N/A	X
16	CUF-209-SB03-22.5/24.0-03092021	CUF-209-SB03	22.5	24.0	SS	G	N	3/9/2021	1151	1	N/A	X
17	CUF-209-SB03-24.0/25.5-03092021	CUF-209-SB03	24.0	25.5	SS	G	N	3/9/2021	1202	1	N/A	X
18	CUF-209-SB03-25.5/27.0-03092021	CUF-209-SB03	25.5	27.0	SS	G	N	3/9/2021	1328	1	N/A	X
19	CUF-209-SB03-27.0/28.5-03092021	CUF-209-SB03	27.0	28.5	SS	G	N	3/9/2021	1339	1	N/A	X
20	CUF-209-SB03-28.5/30.0-03092021	CUF-209-SB03	28.5	30.0	SS	G	N	3/9/2021	1358	1	N/A	X
21	CUF-209-SB03-31.5/31.8-03092021	CUF-209-SB03	31.5	31.8	SS	G	N	3/9/2021	1408	1	N/A	X

ABE 03-15-2021

Additional Comments/Special Instructions: ABE 3/15/2021

~~Additional volume collected should be used for MS/MSDs.~~

ABE 03-15-2021

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Briggs Evans / Stantec	3/15/2021	13:30	M. Carse / RJ Lee Group	03-16-21	10:08 am

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
Yes / No ✓	Yes / No ✓	Yes ✓ / No	Yes / No ✓
Yes / No	Yes / No	Yes / No	Yes / No
Yes / No	Yes / No	Yes / No	Yes / No
Yes / No	Yes / No	Yes / No	Yes / No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Briggs Evans
	John Myer

Form TVA 30067A

A0H1061249-1

Monica Carse

From: Sexton, Carolyn <Carolyn.Sexton@stantec.com>
Sent: Thursday, March 18, 2021 10:12 AM
To: Amanda Cover; Evans, Briggs; Myer, John
Cc: Bryan J. Eck; TVA_Deliverables; Monica Carse; prthomas0; Thomas Dicken
Subject: RE: Sample Discrepancy

My apologies Amanda,
The COC is correct, sample time is 1137.
Thanks,
CS

From: Amanda Cover <ACover@envstd.com>
Sent: Thursday, March 18, 2021 10:06 AM
To: Sexton, Carolyn <Carolyn.Sexton@stantec.com>; Evans, Briggs <Briggs.Evans@stantec.com>; Myer, John <John.Myer@stantec.com>
Cc: Bryan J. Eck <beck@envstd.com>; TVA_Deliverables <tva_deliverables@envstd.com>; Monica Carse <MCarse@rjleegroup.com>; prthomas0 <prthomas0@tva.gov>; Thomas Dicken <TDicken@envstd.com>
Subject: RE: Sample Discrepancy
Importance: High

Good morning:

Please confirm the collection time for the sample in RJ Lee's email below as the laboratory is holding the SRC until a response is provided.

Thanks
Amanda

Amanda J. Cover
Senior Quality Assurance Chemist
Environmental Standards, Inc.
610.935.5577 x408

From: Amanda Cover
Sent: Wednesday, March 17, 2021 9:11 AM
To: Sexton, Carolyn <Carolyn.Sexton@stantec.com>; Evans, Briggs <Briggs.Evans@stantec.com>
Cc: Bryan J. Eck <beck@envstd.com>; TVA_Deliverables <tva_deliverables@envstd.com>; Monica Carse <MCarse@rjleegroup.com>
Subject: FW: Sample Discrepancy
Importance: High

Carolyn or Briggs,

Please see RJ Lee's email below and confirm. At this time, please do not provide a revised COC as we have not yet received the SRC for review. Once RJ Lee provides the SRC document, we will follow up to request this revision and ask for any other clarification/revisions that may be needed to get it all done in one shot.

Thanks!

A0H1061249-1

Amanda J. Cover
Senior Quality Assurance Chemist
Environmental Standards, Inc.
610.935.5577 x408

From: Monica Carse <MCarse@rjleegroup.com>
Sent: Wednesday, March 17, 2021 8:57 AM
To: TVA_Deliverables <tva_deliverables@envstd.com>
Cc: Amanda Cover <ACover@envstd.com>; Kara Hagan <khagan@envstd.com>
Subject: Sample Discrepancy
Importance: High

Good Morning,

Upon verification of the samples received yesterday for COC #GEOCUF03092021_1C, there is a discrepancy between the COC and sample.

- Item #15, sample #CUF-209-SB03-21.0/22.5-03092021 states the sample time as 11:37 on the COC but the jar has 11:36 written on it.

Please verify correct sample time.

Have a Great Day!
Monica

Monica Carse

Project Coordinator, TEM Department
RJ Lee Group

724.325.1776 Office
724.387.1927 Direct
MCarse@rjleegroup.com

Appendix B

Mineral Identification Report

RJ LeeGroup, Inc.

Mineral Identification

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 03/23/2021
Sample Received Date: 03/16/2021
RJLG Project: AOH1061249-1
Customer COC: GEOCUF03092021_1C
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-209-SB03-0.0/1.5-03092021	10534298	03/22/2021	03/09/2021	2%	Carbonate Feldspar Opaques Organic Particulate Quartz	Gray sediment
CUF-209-SB03-10.5/12.0-03092021	10534304	03/22/2021	03/09/2021	ND	Carbonate Clay Feldspar Misc. Silicates Opaques Organic Particulate Quartz	Tan sediment
CUF-209-SB03-12.0/13.5-03092021	10534305	03/22/2021	03/09/2021	ND	Carbonate Clay Feldspar Misc. Silicates Opaques Quartz	Light brown sediment

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-209-SB03-13.5/15.0-03 092021	10534306	03/22/2021	03/09/2021	ND	Carbonate Clay Feldspar Misc. Silicates Opaques Quartz	Tan sediment
CUF-209-SB03-15.0/16.5-03 092021	10534307	03/22/2021	03/09/2021	ND	Carbonate Clay Feldspar Misc. Silicates Opaques Quartz	Tan sediment
CUF-209-SB03-16.5/18.0-03 092021	10534308	03/22/2021	03/09/2021	ND	Carbonate Clay Feldspar Opaques Organic Particulate Quartz	Tan/gray sediment
CUF-209-SB03-18.0/19.5-03 092021	10534309	03/23/2021	03/09/2021	ND	Carbonate Clay Feldspar Opaques Quartz	Tan sediment
CUF-209-SB03-19.5/21.0-03 092021	10534310	03/23/2021	03/09/2021	ND	Carbonate Clay Feldspar Opaques Quartz	Light brown sediment
CUF-209-SB03-21.0/22.5-03 092021	10534312	03/23/2021	03/09/2021	ND	Clay Feldspar Misc. Silicates Opaques Quartz	Reddish Yellow Sediment

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-209-SB03-22.5/24.0-03 092021	10534313	03/23/2021	03/09/2021	ND	Clay Feldspar Misc. Silicates Opaques Quartz	Reddish Yellow Sediment
CUF-209-SB03-24.0/25.5-03 092021	10534314	03/23/2021	03/09/2021	ND	Clay Feldspar Misc. Silicates Opaques Quartz	Reddish Yellow Sediment
CUF-209-SB03-25.5/27.0-03 092021	10534315	03/23/2021	03/09/2021	1%	Carbonate Clay Feldspar Opaques Organic Particulate Quartz	Light brown sediment
CUF-209-SB03-27.0/28.5-03 092021	10534316	03/23/2021	03/09/2021	ND	Carbonate Clay Feldspar Misc. Silicates Opaques Quartz	Light brown sediment
CUF-209-SB03-28.5/30.0-03 092021	10534317	03/23/2021	03/09/2021	ND	Carbonate Clay Feldspar Misc. Silicates Opaques Organic Particulate Quartz	Light brown sediment

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-209-SB03-3.0/4.5-0309 2021	10534299	03/22/2021	03/09/2021	1%	Carbonate Clay Feldspar Misc. Silicates Opaques Organic Particulate Quartz	Tan sediment
CUF-209-SB03-31.5/31.8-03 092021	10534318	03/23/2021	03/09/2021	ND	Carbonate Clay Feldspar Misc. Silicates Opaques Quartz Coal	Tan/gray sediment
CUF-209-SB03-4.5/6.0-0309 2021	10534300	03/22/2021	03/09/2021	ND	Carbonate Clay Feldspar Misc. Silicates Opaques Organic Particulate Quartz	Tan sediment
CUF-209-SB03-6.0/7.5-0309 2021	10534301	03/22/2021	03/09/2021	ND	Carbonate Feldspar Misc. Silicates Opaques Quartz	Light brown sediment
CUF-209-SB03-7.5/9.0-0309 2021	10534302	03/22/2021	03/09/2021	ND	Carbonate Clay Feldspar Mica Opaques Quartz	Light brown sediment

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-209-SB03-9.0/10.5-03092021	10534303	03/22/2021	03/09/2021	ND	Carbonate Clay Feldspar Misc. Silicates Opaques Quartz	Light brown sediment
CUF-209-SB03-FD-03092021	10534311	03/23/2021	03/09/2021	ND	Clay Feldspar Misc. Silicates Opaques Quartz	Reddish Yellow Sediment
QC01_CUF-209-SB03-13.5/15.0-03092021	10534319	03/23/2021	03/09/2021	ND	NA	Reddish Yellow Sediment
QC02_CUF-209-SB03-27.0/28.5-03092021	10534320	03/23/2021	03/09/2021	ND	NA	Reddish Yellow Sediment

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory's results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

March 31, 2021

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716

RE: Cumberland Fossil Plant – Analytical Report
RJ Lee Group Project Number AOH1061249-2

Dear Mr. Thomas,

RJ Lee Group, Inc. (RJLG) Monroeville laboratory received 27 samples on March 25, 2021 associated with Tennessee Valley Authority (TVA) Cumberland Fossil Plant Project 182603589. The samples were logged into RJ Lee Group project number AOH1061249-2 and assigned RJLG sample numbers as indicated in Appendix A.

The samples were received in good condition with all custody seals in place and intact. Attached in Appendix A is the sample receipt confirmation form, revised COC and sample receipt check list.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified to return the samples covered in this report, RJ Lee Group will store them for a period of ninety (90) days before discarding.

Should you have any questions regarding this information, please do not hesitate to contact us.

Sincerely,

Monica McGrath-Koerner
Geologist

Attachments: Chain of Custody Forms
Mineral Identification Report

Appendix A
Chain of Custody Forms

Chain of Custody

RJ Lee Group Work Order #: AOH1061249-2

Project Name/Case #: Cumberland Fossil Plant

Received From:	Relinquished To:
Briggs Evans Stantec 601 Grassmere Park Road Suite 22 Nashville, TN 37211 United States Main: 615-885-1144	RJLee Group, Inc. 350 Hochberg Road Monroeville, PA 15146 United States Main: 724-325-1776 Fax: 724-325-1775

Sample ID	Client Sample ID	Date Received
10534585	CUF-209-SB05-0.0/1.5-03232021	03/25/2021 9:29 AM EDT
10534586	CUF-209-SB05-1.5/3.0-03232021	03/25/2021 9:29 AM EDT
10534587	CUF-209-SB05-3.0/4.5-03232021	03/25/2021 9:29 AM EDT
10534588	CUF-209-SB05-6.0/7.5-03232021	03/25/2021 9:29 AM EDT
10534589	CUF-209-SB05-7.5/9.0-03232021	03/25/2021 9:29 AM EDT
10534590	CUF-209-SB05-9.0/10.5-03232021	03/25/2021 9:29 AM EDT
10534591	CUF-209-SB05-10.5/12.0-03232021	03/25/2021 9:29 AM EDT
10534592	CUF-209-SB05-12.0/13.5-03232021	03/25/2021 9:29 AM EDT
10534593	CUF-209-SB05-13.5/15.0-03232021	03/25/2021 9:29 AM EDT
10534594	CUF-209-SB05-15.0/16.5-03232021	03/25/2021 9:29 AM EDT
10534595	CUF-209-SB05-16.5/18.0-03232021	03/25/2021 9:29 AM EDT
10534596	CUF-209-SB05-18.0/19.5-03232021	03/25/2021 9:29 AM EDT
10534597	CUF-209-SB05-19.5/21.0-03232021	03/25/2021 9:29 AM EDT
10534598	CUF-209-SB05-21.0/22.5-03232021	03/25/2021 9:29 AM EDT
10534599	CUF-209-SB05-22.5/24.0-03232021	03/25/2021 9:29 AM EDT
10534600	CUF-209-SB05-24.0/25.5-03232021	03/25/2021 9:29 AM EDT
10534601	CUF-209-SB05-25.5/27.0-03232021	03/25/2021 9:29 AM EDT
10534602	CUF-209-SB05-27.0/28.5-03232021	03/25/2021 9:29 AM EDT
10534603	CUF-209-SB05-28.5/30.0-03232021	03/25/2021 9:29 AM EDT
10534604	CUF-209-SB05-30.0/31.5-03232021	03/25/2021 9:29 AM EDT
10534605	CUF-209-SB05-31.5/33.0-03232021	03/25/2021 9:29 AM EDT
10534606	CUF-209-SB05-33.0/34.5-03232021	03/25/2021 9:29 AM EDT
10534607	CUF-209-SB05-34.5/36.0-03232021	03/25/2021 9:29 AM EDT
10534608	CUF-209-SB05-36.0/37.5-03232021	03/25/2021 9:29 AM EDT
10534609	CUF-209-SB05-37.5/37.8-03232021	03/25/2021 9:29 AM EDT
10534610	CUF-209-SB05-FD01-03232021	03/25/2021 9:29 AM EDT
10534611	CUF-209-SB05-FD02-03232021	03/25/2021 9:29 AM EDT
10534612	QC01_CUF-209-SB05-0.0/1.5-03232021	03/25/2021 9:29 AM EDT
10534613	QC02_CUF-209-SB05-15.0/16.5-03232021	03/25/2021 9:29 AM EDT

Sample ID	Client Sample ID	Date Received
10534614	QC03_CUF-209-SB05-30.0/31.5-03232021	03/25/2021 9:29 AM EDT

	Received From: Briggs Evans	*Method of Shipment:* *Federal Express*
	Company: Stantec	**Date:** 03/25/2021
	Received By: Monica Carse	*Package Condition Upon Receipt:* *Sealed*
	Company: RJ Lee Group, Inc.	**Date:** 03/25/2021

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

	Relinquished	*Method of Shipment:*
	Company:	**Date:**
	Received By:	*Package Condition Upon Receipt:*
	Company:	**Date:**

RJ Lee Group
Sample Receipt and Log in Check List

Client:	Tennessee Valley Authority	Date Received:	3/25/2021	Log in Date:	3/26/2021
Time Received:	9:29 AM	By:	Monica Carse	COC# :	GEOCUF03232021_1C
Project:	AOH1061249-2	# Coolers Received	1	Means of Shipment:	FedEx
Air Bill:	6498 5715 0267				

As Received Screen	Yes	No	Comments
Were the Coolers received in good condition?	✓		
Was there evidence of tampering?		✓	
Are Custody Seals intact and in good condition?	✓		
Were Coolers received between 2 and 4 degrees C?	N/A		
Were all samples intact?	✓		
Were all samples accurately labeled?		X	See Below
Was the COC received in good condition?	✓		
Did the sample ID on COC match the ID on the sample jars?		X	See Below
Were there any discrepancies among samples and COC?	X		See Below
Is the COC completely filled out?	✓		
Was the COC relinquished properly?	✓		

List any anomalies associated with Sample Receipt

See e-mail attached to COC for sample discrepancy.

Analyst Signature: M. Carse 03-26-21

Manager Signature: [signature] 03-26-21

AOH1061249-2

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1 of 1
COC No:	GEOCUF03232021_1C
	1 of 1 Pages
Task Desc:	CUF_Geochemical_2021_03

Required Ship to Lab:

Lab Name:	RJ Lee Group, Inc.
Lab Address:	350 Hochberg Road Monroeville, PA 15146

Lab Manager Contact Information

Lab PM:	Monica Carse
Phone/Fax:	724-325-1776
Lab Email:	MCarse@rjleegroup.com

Required Project Information:

Site ID #:	CUMBERLAND FOSSIL PLANT
Project #:	182603589
Site Address	Plant 815 Cumberland City Road
City	Cumberland City; State, Zip: TN, 37050
Site PM Name:	Paul Thomas
Phone/Fax:	(423) 751-2926
Site PM Email:	prthomas0@tva.gov

Required Sampler Information

Sampler:	Briggs Evans/Evan Holecombe
Sampling Company:	Stantec
Address	601 Grassmere Park, Suite 22
City/State	Nashville, TN; Phone No: 6158851144
Sampling Team Number:	1
Send EDD/Hard Copy to:	tva_deliverables@envstd.com

Analysis Turnaround Time

CALENDAR DAYS / WORKING DAYS

TAT if different from Below ______

- [ ] 24 Hours
- [x] 3 Business Days
- [ ] 5 Business Days
- [ ] 10 Business Days (Standard)

Filtered: N — Preserve: None — Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Feet)	End Depth (Feet)	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
1	CUF-209-SB05-0.0/1.5-03232021	CUF-209-SB05	0.0	1.5	SO	G	N	3/23/2021	1051	1	N/A	X
2	CUF-209-SB05-1.5/3.0-03232021	CUF-209-SB05	1.5	3.0	SO	G	N	3/23/2021	1056	1	N/A	X
3	CUF-209-SB05-3.0/4.5-03232021	CUF-209-SB05	3.0	4.5	SO	G	N	3/23/2021	1104	1	N/A	X
4	CUF-209-SB05-6.0/7.5-03232021	CUF-209-SB05	6.0	7.5	SO	G	N	3/23/2021	1116	1	N/A	X
5	CUF-209-SB05-7.5/9.0-03232021	CUF-209-SB05	7.5	9.0	SO	G	N	3/23/2021	1127	1	N/A	X
6	CUF-209-SB05-9.0/10.5-03232021	CUF-209-SB05	9.0	10.5	SO	G	N	3/23/2021	1149	1	N/A	X
7	CUF-209-SB05-10.5/12.0-03232021	CUF-209-SB05	10.5	12.0	SO	G	N	3/23/2021	1157	1	N/A	X
8	CUF-209-SB05-12.0/13.5-03232021	CUF-209-SB05	12.0	13.5	SO	G	N	3/23/2021	1301	1	N/A	X
9	CUF-209-SB05-13.5/15.0-03232021	CUF-209-SB05	13.5	15.0	SO	G	N	3/23/2021	1310	1	N/A	X
10	CUF-209-SB05-15.0/16.5-03232021	CUF-209-SB05	15.0	16.5	SO	G	N	3/23/2021	1320	1	N/A	X
11	CUF-209-SB05-16.5/18.0-03232021	CUF-209-SB05	16.5	18.0	SO	G	N	3/23/2021	1330	1	N/A	X
12	CUF-209-SB05-18.0/19.5-03232021	CUF-209-SB05	18.0	19.5	SO	G	N	3/23/2021	1340	1	N/A	X
13	CUF-209-SB05-19.5/21.0-03232021	CUF-209-SB05	19.5	21.0	SO	G	N	3/23/2021	1354	1	N/A	X
14	CUF-209-SB05-21.0/22.5-03232021	CUF-209-SB05	21.0	22.5	SO	G	N	3/23/2021	1401	1	N/A	X
15	CUF-209-SB05-22.5/24.0-03232021	CUF-209-SB05	22.5	24.0	SO	G	N	3/23/2021	1411	1	N/A	X
16	CUF-209-SB05-24.0/25.5-03232021	CUF-209-SB05	24.0	25.5	SO	G	N	3/23/2021	1417	1	N/A	X
17	CUF-209-SB05-25.5/27.0-03232021	CUF-209-SB05	25.5	27.0	SO	G	N	3/23/2021	1425	1	N/A	X
18	CUF-209-SB05-27.0/28.5-03232021	CUF-209-SB05	27.0	28.5	SO	G	N	3/23/2021	1431	1	N/A	X
19	CUF-209-SB05-28.5/30.0-03232021	CUF-209-SB05	28.5	30.0	SO	G	N	3/23/2021	1444	1	N/A	X
20	CUF-209-SB05-30.0/31.5-03232021	CUF-209-SB05	30.0	31.5	SO	G	N	3/23/2021	1454	1	N/A	X
21	CUF-209-SB05-31.5/33.0-03232021	CUF-209-SB05	31.5	33.0	SO	G	N	3/23/2021	1505	1	N/A	X
22	CUF-209-SB05-33.0/34.5-03232021	CUF-209-SB05	33.0	34.5	SO	G	N	3/23/2021	1518	1	N/A	X
23	CUF-209-SB05-34.5/36.0-03232021	CUF-209-SB05	34.5	36.0	SO	G	N	3/23/2021	1529	1	N/A	X
24	CUF-209-SB05-36.0/37.5-03232021	CUF-209-SB05	36.0	37.5	SO	G	N	3/23/2021	1544	1	N/A	X
25	CUF-209-SB05-37.5/38.0-03232021	CUF-209-SB05	37.5	37.8	SO	G	N	3/23/2021	1555	1	N/A	X
26	CUF-SS-FD01-03232021	CUF-209-SB05	NA	NA	SO	G	FD	3/23/2021	N/A	1	N/A	X
28	CUF-SS-FD02-03232021	CUF-209-SB05	NA	NA	SO	G	FD	3/23/2021	N/A	1	N/A	X

ABL 03240021

Additional Comments/Special Instructions:

ABL 03240021

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Briggs Evans / Stantec	3/24/2021	19:30	M. Carse RJ Lee Group	03-25-21	9:39 am

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
Yes / No ✓	Yes / No ✓	Yes ✓ / No	Yes / No ✓
Yes / No	Yes / No	Yes / No	Yes / No
Yes / No	Yes / No	Yes / No	Yes / No
Yes / No	Yes / No	Yes / No	Yes / No

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME AND SIGNATURE
Fedex	Briggs Evans
	Evan Holcombe

Form TVA 30067A

AOH1061249-2

Monica Carse

From:	Amanda Cover <ACover@envstd.com>
Sent:	Friday, March 26, 2021 8:59 AM
To:	Monica Carse; Bryan J. Eck; Evans, Briggs; Sexton, Carolyn
Cc:	TVA_Deliverables; Jennifer Gable
Subject:	RE: Sample Discrepancy

Hi Monica,

Please use the sample IDs as written on the jars: CUF-209-SB05-FD01-03232021 and CUF-209-SB05-FD02-03232021

This is inline with the nomenclature in the associated SAP. We'll request COC revisions once the SRC has been received and reviewed.

Thanks
Amanda

Amanda J. Cover
Senior Quality Assurance Chemist
Environmental Standards, Inc.
610.935.5577 x408

From: Monica Carse <MCarse@rjleegroup.com>
Sent: Thursday, March 25, 2021 3:10 PM
To: Bryan J. Eck <beck@envstd.com>; Evans, Briggs <Briggs.Evans@stantec.com>; Sexton, Carolyn <Carolyn.Sexton@stantec.com>
Cc: Amanda Cover <ACover@envstd.com>; TVA_Deliverables <tva_deliverables@envstd.com>; Jennifer Gable <jgable@envstd.com>
Subject: RE: Sample Discrepancy
Importance: High

Sorry to jump the gun, but there are two more discrepancies.

- Item #26 and #28 list the samples as CUF-SS-FD01-03232021 and CUF-SS-FD02-03232021 on the COC. The jars have CUF-209-SB05-FD02-03232021 and CUF-209-SB05-FD02-03232021 written on them.

Please verify the correct sample ID that I am to use.

Thank you!
Monica

Monica Carse

Project Coordinator, TEM Department
RJ Lee Group

724.325.1776 Office

A0H20641249.2

724.387.1927 Direct
MCarse@rjleegroup.com

Website | Lab Services | Shop | Pay My Bill

350 Hochberg Road | Monroeville, PA 15146

From: Bryan J. Eck <beck@envstd.com>
Sent: Thursday, March 25, 2021 1:30 PM
To: Evans, Briggs <Briggs.Evans@stantec.com>; Sexton, Carolyn <Carolyn.Sexton@stantec.com>
Cc: Amanda Cover <ACover@envstd.com>; Monica Carse <MCarse@rjleegroup.com>; TVA_Deliverables <tva_deliverables@envstd.com>; Jennifer Gable <jgable@envstd.com>
Subject: RE: Sample Discrepancy

Thanks Evan,

We will wait to revise the COC until the SRC review has been completed.

Bryan J. Eck
Staff Chemist II
Environmental Standards, Inc.
1140 Valley Forge Road • PO Box 810 • Valley Forge, PA 19482
610.935.5577 ext 417 • www.envstd.com • beck@envstd.com

Emergency Response Quality Assurance Hotline: 855.374.7272

ENVIRONMENTAL® STANDARDS

From: Evans, Briggs <Briggs.Evans@stantec.com>
Sent: Thursday, March 25, 2021 1:23 PM
To: Bryan J. Eck <beck@envstd.com>; Sexton, Carolyn <Carolyn.Sexton@stantec.com>
Cc: Amanda Cover <ACover@envstd.com>; Monica Carse <MCarse@rjleegroup.com>; TVA_Deliverables <tva_deliverables@envstd.com>; Jennifer Gable <jgable@envstd.com>
Subject: Re: Sample Discrepancy

The correct interval is 37.5' to 37.8'. Should I revise the COC now or wait until the lab provides their copy?

Briggs Evans, PG
Senior Geologist
Stantec
601 Grassmere Park Road Suite 22 Nashville TN 37211-3681
Phone: 615-885-1144 ext 251
Cell: 615-585-4685

A021061249-2

Fax: 615-885-1102
briggs.evans@stantec.com
Stantec

From: Bryan J. Eck <beck@envstd.com>
Sent: Thursday, March 25, 2021 12:15:13 PM
To: Evans, Briggs <Briggs.Evans@stantec.com>; Sexton, Carolyn <Carolyn.Sexton@stantec.com>
Cc: Amanda Cover <ACover@envstd.com>; Monica Carse <MCarse@rjleegroup.com>; TVA_Deliverables <tva_deliverables@envstd.com>; Jennifer Gable <jgable@envstd.com>
Subject: RE: Sample Discrepancy

Good Afternoon,

Can the sample ID below please be confirmed. The start and end depths for this sample are 37.5 and 37.8, respectively.

Thank you,

Bryan J. Eck
Staff Chemist II
Environmental Standards, Inc.
1140 Valley Forge Road • PO Box 810 • Valley Forge, PA 19482
610.935.5577 ext 417 • www.envstd.com • beck@envstd.com

Emergency Response Quality Assurance Hotline: 855.374.7272

ENVIRONMENTAL® STANDARDS

From: Monica Carse <MCarse@rjleegroup.com>
Sent: Thursday, March 25, 2021 1:00 PM
To: TVA_Deliverables <tva_deliverables@envstd.com>
Cc: Amanda Cover <ACover@envstd.com>; Bryan J. Eck <beck@envstd.com>
Subject: Sample Discrepancy
Importance: High

Good Afternoon,

Upon verification of the samples received this morning for COC #GEOCUF03232021_1C, there is a discrepancy between the COC and sample.

- Item #25, the COC has sample ID listed as CUF-209-SB05-37.5/38.0-03232021 but the jar has CUF-209-SB05-37.5/37.8-0323202 written on it.

Please verify correct sample ID.

Have a Great Day!
Monica

A011061249-2

Monica Carse

Project Coordinator, TEM Department
RJ Lee Group

724.325.1776 Office
724.387.1927 Direct
MCarse@rjleegroup.com

Website | Lab Services | Shop | Pay My Bill

350 Hochberg Road | Monroeville, PA 15146

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AOH1061249-2

GEOCUF03232021_1C REV1
(03/31/2021, abe)

CCR RULE GROUND-WATER QUALITY MONITORING PROGRAM

TVA
Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	1	of	1
COC No:	GEOCUF03232021_1C		
1 of 1 Pages			
Task Desc:	CUF_Geochemical_2021_03		

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	RJ Lee Group, Inc.	Site ID #:	CUMBERLAND FOSSIL PLANT	Sampler:	Briggs Evans/Evan Holecombe
Lab Address:	350 Hochberg Road, Monroeville, PA 15146	Project #:	182603589	Sampling Company:	Stantec
		Site Address	Plant 815 Cumberland City Road	Address	601 Grassmere Park, Suite 22
		City	Cumberland City; State, Zip: TN, 37050	City/State	Nashville, TN; Phone No: 6158851144
Lab Manager Contact Information		Site PM Name:	Paul Thomas		
Lab PM:	Monica Carse	Phone/Fax:	(423) 751-2926	Sampling Team Number:	1
Phone/Fax:	724-325-1776	Site PM Email:	prthomas0@tva.gov	Send EDD/Hard Copy to:	tva_deliverables@envstd.com
Lab Email:	MCarse@rjleegroup.com				

Analysis Turnaround Time
CALENDAR DAYS / WORKING DAYS
TAT if different from Below
- [ ] 24 Hours
- [x] 3 Business Days
- [ ] 5 Business Days
- [ ] 10 Business Days (Standard)

Filtered: N; Preserve: None; Analysis: PLM

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	PLM
			Sample Depth — Depth Unit: Feet									
1	CUF-209-SB05-0.0/1.5-03232021	CUF-209-SB05	0.0	1.5	SO	G	N	3/23/2021	1051	1	N/A	X
2	CUF-209-SB05-1.5/3.0-03232021	CUF-209-SB05	1.5	3.0	SO	G	N	3/23/2021	1056	1	N/A	X
3	CUF-209-SB05-3.0/4.5-03232021	CUF-209-SB05	3.0	4.5	SO	G	N	3/23/2021	1104	1	N/A	X
4	CUF-209-SB05-6.0/7.5-03232021	CUF-209-SB05	6.0	7.5	SO	G	N	3/23/2021	1116	1	N/A	X
5	CUF-209-SB05-7.5/9.0-03232021	CUF-209-SB05	7.5	9.0	SO	G	N	3/23/2021	1127	1	N/A	X
6	CUF-209-SB05-9.0/10.5-03232021	CUF-209-SB05	9.0	10.5	SO	G	N	3/23/2021	1149	1	N/A	X
7	CUF-209-SB05-10.5/12.0-03232021	CUF-209-SB05	10.5	12.0	SO	G	N	3/23/2021	1157	1	N/A	X
8	CUF-209-SB05-12.0/13.5-03232021	CUF-209-SB05	12.0	13.5	SO	G	N	3/23/2021	1301	1	N/A	X
9	CUF-209-SB05-13.5/15.0-03232021	CUF-209-SB05	13.5	15.0	SO	G	N	3/23/2021	1310	1	N/A	X
10	CUF-209-SB05-15.0/16.5-03232021	CUF-209-SB05	15.0	16.5	SO	G	N	3/23/2021	1320	1	N/A	X
11	CUF-209-SB05-16.5/18.0-03232021	CUF-209-SB05	16.5	18.0	SO	G	N	3/23/2021	1330	1	N/A	X
12	CUF-209-SB05-18.0/19.5-03232021	CUF-209-SB05	18.0	19.5	SO	G	N	3/23/2021	1340	1	N/A	X
13	CUF-209-SB05-19.5/21.0-03232021	CUF-209-SB05	19.5	21.0	SO	G	N	3/23/2021	1354	1	N/A	X
14	CUF-209-SB05-21.0/22.5-03232021	CUF-209-SB05	21.0	22.5	SO	G	N	3/23/2021	1401	1	N/A	X
15	CUF-209-SB05-22.5/24.0-03232021	CUF-209-SB05	22.5	24.0	SO	G	N	3/23/2021	1411	1	N/A	X
16	CUF-209-SB05-24.0/25.5-03232021	CUF-209-SB05	24.0	25.5	SO	G	N	3/23/2021	1417	1	N/A	X
17	CUF-209-SB05-25.5/27.0-03232021	CUF-209-SB05	25.5	27.0	SO	G	N	3/23/2021	1425	1	N/A	X
18	CUF-209-SB05-27.0/28.5-03232021	CUF-209-SB05	27.0	28.5	SO	G	N	3/23/2021	1431	1	N/A	X
19	CUF-209-SB05-28.5/30.0-03232021	CUF-209-SB05	28.5	30.0	SO	G	N	3/23/2021	1444	1	N/A	X
20	CUF-209-SB05-30.0/31.5-03232021	CUF-209-SB05	30.0	31.5	SO	G	N	3/23/2021	1454	1	N/A	X
21	CUF-209-SB05-31.5/33.0-03232021	CUF-209-SB05	31.5	33.0	SO	G	N	3/23/2021	1505	1	N/A	X
22	CUF-209-SB05-33.0/34.5-03232021	CUF-209-SB05	33.0	34.5	SO	G	N	3/23/2021	1518	1	N/A	X
23	CUF-209-SB05-34.5/36.0-03232021	CUF-209-SB05	34.5	36.0	SO	G	N	3/23/2021	1529	1	N/A	X
24	CUF-209-SB05-36.0/37.5-03232021	CUF-209-SB05	36.0	37.5	SO	G	N	3/23/2021	1544	1	N/A	X
25	~~[illegible]~~ CUF-209-SB05-37.5/37.8-03232021	CUF-209-SB05	37.5	37.8	SO	G	N	3/23/2021	1555	1	N/A	X
26	~~[illegible]~~ CUF-209-SB05-FD01-03232021	CUF-209-SB05	NA	NA	SO	G	FD	3/23/2021	N/A	1	N/A	X
28	~~[illegible]~~ CUF-209-SB05-FD02-03232021	CUF-209-SB05	NA	NA	SO	G	FD	3/23/2021	N/A	1	N/A	X

Additional Comments/Special Instructions: (03/31/2021, abe)

ABE 03240021

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Briggs Evans / Stantec	3/24/2021	19:30	M. Carse RJ Lee Group	03-25-21	9:39 AM

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
No	No	Yes	No

SHIPPING METHOD: (Select Appropriate)
Fedex

SAMPLER NAME AND SIGNATURE
Briggs Evans
Evan Holcombe

Form TVA 30067A

Appendix B
Mineral Identification Report

Mineral Identification

RJ LeeGroup, Inc.

Polarized Light Microscopy (PLM) Laboratory Report

Paul Thomas
TVA Bull Run Fossil Plant
1265 Edgemoor Road
Clinton, TN 37716 United States
Email: prthomas0@tva.gov
Main: 423-751-2926

Report Date: 03/26/2021
Sample Received Date: 03/25/2021
RJLG Project: AOH1061249-2
Customer COC: GEOCUF03232021_1C
Purchase Order: 6302462
Analytical Method: Fly Ash Determination by PLM

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-209-SB05-0.0/1.5-03232021	10534585	03/29/2021	03/23/2021	1%	Carbonate Feldspar Mica Misc. Silicates Opaques Organic Particulate Quartz	Gray sediment
CUF-209-SB05-1.5/3.0-03232021	10534586	03/29/2021	03/23/2021	ND	Carbonate Clay Feldspar Misc. Silicates Opaques Quartz	Light brown sediment
CUF-209-SB05-10.5/12.0-03232021	10534591	03/30/2021	03/23/2021	ND	Carbonate Clay Feldspar Mica Misc. Silicates Opaques Quartz	Tan sediment

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-209-SB05-12.0/13.5-03 232021	10534592	03/30/2021	03/23/2021	ND	Carbonate Clay Misc. Silicates Opaques Quartz	Light Brown Sediment
CUF-209-SB05-13.5/15.0-03 232021	10534593	03/30/2021	03/23/2021	ND	Carbonate Clay Misc. Silicates Opaques Quartz	Light Brown Sediment
CUF-209-SB05-15.0/16.5-03 232021	10534594	03/30/2021	03/23/2021	ND	Carbonate Clay Misc. Silicates Opaques Quartz	Light Brown Sediment
CUF-209-SB05-16.5/18.0-03 232021	10534595	03/30/2021	03/23/2021	ND	Carbonate Clay Misc. Silicates Opaques Quartz	Brown Sediment
CUF-209-SB05-18.0/19.5-03 232021	10534596	03/30/2021	03/23/2021	ND	Carbonate Clay Misc. Silicates Opaques Quartz	Light Brown Sediment
CUF-209-SB05-19.5/21.0-03 232021	10534597	03/30/2021	03/23/2021	ND	Carbonate Clay Feldspar Mica Misc. Silicates Opaques Quartz	Light brown sediment

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-209-SB05-21.0/22.5-03 232021	10534598	03/30/2021	03/23/2021	ND	Carbonate Feldspar Mica Misc. Silicates Opaques Quartz	Tan/yellowish sediment
CUF-209-SB05-22.5/24.0-03 232021	10534599	03/30/2021	03/23/2021	ND	Carbonate Clay Feldspar Mica Misc. Silicates Opaques Quartz	Light brown/reddish sediment
CUF-209-SB05-24.0/25.5-03 232021	10534600	03/30/2021	03/23/2021	ND	Clay Mica Misc. Silicates Opaques Quartz	Reddish Yellow Sediment
CUF-209-SB05-25.5/27.0-03 232021	10534601	03/30/2021	03/23/2021	ND	Clay Mica Misc. Silicates Opaques Quartz	Reddish Yellow Sediment
CUF-209-SB05-27.0/28.5-03 232021	10534602	03/30/2021	03/23/2021	ND	Clay Mica Misc. Silicates Opaques Quartz	Reddish Yellow Sediment
CUF-209-SB05-28.5/30.0-03 232021	10534603	03/30/2021	03/23/2021	ND	Clay Mica Misc. Silicates Opaques Quartz	Reddish Yellow Sediment

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-209-SB05-3.0/4.5-03232021	10534587	03/29/2021	03/23/2021	ND	Carbonate Feldspar Misc. Silicates Opaques Quartz	Tan sediment
CUF-209-SB05-30.0/31.5-03232021	10534604	03/30/2021	03/23/2021	1%	Clay Mica Misc. Silicates Opaques Quartz	Reddish Yellow Sediment
CUF-209-SB05-31.5/33.0-03232021	10534605	03/30/2021	03/23/2021	ND	Carbonate Misc. Silicates Opaques Quartz	Brown Sediment
CUF-209-SB05-33.0/34.5-03232021	10534606	03/30/2021	03/23/2021	1%	Carbonate Clay Misc. Silicates Opaques Quartz	Brown Sediment
CUF-209-SB05-34.5/36.0-03232021	10534607	03/30/2021	03/23/2021	ND	Carbonate Clay Misc. Silicates Opaques Quartz	Brown Sediment
CUF-209-SB05-36.0/37.5-03232021	10534608	03/30/2021	03/23/2021	ND	Carbonate Clay Feldspar Misc. Silicates Opaques Quartz	Light brown sediment

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-209-SB05-37.5/37.8-03232021	10534609	03/30/2021	03/23/2021	ND	Carbonate Clay Feldspar Misc. Silicates Opaques Quartz	Light brown sediment
CUF-209-SB05-6.0/7.5-03232021	10534588	03/29/2021	03/23/2021	ND	Carbonate Clay Feldspar Mica Opaques Quartz	Light brown/reddish sediment
CUF-209-SB05-7.5/9.0-03232021	10534589	03/29/2021	03/23/2021	ND	Carbonate Clay Feldspar Mica Misc. Silicates Opaques Quartz	Tan sediment
CUF-209-SB05-9.0/10.5-03232021	10534590	03/29/2021	03/23/2021	ND	Carbonate Clay Feldspar Mica Misc. Silicates Opaques Quartz	Tan sediment
CUF-209-SB05-FD01-03232021	10534610	03/30/2021	03/23/2021	ND	Carbonate Clay Feldspar Misc. Silicates Opaques Quartz	Light brown/reddish sediment

Customer Sample # :	RJLG ID	Date Analyzed	Date Collected	Area % Fly Ash	Non-Fly Ash Components	Comments
CUF-209-SB05-FD02-03232021	10534611	03/30/2021	03/23/2021	ND	Carbonate Clay Feldspar Mica Opaques Quartz	Tan sediment
QC01_CUF-209-SB05-0.0/1.5-03232021	10534612	03/29/2021	03/23/2021	2%	NA	
QC02_CUF-209-SB05-15.0/16.5-03232021	10534613	03/30/2021	03/23/2021	ND	NA	Light brown sediment
QC03_CUF-209-SB05-30.0/31.5-03232021	10534614	03/30/2021	03/23/2021	1%	NA	Brown sediment

Disclaimer Notes

* Samples will be returned to client immediately upon the release of final report.
* These results are submitted pursuant to RJ Lee Group’s current terms and conditions of sale, including the company’s standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which these results are used or interpreted.
* This test report relates to the items tested.
* Any reproduction of this document must include the entire document in order for the report to be valid.
* This report may not be used to claim product endorsement by NVLAP Lab Code 101208-0 or any agency of the U.S. Government.
* Sample(s) for this project were analyzed at our: Monroeville, PA (AIHA # 100364, NVLAP # 101208-0, NY ELAP # 10884) facility.
* If RJ Lee Group, Inc. did not collect the samples analyzed, the verifiability of the laboratory’s results is limited to the reported values.
* For the purposes of this method, Fly Ash is defined as any particle consistent with Coal Ash.
* The method reporting level is 1% and anything <1% is considered a not-detected.

Quartz – Angular anisotropic particulate with low relief.
Feldspar – Angular to blocky anisotropic particulate, low to moderate relief, biaxial, can have polysynthetic twinning.
Clay – Sheet silicates with polycrystalline or display non-uniform extinction with low to moderate relief, and zero to low birefringence. Clay also refers to particles that are less than 2.0 microns.
Opaques – Opaque is a generic term for a particle that does not transmit light. Opaque minerals are distinguished from opaque bottom ash based on morphology of fracture.
Fly Ash – Isotropic to opaque spheres, agglomeration of spheres, and angular ash particles.
Organic Particulate – Pollen, plant and insect matter, and carbonaceous matter.
Carbonates – High birefringent, can be rhombohedral, with high relief.
Diatoms – Silica rich isotropic particles with various morphologies.
Mica – Sheet silicate with moderate to high relief and low birefringence, mono-crystalline, and normal extinction.
Miscellaneous Silicate – Isotropic and anisotropic silicates, with low to high relief, identification unsure and beyond the scope of the method to identify.
Amphibole – Elongated anisotropic particulate with moderate to high relief.
Coal – Irregular to angular particles with moderate opacity, edges and thin particles are reddish brown in color.
<1% Fly Ash – Fly Ash observed, none counted.
ND – No Fly Ash detected.

ATTACHMENT H.1-B
GROUNDWATER, PORE WATER, RIVER STAGE LEVEL AND RAINFALL HYDROGRAPHS

Instrument Name	Northing TN STP NAD27	Easting TN STP NAD27
CUF_DAS_A_1	731,857.08	1,510,656.05
CUF_DAS_A_2	731,762.61	1,510,654.21
CUF_P_2C	732,300.93	1,509,485.27
CUF_P_2C_R	732,300.67	1,509,472.57
CUF_PZ100	732,555.67	1,509,526.00
CUF_PZ3A	732,139.24	1,509,474.38
CUF_PZ49	732,928.84	1,509,696.68
CUF_PZ53A	733,456.66	1,510,307.93
CUF_PZ53B	733,450.68	1,510,313.25
CUF_PZ54A	733,417.30	1,510,371.66
CUF_PZ57A	733,368.90	1,511,362.59
CUF_PZ58A	733,308.71	1,511,311.51
CUF_R_2B	733,223.18	1,510,124.27
CUF_R_4C	733,222.23	1,510,019.92
CUF_S_2A	733,490.10	1,510,465.54
CUF_T_2A	733,555.71	1,510,771.61
CUF_TPZ1	732,545.68	1,510,631.12
CUF_TPZ10	732,157.00	1,510,977.63
CUF_TPZ11	732,167.30	1,510,507.42
CUF_TPZ12	732,157.32	1,510,660.16
CUF_TPZ14	732,349.80	1,510,535.53
CUF_TPZ15	732,318.91	1,510,726.24
CUF_TPZ16	732,510.92	1,511,009.65
CUF_TPZ17	732,614.84	1,511,017.63

Instrument Name	Northing TN STP NAD27	Easting TN STP NAD27
CUF_TPZ18	732,388.87	1,510,807.18
CUF_TPZ19	732,437.43	1,510,779.11
CUF_TPZ20	732,475.43	1,510,757.12
CUF_TPZ4	732,422.15	1,510,926.28
CUF_TPZ7	732,299.42	1,510,862.77
PWB-PZ200	732,567.02	1,509,483.85
PWB-PZ35	732,949.29	1,510,068.15
PWB-PZ36	732,870.99	1,510,065.47
PWB-PZ37	732,905.68	1,511,044.82
PWB-PZ38	732,811.22	1,511,032.35
PZ-58A	733,305.17	1,511,314.73
CUF_TPZ22	732,687.05	1,510,497.43
CUF_TPZ25	732,586.95	1,509,895.56
CUF_TPZ28	732,498.31	1,510,168.78
CUF_TPZ29	732,676.57	1,510,392.59
CUF_TPZ30	732,876.19	1,509,929.61
CUF_TPZ21	732,684.15	1,510,627.56
CUF_TPZ23	732,323.85	1,510,258.32
CUF_TPZ24	732,443.36	1,510,193.74
CUF_TPZ26	732,610.65	1,509,943.44
CUF_TPZ31A/B	732,565.93	1,510,100.76
CUF_TPZ32A/B	732,415.30	1,510,065.97
CUF_TPZ33A/B	732,650.88	1,510,386.34
CUF_TPZ34A/B	732,560.49	1,510,390.76

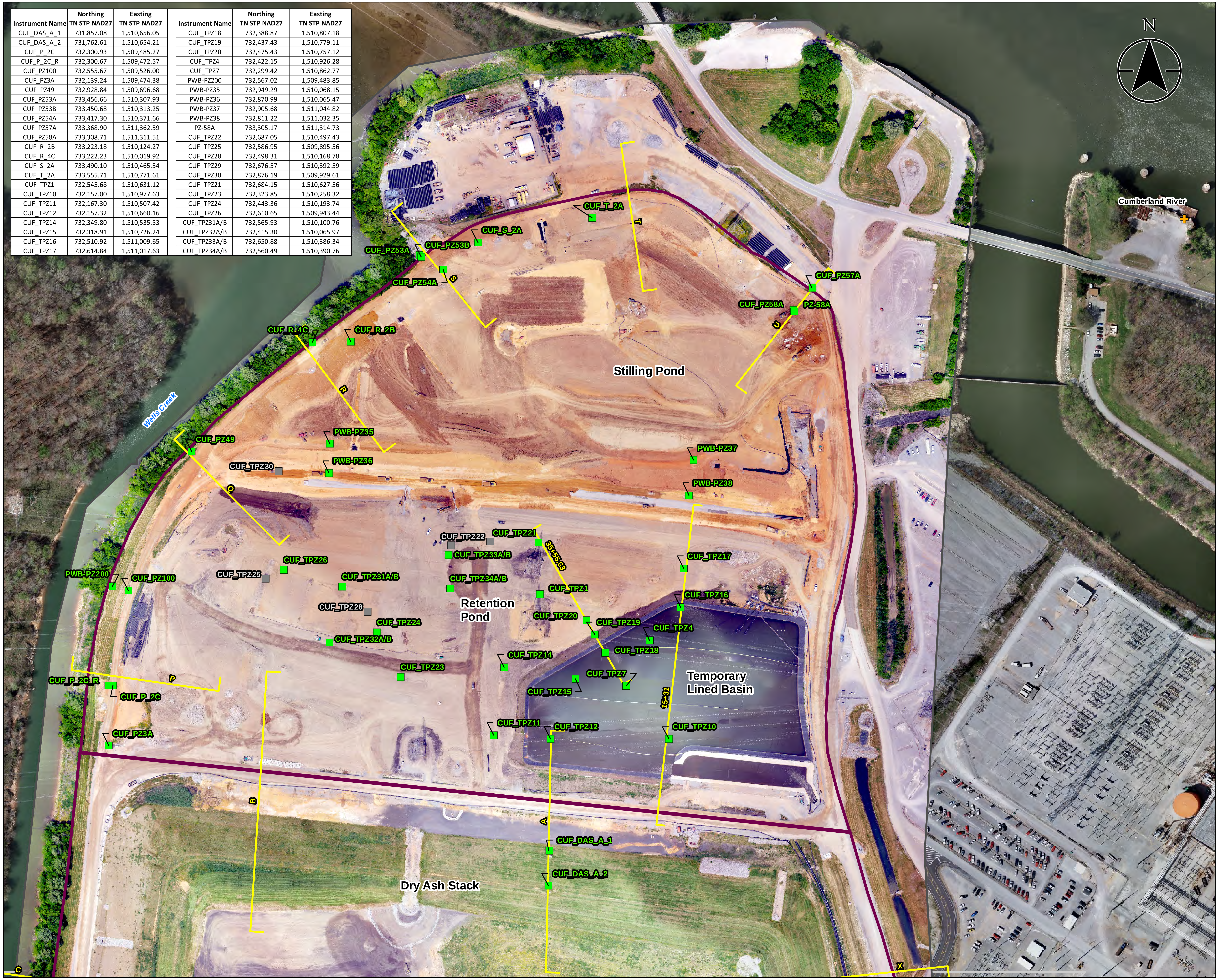


Figure No.

Attachment H.1-B, Figure 1

Title

CUF Instrumentation Main Ash Pond and Temporary Lined Basin

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant
Monthly Instrumentation Reports

Project Location | 175568429

Stewart County, Tennessee

Prepared by SMH on 2023-01-23
Technical Review by VB on 2023-01-23
Independent Review by JK on 2023-01-23

0 125 250 375 500 Feet

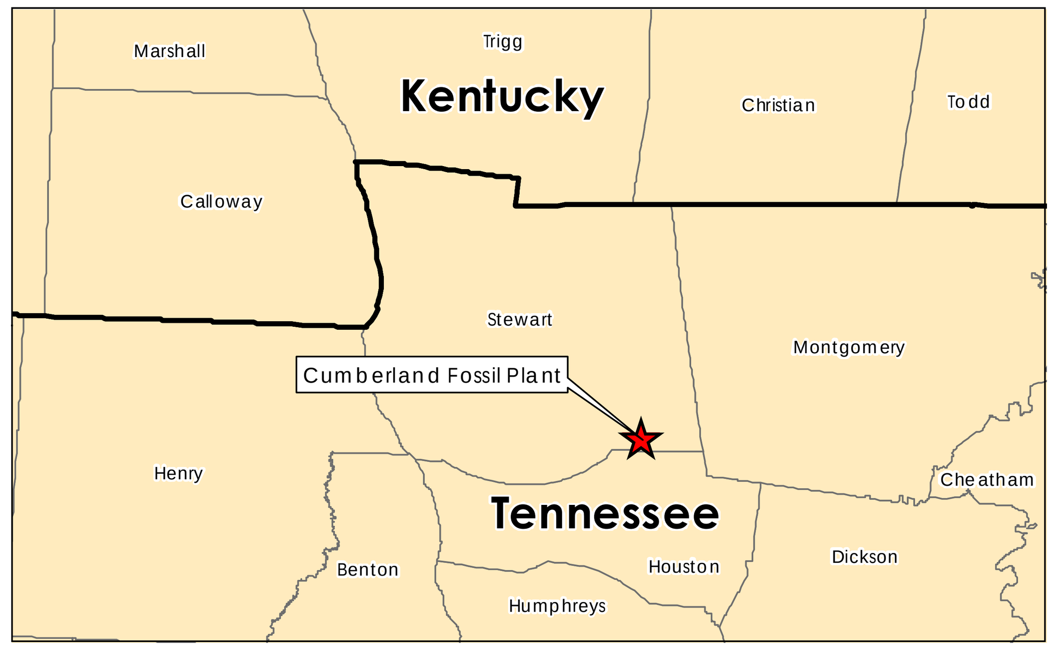
1:1,500 (At original document size of 22x34)

Legend

- Piezometer
- Piezometer (Removed/Abandoned)
- Cumberland River Gauging Station
- Stability Cross Section
- CCR Unit Area (Approximate)

Notes

1. Coordinate System: NAD 1927 StatePlane Tennessee FIPS 4100
2. Imagery Provided by TVA dated 5/12/2022 and 2017.
3. Instruments shown are monitored under the long-term instrumentation monitoring program. Additional instruments may be installed at the site for other purposes.



Stantec TVA

U:\TVA-EIP\175568209_CUF_Phase2\gis\mxd\EAR\H.1-B_Att.B_Instrumentation_MAP.mxd Revised: 2023-01-23 By: mbough

Figure No.

Attachment H.1-B, Figure 2

Title

CUF Instrumentation Bottom Ash Pond, Dry Ash Stack, and Gypsum Storage Area (as of 10/2021)

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant
Monthly Instrumentation Reports

Project Location

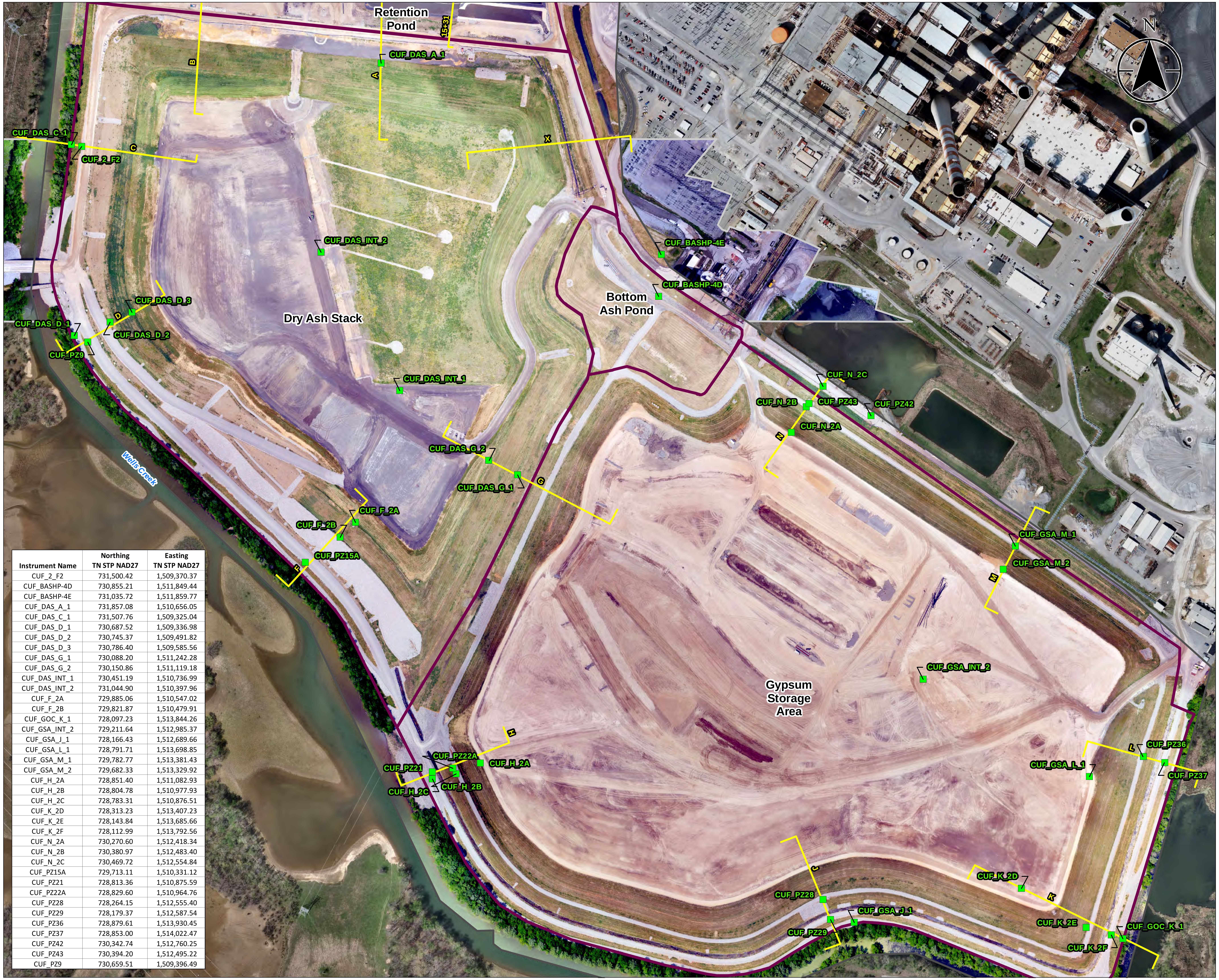
Stewart County, Tennessee

175568429

Prepared by SMH on 2023-01-23
Technical Review by MC on 2023-01-23
Independent Review by JK on 2023-01-23

0 200 400 600 800 Feet

1:2,400 (At original document size of 22x34)



Instrument Name	Northing TN STP NAD27	Easting TN STP NAD27
CUF_2_F2	731,500.42	1,509,370.37
CUF_BASHP-4D	730,855.21	1,511,849.44
CUF_BASHP-4E	731,035.72	1,511,859.77
CUF_DAS_A_1	731,857.08	1,510,656.05
CUF_DAS_C_1	731,507.76	1,509,325.04
CUF_DAS_D_1	730,687.52	1,509,336.98
CUF_DAS_D_2	730,745.37	1,509,491.82
CUF_DAS_D_3	730,786.40	1,509,585.56
CUF_DAS_G_1	730,088.20	1,511,242.28
CUF_DAS_G_2	730,150.86	1,511,119.18
CUF_DAS_INT_1	730,451.19	1,510,736.99
CUF_DAS_INT_2	731,044.90	1,510,397.96
CUF_F_2A	729,885.06	1,510,547.02
CUF_F_2B	729,821.87	1,510,479.91
CUF_GOC_K_1	728,097.23	1,513,844.26
CUF_GSA_INT_2	729,211.64	1,512,985.37
CUF_GSA_J_1	728,166.43	1,512,689.66
CUF_GSA_L_1	728,791.71	1,513,698.85
CUF_GSA_M_1	729,782.77	1,513,381.43
CUF_GSA_M_2	729,682.33	1,513,329.92
CUF_H_2A	728,851.40	1,511,082.93
CUF_H_2B	728,804.78	1,510,977.93
CUF_H_2C	728,783.31	1,510,876.51
CUF_K_2D	728,313.23	1,513,407.23
CUF_K_2E	728,143.84	1,513,685.66
CUF_K_2F	728,112.99	1,513,792.56
CUF_N_2A	730,270.60	1,512,418.34
CUF_N_2B	730,380.97	1,512,483.40
CUF_N_2C	730,469.72	1,512,554.84
CUF_PZ15A	729,713.11	1,510,331.12
CUF_PZ21	728,813.36	1,510,875.59
CUF_PZ22A	728,829.60	1,510,964.76
CUF_PZ28	728,264.15	1,512,555.40
CUF_PZ29	728,179.37	1,512,587.54
CUF_PZ36	728,879.61	1,513,930.45
CUF_PZ37	728,853.00	1,514,022.47
CUF_PZ42	730,342.74	1,512,760.25
CUF_PZ43	730,394.20	1,512,495.22
CUF_PZ9	730,659.51	1,509,396.49

Legend

Piezometer

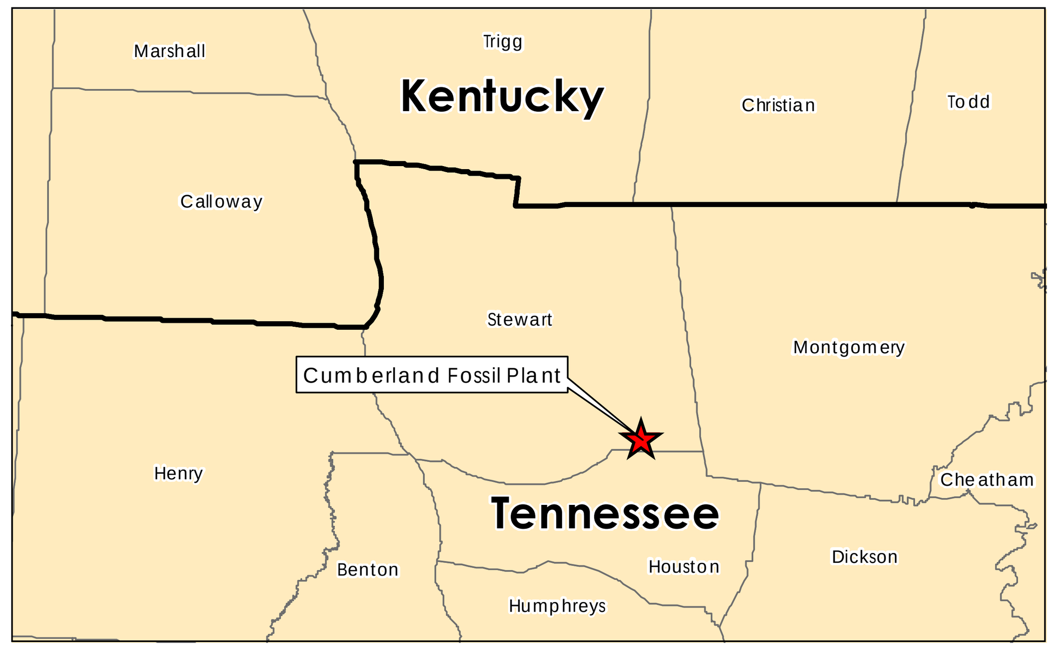
Stability Cross Section

CCR Unit Area (Approximate)

See **Attachment H.1-B, Figure 1** for location of Cumberland River Gauging Station.

Notes

1. Coordinate System: NAD 1927 StatePlane Tennessee FIPS 4100
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA dated 5/21/2021 and 5/12/2022
3. Instruments shown are monitored under the long-term instrumentation monitoring program. Additional instruments may be installed at the site for other purposes.



Stantec
TVA

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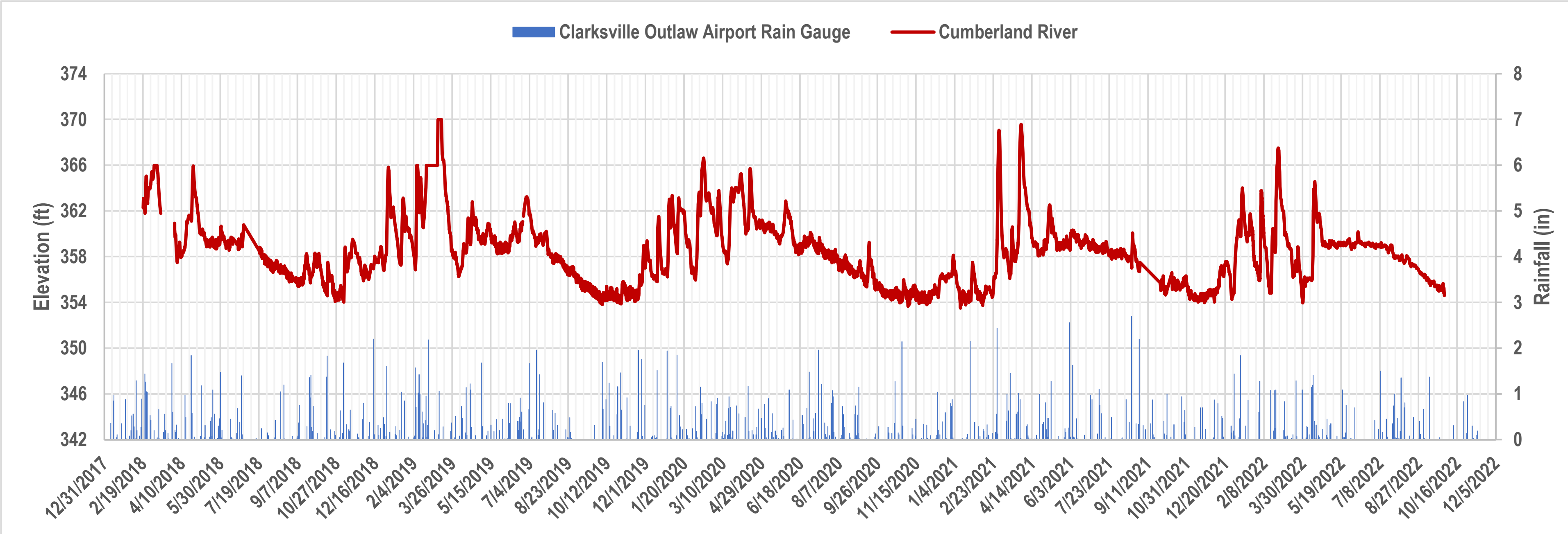
Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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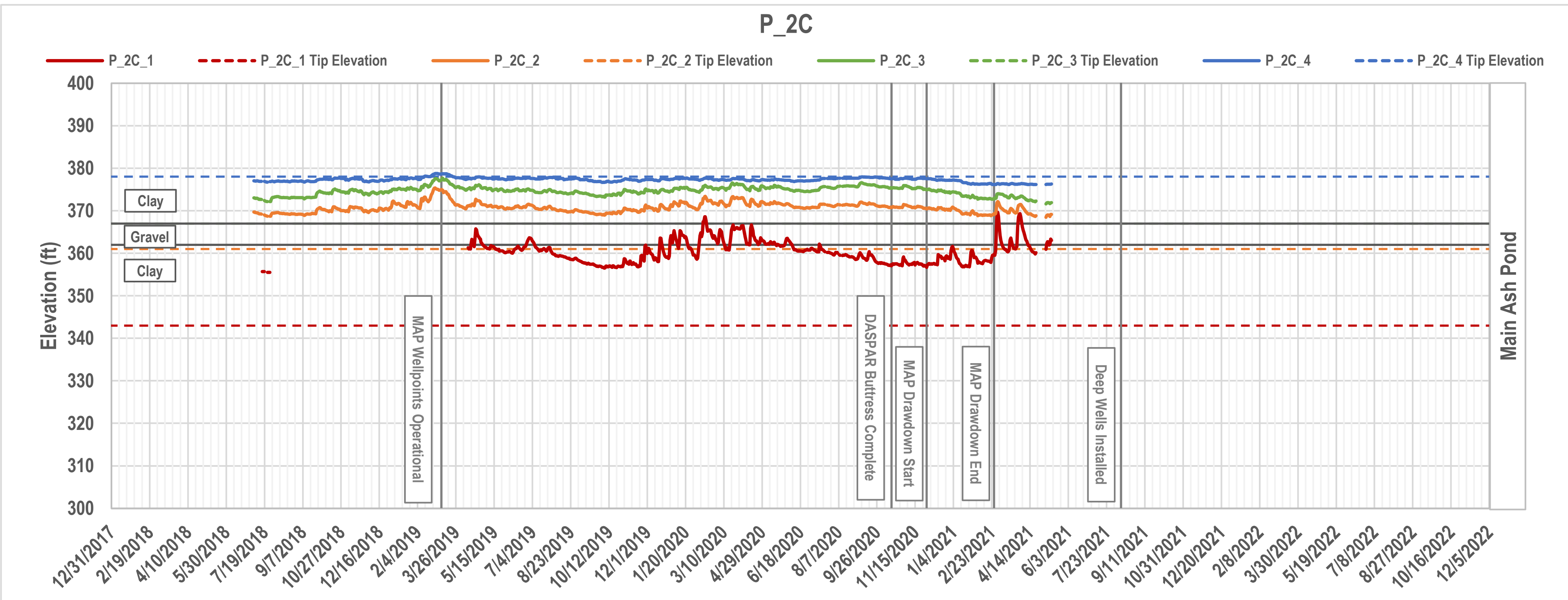
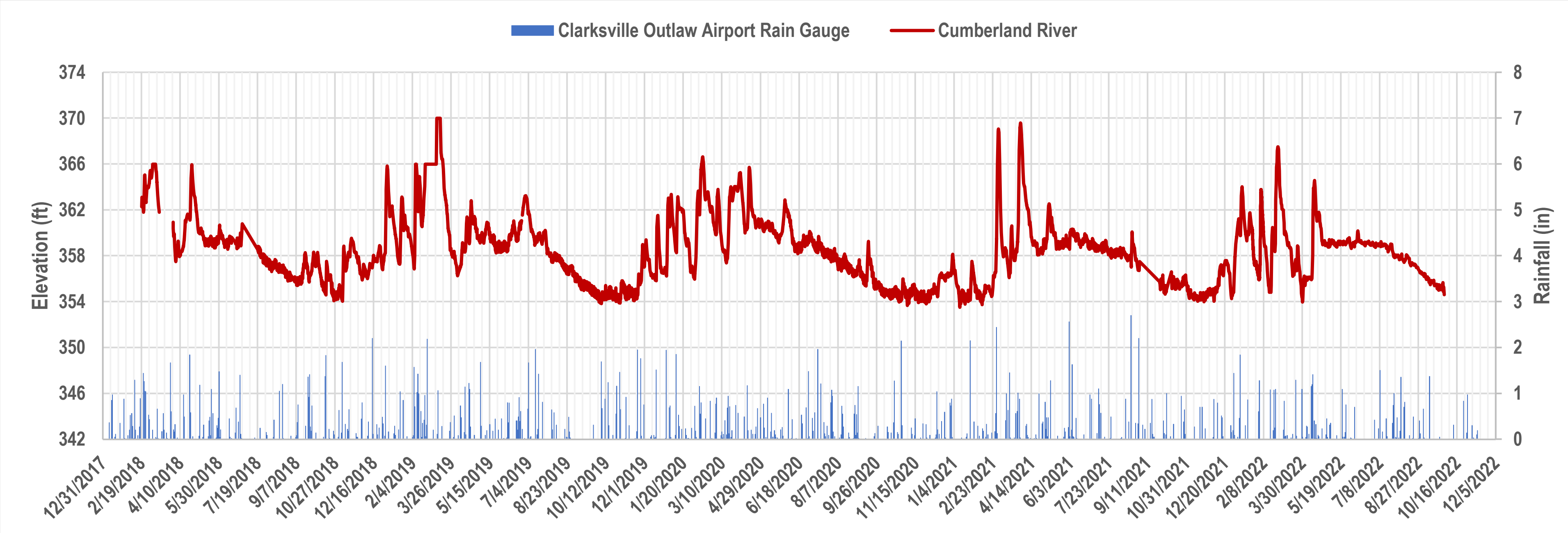
10/16/2022
12/5/2022


P_2C
P_2C_1
P_2C_1 Tip Elevation
P_2C_2
P_2C_2 Tip Elevation
P_2C_3
P_2C_3 Tip Elevation
P_2C_4
P_2C_4 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
Clay
Gravel
Clay
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
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0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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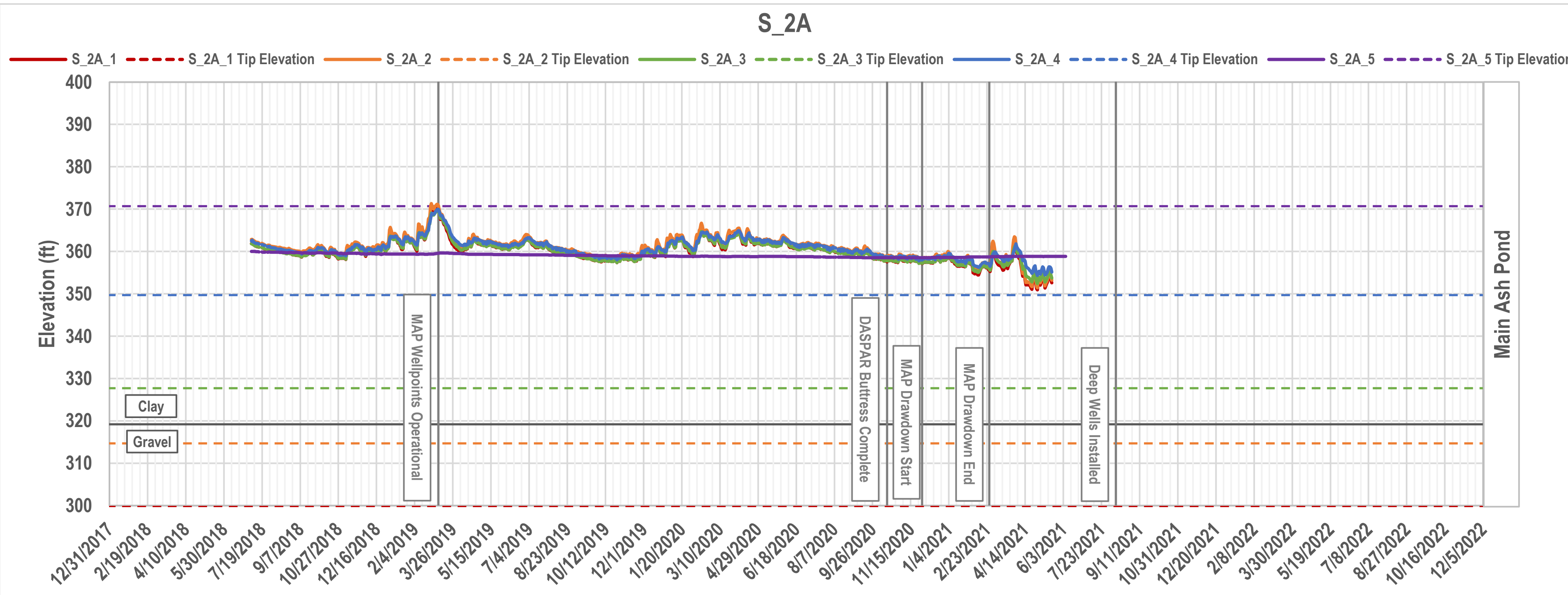
10/16/2022
12/5/2022



S_2A
S_2A_1
S_2A_1 Tip Elevation
S_2A_2
S_2A_2 Tip Elevation
S_2A_3
S_2A_3 Tip Elevation
S_2A_4
S_2A_4 Tip Elevation
S_2A_5
S_2A_5 Tip Elevation
Elevation (ft)
Main Ash Pond
400
390
380
370
360
350
340
330
320
310
300
Clay
Gravel
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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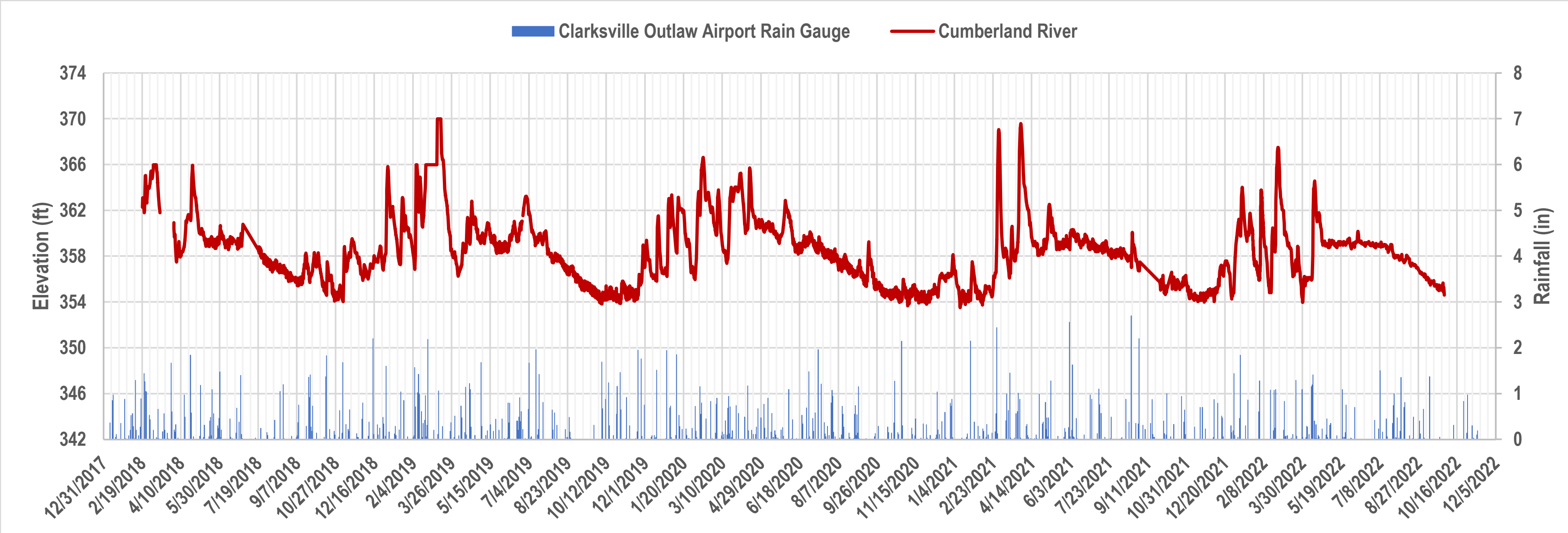
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
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8
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0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
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10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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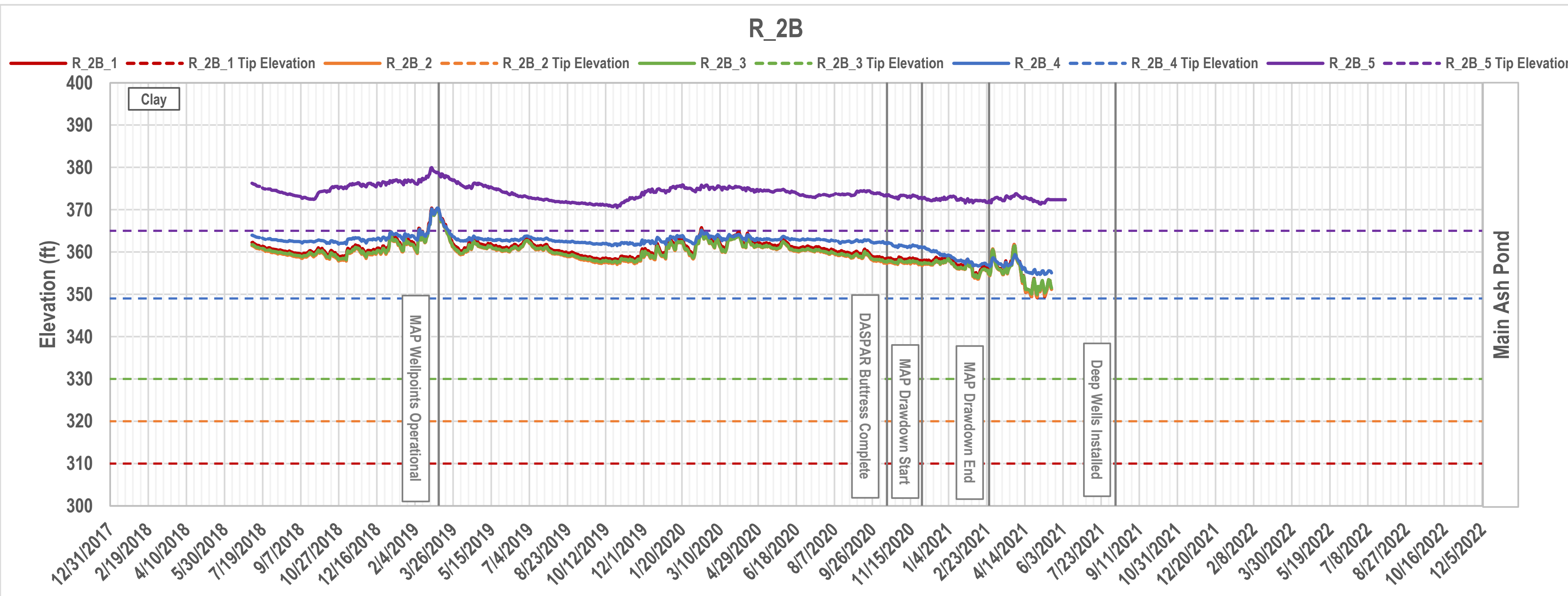
10/16/2022
12/5/2022



R_2B
R_2B_1
R_2B_1 Tip Elevation
R_2B_2
R_2B_2 Tip Elevation
R_2B_3
R_2B_3 Tip Elevation
R_2B_4
R_2B_4 Tip Elevation
R_2B_5
R_2B_5 Tip Elevation
Clay
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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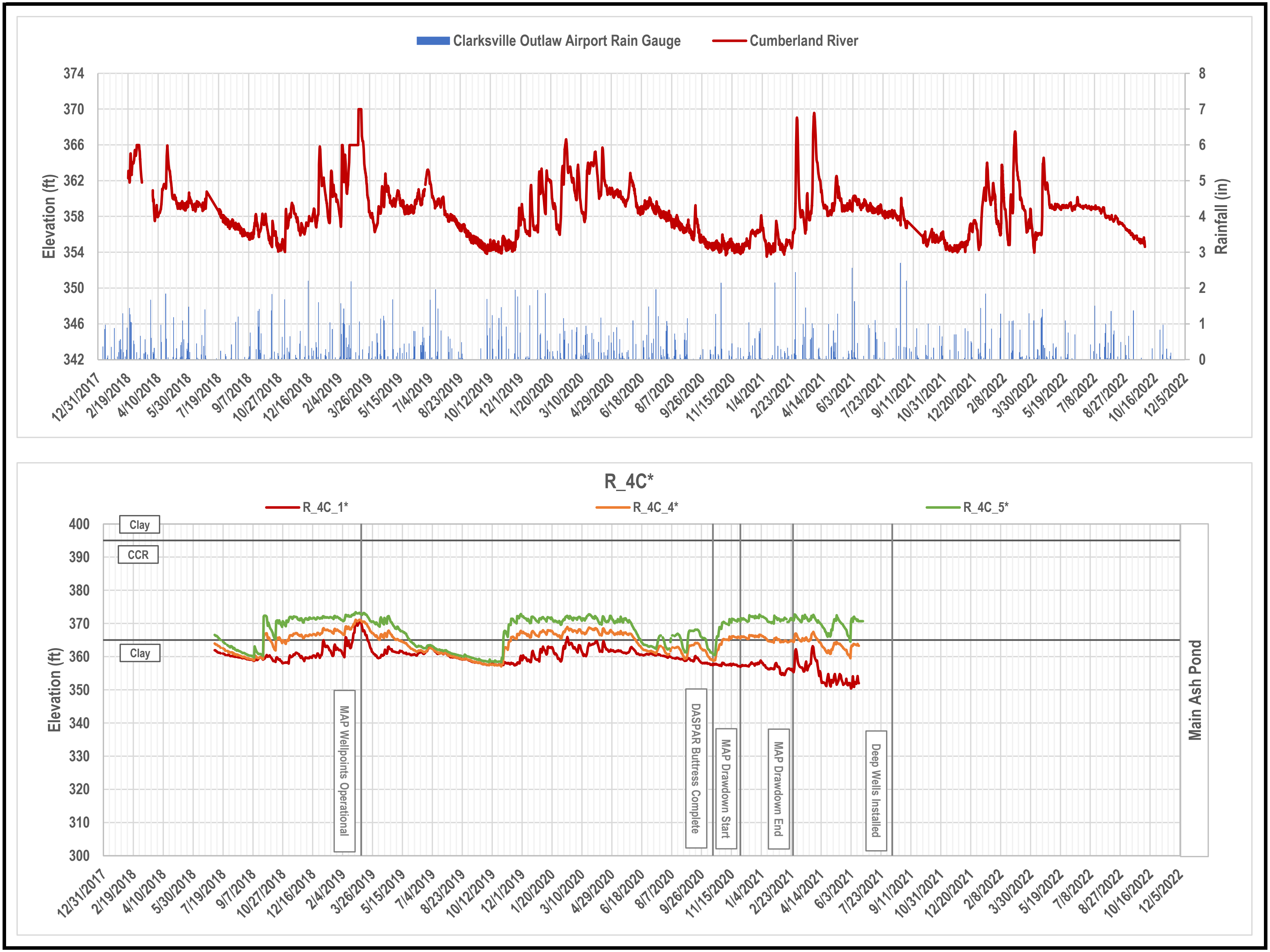
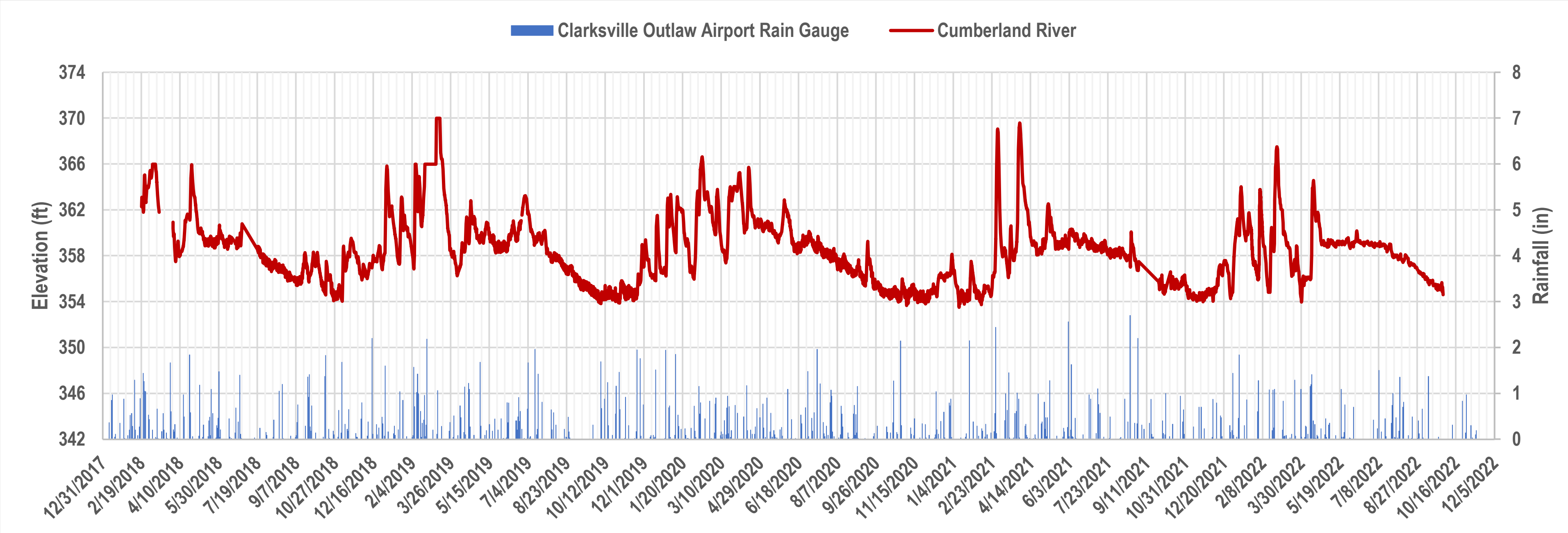
10/16/2022
12/5/2022



* Tip elevation is not available for this instrument.



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
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350
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342
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0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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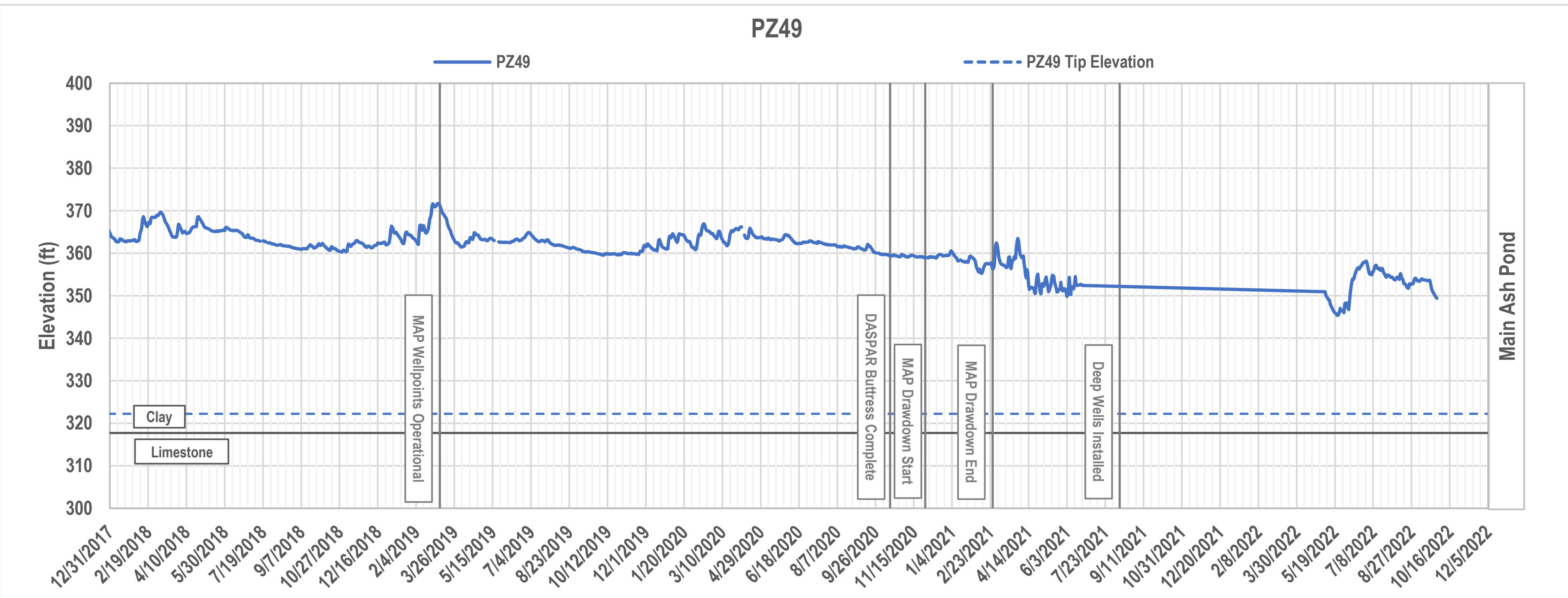
10/16/2022
12/5/2022



PZ49
PZ49
PZ49 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
Clay
Limestone
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
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4/29/2020
6/18/2020
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4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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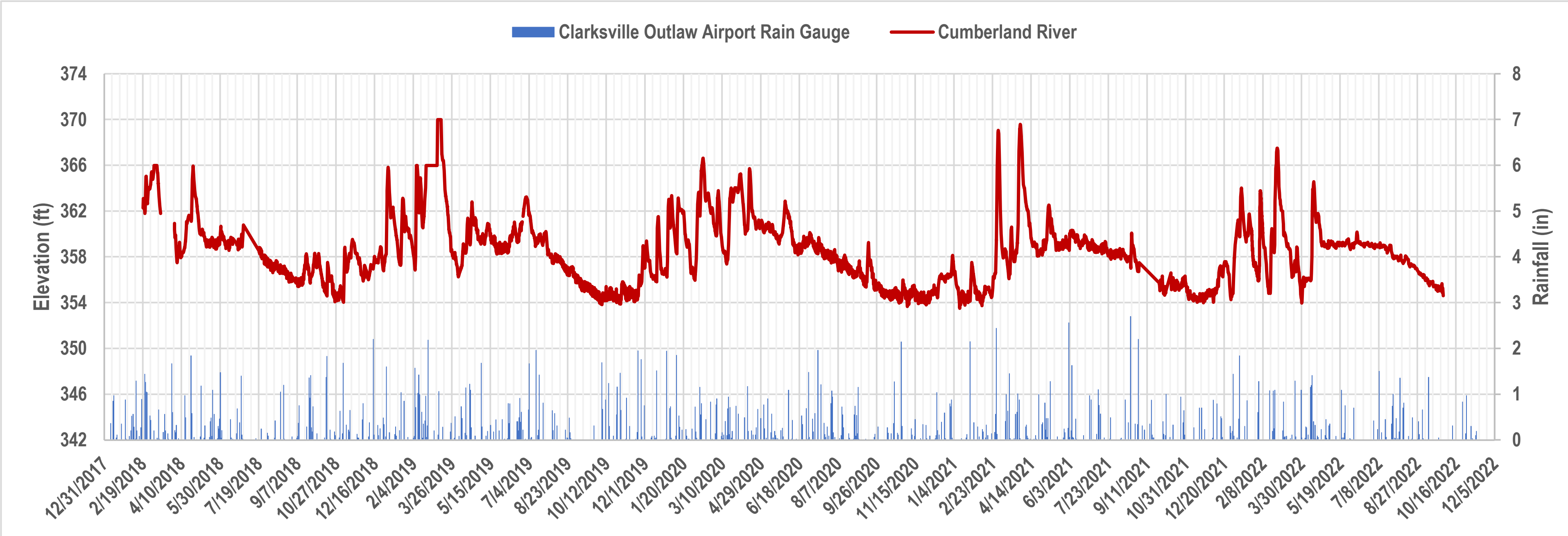
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
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12/1/2019
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11/15/2020
1/4/2021
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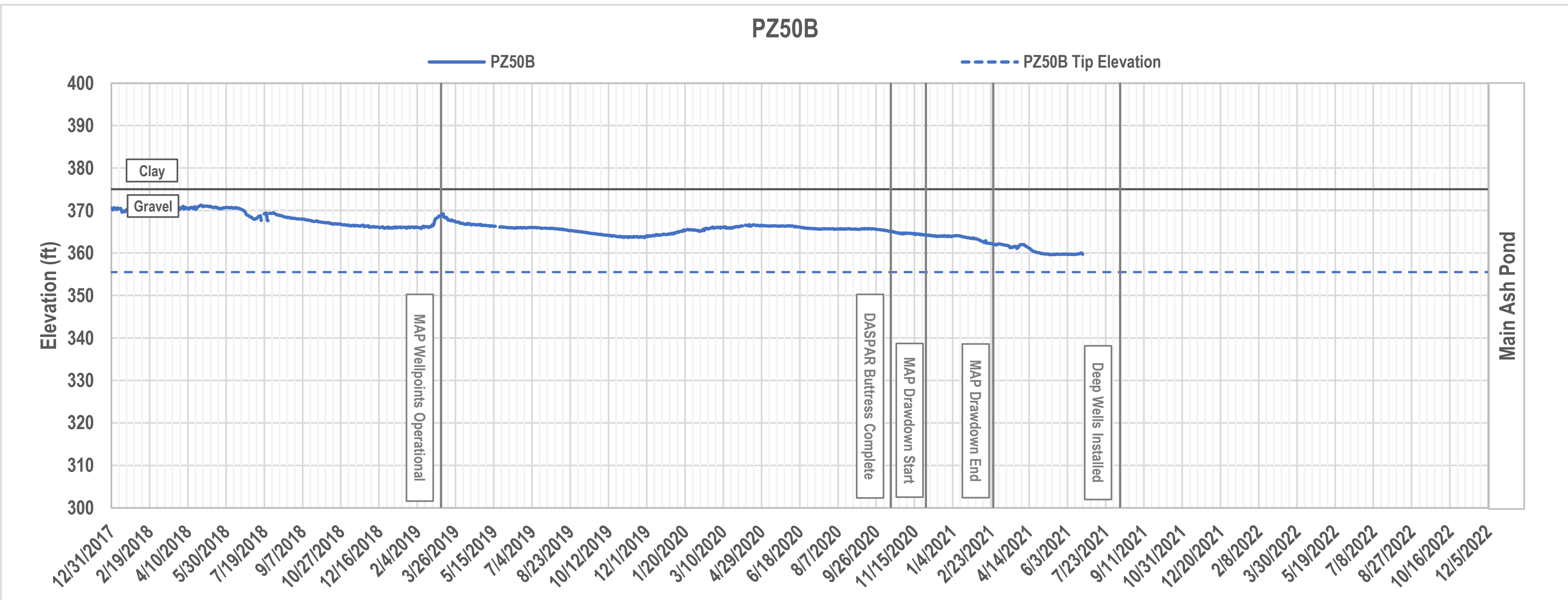
12/5/2022



PZ50B
PZ50B
PZ50B Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
Clay
Gravel
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
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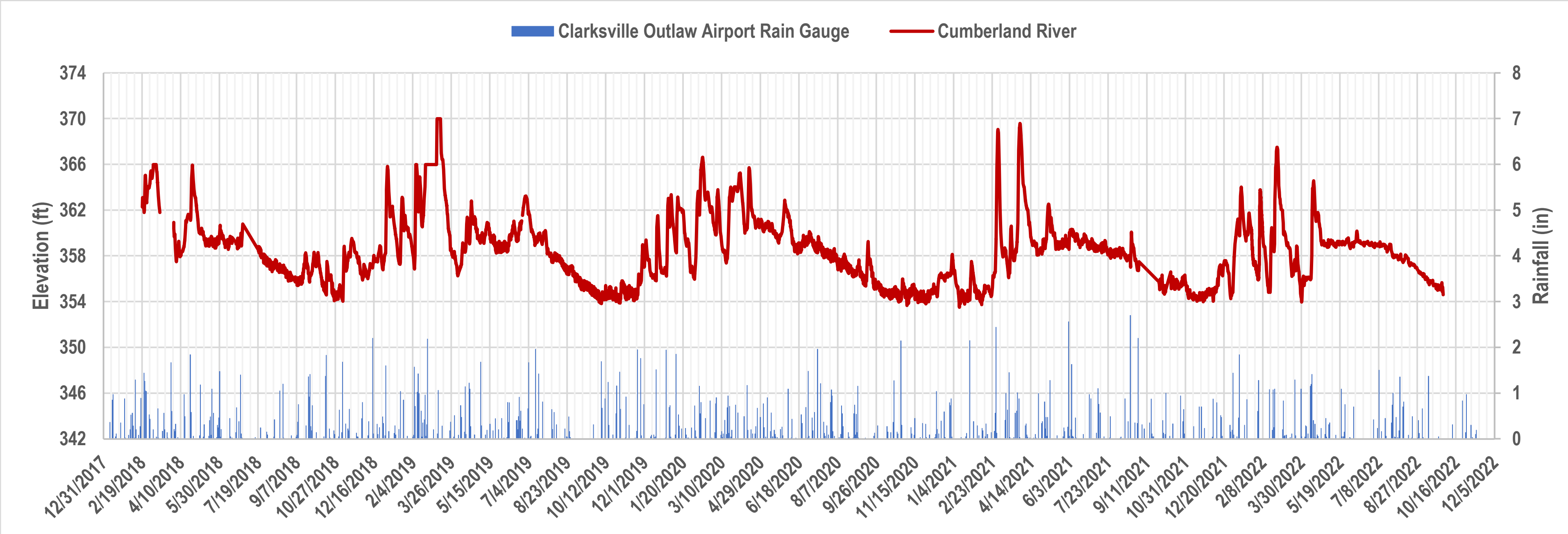
12/5/2022


Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
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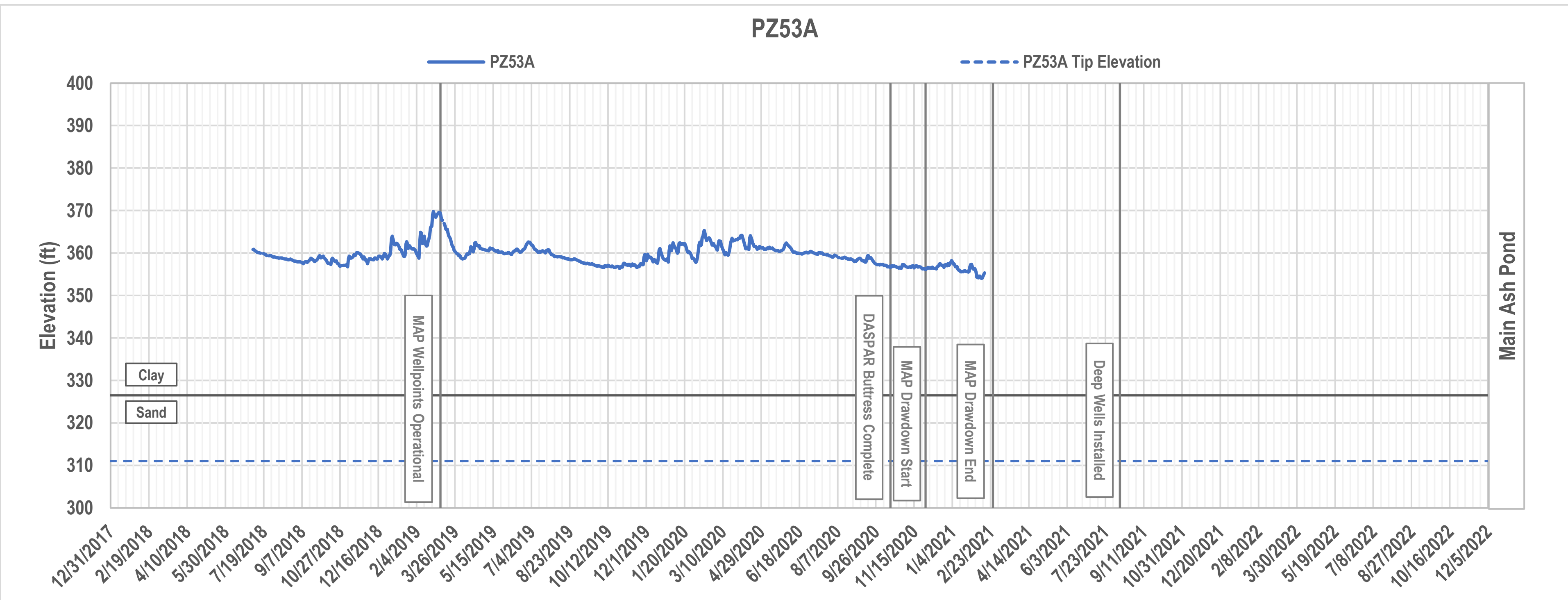
12/5/2022


PZ53A
PZ53A
PZ53A Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
Clay
Sand
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
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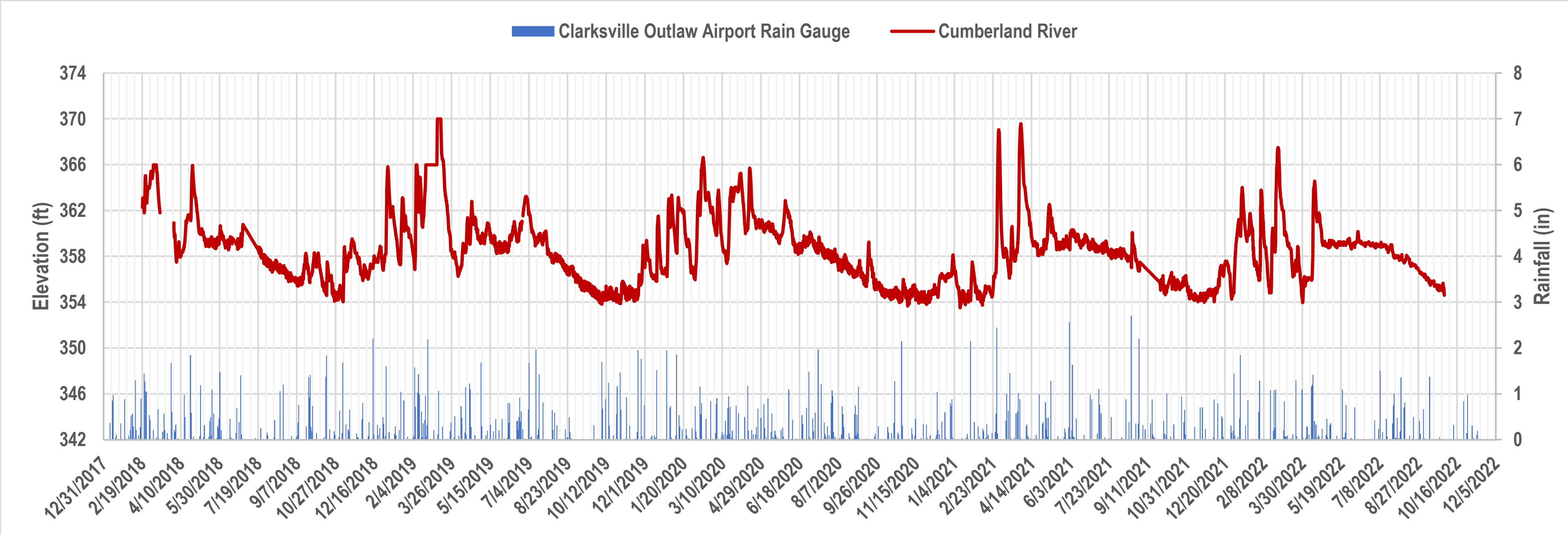
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
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12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
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10/27/2018
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10/12/2019
12/1/2019
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9/26/2020
11/15/2020
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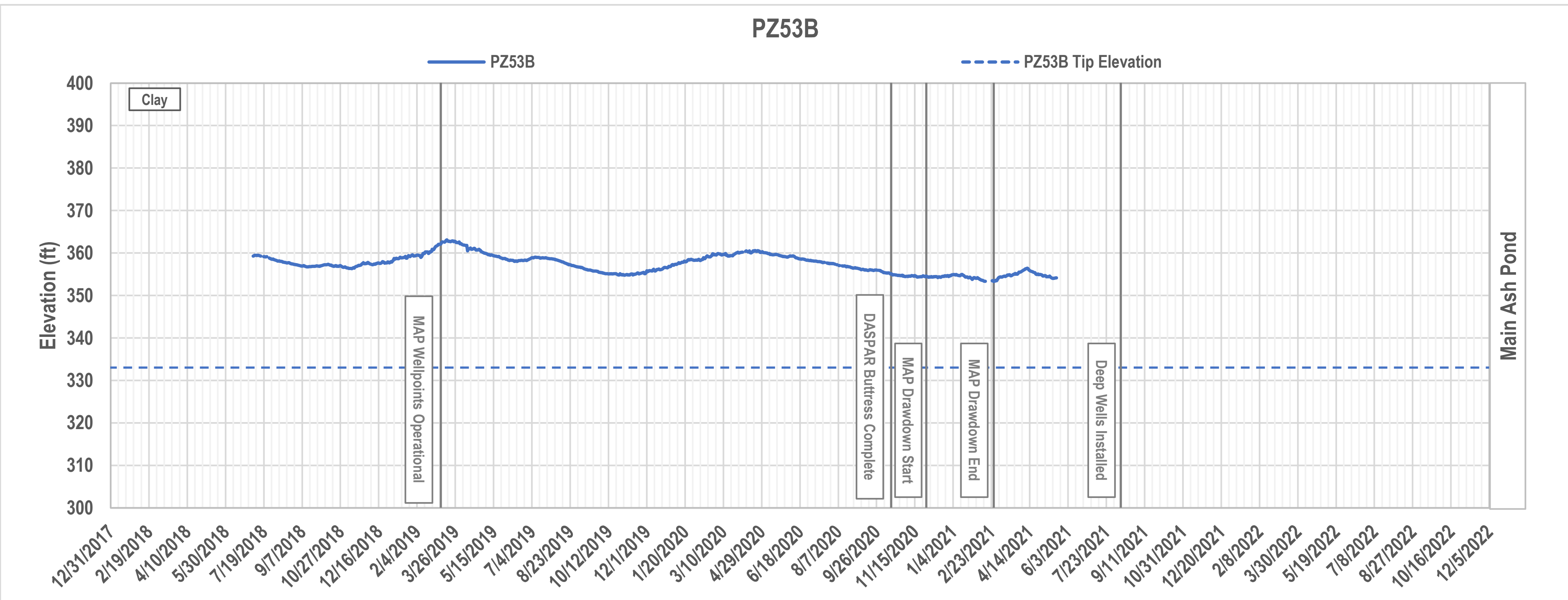
10/16/2022
12/5/2022



PZ53B
PZ53B
PZ53B Tip Elevation
Clay
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
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7/4/2019
8/23/2019
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12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
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9/11/2021
10/31/2021
12/20/2021
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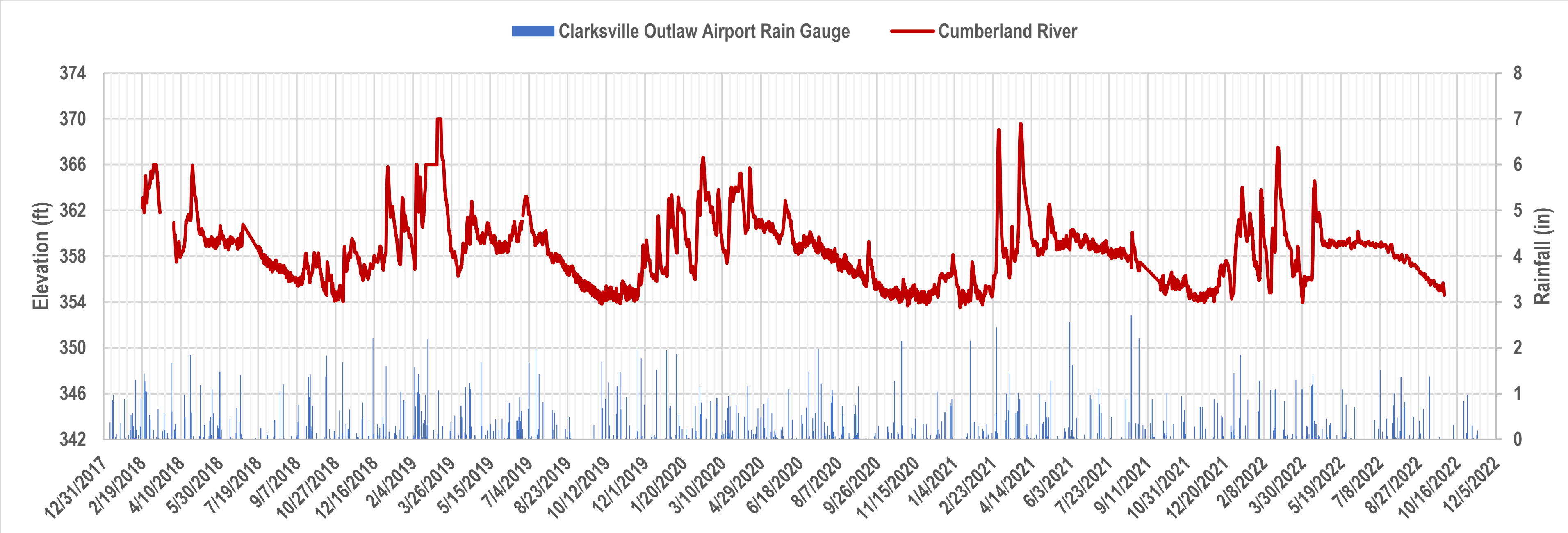
7/8/2022
8/27/2022
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
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350
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12/31/2017
2/19/2018
4/10/2018
5/30/2018
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12/16/2018
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3/26/2019
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4/14/2021
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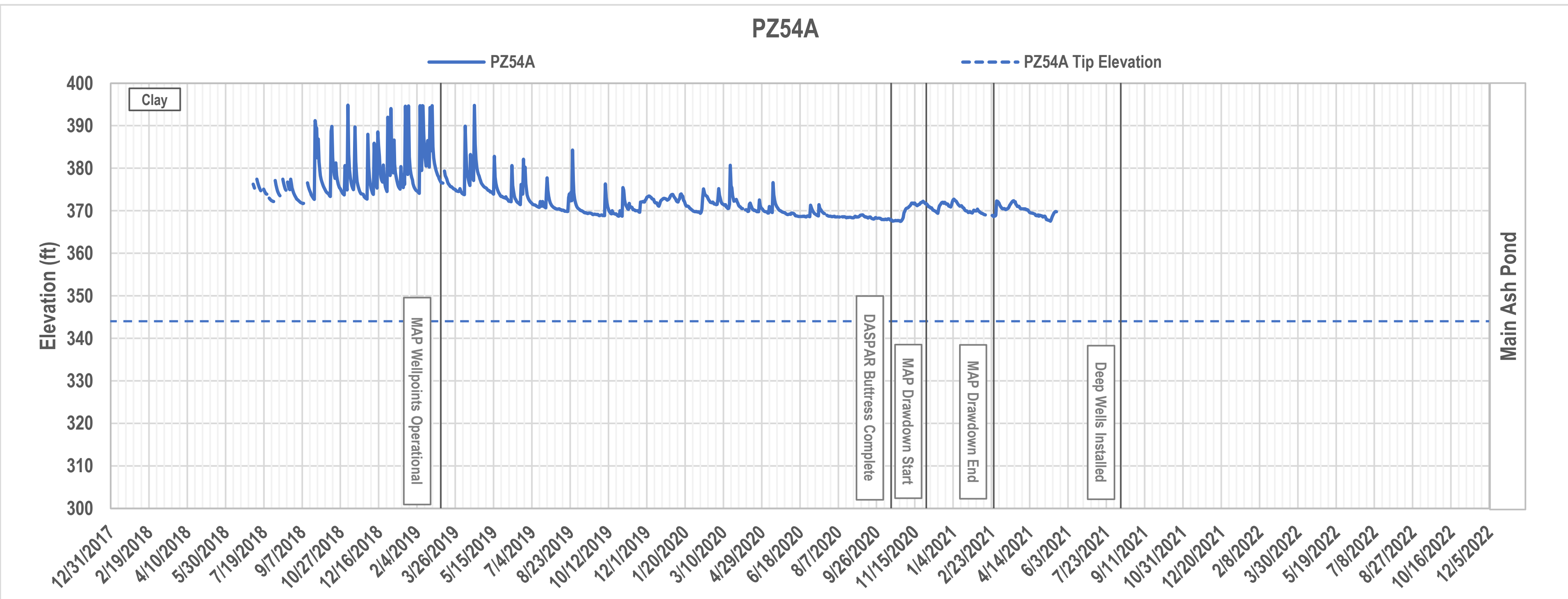
10/16/2022
12/5/2022



PZ54A
PZ54A
PZ54A Tip Elevation
Clay
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
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8/23/2019
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4/29/2020
6/18/2020
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4/14/2021
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10/31/2021
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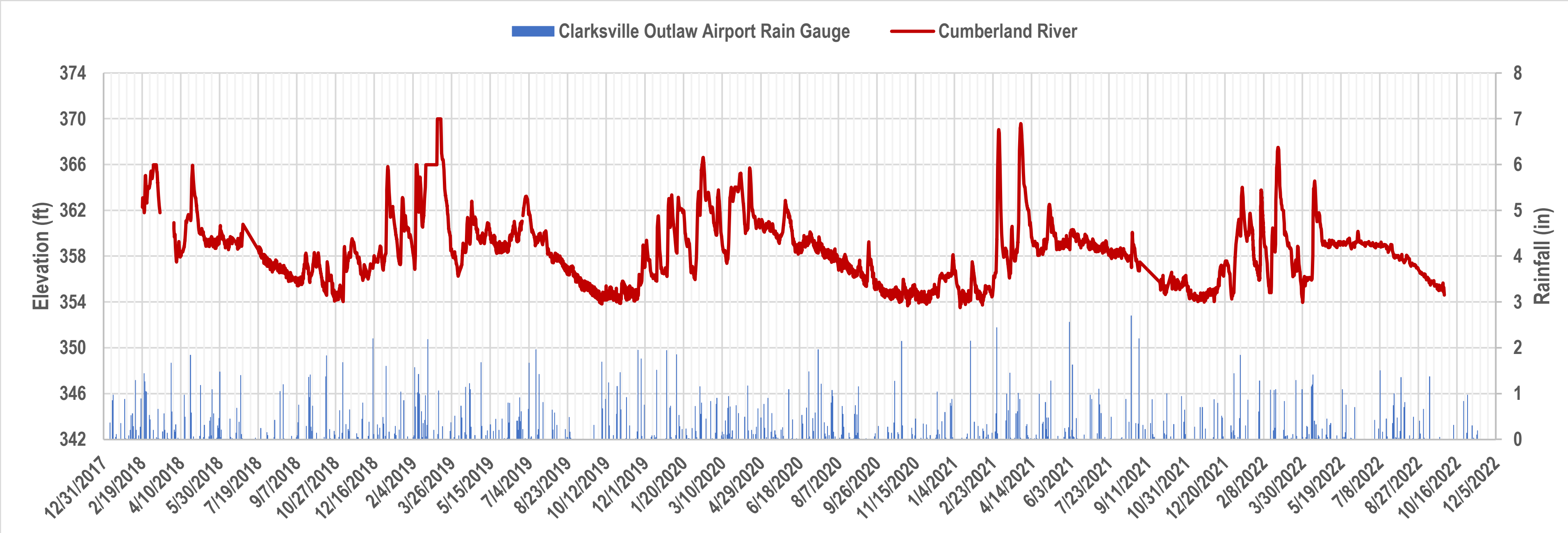
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
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12/31/2017
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3/26/2019
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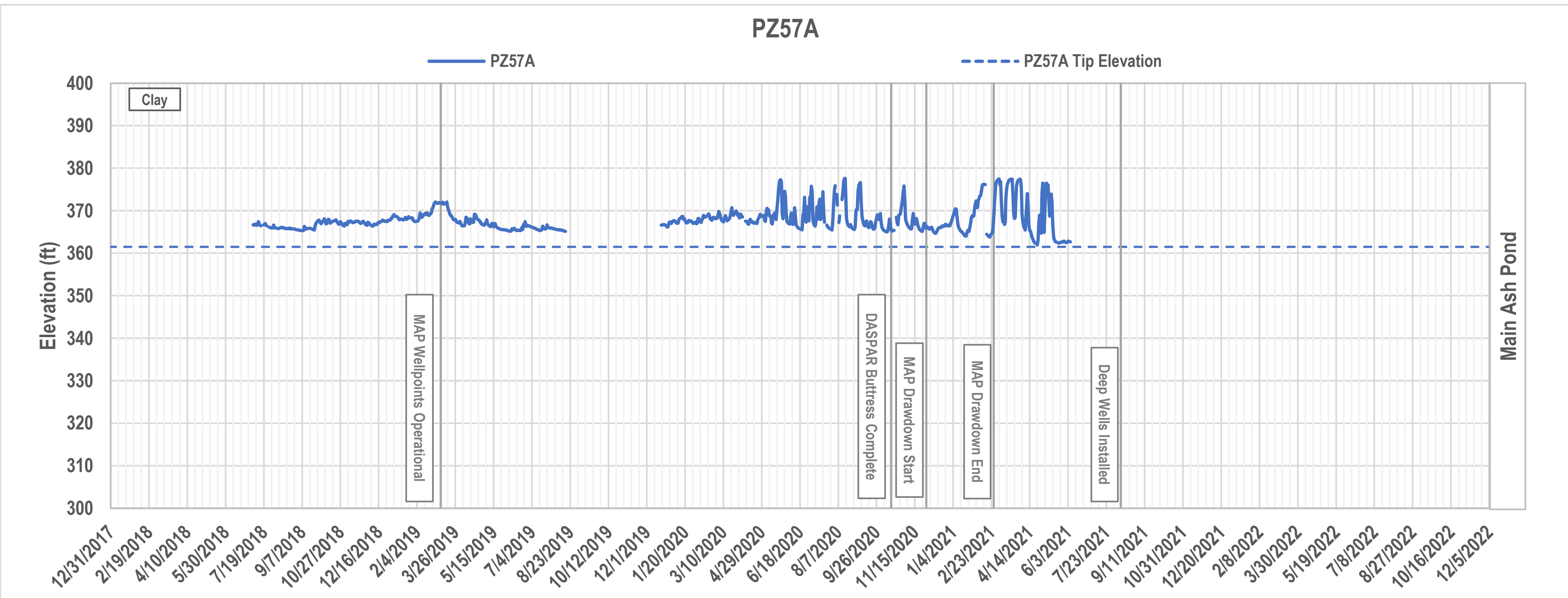
10/16/2022
12/5/2022



PZ57A
PZ57A
PZ57A Tip Elevation
Clay
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
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2/23/2021
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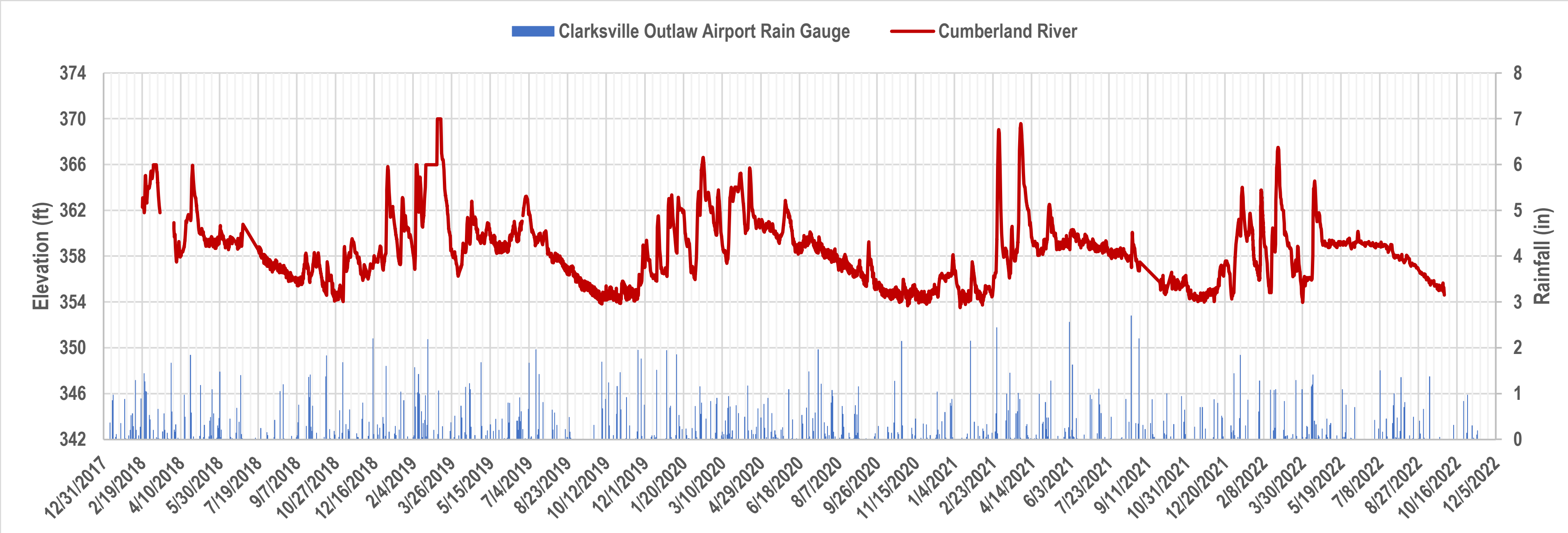

Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
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12/31/2017
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7/19/2018
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10/27/2018
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12/1/2019
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10/16/2022
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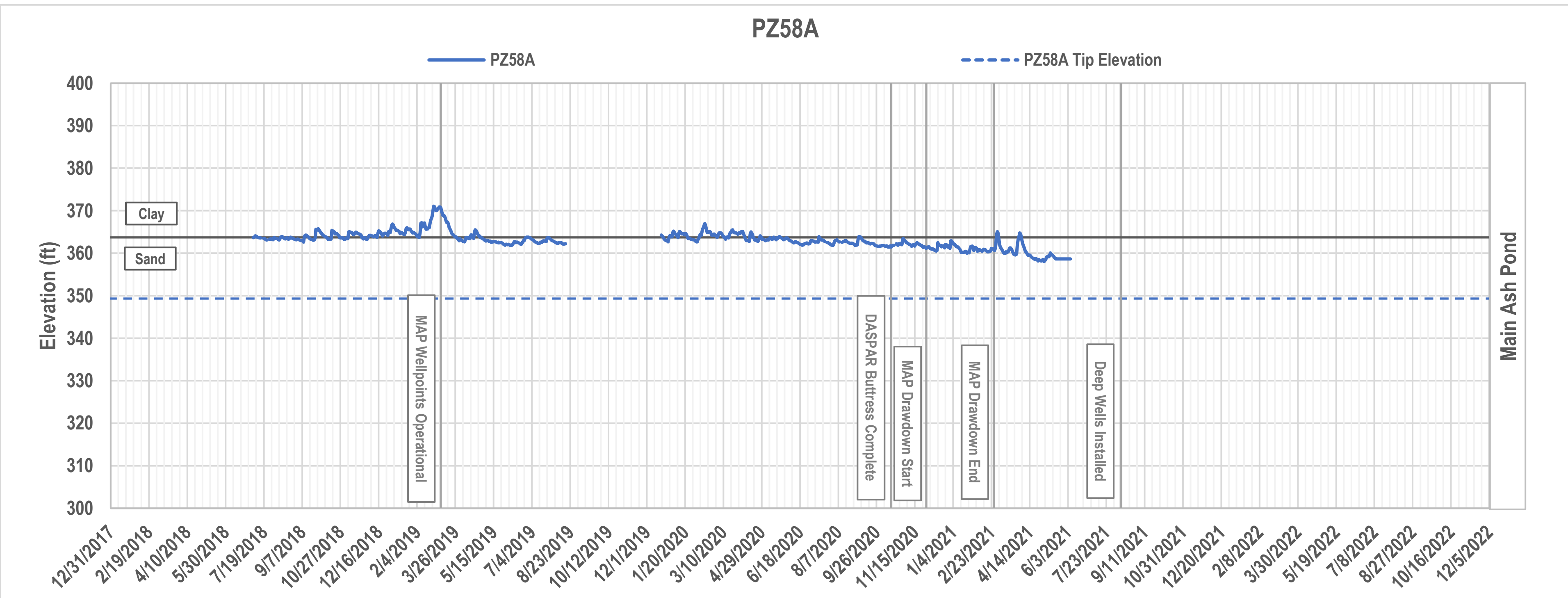

PZ58A
PZ58A
PZ58A Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
Clay
Sand
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
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2/4/2019
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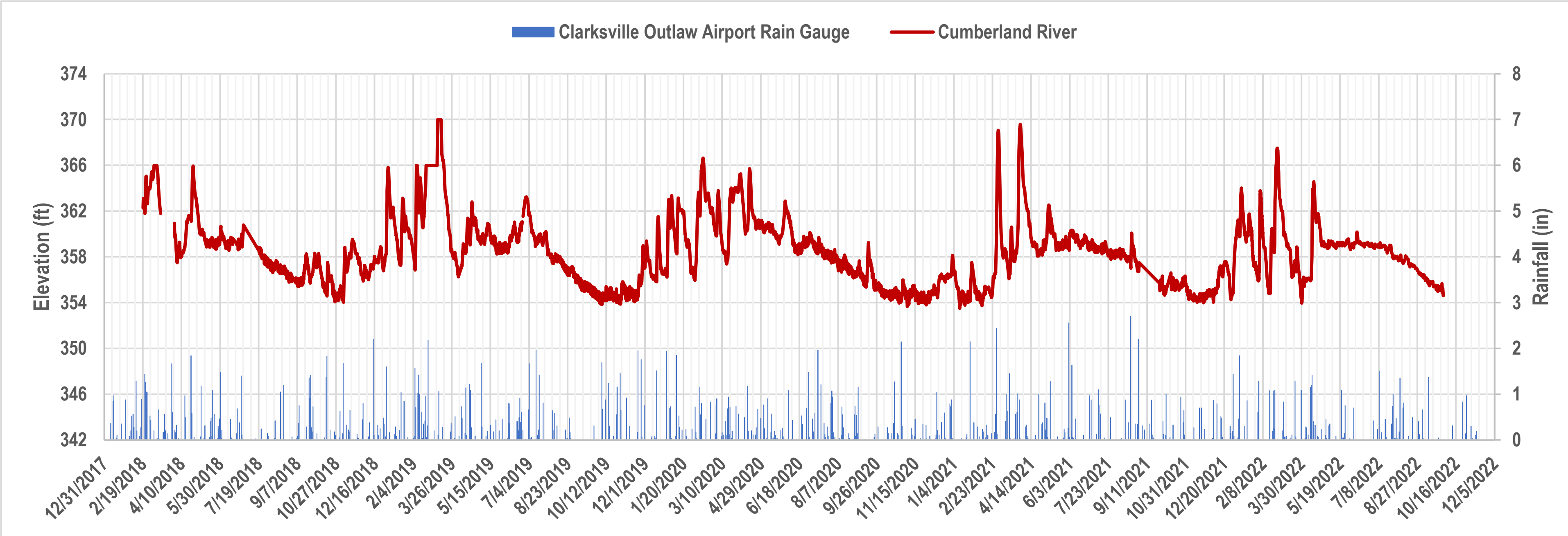
Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
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12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
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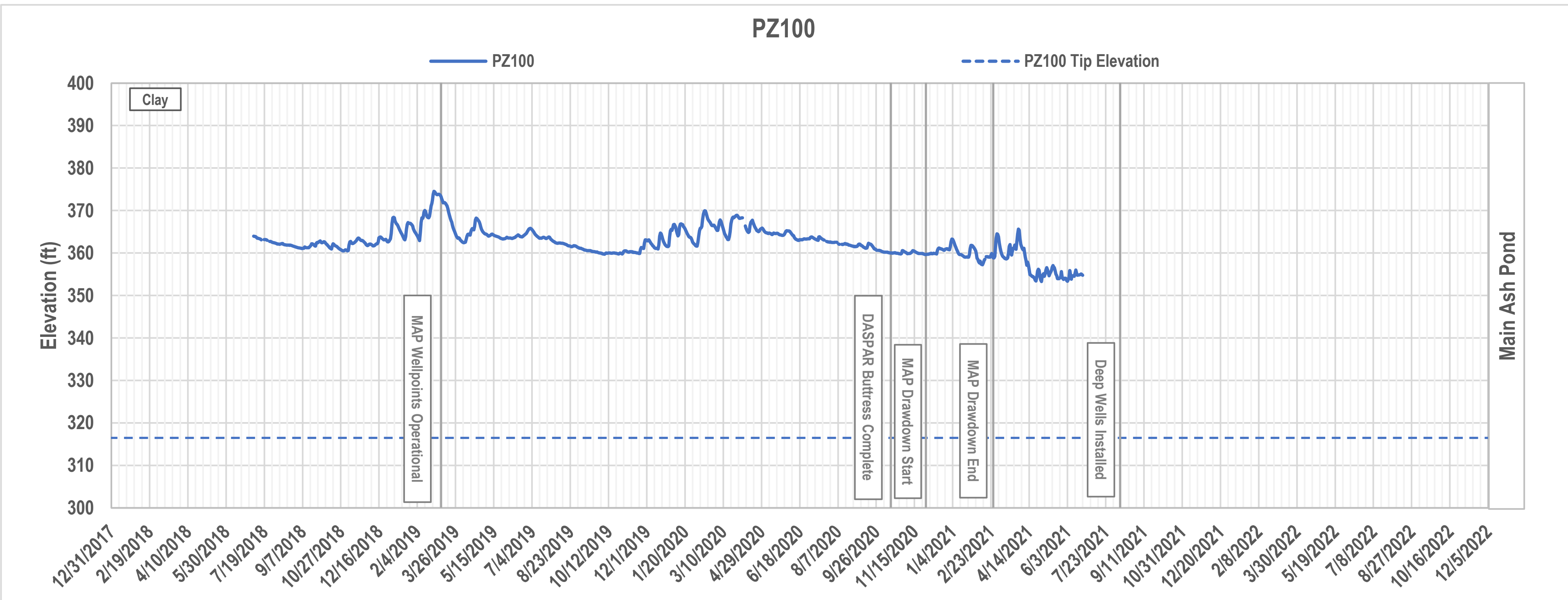
PZ100
PZ100
PZ100 Tip Elevation
Clay
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
2/19/2018
4/10/2018
5/30/2018
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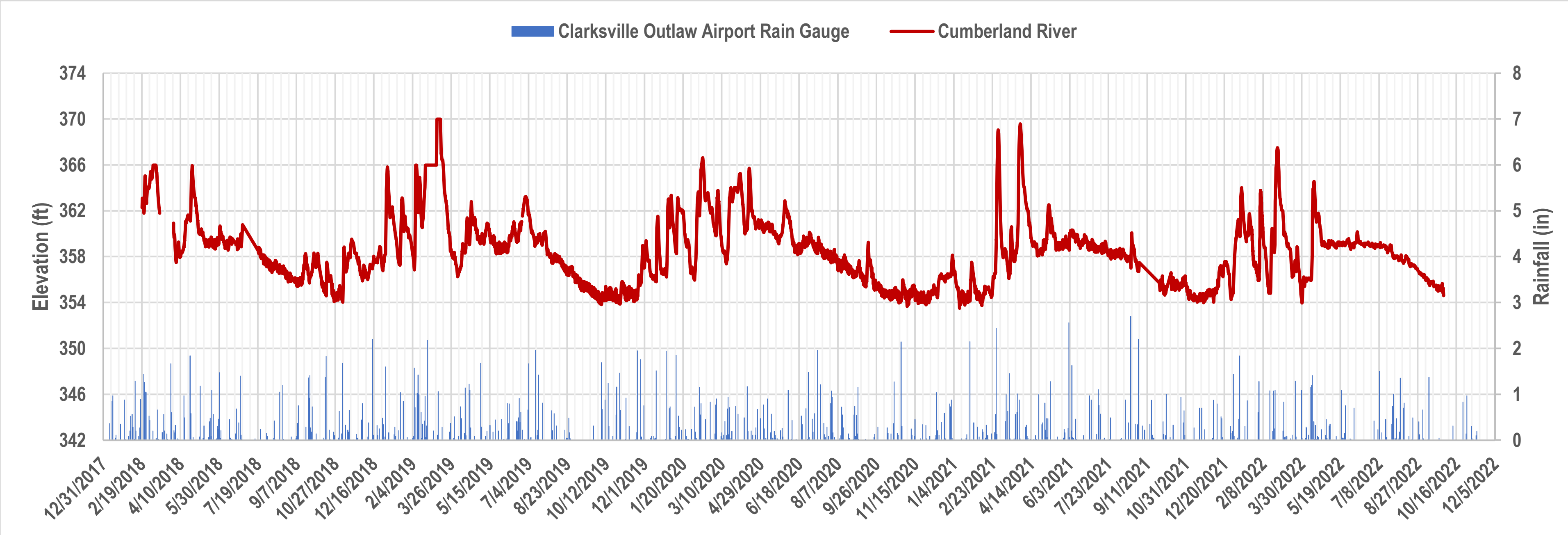

Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
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358
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12/31/2017
2/19/2018
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10/16/2022
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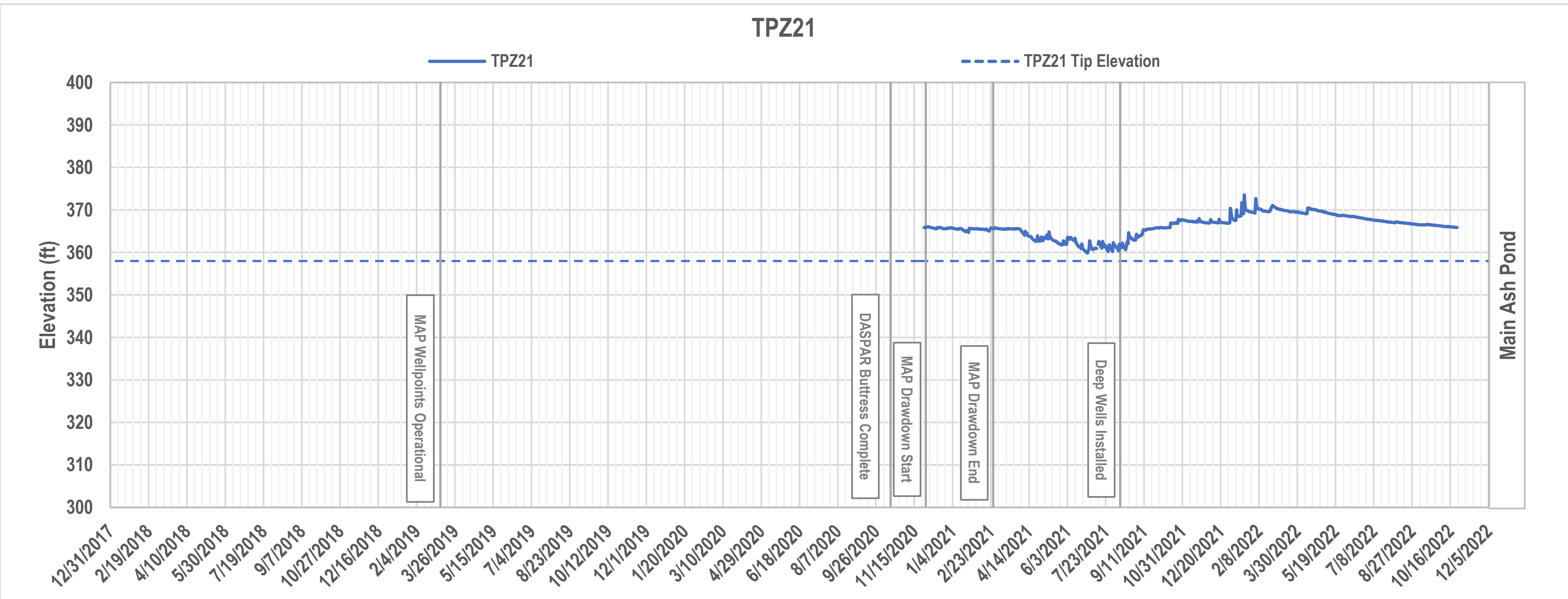

TPZ21
TPZ21
TPZ21 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
2/19/2018
4/10/2018
5/30/2018
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2/4/2019
3/26/2019
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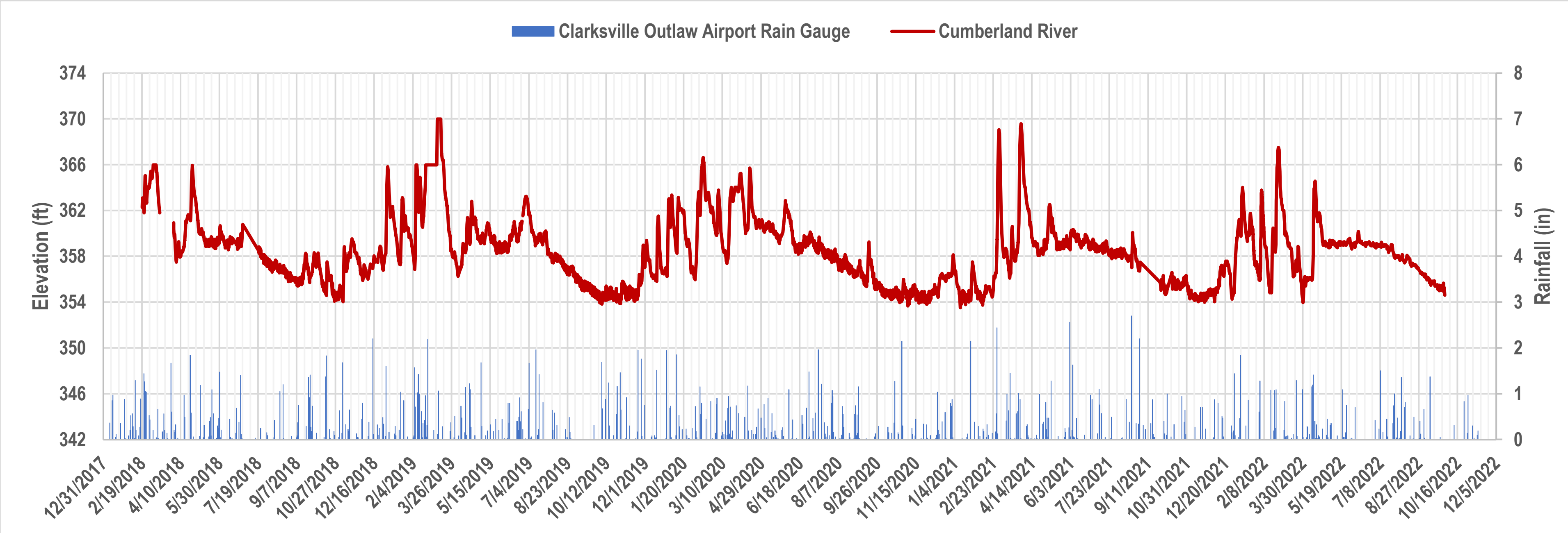
Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
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2/19/2018
4/10/2018
5/30/2018
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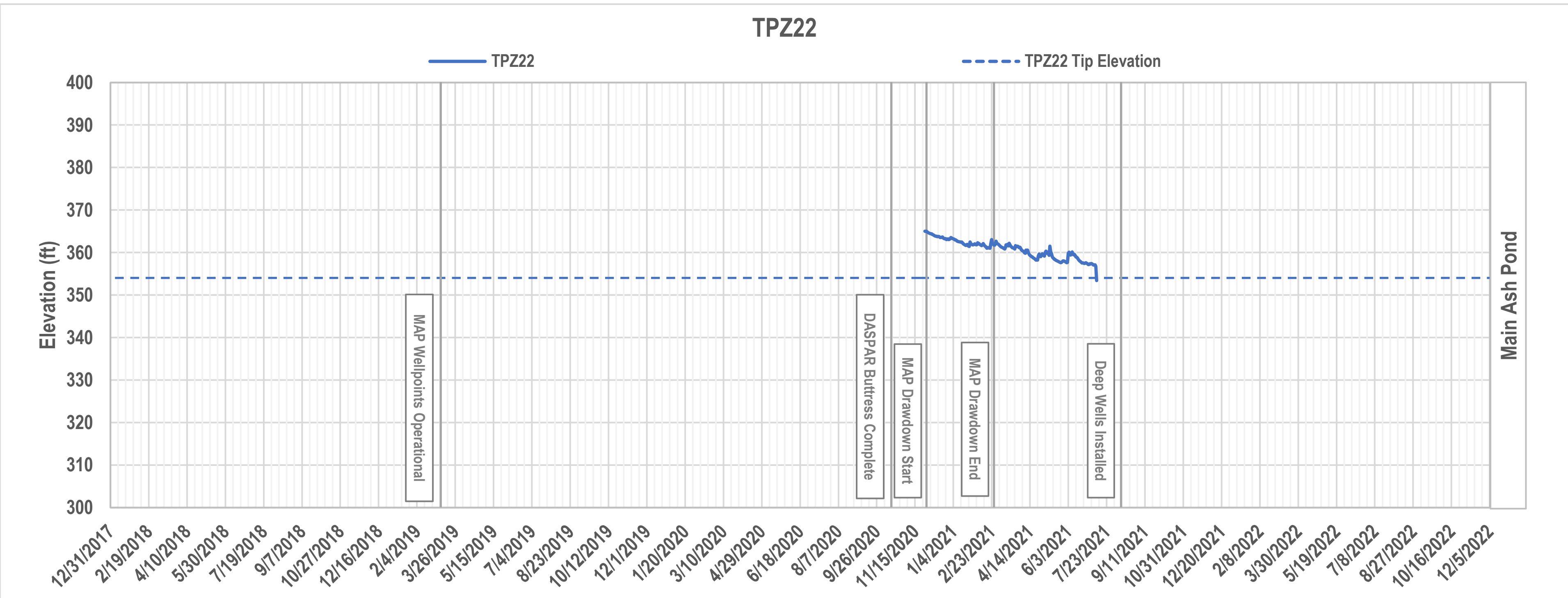
10/16/2022
12/5/2022


TPZ22
TPZ22
TPZ22 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
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12/16/2018
2/4/2019
3/26/2019
5/15/2019
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8/23/2019
10/12/2019
12/1/2019
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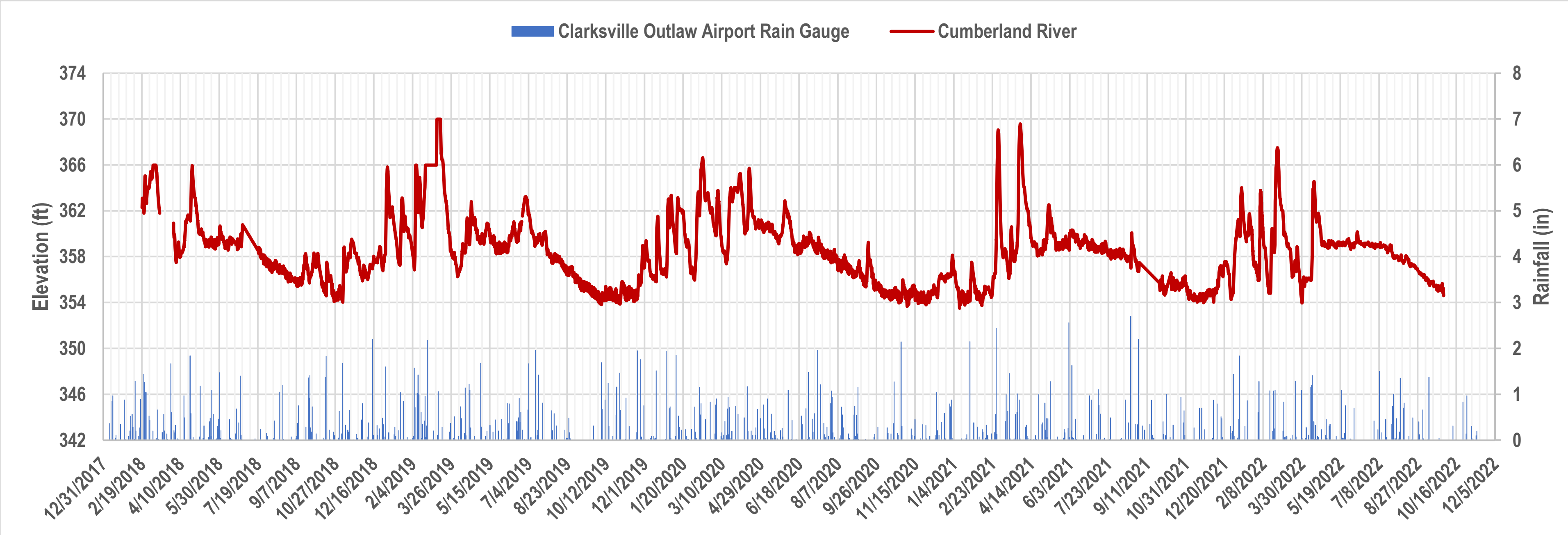
Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
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12/31/2017
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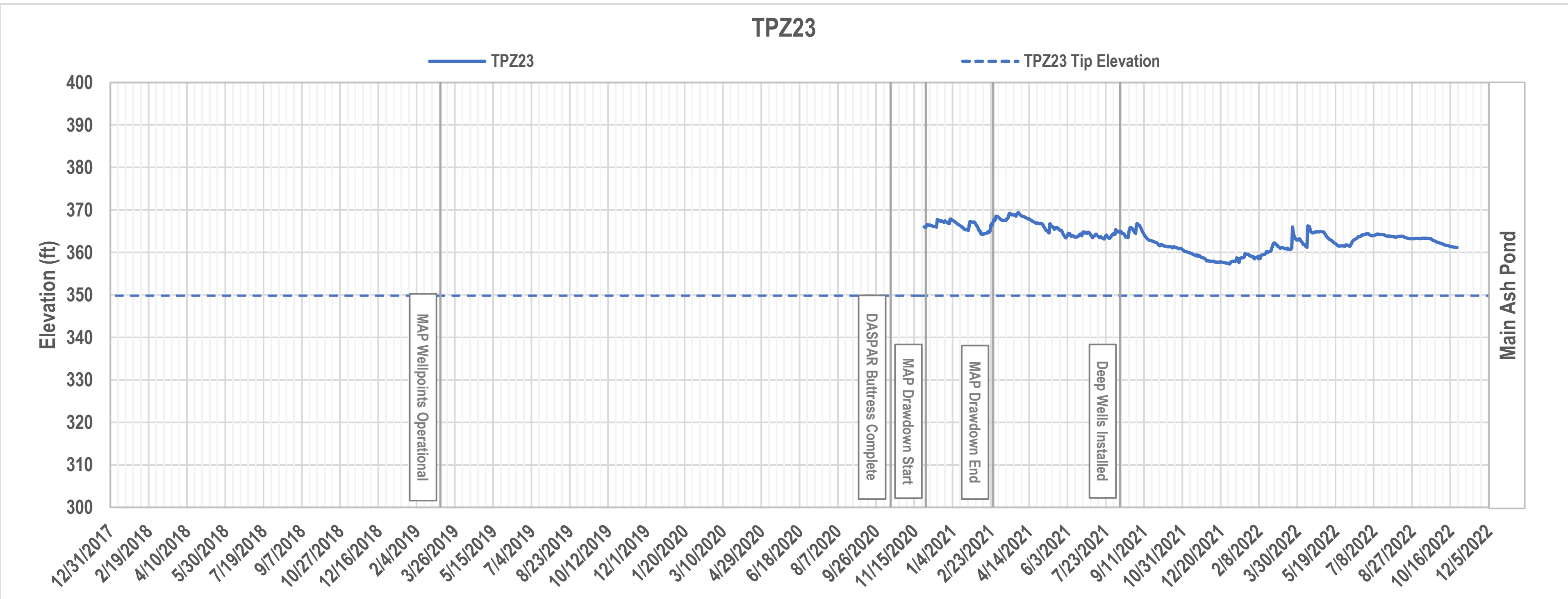
TPZ23
TPZ23
TPZ23 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
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2/4/2019
3/26/2019
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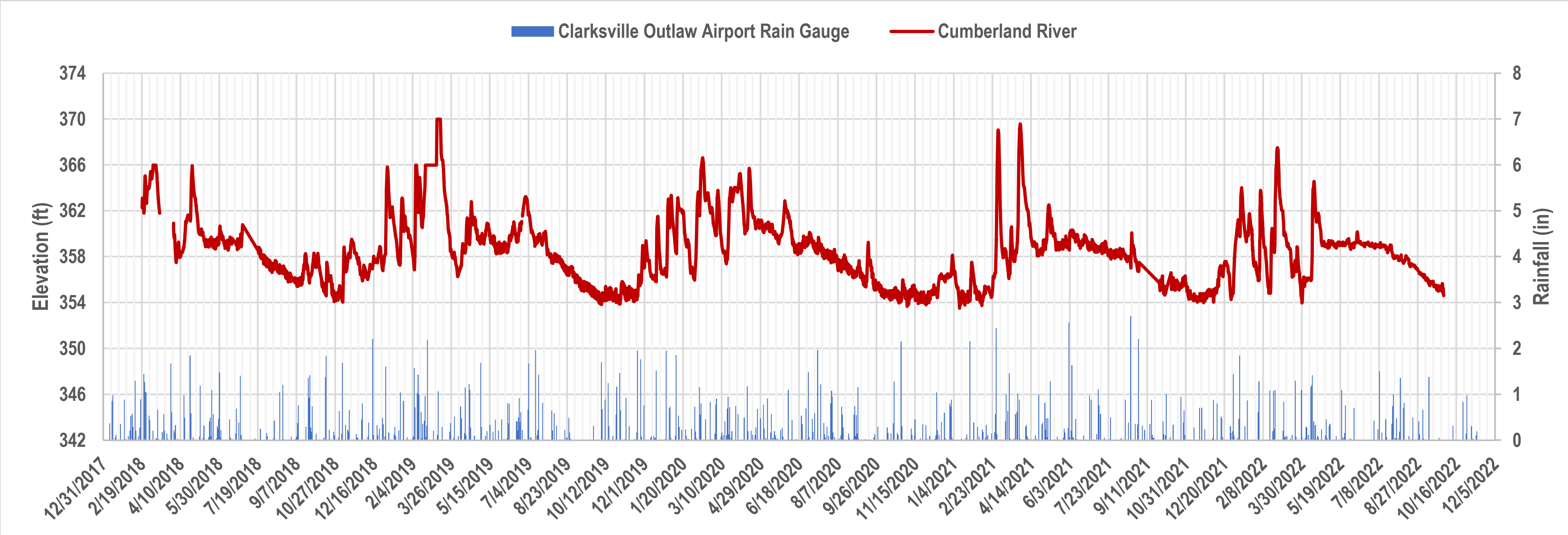
Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
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366
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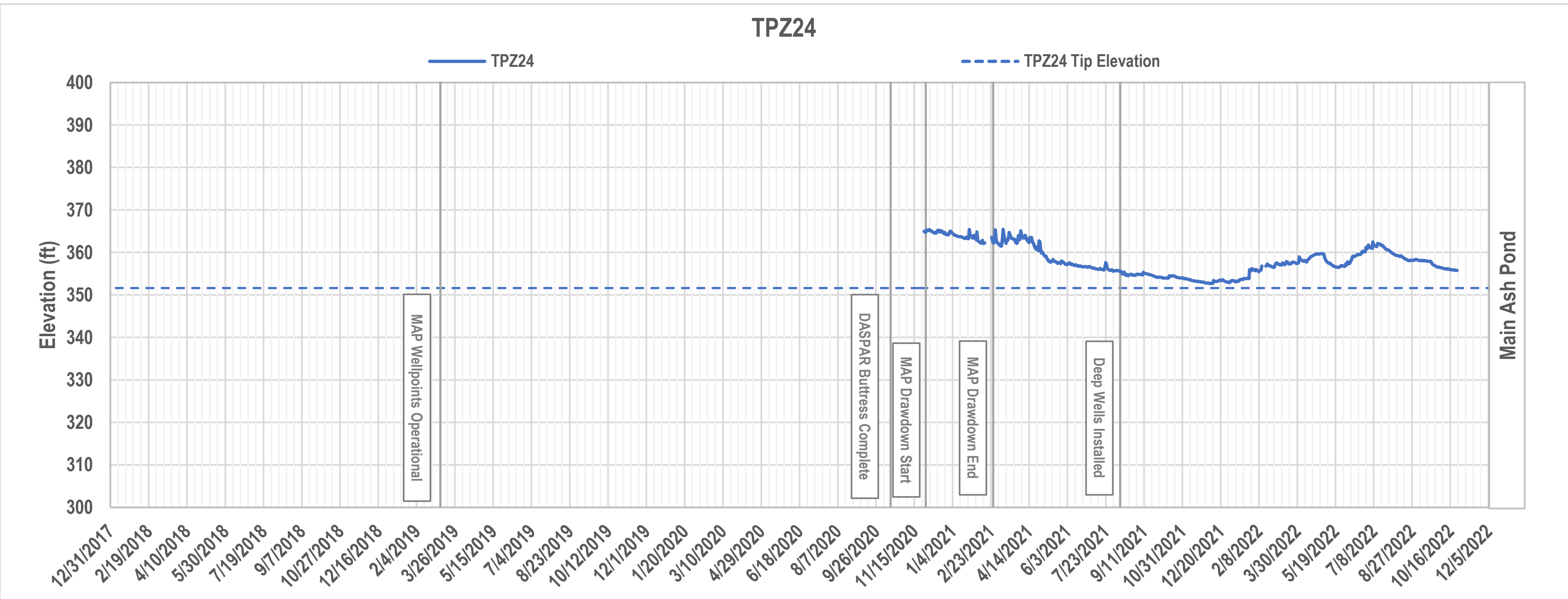
TPZ24
TPZ24
TPZ24 Tip Elevation
Elevation (ft)
400
390
380
370
360
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MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
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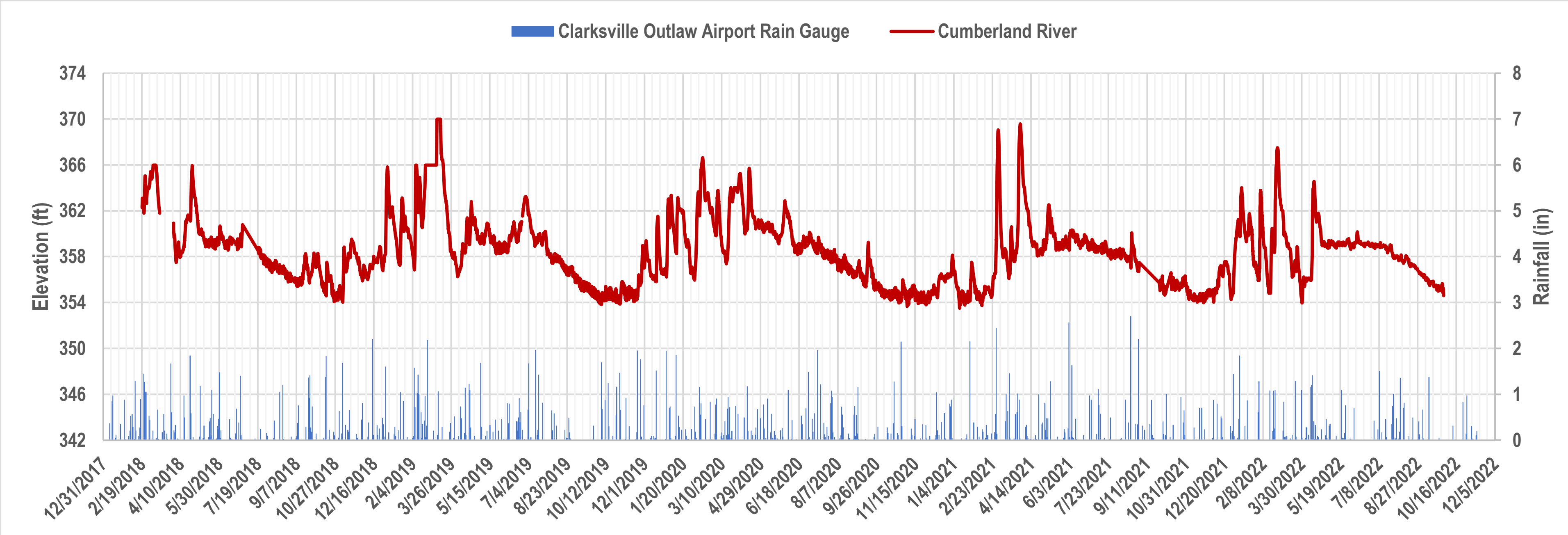

Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
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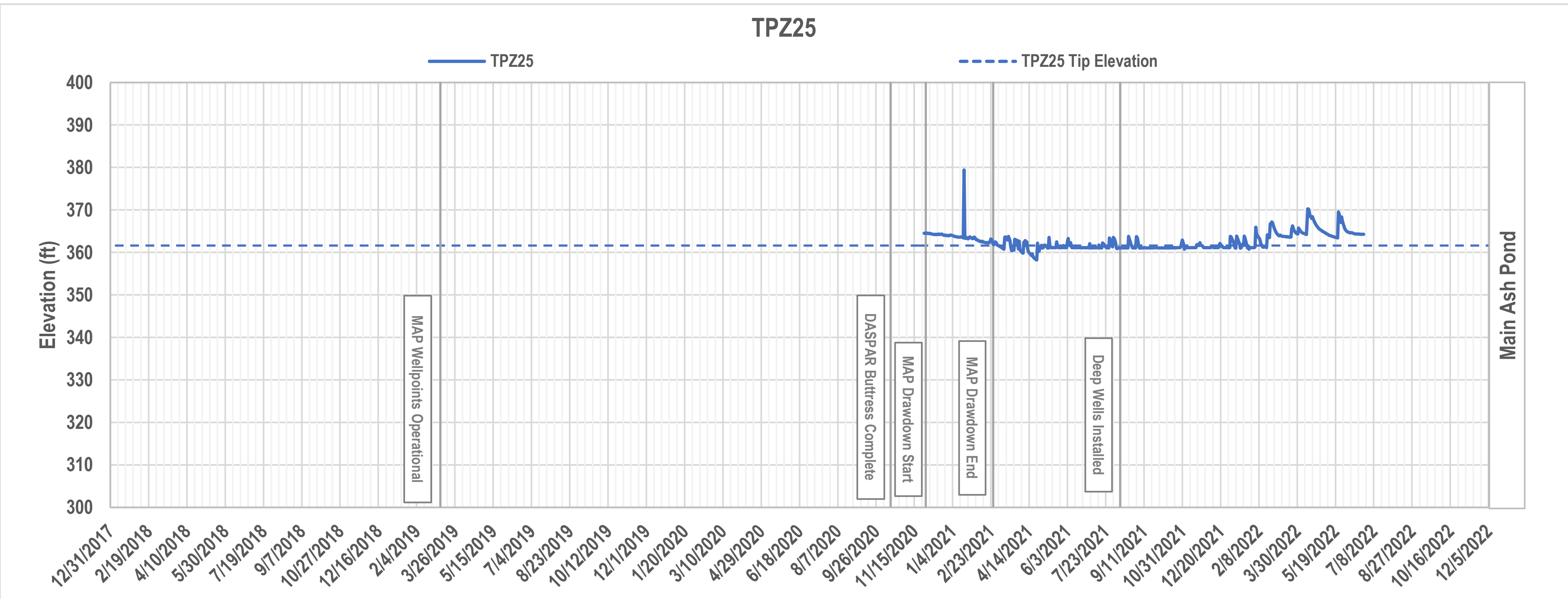

TPZ25
TPZ25
TPZ25 Tip Elevation
Elevation (ft)
400
390
380
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MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
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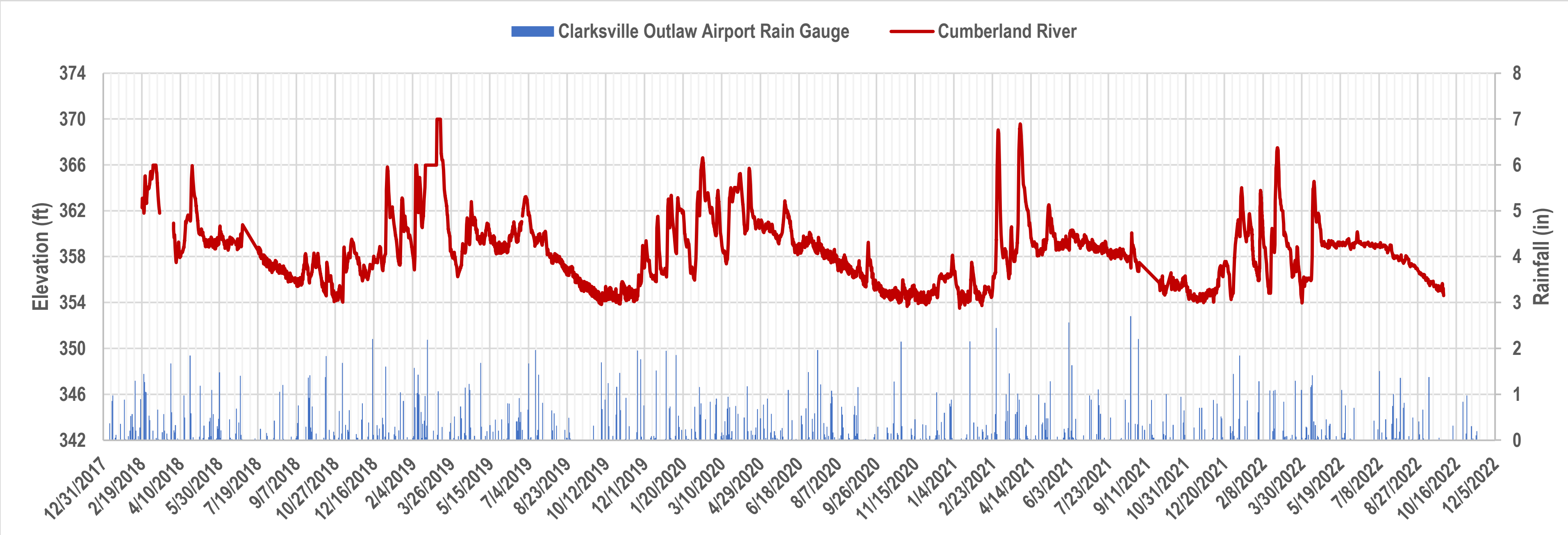
Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
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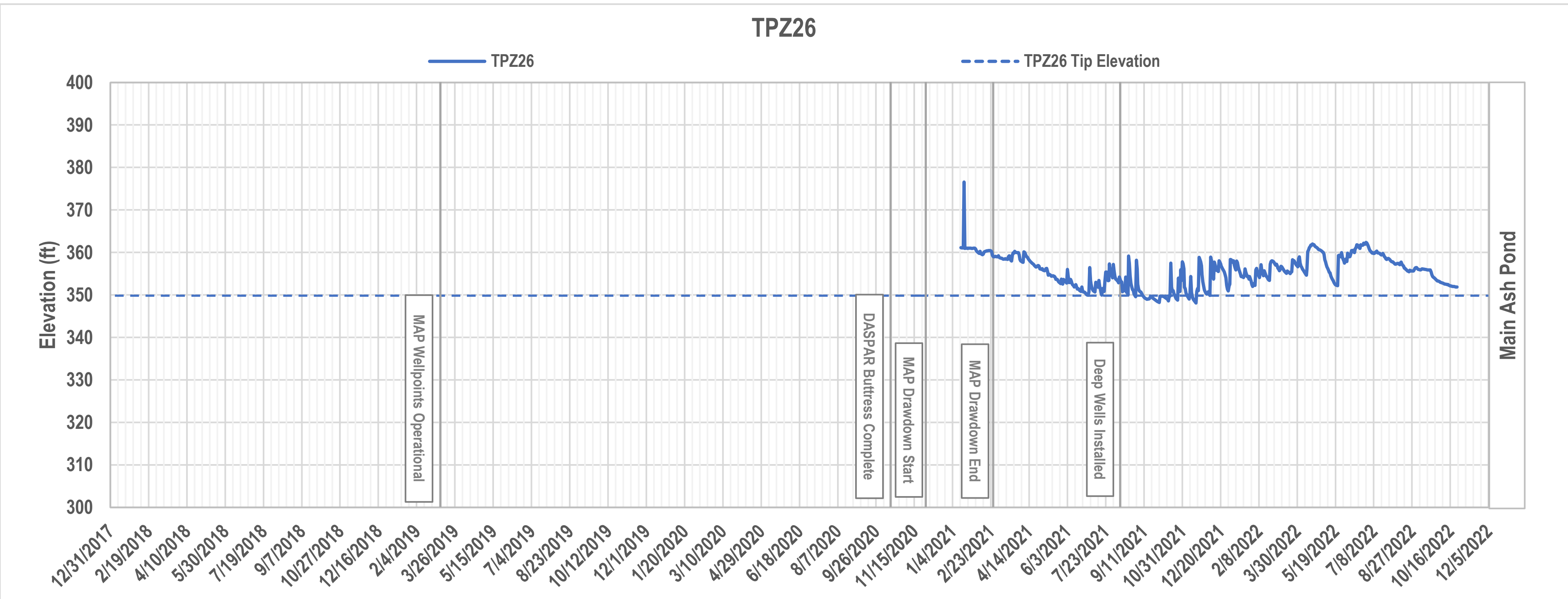
TPZ26
TPZ26
TPZ26 Tip Elevation
Elevation (ft)
400
390
380
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MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
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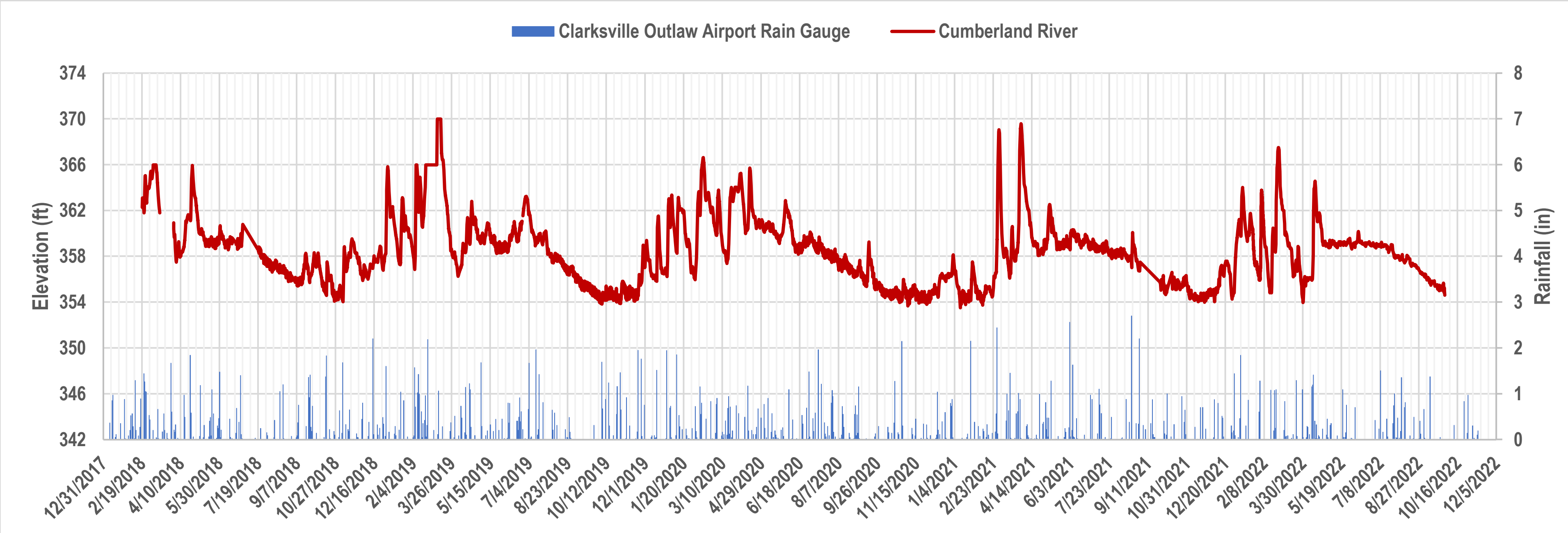

Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
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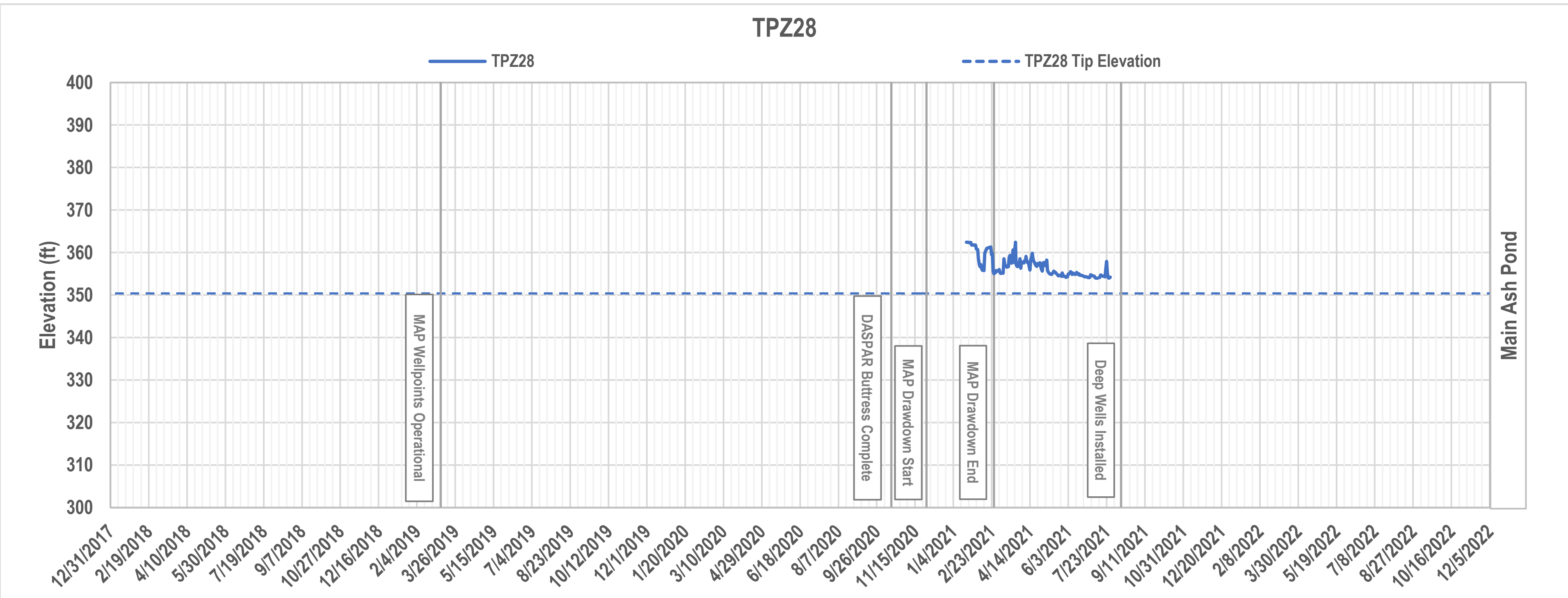

TPZ28
TPZ28
TPZ28 Tip Elevation
Elevation (ft)
400
390
380
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MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
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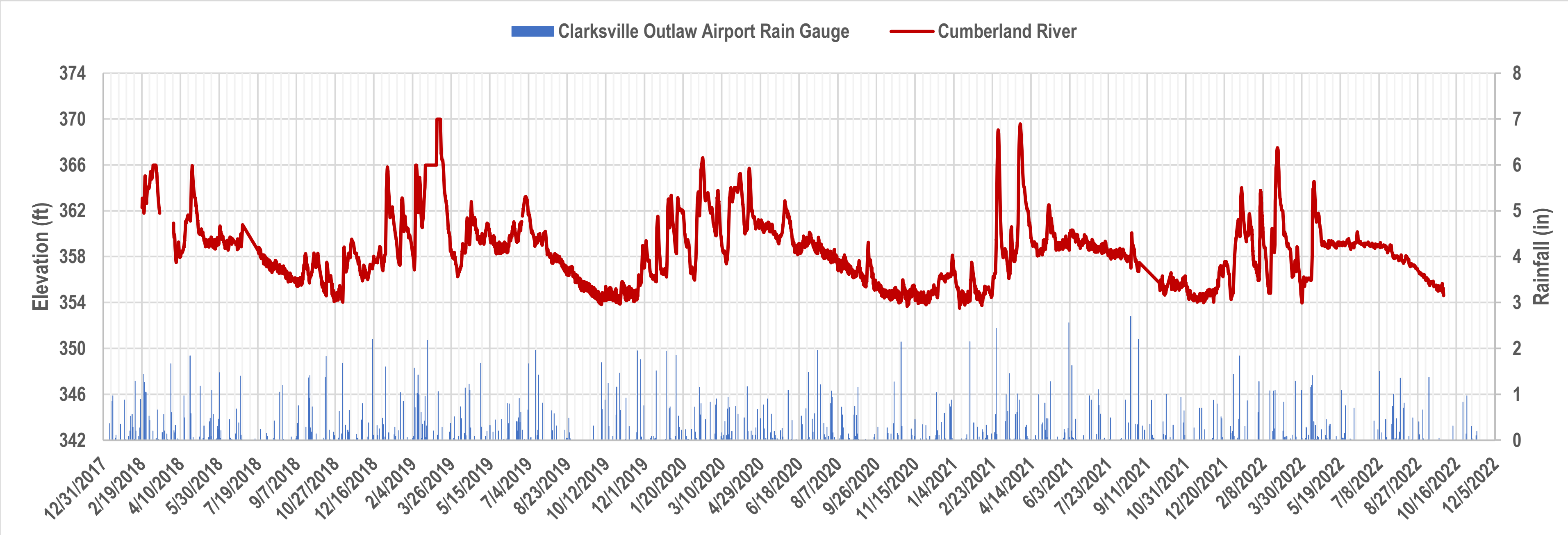
Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
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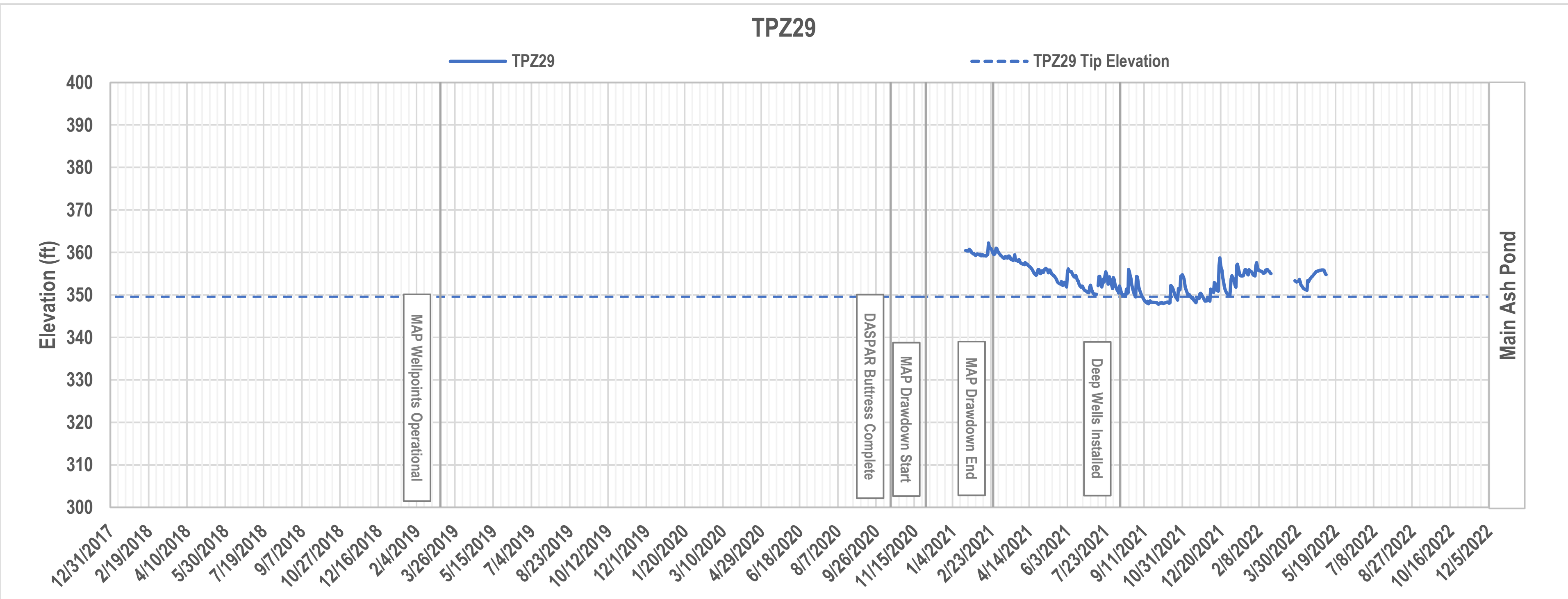
TPZ29
TPZ29
TPZ29 Tip Elevation
Elevation (ft)
400
390
380
370
360
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320
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300
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
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3/26/2019
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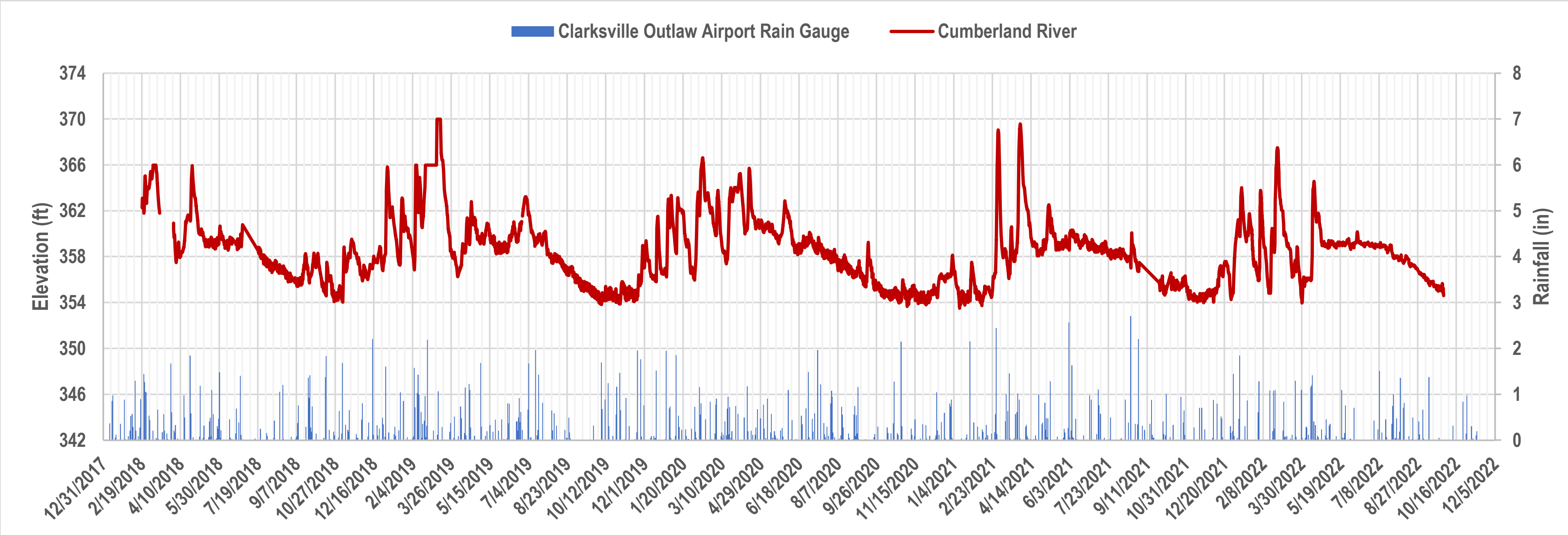
Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
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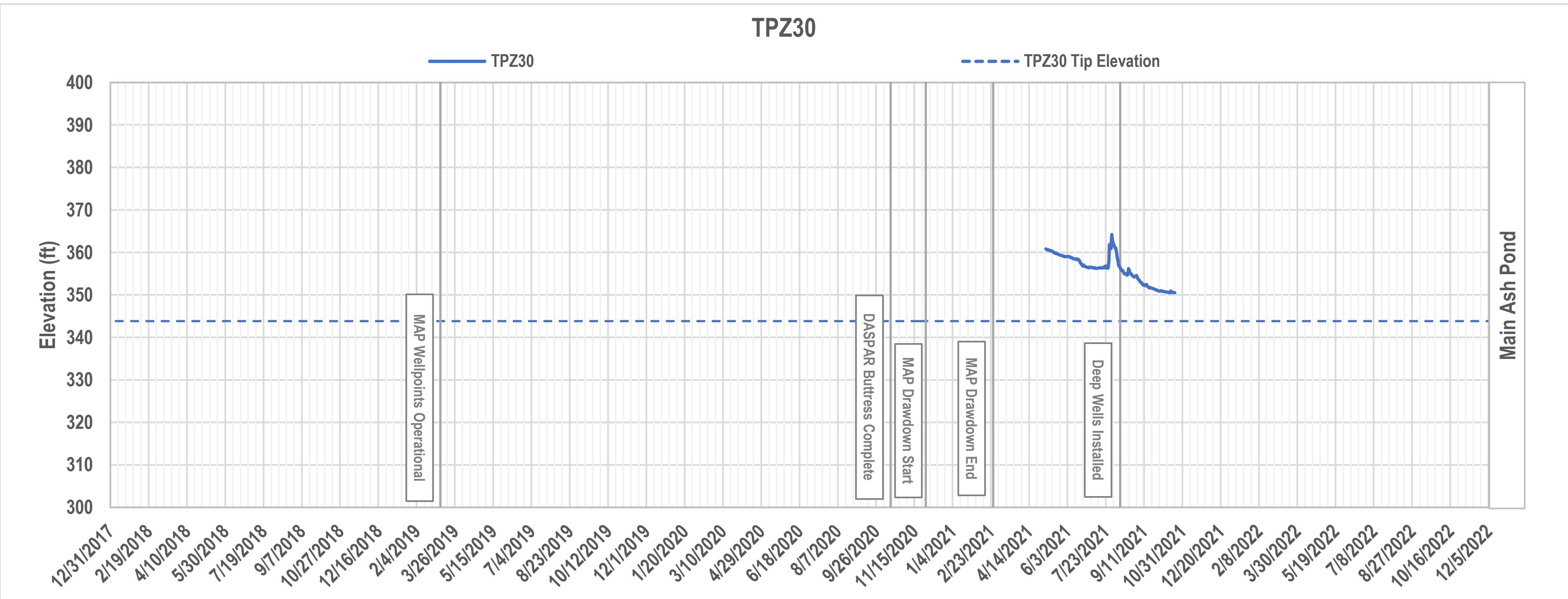
TPZ30
TPZ30
TPZ30 Tip Elevation
Elevation (ft)
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390
380
370
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340
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300
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
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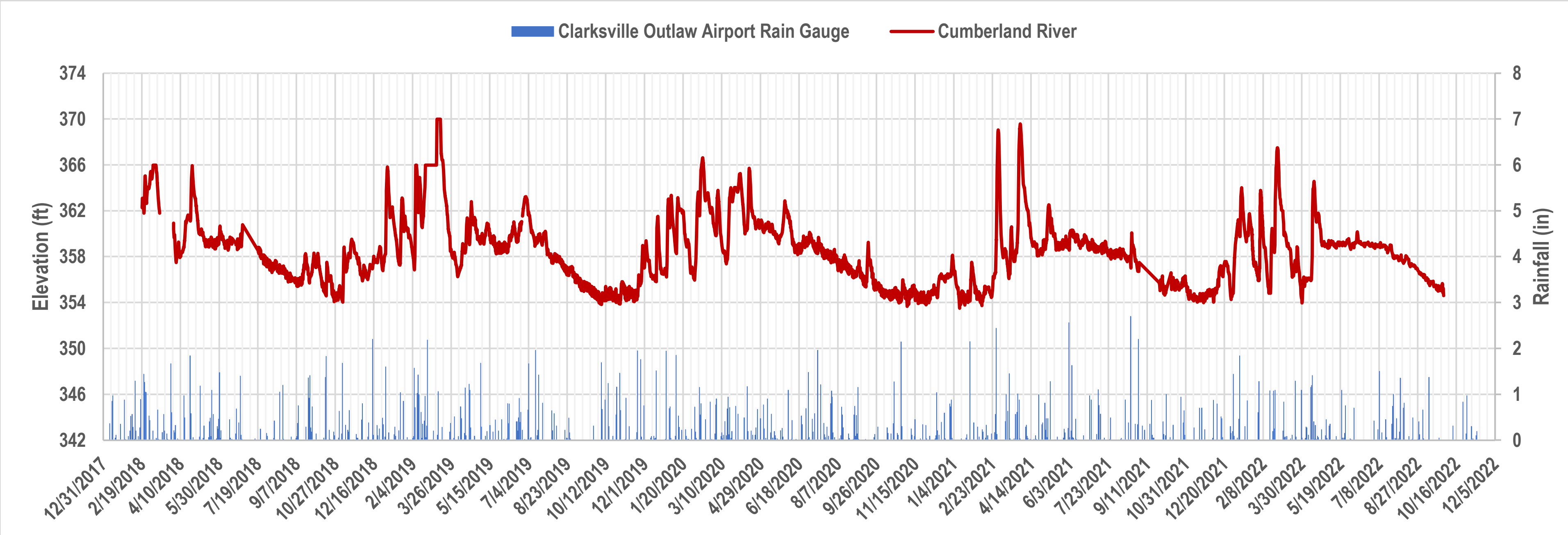
Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
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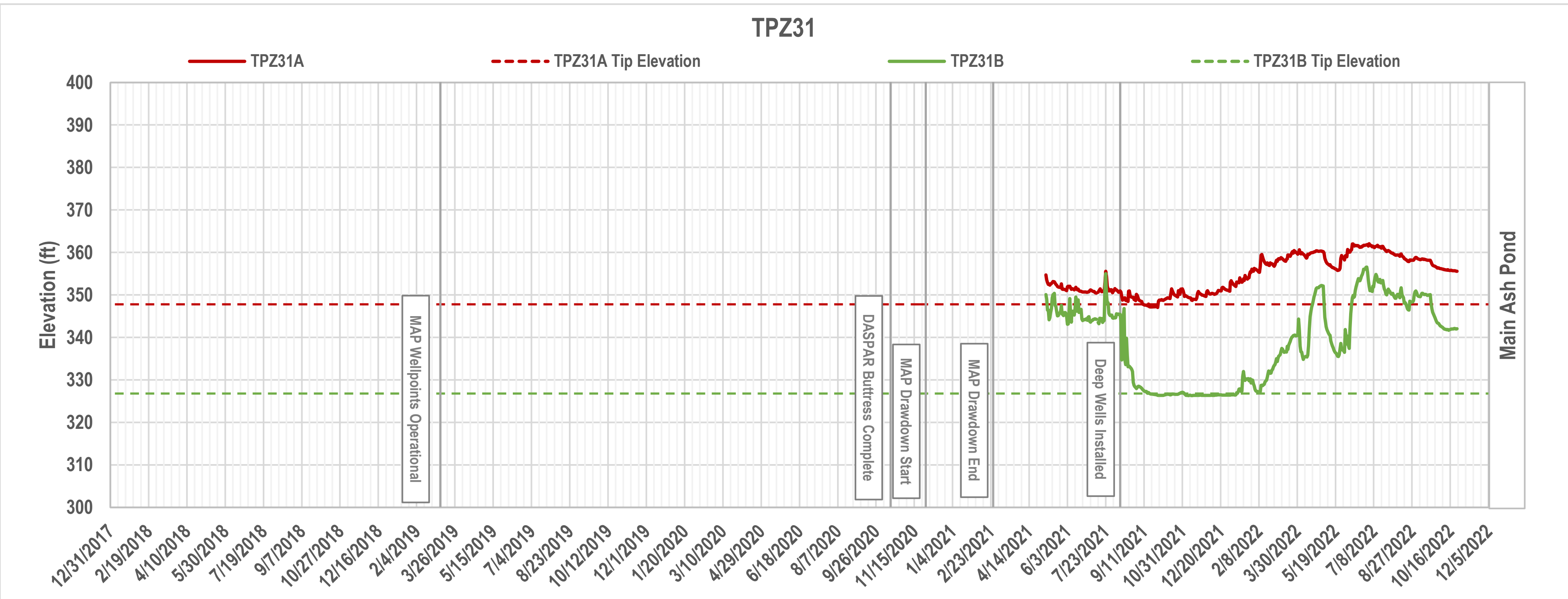
TPZ31
TPZ31A
TPZ31A Tip Elevation
TPZ31B
TPZ31B Tip Elevation
Elevation (ft)
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MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
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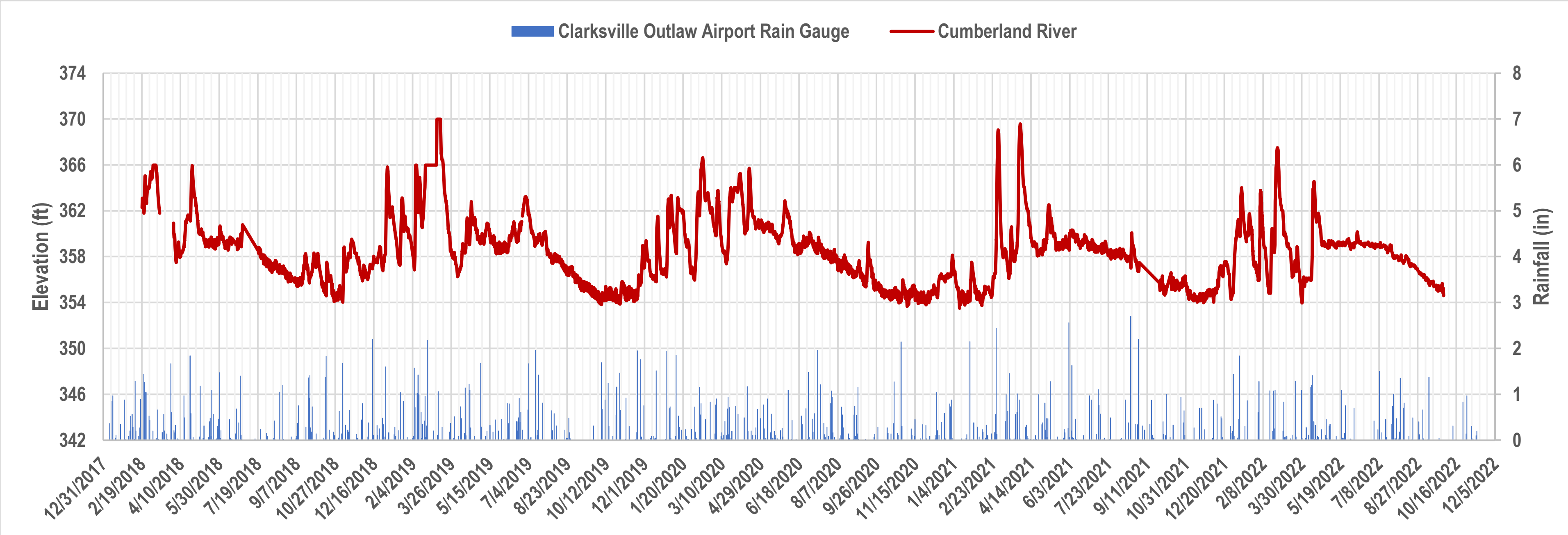
Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
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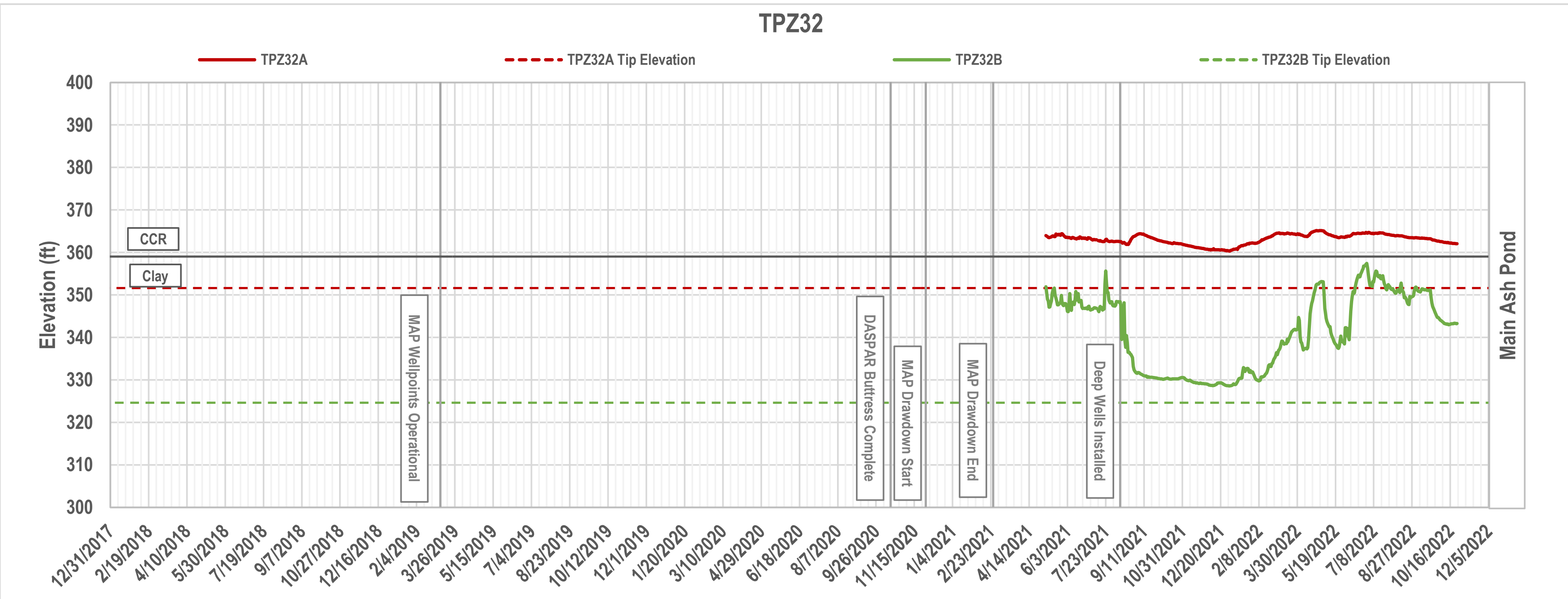
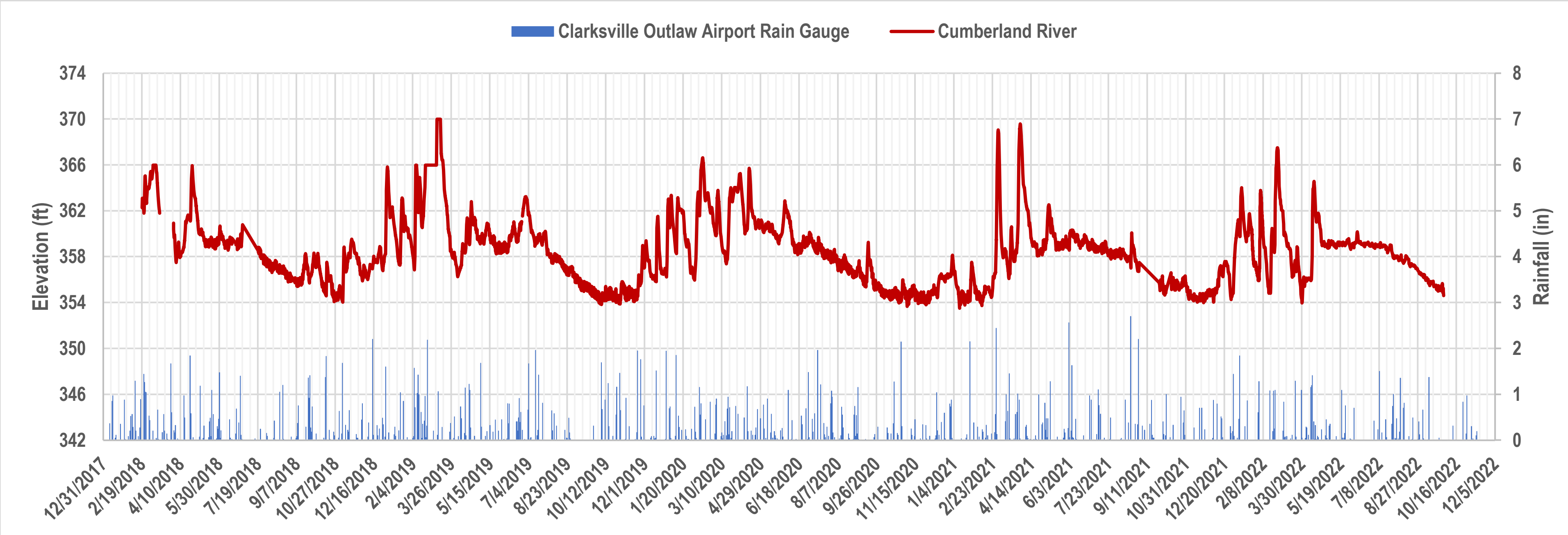
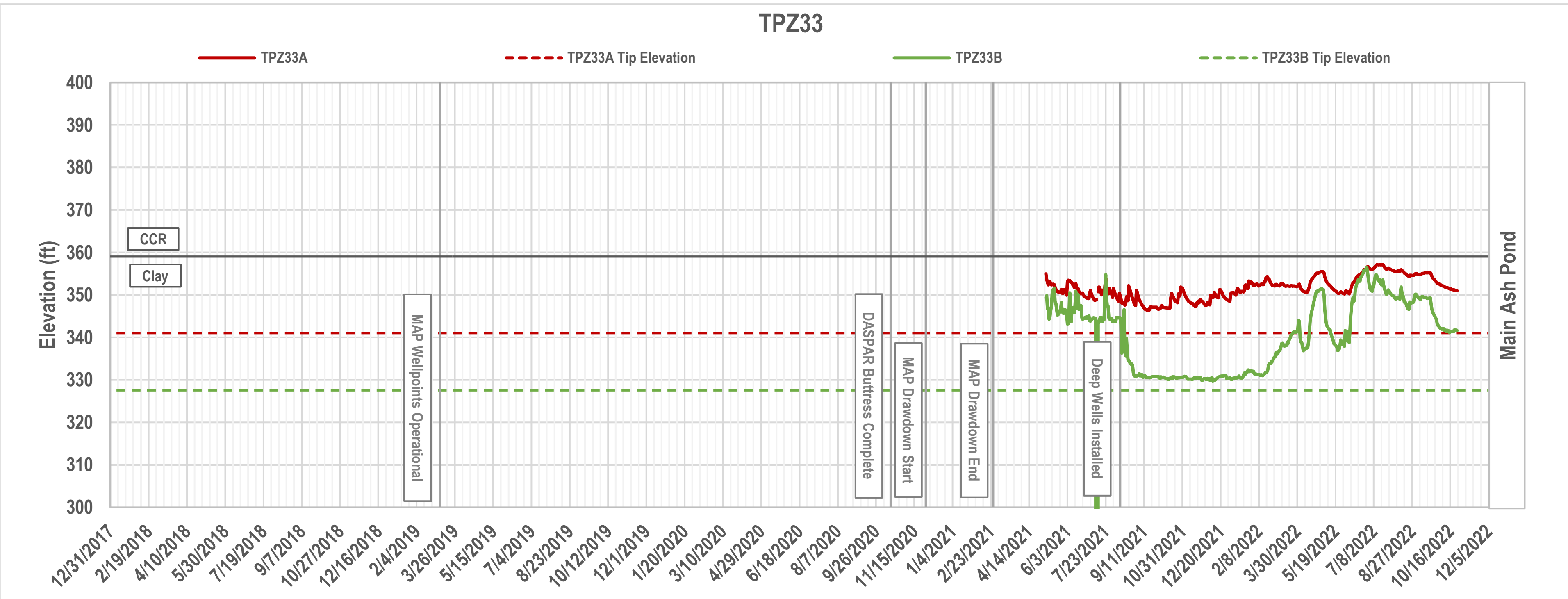
10/16/2022
12/5/2022

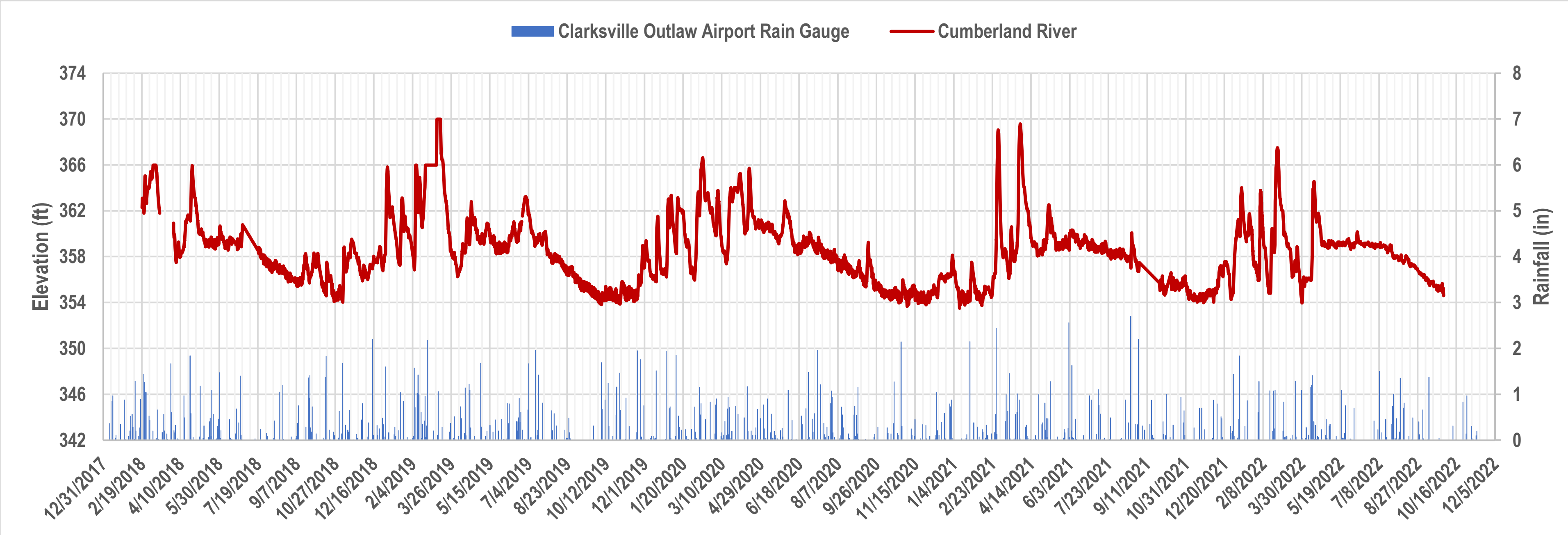

TPZ32
TPZ32A
TPZ32A Tip Elevation
TPZ32B
TPZ32B Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
CCR
Clay
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022



TPZ33
TPZ33A
TPZ33A Tip Elevation
TPZ33B
TPZ33B Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
CCR
Clay
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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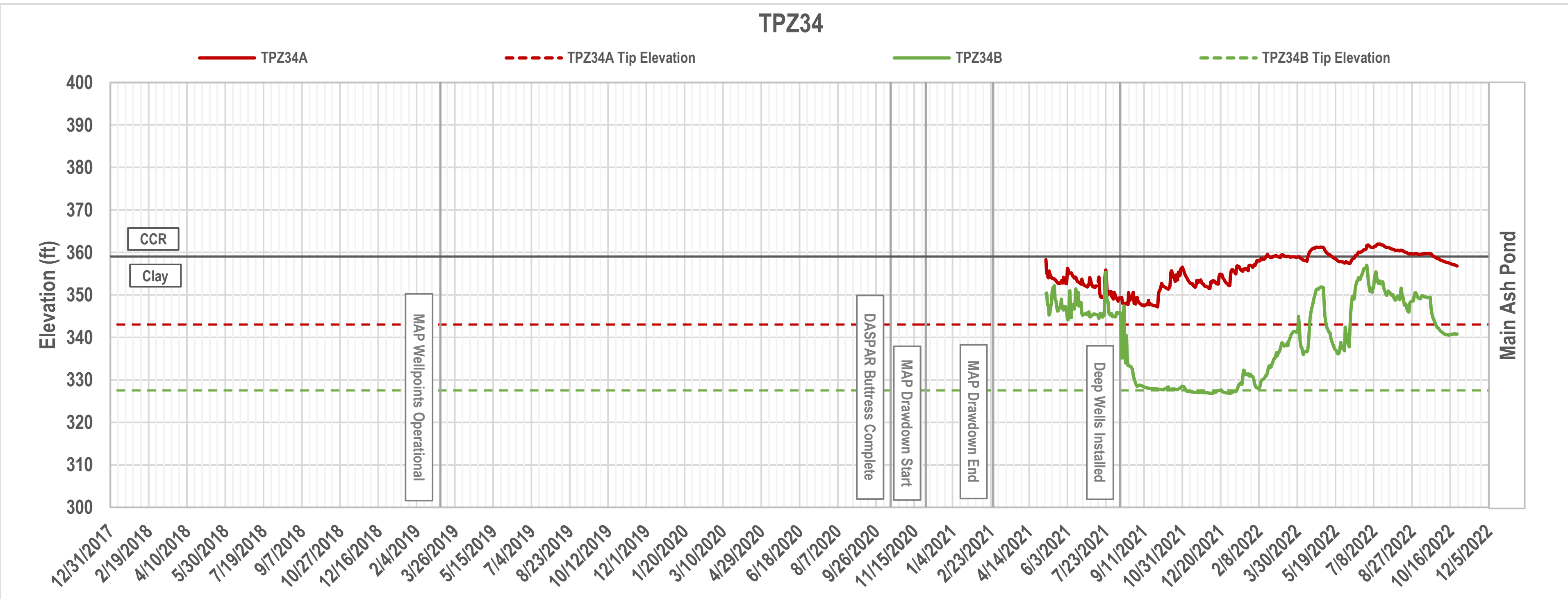
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022



TPZ34
TPZ34A
TPZ34A Tip Elevation
TPZ34B
TPZ34B Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
CCR
Clay
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Main Ash Pond
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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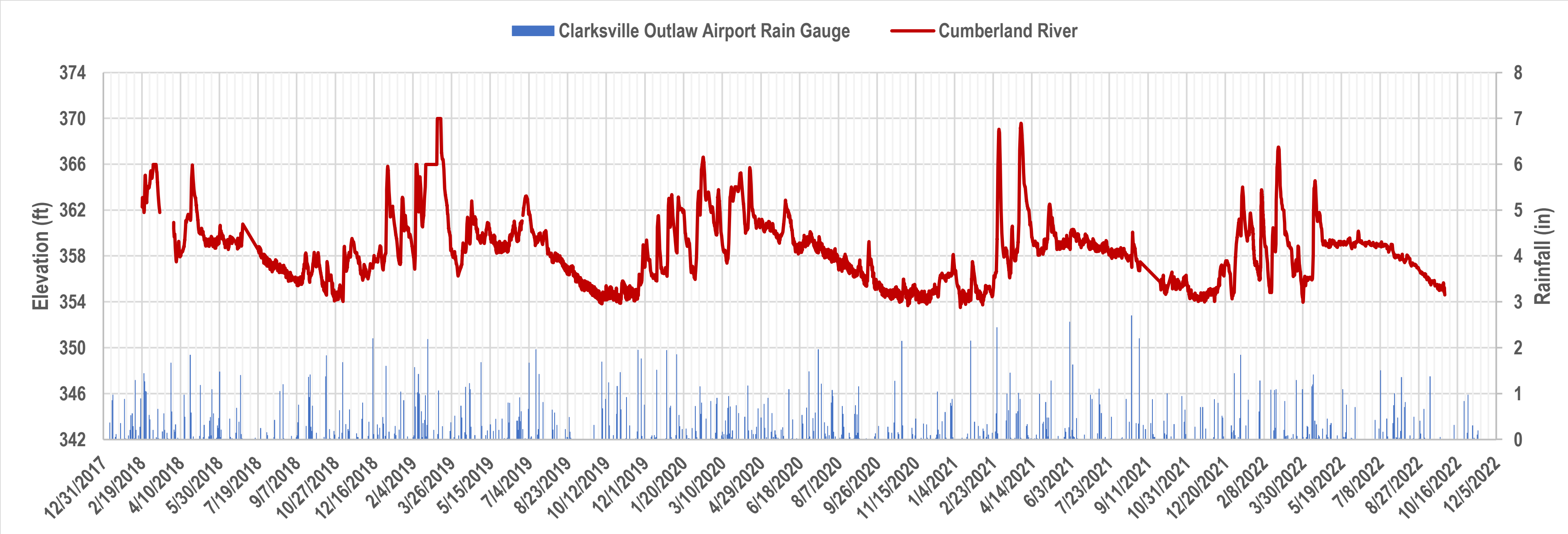
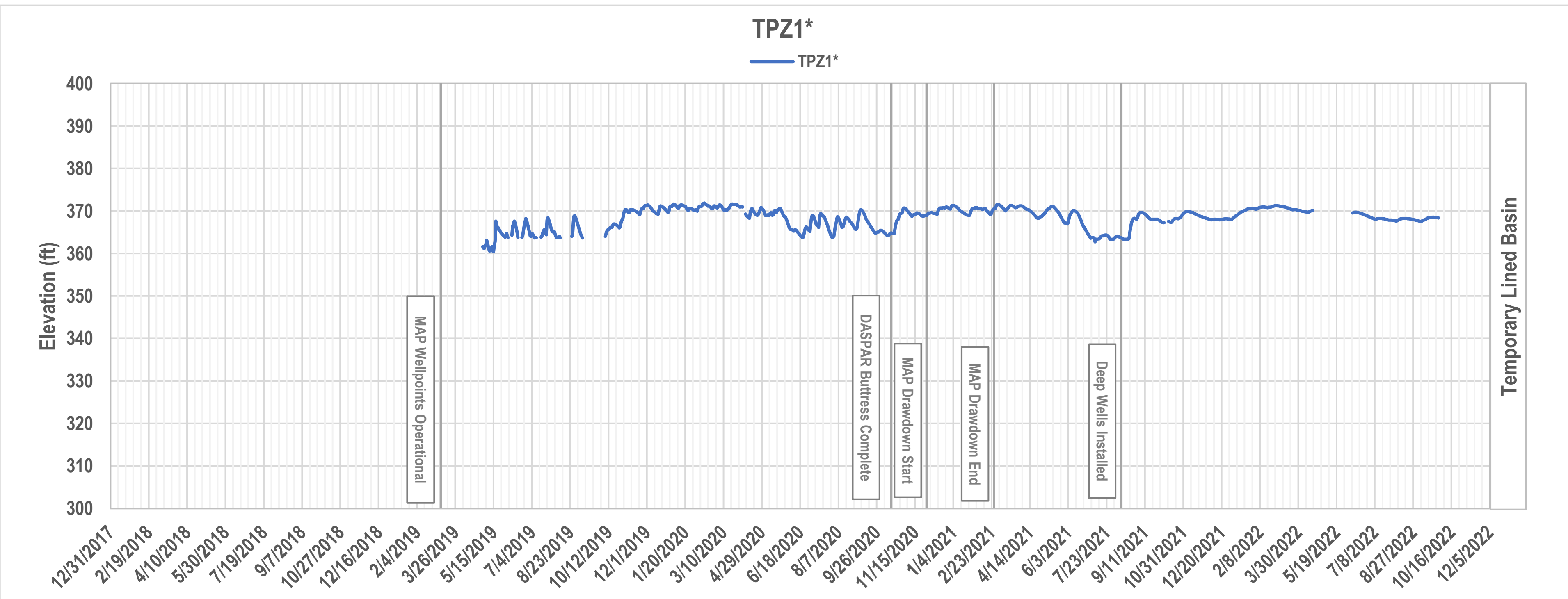
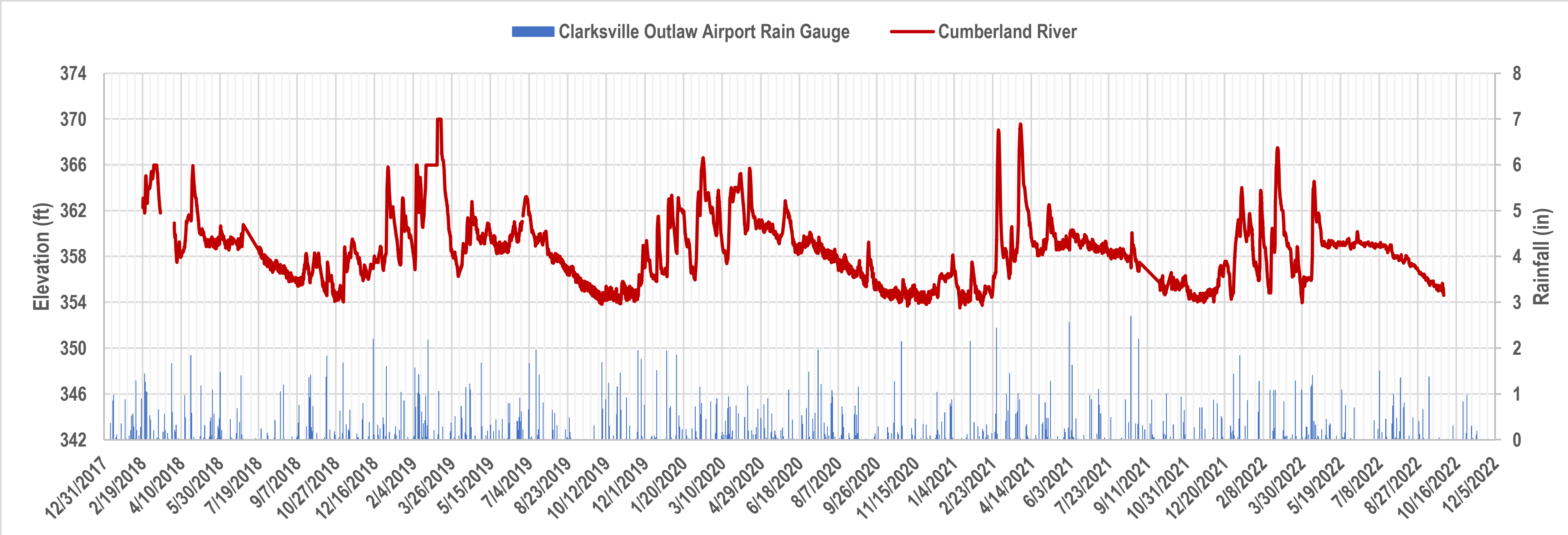
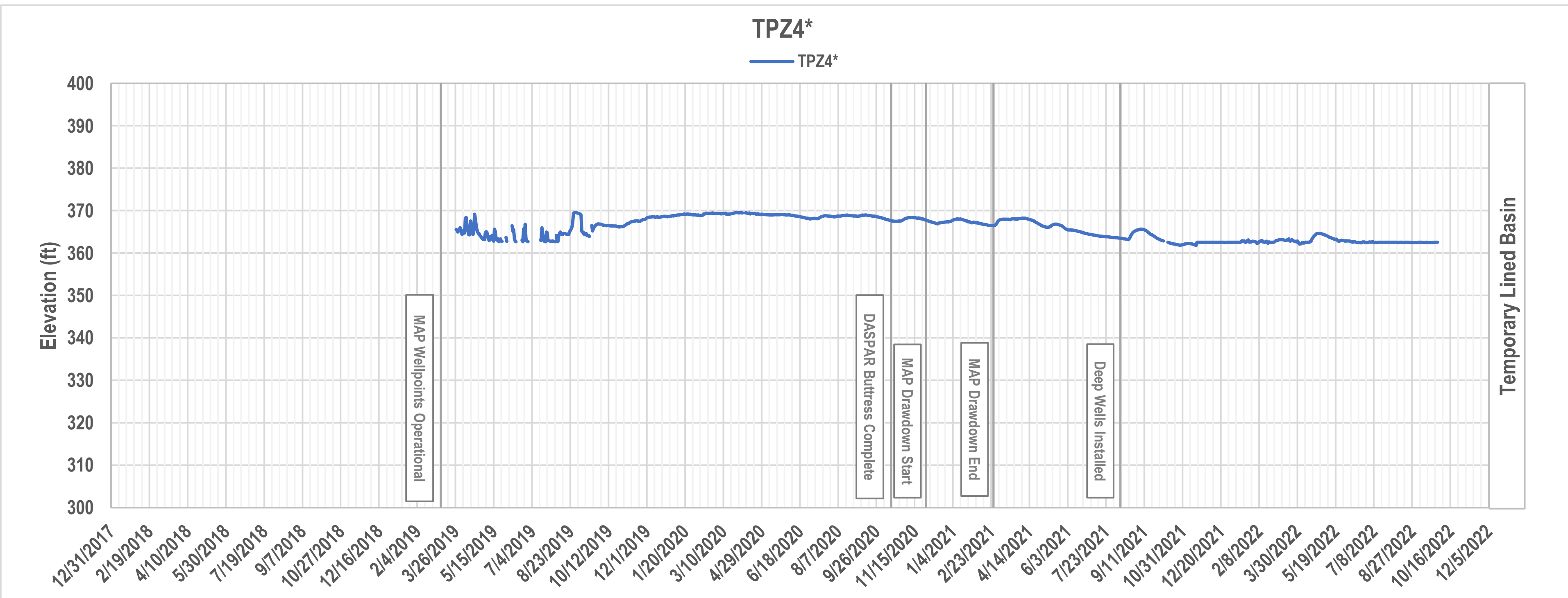
7/8/2022
8/27/2022
10/16/2022
12/5/2022



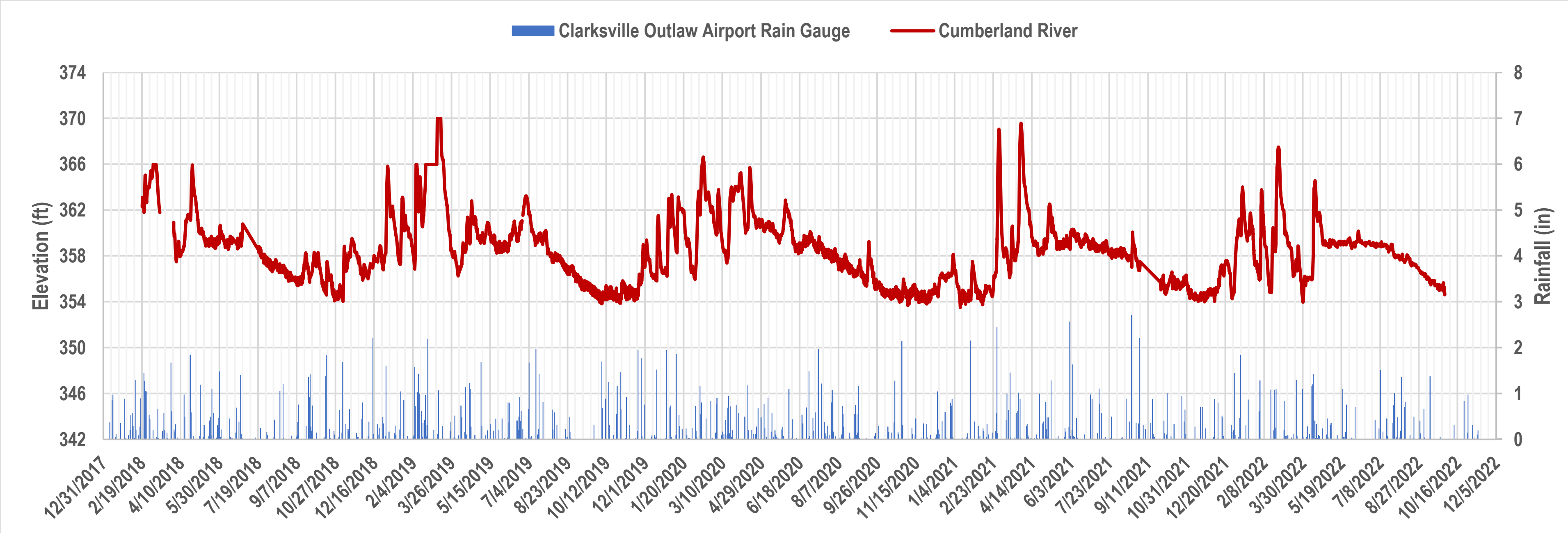


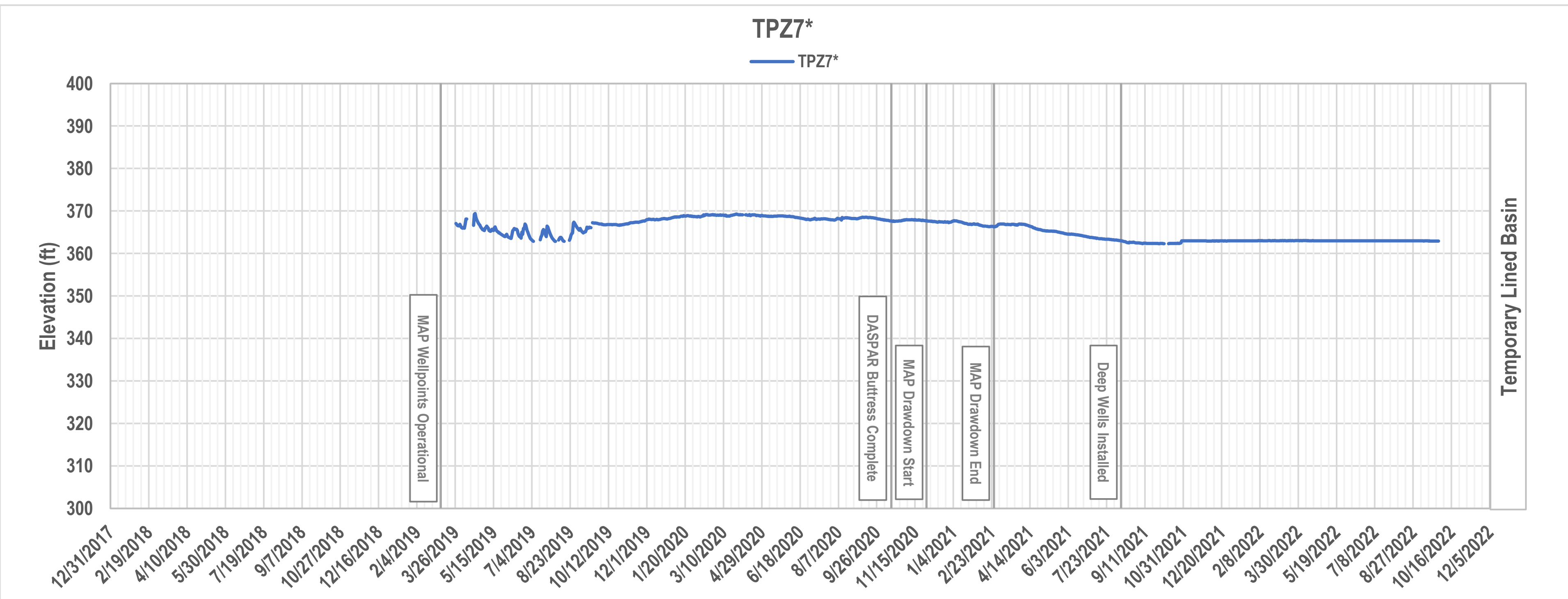
* Tip elevation is not available for this instrument.



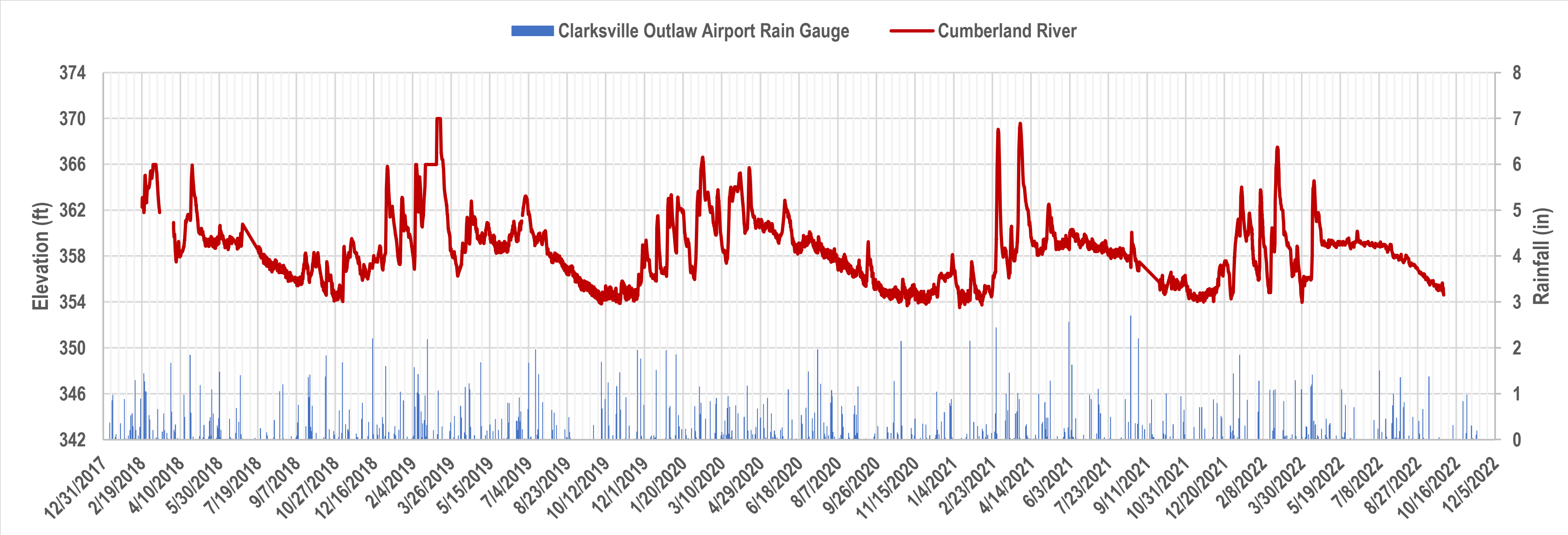


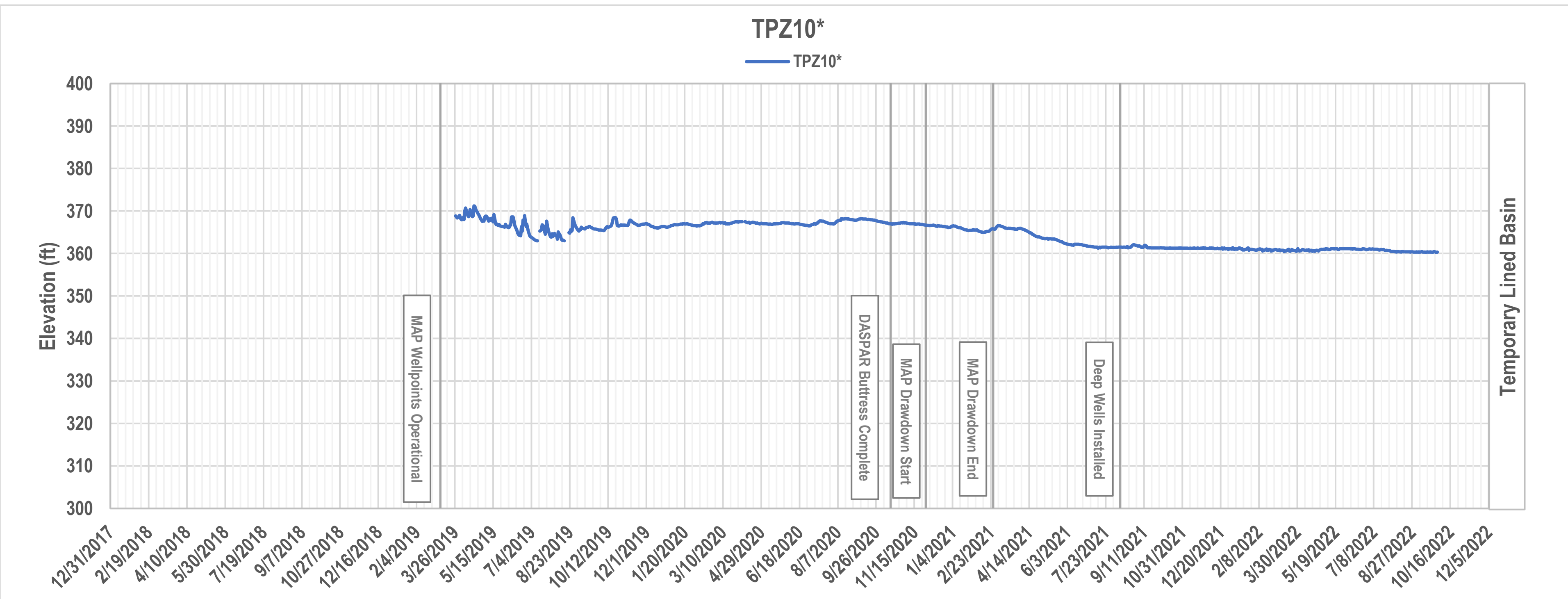
* Tip elevation is not available for this instrument.



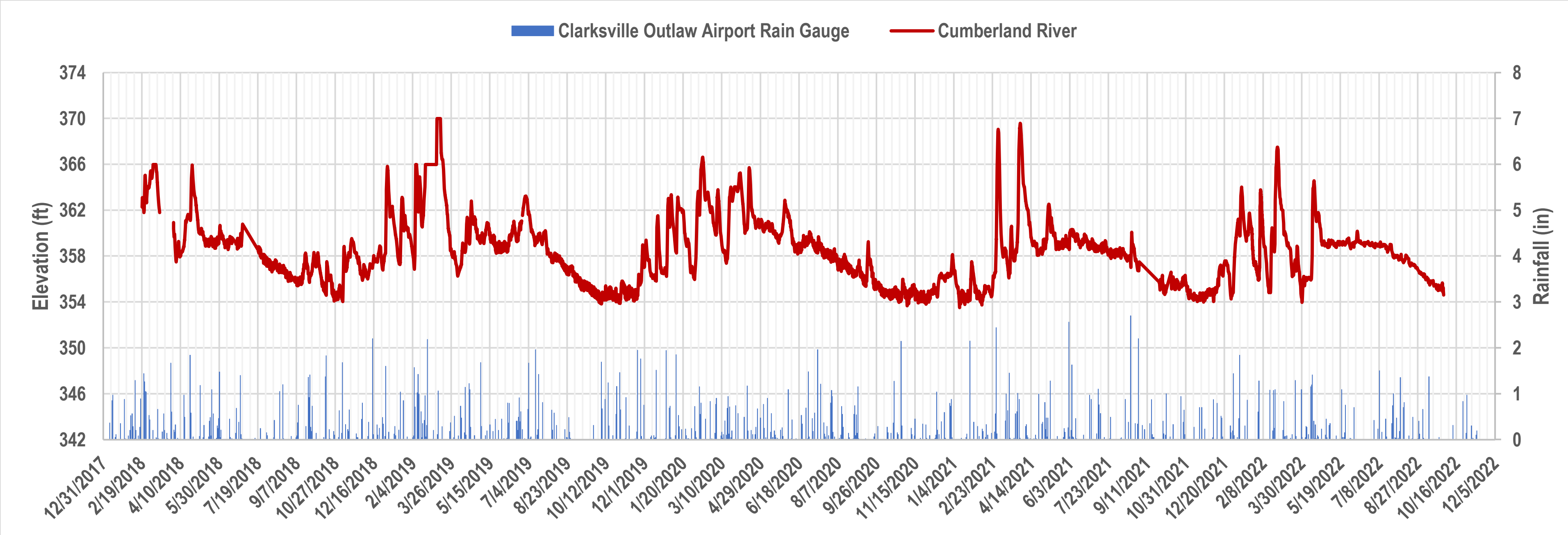


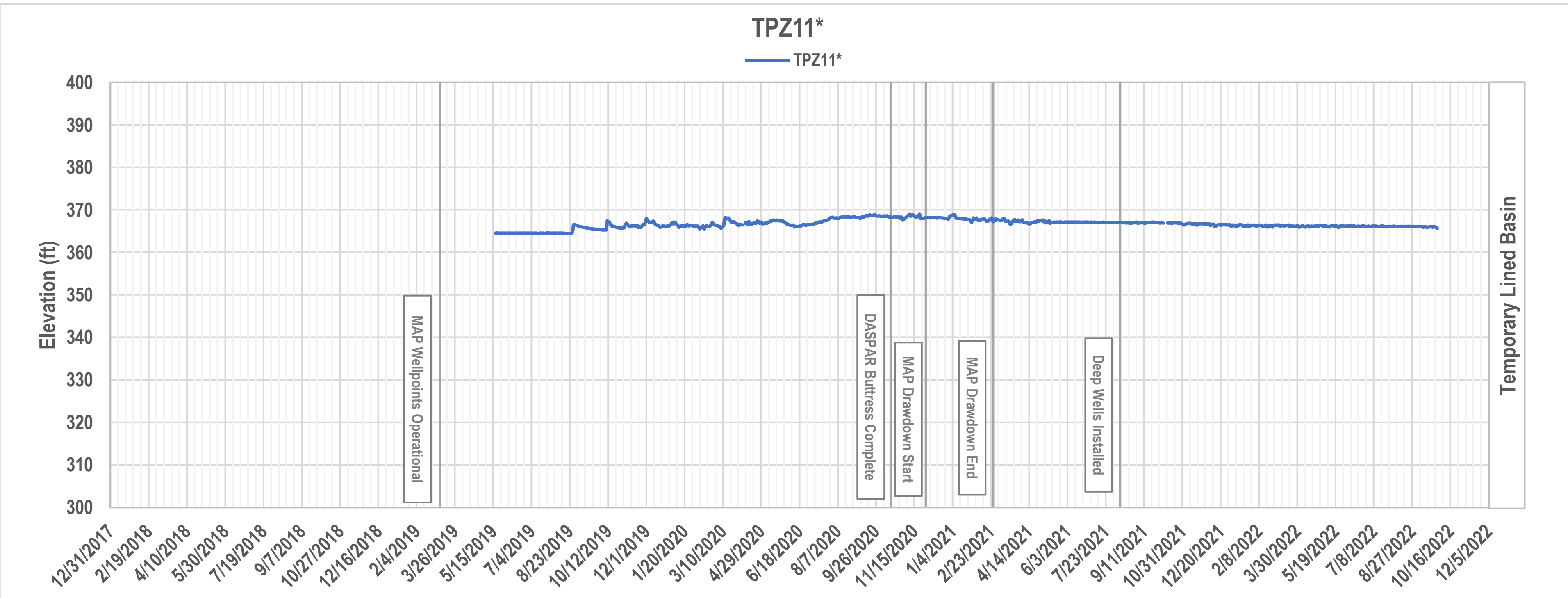
* Tip elevation is not available for this instrument.



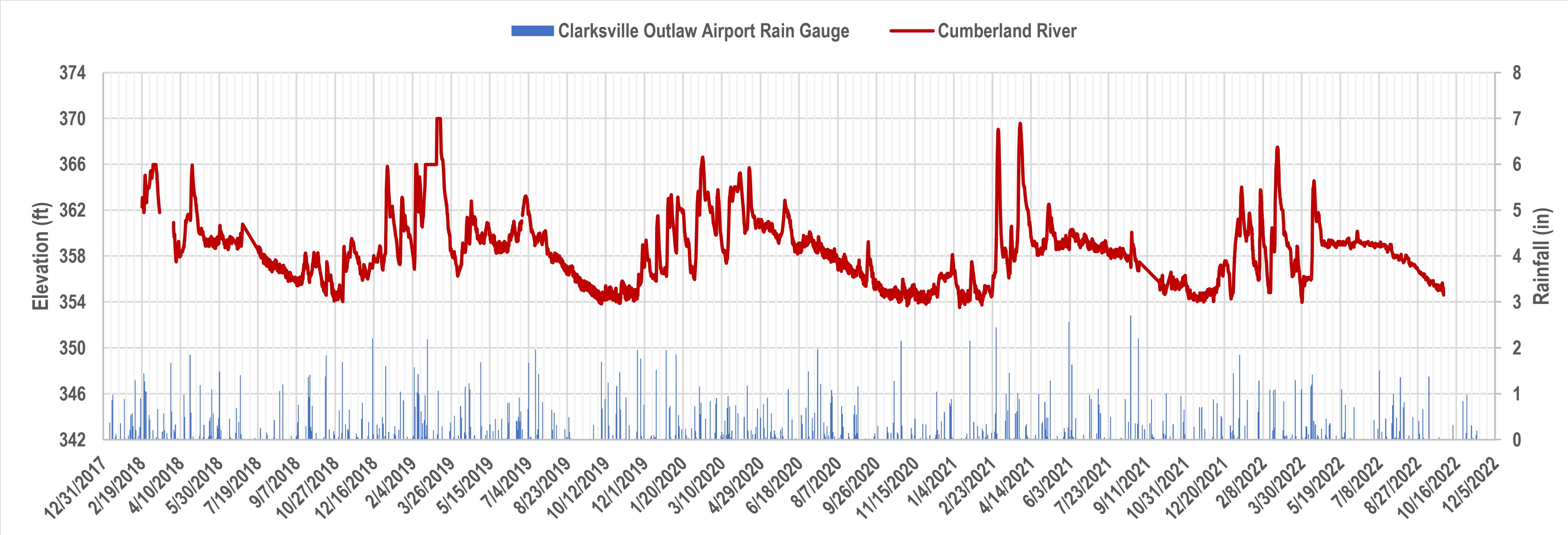


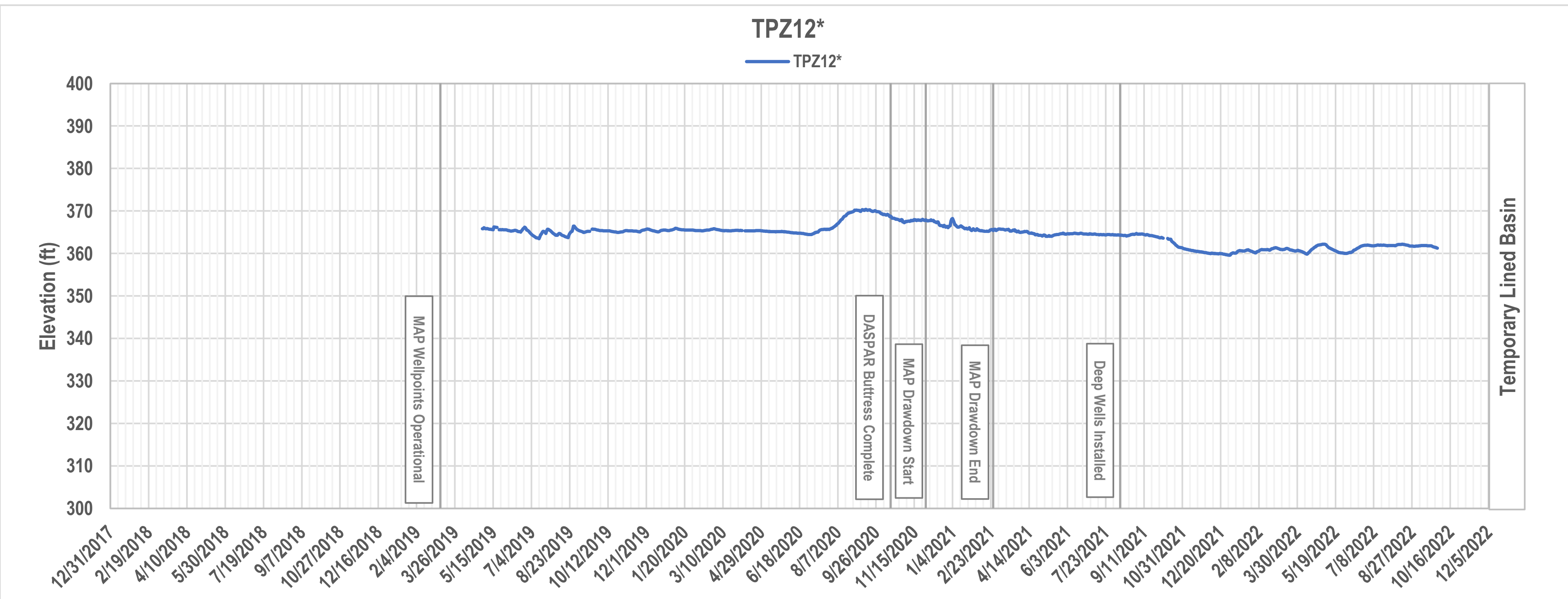
* Tip elevation is not available for this instrument.



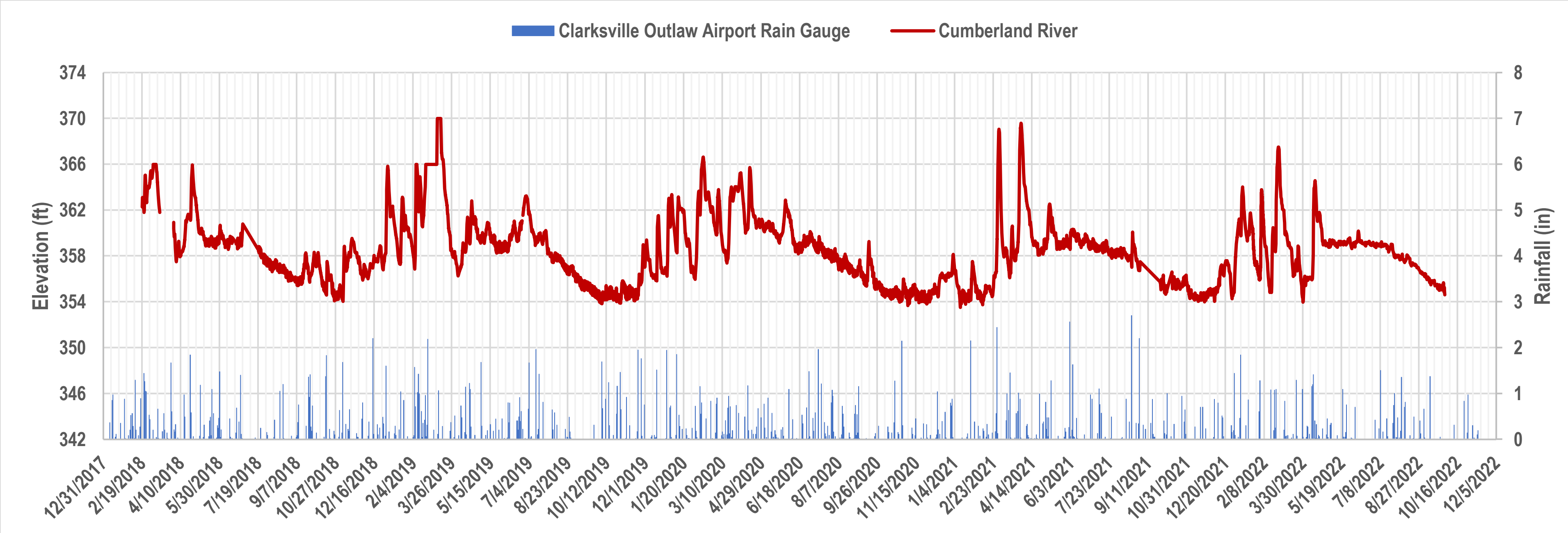


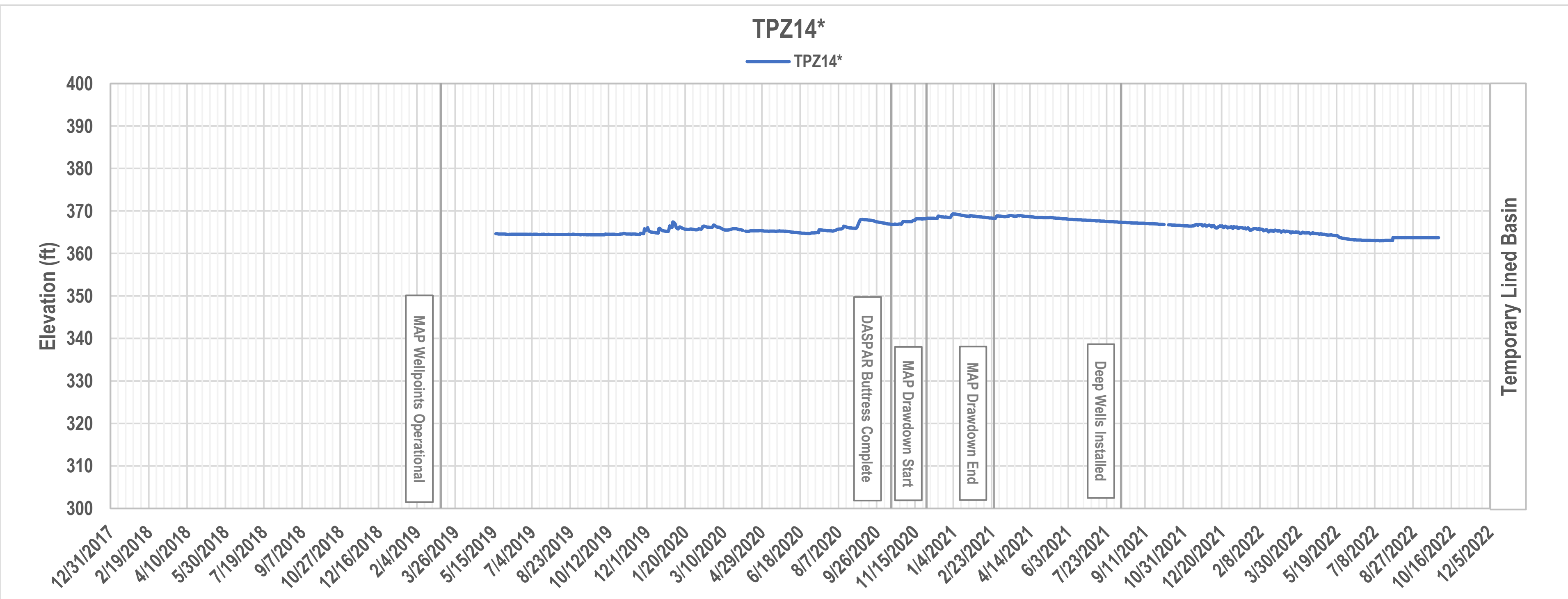
* Tip elevation is not available for this instrument.



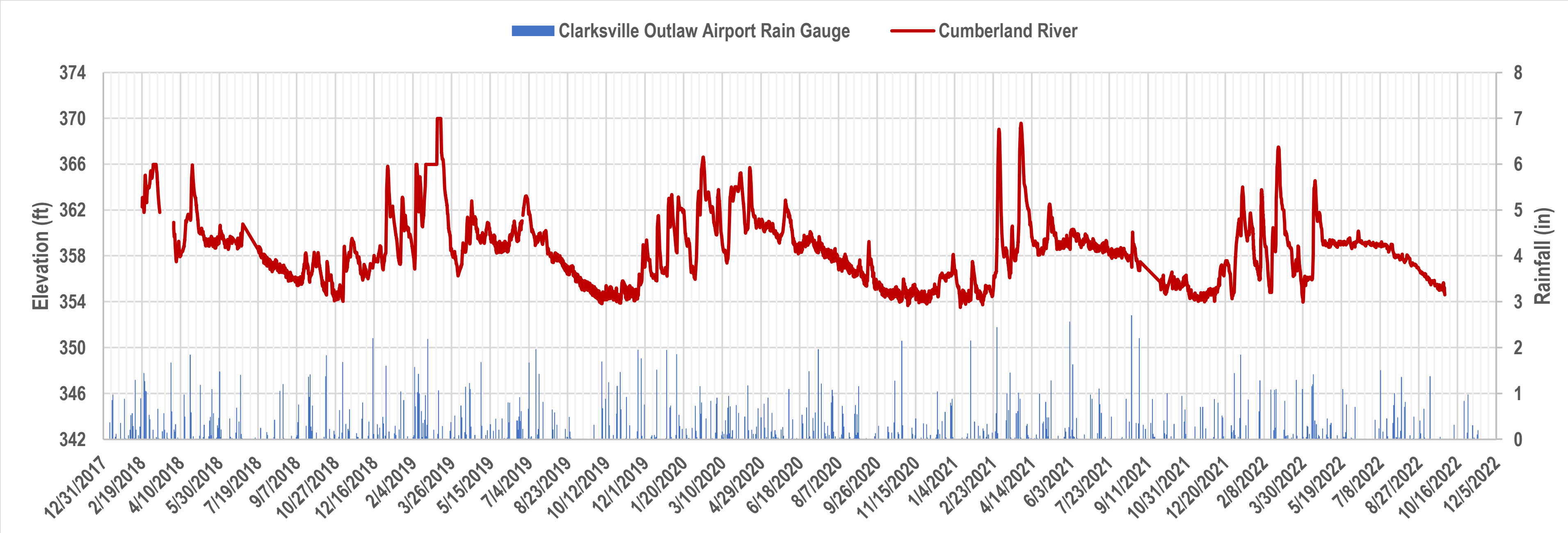


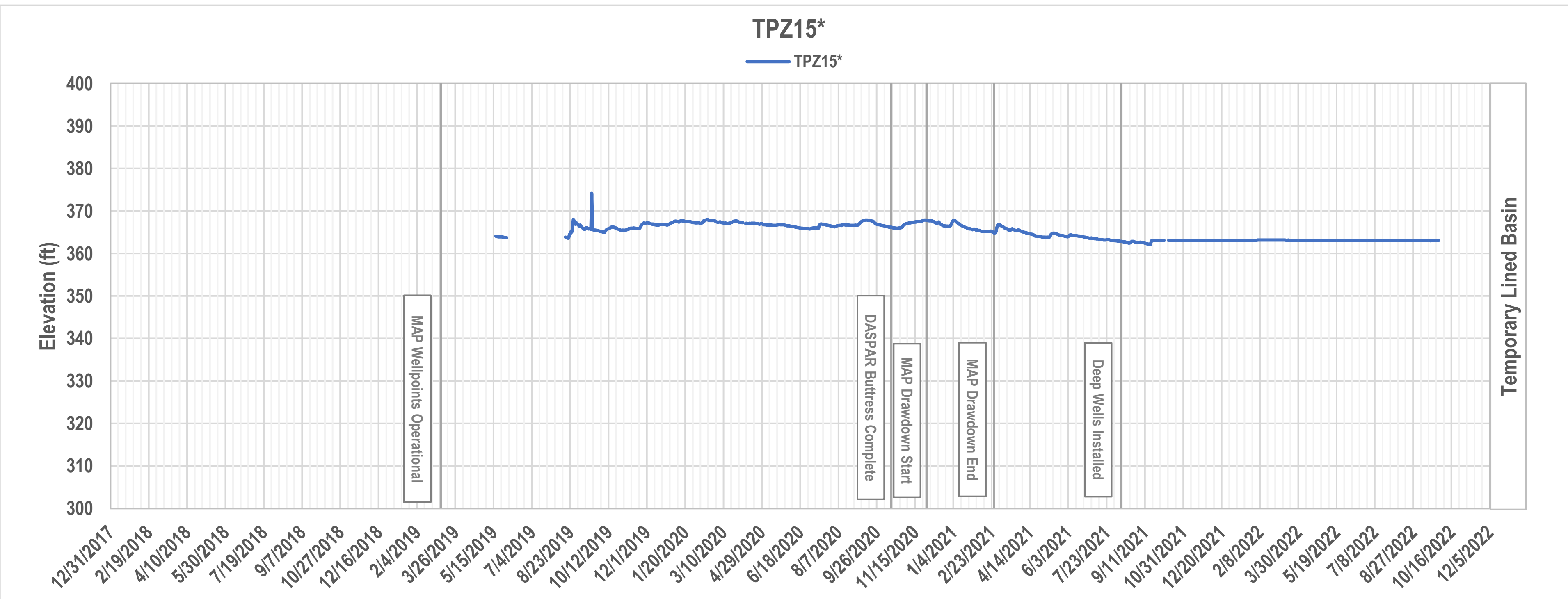
* Tip elevation is not available for this instrument.



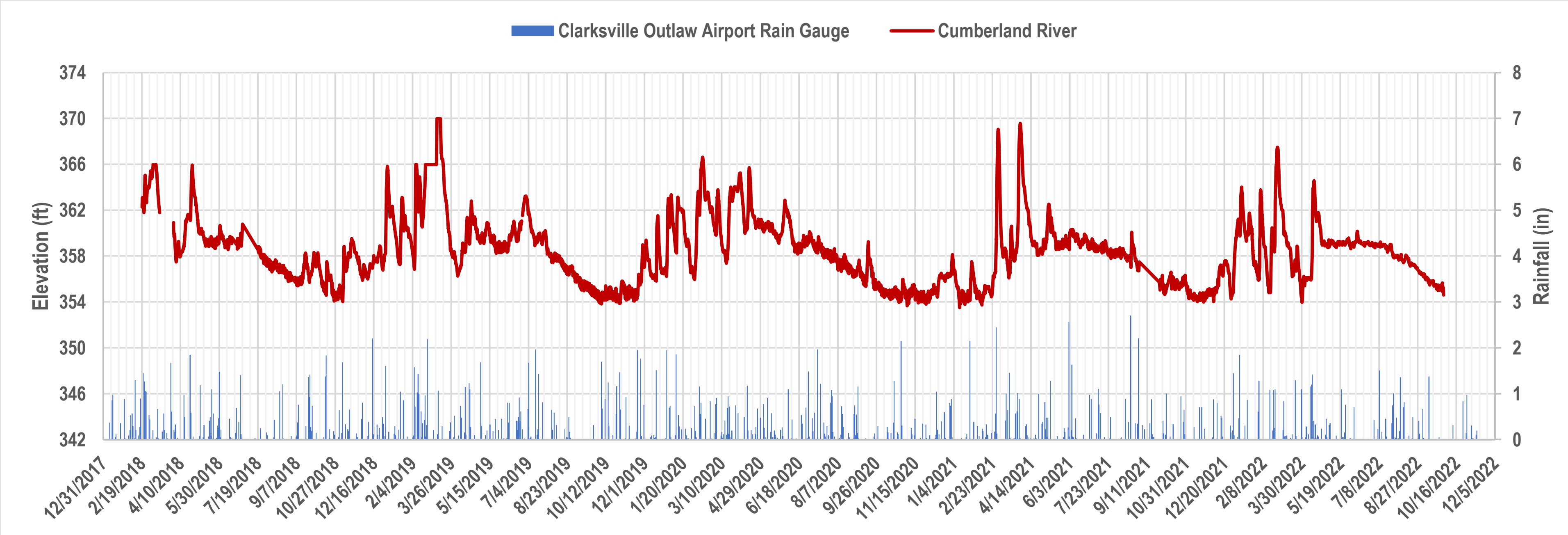


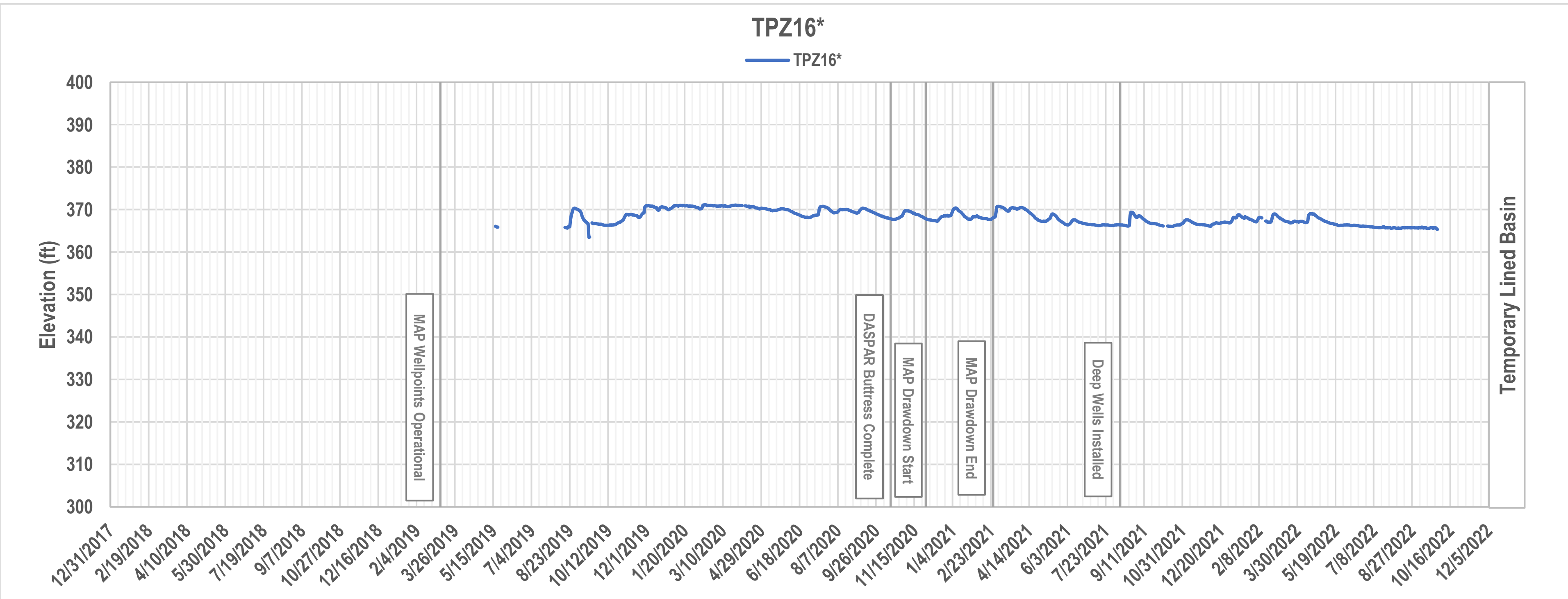
* Tip elevation is not available for this instrument.



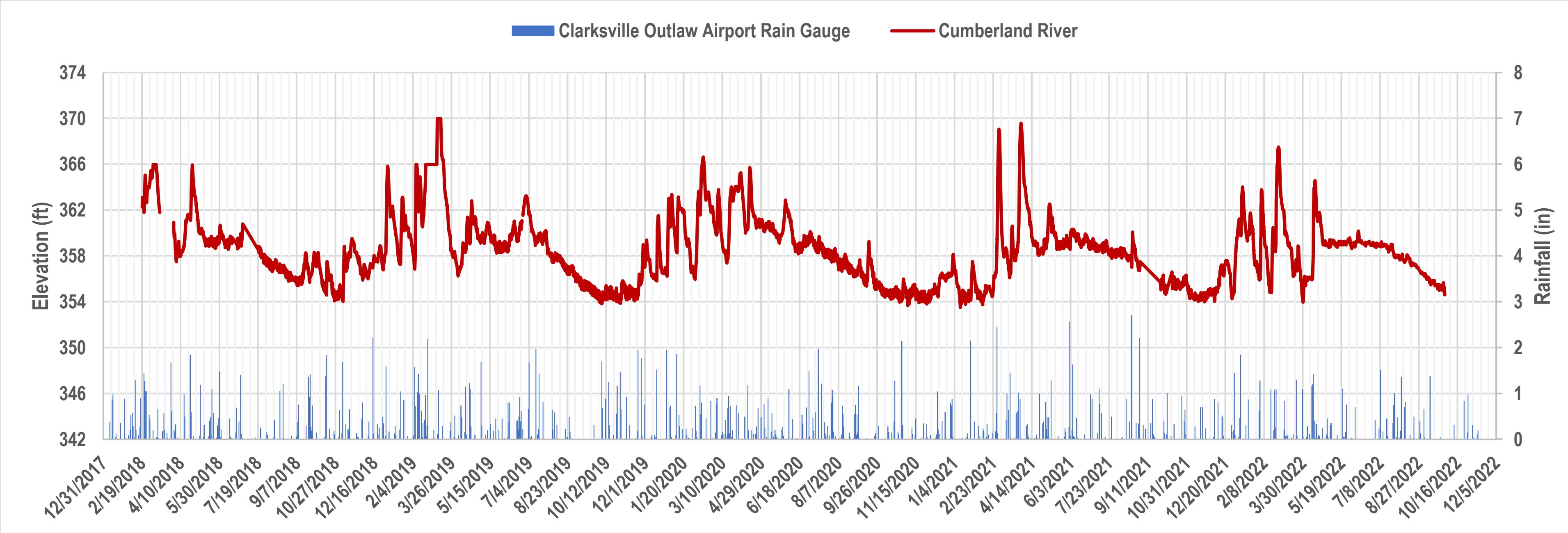


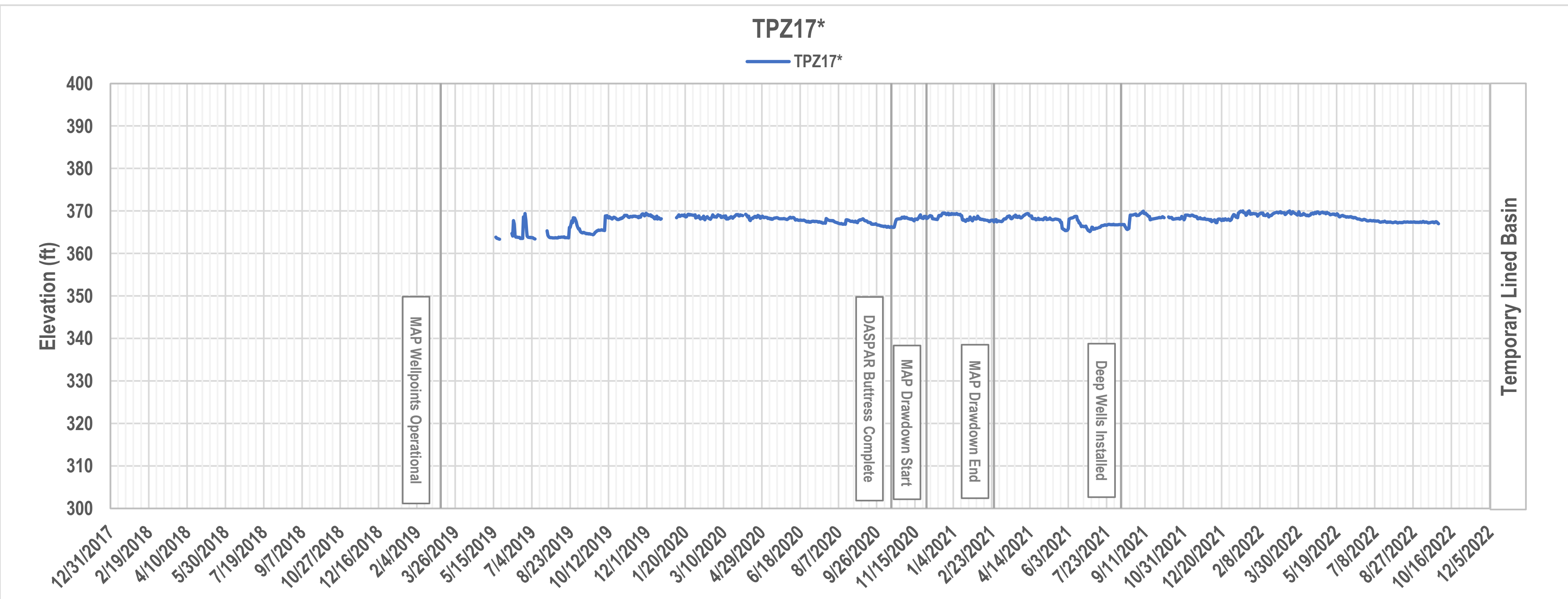
* Tip elevation is not available for this instrument.



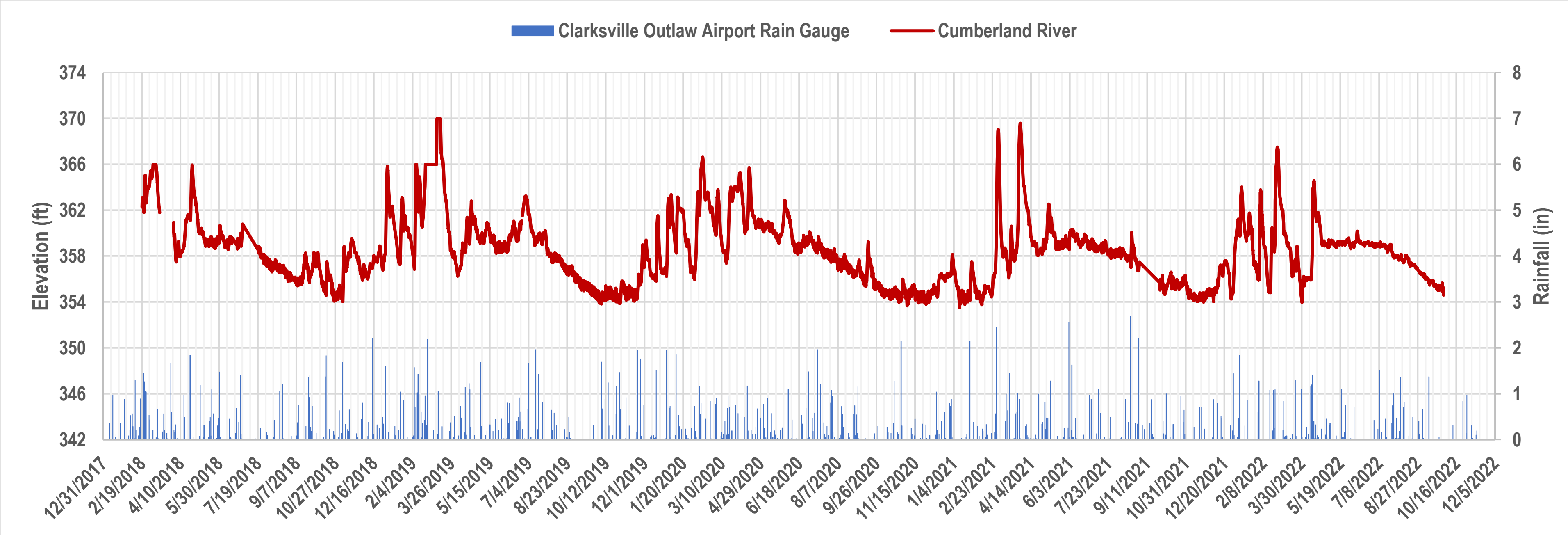


* Tip elevation is not available for this instrument.

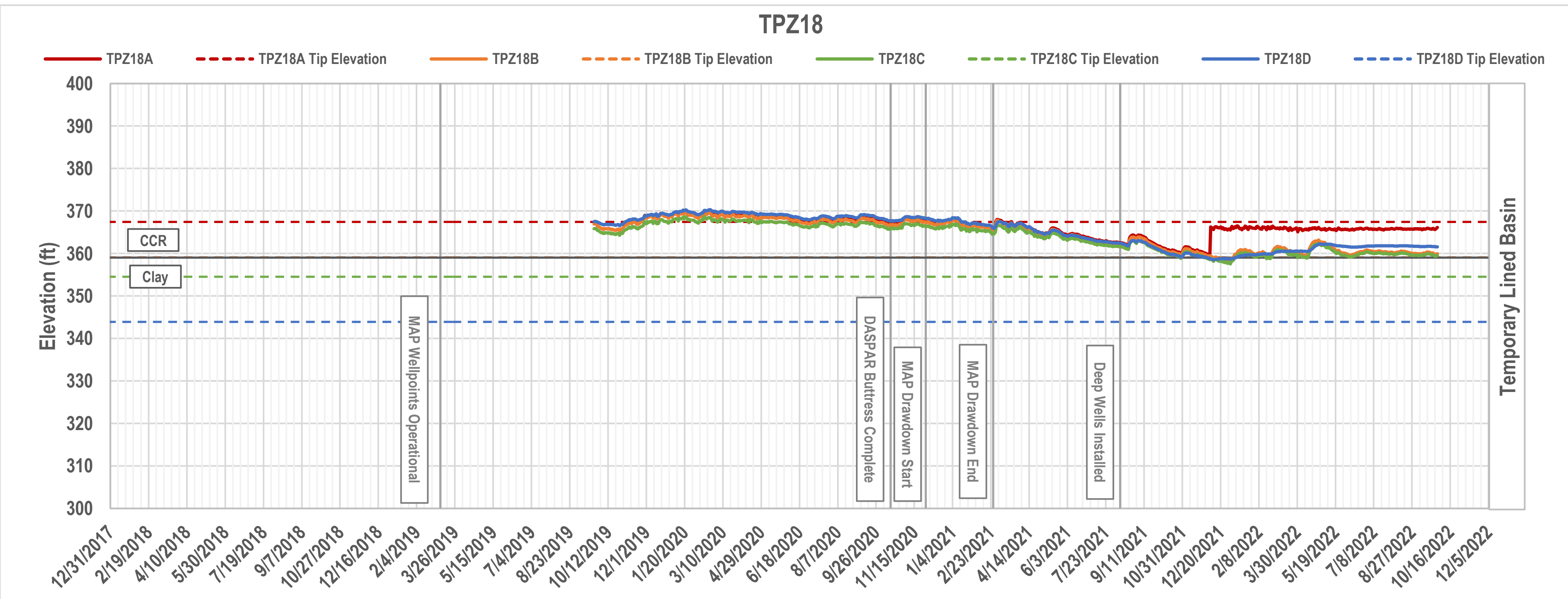




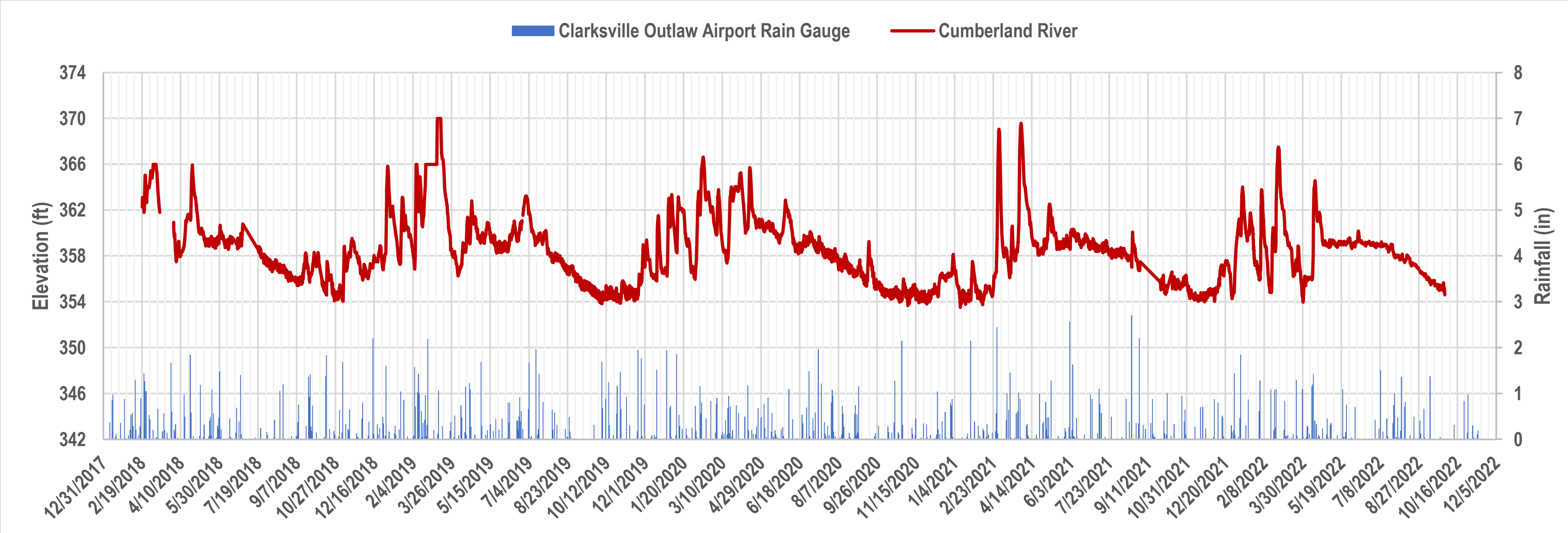
* Tip elevation is not available for this instrument.

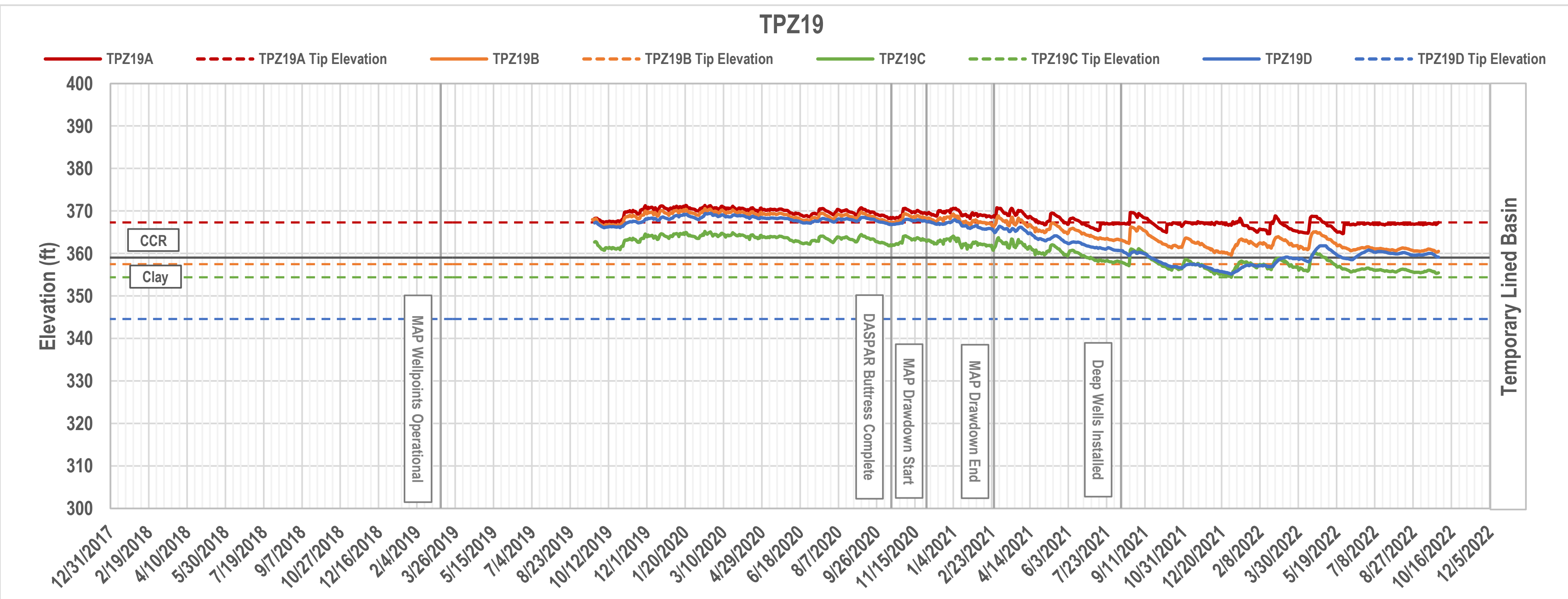


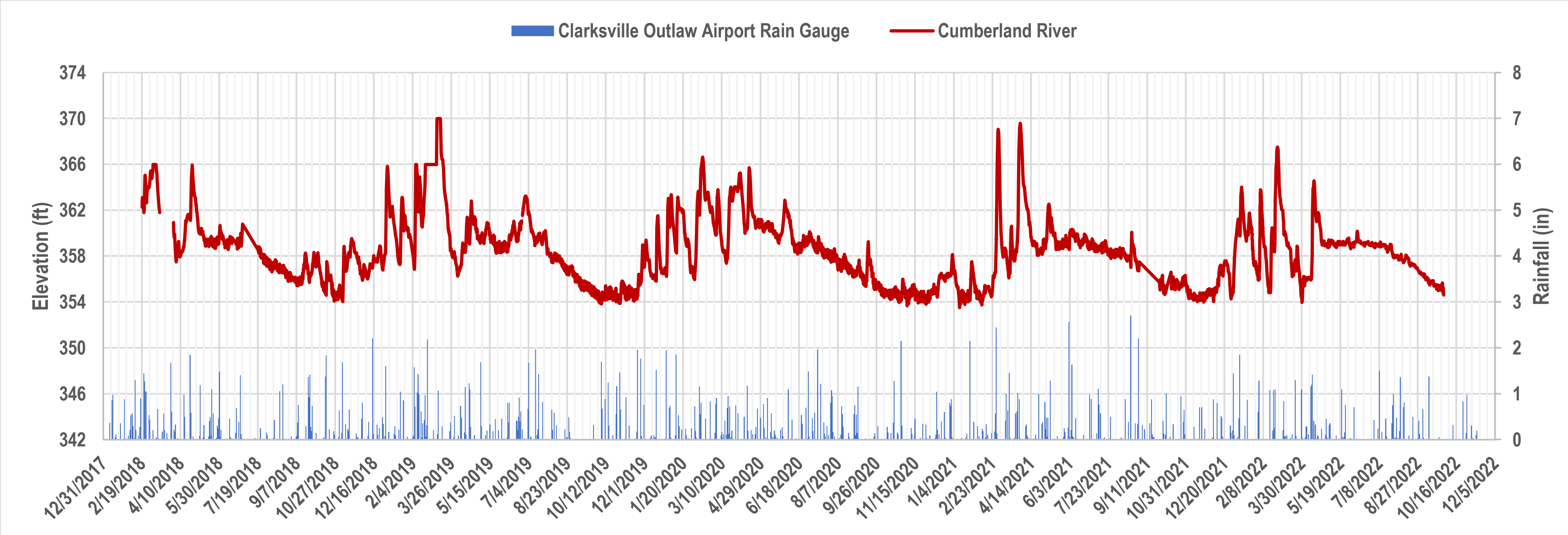
Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022

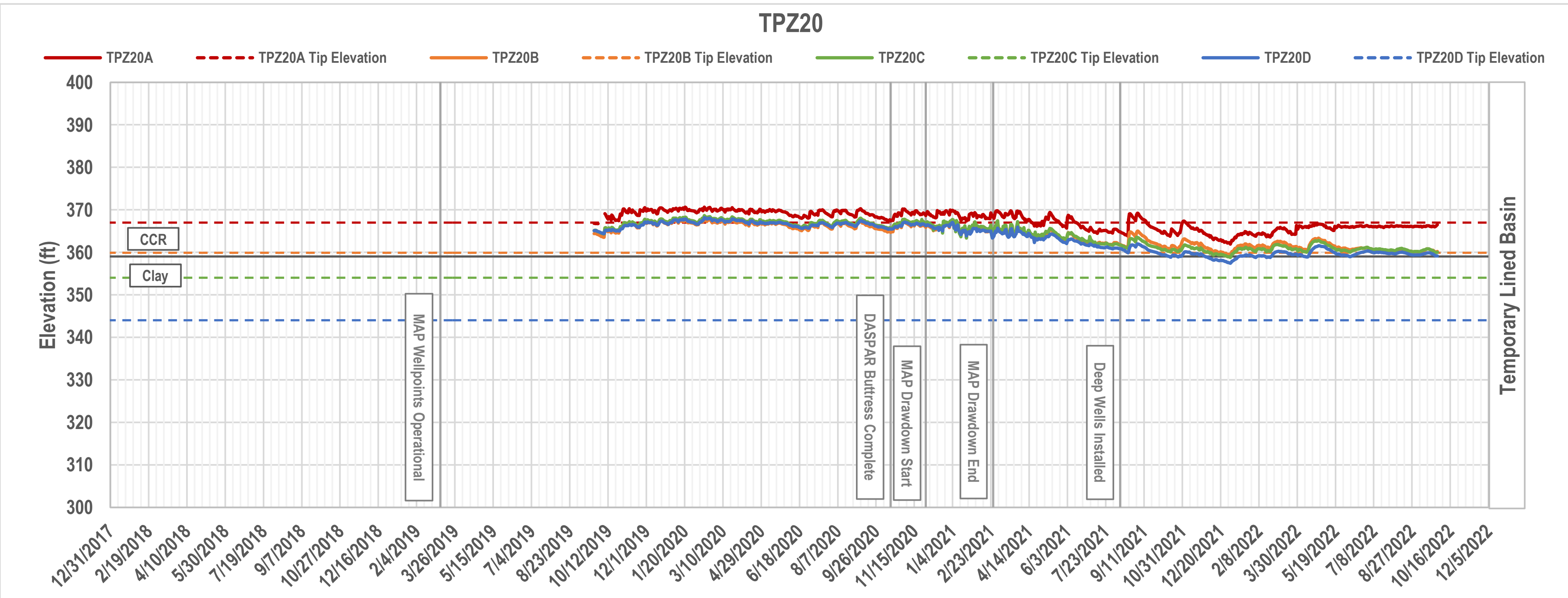


TPZ18
TPZ18A
TPZ18A Tip Elevation
TPZ18B
TPZ18B Tip Elevation
TPZ18C
TPZ18C Tip Elevation
TPZ18D
TPZ18D Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
CCR
Clay
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Temporary Lined Basin
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022


Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022


TPZ19
TPZ19A
TPZ19A Tip Elevation
TPZ19B
TPZ19B Tip Elevation
TPZ19C
TPZ19C Tip Elevation
TPZ19D
TPZ19D Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
CCR
Clay
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Temporary Lined Basin
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022


Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022


TPZ20
TPZ20A
TPZ20A Tip Elevation
TPZ20B
TPZ20B Tip Elevation
TPZ20C
TPZ20C Tip Elevation
TPZ20D
TPZ20D Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
CCR
Clay
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Temporary Lined Basin
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
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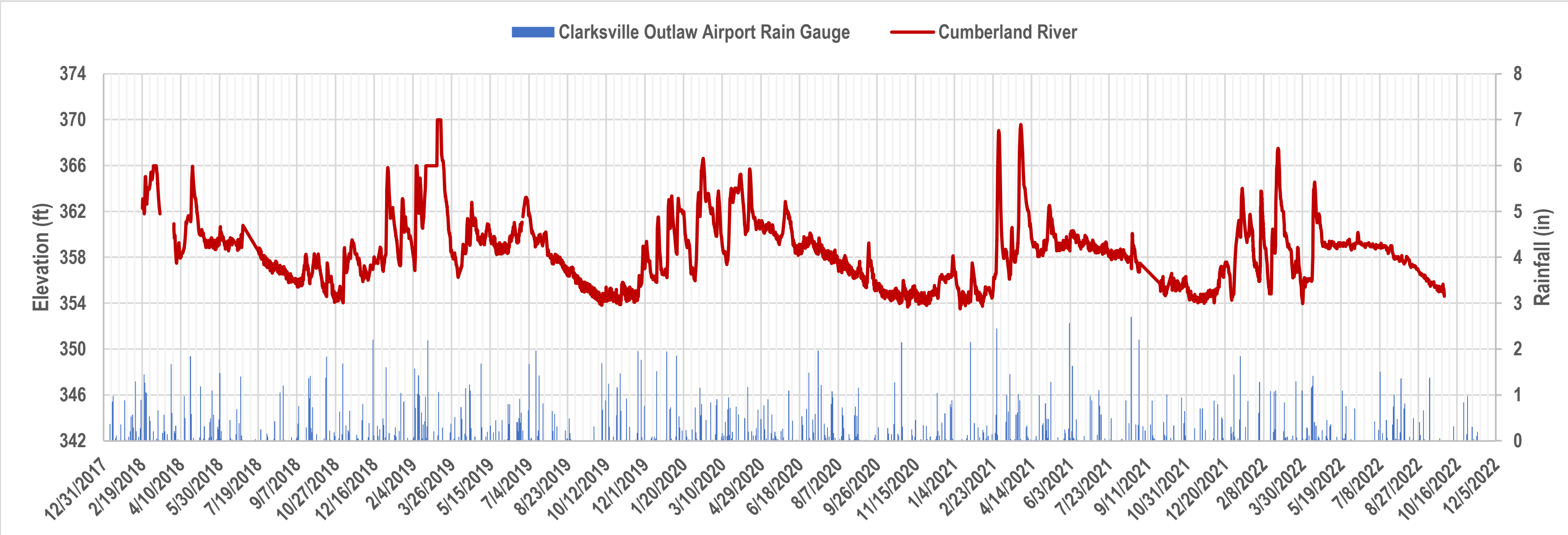
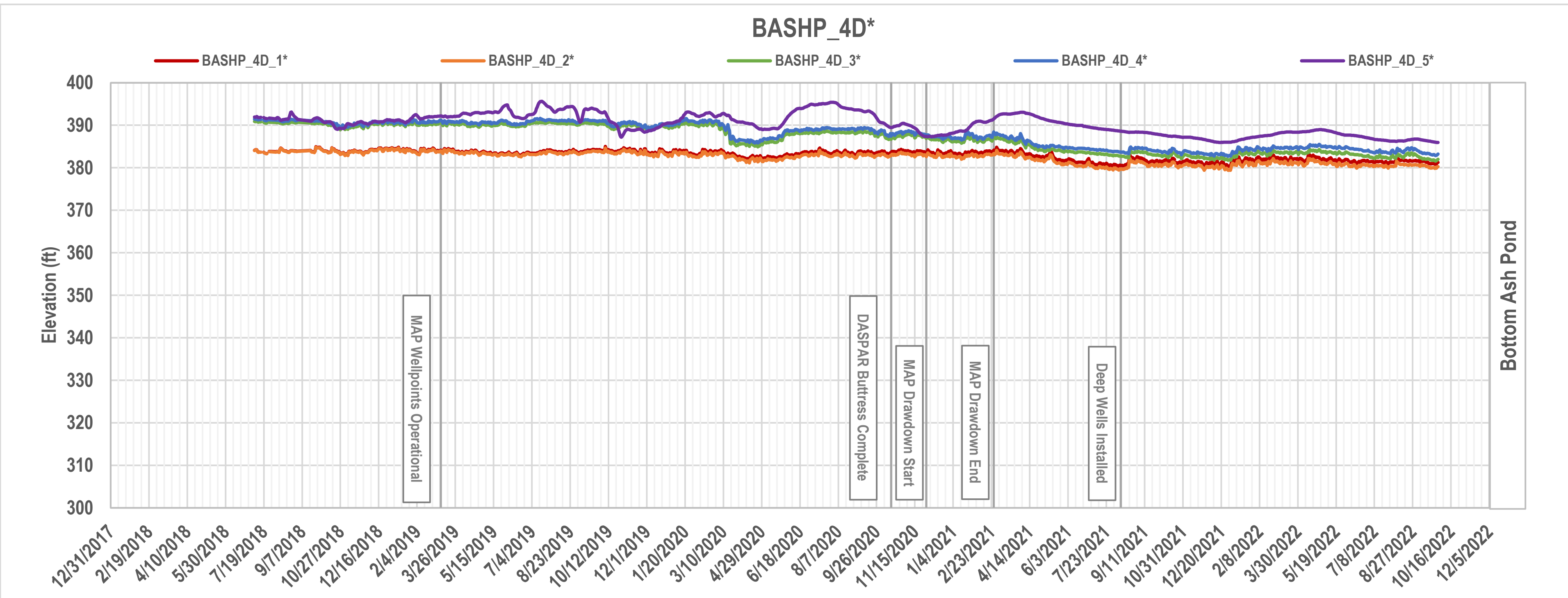
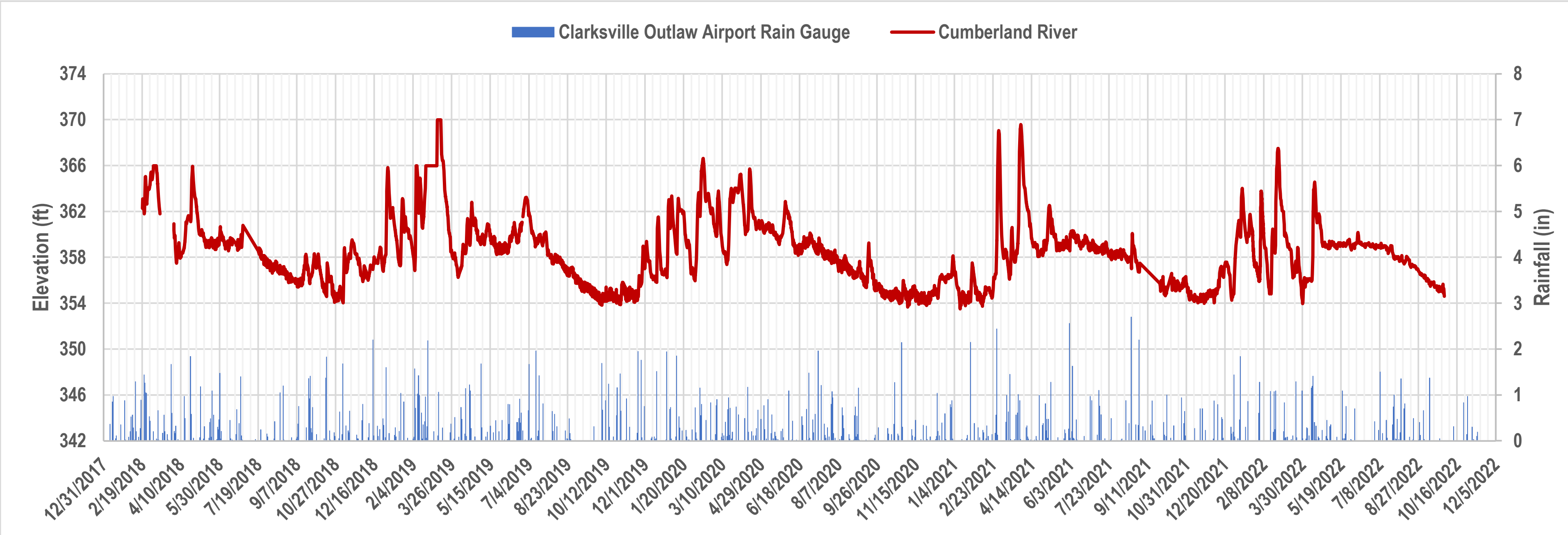
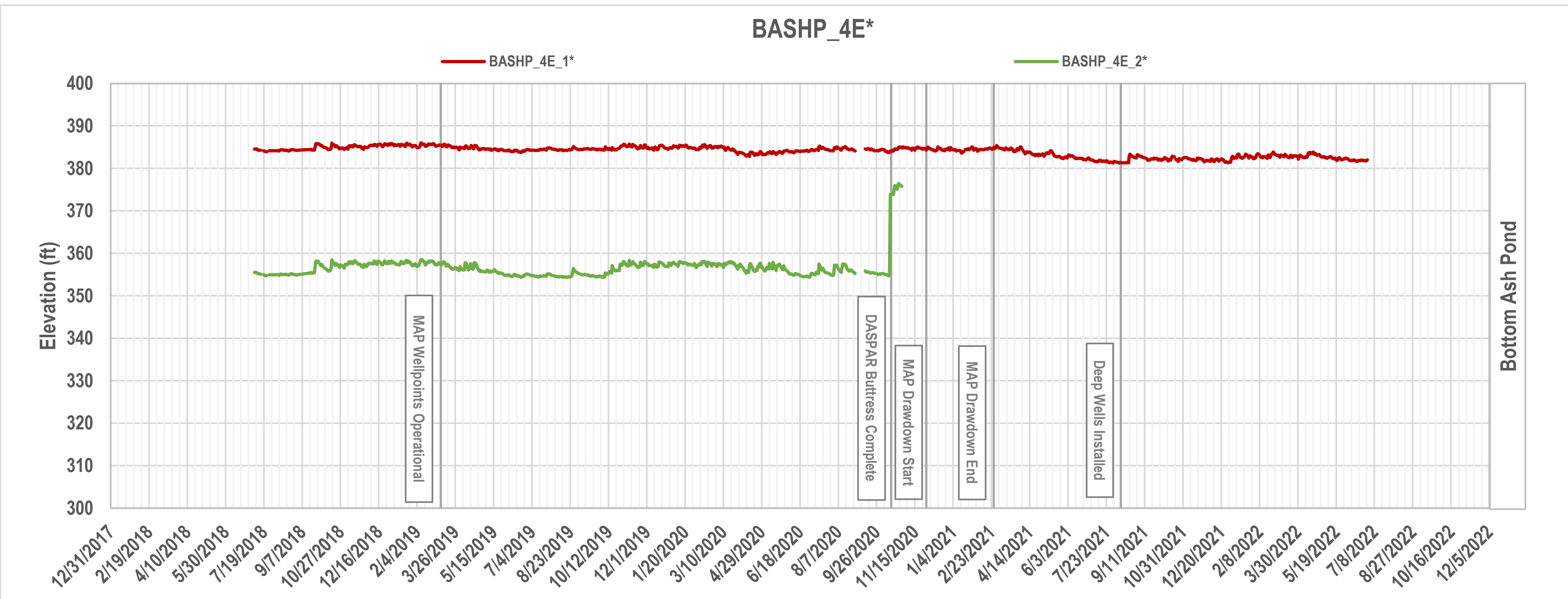
7/8/2022
8/27/2022
10/16/2022
12/5/2022



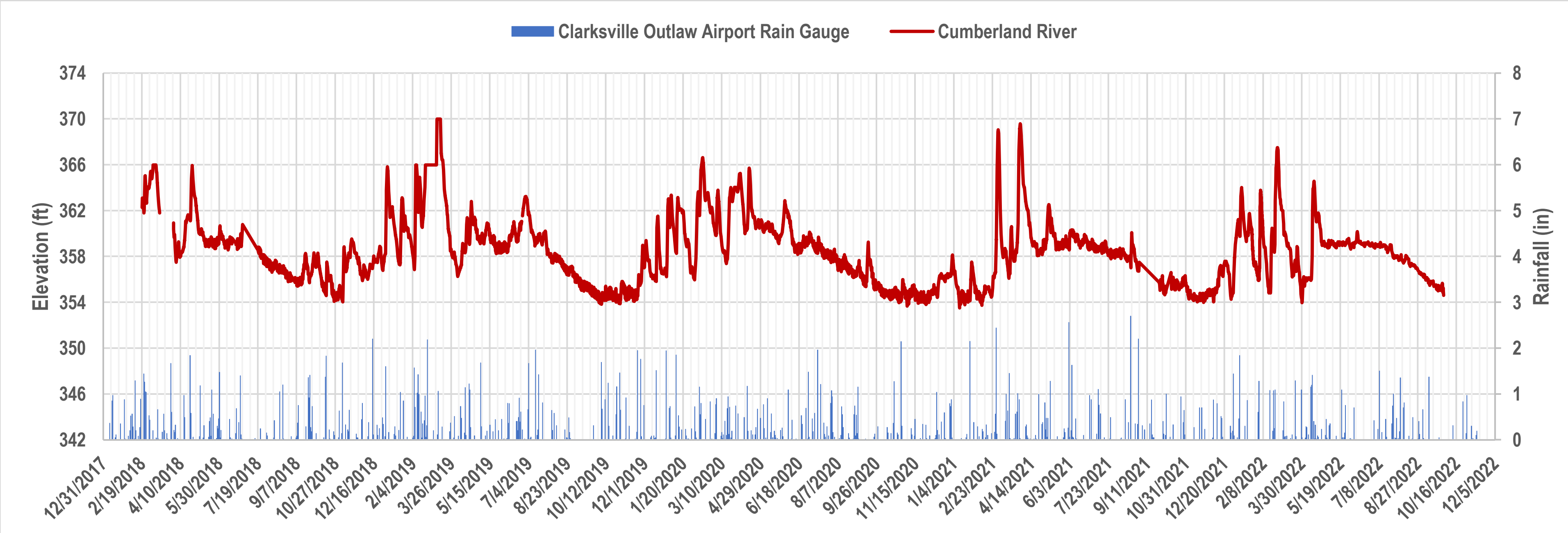


* Tip elevation is not available for this instrument.





* Tip elevation is not available for this instrument


Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
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358
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346
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12/31/2017
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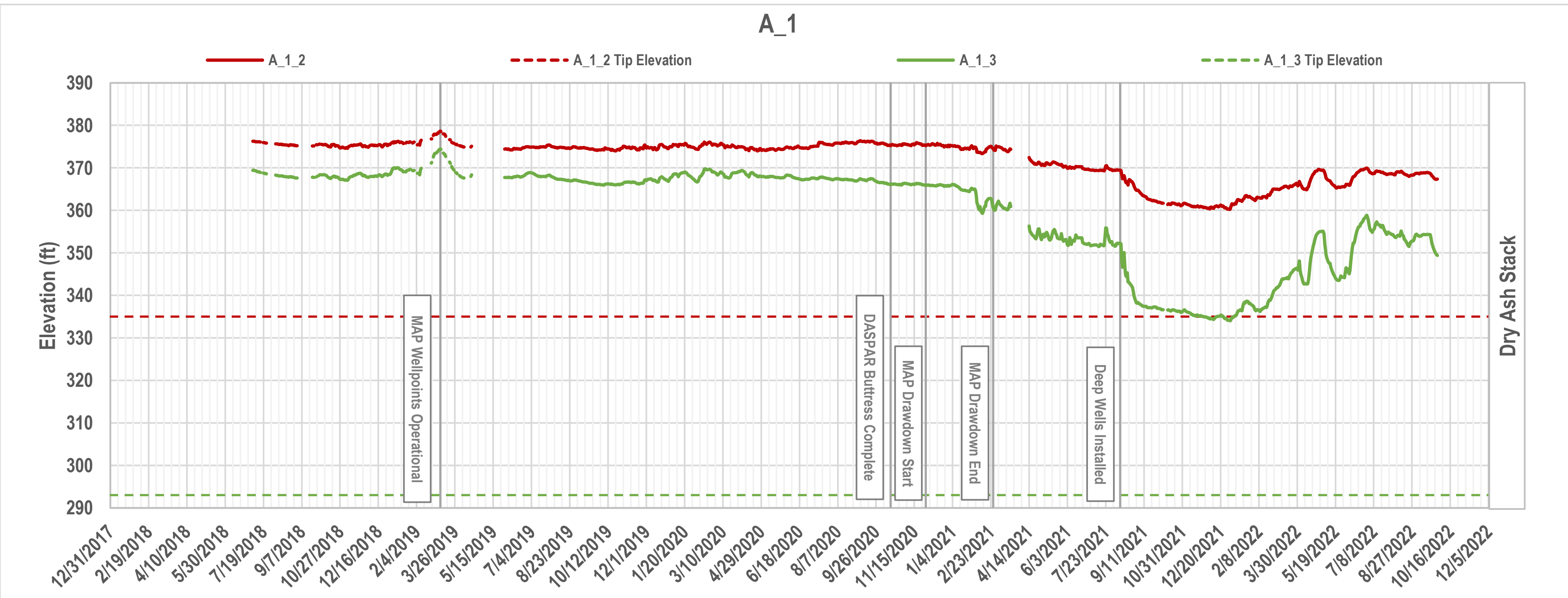
12/5/2022


A_1
A_1_2
A_1_2 Tip Elevation
A_1_3
A_1_3 Tip Elevation
Elevation (ft)
390
380
370
360
350
340
330
320
310
300
290
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
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5/15/2019
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8/23/2019
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12/1/2019
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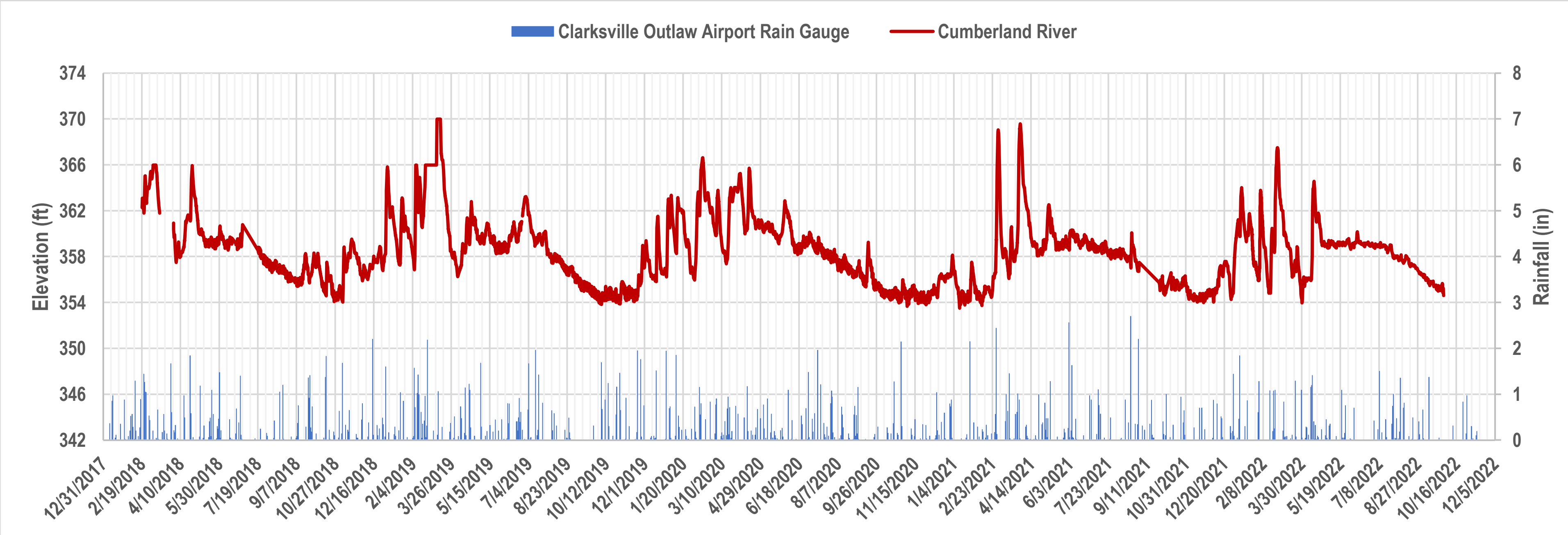
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
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4/14/2021
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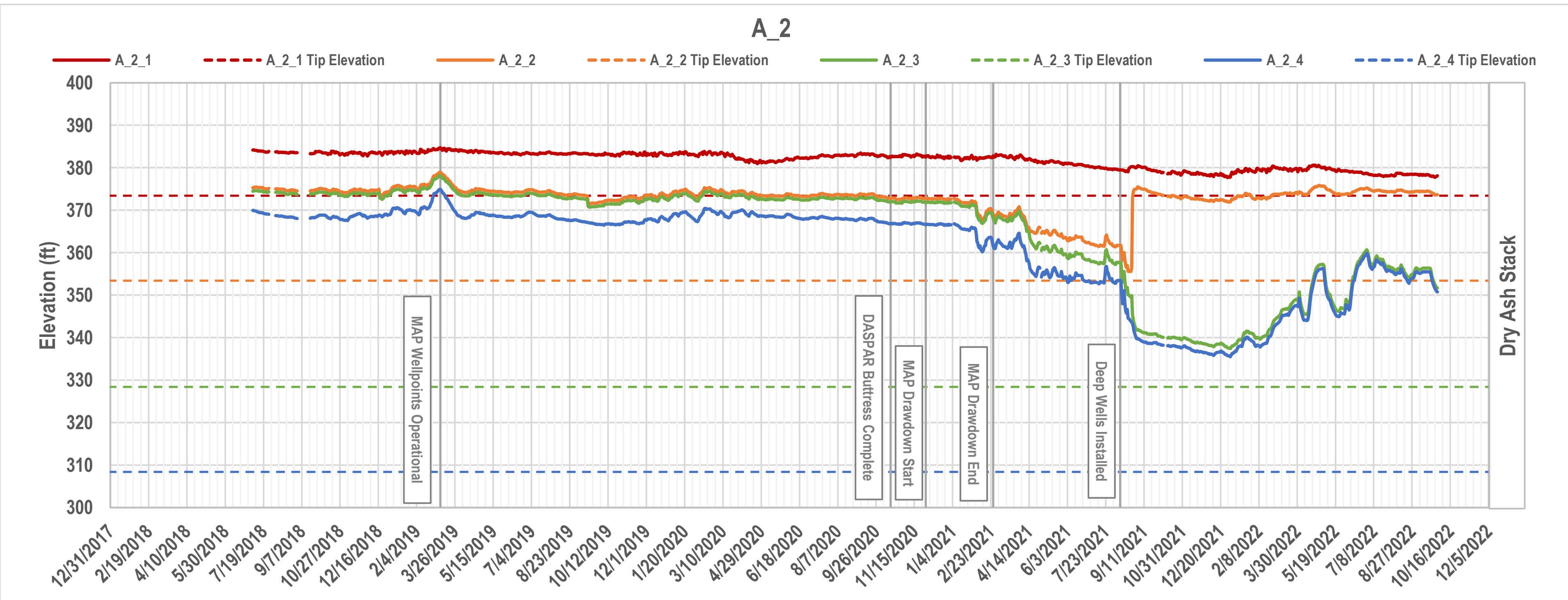
10/16/2022
12/5/2022



A_2
A_2_1
A_2_1 Tip Elevation
A_2_2
A_2_2 Tip Elevation
A_2_3
A_2_3 Tip Elevation
A_2_4
A_2_4 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
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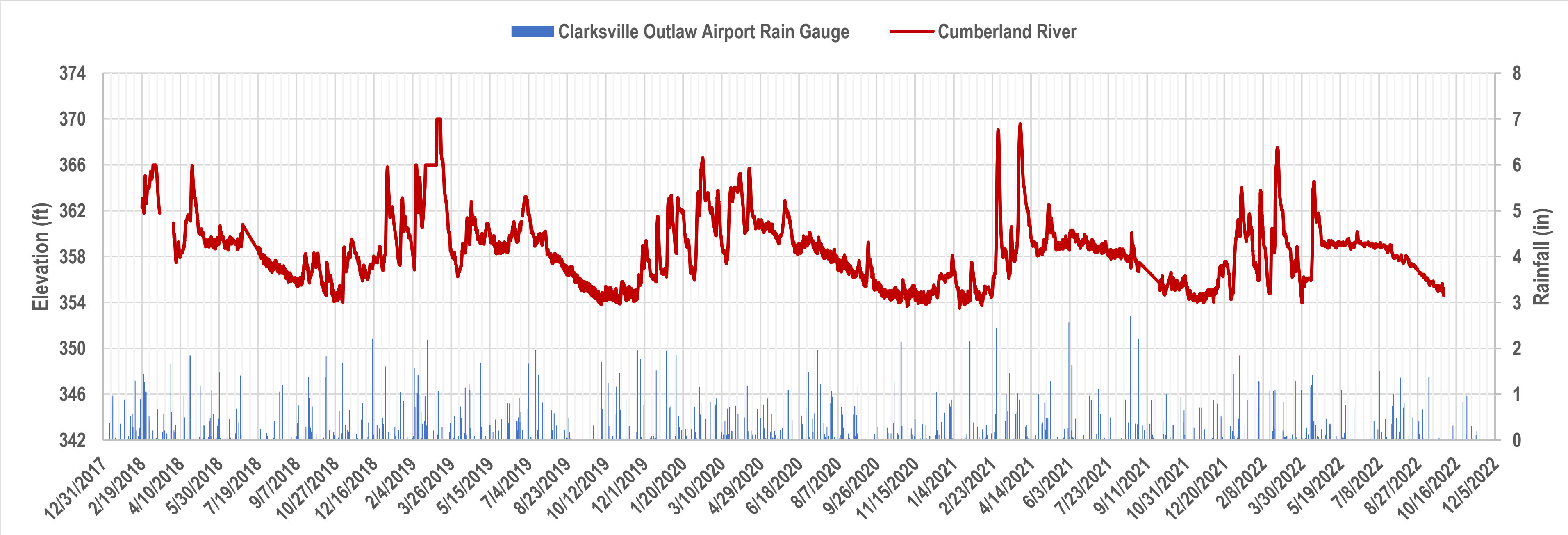
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
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12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
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12/1/2019
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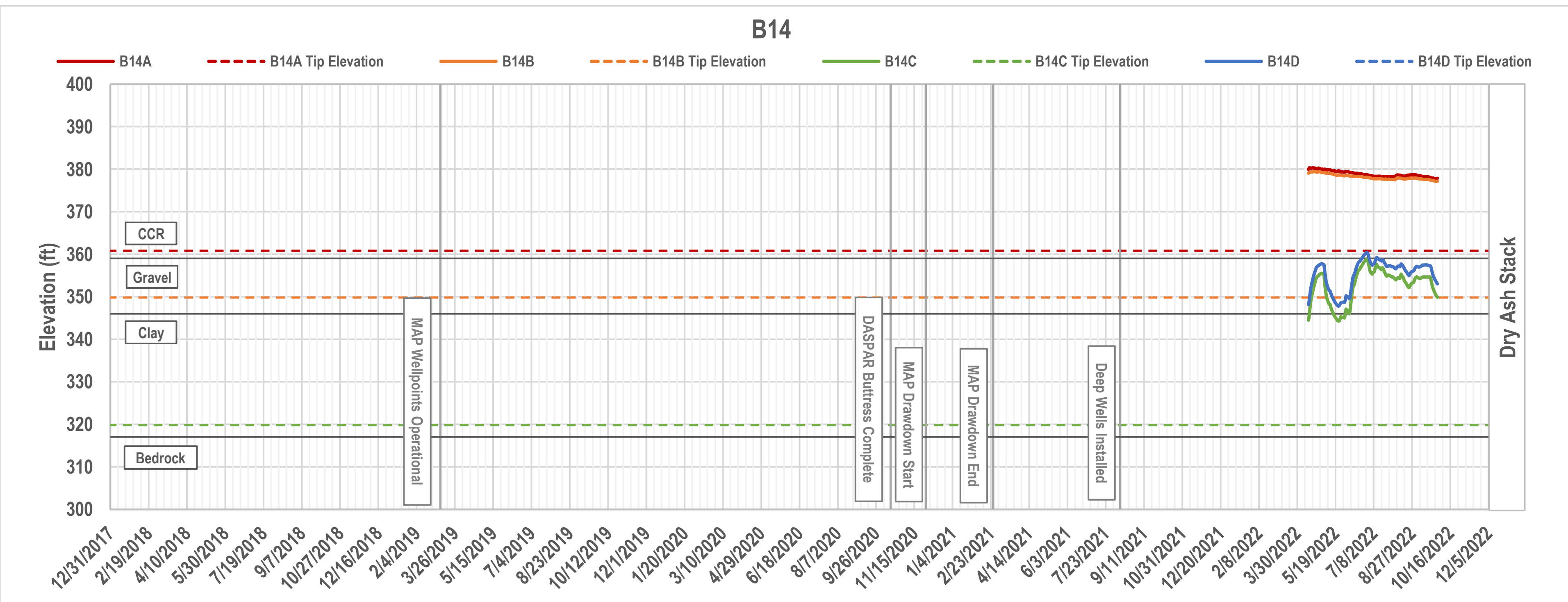
12/5/2022



B14
B14A
B14A Tip Elevation
B14B
B14B Tip Elevation
B14C
B14C Tip Elevation
B14D
B14D Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
CCR
Gravel
Clay
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
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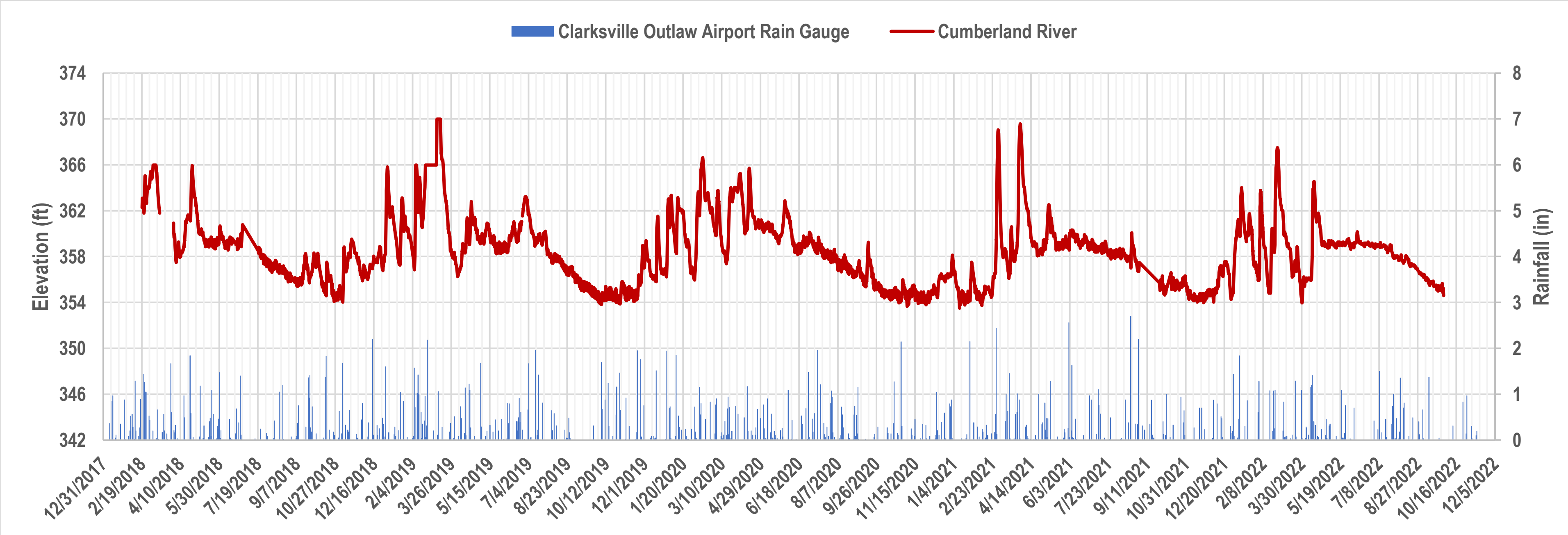
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
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12/31/2017
2/19/2018
4/10/2018
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3/26/2019
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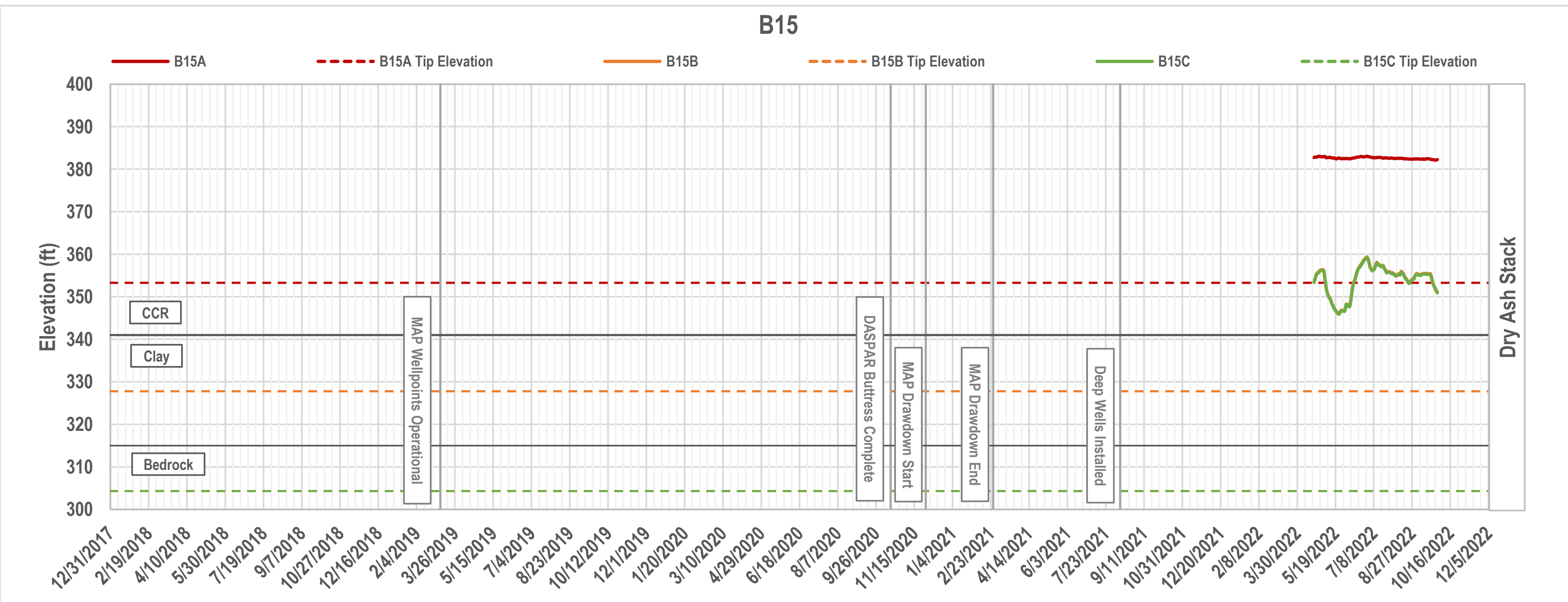
10/16/2022
12/5/2022



B15
B15A
B15A Tip Elevation
B15B
B15B Tip Elevation
B15C
B15C Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
CCR
Clay
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
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10/27/2018
12/16/2018
2/4/2019
3/26/2019
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8/23/2019
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12/1/2019
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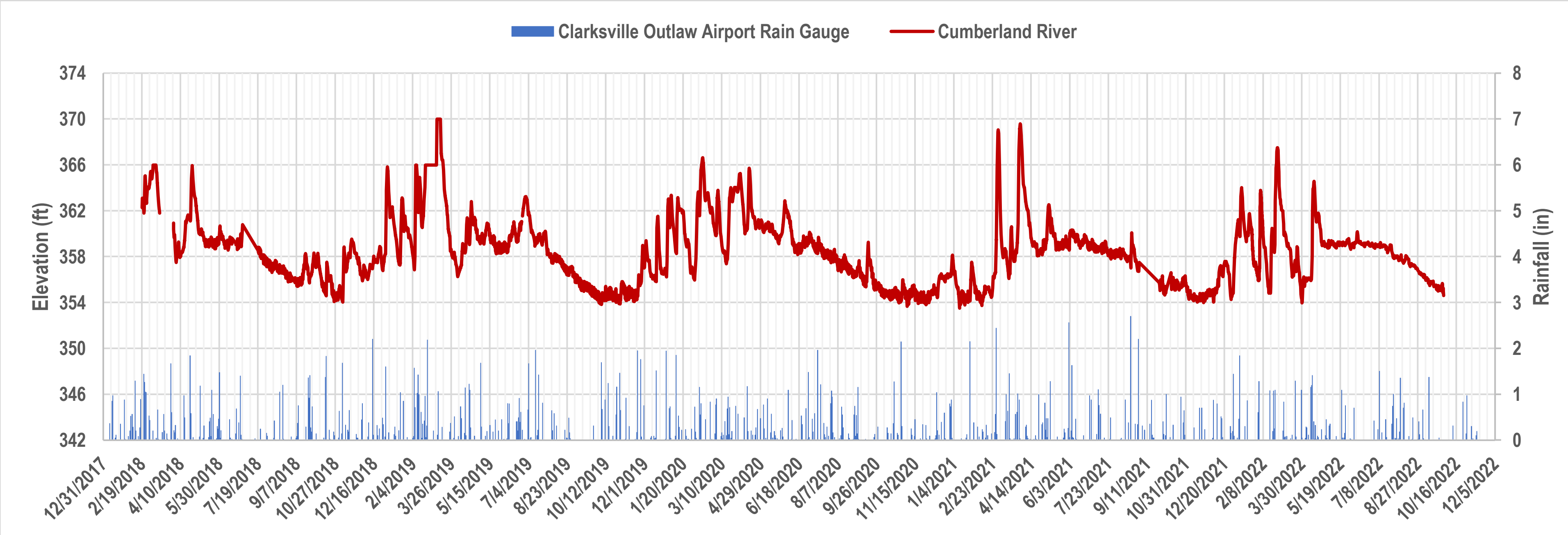
8/27/2022
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
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12/31/2017
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10/16/2022
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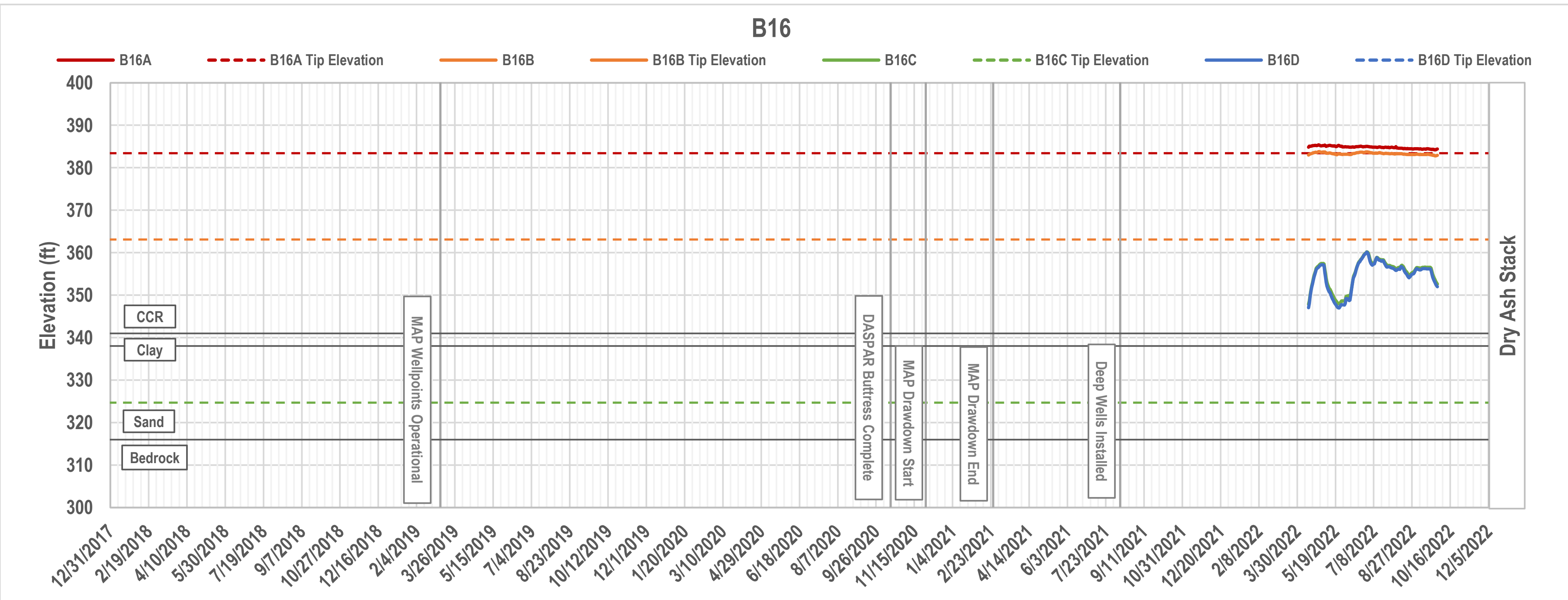

B16
B16A
B16A Tip Elevation
B16B
B16B Tip Elevation
B16C
B16C Tip Elevation
B16D
B16D Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
CCR
Clay
Sand
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
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10/27/2018
12/16/2018
2/4/2019
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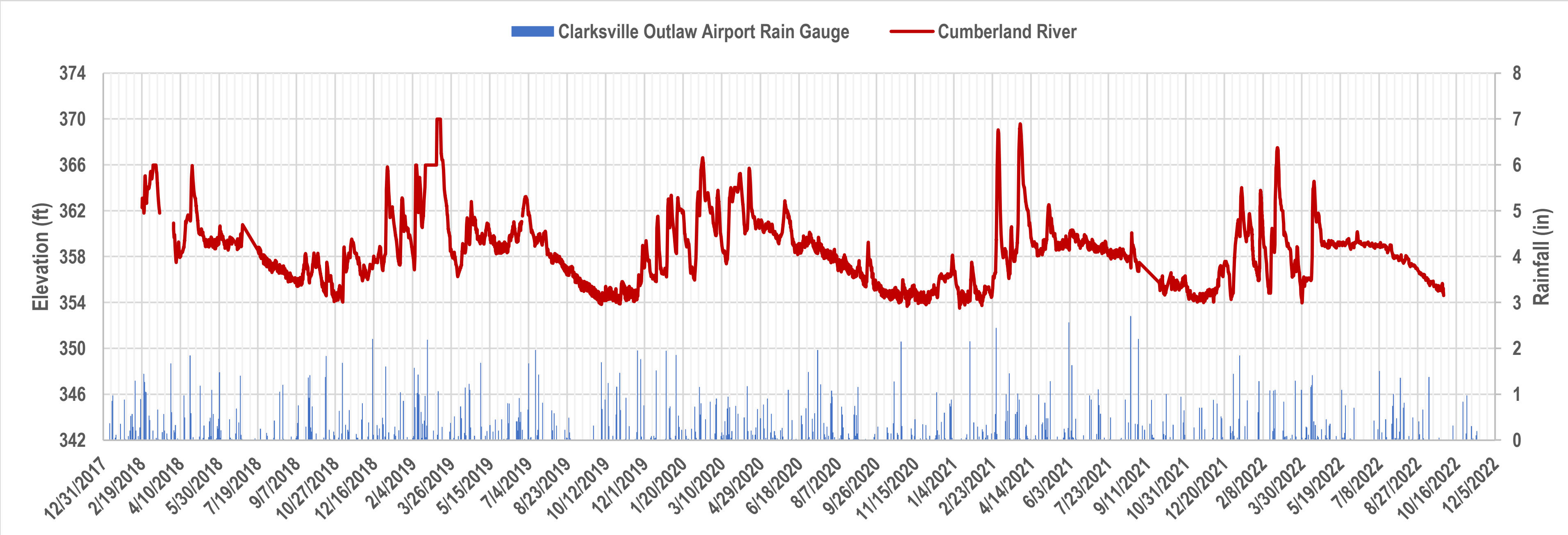
12/5/2022


Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
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12/31/2017
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3/26/2019
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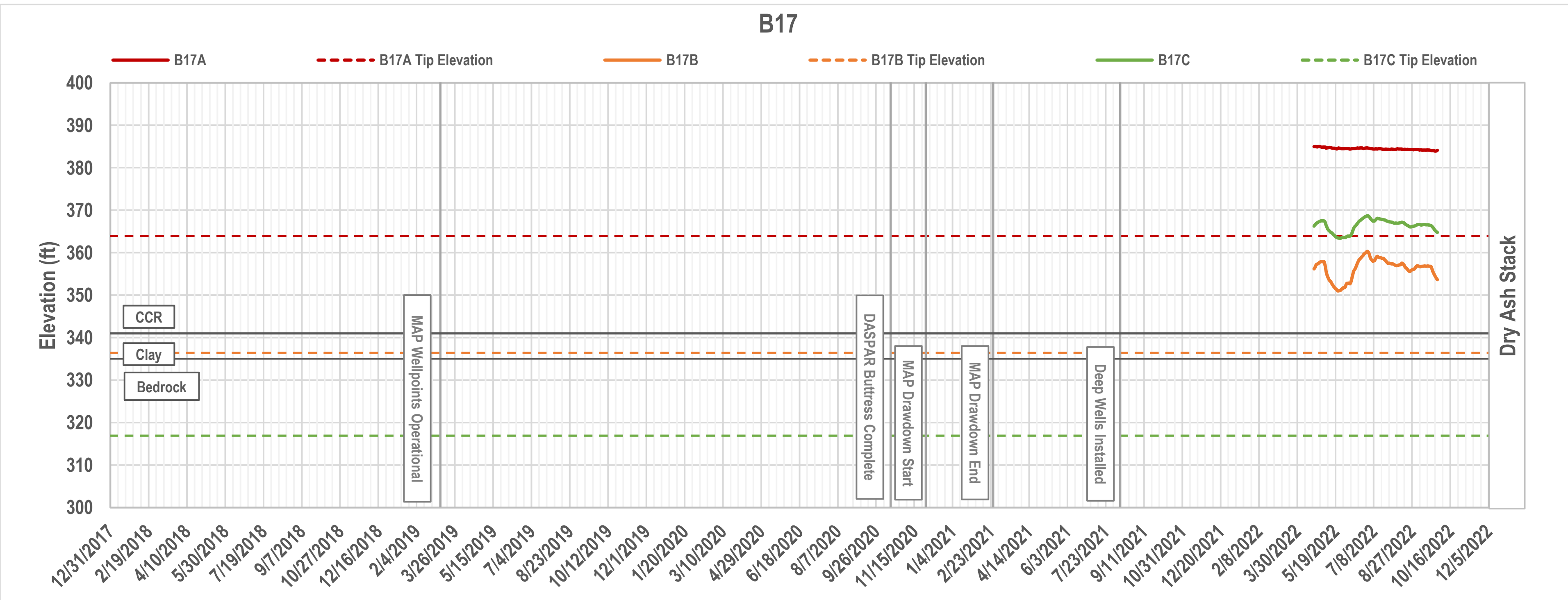
10/16/2022
12/5/2022


B17
B17A
B17A Tip Elevation
B17B
B17B Tip Elevation
B17C
B17C Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
CCR
Clay
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
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5/30/2018
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10/27/2018
12/16/2018
2/4/2019
3/26/2019
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12/1/2019
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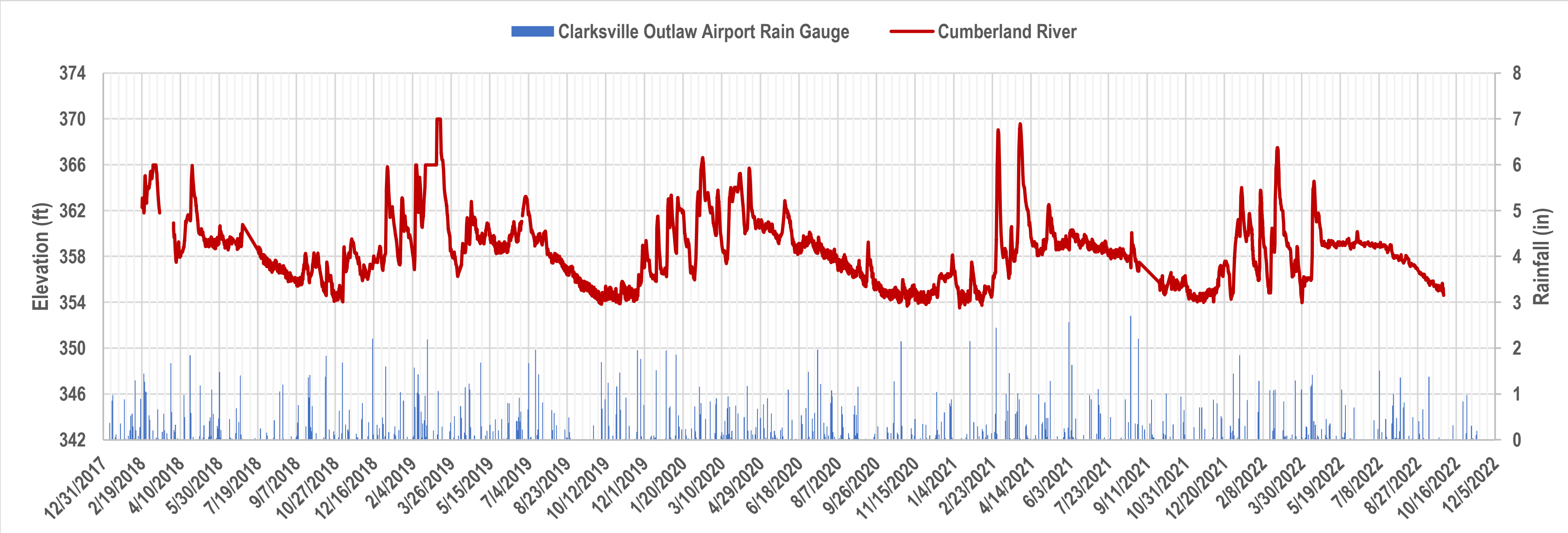
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
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12/31/2017
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4/10/2018
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7/19/2018
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3/26/2019
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12/1/2019
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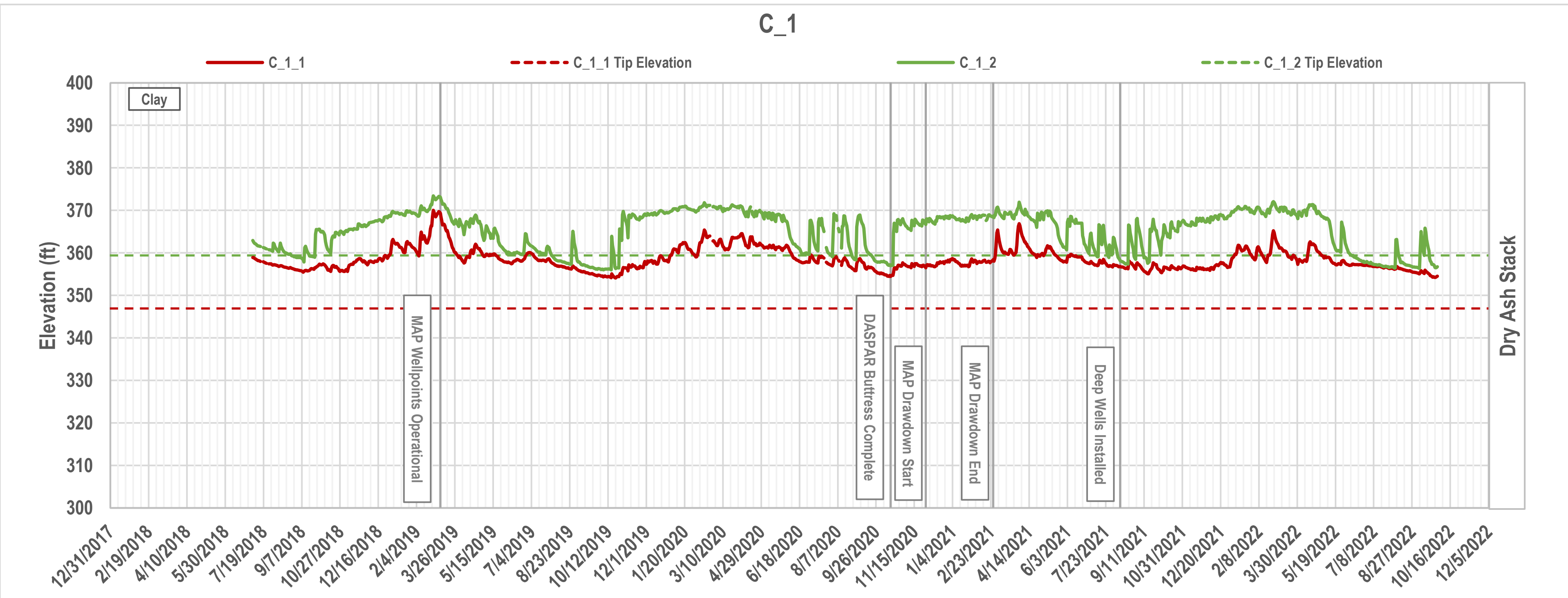
10/16/2022
12/5/2022



C_1
C_1_1
C_1_1 Tip Elevation
C_1_2
C_1_2 Tip Elevation
Clay
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
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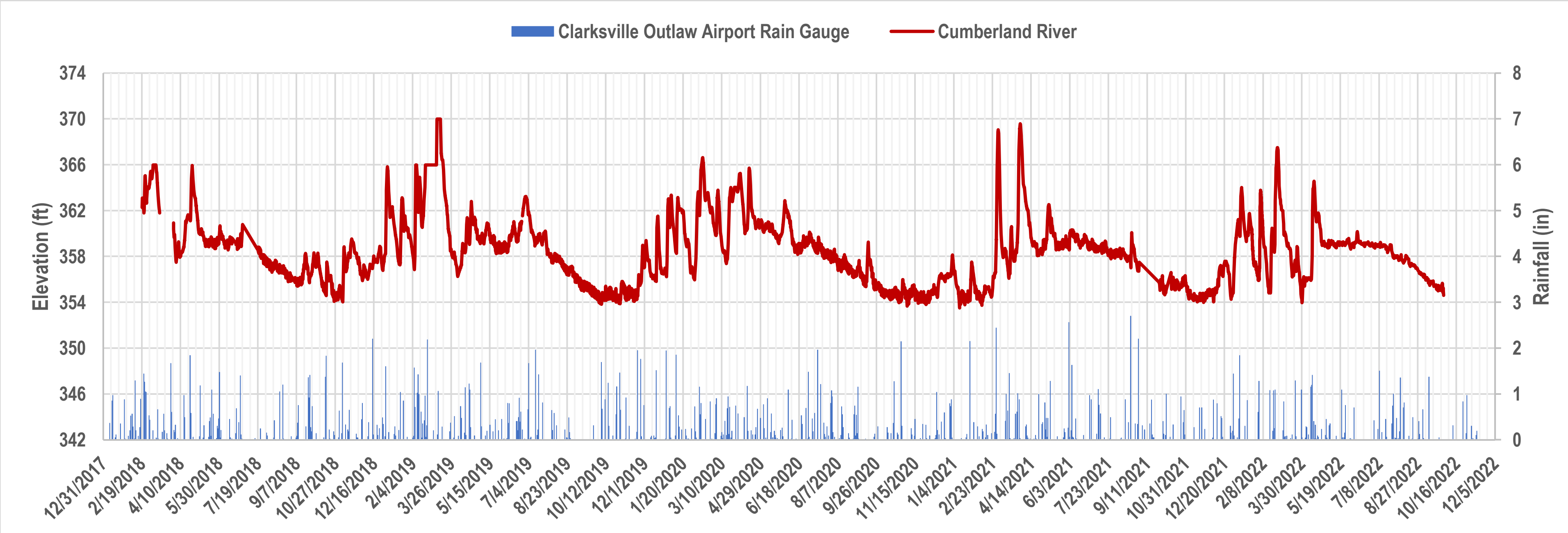

Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
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12/31/2017
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3/26/2019
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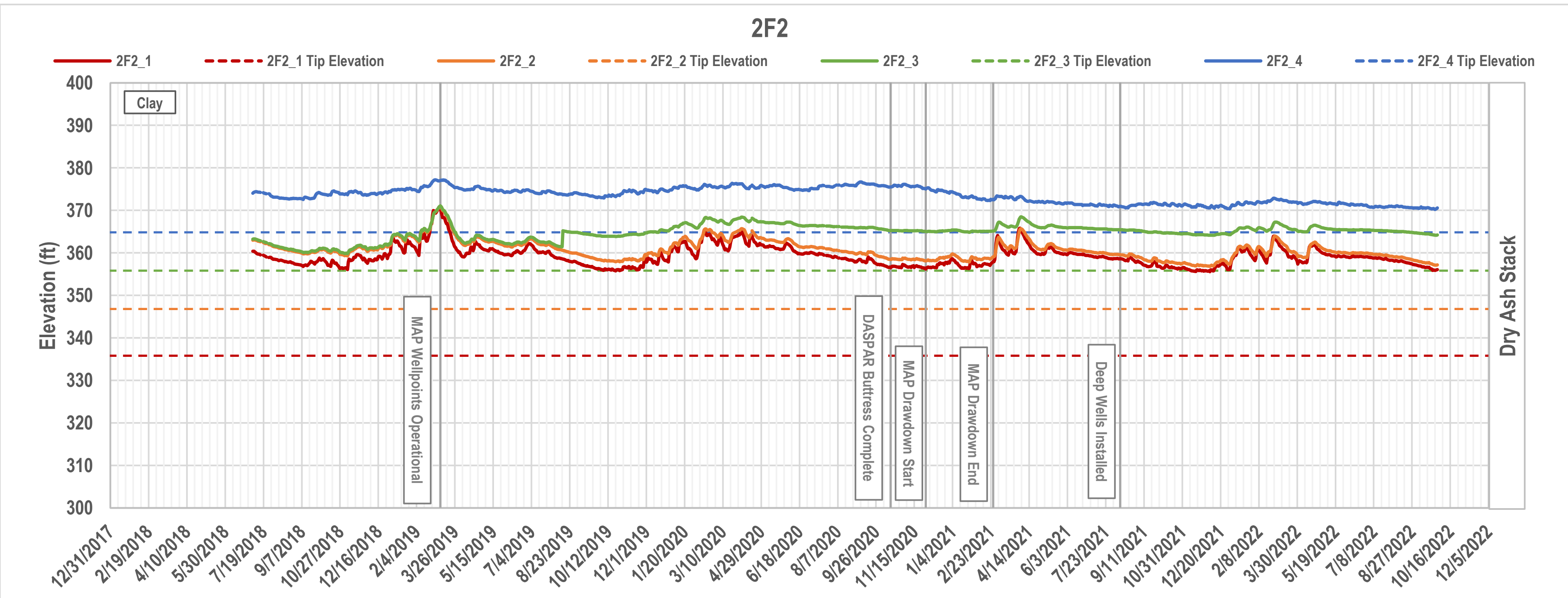
10/16/2022
12/5/2022



2F2
2F2_1
2F2_1 Tip Elevation
2F2_2
2F2_2 Tip Elevation
2F2_3
2F2_3 Tip Elevation
2F2_4
2F2_4 Tip Elevation
Clay
Elevation (ft)
Dry Ash Stack
400
390
380
370
360
350
340
330
320
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300
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
12/31/2017
2/19/2018
4/10/2018
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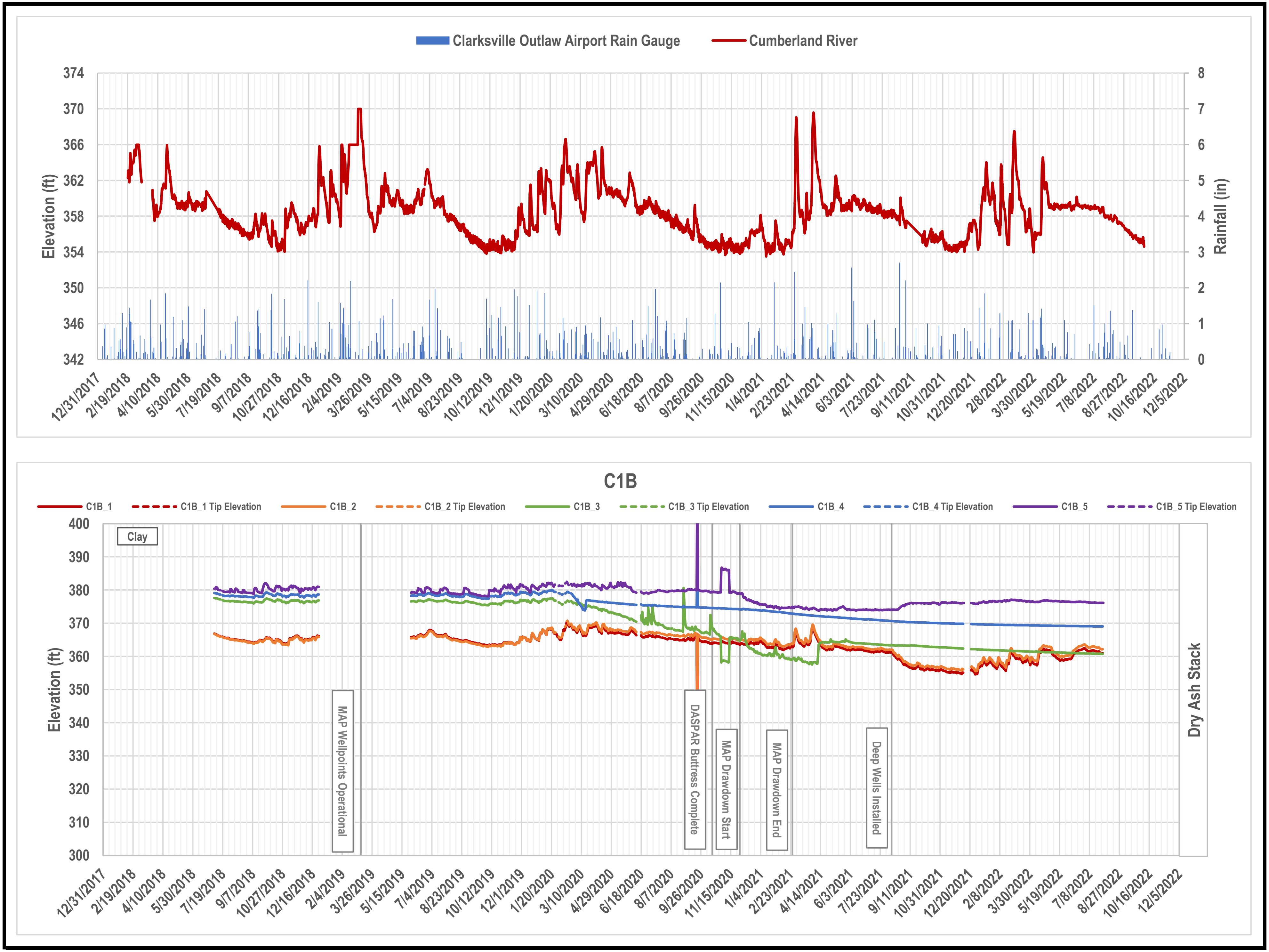

Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
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12/31/2017
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2/8/2022
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8/27/2022
10/16/2022
12/5/2022
C1B
C1B_1
C1B_1 Tip Elevation
C1B_2
C1B_2 Tip Elevation
C1B_3
C1B_3 Tip Elevation
C1B_4
C1B_4 Tip Elevation
C1B_5
C1B_5 Tip Elevation
Clay
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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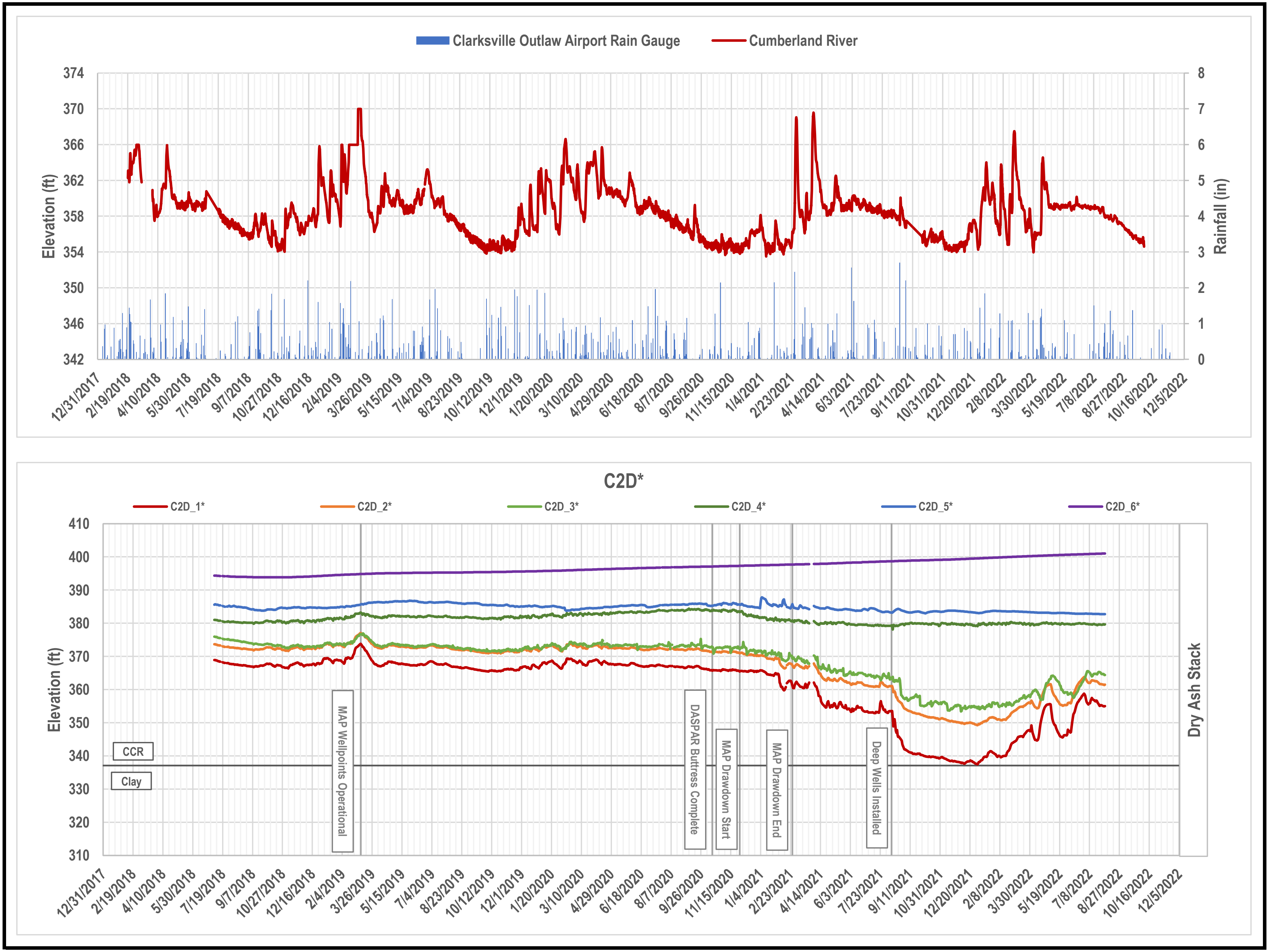
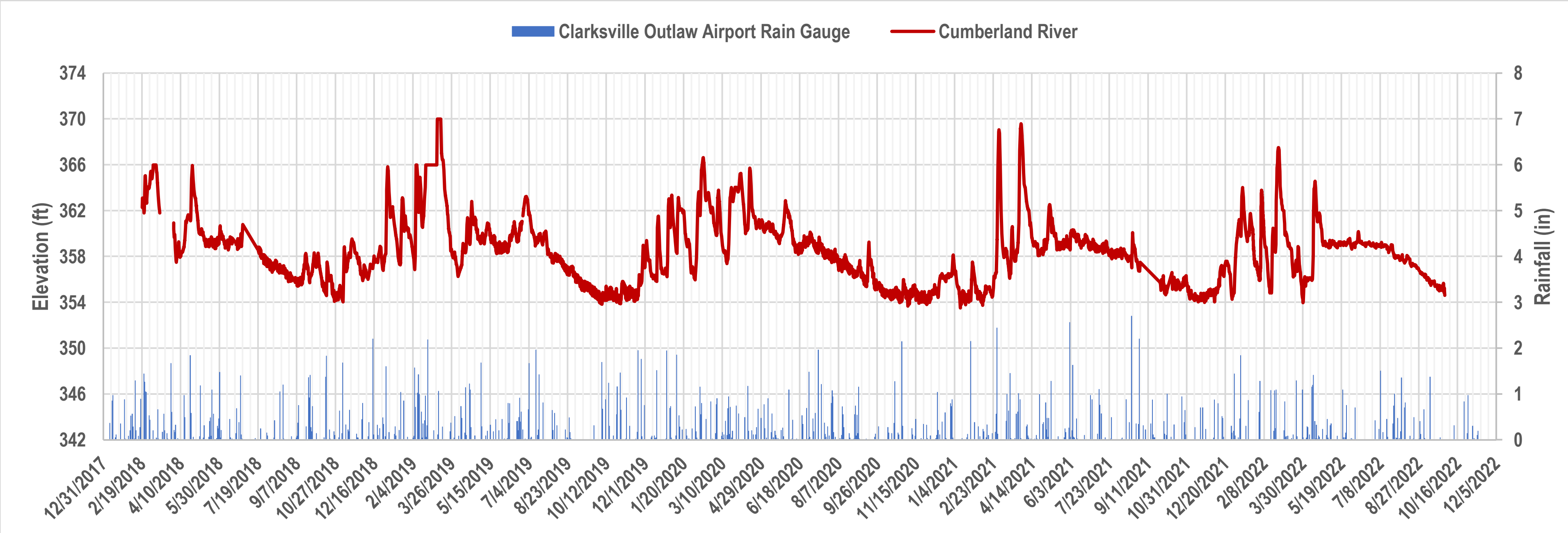
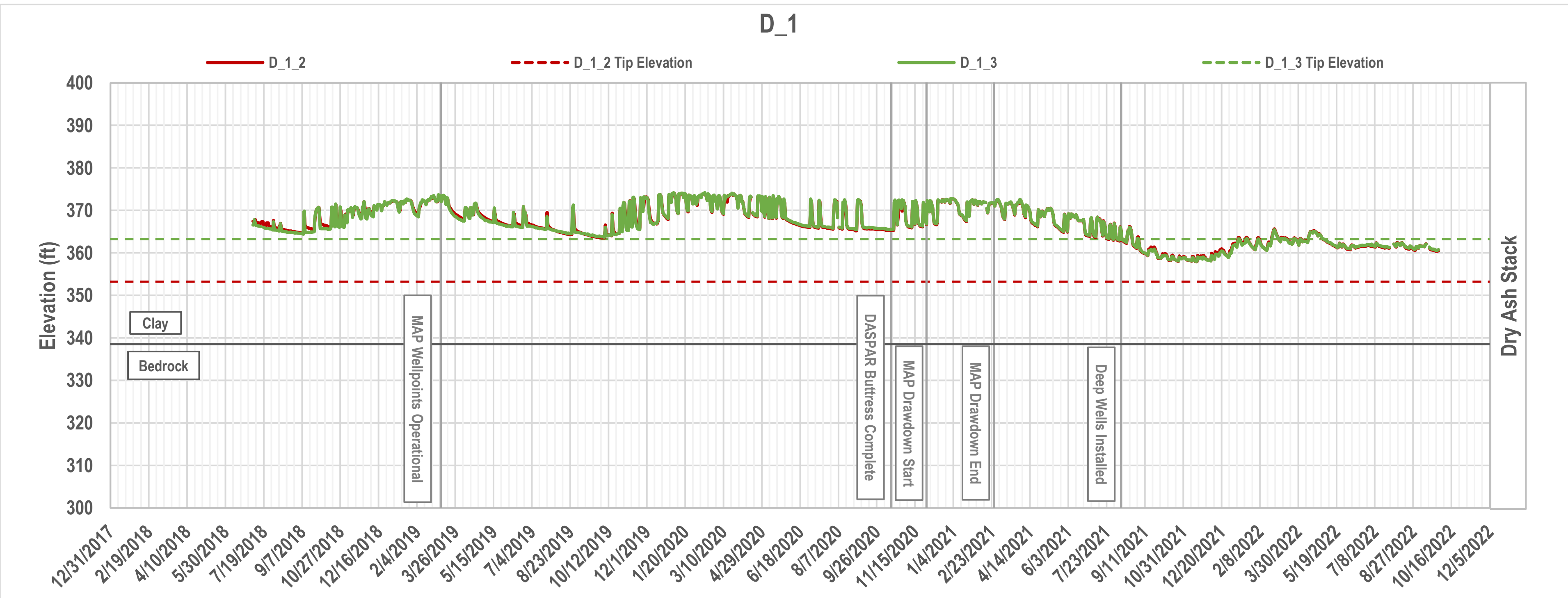
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022



* Tip elevation is not available for this instrument.



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022



D_1
D_1_2
D_1_2 Tip Elevation
D_1_3
D_1_3 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
Clay
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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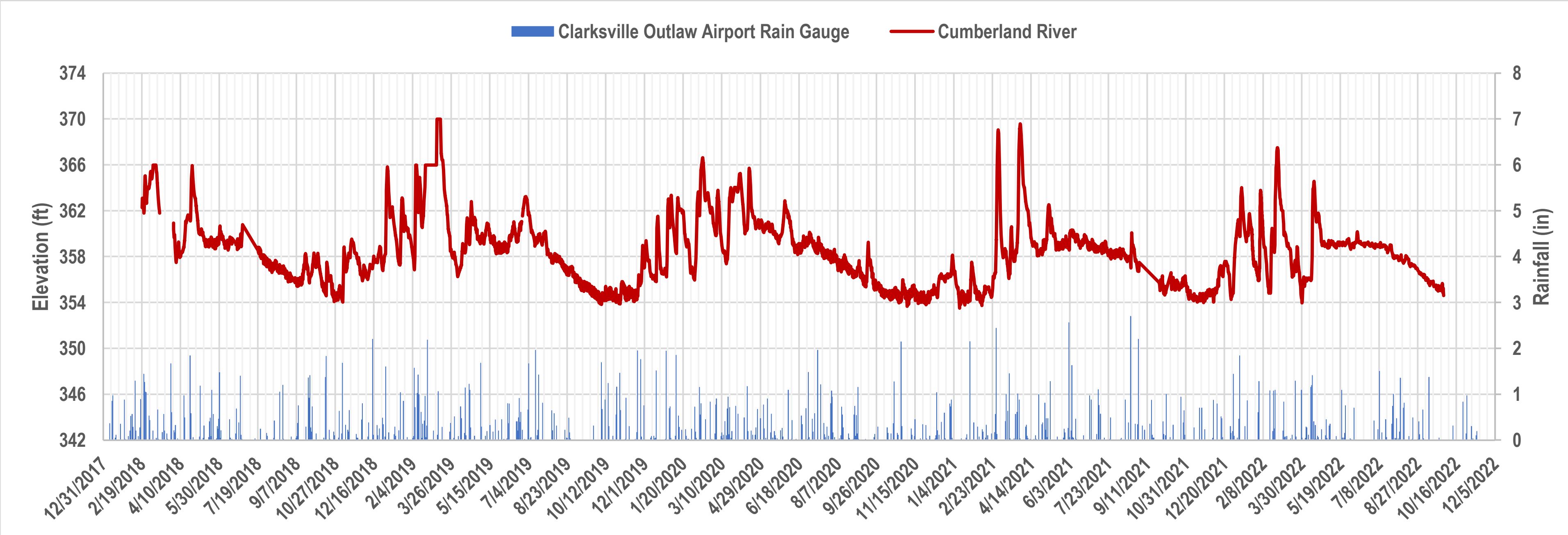
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022


Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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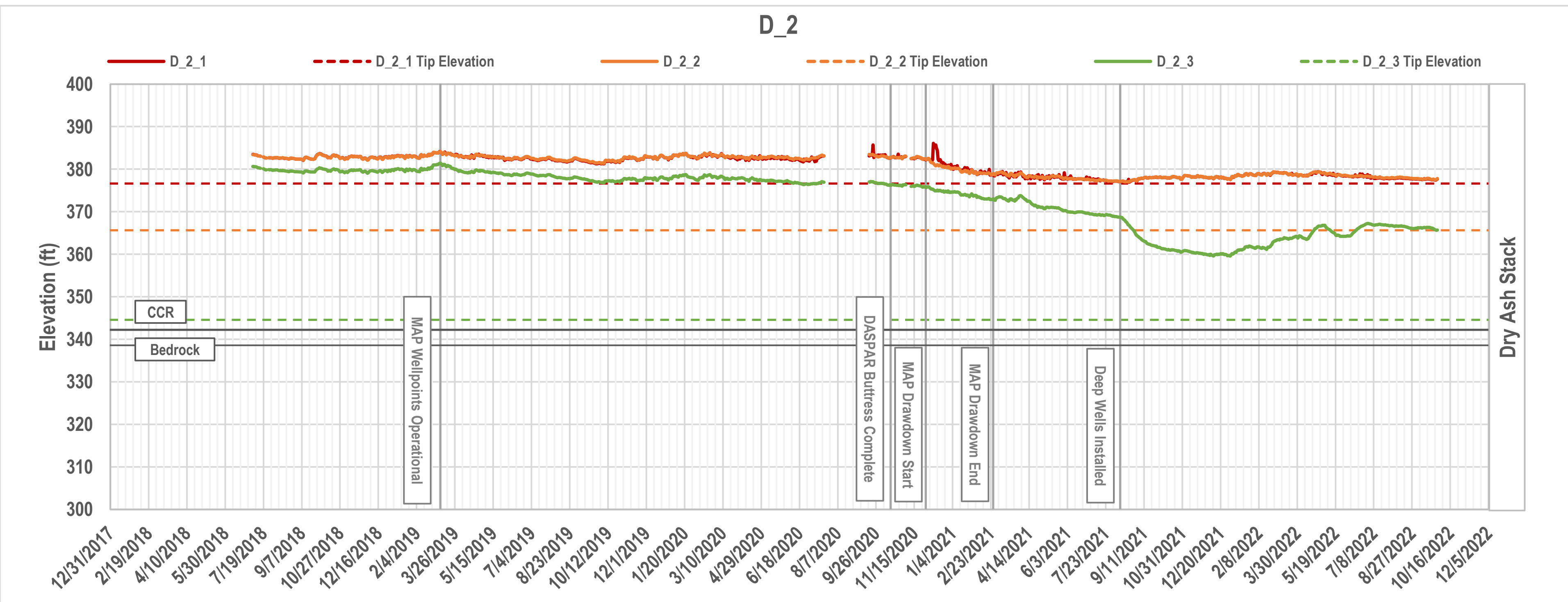
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022


D_2
D_2_1
D_2_1 Tip Elevation
D_2_2
D_2_2 Tip Elevation
D_2_3
D_2_3 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
CCR
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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3/30/2022
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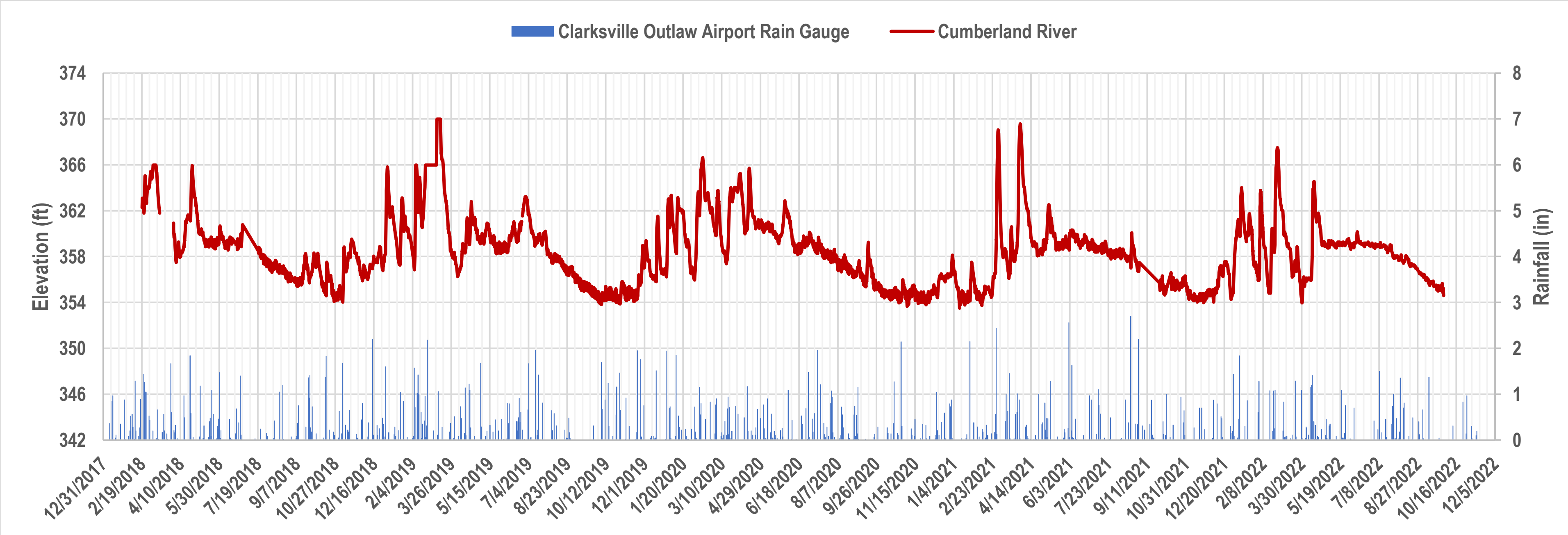
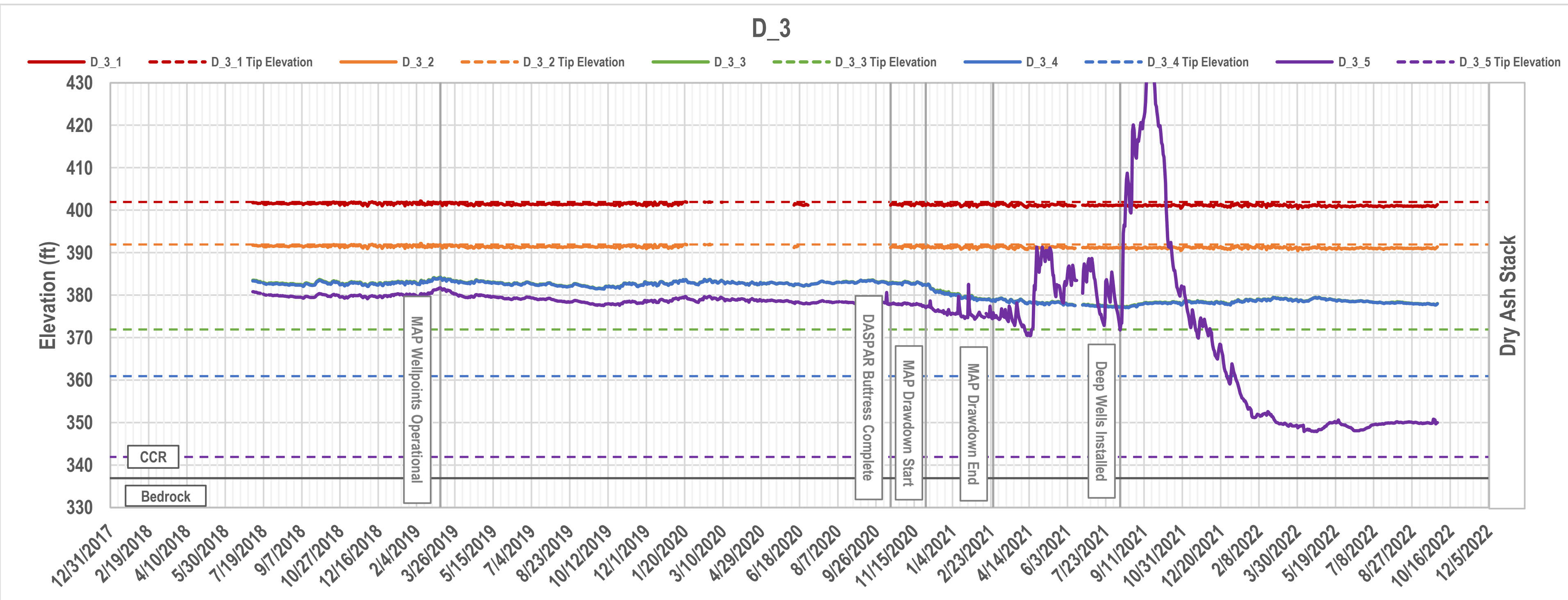
7/8/2022
8/27/2022
10/16/2022
12/5/2022


Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022


D_3
D_3_1
D_3_1 Tip Elevation
D_3_2
D_3_2 Tip Elevation
D_3_3
D_3_3 Tip Elevation
D_3_4
D_3_4 Tip Elevation
D_3_5
D_3_5 Tip Elevation
Elevation (ft)
430
420
410
400
390
380
370
360
350
340
330
CCR
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
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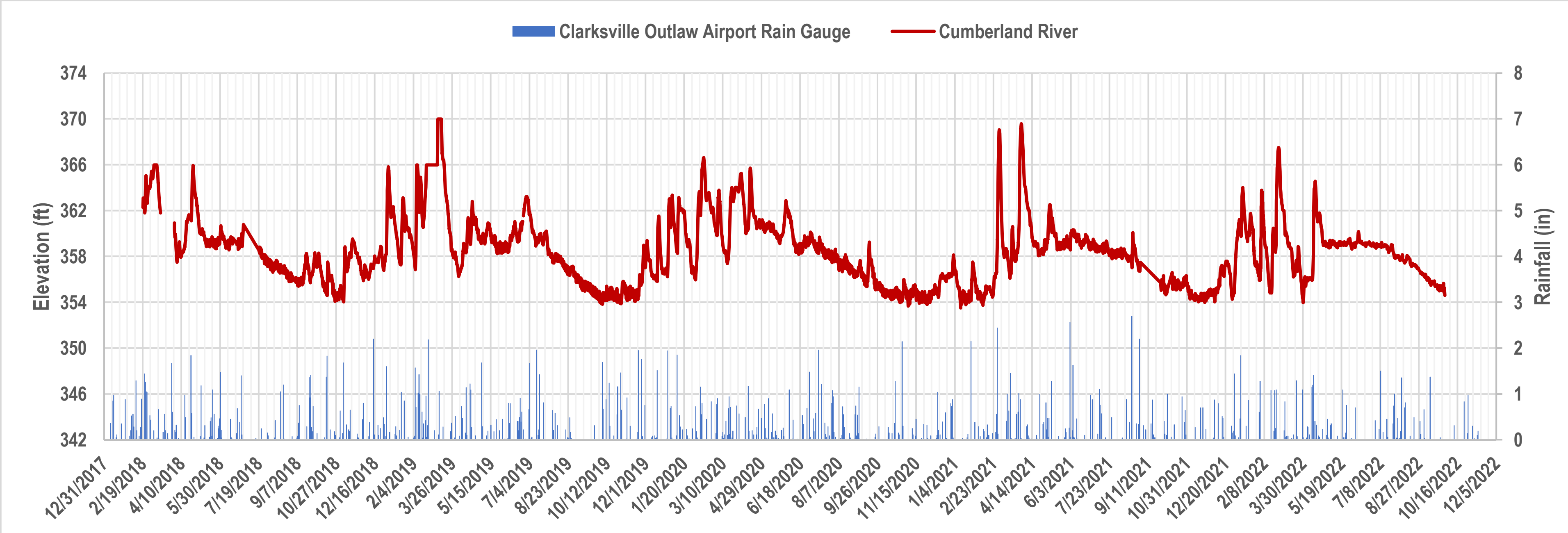
7/8/2022
8/27/2022
10/16/2022
12/5/2022


Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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3/30/2022
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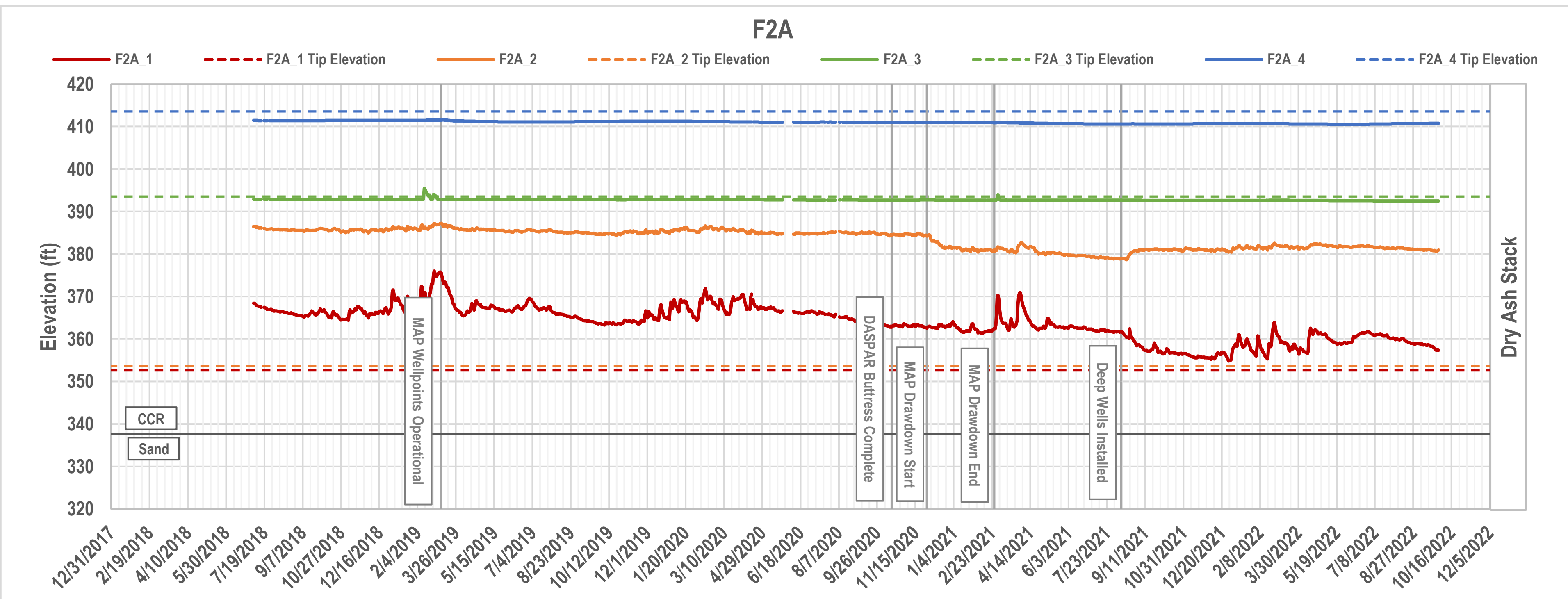
7/8/2022
8/27/2022
10/16/2022
12/5/2022


F2A
F2A_1
F2A_1 Tip Elevation
F2A_2
F2A_2 Tip Elevation
F2A_3
F2A_3 Tip Elevation
F2A_4
F2A_4 Tip Elevation
Elevation (ft)
420
410
400
390
380
370
360
350
340
330
320
CCR
Sand
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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3/30/2022
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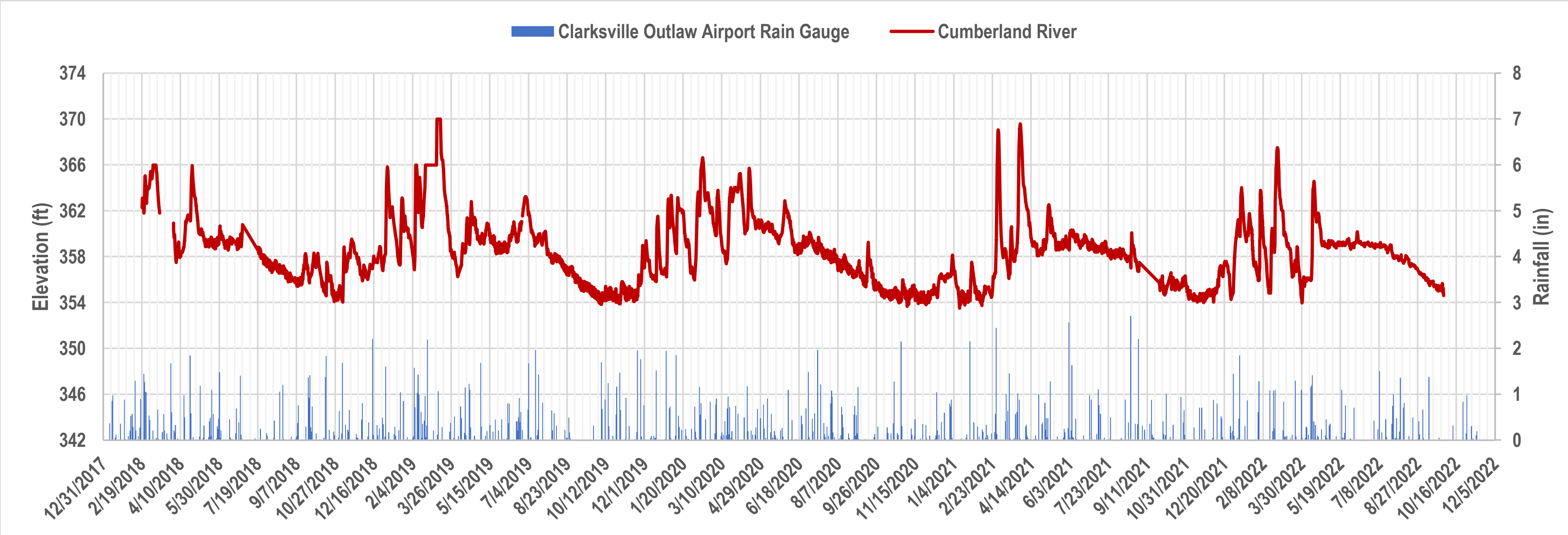
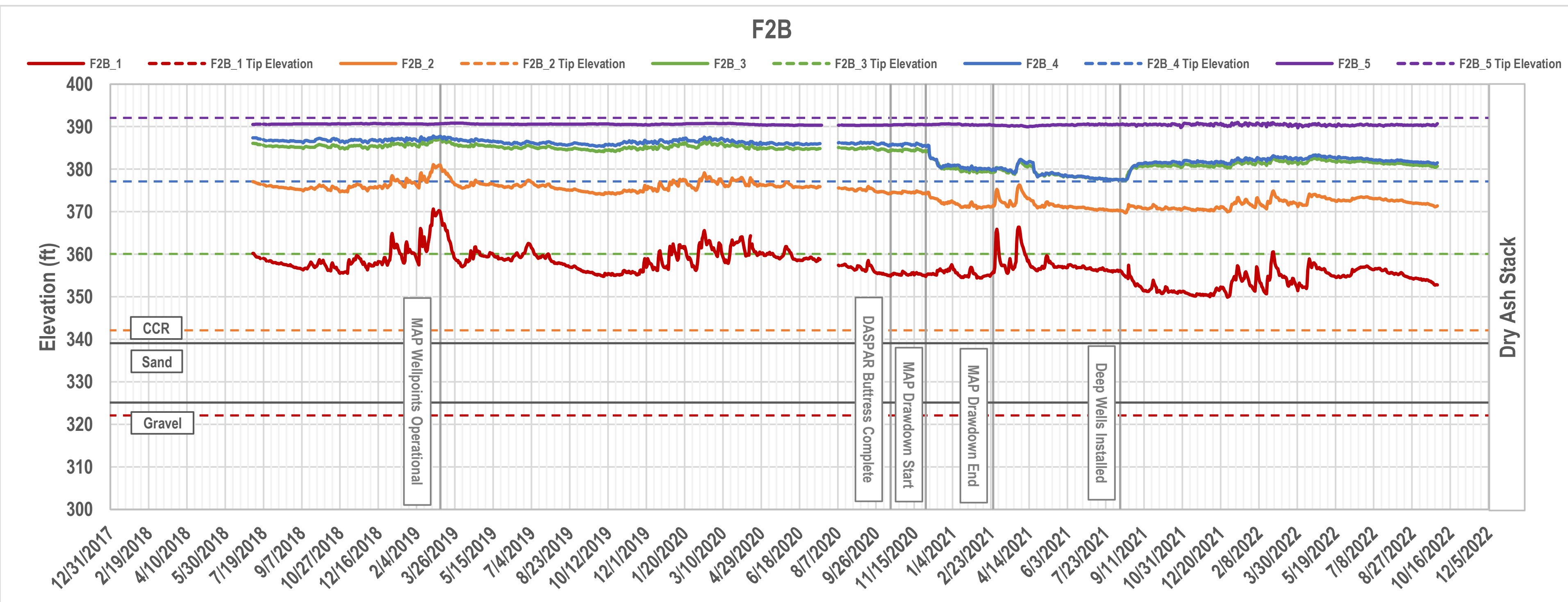
7/8/2022
8/27/2022
10/16/2022
12/5/2022


Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022


F2B
F2B_1
F2B_1 Tip Elevation
F2B_2
F2B_2 Tip Elevation
F2B_3
F2B_3 Tip Elevation
F2B_4
F2B_4 Tip Elevation
F2B_5
F2B_5 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
CCR
Sand
Gravel
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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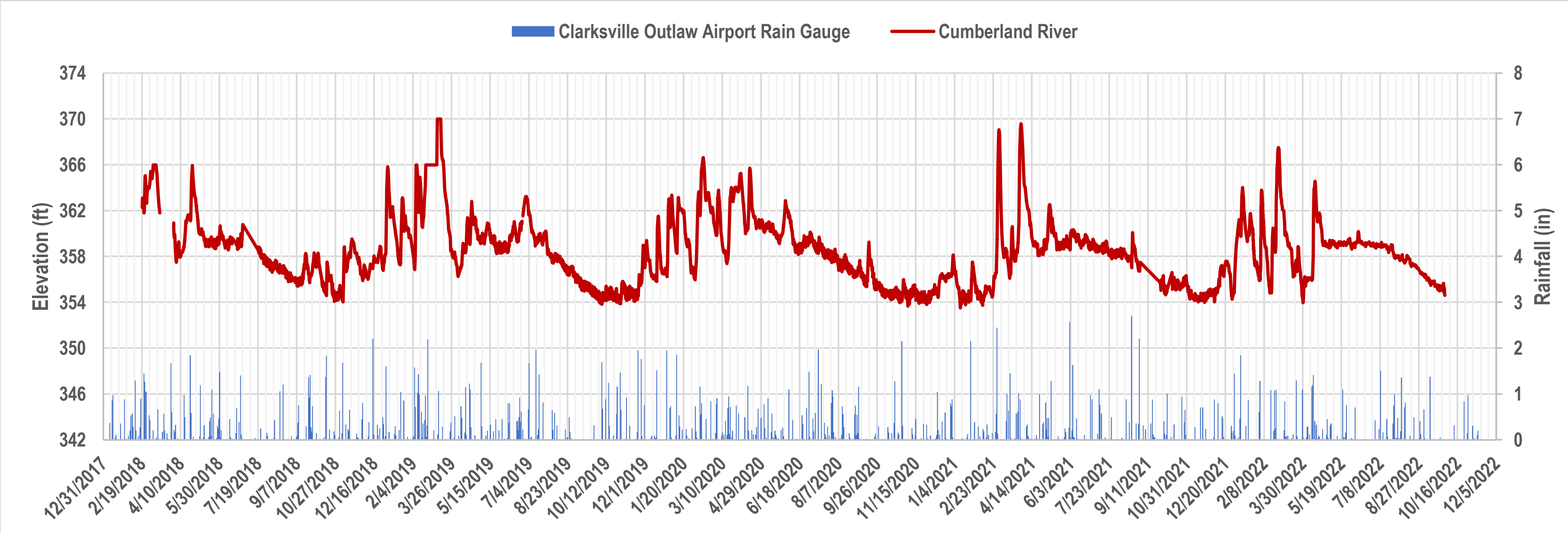
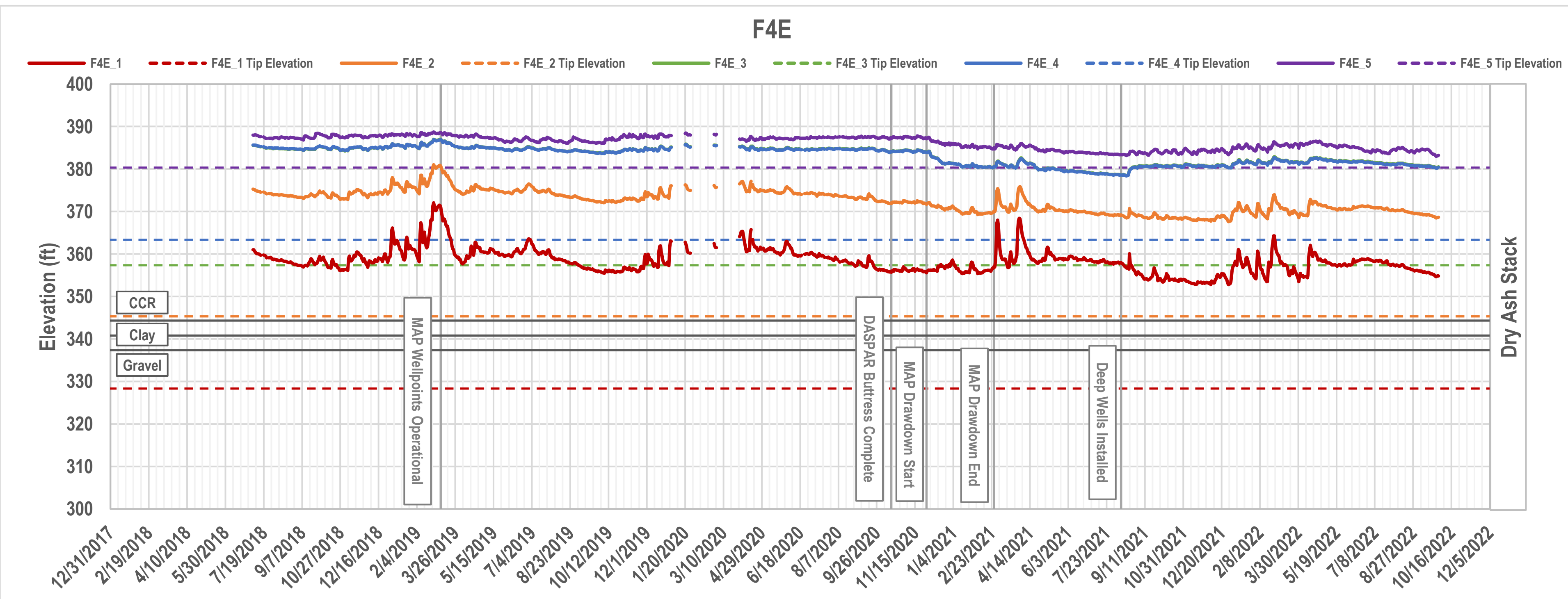
7/8/2022
8/27/2022
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022



F4E
F4E_1
F4E_1 Tip Elevation
F4E_2
F4E_2 Tip Elevation
F4E_3
F4E_3 Tip Elevation
F4E_4
F4E_4 Tip Elevation
F4E_5
F4E_5 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
CCR
Clay
Gravel
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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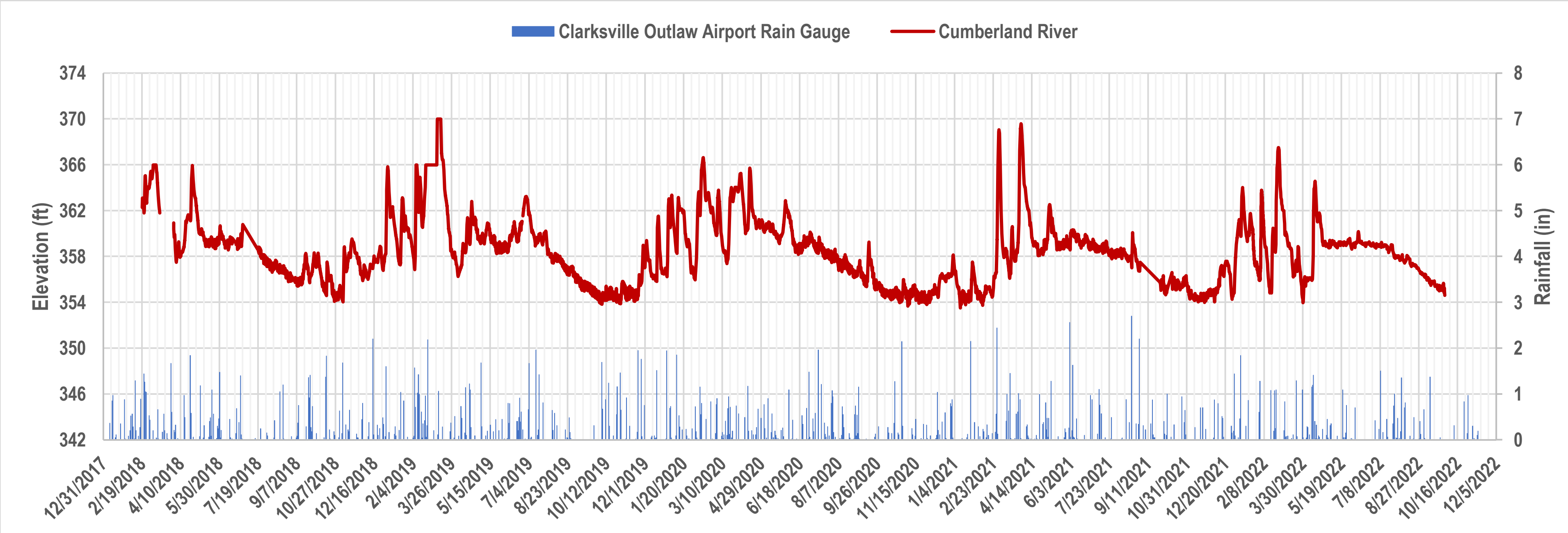
7/8/2022
8/27/2022
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
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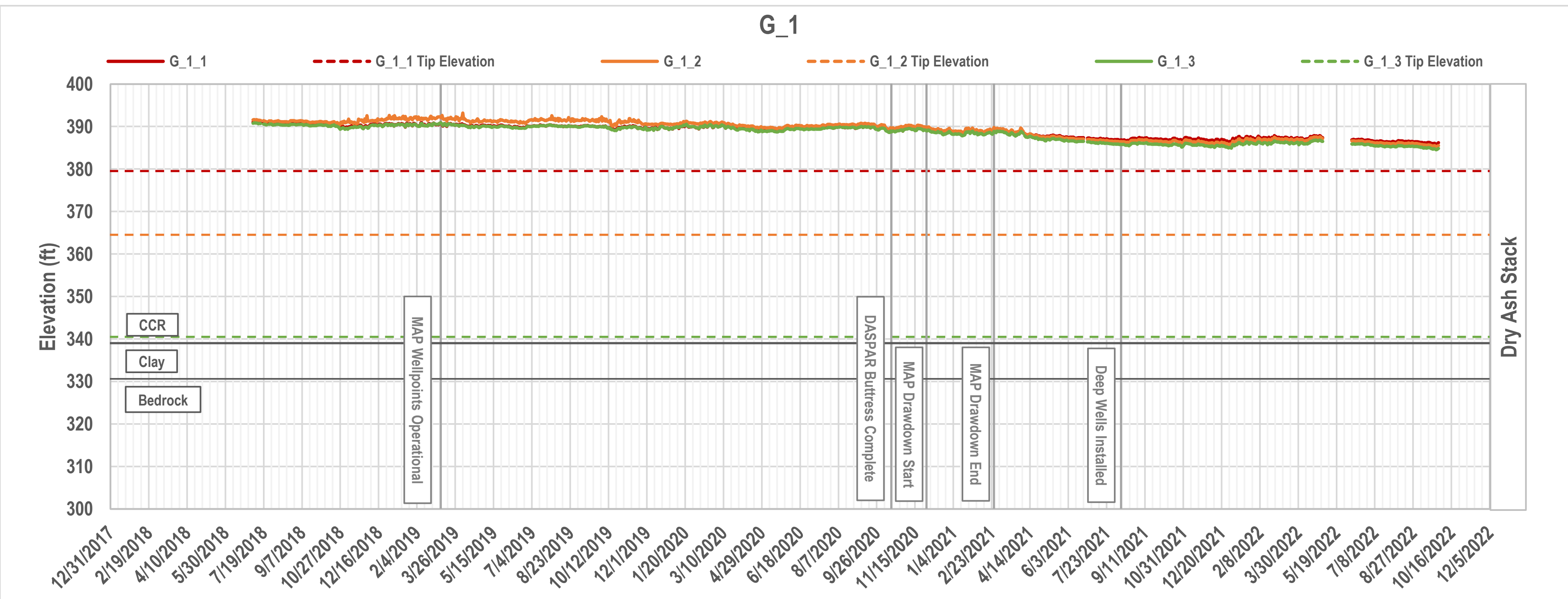
7/8/2022
8/27/2022
10/16/2022
12/5/2022



G_1
G_1_1
G_1_1 Tip Elevation
G_1_2
G_1_2 Tip Elevation
G_1_3
G_1_3 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
CCR
Clay
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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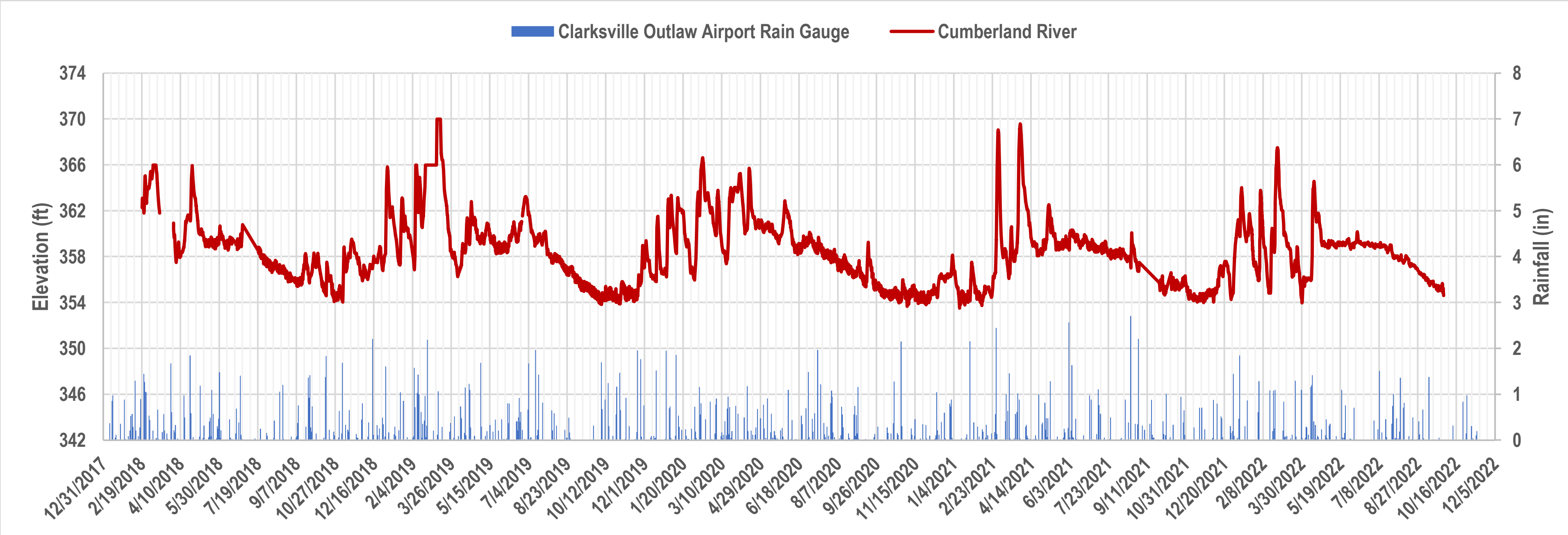
7/8/2022
8/27/2022
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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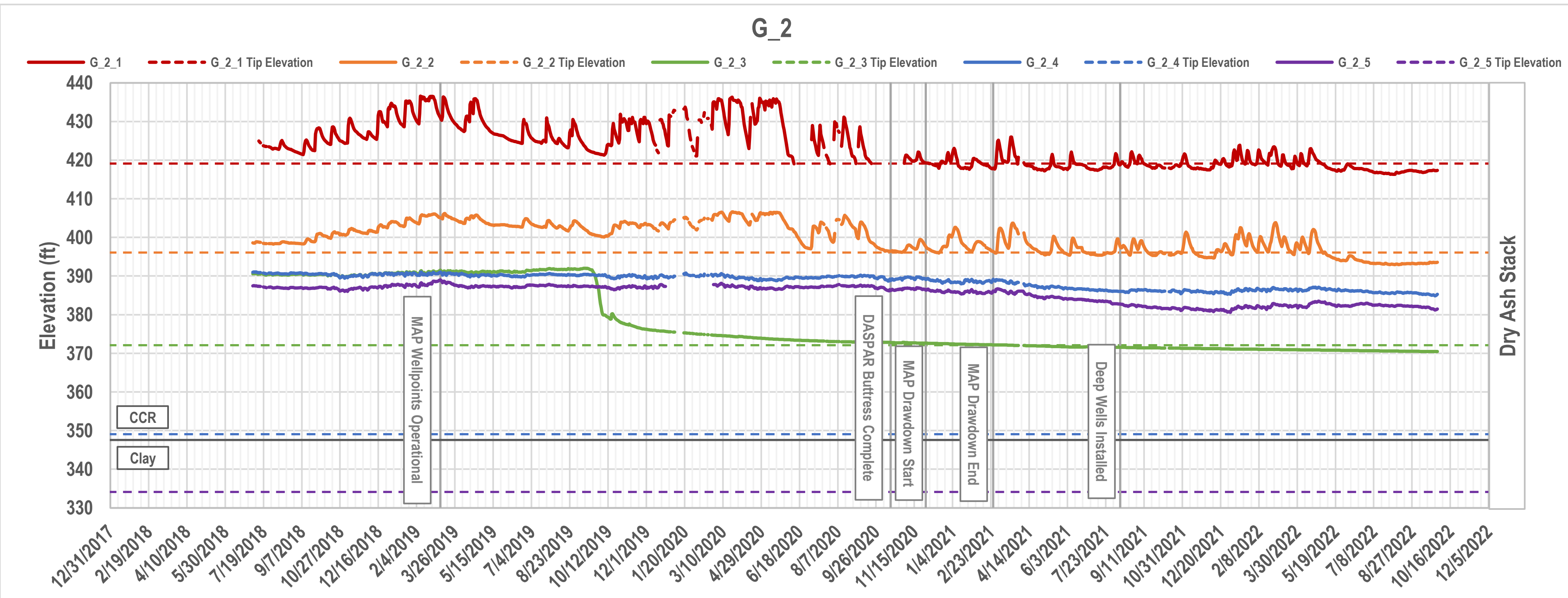
10/16/2022
12/5/2022



G_2
G_2_1
G_2_1 Tip Elevation
G_2_2
G_2_2 Tip Elevation
G_2_3
G_2_3 Tip Elevation
G_2_4
G_2_4 Tip Elevation
G_2_5
G_2_5 Tip Elevation
Elevation (ft)
440
430
420
410
400
390
380
370
360
350
340
330
CCR
Clay
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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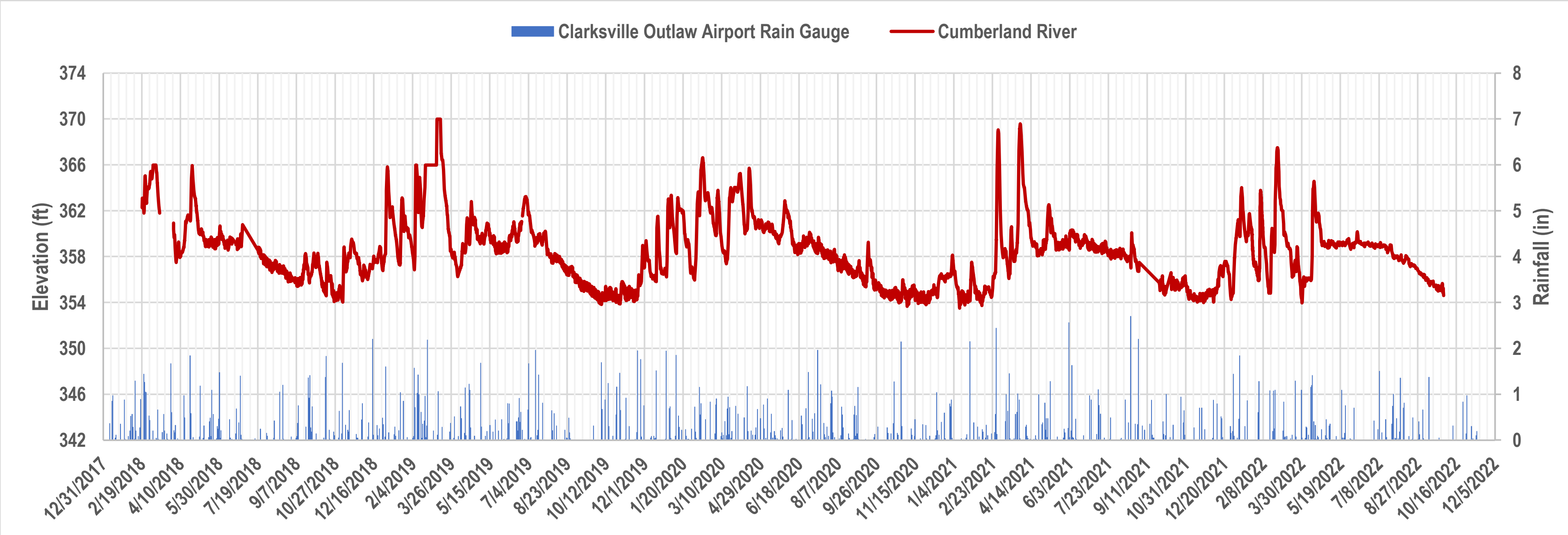
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022


Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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3/30/2022
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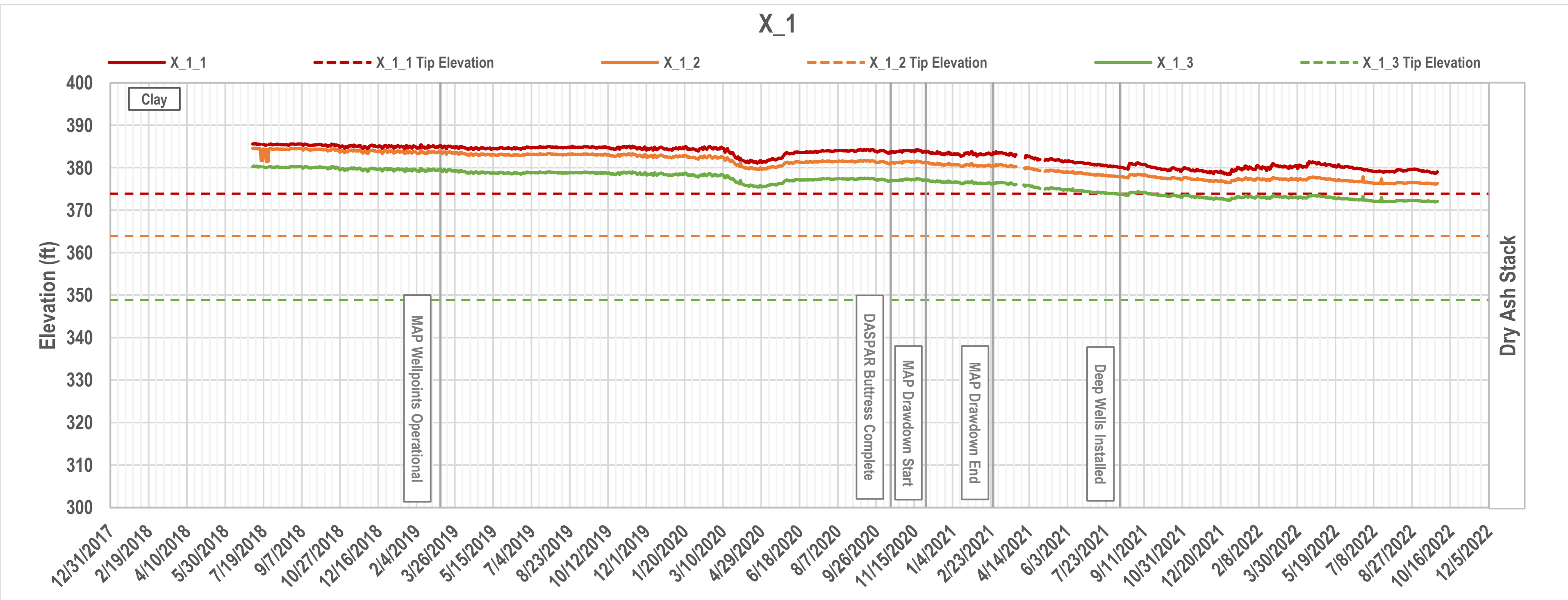
7/8/2022
8/27/2022
10/16/2022
12/5/2022


X_1
X_1_1
X_1_1 Tip Elevation
X_1_2
X_1_2 Tip Elevation
X_1_3
X_1_3 Tip Elevation
Clay
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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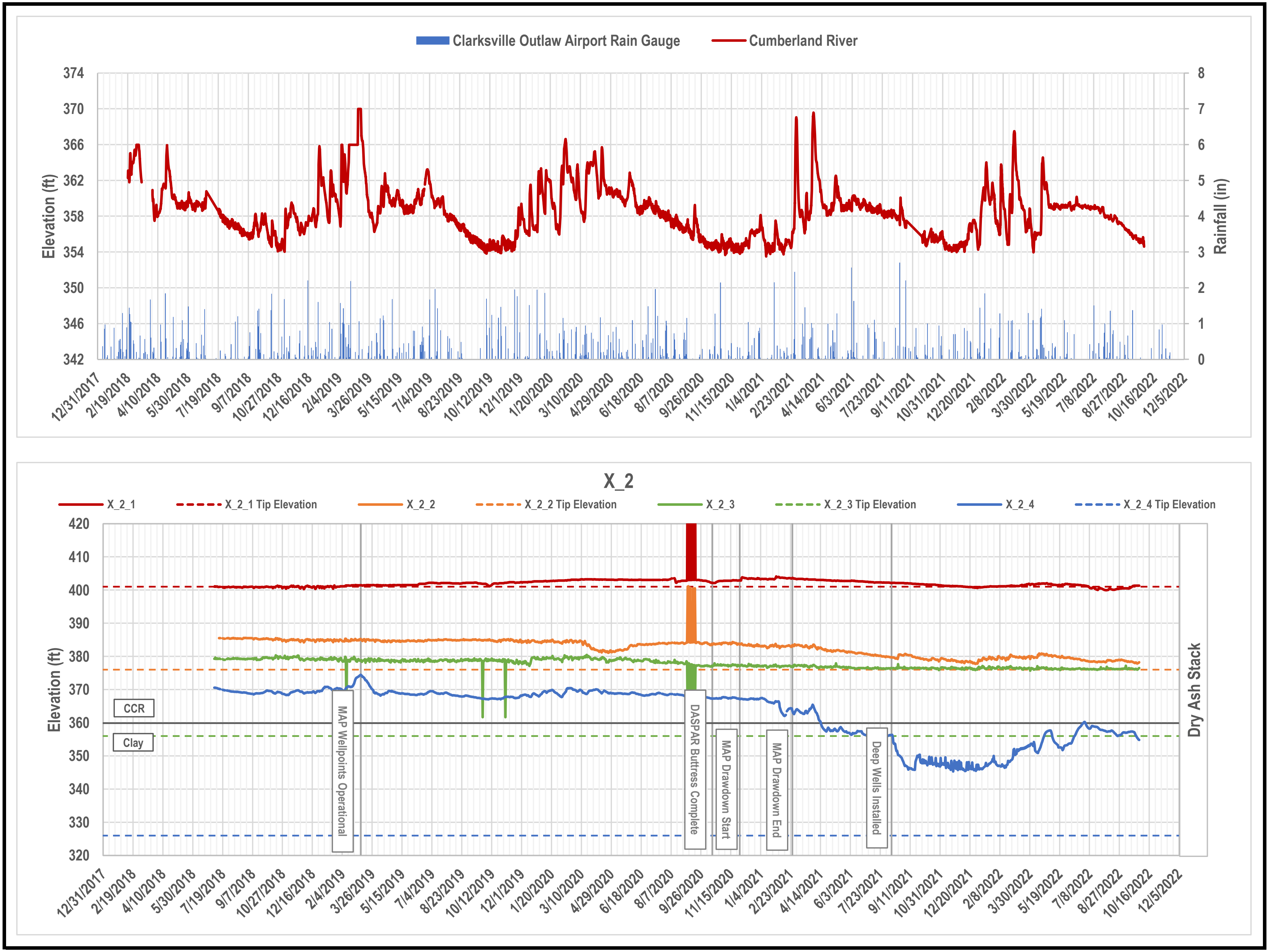
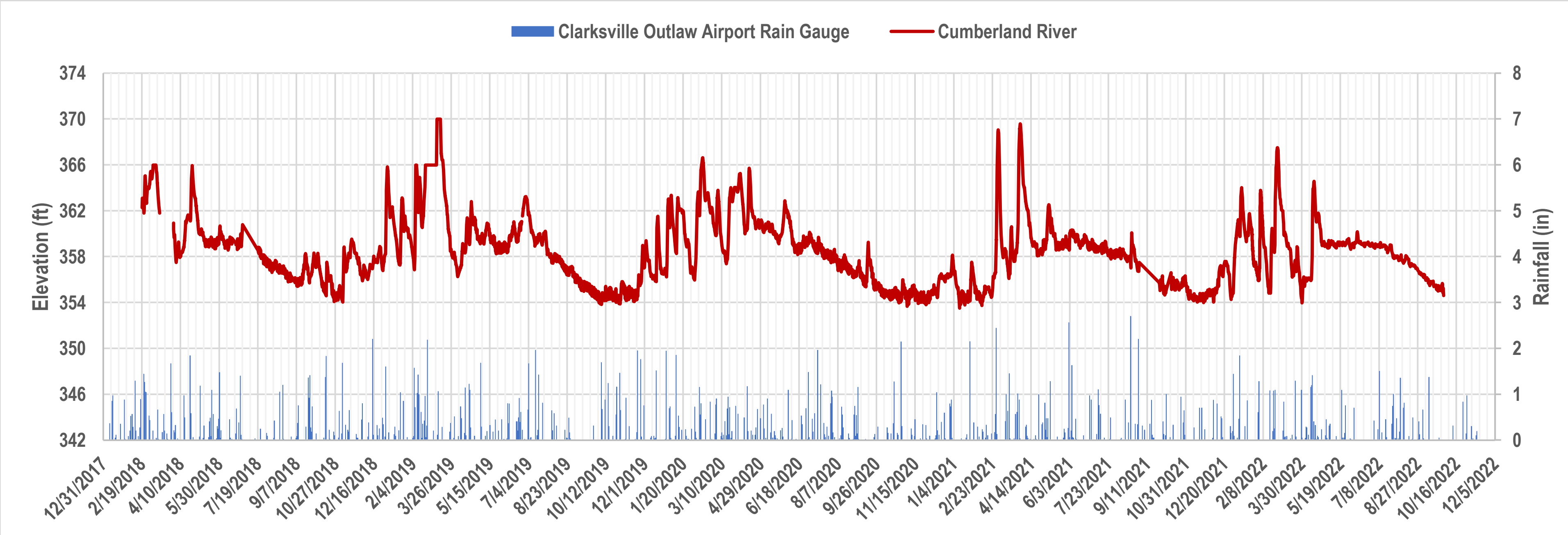
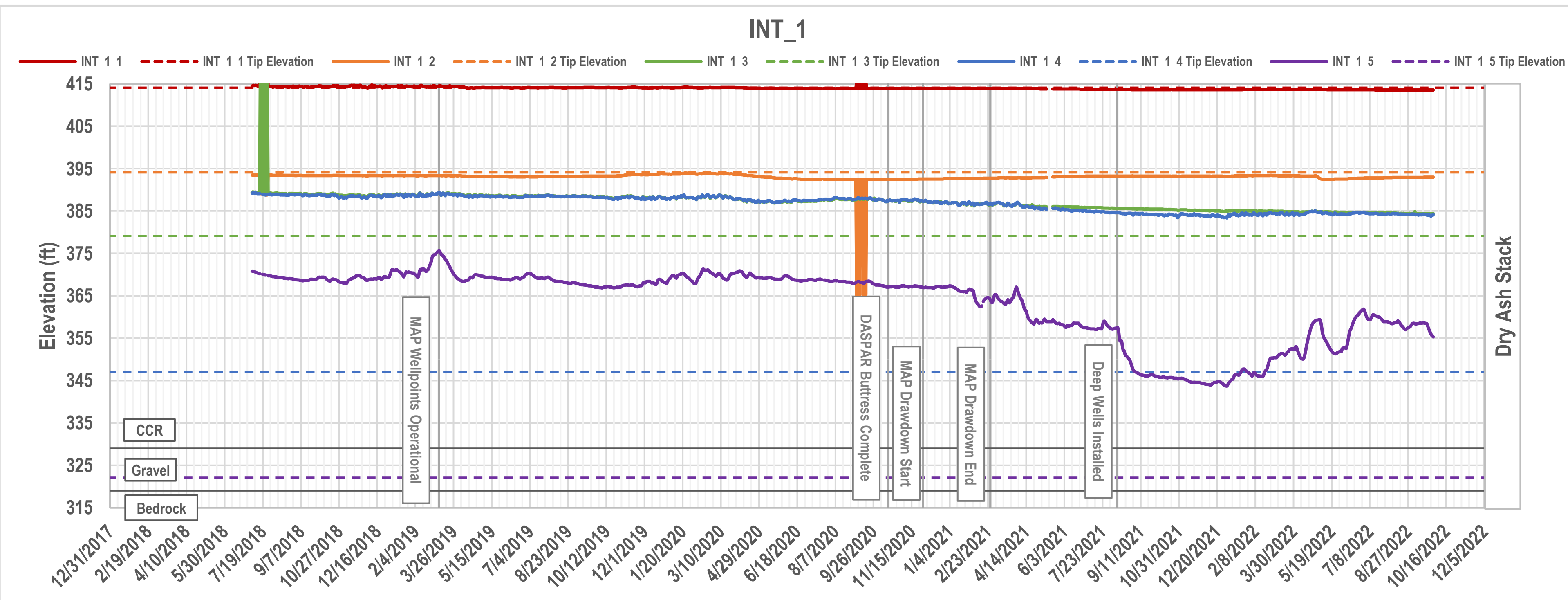
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
X_2
X_2_1
X_2_1 Tip Elevation
X_2_2
X_2_2 Tip Elevation
X_2_3
X_2_3 Tip Elevation
X_2_4
X_2_4 Tip Elevation
CCR
Clay
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022



INT_1
INT_1_1
INT_1_1 Tip Elevation
INT_1_2
INT_1_2 Tip Elevation
INT_1_3
INT_1_3 Tip Elevation
INT_1_4
INT_1_4 Tip Elevation
INT_1_5
INT_1_5 Tip Elevation
Elevation (ft)
415
405
395
385
375
365
355
345
335
325
315
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
CCR
Gravel
Bedrock
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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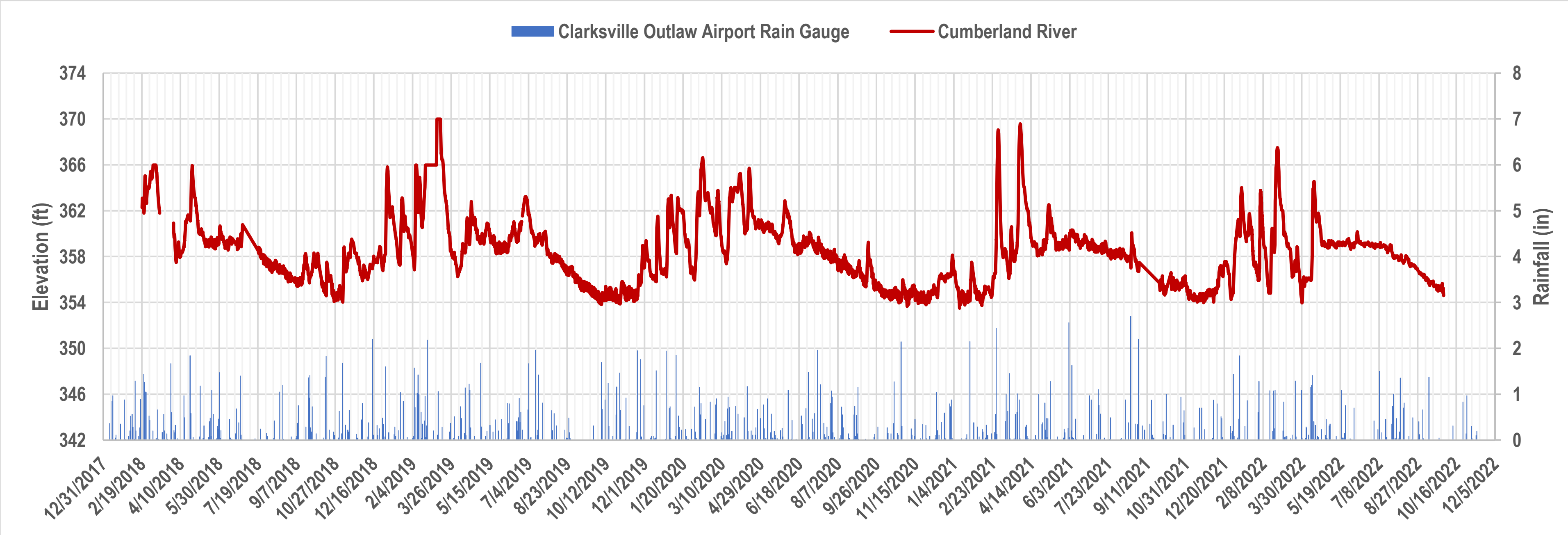
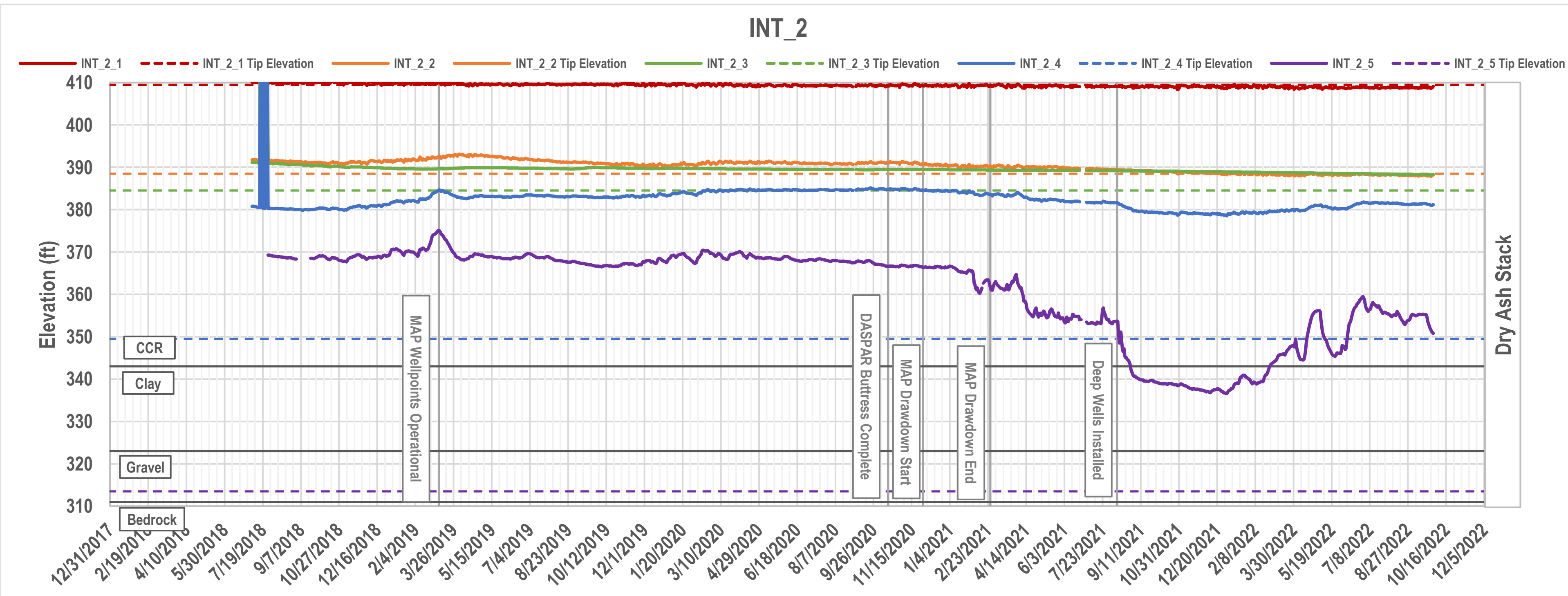
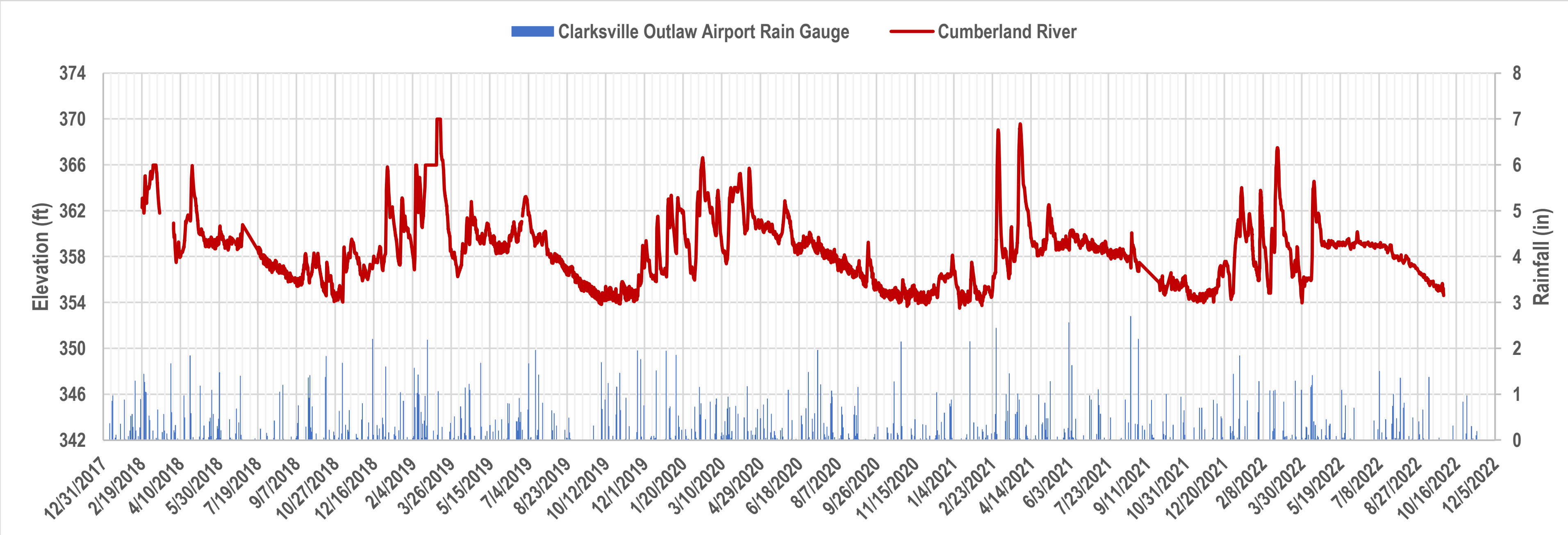
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022

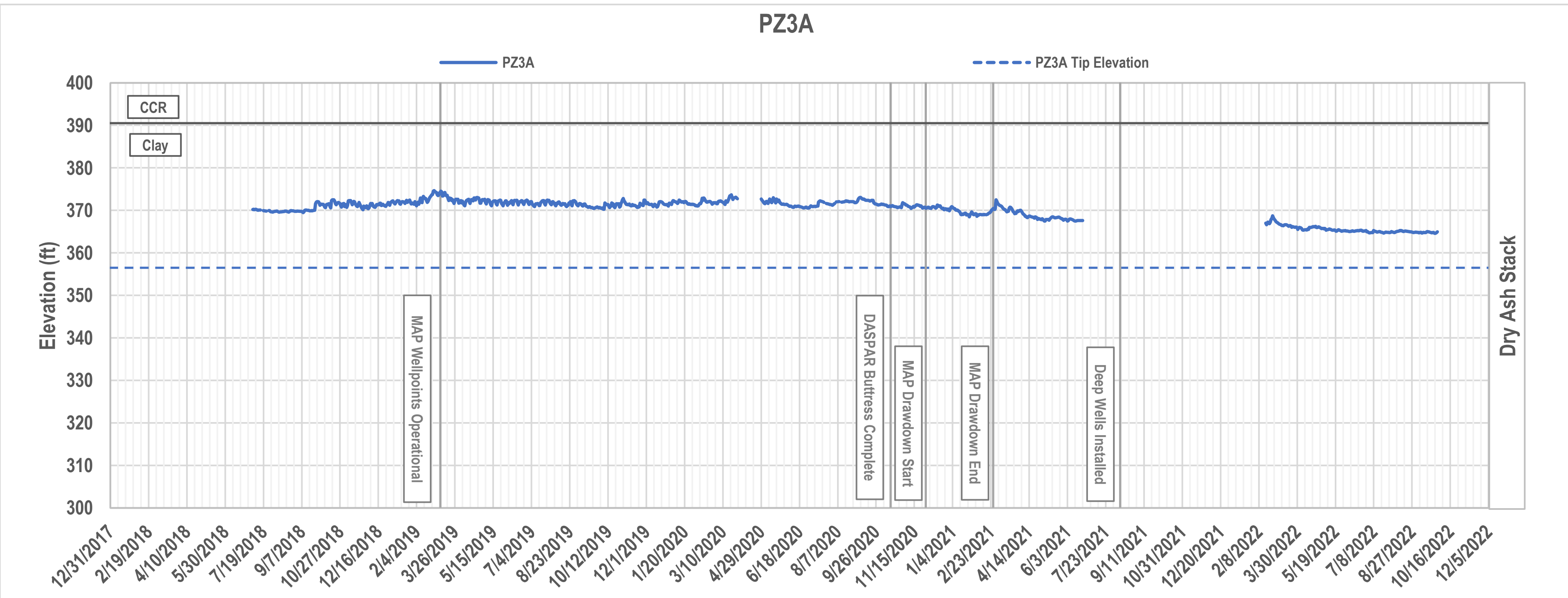


Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)



INT_2
INT_2_1
INT_2_1 Tip Elevation
INT_2_2
INT_2_2 Tip Elevation
INT_2_3
INT_2_3 Tip Elevation
INT_2_4
INT_2_4 Tip Elevation
INT_2_5
INT_2_5 Tip Elevation
Elevation (ft)
CCR
Clay
Gravel
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack


Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022


PZ3A
PZ3A
PZ3A Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
CCR
Clay
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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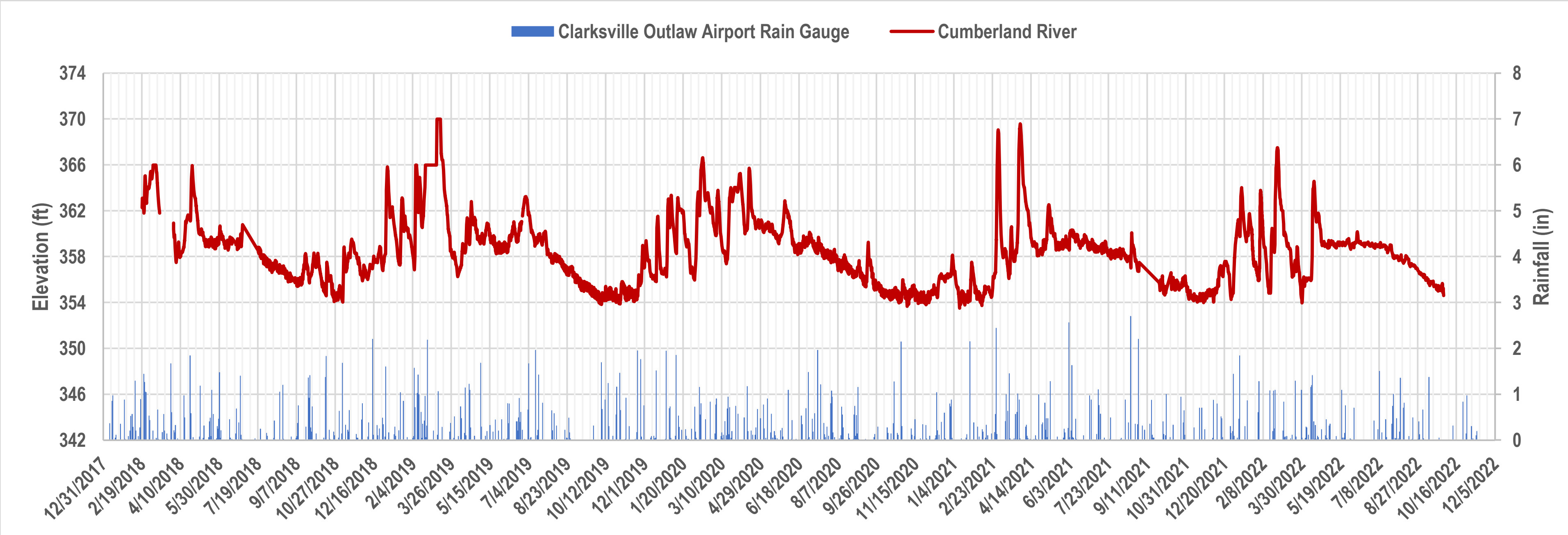
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
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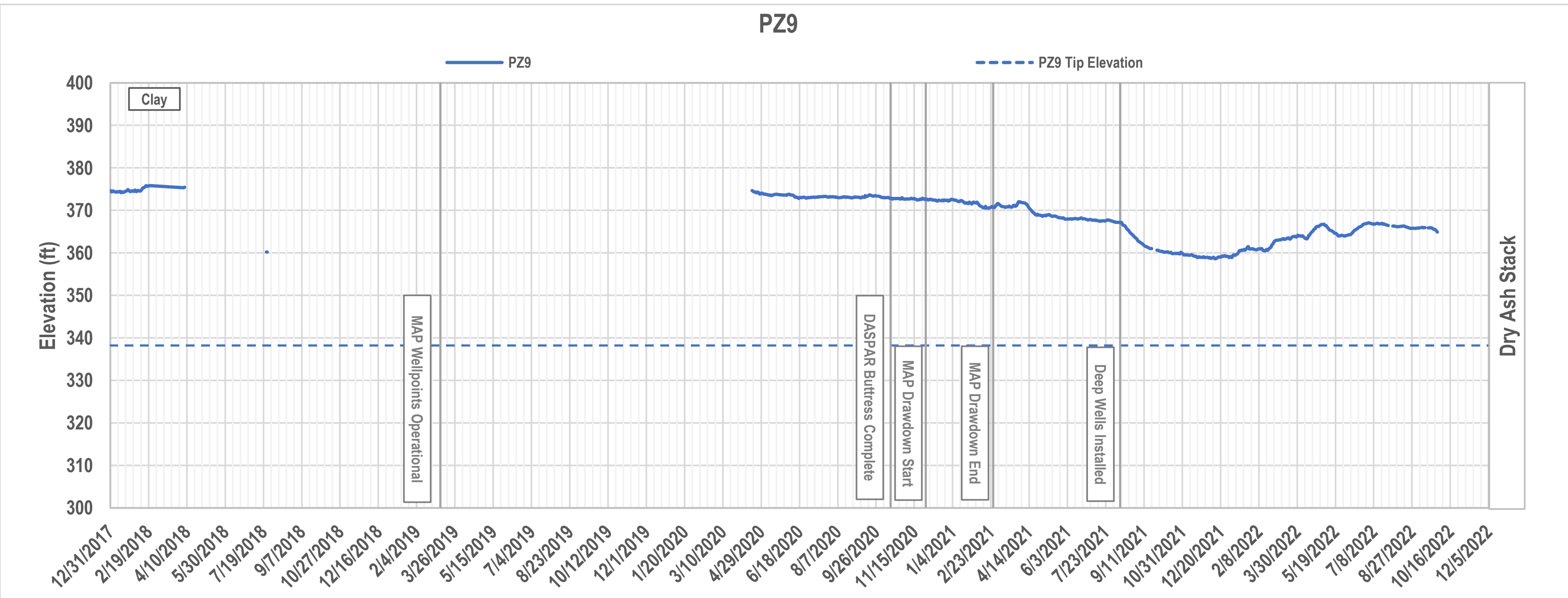
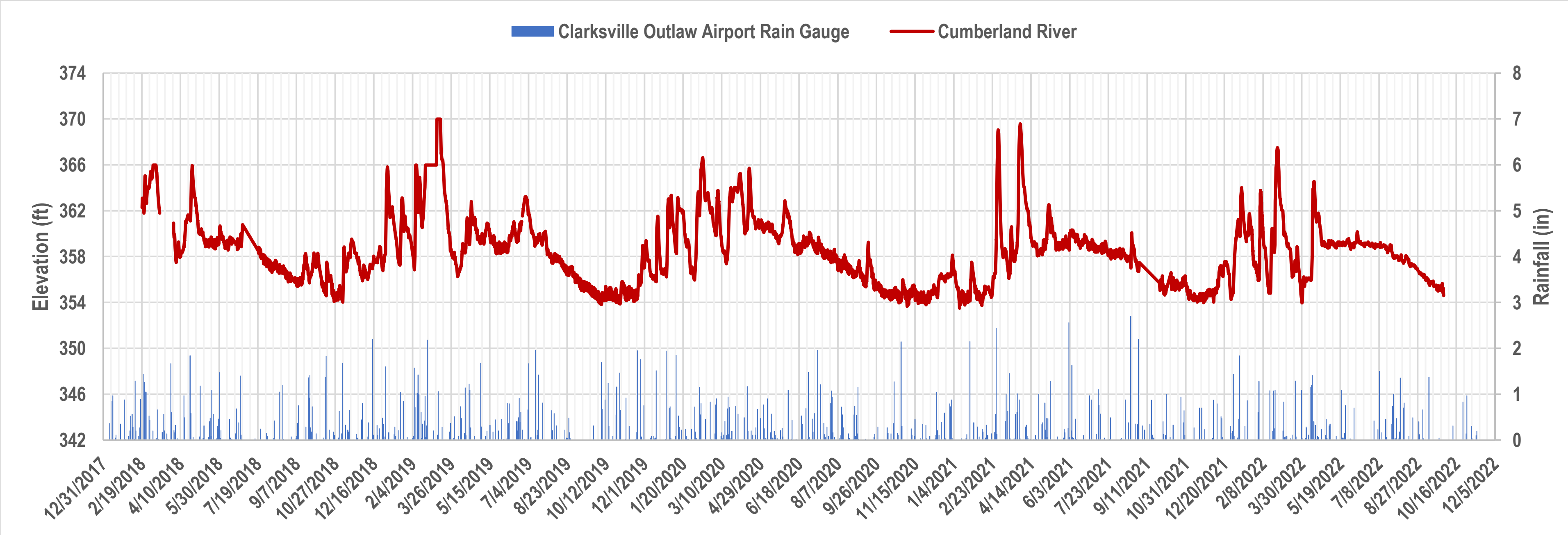
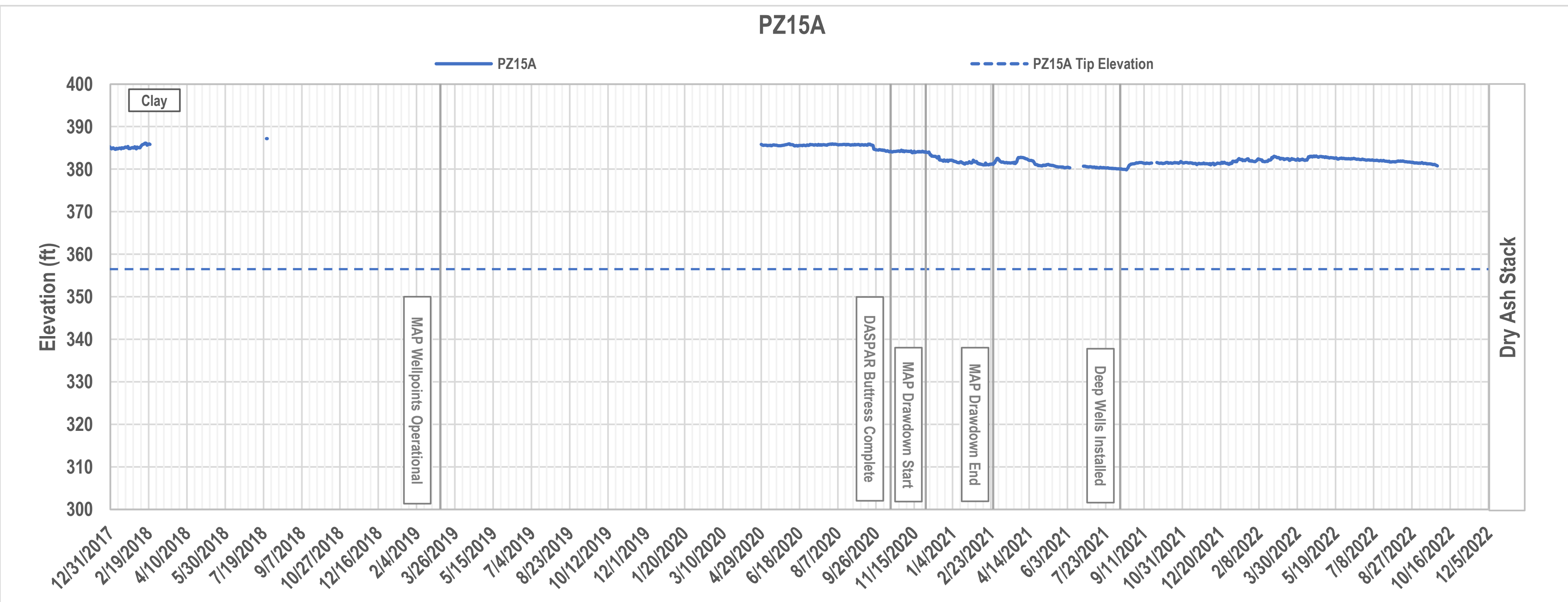
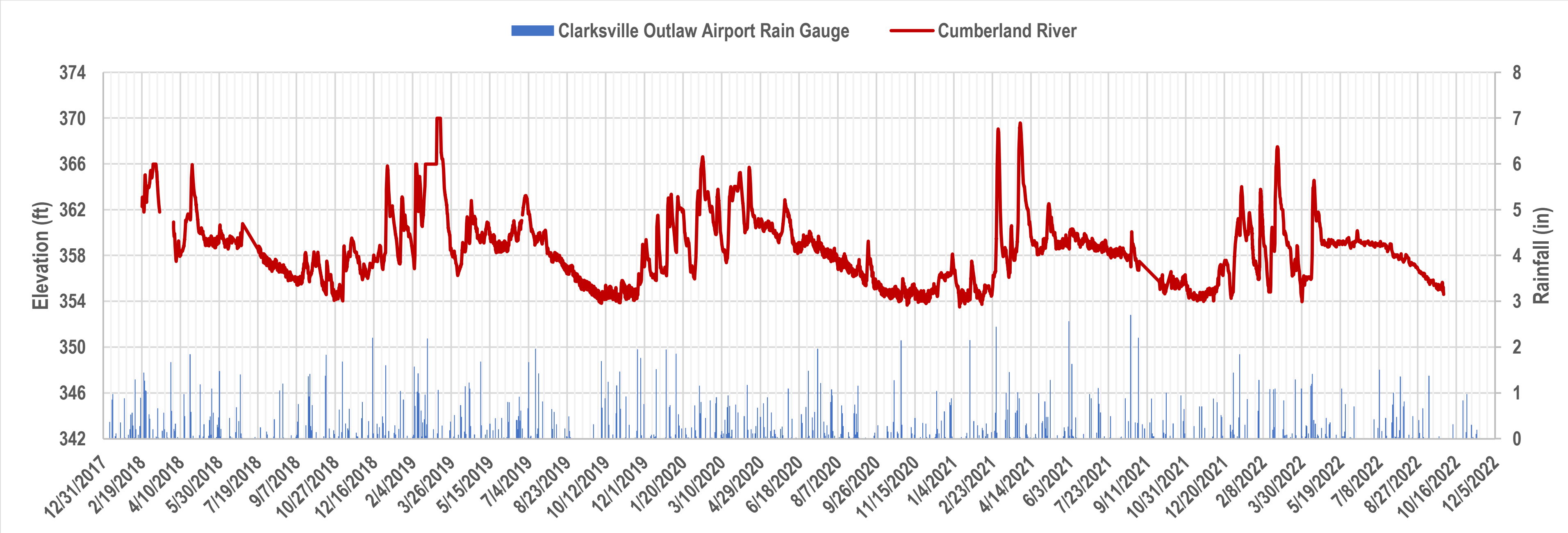
7/8/2022
8/27/2022
10/16/2022
12/5/2022



PZ9
PZ9
PZ9 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
Clay
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022


Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022


PZ15A
PZ15A
PZ15A Tip Elevation
Clay
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Dry Ash Stack
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
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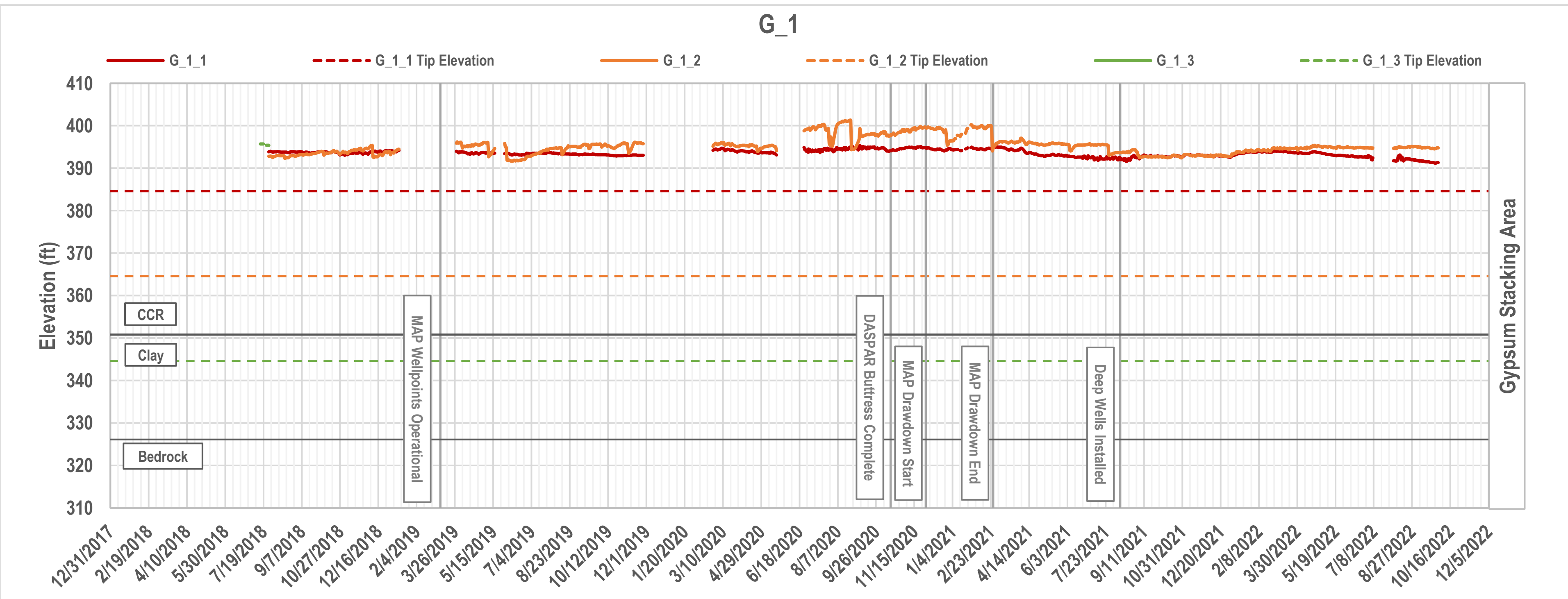
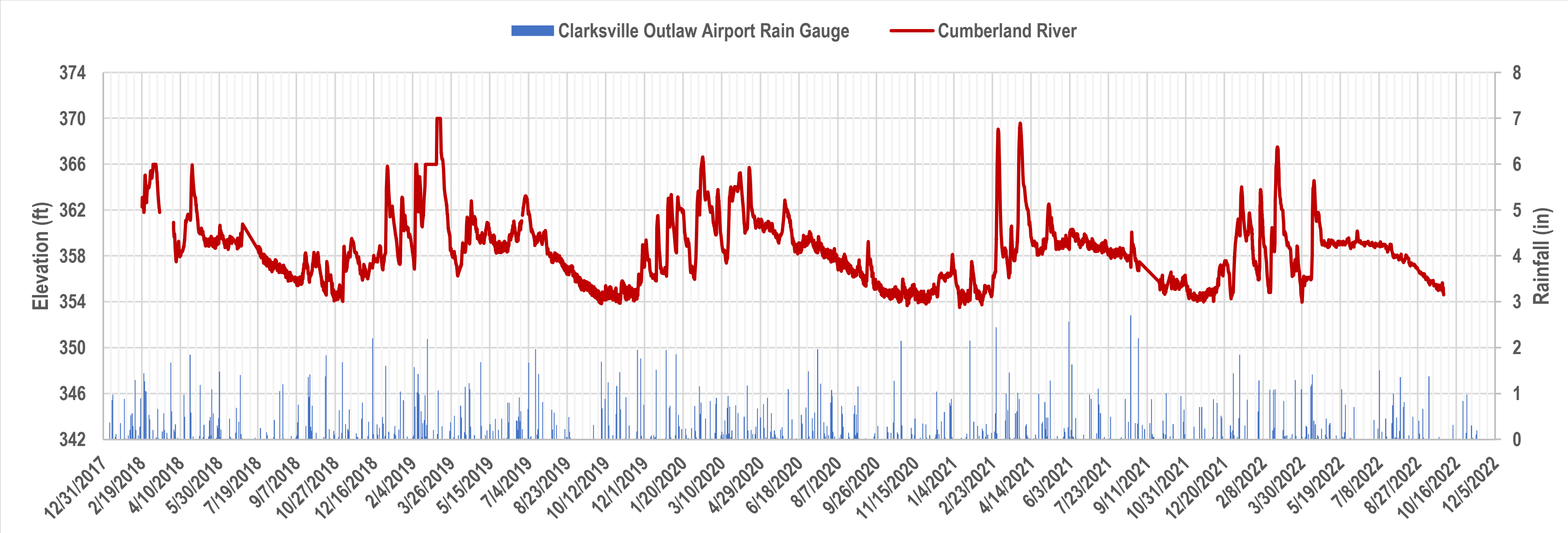
7/8/2022
8/27/2022
10/16/2022
12/5/2022



G_1
G_1_1
G_1_1 Tip Elevation
G_1_2
G_1_2 Tip Elevation
G_1_3
G_1_3 Tip Elevation
Elevation (ft)
410
400
390
380
370
360
350
340
330
320
310
CCR
Clay
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022


Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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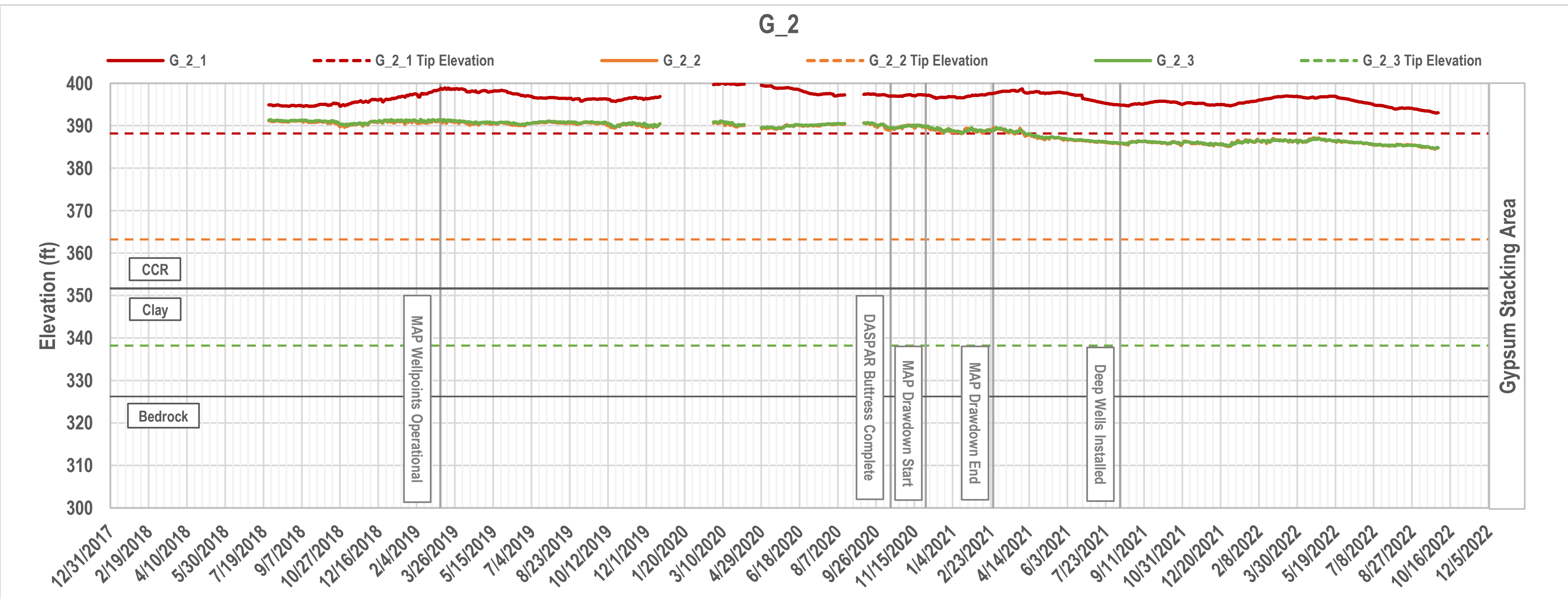
8/27/2022
10/16/2022
12/5/2022


G_2
G_2_1
G_2_1 Tip Elevation
G_2_2
G_2_2 Tip Elevation
G_2_3
G_2_3 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
CCR
Clay
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
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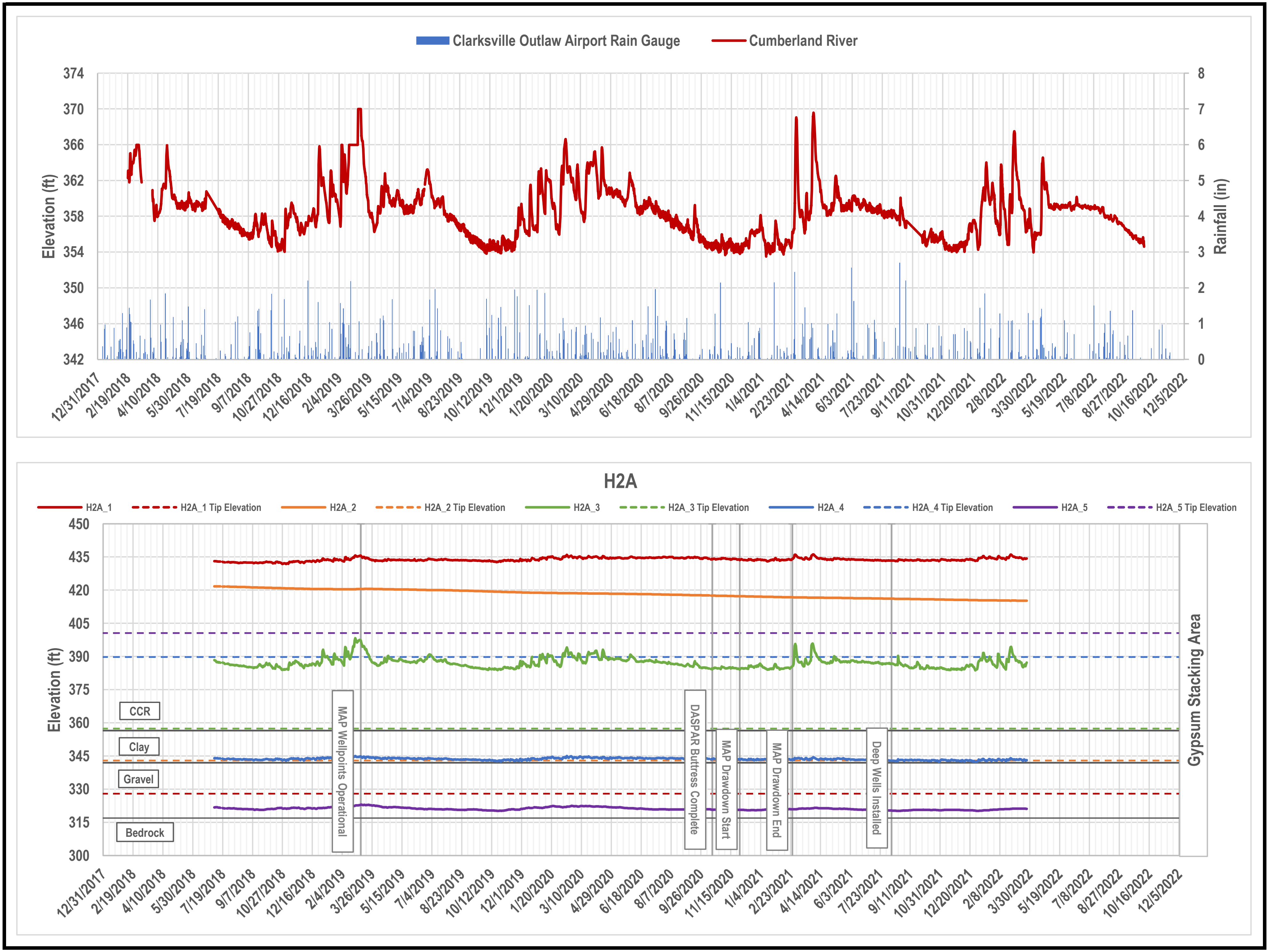
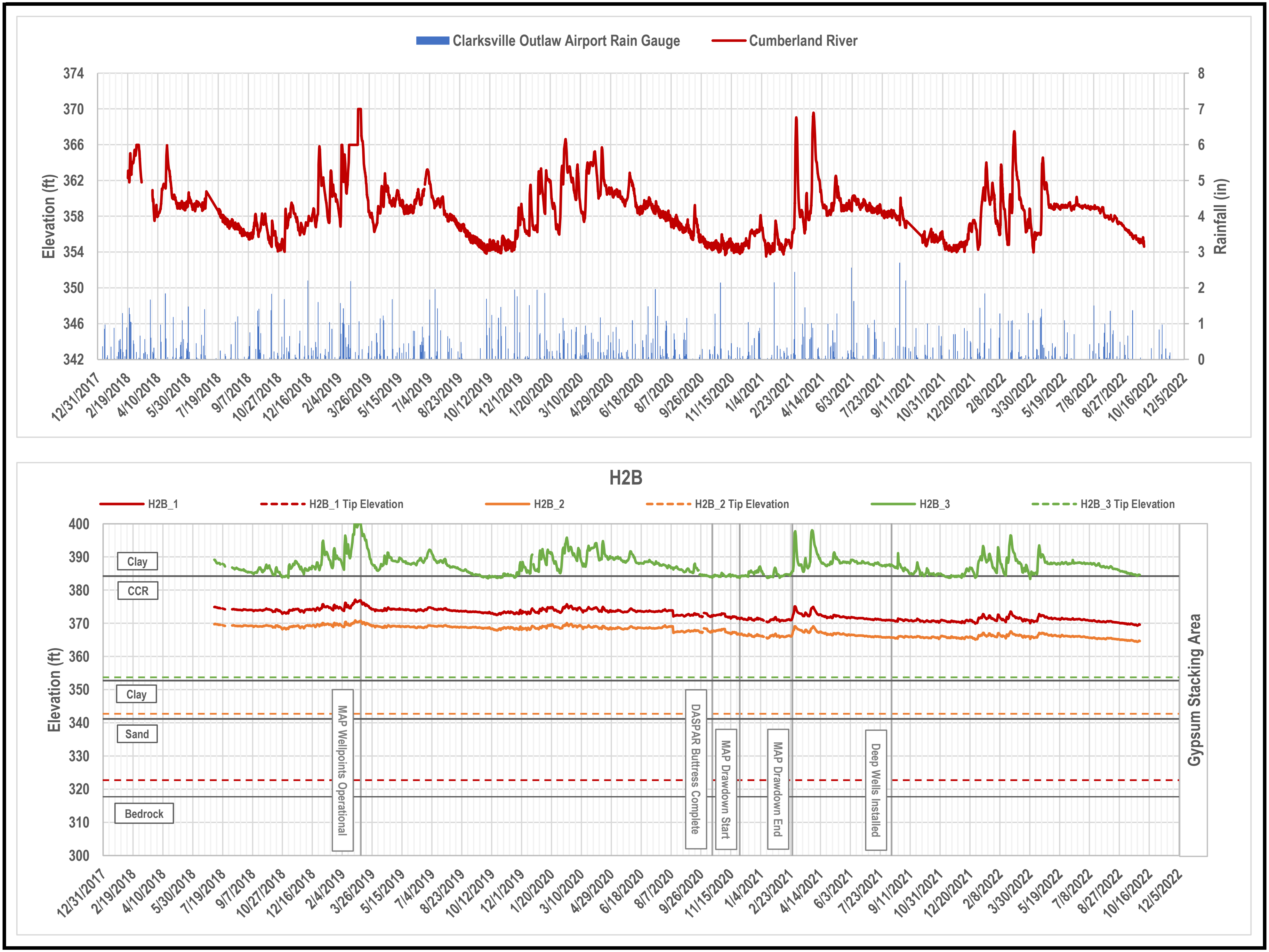
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
H2A
H2A_1
H2A_1 Tip Elevation
H2A_2
H2A_2 Tip Elevation
H2A_3
H2A_3 Tip Elevation
H2A_4
H2A_4 Tip Elevation
H2A_5
H2A_5 Tip Elevation
CCR
Clay
Gravel
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
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12/31/2017
2/19/2018
4/10/2018
5/30/2018
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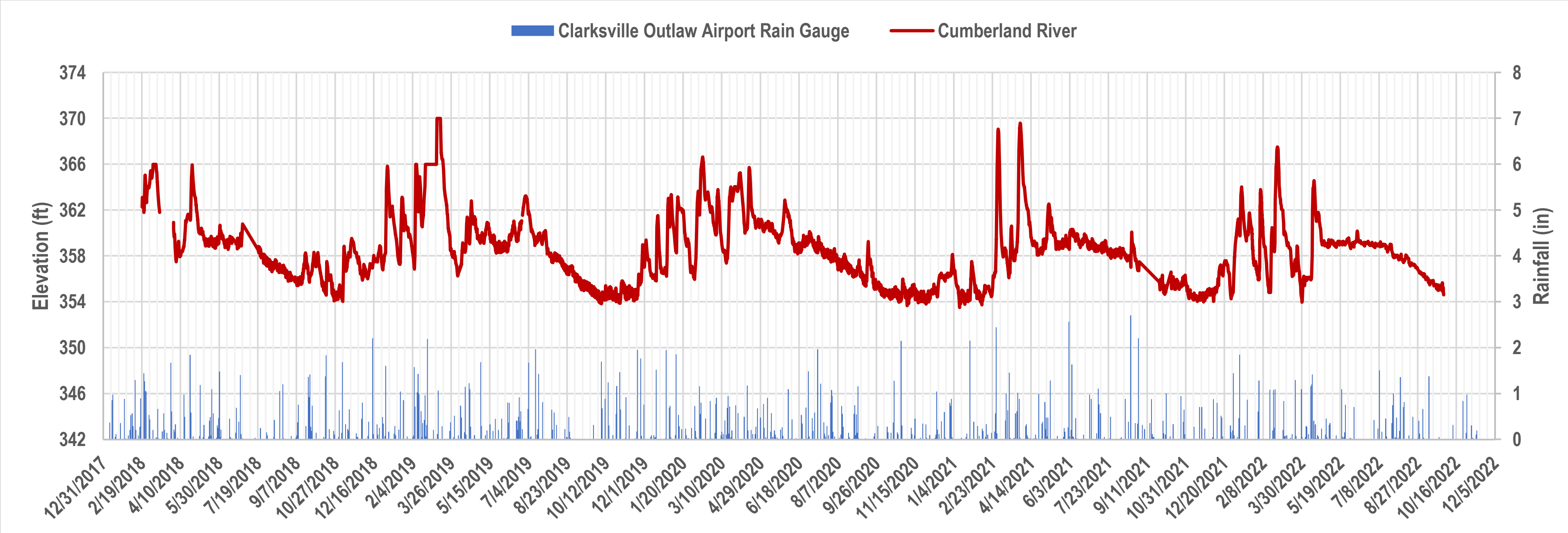
7/8/2022
8/27/2022
10/16/2022
12/5/2022
H2B
H2B_1
H2B_1 Tip Elevation
H2B_2
H2B_2 Tip Elevation
H2B_3
H2B_3 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
Clay
CCR
Clay
Sand
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
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354
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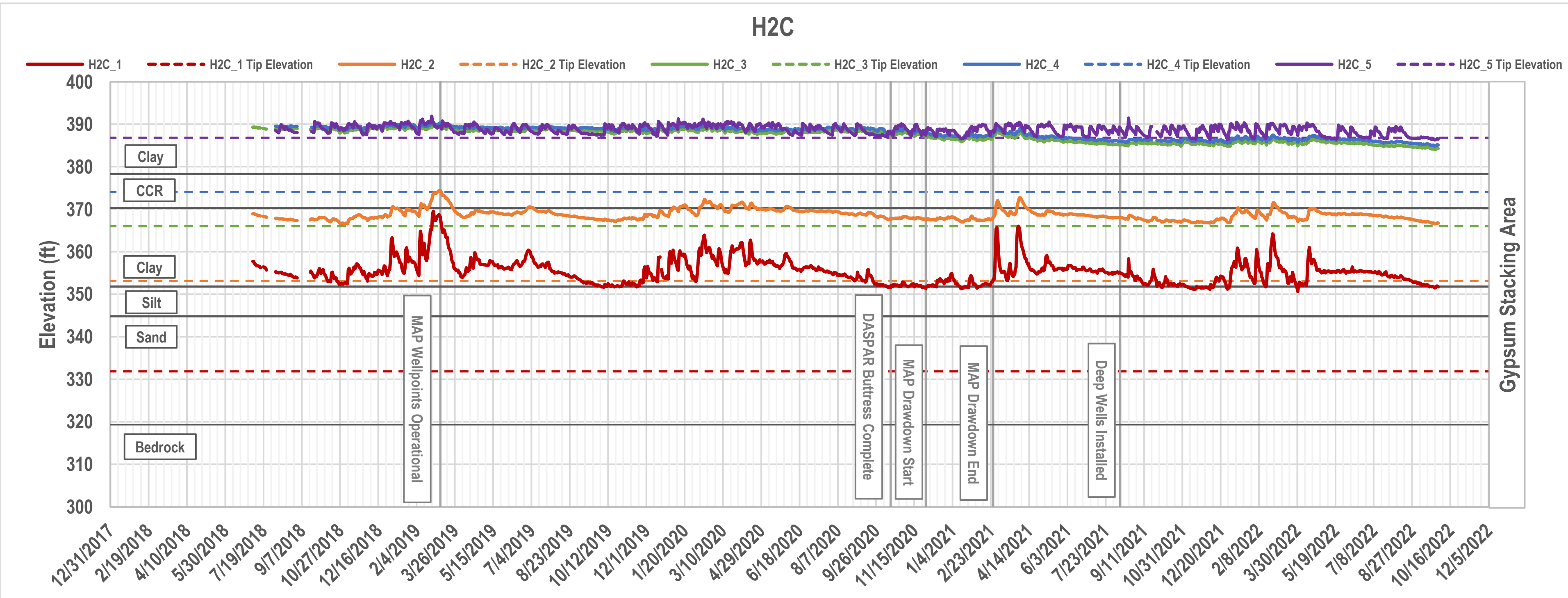

H2C
H2C_1
H2C_1 Tip Elevation
H2C_2
H2C_2 Tip Elevation
H2C_3
H2C_3 Tip Elevation
H2C_4
H2C_4 Tip Elevation
H2C_5
H2C_5 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
Clay
CCR
Clay
Silt
Sand
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
12/31/2017
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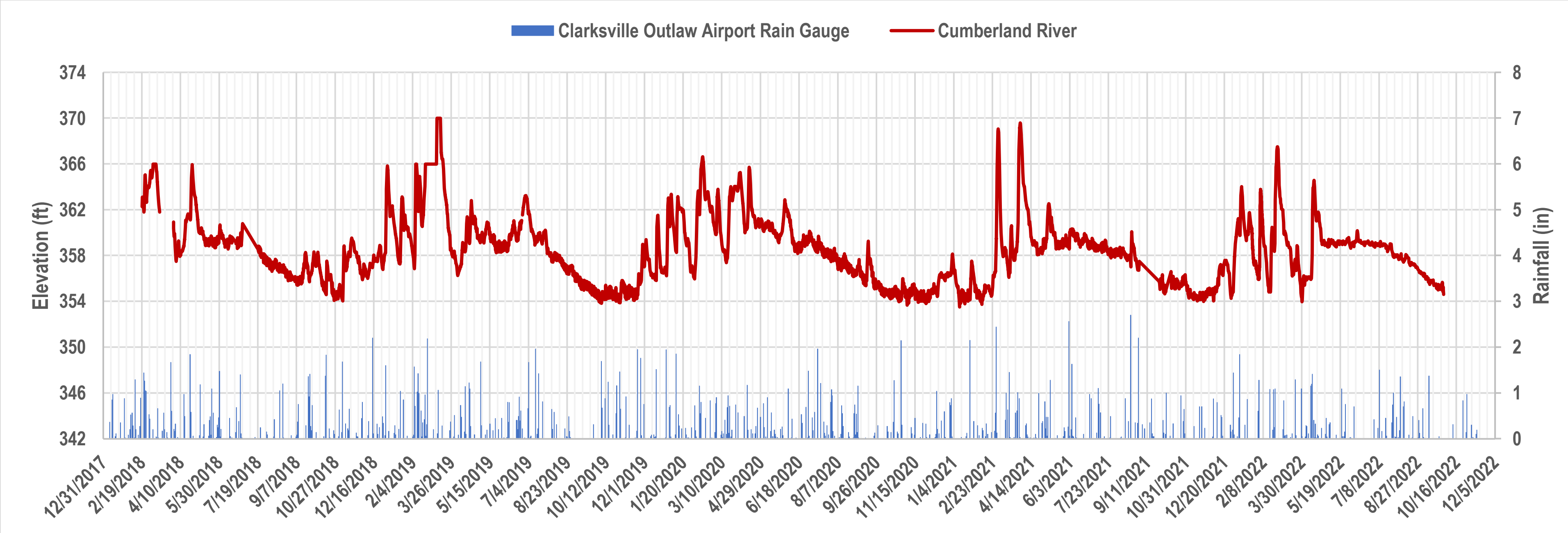

Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
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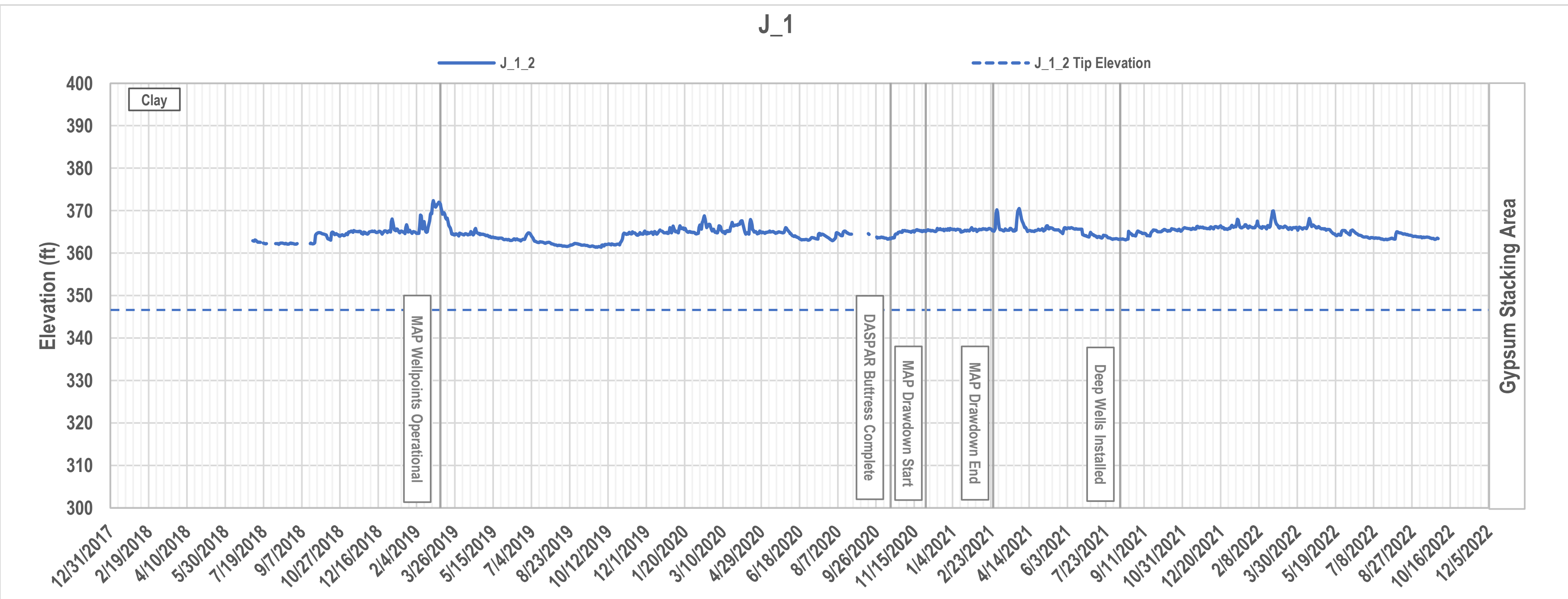

J_1
J_1_2
J_1_2 Tip Elevation
Clay
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
12/31/2017
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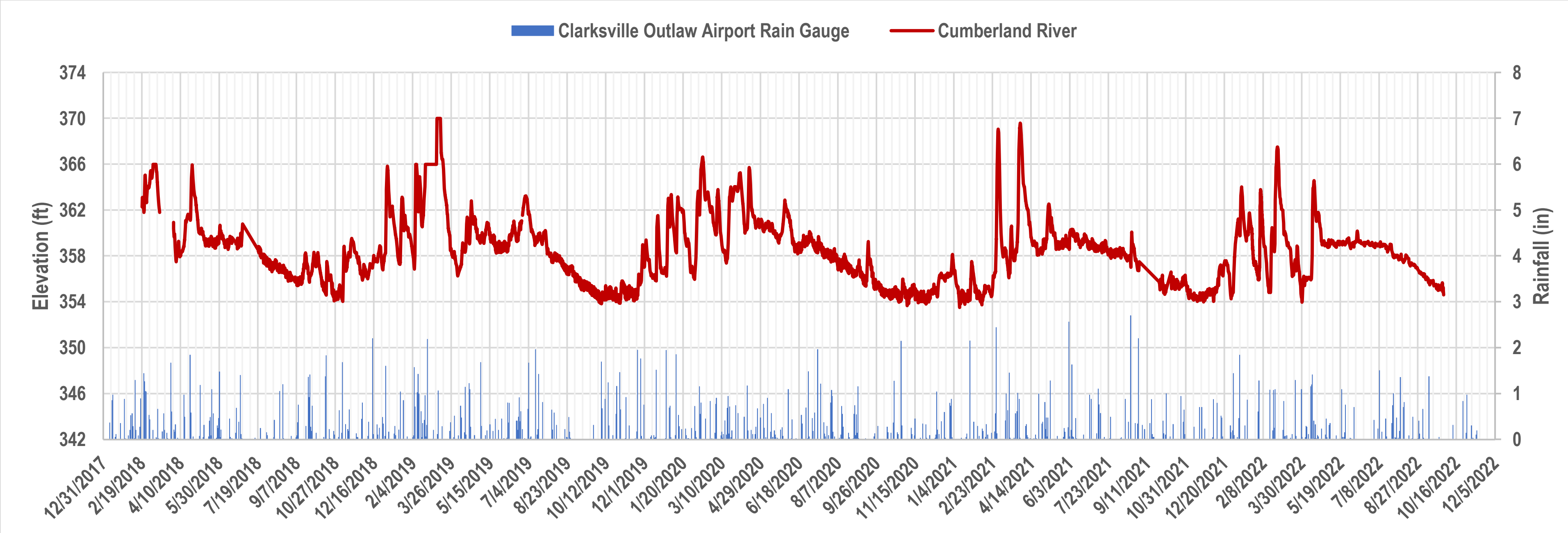
Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
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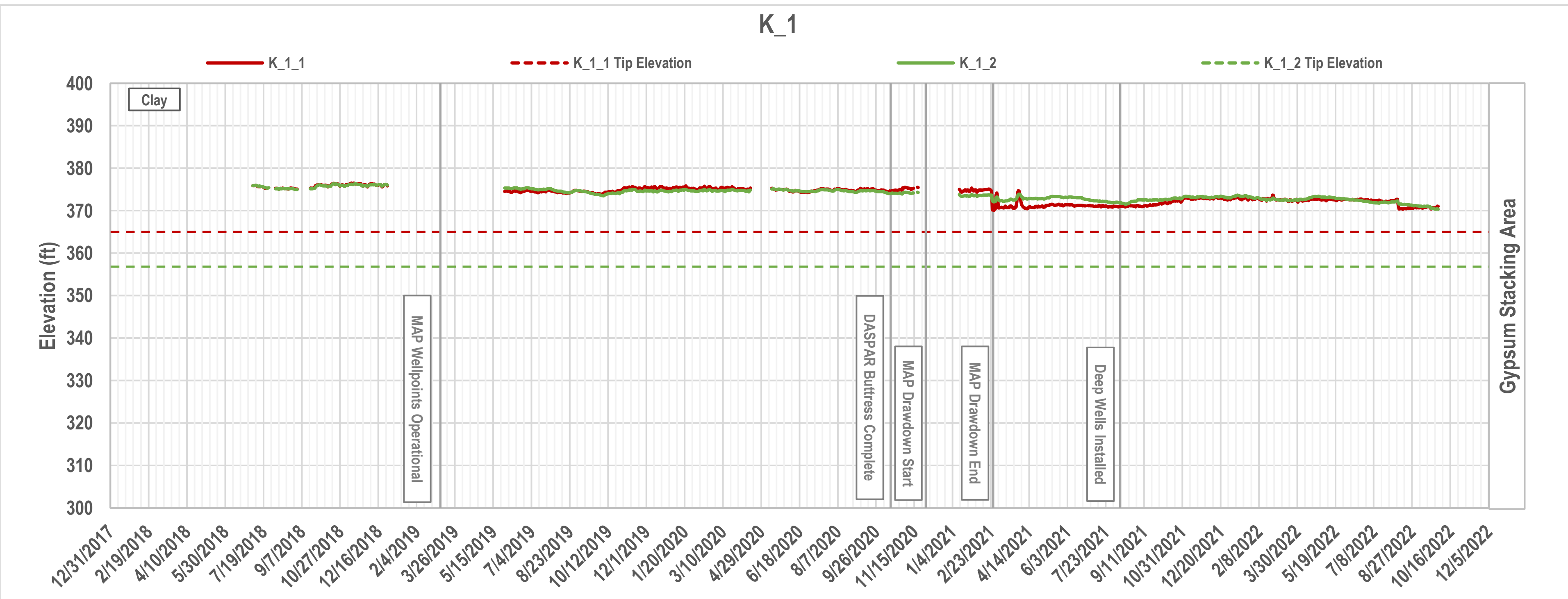
10/16/2022
12/5/2022


K_1
K_1_1
K_1_1 Tip Elevation
K_1_2
K_1_2 Tip Elevation
Clay
Elevation (ft)
400
390
380
370
360
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MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
12/31/2017
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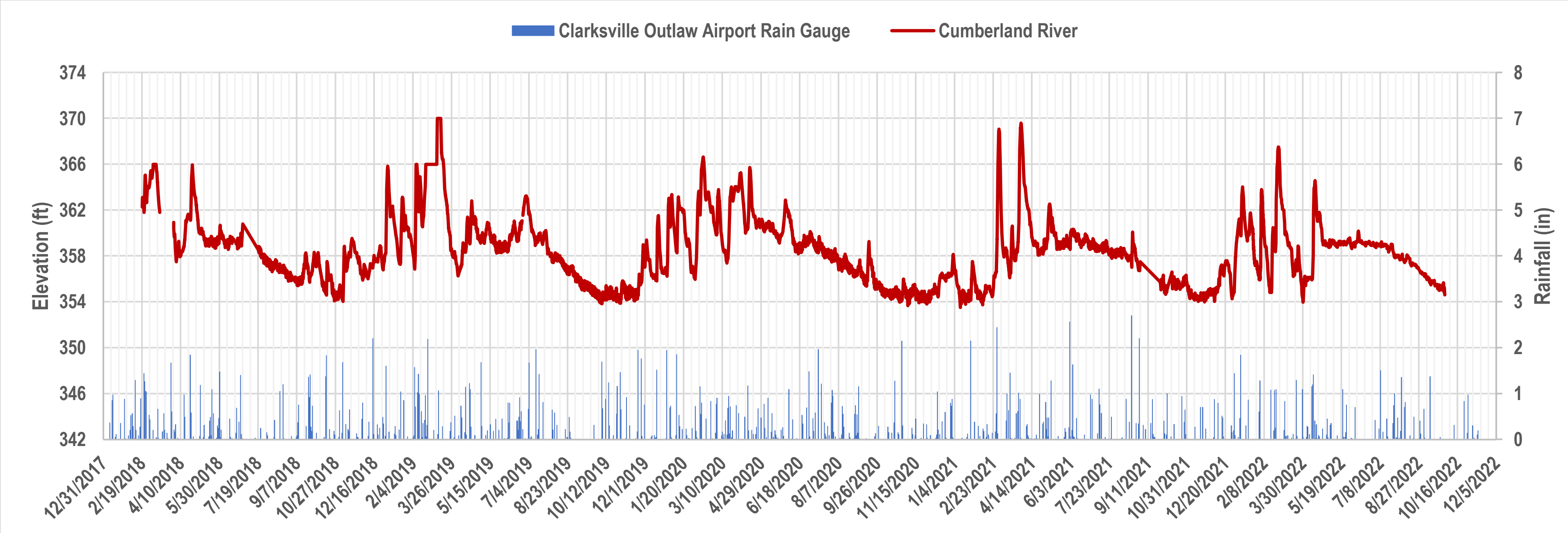

Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
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12/31/2017
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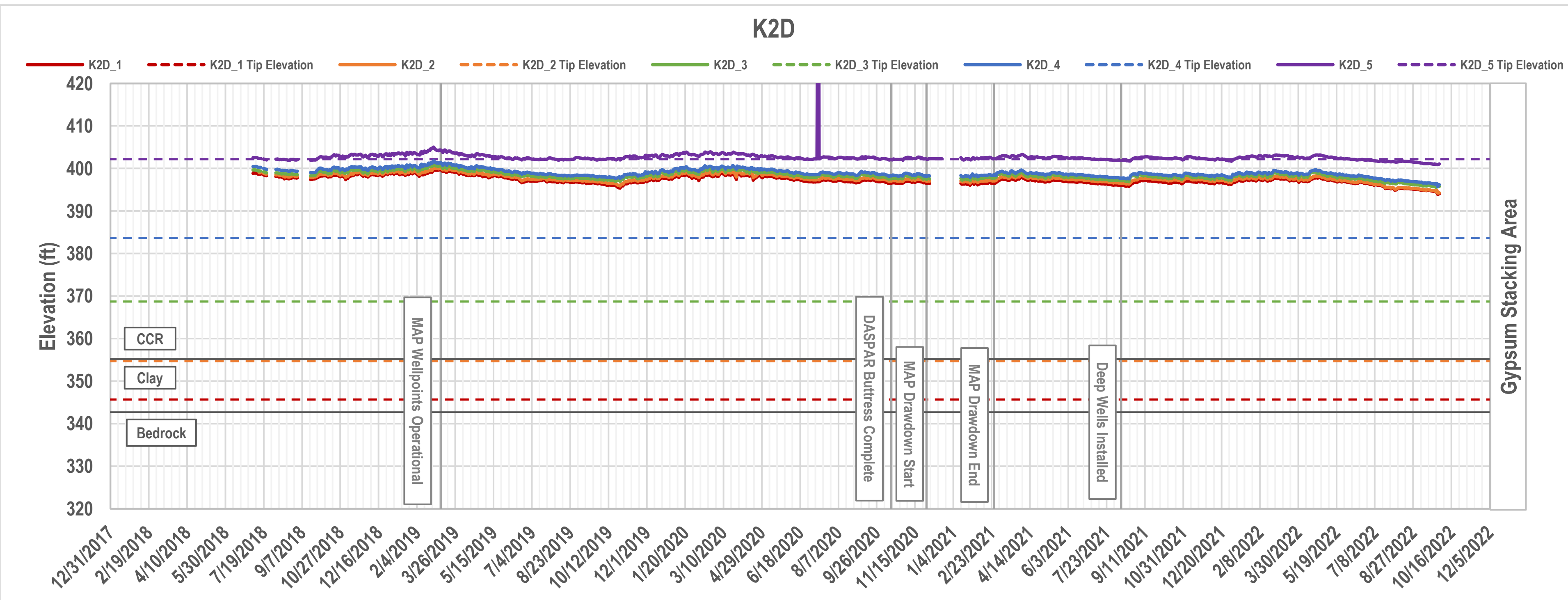

K2D
K2D_1
K2D_1 Tip Elevation
K2D_2
K2D_2 Tip Elevation
K2D_3
K2D_3 Tip Elevation
K2D_4
K2D_4 Tip Elevation
K2D_5
K2D_5 Tip Elevation
Elevation (ft)
420
410
400
390
380
370
360
350
340
330
320
CCR
Clay
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
12/31/2017
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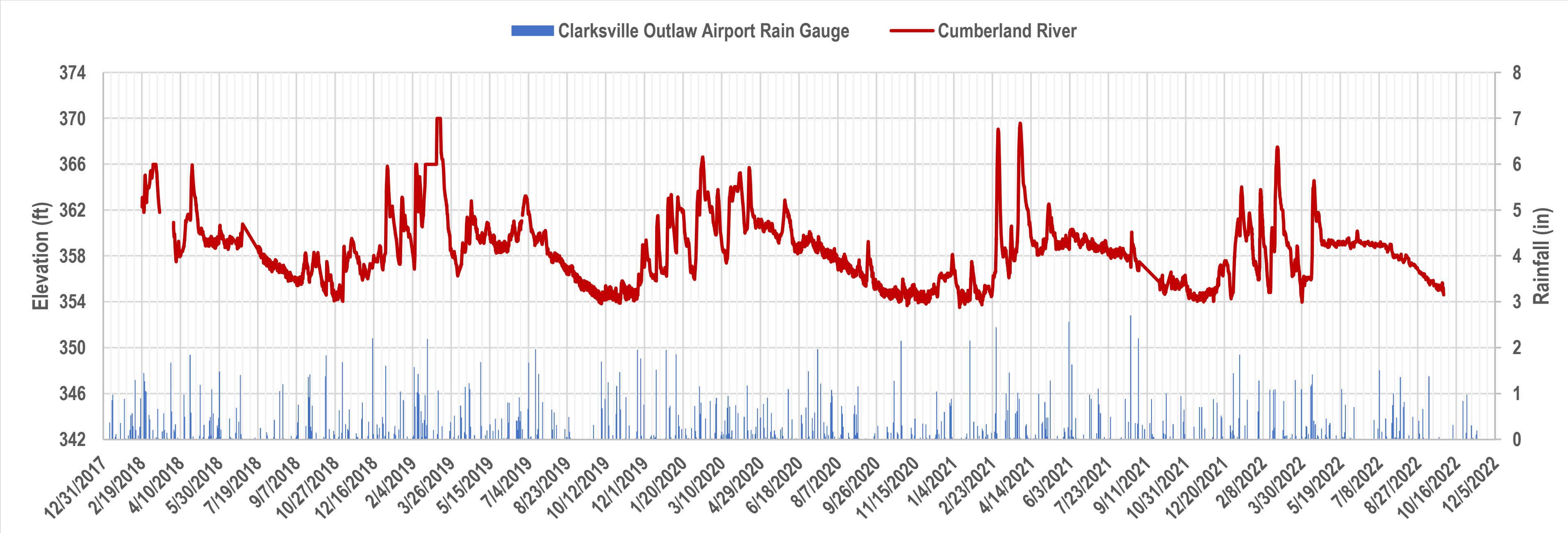

Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
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12/31/2017
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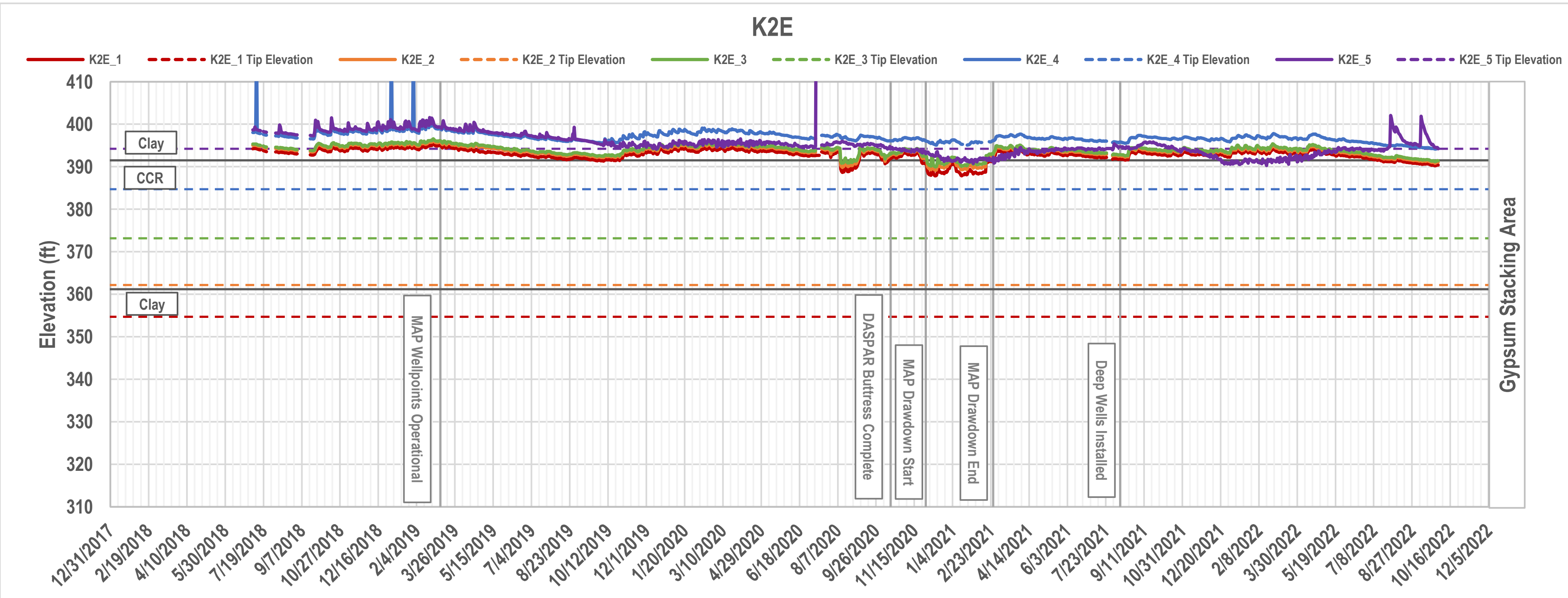

K2E
K2E_1
K2E_1 Tip Elevation
K2E_2
K2E_2 Tip Elevation
K2E_3
K2E_3 Tip Elevation
K2E_4
K2E_4 Tip Elevation
K2E_5
K2E_5 Tip Elevation
Elevation (ft)
410
400
390
380
370
360
350
340
330
320
310
Clay
CCR
Clay
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
12/31/2017
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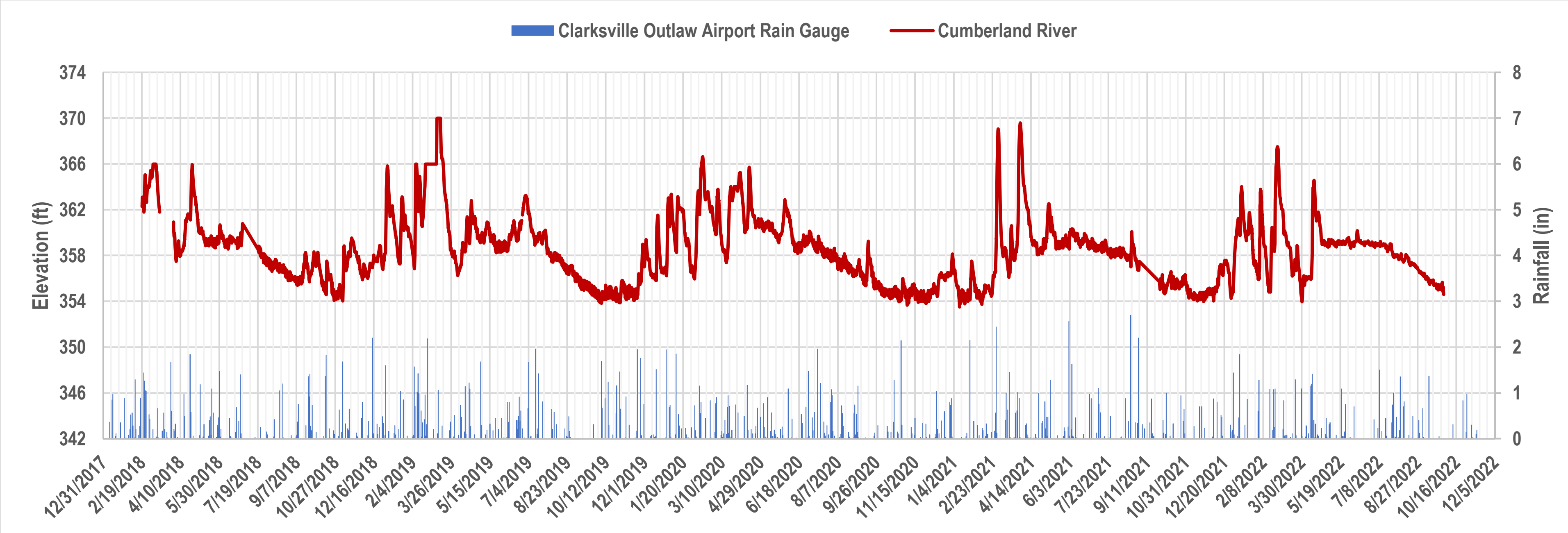

Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
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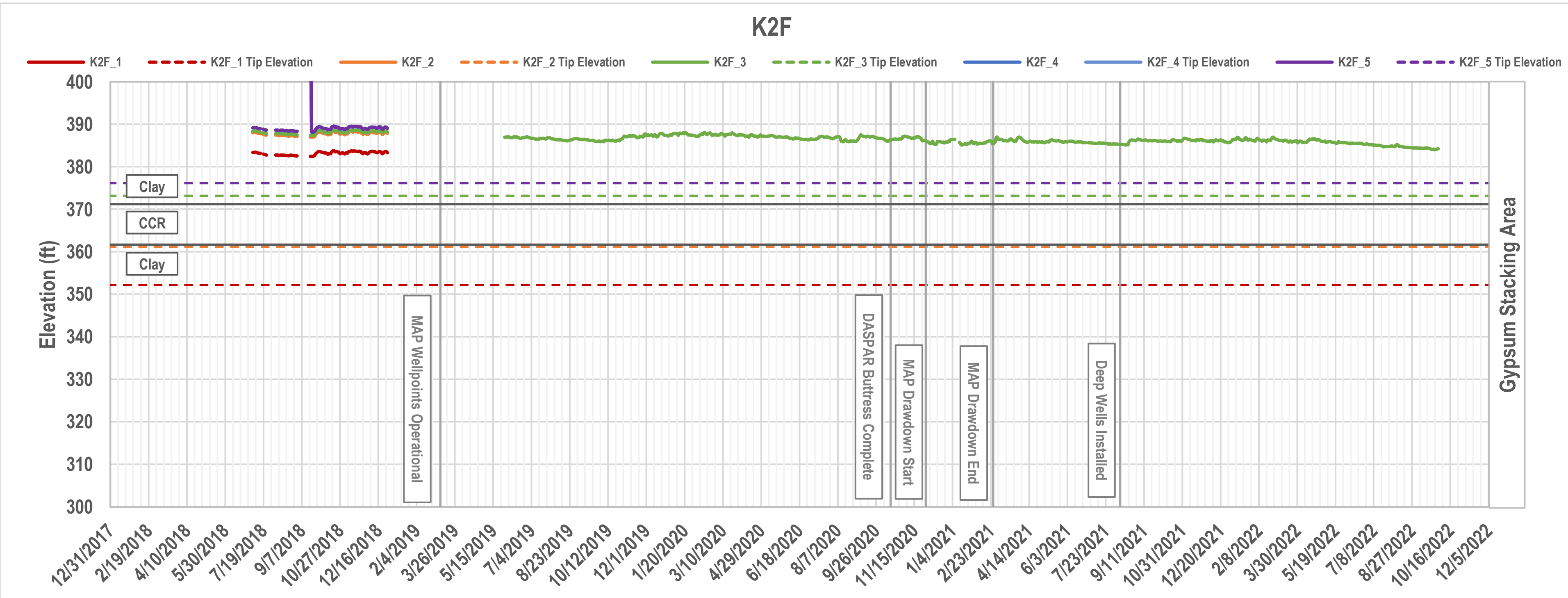

K2F
K2F_1
K2F_1 Tip Elevation
K2F_2
K2F_2 Tip Elevation
K2F_3
K2F_3 Tip Elevation
K2F_4
K2F_4 Tip Elevation
K2F_5
K2F_5 Tip Elevation
Elevation (ft)
400
390
380
370
360
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340
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310
300
Clay
CCR
Clay
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
12/31/2017
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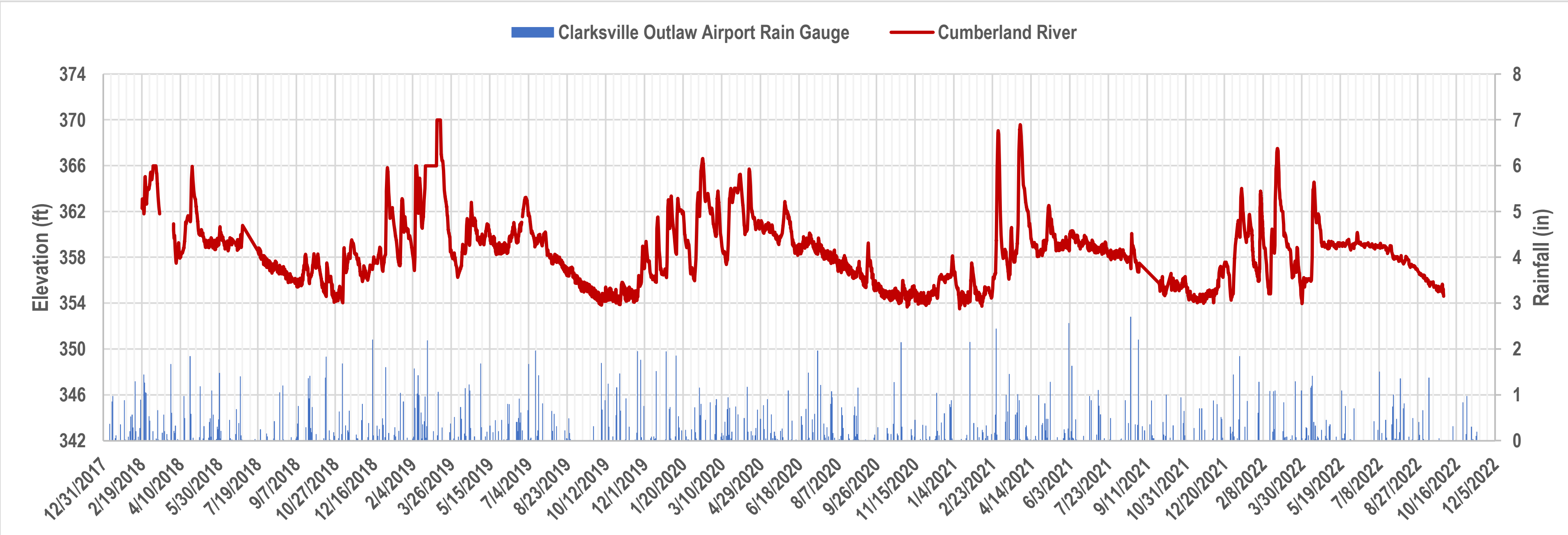

Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
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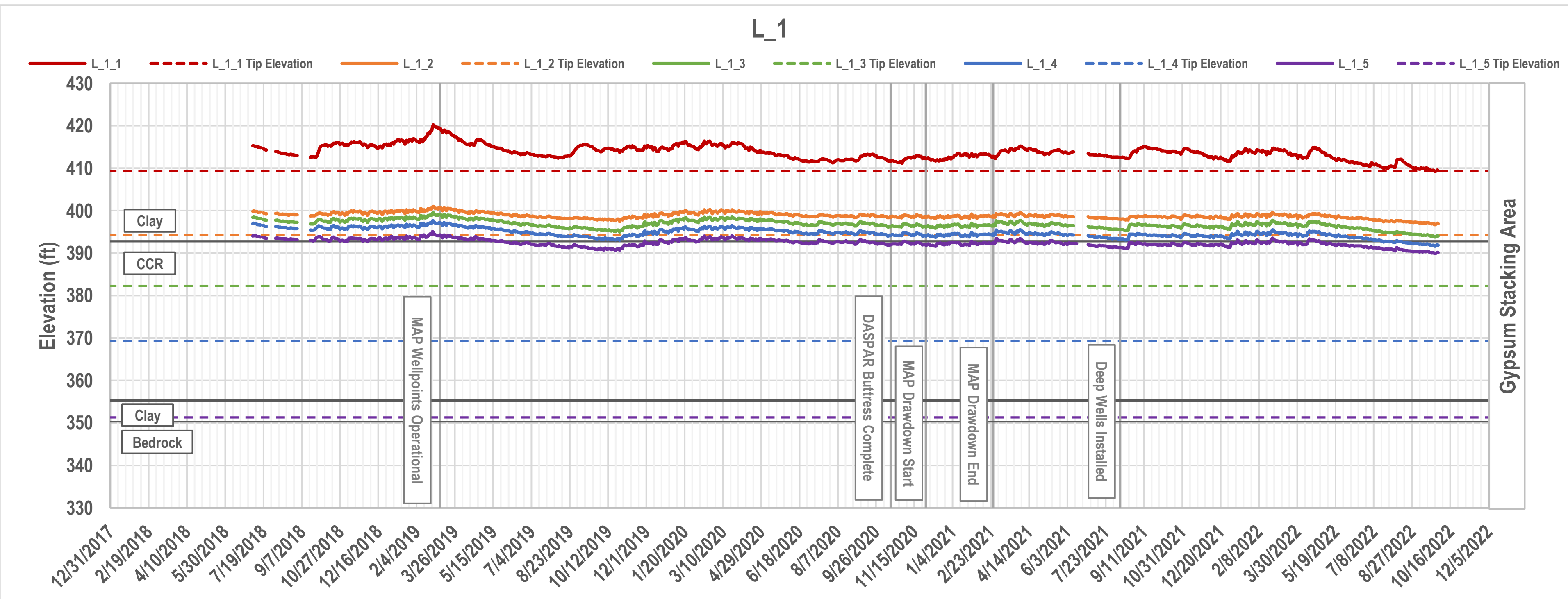

L_1
L_1_1
L_1_1 Tip Elevation
L_1_2
L_1_2 Tip Elevation
L_1_3
L_1_3 Tip Elevation
L_1_4
L_1_4 Tip Elevation
L_1_5
L_1_5 Tip Elevation
Elevation (ft)
430
420
410
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Clay
CCR
Clay
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
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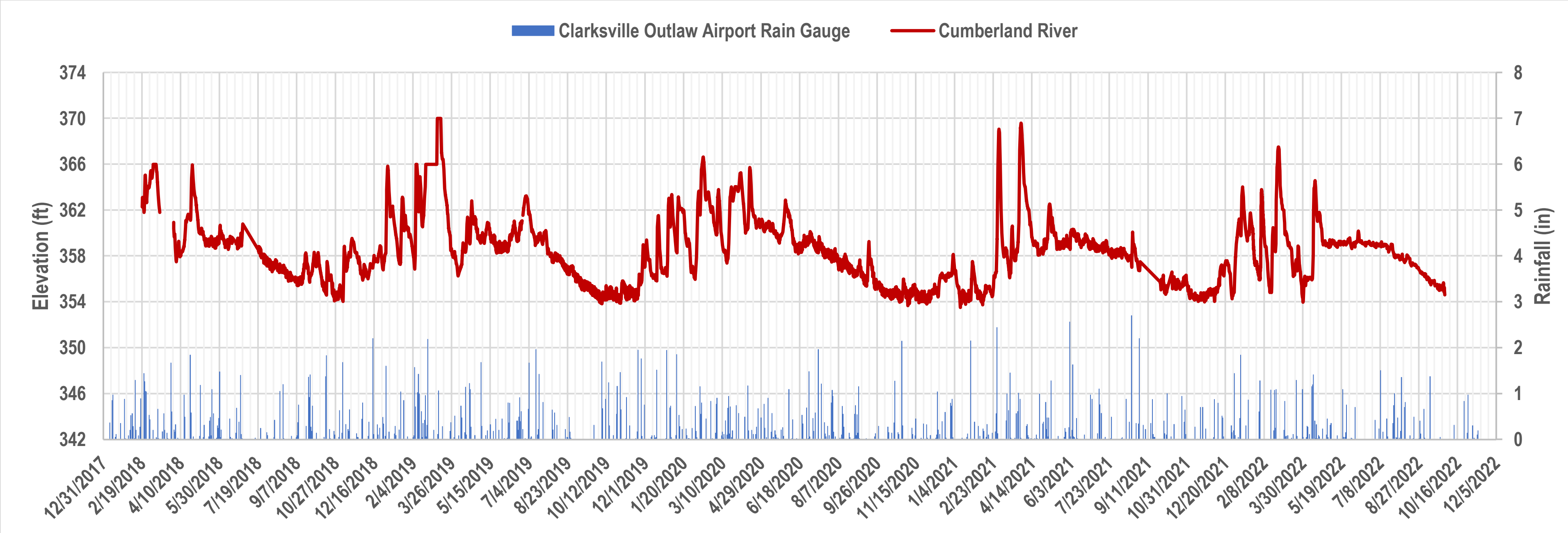

Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
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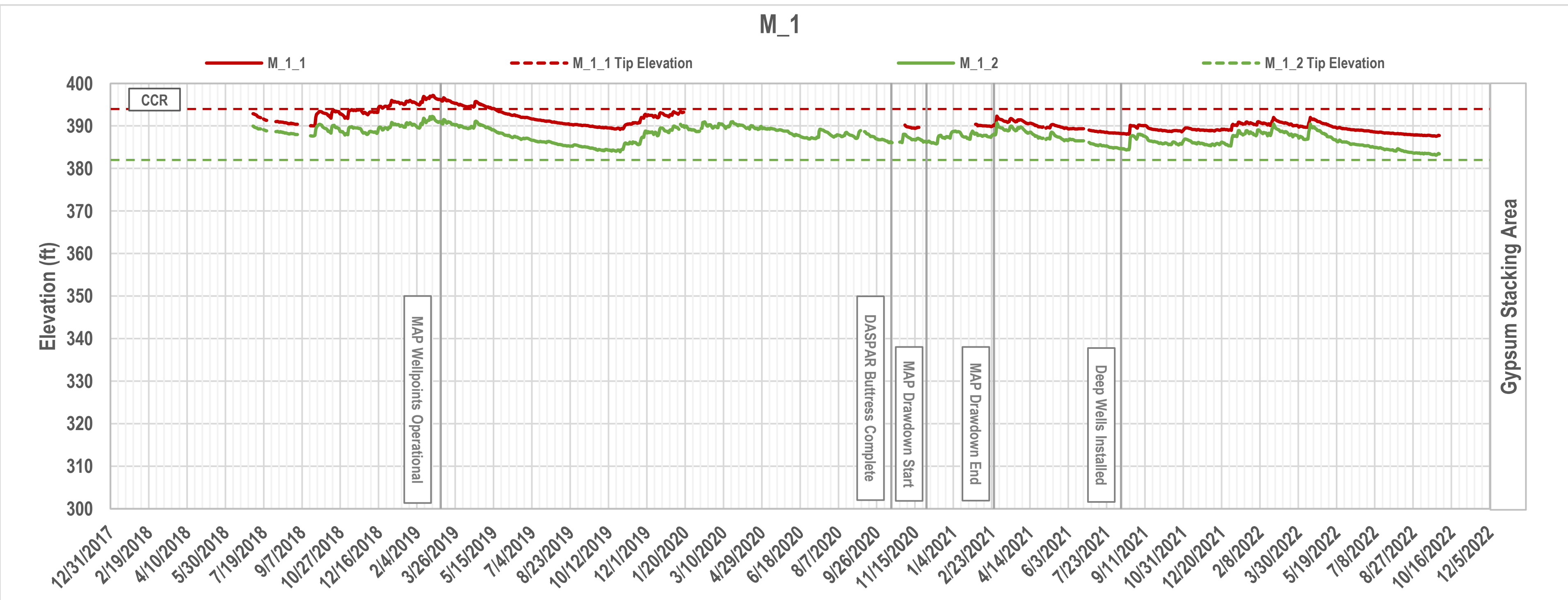
10/16/2022
12/5/2022



M_1
M_1_1
M_1_1 Tip Elevation
M_1_2
M_1_2 Tip Elevation
CCR
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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3/30/2022
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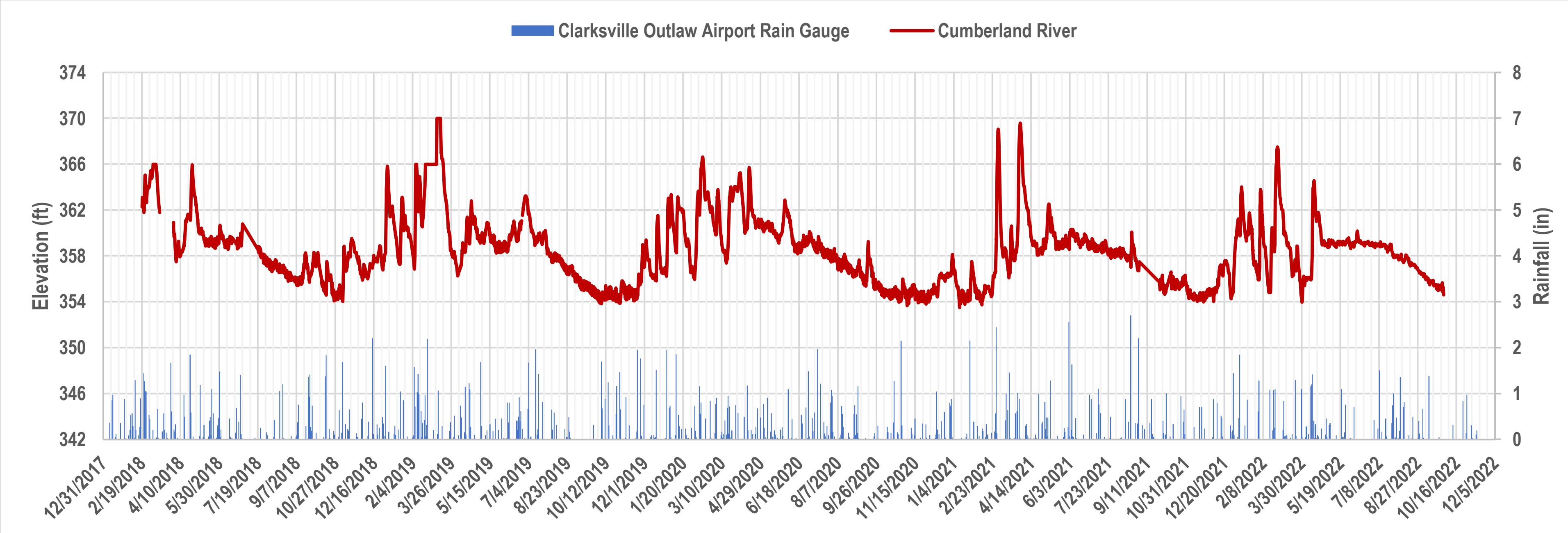
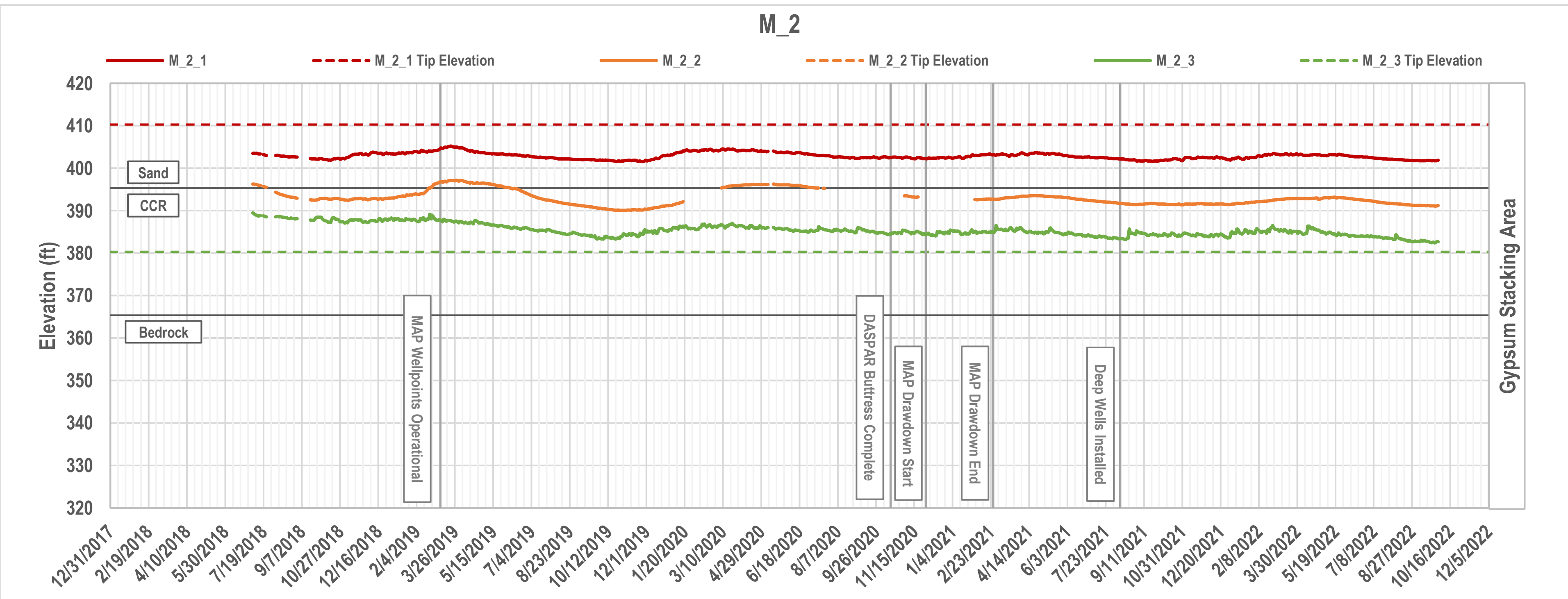
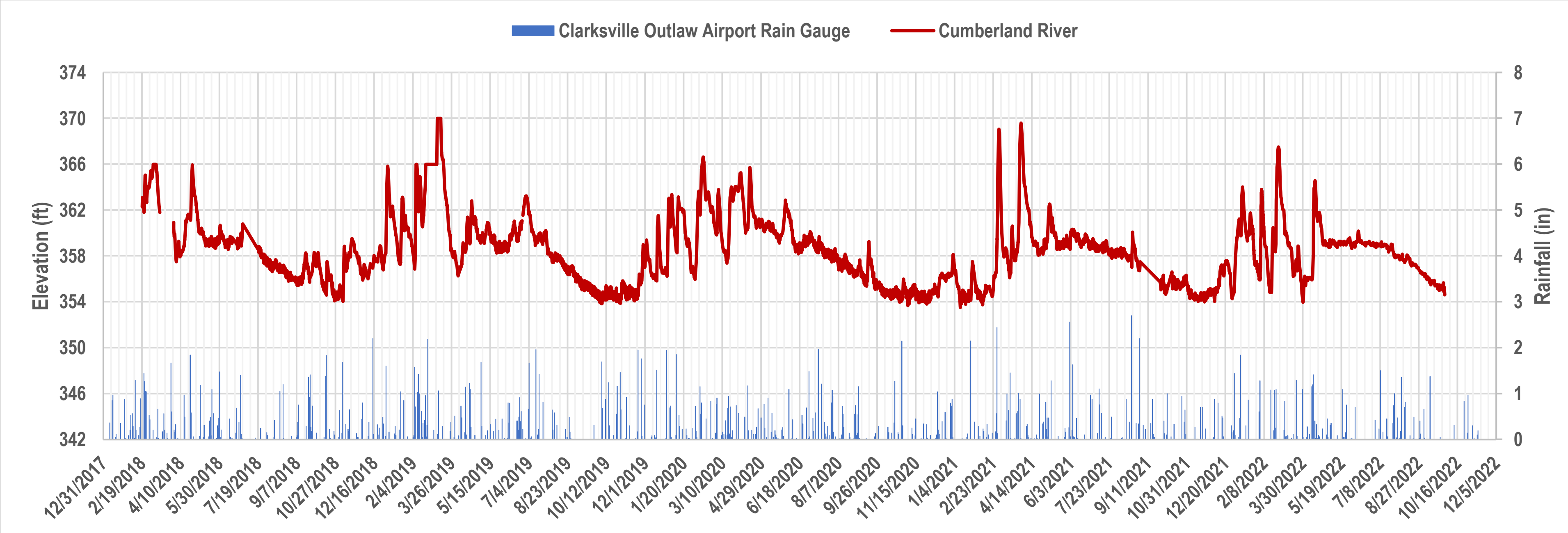
7/8/2022
8/27/2022
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)



M_2
M_2_1
M_2_1 Tip Elevation
M_2_2
M_2_2 Tip Elevation
M_2_3
M_2_3 Tip Elevation
Sand
CCR
Bedrock
Elevation (ft)
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area


Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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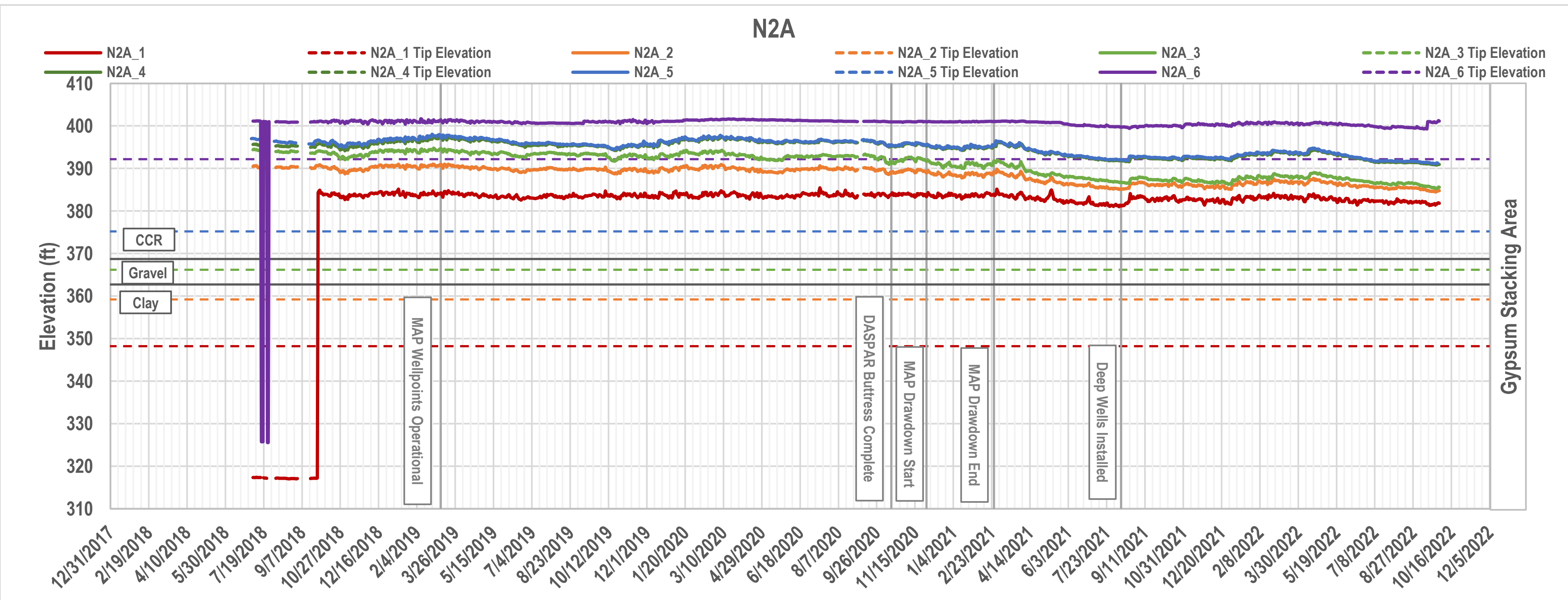
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022


N2A
N2A_1
N2A_1 Tip Elevation
N2A_2
N2A_2 Tip Elevation
N2A_3
N2A_3 Tip Elevation
N2A_4
N2A_4 Tip Elevation
N2A_5
N2A_5 Tip Elevation
N2A_6
N2A_6 Tip Elevation
Elevation (ft)
410
400
390
380
370
360
350
340
330
320
310
CCR
Gravel
Clay
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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3/30/2022
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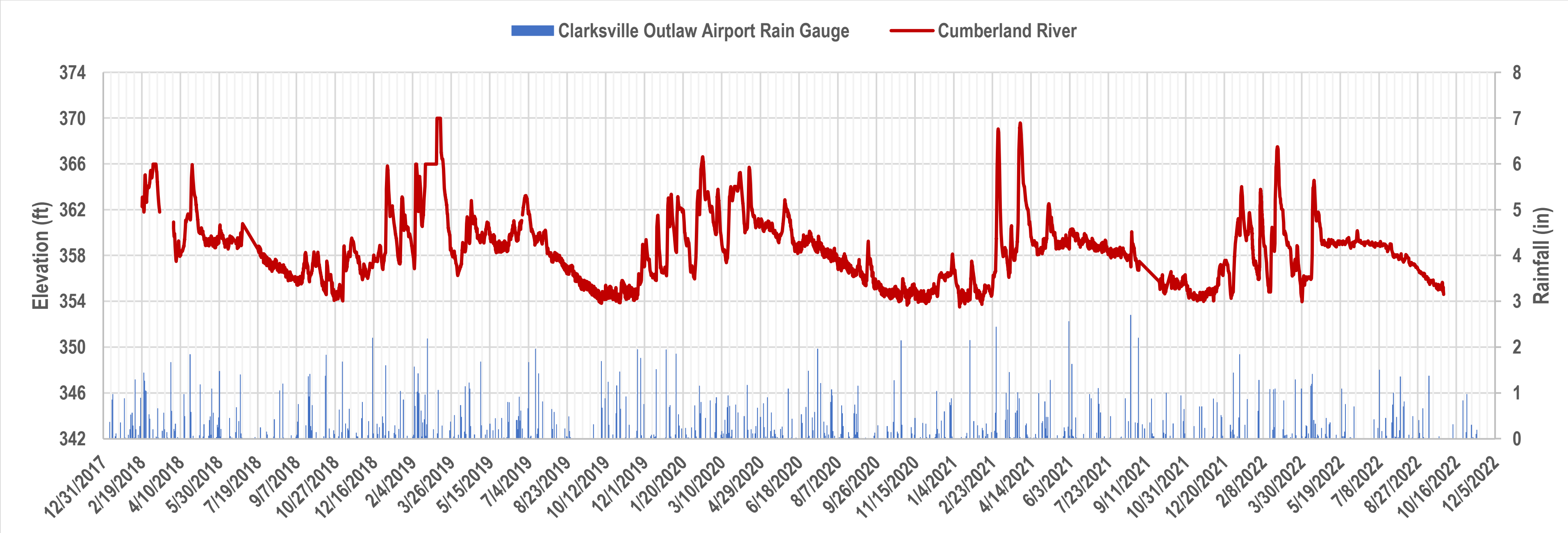
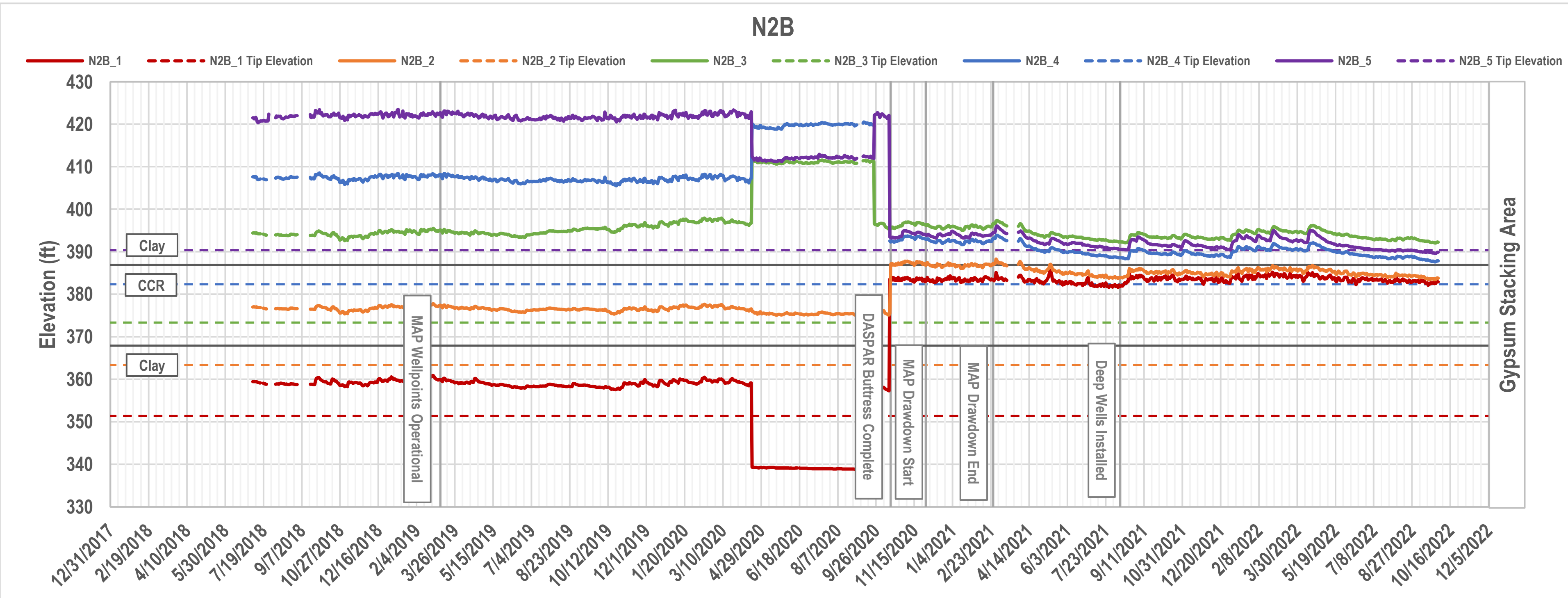
7/8/2022
8/27/2022
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022



N2B
N2B_1
N2B_1 Tip Elevation
N2B_2
N2B_2 Tip Elevation
N2B_3
N2B_3 Tip Elevation
N2B_4
N2B_4 Tip Elevation
N2B_5
N2B_5 Tip Elevation
Elevation (ft)
430
420
410
400
390
380
370
360
350
340
330
Clay
CCR
Clay
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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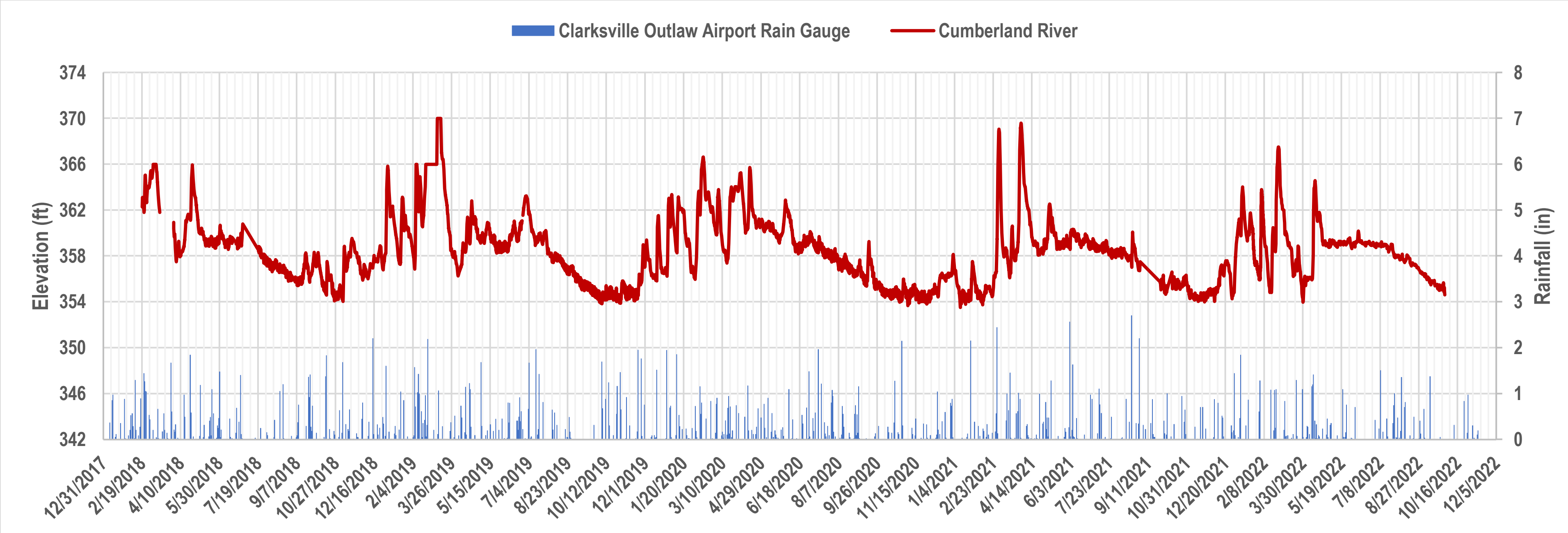
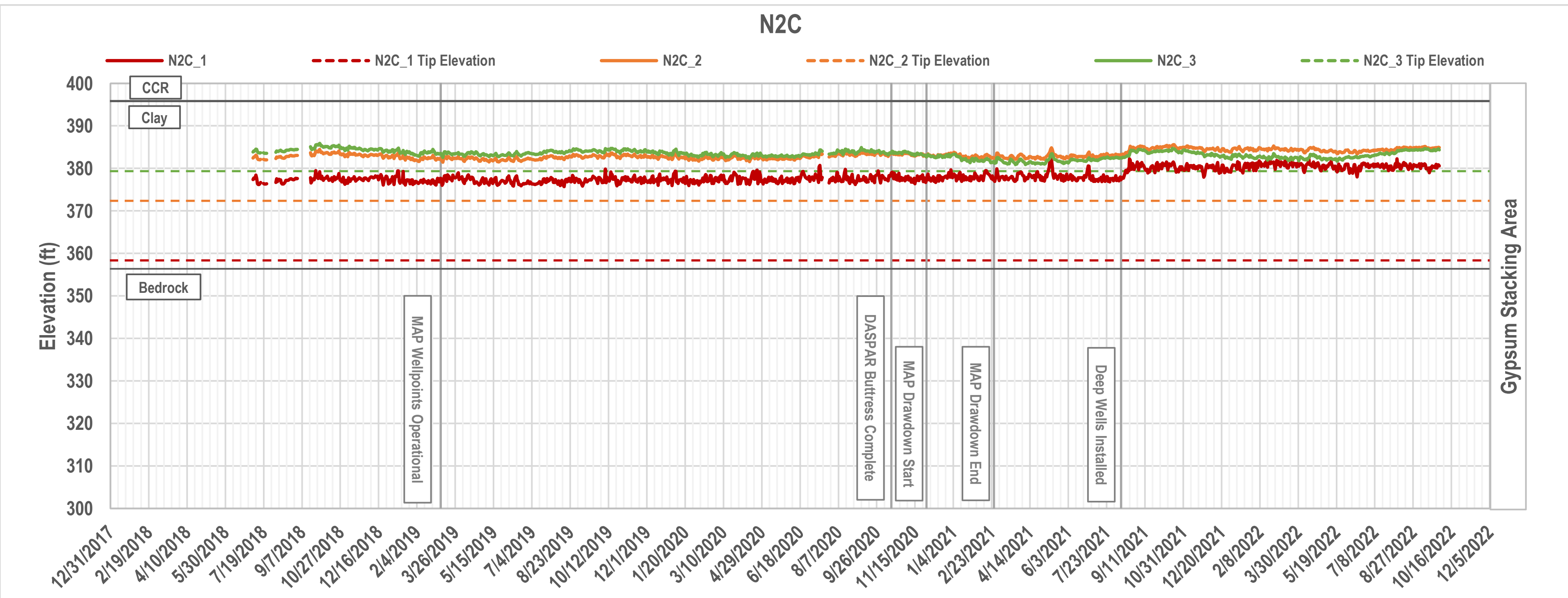
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022



N2C
N2C_1
N2C_1 Tip Elevation
N2C_2
N2C_2 Tip Elevation
N2C_3
N2C_3 Tip Elevation
CCR
Clay
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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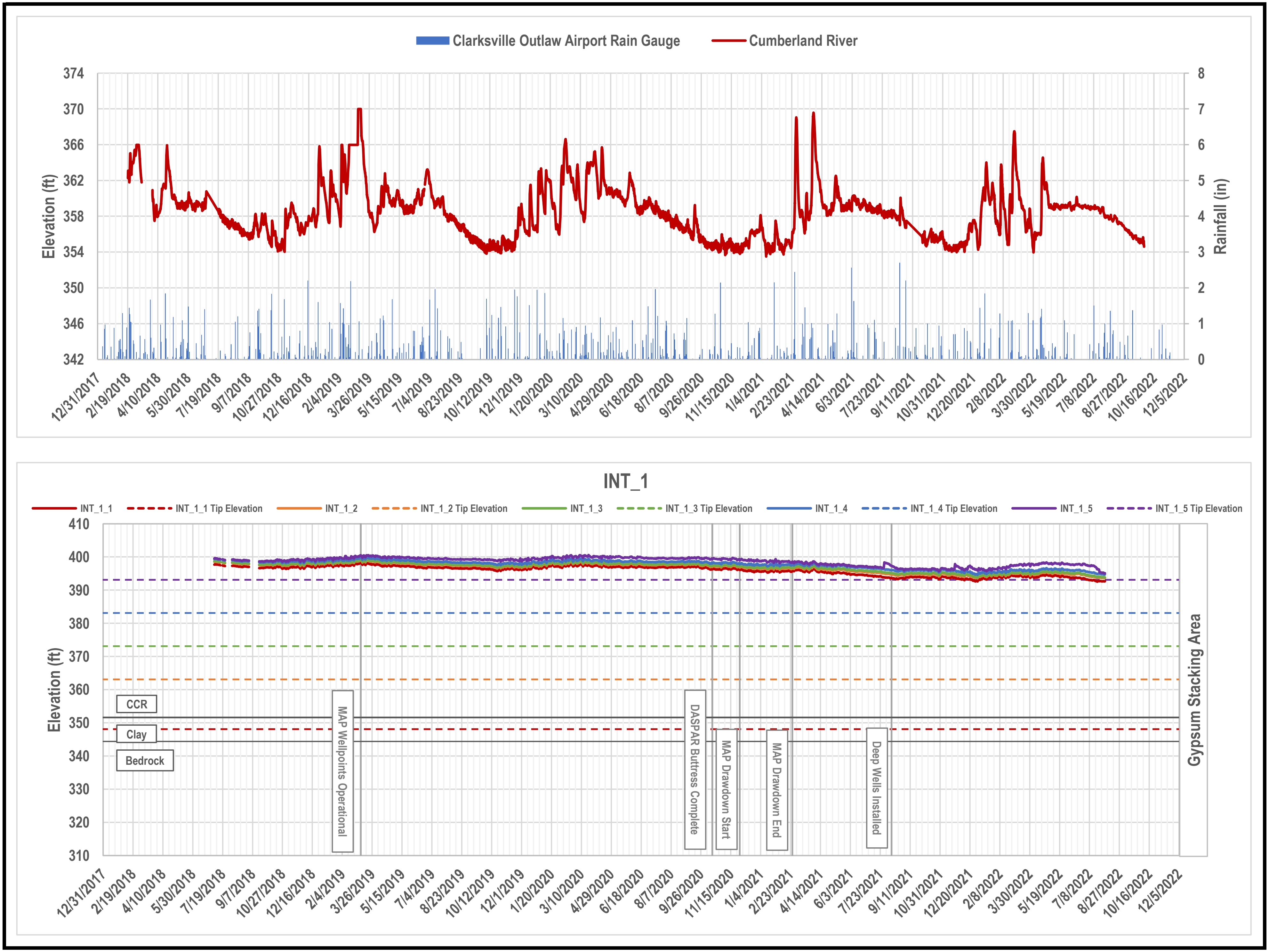
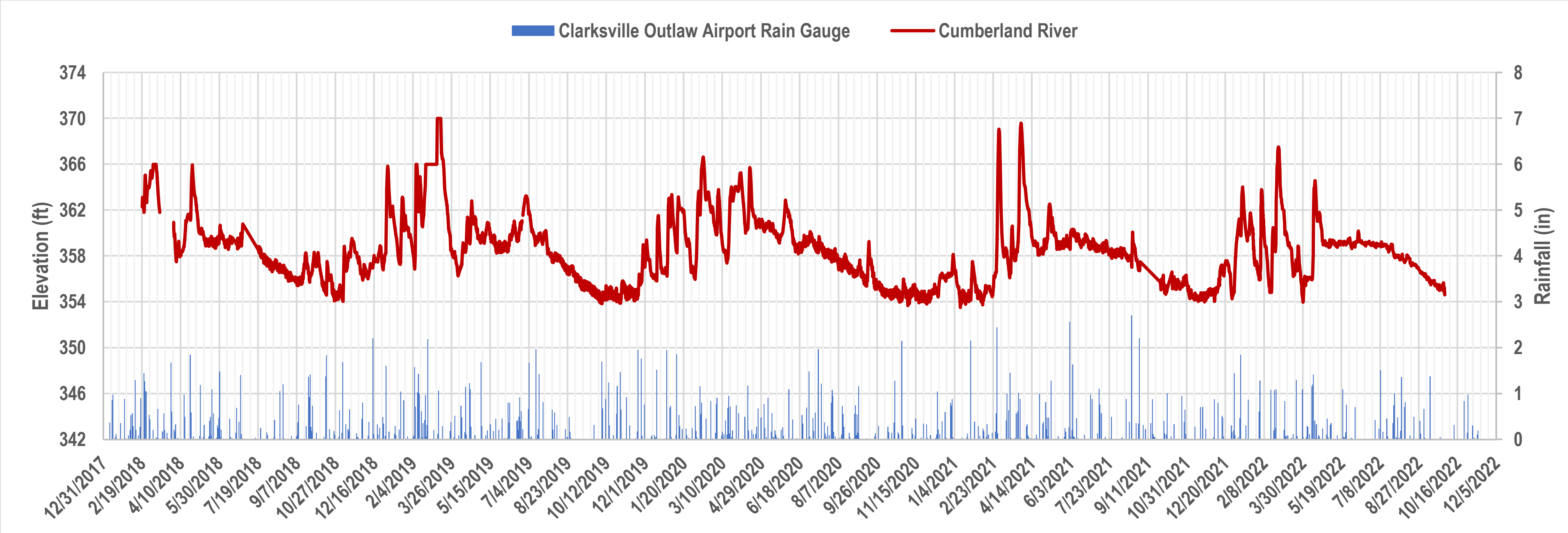
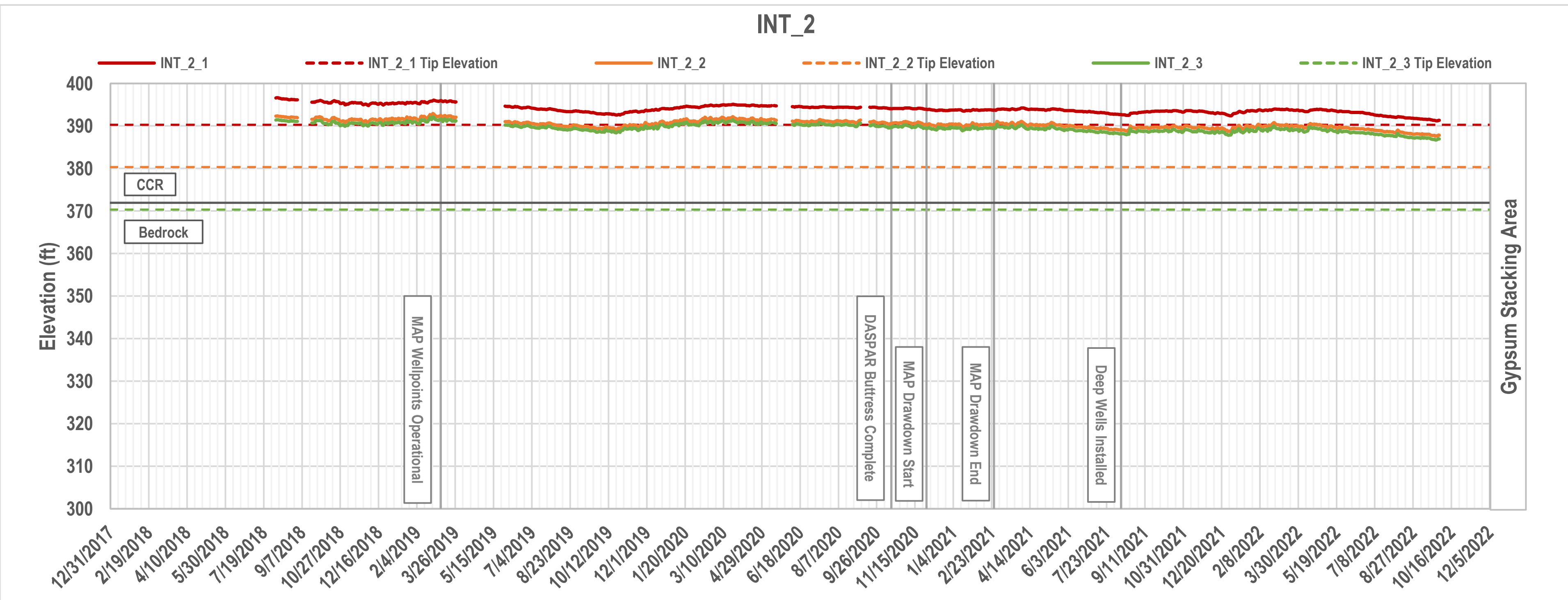
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022


Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
INT_1
INT_1_1
INT_1_1 Tip Elevation
INT_1_2
INT_1_2 Tip Elevation
INT_1_3
INT_1_3 Tip Elevation
INT_1_4
INT_1_4 Tip Elevation
INT_1_5
INT_1_5 Tip Elevation
CCR
Clay
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022



INT_2
INT_2_1
INT_2_1 Tip Elevation
INT_2_2
INT_2_2 Tip Elevation
INT_2_3
INT_2_3 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
CCR
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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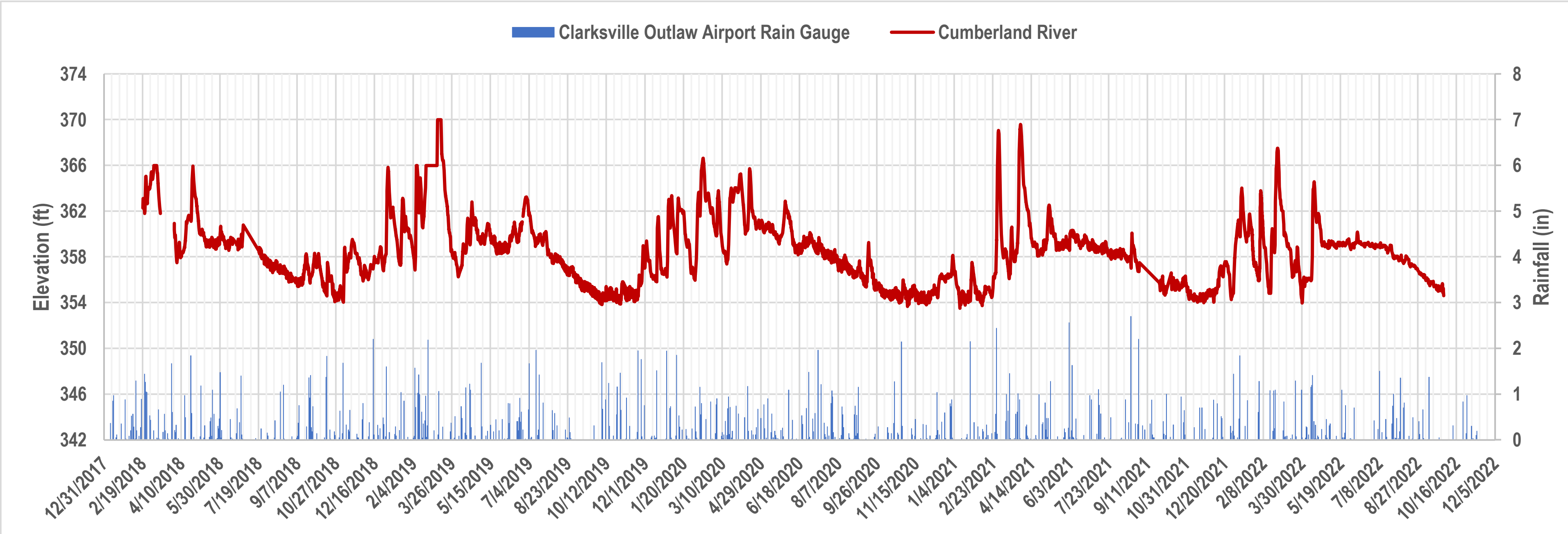
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
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10/31/2021
12/20/2021
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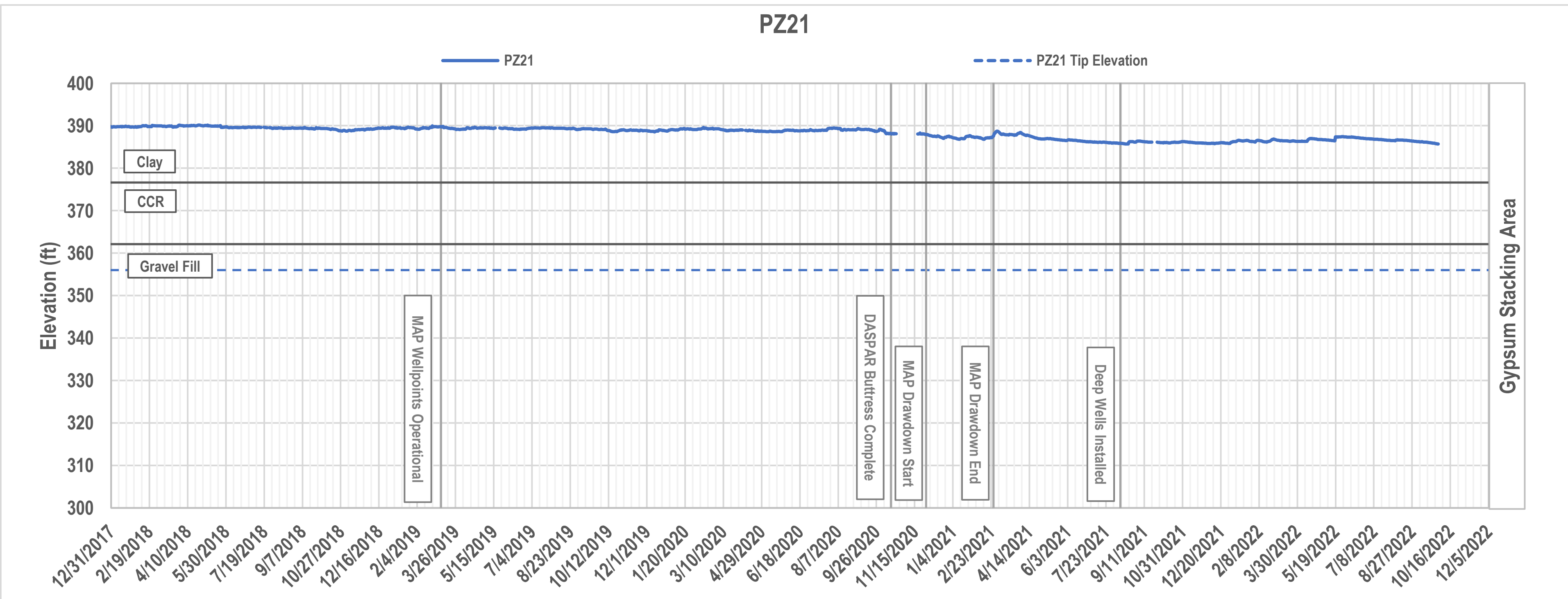
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022



PZ21
PZ21
PZ21 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
Clay
CCR
Gravel Fill
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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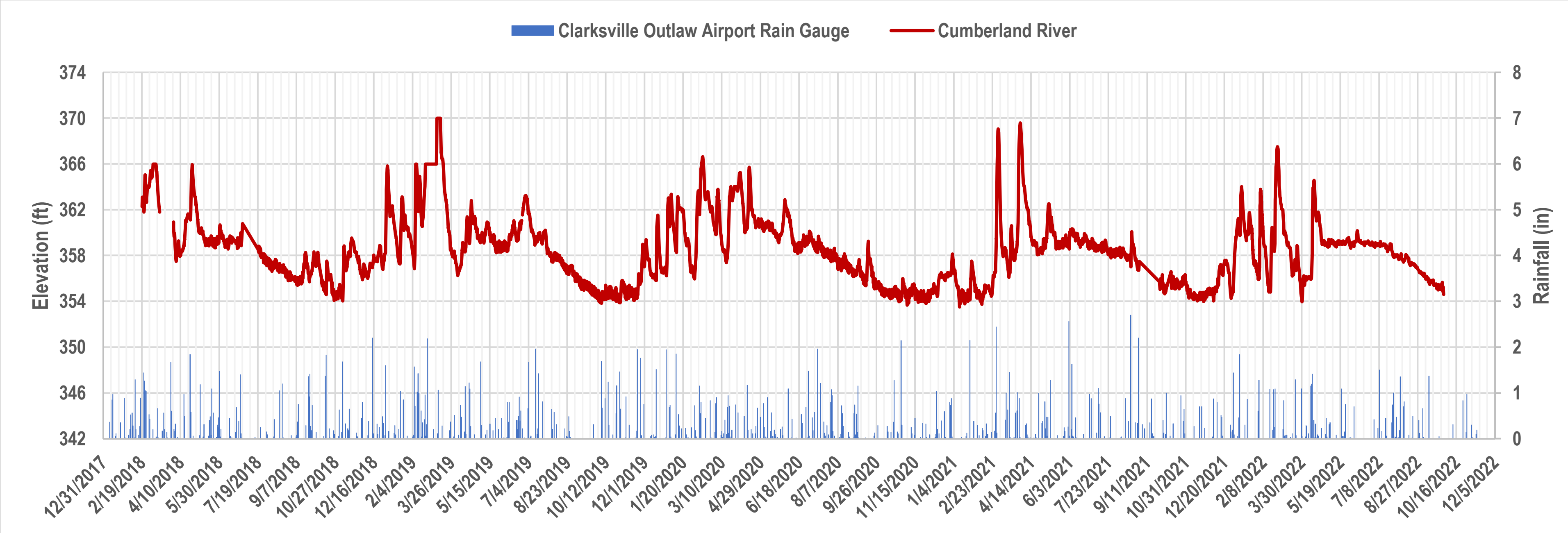
8/27/2022
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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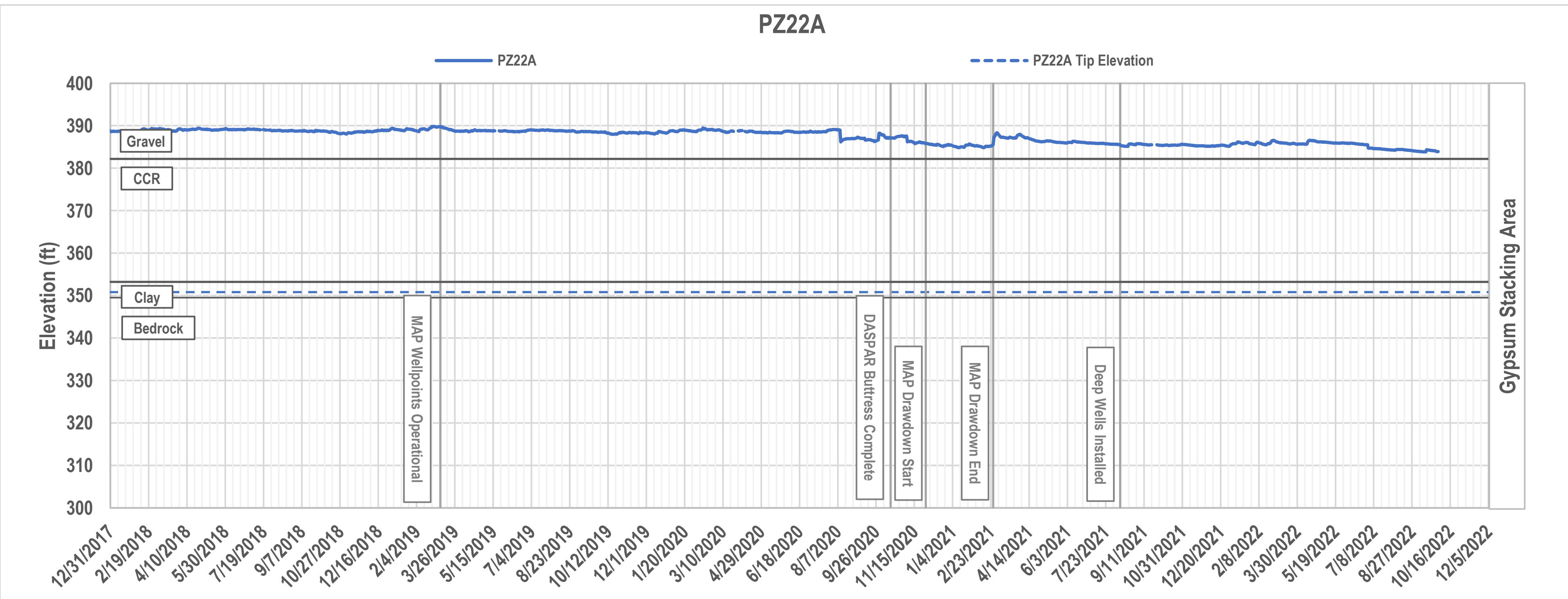
7/8/2022
8/27/2022
10/16/2022
12/5/2022



PZ22A
PZ22A
PZ22A Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
Gravel
CCR
Clay
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
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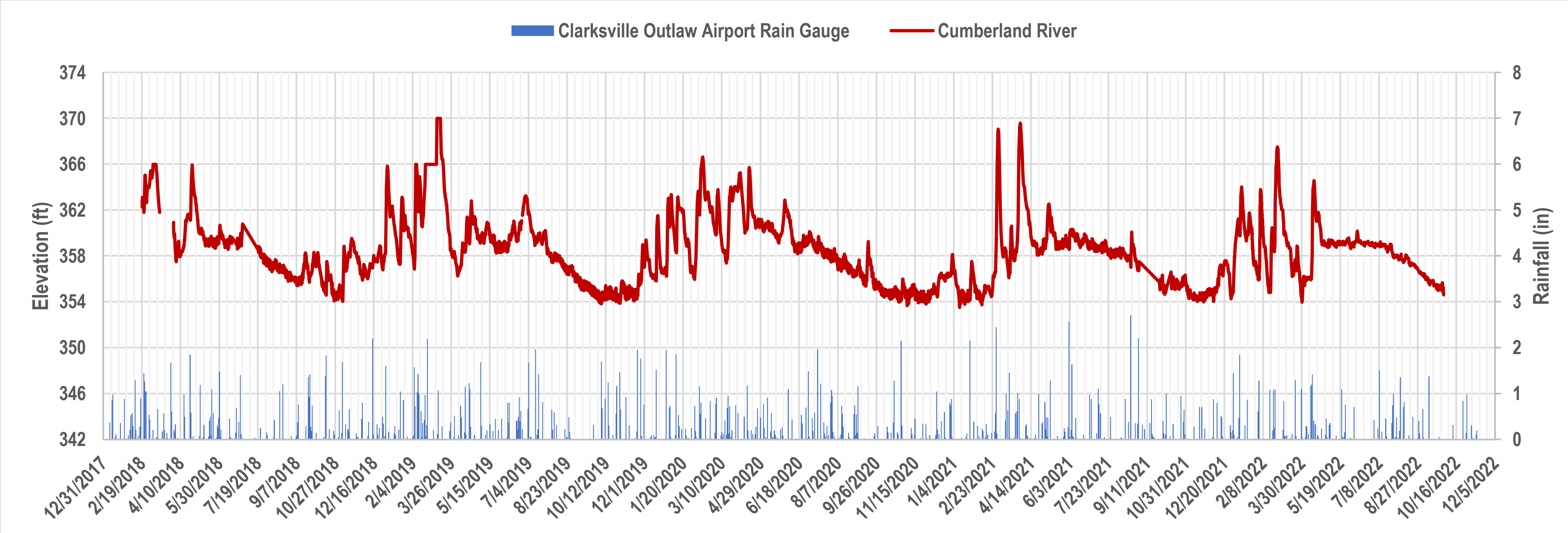
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
2/8/2022
3/30/2022
5/19/2022
7/8/2022
8/27/2022
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
362
358
354
350
346
342
8
7
6
5
4
3
2
1
0
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
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7/23/2021
9/11/2021
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12/20/2021
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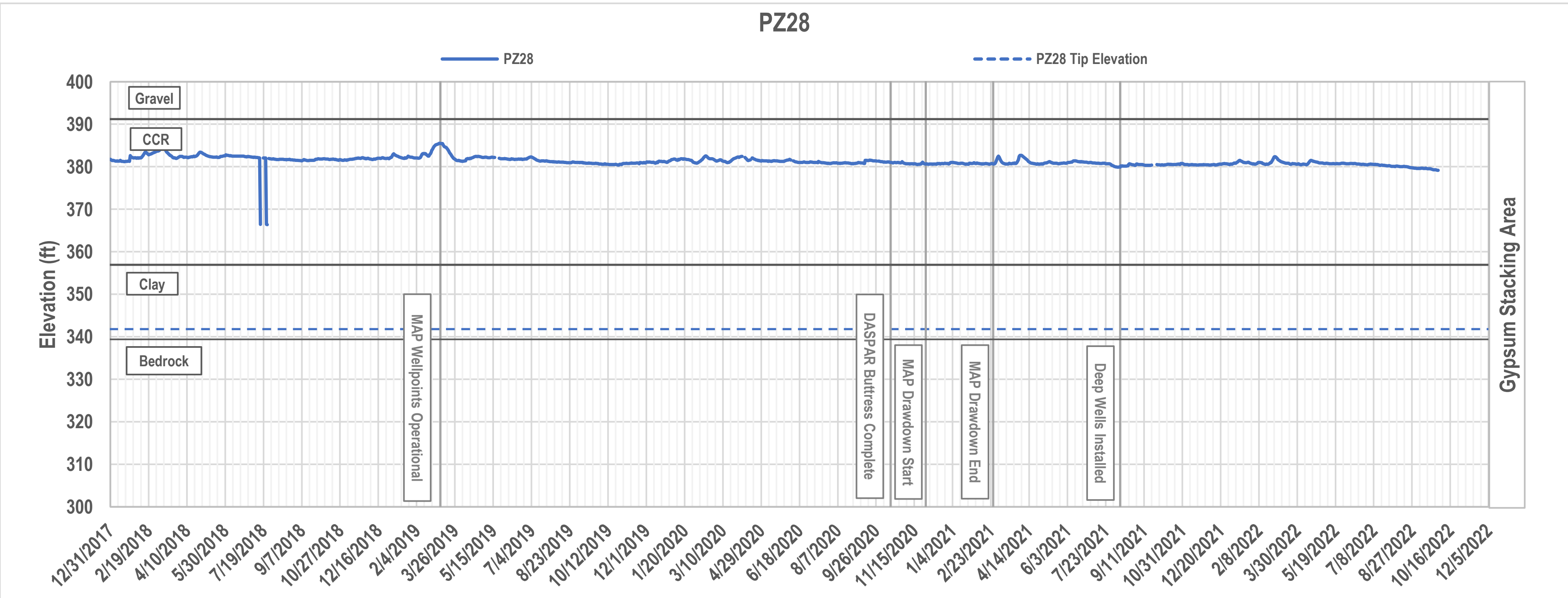
7/8/2022
8/27/2022
10/16/2022
12/5/2022



PZ28
PZ28
PZ28 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
Gravel
CCR
Clay
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
6/3/2021
7/23/2021
9/11/2021
10/31/2021
12/20/2021
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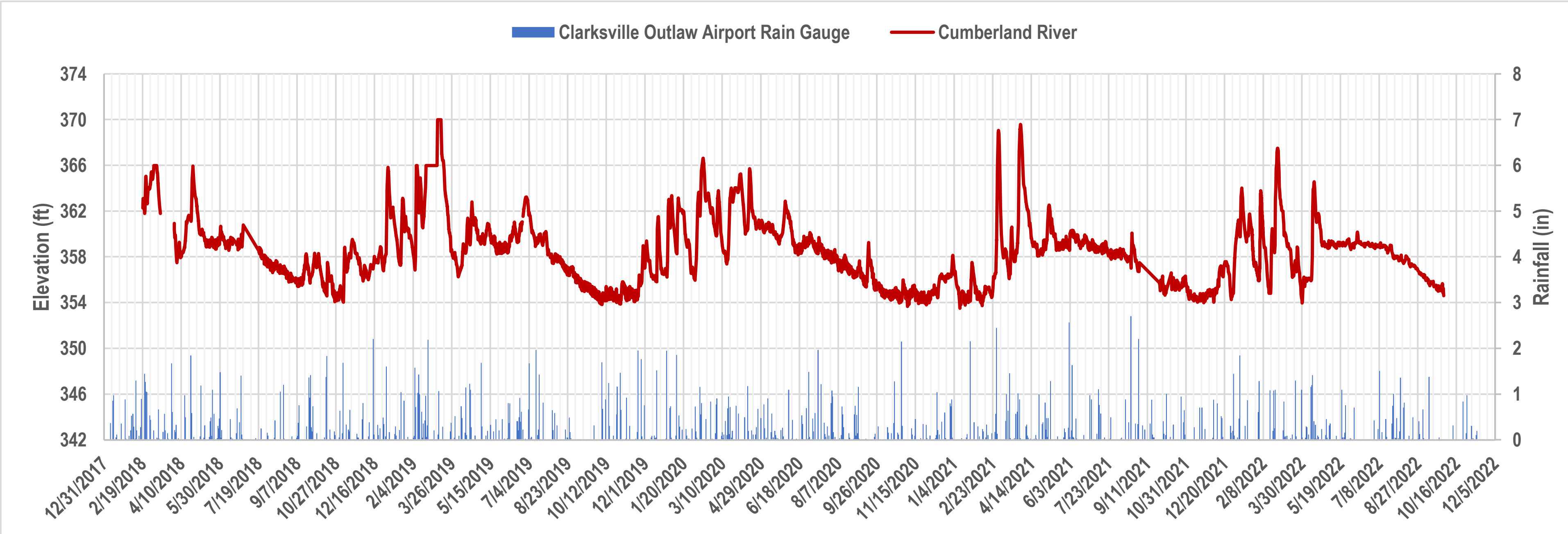
10/16/2022
12/5/2022



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
366
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358
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346
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12/31/2017
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10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
10/12/2019
12/1/2019
1/20/2020
3/10/2020
4/29/2020
6/18/2020
8/7/2020
9/26/2020
11/15/2020
1/4/2021
2/23/2021
4/14/2021
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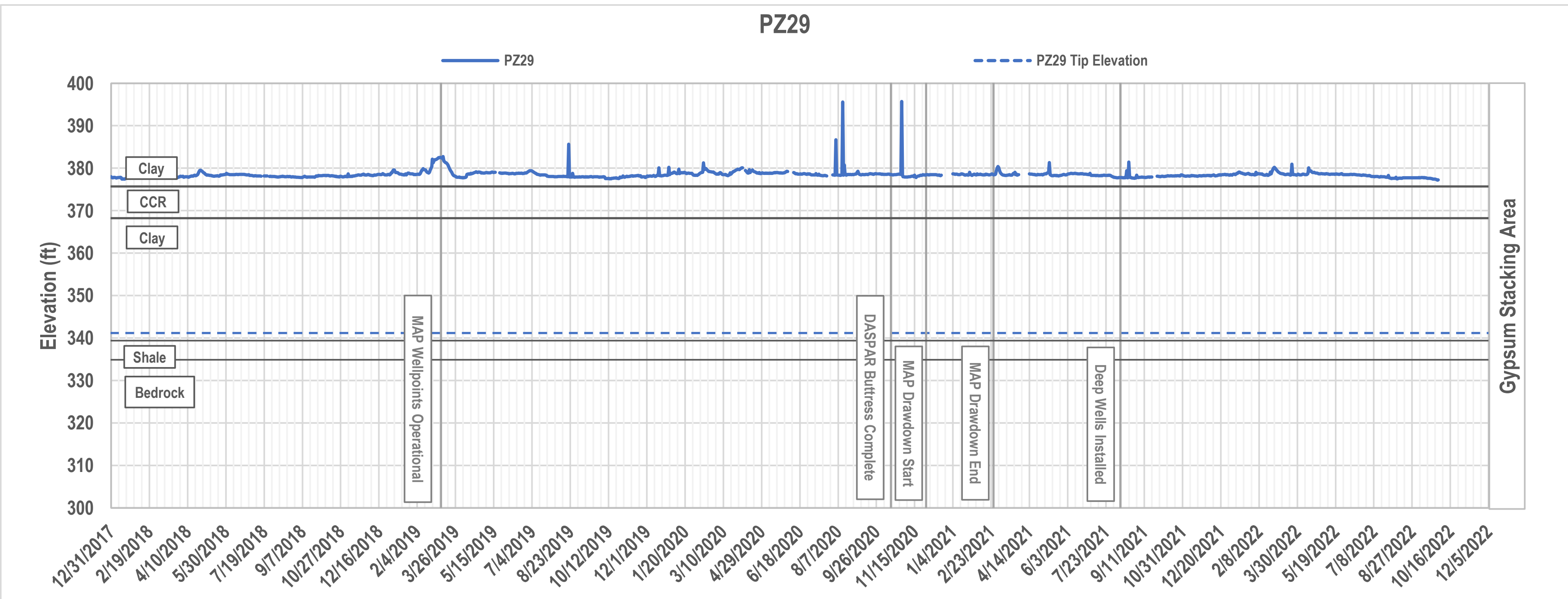

PZ29
PZ29
PZ29 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
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Clay
CCR
Clay
Shale
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
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12/16/2018
2/4/2019
3/26/2019
5/15/2019
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8/23/2019
10/12/2019
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3/10/2020
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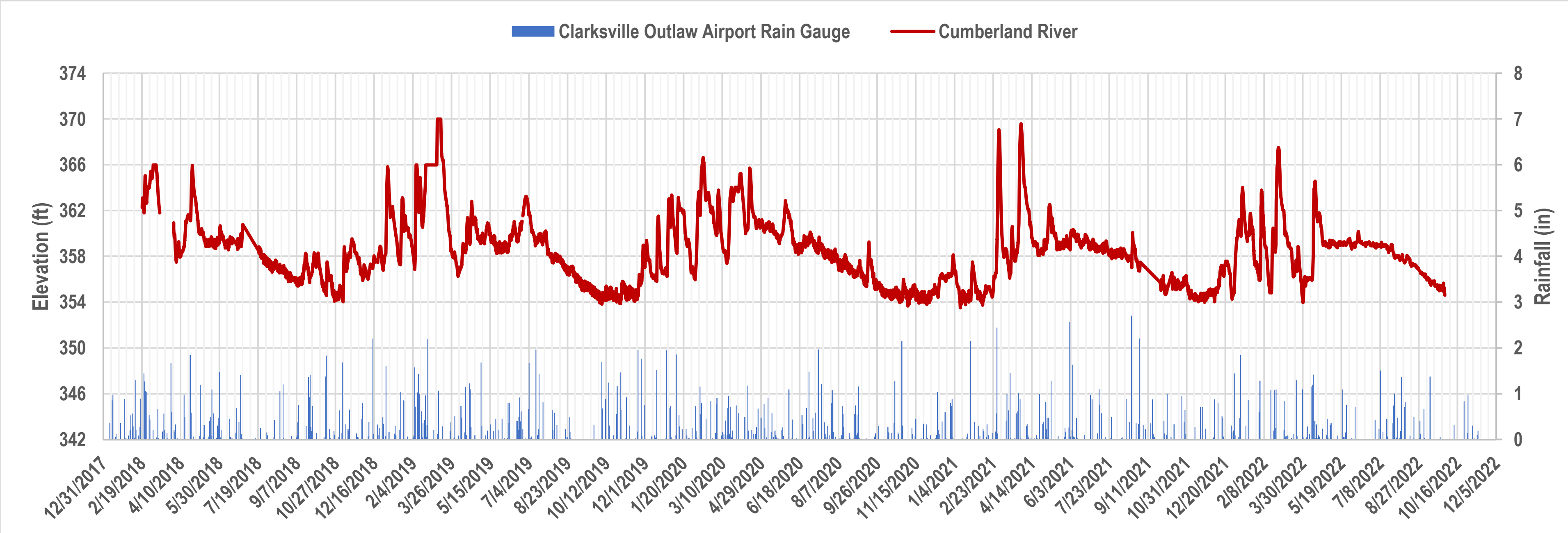
Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
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7/4/2019
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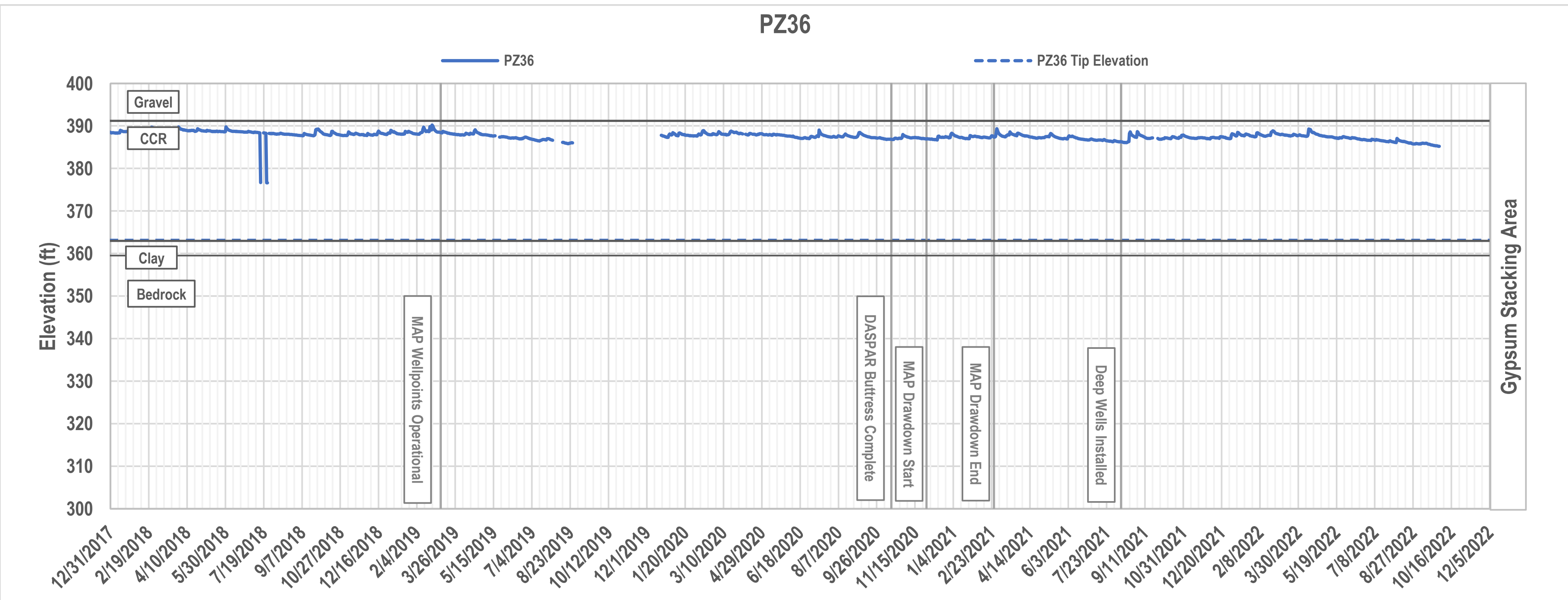
PZ36
PZ36
PZ36 Tip Elevation
Elevation (ft)
400
390
380
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360
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330
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300
Gravel
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Clay
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
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11/15/2020
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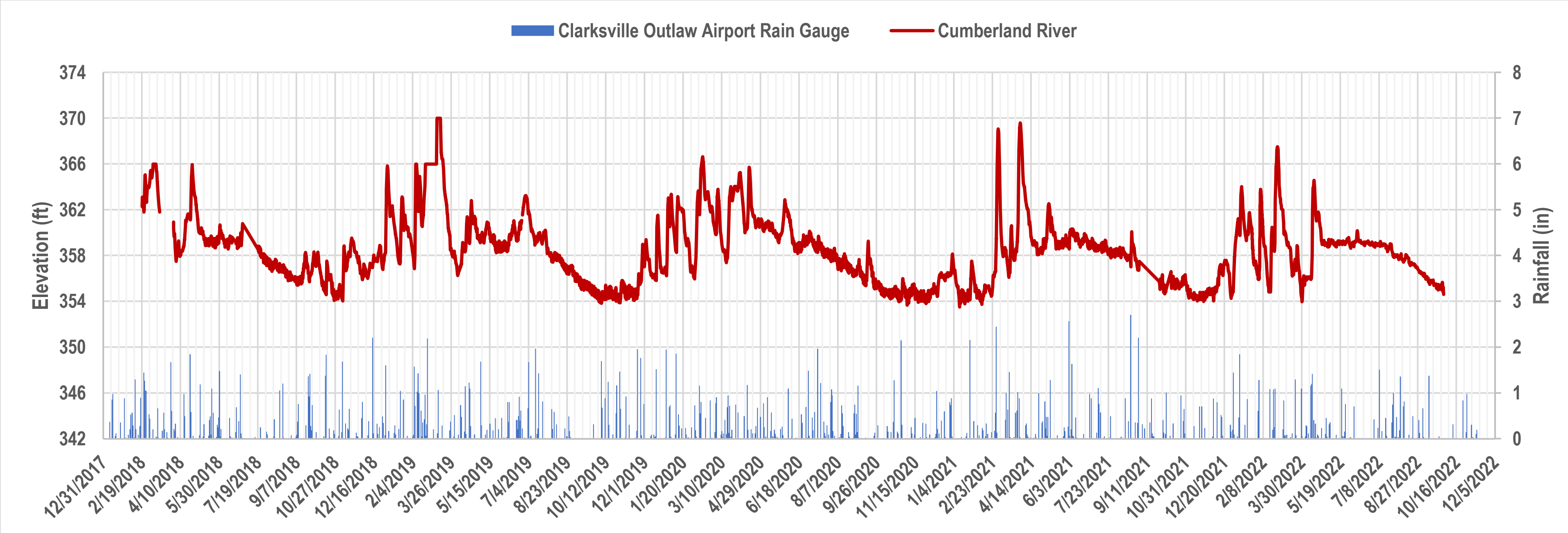
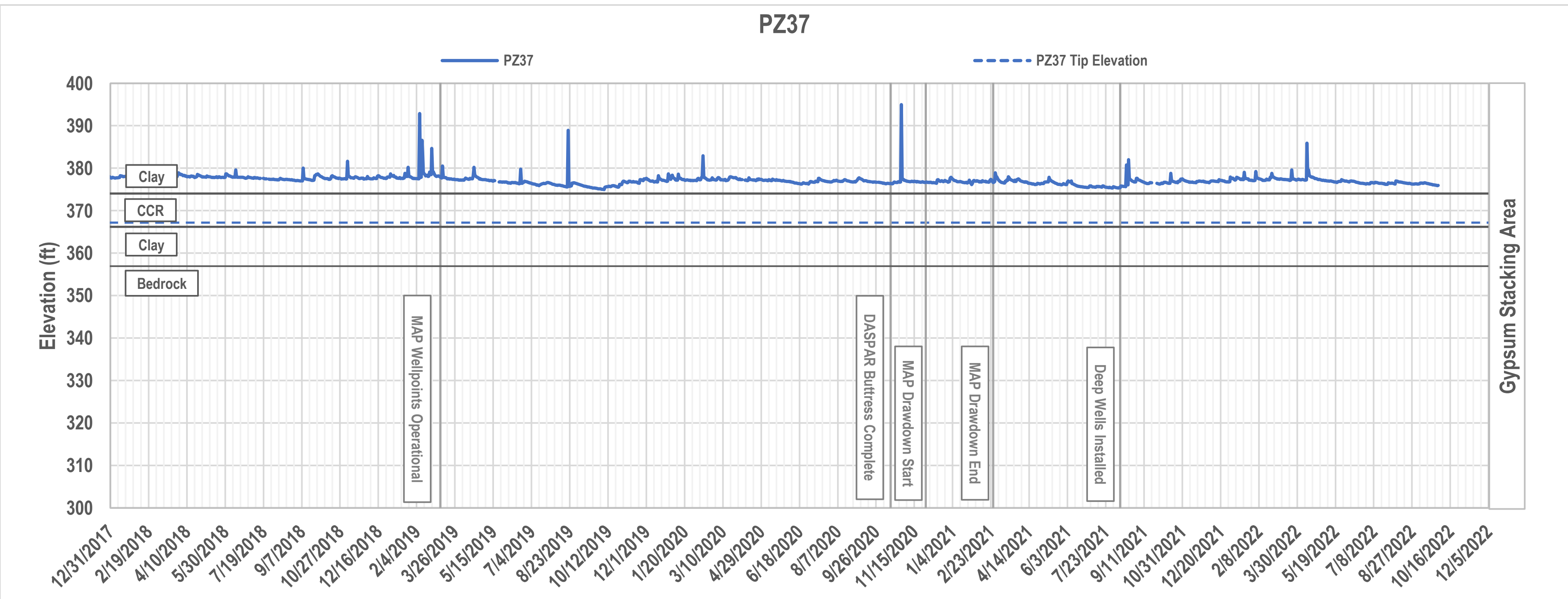


Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)



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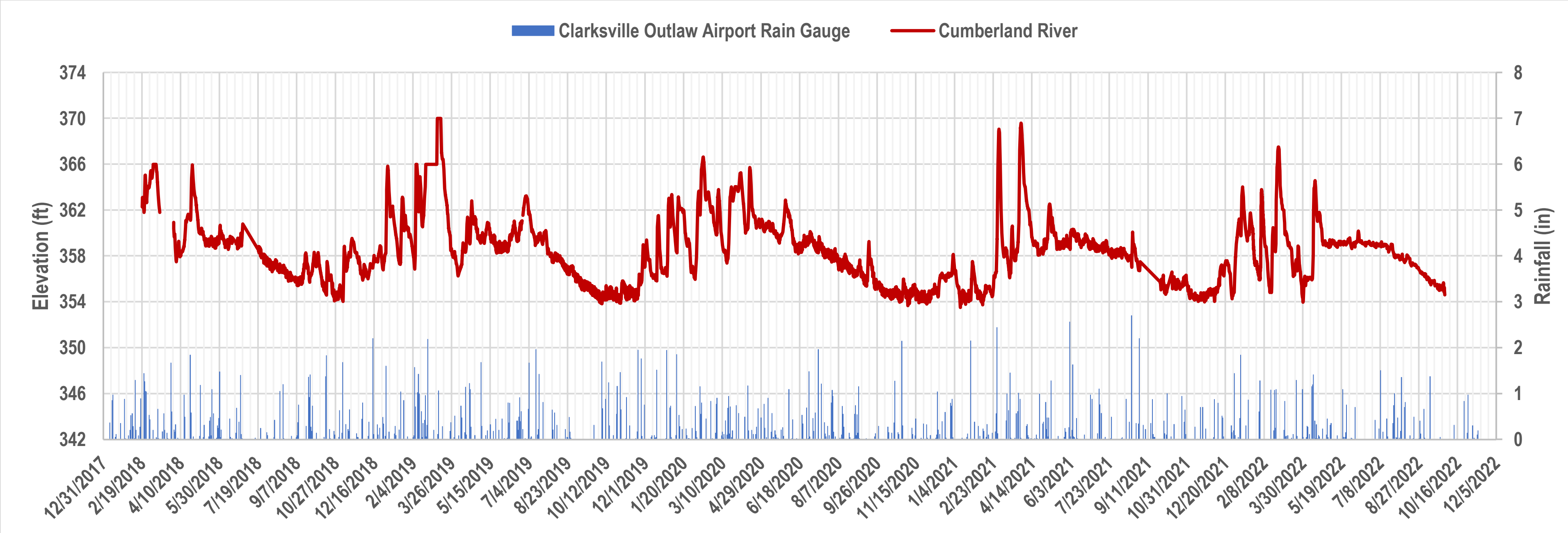
PZ37 Tip Elevation
Elevation (ft)
Clay
CCR
Clay
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area



Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
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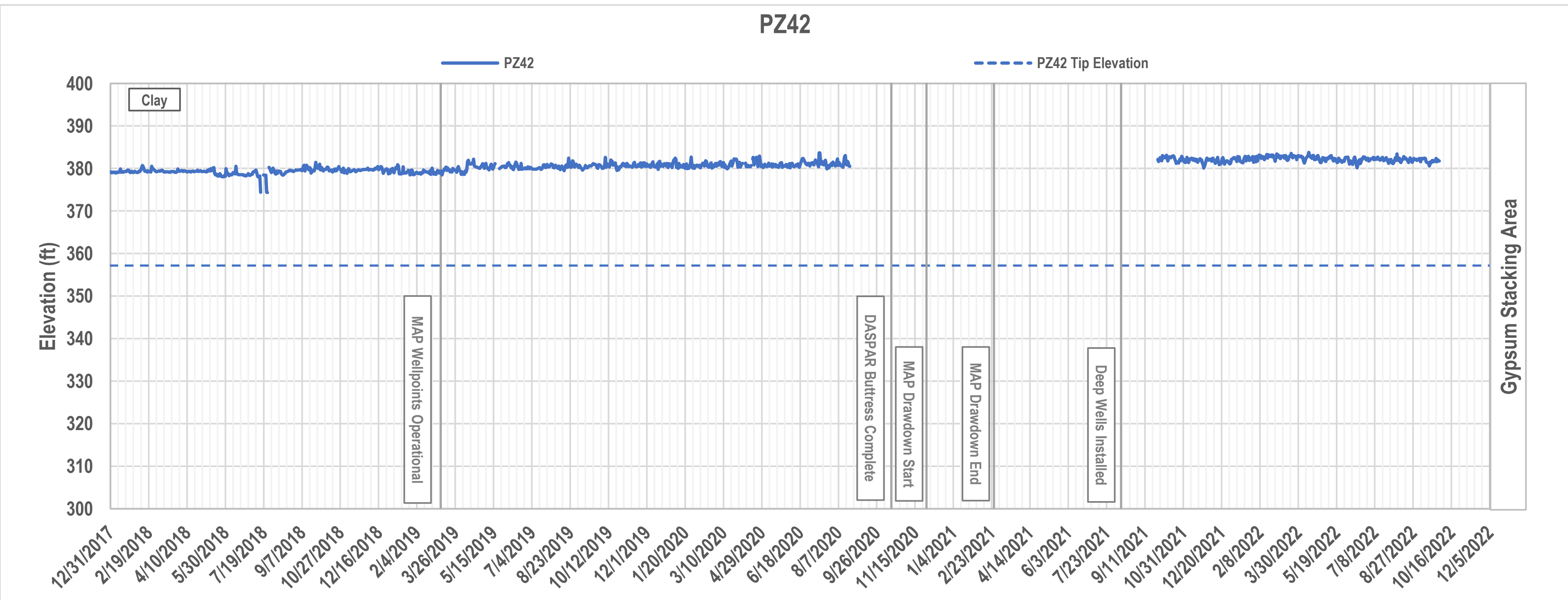

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Elevation (ft)
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MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
12/31/2017
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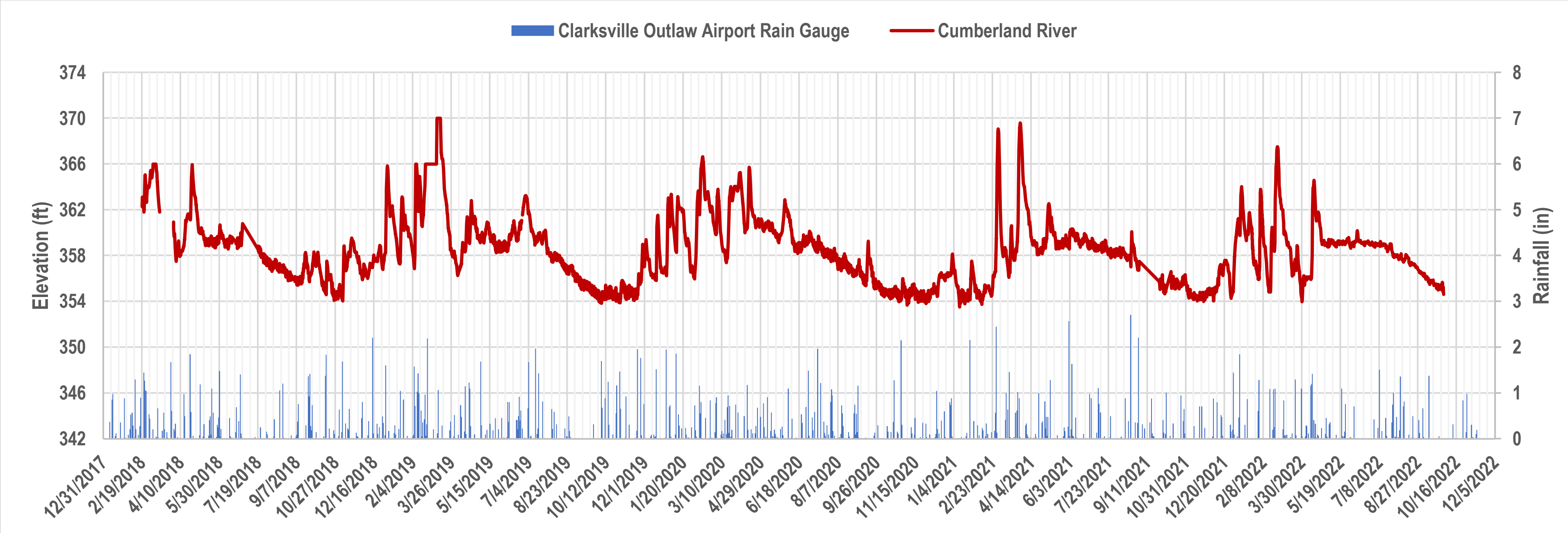
Clarksville Outlaw Airport Rain Gauge
Cumberland River
Elevation (ft)
Rainfall (in)
374
370
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12/31/2017
2/19/2018
4/10/2018
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7/19/2018
9/7/2018
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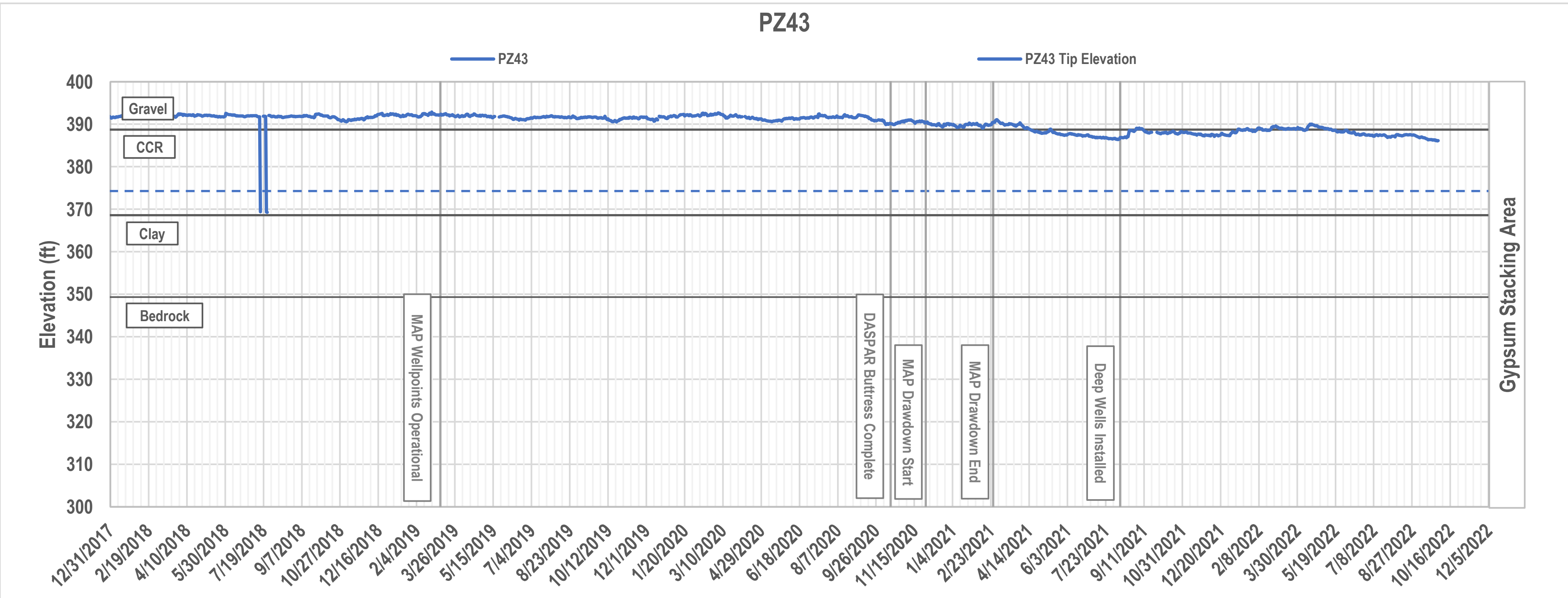
12/5/2022


PZ43
PZ43
PZ43 Tip Elevation
Elevation (ft)
400
390
380
370
360
350
340
330
320
310
300
Gravel
CCR
Clay
Bedrock
MAP Wellpoints Operational
DASPAR Buttress Complete
MAP Drawdown Start
MAP Drawdown End
Deep Wells Installed
Gypsum Stacking Area
12/31/2017
2/19/2018
4/10/2018
5/30/2018
7/19/2018
9/7/2018
10/27/2018
12/16/2018
2/4/2019
3/26/2019
5/15/2019
7/4/2019
8/23/2019
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6/18/2020
8/7/2020
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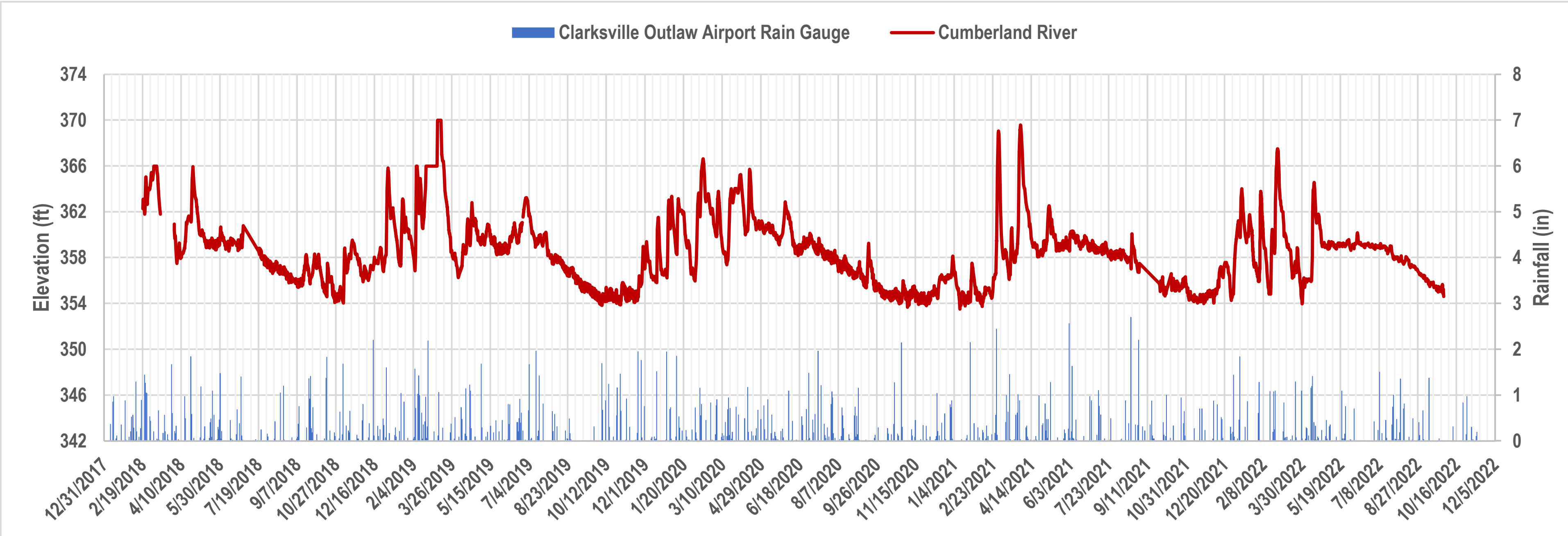
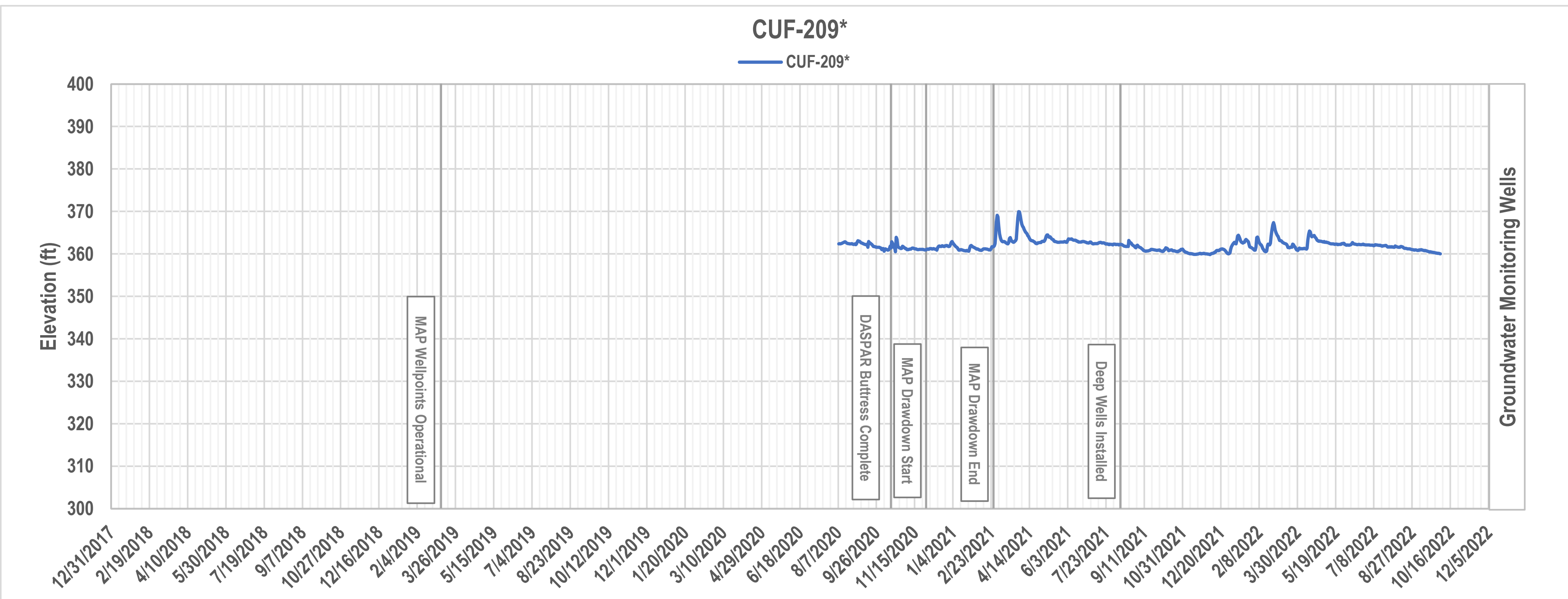
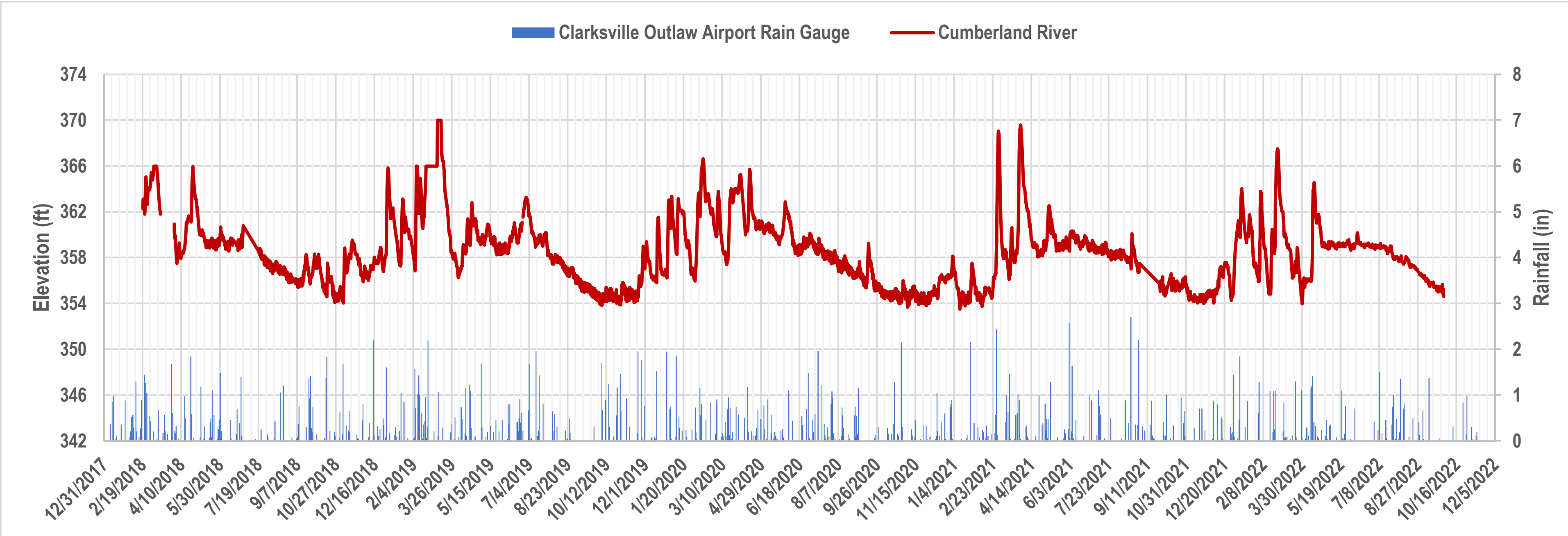
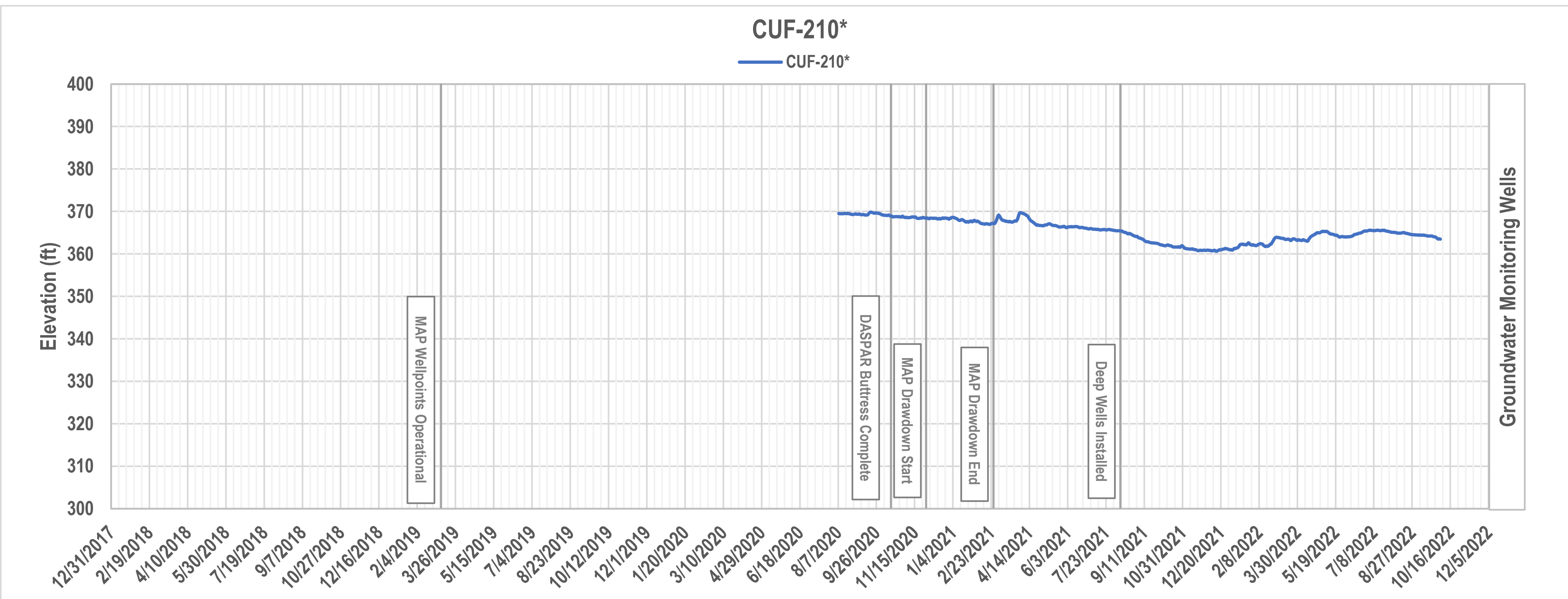
12/5/2022



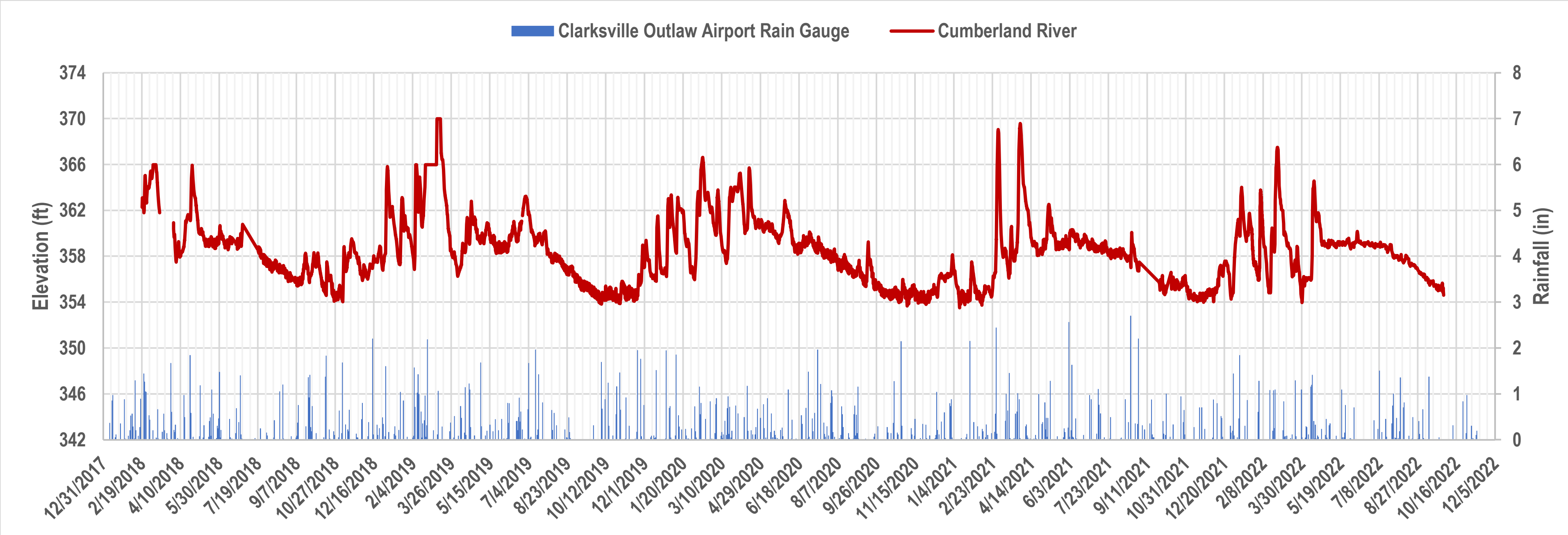


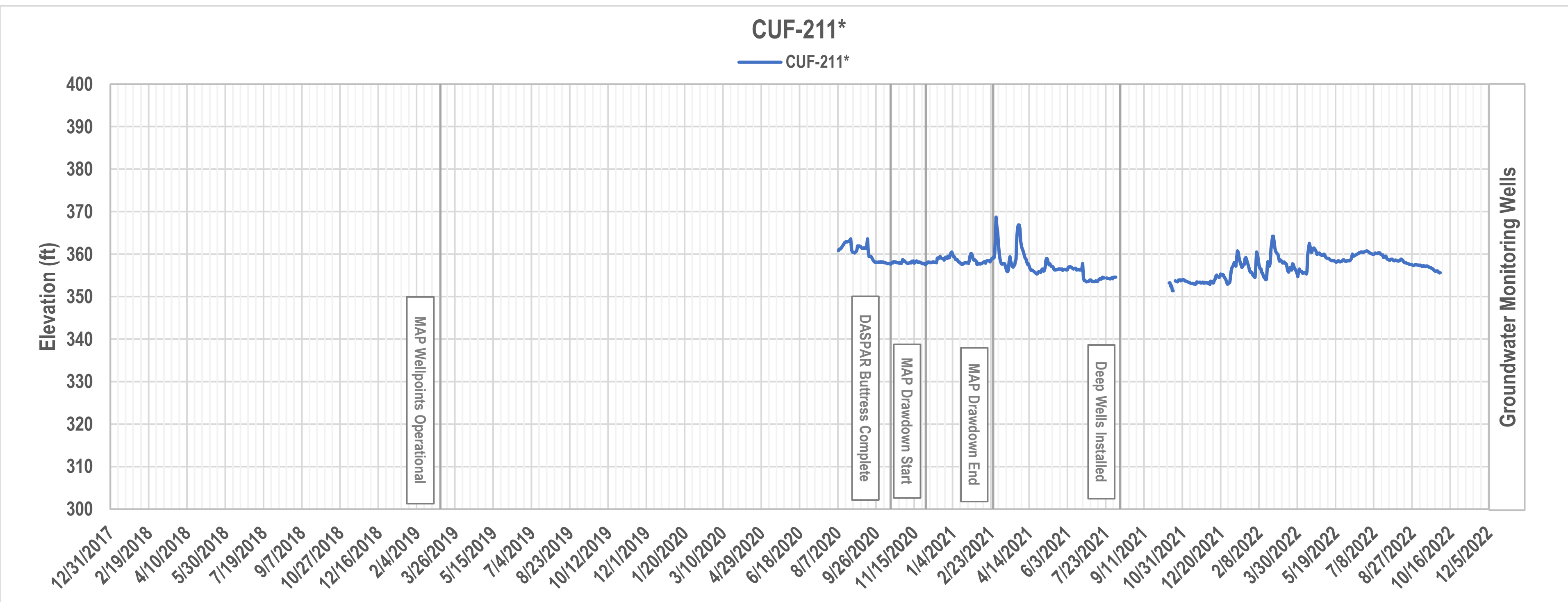
* Tip elevation is not available for this instrument



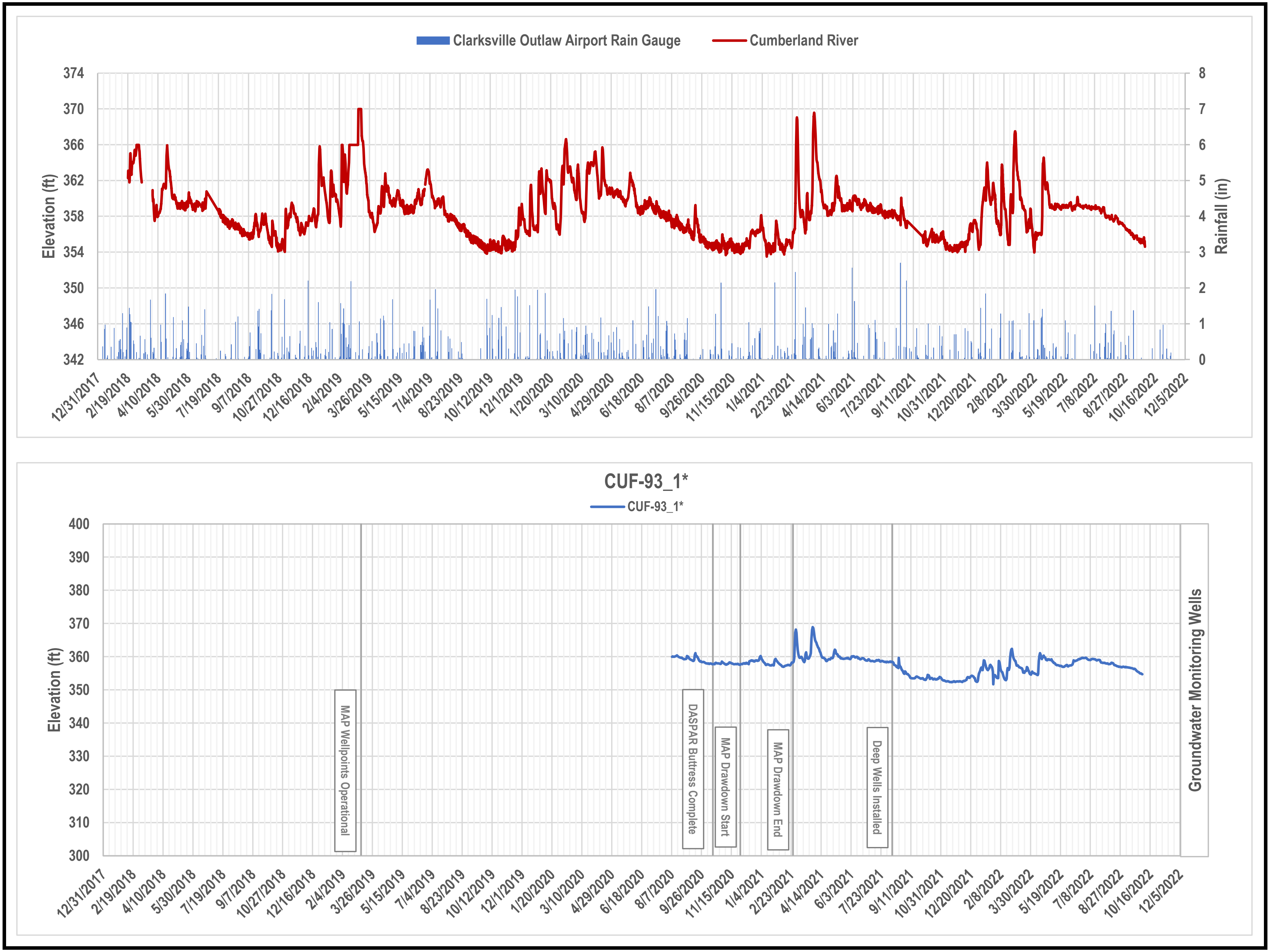


* Tip elevation is not available for this instrument



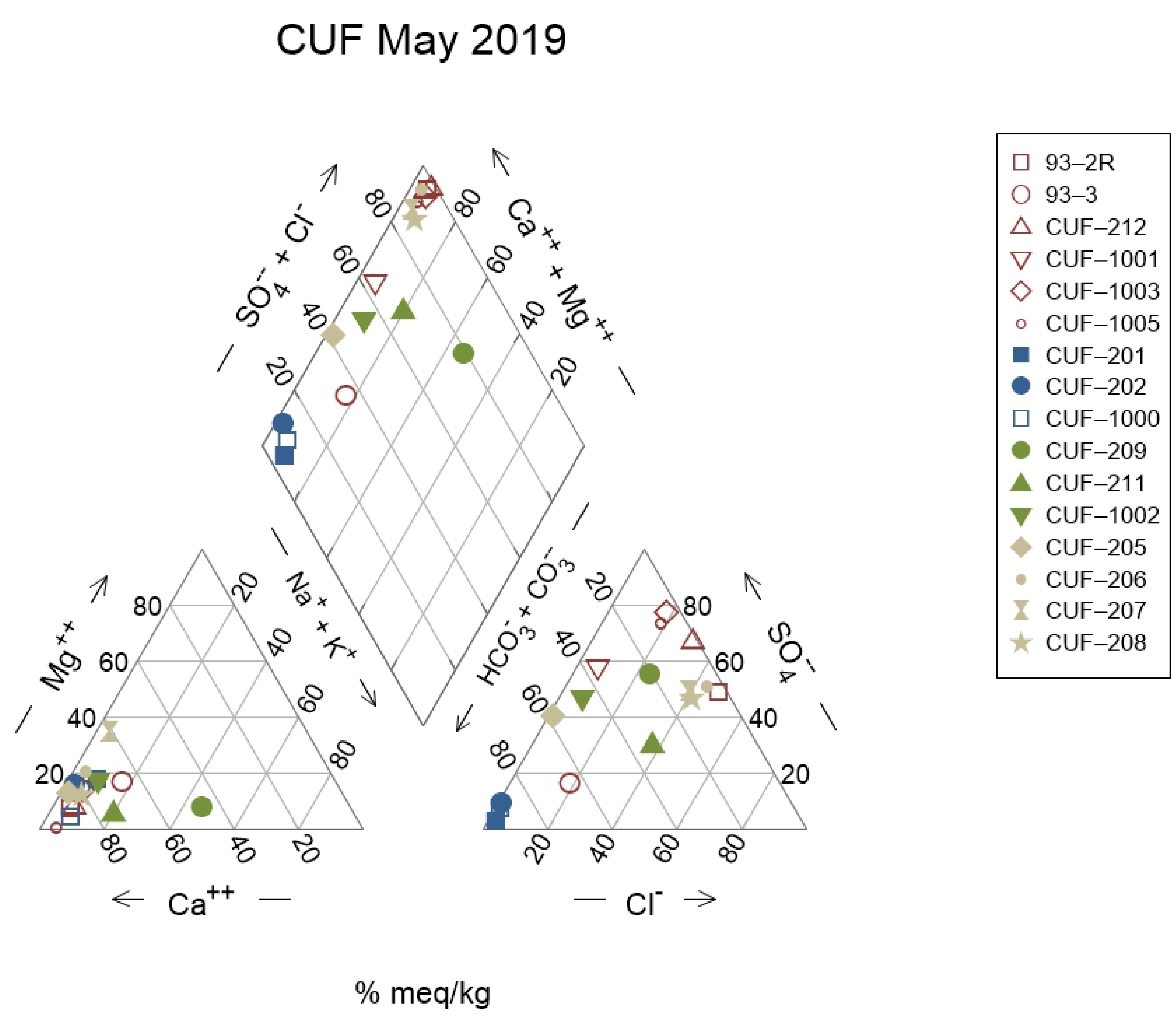


* Tip elevation is not available for this instrument



* Tip elevation is not available for this instrument

ATTACHMENT H.1-C PIPER DIAGRAMS



Title

Piper Diagram - May 2019

Client/Project 175568209

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Clinton, Tennessee
Stewart County, Tennessee

Prepared by AB on 2021-08-27
ITR by RB on TBD
IQR by TBD on TBD

Legend

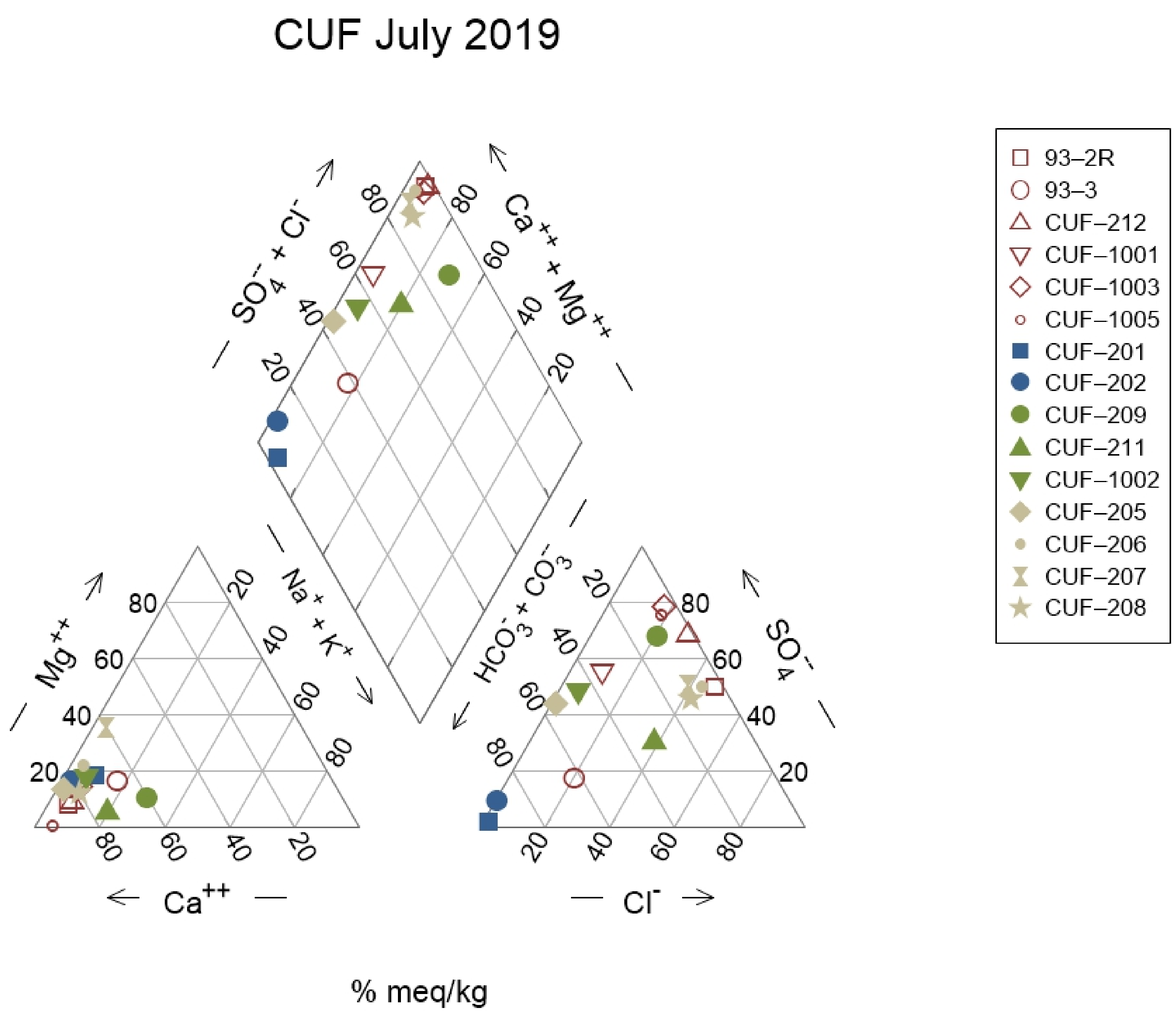
Notes

1. % meq/kg - Percent milliequivalent per kilogram
2. Ca^{++} - Calcium
3. Cl^- - Chloride
4. CO_3^{--} - Carbonate
5. HCO_3^- - Bicarbonate
6. K^+ - Potassium
7. Mg^{++} - Magnesium
8. Na^+ - Sodium
9. SO_4^{--} - Sulfate

Stantec

TVA

U:\TVA-EIP\175568209_CUF_Phase2\gis\mxd\EAR\CUF_EAR_A.14_StillingPondMineralogy11X17.mxd Revised: 2021-08-12 By: lblackman



Title

Piper Diagram - July 2019

Client/Project 175568209

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Clinton, Tennessee

Stewart County, Tennessee

Prepared by AB on 2021-08-27
ITR by RB on TBD
IQR by TBD on TBD

Legend

Notes

1. % meq/kg - Percent milliequivalent per kilogram
2. Ca^{++} - Calcium
3. Cl^{-} - Chloride
4. CO_3^{--} - Carbonate
5. HCO_3^{-} - Bicarbonate
6. K^{+} - Potassium
7. Mg^{++} - Magnesium
8. Na^{+} - Sodium
9. SO_4^{--} - Sulfate

Stantec

TVA

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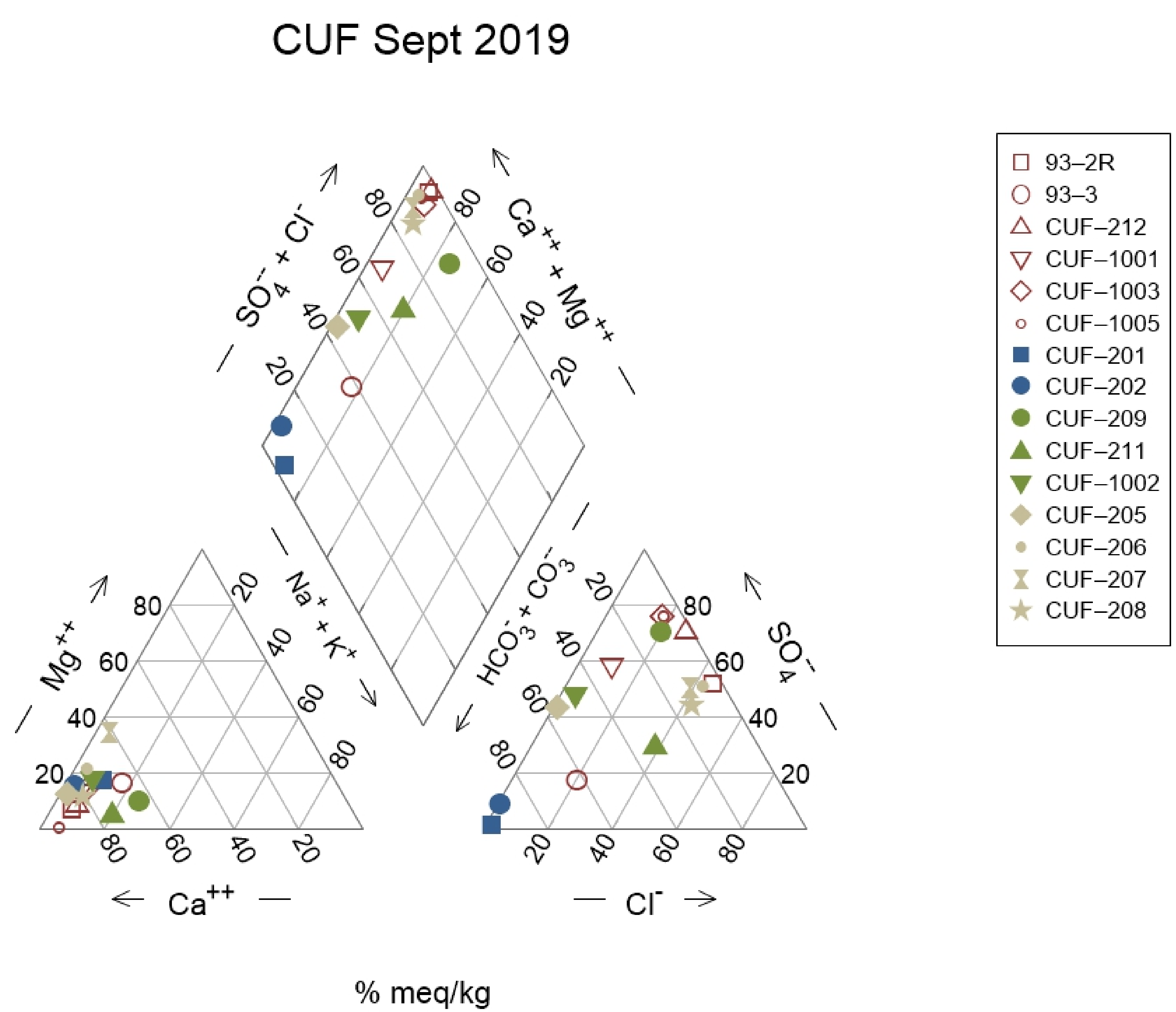

Title

Piper Diagram - September 2019

Client/Project 175568209

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Clinton, Tennessee
Stewart County, Tennessee

Prepared by AB on 2021-08-27
ITR by RB on TBD
IQR by TBD on TBD

Legend

Notes

1. % meq/kg - Percent milliequivalent per kilogram
2. Ca^{++} - Calcium
3. Cl^- - Chloride
4. CO_3^{--} - Carbonate
5. HCO_3^- - Bicarbonate
6. K^+ - Potassium
7. Mg^{++} - Magnesium
8. Na^+ - Sodium
9. SO_4^{--} - Sulfate

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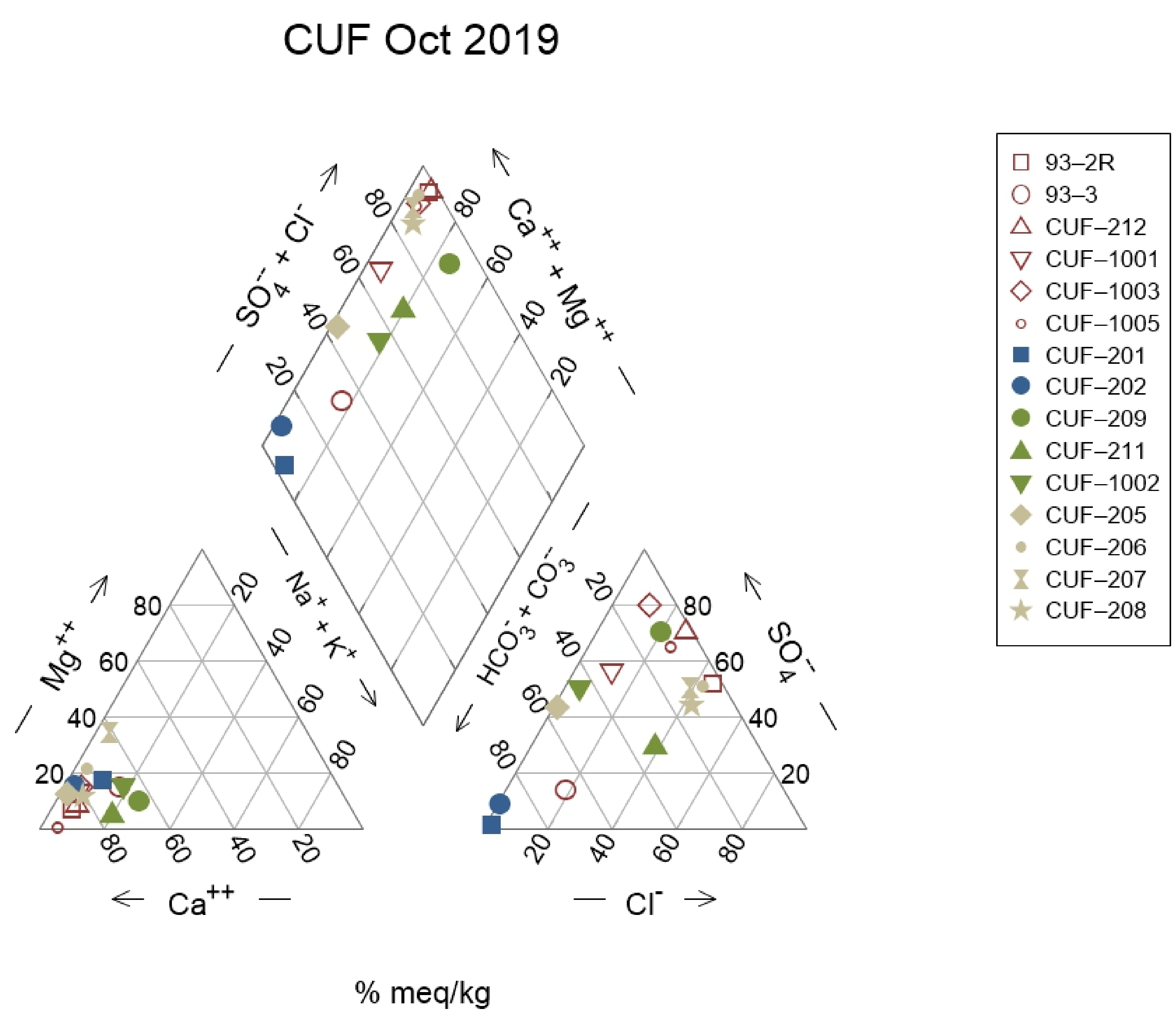

Title

Piper Diagram - October 2019

Client/Project 175568209

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Clinton, Tennessee
Stewart County, Tennessee

Prepared by AB on 2021-08-27
ITR by RB on TBD
IQR by TBD on TBD

Legend

Notes
1. % meq/kg - Percent milliequivalent per kilogram
2. Ca^{++} - Calcium
3. Cl^- - Chloride
4. CO_3^{--} - Carbonate
5. HCO_3^- - Bicarbonate
6. K^+ - Potassium
7. Mg^{++} - Magnesium
8. Na^+ - Sodium
9. SO_4^{--} - Sulfate

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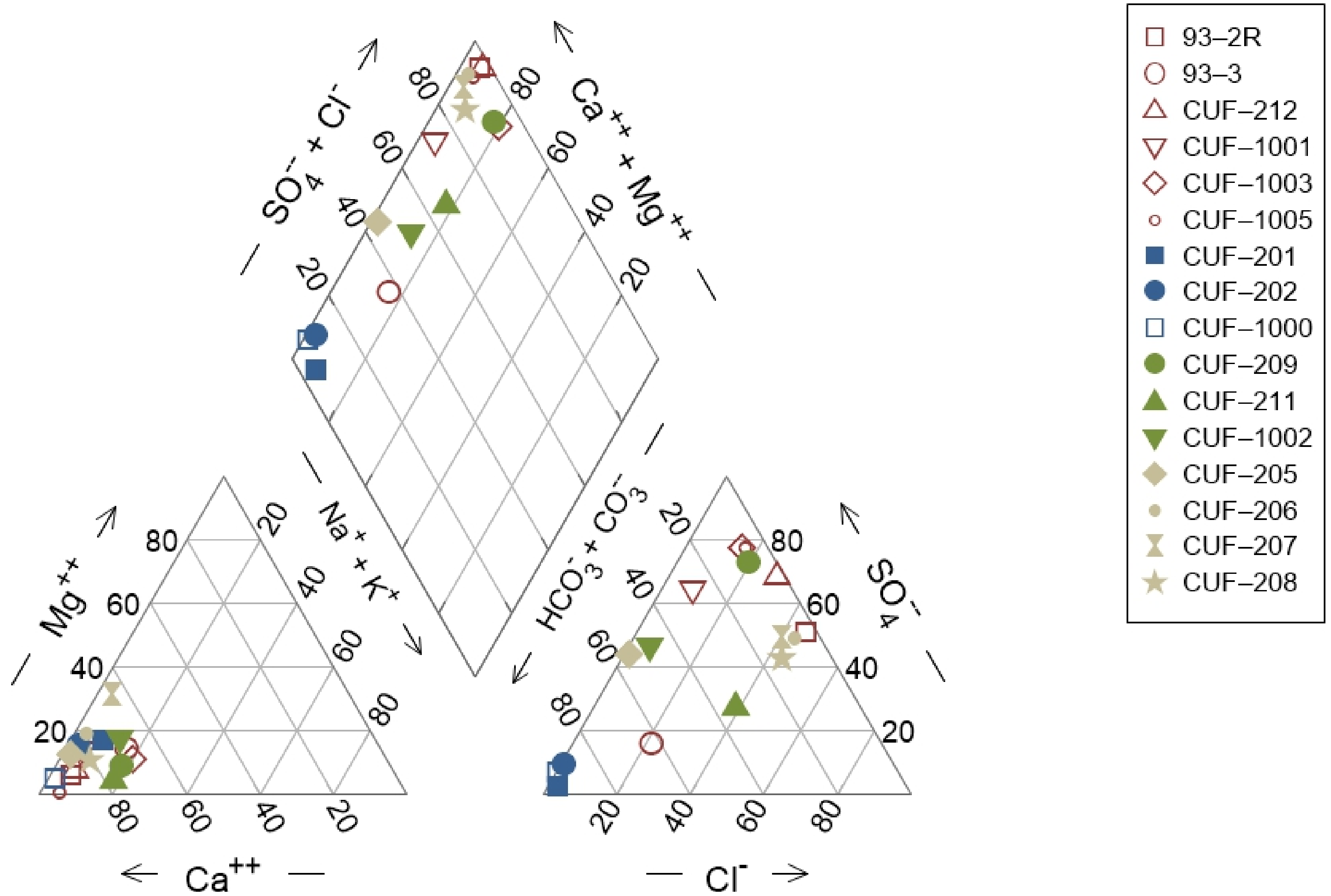
CUF Jan 2020



% meq/kg

Title

Piper Diagram - January 2020

Client/Project 175568209

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Clinton, Tennessee
Stewart County, Tennessee

Prepared by AB on 2021-08-27
ITR by RB on TBD
IQR by TBD on TBD

Legend

Notes

1. % meq/kg - Percent milliequivalent per kilogram
2. Ca^{++} - Calcium
3. Cl^- - Chloride
4. CO_3^{--} - Carbonate
5. HCO_3^- - Bicarbonate
6. K^+ - Potassium
7. Mg^{++} - Magnesium
8. Na^+ - Sodium
9. SO_4^{--} - Sulfate

Stantec

TVA

U:\TVA-EIP\175568209_CUF_Phase2\gis\mxd\EAR\CUF_EAR_A.14_StillingPondMineralogy11X17.mxd Revised: 2021-08-12 By: lblackman

APPENDIX H.2

HYDROGEOLOGY INVESTIGATION SAMPLING AND ANALYSIS REPORT

Cumberland Fossil Plant Hydrogeological Investigation Sampling and Analysis Report

TDEC Commissioner's Order:
Environmental Investigation Plan
Cumberland Fossil Plant
Cumberland City, Tennessee

September 1, 2020

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

Revision Record

Revision	Description	Date
0	Submittal to TDEC	June 29, 2020
1	Addresses August 17, 2020 TDEC Review Comments and Issued for TDEC	September 1, 2020

Sign-off Sheet

This document entitled Cumberland Fossil Plant Hydrogeological Investigation Sampling and Analysis Report was prepared by Stantec Consulting Services Inc. ("Stantec") for the account of Tennessee Valley Authority (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ______________________________

Michael J. Winkler, Geologic Associate

Reviewed by ______________________________

Mark Densmore, Senior Geologist

Reviewed by ______________________________

James M. Kerr, Jr., Senior Principal Geologist

Approved by ______________________________

Rebekah Brooks, Principal Hydrogeologist

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APPENDIX A – EXHIBITS

APPENDIX B – TABLES

Abbreviations

ASTM	American Society for Testing and Materials
CCR	Coal Combustion Residuals
CCR Parameters	Constituents listed in Appendices III and IV of 40 CFR 257 and five inorganic constituents included in Appendix I of Tennessee Rule 0400-11-01-.04
CFR	Code of Federal Regulations
COC	Chain-of-Custody
CUF Plant	Cumberland Fossil Plant
EAR	Environmental Assessment Report
EIP	Environmental Investigation Plan
ENV	Environmental
EnvStds	Environmental Standards, Inc.
FSP	Field Sampling Personnel
ft bgs	Feet Below Ground Surface
GPS	Global Positioning System
HGI	Hydrogeological Investigation
HSA	Hollow-Stem Auger
IDW	Investigation Derived Waste
PG	Professional Geologist
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan
SAP	Sampling and Analysis Plan
SAR	Sampling and Analysis Report
Stantec	Stantec Consulting Services Inc.
TDEC	Tennessee Department of Environment and Conservation
TDEC Order	Commissioner’s Order No. OGC15-0177
TI	Technical Instruction
TVA	Tennessee Valley Authority

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) has prepared this sampling and analysis report (SAR), on behalf of the Tennessee Valley Authority (TVA), to document activities related to a hydrogeological investigation (HGI) at TVA's Cumberland Fossil (CUF) Plant located in Cumberland City, Tennessee.

The purpose of the HGI was to install permanent monitoring wells to evaluate hydrogeological conditions at the CUF Plant in support of fulfilling the requirements for the Tennessee Department of Environment and Conservation (TDEC) issued Commissioner's Order No. OGC15-0177 (TDEC Order) to TVA (TDEC 2015). The TDEC Order sets forth a "process for the investigation, assessment, and remediation of unacceptable risks" at TVA's coal ash disposal sites in Tennessee.

The purpose of this SAR is to summarize activities completed to meet the objectives of the HGI Sampling and Analysis Plan (SAP) (Stantec 2018a). This SAR is not intended to provide conclusions or evaluations of results. The scope of the HGI represented herein was conducted pursuant to the SAP and is part of a larger environmental investigation at the CUF Plant. The evaluation of the results from this HGI will consider other aspects of the environmental investigation, as well as data collected under other State and/or coal combustion residuals (CCR) programs, and be presented in the Environmental Assessment Report (EAR).

The HGI activities were performed in conjunction with the background soil investigation at the CUF Plant and in general accordance with the following documents developed by TVA to support fulfilling the requirements of the TDEC Order:

- *Hydrogeological Investigation SAP* (Stantec 2018a)
- *Environmental Investigation Plan EIP* (Stantec 2018b)
- *Background Soil SAP* (Stantec 2018c)
- *Quality Assurance Project Plan (QAPP)* (Environmental Standards, Inc. 2018).

The hydrogeological and background soil investigations were implemented in accordance with TVA- and TDEC-approved Programmatic- and Project-specific changes. Minor variances in scope and procedures from those outlined in the CUF Plant HGI SAP and Background Soil SAP occurred during field activities due to field conditions and programmatic updates and are referenced in Section 3.6.

HGI field work consisted of two primary activities – drilling and sampling, and permanent monitoring well installation. Quality Assurance oversight of field data acquisition protocols, sampling practices, and data review were performed by Environmental Standards, Inc. (EnvStds) under direct contract to TVA.

2.0 OBJECTIVE AND SCOPE

The primary objective of the HGI conducted pursuant to the HGI SAP was to install permanent monitoring wells to evaluate hydrogeological conditions at the CUF Plant in response to the TDEC Order. The activities conducted during the HGI support data collection for the groundwater and background soil investigations at the CUF Plant, including groundwater level measurements and groundwater and background soil sample collection for analysis of coal combustion residuals (CCR) related constituents.

The approach for the HGI was to:

- Identify permanent monitoring well and background well locations targeting unconsolidated materials at the CUF Plant
- Use hollow-stem auger (HSA) drilling techniques to collect soil samples at staked monitoring locations approved by TDEC and considered suitable for the HSA rig to safely drill
- Complete monitoring well installation, well development, hydraulic conductivity (slug) testing, pump installation, and survey activities.

The scope of work of the HGI consisted of the following tasks:

- Confirming drilling locations for planned permanent monitoring well and background monitoring well locations using global positioning system (GPS) survey
- Drilling and logging soil borings for geotechnical and lithologic information
- Collecting soil samples for analysis of geotechnical parameters (if deemed warranted), and CCR-related constituents from the background monitoring well boring locations (as part of the Background Soil SAP)
- Installing permanent monitoring wells in the borings and constructing surface completions
- Developing each permanent monitoring well and conducting slug tests to estimate hydraulic conductivity for evaluation of hydrogeologic conditions for the EAR
- Surveying each permanent monitoring well.

Details on each activity are presented in the sections below. Groundwater level measurements and sampling are being conducted as part of six groundwater monitoring events being performed pursuant to the Groundwater Investigation SAP, and reported in a series of Groundwater Investigation SARs for the CUF Plant. Soil sampling for CCR-related constituents was performed in accordance with the Background Soil SAP and reported in the CUF Plant Background Soil Investigation SAR.

3.0 FIELD ACTIVITIES

HGI field activities were conducted between November 29 and July 19, 2019 and consisted of HSA drilling, monitoring well installation, well development, slug tests, pump installation, and well surveys. Prior to initiating field activities, TVA conducted environmental reviews, obtained necessary permits, and performed utility clearances as necessary to complete the field work.

Stantec performed HGI field activities based on guidance and specifications listed in TVA's Environmental (ENV) Technical Instructions (TIs), the SAPs, and the QAPP prepared by EnvStds, except as noted in the Variations section of this report. As part of TVA's commitment to generate representative and reliable data, oversight of select field activities, field documentation, and centralized data management were performed by EnvStds under direct contract with TVA. EnvStds also conducted audits of field activities and provided quality reviews of field documentation.

During the HGI, Stantec conducted the following field activities:

- Confirmed drilling locations for planned monitoring well and background monitoring well locations
- Drilled 12 soil borings for installation of three permanent monitoring wells and two background monitoring wells under the direction of a Stantec Professional Geologist (PG) licensed in the State of Tennessee
- Collected soil samples using a split-spoon sampler to develop a continuous boring log/soil profile for each well boring, and for potential analysis of geotechnical parameters (if deemed warranted)
- Collected seven soil samples and one field duplicate for analysis of CCR-related constituents from the screened interval depth range of four background monitoring well borings
- Installed permanent monitoring wells in five of the borings
- Developed each well and conducted slug tests in four wells to estimate hydraulic conductivity.

Following monitoring well installation, TVA constructed surface completions and surveyed each new permanent well.

3.1 WORK LOCATIONS

The HGI field activities were conducted at 12 soil boring/monitoring well locations at the CUF Plant under the HGI scope of work. The HGI boring/monitoring well locations are shown on Exhibit A.1 in Appendix A and are described in Table 1 following Section 3.1.2. As shown in Table 1, several locations required multiple borings to complete the HGI. Soil samples were collected from within the anticipated depth range for the well screened interval at four soil boring/background monitoring well location borings as described in the Background Soil SAP.

Additionally, Tables B.1 through B.5 in Appendix B provide data and information obtained at the HGI boring/monitoring well locations as described in Section 3.4.

3.1.1 Background Locations

Two of three background monitoring wells (CUF-1000 and CUF-1001) were installed in unconsolidated materials to provide groundwater samples that have not been affected by the CCR units and to be representative of background conditions. The third proposed background monitoring well (CUF-1004) was planned at a location south of the CCR units; however, none of the three CUF-1004 borings were completed as a monitoring well because groundwater was not encountered.

3.1.2 Coal Combustion Residuals Unit Locations

The three proposed permanent monitoring wells (CUF-1002, CUF-1003, and CUF-1005) were installed near the CCR units to provide locations to evaluate groundwater flow and quality in these areas.

Table 1 - Summary of Boring and Monitoring Well Locations

Boring ID	Well ID	Location	Rationale
CUF-1000ALT	NC	West/southwest of the CCR units and Wells Creek; in flood plain alluvial deposits	To collect groundwater data from a background location
CUF-1000ALTA	CUF-1000		
CUF-1001ALT	NC	Between the CCR units and the main plant, northeast of the CCR units; adjacent to a gravel road	To collect groundwater data from a background location
CUF-1001ALT2	CUF-1001		
CUF-1002ALT2	CUF-1002	Between the CCR units and the main plant, adjacent to the Dry Ash Stack; in a parking area	To collect groundwater data between the CCR units and the Cumberland River
CUF-1003	NC	Between the CCR units and the main plant, adjacent to the Gypsum Storage Area and a laydown area	To collect groundwater data between the CCR units and the Cumberland River
CUF-1003A	NC		
CUF-1003B	CUF1003		
CUF-1004ALT	NC	Proposed south of the CCR units and Wells Creek; in Knox Dolomite	To collect groundwater data from a background location (well not installed because groundwater was not encountered)
CUF-1004ALT2	NC		
CUF-1004ALT2A	NC		
CUF-1005	CUF-1005	Adjacent to the eastern limit of the Gypsum Storage Area; adjacent to a gravel road and unnamed pond	To collect groundwater data near the eastern boundary of the CCR units

Notes:

ID Identification
NC Not completed as a monitoring well

1. Monitoring well CUF-1001 was initially installed in boring CUF-1001ALT, but it yielded insufficient groundwater and the well was abandoned. Monitoring well CUF-1001 was subsequently installed in soil boring CUF-1001ALT2.

3.2 DOCUMENTATION

Stantec maintained HGI field documentation in general accordance with ENV-TI-05.80.03, *Field Record Keeping*, the HGI SAP, and the QAPP. Field documentation for background soil sampling activities is described in the CUF Plant Background Soil Investigation SAR. Health and safety forms were completed in accordance with TVA and Stantec health and safety requirements. Field activities and data were primarily recorded on program-specific field forms. Additional information regarding HGI field documentation is provided below.

3.2.1 Field Forms

Stantec used program-specific field forms to record field observations and data for specific activities. Field forms used during the HGI included:

- *Daily Field Activity Log*
- *Subsurface Boring Log*
- *Chain-of-Custody (COC)*
- *Monitoring Well Installation Field Log*
- *Well Development Form*
- *Slug Test Data Form*
- *QED Well Wizard Dedicated Sampling Pump Installation Checklist*
- *Well Pump Calibration Form.*

3.2.1.1 Daily Field Activity Log

Stantec field sampling personnel (FSP) recorded field activities, observations, and data on a *Daily Field Activity Log* to chronologically document the field program. Deviations from the SAP or QAPP were also documented on the *Daily Field Activity Log*.

3.2.1.2 Subsurface Boring Log

A Stantec PG licensed in the State of Tennessee prepared a Subsurface Boring Log for each boring. The log documented time, boring location, drilling personnel, tooling/equipment used, depth to water, sample number, sample recovery, blow counts, soil lithology, and other relevant observations. Soil color was logged per the appropriate Munsell Soil Color Chart (Munsell Color 2009). Information from these logs was used to construct the subsurface logs provided in Attachment C.1 in Appendix C.

3.2.1.3 Chain of Custody

Stantec FSP completed *COC* documentation for each geotechnical soil sample collected during the HGI. As described above, documentation of soil sample collection and analysis of CCR-related constituents for the background soil samples collected during the HGI are reported in the CUF Plant Background Soil Investigation SAR.

Information on the geotechnical sample *COC* included the sample ID, sample location, sample depth, type of sample, sampling date, and sample custody record. *COCs* were completed in general accordance with *ENV-TI-05.80.02: Sample Labeling and Custody* and reviewed by the laboratory manager.

3.2.1.4 Monitoring Well Installation Field Log

A Stantec PG licensed in the State of Tennessee prepared a *Monitoring Well installation Field Log* for each monitoring well. The log documented the well location, well installation date(s), well installation materials, well depth, screened interval, depth interval for each backfill material, and surface completion details (protective casing, concrete pad, bollards, etc.). Information from these logs was used to construct the well installation details provided in Attachment C.2 in Appendix C.

3.2.1.5 Well Development Form

Stantec FSP completed a *Well Development Form* for each monitoring well. The form documented well location, well development date(s), elapsed time since development started, depth to water, purge rate, cumulative purge volume, and water quality parameter measurements throughout and at completion of the development process.

3.2.1.6 Slug Test Data Form

Stantec FSP completed a *Slug Test Data Form* for the hydraulic conductivity tests performed at each monitoring well. The form primarily documented well location, slug test date(s), and initial and final water level measurements before and after each slug test attempt. The water level measurements during the tests were recorded by an automated pressure transducer and data recorder and subsequently downloaded.

3.2.1.7 QED Well Wizard Dedicated Sampling Pump Installation Checklist

Stantec FSP installed a dedicated bladder pump system in each monitoring well to facilitate subsequent groundwater sampling events. A *QED Well Wizard Dedicated Sampling Pump Installation Checklist* was prepared for each monitoring well to document the well information, pump information, initial testing results, and any relevant comments.

3.2.1.8 Well Pump Calibration Form

Stantec FSP performed a calibration procedure on the dedicated pump in each monitoring well and recorded the results on a *Well Pump Calibration Form*. Each form documented the well location, date, time, depth to water, flow rate, flow volume, and water quality stabilization measurements during and at completion of the calibration.

3.2.2 Photographs

In addition to documentation of field activities described above, photographs were taken to document the field investigation. A photographic log of soil cores recovered from the borings and surface completions of installed monitoring wells are provided in Attachments D.1 and D.2, respectively, in Appendix D.

3.3 DRILLING AND SAMPLING

The following sections present drilling and soil sampling procedures used in the HGI. Additional information for drilling and sampling procedures at the two background monitoring well locations is provided in the Background Soil Investigation SAR. Drilling and sampling activities were performed under the direction of a Stantec PG licensed in the State of Tennessee.

3.3.1 Drilling

The HGI borings were advanced by Stantec drillers, licensed in the state of Tennessee, using HSA drilling techniques following procedures provided in American Society for Testing and Materials (ASTM) D6151: *Standard Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling*. Borings were generally advanced in ten-foot runs using a 4.25-inch inside diameter auger to advance the pilot boring (resulting in approximately an eight-inch borehole diameter). Standard penetration test sampling was conducted continuously in accordance with ASTM D1586 *Standard Test Method for Standard Penetration Test and Split-Barrel Sampling of Soils* and consisted of dropping a 140-pound hammer from a height of 30 inches, to drive a standard size two-inch diameter split-spoon sampler to a depth of 18-inches. Blow-counts were recorded for each six inches of penetration. Soil samples were recovered for lithologic description, photographic documentation, and sample collection. Each run was then overdrilled using an 8.25-inch inside diameter auger where permanent monitoring wells were planned (resulting in approximately a 13-inch borehole diameter).

After reaching the targeted depth for the bottom of a borehole not completed as a permanent well, the augers were withdrawn and the borehole tremie-backfilled using a 30% solids bentonite grout. Well installation procedures for the boreholes completed as permanent wells are described in Section 3.4 below. Following removal, the augers were decontaminated using a high-pressure steam cleaner and potable water after use at each boring.

3.3.2 Soil Sampling

During advancement of each boring, the Stantec PG prepared field subsurface logs using a mobile data collection platform. Inputs included a description of subsurface lithology, sample recovery, color using the Munsell Soil Color Chart, and other relevant parameters as required by the SAPs and TIs. Subsurface logs for the CUF Plant HGI are presented in Attachment C.1 in Appendix C.

Soil samples were collected from each boring to provide geotechnical and lithologic information for a continuous boring log/soil profile for the proposed monitoring wells, and for analysis as described below.

3.3.2.1 Geotechnical Sampling

Following preparation of the subsurface logs, soil samples were placed in laboratory-provided glass jars and labeled in general accordance with the SAP. FSP secured the caps on each bottle, and confirmed it was labeled legibly and externally clean before placing the sample container in a box for storage prior to transport to the laboratory. Geotechnical sample information was recorded on a *COC* as described above in Section 3.2.1.3. The samples were temporarily placed in a secure storage unit onsite under custody protocols until transport and submittal to the geotechnical laboratory.

Stantec personnel transported and submitted the geotechnical samples to the Stantec Geotechnical Laboratory in Lexington, Kentucky. No geotechnical samples were tested since they were not needed for additional lithologic and geotechnical information and they remain stored at the Stantec laboratory.

3.3.2.2 CCR Parameter Sampling

Soil samples were collected from background monitoring well boring locations for analysis of CCR-related constituents following procedures in the Background Soil SAP. Seven soil samples and one field duplicate were collected from the screened interval depth range of the four background monitoring well borings and submitted for laboratory analysis:

- CUF-1000ALTA - two samples were collected (13.5 to 15.0 feet below ground surface [ft bgs] and 18.0 to 19.5 ft bgs)
- CUF-1001ALT - two samples were collected (13.5 to 15.0 ft bgs and 19.5 to 21.0 ft bgs)
- CUF-1001ALT2 - one sample and one field duplicate sample were collected (12.0 to 16.5 ft bgs)
- CUF-1004ALT2A - two samples were collected (12.0 to 13.5 ft bgs and 16.5 to 18.0 ft bgs).

As specified in the CUF Plant Background Soil SAP, the soil samples collected from the background monitoring well boring were analyzed for CCR-related constituents listed in Appendices III and IV of Title 40 of the Code of Federal Regulations (CFR) Part 257 (40 CFR 257). In addition, five inorganic constituents listed in Appendix I of Tennessee Rule 0400-11-01-.04 and not included in the 40 CFR 257 Appendices III and IV were analyzed to maintain continuity with the TDEC environmental programs. These additional TDEC Appendix I constituents included copper, nickel, silver, vanadium, and zinc. The combined federal CCR Appendices III and IV constituents and TDEC Appendix I inorganic constituents are hereafter referred to as "CCR Parameters."

Background soil sampling investigation activities, including sampling procedures, laboratory information, and analytical results are presented in the CUF Plant Background Soil Investigation SAR.

3.4 MONITORING WELL INSTALLATION

3.4.1 Well Installation

Monitoring wells were installed in the borings by qualified drill crews working under the direction of a Stantec PG and a licensed Tennessee driller. Well installation was carried out in general accordance with ENV-TI-05.80.25, *Monitoring Well and Piezometer Installation and Development*. Well construction details are documented on the Well Installation Details provided in Attachment C.2 in Appendix C.

The lowest portions of the borings were backfilled with a layer of sand filter pack (20/40 mesh). The monitoring well was installed above the backfilled portion. Monitoring wells consisted of a four-inch diameter Schedule 40 polyvinyl chloride (PVC) pre-packed well screen (0.010-inch slots) and riser. The screen and riser consisted of flush-joint, threaded PVC pipe. The screen length was selected based on the results of the boring log and the target stratum and varied from 4.8 to 10.6 feet. A four-inch diameter Schedule 40 PVC bottom well plug measuring approximately 0.4 feet in length was threaded onto the bottom of the screen. The PVC riser extended a minimum of 2.5 feet above the ground surface and was capped with a temporary plug or slip cap. The annular space was backfilled with a sand filter pack extending approximately two feet above and six inches below the screen. A bentonite pellet seal approximately two feet thick was placed on top of the sand filter pack. The sand filter pack and bentonite pellets were either placed by tremie method or poured slowly into the annular space of the drill tooling to prevent bridging.

After the bentonite pellet seal had sufficiently hydrated for a duration equal to or greater than the minimum recommended by the manufacturer (a minimum of four hours), the remaining annular space was backfilled with a 30% solids bentonite grout. The grout was placed by tremie method through one-inch diameter PVC pipe using pumps gauged to allow the installation crew to monitor pressures during the grouting process.

Subsequent monitoring well surface completions consisted of an above-grade steel locking protective cover anchored to a concrete surface pad. The protective cover extended above the concrete pad and the annular space was filled with sand or pea gravel to about six inches below the top of PVC casing. Steel protective bollards were installed near each corner of the concrete pad and filled with concrete.

A summary of monitoring well construction specifications is presented in Table B.1 in Appendix B. Full construction details are presented in the Well Installation Details provided in Attachment C.2 in Appendix C.

3.4.2 Well Development

Each new monitoring well was developed in accordance with ENV-TI-05.80.25, *Monitoring Well and Piezometer Installation and Development* by a combination of bailing, surging, and pumping after a minimum of 24 hours following well installation. First, a three-inch diameter PVC bailer was lowered and raised within the screened intervals to create a slight surging action to dislodge particles within the wells and sand filter packs. Then the bailer was used to remove turbid water from the well. Baseline readings of turbidity, pH, temperature, and specific conductance were measured using a calibrated YSI Pro Plus water quality meter and a calibrated Hach 2100Q turbidity meter. This process of alternately surging and bailing was repeated several times to decrease the water turbidity within the wells. Lastly, a submersible pump was employed to further develop the wells until stabilization criteria for turbidity (≤10 Nephelometric Turbidity Units), pH (±0.1 Standard Unit), temperature (±10%), and specific conductance (±10%) were achieved. The target turbidity value was based on well purging criteria specified in ENV-TI-05.80.42, *Groundwater Sampling* at the time of development. Well development details were recorded on the *Well Development Form.* A summary of initial and final water quality measurements is presented in Table B.2 in Appendix B.

3.4.3 Hydraulic Conductivity (Slug) Testing

After development, Stantec performed slug tests in four of the five monitoring wells to estimate hydraulic conductivity. Monitoring well CUF-1000 could not be tested, since it was repeatedly dry and had insufficient water column to conduct the tests. The slug tests were performed in accordance with ASTM D4044: *Standard Test Method for (Field Procedure) for Instantaneous Change in Head (Slug) Tests for Determining Hydraulic Properties of Aquifers*. A pressure transducer with a data recorder was used to collect water level information from the wells.

Three to five rising-head and three to four falling-head slug tests were performed at each well, as shown on Table B.3 in Appendix B. Each well was tested by taking an initial measurement of the static water level followed by the insertion of the pressure transducer into the well. After the transducer had been installed, a falling-head slug test was conducted by introducing a solid slug (e.g., PVC pipe filled with sand) into the well to cause a nearly instantaneous rise in the water level. The water levels were then recorded at regular intervals until reaching near initial static levels. After the first test concluded, a rising-head slug test was conducted by removing the slug to cause a nearly instantaneous drop in the water level. Water levels were recorded until initial static water levels were reached again. The procedure of alternating a falling-head and a rising-head slug test was conducted at least three times at each well. The data were recorded electronically by the transducer and downloaded into a data collector. Raw data were checked in the field for discrepancies prior to demobilizing from the CUF Plant.

The field data were analyzed using AQTESOLV™ Version 4.50 Professional software to estimate the hydraulic conductivity of the saturated soils in the screened interval. Calculated hydraulic conductivities are summarized in Table B.3 in Appendix B, and the software output package is provided in Appendix E. The following assumptions and methods were utilized for the calculations:

- Typically, the solution is matched to the plotted data between 70-80% recovery; however, for CUF-1003 the solution was matched to the initial recovery period. The two-tailed shape of the plotted recovery data indicates the initial period is most likely the gravel and cobble interval at 9.9 to 12 ft bgs, and the later period is the underlying clay. The most conservative estimate of hydraulic conductivity is to use the initial recovery period, which is approximately one order of magnitude larger than the later recovery period.
- The clay intervals in each well were not included when estimating the saturated thickness.
- Wells CUF-1001 and CUF-1005 were assumed to be installed in confined aquifer conditions based on the boring logs. The term "confined" is included on the output chart.

3.4.4 Pump Installation

A new, decontaminated, dedicated QED Environmental Systems, Inc. brand model P1101M bladder pump was installed in each new monitoring well after well development was completed. The pump model installed in each well was either a P1150 if the water column height above the pump intake was less than 10 feet, or a model P1101M if it was more than 10 feet. Each pump intake was placed at approximately the mid-point of the well screened interval or the mid-point of the saturated portion of the well screened interval for future groundwater sampling. Following pump installation, the pumps were calibrated in general accordance with ENV-TI-05.80.42, *Groundwater Sampling*. Well pump placement depths, installation calculations, and calibration details were recorded on the Q*ED Well Wizard Dedicated Sampling Pump Installation Checklist* and the *Dedicated Pump Calibration Form*. Pump installation information is provided in Table B.4 in Appendix B.

3.4.5 Well Surveys

After the surface completions for each monitoring well were installed, the well was professionally surveyed using a survey-grade GPS for horizontal and vertical control. Measurements were calculated relative to the coordinate systems used by the CUF Plant. Well survey information is provided in Table B.5 in Appendix B.

3.5 INVESTIGATION DERIVED WASTE

Investigation derived waste (IDW) generated during the HGI included:

- Soil cuttings
- Well development water
- Decontamination fluids
- Personal protective equipment (PPE)
- General trash.

IDW was handled in general accordance with ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*; ENV-TI-05.80.25, *Monitoring Well and Piezometer Installation and Development*; the HGI SAP; the CUF Plant-specific waste management plan; and local, state, and federal regulations. Transportation and disposal of IDW were coordinated with the CUF Plant facility management. Soil cuttings, decontamination fluids, and well development water were managed as authorized by CUF Plant facility management and in accordance with the HGI SAP. Used disposable PPE (e.g., nitrile gloves) and general trash were placed in garbage bags and disposed of in a municipal waste dumpster onsite.

3.6 VARIATIONS

The proposed scope and procedures for the HGI were outlined in the SAP, QAPP, applicable TVA TIs, and ASTM standards, as detailed in the sections above. ariations in scope or procedures discussed with TDEC and/or TVA, changes based on field conditions, or additional field sampling performed to complete the scope of work in the SAPs are described in the following sections. As discussed below, these variations do not impact the overall usability and representativeness of the dataset provided in this SAR for the HGI at the CUF Plant.

3.6.1 Variations in Scope

Variations in scope are provided below.

- Several boring locations were revised from the locations originally proposed, including:
    - Proposed Boring CUF-1000: Originally this boring location was proposed in the Hollister House floodplain and viewshed. Following approval by TDEC, the boring was relocated as CUF-1000ALT to a location outside of the floodplain and viewshed to target the Stones River Group.
    - Proposed Boring CUF-1001: Originally this boring location was proposed in a depression where stormwater typically accumulates, which could potentially result in the monitoring well becoming submerged during heavy rain events. Following TDEC approval, the boring was

relocated as CUF-1001ALT west of the original location, outside of the depression. An unknown underground utility was then identified approximately four feet southeast of CUF-1001ALT. As such, borehole location CUF-1001ALT was further adjusted to achieve clearance from the utility in accordance with the SAP.

  - Proposed Boring CUF-1002: The original boring location was proposed in an area with high potential for conflicts with underground utilities. As such, and with TDEC approval, this boring was relocated as CUF-1002ALT to the north and then again as CUF-1002ALT2 to the northwest, away from the utility corridors.

  - Proposed Boring CUF-1004: The original boring location was proposed in the floodplain. Following TDEC approval, this boring was relocated as CUF-1004ALT outside of the floodplain.

- Background Monitoring Well CUF-1004 was not installed because all three borings drilled in that area were dry. This change in scope was approved by TDEC.

- Monitoring Well CUF-1000 could not be slug tested due to insufficient water column height within the casing; however, slug testing was performed at the other monitoring wells installed during the HGI.

- Select geotechnical samples were not analyzed as specified in the SAP because sufficient lithologic and geotechnical information were available from other EIP drilling activities to meet the objectives of the HGI.

3.6.2 Variations in Procedures

Variations in procedures occurring in the field are provided below.

- Boring CUF-1000ALTA failed to encounter groundwater at the depth of auger refusal. A temporary one-inch diameter piezometer was placed in the borehole to periodically monitor water levels to determine if a permanent monitoring well should be installed. Well CUF-1000 was subsequently installed at this location.

4.0 SUMMARY

The data presented in this report are from the HGI at the CUF Plant. Five permanent monitoring wells were installed during the HGI to support data collection for the groundwater and background soil investigations at the CUF Plant, including groundwater level measurements, and groundwater and background soil sample collection for analysis of CCR Parameters. The scope of work for the HGI included:

- Drilled 12 soil borings for installation of three permanent monitoring wells and two background monitoring wells at the CUF Plant
- Collected soil samples to develop a continuous boring log/soil profile for each well boring
- Collected seven soil samples and one field duplicate for analysis of CCR Parameters from the screened interval depth range of four background monitoring well borings
- Installed permanent monitoring wells in five of the borings and constructed surface completions
- Developed each well and conducted slug testing in four wells to estimate hydraulic conductivity
- Surveyed each new permanent well.

A summary of boring and monitoring well locations is presented in Table 1. Monitoring well construction specifications, well development, hydraulic testing results, pump installation details, and survey information are presented in Tables B.1 through B.5, respectively. Background soil sampling information and analytical results are reported in the Background Soil Investigation SAR, and groundwater level measurement and sampling analytical results are reported in a series of Groundwater Investigation SARs for the CUF Plant.

Stantec has completed an HGI at the CUF Plant in Cumberland City, Tennessee, in accordance with the HGI SAP as documented herein. The data collected during the HGI are usable for reporting and evaluation in the EAR and meet the objectives of the TDEC Order EIP. HGI drilling and well installation data will be evaluated along with data collected under other TDEC Order SAPs, including but not limited to, the background soil investigation and the six sampling events of the groundwater investigation, as well as data collected under other State and CCR programs. This evaluation will be provided in the EAR.

5.0 REFERENCES

American Society for Testing and Materials (ASTM). D6151: Standard Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling.

ASTM. D1586: Standard Test Method for Standard Penetration Test and Split-Barrel Sampling of Soils.

ASTM. D4044: Standard Test Method for (Field Procedure) for Instantaneous Change in Head (Slug) Tests for Determining Hydraulic Properties of Aquifers.

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Tennessee Valley Authority (TVA). ENV-TI-05.80.02, *Sample Labeling and Custody*.

TVA. ENV-TI-05.80.03, *Field Record Keeping.*

TVA. ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*.

TVA. ENV-TI-05.80.25, *Monitoring Well and Piezometer Installation and Development*.

TVA. ENV-TI-05.80.42, *Groundwater Sampling.*

APPENDIX A - EXHIBITS

Exhibit No.

A.1

Title

Site Map and Monitoring Well Locations

Client/Project

Tennessee Valley Authority
Cumberland Fossil Plant (CUF) TDEC Order

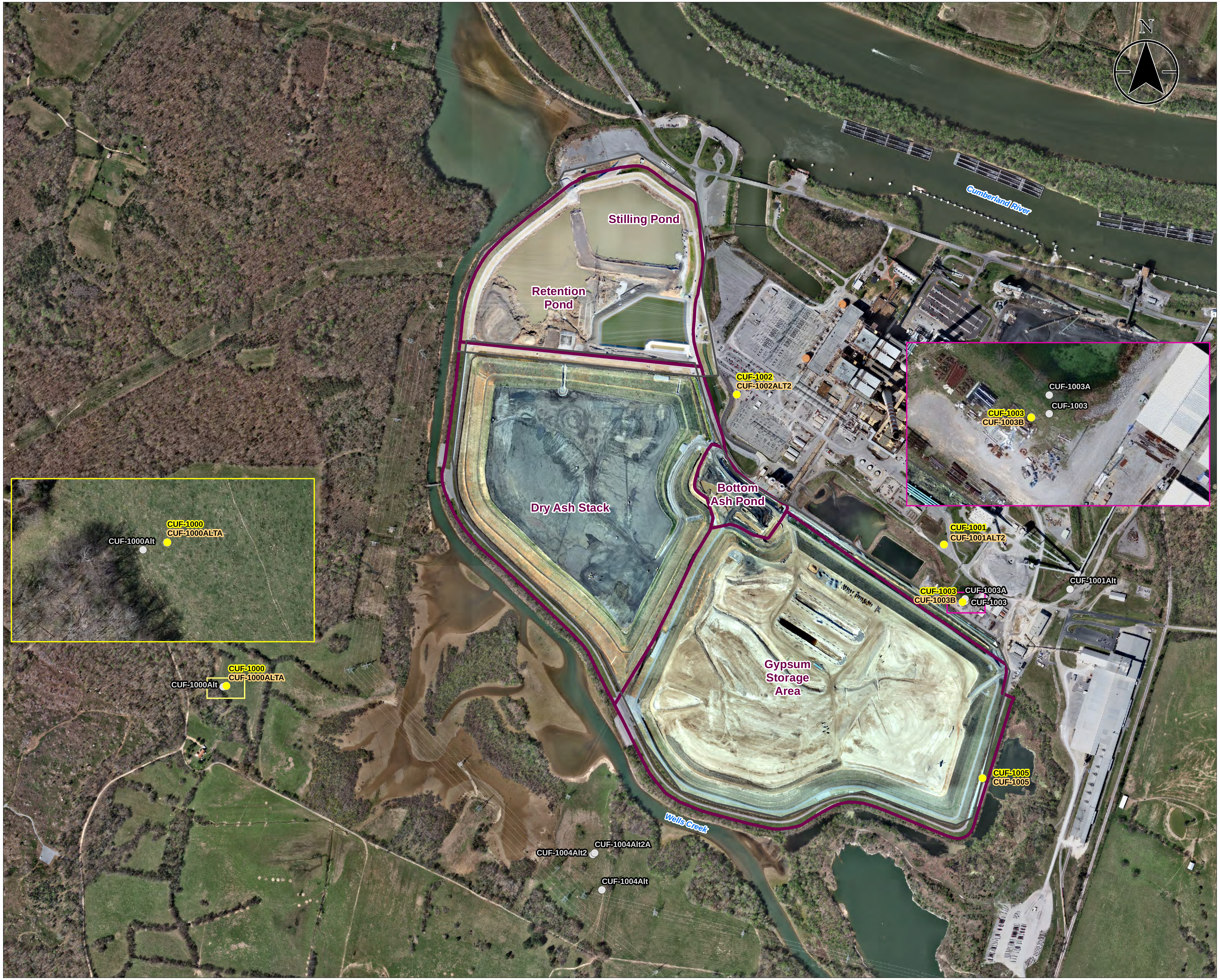
Project Location

Stewart County, Tennessee

175568209
Prepared by DMB on 2020-02-26
Technical Review by DN on 2020-02-26

0 400 800 1,200 1,600 Feet

1:4,800 (At original document size of 22x34)

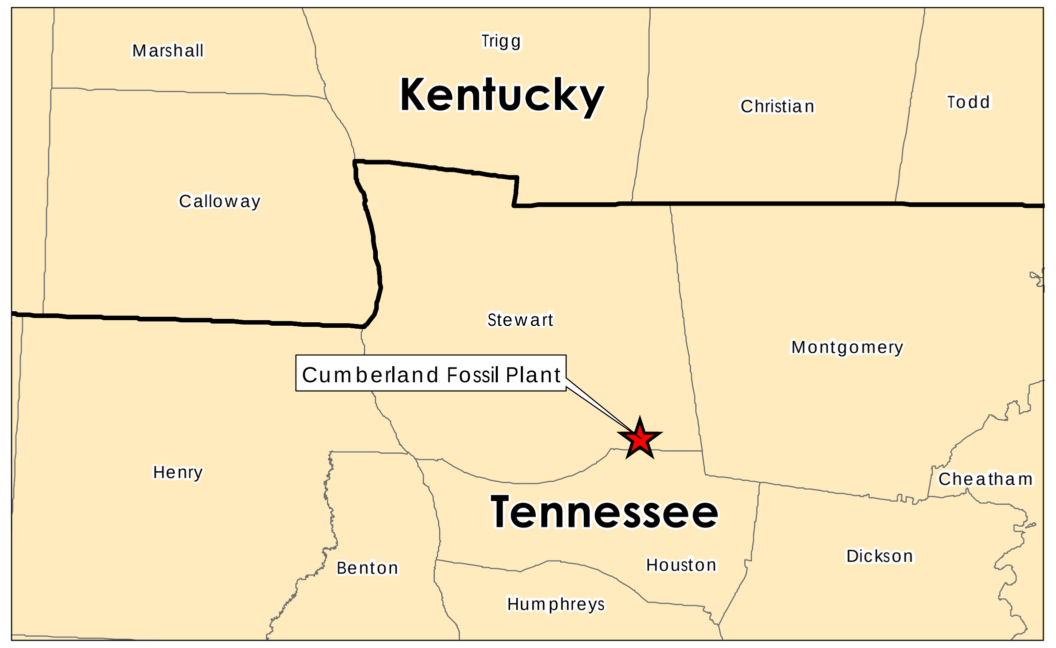


Legend

- Monitoring Well (Survey 5/15/2019) — Well Name / Boring Name
- Drilled and Abandoned Borehole — Boring Name
- 2019 Imagery Boundary
- CCR Unit Area (Approximate)

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA dated 3/6/2019 and 12/11/2019



Stantec TVA

APPENDIX B - TABLES

Table B.1 - Summary of Monitoring Well Construction Specifications
Cumberland Fossil Plant
November 2018 - July 2019

Well ID	Top of Casing		Bottom of Well			Screened Interval					
	Stickup	Elevation	Depth	Depth	Elevation	Depth Top	Depth Bottom	Depth Top	Depth Bottom	Elevation Top	Elevation Bottom
	ft ags	ft NGVD29	ft bgs	ft btoc	ft NGVD29	ft bgs	ft bgs	ft btoc	ft btoc	ft NGVD29	ft NGVD29
CUF-1000	3.7	395.29	21.8	25.5	369.8	10.8	21.4	14.5	25.1	380.8	370.2
CUF-1001	3.5	393.75	17.5	21.0	372.8	12.3	17.1	15.8	20.6	378.0	373.2
CUF-1002	3.4	389.26	17.0	20.4	368.9	11.7	16.6	15.1	20.0	374.2	369.3
CUF-1003	3.4	396.39	14.5	17.9	378.5	9.2	14.1	12.6	17.5	383.8	378.9
CUF-1005	3.5	399.58	25.7	29.2	370.4	14.7	25.3	18.2	28.8	381.4	370.8

Notes:

ags	above ground surface
bgs	below ground surface
btoc	below top of casing
ft	feet
ID	identification
NGVD29	National Geodetic Vertical Datum of 1929

1. Measurement data are from Well Installation Details (Appendix C.2).
2. Wells were surveyed on April 24, 2019 and May 15, 2019.

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Table B.2 - Summary of Well Development Data
Cumberland Fossil Plant
November 2018 - July 2019

Well ID	pH		Turbidity		Specific Conductance		Temperature	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
			NTU	NTU	uS/cm	uS/cm	DEG C	DEG C
CUF-1000	6.87	7.69	1.14	1.89	383	397	15.8	13.9
CUF-1001	7.21	7.02	277	4.85	1,345	1,293	18.3	18.8
CUF-1002	7.34	7.16	84.1	0.92	1,310	1,293	15.1	15.4
CUF-1003	6.75	6.97	66.5	6.47	3,395	3,356	16.9	17.2
CUF-1005	7.95	9.39	978	3.68	1,114	2,680	16.2	16.2

Notes:

DEG C	degrees Celsius
ID	identification
NTU	Nephelometric Turbidity Unit
uS/cm	microSiemens per centimeter

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Table B.3 - Summary of Hydraulic Conductivity Testing Results
Cumberland Fossil Plant
November 2018 - July 2019

Well ID	Saturated Thickness	Number of Tests		Average Hydraulic Conductivity	Average Hydraulic Conductivity
		Falling Head	Rising Head		
	ft			ft/day	cm/s
CUF-1001	0.3	3	3	88.25	3.11E-02
CUF-1002	0.5	3	3	128.3	4.53E-02
CUF-1003	1.3	5	4	48.72	1.72E-02
CUF-1005	7.4	3	3	0.6750	2.38E-04

Notes:

cm/s	centimeters per second
ft	feet
ID	identification

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Table B.4 - Summary of Pump Installation Details
Cumberland Fossil Plant
November 2018 - July 2019

Well ID	Top of Casing Elevation	Bottom of Well Depth	Bottom of Well Elevation	Groundwater Level Depth	Groundwater Level Elevation	Pump Intake Depth	Pump Intake Elevation	Water Column Above Intake
	ft NGVD29	ft btoc	ft NGVD29	ft btoc	ft NGVD29	ft btoc	ft NGVD29	ft
CUF-1000	395.29	25.5	369.8	13.34	381.95	19.5	375.8	6.2
CUF-1001	393.75	21.0	372.8	16.08	377.67	19.0	374.8	2.9
CUF-1002	389.26	20.4	368.9	13.20	376.06	18.0	371.3	4.8
CUF-1003	396.39	17.9	378.5	10.10	386.29	16.8	379.6	6.7
CUF-1005	399.58	29.2	370.4	9.15	390.43	24.0	375.6	14.9

Notes:

btoc	below top of casing
ft	feet
NGVD29	National Geodetic Vertical Datum of 1929

1. Wells were surveyed on April 24, 2019 and May 15, 2019.

2. Depth data are from *QED Well Wizard Dedicated Sampling Pump Installation Checklists* dated January 21, 2019 – May 8, 2019. Depth to groundwater level was measured prior to pump insertion. Pump intake and water column above intake rounded to nearest 0.1 foot.

Table B.5 - Summary of Monitoring Well Survey Data
Cumberland Fossil Plant
November 2018 - July 2019

Well ID	TN State Plane Northing	TN State Plane Easting	Latitude	Longitude	Ground Surface Elevation
	ft NAD27	ft NAD27	DMS NAD27	DMS NAD27	ft NGVD29
CUF-1000	729,161.60	1,507.389.51	36°23’0.83”	-87°40’24.51”	391.6
CUF-1001	730,376.03	1,513,548.74	36°23’13.87”	-87°39’9.45”	390.3
CUF-1002	731,662.39	1,511,771.92	36°23’26.29”	-87°39’31.44”	385.8
CUF-1003	729,882.92	1,513,710.90	36°23’9.02”	-87°39’7.36”	393.0
CUF-1005	728,368.88	1,513,879.56	36°22’54.08”	-87°39’4.99”	396.1

Notes:

DMS	Degrees, Minutes, Seconds
ft	feet
ID	identification
NAD27	North American Datum of 1927
NGVD29	National Geodetic Vertical Datum of 1929
TN	Tennessee

1. Wells were surveyed on April 24, 2019 and May 15, 2019. Coordinates are for the top of well casing, except ground surface elevation which is adjacent to the concrete well pad. State Plane coordinates rounded to the nearest 0.01 feet. Latitude and Longitude rounded to the nearest 0.01 degree. Ground surface elevations rounded to the nearest 0.1 feet.

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APPENDIX C – SUBSURFACE LOGS AND WELL INSTALLATION DETAILS

ATTACHMENT C.1
SUBSURFACE LOGS

REFER TO
APPENDIX B.1
BACKGROUND SOIL BORINGS

ATTACHMENT C.2
WELL INSTALLATION DETAILS

REFER TO

APPENDIX C.3
PERMANENT WELLS

APPENDIX D – PHOTOGRAPHS OF SOIL BORINGS AND MONITORING WELLS

ATTACHMENT D.1

Photographic Log of Soil Lithology

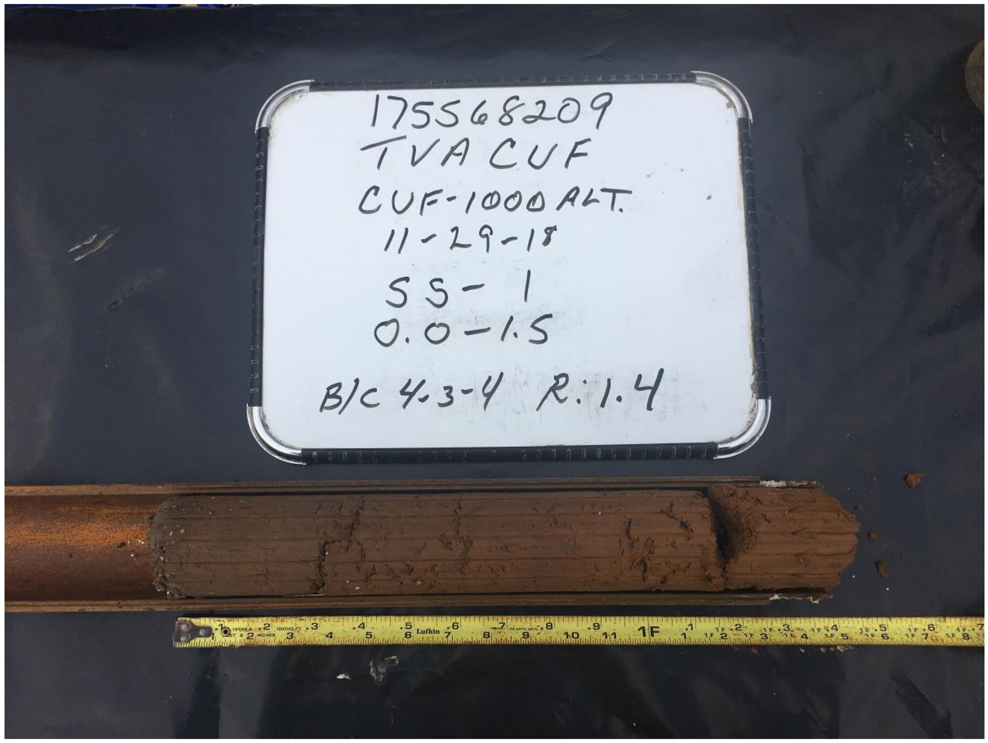
Client:	Tennessee Valley Authority	Project:	CUF TDEC Order
Site Name:	Cumberland Fossil Plant (CUF)	Site Location:	Cumberland City, Tennessee

Photograph ID: 1

Photo Location:
CUF-1000ALT

Photo Date:
11/29/2018

Comments:
Split spoon sample SS-01 (0.0-1.5 feet).

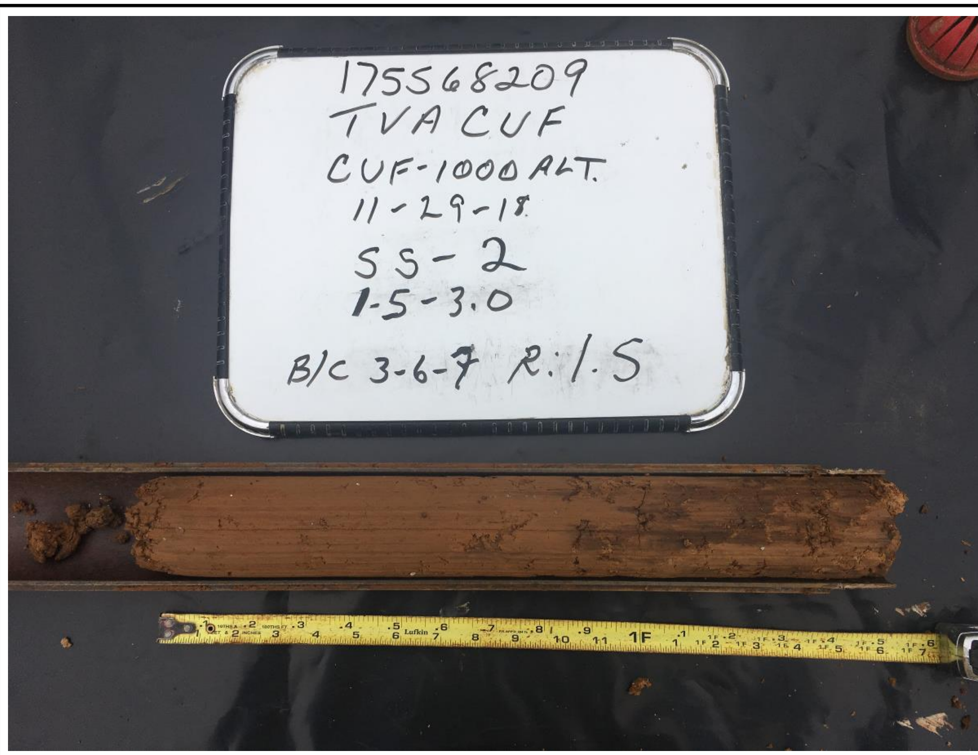


Photograph ID: 2

Photo Location:
CUF-1000ALT

Photo Date:
11/29/2018

Comments:
Split spoon sample SS-02 (1.5-3.0 feet).



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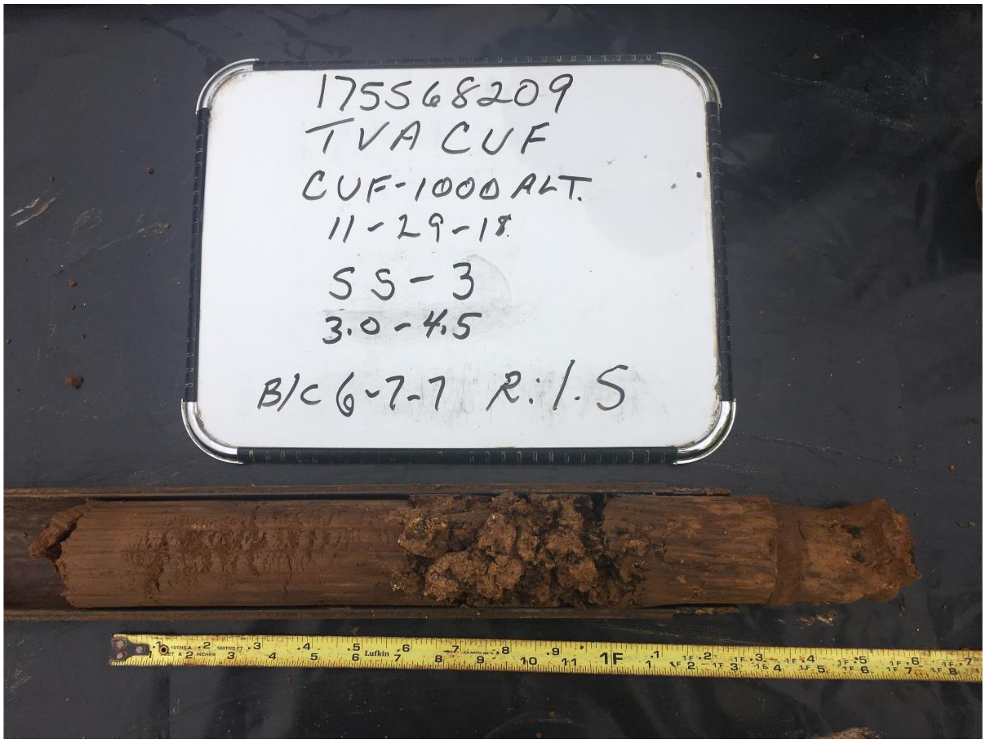
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 3

Photo Location:
CUF-1000ALT

Photo Date:
11/29/2018

Comments:
Split spoon sample SS-03 (3.0-4.5 feet).

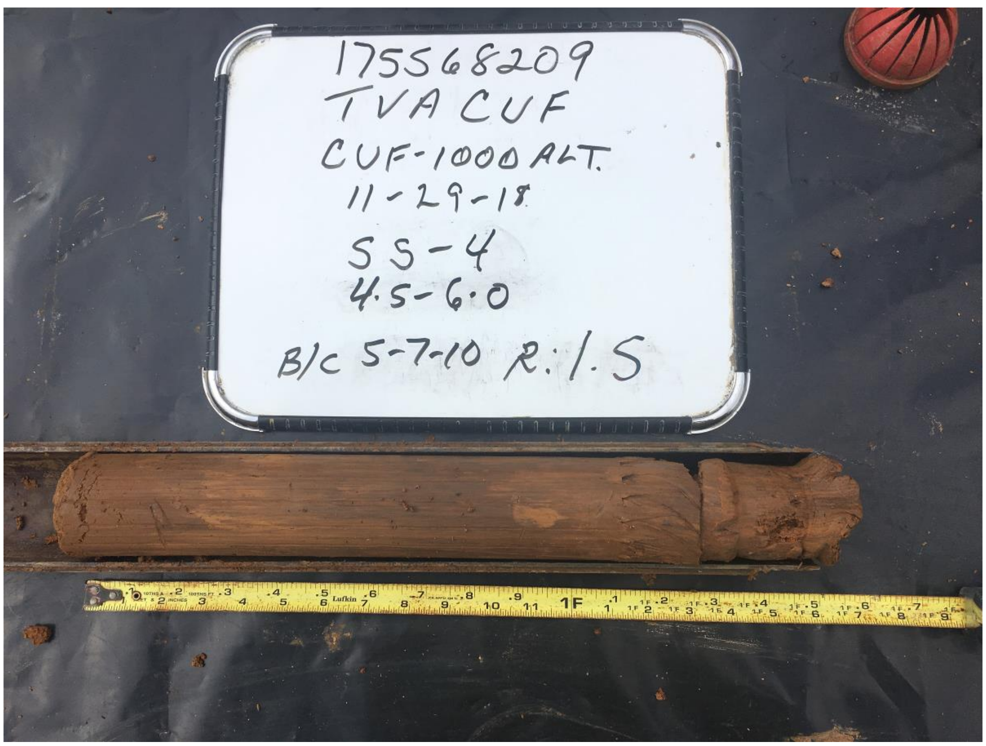


Photograph ID: 4

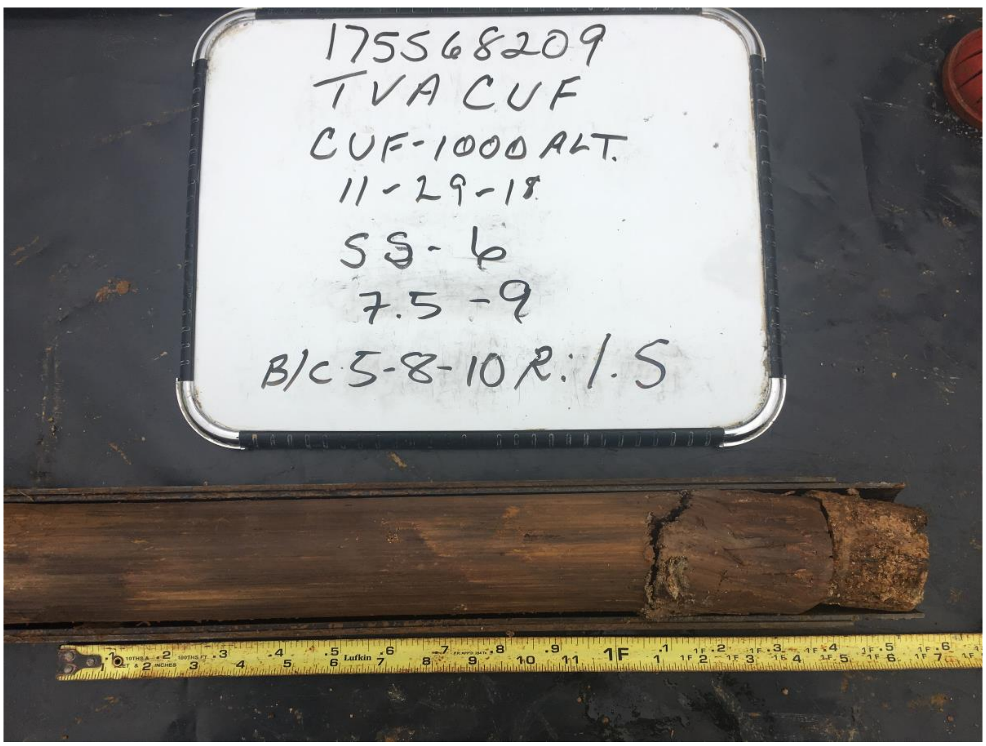
Photo Location:
CUF-1000ALT

Photo Date:
11/29/2018

Comments:
Split spoon sample SS-04 (4.5-6.0 feet).



Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

<table>
<tr><td>Photograph ID: 5
Photo Location:
CUF-1000ALT
Photo Date:
11/29/2018
Comments:
Split spoon sample SS-05 (6.0-7.5 feet).</td><td>
</td></tr>
<tr><td>Photograph ID: 6
Photo Location:
CUF-1000ALT
Photo Date:
11/29/2018
Comments:
Split spoon sample SS-06 (7.5-9.0 feet).</td><td>
</td></tr>
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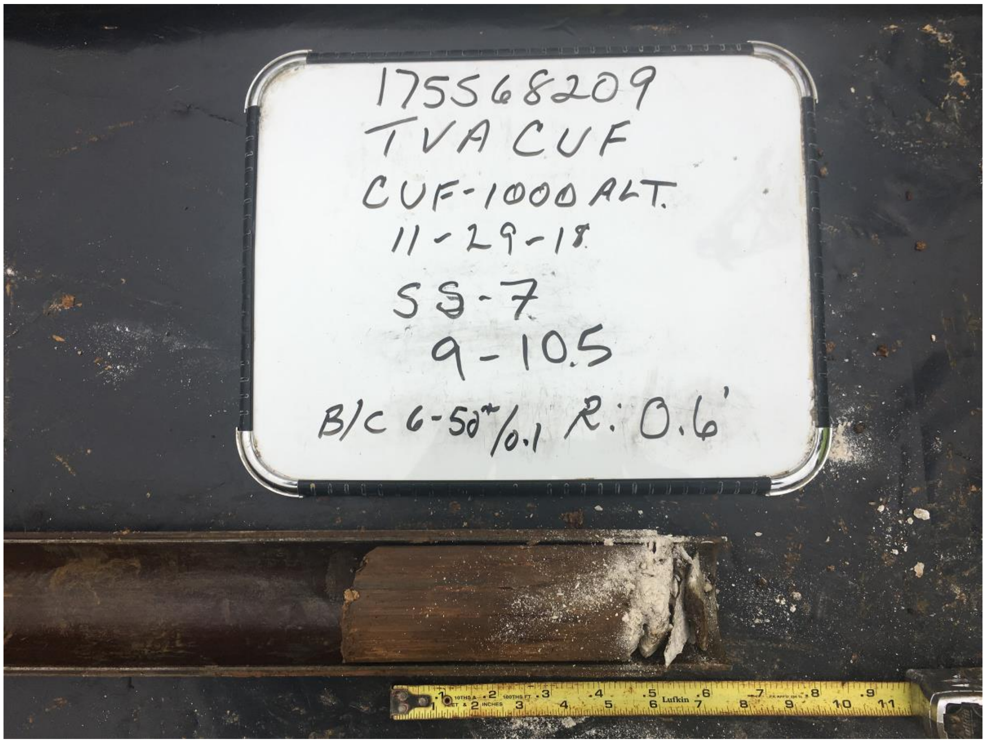
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 7

Photo Location:
CUF-1000ALT

Photo Date:
11/29/2018

Comments:
Split spoon sample SS-07 (9.0-9.9 feet). Refusal at 9.9 feet.



Photograph ID: 8

Photo Location:
CUF-1000ALTA

Photo Date:
11/29/2018

Comments:
Split spoon sample SS-01 (0.0-1.5 feet).

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Photographic Log

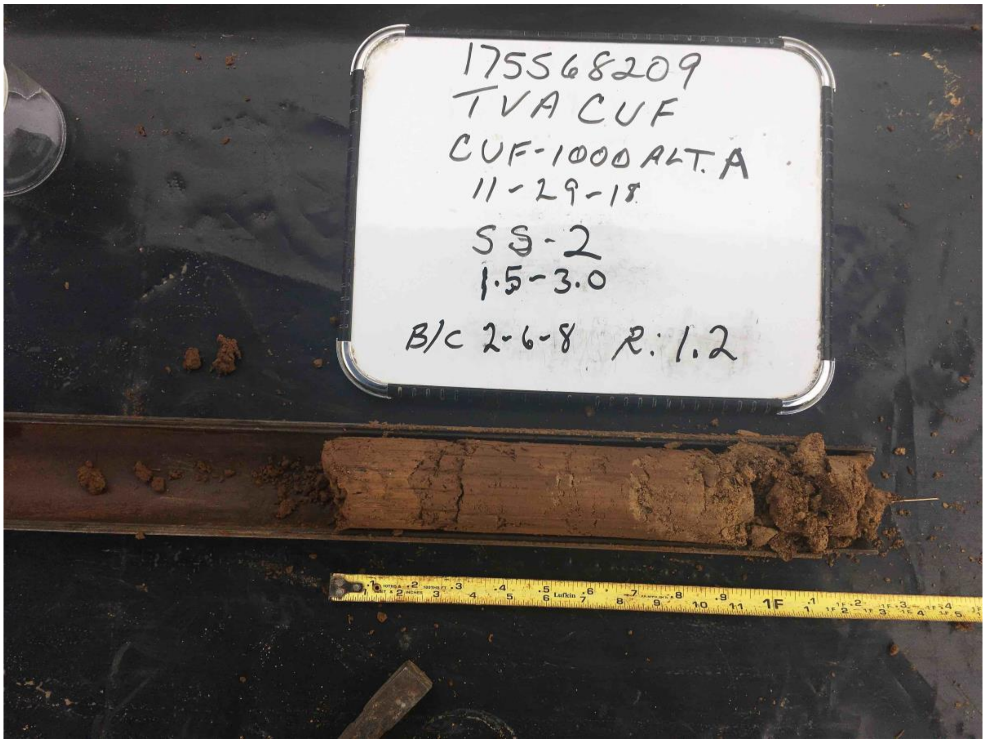
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 9

Photo Location:
CUF-1000ALTA

Photo Date:
11/29/2018

Comments:
Split spoon sample SS-02 (1.5-3.0 feet).



Photograph ID: 10

Photo Location:
CUF-1000ALTA

Photo Date:
11/29/2018

Comments:
Split spoon sample SS-03 (3.0-4.5 feet).

Client:	Tennessee Valley Authority	Project:	CUF TDEC Order
Site Name:	Cumberland Fossil Plant (CUF)	Site Location:	Cumberland City, Tennessee

Photograph ID: 11

Photo Location:
CUF-1000ALTA

Photo Date:
11/29/2018

Comments:
Split spoon sample SS-04 (4.5-6.0 feet).

Photograph ID: 12

Photo Location:
CUF-1000ALTA

Photo Date:
11/29/2018

Comments:
Split spoon sample SS-05 (6.0-7.5 feet).

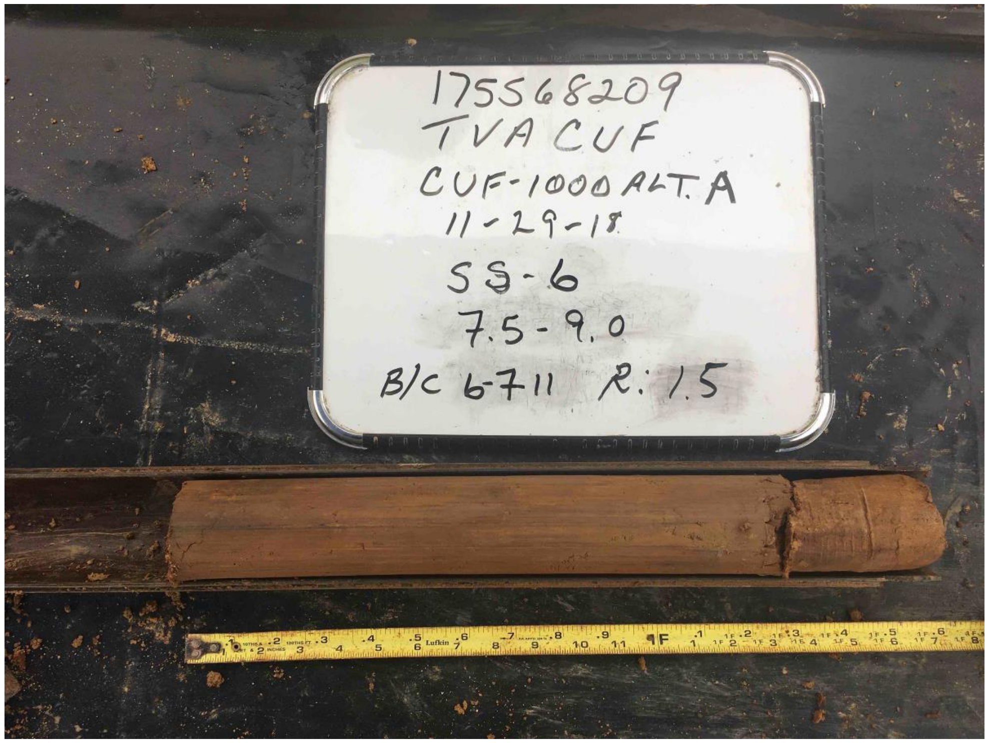
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 13

Photo Location:
CUF-1000ALTA

Photo Date:
11/29/2018

Comments:
Split spoon sample SS-06 (7.5-9.0 feet).



Photograph ID: 14

Photo Location:
CUF-1000ALTA

Photo Date:
11/29/2018

Comments:
Split spoon sample SS-07 (9.0-10.5 feet).

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 15

Photo Location:
CUF-1000ALTA

Photo Date:
11/29/2018

Comments:
Split spoon sample SS-08 (10.5-12.0 feet).

Photograph ID: 16

Photo Location:
CUF-1000ALTA

Photo Date:
11/29/2018

Comments:
Split spoon sample SS-09 (12.0-13.5 feet).

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 17

Photo Location:
CUF-1000ALTA

Photo Date:
11/29/2018

Comments:
Split spoon sample SS-10 (13.5-15.0 feet).

Photograph ID: 18

Photo Location:
CUF-1000ALTA

Photo Date:
11/29/2018

Comments:
Split spoon sample SS-11 (15.0-16.5 feet).

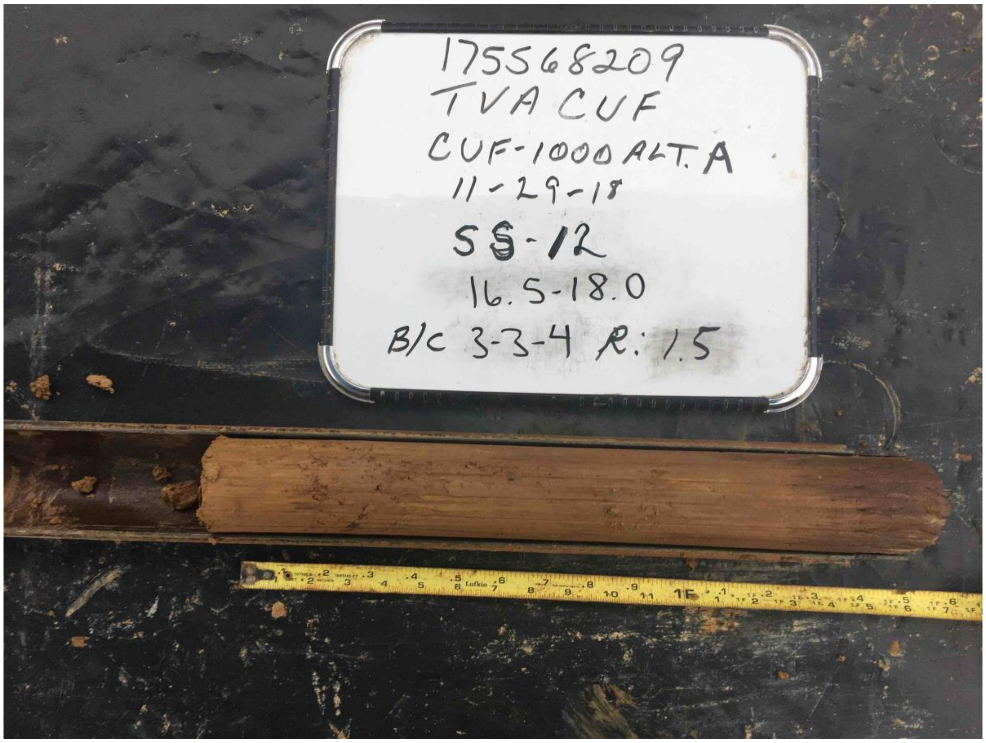
Client:	Tennessee Valley Authority	Project:	CUF TDEC Order
Site Name:	Cumberland Fossil Plant (CUF)	Site Location:	Cumberland City, Tennessee

Photograph ID: 19

Photo Location:
CUF-1000ALTA

Photo Date:
11/29/2018

Comments:
Split spoon sample SS-12 (16.5-18.0 feet).



Photograph ID: 20

Photo Location:
CUF-1000ALTA

Photo Date:
11/29/2018

Comments:
Split spoon sample SS-13 (18.0-19.5 feet).

No Available Picture.

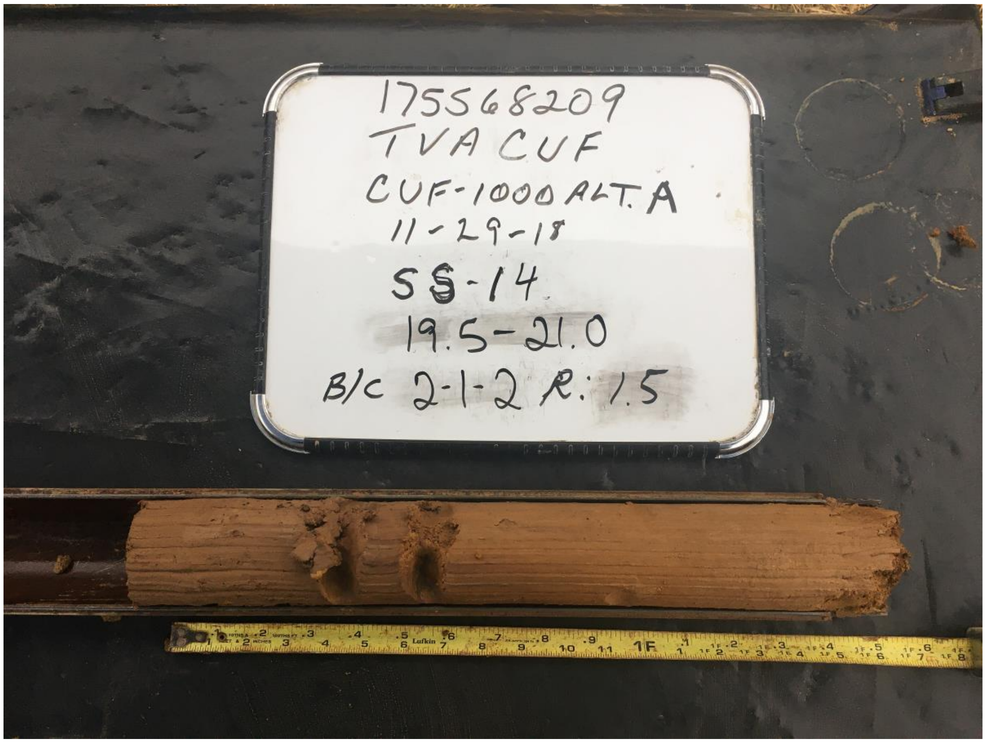
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 21

Photo Location: CUF-1000ALTA

Photo Date: 11/29/2018

Comments: Split spoon sample SS-14 (19.5-21.0 feet).

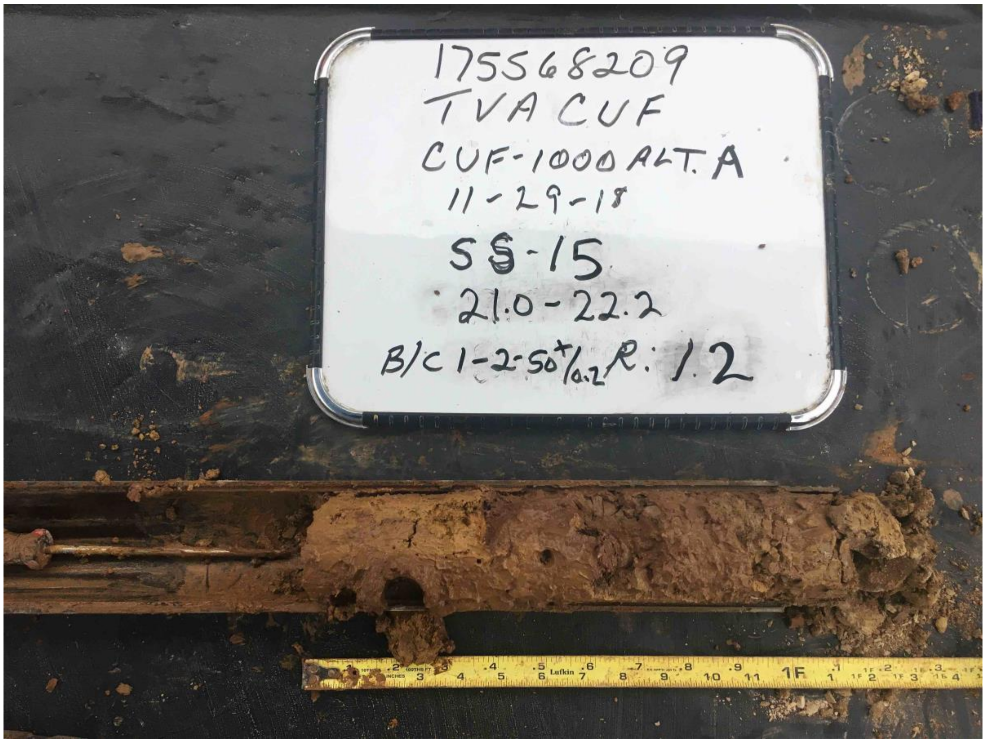


Photograph ID: 22

Photo Location: CUF-1000ALTA

Photo Date: 11/29/2018

Comments: Split spoon sample SS-15 (21.0-22.2 feet). Refusal at 22.4 feet.



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Photographic Log

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 23

Photo Location: CUF-1001ALT

Photo Date: 12/12/2018

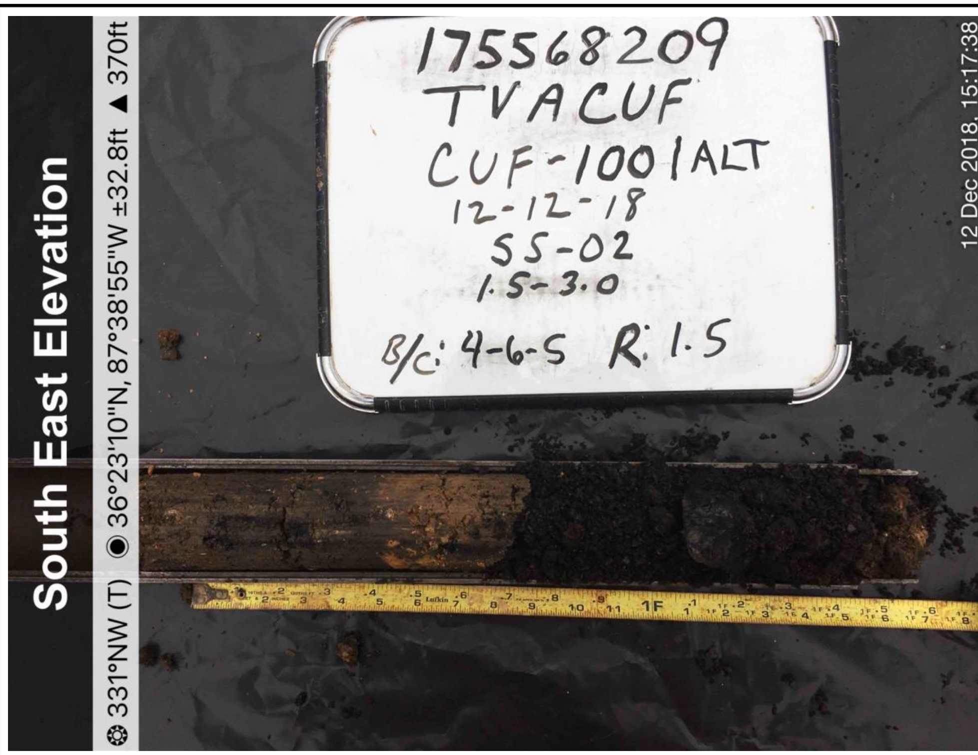
Comments: Split spoon sample SS-01 (0.0-1.5 feet).

Photograph ID: 24

Photo Location: CUF-1001ALT

Photo Date: 12/12/2018

Comments: Split spoon sample SS-02 (1.5-3.0 feet).



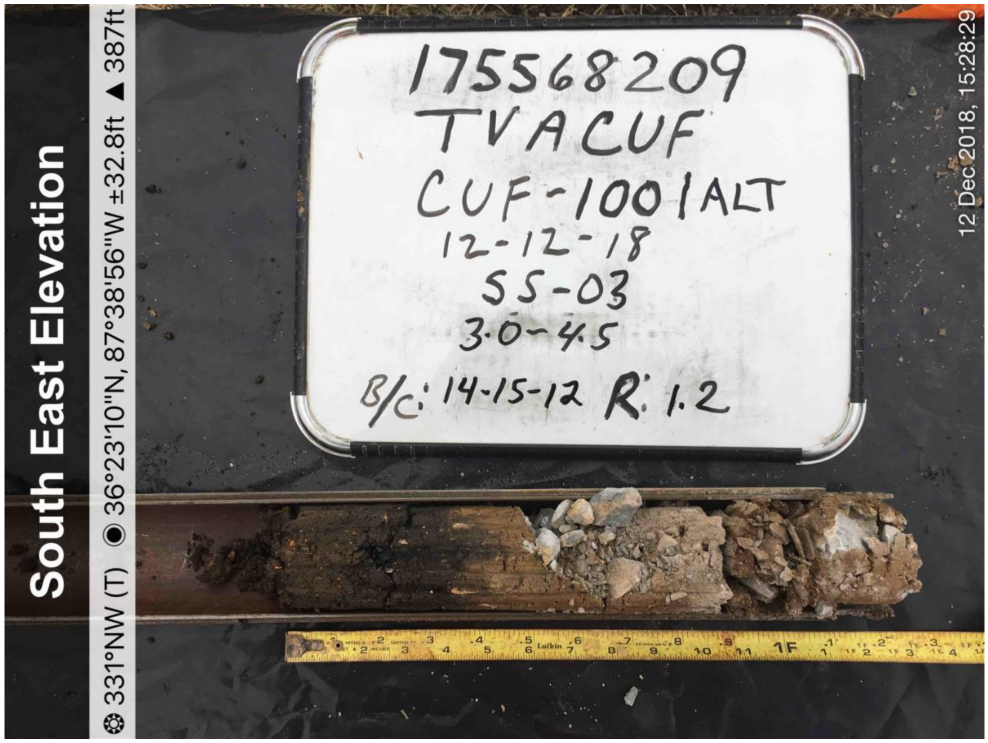
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 25

Photo Location:
CUF-1001ALT

Photo Date:
12/12/2018

Comments:
Split spoon sample SS-03 (3.0-4.5 feet).

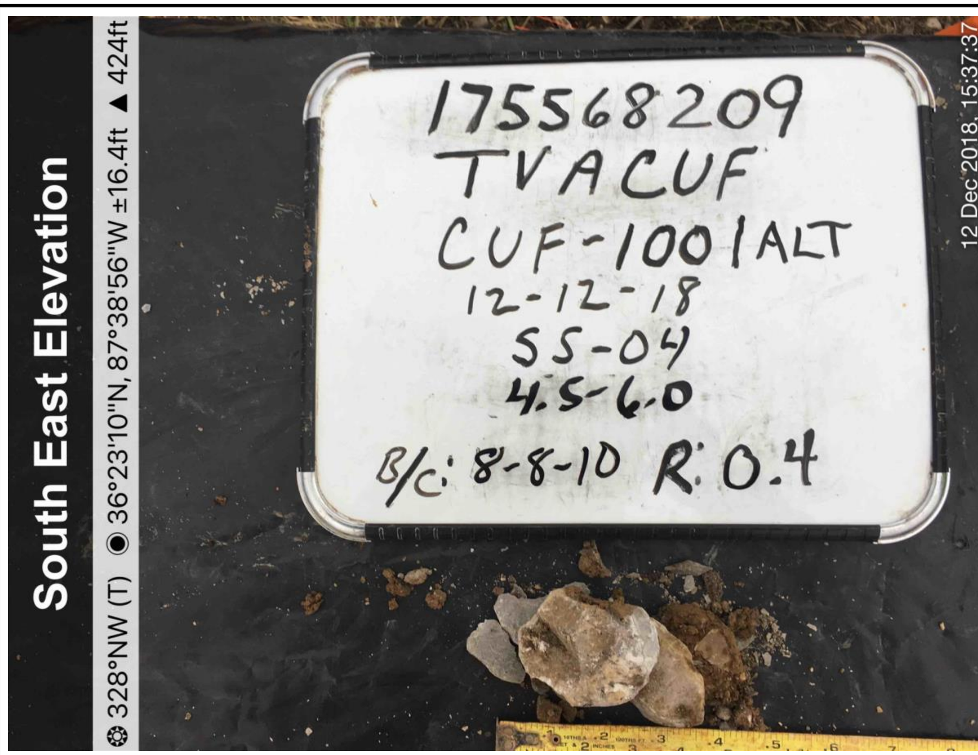


Photograph ID: 26

Photo Location:
CUF-1001ALT

Photo Date:
12/12/2018

Comments:
Split spoon sample SS-04 (4.5-6.0 feet).



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Photographic Log

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 27

Photo Location:
CUF-1001ALT

Photo Date:
12/12/2018

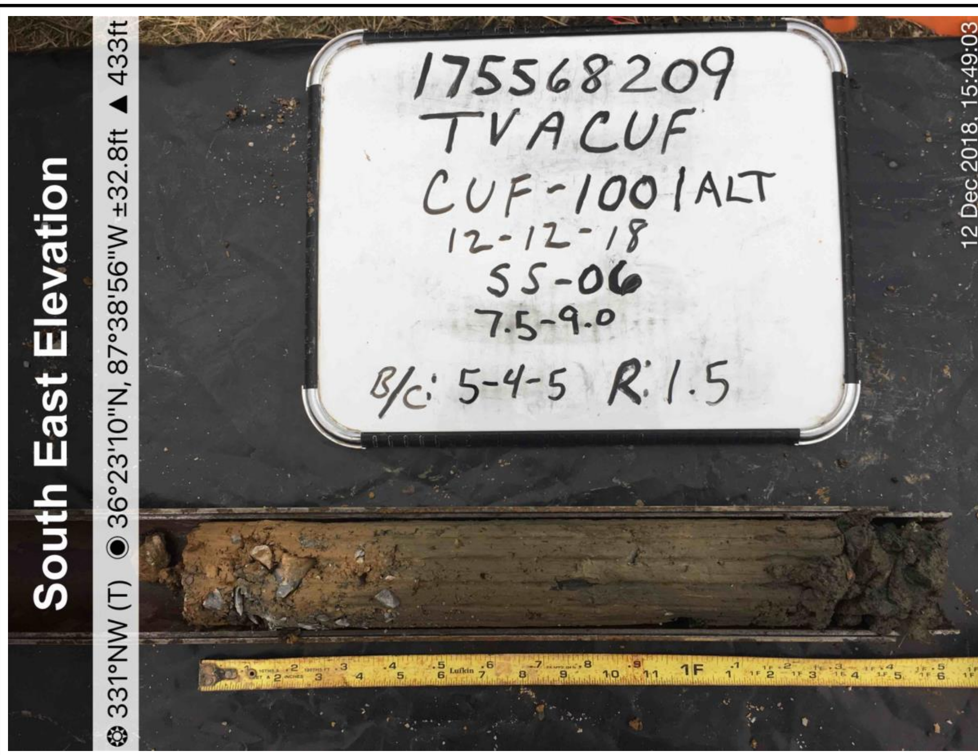
Comments:
Split spoon sample SS-05 (6.0-7.5 feet).

Photograph ID: 28

Photo Location:
CUF-1001ALT

Photo Date:
12/12/2018

Comments:
Split spoon sample SS-06 (7.5-9.0 feet).



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Photographic Log

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 29

Photo Location:
CUF-1001ALT

Photo Date:
12/12/2018

Comments:
Split spoon sample SS-07 (9.0-10.5 feet).

Photograph ID: 30

Photo Location:
CUF-1001ALT

Photo Date:
12/12/2018

Comments:
Split spoon sample SS-08 (10.5-12.0 feet).

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Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 31

Photo Location:
CUF-1001ALT

Photo Date:
12/12/2018

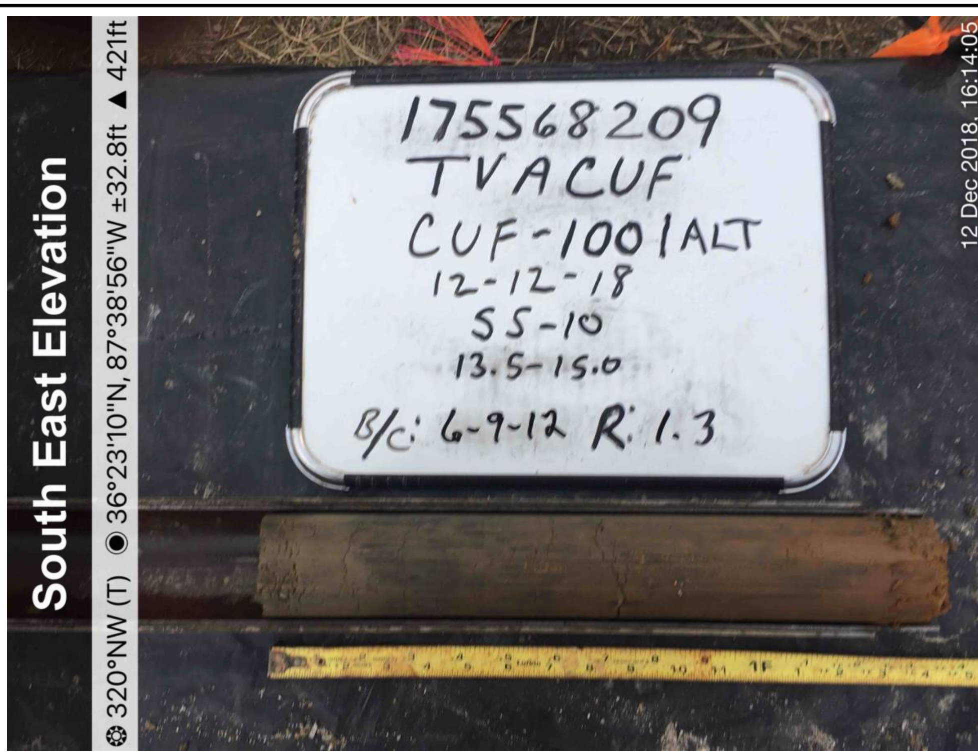
Comments:
Split spoon sample SS-09 (12.0-13.5 feet).

Photograph ID: 32

Photo Location:
CUF-1001ALT

Photo Date:
12/12/2018

Comments:
Split spoon sample SS-10 (13.5-15.0 feet).



Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 33

Photo Location: CUF-1001ALT

Photo Date: 12/12/2018

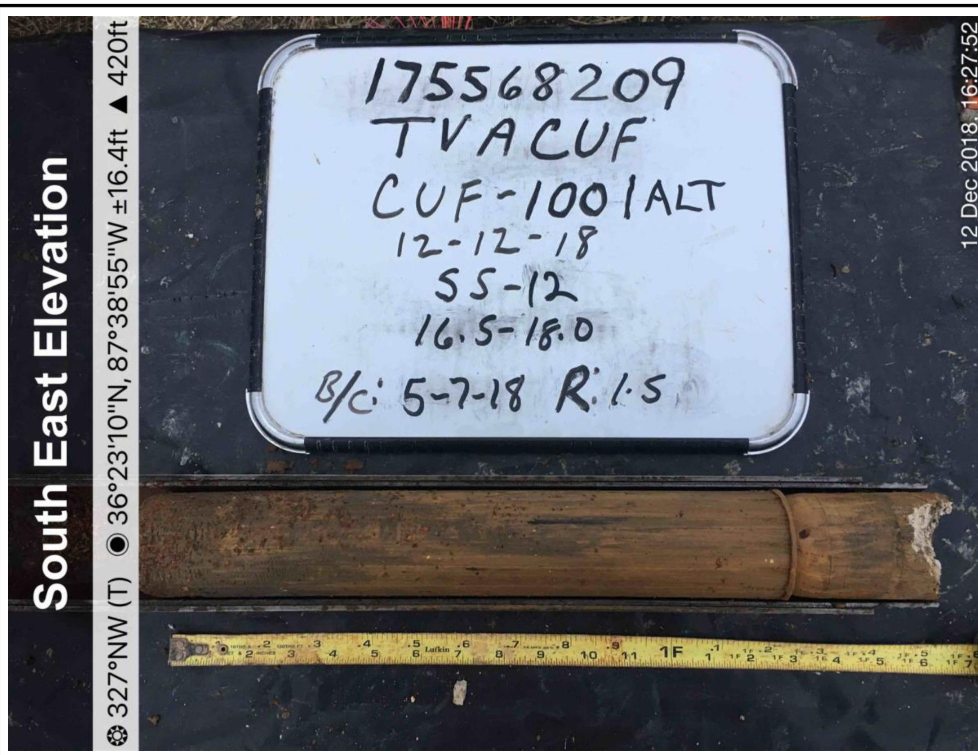
Comments: Split spoon sample SS-11 (15.0-16.5 feet).

Photograph ID: 34

Photo Location: CUF-1001ALT

Photo Date: 12/12/2018

Comments: Split spoon sample SS-12 (16.5-18.0 feet).



Stantec

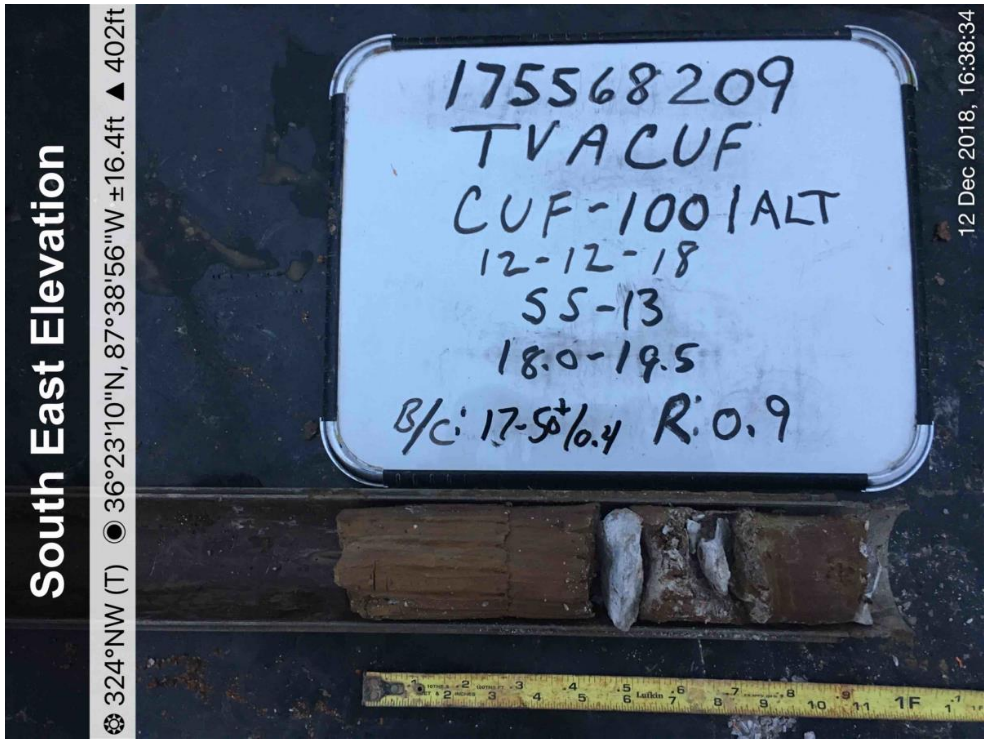
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 35

Photo Location: CUF-1001ALT

Photo Date: 12/12/2018

Comments: Split spoon sample SS-13 (18.0-19.5 feet).

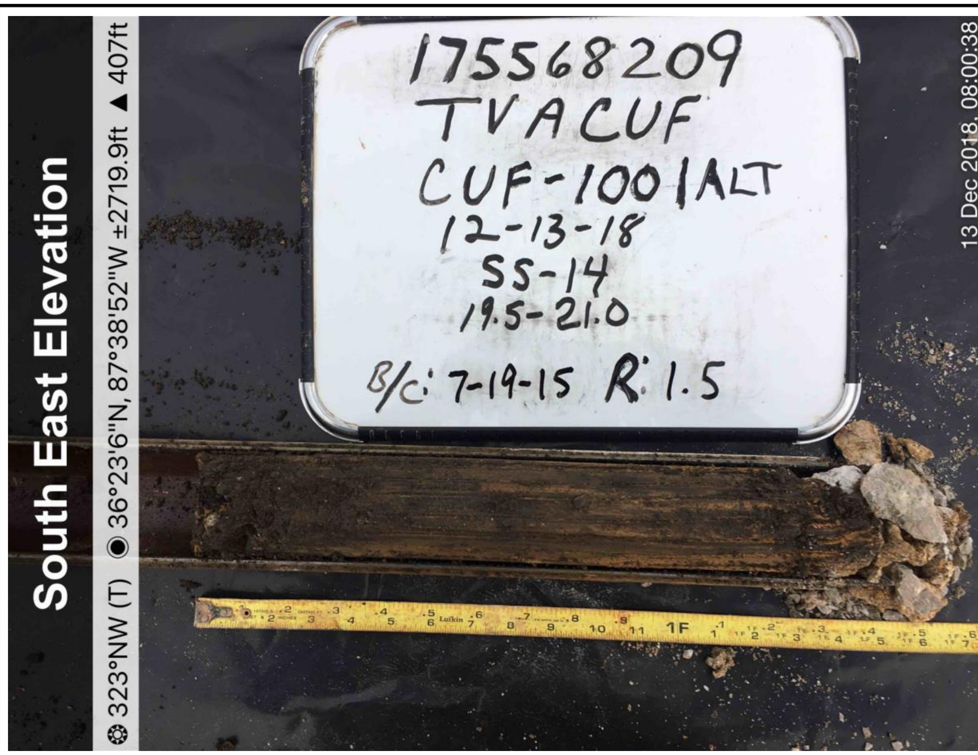


Photograph ID: 36

Photo Location: CUF-1001ALT

Photo Date: 12/13/2018

Comments: Split spoon sample SS-14 (19.5-21.0 feet).



Client:	Tennessee Valley Authority	Project:	CUF TDEC Order
Site Name:	Cumberland Fossil Plant (CUF)	Site Location:	Cumberland City, Tennessee

Photograph ID: 37

Photo Location: CUF-1001ALT

Photo Date: 12/13/2018

Comments: Split spoon sample SS-15 (21.0-22.5 feet).

Photograph ID: 38

Photo Location: CUF-1001ALT

Photo Date: 12/13/2018

Comments: Split spoon sample SS-16 (22.5-22.8 feet). Refusal at 22.8 feet.

Stantec **Photographic Log**

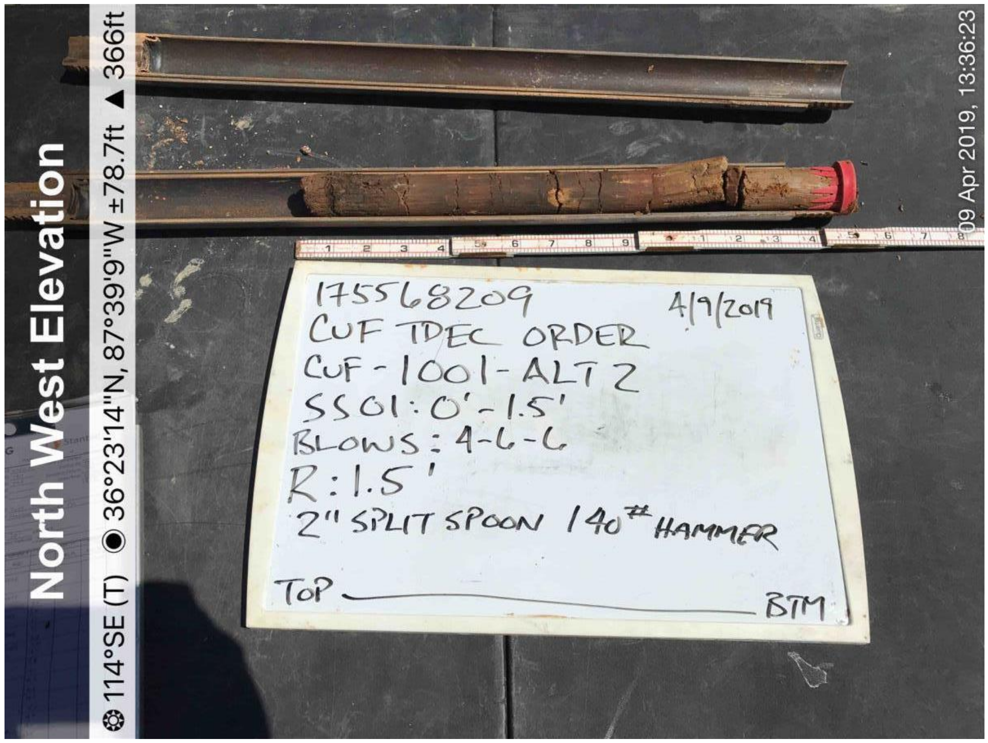
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 39

Photo Location:
CUF-1001ALT2

Photo Date:
4/9/2019

Comments:
Split spoon sample SS-01 (0.0-1.5 feet).

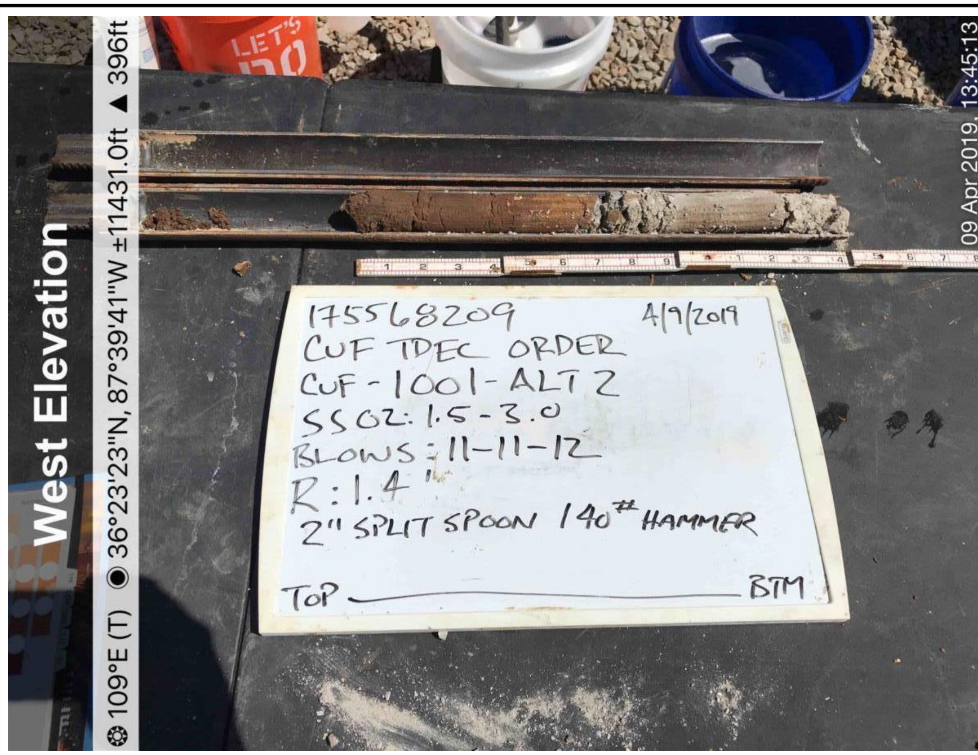


Photograph ID: 40

Photo Location:
CUF-1001ALT2

Photo Date:
4/9/2019

Comments:
Split spoon sample SS-02 (1.5-3.0 feet).



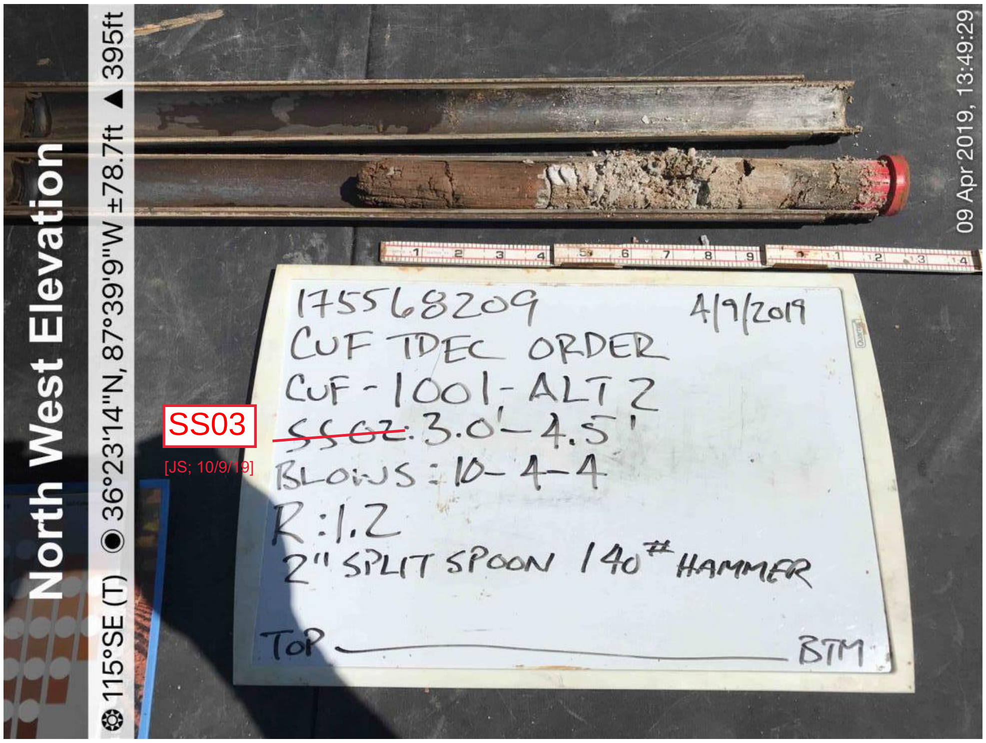
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 41

Photo Location:
CUF-1001ALT2

Photo Date:
4/9/2019

Comments:
Split spoon sample SS-03 (3.0-4.5 feet).

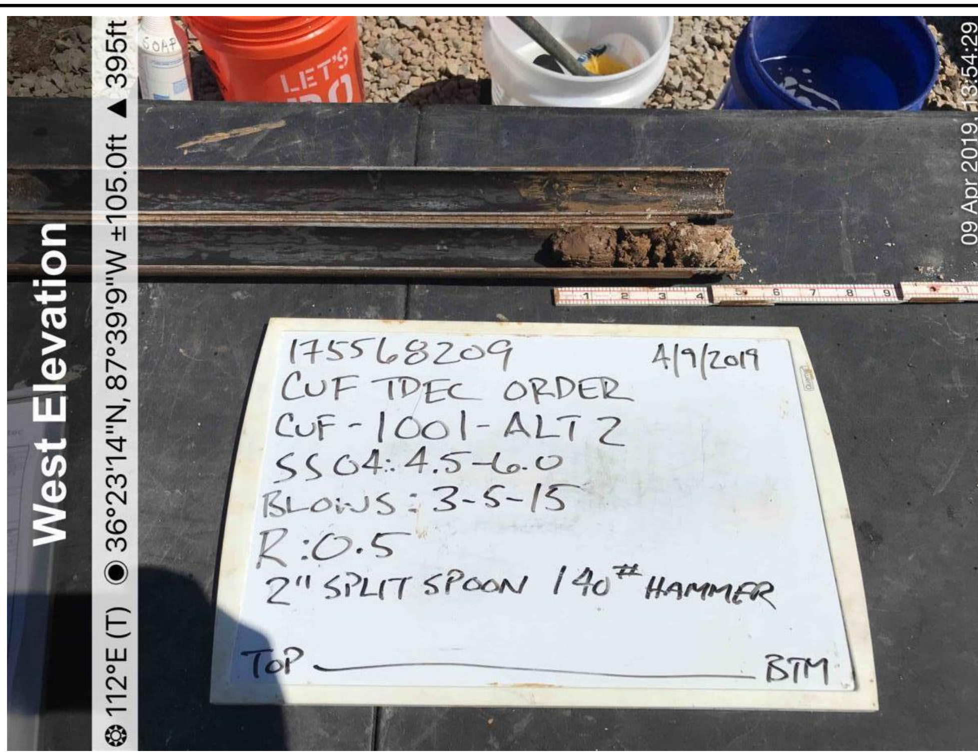


Photograph ID: 42

Photo Location:
CUF-1001ALT2

Photo Date:
4/9/2019

Comments:
Split spoon sample SS-04 (4.5-6.0 feet).



Stantec

Photographic Log

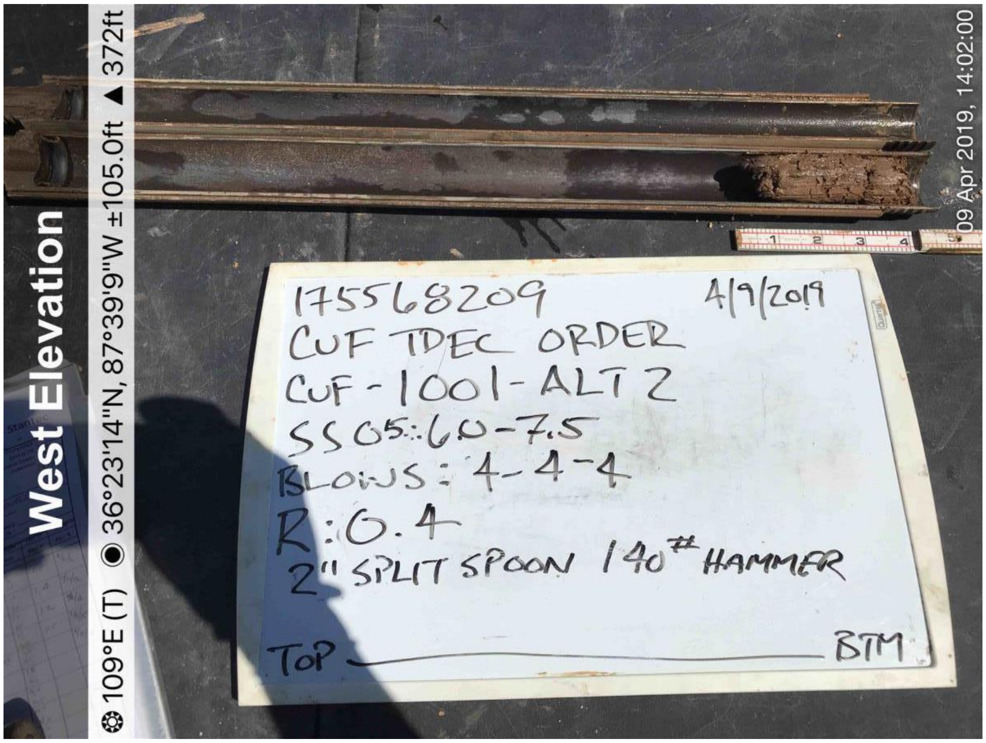
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 43

Photo Location:
CUF-1001ALT2

Photo Date:
4/9/2019

Comments:
Split spoon sample SS-05 (6.0-7.5 feet).

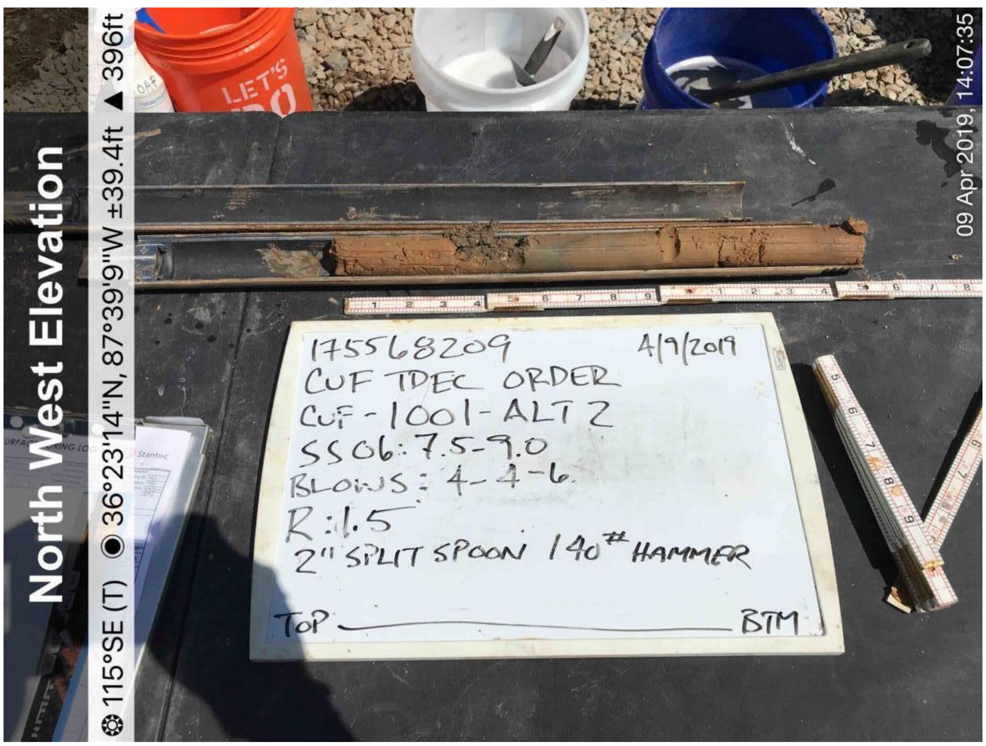


Photograph ID: 44

Photo Location:
CUF-1001ALT2

Photo Date:
4/9/2019

Comments:
Split spoon sample SS-06 (7.5-9.0 feet).



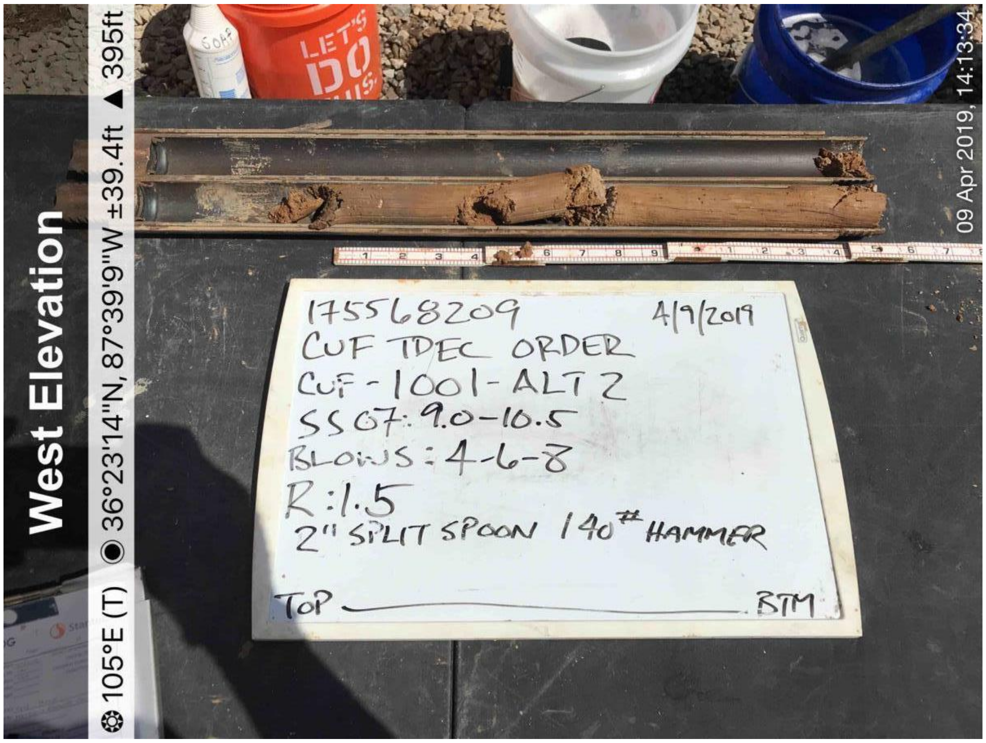
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 45

Photo Location:
CUF-1001ALT2

Photo Date:
4/9/2019

Comments:
Split spoon sample SS-07 (9.0-10.5 feet).

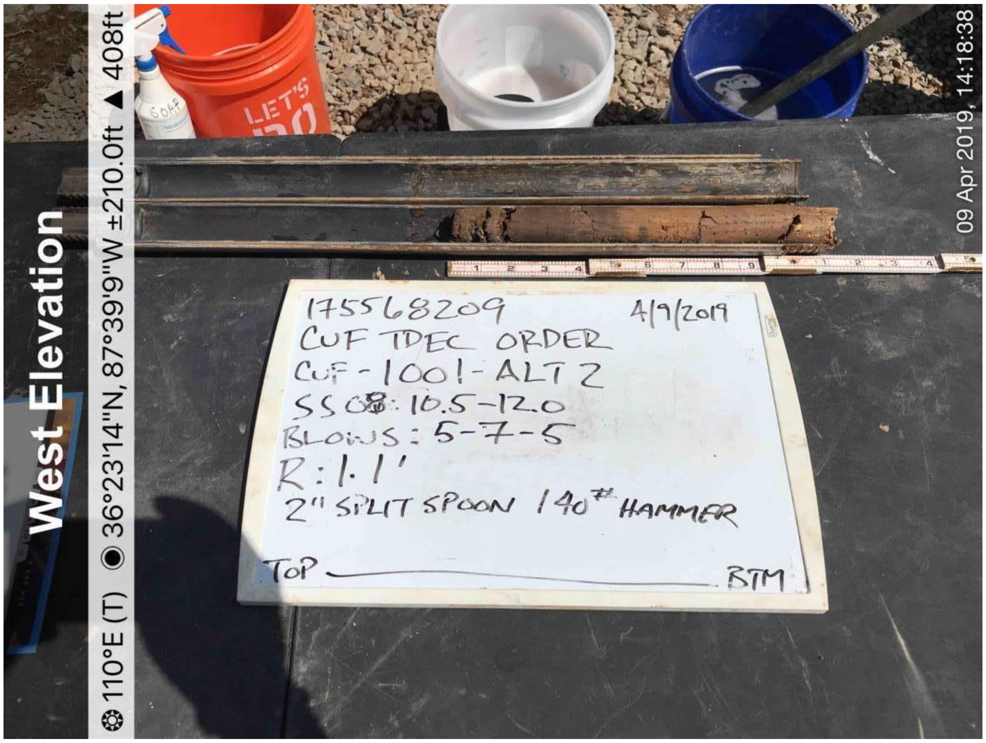


Photograph ID: 46

Photo Location:
CUF-1001ALT2

Photo Date:
4/9/2019

Comments:
Split spoon sample SS-08 (10.5-12.0 feet).



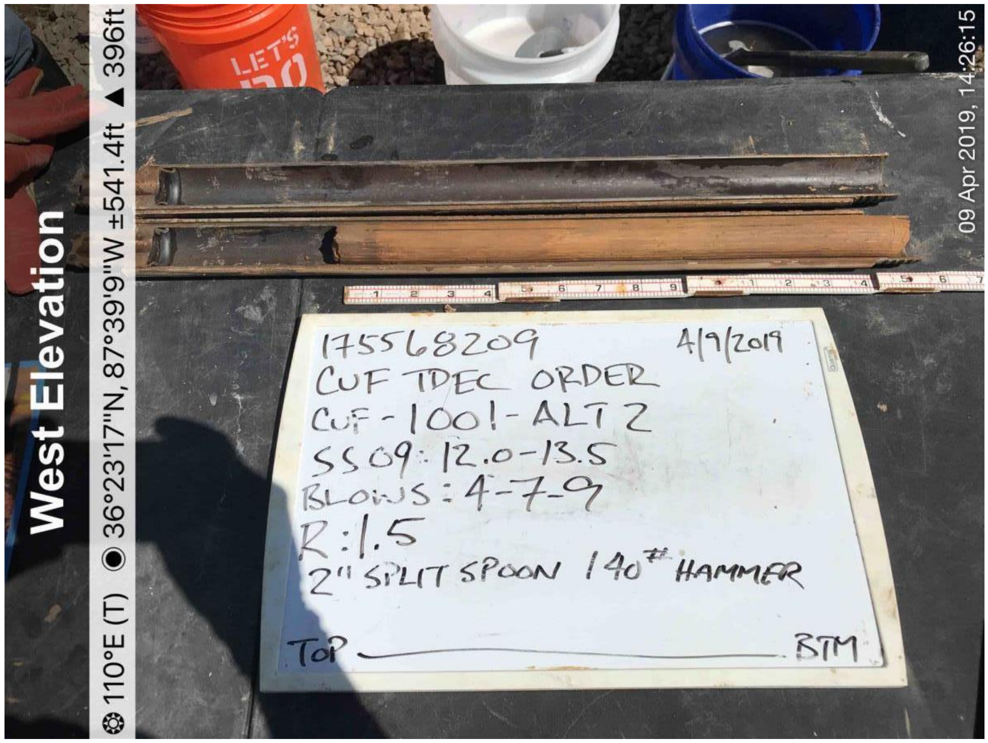
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 47

Photo Location:
CUF-1001ALT2

Photo Date:
4/9/2019

Comments:
Split spoon sample SS-09 (12.0-13.5 feet).

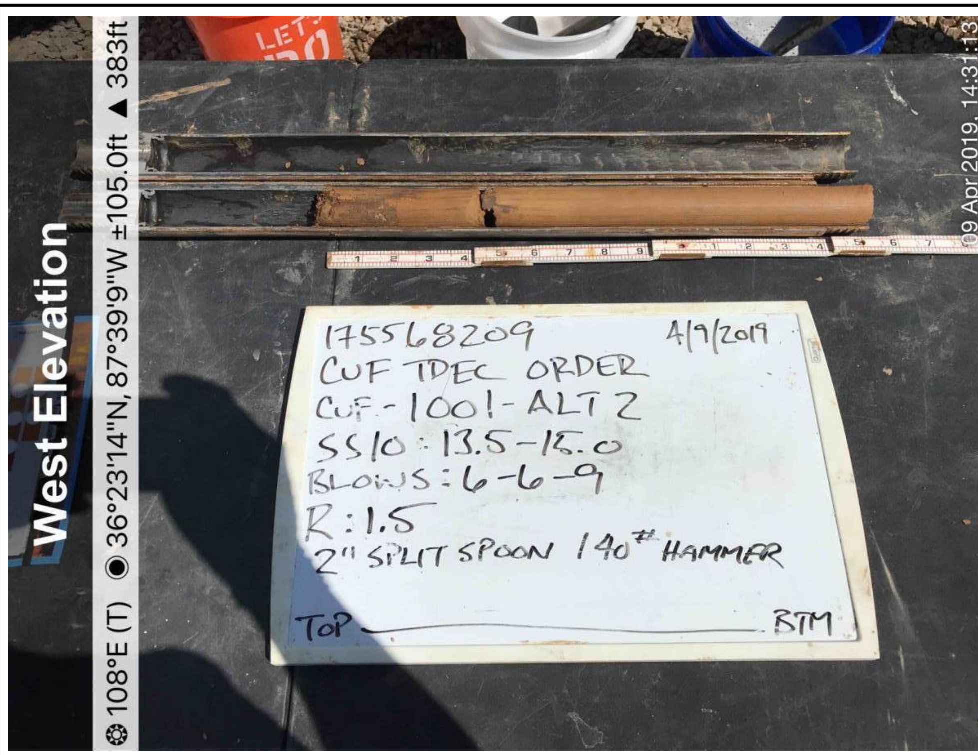


Photograph ID: 48

Photo Location:
CUF-1001ALT2

Photo Date:
4/9/2019

Comments:
Split spoon sample SS-10 (13.5-15.0 feet).



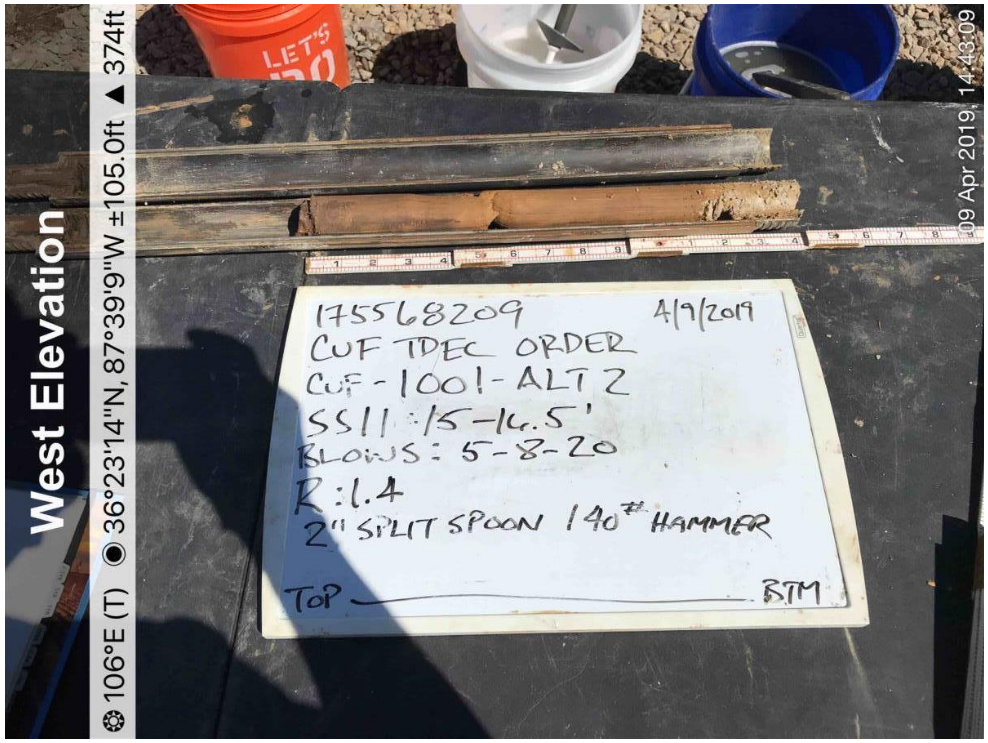
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 49

Photo Location:
CUF-1001ALT2

Photo Date:
4/9/2019

Comments:
Split spoon sample SS-11 (15.0-16.5 feet).

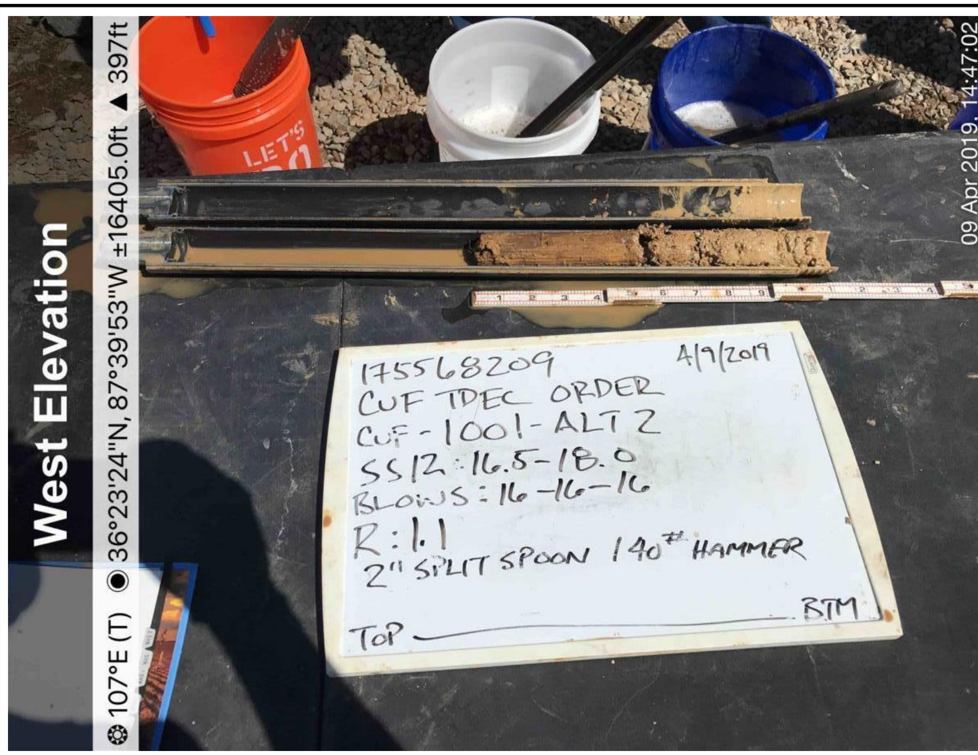


Photograph ID: 50

Photo Location:
CUF-1001ALT2

Photo Date:
4/9/2019

Comments:
Split spoon sample SS-12 (16.5-18.0 feet).



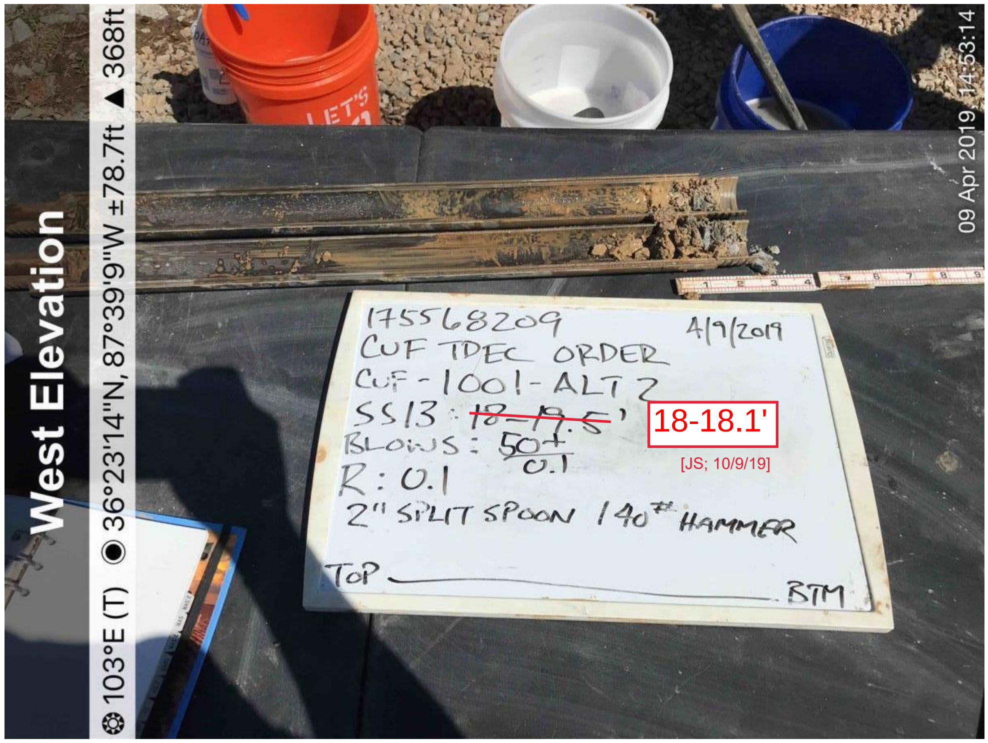
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 51

Photo Location:
CUF-1001ALT2

Photo Date:
4/9/2019

Comments:
Split spoon sample SS-13 (18.0-18.1 feet). Refusal at 18.1 feet.



Photograph ID: 52

Photo Location:
CUF-1002ALT2

Photo Date:
1/24/2019

Comments:
Split spoon sample SS-01 (0.0-1.5 feet).

No Available Picture.

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 53	No Available Picture.
Photo Location: CUF-1002ALT2	
Photo Date: 1/24/2019	
Comments: Split spoon sample SS-02 (1.5-3.0 feet).	

Photograph ID: 54	No Available Picture.
Photo Location: CUF-1002ALT2	
Photo Date: 1/24/2019	
Comments: Split spoon sample SS-03 (3.0-4.5 feet).	

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 55	No Available Picture.
Photo Location: CUF-1002ALT2	
Photo Date: 1/24/2019	
Comments: Split spoon sample SS-04 (4.5-6.0 feet).	

Photograph ID: 56	No Available Picture.
Photo Location: CUF-1002ALT2	
Photo Date: 1/24/2019	
Comments: Split spoon sample SS-05 (6.0-7.5 feet).	

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 57	No Available Picture.
Photo Location: CUF-1002ALT2	
Photo Date: 1/24/2019	
Comments: Split spoon sample SS-06 (7.5-9.0 feet).	

Photograph ID: 58	No Available Picture.
Photo Location: CUF-1002ALT2	
Photo Date: 1/24/2019	
Comments: Split spoon sample SS-07 (9.0-10.5 feet).	

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 59	No Available Picture.
Photo Location: CUF-1002ALT2	
Photo Date: 1/24/2019	
Comments: Split spoon sample SS-08 (10.5-12.0 feet).	

Photograph ID: 60	No Available Picture.
Photo Location: CUF-1002ALT2	
Photo Date: 1/24/2019	
Comments: Split spoon sample SS-09 (12.0-13.5 feet).	

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 61	No Available Picture.
Photo Location: CUF-1002ALT2	
Photo Date: 1/24/2019	
Comments: Split spoon sample SS-10 (13.5-15.0 feet).	

Photograph ID: 62	No Available Picture.
Photo Location: CUF-1002ALT2	
Photo Date: 1/24/2019	
Comments: Split spoon sample SS-11 (15.0-16.5 feet).	

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 63	No Available Picture.
Photo Location: CUF-1002ALT2	
Photo Date: 1/24/2019	
Comments: Split spoon sample SS-12 (16.5-18.0 feet).	

Photograph ID: 64	No Available Picture.
Photo Location: CUF-1002ALT2	
Photo Date: 1/24/2019	
Comments: Split spoon sample SS-13 (18.0-19.5 feet). Refusal at 20.3 feet.	

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Photographic Log

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 65

Photo Location:
CUF-1003

Photo Date:
12/10/2018

Comments:
Split spoon sample SS-01 (0.0-1.5 feet).

Photograph ID: 66

Photo Location:
CUF-1003

Photo Date:
12/10/2018

Comments:
Split spoon sample SS-02 (1.5-3.0 feet).

Stantec **Photographic Log**

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 67

Photo Location:
CUF-1003

Photo Date:
12/10/2018

Comments:
Split spoon sample SS-03 (3.0-4.5 feet).

Photograph ID: 68

Photo Location:
CUF-1003

Photo Date:
12/10/2018

Comments:
Split spoon sample SS-04 (4.5-6.0 feet).

Stantec

Photographic Log

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 69

Photo Location:
CUF-1003

Photo Date:
12/10/2018

Comments:
Split spoon sample SS-05 (6.0-7.5 feet). No recovery.

No Available Picture.

Photograph ID: 70

Photo Location:
CUF-1003

Photo Date:
12/10/2018

Comments:
Split spoon sample SS-06 (7.5-9.0 feet).

Client:	Tennessee Valley Authority	Project:	CUF TDEC Order
Site Name:	Cumberland Fossil Plant (CUF)	Site Location:	Cumberland City, Tennessee

Photograph ID: 71

Photo Location: CUF-1003

Photo Date: 12/10/2018

Comments: Split spoon sample SS-07 (9.0-10.5 feet).

Photograph ID: 72

Photo Location: CUF-1003

Photo Date: 12/10/2018

Comments: Split spoon sample SS-08 (10.5-12.0 feet).

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 73

Photo Location: CUF-1003

Photo Date: 12/10/2018

Comments: Split spoon sample SS-09 (12.0-13.5 feet).

Photograph ID: 74

Photo Location: CUF-1003

Photo Date: 12/10/2018

Comments: Split spoon sample SS-10 (13.5-15.0 feet).

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 75

Photo Location:
CUF-1003

Photo Date:
12/10/2018

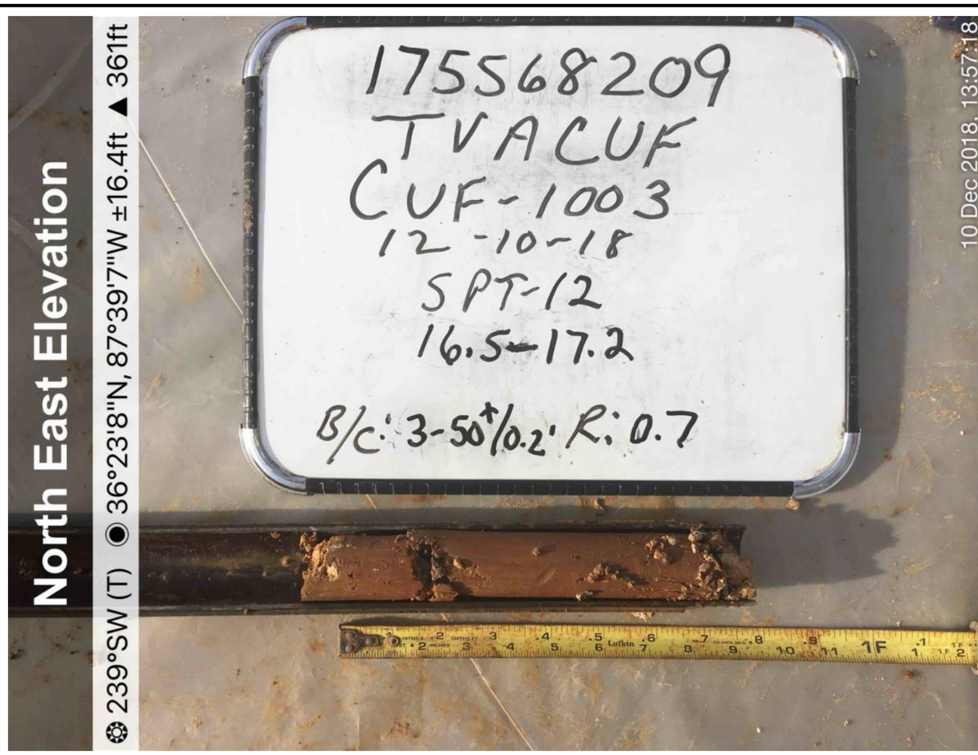
Comments:
Split spoon sample SS-11 (15.0-16.5 feet).

Photograph ID: 76

Photo Location:
CUF-1003

Photo Date:
12/10/2018

Comments:
Split spoon sample SS-12 (16.5-17.2 feet). Refusal at 17.2 feet.



Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 77

Photo Location:
CUF-1003A

Photo Date:
12/11/2018

Comments:
Split spoon sample SS-01 (0.0-1.5 feet).

Photograph ID: 78

Photo Location:
CUF-1003A

Photo Date:
12/11/2018

Comments:
Split spoon sample SS-02 (1.5-3.0 feet).

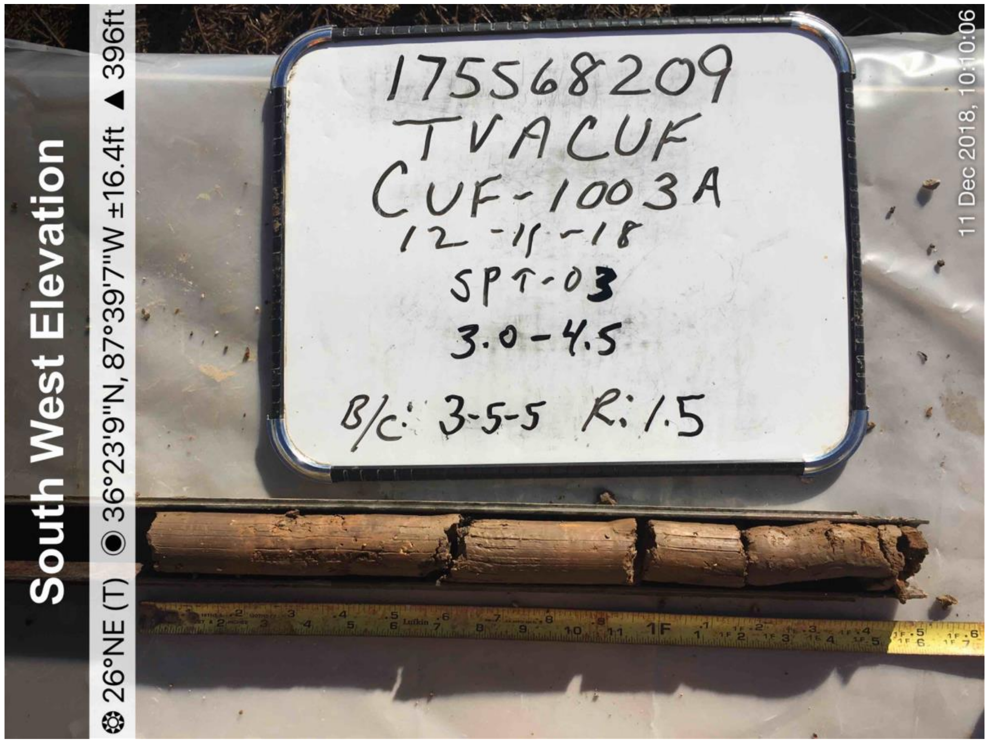
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 79

Photo Location:
CUF-1003A

Photo Date:
12/11/2018

Comments:
Split spoon sample SS-03 (3.0-4.5 feet).

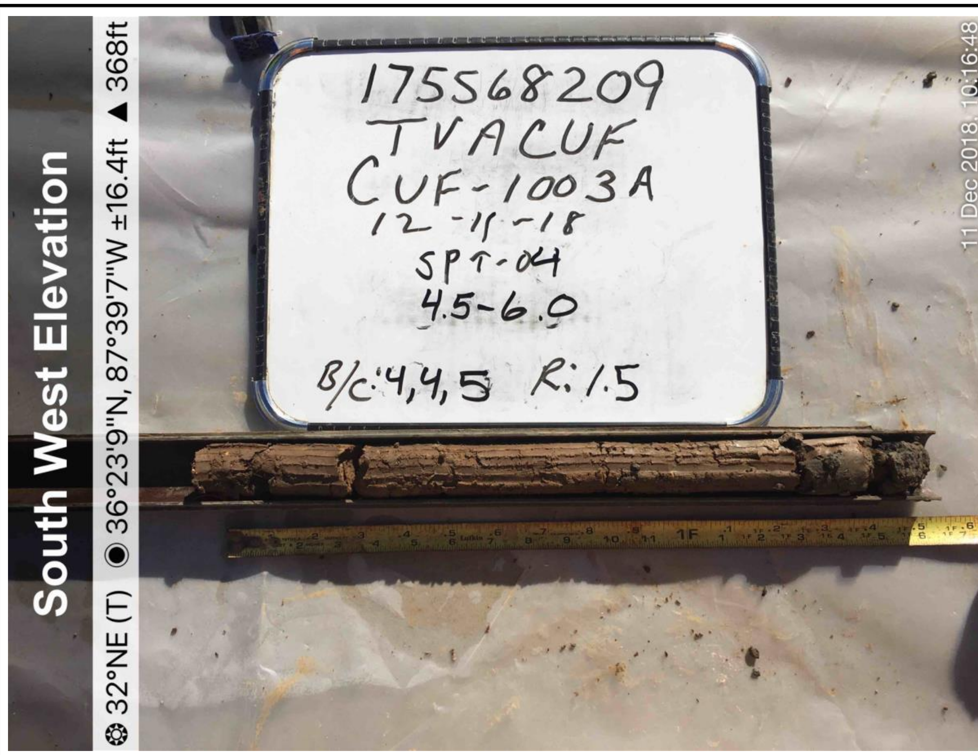


Photograph ID: 80

Photo Location:
CUF-1003A

Photo Date:
12/11/2018

Comments:
Split spoon sample SS-04 (4.5-6.0 feet).



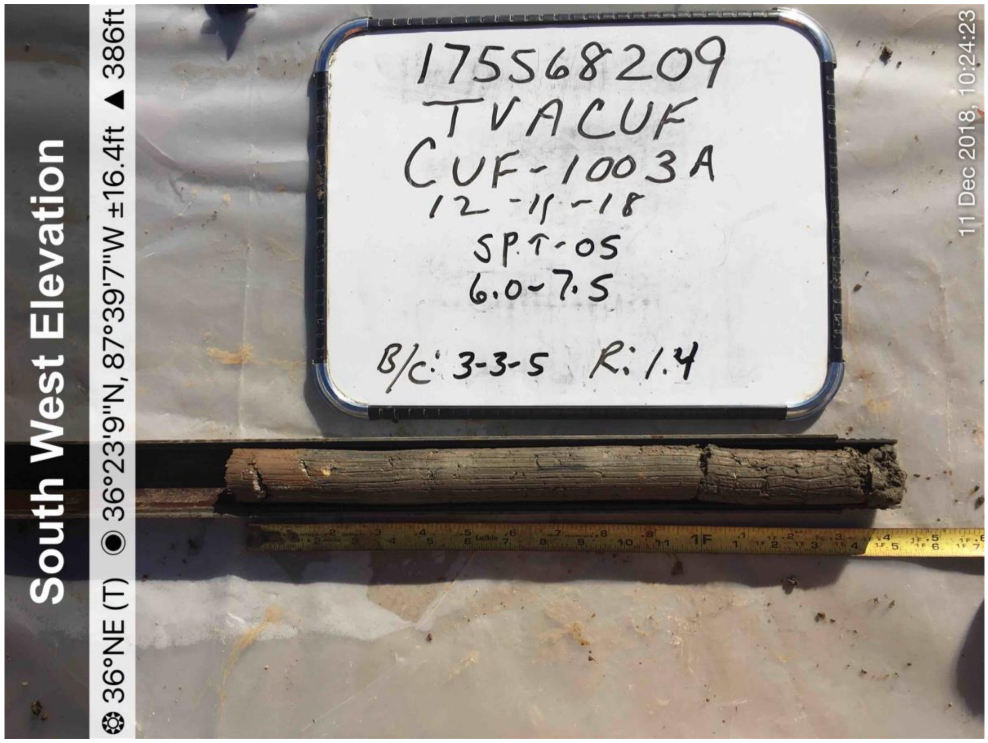
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 81

Photo Location: CUF-1003A

Photo Date: 12/11/2018

Comments: Split spoon sample SS-05 (6.0-7.5 feet).



Photograph ID: 82

Photo Location: CUF-1003A

Photo Date: 12/11/2018

Comments: Split spoon sample SS-06 (7.5-9.0 feet).

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 83

Photo Location:
CUF-1003A

Photo Date:
12/11/2018

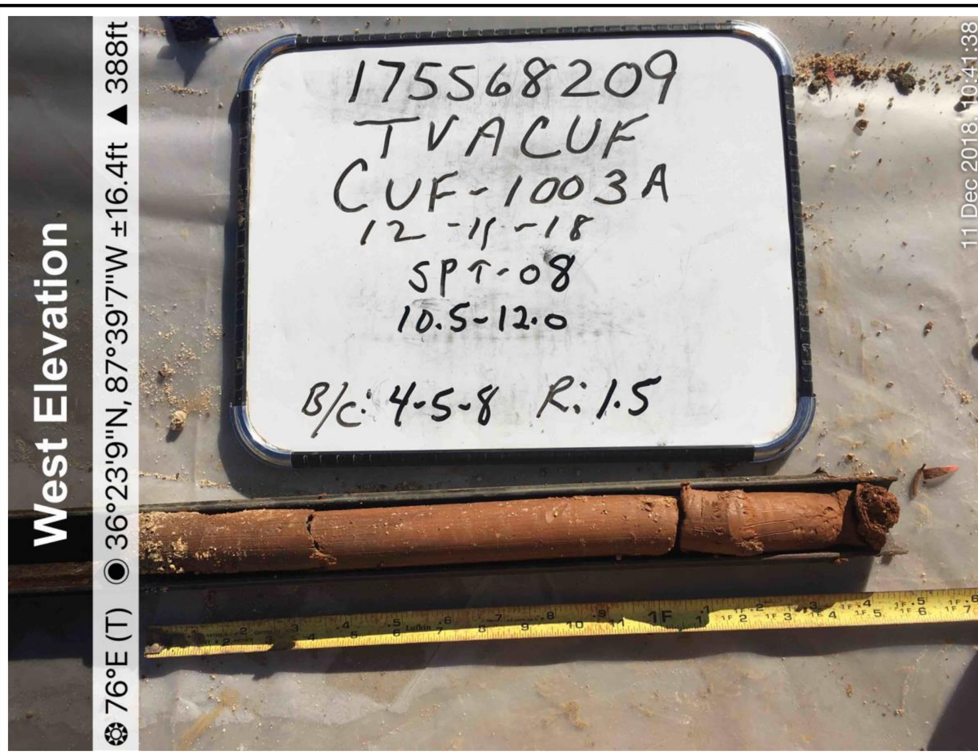
Comments:
Split spoon sample SS-07 (9.0-10.5 feet).

Photograph ID: 84

Photo Location:
CUF-1003A

Photo Date:
12/11/2018

Comments:
Split spoon sample SS-08 (10.5-12.0 feet).



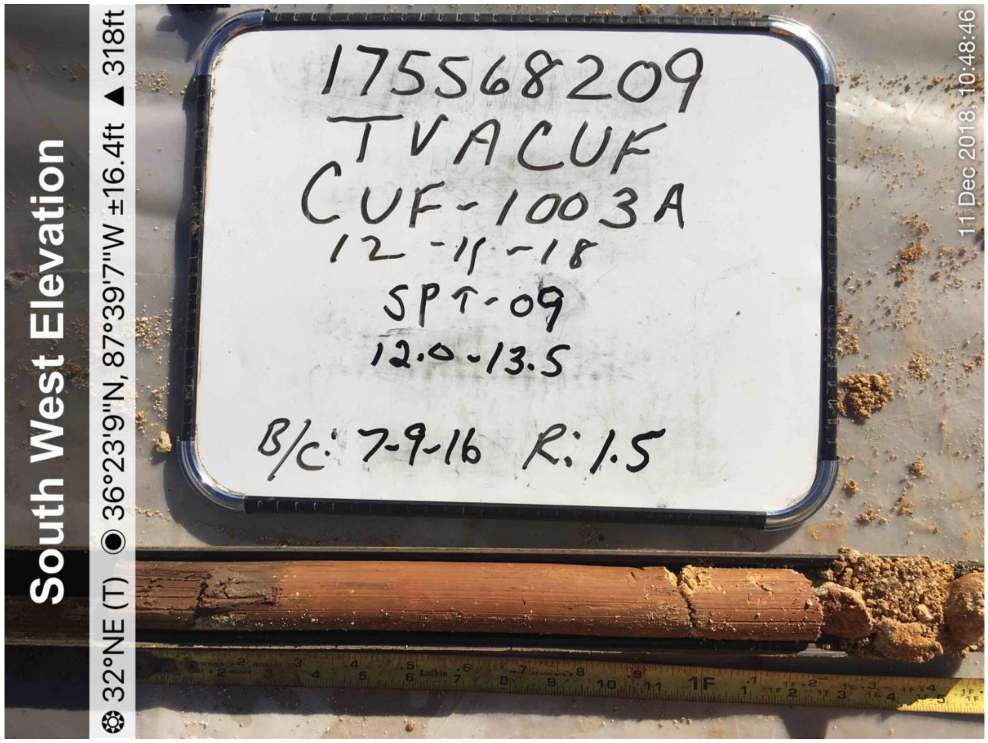
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 85

Photo Location: CUF-1003A

Photo Date: 12/11/2018

Comments: Split spoon sample SS-09 (12.0-13.5 feet).

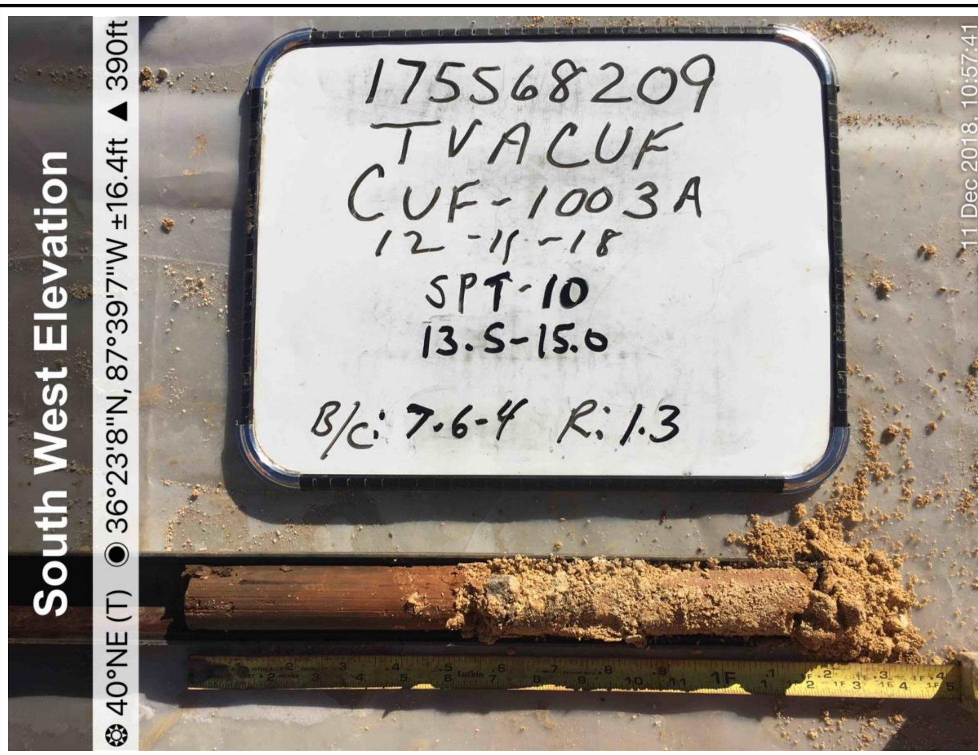


Photograph ID: 86

Photo Location: CUF-1003A

Photo Date: 12/11/2018

Comments: Split spoon sample SS-10 (13.5-15.0 feet).



Stantec

Photographic Log

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 87

Photo Location: CUF-1003A

Photo Date: 12/11/2018

Comments: Split spoon sample SS-11 (15.0-16.3 feet). Refusal at 16.3 feet.

Photograph ID: 88

Photo Location: CUF-1003B

Photo Date: 12/18/2018

Comments: Split spoon sample SS-01 (0.0-1.5 feet).

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 89

Photo Location:
CUF-1003B

Photo Date:
12/18/2018

Comments:
Split spoon sample SS-02 (1.5-3.0 feet).

Photograph ID: 90

Photo Location:
CUF-1003B

Photo Date:
12/18/2018

Comments:
Split spoon sample SS-03 (3.0-4.5 feet).

Client:	Tennessee Valley Authority	Project:	CUF TDEC Order
Site Name:	Cumberland Fossil Plant (CUF)	Site Location:	Cumberland City, Tennessee

Photograph ID: 91

Photo Location:
CUF-1003B

Photo Date:
12/18/2018

Comments:
Split spoon sample SS-04 (4.5-6.0 feet).

Photograph ID: 92

Photo Location:
CUF-1003B

Photo Date:
12/18/2018

Comments:
Split spoon sample SS-05 (6.0-7.5 feet).

Client:	Tennessee Valley Authority	Project:	CUF TDEC Order
Site Name:	Cumberland Fossil Plant (CUF)	Site Location:	Cumberland City, Tennessee

Photograph ID: 93

Photo Location:
CUF-1003B

Photo Date:
12/18/2018

Comments:
Split spoon sample SS-06 (7.5-9.0 feet).

Photograph ID: 94

Photo Location:
CUF-1003B

Photo Date:
12/18/2018

Comments:
Split spoon sample SS-07 (9.0-10.5 feet).

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 95

Photo Location: CUF-1003B

Photo Date: 12/18/2018

Comments: Split spoon sample SS-08 (10.5-12.0 feet).

Photograph ID: 96

Photo Location: CUF-1003B

Photo Date: 12/18/2018

Comments: Split spoon sample SS-09 (12.0-13.5 feet).

Client:	Tennessee Valley Authority	Project:	CUF TDEC Order
Site Name:	Cumberland Fossil Plant (CUF)	Site Location:	Cumberland City, Tennessee

Photograph ID: 97

Photo Location: CUF-1003B

Photo Date: 12/18/2018

Comments: Split spoon sample SS-10 (13.5-15.0 feet).

Photograph ID: 98

Photo Location: CUF-1003B

Photo Date: 12/18/2018

Comments: Split spoon sample SS-11 (15.0-15.7 feet). Refusal at 15.7 feet.

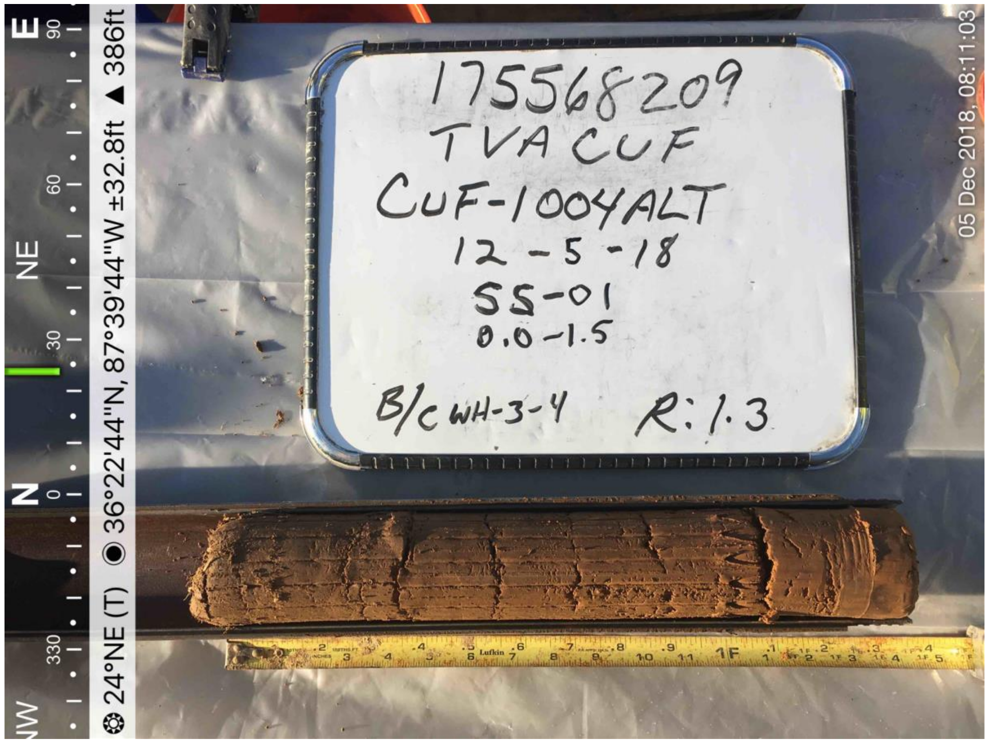
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 99

Photo Location:
CUF-1004ALT

Photo Date:
12/5/2018

Comments:
Split spoon sample SS-01 (0.0-1.5 feet).



Photograph ID: 100

Photo Location:
CUF-1004ALT

Photo Date:
12/5/2018

Comments:
Split spoon sample SS-02 (1.5-3.0 feet).

Stantec **Photographic Log**

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 101

Photo Location: CUF-1004ALT

Photo Date: 12/5/2018

Comments: Split spoon sample SS-03 (3.0-4.5 feet).

Photograph ID: 102

Photo Location: CUF-1004ALT

Photo Date: 12/5/2018

Comments: Split spoon sample SS-04 (4.5-6.0 feet).

Stantec

Photographic Log

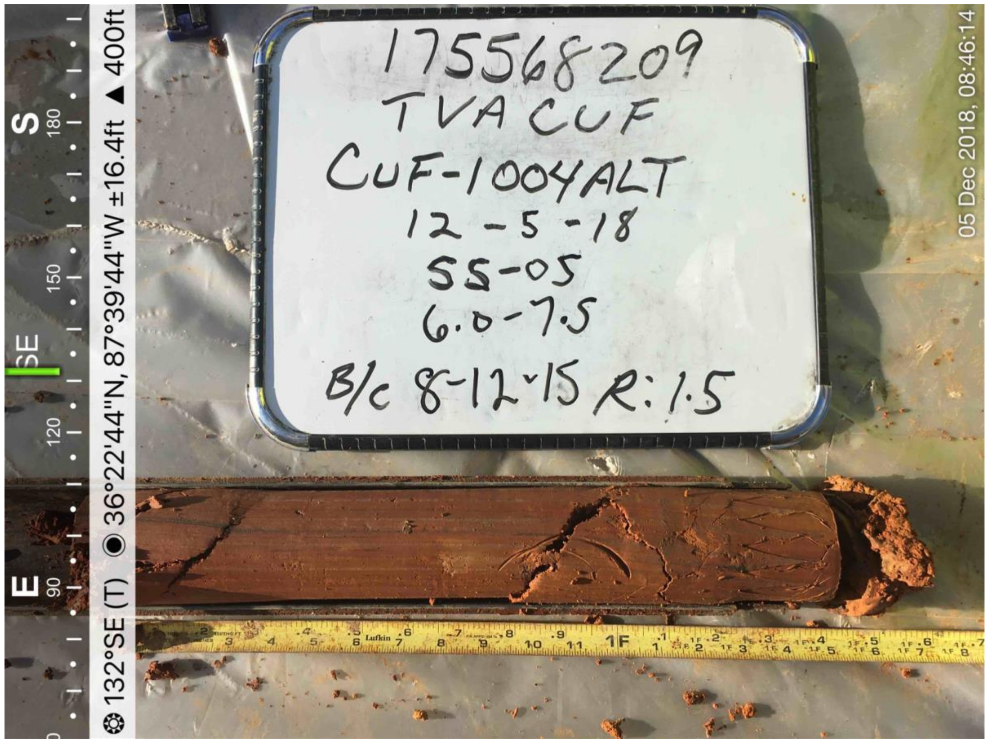
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 103

Photo Location: CUF-1004ALT

Photo Date: 12/5/2018

Comments: Split spoon sample SS-05 (6.0-7.5 feet).

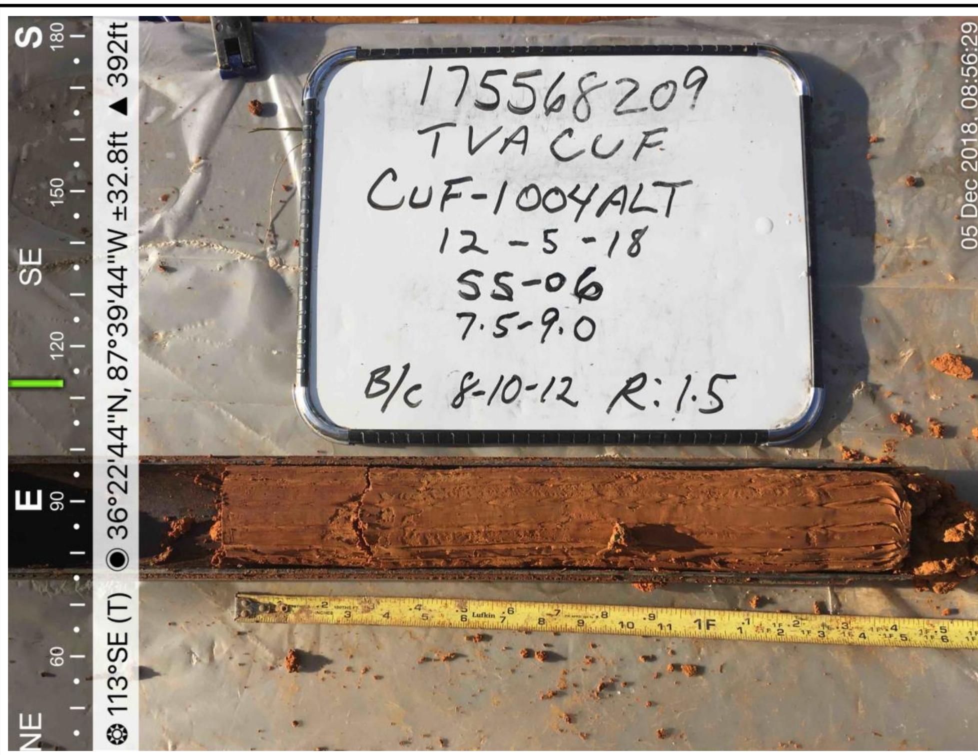


Photograph ID: 104

Photo Location: CUF-1004ALT

Photo Date: 12/5/2018

Comments: Split spoon sample SS-06 (7.5-9.0 feet).



Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 105

Photo Location:
CUF-1004ALT

Photo Date:
12/5/2018

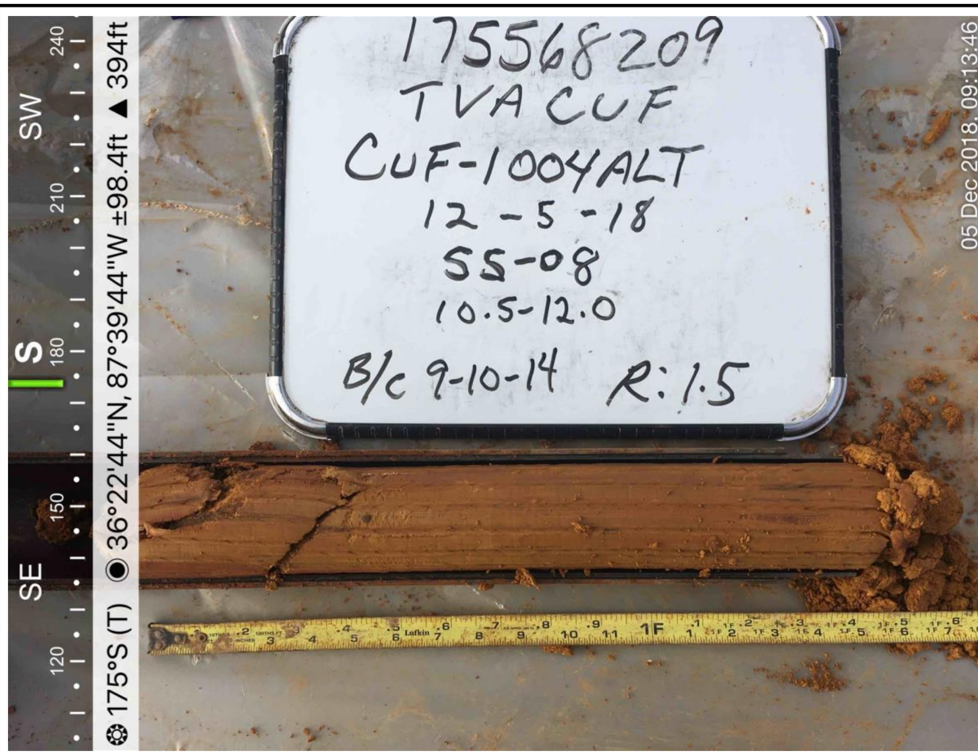
Comments:
Split spoon sample SS-07 (9.0-10.5 feet).

Photograph ID: 106

Photo Location:
CUF-1004ALT

Photo Date:
12/5/2018

Comments:
Split spoon sample SS-08 (10.5-12.0 feet).



Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 107

Photo Location:
CUF-1004ALT

Photo Date:
12/5/2018

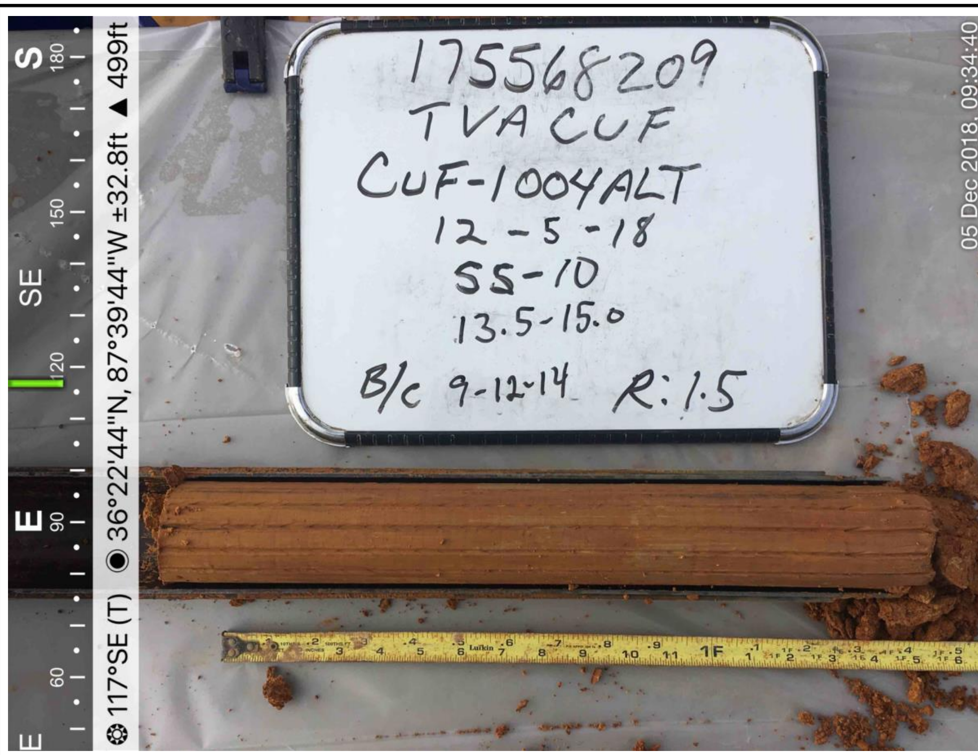
Comments:
Split spoon sample SS-09 (12.0-13.5 feet).

Photograph ID: 108

Photo Location:
CUF-1004ALT

Photo Date:
12/5/2018

Comments:
Split spoon sample SS-10 (13.5-15.0 feet).



Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 109

Photo Location:
CUF-1004ALT

Photo Date:
12/5/2018

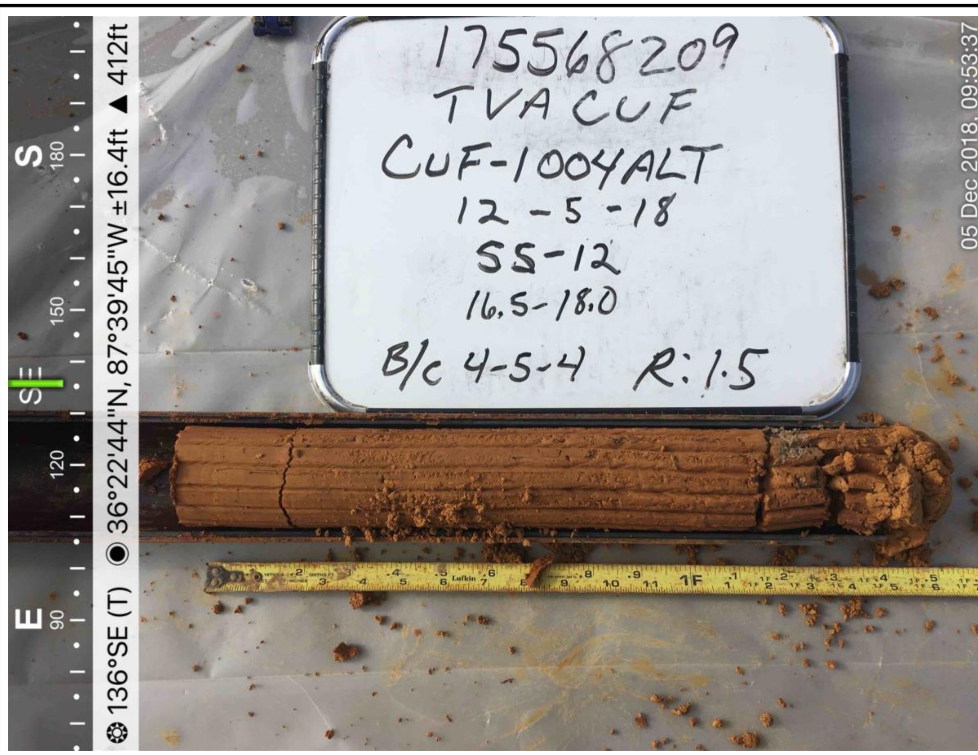
Comments:
Split spoon sample SS-11 (15.0-16.5 feet).

Photograph ID: 110

Photo Location:
CUF-1004ALT

Photo Date:
12/5/2018

Comments:
Split spoon sample SS-12 (16.5-18.0 feet).



Stantec

Photographic Log

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 111

Photo Location:
CUF-1004ALT

Photo Date:
12/5/2018

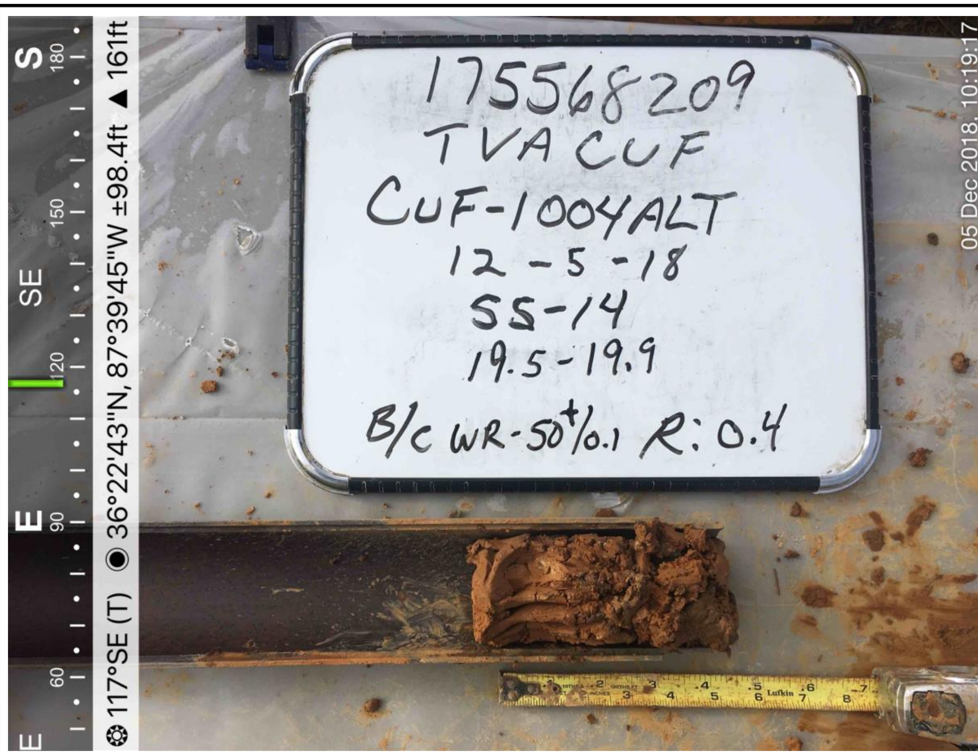
Comments:
Split spoon sample SS-13 (18.0-19.5 feet).

Photograph ID: 112

Photo Location:
CUF-1004ALT

Photo Date:
12/5/2018

Comments:
Split spoon sample SS-14 (19.5-19.9 feet). Refusal at 19.9 feet.



Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 113

Photo Location:
CUF-1004ALT2

Photo Date:
12/4/2018

Comments:
Split spoon sample SS-01 (0.0-1.5 feet).

Photograph ID: 114

Photo Location:
CUF-1004ALT2

Photo Date:
12/4/2018

Comments:
Split spoon sample SS-02 (1.5-3.0 feet).

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 115

Photo Location: CUF-1004ALT2

Photo Date: 12/4/2018

Comments: Split spoon sample SS-03 (3.0-4.5 feet).

Photograph ID: 116

Photo Location: CUF-1004ALT2

Photo Date: 12/4/2018

Comments: Split spoon sample SS-04 (4.5-6.0 feet).

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 117

Photo Location:
CUF-1004ALT2

Photo Date:
12/4/2018

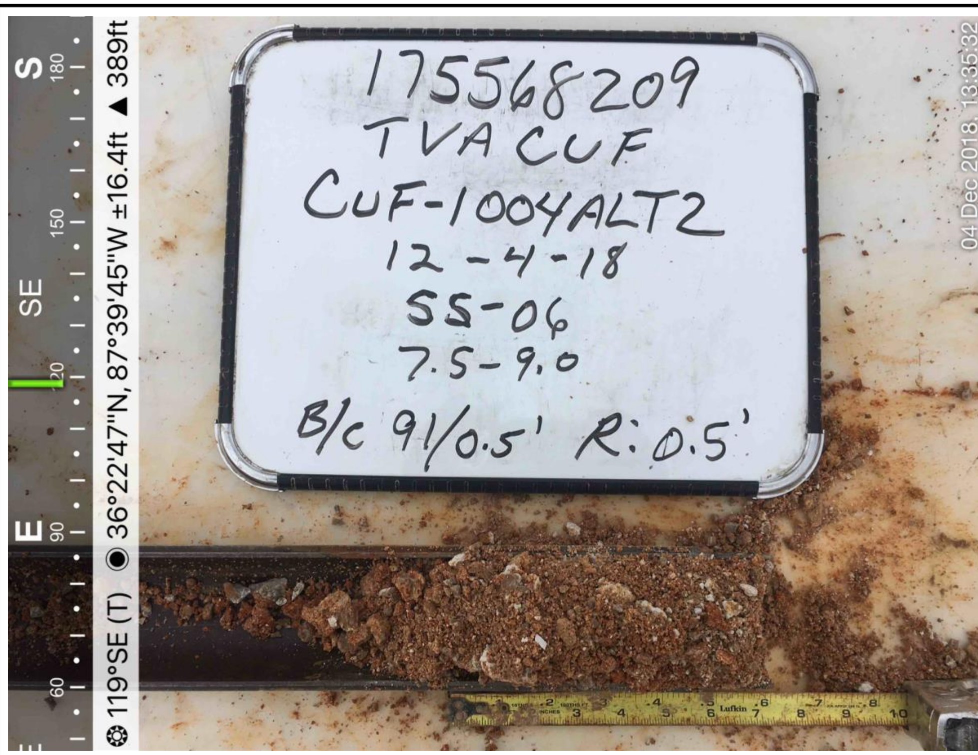
Comments:
Split spoon sample SS-05 (6.0-7.5 feet).

Photograph ID: 118

Photo Location:
CUF-1004ALT2

Photo Date:
12/4/2018

Comments:
Split spoon sample SS-06 (7.5-8.0 feet). Split spoon refusal at 8.0 feet. Auger refusal at 9.0 feet.



Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 119

Photo Location:
CUF-1004ALT2A

Photo Date:
12/6/2018

Comments:
Split spoon sample SS-01 (0.0-1.5 feet).

Photograph ID: 120

Photo Location:
CUF-1004ALT2A

Photo Date:
12/6/2018

Comments:
Split spoon sample SS-02 (1.5-3.0 feet).

Stantec

Photographic Log

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 121

Photo Location:
CUF-1004ALT2A

Photo Date:
12/6/2018

Comments:
Split spoon sample SS-03 (3.0-4.5 feet).

Photograph ID: 122

Photo Location:
CUF-1004ALT2A

Photo Date:
12/6/2018

Comments:
Split spoon sample SS-04 (4.5-6.0 feet).

Stantec

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 123

Photo Location: CUF-1004ALT2A

Photo Date: 12/6/2018

Comments: Split spoon sample SS-05 (6.0-7.5 feet).

Photograph ID: 124

Photo Location: CUF-1004ALT2A

Photo Date: 12/6/2018

Comments: Split spoon sample SS-06 (7.5-9.0 feet).

Stantec **Photographic Log**

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 125

Photo Location:
CUF-1004ALT2A

Photo Date:
12/6/2018

Comments:
Split spoon sample SS-07 (9.0-10.5 feet).

Photograph ID: 126

Photo Location:
CUF-1004ALT2A

Photo Date:
12/6/2018

Comments:
Split spoon sample SS-08 (10.5-12.0 feet).

Stantec

Photographic Log

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 127

Photo Location:
CUF-1004ALT2A

Photo Date:
12/6/2018

Comments:
Split spoon sample SS-09 (12.0-13.5 feet).

Photograph ID: 128

Photo Location:
CUF-1004ALT2A

Photo Date:
12/6/2018

Comments:
Split spoon sample SS-10 (13.5-15.0 feet).

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 129

Photo Location: CUF-1004ALT2A

Photo Date: 12/6/2018

Comments: Split spoon sample SS-11 (15.0-16.5 feet).

Photograph ID: 130

Photo Location: CUF-1004ALT2A

Photo Date: 12/6/2018

Comments: Split spoon sample SS-12 (16.5-18.0 feet).

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 131

Photo Location:
CUF-1004ALT2A

Photo Date:
12/6/2018

Comments:
Split spoon sample SS-13 (18.0-19.5 feet).

Photograph ID: 132

Photo Location:
CUF-1004ALT2A

Photo Date:
12/6/2018

Comments:
Split spoon sample SS-14 (19.5-20.9 feet). Refusal at 20.9 feet.

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 133	No Available Picture.
Photo Location: CUF-1005	
Photo Date: 1/16/2019	
Comments: Split spoon sample SS-01 (0.0-1.5 feet). Fill encountered. No split spoon sample collected.	

Photograph ID: 134	No Available Picture.
Photo Location: CUF-1005	
Photo Date: 1/16/2019	
Comments: Split spoon sample SS-02 (1.5-3.0 feet). Fill encountered. No split spoon sample collected.	

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 135

Photo Location: CUF-1005

Photo Date: 1/16/2019

Comments: Split spoon sample SS-03 (3.0-4.5 feet).

Photograph ID: 136

Photo Location: CUF-1005

Photo Date: 1/16/2019

Comments: Split spoon sample SS-04 (4.5-6.0 feet).

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 137

Photo Location:
CUF-1005

Photo Date:
1/16/2019

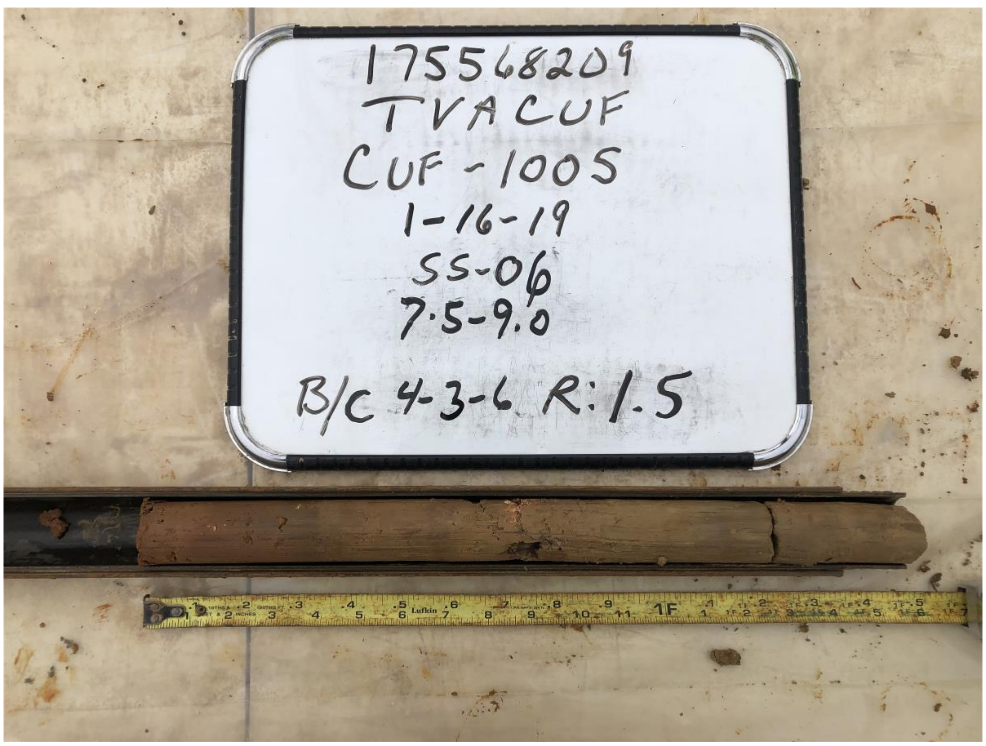
Comments:
Split spoon sample SS-05 (6.0-7.5 feet).

Photograph ID: 138

Photo Location:
CUF-1005

Photo Date:
1/16/2019

Comments:
Split spoon sample SS-06 (7.5-9.0 feet).



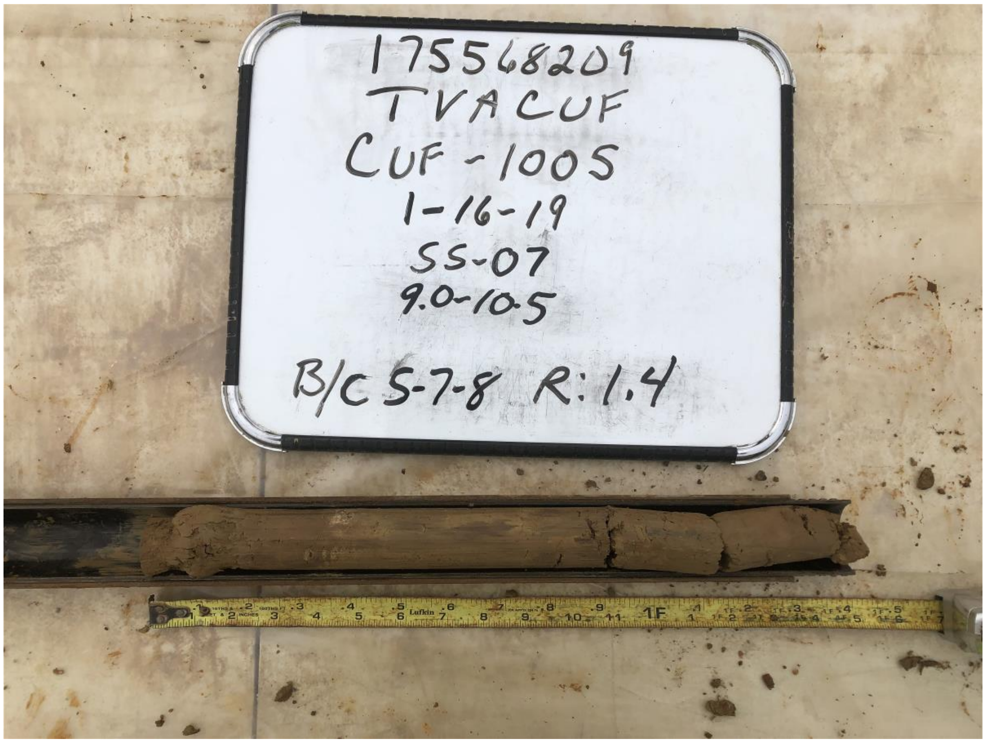
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 139

Photo Location:
CUF-1005

Photo Date:
1/16/2019

Comments:
Split spoon sample SS-07 (9.0-10.5 feet).

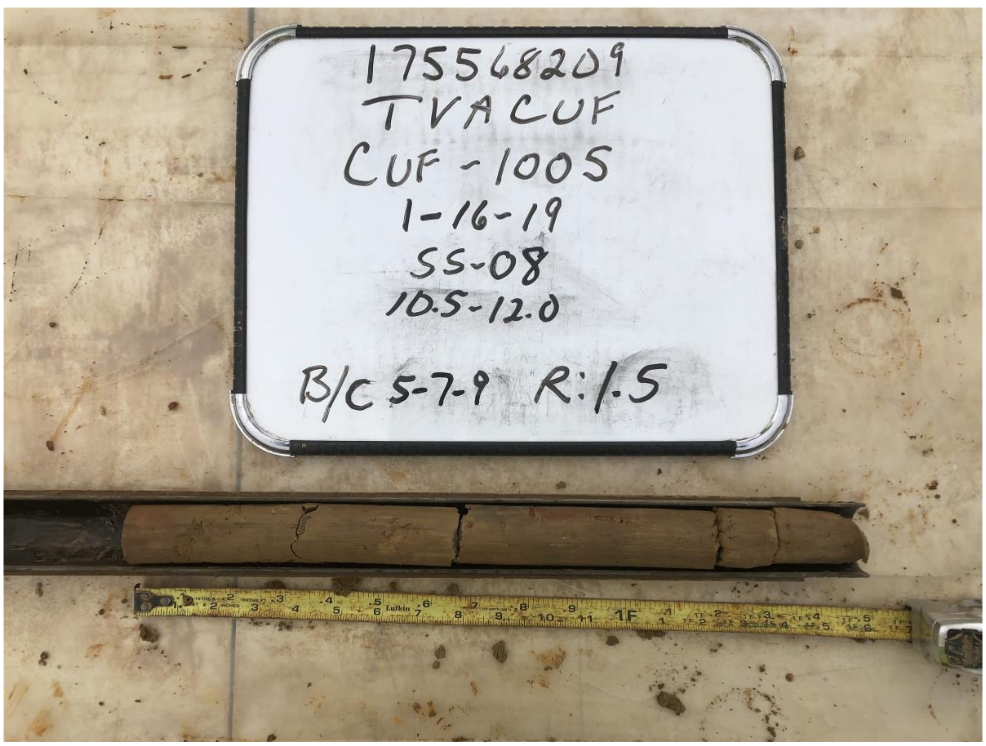


Photograph ID: 140

Photo Location:
CUF-1005

Photo Date:
1/16/2019

Comments:
Split spoon sample SS-08 (10.5-12.0 feet).



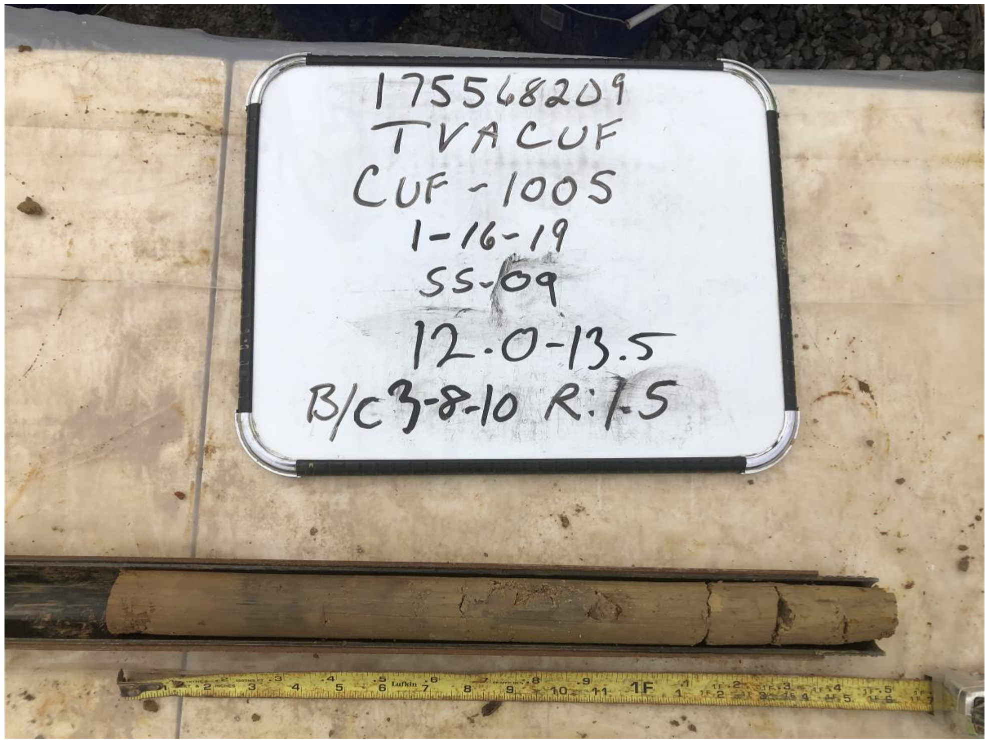
Client:	Tennessee Valley Authority	Project:	CUF TDEC Order
Site Name:	Cumberland Fossil Plant (CUF)	Site Location:	Cumberland City, Tennessee

Photograph ID: 141

Photo Location:
CUF-1005

Photo Date:
1/16/2019

Comments:
Split spoon sample SS-09 (12.0-13.5 feet).

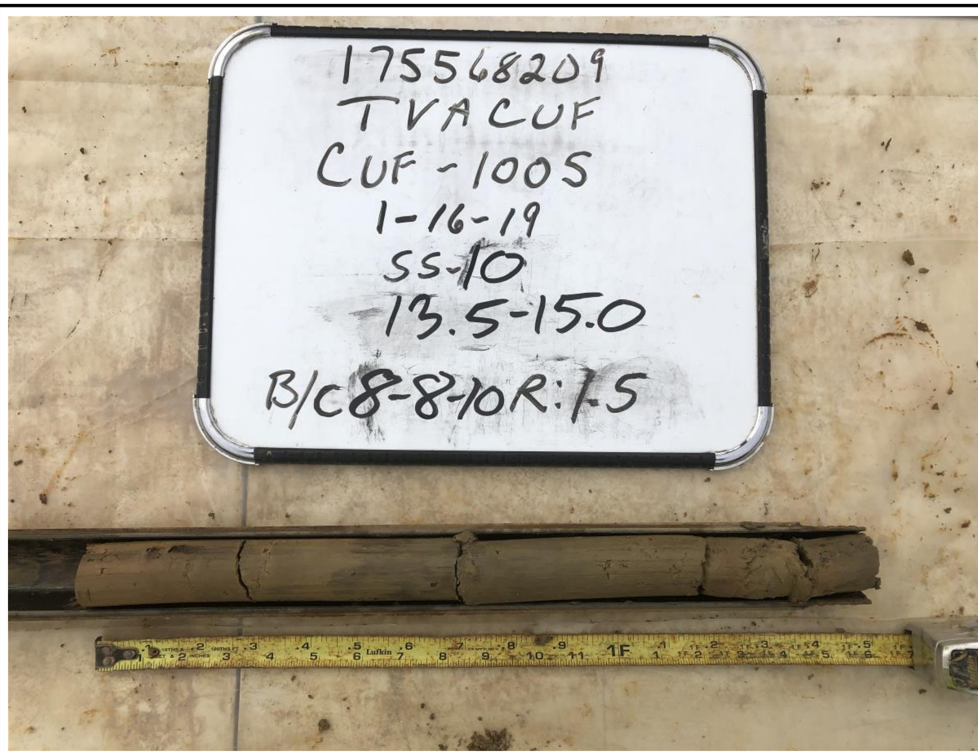


Photograph ID: 142

Photo Location:
CUF-1005

Photo Date:
1/16/2019

Comments:
Split spoon sample SS-10 (13.5-15.0 feet).



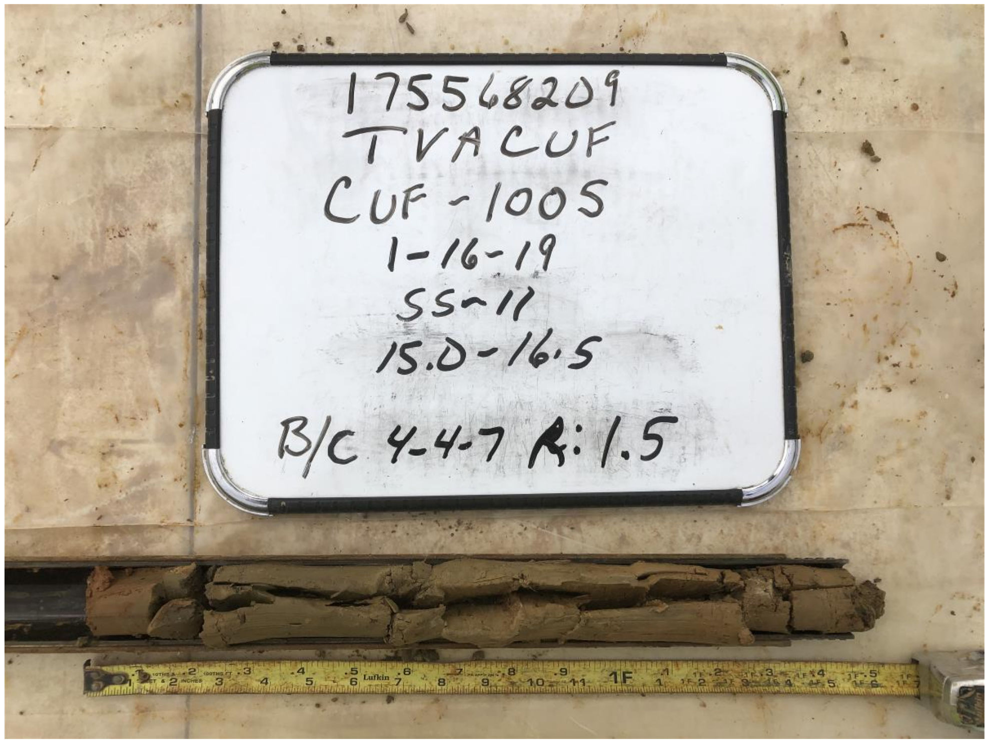
Client:	Tennessee Valley Authority	Project:	CUF TDEC Order
Site Name:	Cumberland Fossil Plant (CUF)	Site Location:	Cumberland City, Tennessee

Photograph ID: 143

Photo Location: CUF-1005

Photo Date: 1/16/2019

Comments: Split spoon sample SS-11 (15.0-16.5 feet).

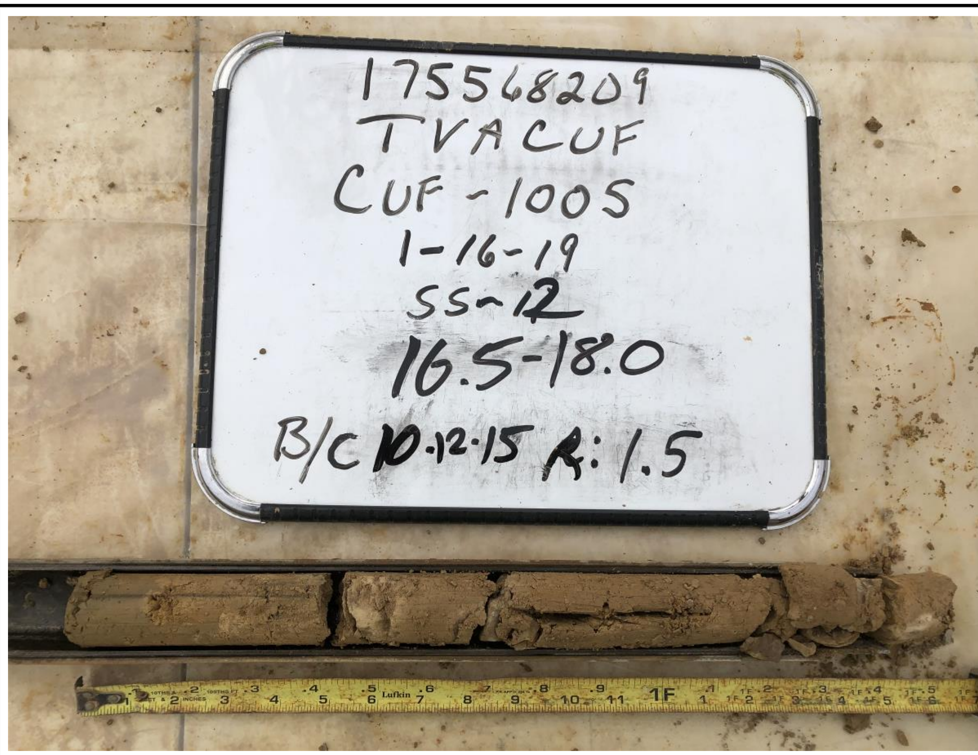


Photograph ID: 144

Photo Location: CUF-1005

Photo Date: 1/16/2019

Comments: Split spoon sample SS-12 (16.5-18.0 feet).



Stantec

Photographic Log

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 145

Photo Location:
CUF-1005

Photo Date:
1/16/2019

Comments:
Split spoon sample SS-13 (18.0-19.5 feet).

Photograph ID: 146

Photo Location:
CUF-1005

Photo Date:
1/16/2019

Comments:
Split spoon sample SS-14 (19.5-21.0 feet). No recovery.

No Available Picture.

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 147

Photo Location:
CUF-1005

Photo Date:
1/16/2019

Comments:
Split spoon sample SS-15 (21.0-22.5 feet).

Photograph ID: 148

Photo Location:
CUF-1005

Photo Date:
1/16/2019

Comments:
Split spoon sample SS-16 (22.5-24.0 feet).

Stantec

Photographic Log

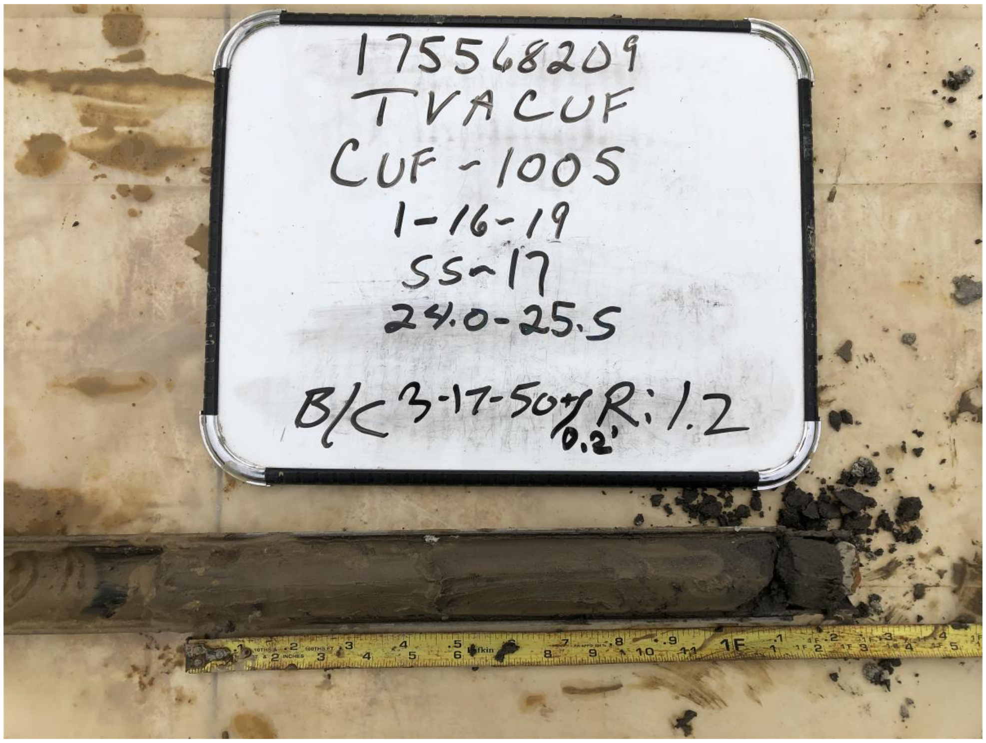
Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 149

Photo Location:
CUF-1005

Photo Date:
1/16/2019

Comments:
Split spoon sample SS-17 (24.0-25.2 feet). Refusal at 26.2 feet.



ATTACHMENT D.2

Photographic Log of Monitoring Wells

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 1

Photo Location:
CUF-1000

Photo Date:
11/29/2018

Comments: Completion of monitoring well CUF-1000. Well was installed in boring CUF-1000ALTA.

Photograph ID: 2

Photo Location:
CUF-1001

Photo Date:
4/9/2019

Comments: Completion of monitoring well CUF-1001. Well was installed in boring CUF-1001ALT2.

Client:	**Tennessee Valley Authority**	**Project:**	**CUF TDEC Order**
Site Name:	**Cumberland Fossil Plant (CUF)**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 3 **Photo Location:** CUF-1002 **Photo Date:** 1/24/2019 **Comments:** Completion of monitoring well CUF-1002. Well was installed in boring CUF-1002ALT2.	
Photograph ID: 4 **Photo Location:** CUF-1003 **Photo Date:** 12/18/2018 **Comments:** Completion of monitoring well CUF-1003. Well was installed in boring CUF-1003B.	

Client:	Tennessee Valley Authority	Project:	CUF TDEC Order
Site Name:	Cumberland Fossil Plant (CUF)	Site Location:	Cumberland City, Tennessee

Photograph ID: 5

Photo Location:
CUF-1005

Photo Date:
1/16/2019

Comments: Completion of monitoring well CUF-1005. Well was installed in boring CUF-1005.

APPENDIX E – SLUG TEST RESULTS

Stantec

Slug Test Results
TVA-CUF Plant
Cumberland City, Tennessee

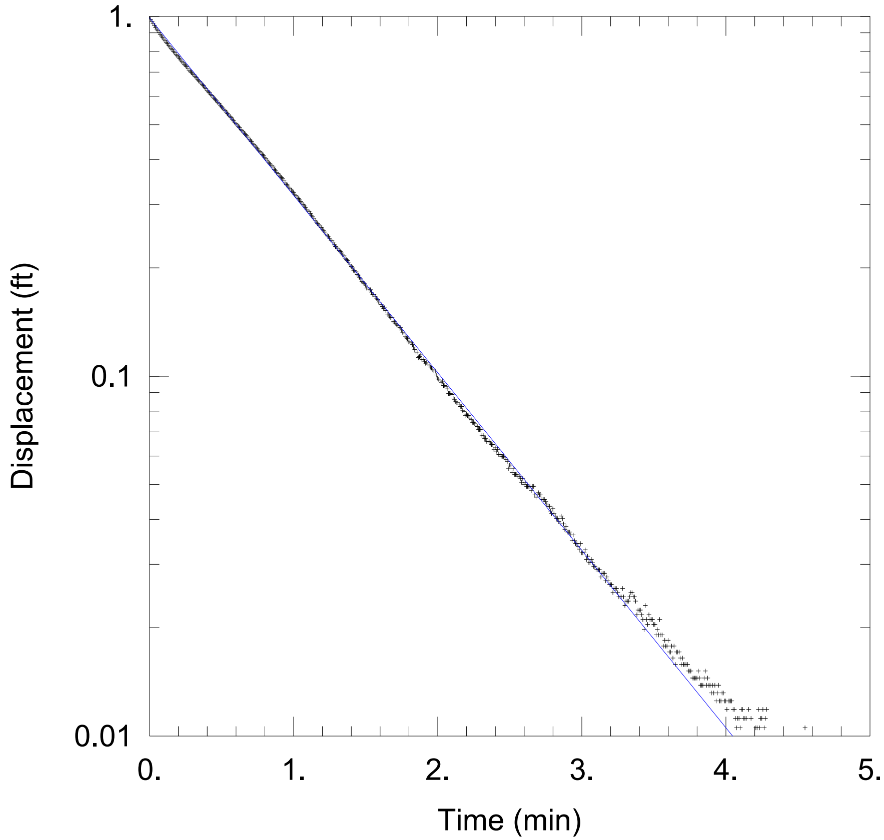
Well ID	Test	Test Date	Bouwer-Rice Hydraulic Conductivity (ft/day)	Bouwer-Rice Hydraulic Conductivity (cm/sec)
CUF-1001	Falling Head 1	6/24/2019	83.27	2.94E-02
	Falling Head 2	6/24/2019	81.01	2.86E-02
	Falling Head 3	6/24/2019	84.17	2.97E-02
	Rising Head 1	6/24/2019	104.5	3.69E-02
	Rising Head 2	6/24/2019	85.32	3.01E-02
	Rising Head 3	6/24/2019	91.25	3.22E-02
CUF-1002	Falling Head 1	6/26/2019	121.5	4.29E-02
	Falling Head 2	6/26/2019	143.2	5.05E-02
	Falling Head 3	6/26/2019	115.3	4.07E-02
	Rising Head 1	6/26/2019	128.2	4.52E-02
	Rising Head 2	6/26/2019	135.7	4.79E-02
	Rising Head 3	6/26/2019	125.6	4.43E-02
CUF-1003	Falling Head 1	6/24/2019	64.43	2.27E-02
	Falling Head 2	6/24/2019	49.71	1.75E-02
	Falling Head 3	6/24/2019	47.26	1.67E-02
	Falling Head 4	6/24/2019	49.23	1.74E-02
	Falling Head 5	6/24/2019	47.56	1.68E-02
	Rising Head 1	6/24/2019	51.20	1.81E-02
	Rising Head 2	6/24/2019	48.59	1.71E-02
	Rising Head 3	6/24/2019	40.80	1.44E-02
	Rising Head 4	6/24/2019	39.52	1.39E-02

Stantec

Slug Test Results
TVA-CUF Plant
Cumberland City, Tennessee

Well ID	Test	Test Date	Bouwer-Rice Hydraulic Conductivity (ft/day)	Bouwer-Rice Hydraulic Conductivity (cm/sec)
CUF-1005	Falling Head 1	6/26/2019	0.9262	3.27E-04
	Falling Head 2	6/26/2019	0.7170	2.53E-04
	Falling Head 3	6/26/2019	0.6656	2.35E-04
	Rising Head 1	6/26/2019	0.5999	2.12E-04
	Rising Head 2	6/26/2019	0.5555	1.96E-04
	Rising Head 3	6/26/2019	0.5855	2.07E-04

Notes
ft/day - feet per day
cm/sec - centimeters per second
Slug test data analysis was completed using AQTESOLV™, Version 4.50 Professional



CUF-1001 FH T1

Data Set: C:\...\CUF-1001_FH_T1.aqt
Date: 07/26/19 Time: 10:51:50

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1001
Test Date: 06/24/2019

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

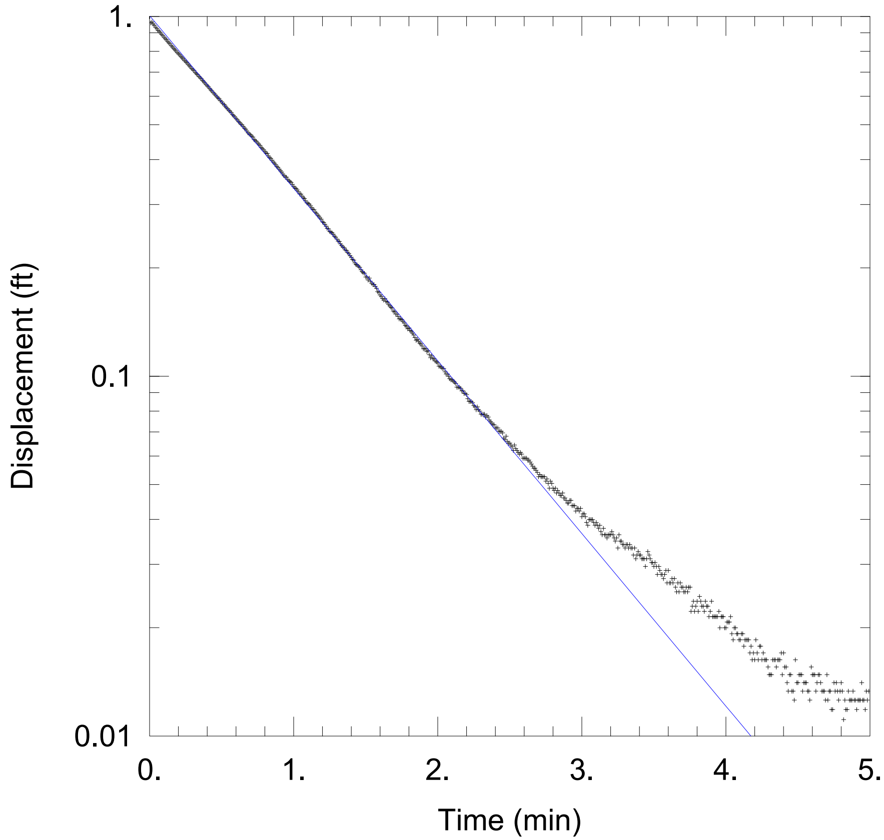
K = 83.27 ft/day
y0 = 0.9901 ft

AQUIFER DATA

Saturated Thickness: 0.3 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1001)

Initial Displacement: 1. ft
Total Well Penetration Depth: 5.73 ft
Casing Radius: 0.167 ft
Static Water Column Height: 5.73 ft
Screen Length: 4.8 ft
Well Radius: 0.344 ft
Gravel Pack Porosity: 0.



CUF-1001 FH T2

Data Set: C:\...\CUF-1001_FH_T2.aqt
Date: 07/26/19 Time: 10:51:26

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1001
Test Date: 06/24/2019

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

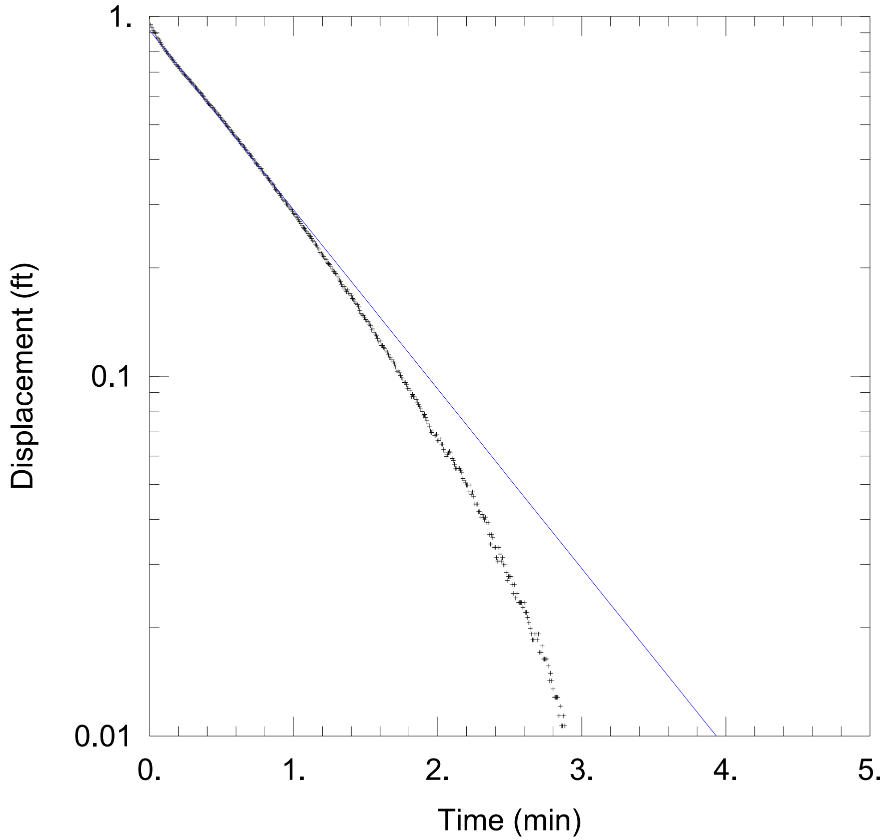
K = 81.01 ft/day
y0 = 1.005 ft

AQUIFER DATA

Saturated Thickness: 0.3 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1001)

Initial Displacement: 1. ft
Total Well Penetration Depth: 5.73 ft
Casing Radius: 0.167 ft
Static Water Column Height: 5.73 ft
Screen Length: 4.8 ft
Well Radius: 0.344 ft
Gravel Pack Porosity: 0.



CUF-1001 FH T3

Data Set: C:\...\CUF-1001_FH_T3.aqt
Date: 07/26/19 Time: 10:51:03

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1001
Test Date: 06/24/2019

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

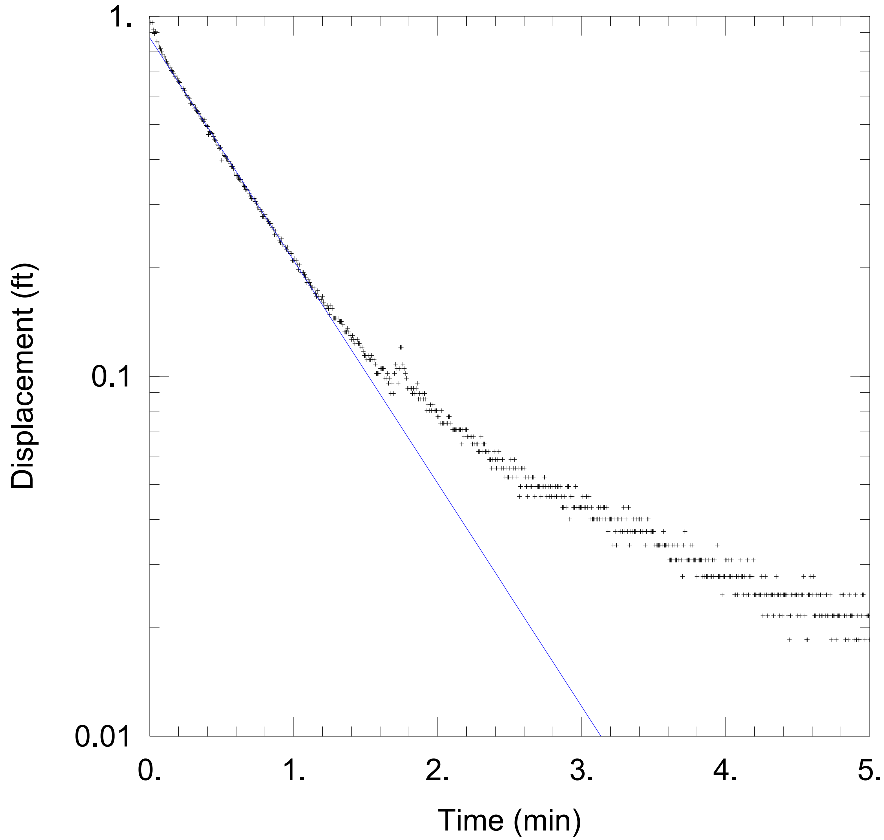
K = 84.17 ft/day
y0 = 0.9141 ft

AQUIFER DATA

Saturated Thickness: 0.3 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1001)

Initial Displacement: 1. ft
Total Well Penetration Depth: 5.73 ft
Casing Radius: 0.167 ft
Static Water Column Height: 5.73 ft
Screen Length: 4.8 ft
Well Radius: 0.344 ft
Gravel Pack Porosity: 0.



CUF-1001 RH T1

Data Set: C:\...\CUF-1001_RH_T1.aqt
Date: 07/26/19 Time: 10:50:28

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1001
Test Date: 06/24/2019

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

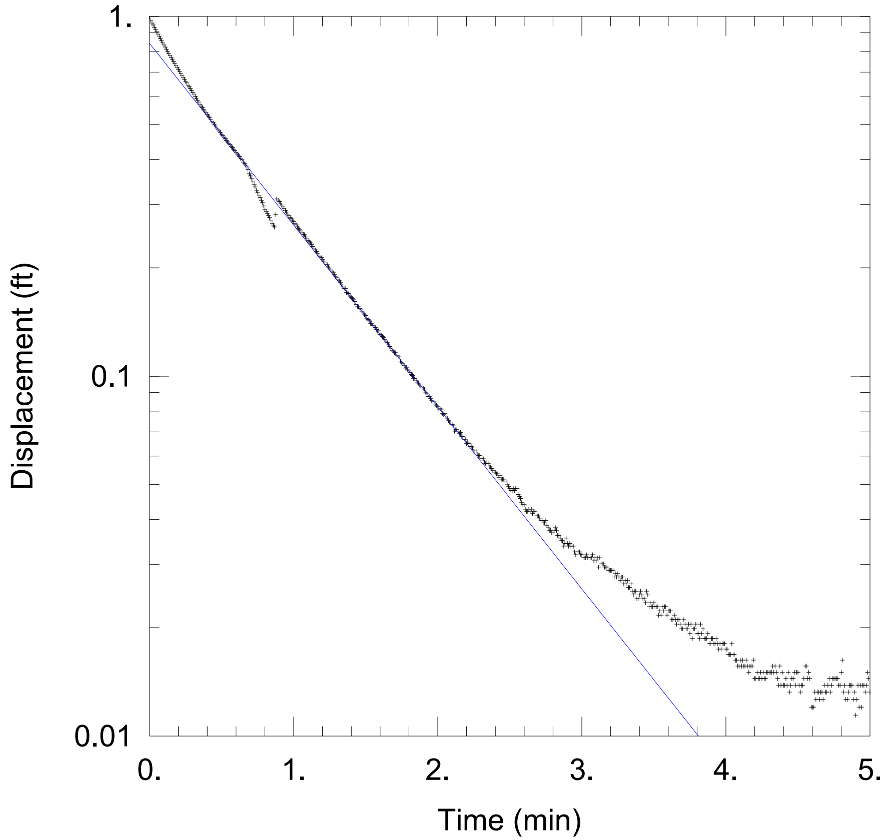
K = 104.5 ft/day
y0 = 0.8708 ft

AQUIFER DATA

Saturated Thickness: 0.3 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1001)

Initial Displacement: 1. ft
Total Well Penetration Depth: 5.73 ft
Casing Radius: 0.167 ft
Static Water Column Height: 5.73 ft
Screen Length: 4.8 ft
Well Radius: 0.344 ft
Gravel Pack Porosity: 0.



CUF-1001 RH T2

Data Set: C:\...\CUF-1001_RH_T2.aqt
Date: 07/26/19 Time: 10:50:03

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1001
Test Date: 06/24/2019

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

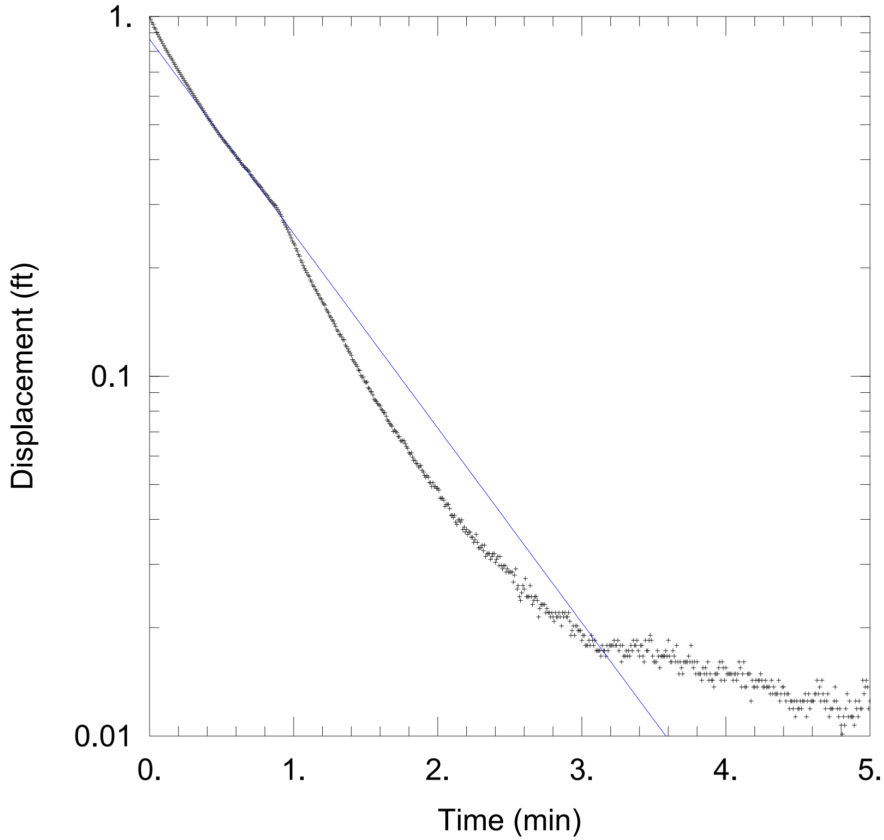
K = 85.32 ft/day
y0 = 0.8411 ft

AQUIFER DATA

Saturated Thickness: 0.3 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1001)

Initial Displacement: 1. ft
Total Well Penetration Depth: 5.73 ft
Casing Radius: 0.167 ft
Static Water Column Height: 5.73 ft
Screen Length: 4.8 ft
Well Radius: 0.344 ft
Gravel Pack Porosity: 0.



CUF-1001 RH T3

Data Set: C:\...\CUF-1001_RH_T3.aqt
Date: 07/26/19 Time: 10:49:26

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1001
Test Date: 06/24/2019

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 91.25 ft/day
y0 = 0.864 ft

AQUIFER DATA

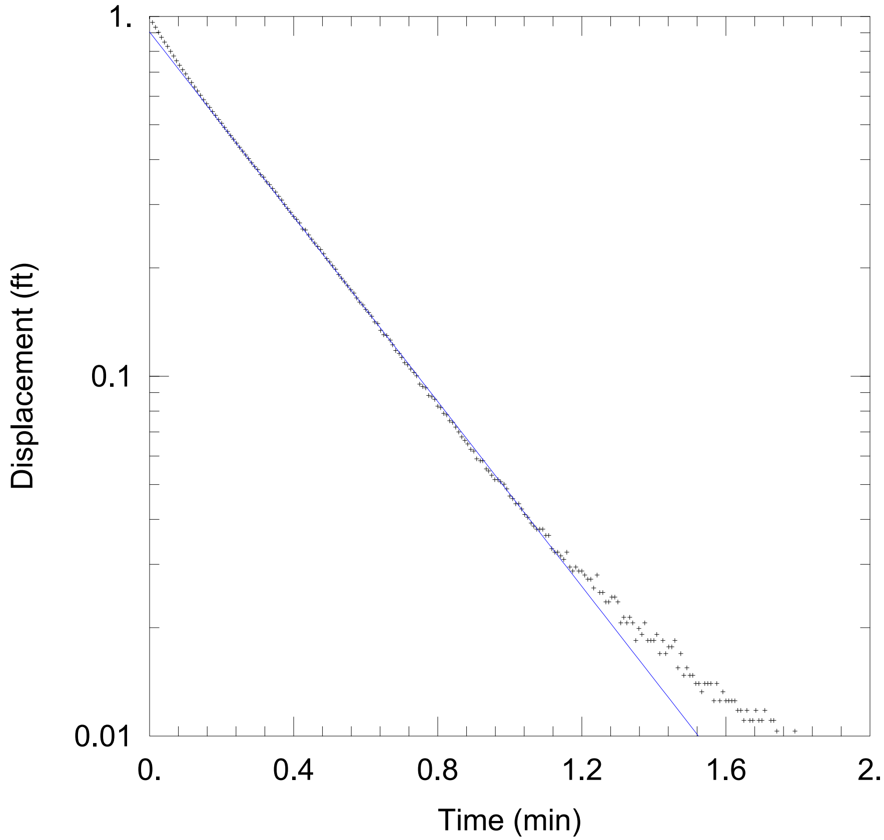
Saturated Thickness: 0.3 ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1001)

Initial Displacement: 1. ft
Total Well Penetration Depth: 5.73 ft
Casing Radius: 0.167 ft

Static Water Column Height: 5.73 ft
Screen Length: 4.8 ft
Well Radius: 0.344 ft
Gravel Pack Porosity: 0.



CUF-1002 FH T1

Data Set: C:\...\CUF-1002_FH_T1.aqt
Date: 07/26/19 Time: 10:56:51

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1002
Test Date: 06/26/2019

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

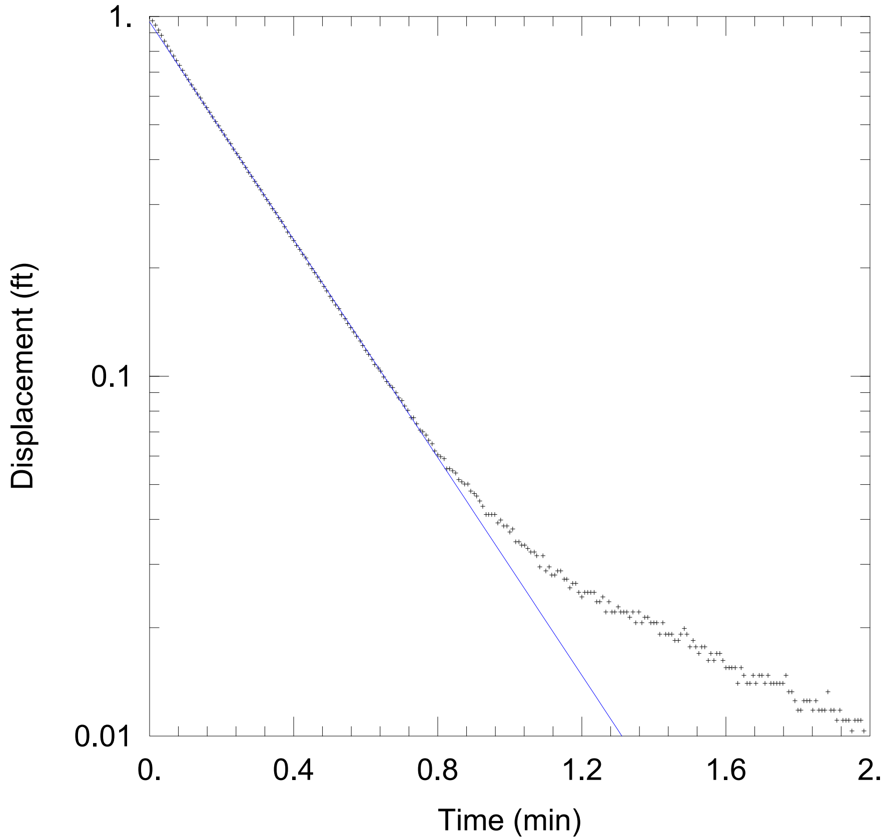
K = 121.5 ft/day
y0 = 0.9053 ft

AQUIFER DATA

Saturated Thickness: 0.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1002)

Initial Displacement: 1. ft
Total Well Penetration Depth: 8.5 ft
Casing Radius: 0.167 ft
Static Water Column Height: 8.5 ft
Screen Length: 4.9 ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1002 FH T2

Data Set: C:\...\CUF-1002_FH_T2.aqt
Date: 07/26/19 Time: 10:56:19

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1002
Test Date: 06/26/2019

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 143.2 ft/day
y0 = 0.9657 ft

AQUIFER DATA

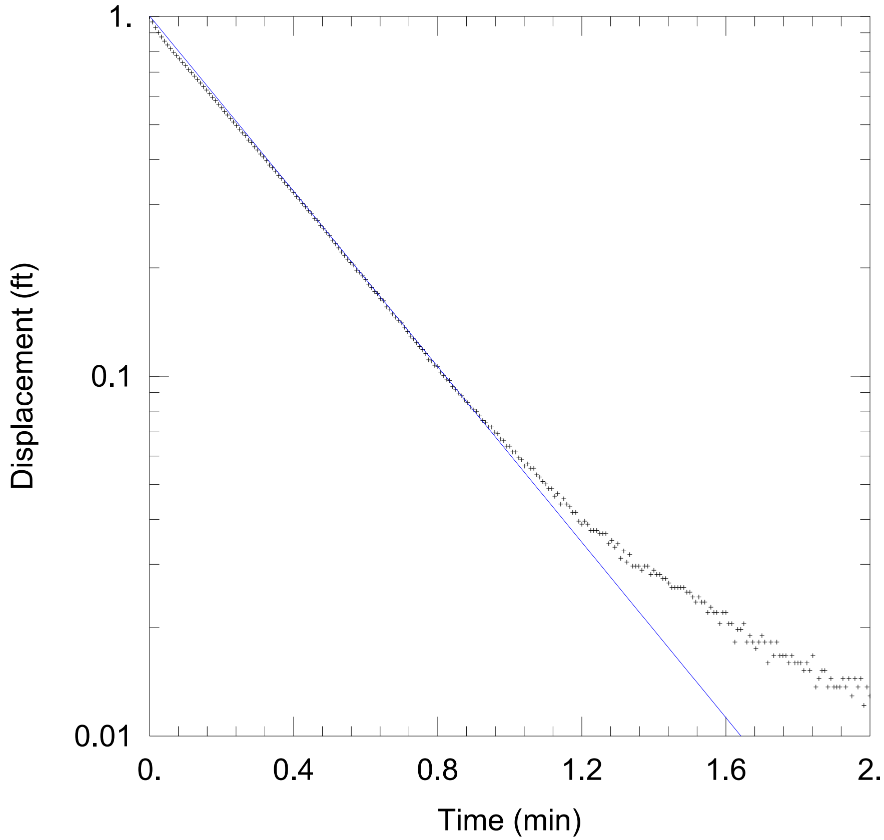
Saturated Thickness: 0.5 ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1002)

Initial Displacement: 1. ft
Total Well Penetration Depth: 8.5 ft
Casing Radius: 0.167 ft

Static Water Column Height: 8.5 ft
Screen Length: 4.9 ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1002 FH T3

Data Set: C:\...\CUF-1002_FH_T3.aqt
Date: 07/26/19 Time: 10:55:54

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1002
Test Date: 06/26/2019

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 115.3 ft/day
y0 = 1.003 ft

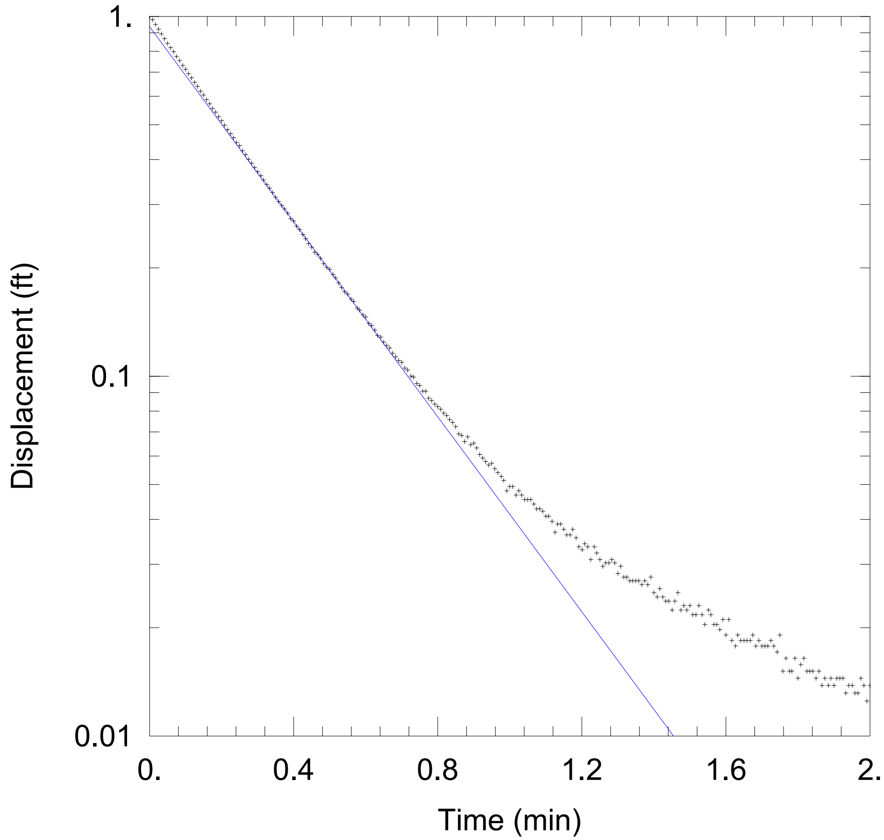
AQUIFER DATA

Saturated Thickness: 0.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1002)

Initial Displacement: 1. ft
Total Well Penetration Depth: 8.5 ft
Casing Radius: 0.167 ft

Static Water Column Height: 8.5 ft
Screen Length: 4.9 ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1002 RH T1

Data Set: C:\...\CUF-1002_RH_T1.aqt
Date: 07/26/19 Time: 10:55:37

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1002
Test Date: 06/26/2019

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

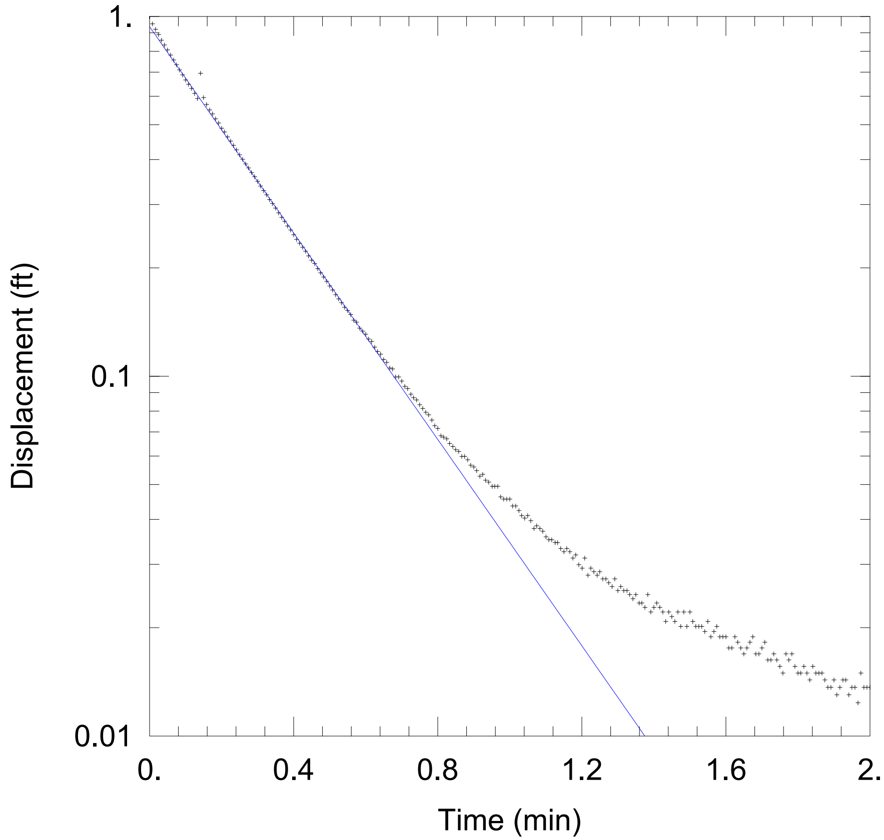
K = 128.2 ft/day
y0 = 0.936 ft

AQUIFER DATA

Saturated Thickness: 0.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1002)

Initial Displacement: 1. ft
Total Well Penetration Depth: 8.5 ft
Casing Radius: 0.167 ft
Static Water Column Height: 8.5 ft
Screen Length: 4.9 ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1002 RH T2

Data Set: C:\...\CUF-1002_RH_T2.aqt
Date: 07/26/19 Time: 10:55:10

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1002
Test Date: 06/26/2019

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

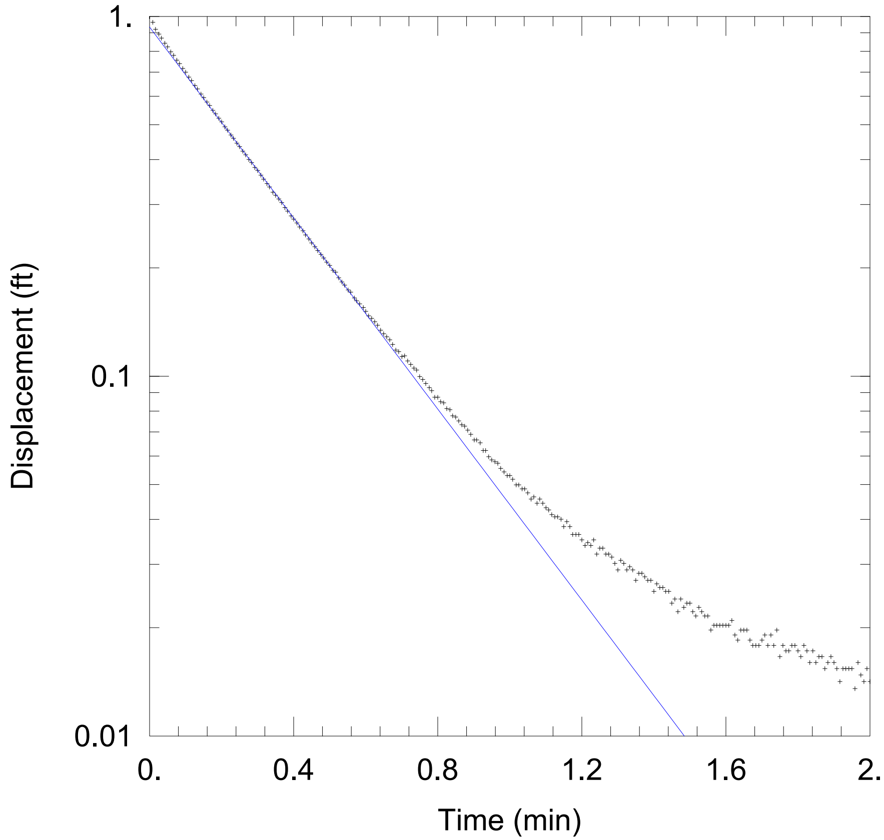
K = 135.7 ft/day
y0 = 0.9364 ft

AQUIFER DATA

Saturated Thickness: 0.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1002)

Initial Displacement: 1. ft
Total Well Penetration Depth: 8.5 ft
Casing Radius: 0.167 ft
Static Water Column Height: 8.5 ft
Screen Length: 4.9 ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1002 RH T3

Data Set: C:\...\CUF-1002_RH_T3.aqt
Date: 07/26/19 Time: 10:54:39

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1002
Test Date: 06/26/2019

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

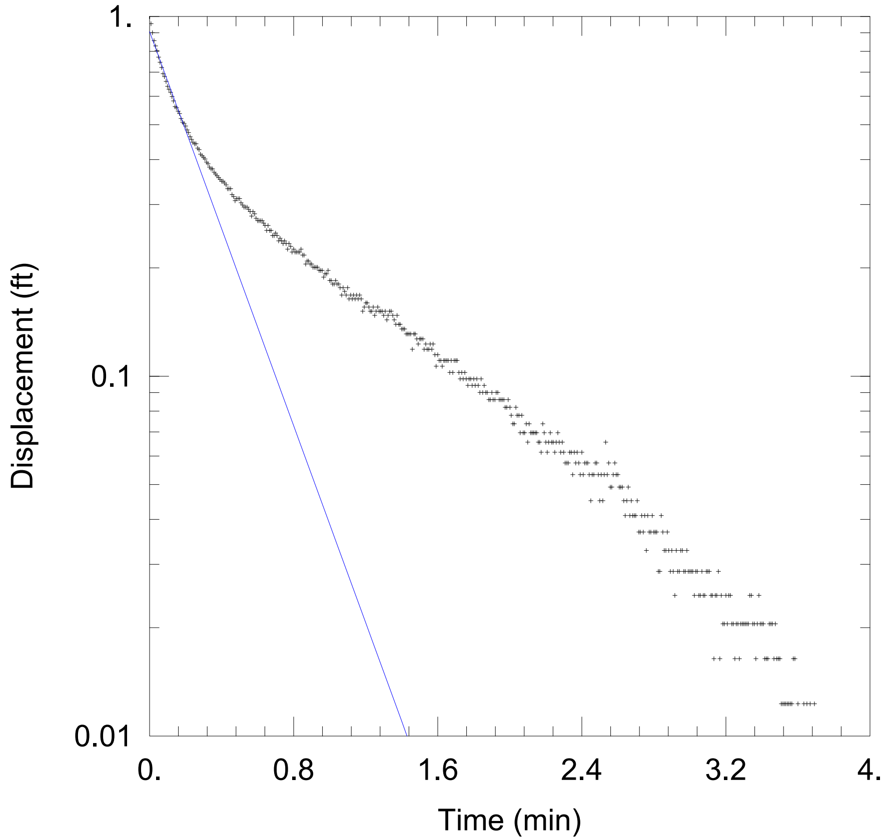
K = 125.6 ft/day
y0 = 0.9341 ft

AQUIFER DATA

Saturated Thickness: 0.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1002)

Initial Displacement: 1. ft
Total Well Penetration Depth: 8.5 ft
Casing Radius: 0.167 ft
Static Water Column Height: 8.5 ft
Screen Length: 4.9 ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1003 FH T1

Data Set: C:\...\CUF-1003_FH_T1-REV.aqt
Date: 07/26/19 Time: 11:00:31

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1003
Test Date: 06/24/2019

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

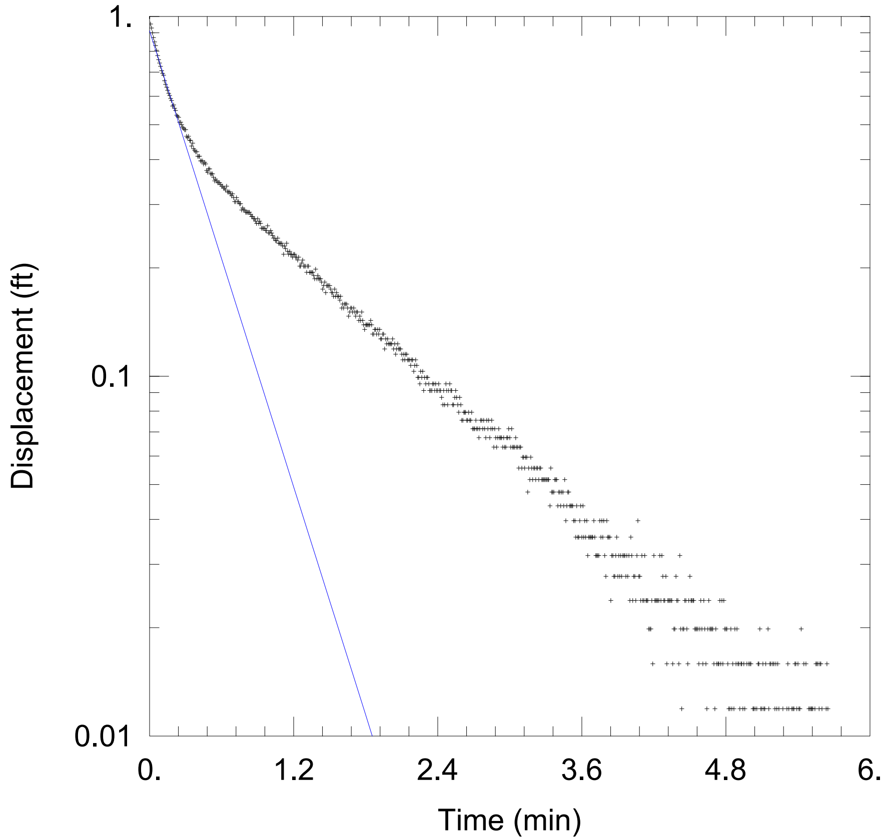
K = 64.43 ft/day
y0 = 0.9067 ft

AQUIFER DATA

Saturated Thickness: 1.3 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1003)

Initial Displacement: 1. ft
Total Well Penetration Depth: 4.9 ft
Casing Radius: 0.167 ft
Static Water Column Height: 3.01 ft
Screen Length: 4.9 ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1003 FH T2

Data Set: C:\...\CUF-1003_FH_T2-REV.aqt
Date: 07/26/19 Time: 11:00:11

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1003
Test Date: 06/24/2019

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 49.71 ft/day
y0 = 0.9118 ft

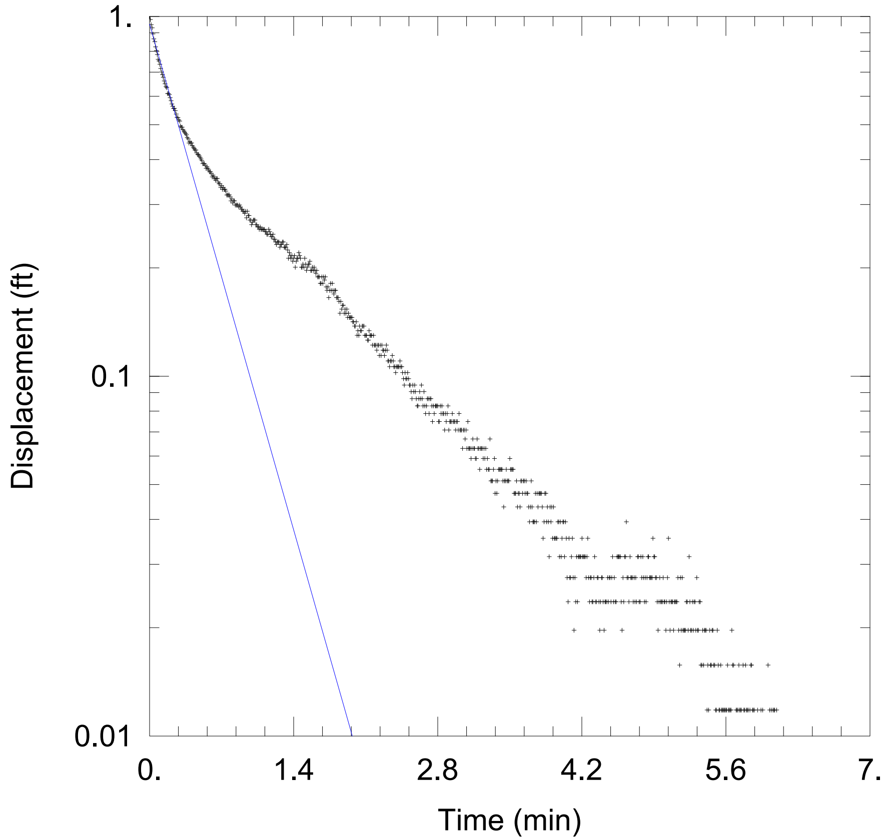
AQUIFER DATA

Saturated Thickness: 1.3 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1003)

Initial Displacement: 1. ft
Total Well Penetration Depth: 4.9 ft
Casing Radius: 0.167 ft

Static Water Column Height: 3.01 ft
Screen Length: 4.9 ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1003 FH T3

Data Set: C:\...\CUF-1003_FH_T3-REV.aqt
Date: 07/26/19 Time: 10:59:51

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1003
Test Date: 06/24/2019

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

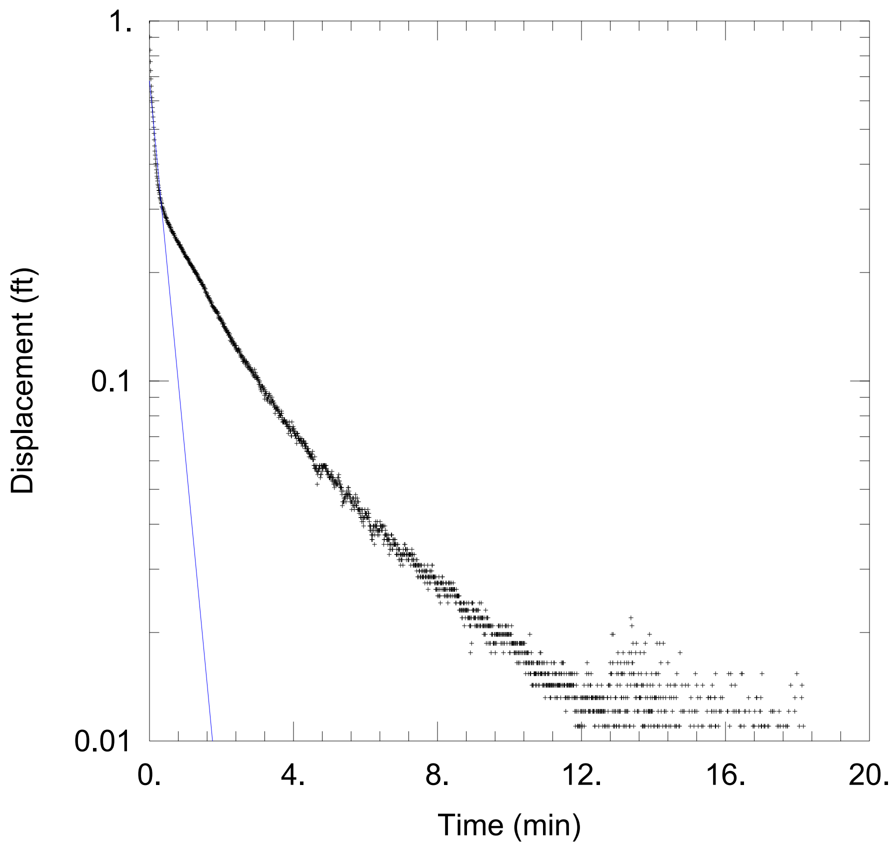
K = 47.26 ft/day
y0 = 0.9519 ft

AQUIFER DATA

Saturated Thickness: 1.3 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1003)

Initial Displacement: 1. ft
Total Well Penetration Depth: 4.9 ft
Casing Radius: 0.167 ft
Static Water Column Height: 3.01 ft
Screen Length: 4.9 ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1003 FH T4

Data Set: C:\...\CUF-1003_FH_T4-REV.aqt
Date: 07/26/19 Time: 10:59:27

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1003
Test Date: 06/24/2019

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

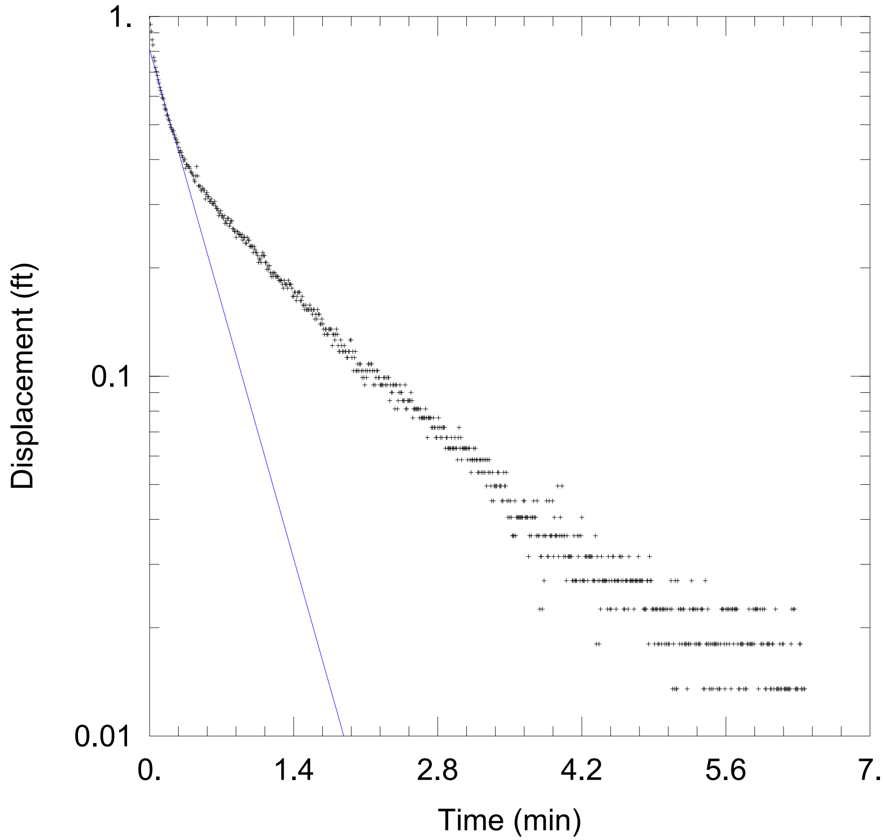
K = 49.23 ft/day
y0 = 0.6809 ft

AQUIFER DATA

Saturated Thickness: 1.3 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1003)

Initial Displacement: 1. ft
Total Well Penetration Depth: 4.9 ft
Casing Radius: 0.167 ft
Static Water Column Height: 3.01 ft
Screen Length: 4.9 ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1003 FH T5

Data Set: C:\...\CUF-1003_FH_T5-REV.aqt
Date: 07/26/19 Time: 10:59:12

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1003
Test Date: 06/24/2019

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

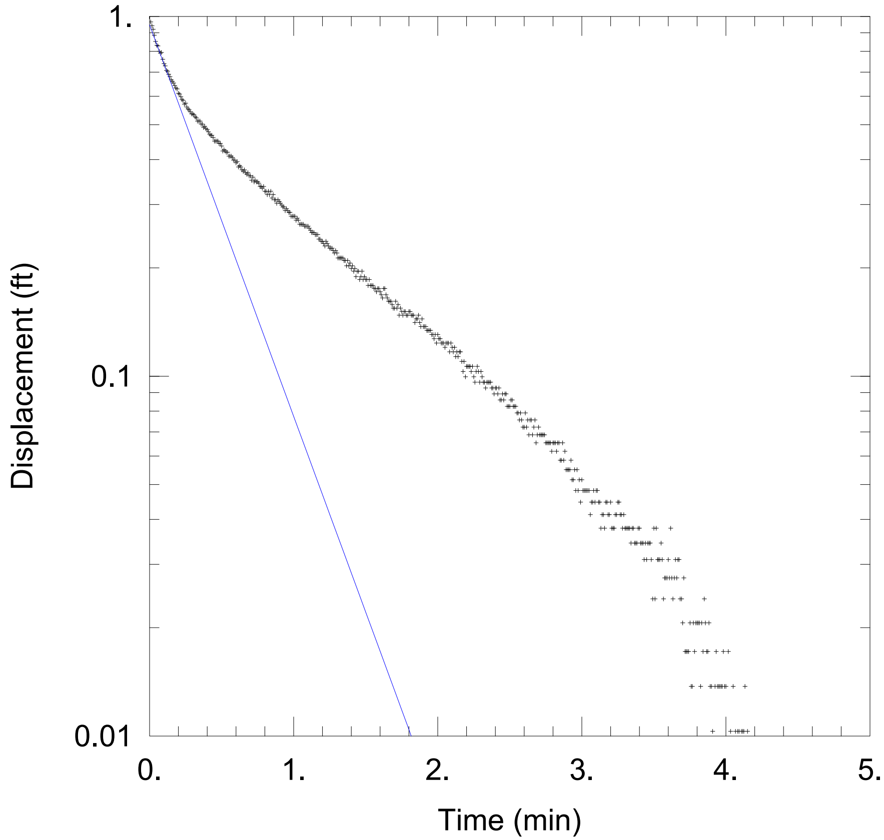
K = 47.56 ft/day
y0 = 0.8088 ft

AQUIFER DATA

Saturated Thickness: 1.3 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1003)

Initial Displacement: 1. ft
Total Well Penetration Depth: 4.9 ft
Casing Radius: 0.167 ft
Static Water Column Height: 3.01 ft
Screen Length: 4.9 ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1003 RH T1

Data Set: C:\...\CUF-1003_RH_T1-REV.aqt
Date: 07/26/19 Time: 10:58:37

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1003
Test Date: 06/24/2019

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

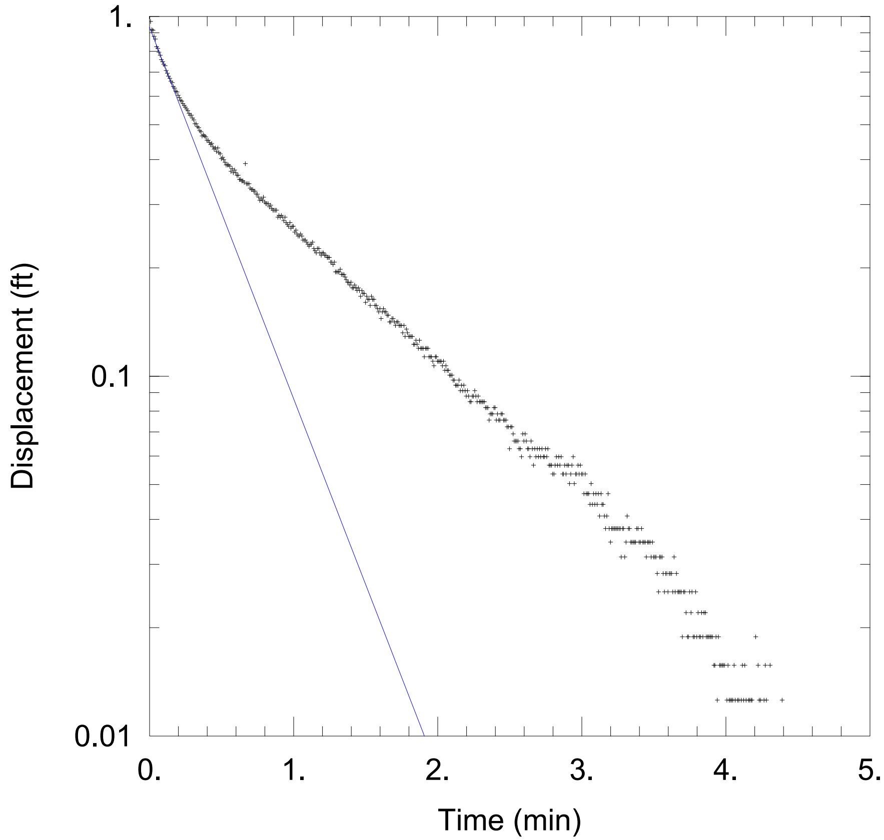
K = 51.2 ft/day
y0 = 0.9469 ft

AQUIFER DATA

Saturated Thickness: 1.3 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1003)

Initial Displacement: 1. ft
Total Well Penetration Depth: 4.9 ft
Casing Radius: 0.167 ft
Static Water Column Height: 3.01 ft
Screen Length: 4.9 ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1003 RH T2

Data Set: C:\...\CUF-1003_RH_T2-REV.aqt
Date: 07/26/19 Time: 10:58:22

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1003
Test Date: 06/24/2019

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

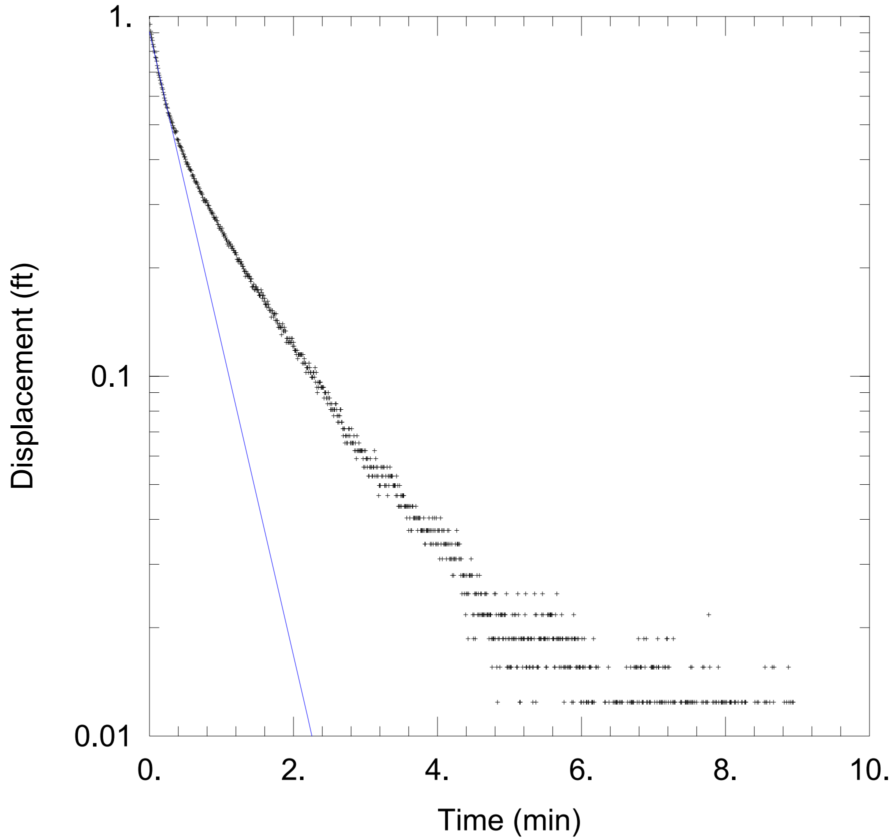
K = 48.59 ft/day
y0 = 0.9318 ft

AQUIFER DATA

Saturated Thickness: 1.3 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1003)

Initial Displacement: 1. ft
Total Well Penetration Depth: 4.9 ft
Casing Radius: 0.167 ft
Static Water Column Height: 3.01 ft
Screen Length: 4.9 ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1003 RH T3

Data Set: C:\...\CUF-1003_RH_T3-REV.aqt
Date: 07/26/19 Time: 10:58:06

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1003
Test Date: 06/24/2019

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

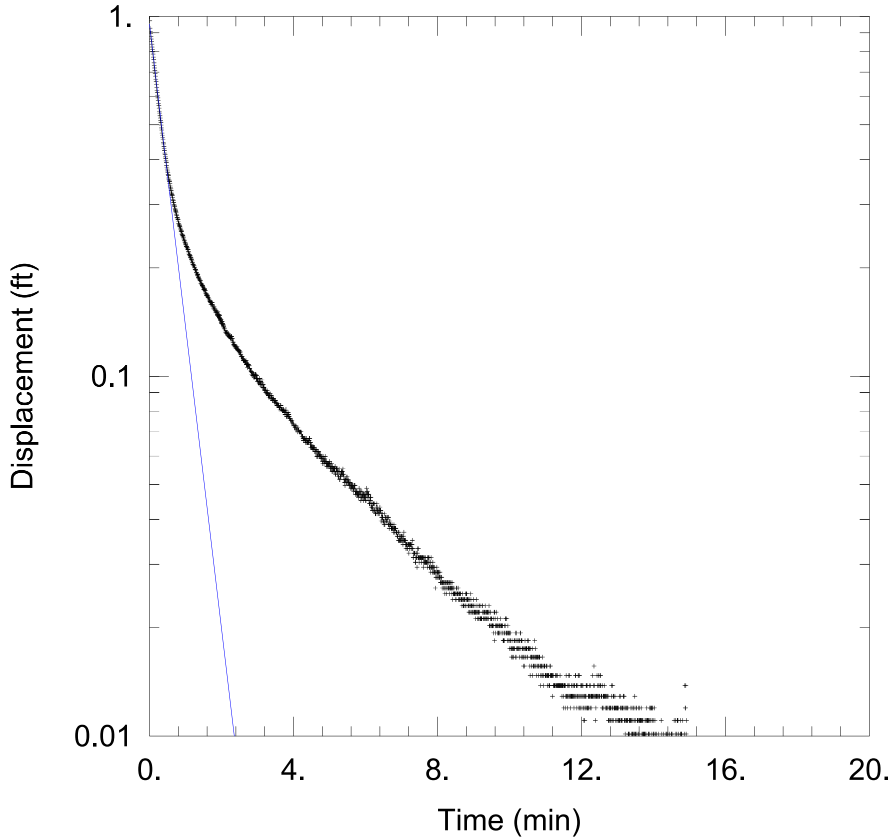
K = 40.8 ft/day
y0 = 0.9053 ft

AQUIFER DATA

Saturated Thickness: 1.3 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1003)

Initial Displacement: 1. ft
Total Well Penetration Depth: 4.9 ft
Casing Radius: 0.167 ft
Static Water Column Height: 3.01 ft
Screen Length: 4.9 ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1003 RH T4

Data Set: C:\...\CUF-1003_RH_T4-REV.aqt
Date: 07/26/19 Time: 10:57:46

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1003
Test Date: 06/24/2019

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 39.52 ft/day
y0 = 0.9513 ft

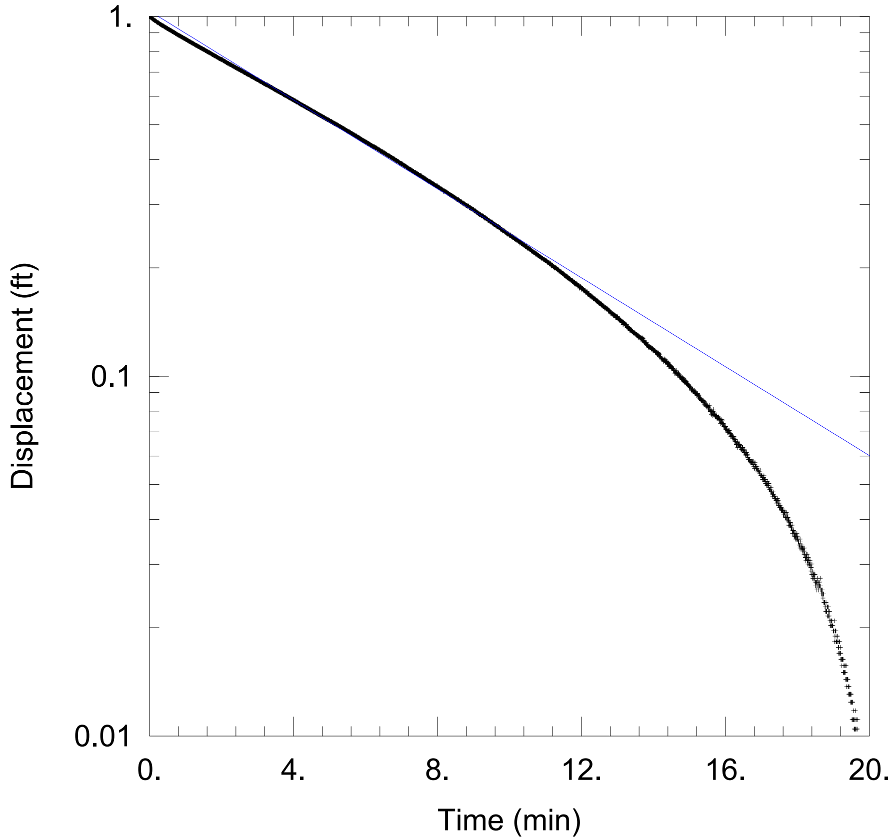
AQUIFER DATA

Saturated Thickness: 1.3 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1003)

Initial Displacement: 1. ft
Total Well Penetration Depth: 4.9 ft
Casing Radius: 0.167 ft

Static Water Column Height: 3.01 ft
Screen Length: 4.9 ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1005 FH T1

Data Set: C:\...\CUF-1005_FH_T1.aqt
Date: 07/26/19 Time: 11:07:12

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1005
Test Date: 06/26/2019

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

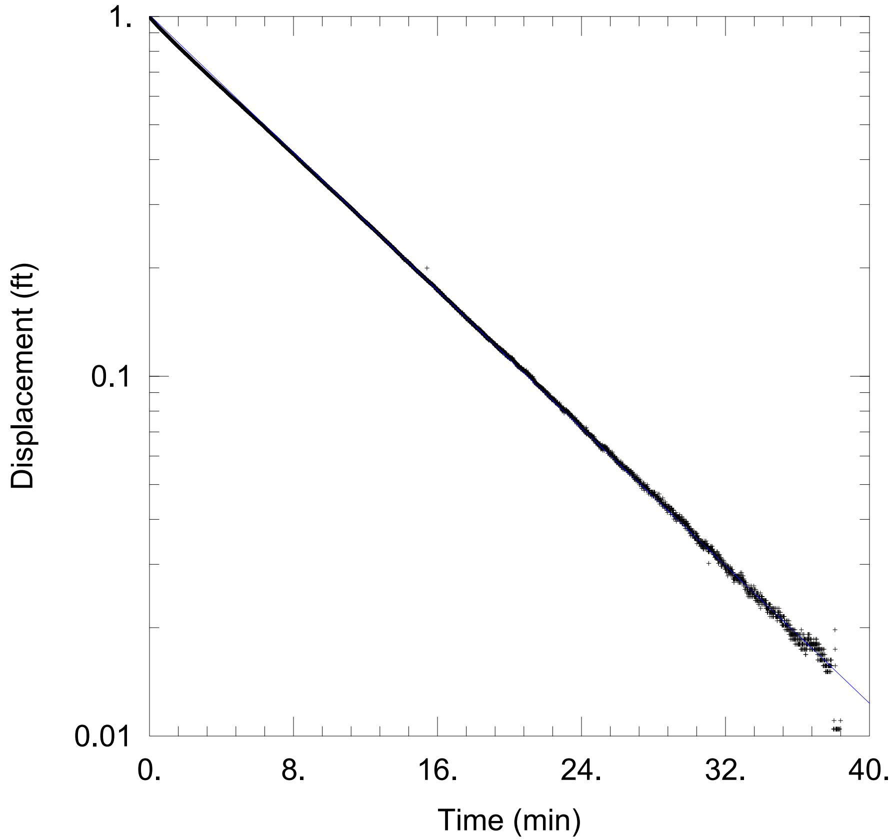
K = 0.9262 ft/day
y0 = 1.035 ft

AQUIFER DATA

Saturated Thickness: 7.4 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1005)

Initial Displacement: 1. ft
Total Well Penetration Depth: 18.71 ft
Casing Radius: 0.167 ft
Static Water Column Height: 18.71 ft
Screen Length: 11. ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1005 FH T2

Data Set: C:\...\CUF-1005_FH_T2.aqt
Date: 07/26/19 Time: 11:06:53

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1005
Test Date: 06/26/2019

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

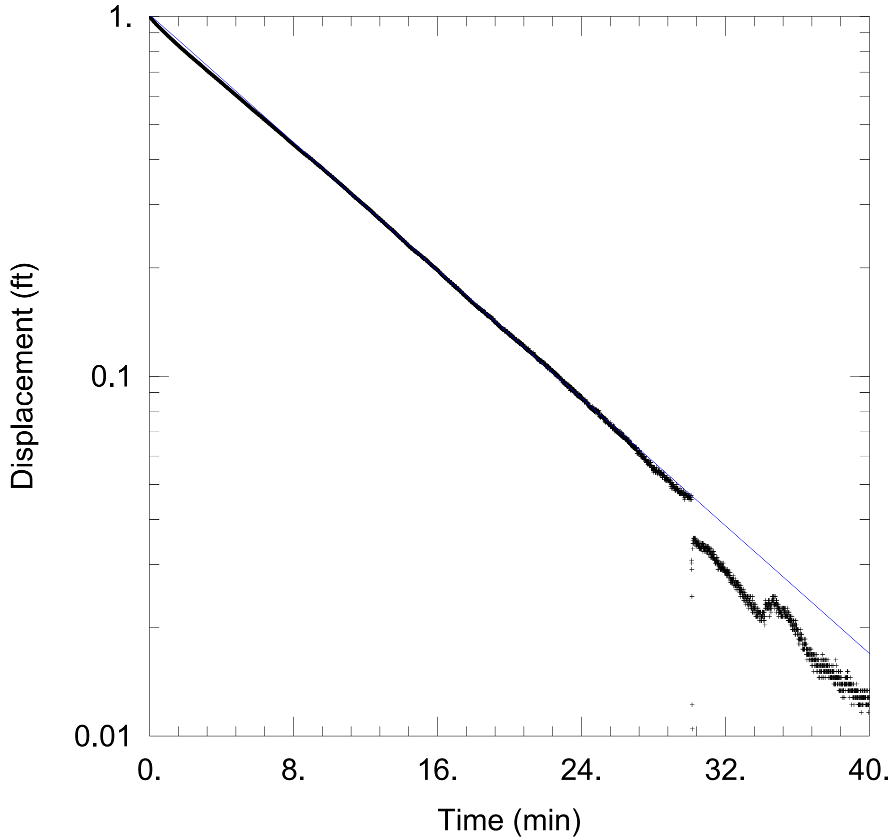
K = 0.717 ft/day
y0 = 1.009 ft

AQUIFER DATA

Saturated Thickness: 7.4 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1005)

Initial Displacement: 1. ft
Total Well Penetration Depth: 18.71 ft
Casing Radius: 0.167 ft
Static Water Column Height: 18.71 ft
Screen Length: 11. ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1005 FH T3

Data Set: C:\...\CUF-1005_FH_T3.aqt
Date: 07/26/19 Time: 11:03:28

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1005
Test Date: 06/26/2019

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.6656 ft/day
y0 = 1.012 ft

AQUIFER DATA

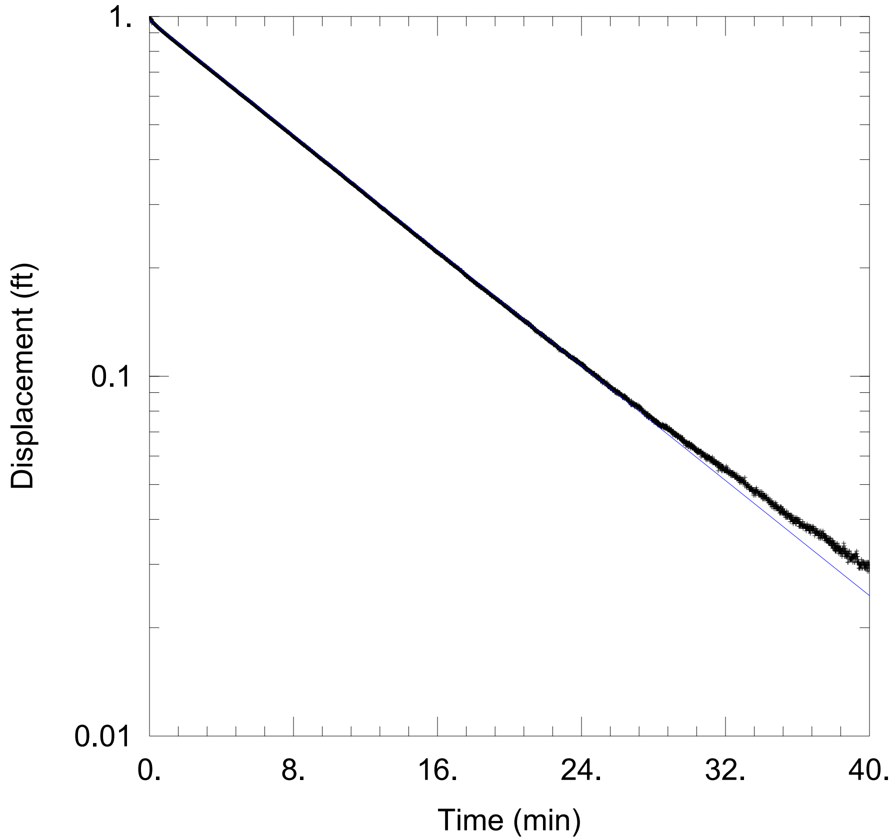
Saturated Thickness: 7.4 ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1005)

Initial Displacement: 1. ft
Total Well Penetration Depth: 18.71 ft
Casing Radius: 0.167 ft

Static Water Column Height: 18.71 ft
Screen Length: 11. ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1005 RH T1

Data Set: C:\...\CUF-1005_RH_T1.aqt
Date: 07/26/19 Time: 11:02:45

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1005
Test Date: 06/26/2019

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

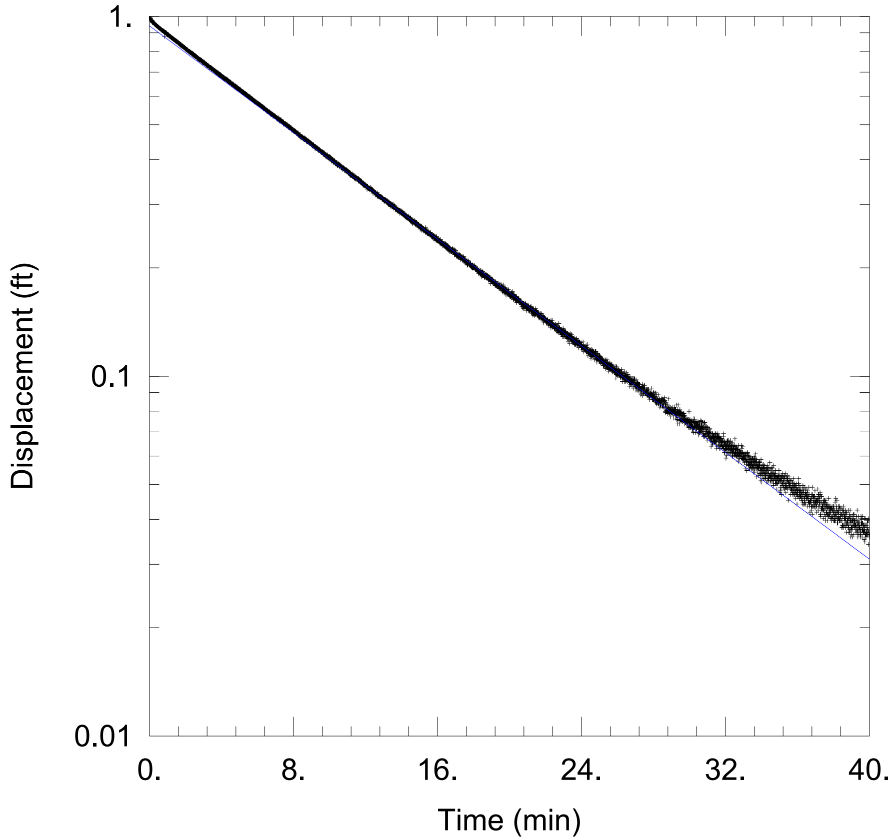
K = 0.5999 ft/day
y0 = 0.9789 ft

AQUIFER DATA

Saturated Thickness: 7.4 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1005)

Initial Displacement: 1. ft
Total Well Penetration Depth: 18.71 ft
Casing Radius: 0.167 ft
Static Water Column Height: 18.71 ft
Screen Length: 11. ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1005 RH T2

Data Set: C:\...\CUF-1005_RH_T2.aqt
Date: 07/26/19 Time: 11:02:17

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1005
Test Date: 06/26/2019

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

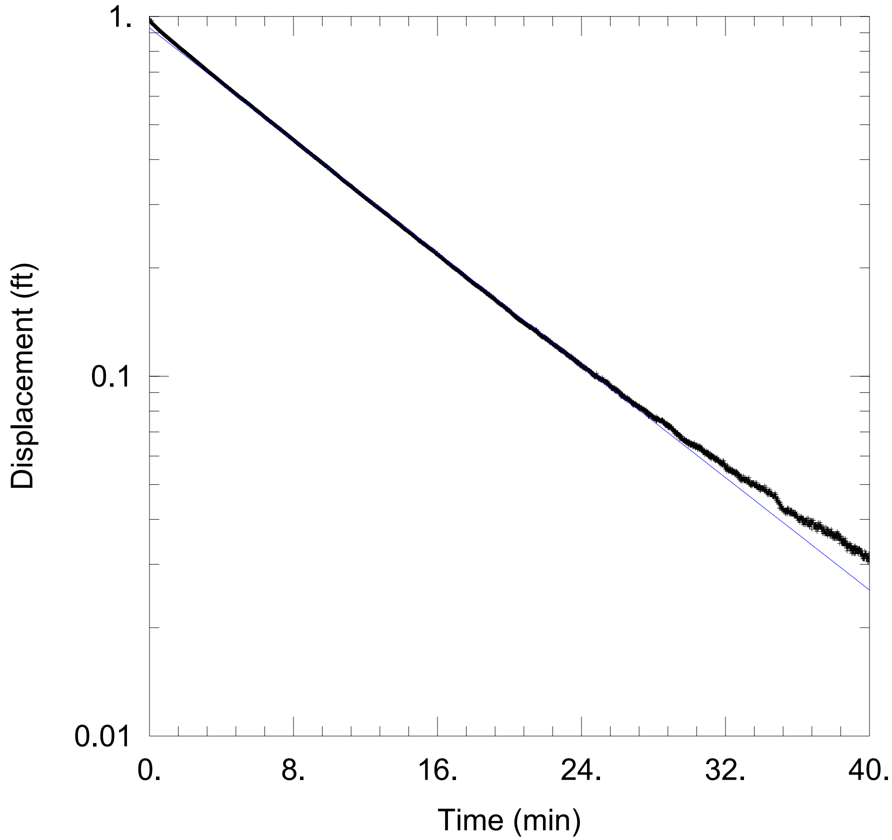
K = 0.5555 ft/day
y0 = 0.9411 ft

AQUIFER DATA

Saturated Thickness: 7.4 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1005)

Initial Displacement: 1. ft
Total Well Penetration Depth: 18.71 ft
Casing Radius: 0.167 ft
Static Water Column Height: 18.71 ft
Screen Length: 11. ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.



CUF-1005 RH T3

Data Set: C:\...\CUF-1005_RH_T3.aqt
Date: 07/26/19 Time: 11:01:35

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Project: 175588209
Location: Cumberland City, TN
Test Well: CUF-1005
Test Date: 06/26/2019

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.5855 ft/day
y0 = 0.929 ft

AQUIFER DATA

Saturated Thickness: 7.4 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1005)

Initial Displacement: 1. ft
Total Well Penetration Depth: 18.71 ft
Casing Radius: 0.167 ft
Static Water Column Height: 18.71 ft
Screen Length: 11. ft
Well Radius: 0.542 ft
Gravel Pack Porosity: 0.

APPENDIX H.3

HYDROGEOLOGY INVESTIGATION SAMPLING AND ANALYSIS REPORT ADDENDUM – CUF-1006

Cumberland Fossil Plant Hydrogeological Investigation Sampling and Analysis Report Addendum – CUF-1006

TDEC Commissioner's Order:
Environmental Investigation Plan
Cumberland Fossil Plant
Cumberland City, Tennessee

October 26, 2022

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

CUMBERLAND FOSSIL PLANT HYDROGEOLOGICAL INVESTIGATION SAMPLING AND ANALYSIS REPORT ADDENDUM – CUF-1006

Revision Record

Revision	Description	Date
0	Submittal to TDEC	September 9, 2022
1	Addresses October 10, 2022 TDEC Review Comments and Issued to TDEC	October 26, 2022

CUMBERLAND FOSSIL PLANT HYDROGEOLOGICAL INVESTIGATION SAMPLING AND ANALYSIS REPORT ADDENDUM – CUF-1006

Sign-off Sheet

This document entitled Cumberland Fossil Plant Hydrogeological Investigation Sampling and Analysis Report Addendum – CUF-1006 was prepared by Stantec Consulting Services Inc. (“Stantec”) for the account of Tennessee Valley Authority (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by Anna Blair

Anna Blair, Earth Scientist

Reviewed by Carole M. Farr

Carole M. Farr, Senior Principal Geologist

Approved by Rebekah Brooks

Rebekah Brooks, Senior Principal Hydrogeologist

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APPENDIX A – EXHIBITS

APPENDIX B – TABLES

Abbreviations

%	Percent
ASTM	ASTM International
CCR	Coal Combustion Residuals
CCR Parameters	Constituents listed in Appendices III and IV of 40 CFR 257, and five metals included in Appendix I of Tennessee Rule 0400-11-01-.04
CFR	Code of Federal Regulations
COC	Chain-of-Custody
CUF Plant	Cumberland Fossil Plant
EAR	Environmental Assessment Report
ENV	Environmental
EnvStds	Environmental Standards, Inc.
FSP	Field Sampling Personnel
GPS	Global Positioning System
HGI	Hydrogeological Investigation
HSA	Hollow-Stem Auger
IDW	Investigation Derived Waste
PG	Professional Geologist
PLM	Polarized Light Microscopy
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan
SAP	Sampling and Analysis Plan
SAR	Sampling and Analysis Report
Stantec	Stantec Consulting Services Inc.
TDEC	Tennessee Department of Environment and Conservation
TDEC Order	Commissioner’s Order No. OGC15-0177
TI	Technical Instruction
TVA	Tennessee Valley Authority

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) has prepared this addendum to the Cumberland Fossil (CUF) Plant *Hydrogeological Investigation Sampling and Analysis Report (SAR)*, dated September 1, 2020 (Stantec 2020a), on behalf of the Tennessee Valley Authority (TVA), to document activities related to an additional hydrogeological investigation (HGI) at TVA's CUF Plant located in Cumberland City, Tennessee.

The purpose of the additional HGI was to install permanent monitoring well CUF-1006 to evaluate hydrogeological conditions downgradient of CUF-1005 and outside of the Gypsum Storage Area coal combustion residuals (CCR) units at the CUF Plant in support of fulfilling the requirements for the Tennessee Department of Environment and Conservation (TDEC) issued Commissioner's Order No. OGC15-0177 (TDEC Order) to the TVA (TDEC 2015). The TDEC Order set forth a "process for the investigation, assessment, and remediation of unacceptable risks" at TVA's coal ash disposal sites in Tennessee.

The purpose of this SAR addendum is to summarize activities completed to meet the objectives of the *HGI Sampling and Analysis Plan (SAP) Addendum – CUF-1006* (SAP Addendum) (Stantec 2021a). Previous HGI activities are summarized in the HGI SAR. This HGI SAR addendum is not intended to provide conclusions or evaluations of results. The scope of the additional HGI represented herein was conducted pursuant to the HGI SAP Addendum and is part of a larger environmental investigation at the CUF Plant. The evaluation of the results from this HGI SAR Addendum will consider other aspects of the environmental investigation, as well as data collected under other State and/or CCR programs and be presented in Revision 1 of the CUF Plant Environmental Assessment Report (EAR).

The HGI activities were performed in general accordance with the following documents developed by TVA to support fulfilling the requirements of the TDEC Order:

- *Hydrogeological Investigation SAP Addendum – CUF-1006* (Stantec 2021a).
- *Hydrogeological Investigation SAP* (Stantec 2018a).
- *Environmental Investigation Plan* (Stantec 2018b).
- *Quality Assurance Project Plan (QAPP)* (Environmental Standards, Inc. 2018).

Also, the HGI was implemented in accordance with TVA- and TDEC-approved Programmatic and Project-specific changes. Field documentation for work performed under the HGI SAP Addendum was reviewed for variations in scope and procedures, and the findings are provided in Section 3.6.

HGI field work consisted of two primary activities – drilling and sampling, and permanent monitoring well installation. Quality Assurance oversight on field data acquisition protocols, sampling practices, and data review were performed by Environmental Standards, Inc. (EnvStds) under direct contract to TVA.

2.0 OBJECTIVE AND SCOPE

The primary objective of the additional HGI conducted pursuant to the HGI SAP Addendum was to install permanent monitoring well CUF-1006 to evaluate hydrogeological conditions in the vicinity of previously installed CUF-1005 at the CUF Plant. The activities conducted during the additional HGI support data collection for the groundwater investigation at the CUF Plant, including groundwater level measurements and groundwater sample collection for analysis of CCR related constituents listed in Appendices III and IV of Title 40 of the Code of Federal Regulations (CFR) Part 257 (40 CFR 257). In addition, five inorganic constituents listed in Appendix I of Tennessee Rule 0400-11-01-.04 and not included in the 40 CFR 257 Appendices III and IV were analyzed to maintain continuity with the TDEC environmental programs. These additional TDEC Appendix I constituents included copper, nickel, silver, vanadium, and zinc. The combined federal CCR Appendices III and IV constituents and TDEC Appendix I inorganic constituents are hereafter referred to as “CCR Parameters.”

The approach for the additional HGI was to:

- Install permanent monitoring well CUF-1006 downgradient of monitoring well CUF-1005 to monitor groundwater quality outside of the CCR unit
- Verify the site stratigraphy downgradient of monitoring well CUF-1005
- Collect soil samples to confirm the absence of CCR materials
- Complete monitoring well installation, well development, hydraulic conductivity (slug) testing, pump installation, and survey activities.

The scope of work of the additional HGI of consisted of the following tasks:

- Confirming drilling locations for the planned permanent downgradient monitoring well location using global positioning system (GPS) survey
- Drilling and logging the soil boring for lithologic information
- Collecting soil samples for analysis of geotechnical parameters (if deemed warranted), and percent (%) ash by polarized light microscopy (PLM)
- Installing permanent monitoring well CUF-1006 in the boring and constructing the surface completion
- Developing the monitoring well and conducting slug tests in well CUF-1006 to estimate hydraulic conductivity for evaluation of hydrogeologic conditions for the EAR
- Installing a dedicated groundwater sampling pump

- Surveying permanent monitoring well CUF-1006.

Details on each activity are presented in the sections below. Groundwater level measurements and sampling are being conducted as part of groundwater monitoring events being performed in conjunction with other groundwater monitoring programs. The results of these groundwater monitoring events will be incorporated into Revision 1 of the EAR. The installation of other EI permanent monitoring wells performed in accordance with the HGI SAP (Stantec 2018a) is reported in the CUF *Hydrogeological Investigation SAR* (Stantec 2020a).

3.0 FIELD ACTIVITIES

HGI SAP Addendum field activities were conducted between March 11 and August 31, 2021 and consisted of hollow-stem auger (HSA) drilling, monitoring well installation, well development, slug testing, pump installation, and well survey. Prior to initiating field activities, TVA conducted environmental reviews, obtained permits, and performed utility clearances as necessary to complete the field work.

Stantec performed the additional HGI field activities based on guidance and specifications listed in TVA's Environmental (ENV) Technical Instructions (TIs), the SAP, and the QAPP, except as noted in the Variations section of this report. As part of TVA's commitment to generate representative and reliable data, oversight of select field activities, field documentation, and centralized data management were performed by EnvStds under direct contract with TVA. EnvStds also provided quality reviews of field documentation.

During the additional HGI, Stantec conducted the following field activities:

- Confirmed drilling location for planned monitoring well CUF-1006
- Drilled one soil boring for installation of permanent monitoring well CUF-1006 under the direction of a Stantec Professional Geologist (PG) licensed in the State of Tennessee
- Collected soil samples using a split-spoon sampler to develop a continuous boring log/soil profile for the well boring and for potential analysis of geotechnical parameters (if deemed warranted)
- Collected 20 soil samples and one field duplicate for % ash by PLM analysis at R.J. Lee Group, Inc. Soil samples from each interval were also archived at Eurofins Environment Testing America, Pittsburgh for future analysis if needed.
- Installed permanent monitoring well CUF-1006
- Developed and conducted slug tests in well CUF-1006 to estimate hydraulic conductivity and installed a dedicated water sampling pump.

Following monitoring well installation, TVA constructed a surface completion and surveyed the new permanent well.

3.1 WORK LOCATION

The additional HGI field activities were conducted at one soil boring/monitoring well location (CUF-1006) at the CUF Plant under the HGI SAP Addendum scope of work. The HGI boring/monitoring well location for CUF-1006 is shown on Exhibit A.1 in Appendix A and is described in Table 1 in Section 3.1.1. Tables B.1 through B.5 in Appendix B provide data and information obtained at well CUF-1006, as described in Section 3.4. The subsurface log and well installation detail are provided in Appendix C.

3.1.1 Coal Combustion Residuals Unit Location

The proposed permanent monitoring well CUF-1006 was installed near, but outside the CCR management unit boundary, of the Gypsum Storage Area and downgradient of well CUF-1005 to monitor the groundwater flow and quality outside of the CCR unit.

Table 1. Summary of Boring and Monitoring Well Location

Boring ID	Well ID	Location	Rationale
CUF-1006	CUF-1006	Lower bench on the southeast side of the Gypsum Storage Area, downgradient of well CUF-1005 and adjacent to the Unnamed Tributary	Install a permanent monitoring well in the vicinity of well CUF-1005 at an elevation that is consistent with the elevation of native material

3.2 DOCUMENTATION

Stantec maintained HGI field documentation in general accordance with ENV-TI-05.80.03, *Field Record Keeping*, the HGI SAP Addendum, and the QAPP. Health and safety forms were completed in accordance with TVA and Stantec health and safety requirements. Field activities and data were primarily recorded on program-specific field forms. Additional information regarding HGI field documentation is provided below.

3.2.1 Field Forms

Stantec used program-specific field forms to record field observations and data for specific activities. Field forms used during the HGI included:

- *Daily Field Activity Log*
- *Subsurface Boring Log*
- *Chain-of-Custody (COC)*
- *Monitoring Well Installation Field Log*
- *Well Development Form*
- *Equipment Calibration Form*
- *Slug Test Data Form*
- *QED Well Wizard Dedicated Sampling Pump Installation Checklist*
- *Well Pump Calibration Form.*

3.2.1.1 Daily Field Activity Log

Stantec field sampling personnel (FSP) recorded field activities, observations, and data on a *Daily Field Activity Log* to chronologically document the field program. Deviations from the SAP or QAPP are summarized in the Variations section of this report.

3.2.1.2 Subsurface Boring Log

A Stantec PG licensed in the State of Tennessee prepared a *Subsurface Boring Log* for well CUF-1006. The log documented time, boring location, drilling personnel, tooling/equipment used, depth to water, sample number, sample recovery, blow counts, soil lithology, and other relevant observations. Soil color was logged per the appropriate Munsell Soil Color Chart (Munsell Color 2009). Information from these logs was used to construct the subsurface log provided in Appendix C.

3.2.1.3 Chain of Custody

Stantec FSP logged each soil sample collected during the HGI on a *COC*. Information on the *COC* included the sample ID, sample location, sample depth, type of sample, sampling date, and sample custody record. *COCs* were completed in general accordance with *ENV-TI-05.80.02: Sample Labeling and Custody* and reviewed by the laboratory manager.

3.2.1.4 Monitoring Well Installation Field Log

A Stantec PG licensed in the State of Tennessee prepared a *Monitoring Well Installation Field Log* for the monitoring well. The log documented the well location, well installation date, well installation materials, well depth, screened interval, depth interval for each backfill material, and surface completion details (protective casing, concrete pad, bollards, etc.). Information from this log was used to construct the well installation detail provided in Appendix C.

3.2.1.5 Well Development Form

Stantec FSP completed a *Well Development Form* for monitoring well CUF-1006. The form documented well location, well development dates, elapsed time since development started, depth to water, purge rate, cumulative purge volume, and water quality parameter measurements throughout and at completion of the development process.

3.2.1.6 Equipment Calibration Form

Stantec FSP performed daily calibration of the water quality meter and turbidity meter when used and documented the results on an *Equipment Calibration Form*. The form documented the calibration results for temperature, turbidity, specific conductance, pH, dissolved oxygen, and oxidation-reduction potential, and verified that the field instruments' sensors were operating within acceptance criteria. Refer to Section 3.2.2 for additional details on equipment calibration procedures.

3.2.1.7 Slug Test Data Form

Stantec FSP completed a *Slug Test Data Form* for the hydraulic conductivity tests performed at well CUF-1006. The form primarily documented well location, slug test dates, and initial and final water level measurements before and after each slug test attempt. The water level measurements during the tests were recorded by an automated pressure transducer and data recorder and subsequently downloaded.

3.2.1.8 QED Well Wizard Dedicated Sampling Pump Installation Checklist

Stantec FSP installed a dedicated bladder pump system in CUF-1006 to facilitate subsequent groundwater sampling events. A *QED Well Wizard Dedicated Sampling Pump Installation Checklist* was prepared for the monitoring well to document the well information, pump information, initial testing results, and any relevant comments.

3.2.1.9 Well Pump Calibration Form

Stantec FSP performed a calibration procedure on the dedicated pump in well CUF-1006 and recorded the results on a *Well Pump Calibration Form*. Each form documented the well location, date, time, depth to water, flow rate, flow volume, and water quality stabilization measurements during and at completion of the calibration.

3.2.2 Equipment Calibration

Field instruments used to collect, generate, or measure water quality parameters were calibrated each day prior to use as specified in the SAP, QAPP, and ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde.* Afternoon calibration verification was performed to evaluate if the instrument remained within acceptance criteria during use. Temperature and barometric pressure instrument readings were verified using a calibrated National Institute of Standards and Technology traceable thermometer and National Weather Service (via mesowest.utah.edu) barometric pressure readings for Clarksville Outlaw Field (KCKV), Clarksville, Tennessee. Additional details regarding equipment calibration were recorded on an *Equipment Calibration Form*, as described in Section 3.2.1.6

3.2.3 Photographs

In addition to documentation of field activities described above, photographs were taken to document the field investigation. A photographic log of soil cores recovered from the boring and the surface completion of the installed monitoring well CUF-1006 are provided in Attachments D.1 and D.2, respectively, in Appendix D.

3.3 DRILLING AND SAMPLING

The following sections present drilling and soil sampling procedures used during implementation of the HGI SAP Addendum. Drilling and sampling activities were performed under the direction of a Stantec PG licensed in the State of Tennessee.

3.3.1 Drilling

The CUF-1006 boring was advanced by Stantec drillers licensed in Tennessee using HSA drilling techniques following procedures provided in ASTM International (ASTM) D6151: *Standard Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling*. The boring was advanced in 10-foot runs using a 4.25-inch inside diameter auger (resulting in approximately an 8-inch borehole diameter). Standard penetration test sampling was conducted continuously in accordance with ASTM D1586 *Standard Test Method for Standard Penetration Test and Split-Barrel Sampling of Soils* and consisted of dropping a 140-pound hammer from a height of 30 inches, to drive a standard size 2-inch diameter split-spoon sampler to a depth of 18-inches. Blow-counts were recorded for each six inches of penetration. Soil samples were recovered for lithologic description, photographic documentation, and sample collection. Each run was then over-drilled using an 8.25-inch inside diameter auger (resulting in approximately a 13-inch borehole diameter). Following removal, the augers were decontaminated using a high-pressure steam cleaner and potable water after use.

The well installation procedure for CUF-1006 is described in Section 3.4.

3.3.2 Soil Sampling

During advancement of the boring, the Stantec PG prepared field subsurface logs using a mobile data collection platform. Inputs included a description of subsurface lithology, sample recovery, color using the Munsell soil color chart, and other relevant parameters as required by the SAPs and TIs. The subsurface log for CUF-1006 is presented in Appendix C.

Soil samples were collected from the boring to provide lithologic information for a continuous boring log/soil profile for monitoring well CUF-1006. Additionally, soil samples for analysis of % ash by PLM were collected throughout the boring and sent to R.J. Lee Group, Inc. for analysis. Results of PLM analysis are summarized in Table B.1 in Appendix B and were used to determine the screened interval of CUF-1006. Additional homogenized sample material from each sample interval was shipped to Eurofins TestAmerica Pittsburgh to be archived for potential future testing. 20 soil samples and a field duplicate were collected and submitted for PLM laboratory analysis under standard COC protocols and sampling procedures provided in the HGI SAP Addendum and the QAPP.

Prior to well installation activities and to allow time to receive the PLM analytical results, the borehole was protected in accordance with the SAP. Generally, the augers were left in place and bentonite pellets were placed around the base of the augers. The augers were also capped with plastic to prevent water infiltration.

3.4 MONITORING WELL INSTALLATION

3.4.1 Well Installation

Permanent monitoring well CUF-1006 was installed in the boring by qualified drill crews working under the direction of a Stantec PG and a licensed Tennessee driller. Well installation was carried out in general accordance with ENV-TI-05.80.25, *Monitoring Well and Piezometer Installation and Development*. Well construction details are documented on the Well Installation Detail provided in Attachment C.2 in Appendix C.

The lowest portion of the boring was backfilled with a one-foot layer of sand filter pack (20/40 mesh). The monitoring well was installed above the backfilled portion. The monitoring well consisted of a four-inch diameter Schedule 40 polyvinyl chloride (PVC) pre-packed well screen (0.010-inch slots) and riser. The screen and riser consisted of flush-joint, threaded PVC pipe. The screen placement and length were selected based on the results of PLM analysis and the boring log to identify the target stratum and minimal levels of % ash. The screen length was 9.8 feet. A four-inch diameter Schedule 40 PVC bottom well plug measuring approximately 0.4 feet in length was threaded onto the bottom of the screen. The PVC riser extended 8.7 feet above the ground surface and was capped with a temporary plug or slip cap. The annular space was backfilled with a sand filter pack extending approximately two feet above and 1.4 feet below the screen. A bentonite pellet seal approximately two feet thick was placed on top of the sand filter pack. The sand filter pack and bentonite pellets were either placed by tremie method or poured slowly into the annular space of the drill tooling to prevent bridging.

After the bentonite pellet seal had sufficiently hydrated for a duration equal to or greater than the minimum recommended by the manufacturer (a minimum of four hours), the remaining annular space was backfilled with a 30% solids bentonite grout. The grout was placed by tremie method through one-inch diameter PVC pipe using pumps gauged to allow the installation crew to monitor pressures during the grouting process.

The final well completion was constructed atop an elevated gravel surface from ground surface. The monitoring well surface completion consisted of an above-grade steel locking protective cover anchored to a concrete surface pad. The protective cover extended above the concrete pad and the annular space was filled with sand or pea gravel to about six inches below the top of PVC casing. Steel protective bollards were installed near each corner of the concrete pad and filled with concrete.

A summary of monitoring well construction specifications is presented in Table B.2 in Appendix B. A construction detail is presented in the Well Installation Detail provided in Appendix C.

3.4.2 Well Development

Monitoring well CUF-1006 was developed in accordance with ENV-TI-05.80.25, *Monitoring Well and Piezometer Installation and Development* by a combination of bailing, surging, and pumping. Well development activities were conducted from June 25 through July 9, 2021. First, a three-inch diameter PVC bailer was lowered and raised within the screened interval to create a slight surging action to dislodge particles within the well casing and sand filter pack. Then the bailer was used to remove turbid water from the well. Baseline readings of turbidity, pH, temperature, and specific conductance were measured using a calibrated YSI Pro Plus water quality meter and a calibrated Hach 2100Q turbidity meter. This process of alternately surging and bailing was repeated several times to decrease the water turbidity within the well. Lastly, a submersible pump was employed to further develop the well until stabilization criteria for turbidity (≤5 Nephelometric Turbidity Units), pH (±0.1 Standard Unit), temperature (±10%), and specific conductance (±10%) were achieved. Well development stabilization criteria were in accordance with ENV-TI-05.80.25, *Monitoring Well and Piezometer Installation and Development.* Well development details were recorded on the *Well Development Form.* A summary of initial and final water quality measurements is presented in Table B.3 in Appendix B.

3.4.3 Hydraulic Conductivity (Slug) Testing

After development, Stantec performed slug tests in well CUF-1006 to estimate hydraulic conductivity. The slug tests were performed in accordance with ASTM D4044: *Standard Test Method for (Field Procedure) for Instantaneous Change in Head (Slug) Tests for Determining Hydraulic Properties of Aquifers*. A pressure transducer with a data recorder was used to collect water level information from the well.

Three rising-head and three falling-head slug tests were performed at well CUF-1006, as shown on Table B.4 in Appendix B. The well was tested by taking an initial measurement of the static water level followed by the insertion of the pressure transducer into the well. After the transducer had been installed, a falling-head slug test was conducted by introducing a solid slug (e.g., PVC pipe filled with sand) into the well to cause a nearly instantaneous rise in the water level. The water levels were then recorded at regular intervals until reaching near initial static levels. After the first test concluded, a rising-head slug test was conducted by removing the slug to cause a nearly instantaneous drop in the water level. Water levels were recorded until initial static water levels were reached again. The procedure of alternating a falling-head and a rising-head slug test was conducted three times at each well. The data were recorded electronically by the transducer and downloaded into a data collector. Raw data were checked in the field for discrepancies prior to demobilizing from the CUF Plant.

The field data were analyzed using AQTESOLV™ Version 4.50 Professional software to estimate the hydraulic conductivity of the saturated soils in the screened interval. Calculated hydraulic conductivities are summarized in Table B.4 in Appendix B, and the software output package is provided in Appendix E. The following assumptions and methods were utilized for the calculations:

- The analysis was completed using the Bouwer-Rice method. The solution was matched to the normalized plotted recovery data between 70-80% recovery.
- Well CUF-1006 was assumed to be installed in unconfined aquifer conditions based on the boring log.

3.4.4 Pump Installation

A new, decontaminated, dedicated QED Environmental Systems, Inc. brand dedicated bladder pump was installed in well CUF-1006 after well development was completed. The pump model installed was a model P1101M due to a water column height of more than 10 feet. The pump was placed at approximately the mid-point of the saturated portion of the well screened interval for future groundwater sampling. Following pump installation, the pump was calibrated in general accordance with ENV-TI-05.80.42, *Groundwater Sampling*. Well pump placement depths, installation calculations, and calibration details were recorded on the Q*ED Well Wizard Dedicated Sampling Pump Installation Checklist* and the *Dedicated Pump Calibration Form*. Pump installation information is provided in Table B.5 in Appendix B.

3.4.5 Well Surveys

After the surface completion for well CUF-1006 was installed, the well was professionally surveyed using a survey-grade GPS for horizontal and vertical control. Measurements were calculated relative to the coordinate systems used by the CUF Plant. Well survey information is provided in Table B.6 in Appendix B.

3.5 INVESTIGATION DERIVED WASTE

Investigation derived waste (IDW) generated during the HGI included:

- Soil cuttings
- Used calibration fluids
- Well development water
- Decontamination fluids
- Personal protective equipment (PPE)
- General trash.

IDW was handled in general accordance with ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*;; the HGI SAP (Stantec 2018a); the CUF Plant-specific waste management plan; and local, state, and federal regulations. Transportation and disposal of IDW were coordinated with the CUF Plant facility management. Soil cuttings, used calibration fluids, decontamination fluids, and well development water were managed as authorized by CUF Plant facility management and in accordance with the HGI SAP (Stantec 2018a). Used disposable PPE (e.g., nitrile gloves) and general trash were placed in garbage bags and disposed of in a municipal waste dumpster onsite.

3.6 VARIATIONS

The proposed scope and procedures for the HGI investigation were outlined in the HGI SAP Addendum, QAPP, applicable TVA TIs, and ASTM standards, as detailed in the sections above. Deviations from these procedures are described below and do not impact the usability of the data provided. Variations from the SAP and standard procedures were as follows:

- Boring CUF-1006 was left open for six days prior to well installation to allow time to receive the PLM analytical results. According to the SAP, the timeframe for leaving the borehole open was up to five days. Other SAP procedures related to protecting the open borehole were followed.

4.0 SUMMARY

The data presented in this report are from implementation of the HGI SAP Addendum at the CUF Plant. Permanent monitoring well CUF-1006 was installed as part of additional HGI activities to support data collection for the groundwater investigations at the CUF Plant, including groundwater level measurements, and groundwater sample collection for analysis of CCR Parameters. The scope of work for the HGI SAP Addendum included:

- Drilled one soil boring for installation of permanent monitoring well CUF-1006
- Collected soil samples to develop a continuous boring log/soil profile for the well boring
- Collected 20 soil samples and one field duplicate for PLM analysis. Additional homogenized sample material from each sample interval was shipped to Eurofins Environment Testing America Pittsburgh to be archived for potential future testing
- Installed permanent monitoring well CUF-1006 and constructed a surface completion
- Developed well CUF-1006
- Conducted slug tests to estimate hydraulic conductivity
- Installed and calibrated a dedicated sampling pump in well CUF-1006
- Surveyed well CUF-1006.

A boring and monitoring well location summary is presented in Table 1. Soil sample PLM results, monitoring well construction specifications, well development, hydraulic testing results, pump installation details, and survey information are presented in Tables B.1 through B.6, respectively. Field documentation of previous HGI sampling activities is described in the CUF Plant *Hydrogeological Investigation SAR* (Stantec 2020a). Groundwater level measurement and groundwater analytical results for other EI and permanent wells are reported the Groundwater Investigation SARs for Events # 1 through #6 (Stantec 2020b, Stantec 2021b, Stantec 2021c, Stantec 2021d, Stantec 2021e, Stantec 2021f) and Revision 1 of the EAR for the CUF Plant.

Stantec has completed an additional HGI at well CUF-1006 at the CUF Plant in Cumberland City, Tennessee, in accordance with the HGI SAP Addendum as documented herein. The data collected during the additional HGI are usable for reporting and evaluation in the EAR and meet the objectives of the TDEC Order EIP. The complete dataset from this event will be evaluated along with data collected under other TDEC Order SAPs, as well as data collected under other State and CCR programs. This evaluation will be provided in Revision 1 of the CUF Plant EAR.

5.0 REFERENCES

ASTM. D1586: *Standard Test Method for Standard Penetration Test and Split-Barrel Sampling of Soils*.

ASTM. D4044: Standard Test Method for (Field Procedure) for Instantaneous Change in Head (Slug) Tests for Determining Hydraulic Properties of Aquifers.

ASTM International (ASTM). D6151: Standard Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling.

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Stantec. (2021b). *Groundwater Investigation Event #2 Sampling and Analysis Report, Cumberland Fossil Plant*. Revision 1. Prepared for TVA. February 5, 2021.

Stantec. (2021c). *Groundwater Investigation Event #3 Sampling and Analysis Report, Cumberland Fossil Plant*. Revision 1. Prepared for TVA. February 5, 2021.

Stantec. (2021d). *Groundwater Investigation Event #4 Sampling and Analysis Report, Cumberland Fossil Plant*. Prepared for TVA. March 26, 2021.

Stantec. (2021e). *Groundwater Investigation Event #5 Sampling and Analysis Report, Cumberland Fossil Plant*. Prepared for TVA. March 26, 2021.

Stantec. (2021f). *Groundwater Investigation Event #6 Sampling and Analysis Report, Cumberland Fossil Plant*. Prepared for TVA. March 26, 2021.

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TVA. ENV-TI-05.80.02, *Sample Labeling and Custody*.

TVA. ENV-TI-05.80.03, *Field Record Keeping.*

TVA. ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*.

TVA. ENV-TI-05.80.25, *Monitoring Well and Piezometer Installation and Development*.

TVA. ENV-TI-05.80.42, *Groundwater Sampling.*

APPENDIX A - EXHIBITS

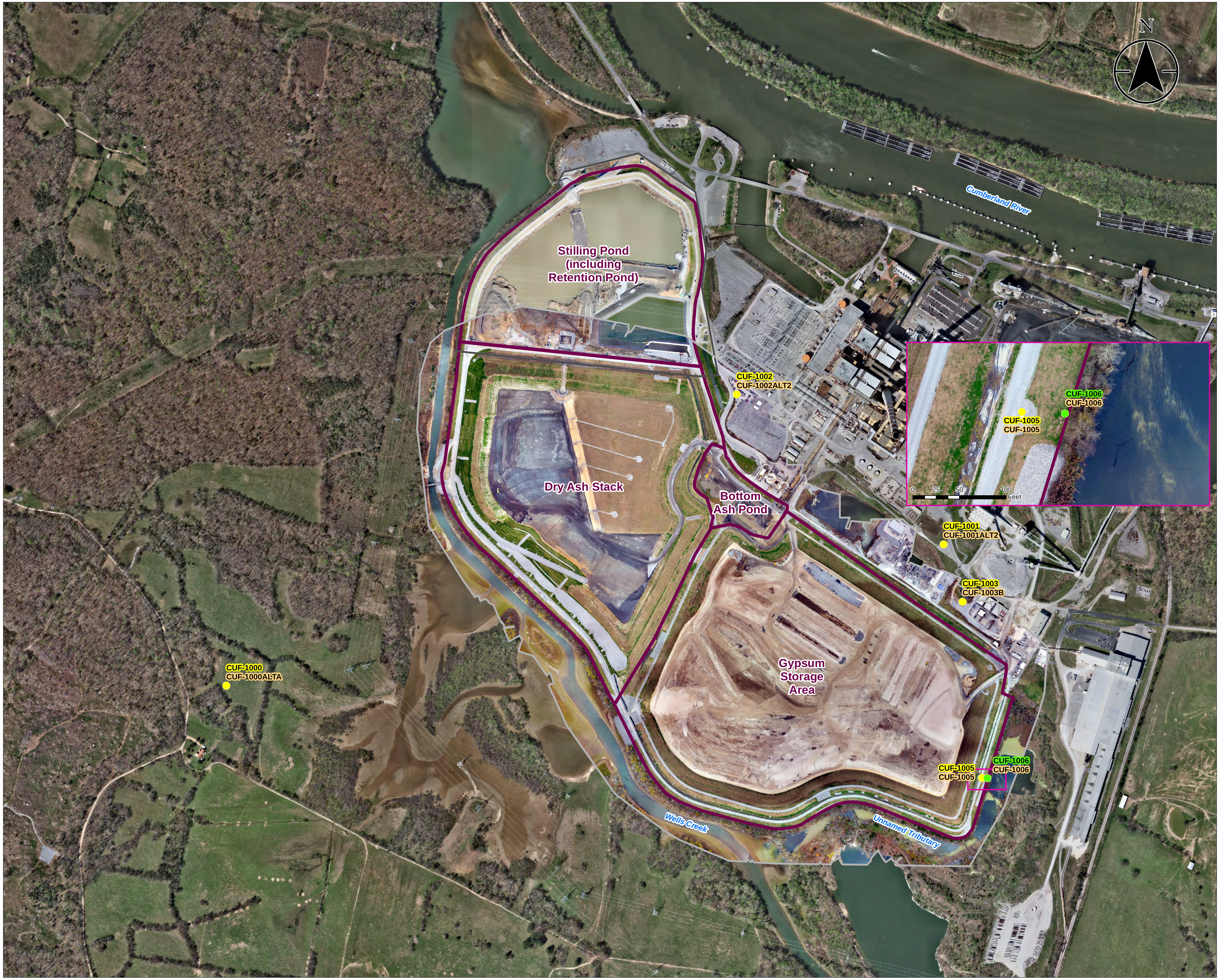


Exhibit No.

A.1

Title

Site Map and Monitoring Well Locations

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location

Stewart County, Tennessee

175568209
Prepared by DMB on 2022-03-28
Technical Review by CS on 2022-03-28

0 400 800 1,200 1,600 Feet

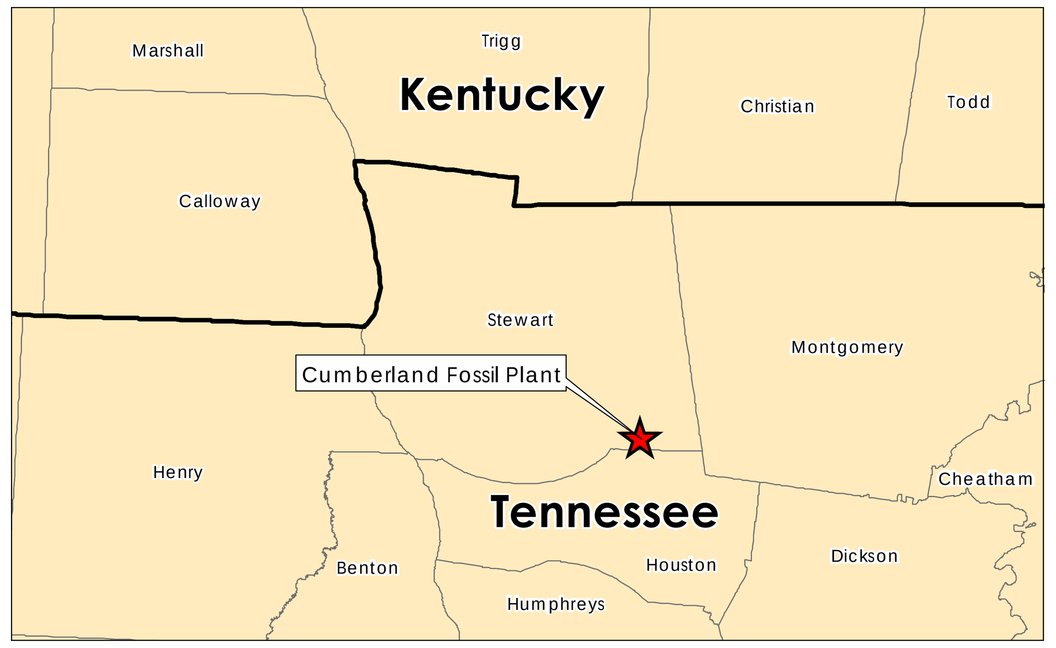
1:4,800 (At original document size of 22x34)

Legend

- Monitoring Well (Survey 4/14/2021) Installed under SAP Addendum — Well Name / Boring Name
- Monitoring Well (Survey 5/15/2019) — Well Name / Boring Name
- 2019 Imagery Boundary
- 2020 Imagery Boundary
- CCR Unit Area (Approximate)

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA dated 12/11/2019 and 11/9/2020



Stantec TVA

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APPENDIX B - TABLES

Table B.1. - Soil Analytical Results - CUF-1006
Cumberland Fossil Plant
March 2021

Sample Location	Sample Date	Sample ID	Parent Sample ID	Sample Depth	Sample Type	Level of Review	% ASH %
CUF-1006	11-Mar-21	CUF-SO-CUF1006-0.0/1.5-20210311		0 - 1.5 ft	Normal Environmental Sample	Final-Verified	2
	11-Mar-21	CUF-SO-CUF1006-1.5/3.0-20210311		1.5 - 3 ft	Normal Environmental Sample	Final-Verified	<1
	11-Mar-21	CUF-SO-CUF1006-3.0/4.5-20210311		3 - 4.5 ft	Normal Environmental Sample	Final-Verified	<1
	11-Mar-21	CUF-SO-CUF1006-4.5/6.0-20210311		4.5 - 6 ft	Normal Environmental Sample	Final-Verified	<1
	11-Mar-21	CUF-SO-CUF1006-7.5/9.0-20210311		7.5 - 9 ft	Normal Environmental Sample	Final-Verified	1
	11-Mar-21	CUF-SO-CUF1006-9.0/10.5-20210311		9 - 10.5 ft	Normal Environmental Sample	Final-Verified	1
	11-Mar-21	CUF-SO-CUF1006-10.5/11.4-20210311		10.5 - 11.4 ft	Normal Environmental Sample	Final-Verified	<1
	11-Mar-21	CUF-SO-CUF1006-11.4/12.0-20210311		11.4 - 12 ft	Normal Environmental Sample	Final-Verified	<1
	11-Mar-21	CUF-SO-CUF1006-12.0/13.5-20210311		12 - 13.5 ft	Normal Environmental Sample	Final-Verified	1
	11-Mar-21	CUF-SO-CUF1006-13.5/14.2-20210311		13.5 - 14.2 ft	Normal Environmental Sample	Final-Verified	<1
	11-Mar-21	CUF-SO-CUF1006-14.2/15.0-20210311		14.2 - 15 ft	Normal Environmental Sample	Final-Verified	1
	11-Mar-21	CUF-SO-CUF1006-15.0/16.5-20210311		15 - 16.5 ft	Normal Environmental Sample	Final-Verified	1
	11-Mar-21	CUF-SO-CUF1006-16.5/18.0-20210311		16.5 - 18 ft	Normal Environmental Sample	Final-Verified	2
	11-Mar-21	CUF-SO-CUF1006-18.0/19.5-20210311		18 - 19.5 ft	Normal Environmental Sample	Final-Verified	2
	11-Mar-21	CUF-SO-DUP01-20210311	CUF-SO-CUF1006-18.0/19.5-20210311	18 - 19.5 ft	Field Duplicate Sample	Final-Verified	2
	11-Mar-21	CUF-SO-CUF1006-19.5/21.0-20210311		19.5 - 21 ft	Normal Environmental Sample	Final-Verified	<1
	11-Mar-21	CUF-SO-CUF1006-21.0/22.5-20210311		21 - 22.5 ft	Normal Environmental Sample	Final-Verified	1
	11-Mar-21	CUF-SO-CUF1006-22.5/24.0-20210311		22.5 - 24 ft	Normal Environmental Sample	Final-Verified	2
	11-Mar-21	CUF-SO-CUF1006-24.0/25.5-20210311		24 - 25.5 ft	Normal Environmental Sample	Final-Verified	1
	11-Mar-21	CUF-SO-CUF1006-25.5/27.0-20210311		25.5 - 27 ft	Normal Environmental Sample	Final-Verified	<1
	11-Mar-21	CUF-SO-CUF1006-27.0/27.8-20210311		27 - 28 ft	Normal Environmental Sample	Final-Verified	<1

Notes:

<1	analyte was not detected at a concentration greater than the method detection limit
%	percent
ft	feet
ID	Identification

1. Level of review is defined in the Quality Assurance Project Plan.

Table B.2 - Summary of Monitoring Well Construction Specifications
Cumberland Fossil Plant
March 2021

Well ID	Top of Casing		Bottom of Well			Screened Interval					
	Stickup	Elevation	Depth	Depth	Elevation	Depth Top	Depth Bottom	Depth Top	Depth Bottom	Elevation Top	Elevation Bottom
	ft ags	ft NGVD29	ft bgs	ft btoc	ft NGVD29	ft bgs	ft bgs	ft btoc	ft btoc	ft NGVD29	ft NGVD29
CUF-1006	8.7	387.58	26.8	35.5	352.1	16.6	26.4	25.3	35.1	362.3	352.5

Notes:

ags	above ground surface
bgs	below ground surface
btoc	below top of casing
ft	feet
ID	identification
NGVD29	National Geodetic Vertical Datum of 1929

1. Measurement data are from Well Installation Details (Appendix C).
2. Well CUF-1006 was surveyed on April 14, 2021 and June 28, 2021.

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Table B.3 - Summary of Well Development Data
Cumberland Fossil Plant
June-July 2021

Well ID	pH		Turbidity		Specific Conductance		Temperature	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
			NTU	NTU	uS/cm	uS/cm	DEG C	DEG C
CUF-1006	6.88	6.90	>1000	4.82	2863	2837	21.0	22.5

Notes:

>	result greater than
DEG C	degrees Celsius
ID	identification
NTU	Nephelometric Turbidity Unit
uS/cm	microSiemens per centimeter

Stantec

Table B.4 - Summary of Hydraulic Conductivity Testing Results
Cumberland Fossil Plant
August 2021

Well ID	Saturated Thickness	Number of Tests		Average Hydraulic Conductivity	Average Hydraulic Conductivity
		Falling Head	Rising Head		
	ft			ft/day	cm/s
CUF-1006	15.6	3	3	0.1604	5.66E-05

Notes:

cm/s centimeters per second
ft feet
ID identification

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Table B.5 - Summary of Pump Installation Details
Cumberland Fossil Plant
July 2021

Well ID	Top of Casing Elevation	Bottom of Well		Groundwater Level		Pump Intake		Water Column Above Intake
		Depth	Elevation	Depth	Elevation	Depth	Elevation	
	ft NGVD29	ft btoc	ft NGVD29	ft btoc	ft NGVD29	ft btoc	ft NGVD29	ft
CUF-1006	387.58	35.5	352.1	19.49	368.09	30.0	357.6	10.5

Notes:

btoc — below top of casing
ft — feet
NGVD29 — National Geodetic Vertical Datum of 1929

1. Well CUF-1006 was surveyed on April 14, 2021 and June 28, 2021.
2. Depth data are from *QED Well Wizard Dedicated Sampling Pump Installation Checklist* dated July 12,2021. Depth to groundwater level was measured prior to pump insertion. Pump intake and water column above intake rounded to nearest 0.1 foot.

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Table B.6 - Summary of Monitoring Well Survey Data
Cumberland Fossil Plant
April-June 2021

Well ID	TN State Plane Northing	TN State Plane Easting	Latitude	Longitude	Ground Surface Elevation
	ft NAD27 Plant	ft NAD27 Plant	DMS NAD27 Plant	DMS NAD27 Plant	ft NGVD29
CUF-1006	728,366.86	1,513,925.62	36*22'54.07"	-87*39'4.42"	378.8

Notes:

DMS	Degrees, Minutes, Seconds
ft	feet
ID	identification
NAD27	North American Datum of 1927
NGVD29	National Geodetic Vertical Datum of 1929
TN	Tennessee

1. Well CUF-1006 was surveyed on April 14, 2021 and June 28, 2021. Coordinates are for the top of well casing, except ground surface elevation which is adjacent to the concrete well pad. Plant Local coordinates rounded to the nearest 0.01 feet. Latitude and Longitude rounded to the nearest 0.01 degree. Ground surface elevations rounded to the nearest 0.1 feet.

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APPENDIX C – SUBSURFACE LOG AND WELL INSTALLATION DETAIL

Subsurface Boring Legend

Lithology Graphics

Symbol	Lithology
	Fill
	Top Soil
	Gravel
	Well Graded Gravel (GW)
	Poorly Graded Gravel (GP)
	Silty Gravel (GM)
	Silty, Clayey Gravel (GC-GM)
	Clayey Gravel (GC)
	Well Graded Gravel with Silt (GW-GM)
	Well Graded Gravel with Clay (GW-GC)
	Poorly Graded Gravel with Silt (GP-GM)
	Poorly Graded Gravel with Clay (GP-GC)
	Well Graded Sand (SW)
	Poorly Graded Sand (SP)
	Silty Sand (SM)
	Silty, Clayey Sand (SC-SM)
	Clayey Sand (SC)
	Well Graded Sand with Silt (SW-SM)
	Well Graded Sand with Clay (SW-SC)
	Poorly Graded Sand with Silt (SP-SM)
	Poorly Graded Sand with Clay (SP-SC)
	Silt (ML)
	Silty Clay (CL-ML)
	Lean Clay (CL)
	Organic Silt (OL)
	Elastic Silt (MH)
	Fat Clay (CH)
	Organic Clay (OH)
	Shale
	Siltstone
	Coal
	Limestone
	Sandstone

Lithology Graphics are based on TVA drafting standards.

Other Graphics

Symbol	Description
	Denotes environmental analytical sample interval
	Denotes SS sample interval
	Denotes ST sample interval
	Denotes DP sample interval
	Denotes RS sample interval
	Denotes RC sample interval
	First water level reading
	Second water level reading

Common Abbreviations

Abbreviation	Definition
DP	Direct Push
HA	Hand Auger
HSA	Hollow Stem Auger
N/A	Not Applicable
NR	Not Recorded
RC	Rock Core
RQD	Rock Quality Designation
RS	Rotary Sonic
SS	Split Spoon
ST	Shelby Tube
WH	Weight of Hammer
WR	Weight of Rod

General Notes

The boring logs include sample numbering used during drilling. For assigned Environmental Analytical Sample ID numbers, see relevant Environmental Chain-of- Custody forms from the drilling date range listed on each log.

For pH readings and additional field data, see applicable field documentation (e.g., Soil pH Data Form) from the drilling date range listed on each log.

Client Borehole ID	N/A	Stantec Boring No.	**CUF-1006**
Client	Tennessee Valley Authority	Boring Location	728,366.86 N; 1,513,925.62 E NAD27 Plant Local
Project Number	175568209	Surface Elevation	378.8 ft
		Elevation Datum	NGVD29
Project Name	CUF TDEC Order	Date Started	3/11/21
		Completed	3/11/21
Project Location	Stewart Co, Cumberland City, TN	Depth to Water	N/A
		Date/Time	N/A
Inspector	B. Evans	Depth to Water	N/A
Logger	B. Evans	Date/Time	N/A
Drilling Contractor	Stantec Consulting Services Inc.	Drill Rig Type and ID	CME 55LCX #714
Overburden Drilling and Sampling Tools (Type and Size)	4.25" HSA, 2" SS w/o liners		
Rock Drilling and Sampling Tools (Type and Size)	N/A		
Overdrill Tooling (Type and Size)	8-1/4" HSA overdrill of boring	Overdrill Depth	27.8 ft
Sampler Hammer Type	Automatic	Weight	140 lb
Drop	30"	Efficiency	N/A
Borehole Azimuth	N/A	Borehole Inclination (from Vertical)	N/A
Reviewed By	C. Sexton	Approved By	C. Millhollin

Lithology Depth Ft[3]	Elevation	Description	Overburden: Sample[1,2] / Rock Core: RQD %	Depth Ft[3] / Run Ft	Rec. Ft	Blows/PSI / Rec. %
0.0	378.8	Top of Hole				
0.5	378.3	Topsoil	SS01E	0.0 - 1.5	0.9	2-4-5
1.7	377.1	LEAN CLAY, CL, 10YR 5/6 (yellowish brown), low to medium plasticity, firm, moist, [FILL]				
7.5	371.3	FAT CLAY, CH, 7.5YR 5/8 (strong brown) to 7.5YR 4/4 (brown), medium plasticity, firm, moist, angular chert gravel, [FILL]	SS02E	1.5 - 3.0	1.1	5-6-7
			SS03E	3.0 - 4.5	1.0	5-4-6
			SS04E	4.5 - 6.0	1.4	4-4-5
			SS05E	6.0 - 7.5	0.0	3-5-6
11.5	367.3	SANDY LEAN CLAY, CL, 5Y 4/2 (olive gray) to 7.5YR 4/4 (brown), low to medium plasticity, firm to hard, moist, trace chert gravel	SS06E	7.5 - 9.0	0.8	1-2-2
			SS07E	9.0 - 10.5	1.5	3-4-8
			SS08aE	10.5 - 11.4	1.4	5-6-8
14.2	364.6	LEAN CLAY, CH, 10YR 4/6 (dark yellowish brown) to 2.5Y 5/4 (light olive brown), medium plasticity, firm to very hard, moist, some manganese staining/nodules	SS08bE	11.4 - 12.0		
			SS09E	12.0 - 13.5	1.3	3-3-4
			SS10aE	13.5 - 14.2	1.5	5-3-5
18.0	360.8	SANDY LEAN CLAY, CL, 2.5Y 4/2 (dark grayish brown), low to medium plasticity, firm to very hard, moist	SS10bE	14.2 - 15.0		
			SS11E	15.0 - 16.5	0.8	1-2-3
			SS12E	16.5 - 18.0	1.1	1-3-4

TVA EIP BORING LOG 175568209 CUF TDEC ORDER.GPJ TDEC SUBSURF DT 20190530.GDT 10/20/22

Client Borehole ID	N/A	Stantec Boring No.	**CUF-1006**
Client	Tennessee Valley Authority	Boring Location	728,366.86 N; 1,513,925.62 E NAD27 Plant Local
Project Number	175568209	Surface Elevation	378.8 ft
		Elevation Datum	NGVD29

Depth Ft[3]	Elevation	Graphic	Description	Overburden: Sample[1,2] / Rock Core: RQD %	Depth Ft[3] / Run Ft	Rec. Ft	Blows/PSI / Rec. %
			FAT CLAY SOME SAND, CH, 5Y 2.5/1 (black) to 2.5Y 3/2 (very dark grayish brown), medium plasticity, firm to very hard, moist	SS13E	18.0 - 19.5	1.3	2-2-4
				SS14E	19.5 - 21.0	1.3	1-2-3
				SS15E	21.0 - 22.5	1.5	2-4-3
				SS16E	22.5 - 24.0	1.2	4-3-4
24.2	354.6		LEAN CLAY SOME SAND, CL, 10YR 5/4 (yellowish brown), low to medium plasticity, soft to firm, moist to wet	SS17E	24.0 - 25.5	1.3	3-3-4
				SS18E	25.5 - 27.0	1.4	1-2-3
27.5	351.3		Limestone, highly weathered to slightly weathered	SS19E	27.0 - 27.8	0.8	4-50+/4"
27.8	351.0						

Refusal /
Bottom of Hole at 27.8 Ft.

Top of Rock = 27.5 Ft.
Top of Rock Elevation = 351.3 Ft.

Monitoring Well CUF-1006 was installed in boring on 03/18/2021. Refer to Monitoring Well Installation Detail CUF-1006, dated 03/18/2021 for well construction details.

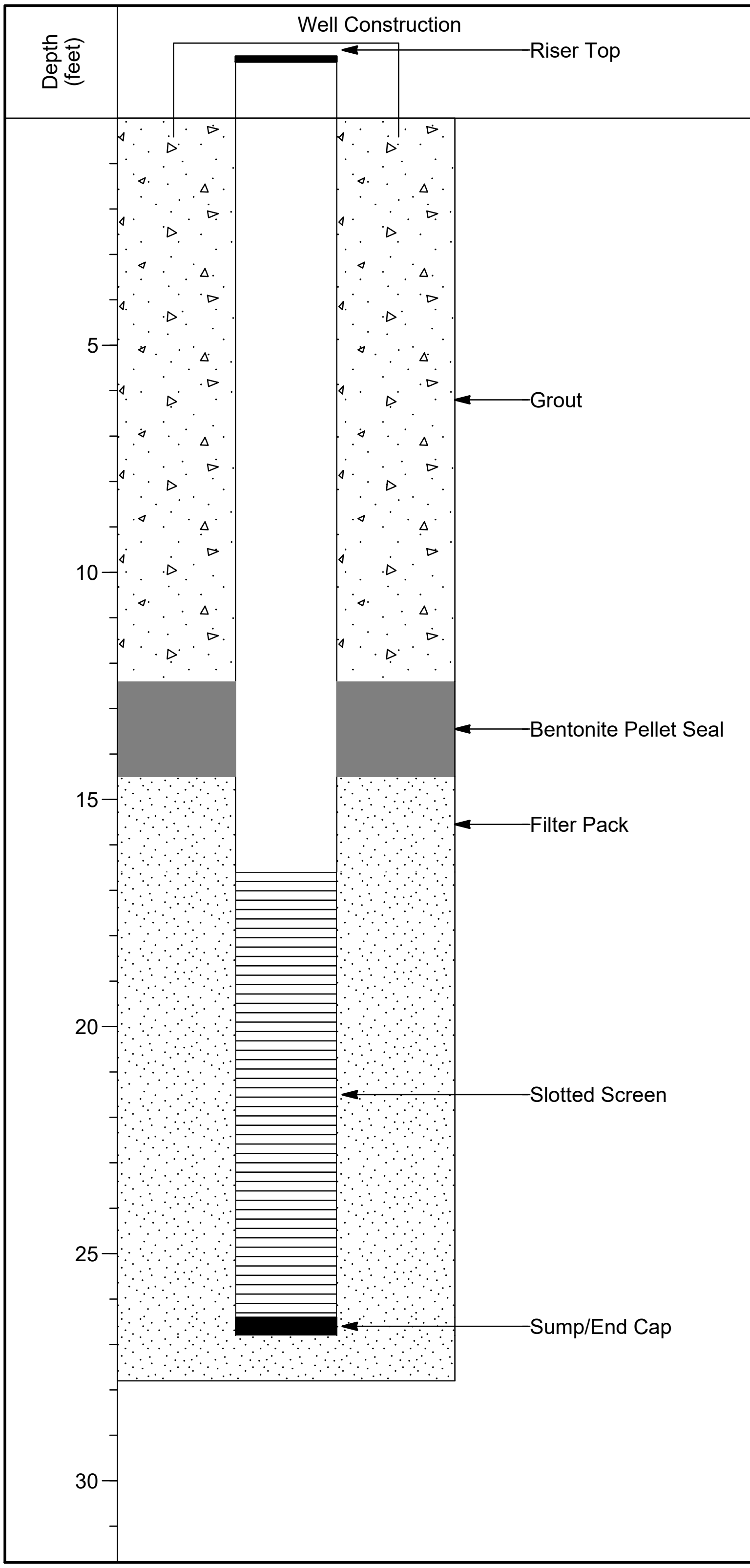
1: E = Environmental Sample Custody (two Split Spoons may be required to obtain sufficient sample)
G = Geotechnical Sample Custody
2: a,b,c denote Split Spoon divided between Environmental and Geotechnical Samples
3: Depths are reported in feet below ground surface

WELL INSTALLATION DETAIL

WELL / PROBEHOLE / BOREHOLE NO: **CUF-1006** (Boring CUF-1006)

PROJECT: **CUF TDEC Order**
PROJECT NUMBER: **175568209**
DRILLING COMPANY: **Stantec Consulting Services Inc.**
DRILLING EQUIPMENT: **CME 55LCX #714**
DRILLING METHOD: **8-1/4" HSA overdrill of boring**
SAMPLING METHOD: **4.25" HSA, 2" SS w/o liners**
OBSERVED BY: **B. Evans**
REVIEWED BY: **C. Sexton**
APPROVED BY: **C. Millhollin**

INSTALLATION: STARTED: **3/18/21** COMPLETED: **3/18/21**
LOCATION: **728,366.86 N; 1,513,925.62 E** DATUM: **NAD27 Plant Local**
LOC. DESCRIP: **East of Gypsum Disposal Area**
LATITUDE: **36° 22' 54.07"** LONGITUDE: **-87° 39' 4.42"**
GROUND ELEV (ft): **378.8** TOC ELEV (ft): **387.58**
ELEVATION DATUM: **NGVD29**
WELL DEPTH (ft, bgs): **26.8**
DTW AT COMPLETION (ft, bgs): **N/A**
BOREHOLE DIA. (in): **13.0** WELL DIA. (in): **4.0**



Materials Inventory

RISER TYPE: **4" Sch 40 PVC Riser**

RISER: TOP (AGS): **8.7 ft** BOTTOM (BGS): **16.6 ft**

SCREEN TYPE: **5"ID x 4"ID U-Pack**

SCREEN SLOT SIZE (in): **0.010**

SCREEN: TOP (BGS): **16.6 ft** BOTTOM (BGS): **26.4 ft**

END CAP: TOP (BGS): **26.4 ft** BOTTOM (BGS): **26.8 ft**

GROUT QUANTITY: **87.5 gal**

GROUT TYPE: **30% Solids Bentonite Grout**

GROUT: TOP (BGS): **0.0 ft** BOTTOM (BGS): **12.4 ft**

GROUT DENSITY:
INITIAL (lbs/gal): **10.2** RETURN (lbs/gal): **10.0**

BENTONITE TYPE: **3/8" PDS TR30 pellets**

BENTONITE SEAL:
TOP (BGS): **12.4 ft** BOTTOM (BGS): **14.5 ft**

FILTER PACK - PRE-PACK AND ANNULAR SPACE:
TYPE: **20/40 Mesh (Global #7)**

FILTER PACK: TOP (BGS): **14.5 ft** BOTTOM (BGS): **27.8 ft**

NOTES:
Final well completion is constructed atop an elevated gravel surface from ground surface.

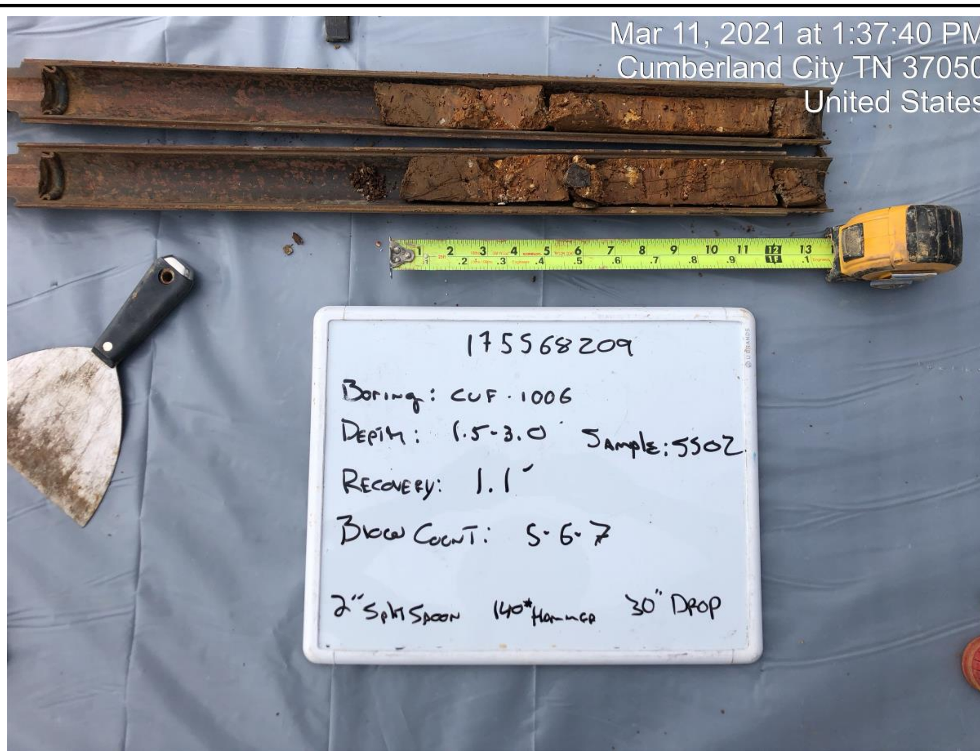
VERTICAL SCALE: AS SHOWN. HORIZONTAL SCALE: NOT TO SCALE (EXAGGERATED TO SHOW DETAIL)

APPENDIX D – PHOTOGRAPHS OF SOIL BORING AND MONITORING WELL

ATTACHMENT D.1

Photographic Log of Soil Lithology

Client:	**Tennessee Valley Authority**	**Project:**	**TDEC Order**
Site Name:	**Cumberland Fossil (CUF) Plant**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 1 **Photo Location:** CUF-1006 **Photo Date:** 3/11/2021 **Comments:** Interval (0.0-1.5 feet).	
Photograph ID: 2 **Photo Location:** CUF-1006 **Photo Date:** 3/11/2021 **Comments:** Interval (1.5-3.0 feet).	

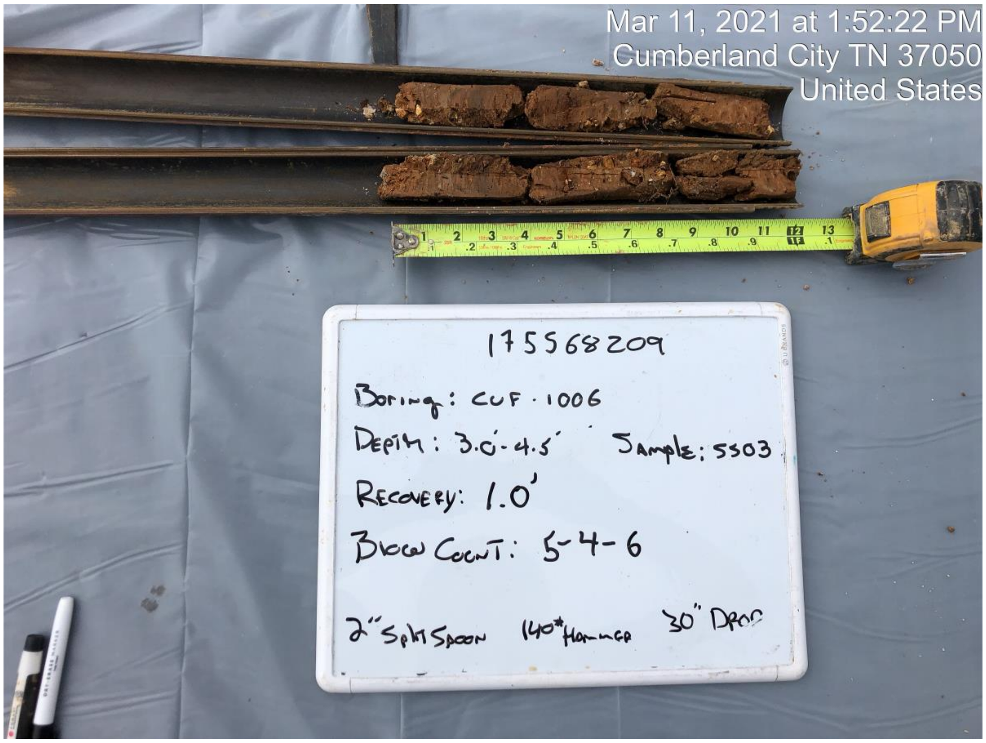
Client:	**Tennessee Valley Authority**	**Project:**	**TDEC Order**
Site Name:	**Cumberland Fossil (CUF) Plant**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 3

Photo Location:
CUF-1006

Photo Date:
3/11/2021

Comments:
Interval (3.0-4.5 feet).



Photograph ID: 4

Photo Location:
CUF-1006

Photo Date:
3/11/2021

Comments:
Interval (4.5-6.0 feet).

Stantec **Photographic Log**

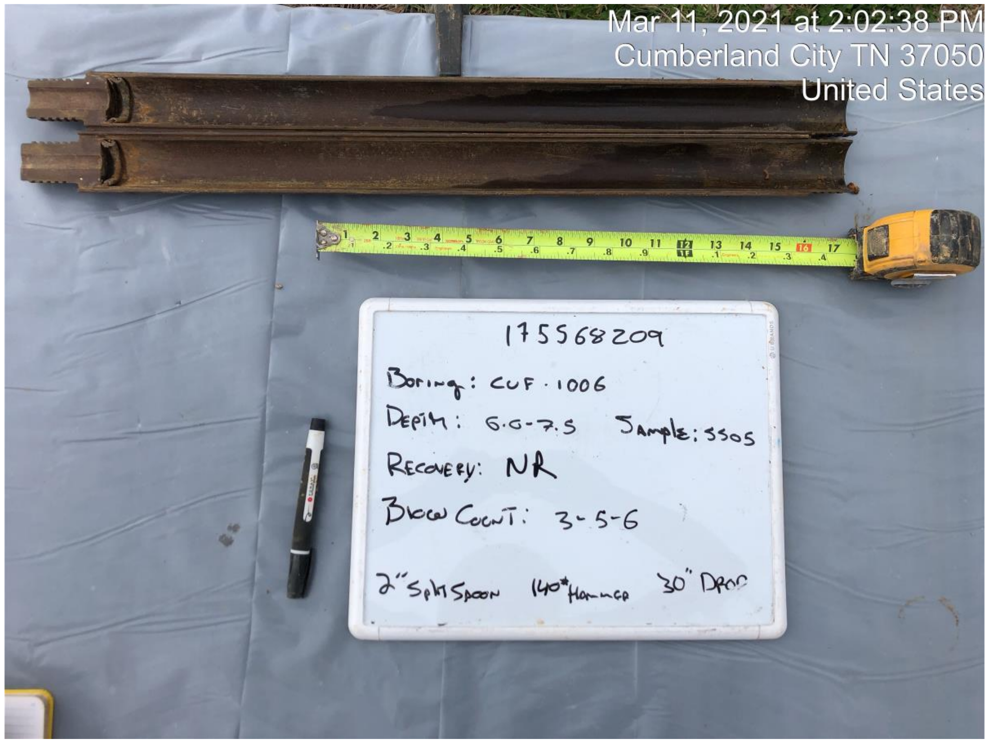
Client:	**Tennessee Valley Authority**	**Project:**	**TDEC Order**
Site Name:	**Cumberland Fossil (CUF) Plant**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 5

Photo Location:
CUF-1006

Photo Date:
3/11/2021

Comments:
Interval (6.0-7.5 feet). NR on white board is the same as 0.0 recovery on boring log.



Photograph ID: 6

Photo Location:
CUF-1006

Photo Date:
3/11/2021

Comments:
Interval (7.5-9.0 feet).

Client:	**Tennessee Valley Authority**	**Project:**	**TDEC Order**
Site Name:	**Cumberland Fossil (CUF) Plant**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 7

Photo Location: CUF-1006

Photo Date: 3/11/2021

Comments: Interval (9.0-10.5 feet).

Photograph ID: 8

Photo Location: CUF-1006

Photo Date: 3/11/2021

Comments: Interval (10.5-12.0 feet).

Stantec

Photographic Log

Client:	**Tennessee Valley Authority**	**Project:**	**TDEC Order**
Site Name:	**Cumberland Fossil (CUF) Plant**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 9

Photo Location:
CUF-1006

Photo Date:
3/11/2021

Comments:
Interval (12.0-13.5 feet).

Photograph ID: 10

Photo Location:
CUF-1006

Photo Date:
3/11/2021

Comments:
Interval (13.5-15.0 feet).

Client:	**Tennessee Valley Authority**	**Project:**	**TDEC Order**
Site Name:	**Cumberland Fossil (CUF) Plant**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 11 **Photo Location:** CUF-1006 **Photo Date:** 3/11/2021 **Comments:** Interval (15.0-16.5 feet). Depth interval shown on white board should be 15.0-16.5.	
Photograph ID: 12 **Photo Location:** CUF-1006 **Photo Date:** 3/11/2021 **Comments:** Interval (16.5-18.0 feet).	

Stantec

Photographic Log

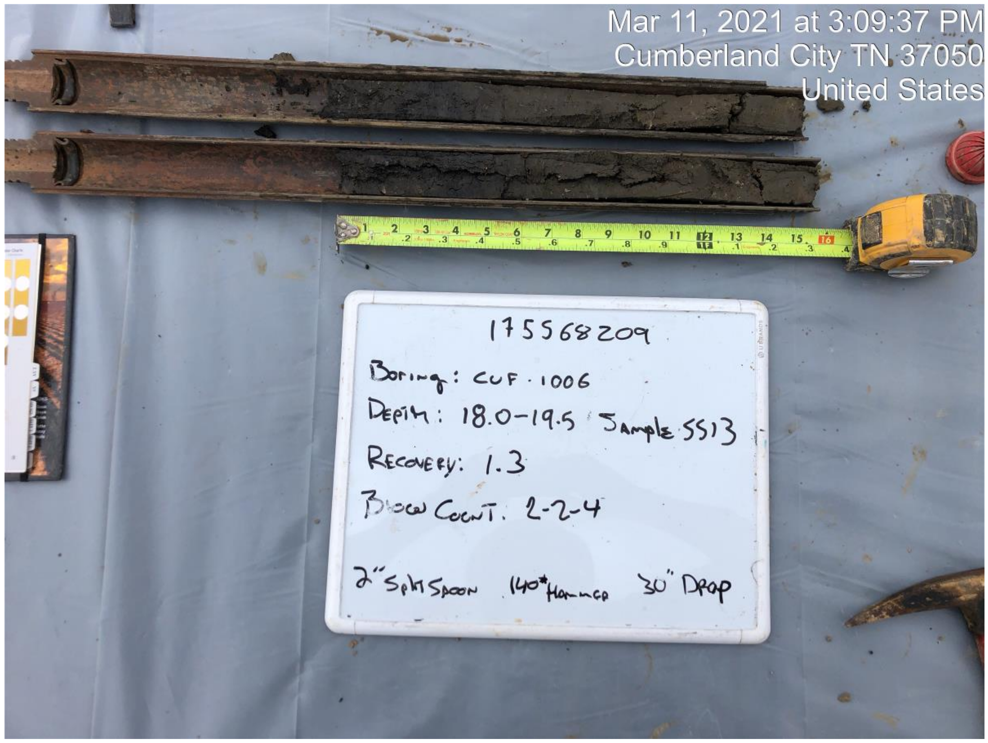
Client:	**Tennessee Valley Authority**	**Project:**	**TDEC Order**
Site Name:	**Cumberland Fossil (CUF) Plant**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 13

Photo Location:
CUF-1006

Photo Date:
3/11/2021

Comments:
Interval (18.0-19.5 feet).

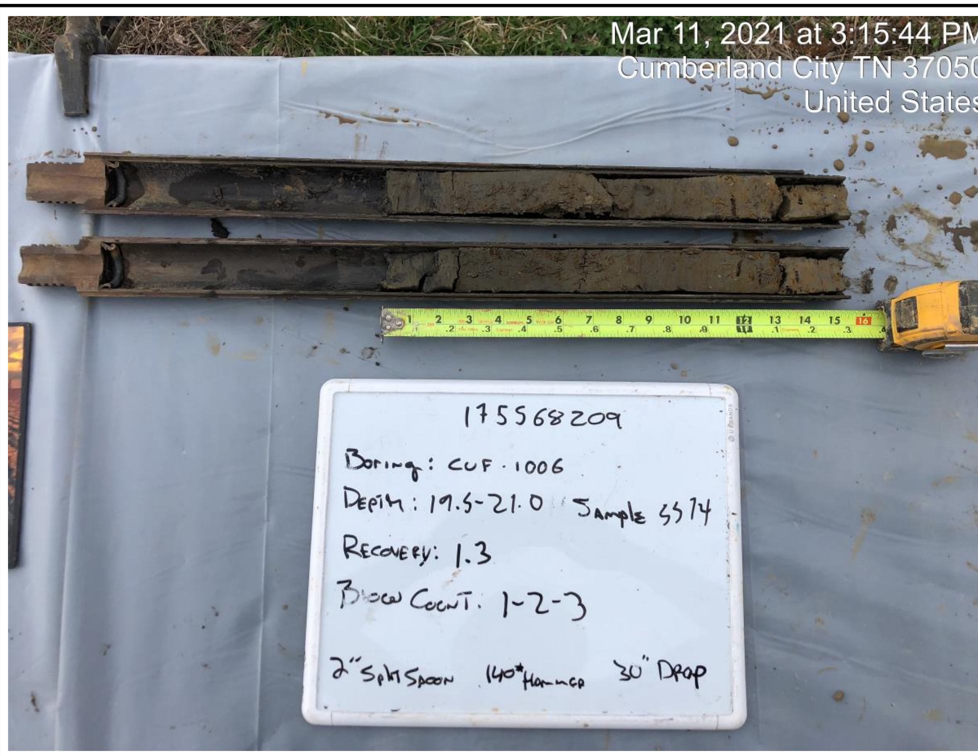


Photograph ID: 14

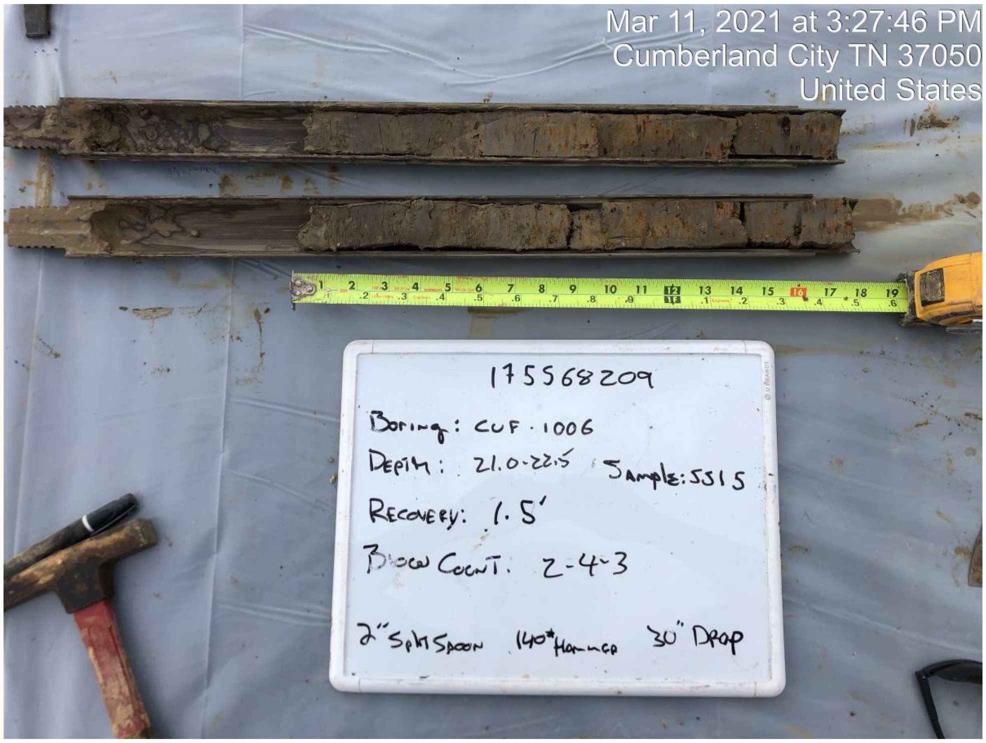
Photo Location:
CUF-1006

Photo Date:
3/11/2021

Comments:
Interval (19.5-21.0 feet).



Client:	**Tennessee Valley Authority**	**Project:**	**TDEC Order**
Site Name:	**Cumberland Fossil (CUF) Plant**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 15 **Photo Location:** CUF-1006 **Photo Date:** 3/11/2021 **Comments:** Interval (21.0-22.5 feet).	

Photograph ID: 16 **Photo Location:** CUF-1006 **Photo Date:** 3/11/2021 **Comments:** Interval (22.5-24.0 feet).	

Stantec

Client:	**Tennessee Valley Authority**	**Project:**	**TDEC Order**
Site Name:	**Cumberland Fossil (CUF) Plant**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 17

Photo Location:
CUF-1006

Photo Date:
3/11/2021

Comments:
Interval (24.0-25.5 feet). Depth interval shown on white board should be 24.0-25.5.

Photograph ID: 18

Photo Location:
CUF-1006

Photo Date:
3/11/2021

Comments:
Interval (25.5-27.0 feet).

Client:	**Tennessee Valley Authority**	**Project:**	**TDEC Order**
Site Name:	**Cumberland Fossil (CUF) Plant**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 19

Photo Location:
CUF-1006

Photo Date:
3/11/2021

Comments:
Interval (27.0-27.8 feet). Depth interval shown on white board should be 27.0-27.8.

ATTACHMENT D.2

Photographic Log of Monitoring Well

Client:	**Tennessee Valley Authority**	**Project:**	**TDEC Order**
Site Name:	**Cumberland Fossil (CUF) Plant**	**Site Location:**	**Cumberland City, Tennessee**

Photograph ID: 1

Photo Location:
CUF-1006

Photo Date:
12/3/2021

Comments:
Completion of monitoring well CUF-1006. Well was installed in boring CUF-1006.

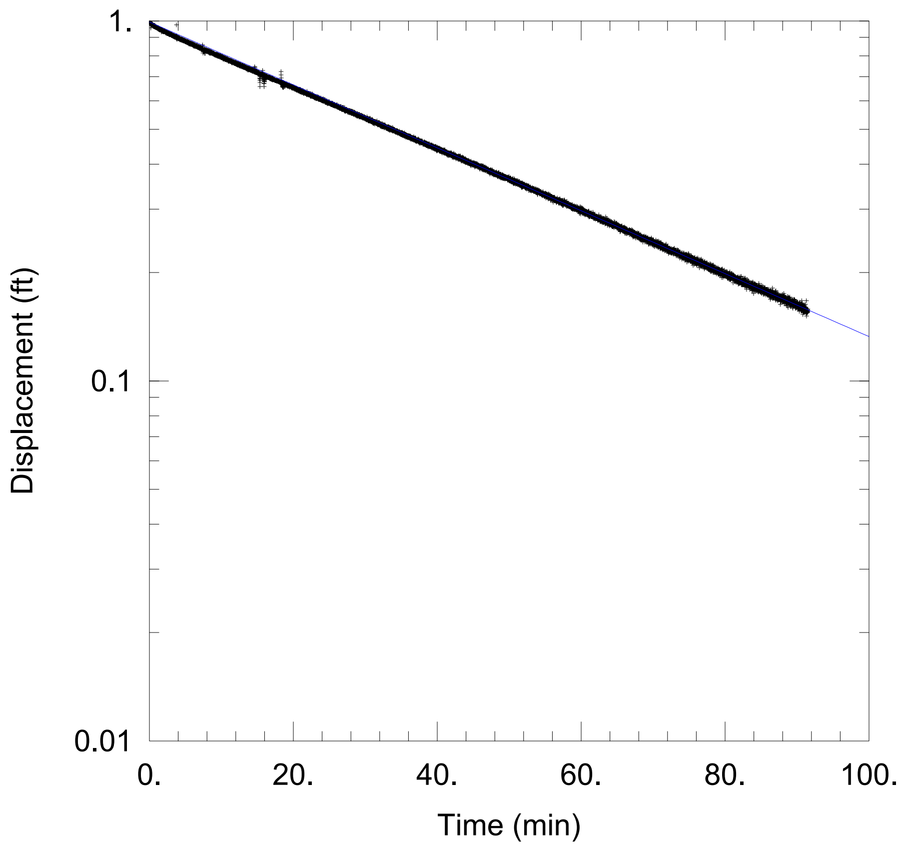
APPENDIX E – SLUG TEST RESULTS

Stantec

Slug Test Results
CUF-1006

Well ID	Test	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/sec)
CUF-1006	Falling Head 1	0.1400	4.94E-05
	Rising Head 1	0.1283	4.53E-05
	Falling Head 2	0.1496	5.28E-05
	Rising Head 2	0.2125	7.50E-05
	Falling Head 3	0.1305	4.60E-05
	Rising Head 3	0.2014	7.10E-05

Notes
ft/day - feet per day
cm/sec - centimeters per second
Slug tests were conducted between August 30 and August 31, 2021.
Data analysis was completed using AQTESOLV™, Version 4.50 Professional
Analysis was completed using the Bouwer-Rice (1976) solution



CUF-1006 FH1

Data Set: C:\...\CUF-1006_FH1.aqt
Date: 03/16/22 Time: 13:38:26

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Location: Cumberland City, TN
Test Well: CUF-1006
Test Date: 08/30/21

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

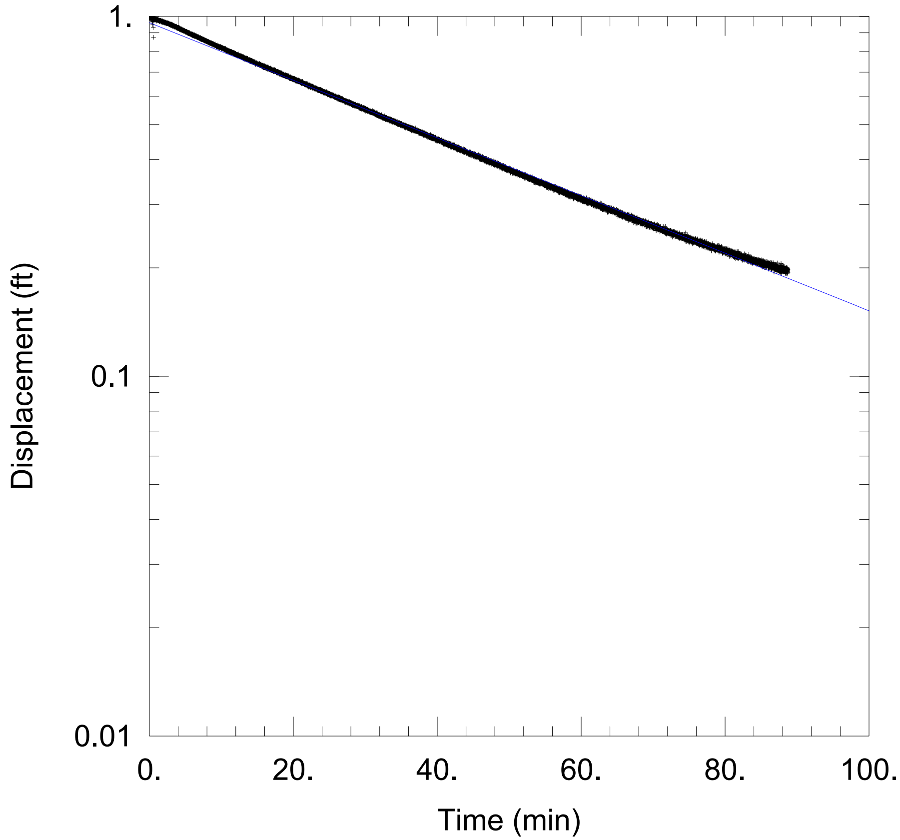
K = 4.94E-5 cm/sec
y0 = 0.9933 ft

AQUIFER DATA

Saturated Thickness: 15.6 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1006)

Initial Displacement: 1. ft
Total Well Penetration Depth: 15.6 ft
Casing Radius: 0.167 ft
Static Water Column Height: 15.6 ft
Screen Length: 9.8 ft
Well Radius: 0.542 ft



CUF-1006 RH1

Data Set: C:\...\CUF-1006_RH1.aqt
Date: 03/16/22 Time: 13:41:04

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Location: Cumberland City, TN
Test Well: CUF-1006
Test Date: 08/30/21

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

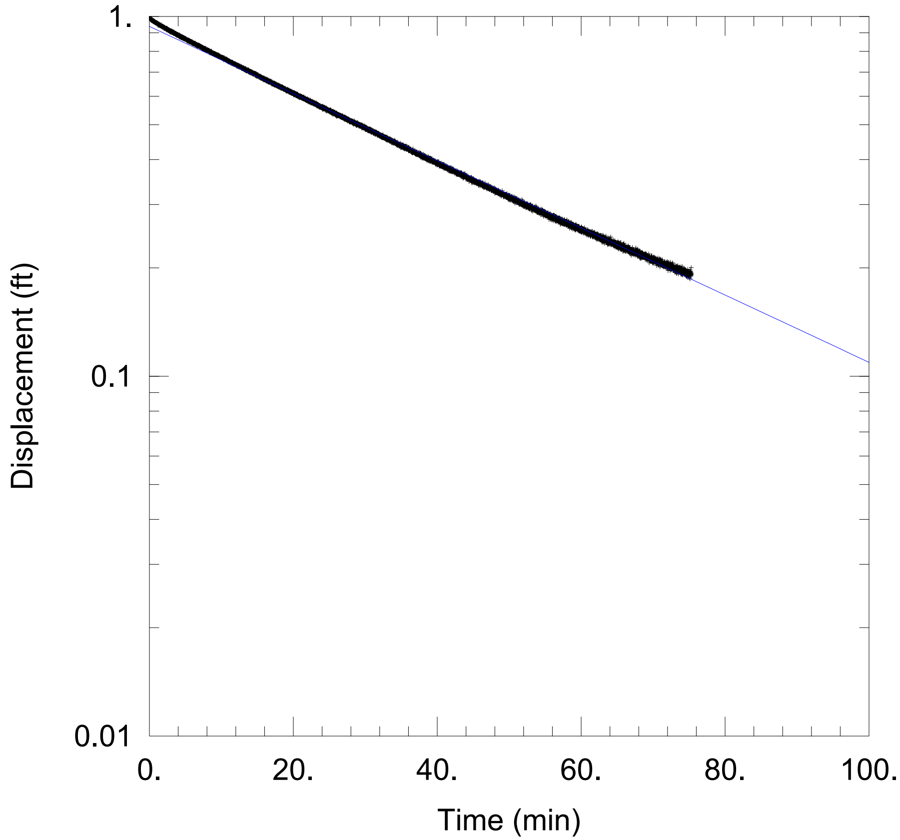
K = 4.527E-5 cm/sec
y0 = 0.9606 ft

AQUIFER DATA

Saturated Thickness: 15.6 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1006)

Initial Displacement: 1. ft
Total Well Penetration Depth: 15.6 ft
Casing Radius: 0.167 ft
Static Water Column Height: 15.6 ft
Screen Length: 9.8 ft
Well Radius: 0.542 ft



CUF-1006 FH2

Data Set: C:\...\CUF-1006_FH2.aqt
Date: 03/16/22 Time: 13:42:37

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Location: Cumberland City, TN
Test Well: CUF-1006
Test Date: 08/30/21

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

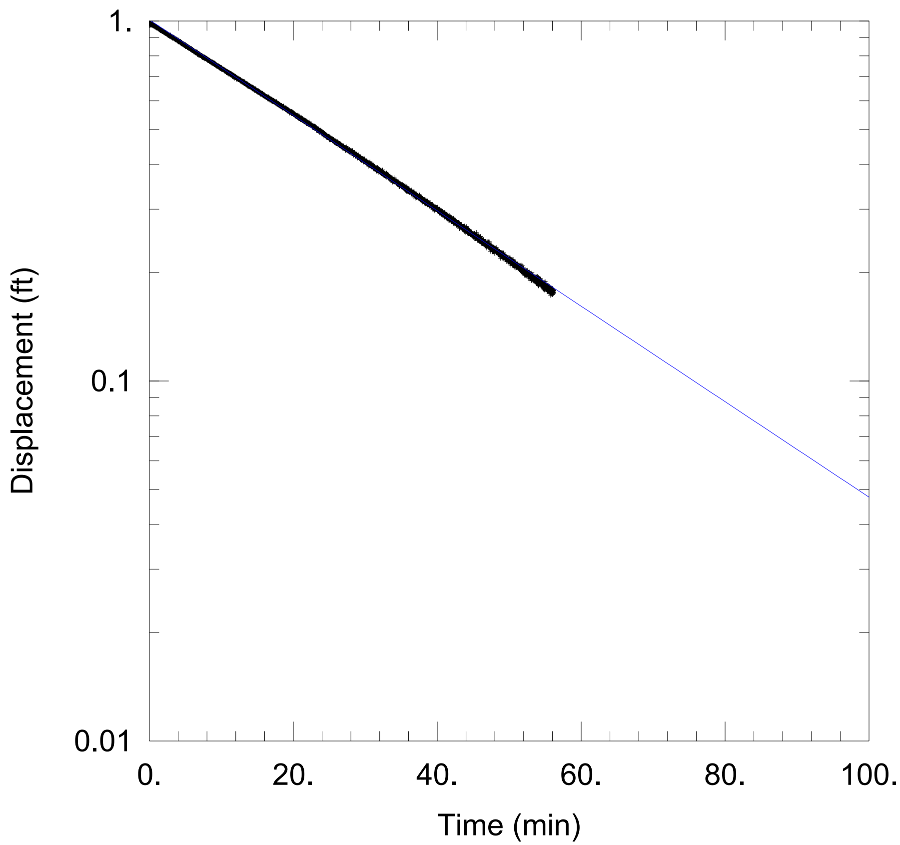
K = 5.278E-5 cm/sec
y0 = 0.9382 ft

AQUIFER DATA

Saturated Thickness: 15.6 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1006)

Initial Displacement: 1. ft
Total Well Penetration Depth: 15.6 ft
Casing Radius: 0.167 ft
Static Water Column Height: 15.6 ft
Screen Length: 9.8 ft
Well Radius: 0.542 ft



CUF-1006 RH2

Data Set: C:\...\CUF-1006_RH2.aqt
Date: 03/16/22 Time: 13:40:21

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Location: Cumberland City, TN
Test Well: CUF-1006
Test Date: 08/31/21

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

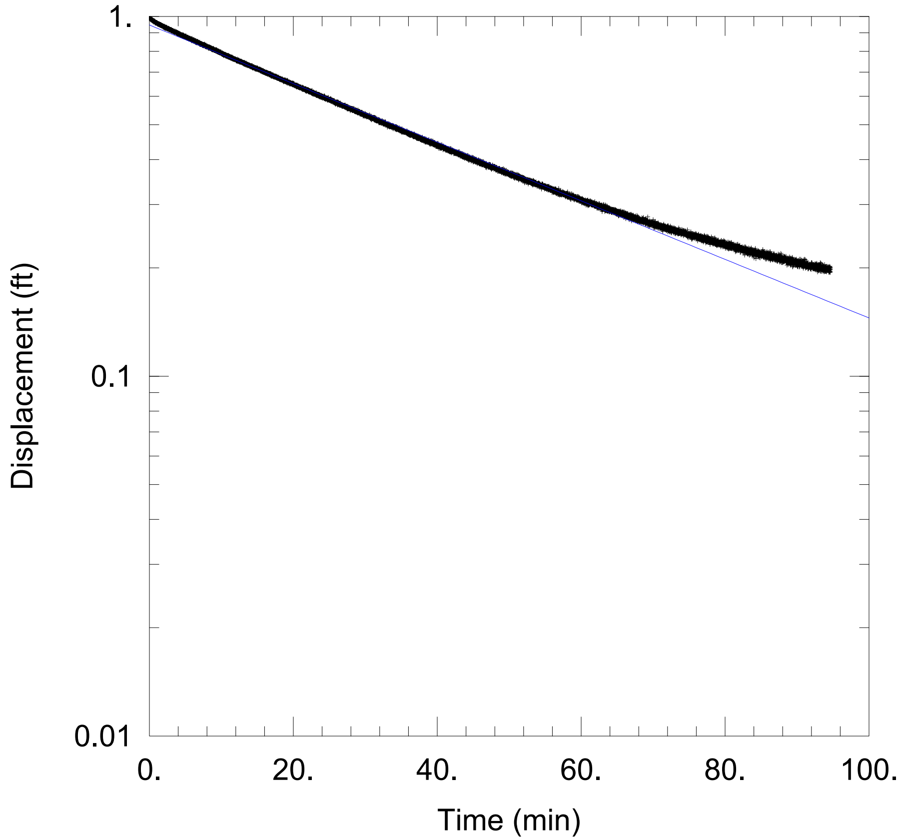
K = 7.496E-5 cm/sec
y0 = 1.007 ft

AQUIFER DATA

Saturated Thickness: 15.6 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1006)

Initial Displacement: 1. ft
Total Well Penetration Depth: 15.6 ft
Casing Radius: 0.167 ft
Static Water Column Height: 15.6 ft
Screen Length: 9.8 ft
Well Radius: 0.542 ft



CUF-1006 FH3

Data Set: C:\...\CUF-1006_FH3.aqt
Date: 03/16/22 Time: 13:41:57

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Location: Cumberland City, TN
Test Well: CUF-1006
Test Date: 08/31/21

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

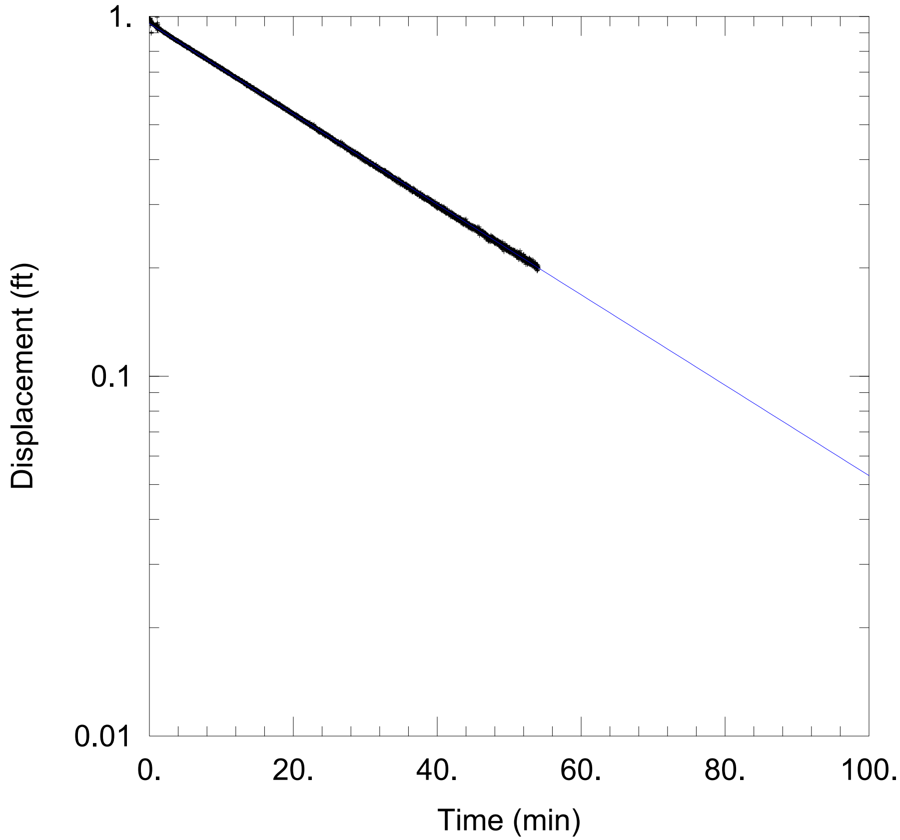
K = 4.604E-5 cm/sec
y0 = 0.9464 ft

AQUIFER DATA

Saturated Thickness: 15.6 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1006)

Initial Displacement: 1. ft
Total Well Penetration Depth: 15.6 ft
Casing Radius: 0.167 ft
Static Water Column Height: 15.6 ft
Screen Length: 9.8 ft
Well Radius: 0.542 ft



CUF-1006 RH3

Data Set: C:\...\CUF-1006_RH3.aqt
Date: 03/16/22 Time: 13:39:26

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Location: Cumberland City, TN
Test Well: CUF-1006
Test Date: 08/31/21

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

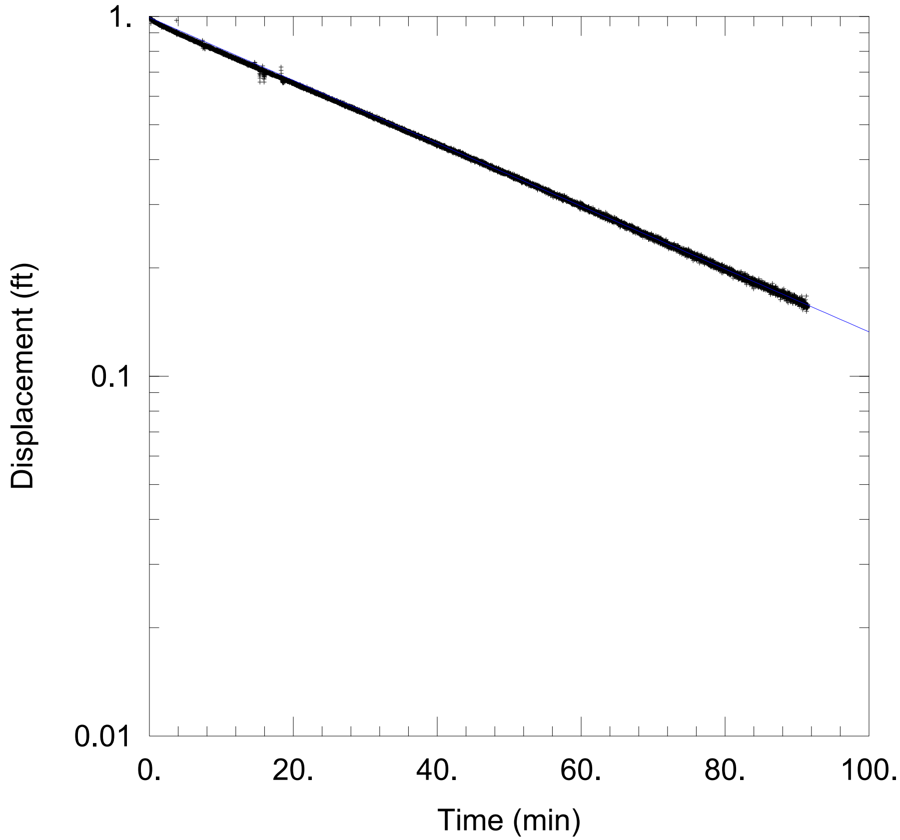
K = 7.104E-5 cm/sec
y0 = 0.9556 ft

AQUIFER DATA

Saturated Thickness: 15.6 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1006)

Initial Displacement: 1. ft
Total Well Penetration Depth: 15.6 ft
Casing Radius: 0.167 ft
Static Water Column Height: 15.6 ft
Screen Length: 9.8 ft
Well Radius: 0.542 ft



CUF-1006 FH1

Data Set: C:\...\CUF-1006_FH1.aqt
Date: 03/16/22 Time: 13:38:03

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Location: Cumberland City, TN
Test Well: CUF-1006
Test Date: 08/30/21

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

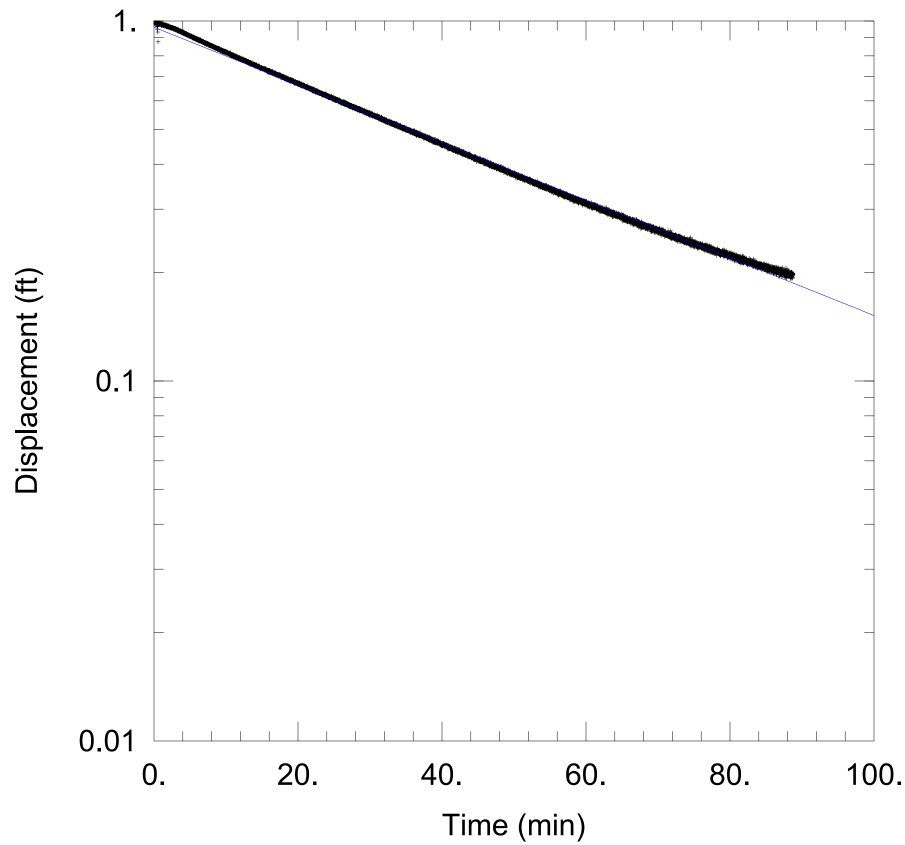
K = 0.14 ft/day
y0 = 0.9933 ft

AQUIFER DATA

Saturated Thickness: 15.6 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1006)

Initial Displacement: 1. ft
Total Well Penetration Depth: 15.6 ft
Casing Radius: 0.167 ft
Static Water Column Height: 15.6 ft
Screen Length: 9.8 ft
Well Radius: 0.542 ft



CUF-1006 RH1

Data Set: C:\...\CUF-1006_RH1.aqt
Date: 03/16/22 Time: 13:40:47

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Location: Cumberland City, TN
Test Well: CUF-1006
Test Date: 08/30/21

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

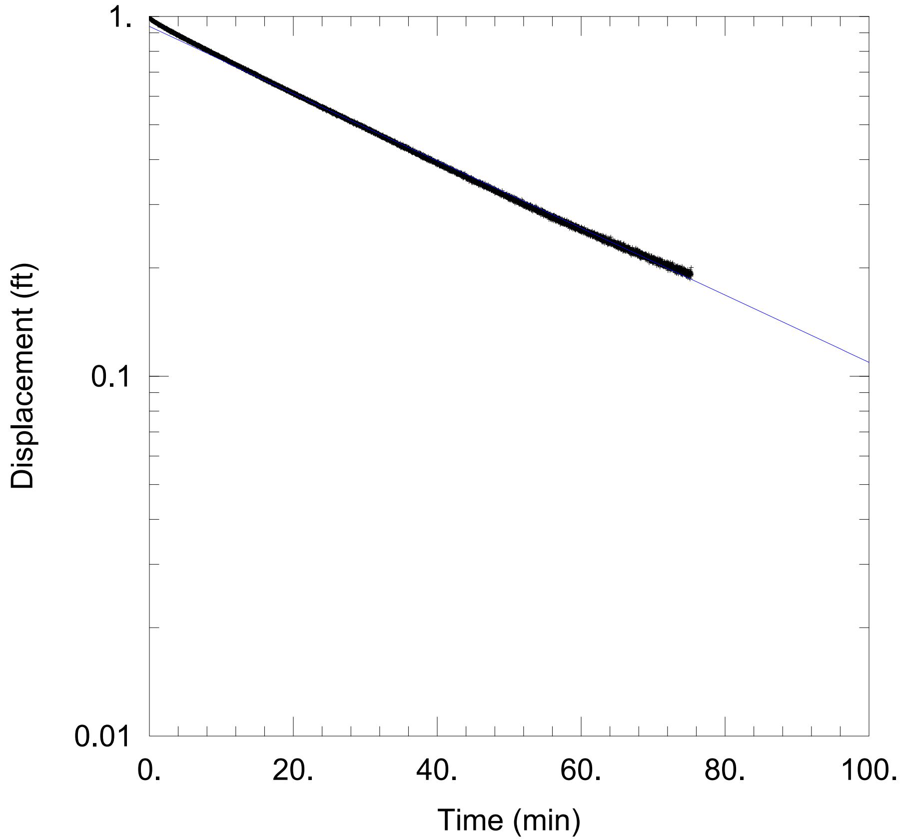
K = 0.1283 ft/day
y0 = 0.9606 ft

AQUIFER DATA

Saturated Thickness: 15.6 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1006)

Initial Displacement: 1. ft
Total Well Penetration Depth: 15.6 ft
Casing Radius: 0.167 ft
Static Water Column Height: 15.6 ft
Screen Length: 9.8 ft
Well Radius: 0.542 ft



CUF-1006 FH2

Data Set: C:\...\CUF-1006_FH2.aqt
Date: 03/16/22 Time: 13:42:18

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Location: Cumberland City, TN
Test Well: CUF-1006
Test Date: 08/30/21

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

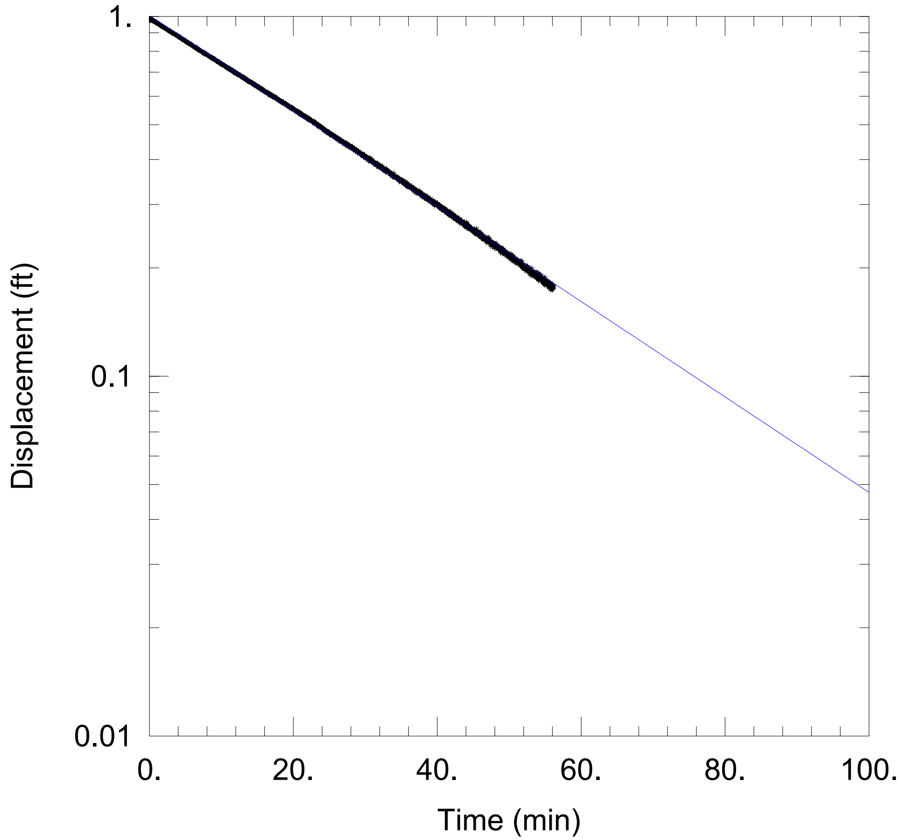
K = 0.1496 ft/day
y0 = 0.9382 ft

AQUIFER DATA

Saturated Thickness: 15.6 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1006)

Initial Displacement: 1. ft
Total Well Penetration Depth: 15.6 ft
Casing Radius: 0.167 ft
Static Water Column Height: 15.6 ft
Screen Length: 9.8 ft
Well Radius: 0.542 ft



CUF-1006 RH2

Data Set: C:\...\CUF-1006_RH2.aqt
Date: 03/16/22 Time: 13:39:52

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Location: Cumberland City, TN
Test Well: CUF-1006
Test Date: 08/31/21

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

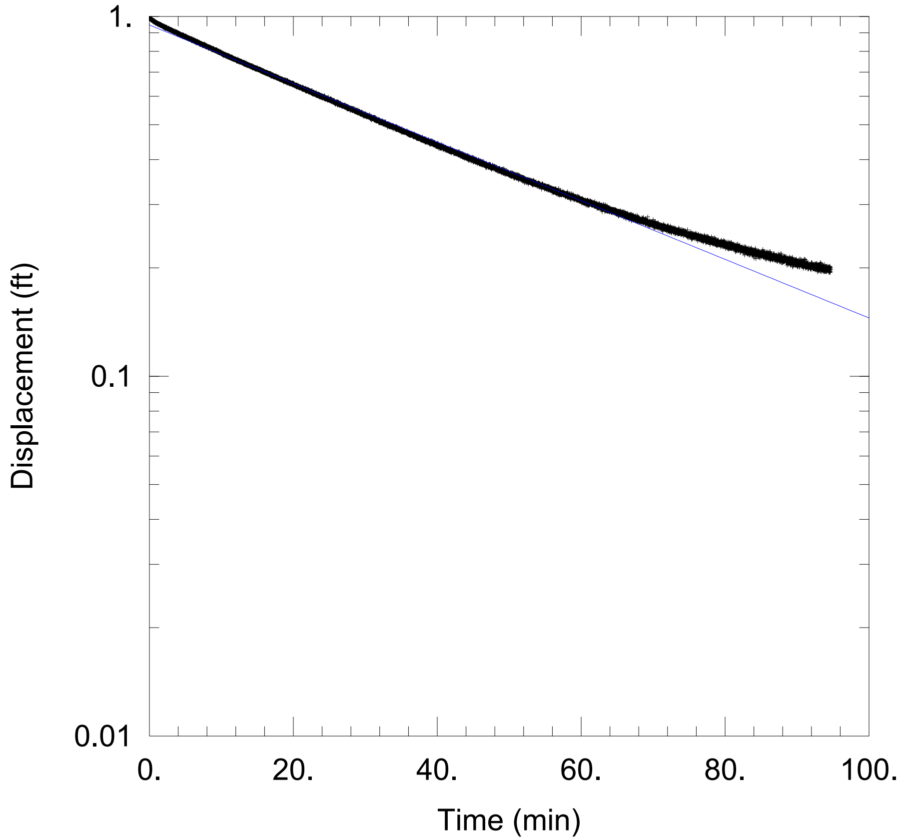
K = 0.2125 ft/day
y0 = 1.007 ft

AQUIFER DATA

Saturated Thickness: 15.6 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1006)

Initial Displacement: 1. ft
Total Well Penetration Depth: 15.6 ft
Casing Radius: 0.167 ft
Static Water Column Height: 15.6 ft
Screen Length: 9.8 ft
Well Radius: 0.542 ft



CUF-1006 FH3

Data Set: C:\...\CUF-1006_FH3.aqt
Date: 03/16/22 Time: 13:41:37

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Location: Cumberland City, TN
Test Well: CUF-1006
Test Date: 08/31/21

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

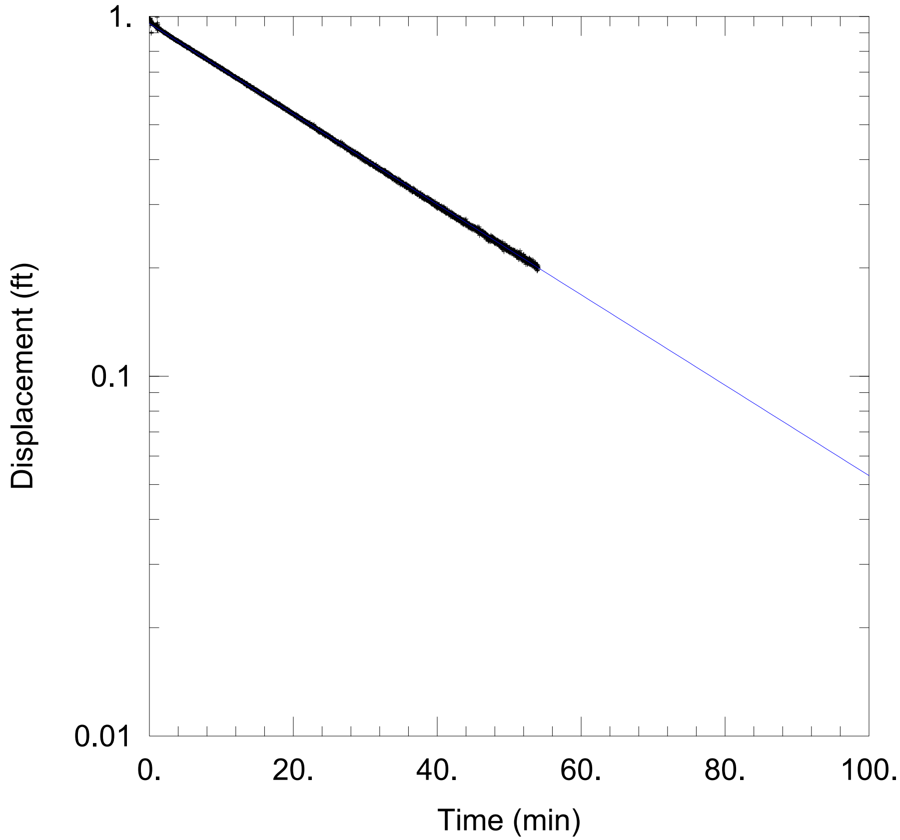
K = 0.1305 ft/day
y0 = 0.9464 ft

AQUIFER DATA

Saturated Thickness: 15.6 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1006)

Initial Displacement: 1. ft
Total Well Penetration Depth: 15.6 ft
Casing Radius: 0.167 ft
Static Water Column Height: 15.6 ft
Screen Length: 9.8 ft
Well Radius: 0.542 ft



CUF-1006 RH3

Data Set: C:\...\CUF-1006_RH3.aqt
Date: 03/16/22 Time: 13:39:07

PROJECT INFORMATION

Company: Stantec
Client: TVA-CUF
Location: Cumberland City, TN
Test Well: CUF-1006
Test Date: 08/31/21

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.2014 ft/day
y0 = 0.9556 ft

AQUIFER DATA

Saturated Thickness: 15.6 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CUF-1006)

Initial Displacement: 1. ft
Total Well Penetration Depth: 15.6 ft
Casing Radius: 0.167 ft
Static Water Column Height: 15.6 ft
Screen Length: 9.8 ft
Well Radius: 0.542 ft

APPENDIX H.4

GROUNDWATER INVESTIGATION EVENT #1 SAMPLING AND ANALYSIS REPORT

Cumberland Fossil Plant Groundwater Investigation Event #1 Sampling and Analysis Report

TDEC Commissioner’s Order:
Environmental Investigation Plan
Cumberland Fossil Plant
Cumberland City, Tennessee

August 17, 2020

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

REVISION LOG

Revision	Description	Date
0	Submittal to TDEC	April 7, 2020
1	Addresses June 16, 2020 TDEC Review Comments and Issued for TDEC	August 17, 2020

Sign-off Sheet

This document entitled Cumberland Fossil Plant Groundwater Investigation Event #1 Sampling and Analysis Report was prepared by Stantec Consulting Services Inc. ("Stantec") for the account of Tennessee Valley Authority (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ____________________

Michael J. Winkler, Geologic Associate

Reviewed by ____________________

John Griggs, Senior Principal

Approved by ____________________

Carole Farr, Senior Principal

Table of Contents

LIST OF APPENDICES

Abbreviations

BTOC	Below Top of Casing
CCR	Coal Combustion Residuals
CCR Parameters	Constituents listed in Appendices III and IV of 40 CFR 257 and five inorganic constituents included in Appendix I of Tennessee Rule 0400-11-01-.04
CEC	Civil and Environmental Consultants, Inc.
CFR	Code of Federal Regulations
COC	Chain-of-Custody
CUF Plant	Cumberland Fossil Plant
DO	Dissolved Oxygen
EAR	Environmental Assessment Report
EnvStds	Environmental Standards, Inc.
Event #1	Groundwater Investigation sampling event performed May 6-10, 2019
ft	Feet
ID	Identification
IDW	Investigation Derived Waste
mg/L	Milligrams per Liter
NTU	Nephelometric Turbidity Units
ORP	Oxidation-Reduction Potential
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
QC	Quality Control
SAP	Sampling and Analysis Plan
SAR	Sampling and Analysis Report
Stantec	Stantec Consulting Services Inc.
TDEC	Tennessee Department of Environment and Conservation
TDEC Order	Commissioner's Order No. OGC15-0177
TestAmerica	Eurofins TestAmerica Inc.
TI	Technical Instruction
TVA	Tennessee Valley Authority

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) has prepared this sampling and analysis report (SAR) on behalf of the Tennessee Valley Authority (TVA) to document the completion of activities related to a groundwater investigation sampling event performed May 6-10, 2019 (Event #1) at TVA's Cumberland Fossil Plant (CUF Plant) located at 815 Cumberland City Road in Cumberland City, Tennessee.

The purpose of the groundwater investigation upon completion of six groundwater sampling events is to characterize groundwater conditions at the CUF Plant in support of fulfilling the requirements for the Tennessee Department of Environment and Conservation (TDEC) issued Commissioner's Order No. OGC15-0177 (TDEC Order) to TVA (TDEC 2015). The TDEC Order sets forth a "process for the investigation, assessment, and remediation of unacceptable risks" at TVA's coal ash disposal sites in Tennessee.

The purpose of this SAR is to document the work completed during groundwater sampling Event #1 of 6 total events and to present the information and data collected during the execution of the Groundwater Investigation Sampling and Analysis Plan (SAP) (Stantec 2018a). This SAR is not intended to provide conclusions or evaluations of results. The scope of the groundwater investigation represented herein was conducted pursuant to the SAP and is part of a larger environmental investigation at the CUF Plant. The data provided in this SAR are not inclusive of other programmatic data that exist for the site. The evaluation of the results will consider other aspects of the environmental investigation, as well as data collected under other State and/or coal combustion residuals (CCR) programs, and be presented in the Environmental Assessment Report (EAR).

Event #1 activities were performed in general accordance with the following documents developed by TVA to support fulfilling the requirements of the TDEC Order at the CUF Plant.

- *Environmental Investigation Plan (EIP)* (Stantec 2018b)
- *Groundwater Investigation SAP* (Stantec 2018a)
- *Quality Assurance Project Plan (QAPP)* (Environmental Standards, Inc. 2018).

The Groundwater Investigation SAP was updated based on TVA- and TDEC-approved Programmatic- and Project-specific changes. Minor variations in scope and procedures from those outlined in the SAP occurred during field activities due to field conditions and programmatic updates and are referenced in Section 3.6.

Event #1 is the first in a series of six planned sampling events for the groundwater investigation. Stantec performed the field work activities for this event. Laboratory analysis of constituents was performed by Eurofins TestAmerica, Inc. (TestAmerica) in Pittsburgh, Pennsylvania and St. Louis, Missouri (radium samples only). Quality Assurance oversight on data acquisition protocols, sampling practices, and data validation or verification was performed by Environmental Standards, Inc. (EnvStds) under direct contract to TVA.

This report summarizes the groundwater investigation activities for Event #1. The remaining five sampling events will be completed before overall conclusions and findings about the groundwater investigation and groundwater conditions at the CUF Plant are made and documented in the EAR.

2.0 OBJECTIVE AND SCOPE

The primary objectives of the groundwater investigation conducted pursuant to the Groundwater Investigation SAP (which includes six sampling events) are to characterize existing groundwater quality and to evaluate groundwater flow conditions at the CUF Plant in response to the TDEC Order. The approach to characterizing the groundwater conditions is to:

- Collect groundwater samples for chemical analyses to evaluate the potential presence of constituents related to coal combustion residuals (CCR) in groundwater
- Measure groundwater and surface water elevations to evaluate the direction of groundwater flow.

The scope of work intended to achieve the objectives of the groundwater investigation consists of six sampling events at a frequency of one event every two months for one year to characterize seasonal groundwater quality and flow direction. This report describes the activities related to Event #1, performed in May 2019, the scope of which included:

- Collecting groundwater and surface water level measurements
- Collecting field measurements of groundwater quality parameters
- Collecting groundwater samples and associated quality control (QC) samples for laboratory analysis.

These activities were carried out after the installation of five monitoring wells – CUF-1000 through CUF-1003 and CUF-1005. Details of the monitoring well installation activities are provided in the CUF Plant Hydrogeological Investigation SAR.

3.0 FIELD ACTIVITIES

Groundwater investigation field activities for Event #1 were conducted May 6-10, 2019. Stantec performed groundwater level measurements and sample collection activities based on guidance and specifications in TVA's Technical Instructions (TIs), the SAP, and the QAPP, except as noted in the Variations section of this report. As part of TVA's commitment to generate representative and reliable data, data validation and/or verification of laboratory analytical results were performed by EnvStds under direct contract with TVA. EnvStds also conducted audits of field activities and provided quality reviews of field documentation. In addition, on behalf of TDEC, Civil and Environmental Consultants, Inc. (CEC) collected split groundwater samples during this sampling event. Additional information regarding CEC split sample collection is provided in Section 3.3.2.

During Event #1, Stantec conducted the following field activities:

- Measured water levels at five monitoring wells installed for the TDEC Order environmental investigation, 20 monitoring wells and 14 piezometers installed for other programs, and one surface water gauge in the Cumberland River
- Collected groundwater samples from five monitoring wells installed for the TDEC Order
- Recorded field measurements of groundwater quality parameters at the five sampled monitoring wells
- Collected QC samples including one field duplicate, three field blanks, and one equipment blank
- Conveyed collected samples via laboratory-provided courier service to TestAmerica for analysis.

Details on each activity are presented in the sections below.

3.1 WORK LOCATIONS

The TDEC Order CCR units at the CUF Plant (the Stilling Pond including Retention Pond, Dry Ash Stack, Bottom Ash Pond, and Gypsum Storage Area), as well as the monitoring wells sampled and monitoring wells/piezometers gauged during Event #1 are shown on Exhibit A.1 in Appendix A. TVA is currently sampling groundwater at the CUF Plant for TDEC Solid Waste Management permit requirements and the United States Environmental Protection Agency CCR Rule codified in Title 40 of the Code of Federal Regulations (CFR) Part 257 (40 CFR 257). Monitoring wells that are being sampled as part of other programs are not sampled as part of the groundwater investigation for the TDEC Order. However, groundwater levels were measured in certain wells and piezometers, as shown in Table B.1 in Appendix B, to provide information to prepare groundwater contour maps for this SAR and the CUF Plant EAR.

Groundwater analytical and field duplicate samples were collected from the five groundwater investigation monitoring wells as shown in Table B.2 in Appendix B.

3.2 DOCUMENTATION

Stantec maintained field documentation in accordance with ENV-TI-05.80.03, *Field Record Keeping*, and the QAPP. Field activities and data were recorded on program-specific field forms. Health and safety forms were completed in accordance with TVA and Stantec health and safety requirements. Additional information regarding field documentation is provided below.

3.2.1 Field Forms

Stantec used program-specific field forms to record field observations and data for specific activities. Field forms used during the groundwater investigation included:

- *Daily Field Activity Log*
- *Monitoring Well Inspection Checklist*
- *Equipment Calibration Form*
- *Groundwater Level Measurement Form*
- *Groundwater Sampling Form*
- *Chain-of-Custody.*

3.2.1.1 Daily Field Activity Log

Stantec field sampling personnel recorded field activities, observations, and data on a *Daily Field Activity Log* to chronologically document the field program using digital media and field forms. Deviations from the SAP, TIs, or QAPP were documented on the *Daily Field Activity Log*.

3.2.1.2 Monitoring Well Inspection Checklist

Prior to measuring water levels, Stantec field sampling personnel inspected each monitoring well for damage or indications that the well integrity had been compromised in accordance with ENV-TI-05.80.21, *Monitoring Well Inspection and Maintenance.* Inspection results were documented on a *Monitoring Well Inspection Checklist*. No signs of damage or necessary repairs were noted during Event #1.

3.2.1.3 Equipment Calibration Form

Stantec field sampling personnel performed daily calibration of the water quality meter and turbidity meter and documented the results on an *Equipment Calibration Form*. The log documented the calibration results for temperature, turbidity, specific conductance, pH, dissolved oxygen (DO), and oxidation-reduction potential (ORP), and verified that the field instruments' sensors were operating within acceptance criteria. Refer to Section 3.2.2 for additional details on equipment calibration procedures.

3.2.1.4 Groundwater Level Measurement Form

Stantec field sampling personnel recorded groundwater level field measurement data in accordance with ENV-TI-05.80.44, *Groundwater Level and Well Depth Measurement* on a *Groundwater Level Measurement Form*. The form includes the monitoring well identification (ID), time, and depth to water measured from a standardized reference point on the top of each well casing, recorded in feet (ft) below top of casing (btoc).

3.2.1.5 Groundwater Sampling Form

Stantec field sampling personnel recorded the depth to water, purge flow rate, volume of groundwater purged, temperature, pH, specific conductance, DO, ORP, turbidity, color of water, and other observations during groundwater purging and sampling activities at each monitoring well in accordance with ENV-TI-05.80.42, *Groundwater Sampling*. Field measurements were recorded on a *Groundwater Sampling Form*. The forms document the time intervals between measurement of field parameters, low-flow extraction rates, water level drawdown, and water quality parameter measurements until stabilization criteria were met.

3.2.1.6 Chain-of-Custody

Stantec field sampling personnel completed a chain-of-custody (COC) for each groundwater sample collected during Event #1. The sample ID, sample location, type of sample, sampling date, and time were recorded on the COC. The Field Team Leader reviewed the COC for completeness, and a QC check of samples in each cooler compared to sample IDs on the corresponding COC was conducted. COCs were completed in accordance with TVA TI ENV-TI-05.80.02, *Sample Labeling and Custody*.

3.2.2 Equipment Calibration

Field instruments used to collect, generate, or measure environmental data were calibrated each day prior to use as specified in the SAP, QAPP, and ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde.* Afternoon calibration verifications were performed to evaluate if instruments remained within acceptance criteria during sampling. Temperature and barometric pressure instrument readings were verified using a calibrated National Institute of Standards and Technology traceable thermometer and National Weather Service (via mesowest.utah.edu) barometric pressure readings for Cumberland City, Tennessee, respectively. Additional details regarding equipment calibration were recorded on an *Equipment Calibration Form*.

3.3 SAMPLING METHODS

The following sections present monitoring well data collection and sampling procedures used in the groundwater investigation Event #1. Stantec field sampling personnel completed groundwater sampling training provided by EnvStds and internal Stantec training prior to conducting the work.

3.3.1 Static Water Level Measurements

Static water levels were measured at 25 monitoring wells as specified in ENV-TI-05.80.44, *Groundwater Level and Well Depth Measurement,* and at one surface water gauge. Data are shown in Table B.1 in Appendix B. On May 6, 2019, static water level readings were measured and recorded to the nearest 0.01 ft from a reference point on the top of each polyvinyl chloride well casing using an electronic water level indicator. Water level indicator probes were decontaminated prior to the first use and between measurements, and the decontamination was documented as specified in ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination.* Depth to water measurements were recorded on a *Groundwater Level Measurement Form*. A water level measurement could not be obtained at monitoring well 93-4 because the water level indicator probe stopped at the top of the dedicated pump and no water was encountered. A surface water level measurement was obtained using the 1200 (noon) reading from the automated Cumberland River gauge provided by TVA.

A groundwater elevation contour map, based on measurements made in groundwater wells and piezometers, is included as Exhibit A.2 in Appendix A.

3.3.2 Groundwater Purging & Sampling

Event #1 sampling activities were conducted at the CUF Plant on May 6-10, 2019. Analytical and field duplicate samples were collected from five monitoring wells as shown in Table B.2 in Appendix B. Split samples collected by CEC during Event #1 are also identified in Table B.2. Monitoring wells were purged using dedicated bladder pumps equipped with dedicated tubing using low-flow purging and sampling techniques as specified in ENV-TI-05.80.42, *Groundwater Sampling*. One exception occurred at CUF-1000 where the depth to water was below the dedicated pump intake depth (pump intake is 19.9 ft btoc, DTW measured at 20.71 ft btoc). Therefore, a decontaminated, non-dedicated pump and length of disposable tubing were used to obtain that groundwater sample.

During the purging process, water quality field parameters including pH, specific conductance, temperature, ORP, and DO were measured using water quality meters (YSI ProPlus with flow-through cell) and recorded on field forms. Depth to water and turbidity were measured and recorded using decontaminated electronic water-level indicators (Heron Dipper-T) and calibrated turbidimeters (Hach 2100Q). Field parameters were measured and recorded on *Groundwater Sampling Forms* until readings were stabilized as specified in the SAP and TI. Well purging was considered complete when three consecutive readings were within the following stabilization limits:

- pH – ± 0.1 Standard Units
- Specific Conductance – ± 5% microsiemens per centimeter
- Turbidity – Less than 10 Nephelometric Turbidity Units (NTUs) or ± 10% for values above 10 NTUs
- DO – Less than 0.5 milligrams per liter (mg/L) or ± 10% for values above 0.5 mg/L.

After water quality stabilization criteria were achieved, purging was discontinued and a sample was collected as specified in the SAP. Laboratory-provided, pre-preserved sample containers were filled directly from the pump discharge line. Field sampling personnel wore new, clean nitrile gloves when handling sample containers and did not touch the interior of containers or container caps. New gloves were used when handling each sample. When filling sample bottles, care was taken to minimize sample aeration (i.e., water was directed down the inner walls of the sample bottle) and to avoid overfilling and diluting preservatives. Each sample bottle was capped before filling the next bottle. Sample containers were labeled and handled in accordance with ENV-TI-05.80.02, *Sample Labeling and Custody.* Field sampling personnel secured caps on each bottle, attached a custody seal across the cap, and placed in a cooler on ice within 15 minutes of collection. QC samples were collected in accordance with TVA, ENV-TI-05.80.04, *Field Sampling Quality Control.* Custody of the samples was maintained until samples were delivered to the laboratory-provided courier for transport to TestAmerica's Nashville, Tennessee facility.

Groundwater samples were analyzed for the CCR-related constituents listed in Appendices III and IV of 40 CFR 257. In addition, five inorganic constituents listed in Appendix I of Tennessee Rule 0400-11-01-.04 and not included in the 40 CFR 257 Appendices III and IV were analyzed to maintain continuity with TDEC environmental programs. These additional TDEC Appendix I constituents included copper, nickel, silver, vanadium, and zinc. The combined federal CCR Appendices III and IV constituents and TDEC Appendix I inorganic constituents will hereafter be referred to collectively as "CCR Parameters." For geochemical evaluation, major cations/anions not included in the CCR Parameters were included in the analyses. The additional geochemical parameters included bicarbonate, carbonate, magnesium, potassium, and sodium.

3.4 INVESTIGATION DERIVED WASTE

Investigation derived waste (IDW) generated during groundwater investigation activities included:

- Used calibration solutions
- Purge water
- Decontamination fluids
- Disposable personal protective equipment (PPE)
- General trash.

IDW was handled in accordance with ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*; ENV-TI-05.80.42, *Groundwater Sampling* (purge water); the Plant-specific waste management plan; and local, state, and federal regulations. Transportation and disposal of IDW was coordinated with TVA Plant personnel. Used calibration solution was containerized and stored for disposal as directed by the Plant facility management. Purge water and decontamination fluids were containerized for later disposal as specified in the Plant-specific waste management plan. Used disposable PPE (e.g., nitrile gloves) and general trash generated throughout the day were stored in garbage bags and disposed of in a general trash dumpster onsite at the end of each day.

3.5 SAMPLE SHIPMENT

Samples were packed and secured under COC procedures specified in ENV-TI-05.80.06, *Handling and Shipping of Samples*. The samples were conveyed to TestAmerica in Nashville, Tennessee, via a laboratory-provided courier service that arrived at the CUF Plant each morning to take custody of samples collected the previous day. Samples were shipped by TestAmerica from the Nashville, Tennessee, facility to the Pittsburgh, Pennsylvania, laboratory for official sample login. Once samples were logged in, the radium samples were shipped under internal lab protocols to the TestAmerica St. Louis, Missouri, laboratory. TestAmerica submitted sample receipt confirmation forms to EnvStds for review and confirmation that there were no issues.

3.6 VARIATIONS

The proposed scope and procedures for the groundwater investigation were outlined in the SAP, QAPP, and applicable TVA TIs as detailed in the sections above. Variations in scope or procedures discussed with TDEC and/or TVA, changes based on field conditions, or additional field sampling performed to complete the scope of work in the SAP are described in the following sections. As discussed below, these variations do not impact the overall usability and representativeness of the dataset provided in this SAR for groundwater investigation sampling Event #1 at the CUF Plant.

3.6.1 Variations in Scope

Variations in scope are provided below.

- A surface water level measurement was not obtained for Wells Creek because a water level gauge has not yet been installed due to concerns of safe access to that location; however, a surface water measurement was obtained from the Cumberland River. Once the gauge is installed in Wells Creek, surface water measurements will be collected.
- Groundwater level gauging and sampling was not performed at well CUF-1004 as specified in the SAP because it was not installed (the three borings drilled in that area were dry). This change in scope was approved by TDEC.

3.6.2 Variations in Procedures

Variations in procedures occurring in the field are provided below.

- Sample IDs were reformatted to follow a revised nomenclature using the last three digits of the UNID in the sample ID, in lieu of the Well ID indicated in the example in Attachment D, Table A of the QAPP. The QAPP will be revised to use the UNID nomenclature going forward
- On 5/7/19, monitoring well CUF-1000 was sampled using a decontaminated, non-dedicated pump and length of disposable tubing because the depth to water was below the dedicated pump intake depth (pump intake is 19.9 ft btoc, depth to water measured at 20.71 ft btoc).

4.0 SUMMARY

Stantec has completed groundwater investigation Event #1 at the CUF Plant in Cumberland City, Tennessee. The data presented in this report are only for sampling Event #1. Following completion of the six planned sampling events, the complete data set will be evaluated with data collected during implementation of other SAPs. These evaluations will be presented in the CUF Plant EAR.

The scope of work for Event #1 was to:

- Collect groundwater samples for chemical analyses to assist with subsequent evaluation of the potential presence of CCR-related constituents in groundwater
- Measure groundwater and surface water elevations to assist with subsequent evaluation of groundwater flow direction after multiple data sets have been collected.

Event #1 included taking water level measurements at 25 monitoring wells, 14 piezometers, and one surface water gauge located in the Cumberland River. Groundwater elevations measured in monitoring wells and piezometers are summarized in Table B.1 and depicted on Exhibit A.2.

Water quality measurements and groundwater analytical samples were collected at five monitoring wells (CUF 1000 through CUF 1003 and CUF 1005) as summarized in Table B.2. Water quality parameters were recorded during purging. Stabilization criteria for pH, specific conductance, turbidity, and DO were achieved at each of the sampling locations. The final measurements prior to initiating sample collection are presented in Table B.3.

Groundwater analytical data for CCR Parameters and geochemical parameters are presented in Table B.4. Analytical data for radium analyses are presented in Table B.5. Analytical data were reported by TestAmerica and data verification or validation was performed by EnvStds.

Stantec has completed Event #1 of the groundwater investigation at the CUF Plant in Cumberland City, Tennessee, in accordance with the Groundwater Investigation SAP as documented herein. The data collected during the investigation are usable for reporting and evaluation in the EAR and meet the objectives of the TDEC Order. The complete dataset from this event will be evaluated along with data collected during the remaining groundwater sampling events and under other TDEC Order SAPs, as well as data collected under other State and CCR programs. This evaluation will be provided in the EAR.

5.0 REFERENCES

Code of Federal Regulations, Title 40: *Protection of the Environment*, Chapter I: *Environmental Protection Agency*, Subchapter I: *Solid Wastes*, Part 257*: Criteria for Classification of Solid Waste Disposal Facilities and Practices*, Subpart D: *Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments*, Groundwater Monitoring and Corrective Action §257.90 to §257.98.

Environmental Standards, Inc. 2018. *Quality Assurance Project Plan for the Tennessee Valley Authority Cumberland Fossil Plant Environmental Investigation*. *Revision 2.* Prepared for Tennessee Valley Authority. January 2018.

Stantec Consulting Services Inc. (Stantec). 2018a. *Groundwater Investigation Sampling and Analysis Plan (SAP), Cumberland Fossil Plant. Revision 3 Final.* Prepared for Tennessee Valley Authority. June 25, 2018.

Stantec. 2018b. *Environmental Investigation Plan, Cumberland Fossil Plant. Revision 3 Final.* Prepared for Tennessee Valley Authority. June 25, 2018.

Tennessee Department of Environment and Conservation. 2015. *Commissioner's Order No. OGC15-0177.*

Tennessee Valley Authority (TVA), ENV-TI-05.80.02, *Sample Labeling and Custody*.

TVA, ENV-TI-05.80.03, *Field Record Keeping*.

TVA, ENV-TI-05.80.04, *Field Sampling Quality Control*.

TVA, ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*.

TVA, ENV-TI-05.80.06, *Handling and Shipping of Samples*.

TVA, ENV-TI-05.80.21, *Monitoring Well Inspection and Maintenance*.

TVA, ENV-TI-05.80.42, *Groundwater Sampling*.

TVA, ENV-TI-05.80.44, *Groundwater Level and Well Depth Measurement*.

TVA, ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde*.

APPENDIX A - EXHIBITS

Exhibit No.

A.1

Title

Monitoring Well Network

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location

Stewart County, Tennessee

175568209
Prepared by MB on 2020-08-11
Technical Review by MW on 2020-08-11

0 400 800 1,200 1,600 Feet

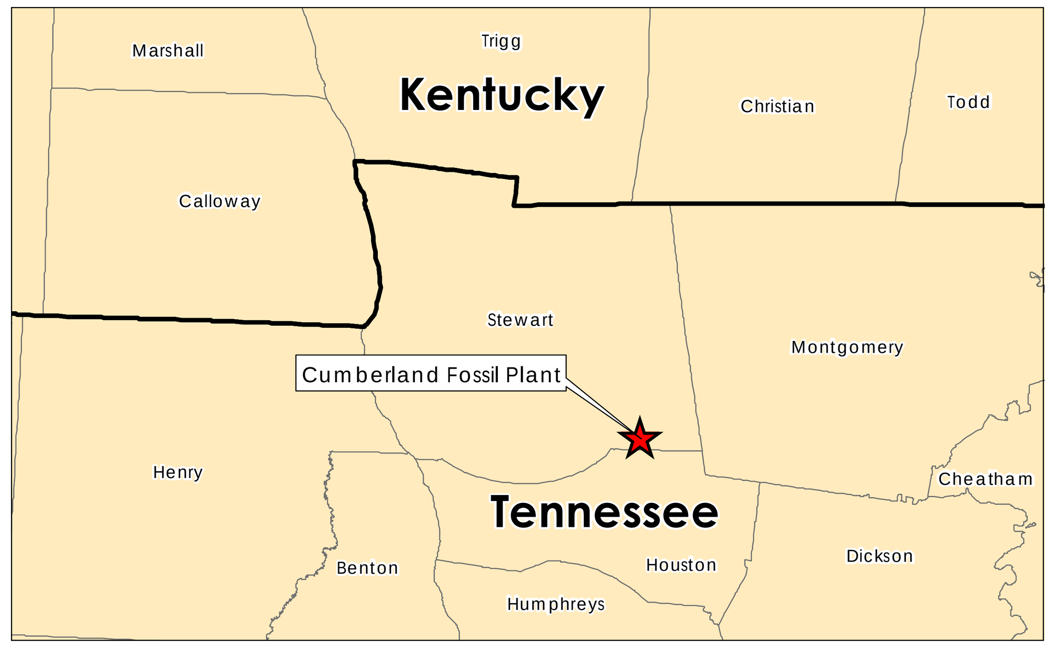
1:4,800 (At original document size of 22x34)

Legend

- Groundwater Investigation Monitoring Well
- Other Monitoring Welll
- Piezometer
- Cumberland River Gauging Station
- 2019 Imagery Boundary
- CCR Unit Area (Approximate)

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)



Stantec TVA

U:\TVA-EIP\175568209_CUF_Phase2\gis\mxd\GW_TechMemo\CUF_GWTechMemo_FigA1_MonitoringWellNetwork_wPZ.mxd Revised: 2020-08-11 By: mbough

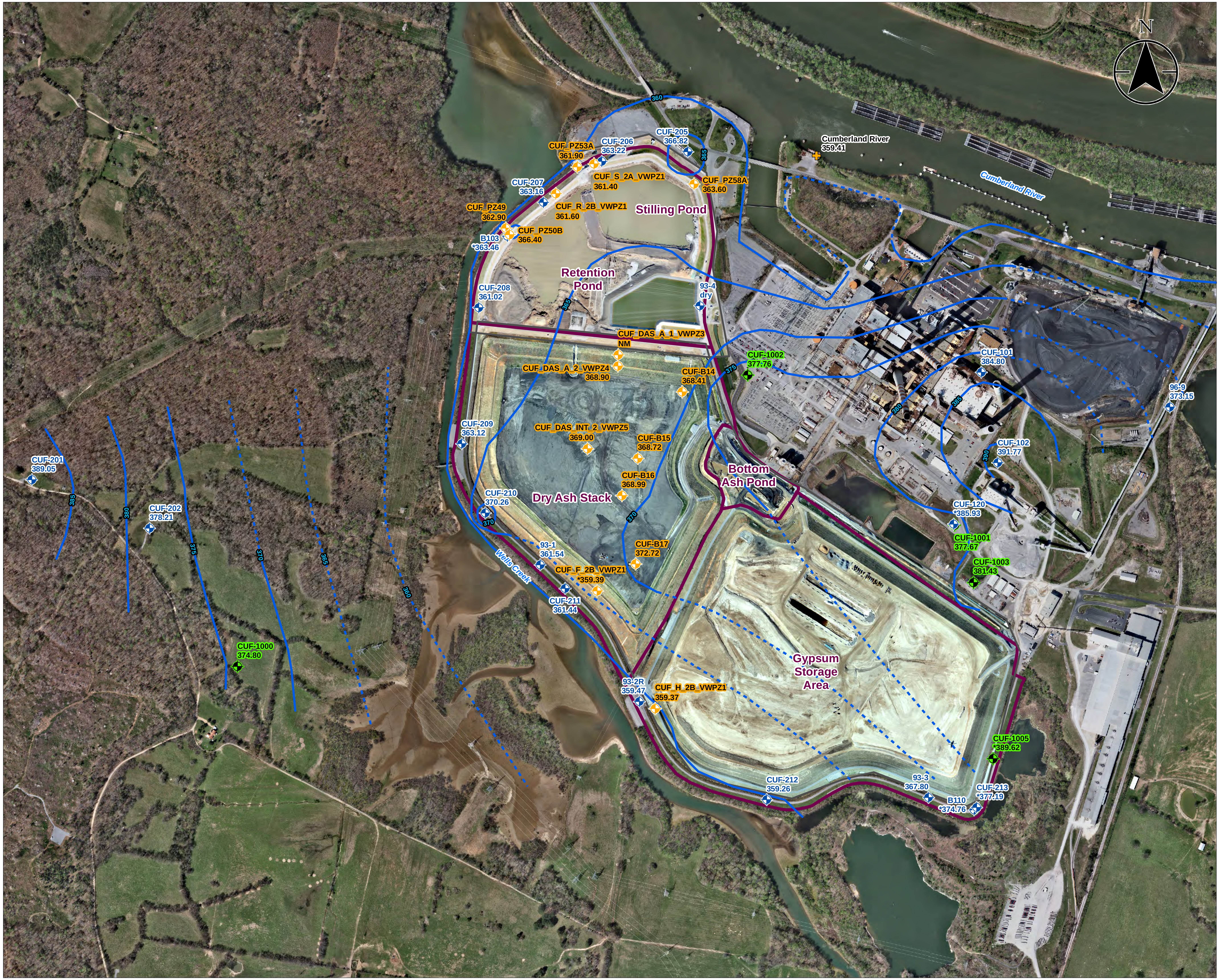


Exhibit No.

A.2

Title

Groundwater Elevation Contour Map Event #1 (May 6, 2019)

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location

175568209

Stewart County, Tennessee

Prepared by MB on 2020-08-11
Technical Review by MW on 2020-08-11

0 400 800 1,200 1,600 Feet

1:4,800 (At original document size of 22x34)

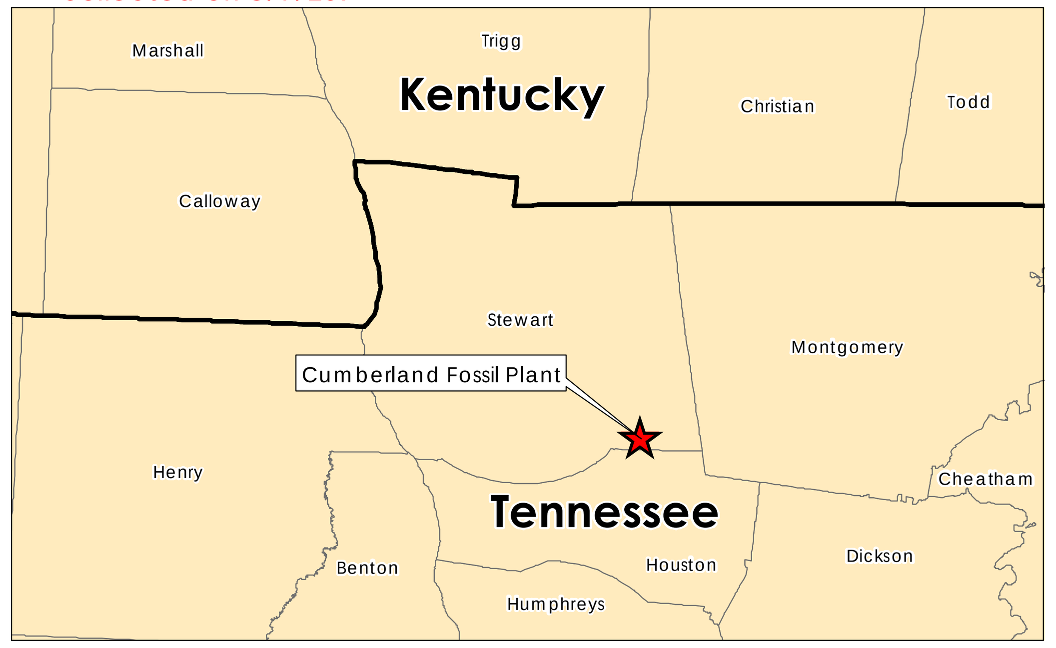
Legend

- Groundwater Investigation Monitoring Well groundwater elevation in feet above mean sea level (ft amsl)
- Other Monitoring Well groundwater elevation in ft amsl
- Piezometer groundwater elevation in ft amsl; NM is not measured
- Cumberland River Gauging Station surface water elevation in ft amsl
- Interpolated Groundwater Contour (5 ft interval; elevations are in ft amsl)
- Groundwater Contour (5 ft interval; elevations are in ft amsl)
- 2019 Imagery Boundary
- CCR Unit Area (Approximate)

*Groundwater elevation displayed but not used as input for contouring due to factors such as well construction or being screened in a different hydrogeologic unit.

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)
3. Groundwater contours were created using Surfer Version 16.1.350 (December 13, 2018) and manual adjustment
4. CUF-B14 data was collected on 5/8/19, and CUF-B15 data was collected on 5/7/19.



Stantec TVA

U:\TVA-EP\175568209_CUF_Phase2\gis\mxd\GW_TechMemo\CUF_GWTechMemo_Fig2_GroundwaterContour_wP2_Event1.mxd Revised: 2020-08-11 By: mbough

APPENDIX B - TABLES

TABLE B.1 – Groundwater Level Measurements
Cumberland Fossil Plant
May 2019

UNID	Well / Piezometer ID	Date Measured	Depth to Groundwater	Top of Casing Elevation	Groundwater Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
			ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft btoc	
CUF-00-GW-43-001	93-1	6-May-19	35.63	397.17	361.54	n/a	n/a	n/a	52.3 - 62.3	Alluvial Silts and Clays / Alluvial Sands and Gravels
CUF-00-GW-43-002	93-2R	6-May-19	38.41	397.88	359.47	n/a	n/a	n/a	62.3 - 72.0	Alluvial Sands and Gravels
CUF-00-GW-43-003	93-3	6-May-19	29.70	397.50	367.80	n/a	n/a	n/a	45.0 - 55.0	Alluvial Silts and Clays
CUF-00-GW-43-004	93-4	6-May-19	NM	397.34	NM	n/a	n/a	n/a	27.2 - 36.6	Bedrock: Limestone
CUF-00-GW-43-005	96-9	6-May-19	19.44	392.59	373.15	n/a	n/a	n/a	16.1 - 30.9	Bedrock: Fernvale and Hermitage Limestones
CUF-00-GW-43-006	B103	6-May-19	32.51	395.97	363.46	n/a	n/a	n/a	74.0 - 84.0	Alluvial Silts and Clays
CUF-00-GW-43-007	B110	6-May-19	23.51	398.27	374.76	n/a	n/a	n/a	48.3 - 52.5	Alluvial Silts and Clays
CUF-00-GW-43-008	CUF-101	6-May-19	0.88	385.68	384.80	n/a	n/a	n/a	2.0 - 17.2	Clay
CUF-00-GW-43-009	CUF-102	6-May-19	11.16	402.93	391.77	n/a	n/a	n/a	3.8 - 13.8	Bedrock: Limestone
CUF-00-GW-43-010	CUF-120	6-May-19	7.26	393.19	385.93	n/a	n/a	n/a	9.3 - 14.3	Bedrock
CUF-00-GW-43-011	CUF-201	6-May-19	11.36	400.41	389.05	n/a	n/a	n/a	17.6 - 27.7	Alluvial Sands and Gravels
CUF-00-GW-43-012	CUF-202	6-May-19	5.07	383.28	378.21	n/a	n/a	n/a	14.3 - 19.6	Alluvial Sands and Gravels
CUF-00-GW-43-014	CUF-205	6-May-19	17.69	384.51	366.82	n/a	n/a	n/a	16.9 - 27.1	Alluvial Sands and Gravels
CUF-00-GW-43-015	CUF-206	6-May-19	35.47	398.67	363.20	n/a	n/a	n/a	82.7 - 92.9	Alluvial Sands and Gravels
CUF-00-GW-43-016	CUF-207	6-May-19	35.03	398.19	363.16	n/a	n/a	n/a	75.0 - 85.1	Alluvial Sands and Gravels
CUF-00-GW-43-017	CUF-208	6-May-19	37.36	398.38	361.02	n/a	n/a	n/a	47.9 - 58.0	Alluvial Sands and Gravels
CUF-00-GW-43-018	CUF-209	6-May-19	35.11	398.23	363.12	n/a	n/a	n/a	53.1 - 63.3	Alluvial Sands and Gravels
CUF-00-GW-43-019	CUF-210	6-May-19	27.94	398.20	370.26	n/a	n/a	n/a	63.5 - 68.5	Alluvial Sands and Gravels
CUF-00-GW-43-020	CUF-211	6-May-19	37.32	398.76	361.44	n/a	n/a	n/a	57.7 - 67.9	Alluvial Sands and Gravels
CUF-00-GW-43-021	CUF-212	6-May-19	39.45	398.71	359.26	n/a	n/a	n/a	62.6 - 72.8	Alluvial Sands and Gravels
CUF-00-GW-43-022	CUF-213	6-May-19	21.86	399.05	377.19	n/a	n/a	n/a	40.0 - 45.2	Alluvial Sands and Gravels
CUF-00-GW-43-026	CUF-1000	6-May-19	20.49	395.29	374.80	n/a	n/a	n/a	14.5 - 25.1	Alluvial Sands and Clay
CUF-00-GW-43-027	CUF-1001	6-May-19	16.08	393.75	377.67	n/a	n/a	n/a	15.8 - 20.6	Alluvial Silts and Clays / Alluvial Sands and Gravels
CUF-00-GW-43-028	CUF-1002	6-May-19	11.50	389.26	377.76	n/a	n/a	n/a	15.1 - 20.0	Alluvial Clay and Gravel
CUF-00-GW-43-029	CUF-1003	6-May-19	14.96	396.39	381.43	n/a	n/a	n/a	12.6 - 17.5	Alluvial Clay
CUF-00-GW-43-030	CUF-1005	6-May-19	9.96	399.58	389.62	n/a	n/a	n/a	18.2 - 28.8	Alluvial Silts and Clays / Alluvial Sands and Gravels
Piezometers										
n/a	B-14C	8-May-19	72.41	n/a	368.41	440.82	319.82	121.0	n/a	Alluvial Clay and Granular
n/a	B-15B	7-May-19	69.60	n/a	368.72	438.32	327.82	110.5	n/a	Alluvial Granular
n/a	B-16C	6-May-19	70.75	n/a	368.99	439.74	324.74	115.0	n/a	Alluvial Granular
n/a	B-17B	6-May-19	70.63	n/a	372.72	443.35	336.35	107.0	n/a	Alluvial Granular
n/a	CUF_PZ49	7-May-19	16.27	n/a	362.93	379.2	322.2	57.0	n/a	Alluvial Granular
n/a	CUF_PZ50B	7-May-19	28.09	n/a	366.41	394.5	355.5	39.0	n/a	Alluvial Granular
n/a	CUF_PZ53A	7-May-19	14.08	n/a	361.92	376	311.0	65.0	n/a	Alluvial Granular
n/a	CUF_PZ58A	7-May-19	31.21	n/a	363.59	394.8	349.3	45.5	n/a	Alluvial Granular
n/a	CUF_R_2B_VWPZ1	7-May-19	33.68	n/a	361.62	395.3	310.0	85.3	n/a	Alluvial Granular
n/a	CUF_S_2A_VWPZ1	7-May-19	33.93	n/a	361.37	395.3	299.7	95.6	n/a	Alluvial Granular
n/a	CUF_F_2B_VWPZ1	7-May-19	52.71	n/a	359.39	412.1	322.1	90.0	n/a	Alluvial Granular
n/a	CUF_DAS_A_1_VWPZ3	n/a	NM	n/a	NM	388	293.0	95.0	n/a	Alluvial Granular
n/a	CUF_DAS_A_2_VWPZ4	7-May-19	44.00	n/a	368.90	412.9	308.4	104.5	n/a	Alluvial Granular
n/a	CUF_DAS_INT_2_VWPZ5	7-May-19	65.49	n/a	369.01	434.5	313.5	121.0	n/a	Alluvial Granular
n/a	CUF_H_2B_VWPZ1	7-May-19	51.33	n/a	359.37	410.7	322.7	88.0	n/a	Alluvial Granular
Surface Water Gauge										
Cumberland River gauge	n/a	6-May-19	n/a	n/a	359.41	n/a	n/a	n/a	n/a	n/a

See notes on last page.

TABLE B.1 – Groundwater Level Measurements
Cumberland Fossil Plant
May 2019

UNID	Well / Piezometer ID	Date Measured	Depth to Groundwater	Top of Casing Elevation	Groundwater Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
			ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft btoc	

Notes:

bgs	below ground surface
btoc	below top of casing
ft	feet
ID	identification
msl	mean sea level
n/a	not applicable
NM	not measured
UNID	Unique Numerical Identification

1. Top of casing elevations, screen intervals, and screened formations were obtained from the TVA Well Inventory Log provided by TVA.
2. Cumberland River data point is the reading at 1200 recorded by the automated staff gauge provided by TVA.
3. Ground Surface Elevation, groundwater elevations and piezometer data obtained from Geotech instrumentation database. Vibrating wire sensor formation information obtained from boring logs.
4. Depth to groundwater and groundwater elevations are calculated values.
5. Piezometer CUF_DAS_A_1_VWPZ3 was not recording data during this sampling event (May 6-10, 2019).

TABLE B.2 – Summary of Groundwater Samples
Cumberland Fossil Plant
May 2019

			Analysis Type								
Location ID	**Sample ID**	**Sample Type**	Field Parameters	Total Metals	Total Mercury	Anions	Alkalinity	Total Dissolved Solids	Radium-226	Radium-228	Radium-226+228
CUF-1000	CUF-GW-026-20190507	Normal Environmental Sample	x	x	x	x	x	x	x	x	x
	CUF-GW-DUP01-20190507	Field Duplicate Sample		x	x	x	x	x	x	x	x
CUF-1001	CUF-GW-027-20190508	Normal Environmental Sample	x	x	x	x	x	x	x	x	x
CUF-1002	CUF-GW-028-20190509	Normal Environmental Sample	x	x	x	x	x	x	x	x	x
CUF-1003	CUF-GW-029-20190508	Normal Environmental Sample	x	x	x	x	x	x	x	x	x
CUF-1005	CUF-GW-030-20190509	Normal Environmental Sample	x	x	x	x	x	x	x	x	x

Notes:

Total and Dissolved Metals	SW-846 6020A
Total and Dissolved Mercury	SW-846 7470A
Anions	SW-846 9056A
Alkalinity	SM2320B
Total Dissolved Solids	SM2540C
Radium-226	EPA 903.0
Radium-228	EPA 904.0
Radium-226+228	CALC
ID	identification

1. Field and laboratory quality control sample results except for field duplicates are not included in report tables but were used for data validation.
2. CEC collected split samples from CUF-1001, CUF-1002, and CUF-1003.

TABLE B.3 – Summary of Groundwater Quality Parameters
Cumberland Fossil Plant
May 2019

Sample Location Sample Date Sample ID Sample Depth Sample Type Level of Review	Units	CUF-1000 7-May-19 CUF-GW-026-20190507 24 ft Normal Environmental Sample Final QC Review	CUF-1001 8-May-19 CUF-GW-027-20190508 19 ft Normal Environmental Sample Final QC Review	CUF-1002 9-May-19 CUF-GW-028-20190509 18 ft Normal Environmental Sample Final QC Review	CUF-1003 8-May-19 CUF-GW-029-20190508 16.8 ft Normal Environmental Sample Final QC Review	CUF-1005 9-May-19 CUF-GW-030-20190509 24 ft Normal Environmental Sample Final QC Review
Field Parameters						
Dissolved Oxygen	%	75.2	4.9	2.9	30.4	5.8
Dissolved Oxygen	mg/L	7.24	0.47	0.28	2.83	0.53
ORP	mV	140.2	-71.1	34.6	121.9	129.1
pH (field)	SU	7.39	7.15	6.71	6.48	9.87
Specific Cond. (Field)	uS/cm	408.2	1,285	1,273	3,412	3,205
Temperature, Water (C)	DEG C	17.2	17.5	16.4	19.0	16.7
Turbidity, field	NTU	2.90	0.49	8.35	1.10	0.37

Notes:

%	percent
Cond.	conductance
DEG C	degrees Celsius
ft	feet below top of casing
ID	identification
mg/L	milligrams per Liter
mV	milliVolts
NTU	Nephelometric Turbidity Unit
ORP	Oxidation Reduction Potential, measured using a silver reference electrode which has a standard potential of 200 mV
SU	Standard Units
uS/cm	microSiemens per centimeter

Stantec

TABLE B.4 - Groundwater Analytical Results for Metals, Anions, and General Chemistry
Cumberland Fossil Plant
May 2019

Sample Location				CUF-1000		CUF-1001	CUF-1002	CUF-1003	CUF-1005
Sample Date				7-May-19	7-May-19	8-May-19	9-May-19	8-May-19	9-May-19
Sample ID				CUF-GW-026-20190507	CUF-GW-DUP01-20190507	CUF-GW-027-20190508	CUF-GW-028-20190509	CUF-GW-029-20190508	CUF-GW-030-20190509
Sample Depth				24 ft	24 ft	19 ft	18 ft	16.8 ft	24 ft
Sample Type				Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Level of Review	Units	EPA MCLs	CCR Rule GWPS	Validated	Validated	Final-Verified	Final-Verified	Final-Verified	Final-Verified
Total Metals									
Antimony	ug/L	6[A]	n/v	<0.378	0.462 J	<0.378	<0.378	<0.378	1.86 J
Arsenic	ug/L	10[A]	n/v	0.696 U*	0.848 U*	0.520 U*	3.05	0.335 U*	4.94
Barium	ug/L	2,000[A]	n/v	33.7	34.5	62.3	75.2	42.3	101
Beryllium	ug/L	4[A]	n/v	<0.155	<0.155	<0.155	<0.155	<0.155	<0.155
Boron	ug/L	n/v	n/v	<30.3	<30.3	3,210	258 U*	24,900	29,100
Cadmium	ug/L	5[A]	n/v	<0.125	0.149 J	<0.125	<0.125	0.299 J	0.325 J
Calcium	ug/L	n/v	n/v	81,400	81,000	228,000	240,000	674,000	843,000
Chromium	ug/L	100[A]	n/v	3.81 U*	4.79 U*	1.56 U*	<1.53	3.19 U*	<1.53
Cobalt	ug/L	n/v	6[B]	0.0990 J	0.366 J	3.96	1.32	4.29	0.549
Copper	ug/L	n/v	n/v	1.06 J	1.12 J	<0.627	<0.627	3.04	1.44 J
Lead	ug/L	n/v	15[B]	<0.128	0.130 U*	<0.128	0.136 U*	<0.128	<0.128
Lithium	ug/L	n/v	40[B]	<3.14	<3.14	4.01 J	<3.14	5.65	22.6 U*
Magnesium	ug/L	n/v	n/v	2,330	2,310	25,200	33,700	70,700	1,260
Mercury	ug/L	2[A]	n/v	<0.101	<0.101	<0.101	<0.101	<0.101	<0.101
Molybdenum	ug/L	n/v	100[B]	<0.610	0.773 J	**225[B]**	1.83 J	**561[B]**	**1,030[B]**
Nickel	ug/L	100(TN MCL)[A]	n/v	1.17	1.32	3.96	2.35	6.03	1.19
Potassium	ug/L	n/v	n/v	316 J	377 J	8,240	1,760	29,100	37,900
Selenium	ug/L	50[A]	n/v	<2.62	<2.62	<2.62	<2.62	<2.62	15.4
Silver	ug/L	100(TN MCL)[A]	n/v	<0.121	<0.121	<0.121	<0.121	<0.121	<0.121
Sodium	ug/L	n/v	n/v	7,540	7,280	15,400	35,300	45,400	30,600
Thallium	ug/L	2[A]	n/v	<0.128	0.220 J	<0.128	<0.128	0.284 J	0.347 J
Vanadium	ug/L	n/v	n/v	2.88 U*	3.63 U*	1.34 U*	1.19 U*	2.43 U*	293
Zinc	ug/L	n/v	n/v	6.25	6.45	<3.22	9.13	7.99	<3.22
Anions									
Chloride	mg/L	n/v	n/v	3.00	2.16	40.6	43.2	305	320
Fluoride	mg/L	4,000[A]	n/v	0.273	0.256	0.169	0.313	0.125 J	0.161 J
Sulfate	mg/L	n/v	n/v	16.4	15.8	456	367	1,740	1,680
General Chemistry									
Alkalinity, Bicarbonate	mg/L	n/v	n/v	217	241	295	374	113	<5.00
Alkalinity, Carbonate	mg/L	n/v	n/v	<5.00	<5.00	<5.00	<5.00	<5.00	171
Alkalinity, Total as CaCO3	mg/L	n/v	n/v	217	241	295	374	113	195
Total Dissolved Solids	mg/L	n/v	n/v	233	230	975	957	3,210	3,410

Notes:

A	EPA Maximum Contaminant Level
B	CCR Rule GWPS (Federal Register / Vol. 83, No. 146 / Monday, July 30, 2018 / Rules and Regulations)
n/v	No standard/guideline value
6.5[A]	Concentration is greater than the indicated standard.
<0.03	analyte was not detected at a concentration greater than the Method Detection Limit
ft	feet below top of casing
ID	identification
J	quantitation is approximate due to limitations identified during data validation
mg/L	milligrams per Liter
U*	result should be considered "not detected" because it was detected in an associated field or laboratory blank at a similar level
ug/L	micrograms per Liter
(TN MCL)	Tennessee Maximum Contaminant Level

1. Level of review is defined in the Quality Assurance Project Plan.

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TABLE B.5 – Groundwater Analytical Results for Radiological Parameters
Cumberland Fossil Plant
May 2019

Sample Location				CUF-1000		CUF-1001	CUF-1002	CUF-1003	CUF-1005
Sample Date				7-May-19	7-May-19	8-May-19	9-May-19	8-May-19	9-May-19
Sample ID				CUF-GW-026-20190507	CUF-GW-DUP01-20190507	CUF-GW-027-20190508	CUF-GW-028-20190509	CUF-GW-029-20190508	CUF-GW-030-20190509
Sample Depth				24 ft	24 ft	19 ft	18 ft	16.8 ft	24 ft
Sample Type				Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Level of Review				Validated	Validated	Final-Verified	Final-Verified	Final-Verified	Final-Verified
	Units	EPA MCLs	CCR Rule GWPS						
Radiological Parameters									
Radium-226	pCi/L	n/v	n/v	0.0468 +/-(0.0595)U	-0.0101 +/-(0.0349)U	0.123 +/-(0.0796)	0.125 +/-(0.0837)	0.217 +/-(0.0944)	0.285 +/-(0.122)J
Radium-228	pCi/L	n/v	n/v	0.119 +/-(0.273)U	0.138 +/-(0.288)U	0.184 +/-(0.252)U	-0.198 +/-(0.292)U	0.331 +/-(0.313)U	0.147 +/-(0.278)U
Radium-226+228	pCi/L	5[A]	n/v	0.166 +/-(0.279)U	0.138 +/-(0.290)U	0.307 +/-(0.264)J	0.125 +/-(0.304)J	0.548 +/-(0.327)J	0.432 +/-(0.304)J

Notes:

A	EPA Maximum Contaminant Level
B	CCR Rule GWPS (Federal Register / Vol. 83, No. 146 / Monday, July 30, 2018 / Rules and Regulations)
n/v	No standard/guideline value
ft	feet below top of casing
ID	identification
J	quantitation is approximate due to limitations identified during data validation
pCi/L	picoCurie per Liter
U	not detected
UJ	compound was not detected, but the reporting or detection limit should be considered estimated due to a bias identified during data validation

1. Level of review is defined in the Quality Assurance Project Plan.

Stantec

APPENDIX H.5

GROUNDWATER INVESTIGATION EVENT #2 SAMPLING AND ANALYSIS REPORT

Cumberland Fossil Plant Groundwater Investigation Event #2 Sampling and Analysis Report

TDEC Commissioner's Order:
Environmental Investigation Plan
Cumberland Fossil Plant
Cumberland City, Tennessee

February 5, 2021

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

Revision Record

Revision	Description	Date
0	Submittal to TDEC	October 20, 2020
1	Addresses December 7, 2020 TDEC Review Comments and Issued for TDEC	February 5, 2021

Sign-off Sheet

This document entitled Cumberland Fossil Plant Groundwater Investigation Event #2 Sampling and Analysis Report was prepared by Stantec Consulting Services Inc. ("Stantec") for the account of Tennessee Valley Authority (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ______________________

Michael J. Winkler, LPG, Geologic Associate

Reviewed by ______________________

Carole M. Farr, PG, Senior Principal

Approved by J. M. Kerr, Jr.

James M. Kerr, Jr., PG, Senior Principal Geologist

Table of Contents

LIST OF APPENDICES

APPENDIX A - EXHIBITS

APPENDIX B - TABLES

Abbreviations

CCR	Coal Combustion Residuals
CCR Parameters	Constituents listed in Appendices III and IV of 40 CFR 257 and five inorganic constituents included in Appendix I of Tennessee Rule 0400-11-01-.04
CFR	Code of Federal Regulations
COC	Chain-of-Custody
CUF Plant	Cumberland Fossil Plant
DO	Dissolved Oxygen
EAR	Environmental Assessment Report
EIP	Environmental Investigation Plan
ENV	Environmental
EnvStds	Environmental Standards, Inc.
Event #2	Groundwater investigation sampling event performed July 8-10, 2019
FSP	Field Sampling Personnel
ft	Feet
ID	Identification
IDW	Investigation Derived Waste
mg/L	Milligrams per Liter
NTU	Nephelometric Turbidity Units
ORP	Oxidation-Reduction Potential
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
QC	Quality Control
SAP	Sampling and Analysis Plan
SAR	Sampling and Analysis Report
Stantec	Stantec Consulting Services Inc.
TDEC	Tennessee Department of Environment and Conservation
TDEC Order	Commissioner’s Order No. OGC15-0177
TestAmerica	Eurofins TestAmerica Inc.
TI	Technical Instruction
TVA	Tennessee Valley Authority
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) has prepared this sampling and analysis report (SAR) on behalf of the Tennessee Valley Authority (TVA) to document the completion of activities related to a groundwater investigation sampling event performed July 8-10, 2019 (Event #2) at TVA's Cumberland Fossil Plant (CUF Plant) located in Cumberland City, Tennessee.

The purpose of the groundwater investigation, upon completion of six groundwater sampling events, is to characterize groundwater conditions at the CUF Plant in support of fulfilling the requirements for the Tennessee Department of Environment and Conservation (TDEC) issued Commissioner's Order No. OGC15-0177 (TDEC Order) to TVA (TDEC 2015). The TDEC Order sets forth a "process for the investigation, assessment, and remediation of unacceptable risks" at TVA's coal ash disposal sites in Tennessee.

The purpose of this SAR is to document the work completed during groundwater sampling Event #2 of 6 total events and to present the information and data collected during the execution of the Groundwater Investigation Sampling and Analysis Plan (SAP) (Stantec 2018a). This SAR is not intended to provide conclusions or evaluations of results. The scope of the groundwater investigation represented herein was conducted pursuant to the SAP and is part of a larger environmental investigation at the CUF Plant. The data provided in this SAR are not inclusive of other programmatic data that exist for the site. The evaluation of the results will include data from the six groundwater sampling events and consider other aspects of the environmental investigation, as well as data collected under other State and/or coal combustion residuals (CCR) programs. This evaluation will be presented in the Environmental Assessment Report (EAR).

Event #2 activities were performed in general accordance with the following documents developed by TVA to support fulfilling the requirements of the TDEC Order at the CUF Plant.

- *Groundwater Investigation SAP* (Stantec 2018a)
- *Environmental Investigation Plan (EIP)* (Stantec 2018b)
- *Quality Assurance Project Plan (QAPP)* (Environmental Standards, Inc. 2018).

The Groundwater Investigation SAP was updated based on TVA- and TDEC-approved Programmatic- and Project-specific changes. Minor variations in scope and procedures from those outlined in the SAP occurred during field activities due to field conditions and programmatic updates and are referenced in Section 3.6.

Event #2 is the second in a series of six planned sampling events for the groundwater investigation. Stantec performed the field work activities for this event. Laboratory analysis of constituents was performed by Eurofins TestAmerica, Inc. (TestAmerica) in Pittsburgh, Pennsylvania and St. Louis, Missouri (radium samples only). Quality assurance oversight on data acquisition protocols, sampling practices, and data validation or verification was performed by Environmental Standards, Inc. (EnvStds) under direct contract to TVA.

This report summarizes the groundwater investigation activities for Event #2. The remaining sampling events will be completed before overall conclusions and findings about the groundwater investigation and groundwater conditions at the CUF Plant are made and documented in the EAR.

2.0 OBJECTIVE AND SCOPE

The primary objectives of the groundwater investigation conducted pursuant to the Groundwater Investigation SAP (which includes six sampling events) are to characterize existing groundwater quality and to evaluate groundwater flow conditions at the CUF Plant in response to the TDEC Order. The approach to characterizing the groundwater conditions is to:

- Collect groundwater samples for chemical analyses to evaluate the potential presence of constituents related to CCR in groundwater
- Measure groundwater and surface water elevations for subsequent evaluation of the direction and rate of groundwater flow.

The scope of work intended to achieve the objectives of the groundwater investigation consists of six sampling events at a frequency of one event every two months for one year to characterize seasonal groundwater quality and flow direction. This report describes the activities related to Event #2, performed in July 2019, the scope of which included:

- Collecting groundwater and surface water level measurements
- Collecting field measurements of groundwater quality parameters
- Collecting groundwater samples and associated quality control (QC) samples for laboratory analysis.

These activities were carried out after the installation of permanent monitoring wells specified in the Groundwater Investigation SAP. Details of the monitoring well installation activities are provided in the CUF Plant Hydrogeological Investigation SAR.

In addition, pore water measurements from piezometers and temporary wells installed in the CCR units at the CUF Plant are presented in this SAR for comparison with groundwater data. Temporary well and piezometer installation activities are described in the CUF Plant Exploratory Drilling SAR, and temporary well gauging and sampling information is provided in the CUF Plant CCR Material Characteristics SAR.

3.0 FIELD ACTIVITIES

Groundwater investigation field activities for Event #2 were conducted July 8-10, 2019. Stantec performed groundwater level measurements and sample collection activities based on guidance and specifications in TVA's Environmental (ENV) Technical Instructions (TIs), the SAP, the QAPP, and applicable United States Environmental Protection Agency (USEPA) documents except as noted in the Variations section of this report. As part of TVA's commitment to generate representative and reliable data, data validation, and/or verification of laboratory analytical results were performed by EnvStds under direct contract with TVA. EnvStds also conducted audits of field activities and provided quality reviews of field documentation.

During Event #2, Stantec conducted the following field activities:

- Measured groundwater levels at five monitoring wells installed for the TDEC Order, and 20 monitoring wells and 12 piezometers installed for other environmental programs (25 total monitoring wells)
- Measured pore water levels at six temporary wells and 27 piezometers installed in the CCR units
- Measured the surface water level at one location in the Cumberland River
- Collected groundwater samples from four monitoring wells installed for the TDEC Order
- Recorded field measurements of groundwater quality parameters during purging and stabilization at the sampled monitoring wells
- Collected QC samples including one field duplicate, one matrix spike/matrix spike duplicate/lab duplicate, two field blanks, and one equipment blank
- Transported the collected samples to the TestAmerica facility in Nashville, Tennessee.

Details on each activity are presented in the sections below.

3.1 WORK LOCATIONS

The TDEC Order CCR units at the CUF Plant (the Stilling Pond, including the Retention Pond, the Dry Ash Stack, the Bottom Ash Pond, and the Gypsum Storage Area) as well as the monitoring wells, temporary wells, and piezometers sampled and/or gauged during Event #2 are shown on Exhibit A.1 in Appendix A. TVA is currently sampling groundwater at the CUF Plant for TDEC Solid Waste Management permit requirements and the USEPA CCR Rule codified in Title 40 of the Code of Federal Regulations (CFR) Part 257 (40 CFR 257). Monitoring wells that are sampled as part of other environmental programs are not sampled as part of the groundwater investigation for the TDEC Order.

Groundwater levels were measured in TDEC Order monitoring wells, as well as in select additional wells and piezometers from other environmental programs, as shown in Table B.1a in Appendix B to provide information to prepare groundwater contour maps for this SAR and the CUF Plant EAR. Pore water levels measured in temporary wells and piezometers installed in the CCR units are presented in Table B.1b. The groundwater elevation contour map, including pore water elevations, is shown on Exhibit A.2 in Appendix A.

Groundwater analytical and field duplicate samples were collected from the TDEC Order groundwater investigation monitoring wells as shown in Table B.2 in Appendix B. Groundwater analytical data collected for the TDEC Order and other environmental programs will be provided in the EAR.

3.2 DOCUMENTATION

Stantec maintained field documentation in accordance with ENV-TI-05.80.03, *Field Record Keeping*, and the QAPP. Field activities and data were recorded on program-specific field forms. Health and safety forms were completed in accordance with TVA and Stantec health and safety requirements. Additional information regarding field documentation is provided below.

3.2.1 Field Forms

Stantec used program-specific field forms to record field observations and data for specific activities. Field forms used during the groundwater investigation included:

- *Daily Field Activity Log*
- *Monitoring Well Inspection Checklist*
- *Equipment Calibration Form*
- *Groundwater Level Measurement Form*
- *Groundwater Sampling Form*
- *Chain-of-Custody (COC).*

3.2.1.1 Daily Field Activity Log

Stantec field sampling personnel (FSP) recorded field activities, observations, and data on a *Daily Field Activity Log* to chronologically document the field program. Deviations from the SAP, TIs, or QAPP were documented on the *Daily Field Activity Log*.

3.2.1.2 Monitoring Well Inspection Checklist

Prior to measuring water levels, Stantec FSP inspected each monitoring well for damage or indications that the well integrity had been compromised in accordance with ENV-TI-05.80.21, *Monitoring Well Inspection and Maintenance.* Inspection results were documented on a *Monitoring Well Inspection Checklist*. No signs of damage or necessary repairs were noted during Event #2.

3.2.1.3 Equipment Calibration Form

Stantec FSP performed daily calibration of the water quality meter and turbidity meter and documented the results on an *Equipment Calibration Form*. The form documented the calibration results for temperature, turbidity, specific conductance, pH, dissolved oxygen (DO), and oxidation-reduction potential (ORP), and verified that the field instruments' sensors were operating within acceptance criteria. Refer to Section 3.2.2 for additional details on equipment calibration procedures.

3.2.1.4 Groundwater Level Measurement Form

Stantec FSP recorded groundwater level field measurement data on a *Groundwater Level Measurement Form* in accordance with ENV-TI-05.80.44, *Groundwater Level and Well Depth Measurement*. The form includes the monitoring well identification (ID), time, and depth to water measured from a standardized reference point on the top of each well casing, recorded in feet (ft) below top of casing.

3.2.1.5 Groundwater Sampling Form

Stantec FSP recorded the depth to water, purge flow rate, volume of groundwater purged, temperature, pH, specific conductance, DO, ORP, turbidity, color of water, and other observations during groundwater purging and sampling activities at each monitoring well in accordance with ENV-TI-05.80.42, *Groundwater Sampling*. Field measurements were recorded on a *Groundwater Sampling Form*. The form also documents the time intervals between measurement of field parameters, low-flow extraction rates, water level drawdown, and water quality parameter measurements until stabilization criteria were met.

3.2.1.6 Chain-of-Custody

Stantec FSP completed *COC* documentation for each groundwater sample collected. The sample ID, sample location, type of sample, sampling date and time, analyses requested, sample pH, and sample custody record were recorded on the *COC*. The Field Team Leader reviewed the *COC* for completeness, and the FSP conducted a QC check of samples in each cooler compared to sample IDs on the corresponding *COC*. *COCs* were completed in accordance with ENV-TI-05.80.02, *Sample Labeling and Custody*.

3.2.2 Equipment Calibration

Field instruments used to collect, generate, or measure water quality parameters were calibrated each day prior to use as specified in the SAP, QAPP, and ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde.* Afternoon calibration verifications were performed to evaluate if these instruments remained within acceptance criteria during sampling. Temperature and barometric pressure instrument readings were verified using a calibrated National Institute of Standards and Technology traceable thermometer and National Weather Service (via mesowest.utah.edu) barometric pressure readings for Clarksville Outlaw Field (KCKV) in Clarksville, Tennessee, respectively. Additional details regarding equipment calibration were recorded on an *Equipment Calibration Form*, as described in Section 3.2.1.3.

3.3 SAMPLING METHODS

The following sections present monitoring well data collection and sampling procedures used during Event #2. As approved by TDEC, monitoring well CUF-1004 was not gauged or sampled during this event because it was not installed as part of the hydrogeologic investigation.

3.3.1 Static Water Level Measurements

FSP measured static groundwater levels at 25 monitoring wells and pore water levels at six temporary wells in accordance with ENV-TI-05.80.44, *Groundwater Level and Well Depth Measurement*. On July 8, 2019, static groundwater and pore water level readings were measured and recorded to the nearest 0.01 ft from a reference point on the top of each well casing using an electronic water level indicator. Water level indicator probes were decontaminated prior to the first use and between measurements, and the decontamination was documented as specified in ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination.* Depth to groundwater and pore water measurements were recorded on a *Groundwater Level Measurement Form*. A water level measurement could not be obtained at monitoring well 93-4 because the water level indicator probe stopped at the top of the dedicated pump and no water was encountered.

Groundwater and pore water measurements were also obtained from transducers installed within 12 and 27 piezometers, respectively. Additionally, a surface water level measurement for the Cumberland River was provided by TVA using the reading at 1150 Central Daylight Time (the reading recorded closest to noon) recorded by an automated staff gauge. The surface water staff gauge location is shown on Exhibit A.1 in Appendix A.

Groundwater level data and pore water level data are shown in Tables B.1a and B.1b, respectively, in Appendix B. A groundwater elevation contour map based on groundwater measurements in wells and piezometers, along with pore water elevations, are included on Exhibit A.2 in Appendix A.

3.3.2 Groundwater Purging & Sampling

Analytical and field duplicate samples (as specified in the SAP) were collected from four monitoring wells as shown in Table B.2 in Appendix B. Monitoring wells were purged using dedicated bladder pumps equipped with dedicated tubing using low-flow purging and sampling techniques as specified in ENV-TI-05.80.42, *Groundwater Sampling*. A groundwater sample was not collected from well CUF-1000 because less than 0.1 ft of water was present in the sump/end cap of the well and was not indicative of groundwater; the well was considered dry.

During the purging process, water quality field parameters including pH, specific conductance, temperature, ORP, and DO were measured using water quality meters (YSI ProPlus with flow-through cell) and recorded on field forms. Depth to water and turbidity were measured and recorded using decontaminated electronic water-level indicators (Heron Dipper-T) and calibrated turbidimeters (Hach 2100Q). Field parameters were measured and recorded on *Groundwater Sampling Forms* during purging until readings were stabilized as specified in the SAP. Well purging was considered complete when three consecutive readings were within the following stabilization limits:

- pH – ± 0.1 Standard Units
- Specific Conductance – ± 5% microSiemens per centimeter
- Turbidity – Less than 10 Nephelometric Turbidity Units (NTUs) or ± 10% for values above 10 NTUs
- DO – Less than 0.5 milligrams per Liter (mg/L) or ± 10% for values above 0.5 mg/L.

After water quality stabilization criteria were achieved, the final field parameter results were recorded, purging was discontinued, and a sample was collected as specified in the SAP. Laboratory-provided, pre-preserved sample containers were filled directly from the pump discharge line. FSP wore new, clean nitrile gloves when handling sample containers and did not touch the interior of containers or container caps. New gloves were used when handling each sample. When filling sample bottles, care was taken to minimize sample aeration (i.e., water was directed down the inner walls of the sample bottle) and to avoid overfilling and diluting preservatives. Each sample bottle was capped before filling the next bottle. Following completion of sampling, final turbidity measurements were made.

Sample containers were labeled and handled in accordance with ENV-TI-05.80.02, *Sample Labeling and Custody.* FSP secured caps on each bottle, attached a custody seal across the cap, and placed the bottles in a cooler on ice within 15 minutes of collection. QC samples were collected in accordance with ENV-TI-05.80.04, *Field Sampling Quality Control.*

Groundwater samples were analyzed for the CCR-related constituents listed in Appendices III and IV of 40 CFR 257. In addition, five inorganic constituents listed in Appendix I of Tennessee Rule 0400-11-01-.04 and not included in the 40 CFR 257 Appendices III and IV were analyzed to maintain continuity with TDEC environmental programs. These additional TDEC Appendix I constituents included copper, nickel, silver, vanadium, and zinc. The combined federal CCR Appendices III and IV constituents and TDEC Appendix I inorganic constituents will hereafter be referred to collectively as “CCR Parameters.” For geochemical evaluation, major cations/anions not included in the CCR Parameters were included in the analyses. The additional geochemical parameters included bicarbonate, carbonate, magnesium, potassium, and sodium.

3.4 INVESTIGATION DERIVED WASTE

Investigation derived waste (IDW) generated during groundwater investigation activities included:

- Used calibration solutions
- Purge water
- Decontamination fluids
- Disposable personal protective equipment (PPE)
- General trash.

IDW was handled in accordance with ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*; ENV-TI-05.80.42, *Groundwater Sampling* (purge water); the CUF Plant-specific waste management plan; and local, state, and federal regulations. Transportation and disposal of IDW was coordinated with CUF Plant facility management. Used calibration solution was containerized and stored for disposal as directed by the CUF Plant facility management. Purge water and decontamination fluids were containerized for later disposal as specified in the CUF Plant-specific waste management plan. Used disposable PPE (e.g., nitrile gloves) and general trash generated throughout the day were placed in garbage bags and disposed of in a general trash dumpster onsite at the end of each day.

3.5 SAMPLE SHIPMENT

Samples were packed and shipped under *COC* procedures specified in ENV-TI-05.80.06, *Handling and Shipping of Samples*. The samples were transported by Stantec personnel directly to TestAmerica in Nashville, Tennessee. Samples were shipped by TestAmerica from the Nashville, Tennessee, facility to the Pittsburgh, Pennsylvania, laboratory for official sample login. Once samples were logged in, the radium samples were shipped under internal lab protocols to the TestAmerica St. Louis, Missouri, laboratory. TestAmerica submitted sample receipt confirmation forms to EnvStds for review and confirmation.

3.6 VARIATIONS

The proposed scope and procedures for the groundwater investigation were outlined in the SAP, QAPP, and applicable TVA TIs as detailed in the sections above. Variations in scope or procedures discussed with TDEC and/or TVA, changes based on field conditions, or additional field sampling performed to complete the scope of work in the SAP are described in the following sections. As discussed below, these variations do not impact the overall usability and representativeness of the dataset provided in this SAR for groundwater investigation sampling Event #2 at the CUF Plant.

3.6.1 Variations in Scope

Variations in scope are provided below.

- A surface water level measurement was not obtained for Wells Creek because a water level gauge had not yet been installed due to concerns of safe access to that location; however, a surface water measurement was obtained from the Cumberland River. Once the gauge is installed in Wells Creek, surface water measurements will be collected.
- A groundwater sample was not collected from well CUF-1000 because less than 0.1 ft of water was present in the sump/end cap of the well and was not indicative of groundwater; the well was considered dry
- Groundwater level gauging and sampling was not performed at well CUF-1004 as specified in the SAP because it was not installed (the three borings drilled in that area were dry). This change in scope was approved by TDEC.

3.6.2 Variations in Procedures

There were no variations in procedures during the groundwater investigation sampling Event #2 at the CUF Plant.

4.0 SUMMARY

The data presented in this report are only for groundwater investigation sampling Event #2 at the CUF Plant. The scope of work for Event #2 was to:

- Collect groundwater samples for chemical analyses to assist with subsequent evaluation of the potential presence of CCR-related constituents in groundwater
- Measure groundwater and surface water elevations to assist with subsequent evaluation of groundwater flow direction and rate after multiple data sets have been collected.

In addition, pore water measurements from piezometers and temporary wells installed in the CCR units at the CUF Plant are presented in this SAR for comparison with groundwater data.

Event #2 included collecting groundwater level measurements at 25 monitoring wells and 12 piezometers; pore water measurements at six temporary wells and 27 piezometers in the CCR units; and a surface water measurement at one gauge located in the Cumberland River. Groundwater and surface water measurements and elevations are provided in Table B.1a, and pore water measurements and elevations are provided in Table B.1b, and depicted on Exhibit A.2.

Groundwater quality measurements and groundwater analytical samples were collected at four monitoring wells as summarized in Table B.2. Groundwater quality parameters were recorded during purging. Stabilization criteria for pH, specific conductance, turbidity, and DO were achieved at each sampling location. The final measurements prior to initiating sample collection are presented in Table B.3.

Groundwater analytical data for CCR Parameters and geochemical parameters are presented in Table B.4. Analytical data for radium analyses are presented in Table B.5. Analytical data were reported by TestAmerica and validated or verified by EnvStds.

Stantec has completed Event #2 of the groundwater investigation at the CUF Plant in Cumberland City, Tennessee, in accordance with the Groundwater Investigation SAP as documented herein. The data collected during Event #2 are usable for reporting and evaluation in the EAR and meet the objectives of the TDEC Order EIP. The complete datasets from the six groundwater sampling events will be evaluated along with data collected under other TDEC Order SAPs, as well as data collected under other State and CCR programs. This evaluation will be provided in the EAR.

5.0 REFERENCES

Environmental Standards, Inc. 2018. *Quality Assurance Project Plan for the Tennessee Valley Authority Cumberland Fossil Plant Environmental Investigation*. Prepared for Tennessee Valley Authority. Revision 2. January 2018.

Stantec Consulting Services Inc. (Stantec). 2018a. *Groundwater Investigation Sampling and Analysis Plan (SAP), Cumberland Fossil Plant.* Revision 3 Final. Prepared for Tennessee Valley Authority. June 25, 2018.

Stantec. 2018b. *Environmental Investigation Plan, Cumberland Fossil Plant.* Revision 3 Final. Prepared for Tennessee Valley Authority. June 25, 2018.

Tennessee Department of Environment and Conservation. 2015. *Commissioner's Order No. OGC15-0177.*

Tennessee Valley Authority (TVA). ENV-TI-05.80.02, *Sample Labeling and Custody*.

TVA, ENV-TI-05.80.03. *Field Record Keeping*.

TVA, ENV-TI-05.80.04. *Field Sampling Quality Control*.

TVA, ENV-TI-05.80.05. *Field Sampling Equipment Cleaning and Decontamination*.

TVA, ENV-TI-05.80.06. *Handling and Shipping of Samples*.

TVA, ENV-TI-05.80.21. *Monitoring Well Inspection and Maintenance*.

TVA, ENV-TI-05.80.42. *Groundwater Sampling*.

TVA, ENV-TI-05.80.44. *Groundwater Level and Well Depth Measurement*.

TVA, ENV-TI-05.80.46. *Field Measurement Using a Multi-Parameter Sonde*.

APPENDIX A - EXHIBITS

Exhibit No.

A.1

Title

Monitoring Well Network

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location 175568209

Stewart County, Tennessee

Prepared by MB on 2020-09-14
Technical Review by MW on 2020-09-14

0 400 800 1,200 1,600 Feet

1:4,800 (At original document size of 22x34)

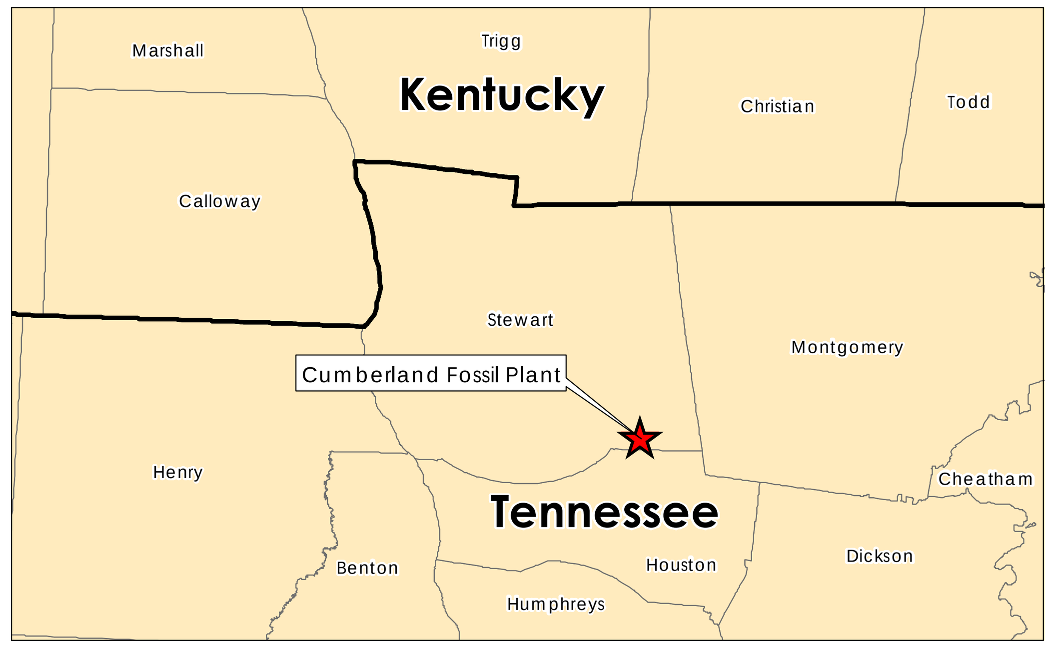
Legend

- Groundwater Investigation Monitoring Well
- Other Monitoring Well
- Piezometer
- Pore Water Piezometer in CCR Material
- Temporary Well within CCR Material
- Cumberland River Gauging Station
- 2019 Imagery Boundary
- CCR Unit Area (Approximate)

CCR: Coal combustion residuals

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)



Stantec TVA

Exhibit No.
A.2

Title

Groundwater Elevation Contour Map, Event #2 (July 8, 2019)

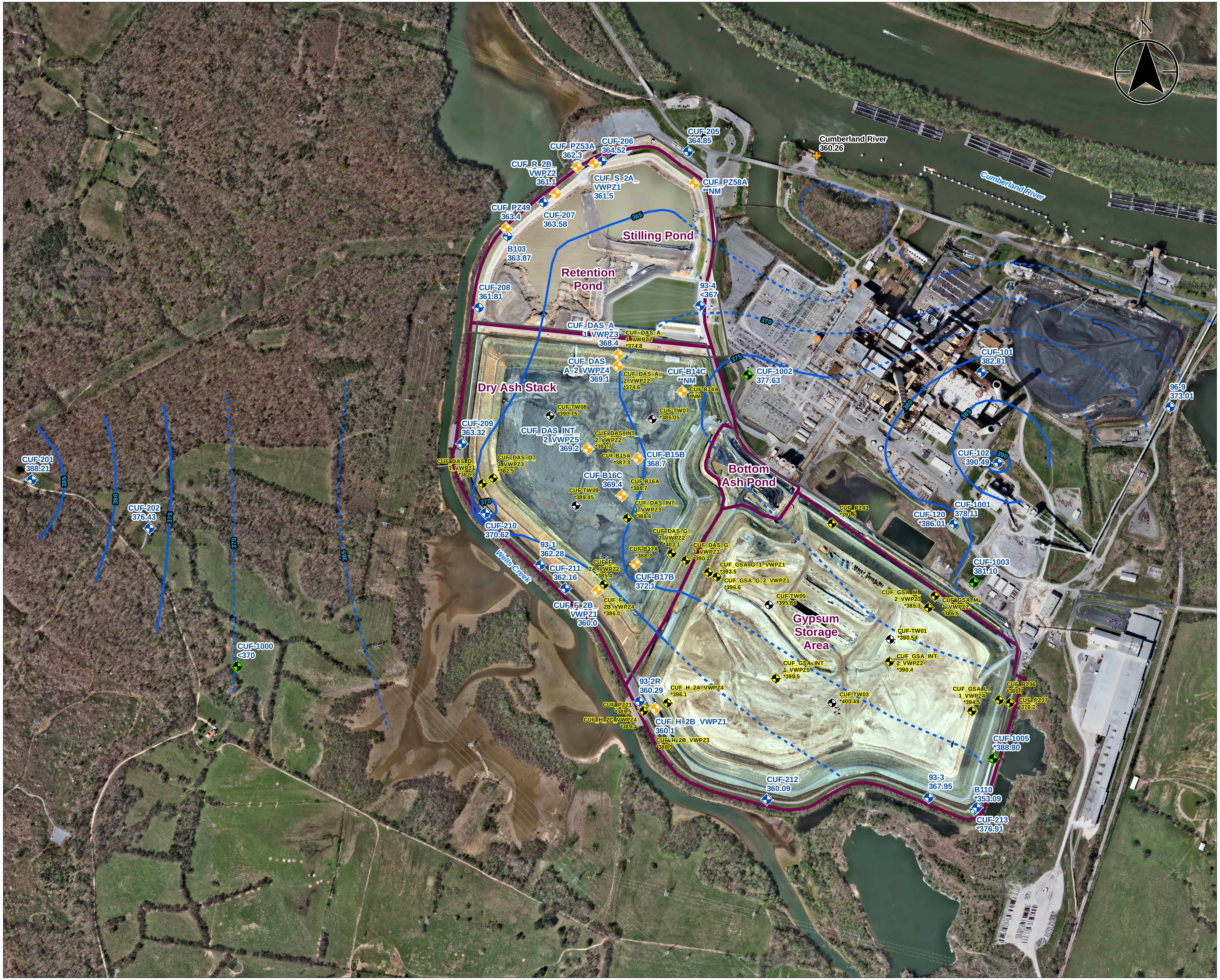
Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location
Stewart County, Tennessee

175568209
Prepared by MB on 2021-02-11
Technical Review by MD on 2021-02-11

0 400 800 1,200 1,600 Feet
1:4,800 (At original document size of 22x34)



Legend

Groundwater Investigation Monitoring Well
groundwater elevation in feet above mean sea level (ft amsl)

Other Monitoring Well
groundwater elevation in ft amsl

Piezometer
groundwater elevation in ft amsl

Piezometer in CCR
pore water elevation in ft amsl; value not used for contouring

Temporary well in CCR
pore water elevation in ft amsl; value not used for contouring

Cumberland River Gauging Station
surface water elevation in ft amsl

Interpolated Groundwater Contour (5 ft interval; elevations are in ft amsl)

Groundwater Contour (5 ft interval; elevations are in ft amsl)

2019 Imagery Boundary

CCR Unit Area (Approximate)

CCR: Coal combustion residuals

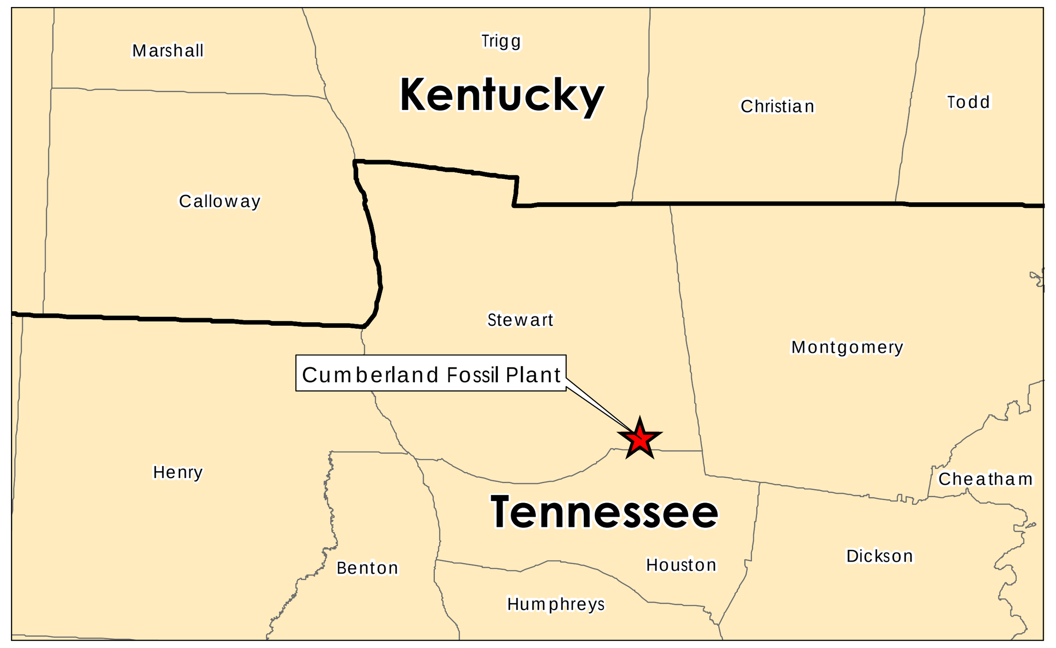
< Groundwater elevations are rounded to nearest foot to constrain potential elevation when depth to groundwater could not be measured.

*Groundwater elevation displayed but not used as input for contouring due to factors such as well construction or being screened in a different hydrogeologic unit.

**Piezometers were not collecting groundwater measurements during this monitoring event.

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)
3. Groundwater contours were created using Surfer Version 16.1.350 (December 13, 2018) and manual adjustment
4. For PZ's with multiple instruments in CCR material, the reading with the highest pore water elevation is displayed, unless that reading is suspected of being erroneous.



Stantec TVA

U:\TVA-EP\175568209_CUF_Phase2\gis\mxd\GW_TechMemo\CUF_GWTechMemo_FigA2_GroundwaterContour_wPZ_Event2v2porewater.mxd Revised: 2021-02-11 By: mbough

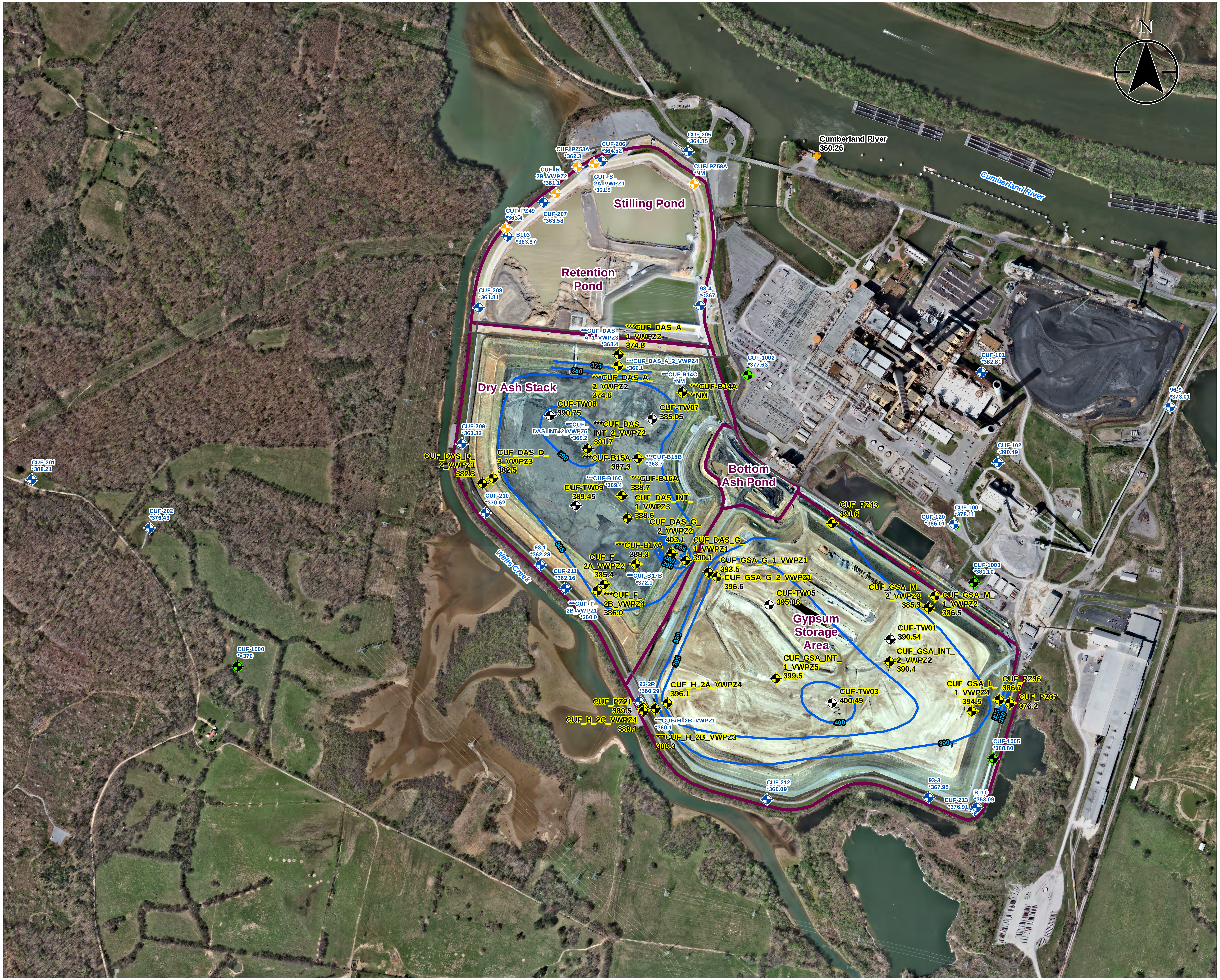


Exhibit No.

A.3

Title

Pore water Elevation Contour Map, Event #2 (July 8, 2019)

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location 175568209

Stewart County, Tennessee

Prepared by MB on 2021-02-11
Technical Review by MD on 2021-02-11

0 400 800 1,200 1,600 Feet

1:4,800 (At original document size of 22x34)

Legend

- Groundwater Investigation Monitoring Well: groundwater elevation in feet above mean sea level (ft amsl); value not used for contouring
- Other Monitoring Well: groundwater elevation in ft amsl; value not used for contouring
- Piezometer: groundwater elevation in ft amsl; value not used for contouring
- Piezometer in CCR: pore water elevation in ft amsl
- Temporary well in CCR: pore water elevation in ft amsl
- Cumberland River Gauging Station: surface water elevation in ft amsl
- Interpolated Pore water Contour (5 ft interval; elevations are in ft amsl)
- Pore water Contour (5 ft interval; elevations are in ft amsl)
- 2019 Imagery Boundary
- CCR Unit Area (Approximate)

CCR: Coal combustion residuals

< Groundwater elevations are rounded to nearest foot to constrain potential elevation when depth to groundwater could not be measured.

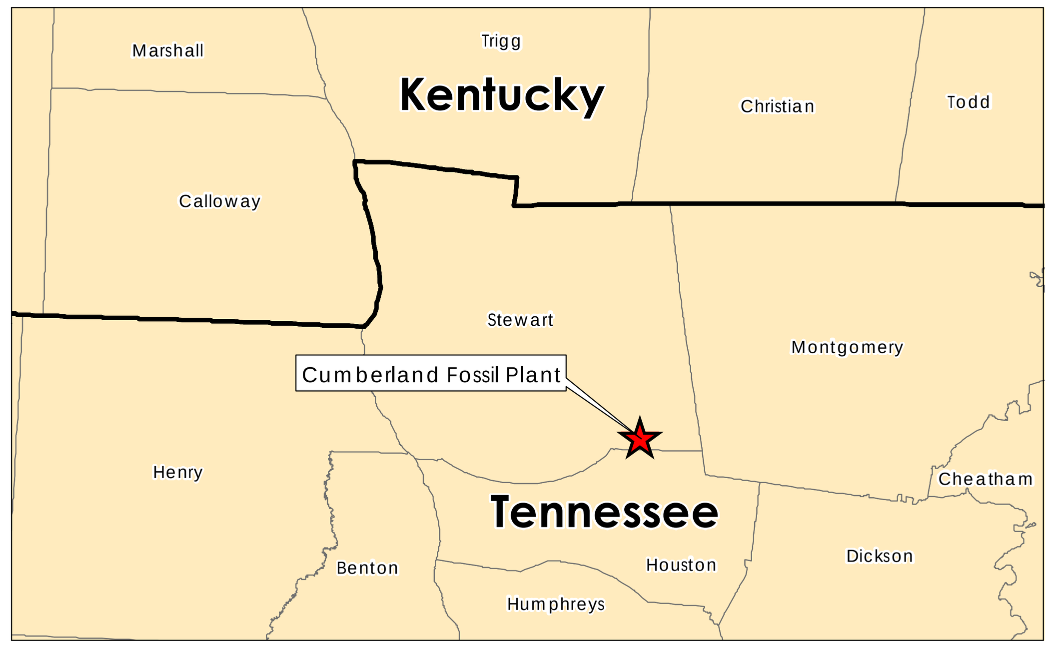
*Groundwater elevation displayed but not used as input for contouring due to factors such as well construction or being screened in a different hydrogeologic unit.

**Piezometer was not collecting groundwater measurements during this monitoring event.

***Nested VWPZ sensors monitoring pore water and groundwater elevations in the same borehole, and the location is shown by a single symbol.

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)
3. Pore water contours were created with manual adjustment using Surfer Version 16 (December 13, 2018)
4. For PZ's with multiple instruments in CCR material, the reading with the highest pore water elevation is displayed, unless that reading is suspected of being erroneous.



Stantec TVA

APPENDIX B - TABLES

TABLE B.1a – Groundwater Level Measurements
Cumberland Fossil Plant
July 2019

UNID	Well / Piezometer ID	Date Measured	Depth to Groundwater	Top of Casing Elevation	Groundwater Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
			ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft btoc	
CUF-00-GW-43-001	93-1	8-Jul-19	34.89	397.17	362.28	n/a	n/a	n/a	52.3 - 62.3	Alluvial Silts and Clays / Alluvial Sands and Gravels
CUF-00-GW-43-002	93-2R	8-Jul-19	37.59	397.88	360.29	n/a	n/a	n/a	62.3 - 72.0	Alluvial Sands and Gravels
CUF-00-GW-43-003	93-3	8-Jul-19	29.55	397.50	367.95	n/a	n/a	n/a	45.0 - 55.0	Alluvial Silts and Clays
CUF-00-GW-43-004	93-4	8-Jul-19	NM	397.34	NM	n/a	n/a	n/a	27.2 - 36.6	Bedrock: Limestone
CUF-00-GW-43-005	96-9	8-Jul-19	19.58	392.59	373.01	n/a	n/a	n/a	16.1 - 30.9	Bedrock: Fernvale and Hermitage Limestones
CUF-00-GW-43-006	B103	8-Jul-19	32.10	395.97	363.87	n/a	n/a	n/a	74.0 - 84.0	Alluvial Silts and Clays
CUF-00-GW-43-007	B110	8-Jul-19	45.18	398.27	353.09	n/a	n/a	n/a	48.3 - 52.5	Alluvial Silts and Clays
CUF-00-GW-43-008	CUF-101	8-Jul-19	2.87	385.68	382.81	n/a	n/a	n/a	2.0 - 17.2	Clay
CUF-00-GW-43-009	CUF-102	8-Jul-19	12.44	402.93	390.49	n/a	n/a	n/a	3.8 - 13.8	Bedrock: Limestone
CUF-00-GW-43-010	CUF-120	8-Jul-19	7.18	393.19	386.01	n/a	n/a	n/a	9.3 - 14.3	Bedrock
CUF-00-GW-43-011	CUF-201	8-Jul-19	12.20	400.41	388.21	n/a	n/a	n/a	17.6 - 27.7	Alluvial Sands and Gravels
CUF-00-GW-43-012	CUF-202	8-Jul-19	6.85	383.28	376.43	n/a	n/a	n/a	14.3 - 19.6	Alluvial Sands and Gravels
CUF-00-GW-43-014	CUF-205	8-Jul-19	19.66	384.51	364.85	n/a	n/a	n/a	16.9 - 27.1	Alluvial Sands and Gravels
CUF-00-GW-43-015	CUF-206	8-Jul-19	34.15	398.67	364.52	n/a	n/a	n/a	82.7 - 92.9	Alluvial Sands and Gravels
CUF-00-GW-43-016	CUF-207	8-Jul-19	34.61	398.19	363.58	n/a	n/a	n/a	75.0 - 85.1	Alluvial Sands and Gravels
CUF-00-GW-43-017	CUF-208	8-Jul-19	36.57	398.38	361.81	n/a	n/a	n/a	47.9 - 58.0	Alluvial Sands and Gravels
CUF-00-GW-43-018	CUF-209	8-Jul-19	34.91	398.23	363.32	n/a	n/a	n/a	53.1 - 63.3	Alluvial Sands and Gravels
CUF-00-GW-43-019	CUF-210	8-Jul-19	27.58	398.20	370.62	n/a	n/a	n/a	63.5 - 68.5	Alluvial Sands and Gravels
CUF-00-GW-43-020	CUF-211	8-Jul-19	36.60	398.76	362.16	n/a	n/a	n/a	57.7 - 67.9	Alluvial Sands and Gravels
CUF-00-GW-43-021	CUF-212	8-Jul-19	38.62	398.71	360.09	n/a	n/a	n/a	62.6 - 72.8	Alluvial Sands and Gravels
CUF-00-GW-43-022	CUF-213	8-Jul-19	22.14	399.05	376.91	n/a	n/a	n/a	40.0 - 45.2	Alluvial Sands and Gravels
CUF-00-GW-43-026	CUF-1000	8-Jul-19	25.45*	395.29	Dry*	n/a	n/a	n/a	14.5 - 25.1	Clay and Clayey Sand
CUF-00-GW-43-027	CUF-1001	8-Jul-19	15.64	393.75	378.11	n/a	n/a	n/a	15.8 - 20.6	Clayey Gravel and Clay
CUF-00-GW-43-028	CUF-1002	8-Jul-19	11.63	389.26	377.63	n/a	n/a	n/a	15.1 - 20.0	Clay and Gravel/Clay
CUF-00-GW-43-029	CUF-1003	8-Jul-19	15.29	396.39	381.10	n/a	n/a	n/a	12.6 - 17.5	Gravel/Cobbles and Clay
CUF-00-GW-43-030	CUF-1005	8-Jul-19	10.78	399.58	388.80	n/a	n/a	n/a	18.2 - 28.8	Sand, Clayey Gravel, Clay
Piezometers										
n/a	CUF-B14C	n/a	NM	n/a	NM	440.8	319.8	121.0	n/a	Alluvial Clay and Granular
n/a	CUF-B15B	8-Jul-19	69.6	n/a	368.7	438.3	327.8	110.5	n/a	Alluvial Granular
n/a	CUF-B16C	8-Jul-19	70.4	n/a	369.4	439.7	324.7	115.0	n/a	Alluvial Granular
n/a	CUF-B17B	8-Jul-19	71.2	n/a	372.1	443.4	336.4	107.0	n/a	Alluvial Granular
n/a	CUF_PZ49	8-Jul-19	15.8	n/a	363.4	379.2	322.2	57.0	n/a	Alluvial Granular
n/a	CUF_PZ53A	8-Jul-19	13.7	n/a	362.3	376.0	311.0	65.0	n/a	Alluvial Granular
n/a	CUF_PZ58A	n/a	NM	n/a	NM	394.8	349.3	45.5	n/a	Alluvial Granular
n/a	CUF_R_2B_VWPZ2	8-Jul-19	34.2	n/a	361.1	395.3	320.0	75.3	n/a	Alluvial Granular
n/a	CUF_S_2A_VWPZ1	8-Jul-19	33.8	n/a	361.5	395.3	299.7	95.6	n/a	Alluvial Granular
n/a	CUF_F_2B_VWPZ1	8-Jul-19	52.1	n/a	360.0	412.1	322.1	90.0	n/a	Alluvial Granular
n/a	CUF_DAS_A_1_VWPZ3	8-Jul-19	19.6	n/a	368.4	388.0	293.0	95.0	n/a	Alluvial Granular
n/a	CUF_DAS_A_2_VWPZ4	8-Jul-19	43.8	n/a	369.1	412.9	308.4	104.5	n/a	Alluvial Granular
n/a	CUF_DAS_INT_2_VWPZ5	8-Jul-19	65.3	n/a	369.2	434.5	313.5	121.0	n/a	Alluvial Granular
n/a	CUF_H_2B_VWPZ1	8-Jul-19	50.6	n/a	360.1	410.7	322.7	88.0	n/a	Alluvial Granular
Surface Water Gauge										
Cumberland River gauge	n/a	8-Jul-19	n/a	n/a	360.26	n/a	n/a	n/a	n/a	n/a

See notes on last page.

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TABLE B.1a – Groundwater Level Measurements
Cumberland Fossil Plant
July 2019

UNID	Well / Piezometer ID	Date Measured	Depth to Groundwater	Top of Casing Elevation	Groundwater Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
			ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft btoc	

Notes:

*	<0.1 ft of water was present in the sump/end cap of the well and is not indicative of groundwater, the well is considered dry
bgs	below ground surface
btoc	below top of casing
ft	feet
ID	identification
msl	mean sea level
n/a	not applicable
NM	not measured
UNID	Unique Numerical Identification

1. Top of casing elevations, screen intervals, and screened formations were obtained from the TVA Well Inventory Log provided by TVA.
2. Cumberland River data point is the closest reading to noon Central Daylight Time recorded by the automated staff gauge provided by TVA.
3. Ground surface elevation, groundwater elevations and piezometer data were obtained from geotechnical instrumentation database. Vibrating wire sensor formation information were obtained from boring logs. Data used were based on average of readings on the measurement date.
4. Depth to groundwater and groundwater elevations in piezometers are calculated values. Accuracy of piezometer data is to 0.1 ft.
5. A groundwater level was not measured in well 93-4 because the meter was obstructed by the pump. Groundwater levels were not measured in select peizometers as noted above because the sensors were not recording data.

TABLE B.1b – Pore Water Level Measurements
Cumberland Fossil Plant
July 2019

Temporary Well / Piezometer ID	Date Measured	Depth to Pore Water	Top of Casing Elevation	Pore Water Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
		ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft bgs	
Temporary Wells									
CUF-TW01	8-Jul-19	40.45	430.99	390.54	n/a	n/a	n/a	41.3 - 51.9	CCR
CUF-TW03	8-Jul-19	29.04	429.53	400.49	n/a	n/a	n/a	54.9 - 65.5	CCR
CUF-TW05	8-Jul-19	30.94	426.80	395.86	n/a	n/a	n/a	49.5 - 56.5	CCR
CUF-TW07	8-Jul-19	58.64	443.69	385.05	n/a	n/a	n/a	81.5 - 92.1	CCR
CUF-TW08	8-Jul-19	52.61	443.36	390.75	n/a	n/a	n/a	72.1 - 82.7	CCR
CUF-TW09	8-Jul-19	56.99	446.44	389.45	n/a	n/a	n/a	79.5 - 90.1	CCR
Piezometers									
CUF-B14A	n/a	NM	n/a	NM	440.8	360.8	80.0	n/a	CCR
CUF-B15A	8-Jul-19	51.1	n/a	387.3	438.3	353.3	85.0	n/a	CCR
CUF-B16A	8-Jul-19	51.0	n/a	388.7	439.7	383.4	56.3	n/a	CCR
CUF-B17A	8-Jul-19	55.0	n/a	388.3	443.4	363.9	79.5	n/a	CCR
CUF_DAS_A_1_VWPZ2	8-Jul-19	13.2	n/a	374.8	388.0	335.0	53.0	n/a	CCR
CUF_DAS_A_2_VWPZ2	8-Jul-19	38.3	n/a	374.6	412.9	353.4	59.5	n/a	CCR
CUF_DAS_D_2_VWPZ1	8-Jul-19	16.5	n/a	382.3	398.7	376.6	22.1	n/a	CCR
CUF_DAS_D_3_VWPZ3	8-Jul-19	44.7	n/a	382.5	427.2	371.9	55.3	n/a	CCR
CUF_DAS_G_1_VWPZ1	8-Jul-19	15.4	n/a	390.1	405.5	379.6	25.9	n/a	CCR
CUF_DAS_G_2_VWPZ2	8-Jul-19	36.0	n/a	403.1	439.1	396.1	43.0	n/a	CCR
CUF_DAS_INT_1_VWPZ3	8-Jul-19	50.5	n/a	388.6	439.1	379.1	60.0	n/a	CCR
CUF_DAS_INT_2_VWPZ2	8-Jul-19	42.8	n/a	391.7	434.5	388.5	46.0	n/a	CCR
CUF_F_2A_VWPZ2	8-Jul-19	48.2	n/a	385.4	433.6	353.6	80.0	n/a	CCR
CUF_F_2B_VWPZ4	8-Jul-19	26.1	n/a	386.0	412.1	377.1	35.0	n/a	CCR
CUF_GSA_G_1_VWPZ1	8-Jul-19	19.8	n/a	393.5	413.3	384.6	28.7	n/a	CCR
CUF_GSA_G_2_VWPZ1	8-Jul-19	31.6	n/a	396.6	428.2	388.2	40.0	n/a	CCR
CUF_GSA_INT_1_VWPZ5	8-Jul-19	23.6	n/a	399.5	423.1	393.1	30.0	n/a	CCR
CUF_GSA_INT_2_VWPZ2	8-Jul-19	29.9	n/a	390.4	420.3	380.3	40.0	n/a	CCR
CUF_GSA_L_1_VWPZ4	8-Jul-19	35.8	n/a	394.5	430.3	369.3	61.0	n/a	CCR
CUF_GSA_M_1_VWPZ2	8-Jul-19	23.5	n/a	386.5	410.0	382.0	28.0	n/a	CCR
CUF_GSA_M_2_VWPZ3	8-Jul-19	45.0	n/a	385.3	430.3	380.3	50.0	n/a	CCR
CUF_H_2A_VWPZ4	8-Jul-19	27.9	n/a	396.1	424.0	389.8	34.2	n/a	CCR
CUF_H_2B_VWPZ3	8-Jul-19	22.4	n/a	388.3	410.7	353.7	57.0	n/a	CCR
CUF_H_2C_VWPZ4	8-Jul-19	6.3	n/a	389.1	395.3	374.0	21.3	n/a	CCR
CUF_PZ21	8-Jul-19	5.6	n/a	389.5	395.1	356.0	39.1	n/a	CCR
CUF_PZ36	8-Jul-19	24.5	n/a	386.7	411.2	363.2	48.0	n/a	CCR
CUF_PZ37	8-Jul-19	19.0	n/a	376.2	395.2	367.2	28.0	n/a	CCR
CUF_PZ43	8-Jul-19	19.7	n/a	391.6	411.3	374.3	37.0	n/a	CCR

See notes on last page.

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TABLE B.1b – Pore Water Level Measurements
Cumberland Fossil Plant
July 2019

Temporary Well / Piezometer ID	Date Measured	Depth to Pore Water	Top of Casing Elevation	Pore Water Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation

Notes:

bgs	below ground surface
btoc	below top of casing
CCR	coal combustion residuals
ft	feet
ID	identification
msl	mean sea level
n/a	not applicable
NM	not measured

1. Top of casing elevations, screen intervals, and screened formations were obtained from boring logs, well detail and well survey data.

2. For piezometers, ground surface elevation, pore water elevations, and piezometer data obtained from Geotech instrumentation database. Vibrating wire sensor formation information obtained from boring logs. Data from vibrating wire piezometers are averaged for the measurement date.

3. Depth to pore water in piezometers and pore water elevations at all locations are calculated values. Accuracy of piezometer data is to 0.1 ft.

4. Screen interval shown for temporary wells is below ground surface when drilled.

TABLE B.2 – Summary of Groundwater Samples
Cumberland Fossil Plant
July 2019

			Analysis Type								
Location ID	**Sample ID**	**Sample Type**	Field Parameters	Total Metals	Total Mercury	Anions	Alkalinity	Total Dissolved Solids	Radium-226	Radium-228	Radium-226+228
CUF-1001	CUF-GW-027-20190708	Normal Environmental Sample	x	x	x	x	x	x	x	x	x
	CUF-GW-DUP01-20190708	Field Duplicate Sample		x	x	x	x	x	x	x	x
CUF-1002	CUF-GW-028-20190709	Normal Environmental Sample	x	x	x	x	x	x	x	x	x
CUF-1003	CUF-GW-029-20190709	Normal Environmental Sample	x	x	x	x	x	x	x	x	x
CUF-1005	CUF-GW-030-20190709	Normal Environmental Sample	x	x	x	x	x	x	x	x	x

Notes:

Total and Dissolved Metals	SW-846 6020A
Total and Dissolved Mercury	SW-846 7470A
Anions	SW-846 9056A
Alkalinity	SM2320B
Total Dissolved Solids	SM2540C
Radium-226	EPA 903.0
Radium-228	EPA 904.0
Radium-226+228	CALC
ID	identification

1. Field and laboratory quality control sample results except for field duplicates are not included in report tables but were used for data validation.

TABLE B.3 – Summary of Groundwater Quality Parameters
Cumberland Fossil Plant
July 2019

Sample Location Sample Date Sample ID Sample Depth Sample Type Level of Review	Units	CUF-1001 8-Jul-19 CUF-GW-027-20190708 19 ft Normal Environmental Sample Final QC Review	CUF-1002 9-Jul-19 CUF-GW-028-20190709 18 ft Normal Environmental Sample Final QC Review	CUF-1003 9-Jul-19 CUF-GW-029-20190709 16.8 ft Normal Environmental Sample Final QC Review	CUF-1005 9-Jul-19 CUF-GW-030-20190709 24 ft Normal Environmental Sample Final QC Review
Field Parameters					
Dissolved Oxygen	%	2.4	2.9	3.6	5.2
Dissolved Oxygen	mg/L	0.22	0.26	0.33	0.45
ORP	mV	-173.8	-81.2	103.5	20.1
pH (field)	SU	7.24	6.83	6.44	9.84
Specific Cond. (Field)	uS/cm	1,223	1,256	3,187	3,371
Temperature, Water (C)	DEG C	19.6	19.2	20.7	22.4
Turbidity, field	NTU	0.78	4.13	1.86	2.45

Notes:

%	percent
Cond.	conductance
DEG C	degrees Celsius
ft	feet below top of casing
ID	identification
mg/L	milligrams per Liter
mV	milliVolts
NTU	Nephelometric Turbidity Unit
ORP	Oxidation Reduction Potential, measured using a silver reference electrode which has a standard potential of 200 mV
SU	Standard Units
uS/cm	microSiemens per centimeter

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TABLE B.4 - Groundwater Analytical Results for Metals, Anions, and General Chemistry
Cumberland Fossil Plant
July 2019

Sample Location	Units	EPA MCLs	CCR Rule GWPS	CUF-1001		CUF-1002	CUF-1003	CUF-1005
Sample Date				8-Jul-19	8-Jul-19	9-Jul-19	9-Jul-19	9-Jul-19
Sample ID				CUF-GW-027-20190708	CUF-GW-DUP01-20190708	CUF-GW-028-20190709	CUF-GW-029-20190709	CUF-GW-030-20190709
Sample Depth				19 ft	19 ft	18 ft	16.8 ft	24 ft
Sample Type				Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Level of Review				Validated	Validated	Final-Verified	Final-Verified	Final-Verified
Total Metals								
Antimony	ug/L	6[A]	n/v	<0.378	<0.378	<0.378	0.584 J	1.98 J
Arsenic	ug/L	10[A]	n/v	2.72	2.72	6.27	0.719 J	5.75
Barium	ug/L	2,000[A]	n/v	62.2	64.2	54.7	40.3	65.4
Beryllium	ug/L	4[A]	n/v	<0.155	<0.155	<0.155	0.342 U*	0.203 U*
Boron	ug/L	n/v	n/v	3,430	3,650	414	22,400	31,700
Cadmium	ug/L	5[A]	n/v	<0.125	<0.125	<0.125	0.188 J	0.235 J
Calcium	ug/L	n/v	n/v	234,000	242,000	224,000	633,000	862,000
Chromium	ug/L	100[A]	n/v	<1.53	2.29 U*	<1.53	2.73 U*	1.64 U*
Cobalt	ug/L	n/v	6[B]	0.529	0.517	0.779	1.99	0.536
Copper	ug/L	n/v	n/v	<0.627	0.635 U*	<0.627	1.40 U*	1.38 U*
Lead	ug/L	n/v	15[B]	<0.128	<0.128	<0.128	0.128 J	<0.128
Lithium	ug/L	n/v	40[B]	5.15 U*	5.75 U*	4.52 U*	8.10 U*	36.1
Magnesium	ug/L	n/v	n/v	24,400	25,400	31,700	70,300	1,600
Mercury	ug/L	2[A]	n/v	<0.101	<0.101	0.101 UJ	0.101 UJ	0.101 UJ
Molybdenum	ug/L	n/v	100[B]	80.0	81.6	2.02 J	**597[B]**	**960[B]**
Nickel	ug/L	100(TN MCL)[A]	n/v	0.574 U*	0.638 U*	1.86 U*	1.66 U*	1.63 U*
Potassium	ug/L	n/v	n/v	6,590	6,830	1,620	35,000	46,000
Selenium	ug/L	50[A]	n/v	<2.62	<2.62	<2.62	<2.62	26.5
Silver	ug/L	100(TN MCL)[A]	n/v	<0.121	<0.121	<0.121	<0.121	<0.121
Sodium	ug/L	n/v	n/v	15,500	16,100	24,100	45,500	28,100
Thallium	ug/L	2[A]	n/v	<0.128	<0.128	<0.128	0.479 U*	0.495 U*
Vanadium	ug/L	n/v	n/v	1.07 U*	1.65 U*	0.926 U*	2.67 U*	455
Zinc	ug/L	n/v	n/v	<3.22	<3.22	<3.22	3.63 J	<3.22
Anions								
Chloride	mg/L	n/v	n/v	54.7	53.6	33.0	285	325
Fluoride	mg/L	4[A]	n/v	0.140	0.140	0.329	0.249 J	0.172 J
Sulfate	mg/L	n/v	n/v	388	379	343	1,720	1,770
General Chemistry								
Alkalinity, Bicarbonate	mg/L	n/v	n/v	252	251	335	94.6	<5.00
Alkalinity, Carbonate	mg/L	n/v	n/v	<5.00	<5.00	<5.00	<5.00	71.1
Alkalinity, Total as CaCO3	mg/L	n/v	n/v	252	251	335	94.6	153
Total Dissolved Solids	mg/L	n/v	n/v	938	952	897	2,980	3,800

Notes:

A	EPA Maximum Contaminant Level
B	CCR Rule GWPS (Federal Register / Vol. 83, No. 146 / Monday, July 30, 2018 / Rules and Regulations)
n/v	No standard/guideline value
6.5[A]	Concentration is greater than or equal to the indicated standard.
<0.03	analyte was not detected at a concentration greater than the Method Detection Limit
ft	feet below top of casing
ID	identification
J	quantitation is approximate due to limitations identified during data validation
mg/L	milligrams per Liter
U*	result should be considered “not detected” because it was detected in an associated field or laboratory blank at a similar level
ug/L	micrograms per Liter
(TN MCL)	Tennessee Maximum Contaminant Level

1. Level of review is defined in the Quality Assurance Project Plan.

Stantec

TABLE B.5 – Groundwater Analytical Results for Radiological Parameters Cumberland Fossil Plant
July 2019

Sample Location				CUF-1001		CUF-1002	CUF-1003	CUF-1005
Sample Date				8-Jul-19	8-Jul-19	9-Jul-19	9-Jul-19	9-Jul-19
Sample ID				CUF-GW-027-20190708	CUF-GW-DUP01-20190708	CUF-GW-028-20190709	CUF-GW-029-20190709	CUF-GW-030-20190709
Sample Depth				19 ft	19 ft	18 ft	16.8 ft	24 ft
Sample Type				Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Level of Review				Validated	Validated	Final-Verified	Final-Verified	Final-Verified
	Units	EPA MCLs	CCR Rule GWPS					
Radiological Parameters								
Radium-226	pCi/L	n/v	n/v	0.106 +/-(0.162)U	0.0722 +/-(0.164)UJ	-0.0415 +/-(0.0652)U	0.0881 +/-(0.0655)	0.151 +/-(0.0897)
Radium-228	pCi/L	n/v	n/v	0.223 +/-(0.672)U	0.824 +/-(0.823)UJ	-0.0443 +/-(0.231)U	0.329 +/-(0.243)U	0.316 +/-(0.252)U
Radium-226+228	pCi/L	5[A]	n/v	0.329 +/-(0.691)U	0.896 +/-(0.839)UJ	0.000 +/-(0.240)U	0.417 +/-(0.252)J	0.467 +/-(0.267)J

Notes:

A	EPA Maximum Contaminant Level
B	CCR Rule GWPS (Federal Register / Vol. 83, No. 146 / Monday, July 30, 2018 / Rules and Regulations)
n/v	No standard/guideline value
ft	feet below top of casing
ID	identification
J	quantitation is approximate due to limitations identified during data validation
pCi/L	picoCurie per Liter
U	not detected
UJ	compound was not detected, but the reporting or detection limit should be considered estimated due to a bias identified during data validation

1. Level of review is defined in the Quality Assurance Project Plan.

APPENDIX H.6

GROUNDWATER INVESTIGATION EVENT #3 SAMPLING AND ANALYSIS REPORT

Cumberland Fossil Plant Groundwater Investigation Event #3 Sampling and Analysis Report

TDEC Commissioner's Order
Environmental Investigation Plan
Cumberland Fossil Plant
Cumberland City, Tennessee

February 5, 2021

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

REVISION RECORD

Revision	Description	Date
0	Submittal to TDEC	October 20, 2020
1	Addresses December 8, 2020 TDEC Review Comments and Issued for TDEC	February 5, 2021

Sign-off Sheet

This document entitled Cumberland Fossil Plant Groundwater Investigation Event #3 Sampling and Analysis Report was prepared by Stantec Consulting Services Inc. (“Stantec”) for the account of Tennessee Valley Authority (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ______________________________

Michael J. Winkler, Geologic Associate

Reviewed by ______________________________

Carole M. Farr, Senior Principal Geologist

Approved by ______________________________

Rebekah Brooks, Principal Hydrogeologist

Table of Contents

Abbreviations

CCR	Coal Combustion Residuals
CCR Parameters	Constituents listed in Appendices III and IV of 40 CFR 257 and five inorganic constituents included in Appendix I of Tennessee Rule 0400-11-01-.04
CFR	Code of Federal Regulations
COC	Chain-of-Custody
CUF Plant	Cumberland Fossil Plant
DO	Dissolved Oxygen
EAR	Environmental Assessment Report
EIP	Environmental Investigation Plan
ENV	Environmental
EnvStds	Environmental Standards, Inc.
Event #3	Groundwater investigation field event performed September 9-11, 2019
FSP	Field Sampling Personnel
ft	Feet
GEL	GEL Laboratories LLC
ID	Identification
IDW	Investigation Derived Waste
mg/L	Milligrams per Liter
NTU	Nephelometric Turbidity Units
ORP	Oxidation-Reduction Potential
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
QC	Quality Control
SAP	Sampling and Analysis Plan
SAR	Sampling and Analysis Report
Stantec	Stantec Consulting Services Inc.
TDEC	Tennessee Department of Environment and Conservation
TDEC Order	Commissioner’s Order No. OGC15-0177
TestAmerica	Eurofins TestAmerica Inc.
TI	Technical Instruction
TVA	Tennessee Valley Authority
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) has prepared this sampling and analysis report (SAR) on behalf of the Tennessee Valley Authority (TVA) to document the completion of activities related to a groundwater investigation sampling event performed September 9-11, 2019 (Event #3) at TVA's Cumberland Fossil Plant (CUF Plant) located in Cumberland City, Tennessee.

The purpose of the groundwater investigation, upon completion of six groundwater sampling events, is to characterize groundwater conditions at the CUF Plant in support of fulfilling the requirements for the Tennessee Department of Environment and Conservation (TDEC) issued Commissioner's Order No. OGC15-0177 (TDEC Order) to TVA (TDEC 2015). The TDEC Order sets forth a "process for the investigation, assessment, and remediation of unacceptable risks" at TVA's coal ash disposal sites in Tennessee.

The purpose of this SAR is to document the work completed during groundwater sampling Event #3 of 6 total events and to present the information and data collected during the execution of the Groundwater Investigation Sampling and Analysis Plan (SAP) (Stantec 2018a). This SAR is not intended to provide conclusions or evaluations of results. The scope of the groundwater investigation represented herein was conducted pursuant to the SAP and is part of a larger environmental investigation at the CUF Plant. The data provided in this SAR are not inclusive of other programmatic data that exist for the site. The evaluation of the results will include data from the six groundwater sampling events and will consider other aspects of the environmental investigation, as well as data collected under other State and/or coal combustion residuals (CCR) programs. This evaluation will be presented in the Environmental Assessment Report (EAR).

Event #3 activities were performed in general accordance with the following documents developed by TVA to support fulfilling the requirements of the TDEC Order at the CUF Plant:

- *Groundwater Investigation SAP* (Stantec 2018a)
- *Environmental Investigation Plan (EIP)* (Stantec 2018b)
- *Quality Assurance Project Plan (QAPP)* (Environmental Standards, Inc. 2018).

The Groundwater Investigation SAP was updated based on TVA- and TDEC-approved Programmatic- and Project-specific changes. Minor variations in scope and procedures from those outlined in the SAP occurred during field activities due to field conditions and programmatic updates and are referenced in Section 3.6.

Event #3 is the third in a series of six planned sampling events for the groundwater investigation. Stantec performed the field work activities for this event. Laboratory analysis of constituents was performed by GEL Laboratories LLC (GEL) in Charleston, South Carolina (radium samples only) and Eurofins TestAmerica, Inc. (TestAmerica) in Pittsburgh, Pennsylvania (other analytes). Quality assurance oversight on data acquisition protocols, sampling practices, and data validation or verification was performed by Environmental Standards, Inc. (EnvStds) under direct contract to TVA.

This report summarizes the groundwater investigation activities for Event #3. The remaining sampling events will be completed before overall conclusions and findings about the groundwater investigation and groundwater conditions at the CUF Plant are made and documented in the EAR.

2.0 OBJECTIVE AND SCOPE

The primary objectives of the groundwater investigation conducted pursuant to the Groundwater Investigation SAP (which includes six sampling events) are to characterize existing groundwater quality and to evaluate groundwater flow conditions at the CUF Plant in response to the TDEC Order. The approach to characterizing the groundwater conditions is to:

- Collect groundwater samples for chemical analyses to evaluate the potential presence of constituents related to CCR in groundwater
- Measure groundwater and surface water elevations for subsequent evaluation of the direction and rate of groundwater flow.

The scope of work intended to achieve the objectives of the groundwater investigation consists of six sampling events at a frequency of one event every two months for one year to characterize seasonal groundwater quality and flow direction. This report describes the activities related to Event #3, performed in September 2019, the scope of which included:

- Collecting groundwater and surface water level measurements
- Collecting field measurements of groundwater quality parameters
- Collecting groundwater samples and associated quality control (QC) samples for laboratory analysis.

These activities were carried out after the installation of permanent monitoring wells specified in the Groundwater Investigation SAP. Details of the monitoring well installation activities are provided in the CUF Plant Hydrogeological Investigation SAR.

In addition, pore water measurements from piezometers and temporary wells installed in the CCR units at the CUF Plant are presented in this SAR for comparison with groundwater data. Temporary well and piezometer installation activities are described in the CUF Plant Exploratory Drilling SAR, and temporary well gauging and sampling information is provided in the CUF Plant CCR Material Characteristics SAR.

3.0 FIELD ACTIVITIES

Groundwater investigation field activities for Event #3 were conducted September 9-11, 2019. Stantec performed groundwater level measurements and sample collection activities based on guidance and specifications in TVA's Environmental (ENV) Technical Instructions (TIs), the SAP, the QAPP, and applicable United States Environmental Protection Agency (USEPA) documents except as noted in the Variations section of this report. As part of TVA's commitment to generate representative and reliable data, data validation and/or verification of laboratory analytical results were performed by EnvStds under direct contract with TVA. EnvStds also provided quality reviews of field documentation.

During Event #3, Stantec conducted the following field activities:

- Measured groundwater levels at five monitoring wells installed for the TDEC Order, and 20 monitoring wells, and 13 piezometers installed for other environmental programs (25 total monitoring wells)
- Measured pore water levels at six temporary wells and 27 piezometers installed in the CCR units
- Measured the surface water level at one location in the Cumberland River
- Collected groundwater samples from four monitoring wells installed for the TDEC Order
- Recorded field measurements of groundwater quality parameters during purging and stabilization at the sampled monitoring wells
- Collected QC samples including one field duplicate, one matrix spike/matrix spike duplicate, two field blanks, and one equipment blank
- Shipped the collected samples to GEL in Charleston, South Carolina, and TestAmerica in Pittsburgh, Pennsylvania.

Details on each activity are presented in the sections below.

3.1 WORK LOCATIONS

The TDEC Order CCR units at the CUF Plant (the Stilling Pond, including the Retention Pond, the Dry Ash Stack, the Bottom Ash Pond, and the Gypsum Storage Area) as well as the monitoring wells, temporary wells, and piezometers sampled and/or gauged during Event #3 are shown on Exhibit A.1 in Appendix A. TVA is currently sampling groundwater at the CUF Plant for TDEC Solid Waste Management permit requirements and the USEPA CCR Rule codified in Title 40 of the Code of Federal Regulations (CFR) Part 257 (40 CFR 257). Monitoring wells that are sampled as part of other environmental programs are not sampled as part of the groundwater investigation for the TDEC Order.

Groundwater levels were measured in TDEC Order monitoring wells, as well as in select additional wells and piezometers from other environmental programs, as shown in Table B.1a in Appendix B, to provide information to prepare groundwater contour maps for this SAR and the CUF Plant EAR. Pore water levels measured in temporary wells and piezometers installed in the CCR units are presented in Table B.1b. The groundwater elevation contour map, including pore water elevations, is shown on Exhibit A.2 in Appendix A.

Groundwater analytical and field duplicate samples were collected from the TDEC Order groundwater investigation wells as shown in Table B.2 in Appendix B. Groundwater analytical data collected for TDEC Order and other environmental programs will be provided in the EAR.

3.2 DOCUMENTATION

Stantec maintained field documentation in accordance with ENV-TI-05.80.03, *Field Record Keeping*, and the QAPP. Field activities and data were recorded on program-specific field forms. Health and safety forms were completed in accordance with TVA and Stantec health and safety requirements. Additional information regarding field documentation is provided below.

3.2.1 Field Forms

Stantec used program-specific field forms to record field observations and data for specific activities. Field forms used during the groundwater investigation included:

- *Daily Field Activity Log*
- *Monitoring Well Inspection Checklist*
- *Equipment Calibration Form*
- *Groundwater Level Measurement Form*
- *Groundwater Sampling Form*
- *Chain-of-Custody (COC).*

3.2.1.1 Daily Field Activity Log

Stantec field sampling personnel (FSP) recorded field activities, observations, and data on a *Daily Field Activity Log* to chronologically document the field program. Deviations from the SAP, TIs, or QAPP were documented on the *Daily Field Activity Log*.

3.2.1.2 Monitoring Well Inspection Checklist

Prior to measuring water levels, Stantec FSP inspected each monitoring well for damage or indications that the well integrity had been compromised in accordance with ENV-TI-05.80.21, *Monitoring Well*

Inspection and Maintenance. Inspection results were documented on a *Monitoring Well Inspection Checklist*. No signs of damage or necessary repairs were noted during Event #3.

3.2.1.3 Equipment Calibration Form

Stantec FSP performed daily calibration of the water quality meter and turbidity meter and documented the results on an *Equipment Calibration Form*. The form documented the calibration results for temperature, turbidity, specific conductance, pH, dissolved oxygen (DO), and oxidation-reduction potential (ORP), and verified that the field instruments' sensors were operating within acceptance criteria. Refer to Section 3.2.2 for additional details on equipment calibration procedures.

3.2.1.4 Groundwater Level Measurement Form

Stantec FSP recorded groundwater level field measurement data on a *Groundwater Level Measurement Form* in accordance with ENV-TI-05.80.44, *Groundwater Level and Well Depth Measurement*. The form includes the monitoring well identification (ID), time, and depth to water measured from a standardized reference point on the top of each well casing, recorded in feet (ft) below top of casing.

3.2.1.5 Groundwater Sampling Form

Stantec FSP recorded the depth to water, purge flow rate, volume of groundwater purged, temperature, pH, specific conductance, DO, ORP, turbidity, color of water, and other observations during groundwater purging and sampling activities at each monitoring well in accordance with ENV-TI-05.80.42, *Groundwater Sampling*. Field measurements were recorded on a *Groundwater Sampling Form*. The form also documents the time intervals between measurement of field parameters, low-flow extraction rates, water level drawdown, and water quality parameter measurements until stabilization criteria were met.

3.2.1.6 Chain-of-Custody

Stantec FSP completed *COC* documentation for each groundwater sample collected. The sample ID, sample location, type of sample, sampling date and time, analyses requested, sample pH, and sample custody record were recorded on the *COC*. The Field Team Leader reviewed the *COC* for completeness, and the FSP conducted a QC check of samples in each cooler compared to sample IDs on the corresponding *COC*. *COCs* were completed in accordance with ENV-TI-05.80.02, *Sample Labeling and Custody*.

3.2.2 Equipment Calibration

Field instruments used to collect, generate, or measure water quality parameters were calibrated each day prior to use as specified in the SAP, QAPP, and ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde.* Afternoon calibration verifications were performed to evaluate if these instruments remained within acceptance criteria during sampling. Temperature and barometric pressure instrument readings were verified using a calibrated National Institute of Standards and Technology traceable thermometer and National Weather Service (via mesowest.utah.edu) barometric pressure readings for

Clarksville Outlaw Field (KCKV) in Clarksville, Tennessee, respectively. Additional details regarding equipment calibration were recorded on an *Equipment Calibration Form*, as described in Section 3.2.1.3.

3.3 SAMPLING METHODS

The following sections present monitoring well data collection and sampling procedures used during Event #3. As approved by TDEC, monitoring well CUF-1004 was not gauged or sampled during this event because it was not installed as part of the hydrogeologic investigation.

3.3.1 Static Water Level Measurements

FSP measured static groundwater levels at 25 monitoring wells and pore water levels at six temporary wells in accordance with ENV-TI-05.80.44, *Groundwater Level and Well Depth Measurement*. On September 9, 2019, static groundwater and pore water level readings were measured and recorded to the nearest 0.01 ft from a reference point on the top of each well casing using an electronic water level indicator. Water level indicator probes were decontaminated prior to the first use and between measurements, and the decontamination was documented as specified in ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination.* Depth to groundwater and pore water measurements were recorded on a *Groundwater Level Measurement Form*. A water level measurement could not be obtained at monitoring well 93-4 because the water level indicator probe stopped at the top of the dedicated pump and no water was encountered.

Groundwater and pore water measurements were also obtained from transducers installed within 13 and 27 piezometers, respectively. Additionally, a surface water level measurement for the Cumberland River was provided by TVA using the reading at 1200 (noon) Central Daylight Time recorded by an automated staff gauge. The surface water staff gauge location is shown on Exhibit A.1 in Appendix A.

Groundwater level data and pore water level data are shown in Tables B.1a and B.1b, respectively, in Appendix B. A groundwater elevation contour map based on groundwater measurements in wells and piezometers, along with pore water elevations, is included on Exhibit A.2 in Appendix A.

3.3.2 Groundwater Purging & Sampling

Analytical and field duplicate samples (as specified in the SAP) were collected from four monitoring wells as shown in Table B.2 in Appendix B. Monitoring wells were purged using dedicated bladder pumps equipped with dedicated tubing using low-flow purging and sampling techniques as specified in ENV-TI-05.80.42, *Groundwater Sampling*. A groundwater sample was not collected from well CUF-1000 because less than 0.1 ft of water was present in the sump/end cap of the well and was not indicative of groundwater; the well was considered dry.

During the purging process, water quality field parameters including pH, specific conductance, temperature, ORP, and DO were measured using water quality meters (YSI ProPlus with flow-through cell) and recorded on field forms. Depth to water and turbidity were measured and recorded using decontaminated electronic water-level indicators (Heron Dipper-T) and calibrated turbidimeters (Hach

2100Q). Field parameters were measured and recorded on *Groundwater Sampling Forms* during purging until readings were stabilized as specified in the SAP. Well purging was considered complete when three consecutive readings were within the following stabilization limits:

- pH – ± 0.1 Standard Units
- Specific Conductance – ± 5% microSiemens per centimeter
- Turbidity – Less than 10 Nephelometric Turbidity Units (NTUs) or ± 10% for values above 10 NTUs
- DO – Less than 0.5 milligrams per Liter (mg/L) or ± 10% for values above 0.5 mg/L.

After water quality stabilization criteria were achieved, the final field parameter results were recorded, purging was discontinued, and a sample was collected as specified in the SAP. Laboratory-provided, pre-preserved sample containers were filled directly from the pump discharge line. Turbidity readings at the wells stabilized below 10 NTUs, therefore samples were not collected for dissolved metals analysis. FSP wore new, clean nitrile gloves when handling sample containers and did not touch the interior of containers or container caps. New gloves were used when handling each sample. When filling sample bottles, care was taken to minimize sample aeration (i.e., water was directed down the inner walls of the sample bottle) and to avoid overfilling and diluting preservatives. Each sample bottle was capped before filling the next bottle. Following completion of sampling, final turbidity measurements were made.

Sample containers were labeled and handled in accordance with ENV-TI-05.80.02, *Sample Labeling and Custody.* FSP secured caps on each bottle, attached a custody seal across the cap, and placed the bottles in a cooler on ice within 15 minutes of collection. QC samples were collected in accordance with ENV-TI-05.80.04, *Field Sampling Quality Control.*

Groundwater samples were analyzed for the CCR-related constituents listed in Appendices III and IV of 40 CFR 257. In addition, five inorganic constituents listed in Appendix I of Tennessee Rule 0400-11-01-.04 and not included in the 40 CFR 257 Appendices III and IV were analyzed to maintain continuity with TDEC environmental programs. These additional TDEC Appendix I constituents included copper, nickel, silver, vanadium, and zinc. The combined federal CCR Appendices III and IV constituents and TDEC Appendix I inorganic constituents will hereafter be referred to collectively as “CCR Parameters.” For geochemical evaluation, major cations/anions not included in the CCR Parameters were included in the analyses. The additional geochemical parameters included bicarbonate, carbonate, magnesium, potassium, and sodium.

3.4 INVESTIGATION DERIVED WASTE

Investigation derived waste (IDW) generated during groundwater investigation activities included:

- Used calibration solutions
- Purge water
- Decontamination fluids

- Disposable personal protective equipment (PPE)
- General trash.

IDW was handled in accordance with ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*; ENV-TI-05.80.42, *Groundwater Sampling* (purge water); the CUF Plant-specific waste management plan; and local, state, and federal regulations. Transportation and disposal of IDW was coordinated with CUF Plant facility management. Used calibration solution was containerized and stored for disposal as directed by the CUF Plant facility management. Purge water and decontamination fluids were containerized for later disposal as specified in the CUF Plant-specific waste management plan. Used disposable PPE (e.g., nitrile gloves) and general trash generated throughout the day were placed in garbage bags and disposed of in a general trash dumpster onsite at the end of each day.

3.5 SAMPLE SHIPMENT

Samples were packed and shipped under *COC* procedures specified in ENV-TI-05.80.06, *Handling and Shipping of Samples*. The samples were shipped by FedEx to GEL in Charleston, South Carolina (radium samples only), and to TestAmerica in Pittsburgh, Pennsylvania (other analytes). The laboratories submitted sample receipt confirmation forms to EnvStds for review and confirmation.

3.6 VARIATIONS

The proposed scope and procedures for the groundwater investigation were outlined in the SAP, QAPP, and applicable TVA TIs as detailed in the sections above. Variations in scope or procedures discussed with TDEC and/or TVA, changes based on field conditions, or additional field sampling performed to complete the scope of work in the SAP are described in the following sections. As discussed below, these variations do not impact the overall usability and representativeness of the dataset provided in this SAR for groundwater investigation sampling Event #3 at the CUF Plant.

3.6.1 Variations in Scope

Variations in scope are provided below.

- A surface water level measurement was not obtained for Wells Creek because a water level gauge had not yet been installed due to concerns of safe access to that location; however, a surface water measurement was obtained from the Cumberland River. Once the gauge is installed in Wells Creek, surface water measurements will be collected.
- A groundwater sample was not collected from well CUF-1000 because less than 0.1 ft of water was present in the sump/end cap of the well and was not indicative of groundwater; the well was considered dry.
- Groundwater level gauging and sampling was not performed at well CUF-1004 as specified in the SAP because it was not installed (the three borings drilled in that area were dry). This change in scope was approved by TDEC.

3.6.2 Variations in Procedures

There were no variations in procedures during the groundwater investigation sampling Event #3 at the CUF Plant.

4.0 SUMMARY

The data presented in this report are only for groundwater investigation sampling Event #3 at the CUF Plant. The scope of work for Event #3 was to:

- Collect groundwater samples for chemical analyses to assist with subsequent evaluation of the potential presence of CCR-related constituents in groundwater
- Measure groundwater and surface water elevations to assist with subsequent evaluation of groundwater flow direction and rate after multiple data sets have been collected.

In addition, pore water measurements from piezometers and temporary wells installed in the CCR units at the CUF Plant are presented in this SAR for comparison with groundwater data.

Event #3 included collecting groundwater level measurements at 25 monitoring wells and 13 piezometers; pore water measurements at six temporary wells and 27 piezometers in the CCR units; and a surface water measurement at one gauge located in the Cumberland River. Groundwater and surface water measurements and elevations are provided in Table B.1a, and pore water measurements and elevations are provided in Table B.1b, and depicted on Exhibit A.2.

Groundwater quality measurements and groundwater analytical samples were collected at four monitoring wells as summarized in Table B.2. Groundwater quality parameters were recorded during purging. Stabilization criteria for pH, specific conductance, turbidity, and DO were achieved at each sampling location. The final measurements prior to initiating sample collection are presented in Table B.3.

Groundwater analytical data for CCR Parameters and geochemical parameters are presented in Table B.4. Analytical data for radium analyses are presented in Table B.5. Analytical data were reported by GEL and TestAmerica, and then validated or verified by EnvStds.

Stantec has completed Event #3 of the groundwater investigation at the CUF Plant in Cumberland City, Tennessee, in accordance with the Groundwater Investigation SAP as documented herein. The data collected during Event #3 are usable for reporting and evaluation in the EAR and meet the objectives of the TDEC Order EIP. The complete datasets from the six groundwater sampling events will be evaluated along with data collected under other TDEC Order SAPs, as well as data collected under other State and CCR programs. This evaluation will be provided in the EAR.

5.0 REFERENCES

Environmental Standards. Inc. 2018. *Quality Assurance Project Plan for the Tennessee Valley Authority Cumberland Fossil Plant Environmental Investigation*. Prepared for Tennessee Valley Authority. Revision 2. January 2018.

Stantec Consulting Services Inc. (Stantec). 2018a. *Groundwater Investigation Sampling and Analysis Plan, Cumberland Fossil Plant.* Revision 3. Prepared for Tennessee Valley Authority. June 25, 2018.

Stantec. 2018b. *Environmental Investigation Plan, Cumberland Fossil Plant.* Revision 3. Prepared for Tennessee Valley Authority. June 25, 2018.

Tennessee Department of Environment and Conservation. 2015. *Commissioner's Order No. OGC15-0177.*

Tennessee Valley Authority (TVA). ENV-TI-05.80.02, *Sample Labeling and Custody*.

TVA. ENV-TI-05.80.03, *Field Record Keeping*.

TVA. ENV-TI-05.80.04, *Field Sampling Quality Control*.

TVA. ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*.

TVA. ENV-TI-05.80.06, *Handling and Shipping of Samples*.

TVA. ENV-TI-05.80.21, *Monitoring Well Inspection and Maintenance*.

TVA. ENV-TI-05.80.42, *Groundwater Sampling*.

TVA. ENV-TI-05.80.44, *Groundwater Level and Well Depth Measurement*.

TVA. ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sond.*

APPENDIX A - EXHIBITS

Exhibit No.
A.1

Title

Monitoring Well Network

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location
Stewart County, Tennessee

175568209
Prepared by MB on 2020-09-14
Technical Review by MW on 2020-09-14

0 400 800 1,200 1,600 Feet

1:4,800 (At original document size of 22x34)

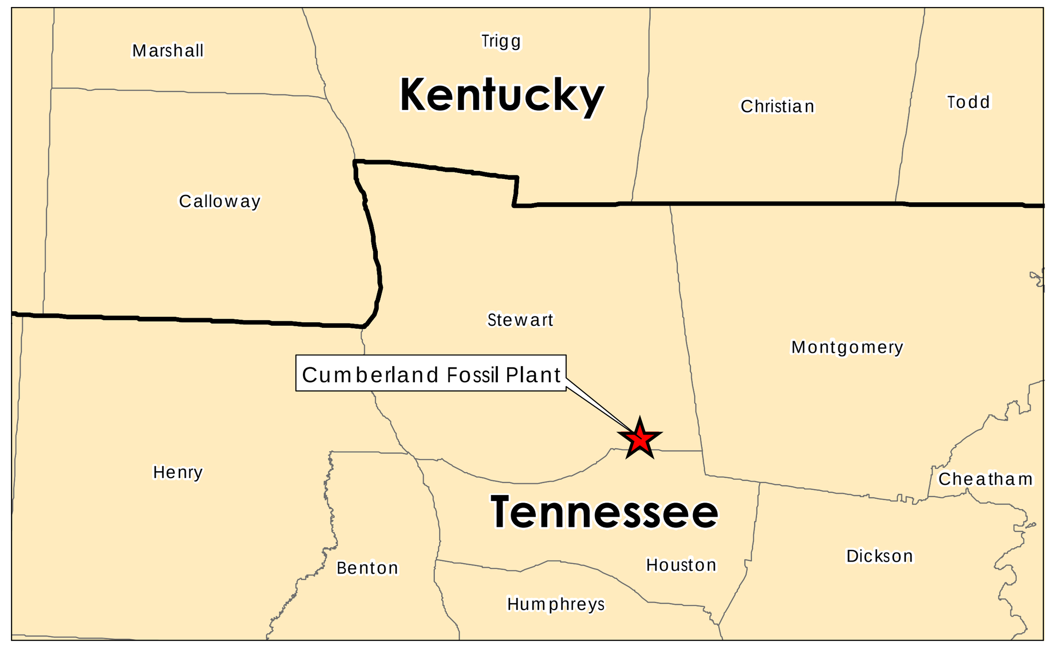
Legend

- Groundwater Investigation Monitoring Well
- Other Monitoring Well
- Piezometer
- Pore Water Piezometer in CCR Material
- Temporary Well within CCR Material
- Cumberland River Gauging Station
- 2019 Imagery Boundary
- CCR Unit Area (Approximate)

CCR: Coal combustion residuals

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)



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Revised: 2020-09-14 By: mbough

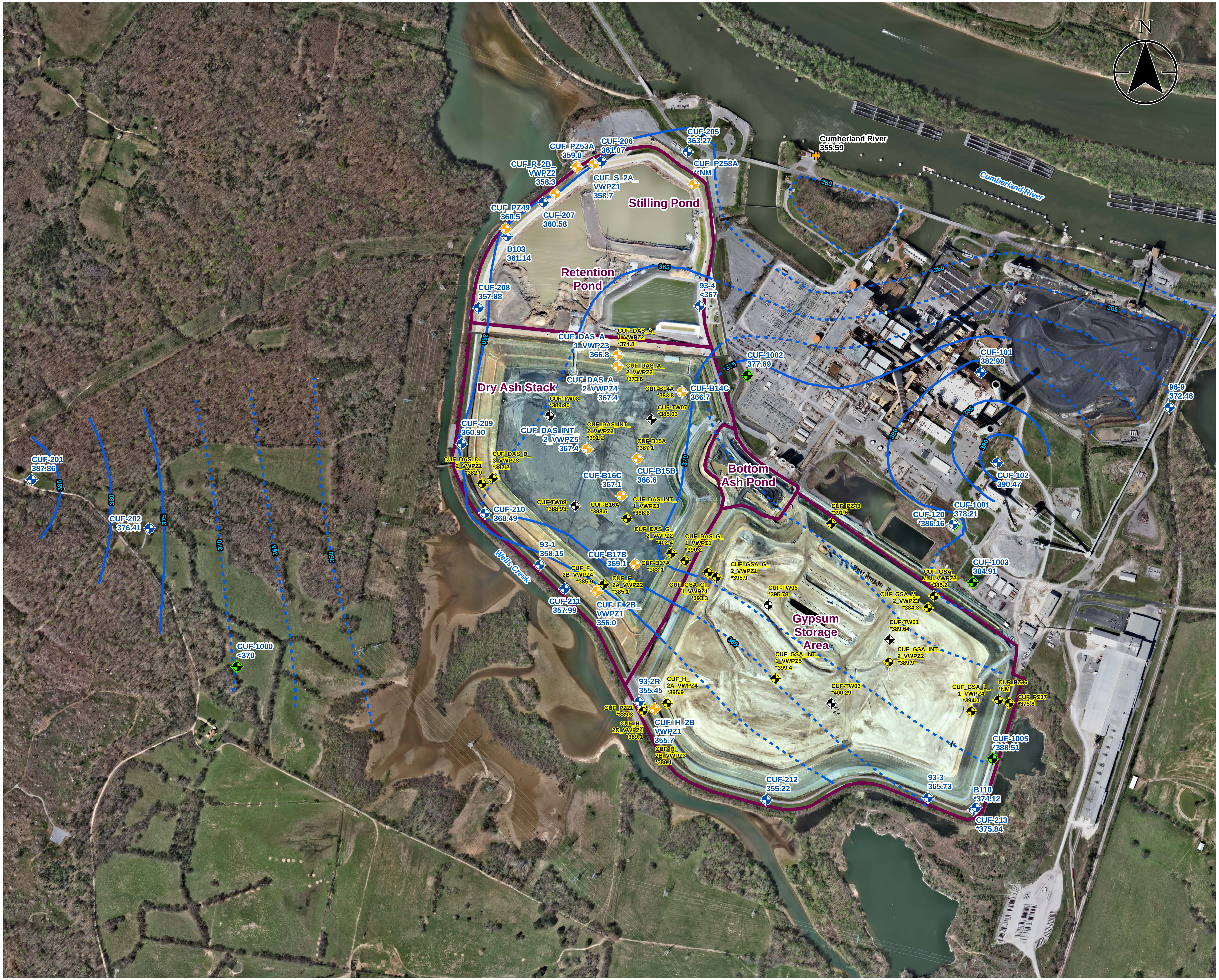
Exhibit No.
A.2

Title
Groundwater Elevation Contour Map, Event #3 (September 9, 2019)

Client/Project
Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location 175568209
Stewart County, Tennessee
Prepared by MB on 2021-02-12
Technical Review by MW on 2021-02-12

0 400 800 1,200 1,600 Feet
1:4,800 (At original document size of 22x34)



Legend

- Groundwater Investigation Monitoring Well groundwater elevation in feet above mean sea level (ft amsl)
- Other Monitoring Well groundwater elevation in ft amsl
- Piezometer groundwater elevation in ft amsl
- Piezometer in CCR pore water elevation in ft amsl; value not used for contouring
- Temporary well in CCR pore water elevation in ft amsl; value not used for contouring
- Cumberland River Gauging Station surface water elevation in ft amsl
- Interpolated Groundwater Contour (5 ft interval; elevations are in ft amsl)
- Groundwater Contour (5 ft interval; elevations are in ft amsl)
- 2019 Imagery Boundary
- CCR Unit Area (Approximate)

CCR: Coal combustion residuals

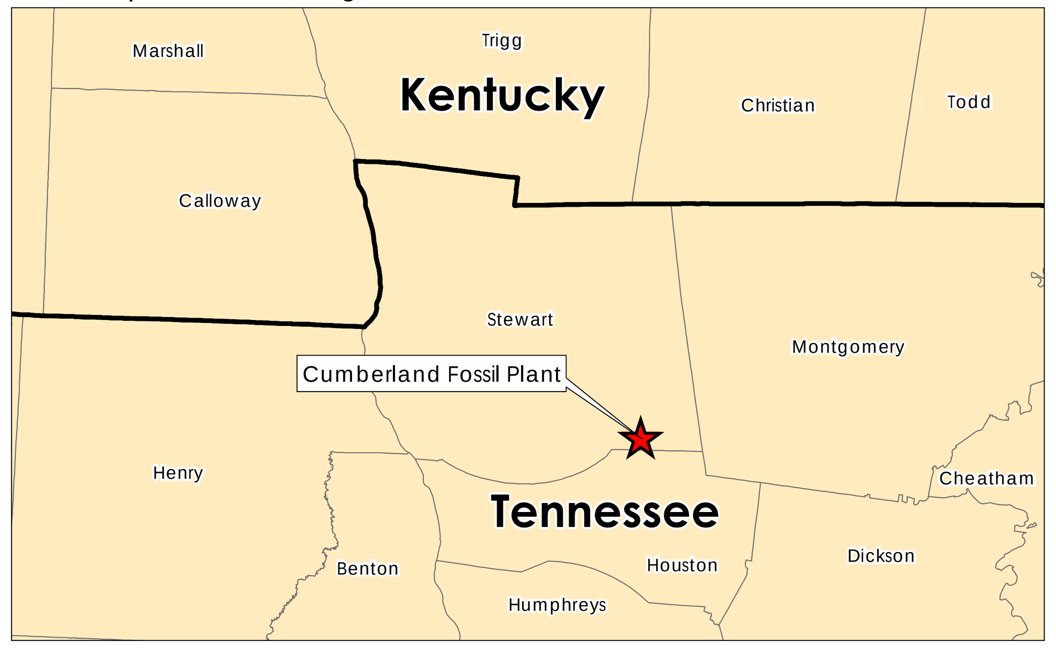
< Groundwater elevations are rounded to nearest foot to constrain potential elevation when depth to groundwater could not be measured.

*Groundwater elevation displayed but not used as input for contouring due to factors such as well construction or being screened in a different hydrogeologic unit.

**Piezometer was not collecting groundwater measurements during this monitoring event.

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)
3. Groundwater contours were created using Surfer Version 16.1.350 (December 13, 2018) and manual adjustment
4. For PZ's with multiple instruments in CCR material, the reading with the highest pore water elevation is displayed, unless that reading is suspected of being erroneous.



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U:\TVA-EP\175568209_CUF_Phase2\gis\mxd\GW_TechMemo\CUF_GWTechMemo_figA2_GroundwaterContour_wPZ_Event3v2porewater.mxd Revised: 2021-02-12 By: cwooten

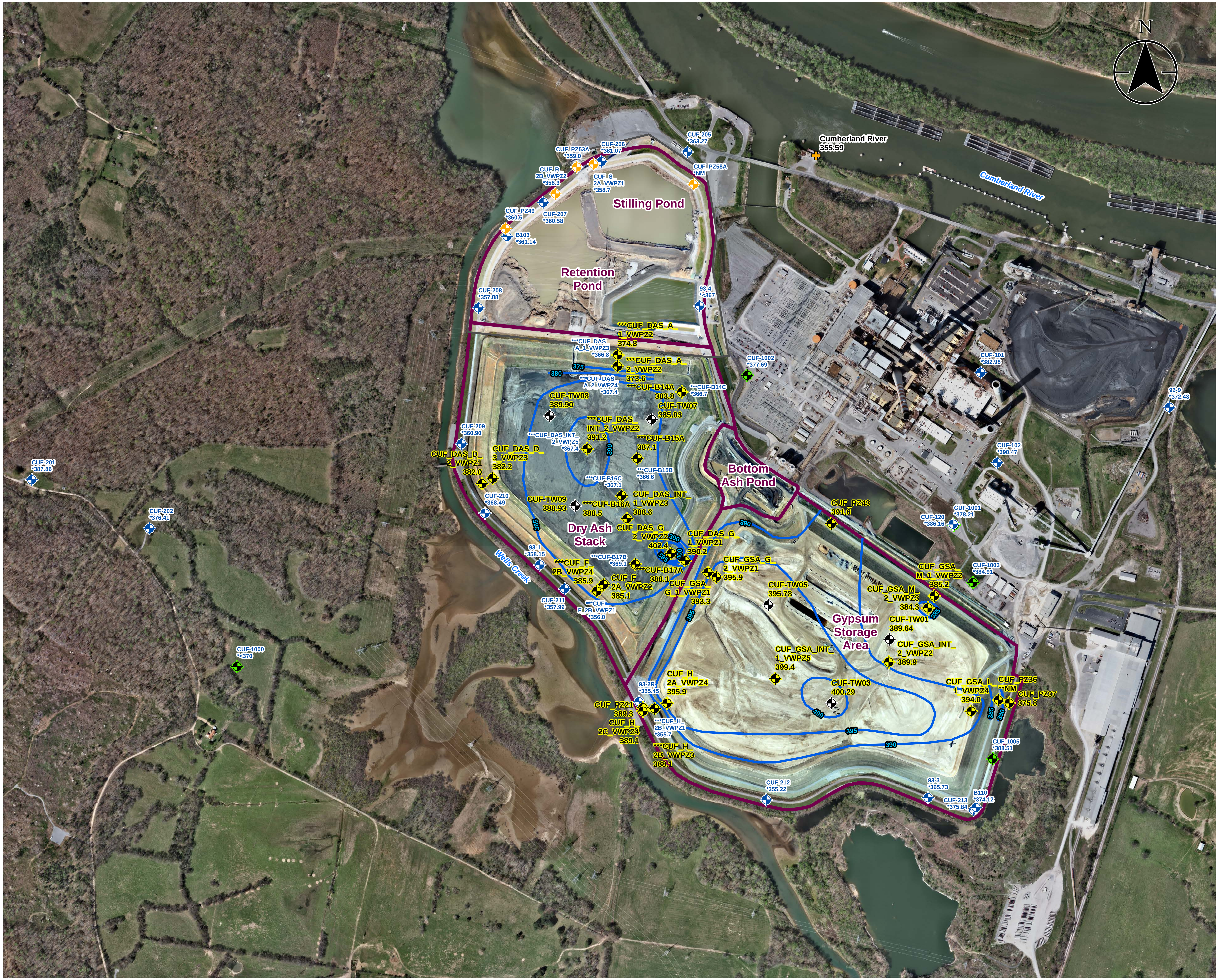


Exhibit No.

A.3

Title

Pore water Elevation Contour Map, Event #3 (September 9, 2019)

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location

175568209

Stewart County, Tennessee

Prepared by MB on 2021-02-12
Technical Review by MW on 2021-02-12

0 400 800 1,200 1,600 Feet

1:4,800 (At original document size of 22x34)

Legend

- Groundwater Investigation Monitoring Well groundwater elevation in feet above mean sea level (ft amsl); value not used for contouring
- Other Monitoring Well groundwater elevation in ft amsl; value not used for contouring
- Piezometer groundwater elevation in ft amsl; value not used for contouring
- Piezometer in CCR pore water elevation in ft amsl
- Temporary well in CCR pore water elevation in ft amsl
- Cumberland River Gauging Station surface water elevation in ft amsl
- Pore water Contour (5 ft interval; elevations are in ft amsl)
- 2019 Imagery Boundary
- CCR Unit Area (Approximate)

CCR: Coal combustion residuals

< Groundwater elevations are rounded to nearest foot to constrain potential elevation when depth to groundwater could not be measured.

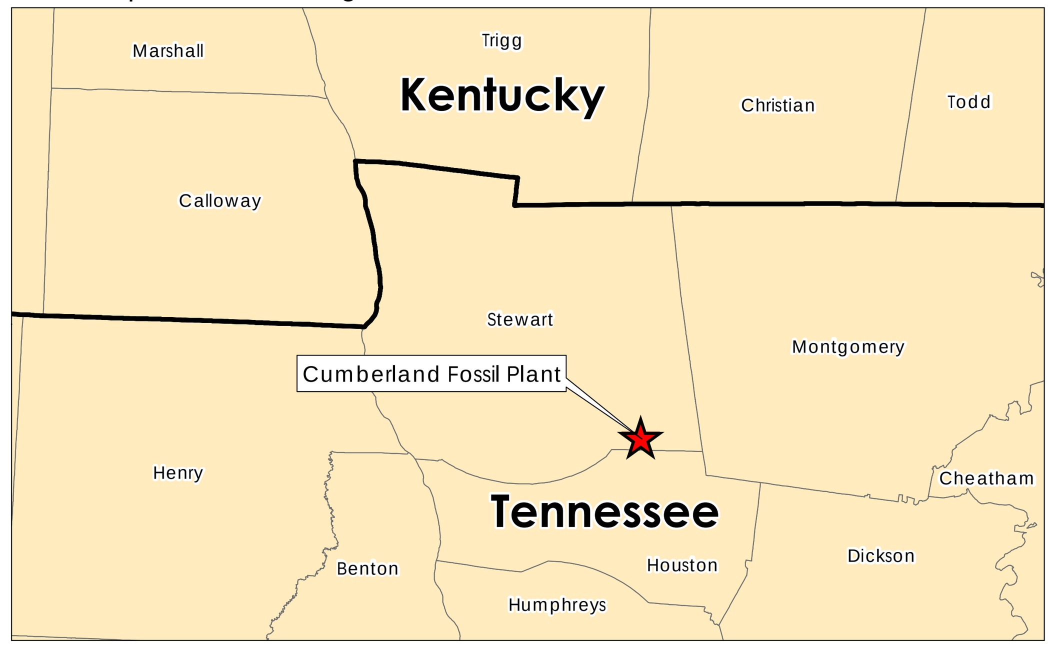
*Groundwater elevation displayed but not used as input for contouring due to factors such as well construction or being screened in a different hydrogeologic unit.

**Piezometer was not collecting groundwater measurements during this monitoring event.

***Nested VWPZ sensors monitoring pore water and groundwater elevations in the same borehole, and the location is shown by a single symbol.

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)
3. Pore water contours were created with manual adjustment using Surfer Version 16 (December 13, 2018)
4. For PZ's with multiple instruments in CCR material, the reading with the highest pore water elevation is displayed, unless that reading is suspected of being erroneous.



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APPENDIX B - TABLES

TABLE B.1a – Groundwater Level Measurements
Cumberland Fossil Plant
September 2019

UNID	Well / Piezometer ID	Date Measured	Depth to Groundwater	Top of Casing Elevation	Groundwater Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
			ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft btoc	
CUF-00-GW-43-001	93-1	9-Sep-19	39.02	397.17	358.15	n/a	n/a	n/a	52.3 - 62.3	Alluvial Silts and Clays / Alluvial Sands and Gravels
CUF-00-GW-43-002	93-2R	9-Sep-19	42.43	397.88	355.45	n/a	n/a	n/a	62.3 - 72.0	Alluvial Sands and Gravels
CUF-00-GW-43-003	93-3	9-Sep-19	31.77	397.50	365.73	n/a	n/a	n/a	45.0 - 55.0	Alluvial Silts and Clays
CUF-00-GW-43-004	93-4	n/a	NM	397.34	NM	n/a	n/a	n/a	27.2 - 36.6	Bedrock: Limestone
CUF-00-GW-43-005	96-9	9-Sep-19	20.11	392.59	372.48	n/a	n/a	n/a	16.1 - 30.9	Bedrock: Fernvale and Hermitage Limestones
CUF-00-GW-43-006	B103	9-Sep-19	34.83	395.97	361.14	n/a	n/a	n/a	74.0 - 84.0	Alluvial Silts and Clays
CUF-00-GW-43-007	B110	9-Sep-19	24.15	398.27	374.12	n/a	n/a	n/a	48.3 - 52.5	Alluvial Silts and Clays
CUF-00-GW-43-008	CUF-101	9-Sep-19	2.70	385.68	382.98	n/a	n/a	n/a	2.0 - 17.2	Clay
CUF-00-GW-43-009	CUF-102	9-Sep-19	12.46	402.93	390.47	n/a	n/a	n/a	3.8 - 13.8	Bedrock: Limestone
CUF-00-GW-43-010	CUF-120	9-Sep-19	7.03	393.19	386.16	n/a	n/a	n/a	9.3 - 14.3	Bedrock
CUF-00-GW-43-011	CUF-201	9-Sep-19	12.55	400.41	387.86	n/a	n/a	n/a	17.6 - 27.7	Alluvial Sands and Gravels
CUF-00-GW-43-012	CUF-202	9-Sep-19	6.87	383.28	376.41	n/a	n/a	n/a	14.3 - 19.6	Alluvial Sands and Gravels
CUF-00-GW-43-014	CUF-205	9-Sep-19	21.24	384.51	363.27	n/a	n/a	n/a	16.9 - 27.1	Alluvial Sands and Gravels
CUF-00-GW-43-015	CUF-206	9-Sep-19	37.60	398.67	361.07	n/a	n/a	n/a	82.7 - 92.9	Alluvial Sands and Gravels
CUF-00-GW-43-016	CUF-207	9-Sep-19	37.61	398.19	360.58	n/a	n/a	n/a	75.0 - 85.1	Alluvial Sands and Gravels
CUF-00-GW-43-017	CUF-208	9-Sep-19	40.50	398.38	357.88	n/a	n/a	n/a	47.9 - 58.0	Alluvial Sands and Gravels
CUF-00-GW-43-018	CUF-209	9-Sep-19	37.33	398.23	360.90	n/a	n/a	n/a	53.1 - 63.3	Alluvial Sands and Gravels
CUF-00-GW-43-019	CUF-210	9-Sep-19	29.71	398.20	368.49	n/a	n/a	n/a	63.5 - 68.5	Alluvial Sands and Gravels
CUF-00-GW-43-020	CUF-211	9-Sep-19	40.77	398.76	357.99	n/a	n/a	n/a	57.7 - 67.9	Alluvial Sands and Gravels
CUF-00-GW-43-021	CUF-212	9-Sep-19	43.49	398.71	355.22	n/a	n/a	n/a	62.6 - 72.8	Alluvial Sands and Gravels
CUF-00-GW-43-022	CUF-213	9-Sep-19	23.21	399.05	375.84	n/a	n/a	n/a	40.0 - 45.2	Alluvial Sands and Gravels
CUF-00-GW-43-026	CUF-1000	9-Sep-19	25.45*	395.29	Dry*	n/a	n/a	n/a	14.5 - 25.1	Clay and Clayey Sand
CUF-00-GW-43-027	CUF-1001	9-Sep-19	15.54	393.75	378.21	n/a	n/a	n/a	15.8 - 20.6	Clayey Gravel and Clay
CUF-00-GW-43-028	CUF-1002	9-Sep-19	11.57	389.26	377.69	n/a	n/a	n/a	15.1 - 20.0	Clay and Gravel/Clay
CUF-00-GW-43-029	CUF-1003	9-Sep-19	11.48	396.39	384.91	n/a	n/a	n/a	12.6 - 17.5	Gravel/Cobbles and Clay
CUF-00-GW-43-030	CUF-1005	9-Sep-19	11.07	399.58	388.51	n/a	n/a	n/a	18.2 - 28.8	Sand, Clayey Gravel, Clay
Piezometers										
n/a	CUF-B14C	9-Sep-19	74.1	n/a	366.7	440.8	319.8	121.0	n/a	Alluvial Clay and Granular
n/a	CUF-B15B	9-Sep-19	71.7	n/a	366.6	438.3	327.8	110.5	n/a	Alluvial Granular
n/a	CUF-B16C	9-Sep-19	72.6	n/a	367.1	439.7	324.7	115.0	n/a	Alluvial Granular
n/a	CUF-B17B	9-Sep-19	74.3	n/a	369.1	443.4	336.4	107.0	n/a	Alluvial Granular
n/a	CUF_PZ49	9-Sep-19	18.7	n/a	360.5	379.2	322.2	57.0	n/a	Alluvial Granular
n/a	CUF_PZ53A	9-Sep-19	17.0	n/a	359.0	376.0	311.0	65.0	n/a	Alluvial Granular
n/a	CUF_PZ58A	n/a	NM	n/a	NM	394.8	349.3	45.5	n/a	Alluvial Granular
n/a	CUF_R_2B_VWPZ2	9-Sep-19	37.0	n/a	358.3	395.3	320.0	75.3	n/a	Alluvial Granular
n/a	CUF_S_2A_VWPZ1	9-Sep-19	36.6	n/a	358.7	395.3	299.7	95.6	n/a	Alluvial Granular
n/a	CUF_F_2B_VWPZ1	9-Sep-19	56.1	n/a	356.0	412.1	322.1	90.0	n/a	Alluvial Granular
n/a	CUF_DAS_A_1_VWPZ3	9-Sep-19	21.2	n/a	366.8	388.0	293.0	95.0	n/a	Alluvial Granular
n/a	CUF_DAS_A_2_VWPZ4	9-Sep-19	45.6	n/a	367.4	412.9	308.4	104.5	n/a	Alluvial Granular
n/a	CUF_DAS_INT_2_VWPZ5	9-Sep-19	67.1	n/a	367.4	434.5	313.5	121.0	n/a	Alluvial Granular
n/a	CUF_H_2B_VWPZ1	9-Sep-19	55.0	n/a	355.7	410.7	322.7	88.0	n/a	Alluvial Granular
Surface Water Gauge										
Cumberland River gauge	n/a	9-Sep-19	n/a	n/a	355.59	n/a	n/a	n/a	n/a	n/a

See notes on last page.

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TABLE B.1a – Groundwater Level Measurements
Cumberland Fossil Plant
September 2019

UNID	Well / Piezometer ID	Date Measured	Depth to Groundwater	Top of Casing Elevation	Groundwater Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
			ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft btoc	

Notes:

*	<0.1 ft of water was present in the sump/end cap of the well and is not indicative of groundwater, the well is considered dry
bgs	below ground surface
btoc	below top of casing
ft	feet
ID	identification
msl	mean sea level
n/a	not applicable
NM	not measured
UNID	Unique Numerical Identification

1. Top of casing elevations, screen intervals, and screened formations were obtained from the TVA Well Inventory Log provided by TVA.
2. Cumberland River data point is the closest reading to noon Central Daylight Time recorded by the automated staff gauge provided by TVA.
3. Ground surface elevation, groundwater elevations and piezometer data were obtained from geotechnical instrumentation database. Vibrating wire sensor formation information were obtained from boring logs. Data used were based on average of readings on the measurement date.
4. Depth to groundwater and groundwater elevations in piezometers are calculated values. Accuracy of piezometer data is to 0.1 ft.
5. A groundwater level was not measured in well 93-4 because the meter was obstructed by the pump. Groundwater levels were not measured in select peizometers as noted above because the sensors were not recording data.

TABLE B.1b – Pore Water Level Measurements
Cumberland Fossil Plant
September 2019

Temporary Well / Piezometer ID	Date Measured	Depth to Pore Water	Top of Casing Elevation	Pore Water Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
		ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft bgs	
Temporary Wells									
CUF-TW01	9-Sep-19	41.35	430.99	389.64	n/a	n/a	n/a	41.3 - 51.9	CCR
CUF-TW03	9-Sep-19	29.24	429.53	400.29	n/a	n/a	n/a	54.9 - 65.5	CCR
CUF-TW05	9-Sep-19	31.02	426.80	395.78	n/a	n/a	n/a	49.5 - 56.5	CCR
CUF-TW07	9-Sep-19	58.66	443.69	385.03	n/a	n/a	n/a	81.5 - 92.1	CCR
CUF-TW08	9-Sep-19	53.46	443.36	389.90	n/a	n/a	n/a	72.1 - 82.7	CCR
CUF-TW09	9-Sep-19	57.51	446.44	388.93	n/a	n/a	n/a	79.5 - 90.1	CCR
Piezometers									
CUF-B14A	9-Sep-19	57.0	n/a	383.8	440.8	360.8	80.0	n/a	CCR
CUF-B15A	9-Sep-19	51.2	n/a	387.1	438.3	353.3	85.0	n/a	CCR
CUF-B16A	9-Sep-19	51.2	n/a	388.5	439.7	383.4	56.3	n/a	CCR
CUF-B17A	9-Sep-19	55.3	n/a	388.1	443.4	363.9	79.5	n/a	CCR
CUF_DAS_A_1_VWPZ2	9-Sep-19	13.2	n/a	374.8	388.0	335.0	53.0	n/a	CCR
CUF_DAS_A_2_VWPZ2	9-Sep-19	39.3	n/a	373.6	412.9	353.4	59.5	n/a	CCR
CUF_DAS_D_2_VWPZ1	9-Sep-19	16.7	n/a	382.0	398.7	376.6	22.1	n/a	CCR
CUF_DAS_D_3_VWPZ3	9-Sep-19	45.0	n/a	382.2	427.2	371.9	55.3	n/a	CCR
CUF_DAS_G_1_VWPZ1	9-Sep-19	15.3	n/a	390.2	405.5	379.6	25.9	n/a	CCR
CUF_DAS_G_2_VWPZ2	9-Sep-19	36.7	n/a	402.4	439.1	396.1	43.0	n/a	CCR
CUF_DAS_INT_1_VWPZ3	9-Sep-19	50.5	n/a	388.6	439.1	379.1	60.0	n/a	CCR
CUF_DAS_INT_2_VWPZ2	9-Sep-19	43.3	n/a	391.2	434.5	388.5	46.0	n/a	CCR
CUF_F_2A_VWPZ2	9-Sep-19	48.5	n/a	385.1	433.6	353.6	80.0	n/a	CCR
CUF_F_2B_VWPZ4	9-Sep-19	26.2	n/a	385.9	412.1	377.1	35.0	n/a	CCR
CUF_GSA_G_1_VWPZ1	9-Sep-19	20.0	n/a	393.3	413.3	384.6	28.7	n/a	CCR
CUF_GSA_G_2_VWPZ1	9-Sep-19	32.3	n/a	395.9	428.2	388.2	40.0	n/a	CCR
CUF_GSA_INT_1_VWPZ5	9-Sep-19	23.7	n/a	399.4	423.1	393.1	30.0	n/a	CCR
CUF_GSA_INT_2_VWPZ2	9-Sep-19	30.4	n/a	389.9	420.3	380.3	40.0	n/a	CCR
CUF_GSA_L_1_VWPZ4	9-Sep-19	36.3	n/a	394.0	430.3	369.3	61.0	n/a	CCR
CUF_GSA_M_1_VWPZ2	9-Sep-19	24.8	n/a	385.2	410.0	382.0	28.0	n/a	CCR
CUF_GSA_M_2_VWPZ3	9-Sep-19	46.0	n/a	384.3	430.3	380.3	50.0	n/a	CCR
CUF_H_2A_VWPZ4	9-Sep-19	28.1	n/a	395.9	424.0	389.8	34.2	n/a	CCR
CUF_H_2B_VWPZ3	9-Sep-19	22.6	n/a	388.1	410.7	353.7	57.0	n/a	CCR
CUF_H_2C_VWPZ4	9-Sep-19	6.2	n/a	389.1	395.3	374.0	21.3	n/a	CCR
CUF_PZ21	9-Sep-19	5.8	n/a	389.3	395.1	356.0	39.1	n/a	CCR
CUF_PZ36	n/a	NM	n/a	NM	411.2	363.2	48.0	n/a	CCR
CUF_PZ37	9-Sep-19	19.4	n/a	375.8	395.2	367.2	28.0	n/a	CCR
CUF_PZ43	9-Sep-19	19.7	n/a	391.6	411.3	374.3	37.0	n/a	CCR

See notes on last page.

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TABLE B.1b – Pore Water Level Measurements
Cumberland Fossil Plant
September 2019

Temporary Well / Piezometer ID	Date Measured	Depth to Pore Water	Top of Casing Elevation	Pore Water Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
		ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft bgs	

Notes:

bgs	below ground surface
btoc	below top of casing
CCR	coal combustion residuals
ft	feet
ID	identification
msl	mean sea level
n/a	not applicable
NM	not measured

1. Top of casing elevations, screen intervals, and screened formations were obtained from boring logs, well detail and well survey data.
2. For piezometers, ground surface elevation, pore water elevations, and piezometer data obtained from Geotech instrumentation database. Vibrating wire sensor formation information obtained from boring logs. Data from vibrating wire piezometers are averaged for the measurement date.
3. Depth to pore water in piezometers and pore water elevations at all locations are calculated values. Accuracy of piezometer data is to 0.1 ft.
4. Screen interval shown for temporary wells is below ground surface when drilled.

TABLE B.2 – Summary of Groundwater Samples
Cumberland Fossil Plant
September 2019

			Analysis Type								
Location ID	**Sample ID**	**Sample Type**	Field Parameters	Total Metals	Total Mercury	Anions	Alkalinity	Total Dissolved Solids	Radium-226	Radium-228	Radium-226+228
CUF-1001	CUF-GW-027-20190910	Normal Environmental Sample	x	x	x	x	x	x	x	x	x
CUF-1002	CUF-GW-028-20190911	Normal Environmental Sample	x	x	x	x	x	x	x	x	x
	CUF-GW-DUP01-20190911	Field Duplicate Sample		x	x	x	x	x	x	x	x
CUF-1003	CUF-GW-029-20190910	Normal Environmental Sample	x	x	x	x	x	x	x	x	x
CUF-1005	CUF-GW-030-20190910	Normal Environmental Sample	x	x	x	x	x	x	x	x	x

Notes

Total and Dissolved Metals	SW-846 6020A
Total and Dissolved Mercury	SW-846 7470A
Anions	EPA 300.0/SW 9056
Alkalinity	SM2320B
Total Dissolved Solids	SM2540C
Radium-226	EPA 903.0
Radium-228	EPA 904.0
Radium-226+228	CALC
ID	identification

1. Field and laboratory quality control sample results except for field duplicates are not included in report tables but were used for data validation.

TABLE B.3 – Summary of Groundwater Quality Parameters
Cumberland Fossil Plant
September 2019

Sample Location Sample Date Sample ID Sample Depth Sample Type Level of Review	Units	CUF-1001 10-Sep-19 CUF-GW-027-20190910 19 ft Normal Environmental Sample Final QC Review	CUF-1002 11-Sep-19 CUF-GW-028-20190911 18 ft Normal Environmental Sample Final QC Review	CUF-1003 10-Sep-19 CUF-GW-029-20190910 16.8 ft Normal Environmental Sample Final QC Review	CUF-1005 10-Sep-19 CUF-GW-030-20190910 24 ft Normal Environmental Sample Final QC Review
Field Parameters					
Dissolved Oxygen	%	3.0	3.4	5.0	4.7
Dissolved Oxygen	mg/L	0.28	0.29	0.42	0.39
ORP	mV	-144.6	-163.1	-15.9	0.6
pH (field)	SU	6.91	6.97	7.17	9.78
Specific Cond. (Field)	uS/cm	1,435	1,288	3,121	3,536
Temperature, Water (C)	DEG C	21.8	21.6	23.4	23.3
Turbidity, field	NTU	0.35	2.44	0.62	0.82

Notes:

%	percent
Cond.	conductance
DEG C	degrees Celsius
ft	feet below top of casing
ID	identification
mg/L	milligrams per Liter
mV	milliVolts
NTU	Nephelometric Turbidity Unit
ORP	Oxidation Reduction Potential, measured using a silver reference electrode which has a standard potential of 200 mV
SU	Standard Units
uS/cm	microSiemens per centimeter

TABLE B.4 - Groundwater Analytical Results for Metals, Anions, and General Chemistry
Cumberland Fossil Plant
September 2019

Sample Location	Units	EPA MCLs	CCR Rule GWPS	CUF-1001	CUF-1002		CUF-1003	CUF-1005
Sample Date				10-Sep-19	11-Sep-19	11-Sep-19	10-Sep-19	10-Sep-19
Sample ID				CUF-GW-027-20190910	CUF-GW-028-20190911	CUF-GW-DUP01-20190911	CUF-GW-029-20190910	CUF-GW-030-20190910
Sample Depth				19 ft	18 ft	18 ft	16.8 ft	24 ft
Sample Type				Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample
Level of Review				Final-Verified	Final-Verified	Final-Verified	Final-Verified	Final-Verified
Total Metals								
Antimony	ug/L	6[A]	n/v	<0.378	<0.378	<0.378	<0.378	2.02
Arsenic	ug/L	10[A]	n/v	2.83	6.30	7.08	0.608 U*	7.35
Barium	ug/L	2,000[A]	n/v	82.3	59.8	63.4	42.1	65.6
Beryllium	ug/L	4[A]	n/v	0.228 U*	0.212 U*	0.925 U*	0.192 U*	0.213 U*
Boron	ug/L	n/v	n/v	3,960	341 U*	374 U*	23,200	33,200
Cadmium	ug/L	5[A]	n/v	<0.125	<0.125	0.247 J	0.174 J	0.244 J
Calcium	ug/L	n/v	n/v	243,000	212,000	222,000	591,000	819,000
Chromium	ug/L	100[A]	n/v	2.78 U*	2.71 U*	3.28 U*	2.87 U*	2.52 U*
Cobalt	ug/L	n/v	6[B]	0.737	0.598	0.870	1.46	0.562
Copper	ug/L	n/v	n/v	1.08 U*	0.919 U*	1.15 U*	1.52 U*	1.56 U*
Lead	ug/L	n/v	15[B]	<0.128	<0.128	0.245 J	<0.128	<0.128
Lithium	ug/L	n/v	40[B]	8.05 U*	6.08 U*	8.37 U*	7.50 U*	**55.4[B]**
Magnesium	ug/L	n/v	n/v	24,100	30,600	32,100	63,700	1,500
Mercury	ug/L	2[A]	n/v	<0.101	<0.101	<0.101	<0.101	<0.101
Molybdenum	ug/L	n/v	100[B]	63.9	2.61 J	2.92 J	**579[B]**	**1,020[B]**
Nickel	ug/L	100 (TN MCL)[A]	n/v	0.481 J	1.02	1.18	1.36	1.01
Potassium	ug/L	n/v	n/v	5,570	1,710	1,810	34,100	48,800
Selenium	ug/L	50[A]	n/v	<1.51	<1.51	<1.51	<1.51	24.1
Silver	ug/L	100 (TN MCL)[A]	n/v	<0.177	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	n/v	n/v	17,700	23,500	24,800	48,700	28,500
Thallium	ug/L	2[A]	n/v	<0.148	<0.148	0.427 U*	0.416 J	1.18
Vanadium	ug/L	n/v	n/v	1.57 U*	1.66 U*	1.82 U*	2.70 U*	642
Zinc	ug/L	n/v	n/v	4.07 U*	4.46 U*	3.46 U*	3.60 U*	7.86 U*
Anions								
Chloride	mg/L	n/v	n/v	64.6	25.2	25.6	258	313
Fluoride	mg/L	4[A]	n/v	0.147	0.323	0.325	0.202 J	<0.132
Sulfate	mg/L	n/v	n/v	466	345	334	1,490	1,760
General Chemistry								
Alkalinity, Bicarbonate	mg/L	n/v	n/v	257	357	346	132	<5.00
Alkalinity, Carbonate	mg/L	n/v	n/v	<5.00	<5.00	<5.00	<5.00	88.9
Alkalinity, Total as CaCO3	mg/L	n/v	n/v	257	357	346	132	153
Total Dissolved Solids	mg/L	n/v	n/v	1,040	900	907	2,680	3,600

Notes:

A	EPA Maximum Contaminant Level
B	CCR Rule GWPS (Federal Register / Vol. 83, No. 146 / Monday, July 30, 2018 / Rules and Regulations)
n/v	No standard/guideline value
6.5[A]	Concentration is greater than or equal to the indicated standard.
<0.03	analyte was not detected at a concentration greater than the Method Detection Limit
ft	feet below top of casing
ID	identification
J	quantitation is approximate due to limitations identified during data validation
mg/L	milligrams per Liter
U*	result should be considered “not detected” because it was detected in an associated field or laboratory blank at a similar level
ug/L	micrograms per Liter
(TN MCL)	Tennessee Maximum Contaminant Level

1. Level of review is defined in the Quality Assurance Project Plan.

TABLE B.5 – Groundwater Analytical Results for Radiological Parameters Cumberland Fossil Plant
September 2019

Sample Location				CUF-1001	CUF-1002		CUF-1003	CUF-1005
Sample Date				10-Sep-19	11-Sep-19	11-Sep-19	10-Sep-19	10-Sep-19
Sample ID				CUF-GW-027-20190910	CUF-GW-028-20190911	CUF-GW-DUP01-20190911	CUF-GW-029-20190910	CUF-GW-030-20190910
Sample Depth				19 ft	18 ft	18 ft	16.8 ft	24 ft
Sample Type				Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample
Level of Review	Units	EPA MCLs	CCR Rule GWPS	Final-Verified	Final-Verified	Final-Verified	Final-Verified	Final-Verified
Radiological Parameters								
Radium-226	pCi/L	n/v	n/v	0.811 +/-(0.678)U	0.458 +/-(0.581)U	0.0334 +/-(0.410)U	0.698 +/-(0.585)U	0.775 +/-(0.538)
Radium-228	pCi/L	n/v	n/v	0.0586 +/-(0.298)U	0.246 +/-(0.286)U	0.472 +/-(0.349)U	0.197 +/-(0.291)U	0.438 +/-(0.473)U
Radium-226+228	pCi/L	5[A]	n/v	0.870 +/-(0.741)U	0.703 +/-(0.648)U	0.505 +/-(0.538)U	0.895 +/-(0.653)U	1.21 +/-(0.717)J

Notes:

A	EPA Maximum Contaminant Level
B	CCR Rule GWPS (Federal Register / Vol. 83, No. 146 / Monday, July 30, 2018 / Rules and Regulations)
n/v	No standard/guideline value
ft	feet below top of casing
ID	identification
J	quantitation is approximate due to limitations identified during data validation
pCi/L	picoCurie per Liter
U	not detected

1. Level of review is defined in the Quality Assurance Project Plan.

APPENDIX H.7

GROUNDWATER INVESTIGATION EVENT #4 SAMPLING AND ANALYSIS REPORT

Stantec

Cumberland Fossil Plant Groundwater Investigation Event #4 Sampling and Analysis Report

TDEC Commissioner's Order
Environmental Investigation Plan
Cumberland Fossil Plant
Cumberland City, Tennessee

March 26, 2021

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

TVA

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

Revision Record

Revision	Description	Date
0	Submittal to TDEC	March 26, 2021

Sign-off Sheet

This document entitled Cumberland Fossil Plant Groundwater Investigation Event #4 Sampling and Analysis Report was prepared by Stantec Consulting Services Inc. ("Stantec") for the account of Tennessee Valley Authority (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ______________________________
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Carole M. Farr, Senior Principal Geologist

Approved by ______________________________
Rebekah Brooks, Principal Hydrogeologist

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Abbreviations

CCR	Coal Combustion Residuals
CCR Parameters	Constituents listed in Appendices III and IV of 40 CFR 257 and five inorganic constituents included in Appendix I of Tennessee Rule 0400-11-01-.04
CFR	Code of Federal Regulations
COC	Chain-of-Custody
CUF Plant	Cumberland Fossil Plant
DO	Dissolved Oxygen
EAR	Environmental Assessment Report
EIP	Environmental Investigation Plan
ENV	Environmental
EnvStds	Environmental Standards, Inc.
Event #4	Groundwater investigation field event performed October 28-30, 2019
FSP	Field Sampling Personnel
ft	Feet
GEL	GEL Laboratories LLC
ID	Identification
IDW	Investigation Derived Waste
mg/L	Milligrams per Liter
NTU	Nephelometric Turbidity Units
ORP	Oxidation-Reduction Potential
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
QC	Quality Control
SAP	Sampling and Analysis Plan
SAR	Sampling and Analysis Report
Stantec	Stantec Consulting Services Inc.
TDEC	Tennessee Department of Environment and Conservation
TDEC Order	Commissioner’s Order No. OGC15-0177
TestAmerica	Eurofins TestAmerica Inc.
TI	Technical Instruction
TVA	Tennessee Valley Authority
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) has prepared this sampling and analysis report (SAR) on behalf of the Tennessee Valley Authority (TVA) to document the completion of activities related to a groundwater investigation sampling event performed October 28-30, 2019 (Event #4) at TVA's Cumberland Fossil Plant (CUF Plant) located in Cumberland City, Tennessee.

The purpose of the groundwater investigation, upon completion of six groundwater sampling events, is to characterize groundwater conditions at the CUF Plant in support of fulfilling the requirements for the Tennessee Department of Environment and Conservation (TDEC) issued Commissioner's Order No. OGC15-0177 (TDEC Order) to TVA (TDEC 2015). The TDEC Order sets forth a "process for the investigation, assessment, and remediation of unacceptable risks" at TVA's coal ash disposal sites in Tennessee.

The purpose of this SAR is to document the work completed during groundwater sampling Event #4 of 6 total events and to present the information and data collected during the execution of the Groundwater Investigation Sampling and Analysis Plan (SAP) (Stantec 2018a). This SAR is not intended to provide conclusions or evaluations of results. The scope of the groundwater investigation represented herein was conducted pursuant to the SAP and is part of a larger environmental investigation at the CUF Plant. The data provided in this SAR are not inclusive of other programmatic data that exist for the site. The evaluation of the results will include data from the six groundwater sampling events and consider other aspects of the environmental investigation, as well as data collected under other State and/or coal combustion residuals (CCR) programs. This evaluation will be presented in the Environmental Assessment Report (EAR).

Event #4 activities were performed in general accordance with the following documents developed by TVA to support fulfilling the requirements of the TDEC Order at the CUF Plant:

- *Groundwater Investigation SAP* (Stantec 2018a)
- *Environmental Investigation Plan (EIP)* (Stantec 2018b)
- *Quality Assurance Project Plan (QAPP)* (Environmental Standards, Inc. 2018).

The Groundwater Investigation SAP was updated based on TVA- and TDEC-approved Programmatic- and Project-specific changes. Minor variations in scope and procedures from those outlined in the SAP occurred during field activities due to field conditions and programmatic updates and are referenced in Section 3.6.

Event #4 is the fourth in a series of six planned sampling events for the groundwater investigation. Stantec performed the field work activities for this event. Laboratory analysis of constituents was performed by GEL Laboratories LLC (GEL) in Charleston, South Carolina (radium samples only) and Eurofins TestAmerica, Inc. (TestAmerica) in Pittsburgh, Pennsylvania (other analytes). Quality assurance oversight on data acquisition protocols, sampling practices, and data validation or verification was performed by Environmental Standards, Inc. (EnvStds) under direct contract to TVA.

This report summarizes the groundwater investigation activities for Event #4. The remaining sampling events will be completed before overall conclusions and findings about the groundwater investigation and groundwater conditions at the CUF Plant are made and documented in the EAR.

2.0 OBJECTIVE AND SCOPE

The primary objectives of the groundwater investigation conducted pursuant to the Groundwater Investigation SAP (which includes six sampling events) are to characterize existing groundwater quality and to evaluate groundwater flow conditions at the CUF Plant in response to the TDEC Order. The approach to characterizing the groundwater conditions is to:

- Collect groundwater samples for chemical analyses to evaluate the potential presence of constituents related to CCR in groundwater
- Measure groundwater and surface water elevations for subsequent evaluation of direction and rate of groundwater flow.

The scope of work intended to achieve the objectives of the groundwater investigation consists of six sampling events at a frequency of one event every two months for one year to characterize seasonal groundwater quality and flow direction. This report describes the activities related to Event #4, performed in October 2019, the scope of which included:

- Collecting groundwater and surface water level measurements
- Collecting field measurements of groundwater quality parameters
- Collecting groundwater samples and associated quality control (QC) samples for laboratory analysis.

These activities were carried out after the installation of permanent monitoring wells specified in the Groundwater Investigation SAP. Details of the monitoring well installation activities are provided in the CUF Plant Hydrogeological Investigation SAR.

In addition, pore water measurements from piezometers and temporary wells installed in the CCR units at the CUF Plant are presented in this SAR for comparison with groundwater data. Temporary well and piezometer installation activities are described in the CUF Plant Exploratory Drilling SAR, and temporary well gauging and sampling information is provided in the CUF Plant CCR Material Characteristics SAR.

3.0 FIELD ACTIVITIES

Groundwater investigation field activities for Event #4 were conducted October 28-30, 2019. Stantec performed groundwater level measurements and sample collection activities based on guidance and specifications in TVA's Environmental (ENV) Technical Instructions (TIs), the SAP, the QAPP, and applicable United States Environmental Protection Agency (USEPA) documents except as noted in the Variations section of this report. As part of TVA's commitment to generate representative and reliable data, data validation and/or verification of laboratory analytical results were performed by EnvStds under direct contract with TVA. EnvStds also provided quality reviews of field documentation.

During Event #4, Stantec conducted the following field activities:

- Measured groundwater levels at five monitoring wells installed for the TDEC Order, and 20 monitoring wells and 13 piezometers installed for other environmental programs (25 total monitoring wells)
- Measured pore water levels at six temporary wells and 27 piezometers installed in the CCR units
- Measured the surface water level at one location in the Cumberland River
- Collected groundwater samples from four monitoring wells installed for the TDEC Order
- Recorded field measurements of groundwater quality parameters during purging and stabilization at the sampled monitoring wells
- Collected QC samples including one field duplicate, one matrix spike/matrix spike duplicate, two field blanks, and one equipment blank
- Shipped the collected samples to GEL in Charleston, South Carolina, and TestAmerica in Pittsburgh, Pennsylvania.

Details on each activity are presented in the sections below.

3.1 WORK LOCATIONS

The TDEC Order CCR units at the CUF Plant (the Stilling Pond, including the Retention Pond, the Dry Ash Stack, the Bottom Ash Pond, and the Gypsum Storage Area), as well as the monitoring wells, temporary wells, and piezometers sampled and/or gauged during Event #4 are shown on Exhibit A.1 in Appendix A. TVA is currently sampling groundwater at the CUF Plant for TDEC Solid Waste Management permit requirements and the USEPA CCR Rule codified in Title 40 of the Code of Federal Regulations (CFR) Part 257 (40 CFR 257). Monitoring wells that are sampled as part of other environmental programs are not sampled as part of the groundwater investigation for the TDEC Order.

Groundwater levels were measured in TDEC Order monitoring wells, as well as in select additional wells and piezometers from other environmental programs, as shown in Table B.1a in Appendix B, to provide information to prepare groundwater contour maps for this SAR and the CUF Plant EAR. Pore water levels measured in temporary wells and piezometers installed in the CCR units are presented in Table B.1b. Groundwater and pore water elevations are shown on Exhibits A.2 and A.3 in Appendix A. Groundwater elevation contours are depicted on Exhibit A.2 and pore water elevation contours are depicted on Exhibit A.3.

Groundwater analytical and field duplicate samples were collected from the TDEC Order groundwater investigation monitoring wells as shown in Table B.2 in Appendix B. Groundwater analytical data collected for the TDEC Order and other environmental programs will be provided in the EAR.

3.2 DOCUMENTATION

Stantec maintained field documentation in accordance with ENV-TI-05.80.03, *Field Record Keeping*, and the QAPP. Field activities and data were recorded on program-specific field forms. Health and safety forms were completed in accordance with TVA and Stantec health and safety requirements. Additional information regarding field documentation is provided below.

3.2.1 Field Forms

Stantec used program-specific field forms to record field observations and data for specific activities. Field forms used during the groundwater investigation included:

- *Daily Field Activity Log*
- *Monitoring Well Inspection Checklist*
- *Equipment Calibration Form*
- *Groundwater Level Measurement Form*
- *Vibrating Wire Piezometer Measurement Form*
- *Groundwater Sampling Form*
- *Chain-of-Custody (COC).*

3.2.1.1 Daily Field Activity Log

Stantec field sampling personnel (FSP) recorded field activities, observations, and data on a *Daily Field Activity Log* to chronologically document the field program. Deviations from the SAP, TIs, or QAPP were documented on the *Daily Field Activity Log*.

3.2.1.2 Monitoring Well Inspection Checklist

Prior to measuring water levels, Stantec FSP inspected each monitoring well for damage or indications that the well integrity had been compromised in accordance with ENV-TI-05.80.21, *Monitoring Well Inspection and Maintenance.* Inspection results were documented on a *Monitoring Well Inspection Checklist*. No signs of damage or necessary repairs were noted during Event #4.

3.2.1.3 Equipment Calibration Form

Stantec FSP performed daily calibration of the water quality meter and turbidity meter and documented the results on an *Equipment Calibration Form*. The form documented the calibration results for temperature, turbidity, specific conductance, pH, dissolved oxygen (DO), and oxidation-reduction potential (ORP), and verified that the field instruments' sensors were operating within acceptance criteria. Refer to Section 3.2.2 for additional details on equipment calibration procedures.

3.2.1.4 Groundwater Level Measurement Form

Stantec FSP recorded groundwater level field measurement data on a *Groundwater Level Measurement Form* in accordance with ENV-TI-05.80.44, *Groundwater Level and Well Depth Measurement*. The form includes the monitoring well identification (ID), time, and depth to water measured from a standardized reference point on the top of each well casing, recorded in feet (ft) below top of casing.

3.2.1.5 Vibrating Wire Piezometer Measurement Form

Stantec FSP recorded field measurement data on a *Vibrating Wire Piezometer Measurement Form*. The form includes the vibrating wire piezometer ID, serial number, time, digits, temperature, and length of the wire in feet. The readings were used to calculate the pressure head (ft of water) above the vibrating wire sensor to obtain the groundwater or pore water elevation.

3.2.1.6 Groundwater Sampling Form

Stantec FSP recorded the depth to water, purge flow rate, volume of groundwater purged, temperature, pH, specific conductance, DO, ORP, turbidity, color of water, and other observations during groundwater purging and sampling activities at each monitoring well in accordance with ENV-TI-05.80.42, *Groundwater Sampling*. Field measurements were recorded on a *Groundwater Sampling Form*. The form also documents the time intervals between measurement of field parameters, low-flow extraction rates, water level drawdown, and water quality parameter measurements until stabilization criteria were met.

3.2.1.7 Chain-of-Custody

Stantec FSP completed *COC* documentation for each groundwater sample collected. The sample ID, sample location, type of sample, sampling date and time, analyses requested, sample pH, and sample custody record were recorded on the *COC*. The Field Team Leader reviewed the *COC* for completeness, and the FSP conducted a QC check of samples in each cooler compared to sample IDs on the corresponding *COC*. *COCs* were completed in accordance with ENV-TI-05.80.02, *Sample Labeling and Custody*.

3.2.2 Equipment Calibration

Field instruments used to collect, generate, or measure water quality parameters were calibrated each day prior to use as specified in the SAP, QAPP, and ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde.* Afternoon calibration verifications were performed to evaluate if these instruments remained within acceptance criteria during sampling. Temperature and barometric pressure instrument readings were verified using a calibrated National Institute of Standards and Technology traceable thermometer and National Weather Service (via mesowest.utah.edu) barometric pressure readings for Clarksville Outlaw Field (KCKV) in Clarksville, Tennessee, respectively. Additional details regarding equipment calibration were recorded on an *Equipment Calibration Form*, as described in Section 3.2.1.3.

3.3 SAMPLING METHODS

The following sections present monitoring well data collection and sampling procedures used during Event #4. As approved by TDEC, monitoring well CUF-1004 was not gauged or sampled during this event because it was not installed as part of the hydrogeologic investigation.

3.3.1 Static Water Level Measurements

FSP measured static groundwater levels at 25 monitoring wells and pore water levels at six temporary wells in accordance with ENV-TI-05.80.44, Groundwater Level and Well Depth Measurement. On October 28, 2019, static groundwater and pore water level readings were measured and recorded to the nearest 0.01 ft from a reference point on the top of each well casing using an electronic water level indicator. Water level indicator probes were decontaminated prior to the first use and between measurements, and the decontamination was documented as specified in ENV-TI-05.80.05, Field Sampling Equipment Cleaning and Decontamination. Depth to groundwater and pore water measurements were recorded on a Groundwater Level Measurement Form. A water level measurement could not be obtained at monitoring well 93-4 because the water level indicator probe stopped at the top of the dedicated pump and no water was encountered.

Groundwater and pore water measurements were also obtained from transducers installed within 13 and 27 piezometers, respectively. Additionally, a surface water level measurement for the Cumberland River was provided by TVA using the reading closest to noon recorded by an automated staff gauge. The surface water staff gauge location is shown on Exhibit A.1 in Appendix A.

Groundwater level data and pore water level data are shown in Tables B.1a and B.1b, respectively, in Appendix B. A groundwater elevation contour map based on groundwater measurements in wells and piezometers, along with pore water elevations, is included as Exhibit A.2 in Appendix A. Similarly, a pore water elevation contour map based on pore water measurements in wells and piezometers, along with groundwater elevations, is included as Exhibit A.3 in Appendix A.

3.3.2 Groundwater Purging & Sampling

Analytical and field duplicate samples (as specified in the SAP) were collected from four monitoring wells as shown in Table B.2 in Appendix B. Monitoring wells were purged using dedicated bladder pumps equipped with dedicated tubing using low-flow purging and sampling techniques as specified in ENV-TI-05.80.42, Groundwater Sampling. A groundwater sample was not collected from well CUF-1000 because approximately 0.1 ft of water was present in the sump/end cap of the well and was not indicative of groundwater; the well was considered dry.

During the purging process, water quality field parameters including pH, specific conductance, temperature, ORP, and DO were measured using water quality meters (YSI ProPlus with flow-through cell) and recorded on field forms. Depth to water and turbidity were measured and recorded using decontaminated electronic water-level indicators (Heron Dipper-T) and calibrated turbidimeters (Hach 2100Q). Field parameters were measured and recorded on Groundwater Sampling Forms during purging until readings were stabilized as specified in the SAP and/or applicable TI. As approved by TDEC, the specific conductance and turbidity stabilization limits were revised to the values below to meet overall programmatic objectives for groundwater investigations at the CUF Plant. Well purging was considered complete when three consecutive readings were within the following stabilization limits:

- pH – ± 0.1 Standard Units
- Specific Conductance – ± 3% microSiemens per centimeter
- Turbidity – Less than 5 Nephelometric Turbidity Units (NTUs) or ± 10% for values above 5 NTUs
- DO – Less than 0.5 milligrams per Liter (mg/L) or ± 10% for values above 0.5 mg/L.

Water quality stabilization criteria were met for pH, specific conductance, and turbidity for the four monitoring wells included in this event; however, the DO criterion was not achieved for three successive readings for wells CUF-1003 and CUF-1005 prior to sampling. During purging, both wells had the first of the three final DO measurements equal to 0.50 mg/L, which was considered by the FSP in the field as a measurement that met the stabilization criterion. Two subsequent DO measurements for these wells were less than 0.50 mg/L prior to sampling.

After recording the final field parameter results, purging was discontinued, and a sample was collected as specified in the SAP. Laboratory-provided, pre-preserved sample containers were filled directly from the pump discharge line. Turbidity readings at the wells stabilized below 5 NTUs, therefore samples were not collected for dissolved metals analysis. FSP wore new, clean nitrile gloves when handling sample containers and did not touch the interior of containers or container caps. New gloves were used when handling each sample. When filling sample bottles, care was taken to minimize sample aeration (i.e., water was directed down the inner walls of the sample bottle) and to avoid overfilling and diluting preservatives. Each sample bottle was capped before filling the next bottle. Following completion of sampling, final turbidity measurements were made.

Sample containers were labeled and handled in accordance with ENV-TI-05.80.02, *Sample Labeling and Custody.* FSP secured caps on each bottle, attached a custody seal across the cap, and placed the bottles in a cooler on ice within 15 minutes of collection*.* QC samples were collected in accordance with ENV-TI-05.80.04, *Field Sampling Quality Control.*

Groundwater samples were analyzed for the CCR-related constituents listed in Appendices III and IV of 40 CFR 257. In addition, five inorganic constituents listed in Appendix I of Tennessee Rule 0400-11-01-.04 and not included in the 40 CFR 257 Appendices III and IV were analyzed to maintain continuity with TDEC environmental programs. These additional TDEC Appendix I constituents included copper, nickel, silver, vanadium, and zinc. The combined federal CCR Appendices III and IV constituents and TDEC Appendix I inorganic constituents will hereafter be referred to collectively as “CCR Parameters.” For geochemical evaluation, major cations/anions not included in the CCR Parameters were included in the analyses. The additional geochemical parameters included bicarbonate, carbonate, magnesium, potassium, and sodium.

3.4 INVESTIGATION DERIVED WASTE

Investigation derived waste (IDW) generated during groundwater investigation activities included:

- Used calibration solutions
- Purge water
- Decontamination fluids
- Disposable personal protective equipment (PPE)
- General trash.

IDW was handled in accordance with ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*; ENV-TI-05.80.42, *Groundwater Sampling* (purge water); the CUF Plant-specific waste management plan; and local, state, and federal regulations. Transportation and disposal of IDW was coordinated with CUF Plant facility management. Used calibration solution was containerized and stored for disposal as directed by the CUF Plant facility management. Purge water and decontamination fluids were containerized for later disposal as specified in the CUF Plant-specific waste management plan. Used disposable PPE (e.g., nitrile gloves) and general trash generated throughout the day were placed in garbage bags and disposed of in a general trash dumpster onsite at the end of each day.

3.5 SAMPLE SHIPMENT

Samples were packed and shipped under *COC* procedures specified in ENV-TI-05.80.06, *Handling and Shipping of Samples*. The samples were shipped by FedEx to GEL in Charleston, South Carolina (radium samples only), and to TestAmerica in Pittsburgh, Pennsylvania (other analytes). The laboratories submitted sample receipt confirmation forms to EnvStds for review and confirmation.

3.6 VARIATIONS

The proposed scope and procedures for the groundwater investigation were outlined in the SAP, QAPP, and applicable TVA TIs as detailed in the sections above. Variations in scope or procedures discussed with TDEC and/or TVA, changes based on field conditions, or additional field sampling performed to complete the scope of work in the SAP are described in the following sections. As discussed below, these variations do not impact the overall usability and representativeness of the dataset provided in this SAR for groundwater investigation sampling Event #4 at the CUF Plant.

3.6.1 Variations in Scope

Variations in scope are provided below.

- A surface water level measurement was not obtained for Wells Creek because a water level gauge had not yet been installed due to concerns of safe access to that location; however, a surface water measurement was obtained from the Cumberland River. The surface water gauge in Wells Creek was installed on July 23, 2020 and surface water data are being collected.
- A groundwater sample was not collected from well CUF-1000 because approximately 0.1 ft of water was present in the sump/end cap of the well and was not indicative of groundwater; the well was considered dry.
- Groundwater level gauging and sampling was not performed at well CUF-1004 as specified in the SAP because it was not installed (the three borings drilled in that area were dry). This change in scope was approved by TDEC.

3.6.2 Variations in Procedures

Variations in procedures occurring in the field are provided below.

- As approved by TDEC, the specific conductance and turbidity stabilization limits were revised to meet overall programmatic objectives for groundwater investigations.
- pH and/or ORP were were not within the afternoon calibration verification acceptance criteria on October 29 and 30, 2019. These calibration variations were evaluated as part of the data validation/verification process performed by EnvStds.

4.0 SUMMARY

The data presented in this report are only for groundwater investigation sampling Event #4 at the CUF Plant. The scope of work for Event #4 was to:

- Collect groundwater samples for chemical analyses to assist with subsequent evaluation of the potential presence of CCR-related constituents in groundwater
- Measure groundwater and surface water elevations to assist with subsequent evaluation of groundwater flow direction and rate after multiple data sets have been collected.

In addition, pore water measurements from piezometers and temporary wells installed in the CCR units at the CUF Plant are presented in this SAR for comparison with groundwater data.

Event #4 included collecting groundwater level measurements at 25 monitoring wells and 13 piezometers; pore water measurements at six temporary wells and 27 piezometers in the CCR units; and a surface water measurement at one gauge located in the Cumberland River. Groundwater and surface water measurements and elevations are provided in Table B.1a, and pore water measurements and elevations are provided in Table B.1b, and depicted on Exhibits A.2 and A.3.

Groundwater quality measurements and groundwater analytical samples were collected at four monitoring wells as summarized in Table B.2. Groundwater quality parameters were recorded during purging. Stabilization criteria for pH, specific conductance, turbidity, and DO were achieved at each sampling location. The final measurements prior to initiating sample collection are presented in Table B.3.

Groundwater analytical data for CCR Parameters and geochemical parameters are presented in Table B.4. Analytical data for radium analyses are presented in Table B.5. Analytical data were reported by GEL and TestAmerica, and then validated or verified by EnvStds.

Stantec has completed Event #4 of the groundwater investigation at the CUF Plant in Cumberland City, Tennessee, in accordance with the Groundwater Investigation SAP as documented herein. The data collected during Event #4 are usable for reporting and evaluation in the EAR and meet the objectives of the TDEC Order EIP. The complete datasets from the six groundwater sampling events will be evaluated along with data collected under other TDEC Order SAPs, as well as data collected under other State and CCR programs. This evaluation will be provided in the EAR.

5.0 REFERENCES

Environmental Standards, Inc. 2018. *Quality Assurance Project Plan for the Tennessee Valley Authority Cumberland Fossil Plant Environmental Investigation*. Prepared for Tennessee Valley Authority. Revision 2. January 2018.

Stantec Consulting Services, Inc. (Stantec). 2018a. *Groundwater Investigation Sampling and Analysis Plan, Cumberland Fossil Plant.* Revision 3. Prepared for Tennessee Valley Authority. June 25, 2018.

Stantec. 2018b. *Environmental Investigation Plan, Cumberland Fossil Plant.* Revision 3. Prepared for Tennessee Valley Authority. June 25, 2018.

Tennessee Department of Environment and Conservation. 2015. *Commissioner's Order No. OGC15-0177.*

Tennessee Valley Authority (TVA). ENV-TI-05.80.02, *Sample Labeling and Custody*.

TVA. ENV-TI-05.80.03, *Field Record Keeping*.

TVA. ENV-TI-05.80.04, *Field Sampling Quality Control*.

TVA. ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*.

TVA. ENV-TI-05.80.06, *Handling and Shipping of Samples*.

TVA. ENV-TI-05.80.21, *Monitoring Well Inspection and Maintenance*.

TVA. ENV-TI-05.80.42, *Groundwater Sampling*.

TVA. ENV-TI-05.80.44, *Groundwater Level and Well Depth Measurement*.

TVA. ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde.*

APPENDIX A - EXHIBITS

Exhibit No.

A.1

Title

Monitoring Well Network

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location | 175568209

Stewart County, Tennessee

Prepared by MB on 2020-09-14
Technical Review by MW on 2020-09-14

0 400 800 1,200 1,600 Feet

1:4,800 (At original document size of 22x34)

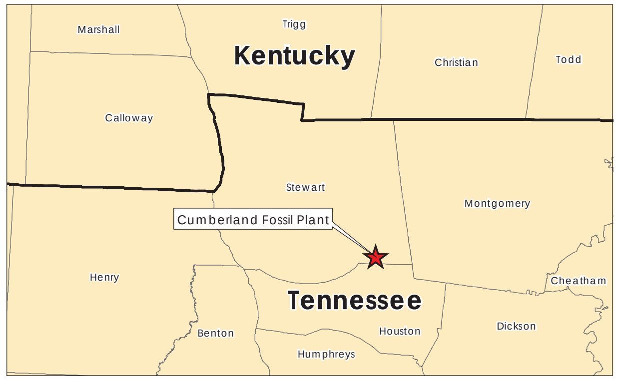
Legend

- Groundwater Investigation Monitoring Well
- Other Monitoring Well
- Piezometer
- Pore Water Piezometer in CCR Material
- Temporary Well within CCR Material
- Cumberland River Gauging Station
- 2019 Imagery Boundary
- CCR Unit Area (Approximate)

CCR: Coal combustion residuals

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)



Stantec TVA

Exhibit No.
A.2

Title
Groundwater Elevation Contour Map, Event #4 (October 28, 2019)

Client/Project
Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location
Stewart County, Tennessee

175568209
Prepared by MB on 2021-02-23
Technical Review by MW on 2021-02-23

0 400 800 1,200 1,600 Feet
1:4,800 (At original document size of 22x34)

Legend

- Groundwater Investigation Monitoring Well groundwater elevation in feet above mean sea level (ft amsl)
- Other Monitoring Well groundwater elevation in ft amsl
- Piezometer groundwater elevation in ft amsl
- Piezometer in CCR pore water elevation in ft amsl; value not used for contouring
- Temporary well in CCR pore water elevation in ft amsl; value not used for contouring
- Cumberland River Gauging Station surface water elevation in ft amsl
- Interpolated Groundwater Contour (5 ft interval; elevations are in ft amsl)
- Groundwater Contour (5 ft interval; elevations are in ft amsl)
- 2019 Imagery Boundary
- CCR Unit Area (Approximate)

CCR: Coal combustion residuals

< Groundwater elevations are rounded to nearest foot to constrain potential elevation when depth to groundwater could not be measured.

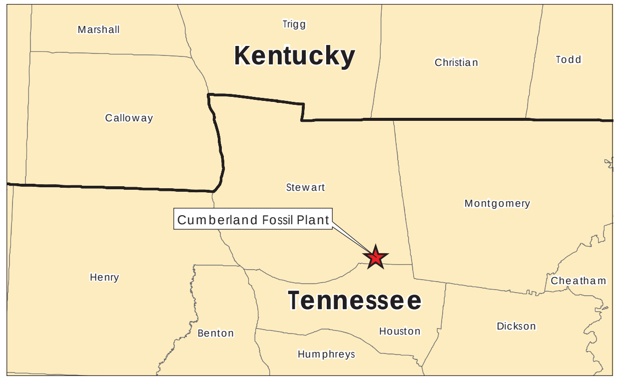
*Groundwater elevation displayed but not used as input for contouring due to factors such as well construction or being screened in a different hydrogeologic unit.

**Piezometer was not collecting groundwater measurements during this monitoring event.

***Nested VWPZ sensors monitoring pore water and groundwater elevations in the same borehole, and the location is shown by a single symbol.

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)
3. Groundwater contours were created using Surfer Version 16 (December 13, 2018) and manual adjustment
4. For PZ's with multiple instruments in CCR material, the reading with the highest pore water elevation is displayed, unless that reading is suspected of being erroneous.



Stantec TVA

Revised: 2021-02-23 By: mbough

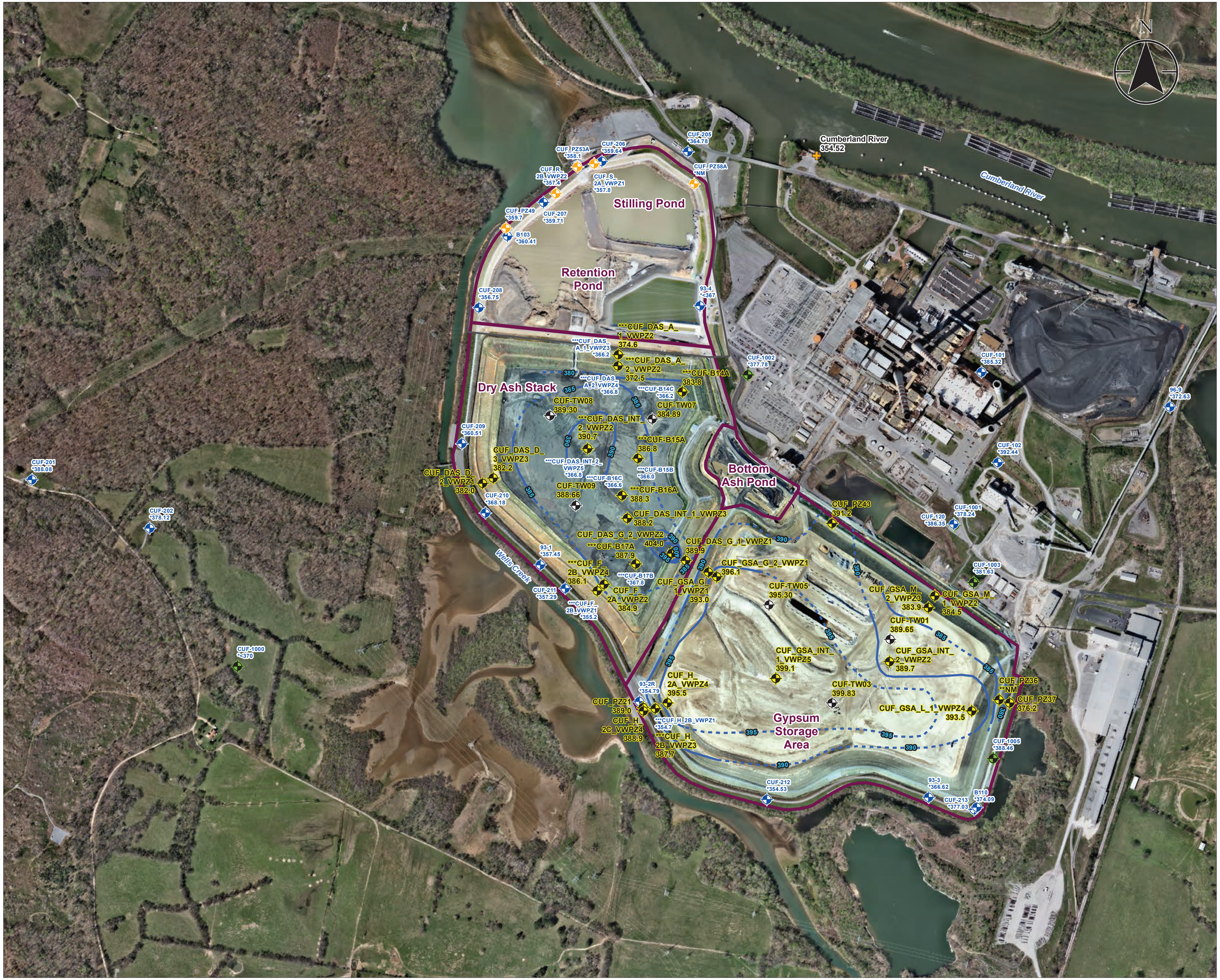


Exhibit No.
A.3

Title
Pore Water Elevation Contour Map, Event #4 (October 28, 2019)

Client/Project
Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location
Stewart County, Tennessee

175568209
Prepared by MB on 2021-02-10
Technical Review by MD on 2021-02-10

0 400 800 1,200 1,600 Feet
1:4,800 (At original document size of 22x34)

Legend

- Groundwater Investigation Monitoring Well: groundwater elevation in feet above mean sea level (ft amsl); value not used for contouring
- Other Monitoring Well: groundwater elevation in ft amsl; value not used for contouring
- Piezometer: groundwater elevation in ft amsl; value not used for contouring
- Piezometer in CCR: pore water elevation in ft amsl
- Temporary well in CCR: pore water elevation in ft amsl
- Cumberland River Gauging Station: surface water elevation in ft amsl
- Interpolated Pore water Contour (5 ft interval; elevations are in ft amsl)
- Pore water Contour (5 ft interval; elevations are in ft amsl)
- 2019 Imagery Boundary
- CCR Unit Area (Approximate)

CCR: Coal combustion residuals

< Groundwater elevations are rounded to nearest foot to constrain potential elevation when depth to groundwater could not be measured.

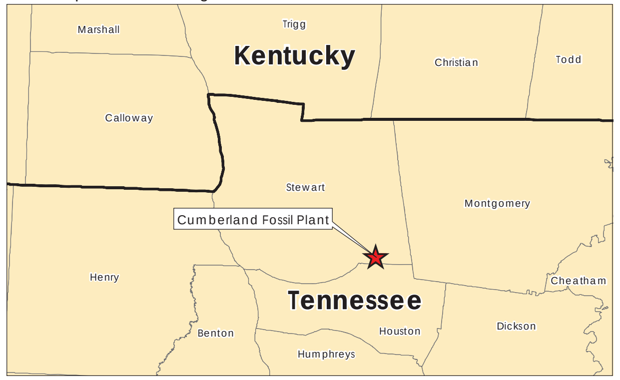
*Groundwater elevation displayed but not used as input for contouring due to factors such as well construction or being screened in a different hydrogeologic unit.

**Piezometer was not collecting groundwater measurements during this monitoring event.

***Nested VWPZ sensors monitoring pore water and groundwater elevations in the same borehole, and the location is shown by a single symbol.

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)
3. Pore water contours were created with manual adjustment using Surfer Version 16 (December 13, 2018)
4. For PZ's with multiple instruments in CCR material, the reading with the highest pore water elevation is displayed, unless that reading is suspected of being erroneous.



Stantec TVA

U:\TVA-EIP\175568209_CUF_Phase2\gis\mxd\GW_TechMemo\CUF_GWTechMemo_FigA3_PorewaterContour_wp2_Event4v2porewater.mxd Revised: 2021-02-10 By: mbough

APPENDIX B - TABLES

TABLE B.1a – Groundwater Level Measurements
Cumberland Fossil Plant
October 2019

UNID	Well / Piezometer ID	Date Measured	Depth to Groundwater	Top of Casing Elevation	Groundwater Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
			ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft btoc	
CUF-00-GW-43-001	93-1	28-Oct-19	39.72	397.17	357.45	n/a	n/a	n/a	52.3 - 62.3	Alluvial Silts and Clays / Alluvial Sands and Gravels
CUF-00-GW-43-002	93-2R	28-Oct-19	43.09	397.88	354.79	n/a	n/a	n/a	62.3 - 72.0	Alluvial Sands and Gravels
CUF-00-GW-43-003	93-3	28-Oct-19	30.88	397.50	366.62	n/a	n/a	n/a	45.0 - 55.0	Alluvial Silts and Clays
CUF-00-GW-43-004	93-4	28-Oct-19	NM	397.34	NM	n/a	n/a	n/a	27.2 - 36.6	Bedrock: Limestone
CUF-00-GW-43-005	96-9	28-Oct-19	19.96	392.59	372.63	n/a	n/a	n/a	16.1 - 30.9	Bedrock: Fernvale and Hermitage Limestones
CUF-00-GW-43-006	B103	28-Oct-19	35.56	395.97	360.41	n/a	n/a	n/a	74.0 - 84.0	Alluvial Silts and Clays
CUF-00-GW-43-007	B110	28-Oct-19	24.18	398.27	374.09	n/a	n/a	n/a	48.3 - 52.5	Alluvial Silts and Clays
CUF-00-GW-43-008	CUF-101	28-Oct-19	0.36	385.68	385.32	n/a	n/a	n/a	2.0 - 17.2	Clay
CUF-00-GW-43-009	CUF-102	28-Oct-19	10.49	402.93	392.44	n/a	n/a	n/a	3.8 - 13.8	Bedrock: Limestone
CUF-00-GW-43-010	CUF-120	28-Oct-19	6.84	393.19	386.35	n/a	n/a	n/a	9.3 - 14.3	Bedrock
CUF-00-GW-43-011	CUF-201	28-Oct-19	12.33	400.41	388.08	n/a	n/a	n/a	17.6 - 27.7	Alluvial Sands and Gravels
CUF-00-GW-43-012	CUF-202	28-Oct-19	5.16	383.28	378.12	n/a	n/a	n/a	14.3 - 19.6	Alluvial Sands and Gravels
CUF-00-GW-43-014	CUF-205	28-Oct-19	19.73	384.51	364.78	n/a	n/a	n/a	16.9 - 27.1	Alluvial Sands and Gravels
CUF-00-GW-43-015	CUF-206	28-Oct-19	39.03	398.67	359.64	n/a	n/a	n/a	82.7 - 92.9	Alluvial Sands and Gravels
CUF-00-GW-43-016	CUF-207	28-Oct-19	38.48	398.19	359.71	n/a	n/a	n/a	75.0 - 85.1	Alluvial Sands and Gravels
CUF-00-GW-43-017	CUF-208	28-Oct-19	41.63	398.38	356.75	n/a	n/a	n/a	47.9 - 58.0	Alluvial Sands and Gravels
CUF-00-GW-43-018	CUF-209	28-Oct-19	37.72	398.23	360.51	n/a	n/a	n/a	53.1 - 63.3	Alluvial Sands and Gravels
CUF-00-GW-43-019	CUF-210	28-Oct-19	30.02	398.20	368.18	n/a	n/a	n/a	63.5 - 68.5	Alluvial Sands and Gravels
CUF-00-GW-43-020	CUF-211	28-Oct-19	41.47	398.76	357.29	n/a	n/a	n/a	57.7 - 67.9	Alluvial Sands and Gravels
CUF-00-GW-43-021	CUF-212	28-Oct-19	44.18	398.71	354.53	n/a	n/a	n/a	62.6 - 72.8	Alluvial Sands and Gravels
CUF-00-GW-43-022	CUF-213	28-Oct-19	22.02	399.05	377.03	n/a	n/a	n/a	40.0 - 45.2	Alluvial Sands and Gravels
CUF-00-GW-43-026	CUF-1000	28-Oct-19	25.42*	395.29	Dry*	n/a	n/a	n/a	14.5 - 25.1	Clay and Clayey Sand
CUF-00-GW-43-027	CUF-1001	28-Oct-19	15.51	393.75	378.24	n/a	n/a	n/a	15.8 - 20.6	Clayey Gravel and Clay
CUF-00-GW-43-028	CUF-1002	28-Oct-19	11.48	389.26	377.78	n/a	n/a	n/a	15.1 - 20.0	Clay and Gravel/Clay
CUF-00-GW-43-029	CUF-1003	28-Oct-19	14.76	396.39	381.63	n/a	n/a	n/a	12.6 - 17.5	Gravel/Cobbles and Clay
CUF-00-GW-43-030	CUF-1005	28-Oct-19	11.12	399.58	388.46	n/a	n/a	n/a	18.2 - 28.8	Sand, Clayey Gravel, Clay
Piezometers										
n/a	CUF-B14C	28-Oct-19	74.6	n/a	366.2	440.8	319.8	121.0	n/a	Alluvial Clay and Granular
n/a	CUF-B15B	28-Oct-19	72.3	n/a	366.0	438.3	327.8	110.5	n/a	Alluvial Granular
n/a	CUF-B16C	28-Oct-19	73.1	n/a	366.6	439.7	324.7	115.0	n/a	Alluvial Granular
n/a	CUF-B17B	28-Oct-19	75.6	n/a	367.8	443.4	336.4	107.0	n/a	Alluvial Granular
n/a	CUF_PZ49	28-Oct-19	19.5	n/a	359.7	379.2	322.2	57.0	n/a	Alluvial Granular
n/a	CUF_PZ53A	28-Oct-19	17.9	n/a	358.1	376.0	311.0	65.0	n/a	Alluvial Granular
n/a	CUF_PZ58A	n/a	NM	n/a	NM	394.8	349.3	45.5	n/a	Alluvial Granular
n/a	CUF_R_2B_VWPZ2	28-Oct-19	37.9	n/a	357.4	395.3	320.0	75.3	n/a	Alluvial Granular
n/a	CUF_S_2A_VWPZ1	28-Oct-19	37.1	n/a	357.8	394.9	299.7	95.2	n/a	Alluvial Granular
n/a	CUF_F_2B_VWPZ1	28-Oct-19	56.9	n/a	355.2	412.1	322.1	90.0	n/a	Alluvial Granular
n/a	CUF_DAS_A_1_VWPZ3	28-Oct-19	21.8	n/a	366.2	388.0	293.0	95.0	n/a	Alluvial Granular
n/a	CUF_DAS_A_2_VWPZ4	28-Oct-19	46.1	n/a	366.8	412.9	308.4	104.5	n/a	Alluvial Granular
n/a	CUF_DAS_INT_2_VWPZ5	28-Oct-19	67.7	n/a	366.8	434.5	313.5	121.0	n/a	Alluvial Granular
n/a	CUF_H_2B_VWPZ1	28-Oct-19	56.0	n/a	354.7	410.7	322.7	88.0	n/a	Alluvial Granular
Surface Water Gauge										
Cumberland River gauge	n/a	28-Oct-19	n/a	n/a	354.52	n/a	n/a	n/a	n/a	n/a

See notes on last page.

TABLE B.1a – Groundwater Level Measurements
Cumberland Fossil Plant
October 2019

UNID	Well / Piezometer ID	Date Measured	Depth to Groundwater	Top of Casing Elevation	Groundwater Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
			ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft btoc	

Notes:

*	approximately 0.1 ft of water was present in the sump/end cap of the well and is not indicative of groundwater, the well is considered dry
bgs	below ground surface
btoc	below top of casing
ft	feet
ID	identification
msl	mean sea level
n/a	not applicable
NM	not measured
UNID	Unique Numerical Identification

1. Top of casing elevations, screened intervals, and screened formations were obtained from the TVA Well Inventory Log provided by TVA.
2. Cumberland River data point is the reading closest to noon recorded by the automated staff gauge provided by TVA.
3. Ground surface elevations, groundwater elevations, and piezometer data were obtained from geotechnical instrumentation database. Piezometer sensor formations were obtained from boring logs. Data from vibrating wire piezometers were averaged for the measurement date. For consistency in reporting for the TDEC Order, historical piezometer IDs were modified (if necessary) to include 'VWPZ' to indicate a vibrating wire piezometer.
4. Depth to groundwater in piezometers and groundwater elevations at all locations are calculated values. Accuracy of piezometer data is to 0.1 ft.
5. A groundwater level was not measured in well 93-4 because the meter was obstructed by the pump. Groundwater levels were not measured in select peizometers as noted above because the sensors were not recording data.

TABLE B.1b – Pore Water Level Measurements
Cumberland Fossil Plant
October 2019

Temporary Well / Piezometer ID	Date Measured	Depth to Pore Water	Top of Casing Elevation	Pore Water Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
		ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft bgs	
Temporary Wells									
CUF-TW01	28-Oct-19	41.34	430.99	389.65	n/a	n/a	n/a	41.3 - 51.9	CCR
CUF-TW03	28-Oct-19	29.70	429.53	399.83	n/a	n/a	n/a	54.9 - 65.5	CCR
CUF-TW05	28-Oct-19	31.50	426.80	395.30	n/a	n/a	n/a	49.5 - 56.5	CCR
CUF-TW07	28-Oct-19	58.80	443.69	384.89	n/a	n/a	n/a	81.5 - 92.1	CCR
CUF-TW08	28-Oct-19	54.06	443.36	389.30	n/a	n/a	n/a	72.1 - 82.7	CCR
CUF-TW09	28-Oct-19	57.78	446.44	388.66	n/a	n/a	n/a	79.5 - 90.1	CCR
Piezometers									
CUF-B14A	28-Oct-19	57.0	n/a	383.8	440.8	360.8	80.0	n/a	CCR
CUF-B15A	28-Oct-19	51.5	n/a	386.8	438.3	353.3	85.0	n/a	CCR
CUF-B16A	28-Oct-19	51.4	n/a	388.3	439.7	383.4	56.3	n/a	CCR
CUF-B17A	28-Oct-19	55.5	n/a	387.9	443.4	363.9	79.5	n/a	CCR
CUF_DAS_A_1_VWPZ2	28-Oct-19	13.4	n/a	374.6	388.0	335.0	53.0	n/a	CCR
CUF_DAS_A_2_VWPZ2	28-Oct-19	40.4	n/a	372.5	412.9	353.4	59.5	n/a	CCR
CUF_DAS_D_2_VWPZ1	28-Oct-19	16.7	n/a	382.0	398.7	376.6	22.1	n/a	CCR
CUF_DAS_D_3_VWPZ3	28-Oct-19	45.0	n/a	382.2	427.2	371.9	55.3	n/a	CCR
CUF_DAS_G_1_VWPZ1	28-Oct-19	15.6	n/a	389.9	405.5	379.6	25.9	n/a	CCR
CUF_DAS_G_2_VWPZ2	28-Oct-19	35.1	n/a	404.0	439.1	396.1	43.0	n/a	CCR
CUF_DAS_INT_1_VWPZ3	28-Oct-19	50.9	n/a	388.2	439.1	379.1	60.0	n/a	CCR
CUF_DAS_INT_2_VWPZ2	28-Oct-19	43.8	n/a	390.7	434.5	388.5	46.0	n/a	CCR
CUF_F_2A_VWPZ2	28-Oct-19	48.7	n/a	384.9	433.6	353.6	80.0	n/a	CCR
CUF_F_2B_VWPZ4	28-Oct-19	26.0	n/a	386.1	412.1	377.1	35.0	n/a	CCR
CUF_GSA_G_1_VWPZ1	28-Oct-19	20.3	n/a	393.0	413.3	384.6	28.7	n/a	CCR
CUF_GSA_G_2_VWPZ1	28-Oct-19	32.1	n/a	396.1	428.2	388.2	40.0	n/a	CCR
CUF_GSA_INT_1_VWPZ5	28-Oct-19	24.0	n/a	399.1	423.1	393.1	30.0	n/a	CCR
CUF_GSA_INT_2_VWPZ2	28-Oct-19	30.6	n/a	389.7	420.3	380.3	40.0	n/a	CCR
CUF_GSA_L_1_VWPZ4	28-Oct-19	36.8	n/a	393.5	430.3	369.3	61.0	n/a	CCR
CUF_GSA_M_1_VWPZ2	28-Oct-19	25.5	n/a	384.5	410.0	382.0	28.0	n/a	CCR
CUF_GSA_M_2_VWPZ3	28-Oct-19	46.4	n/a	383.9	430.3	380.3	50.0	n/a	CCR
CUF_H_2A_VWPZ4	28-Oct-19	28.5	n/a	395.5	424.0	389.8	34.2	n/a	CCR
CUF_H_2B_VWPZ3	28-Oct-19	23.0	n/a	387.7	410.7	353.7	57.0	n/a	CCR
CUF_H_2C_VWPZ4	28-Oct-19	6.4	n/a	388.9	395.3	374.0	21.3	n/a	CCR
CUF_PZ21	28-Oct-19	6.1	n/a	389.0	395.1	356.0	39.1	n/a	CCR
CUF_PZ36	n/a	NM	n/a	NM	411.2	363.2	48.0	n/a	CCR
CUF_PZ37	28-Oct-19	19.0	n/a	376.2	395.2	367.2	28.0	n/a	CCR
CUF_PZ43	28-Oct-19	20.1	n/a	391.2	411.3	374.3	37.0	n/a	CCR

See notes on last page.

TABLE B.1b – Pore Water Level Measurements
Cumberland Fossil Plant
October 2019

Temporary Well / Piezometer ID	Date Measured	Depth to Pore Water	Top of Casing Elevation	Pore Water Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation

Notes:

bgs	below ground surface
btoc	below top of casing
CCR	coal combustion residuals
ft	feet
ID	identification
msl	mean sea level
n/a	not applicable
NM	not measured

1. Top of casing elevations, screened intervals, and screened formations were obtained from boring logs, well details, and well survey data.
2. For piezometers, ground surface elevations, pore water elevations, and piezometer data were obtained from geotechnical instrumentation database. Piezometer sensor formations were obtained from boring logs. Data from vibrating wire piezometers were averaged for the measurement date. For consistency in reporting for the TDEC Order, historical piezometer IDs were modified (if necessary) to include ‘VWPZ’ to indicate a vibrating wire piezometer.
3. Depth to pore water in piezometers and pore water elevations at all locations are calculated values. Accuracy of piezometer data is to 0.1 ft.
4. Screened interval shown for temporary wells is below ground surface when drilled.
5. Groundwater levels were not measured in select piezometers as noted above because the sensors were not recording data.

TABLE B.2 – Summary of Groundwater Samples
Cumberland Fossil Plant
October 2019

			Analysis Type								
Location ID	**Sample ID**	**Sample Type**	Field Parameters	Total Metals	Total Mercury	Anions	Alkalinity	Total Dissolved Solids	Radium-226	Radium-228	Radium-226+228
CUF-1001	CUF-GW-027-20191029	Normal Environmental Sample	x	x	x	x	x	x	x	x	x
	CUF-GW-DUP01-20191029	Field Duplicate Sample		x	x	x	x	x	x	x	x
CUF-1002	CUF-GW-028-20191029	Normal Environmental Sample	x	x	x	x	x	x	x	x	x
CUF-1003	CUF-GW-029-20191030	Normal Environmental Sample	x	x	x	x	x	x	x	x	x
CUF-1005	CUF-GW-030-20191029	Normal Environmental Sample	x	x	x	x	x	x	x	x	x

Notes

Total and Dissolved Metals	SW-846 6020A
Total and Dissolved Mercury	SW-846 7470A
Anions	EPA 300.0/SW 9056
Alkalinity	SM2320B
Total Dissolved Solids	SM2540C
Radium-226	EPA 903.0
Radium-228	EPA 904.0
Radium-226+228	CALC
ID	identification

1. Field and laboratory quality control sample results except for field duplicates are not included in report tables but were used for data validation.

TABLE B.3 – Summary of Groundwater Quality Parameters
Cumberland Fossil Plant
October 2019

Sample Location Sample Date Sample ID Sample Depth Sample Type Level of Review	Units	CUF-1001 29-Oct-19 CUF-GW-027-20191029 19 ft Normal Environmental Sample Final QC Review	CUF-1002 29-Oct-19 CUF-GW-028-20191029 18 ft Normal Environmental Sample Final QC Review	CUF-1003 30-Oct-19 CUF-GW-029-20191030 16.8 ft Normal Environmental Sample Final QC Review	CUF-1005 29-Oct-19 CUF-GW-030-20191029 24 ft Normal Environmental Sample Final QC Review
Field Parameters					
Dissolved Oxygen	%	2.7	1.0	5.1	3.9
Dissolved Oxygen	mg/L	0.24	0.09	0.46	0.36
ORP	mV	-122.0	-142.9	118.0 J	-81.5
pH (field)	SU	6.03 J	6.00 J	7.24 J	9.02 J
Specific Cond. (Field)	uS/cm	1,344	1,378	2,539	3,266
Temperature, Water (C)	DEG C	20.2	21.4	20.2	20.3
Turbidity, field	NTU	1.02	3.66	0.85	1.20

Notes:

%	percent
Cond.	conductance
DEG C	degrees Celsius
ft	feet below top of casing
ID	identification
J	quantitation is approximate due to limitations identified during data validation.
mg/L	milligrams per Liter
mV	milliVolts
NTU	Nephelometric Turbidity Unit
ORP	Oxidation Reduction Potential, measured using a silver reference electrode which has a standard potential of 200 mV
SU	Standard Units
uS/cm	microSiemens per centimeter

TABLE B.4 - Groundwater Analytical Results for Metals, Anions, and General Chemistry
Cumberland Fossil Plant
October 2019

Sample Location				CUF-1001		CUF-1002	CUF-1003	CUF-1005
Sample Date				29-Oct-19	29-Oct-19	29-Oct-19	30-Oct-19	29-Oct-19
Sample ID				CUF-GW-027-20191029	CUF-GW-DUP01-20191029	CUF-GW-028-20191029	CUF-GW-029-20191030	CUF-GW-030-20191029
Sample Depth				19 ft	19 ft	18 ft	16.8 ft	24 ft
Sample Type				Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Level of Review	Units	EPA MCLs	CCR Rule GWPS	Final-Verified	Final-Verified	Final-Verified	Final-Verified	Final-Verified
Total Metals								
Antimony	ug/L	6[A]	n/v	<0.378	<0.378	<0.378	<0.378	1.75 J
Arsenic	ug/L	10[A]	n/v	2.59	2.66	6.92	0.408 J	7.56
Barium	ug/L	2,000[A]	n/v	62.3	63.6	49.6	35.8	56.4
Beryllium	ug/L	4[A]	n/v	<0.182	<0.182	<0.182	0.481 U*	0.682 U*
Boron	ug/L	n/v	n/v	2,930	3,110	226	12,000	32,200
Cadmium	ug/L	5[A]	n/v	<0.125	<0.125	<0.125	0.308 J	1.02
Calcium	ug/L	n/v	n/v	245,000	255,000	214,000	585,000	854,000
Chromium	ug/L	100[A]	n/v	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	n/v	6[B]	0.687	0.671	0.450 J	0.807	<0.0750
Copper	ug/L	n/v	n/v	<0.627	<0.627	<0.627	<0.627	<0.627
Lead	ug/L	n/v	15[B]	0.147 J	<0.128	<0.128	<0.128	<0.128
Lithium	ug/L	n/v	40[B]	11.4	9.85	9.07	5.84 U*	**48.6[B]**
Magnesium	ug/L	n/v	n/v	23,900	24,800	29,700	65,300	1,340
Mercury	ug/L	2[A]	n/v	0.101 UJ	0.101 UJ	0.101 UJ	<0.101	0.101 UJ
Molybdenum	ug/L	n/v	100[B]	81.8	82.0	2.73 U*	**373[B]**	**871[B]**
Nickel	ug/L	100(TN MCL)[A]	n/v	0.582 U*	0.405 U*	0.583 U*	1.07 U*	0.988 U*
Potassium	ug/L	n/v	n/v	5,670	5,870	1,640	32,500	48,100
Selenium	ug/L	50[A]	n/v	<1.51	<1.51	<1.51	<1.51	24.1
Silver	ug/L	100(TN MCL)[A]	n/v	<0.177	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	n/v	n/v	16,300	16,700	66,000	27,800	27,800
Thallium	ug/L	2[A]	n/v	<0.148	<0.148	<0.148	0.557 U*	1.98
Vanadium	ug/L	n/v	n/v	1.66	1.01	1.73	3.34	637
Zinc	ug/L	n/v	n/v	<3.22	6.33 U*	4.62 U*	4.35 U*	3.51 U*
Anions								
Chloride	mg/L	n/v	n/v	67.2	69.0	29.4	163	312
Fluoride	mg/L	4[A]	n/v	0.158	0.154	0.349	0.158 J	<0.132
Sulfate	mg/L	n/v	n/v	465	400	385	1,500	1,040
General Chemistry								
Alkalinity, Bicarbonate	mg/L	n/v	n/v	250	258	359	164	<5.00
Alkalinity, Carbonate	mg/L	n/v	n/v	<5.00	<5.00	<5.00	<5.00	83.8
Alkalinity, Total as CaCO3	mg/L	n/v	n/v	250	258	359	164	157
Total Dissolved Solids	mg/L	n/v	n/v	1,070	1,050	935	2,510	3,400

Notes:

A	EPA Maximum Contaminant Level
B	CCR Rule GWPS (Federal Register / Vol. 83, No. 146 / Monday, July 30, 2018 / Rules and Regulations)
n/v	No standard/guideline value
6.5[A]	Concentration is greater than or equal to the indicated standard.
<0.03	analyte was not detected at a concentration greater than the Method Detection Limit
ft	feet below top of casing
ID	identification
J	quantitation is approximate due to limitations identified during data validation
mg/L	milligrams per Liter
U*	result should be considered “not detected” because it was detected in an associated field or laboratory blank at a similar level
UJ	This compound was not detected, but the reporting or detection limit should be considered estimated due to a bias identified during data validation.
ug/L	micrograms per Liter
(TN MCL)	Tennessee Maximum Contaminant Level

1. Level of review is defined in the Quality Assurance Project Plan.

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TABLE B.5 – Groundwater Analytical Results for Radiological Parameters
Cumberland Fossil Plant
October 2019

Sample Location				CUF-1001		CUF-1002	CUF-1003	CUF-1005
Sample Date				29-Oct-19	29-Oct-19	29-Oct-19	30-Oct-19	29-Oct-19
Sample ID				CUF-GW-027-20191029	CUF-GW-DUP01-20191029	CUF-GW-028-20191029	CUF-GW-029-20191030	CUF-GW-030-20191029
Sample Depth				19 ft	19 ft	18 ft	16.8 ft	24 ft
Sample Type				Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Level of Review				Final-Verified	Final-Verified	Final-Verified	Final-Verified	Final-Verified
	Units	EPA MCLs	CCR Rule GWPS					
Radiological Parameters								
Radium-226	pCi/L	n/v	n/v	0.370 +/-(0.495)U	0.377 +/-(0.292)U	0.393 +/-(0.498)U	0.294 +/-(0.240)U	0.0618 +/-(0.425)U
Radium-226+228	pCi/L	5[A]	n/v	0.905 +/-(0.620)J	0.377 +/-(0.498)UJ	0.775 +/-(0.584)U	0.776 +/-(0.470)U	0.0618 +/-(0.588)U
Radium-228	pCi/L	n/v	n/v	0.535 +/-(0.373)J	-0.156 +/-(0.404)UJ	0.383 +/-(0.304)U	0.482 +/-(0.404)U	-0.431 +/-(0.407)U

Notes:

A	EPA Maximum Contaminant Level
B	CCR Rule GWPS (Federal Register / Vol. 83, No. 146 / Monday, July 30, 2018 / Rules and Regulations)
n/v	No standard/guideline value
ft	feet below top of casing
ID	identification
J	quantitation is approximate due to limitations identified during data validation
pCi/L	picoCurie per Liter
U	not detected
UJ	compound was not detected, but the reporting or detection limit should be considered estimated due to a bias identified during data validation

1. Level of review is defined in the Quality Assurance Project Plan.

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APPENDIX H.8

GROUNDWATER INVESTIGATION EVENT #5 SAMPLING AND ANALYSIS REPORT

Cumberland Fossil Plant Groundwater Investigation Event #5 Sampling and Analysis Report

TDEC Commissioner's Order
Environmental Investigation Plan
Cumberland Fossil Plant
Cumberland City, Tennessee

March 26, 2021

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

Revision Record

Revision	Description	Date
0	Submittal to TDEC	March 26, 2021

Sign-off Sheet

This document entitled Cumberland Fossil Plant Groundwater Investigation Event #5 Sampling and Analysis Report was prepared by Stantec Consulting Services Inc. (“Stantec”) for the account of Tennessee Valley Authority (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ____
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Approved by ____
Rebekah Brooks, Principal Hydrogeologist

Table of Contents

Abbreviations

CCR	Coal Combustion Residuals
CCR Parameters	Constituents listed in Appendices III and IV of 40 CFR 257 and five inorganic constituents included in Appendix I of Tennessee Rule 0400-11-01-.04
CEC	Civil and Environmental Consultants, Inc.
CFR	Code of Federal Regulations
COC	Chain-of-Custody
CUF Plant	Cumberland Fossil Plant
DO	Dissolved Oxygen
EAR	Environmental Assessment Report
EIP	Environmental Investigation Plan
ENV	Environmental
EnvStds	Environmental Standards, Inc.
Event #5	Groundwater investigation field event performed January 6-8, 2020
FSP	Field Sampling Personnel
ft	Feet
GEL	GEL Laboratories LLC
ID	Identification
IDW	Investigation Derived Waste
mg/L	Milligrams per Liter
NTU	Nephelometric Turbidity Units
ORP	Oxidation-Reduction Potential
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
QC	Quality Control
SAP	Sampling and Analysis Plan
SAR	Sampling and Analysis Report
Stantec	Stantec Consulting Services Inc.
TDEC	Tennessee Department of Environment and Conservation
TDEC Order	Commissioner’s Order No. OGC15-0177
TestAmerica	Eurofins TestAmerica Inc.
TI	Technical Instruction
TVA	Tennessee Valley Authority
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) has prepared this sampling and analysis report (SAR) on behalf of the Tennessee Valley Authority (TVA) to document the completion of activities related to a groundwater investigation sampling event performed January 6-8, 2020 (Event #5) at TVA's Cumberland Fossil Plant (CUF Plant) located in Cumberland City, Tennessee.

The purpose of the groundwater investigation, upon completion of six groundwater sampling events, is to characterize groundwater conditions at the CUF Plant in support of fulfilling the requirements for the Tennessee Department of Environment and Conservation (TDEC) issued Commissioner's Order No. OGC15-0177 (TDEC Order) to TVA (TDEC 2015). The TDEC Order sets forth a "process for the investigation, assessment, and remediation of unacceptable risks" at TVA's coal ash disposal sites in Tennessee.

The purpose of this SAR is to document the work completed during groundwater sampling Event #5 of 6 total events and to present the information and data collected during the execution of the Groundwater Investigation Sampling and Analysis Plan (SAP) (Stantec 2018a). This SAR is not intended to provide conclusions or evaluations of results. The scope of the groundwater investigation represented herein was conducted pursuant to the SAP and is part of a larger environmental investigation at the CUF Plant. The data provided in this SAR are not inclusive of other programmatic data that exist for the site. The evaluation of the results will include data from the six groundwater sampling events and consider other aspects of the environmental investigation, as wells as data collected under other State and/or coal combustion residuals (CCR) programs. This evaluation will be presented in the Environmental Assessment Report (EAR).

Event #5 activities were performed in general accordance with the following documents developed by TVA to support fulfilling the requirements of the TDEC Order at the CUF Plant.

- *Groundwater Investigation SAP* (Stantec 2018a)
- *Environmental Investigation Plan (EIP)* (Stantec 2018b)
- *Quality Assurance Project Plan (QAPP)* (Environmental Standards, Inc. 2018).

The Groundwater Investigation SAP was updated based on TVA- and TDEC-approved Programmatic- and Project-specific changes. Minor variations in scope and procedures from those outlined in the SAP occurred during field activities due to field conditions and programmatic updates and are referenced in Section 3.6.

Event #5 is the fifth in a series of six planned sampling events for the groundwater investigation. Stantec performed the field work activities for this event. Laboratory analysis of constituents was performed by GEL Laboratories LLC (GEL) in Charleston, South Carolina (radium samples only) and Eurofins TestAmerica, Inc. (TestAmerica) in Pittsburgh, Pennsylvania (other analytes). Quality assurance oversight on data acquisition protocols, sampling practices, and data validation or verification was performed by Environmental Standards, Inc. (EnvStds) under direct contract to TVA.

This report summarizes the groundwater investigation activities for Event #5. The remaining sampling events will be completed before overall conclusions and findings about the groundwater investigation and groundwater conditions at the CUF Plant are made and documented in the EAR.

2.0 OBJECTIVE AND SCOPE

The primary objectives of the groundwater investigation conducted pursuant to the Groundwater Investigation SAP (which includes six sampling events) are to characterize existing groundwater quality and to evaluate groundwater flow conditions at the CUF Plant in response to the TDEC Order. The approach to characterizing the groundwater conditions is to:

- Collect groundwater samples for chemical analyses to evaluate the potential presence of constituents related to CCR in groundwater
- Measure groundwater and surface water elevations for subsequent evaluation of direction and rate of groundwater flow.

The scope of work intended to achieve the objectives of the groundwater investigation consists of six sampling events at a frequency of one event every two months for one year to characterize seasonal groundwater quality and flow direction. This report describes the activities related to Event #5, performed in January 2020, the scope of which included:

- Collecting groundwater and surface water level measurements
- Collecting field measurements of groundwater quality parameters
- Collecting groundwater samples and associated quality control (QC) samples for laboratory analysis.

These activities were carried out after the installation of permanent monitoring wells specified in the Groundwater Investigation SAP. Details of the monitoring well installation activities are provided in the CUF Plant Hydrogeological Investigation SAR.

In addition, pore water measurements from piezometers and temporary wells installed in the CCR units at the CUF Plant are presented in this SAR for comparison with groundwater data. Temporary well and piezometer installation activities are described in the CUF Plant Exploratory Drilling SAR, and temporary well gauging and sampling information is provided in the CUF Plant CCR Material Characteristics SAR.

3.0 FIELD ACTIVITIES

Groundwater investigation field activities for Event #5 were conducted January 6-8, 2020. Stantec performed groundwater level measurements and sample collection activities based on guidance and specifications in TVA's Environmental (ENV) Technical Instructions (TIs), the SAP, the QAPP, and applicable United States Environmental Protection Agency (USEPA) documents except as noted in the Variations section of this report. As part of TVA's commitment to generate representative and reliable data, data validation and/or verification of laboratory analytical results were performed by EnvStds under direct contract with TVA. EnvStds also conducted audits of field activities and provided quality reviews of field documentation. In addition, on behalf of TDEC, Civil and Environmental Consultants, Inc. (CEC) collected split groundwater samples during this sampling event. Additional information regarding CEC split sample collection is provided in Section 3.3.2.

During Event #5, Stantec conducted the following field activities:

- Measured groundwater levels at five monitoring wells installed for the TDEC Order, and 21 monitoring wells and nine piezometers installed for other environmental programs (26 total monitoring wells)
- Measured pore water levels at six temporary wells and 14 piezometers installed in the CCR units
- Measured the surface water level at one location in the Cumberland River
- Collected groundwater samples from five monitoring wells installed for the TDEC Order
- Recorded field measurements of groundwater quality parameters during purging and stabilization at the sampled monitoring wells
- Collected QC samples including one field duplicate, one matrix spike/matrix spike duplicate, two field blanks, one equipment blank, one tubing blank, and one filter blank
- Shipped the collected samples to GEL in Charleston, South Carolina, and TestAmerica in Pittsburgh, Pennsylvania.

Details on each activity are presented in the sections below.

3.1 WORK LOCATIONS

The TDEC Order CCR units at the CUF Plant (the Stilling Pond, including the Retention Pond, the Dry Ash Stack, the Bottom Ash Pond, and the Gypsum Storage Area) as well as the monitoring wells, temporary wells, and piezometers sampled and/or gauged during Event #5 are shown on Exhibit A.1 in Appendix A. TVA is currently sampling groundwater at the CUF Plant for TDEC Solid Waste Management permit requirements and the USEPA CCR Rule codified in Title 40 of the Code of Federal

Regulations (CFR) Part 257 (40 CFR 257). Monitoring wells that are sampled as part of other environmental programs are not sampled as part of the groundwater investigation for the TDEC Order.

Groundwater levels were measured in TDEC Order monitoring wells as well as in select additional wells and piezometers from other environmental programs, as shown in Table B.1a in Appendix B, to provide information to prepare groundwater contour maps for this SAR and the CUF Plant EAR. Pore water levels measured in temporary wells and piezometers installed in the CCR units are presented in Table B.1b. Groundwater and pore water elevations are shown on Exhibits A.2 and A.3 in Appendix A. Groundwater elevation contours are depicted on Exhibit A.2 and pore water elevation contours are depicted on Exhibit A.3.

Groundwater analytical and field duplicate samples were collected from the TDEC Order groundwater investigation monitoring wells as shown in Table B.2 in Appendix B. Groundwater analytical data collected for the TDEC Order and other environmental programs will be provided in the EAR.

3.2 DOCUMENTATION

Stantec maintained field documentation in accordance with ENV-TI-05.80.03, *Field Record Keeping*, and the QAPP. Field activities and data were recorded on program-specific field forms. Health and safety forms were completed in accordance with TVA and Stantec health and safety requirements. Additional information regarding field documentation is provided below.

3.2.1 Field Forms

Stantec used program-specific field forms to record field observations and data for specific activities. Field forms used during the groundwater investigation included:

- *Daily Field Activity Log*
- *Monitoring Well Inspection Checklist*
- *Equipment Calibration Form*
- *Groundwater Level Measurement Form*
- *Vibrating Wire Piezometer Measurement Form*
- *Groundwater Sampling Form*
- *Chain-of-Custody (COC).*

3.2.1.1 Daily Field Activity Log

Stantec field sampling personnel (FSP) recorded field activities, observations, and data on a *Daily Field Activity Log* to chronologically document the field program. Deviations from the SAP, TIs, or QAPP were documented on the *Daily Field Activity Log*.

3.2.1.2 Monitoring Well Inspection Checklist

Prior to measuring water levels, Stantec FSP inspected each monitoring well for damage or indications that the well integrity had been compromised in accordance with ENV-TI-05.80.21, *Monitoring Well Inspection and Maintenance.* Inspection results were documented on a *Monitoring Well Inspection Checklist*. No signs of damage or necessary repairs were noted during Event #5.

3.2.1.3 Equipment Calibration Form

Stantec FSP performed daily calibration of the water quality meter and turbidity meter and documented the results on an *Equipment Calibration Form*. The form documented the calibration results for temperature, turbidity, specific conductance, pH, dissolved oxygen (DO), and oxidation-reduction potential (ORP), and verified that the field instruments' sensors were operating within acceptance criteria. Refer to Section 3.2.2 for additional details on equipment calibration procedures.

3.2.1.4 Groundwater Level Measurement Form

Stantec FSP recorded groundwater level field measurement data on a *Groundwater Level Measurement Form* in accordance with ENV-TI-05.80.44, *Groundwater Level and Well Depth Measurement*. The form includes the monitoring well identification (ID), time, and depth to water measured from a standardized reference point on the top of each well casing, recorded in feet (ft) below top of casing.

3.2.1.5 Vibrating Wire Piezometer Measurement Form

Stantec FSP recorded field measurement data on a *Vibrating Wire Piezometer Measurement Form*. The form includes the vibrating wire piezometer ID, serial number, time, digits, temperature, and length of the wire in feet. The readings were used to calculate the pressure head (ft of water) above the vibrating wire sensor to obtain the groundwater or pore water elevation.

3.2.1.6 Groundwater Sampling Form

Stantec FSP recorded the depth to water, purge flow rate, volume of groundwater purged, temperature, pH, specific conductance, DO, ORP, turbidity, color of water, and other observations during groundwater purging and sampling activities at each monitoring well in accordance with ENV-TI-05.80.42, *Groundwater Sampling*. Field measurements were recorded on a *Groundwater Sampling Form*. The form also documents the time intervals between measurement of field parameters, low-flow extraction rates, water level drawdown, and water quality parameter measurements until stabilization criteria were met.

3.2.1.7 Chain-of-Custody

Stantec FSP completed *COC* documentation for each groundwater sample collected. The sample ID, sample location, type of sample, sampling date and time, analyses requested, sample pH, and sample custody record were recorded on the *COC*. The Field Team Leader reviewed the *COC* for completeness, and the FSP conducted a QC check of samples in each cooler compared to sample IDs on the corresponding *COC*. *COCs* were completed in accordance with ENV-TI-05.80.02, *Sample Labeling and Custody*.

3.2.2 Equipment Calibration

Field instruments used to collect, generate, or measure water quality parameters were calibrated each day prior to use as specified in the SAP, QAPP, and ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde.* Afternoon calibration verifications were performed to evaluate if these instruments remained within acceptance criteria during sampling. Temperature and barometric pressure instrument readings were verified using a calibrated National Institute of Standards and Technology traceable thermometer and National Weather Service (via mesowest.utah.edu) barometric pressure readings for Clarksville Outlaw Field (KCKV) in Clarksville, Tennessee, respectively. Additional details regarding equipment calibration were recorded on an *Equipment Calibration Form*, as described in Section 3.2.1.3.

3.3 SAMPLING METHODS

The following sections present monitoring well data collection and sampling procedures used during Event #5. As approved by TDEC, monitoring well CUF-1004 was not gauged or sampled during this event because it was not installed as part of the hydrogeologic investigation.

3.3.1 Static Water Level Measurements

FSP measured static groundwater levels at 26 monitoring wells and pore water levels at six temporary wells in accordance with ENV-TI-05.80.44, *Groundwater Level and Well Depth Measurement.* On January 6, 2020, static groundwater and pore water level readings were measured and recorded to the nearest 0.01 ft from a reference point on the top of each well casing using an electronic water level indicator. Water level indicator probes were decontaminated prior to the first use and between measurements, and the decontamination was documented as specified in ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination.* Depth to groundwater and pore water measurements were recorded on a *Groundwater Level Measurement Form*.

Groundwater and pore water measurements were also obtained from transducers installed within nine and 14 piezometers, respectively. Additionally, a surface water level measurement for the Cumberland River was provided by TVA using the reading closest to noon recorded by an automated staff gauge. The surface water staff gauge location is shown on Exhibit A.1 in Appendix A.

Groundwater level data and pore water level data are shown in Tables B.1a and B.1b, respectively, in Appendix B. A groundwater elevation contour map based on groundwater measurements in wells and piezometers, along with pore water elevations, is included as Exhibit A.2 in Appendix A. Similarly, a pore water elevation contour map based on pore water measurements in wells and piezometers, along with groundwater elevations, is included as Exhibit A.3 in Appendix A.

3.3.2 Groundwater Purging & Sampling

Analytical and field duplicate samples (as specified in the SAP) were collected from five monitoring wells as shown in Table B.2 in Appendix B. Split samples collected by CEC during Event #5 are also identified in Table B.2. Monitoring wells were purged using dedicated bladder pumps equipped with dedicated tubing using low-flow purging and sampling techniques as specified in ENV-TI-05.80.42, *Groundwater Sampling*.

During the purging process, water quality field parameters including pH, specific conductance, temperature, ORP, and DO were measured using water quality meters (YSI ProPlus with flow-through cell) and recorded on field forms. Depth to water and turbidity were measured and recorded using decontaminated electronic water-level indicators (Heron Dipper-T) and calibrated turbidimeters (Hach 2100Q). Field parameters were measured and recorded on *Groundwater Sampling Forms* during purging until readings were stabilized as specified in the SAP and/or applicable TI. As approved by TDEC, the specific conductance and turbidity stabilization limits were revised to the values below to meet overall programmatic objectives for groundwater investigations at the CUF Plant. Well purging was considered complete when three consecutive readings were within the following stabilization limits:

- pH – ± 0.1 Standard Units
- Specific Conductance – ± 3% microSiemens per centimeter
- Turbidity – Less than 5 Nephelometric Turbidity Units (NTUs) or ± 10% for values above 5 NTUs
- DO – Less than 0.5 milligrams per Liter (mg/L) or ± 10% for values above 0.5 mg/L.

After water quality stabilization criteria were achieved, the final field parameter results were recorded, purging was discontinued, and a sample was collected as specified in the SAP. Due to a final turbidity reading higher than 5 NTUs at well CUF-1002, an additional sample was collected at that well and submitted to the laboratory for dissolved metals analysis.

Laboratory-provided, pre-preserved sample containers were filled directly from the pump discharge line with the exception of the dissolved metals sample, which was collected via a 0.45-micron disposable inline filter attached to the end of the discharge line to field filter the sample. FSP wore new, clean nitrile gloves when handling sample containers and did not touch the interior of containers or container caps. New gloves were used when handling each sample. When filling sample bottles, care was taken to minimize sample aeration (i.e., water was directed down the inner walls of the sample bottle) and to avoid overfilling and diluting preservatives. Each sample bottle was capped before filling the next bottle. Following completion of sampling, final turbidity measurements were made.

Sample containers were labeled and handled in accordance with ENV-TI-05.80.02, *Sample Labeling and Custody.* FSP secured caps on each bottle, attached a custody seal across the cap, and placed the bottles in a cooler on ice within 15 minutes of collection. QC samples were collected in accordance with ENV-TI-05.80.04, *Field Sampling Quality Control.*

Groundwater samples were analyzed for the CCR-related constituents listed in Appendices III and IV of 40 CFR 257. In addition, five inorganic constituents listed in Appendix I of Tennessee Rule 0400-11-01-.04 and not included in the 40 CFR 257 Appendices III and IV were analyzed to maintain continuity with TDEC environmental programs. These additional TDEC Appendix I constituents included copper, nickel, silver, vanadium, and zinc. The combined federal CCR Appendices III and IV constituents and TDEC Appendix I inorganic constituents will hereafter be referred to collectively as “CCR Parameters.” For geochemical evaluation, major cations/anions not included in the CCR Parameters were included in the analyses. The additional geochemical parameters included bicarbonate, carbonate, magnesium, potassium, and sodium.

3.4 INVESTIGATION DERIVED WASTE

Investigation derived waste (IDW) generated during groundwater investigation activities included:

- Used calibration solutions
- Purge water
- Decontamination fluids
- Disposable personal protective equipment (PPE)
- General trash.

IDW was handled in accordance with ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*; ENV-TI-05.80.42, *Groundwater Sampling* (purge water); the CUF Plant-specific waste management plan; and local, state, and federal regulations. Transportation and disposal of IDW was coordinated with CUF Plant facility management. Used calibration solution was containerized and stored for disposal as directed by the CUF Plant facility management. Purge water and decontamination fluids were containerized for later disposal as specified in the CUF Plant-specific waste management plan. Used disposable PPE (e.g., nitrile gloves) and general trash generated throughout the day were placed in garbage bags and disposed of in a general trash dumpster onsite at the end of each day.

3.5 SAMPLE SHIPMENT

Samples were packed and shipped under *COC* procedures specified in ENV-TI-05.80.06, *Handling and Shipping of Samples*. The samples were shipped by FedEx to GEL in Charleston, South Carolina (radium samples only), and to TestAmerica in Pittsburgh, Pennsylvania (other analytes). The laboratories submitted sample receipt confirmation forms to EnvStds for review and confirmation.

3.6 VARIATIONS

The proposed scope and procedures for the groundwater investigation were outlined in the SAP, QAPP, and applicable TVA TIs as detailed in the sections above. Variations in scope or procedures discussed with TDEC and/or TVA, changes based on field conditions, or additional field sampling performed to complete the scope of work in the SAP are described in the following sections. As discussed below, these variations do not impact the overall usability and representativeness of the dataset provided in this SAR for groundwater investigation sampling Event #5 at the CUF Plant.

3.6.1 Variations in Scope

Variations in scope are provided below.

- A surface water level measurement was not obtained for Wells Creek because a water level gauge has not yet been installed due to concerns of safe access to that location; however, a surface water measurement was obtained from the Cumberland River. The surface water gauge in Wells Creek was installed on July 23, 2020 and surface water data are being collected.
- Groundwater level gauging and sampling was not performed at well CUF-1004 as specified in the SAP because it was not installed (the three borings drilled in that area were dry). This change in scope was approved by TDEC.

3.6.2 Variations in Procedures

Variations in procedures occurring in the field are provided below.

- As approved by TDEC, the specific conductance and turbidity stabilization limits were revised to meet overall programmatic objectives for groundwater investigations.

4.0 SUMMARY

The data presented in this report are only for groundwater investigation sampling Event #5 at the CUF Plant. The scope of work for Event #5 was to:

- Collect groundwater samples for chemical analyses to assist with subsequent evaluation of the potential presence of CCR-related constituents in groundwater
- Measure groundwater and surface water elevations to assist with subsequent evaluation of groundwater flow direction and rate after multiple data sets have been collected.

In addition, pore water measurements from piezometers and temporary wells installed in the CCR units at the CUF Plant are presented in this SAR for comparison with groundwater data.

Event #5 included collecting groundwater level measurements at 26 monitoring wells and nine piezometers; pore water measurements at six temporary wells and 14 piezometers in the CCR units; and a surface water measurement at one gauge located in the Cumberland River. Groundwater and surface water measurements and elevations are provided in Table B.1a, and pore water measurements and elevations are provided in Table B.1b, and depicted on Exhibits A.2 and A.3.

Groundwater quality measurements and groundwater analytical samples were collected at five monitoring wells as summarized in Table B.2. Groundwater quality parameters were recorded during purging. Stabilization criteria for pH, specific conductance, turbidity, and DO were achieved at each sampling location. The final measurements prior to initiating sample collection are presented in Table B.3.

Groundwater analytical data for CCR Parameters and geochemical parameters are presented in Table B.4. Analytical data for radium analyses are presented in Table B.5. Analytical data were reported by GEL and TestAmerica, and then validated or verified by EnvStds.

Stantec has completed Event #5 of the groundwater investigation at the CUF Plant in Cumberland City, Tennessee, in accordance with the Groundwater Investigation SAP as documented herein. The data collected during Event #5 are usable for reporting and evaluation in the EAR and meet the objectives of the TDEC Order EIP. The complete datasets from the six groundwater sampling events will be evaluated along with data collected under other TDEC Order SAPs, as well as data collected under other State and CCR programs. This evaluation will be provided in the EAR.

5.0 REFERENCES

Environmental Standards, Inc. 2018. *Quality Assurance Project Plan for the Tennessee Valley Authority Cumberland Fossil Plant Environmental Investigation*. Prepared for Tennessee Valley Authority. Revision 2. January 2018.

Stantec Consulting Services, Inc. (Stantec). 2018a. *Groundwater Investigation Sampling and Analysis Plan, Cumberland Fossil Plant.* Revision 3. Prepared for Tennessee Valley Authority. June 25, 2018.

Stantec. 2018b. *Environmental Investigation Plan, Cumberland Fossil Plant.* Revision 3. Prepared for Tennessee Valley Authority. June 25, 2018.

Tennessee Department of Environment and Conservation. 2015. *Commissioner's Order No. OGC15-0177.*

Tennessee Valley Authority (TVA). ENV-TI-05.80.02, *Sample Labeling and Custody*.

TVA. ENV-TI-05.80.03, *Field Record Keeping*.

TVA. ENV-TI-05.80.04, *Field Sampling Quality Control*.

TVA. ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*.

TVA. ENV-TI-05.80.06, *Handling and Shipping of Samples*.

TVA. ENV-TI-05.80.21, *Monitoring Well Inspection and Maintenance*.

TVA. ENV-TI-05.80.42, *Groundwater Sampling*.

TVA. ENV-TI-05.80.44, *Groundwater Level and Well Depth Measurement*.

TVA. ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde.*

APPENDIX A - EXHIBITS

Exhibit No.

A.1

Title

Monitoring Well Network

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location

Stewart County, Tennessee

175568209
Prepared by MB on 2020-09-29
Technical Review by MW on 2020-09-29

0 400 800 1,200 1,600 Feet

1:4,800 (At original document size of 22x34)

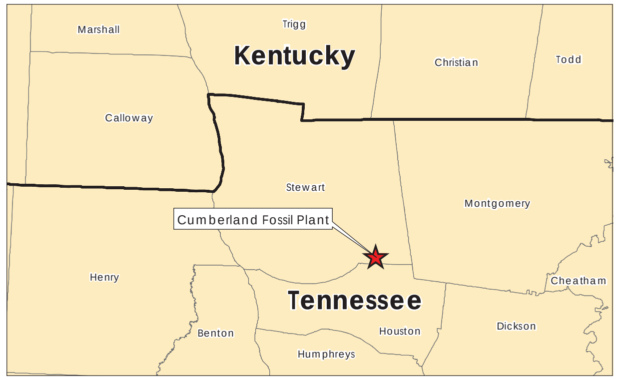
Legend

- Groundwater Investigation Monitoring Well
- Other Monitoring Well
- Piezometer
- Pore Water Piezometer in CCR Material
- Temporary Well within CCR Material
- Cumberland River Gauging Station
- 2019 Imagery Boundary
- CCR Unit Area (Approximate)

CCR: Coal combustion residuals

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)



Stantec

TVA

Exhibit No.

A.2

Title

Groundwater Elevation Contour Map, Event #5 (January 6, 2020)

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location

Stewart County, Tennessee

175568209

Prepared by MB on 2021-02-23
Technical Review by MW on 2021-02-23

0 400 800 1,200 1,600 Feet

1:4,800 (At original document size of 22x34)

Legend

- Groundwater Investigation Monitoring Well: groundwater elevation in feet above mean sea level (ft amsl)
- Other Monitoring Well: groundwater elevation in ft amsl
- Piezometer: groundwater elevation in ft amsl
- Piezometer in CCR: pore water elevation in ft amsl; value not used for contouring
- Temporary well in CCR: pore water elevation in ft amsl; value not used for contouring
- Cumberland River Gauging Station: surface water elevation in ft amsl
- Interpolated Groundwater Contour (5 ft interval; elevations are in ft amsl)
- Groundwater Contour (5 ft interval; elevations are in ft amsl)
- 2019 Imagery Boundary
- CCR Unit Area (Approximate)

CCR: Coal combustion residuals

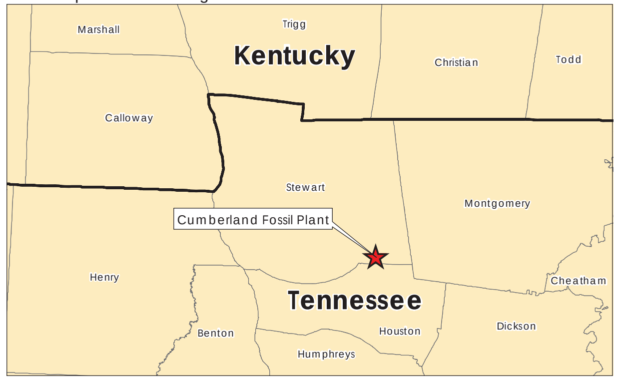
*Groundwater elevation displayed but not used as input for contouring due to factors such as well construction or being screened in a different hydrogeologic unit.

**Piezometers were not collecting groundwater measurements during this monitoring event.

***Nested VWPZ sensors monitoring pore water and groundwater elevations in the same borehole, and the location is shown by a single symbol.

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)
3. Groundwater contours were created using Surfer Version 16 (December 13, 2018) and manual adjustment
4. For PZ's with multiple instruments in CCR material, the reading with the highest pore water elevation is displayed, unless that reading is suspected of being erroneous.



Stantec TVA

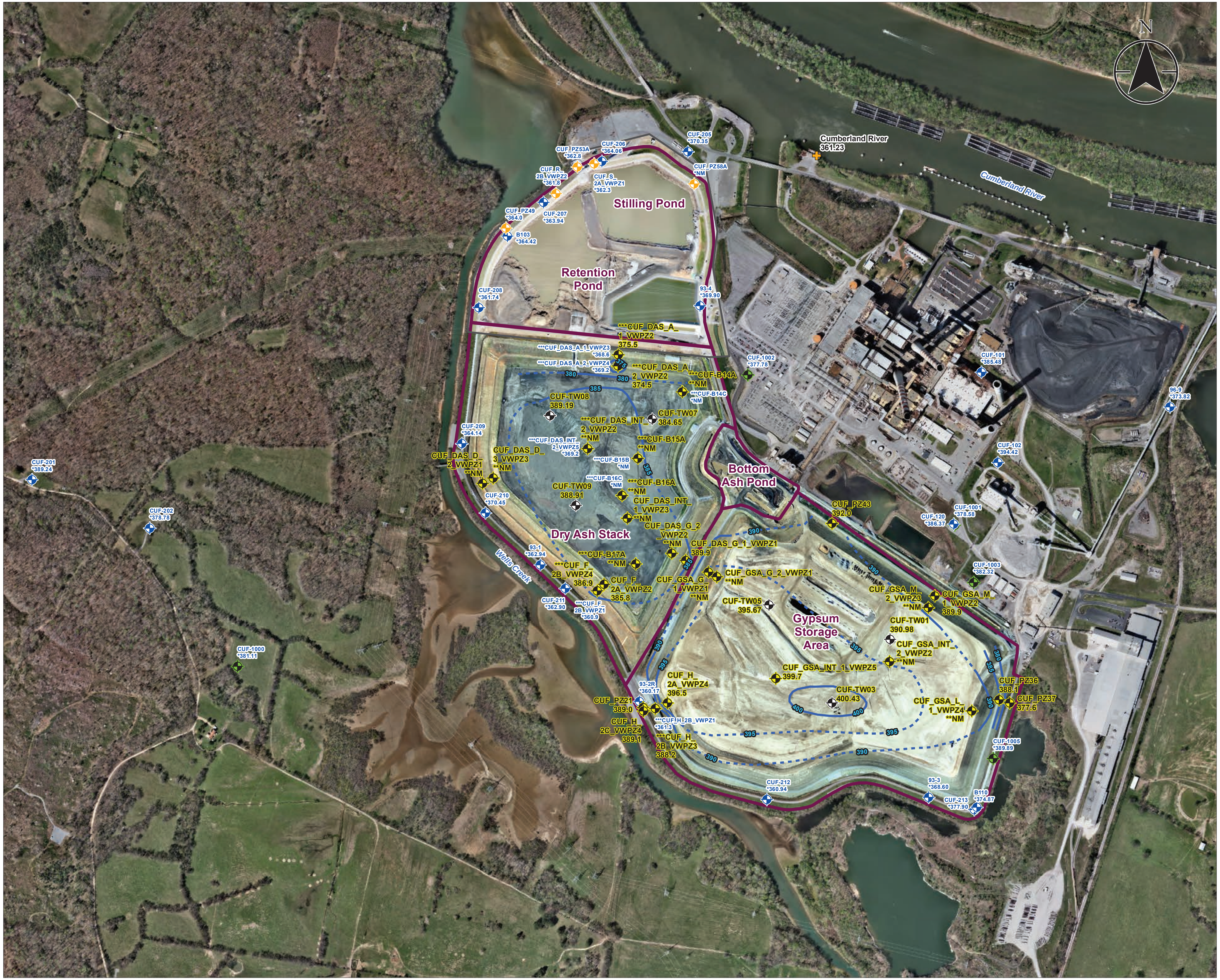


Exhibit No.
A.3

Title
Pore Water Elevation Contour Map, Event #5 (January 6, 2020)

Client/Project
Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location
175568209
Stewart County, Tennessee
Prepared by MB on 2021-02-11
Technical Review by MD on 2021-02-11

0 400 800 1,200 1,600 Feet
1:4,800 (At original document size of 22x34)

Legend

- Groundwater Investigation Monitoring Well: groundwater elevation in feet above mean sea level (ft amsl); value not used for contouring
- Other Monitoring Well: groundwater elevation in ft amsl; value not used for contouring
- Piezometer: groundwater elevation in ft amsl; value not used for contouring
- Piezometer in CCR: pore water elevation in ft amsl
- Temporary well in CCR: pore water elevation in ft amsl
- Cumberland River Gauging Station: surface water elevation in ft amsl
- Interpolated Pore water Contour (5 ft interval; elevations are in ft amsl)
- Pore water Contour (5 ft interval; elevations are in ft amsl)
- 2019 Imagery Boundary
- CCR Unit Area (Approximate)

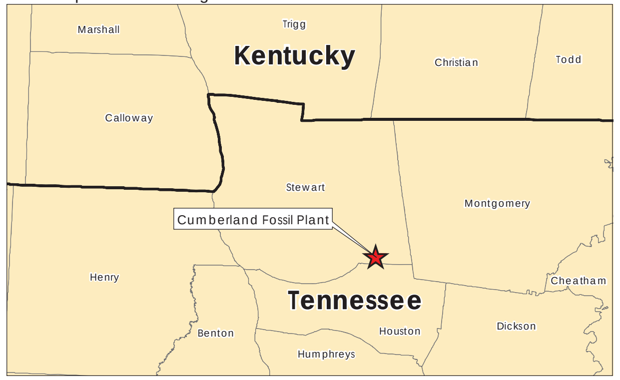
CCR: Coal combustion residuals

*Groundwater elevation displayed but not used as input for contouring due to factors such as well construction or being screened in a different hydrogeologic unit.

**Piezometers were not collecting groundwater measurements during this monitoring event.

***Nested VWPZ sensors monitoring pore water and groundwater elevations in the same borehole, and the location is shown by a single symbol.

Notes
1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)
3. Pore water contours were created with manual adjustment using Surfer Version 16 (December 13, 2018)
4. For PZ's with multiple instruments in CCR material, the reading with the highest pore water elevation is displayed, unless that reading is suspected of being erroneous.



Stantec TVA

APPENDIX B - TABLES

TABLE B.1a – Groundwater Level Measurements
Cumberland Fossil Plant
January 2020

UNID	Well / Piezometer ID	Date Measured	Depth to Groundwater	Top of Casing Elevation	Groundwater Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
			ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft btoc	
CUF-00-GW-43-001	93-1	6-Jan-20	34.23	397.17	362.94	n/a	n/a	n/a	52.3 - 62.3	Alluvial Silts and Clays / Alluvial Sands and Gravels
CUF-00-GW-43-002	93-2R	6-Jan-20	37.71	397.88	360.17	n/a	n/a	n/a	62.3 - 72.0	Alluvial Sands and Gravels
CUF-00-GW-43-003	93-3	6-Jan-20	28.90	397.50	368.60	n/a	n/a	n/a	45.0 - 55.0	Alluvial Silts and Clays
CUF-00-GW-43-004	93-4	6-Jan-20	27.44	397.34	369.90	n/a	n/a	n/a	27.2 - 36.6	Bedrock: Limestone
CUF-00-GW-43-005	96-9	6-Jan-20	18.77	392.59	373.82	n/a	n/a	n/a	16.1 - 30.9	Bedrock: Fernvale and Hermitage Limestones
CUF-00-GW-43-006	B103	6-Jan-20	31.55	395.97	364.42	n/a	n/a	n/a	74.0 - 84.0	Alluvial Silts and Clays
CUF-00-GW-43-007	B110	6-Jan-20	23.40	398.27	374.87	n/a	n/a	n/a	48.3 - 52.5	Alluvial Silts and Clays
CUF-00-GW-43-008	CUF-101	6-Jan-20	0.20	385.68	385.48	n/a	n/a	n/a	2.0 - 17.2	Clay
CUF-00-GW-43-009	CUF-102	6-Jan-20	8.51	402.93	394.42	n/a	n/a	n/a	3.8 - 13.8	Bedrock: Limestone
CUF-00-GW-43-010	CUF-120	6-Jan-20	6.82	393.19	386.37	n/a	n/a	n/a	9.3 - 14.3	Bedrock
CUF-00-GW-43-011	CUF-201	6-Jan-20	11.17	400.41	389.24	n/a	n/a	n/a	17.6 - 27.7	Alluvial Sands and Gravels
CUF-00-GW-43-012	CUF-202	6-Jan-20	4.50	383.28	378.78	n/a	n/a	n/a	14.3 - 19.6	Alluvial Sands and Gravels
CUF-00-GW-43-014	CUF-205	6-Jan-20	14.16	384.51	370.35	n/a	n/a	n/a	16.9 - 27.1	Alluvial Sands and Gravels
CUF-00-GW-43-015	CUF-206	6-Jan-20	34.61	398.67	364.06	n/a	n/a	n/a	82.7 - 92.9	Alluvial Sands and Gravels
CUF-00-GW-43-016	CUF-207	6-Jan-20	34.25	398.19	363.94	n/a	n/a	n/a	75.0 - 85.1	Alluvial Sands and Gravels
CUF-00-GW-43-017	CUF-208	6-Jan-20	36.64	398.38	361.74	n/a	n/a	n/a	47.9 - 58.0	Alluvial Sands and Gravels
CUF-00-GW-43-018	CUF-209	6-Jan-20	34.09	398.23	364.14	n/a	n/a	n/a	53.1 - 63.3	Alluvial Sands and Gravels
CUF-00-GW-43-019	CUF-210	6-Jan-20	27.75	398.20	370.45	n/a	n/a	n/a	63.5 - 68.5	Alluvial Sands and Gravels
CUF-00-GW-43-020	CUF-211	6-Jan-20	35.86	398.76	362.90	n/a	n/a	n/a	57.7 - 67.9	Alluvial Sands and Gravels
CUF-00-GW-43-021	CUF-212	6-Jan-20	37.77	398.71	360.94	n/a	n/a	n/a	62.6 - 72.8	Alluvial Sands and Gravels
CUF-00-GW-43-022	CUF-213	6-Jan-20	21.15	399.05	377.90	n/a	n/a	n/a	40.0 - 45.2	Alluvial Sands and Gravels
CUF-00-GW-43-026	CUF-1000	6-Jan-20	14.18	395.29	381.11	n/a	n/a	n/a	14.5 - 25.1	Clay and Clayey Sand
CUF-00-GW-43-027	CUF-1001	6-Jan-20	15.17	393.75	378.58	n/a	n/a	n/a	15.8 - 20.6	Clayey Gravel and Clay
CUF-00-GW-43-028	CUF-1002	6-Jan-20	11.48	389.26	377.78	n/a	n/a	n/a	15.1 - 20.0	Clay and Gravel/Clay
CUF-00-GW-43-029	CUF-1003	6-Jan-20	14.07	396.39	382.32	n/a	n/a	n/a	12.6 - 17.5	Gravel/Cobbles and Clay
CUF-00-GW-43-030	CUF-1005	6-Jan-20	9.69	399.58	389.89	n/a	n/a	n/a	18.2 - 28.8	Sand, Clayey Gravel, Clay
Piezometers										
n/a	CUF-B14C	n/a	NM	n/a	NM	440.8	319.8	121.0	n/a	Alluvial Clay and Granular
n/a	CUF-B15B	n/a	NM	n/a	NM	438.3	327.8	110.5	n/a	Alluvial Granular
n/a	CUF-B16C	n/a	NM	n/a	NM	439.7	324.7	115.0	n/a	Alluvial Granular
n/a	CUF-B17B	n/a	NM	n/a	NM	443.4	336.4	107.0	n/a	Alluvial Granular
n/a	CUF_PZ49	6-Jan-20	15.2	n/a	364.0	379.2	322.2	57.0	n/a	Alluvial Granular
n/a	CUF_PZ53A	6-Jan-20	13.2	n/a	362.8	376.0	311.0	65.0	n/a	Alluvial Granular
n/a	CUF_PZ58A	n/a	NM	n/a	NM	394.8	349.3	45.5	n/a	Alluvial Granular
n/a	CUF_R_2B_VWPZ2	6-Jan-20	33.5	n/a	361.8	395.3	320.0	75.3	n/a	Alluvial Granular
n/a	CUF_S_2A_VWPZ1	6-Jan-20	32.6	n/a	362.3	394.9	299.7	95.2	n/a	Alluvial Granular
n/a	CUF_F_2B_VWPZ1	6-Jan-20	51.2	n/a	360.9	412.1	322.1	90.0	n/a	Alluvial Granular
n/a	CUF_DAS_A_1_VWPZ3	6-Jan-20	19.4	n/a	368.6	388.0	293.0	95.0	n/a	Alluvial Granular
n/a	CUF_DAS_A_2_VWPZ4	6-Jan-20	43.7	n/a	369.2	412.9	308.4	104.5	n/a	Alluvial Granular
n/a	CUF_DAS_INT_2_VWPZ5	6-Jan-20	65.3	n/a	369.2	434.5	313.5	121.0	n/a	Alluvial Granular
n/a	CUF_H_2B_VWPZ1	6-Jan-20	49.4	n/a	361.3	410.7	322.7	88.0	n/a	Alluvial Granular
Surface Water Gauge										
Cumberland River gauge	n/a	6-Jan-20	n/a	n/a	361.23	n/a	n/a	n/a	n/a	n/a

See notes on last page.

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TABLE B.1a – Groundwater Level Measurements
Cumberland Fossil Plant
January 2020

UNID	Well / Piezometer ID	Date Measured	Depth to Groundwater	Top of Casing Elevation	Groundwater Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
			ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft btoc	

Notes:

bgs	below ground surface
btoc	below top of casing
ft	feet
ID	identification
msl	mean sea level
n/a	not applicable
NM	not measured
UNID	Unique Numerical Identification

1. Top of casing elevations, screened intervals, and screened formations were obtained from the TVA Well Inventory Log provided by TVA.
2. Cumberland River data point is the reading closest to noon recorded by the automated staff gauge provided by TVA.
3. Ground surface elevations, groundwater elevations, and piezometer data were obtained from geotechnical instrumentation database. Piezometer sensor formations were obtained from boring logs. Data from vibrating wire piezometers were averaged for the measurement date. For consistency in reporting for the TDEC Order, historical piezometer IDs were modified (if necessary) to include 'VWPZ' to indicate a vibrating wire piezometer.
4. Depth to groundwater in piezometers and groundwater elevations at all locations are calculated values. Accuracy of piezometer data is to 0.1 ft.
5. Groundwater levels were not measured in select peizometers as noted above because the sensors were not recording data.

TABLE B.1b – Pore Water Level Measurements
Cumberland Fossil Plant
January 2020

Temporary Well / Piezometer ID	Date Measured	Depth to Pore Water	Top of Casing Elevation	Pore Water Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
		ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft bgs	
Temporary Wells									
CUF-TW01	6-Jan-20	40.01	430.99	390.98	n/a	n/a	n/a	41.3 - 51.9	CCR
CUF-TW03	6-Jan-20	29.10	429.53	400.43	n/a	n/a	n/a	54.9 - 65.5	CCR
CUF-TW05	6-Jan-20	31.13	426.80	395.67	n/a	n/a	n/a	49.5 - 56.5	CCR
CUF-TW07	6-Jan-20	59.04	443.69	384.65	n/a	n/a	n/a	81.5 - 92.1	CCR
CUF-TW08	6-Jan-20	54.17	443.36	389.19	n/a	n/a	n/a	72.1 - 82.7	CCR
CUF-TW09	6-Jan-20	57.53	446.44	388.91	n/a	n/a	n/a	79.5 - 90.1	CCR
Piezometers									
CUF-B14A	n/a	NM	n/a	NM	440.8	360.8	80.0	n/a	CCR
CUF-B15A	n/a	NM	n/a	NM	438.3	353.3	85.0	n/a	CCR
CUF-B16A	n/a	NM	n/a	NM	439.7	383.4	56.3	n/a	CCR
CUF-B17A	n/a	NM	n/a	NM	443.4	363.9	79.5	n/a	CCR
CUF_DAS_A_1_VWPZ2	6-Jan-20	12.5	n/a	375.5	388.0	335.0	53.0	n/a	CCR
CUF_DAS_A_2_VWPZ2	6-Jan-20	38.4	n/a	374.5	412.9	353.4	59.5	n/a	CCR
CUF_DAS_D_2_VWPZ1	n/a	NM	n/a	NM	398.7	376.6	22.1	n/a	CCR
CUF_DAS_D_3_VWPZ3	n/a	NM	n/a	NM	427.2	371.9	55.3	n/a	CCR
CUF_DAS_G_1_VWPZ1	6-Jan-20	15.6	n/a	389.9	405.5	379.6	25.9	n/a	CCR
CUF_DAS_G_2_VWPZ2	n/a	NM	n/a	NM	439.1	396.1	43.0	n/a	CCR
CUF_DAS_INT_1_VWPZ3	n/a	NM	n/a	NM	439.1	379.1	60.0	n/a	CCR
CUF_DAS_INT_2_VWPZ2	n/a	NM	n/a	NM	434.5	388.5	46.0	n/a	CCR
CUF_F_2A_VWPZ2	6-Jan-20	47.8	n/a	385.8	433.6	353.6	80.0	n/a	CCR
CUF_F_2B_VWPZ4	6-Jan-20	25.2	n/a	386.9	412.1	377.1	35.0	n/a	CCR
CUF_GSA_G_1_VWPZ1	n/a	NM	n/a	NM	413.3	384.6	28.7	n/a	CCR
CUF_GSA_G_2_VWPZ1	n/a	NM	n/a	NM	428.2	388.2	40.0	n/a	CCR
CUF_GSA_INT_1_VWPZ5	6-Jan-20	23.4	n/a	399.7	423.1	393.1	30.0	n/a	CCR
CUF_GSA_INT_2_VWPZ2	n/a	NM	n/a	NM	420.3	380.3	40.0	n/a	CCR
CUF_GSA_L_1_VWPZ4	n/a	NM	n/a	NM	430.3	369.3	61.0	n/a	CCR
CUF_GSA_M_1_VWPZ2	6-Jan-20	20.1	n/a	389.9	410.0	382.0	28.0	n/a	CCR
CUF_GSA_M_2_VWPZ3	n/a	NM	n/a	NM	430.3	380.3	50.0	n/a	CCR
CUF_H_2A_VWPZ4	6-Jan-20	27.5	n/a	396.5	424.0	389.8	34.2	n/a	CCR
CUF_H_2B_VWPZ3	6-Jan-20	22.5	n/a	388.2	410.7	353.7	57.0	n/a	CCR
CUF_H_2C_VWPZ4	6-Jan-20	6.2	n/a	389.1	395.3	374.0	21.3	n/a	CCR
CUF_PZ21	6-Jan-20	6.1	n/a	389.0	395.1	356.0	39.1	n/a	CCR
CUF_PZ36	6-Jan-20	23.1	n/a	388.1	411.2	363.2	48.0	n/a	CCR
CUF_PZ37	6-Jan-20	17.6	n/a	377.6	395.2	367.2	28.0	n/a	CCR
CUF_PZ43	6-Jan-20	19.3	n/a	392.0	411.3	374.3	37.0	n/a	CCR

See notes on last page.

TABLE B.1b – Pore Water Level Measurements
Cumberland Fossil Plant
January 2020

Temporary Well / Piezometer ID	Date Measured	Depth to Pore Water	Top of Casing Elevation	Pore Water Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation

Notes:

bgs	below ground surface
btoc	below top of casing
CCR	coal combustion residuals
ft	feet
ID	identification
msl	mean sea level
n/a	not applicable
NM	not measured

1. Top of casing elevations, screened intervals, and screened formations were obtained from boring logs, well details, and well survey data.
2. For piezometers, ground surface elevations, pore water elevations, and piezometer data were obtained from geotechnical instrumentation database. Piezometer sensor formations were obtained from boring logs. Data from vibrating wire piezometers were averaged for the measurement date. For consistency in reporting for the TDEC Order, historical piezometer IDs were modified (if necessary) to include 'VWPZ' to indicate a vibrating wire piezometer.
3. Depth to pore water in piezometers and pore water elevations at all locations are calculated values. Accuracy of piezometer data is to 0.1 ft.
4. Screened interval shown for temporary wells is below ground surface when drilled.
5. Groundwater levels were not measured in select piezometers as noted above because the sensors were not recording data.

TABLE B.2 – Summary of Groundwater Samples
Cumberland Fossil Plant
January 2020

			Analysis Type											
Location ID	**Sample ID**	**Sample Type**	Field Parameters	Total Metals	Dissolved Metals	Total Mercury	Dissolved Mercury	Anions	Alkalinity	Total Dissolved Solids	Radium-226	Radium-228	Radium-226+228
CUF-1000	CUF-GW-026-20200107	Normal Environmental Sample	x	x		x		x	x	x	x	x	x
CUF-1001	CUF-GW-027-20200107	Normal Environmental Sample	x	x		x		x	x	x	x	x	x
	CUF-GW-DUP01-20200107	Field Duplicate Sample		x		x		x	x	x	x	x	x
CUF-1002	CUF-GW-028-20200108	Normal Environmental Sample	x	x	x	x	x	x	x	x	x	x	x
CUF-1003	CUF-GW-029-20200107	Normal Environmental Sample	x	x		x		x	x	x	x	x	x
CUF-1005	CUF-GW-030-20200108	Normal Environmental Sample	x	x		x		x	x	x	x	x	x

Notes

Total and Dissolved Metals	SW-846 6020A
Total and Dissolved Mercury	SW-846 7470A
Anions	EPA 300.0/SW 9056
Alkalinity	SM2320B
Total Dissolved Solids	SM2540C
Radium-226	EPA 903.0
Radium-228	EPA 904.0
Radium-226+228	CALC
ID	identification

1. Field and laboratory quality control sample results except for field duplicates are not included in report tables but were used for data validation.
2. CEC collected split samples from CUF-1001, CUF-1002, and CUF-1003.

TABLE B.3 – Summary of Groundwater Quality Parameters
Cumberland Fossil Plant
January 2020

Sample Location Sample Date Sample ID Sample Depth Sample Type Level of Review	Units	CUF-1000 7-Jan-20 CUF-GW-026-20200107 19.5 ft Normal Environmental Sample Final QC Review	CUF-1001 7-Jan-20 CUF-GW-027-20200107 19 ft Normal Environmental Sample Final QC Review	CUF-1002 8-Jan-20 CUF-GW-028-20200108 18 ft Normal Environmental Sample Final QC Review	CUF-1003 7-Jan-20 CUF-GW-029-20200107 16.8 ft Normal Environmental Sample Final QC Review	CUF-1005 8-Jan-20 CUF-GW-030-20200108 24 ft Normal Environmental Sample Final QC Review
Field Parameters						
Dissolved Oxygen	%	58.7	20.2	1.9	27.3	8.0
Dissolved Oxygen	mg/L	5.86	1.89	0.17	2.64	0.78
ORP	mV	181.9	1.8	-77.7	192.4	103.6
pH (field)	SU	7.56	7.19	6.89	6.88	10.02
Specific Cond. (Field)	uS/cm	400.3	1,387	1,336	2,954	3,538
Temperature, Water (C)	DEG C	15.5	17.6	17.9	16.0	18.1
Turbidity, field	NTU	0.12	2.95	6.86	0.24	0.32

Notes:

%	percent
Cond.	conductance
DEG C	degrees Celsius
ft	feet below top of casing
ID	identification
mg/L	milligrams per Liter
mV	milliVolts
NTU	Nephelometric Turbidity Unit
ORP	Oxidation Reduction Potential, measured using a silver reference electrode which has a standard potential of 200 mV
SU	Standard Units
uS/cm	microSiemens per centimeter

TABLE B.4 - Groundwater Analytical Results for Metals, Anions, and General Chemistry
Cumberland Fossil Plant
January 2020

Sample Location				CUF-1000	CUF-1001		CUF-1002	CUF-1003	CUF-1005
Sample Date				7-Jan-20	7-Jan-20	7-Jan-20	8-Jan-20	7-Jan-20	8-Jan-20
Sample ID				CUF-GW-026-20200107	CUF-GW-027-20200107	CUF-GW-DUP01-20200107	CUF-GW-028-20200108	CUF-GW-029-20200107	CUF-GW-030-20200108
Sample Depth				19.5 ft	19 ft	19 ft	18 ft	16.8 ft	24 ft
Sample Type				Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Level of Review				Validated	Validated	Validated	Validated	Validated	Validated
	Units	EPA MCLs	CCR Rule GWPS						
Total Metals									
Antimony	ug/L	6^{A}	n/v	<0.378	<0.378	<0.378	<0.378	<0.378	2.03
Arsenic	ug/L	10^{A}	n/v	0.757 J	2.13	2.14	2.54	1.25	9.41
Barium	ug/L	$2,000^{A}$	n/v	34.5	56.6	60.1	53.9	31.5	67.3
Beryllium	ug/L	4^{A}	n/v	0.235 J	0.182 J	<0.182	<0.182	<0.182	0.197 J
Boron	ug/L	n/v	n/v	<38.6	4,080	4,110	328	12,700	33,000
Cadmium	ug/L	5^{A}	n/v	<0.217	<0.217	<0.217	<0.217	0.295 J	0.723 J
Calcium	ug/L	n/v	n/v	81,700	268,000	278,000	223,000	543,000	907,000
Chromium	ug/L	100^{A}	n/v	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	ug/L	n/v	6^{B}	<0.134	1.51	1.48	0.147 J	0.756	<0.134
Copper	ug/L	n/v	n/v	0.630 J	1.01 J	0.768 J	<0.627	1.14 J	<0.627
Lead	ug/L	n/v	15^{B}	<0.128	<0.128	<0.128	<0.128	<0.128	<0.128
Lithium	ug/L	n/v	40^{B}	<3.39	<3.39	<3.39	<3.39	<3.39	**62.6^{B}**
Magnesium	ug/L	n/v	n/v	2,520	27,600	28,500	33,300	50,200	1,860
Mercury	ug/L	2^{A}	n/v	<0.101	<0.101	<0.101	<0.101	<0.101	<0.101
Molybdenum	ug/L	n/v	100^{B}	<0.610	**184^{B}**	**189^{B}**	2.47 U*	**265^{B}**	**918^{B}**
Nickel	ug/L	$100_{(TN\ MCL)}^{A}$	n/v	0.716 U*	2.61 U*	2.70 U*	1.54 U*	2.04 U*	1.02 U*
Potassium	ug/L	n/v	n/v	286 J	6,850	7,090	1,620	18,400	51,700
Selenium	ug/L	50^{A}	n/v	<1.51	<1.51	<1.51	<1.51	<1.51	23.7
Silver	ug/L	$100_{(TN\ MCL)}^{A}$	n/v	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177
Sodium	ug/L	n/v	n/v	1,700	15,800	16,400	48,400	174,000	29,500
Thallium	ug/L	2^{A}	n/v	<0.148	<0.148	<0.148	<0.148	0.216 J	1.86
Vanadium	ug/L	n/v	n/v	<0.991	<0.991	<0.991	<0.991	<0.991	767
Zinc	ug/L	n/v	n/v	<3.22	<3.22	<3.22	<3.22	<3.22	<3.22
Dissolved Metals									
Antimony	ug/L	6^{A}	n/v	-	-	-	<0.378	-	-
Arsenic	ug/L	10^{A}	n/v	-	-	-	2.45	-	-
Barium	ug/L	$2,000^{A}$	n/v	-	-	-	54.2	-	-
Beryllium	ug/L	4^{A}	n/v	-	-	-	<0.182	-	-
Boron	ug/L	n/v	n/v	-	-	-	316	-	-
Cadmium	ug/L	5^{A}	n/v	-	-	-	<0.217	-	-
Calcium	ug/L	n/v	n/v	-	-	-	220,000	-	-
Chromium	ug/L	100^{A}	n/v	-	-	-	<1.53	-	-
Cobalt	ug/L	n/v	6^{B}	-	-	-	0.441 U*	-	-
Copper	ug/L	n/v	n/v	-	-	-	<0.627	-	-
Lead	ug/L	n/v	15^{B}	-	-	-	<0.128	-	-
Lithium	ug/L	n/v	40^{B}	-	-	-	<3.39	-	-
Magnesium	ug/L	n/v	n/v	-	-	-	32,800	-	-
Mercury	ug/L	2^{A}	n/v	-	-	-	0.101 UJ	-	-
Molybdenum	ug/L	n/v	100^{B}	-	-	-	2.41 J	-	-
Nickel	ug/L	$100_{(TN\ MCL)}^{A}$	n/v	-	-	-	1.18 U*	-	-
Potassium	ug/L	n/v	n/v	-	-	-	1,600	-	-
Selenium	ug/L	50^{A}	n/v	-	-	-	<1.51	-	-
Silver	ug/L	$100_{(TN\ MCL)}^{A}$	n/v	-	-	-	<0.177	-	-
Sodium	ug/L	n/v	n/v	-	-	-	47,600	-	-
Thallium	ug/L	2^{A}	n/v	-	-	-	0.705 U*	-	-
Vanadium	ug/L	n/v	n/v	-	-	-	<0.991	-	-
Zinc	ug/L	n/v	n/v	-	-	-	<3.22	-	-
Anions									
Chloride	mg/L	n/v	n/v	0.980 J	53.3	52.4	32.3	214	298
Fluoride	mg/L	4^{A}	n/v	0.234	0.129	0.124	0.276	0.142 J	0.0770 J
Sulfate	mg/L	n/v	n/v	13.6	514	517	337	1,400	1,870
General Chemistry									
Alkalinity, Bicarbonate	mg/L	n/v	n/v	192	224	226	361	135	<5.00
Alkalinity, Carbonate	mg/L	n/v	n/v	<5.00	<5.00	<5.00	<5.00	<5.00	81.1
Alkalinity, Total as CaCO3	mg/L	n/v	n/v	192	224	226	361	135	157
Total Dissolved Solids	mg/L	n/v	n/v	267	1,060	1,070	947	2,550	3,310

Notes:

A	EPA Maximum Contaminant Level
B	CCR Rule GWPS (Federal Register / Vol. 83, No. 146 / Monday, July 30, 2018 / Rules and Regulations)
n/v	No standard/guideline value
6.5^{A}	Concentration is greater than or equal to the indicated standard.
<0.03	analyte was not detected at a concentration greater than the Method Detection Limit
ft	feet below top of casing
ID	identification
J	quantitation is approximate due to limitations identified during data validation
mg/L	milligrams per Liter
U*	result should be considered "not detected" because it was detected in an associated field or laboratory blank at a similar level
UJ	This compound was not detected, but the reporting or detection limit should be considered estimated due to a bias identified during data validation.
ug/L	micrograms per Liter
(TN MCL)	Tennessee Maximum Contaminant Level

1. Level of review is defined in the Quality Assurance Project Plan.

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TABLE B.5 – Groundwater Analytical Results for Radiological Parameters
Cumberland Fossil Plant
January 2020

Sample Location				CUF-1000	CUF-1001		CUF-1002	CUF-1003	CUF-1005
Sample Date				7-Jan-20	7-Jan-20	7-Jan-20	8-Jan-20	7-Jan-20	8-Jan-20
Sample ID				CUF-GW-026-20200107	CUF-GW-027-20200107	CUF-GW-DUP01-20200107	CUF-GW-028-20200108	CUF-GW-029-20200107	CUF-GW-030-20200108
Sample Depth				19.5 ft	19 ft	19 ft	18 ft	16.8 ft	24 ft
Sample Type				Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Level of Review				Validated	Validated	Validated	Validated	Validated	Validated
	Units	EPA MCLs	CCR Rule GWPS						
Radiological Parameters									
Radium-226	PCI/L	n/v	n/v	0.627 +/-(0.598)U	0.337 +/-(0.542)U	-0.0986 +/-(0.392)U	0.602 +/-(0.580)U	0.229 +/-(0.483)U	0.511 +/-(0.532)U
Radium-228	PCI/L	n/v	n/v	-0.0892 +/-(0.333)U	0.0990 +/-(0.365)U	0.0746 +/-(0.470)U	0.245 +/-(0.322)U	0.137 +/-(0.330)U	0.0753 +/-(0.389)U
Radium-226+228	PCI/L	5[A]	n/v	0.627 +/-(0.684)U	0.436 +/-(0.654)U	0.0746 +/-(0.612)U	0.847 +/-(0.663)U	0.367 +/-(0.585)U	0.586 +/-(0.660)U

Notes:

A	EPA Maximum Contaminant Level
B	CCR Rule GWPS (Federal Register / Vol. 83, No. 146 / Monday, July 30, 2018 / Rules and Regulations)
n/v	No standard/guideline value
ft	feet below top of casing
ID	identification
pCi/L	picoCurie per Liter
U	not detected

1. Level of review is defined in the Quality Assurance Project Plan.

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APPENDIX H.9

GROUNDWATER INVESTIGATION EVENT #6 SAMPLING AND ANALYSIS REPORT

Cumberland Fossil Plant Groundwater Investigation Event #6 Sampling and Analysis Report

TDEC Commissioner's Order
Environmental Investigation Plan
Cumberland Fossil Plant
Cumberland City, Tennessee

March 26, 2021

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

Revision Record

Revision	Description	Date
0	Submittal to TDEC	March 26, 2021

Sign-off Sheet

This document entitled Cumberland Fossil Plant Groundwater Investigation Event #6 Sampling and Analysis Report was prepared by Stantec Consulting Services Inc. (“Stantec”) for the account of Tennessee Valley Authority (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

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Approved by ______________________________

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Abbreviations

CCR	Coal Combustion Residuals
CCR Parameters	Constituents listed in Appendices III and IV of 40 CFR 257 and five inorganic constituents included in Appendix I of Tennessee Rule 0400-11-01-.04
CFR	Code of Federal Regulations
COC	Chain-of-Custody
CUF Plant	Cumberland Fossil Plant
DO	Dissolved Oxygen
EAR	Environmental Assessment Report
EIP	Environmental Investigation Plan
ENV	Environmental
EnvStds	Environmental Standards, Inc.
Event #6	Groundwater investigation field event performed March 9-11, 2020
FSP	Field Sampling Personnel
ft	Feet
GEL	GEL Laboratories LLC
ID	Identification
IDW	Investigation Derived Waste
mg/L	Milligrams per Liter
NTU	Nephelometric Turbidity Units
ORP	Oxidation-Reduction Potential
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
QC	Quality Control
SAP	Sampling and Analysis Plan
SAR	Sampling and Analysis Report
Stantec	Stantec Consulting Services Inc.
TDEC	Tennessee Department of Environment and Conservation
TDEC Order	Commissioner’s Order No. OGC15-0177
Terracon	Terracon Consultants, Inc.
TestAmerica	Eurofins TestAmerica Inc.
TI	Technical Instruction
TVA	Tennessee Valley Authority
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) has prepared this sampling and analysis report (SAR) on behalf of the Tennessee Valley Authority (TVA) to document the completion of activities related to a groundwater investigation sampling event performed March 9-11, 2020 (Event #6) at TVA's Cumberland Fossil Plant (CUF Plant) located in Cumberland City, Tennessee.

The purpose of the groundwater investigation, upon completion of six groundwater sampling events, is to characterize groundwater conditions at the CUF Plant in support of fulfilling the requirements for the Tennessee Department of Environment and Conservation (TDEC) issued Commissioner's Order No. OGC15-0177 (TDEC Order) to TVA (TDEC 2015). The TDEC Order sets forth a "process for the investigation, assessment, and remediation of unacceptable risks" at TVA's coal ash disposal sites in Tennessee.

The purpose of this SAR is to document the work completed during groundwater sampling Event #6 of 6 total events and to present the information and data collected during the execution of the Groundwater Investigation Sampling and Analysis Plan (SAP) (Stantec 2018a). This SAR is not intended to provide conclusions or evaluations of results. The scope of the groundwater investigation represented herein was conducted pursuant to the SAP and is part of a larger environmental investigation at the CUF Plant. The data provided in this SAR are not inclusive of other programmatic data that exist for the site. The evaluation of the results will include data from the six groundwater sampling events and consider other aspects of the environmental investigation, as well as data collected under other State and/or coal combustion residuals (CCR) programs. This evaluation will be presented in the Environmental Assessment Report (EAR).

Event #6 activities were performed in general accordance with the following documents developed by TVA to support fulfilling the requirements of the TDEC Order at the CUF Plant.

- *Groundwater Investigation SAP* (Stantec 2018a)
- *Environmental Investigation Plan (EIP)* (Stantec 2018b)
- *Quality Assurance Project Plan (QAPP)* (Environmental Standards, Inc. 2018).

The Groundwater Investigation SAP was updated based on TVA- and TDEC-approved Programmatic- and Project-specific changes. Minor variations in scope and procedures from those outlined in the SAP occurred during field activities due to field conditions and programmatic updates and are referenced in Section 3.6.

Event #6 is the last in a series of six planned sampling events for the groundwater investigation. Stantec performed the sampling activities for this event. Terracon Consultants, Inc. (Terracon) measured static groundwater levels and pore water levels, and the data are included in this SAR. Laboratory analysis of constituents was performed by GEL Laboratories LLC (GEL) in Charleston, South Carolina (radium samples only) and Eurofins TestAmerica, Inc. (TestAmerica) in Pittsburgh, Pennsylvania (other analytes). Quality assurance oversight on data acquisition protocols, sampling practices, and data validation or verification was performed by Environmental Standards, Inc. (EnvStds) under direct contract to TVA.

This report summarizes the groundwater investigation activities for Event #6. Overall conclusions and findings about the six groundwater investigation events and groundwater conditions at the CUF Plant will be documented in the EAR.

2.0 OBJECTIVE AND SCOPE

The primary objectives of the groundwater investigation conducted pursuant to the Groundwater Investigation SAP (which includes six sampling events) are to characterize existing groundwater quality and to evaluate groundwater flow conditions at the CUF Plant in response to the TDEC Order. The approach to characterizing the groundwater conditions is to:

- Collect groundwater samples for chemical analyses to evaluate the potential presence of constituents related to CCR in groundwater
- Measure groundwater and surface water elevations for subsequent evaluation of the direction and rate of groundwater flow.

The scope of work intended to achieve the objectives of the groundwater investigation consists of six sampling events at a frequency of one event every two months for one year to characterize seasonal groundwater quality and flow direction. This report describes the activities related to Event #6, performed in March 2020, the scope of which included:

- Collecting groundwater and surface water level measurements
- Collecting field measurements of groundwater quality parameters
- Collecting groundwater samples and associated quality control (QC) samples for laboratory analysis.

These activities were carried out after the installation of permanent monitoring wells specified in the Groundwater Investigation SAP. Details of the monitoring well installation activities are provided in the CUF Plant Hydrogeological Investigation SAR.

In addition, pore water measurements from piezometers and temporary wells installed in the CCR units at the CUF Plant are presented in this SAR for comparison with groundwater data. Temporary well and piezometer installation activities are described in the CUF Plant Exploratory Drilling SAR, and temporary well gauging and sampling information is provided in the CUF Plant CCR Material Characteristics SAR.

3.0 FIELD ACTIVITIES

Groundwater investigation field activities for Event #6 were conducted March 9-11, 2020. During this event, Terracon measured static groundwater and pore water levels, and Stantec collected groundwater samples. Field activities were conducted based on guidance and specifications in TVA's Environmental (ENV) Technical Instructions (TIs), the SAP, the QAPP, and applicable United States Environmental Protection Agency (USEPA) documents except as noted in the Variations section of this report. As part of TVA's commitment to generate representative and reliable data, data validation and/or verification of laboratory analytical results were performed by EnvStds under direct contract with TVA. EnvStds also provided quality reviews of field documentation.

During Event #6, the following field activities were conducted:

- Measured groundwater levels at five monitoring wells installed for the TDEC Order, and 20 monitoring wells and eight piezometers installed for other environmental programs (25 total monitoring wells)
- Measured pore water levels at six temporary wells and 15 piezometers installed in the CCR units
- Measured the surface water level at one location in the Cumberland River
- Collected groundwater samples from five monitoring wells installed for the TDEC Order
- Recorded field measurements of groundwater quality parameters during purging and stabilization at the sampled monitoring wells
- Collected QC samples including one field duplicate, one matrix spike/matrix spike duplicate, two field blanks, one equipment blank, one tubing blank, and one filter blank
- Shipped the collected samples to GEL in Charleston, South Carolina, and TestAmerica in Pittsburgh, Pennsylvania.

Details on each activity are presented in the sections below.

3.1 WORK LOCATIONS

The TDEC Order CCR units at the CUF Plant (the Stilling Pond, including the Retention Pond, the Dry Ash Stack, the Bottom Ash Pond, and the Gypsum Storage Area) as well as the monitoring wells, temporary wells, and piezometers sampled and/or gauged during Event #6 are shown on Exhibit A.1 in Appendix A. TVA is currently sampling groundwater at the CUF Plant for TDEC Solid Waste Management permit requirements and the USEPA CCR Rule codified in Title 40 of the Code of Federal Regulations (CFR) Part 257 (40 CFR 257). Monitoring wells that are sampled as part of other environmental programs are not sampled as part of the groundwater investigation for the TDEC Order.

Groundwater levels were measured in TDEC Order monitoring wells as well as in select additional wells and piezometers from other environmental programs, as shown in Table B.1a in Appendix B, to provide information to prepare groundwater contour maps for this SAR and the CUF Plant EAR. Pore water levels measured in temporary wells and piezometers installed in the CCR units are presented in Table B.1b. Groundwater and pore water elevations are shown on Exhibits A.2 and A.3 in Appendix A. Groundwater elevation contours are depicted on Exhibit A.2 and pore water elevation contours are depicted on Exhibit A.3.

Groundwater analytical and field duplicate samples were collected from the TDEC Order groundwater investigation monitoring wells as shown in Table B.2 in Appendix B. Groundwater analytical data collected for the TDEC Order and other environmental programs will be provided in the EAR.

3.2 DOCUMENTATION

Stantec maintained field documentation in accordance with ENV-TI-05.80.03, *Field Record Keeping*, and the QAPP. Field activities and data were recorded on program-specific field forms. Health and safety forms were completed in accordance with TVA and Stantec health and safety requirements. Additional information regarding field documentation is provided below.

3.2.1 Field Forms

Field sampling personnel (FSP) used program-specific field forms to record field observations and data for specific activities. Field forms used during the groundwater investigation included:

- *Daily Field Activity Log*
- *Monitoring Well Inspection Checklist*
- *Equipment Calibration Form*
- *Groundwater Level Measurement Form*
- *Vibrating Wire Piezometer Measurement Form*
- *Groundwater Sampling Form*
- *Chain-of-Custody (COC).*

3.2.1.1 Daily Field Activity Log

Stantec FSP recorded field activities, observations, and data on a *Daily Field Activity Log* to chronologically document the field program. Deviations from the SAP, TIs, or QAPP were documented on the *Daily Field Activity Log*.

3.2.1.2 Monitoring Well Inspection Checklist

Prior to purging and sampling, Stantec FSP inspected each monitoring well for damage or indications that the well integrity had been compromised in accordance with ENV-TI-05.80.21, *Monitoring Well Inspection and Maintenance.* Inspection results were documented on a *Monitoring Well Inspection Checklist*. No signs of damage or necessary repairs were noted during Event #6.

3.2.1.3 Equipment Calibration Form

Stantec FSP performed daily calibration of the water quality meter and turbidity meter and documented the results on an *Equipment Calibration Form*. The form documented the calibration results for temperature, turbidity, specific conductance, pH, dissolved oxygen (DO), and oxidation-reduction potential (ORP), and verified that the field instruments' sensors were operating within acceptance criteria. Refer to Section 3.2.2 for additional details on equipment calibration procedures.

3.2.1.4 Groundwater Level Measurement Form

Terracon FSP recorded groundwater level field measurement data on a *Groundwater Level Measurement Form* in accordance with ENV-TI-05.80.44, *Groundwater Level and Well Depth Measurement* as described in Section 3.3.1 below. The form includes the monitoring well identification (ID), time, and depth to water measured from a standardized reference point on the top of each well casing, recorded in feet (ft) below top of casing.

3.2.1.5 Vibrating Wire Piezometer Measurement Form

Stantec FSP recorded field measurement data on a *Vibrating Wire Piezometer Measurement Form*. The form includes the vibrating wire piezometer ID, serial number, time, digits, temperature, and length of the wire in feet. The readings were used to calculate the pressure head (ft of water) above the vibrating wire sensor to obtain the groundwater or pore water elevation.

3.2.1.6 Groundwater Sampling Form

Stantec FSP recorded the depth to water, purge flow rate, volume of groundwater purged, temperature, pH, specific conductance, DO, ORP, turbidity, color of water, and other observations during groundwater purging and sampling activities at each monitoring well in accordance with ENV-TI-05.80.42, *Groundwater Sampling*. Field measurements were recorded on a *Groundwater Sampling Form*. The form also documents the time intervals between measurement of field parameters, low-flow extraction rates, water level drawdown, and water quality parameter measurements until stabilization criteria were met.

3.2.1.7 Chain-of-Custody

Stantec FSP completed *COC* documentation for each groundwater sample collected. The sample ID, sample location, type of sample, sampling date and time, analyses requested, sample pH, and sample custody record were recorded on the *COC*. The Field Team Leader reviewed the *COC* for completeness, and the FSP conducted a QC check of samples in each cooler compared to sample IDs on the corresponding *COC*. *COCs* were completed in accordance with ENV-TI-05.80.02, *Sample Labeling and Custody*.

3.2.2 Equipment Calibration

Field instruments used to collect, generate, or measure water quality parameters were calibrated each day prior to use as specified in the SAP, QAPP, and ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde.* Afternoon calibration verifications were performed to evaluate if these instruments remained within acceptance criteria during sampling. Temperature and barometric pressure instrument readings were verified using a calibrated National Institute of Standards and Technology traceable thermometer and National Weather Service (via mesowest.utah.edu) barometric pressure readings for Clarksville Outlaw Field (KCKV) in Clarksville, Tennessee, respectively. Additional details regarding equipment calibration were recorded on an *Equipment Calibration Form*, as described in Section 3.2.1.3.

3.3 SAMPLING METHODS

The following sections present monitoring well data collection and sampling procedures used during Event #6. As approved by TDEC, monitoring well CUF-1004 was not gauged or sampled during this event because it was not installed as part of the hydrogeologic investigation.

3.3.1 Static Water Level Measurements

Terracon measured static groundwater levels at 25 monitoring wells and pore water levels at six temporary wells in accordance with ENV-TI-05.80.44, *Groundwater Level and Well Depth Measurement.* On March 9, 2020, static groundwater and pore water level readings were measured and recorded to the nearest 0.01 ft from a reference point on the top of each well casing using an electronic water level indicator. Water level indicator probes were decontaminated prior to the first use and between measurements, and the decontamination was documented as specified in ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination.* Depth to groundwater and pore water measurements were recorded on a *Groundwater Level Measurement Form*. Terracon performed this field activity for TDEC Order monitoring wells in conjunction with water level measurements made for other groundwater investigation programs at the CUF Plant. Field documentation from this gauging event was reviewed by EnvStds for adherence with applicable guidance documents, including TIs, as part of TVA's quality assurance for other environmental programs. A static groundwater level measurement was not obtained for well CUF-213 because this well was inadvertently omitted during gauging activities.

Groundwater and pore water measurements were also obtained from transducers installed within eight and 15 piezometers, respectively. Additionally, a surface water level measurement for the Cumberland River was provided by TVA using the reading closest to noon Central Daylight Time recorded by an automated staff gauge. The surface water staff gauge location is shown on Exhibit A.1 in Appendix A.

Groundwater level data and pore water level data are shown in Tables B.1a and B.1b, respectively, in Appendix B. A groundwater elevation contour map based on groundwater measurements in wells and piezometers, along with pore water elevations, is included as Exhibit A.2 in Appendix A. Similarly, a pore water elevation contour map based on pore water measurements in wells and piezometers, along with groundwater elevations, is included as Exhibit A.3 in Appendix A.

3.3.2 Groundwater Purging & Sampling

Analytical and field duplicate samples (as specified in the SAP) were collected from five monitoring wells as shown in Table B.2 in Appendix B. Monitoring wells were purged using dedicated bladder pumps equipped with dedicated tubing using low-flow purging and sampling techniques as specified in ENV-TI-05.80.42, *Groundwater Sampling*.

During the purging process, water quality field parameters including pH, specific conductance, temperature, ORP, and DO were measured using water quality meters (YSI ProPlus with flow-through cell) and recorded on field forms. Depth to water and turbidity were measured and recorded using decontaminated electronic water-level indicators (Heron Dipper-T) and calibrated turbidimeters (Hach 2100Q). Field parameters were measured and recorded on *Groundwater Sampling Forms* during purging until readings were stabilized as specified in the SAP and/or applicable TI. As approved by TDEC, the specific conductance and turbidity stabilization limits were revised to the values below to meet overall programmatic objectives for groundwater investigations at the CUF Plant. Well purging was considered complete when three consecutive readings were within the following stabilization limits:

- pH – ± 0.1 Standard Units
- Specific Conductance – ± 3% microSiemens per centimeter
- Turbidity – Less than 5 Nephelometric Turbidity Units (NTUs) or ± 10% for values above 5 NTUs
- DO – Less than 0.5 milligrams per Liter (mg/L) or ± 10% for values above 0.5 mg/L.

After water quality stabilization criteria were achieved, the final field parameter results were recorded, purging was discontinued, and a sample was collected as specified in the SAP. Due to a final turbidity reading higher than 5 NTUs at well CUF-1002, an additional sample was collected at that well and submitted to the laboratory for dissolved metals analysis.

Laboratory-provided, pre-preserved sample containers were filled directly from the pump discharge line with the exception of the dissolved metals sample, which was collected via a 0.45-micron disposable inline filter attached to the end of the discharge line to field filter the sample. FSP wore new, clean nitrile gloves when handling sample containers and did not touch the interior of containers or container caps. New gloves were used when handling each sample. When filling sample bottles, care was taken to minimize sample aeration (i.e., water was directed down the inner walls of the sample bottle) and to avoid overfilling and diluting preservatives. Each sample bottle was capped before filling the next bottle. Following completion of sampling, final turbidity measurements were made.

Sample containers were labeled and handled in accordance with ENV-TI-05.80.02, *Sample Labeling and Custody.* FSP secured caps on each bottle, attached a custody seal across the cap, and placed the bottles in a cooler on ice within 15 minutes of collection. QC samples were collected in accordance with ENV-TI-05.80.04, *Field Sampling Quality Control.*

Groundwater samples were analyzed for the CCR-related constituents listed in Appendices III and IV of 40 CFR 257. In addition, five inorganic constituents listed in Appendix I of Tennessee Rule 0400-11-01-.04 and not included in the 40 CFR 257 Appendices III and IV were analyzed to maintain continuity with TDEC environmental programs. These additional TDEC Appendix I constituents included copper, nickel, silver, vanadium, and zinc. The combined federal CCR Appendices III and IV constituents and TDEC Appendix I inorganic constituents will hereafter be referred to collectively as "CCR Parameters." For geochemical evaluation, major cations/anions not included in the CCR Parameters were included in the analyses. The additional geochemical parameters included bicarbonate, carbonate, magnesium, potassium, and sodium.

3.4 INVESTIGATION DERIVED WASTE

Investigation derived waste (IDW) generated during groundwater investigation activities included:

- Used calibration solutions
- Purge water
- Decontamination fluids
- Disposable personal protective equipment (PPE)
- General trash.

IDW was handled in accordance with ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*; ENV-TI-05.80.42, *Groundwater Sampling* (purge water); the CUF Plant-specific waste management plan; and local, state, and federal regulations. Transportation and disposal of IDW was coordinated with CUF Plant facility management. Used calibration solution was containerized and stored for disposal as directed by the CUF Plant facility management. Purge water and decontamination fluids were containerized for later disposal as specified in the CUF Plant-specific waste management plan. Used disposable PPE (e.g., nitrile gloves) and general trash generated throughout the day were placed in garbage bags and disposed of in a general trash dumpster onsite at the end of each day.

3.5 SAMPLE SHIPMENT

Samples were packed and shipped under *COC* procedures specified in ENV-TI-05.80.06, *Handling and Shipping of Samples*. The samples were shipped by FedEx to GEL in Charleston, South Carolina (radium samples only), and to TestAmerica in Pittsburgh, Pennsylvania (other analytes). The laboratories submitted sample receipt confirmation forms to EnvStds for review and confirmation.

3.6 VARIATIONS

The proposed scope and procedures for the groundwater investigation were outlined in the SAP, QAPP, and applicable TVA TIs as detailed in the sections above. Variations in scope or procedures discussed with TDEC and/or TVA, changes based on field conditions, or additional field sampling performed to complete the scope of work in the SAP are described in the following sections. As discussed below, these variations do not impact the overall usability and representativeness of the dataset provided in this SAR for groundwater investigation sampling Event #6 at the CUF Plant.

3.6.1 Variations in Scope

Variations in scope are provided below.

- A surface water level measurement was not obtained for Wells Creek because a water level gauge had not yet been installed due to concerns of safe access to that location; however, a surface water measurement was obtained from the Cumberland River. The surface water gauge in Wells Creek was installed on July 23, 2020 and surface water data are being collected.
- Groundwater level gauging and sampling was not performed at well CUF-1004 as specified in the SAP because it was not installed (the three borings drilled in that area were dry). This change in scope was approved by TDEC.
- Groundwater level gauging was not performed at well CUF-213 as specified in the SAP because this well was inadvertently omitted during gauging activities.

3.6.2 Variations in Procedures

Variations in procedures occurring in the field are provided below.

- As approved by TDEC, the specific conductance and turbidity stabilization limits were revised to meet overall programmatic objectives for groundwater investigations.

4.0 SUMMARY

The data presented in this report are only for groundwater investigation sampling Event #6 at the CUF Plant. The scope of work for Event #6 was to:

- Collect groundwater samples for chemical analyses to assist with subsequent evaluation of the potential presence of CCR-related constituents in groundwater
- Measure groundwater and surface water elevations to assist with subsequent evaluation of groundwater flow direction and rate after multiple data sets have been collected.

In addition, pore water measurements from piezometers and temporary wells installed in the CCR units at the CUF Plant are presented in this SAR for comparison with groundwater data.

Event #6 included collecting groundwater level measurements at 25 monitoring wells and eight piezometers; pore water measurements at six temporary wells and 15 piezometers in the CCR units; and a surface water measurement at one gauge located in the Cumberland River. Groundwater and surface water measurements and elevations are provided in Table B.1a, and pore water measurements and elevations are provided in Table B.1b and depicted on Exhibits A.2 and A.3.

Groundwater quality measurements and groundwater analytical samples were collected at five monitoring wells as summarized in Table B.2. Groundwater quality parameters were recorded during purging. Stabilization criteria for pH, specific conductance, turbidity, and DO were achieved at each sampling location. The final measurements prior to initiating sample collection are presented in Table B.3.

Groundwater analytical data for CCR Parameters and geochemical parameters are presented in Table B.4. Analytical data for radium analyses are presented in Table B.5. Analytical data were reported by GEL and TestAmerica, and then validated or verified by EnvStds.

Stantec has completed Event #6 of the groundwater investigation at the CUF Plant in Cumberland City, Tennessee, in accordance with the Groundwater Investigation SAP as documented herein. The data collected during Event #6 are usable for reporting and evaluation in the EAR and meet the objectives of the TDEC Order EIP. The complete datasets from the six groundwater sampling events will be evaluated along with data collected under other TDEC Order SAPs, as well as data collected under other State and CCR programs. This evaluation will be provided in the EAR.

5.0 REFERENCES

Environmental Standards, Inc. 2018. *Quality Assurance Project Plan for the Tennessee Valley Authority Cumberland Fossil Plant Environmental Investigation*. Prepared for Tennessee Valley Authority. Revision 2. January 2018.

Stantec Consulting Services, Inc. (Stantec). 2018a. *Groundwater Investigation Sampling and Analysis Plan, Cumberland Fossil Plant.* Revision 3. Prepared for Tennessee Valley Authority. June 25, 2018.

Stantec. 2018b. *Environmental Investigation Plan, Cumberland Fossil Plant.* Revision 3. Prepared for Tennessee Valley Authority. June 25, 2018.

Tennessee Department of Environment and Conservation. 2015. *Commissioner's Order No. OGC15-0177.*

Tennessee Valley Authority (TVA). ENV-TI-05.80.02, *Sample Labeling and Custody*.

TVA. ENV-TI-05.80.03, *Field Record Keeping*.

TVA. ENV-TI-05.80.04, *Field Sampling Quality Control*.

TVA. ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*.

TVA. ENV-TI-05.80.06, *Handling and Shipping of Samples*.

TVA. ENV-TI-05.80.21, *Monitoring Well Inspection and Maintenance*.

TVA. ENV-TI-05.80.42, *Groundwater Sampling*.

TVA. ENV-TI-05.80.44, *Groundwater Level and Well Depth Measurement*.

TVA. ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde.*

APPENDIX A - EXHIBITS

Exhibit No.

A.1

Title

Monitoring Well Network

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location

Stewart County, Tennessee

175568209
Prepared by MB on 2020-09-30
Technical Review by MW on 2020-09-30

0 400 800 1,200 1,600 Feet

1:4,800 (At original document size of 22x34)

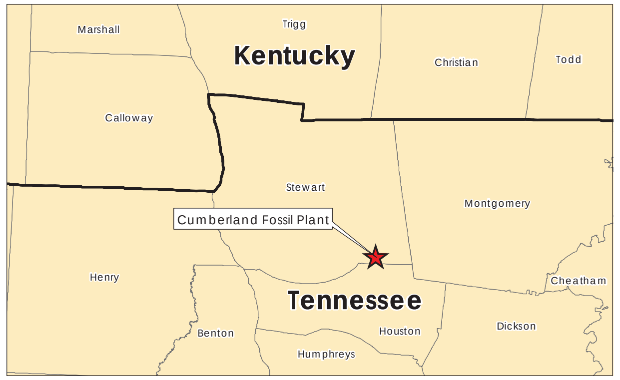
Legend

- Groundwater Investigation Monitoring Well
- Other Monitoring Well
- Piezometer
- Pore Water Piezometer in CCR Material
- Temporary Well within CCR Material
- Cumberland River Gauging Station
- 2019 Imagery Boundary
- CCR Unit Area (Approximate)

CCR: Coal combustion residuals

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)



Stantec TVA

U:\TVA-EP\175568209_CUF_Phase2\gis\mxd\GW_TechMemo\CUF_GWTechMemo_FigA1_MonitoringWellNetwork_wPZ_porewaterEvent6.mxd Revised: 2020-09-30 By: mbough

Exhibit No.

A.2

Title

Groundwater Elevation Contour Map, Event #6 (March 9, 2020)

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location

Stewart County, Tennessee

175568209

Prepared by MB on 2021-02-23
Technical Review by MW on 2021-02-23

0 400 800 1,200 1,600 Feet

1:4,800 (At original document size of 22x34)

Legend

- Groundwater Investigation Monitoring Well — groundwater elevation in feet above mean sea level (ft amsl)
- Other Monitoring Well — groundwater elevation in ft amsl
- Piezometer — groundwater elevation in ft amsl
- Piezometer in CCR — pore water elevation in ft amsl; value not used for contouring
- Temporary well in CCR — pore water elevation in ft amsl; value not used for contouring
- Cumberland River Gauging Station — surface water elevation in ft amsl
- Interpolated Groundwater Contour (5 ft interval; elevations are in ft amsl)
- Groundwater Contour (5 ft interval; elevations are in ft amsl)
- 2019 Imagery Boundary
- CCR Unit Area (Approximate)

CCR: Coal combustion residuals

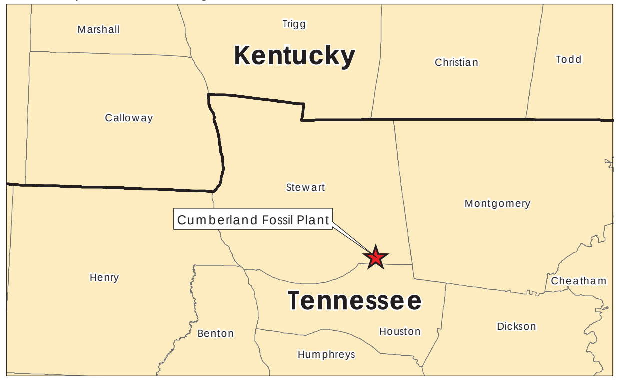
*Groundwater elevation displayed but not used as input for contouring due to factors such as well construction or being screened in a different hydrogeologic unit. Well CUF-213 was not measured because it was inadvertently omitted.

**Piezometers were not collecting groundwater measurements during this monitoring event.

***Nested VWPZ sensors monitoring pore water and groundwater elevations in the same borehole, and the location is shown by a single symbol.

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)
3. Groundwater contours were created using Surfer Version 16 (December 13, 2018) and manual adjustment
4. For PZ's with multiple instruments in CCR material, the reading with the highest pore water elevation is displayed, unless that reading is suspected of being erroneous.



Stantec TVA

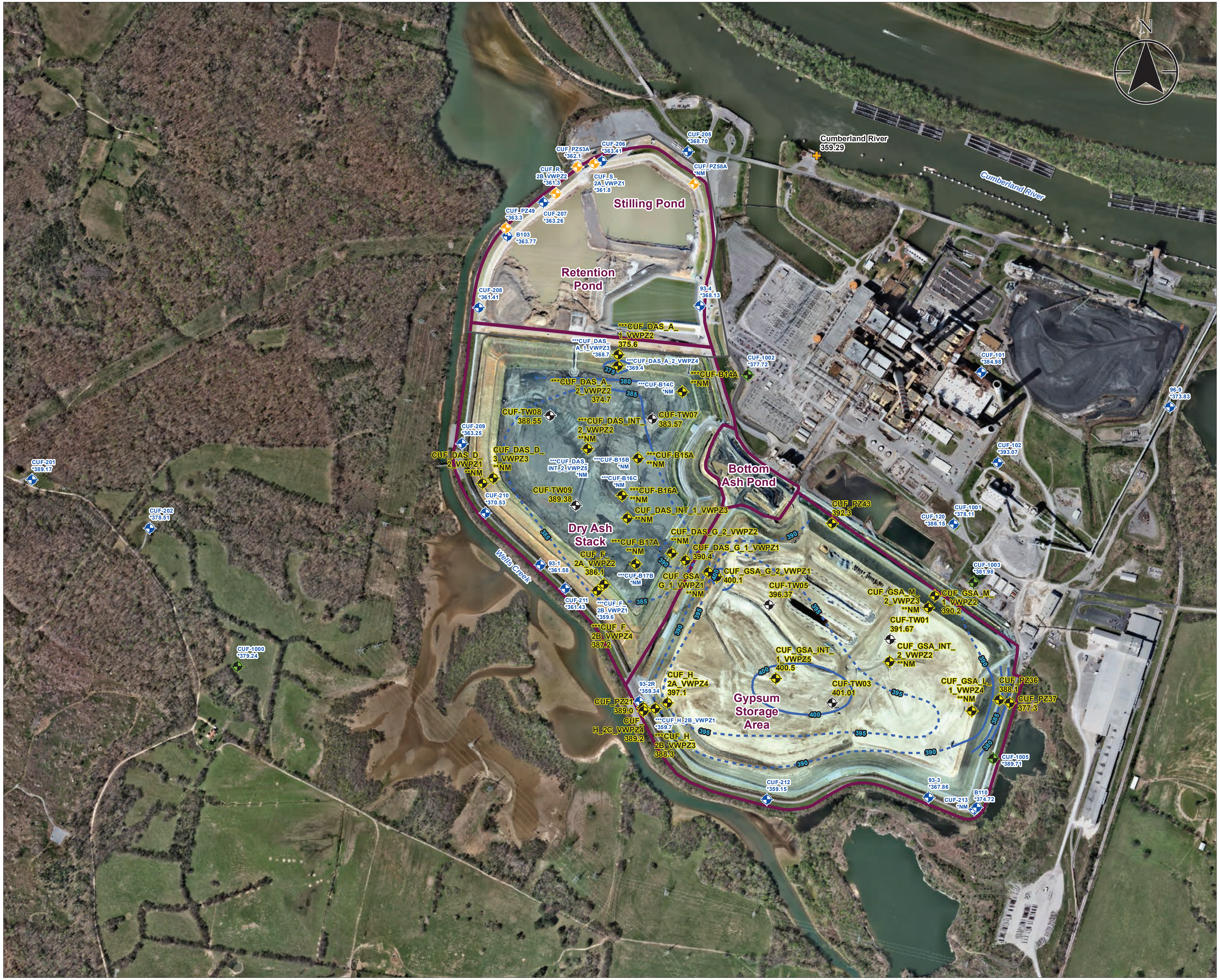


Exhibit No.
A.3

Title

Pore Water Elevation Contour Map, Event #6 (March 9, 2020)

Client/Project

Tennessee Valley Authority
Cumberland Fossil (CUF) Plant TDEC Order

Project Location 175568209

Stewart County, Tennessee

Prepared by MB on 2021-02-23
Technical Review by MD on 2021-02-23

0 400 800 1,200 1,600 Feet

1:4,800 (At original document size of 22x34)

Legend

- Groundwater Investigation Monitoring Well: groundwater elevation in feet above mean sea level (ft amsl); value not used for contouring
- Other Monitoring Well: groundwater elevation in ft amsl; value not used for contouring
- Piezometer: groundwater elevation in ft amsl; value not used for contouring
- Piezometer in CCR: pore water elevation in ft amsl
- Temporary well in CCR: pore water elevation in ft amsl
- Cumberland River Gauging Station: surface water elevation in ft amsl
- Interpolated Pore water Contour (5 ft interval; elevations are in ft amsl)
- Pore water Contour (5 ft interval; elevations are in ft amsl)
- 2019 Imagery Boundary
- CCR Unit Area (Approximate)

CCR: Coal combustion residuals

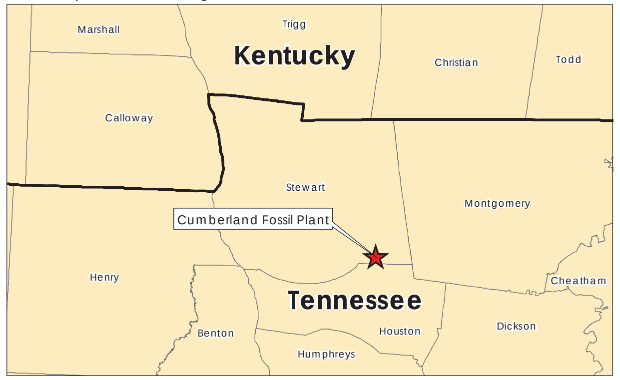
*Groundwater elevation displayed but not used as input for contouring due to factors such as well construction or being screened in a different hydrogeologic unit.

**Piezometers were not collecting groundwater measurements during this monitoring event.

***Nested VWPZ sensors monitoring pore water and groundwater elevations in the same borehole, and the location is shown by a single symbol.

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Tuck Mapping (c. 2017) and TVA (3/6/2019 and 12/11/2019)
3. Pore water contours were created with manual adjustment using Surfer Version 16 (December 13, 2018)
4. For PZ's with multiple instruments in CCR material, the reading with the highest pore water elevation is displayed, unless that reading is suspected of being erroneous.



Stantec TVA

APPENDIX B - TABLES

TABLE B.1a – Groundwater Level Measurements
Cumberland Fossil Plant
March 2020

UNID	Well / Piezometer ID	Date Measured	Depth to Groundwater	Top of Casing Elevation	Groundwater Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
			ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft btoc	
CUF-00-GW-43-001	93-1	9-Mar-20	35.59	397.17	361.58	n/a	n/a	n/a	52.3 - 62.3	Alluvial Silts and Clays / Alluvial Sands and Gravels
CUF-00-GW-43-002	93-2R	9-Mar-20	38.54	397.88	359.34	n/a	n/a	n/a	62.3 - 72.0	Alluvial Sands and Gravels
CUF-00-GW-43-003	93-3	9-Mar-20	29.64	397.50	367.86	n/a	n/a	n/a	45.0 - 55.0	Alluvial Silts and Clays
CUF-00-GW-43-004	93-4	9-Mar-20	29.21	397.34	368.13	n/a	n/a	n/a	27.2 - 36.6	Bedrock: Limestone
CUF-00-GW-43-005	96-9	9-Mar-20	18.76	392.59	373.83	n/a	n/a	n/a	16.1 - 30.9	Bedrock: Fernvale and Hermitage Limestones
CUF-00-GW-43-006	B103	9-Mar-20	32.20	395.97	363.77	n/a	n/a	n/a	74.0 - 84.0	Alluvial Silts and Clays
CUF-00-GW-43-007	B110	9-Mar-20	23.55	398.27	374.72	n/a	n/a	n/a	48.3 - 52.5	Alluvial Silts and Clays
CUF-00-GW-43-008	CUF-101	9-Mar-20	0.70	385.68	384.98	n/a	n/a	n/a	2.0 - 17.2	Clay
CUF-00-GW-43-009	CUF-102	9-Mar-20	9.86	402.93	393.07	n/a	n/a	n/a	3.8 - 13.8	Bedrock: Limestone
CUF-00-GW-43-010	CUF-120	9-Mar-20	7.04	393.19	386.15	n/a	n/a	n/a	9.3 - 14.3	Bedrock
CUF-00-GW-43-011	CUF-201	9-Mar-20	11.24	400.41	389.17	n/a	n/a	n/a	17.6 - 27.7	Alluvial Sands and Gravels
CUF-00-GW-43-012	CUF-202	9-Mar-20	4.77	383.28	378.51	n/a	n/a	n/a	14.3 - 19.6	Alluvial Sands and Gravels
CUF-00-GW-43-014	CUF-205	9-Mar-20	15.81	384.51	368.70	n/a	n/a	n/a	16.9 - 27.1	Alluvial Sands and Gravels
CUF-00-GW-43-015	CUF-206	9-Mar-20	35.26	398.67	363.41	n/a	n/a	n/a	82.7 - 92.9	Alluvial Sands and Gravels
CUF-00-GW-43-016	CUF-207	9-Mar-20	34.93	398.19	363.26	n/a	n/a	n/a	75.0 - 85.1	Alluvial Sands and Gravels
CUF-00-GW-43-017	CUF-208	9-Mar-20	36.97	398.38	361.41	n/a	n/a	n/a	47.9 - 58.0	Alluvial Sands and Gravels
CUF-00-GW-43-018	CUF-209	9-Mar-20	34.98	398.23	363.25	n/a	n/a	n/a	53.1 - 63.3	Alluvial Sands and Gravels
CUF-00-GW-43-019	CUF-210	9-Mar-20	27.67	398.20	370.53	n/a	n/a	n/a	63.5 - 68.5	Alluvial Sands and Gravels
CUF-00-GW-43-020	CUF-211	9-Mar-20	37.33	398.76	361.43	n/a	n/a	n/a	57.7 - 67.9	Alluvial Sands and Gravels
CUF-00-GW-43-021	CUF-212	9-Mar-20	39.56	398.71	359.15	n/a	n/a	n/a	62.6 - 72.8	Alluvial Sands and Gravels
CUF-00-GW-43-022	CUF-213	9-Mar-20	NM	399.05	NM	n/a	n/a	n/a	40.0 - 45.2	Alluvial Sands and Gravels
CUF-00-GW-43-026	CUF-1000	9-Mar-20	16.05	395.29	379.24	n/a	n/a	n/a	14.5 - 25.1	Clay and Clayey Sand
CUF-00-GW-43-027	CUF-1001	9-Mar-20	15.64	393.75	378.11	n/a	n/a	n/a	15.8 - 20.6	Clayey Gravel and Clay
CUF-00-GW-43-028	CUF-1002	9-Mar-20	11.54	389.26	377.72	n/a	n/a	n/a	15.1 - 20.0	Clay and Gravel/Clay
CUF-00-GW-43-029	CUF-1003	9-Mar-20	14.41	396.39	381.98	n/a	n/a	n/a	12.6 - 17.5	Gravel/Cobbles and Clay
CUF-00-GW-43-030	CUF-1005	9-Mar-20	9.87	399.58	389.71	n/a	n/a	n/a	18.2 - 28.8	Sand, Clayey Gravel, Clay
Piezometers										
n/a	CUF-B14C	n/a	NM	n/a	NM	440.8	319.8	121.0	n/a	Alluvial Clay and Granular
n/a	CUF-B15B	n/a	NM	n/a	NM	438.3	327.8	110.5	n/a	Alluvial Granular
n/a	CUF-B16C	n/a	NM	n/a	NM	439.7	324.7	115.0	n/a	Alluvial Granular
n/a	CUF-B17B	n/a	NM	n/a	NM	443.4	336.4	107.0	n/a	Alluvial Granular
n/a	CUF_PZ49	9-Mar-20	15.9	n/a	363.3	379.2	322.2	57.0	n/a	Alluvial Granular
n/a	CUF_PZ53A	9-Mar-20	13.9	n/a	362.1	376.0	311.0	65.0	n/a	Alluvial Granular
n/a	CUF_PZ58A	n/a	NM	n/a	NM	394.8	349.3	45.5	n/a	Alluvial Granular
n/a	CUF_R_2B_VWPZ2	9-Mar-20	34.0	n/a	361.3	395.3	320.0	75.3	n/a	Alluvial Granular
n/a	CUF_S_2A_VWPZ1	9-Mar-20	33.1	n/a	361.8	394.9	299.7	95.2	n/a	Alluvial Granular
n/a	CUF_F_2B_VWPZ1	9-Mar-20	52.5	n/a	359.6	412.1	322.1	90.0	n/a	Alluvial Granular
n/a	CUF_DAS_A_1_VWPZ3	9-Mar-20	19.3	n/a	368.7	388.0	293.0	95.0	n/a	Alluvial Granular
n/a	CUF_DAS_A_2_VWPZ4	9-Mar-20	43.5	n/a	369.4	412.9	308.4	104.5	n/a	Alluvial Granular
n/a	CUF_DAS_INT_2_VWPZ5	n/a	NM	n/a	NM	434.5	313.5	121.0	n/a	Alluvial Granular
n/a	CUF_H_2B_VWPZ1	9-Mar-20	51.0	n/a	359.7	410.7	322.7	88.0	n/a	Alluvial Granular
Surface Water Gauge										
Cumberland River gauge	n/a	9-Mar-20	n/a	n/a	359.29	n/a	n/a	n/a	n/a	n/a

See notes on last page.

TABLE B.1a – Groundwater Level Measurements
Cumberland Fossil Plant
March 2020

UNID	Well / Piezometer ID	Date Measured	Depth to Groundwater	Top of Casing Elevation	Groundwater Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
			ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft btoc	

Notes:

bgs	below ground surface
btoc	below top of casing
ft	feet
ID	identification
msl	mean sea level
n/a	not applicable
NM	not measured
UNID	Unique Numerical Identification

1. Top of casing elevations, screened intervals, and screened formations were obtained from the TVA Well Inventory Log provided by TVA.
2. Cumberland River data point is the reading closest to noon recorded by the automated staff gauge provided by TVA.
3. Ground surface elevations, groundwater elevations, and piezometer data were obtained from geotechnical instrumentation database. Piezometer sensor formations were obtained from boring logs. Data from vibrating wire piezometers were averaged for the measurement date. For consistency in reporting for the TDEC Order, historical piezometer IDs were modified (if necessary) to include 'VWPZ' to indicate a vibrating wire piezometer.
4. Depth to groundwater in piezometers and groundwater elevations at all locations are calculated values. Accuracy of piezometer data is to 0.1 ft.
5. A groundwater level was not obtained at well CUF-213 because it was inadvertently omitted. Groundwater levels were not measured in select peizometers as noted above because the sensors were not recording data.

TABLE B.1b – Pore Water Level Measurements
Cumberland Fossil Plant
March 2020

Temporary Well / Piezometer ID	Date Measured	Depth to Pore Water	Top of Casing Elevation	Pore Water Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation
		ft btoc	ft msl	ft msl	ft msl	ft msl	ft bgs	ft bgs	
Temporary Wells									
CUF-TW01	9-Mar-20	39.32	430.99	391.67	n/a	n/a	n/a	41.3 - 51.9	CCR
CUF-TW03	9-Mar-20	28.52	429.53	401.01	n/a	n/a	n/a	54.9 - 65.5	CCR
CUF-TW05	9-Mar-20	30.43	426.80	396.37	n/a	n/a	n/a	49.5 - 56.5	CCR
CUF-TW07	9-Mar-20	60.12	443.69	383.57	n/a	n/a	n/a	81.5 - 92.1	CCR
CUF-TW08	9-Mar-20	54.81	443.36	388.55	n/a	n/a	n/a	72.1 - 82.7	CCR
CUF-TW09	9-Mar-20	57.06	446.44	389.38	n/a	n/a	n/a	79.5 - 90.1	CCR
Piezometers									
CUF-B14A	n/a	NM	n/a	NM	440.8	360.8	80.0	n/a	CCR
CUF-B15A	n/a	NM	n/a	NM	438.3	353.3	85.0	n/a	CCR
CUF-B16A	n/a	NM	n/a	NM	439.7	383.4	56.3	n/a	CCR
CUF-B17A	n/a	NM	n/a	NM	443.4	363.9	79.5	n/a	CCR
CUF_DAS_A_1_VWPZ2	9-Mar-20	12.4	n/a	375.6	388.0	335.0	53.0	n/a	CCR
CUF_DAS_A_2_VWPZ2	9-Mar-20	38.2	n/a	374.7	412.9	353.4	59.5	n/a	CCR
CUF_DAS_D_2_VWPZ1	n/a	NM	n/a	NM	398.7	376.6	22.1	n/a	CCR
CUF_DAS_D_3_VWPZ3	n/a	NM	n/a	NM	427.2	371.9	55.3	n/a	CCR
CUF_DAS_G_1_VWPZ1	9-Mar-20	15.1	n/a	390.4	405.5	379.6	25.9	n/a	CCR
CUF_DAS_G_2_VWPZ2	n/a	NM	n/a	NM	439.1	396.1	43.0	n/a	CCR
CUF_DAS_INT_1_VWPZ3	n/a	NM	n/a	NM	439.1	379.1	60.0	n/a	CCR
CUF_DAS_INT_2_VWPZ2	n/a	NM	n/a	NM	434.5	388.5	46.0	n/a	CCR
CUF_F_2A_VWPZ2	9-Mar-20	47.5	n/a	386.1	433.6	353.6	80.0	n/a	CCR
CUF_F_2B_VWPZ4	9-Mar-20	24.9	n/a	387.2	412.1	377.1	35.0	n/a	CCR
CUF_GSA_G_1_VWPZ1	n/a	NM	n/a	NM	413.3	384.6	28.7	n/a	CCR
CUF_GSA_G_2_VWPZ1	9-Mar-20	28.1	n/a	400.1	428.2	388.2	40.0	n/a	CCR
CUF_GSA_INT_1_VWPZ5	9-Mar-20	22.6	n/a	400.5	423.1	393.1	30.0	n/a	CCR
CUF_GSA_INT_2_VWPZ2	n/a	NM	n/a	NM	420.3	380.3	40.0	n/a	CCR
CUF_GSA_L_1_VWPZ4	n/a	NM	n/a	NM	430.3	369.3	61.0	n/a	CCR
CUF_GSA_M_1_VWPZ2	9-Mar-20	19.8	n/a	390.2	410.0	382.0	28.0	n/a	CCR
CUF_GSA_M_2_VWPZ3	n/a	NM	n/a	NM	430.3	380.3	50.0	n/a	CCR
CUF_H_2A_VWPZ4	9-Mar-20	26.9	n/a	397.1	424.0	389.8	34.2	n/a	CCR
CUF_H_2B_VWPZ3	9-Mar-20	22.4	n/a	388.3	410.7	353.7	57.0	n/a	CCR
CUF_H_2C_VWPZ4	9-Mar-20	6.1	n/a	389.2	395.3	374.0	21.3	n/a	CCR
CUF_PZ21	9-Mar-20	6.1	n/a	389.0	395.1	356.0	39.1	n/a	CCR
CUF_PZ36	9-Mar-20	23.1	n/a	388.1	411.2	363.2	48.0	n/a	CCR
CUF_PZ37	9-Mar-20	17.9	n/a	377.3	395.2	367.2	28.0	n/a	CCR
CUF_PZ43	9-Mar-20	19.0	n/a	392.3	411.3	374.3	37.0	n/a	CCR

See notes on last page.

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TABLE B.1b – Pore Water Level Measurements
Cumberland Fossil Plant
March 2020

Temporary Well / Piezometer ID	Date Measured	Depth to Pore Water	Top of Casing Elevation	Pore Water Elevation	Piezometer Ground Surface Elevation	Piezometer Sensor Elevation	Piezometer Sensor Depth	Screened Interval	Screened / Piezometer Sensor Formation

Notes:

bgs	below ground surface
btoc	below top of casing
CCR	coal combustion residuals
ft	feet
ID	identification
msl	mean sea level
n/a	not applicable
NM	not measured

1. Top of casing elevations, screened intervals, and screened formations were obtained from boring logs, well details, and well survey data.
2. For piezometers, ground surface elevations, pore water elevations, and piezometer data were obtained from geotechnical instrumentation database. Piezometer sensor formations were obtained from boring logs. Data from vibrating wire piezometers were averaged for the measurement date. For consistency in reporting for the TDEC Order, historical piezometer IDs were modified (if necessary) to include ‘VWPZ’ to indicate a vibrating wire piezometer.
3. Depth to pore water in piezometers and pore water elevations at all locations are calculated values. Accuracy of piezometer data is to 0.1 ft.
4. Screened interval shown for temporary wells is below ground surface when drilled.
5. Groundwater levels were not measured in select piezometers as noted above because the sensors were not recording data.

TABLE B.2 – Summary of Groundwater Samples
Cumberland Fossil Plant
March 2020

			Analysis Type										
Location ID	**Sample ID**	**Sample Type**	Field Parameters	Total Metals	Dissolved Metals	Total Mercury	Dissolved Mercury	Anions	Alkalinity	Total Dissolved Solids	Radium-226	Radium-228	Radium-226+228
CUF-1000	CUF-GW-026-20200310	Normal Environmental Sample	x	x		x		x	x	x	x	x	x
CUF-1001	CUF-GW-027-20200310	Normal Environmental Sample	x	x		x		x	x	x	x	x	x
CUF-1001	CUF-GW-DUP01-20200310	Field Duplicate Sample		x		x		x	x	x	x	x	x
CUF-1002	CUF-GW-028-20200311	Normal Environmental Sample	x	x	x	x	x	x	x	x	x	x	x
CUF-1003	CUF-GW-029-20200310	Normal Environmental Sample	x	x		x		x	x	x	x	x	x
CUF-1005	CUF-GW-030-20200311	Normal Environmental Sample	x	x		x		x	x	x	x	x	x

Notes

Total and Dissolved Metals	SW-846 6020A
Total and Dissolved Mercury	SW-846 7470A
Anions	EPA 300.0/SW 9056
Alkalinity	SM2320B
Total Dissolved Solids	SM2540C
Radium-226	EPA 903.0
Radium-228	EPA 904.0
Radium-226+228	CALC
ID	identification

1. Field and laboratory quality control sample results except for field duplicates are not included in report tables but were used for data validation.

TABLE B.3 – Summary of Groundwater Quality Parameters
Cumberland Fossil Plant
March 2020

Sample Location Sample Date Sample ID Sample Depth Sample Type Level of Review	Units	CUF-1000 10-Mar-20 CUF-GW-026-20200310 19.5 ft Normal Environmental Sample Final QC Review	CUF-1001 10-Mar-20 CUF-GW-027-20200310 19 ft Normal Environmental Sample Final QC Review	CUF-1002 11-Mar-20 CUF-GW-028-20200311 18 ft Normal Environmental Sample Final QC Review	CUF-1003 10-Mar-20 CUF-GW-029-20200310 16.8 ft Normal Environmental Sample Final QC Review	CUF-1005 11-Mar-20 CUF-GW-030-20200311 24 ft Normal Environmental Sample Final QC Review
Field Parameters						
Dissolved Oxygen	%	57.3	33.6	1.4	14.2	14.7
Dissolved Oxygen	mg/L	5.77	3.29	0.15	1.44	1.46
ORP	mV	138.0	124.1	-13.4	139.7	162.8
pH (field)	SU	7.08	7.21	6.96	7.07	10.00
Specific Cond. (Field)	uS/cm	376.4	1,287	1,185	2,290	3,219
Temperature, Water (C)	DEG C	15.7	16.6	15.4	15.1	15.3
Turbidity, field	NTU	0.30	2.81	6.65	0.59	0.52

Notes:

%	percent
Cond.	conductance
DEG C	degrees Celsius
ft	feet below top of casing
ID	identification
mg/L	milligrams per Liter
mV	milliVolts
NTU	Nephelometric Turbidity Unit
ORP	Oxidation Reduction Potential, measured using a silver reference electrode which has a standard potential of 200 mV
SU	Standard Units
uS/cm	microSiemens per centimeter

TABLE B.4 - Groundwater Analytical Results for Metals, Anions, and General Chemistry
Cumberland Fossil Plant
March 2020

Sample Location Sample Date Sample ID Sample Depth Sample Type Level of Review	Units	EPA MCLs	CCR Rule GWPS	CUF-1000 10-Mar-20 CUF-GW-026-20200310 19.5 ft Normal Environmental Sample Final-Verified	CUF-1001 10-Mar-20 CUF-GW-027-20200310 19 ft Normal Environmental Sample Final-Verified	CUF-1001 10-Mar-20 CUF-GW-DUP01-20200310 19 ft Field Duplicate Sample Final-Verified	CUF-1002 11-Mar-20 CUF-GW-028-20200311 18 ft Normal Environmental Sample Final-Verified	CUF-1003 10-Mar-20 CUF-GW-029-20200310 16.8 ft Normal Environmental Sample Final-Verified	CUF-1005 11-Mar-20 CUF-GW-030-20200311 24 ft Normal Environmental Sample Final-Verified
Total Metals									
Antimony	UG/L	6[A]	n/v	<0.378	<0.378	<0.378	<0.378	<0.378	2.26
Arsenic	UG/L	10[A]	n/v	<0.313	0.945 J	0.977 J	0.684 J	<0.313	9.48
Barium	UG/L	2,000[A]	n/v	30.9	49.5	49.2	54.7	24.6	57.3
Beryllium	UG/L	4[A]	n/v	<0.182	<0.182	<0.182	<0.182	<0.182	<1.82
Boron	UG/L	n/v	n/v	<38.6	3,310	3,590	351 U*	7,460	35,400
Cadmium	UG/L	5[A]	n/v	<0.217	<0.217	<0.217	<0.217	<0.217	<0.217
Calcium	UG/L	n/v	n/v	67,200	276,000	272,000	233,000	487,000	964,000
Chromium	UG/L	100[A]	n/v	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Cobalt	UG/L	n/v	6[B]	<0.134	1.63	1.49	0.135 J	0.665	<0.134
Copper	UG/L	n/v	n/v	<0.627	0.888 U*	1.05 U*	<0.627	1.11 U*	<0.627
Lead	UG/L	n/v	15[B]	0.138 U*	<0.128	0.139 U*	<0.128	<0.128	<0.128
Lithium	UG/L	n/v	40[B]	<3.39	<3.39	<3.39	<3.39	<3.39	**59.0[B]**
Magnesium	UG/L	n/v	n/v	1,890	25,500	24,900	29,800	39,000	2,050
Mercury	UG/L	2[A]	n/v	<0.101	<0.101	<0.101	0.101 UJ	<0.101	<0.101
Molybdenum	UG/L	n/v	100[B]	<0.610	**177[B]**	**179[B]**	1.09 J	**181[B]**	**946[B]**
Nickel	UG/L	100(TN MCL)[A]	n/v	<0.336	2.72	2.52	<0.336	1.34	0.622 J
Potassium	UG/L	n/v	n/v	261 J	5,610	5,530	1,450	13,200	50,400
Selenium	UG/L	50[A]	n/v	<1.51	<1.51	<1.51	<1.51	<1.51	26.9 J
Silver	UG/L	100(TN MCL)[A]	n/v	<0.177	<0.177	<0.177	<0.177	<0.177	<0.177
Sodium	UG/L	n/v	n/v	1,460	16,700	16,300	33,200	184,000	30,100
Thallium	UG/L	2[A]	n/v	<0.148	<0.148	<0.148	0.345 J	<0.148	1.85
Vanadium	UG/L	n/v	n/v	<0.991	<0.991	<0.991	<0.991	<0.991	840
Zinc	UG/L	n/v	n/v	<3.22	<3.22	<3.22	<3.22	3.66 J	<3.22
Dissolved Metals									
Antimony	UG/L	6[A]	n/v	-	-	-	<0.378	-	-
Arsenic	UG/L	10[A]	n/v	-	-	-	0.716 J	-	-
Barium	UG/L	2,000[A]	n/v	-	-	-	48.5	-	-
Beryllium	UG/L	4[A]	n/v	-	-	-	<0.182	-	-
Boron	UG/L	n/v	n/v	-	-	-	322	-	-
Cadmium	UG/L	5[A]	n/v	-	-	-	<0.217	-	-
Calcium	UG/L	n/v	n/v	-	-	-	213,000	-	-
Chromium	UG/L	100[A]	n/v	-	-	-	<1.53	-	-
Cobalt	UG/L	n/v	6[B]	-	-	-	<0.134	-	-
Copper	UG/L	n/v	n/v	-	-	-	<0.627	-	-
Lead	UG/L	n/v	15[B]	-	-	-	<0.128	-	-
Lithium	UG/L	n/v	40[B]	-	-	-	<3.39	-	-
Magnesium	UG/L	n/v	n/v	-	-	-	29,200	-	-
Mercury	UG/L	2[A]	n/v	-	-	-	0.101 UJ	-	-
Molybdenum	UG/L	n/v	100[B]	-	-	-	1.13 J	-	-
Nickel	UG/L	100(TN MCL)[A]	n/v	-	-	-	<0.336	-	-
Potassium	UG/L	n/v	n/v	-	-	-	1,320	-	-
Selenium	UG/L	50[A]	n/v	-	-	-	<1.51	-	-
Silver	UG/L	100(TN MCL)[A]	n/v	-	-	-	<0.177	-	-
Sodium	UG/L	n/v	n/v	-	-	-	35,600	-	-
Thallium	UG/L	2[A]	n/v	-	-	-	<0.148	-	-
Vanadium	UG/L	n/v	n/v	-	-	-	<0.991	-	-
Zinc	UG/L	n/v	n/v	-	-	-	<3.22	-	-
Anions									
Chloride	MG/L	n/v	n/v	0.954 J	54.2	55.3	35.9	116	261
Fluoride	MG/L	4[A]	n/v	0.358	0.176	0.185	0.403	0.163 J	1.04
Sulfate	MG/L	n/v	n/v	10.5	479	485	295	1,330	1,780
General Chemistry									
Alkalinity, Bicarbonate	MG/L	n/v	n/v	179	214	223	359	163	<5.00
Alkalinity, Carbonate	MG/L	n/v	n/v	<5.00	<5.00	<5.00	<5.00	<5.00	94.6
Alkalinity, Total as CaCO3	MG/L	n/v	n/v	179	214	223	359	163	153
Total Dissolved Solids	MG/L	n/v	n/v	229	1,050	1,040	853	2,190	3,220

Notes:

A	EPA Maximum Contaminant Level
B	CCR Rule GWPS (Federal Register / Vol. 83, No. 146 / Monday, July 30, 2018 / Rules and Regulations)
n/v	No standard/guideline value
6.5[A]	Concentration is greater than the indicated standard.
<0.03	analyte was not detected at a concentration greater than the Method Detection Limit
ft	feet below top of casing
ID	identification
J	quantitation is approximate due to limitations identified during data validation
mg/L	milligrams per Liter
U*	result should be considered "not detected" because it was detected in an associated field or laboratory blank at a similar level
UJ	This compound was not detected, but the reporting or detection limit should be considered estimated due to a bias identified during data validation.
ug/L	micrograms per Liter
(TN MCL)	Tennessee Maximum Contaminant Level

1. Level of review is defined in the Quality Assurance Project Plan.

TABLE B.5 – Groundwater Analytical Results for Radiological Parameters
Cumberland Fossil Plant
March 2020

Sample Location				CUF-1000	CUF-1001		CUF-1002	CUF-1003	CUF-1005
Sample Date				10-Mar-20	10-Mar-20	10-Mar-20	11-Mar-20	10-Mar-20	11-Mar-20
Sample ID				CUF-GW-026-20200310	CUF-GW-027-20200310	CUF-GW-DUP01-20200310	CUF-GW-028-20200311	CUF-GW-029-20200310	CUF-GW-030-20200311
Sample Depth				19.5 ft	19 ft	19 ft	18 ft	16.8 ft	24 ft
Sample Type				Normal Environmental Sample	Normal Environmental Sample	Field Duplicate Sample	Normal Environmental Sample	Normal Environmental Sample	Normal Environmental Sample
Level of Review				Final-Verified	Final-Verified	Final-Verified	Final-Verified	Final-Verified	Final-Verified
	Units	EPA MCLs	CCR Rule GWPS						
Radiological Parameters									
Radium-226	PCI/L	n/v	n/v	-0.0509 +/-(0.417)U	0.932 +/-(0.699)	0.563 +/-(0.594)U	0.957 +/-(0.686)	0.560 +/-(0.599)U	0.267 +/-(0.531)U
Radium-228	PCI/L	n/v	n/v	-0.250 +/-(0.313)U	0.438 +/-(0.378)U	-0.0684 +/-(0.282)U	-0.164 +/-(0.349)U	0.417 +/-(0.400)U	-0.165 +/-(0.215)U
Radium-226+228	PCI/L	5[A]	n/v	0.000 +/-(0.521)U	1.37 +/-(0.794)J	0.563 +/-(0.658)U	0.957 +/-(0.770)J	0.977 +/-(0.721)U	0.267 +/-(0.573)U

Notes:

A EPA Maximum Contaminant Level
B CCR Rule GWPS (Federal Register / Vol. 83, No. 146 / Monday, July 30, 2018 / Rules and Regulations)
n/v No standard/guideline value
ft feet below top of casing
ID identification
J quantitation is approximate due to limitations identified during data validation
pCi/L picoCurie per Liter
U not detected

1. Level of review is defined in the Quality Assurance Project Plan.

APPENDIX H.10

TECHNICAL EVALUATION OF WATER USE SURVEY

Appendix H.10 - Technical Evaluation of Water Use Survey

TDEC Commissioner's Order:
Environmental Assessment Report
Cumberland Fossil Plant
Cumberland City, Tennessee

August 14, 2023

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

REVISION LOG

Revision	Description	Date
0	Submittal to TDEC	April 29, 2022
1	Addresses August 9, 2022 TDEC Review Comments and Issued for TDEC	January 26, 2023
2	Addresses May 16, 2023 TDEC Review Comments and Issued for TDEC	August 14, 2023

Sign-off Sheet

This document entitled Appendix H.10 - Technical Evaluation of Water Use Survey was prepared by Stantec Consulting Services Inc. (“Stantec”) for the account of Tennessee Valley Authority (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ______________________________

Stu Gross, PG, Senior Project Manager

Reviewed by ______________________________

John Griggs, PG, Senior Principal

Approved by ______________________________

Rebekah Brooks, PG, Senior Principal Hydrogeologist

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Abbreviations

AOI	Area of Interest
CUF Plant	Cumberland Fossil Plant
CCR	Coal Combustion Residuals
EAR	Environmental Assessment Report
EIP	Environmental Investigation Plan
GIS	Geographic Information System
GWPS	Groundwater Protection Standards
IP	Implementation Plan
MCL	Maximum Contaminant Level
SAP	Sampling and Analysis Plan
Stantec	Stantec Consulting Services Inc.
Survey Area	CUF Plant ½-mile boundary
the Survey	Desktop Survey
TDEC	Tennessee Department of Environment and Conservation
TDEC Order	Commissioner's Order OGC15-0177
TVA	Tennessee Valley Authority
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WUS	Water Use Survey
µg/L	Micrograms per liter

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec), on behalf of the Tennessee Valley Authority (TVA), has prepared this technical evaluation appendix to summarize applicable historical and recent water use survey information in the area surrounding TVA's Cumberland Fossil Plant (CUF Plant) in Cumberland City, Tennessee. This technical appendix provides a detailed evaluation of this information for the Environmental Assessment Report (EAR) in support of fulfilling the requirements for the Tennessee Department of Environment and Conservation (TDEC) issued Commissioner's Order OGC15-0177 (TDEC Order) Program (TDEC 2015).

2.0 WATER USE SURVEY

As part of the Environmental Investigation Plan (EIP) (TVA 2018), TVA developed a Water Use Survey (WUS) Sampling and Analysis Plan (SAP). The objectives of the WUS SAP were to identify and sample usable private water supply wells and surface water sources being used for domestic purposes within ½-mile of the CUF Plant boundary. This area is referred to herein as the Survey Area and is illustrated on Exhibit H.10-1. TVA defines a usable water well to be one that will house a pump (even if a pump is not currently present) and does not contain an obstruction or defective construction that would prevent the insertion or operation of a pump.

Initial tasks associated with the WUS included a desktop survey to identify potentially usable water wells and springs within the Survey Area and a review of hydrogeologic information obtained from investigation activities at the CUF Plant. Following this effort, owners of parcels within an Area of Interest (AOI) located downgradient of coal combustion residuals (CCR) management activities at the CUF Plant were contacted and one spring was sampled. The results of the desktop survey, usable well and spring identification, parcel owner outreach, and sampling results are presented in this appendix.

2.1 DESKTOP SURVEY

The first step of the WUS was a desktop survey (the Survey) to identify potentially usable private wells and springs. The Survey included: reviewing well logs obtained from TDEC, historical hydrogeologic reports provided by TVA and aerial photographs; and contacting public water supply providers in the vicinity of the CUF Plant. The goal of the Survey was to identify potential and known wells or springs within the Survey Area. Details of the Survey are provided in the following sections.

2.1.1 Data Sources and Evaluation

The following information and historical reports were obtained and reviewed:

- TVA Engineering Laboratory - Cumberland Fossil Plant Drastic Application Report (TVA 1990) (herein referred to as the "1990 TVA Report")

- Law Engineering - Report of Hydrogeologic Evaluation Cumberland Fossil Plant (Law Engineering 1992) (herein referred to as the "1992 Law Engineering Report")
- United States Geological Survey (USGS) Public Water-Supply Systems and Associated Water Use in Tennessee, 2005 (Robinson and Brooks 2010)
- April 2019 Aerial Photographs (Google Earth© 2020).

The following documents, obtained from government agencies, were reviewed:

- Parcel data received as geographic information system (GIS)-ready electronic data from Stewart County (Stewart County 2018)
- Registered well information received from Luke Ewing, TDEC Division of Water Resources, Drinking Water Unit (Ewing 2019)
- USGS National Water Information System online mapping database (USGS 2019)
- Local Public Water Supply Information
    - Interview – Angela Neilson – City of Erin (Neilson 2019)
    - Interview - Tad Earhart, Water Plant Operator – City of Dover Water Department (Earhart 2019).

2.1.1.1 Desktop Survey Results

The findings from the main data sources reviewed as part of this Survey are presented below.

Public Water Service Providers

The nearest sources of public potable water are the City of Erin and the City of Dover Water Departments (Robinson and Brooks 2010; USGS 2019). The City of Erin Water Department, located in Houston County, obtains their water supply from the Cumberland River at its confluence with Yellow Creek located approximately 3.7 miles northeast (upstream) of the Survey Area and provides potable water to Cumberland City and the entire area within ½-mile of the CUF Plant. The Cumberland City Water Department purchases potable water from the City of Erin Water Department. These water supply systems have been in operation since approximately 1972. The City of Dover's potable water supply system does not service the area surrounding the CUF Plant. Its service area ends east of Highway 49 (approximately 4.5 miles west-northwest of the Survey Area) but connects into the City of Erin system for emergency purposes. The City of Dover Water Department obtains its water supply from the Cumberland River at an intake location near downtown Dover (approximately 10.5 miles downriver from the Survey Area). Table H.10-1 summarizes the identified public water suppliers.

Stewart County Parcel Information

Stantec obtained the complete parcel information set from Stewart County in electronic format and assimilated the information into Stantec's GIS database for the CUF Plant. Stantec used these data to populate Table H.10-2 including only those parcels partially or fully within the Survey Area, which totaled 178 parcels. The parcel information included the following water supply classifications:

- Individual (20 parcels)
- Public (158 parcels).

The 20 parcels identified as having an "individual" water supply are parcels that have no known connection to a municipal water supply. The remaining 158 parcels identified as having a "public" water supply are served by a municipal water supply.

TDEC Water Well Logs

TDEC provided an electronic list of the recorded water well logs within and near the Survey Area (Ewing 2019). Some well logs included the well depth and other well construction details. Stantec geo-referenced the listed latitude/longitude of each well log using GIS to plot the well locations on a map. The provided coordinates were imported into GIS "as is" without modification. Table H.10-3 summarizes the TDEC-documented well logs located on parcels within the Survey Area and the well locations are shown on Exhibit H.10-2. Following this effort, coordinate locations for eight well logs were identified within the Survey Area.

Historical Reports

1990 TVA Report and 1992 Law Engineering Report Findings

The 1990 TVA report and 1992 Law Engineering Reports identified the approximate locations of "wells" and "springs" near the CUF Plant. The companies that prepared each of these reports conducted a survey of non-public water supply wells and springs near the CUF Plant. The wells and springs identified are consistent in both reports. Three non-public water supply wells (labeled W3, W4 and W7) and two springs (labeled S5 and "Rye Spring") were identified in the reports. The water supply wells and springs identified in the historical reports within the Survey Area are shown on Exhibit H.10-2.

Recent Aerial Photograph Review

Stantec reviewed the April 2019 Google Earth© aerial photograph (most recent photograph available) to identify buildings or structures (i.e., residences, businesses) in the Survey Area that are likely to require a potable water source. If a parcel was identified by Stewart County as having an "individual" water source and a building was present, then it was assumed that a private well used for domestic or business purposes was present at the parcel. Alternatively, if a parcel was identified with an "individual" listing but no evidence of recent or current buildings or structures was observed, then it was considered unlikely for a private well to be present or currently in use at the parcel. No additional potential wells were identified in the Survey Area in the aerial photograph review.

2.1.1.2 Summary of Desktop Survey Findings

Based on the records reviewed, the private well information obtained from these data sources as it relates to the Survey Area are summarized in Table H.10-4.

Table H.10-2 provides a complete list of parcels in the Survey Area and includes data presented in Table H.10-3. Exhibit H.10-2 illustrates potential water supply wells and springs identified during the Survey and highlights those parcels in the Survey Area where one or more potential well(s) or spring(s) were identified based on the data reviewed.

Based on the results of the Survey, six parcels (highlighted on Exhibit H.10-2) were identified in the Survey Area that contained up to five wells and two springs used for domestic or business purposes.

2.1.2 Hydrogeological Considerations

In addition to conducting the Survey, the current CUF Plant WUS SAP outlines a process to identify locations where groundwater or surface water has the potential to be affected by CUF Plant CCR management units using results of investigative activities required as part of the EIP. This process includes consideration of geologic and hydrogeologic conditions (i.e. hydraulic barriers [rivers/streams], topography, groundwater flow direction, and watershed boundaries). Relevant hydrogeologic information presented in the EAR Chapter 5 is discussed below as it relates to identifying usable water wells and surface water sources being used for domestic purposes with the potential to be affected by CUF Plant CCR management units.

- The natural unconsolidated deposits at the CUF Plant are primarily of residuum and alluvial deposits underlain by bedrock consisting primarily of limestone, dolomite, or shale. The alluvium can be further differentiated into clays and silts that overlie sands and gravels. Alluvium is underlain at some locations by a layer of residuum primarily consisting of clay and silt. The alluvium averages less than 25 feet in thickness beneath the CUF Plant CCR management units but may be as great as 45 feet thick in the abandoned channel of Wells Creek. Alluvium is underlain at some locations by a layer of residuum primarily consisting of clay and silt.
- The CUF Plant is located within the Wells Creek Basin, which is the result of a meteor impact that changed the geology within the basin. The meteor impact caused bedrock formations that exist at a depth of approximately 2,500 feet below ground in the area surrounding the crater to be brought to ground surface in the center of the crater. Parts of the CCR management units are located above these geologic formations. Based on topography, the CUF Plant is located on a topographic high within the basin. The area surrounding the basin generally consists of flat lying and gentle rolling hills, which generally slope downward in a northerly direction towards the Cumberland River. The CUF Plant is naturally bounded on most sides by surface water bodies including Wells Creek to the west and the Cumberland River along the northern boundary of the CUF Plant. Groundwater levels near the CUF Plant are largely controlled by the stage of the Cumberland River. Groundwater flow in the overburden and bedrock at the CUF Plant is bounded to the north by the Cumberland River and to the south and west by Wells Creek. There is a groundwater flow divide in the northeast portion of the CUF Plant that separates

groundwater flow to the Cumberland River to the north from groundwater flow to the southwest toward Wells Creek as shown in Exhibit H.10-3. In general, groundwater elevation contours follow surface topography, and groundwater flows from areas of higher elevation towards Wells Creek, which ultimately flows into the Cumberland River. The key hydraulic barriers (Cumberland River and Wells Creek) are illustrated on Exhibit H.10-3.

2.1.3 Usable Water Well Identification

Considering the geologic and hydrogeologic conditions present at and in the vicinity of the CUF Plant, parcels containing a well or spring located south/southeast of the CUF Plant would have the greatest likelihood of being downgradient of the CUF Plant CCR management units. This area was termed the AOI. Potable water wells screened in overburden or bedrock located south or west of Wells Creek, or north of the Cumberland River would have a low likelihood of being impacted from groundwater associated with CUF Plant CCR management units based on hydrogeologic boundaries and current groundwater flow patterns.

Based on the results of the Survey, 13 parcels (highlighted on Exhibit H.10-3 and outlined in Table H.10-5) located within the AOI south/southeast of the CUF Plant were identified as potentially containing one spring. No potential wells were identified on the 13 parcels. Using the results of the Survey, delivery of letters and postcards to the owners of these 13 parcels was initiated as described in the WUS Implementation Plan (IP) (Stantec 2021) and is described in further detail in the following sections.

3.0 PARCEL OWNER OUTREACH

Parcel owner outreach is described in section 2.0 and 3.0 of the IP. Using the process outlined in the IP, the following steps were completed in sequential order to contact each owner in the AOI.

1. Mail letter and stamped postcard to parcel owners within the AOI
2. Attempt to contact the parcel owner by telephone.

3.1 LETTER/POSTCARD DELIVERY

On October 4, 2022, TVA mailed a letter and stamped postcard containing basic inquiries into the presence of a well or spring to 12 parcel owners within the AOI. A letter and postcard were also provided to the TVA Plant Manager at a later date. The letter explained to the parcel owner that TVA was attempting to identify and sample private water supply wells and springs and requested the completion and return of a postcard that contained basic questions regarding the presence of a well or spring on the parcel to TVA. For those owners that did not respond to the initial letter, TVA mailed a second similar letter on October 14, 2022.

The delivery of letters and postcards resulted in responses from five parcel owners. In each instance, the parcel owners reported that there was no private water supply well or spring on their parcel. Information obtained from the delivery and return of letters and postcards is presented in Table H.10-6.

3.2 TELEPHONE INTERVIEWS

Between October 28 and November 9, 2022, parcel owners that did not respond to the first or second letter/postcard delivery, were contacted by telephone. A water supply well survey form (Appendix E of the IP) was completed using responses provided by parcel owners contacted via telephone. The seven parcel owners that did not respond to the letter were reached by telephone and reported no private water supply wells or springs on their parcel except for one spring located on a parcel with corresponding parcel identification of 123 005.00 (parcel 123 005.00).

Based on the results of the desktop survey and parcel owner outreach, no water supply wells were identified within the AOI. However, one spring, located on parcel 123 005.00 was identified. The results of the parcel owner outreach are summarized in Table H.10-6. Postcard responses and water supply well survey forms completed during telephone interviews are included in Attachments H.10-A and H.10-B, respectively.

4.0 USABLE WELL/SPRING SAMPLING

TVA contacted the owner of parcel 123 005.00 to secure access to the property for the purpose of sampling the identified spring. On January 4, 2023, water samples were collected from the spring using methodology presented in the June 2018 SAP Revision 3 (Stantec 2018). The spring consisted of a small pool of water where discharge from the spring briefly accumulated prior to flowing down a channel to a nearby pond. Sample collection adhered to applicable United States Environmental Protection Agency (USEPA) methods, TVA Technical Instructions and the SAP. Details of the sampling methodology is included in Attachment H.10-C.

Two separate aliquots of water collected from the spring, labeled with a unique identification number of CUFPV-002, were submitted under chain-of-custody to Pace Analytical. As outlined in the IP, the first aliquot was submitted for expedited laboratory analysis of boron, chloride, and sulfate. The second aliquot was held until results of the first aliquot were available. Further sampling details are summarized in Table H.10-7. Additional details related to sampling methodology are included in Attachment H.10-C.

Laboratory analytical results of the first aliquot were received on January 9, 2023 and are summarized below. Laboratory analytical reports are included in Attachment H.10-D.

PARAMETER	UNITS	CUFPV-002 January 4, 2023	Established CUF UPL
Boron	µg/L	18.7	80
Chloride	µg/L	6,500	1,950
Sulfate	µg/L	55,300	20,600

µg/L – micrograms per liter
UPL – Upper Prediction Limit

Concentrations of boron, chloride, and sulfate above laboratory reporting limits were present in the first aliquot. Neither chloride or sulfate have established USEPA drinking water Maximum Contaminant Levels (MCLs) or Groundwater Protection Standards (GWPS). However, the reported concentrations for chloride and sulfate were present above Plant-specific Upper Prediction Limits (UPLs). As outlined in the IP, when chloride *and* sulfate concentrations are above their respective UPLs, further Plant-specific information would be evaluated to determine the need for analysis of the second aliquot.

5.0 REVIEW OF PLANT-SPECIFIC INFORMATION

The spring located on parcel 123 005.00 was previously identified as the "Rye Spring" and was included in historical CUF Plant groundwater characterization and monitoring activities as a background sampling location. From 1994 to 2016, Rye Spring was sampled more than 55 times for various metals, anions including boron, chloride, and sulfate, and other general chemistry parameters. The reported boron, chloride, and sulfate concentrations of the current sample (CUFPV-002) are generally consistent with historical results of Rye Spring and also provide a large data set for physical and chemical properties of background water quality near the CUF Plant. Historical Rye Spring data are provided in Table H.10-8a.

Historical water quality data for Rye Spring offers an opportunity to evaluate time-dependent changes, if any, in the chemistry of water flowing from the spring. The evaluation of available data focuses on major element chemistry (i.e., calcium, magnesium, sodium, sulfate, chloride, fluoride) as a means of describing the relationships among the major ions in groundwater. For purposes of comparison, the historical Rye Spring data are compared with groundwater quality from background groundwater wells (CUF-201 and CUF-202), pore water from temporary wells in the CCR management units, Wells Creek from an upstream location, and a groundwater well location between the CCR management units and Rye Spring (CUF-1006). Tables H.10-8a through H.10-8c provides a summary of the historical Rye Spring and Upper Wells Creek data. The tables also include pore water and groundwater data from recent monitoring events for comparison.

Figure H.10-1 shows box plots for chloride and sulfate at locations considered in evaluating results for the WUS sampling at Rye Spring that were above the UPL. Both chloride and sulfate are higher in pore water from the Gypsum Storage Area as compared to either background groundwater, Upper Wells Creek, historical Rye Spring, or the WUS sample. As evidenced by the figure, the reported chloride and sulfate concentrations in the current sample (CUFPV-002) are in the range of concentrations measured historically at Rye Spring and are similar to concentrations measured in Upper Wells Creek which does not support a likely connection with CCR management units at the CUF Plant.

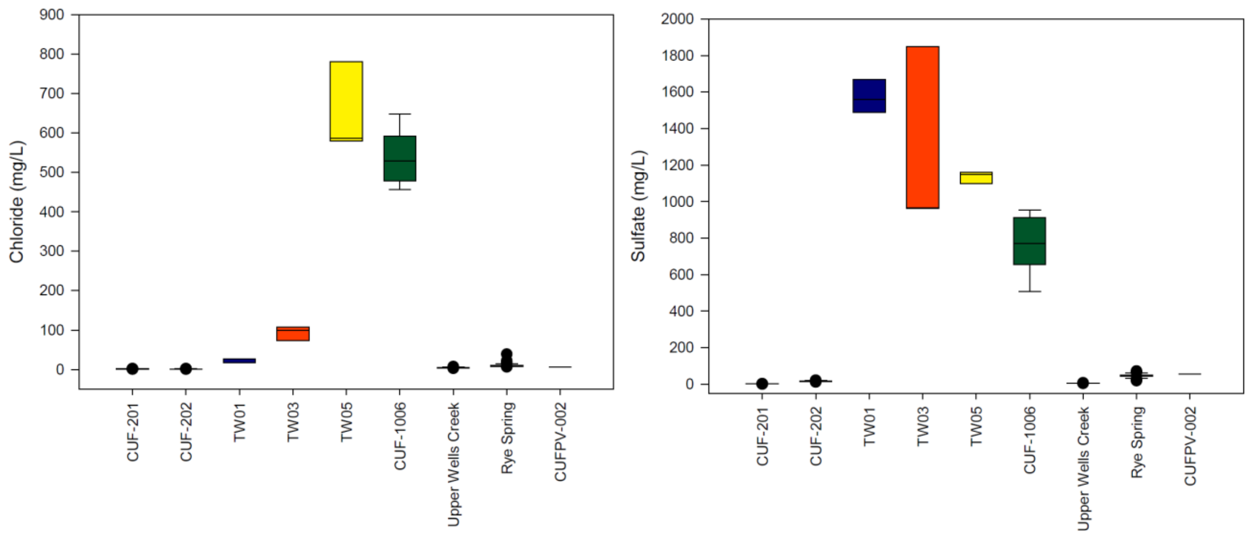

Figure H.10-1 – Chloride and Sulfate Box Plots

Stiff diagrams are chosen as the method of comparison of major ion chemistry among the locations listed and are generated by first converting measured concentrations into equivalent concentrations, which allows direct comparison between concentrations. The equivalent concentrations are then plotted with cations (positively charged ions) horizontally to the left side of the vertical zero line and anions (negatively charged ions) vertically to the right side of the vertical zero line. The points representing the plotted equivalent concentrations are then connected resulting in a polygon, the shape of which provides a distinct characteristic of a given water chemistry. Differences in water chemistry between potential sources and a sampling location can be evaluated by comparing the shapes of the Stiff diagrams.

Figure H.10-2 shows Stiff diagrams for samples collected from Rye Spring at select times over the period from 1994 to 2011.

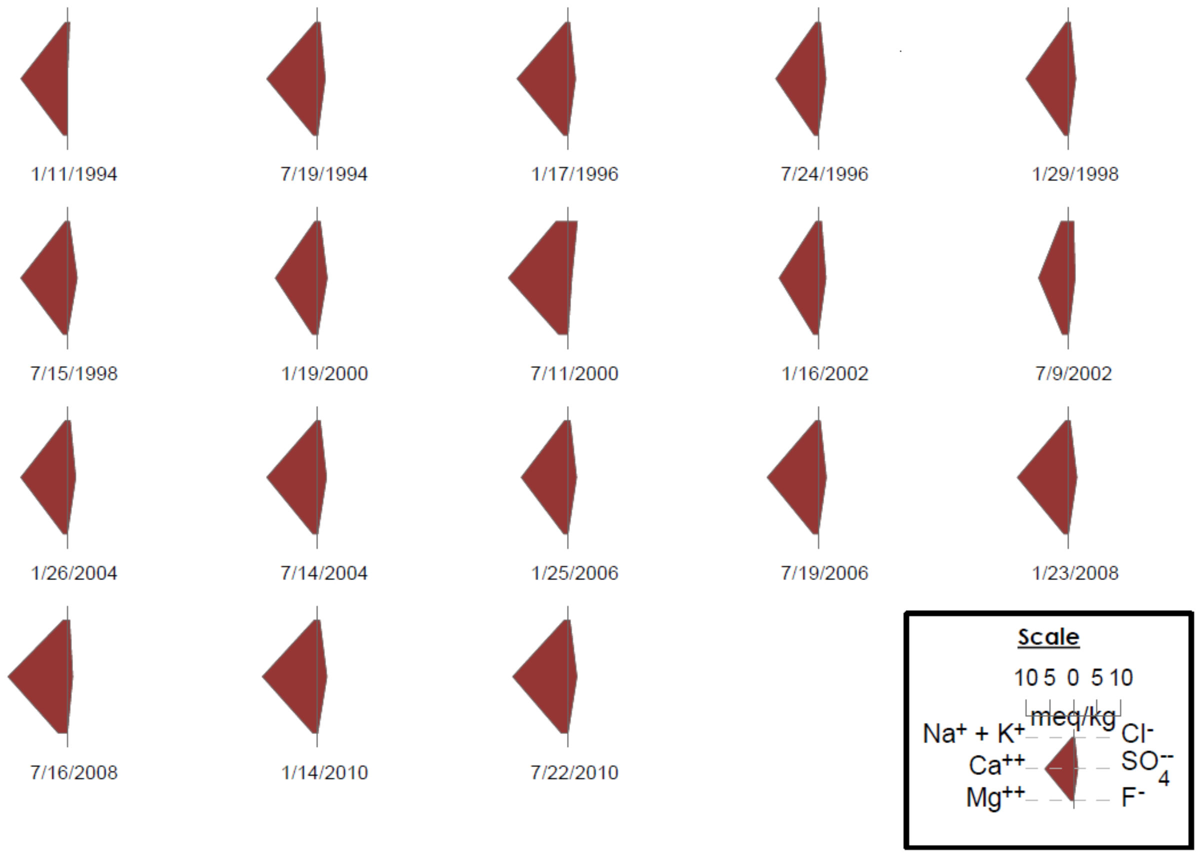

Figure H.10-2 – Stiff Diagram for Select Rye Spring Samples

The Stiff diagrams are plotted at the same scale so a direct comparison of the overall shape can be made. While there may be variations between individual sampling events, the overall shape of Rye Spring Stiff diagrams does not change through time. The dominant cation and anion are calcium and sulfate, respectively. The Rye Spring water does not contain much magnesium, sodium plus potassium, chloride, or fluoride.

Stiff diagrams for other potentially relevant water samples are shown in Figure H.10-3.

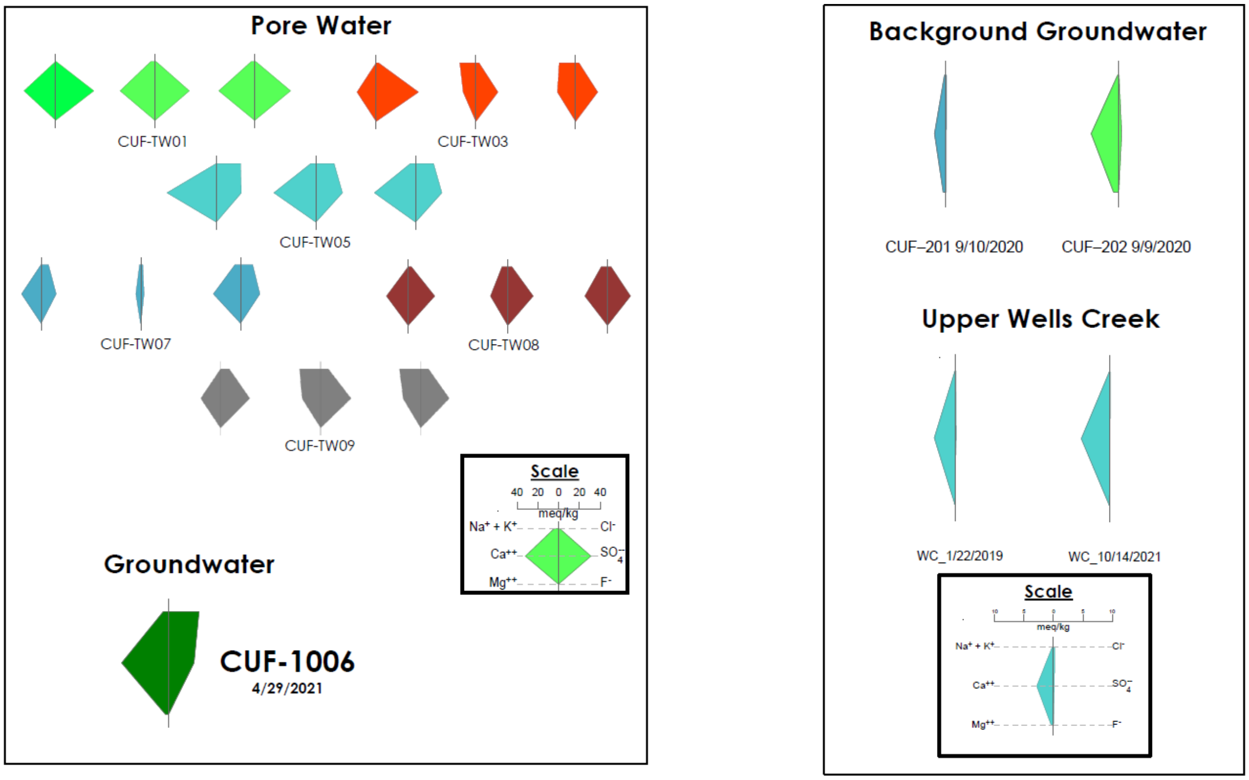

Figure H.10-3 – Stiff Diagram for Pore Water, Groundwater, Background Groundwater and Upper Wells Creek

Stiff diagrams for pore water associated with the CCR management units show generally that the major ion chemistry is dominated by calcium and sulfate, most often in equal amounts. The reported results of groundwater samples collected from monitoring well CUF-1006 located downgradient of the Gypsum Storage Area also showed calcium and sulfate as important constituents, but also included chloride. The upper Wells Creek and the background groundwater locations (CUF-201 and CUF-202) had shapes more similar to Rye Spring than pore water or groundwater downgradient of the CCR management unit.

Figure H.10-4 shows a summary of the Stiff diagrams for relevant locations related to an evaluation of probable source water contributing to Rye Spring.

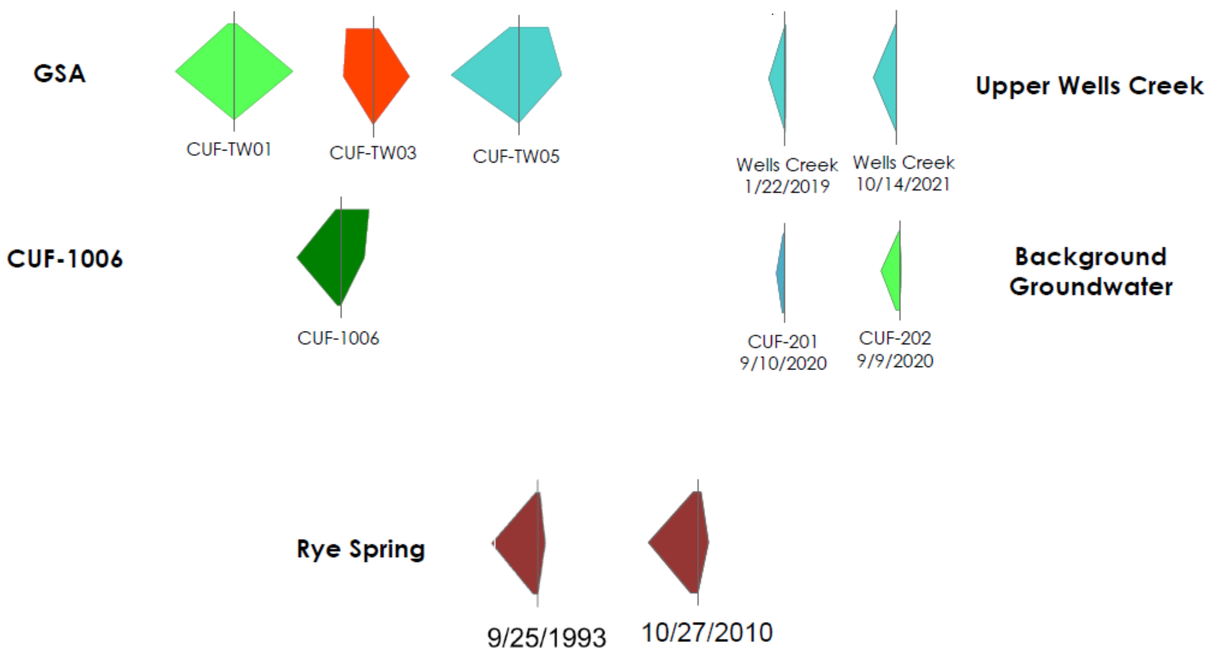

Figure H.10-4 – Stiff Diagrams for Gypsum Storage Area, CUF-1006, Background Groundwater, Upper Wells Creek, and Rye Spring

Based on the major ion chemistry, as reflected in the shape of the Stiff diagrams, the source of water at Rye Spring likely reflects background conditions, and there is no indication from the historical record of samples collected at Rye Spring of influence from the CUF Plant.

In addition, the groundwater elevation measured within monitoring well CUF-1006, located downgradient of the Gypsum Storage Area and between the Gypsum Storage Area and Rye Spring, during the period from July 2021 through October 2022 ranged from approximately 368 to 370 feet above mean sea level. Rye Spring discharges from the ground at an elevation of approximately 398 feet above mean sea level; therefore, the groundwater elevation at Rye Spring is approximately 28 to 30 feet above the groundwater elevation at the downgradient edge of the Gypsum Storage Area nearest to Rye Spring. Figure H.10-5 below depicts the elevation difference between the Gypsum Storage Area and Rye Spring.

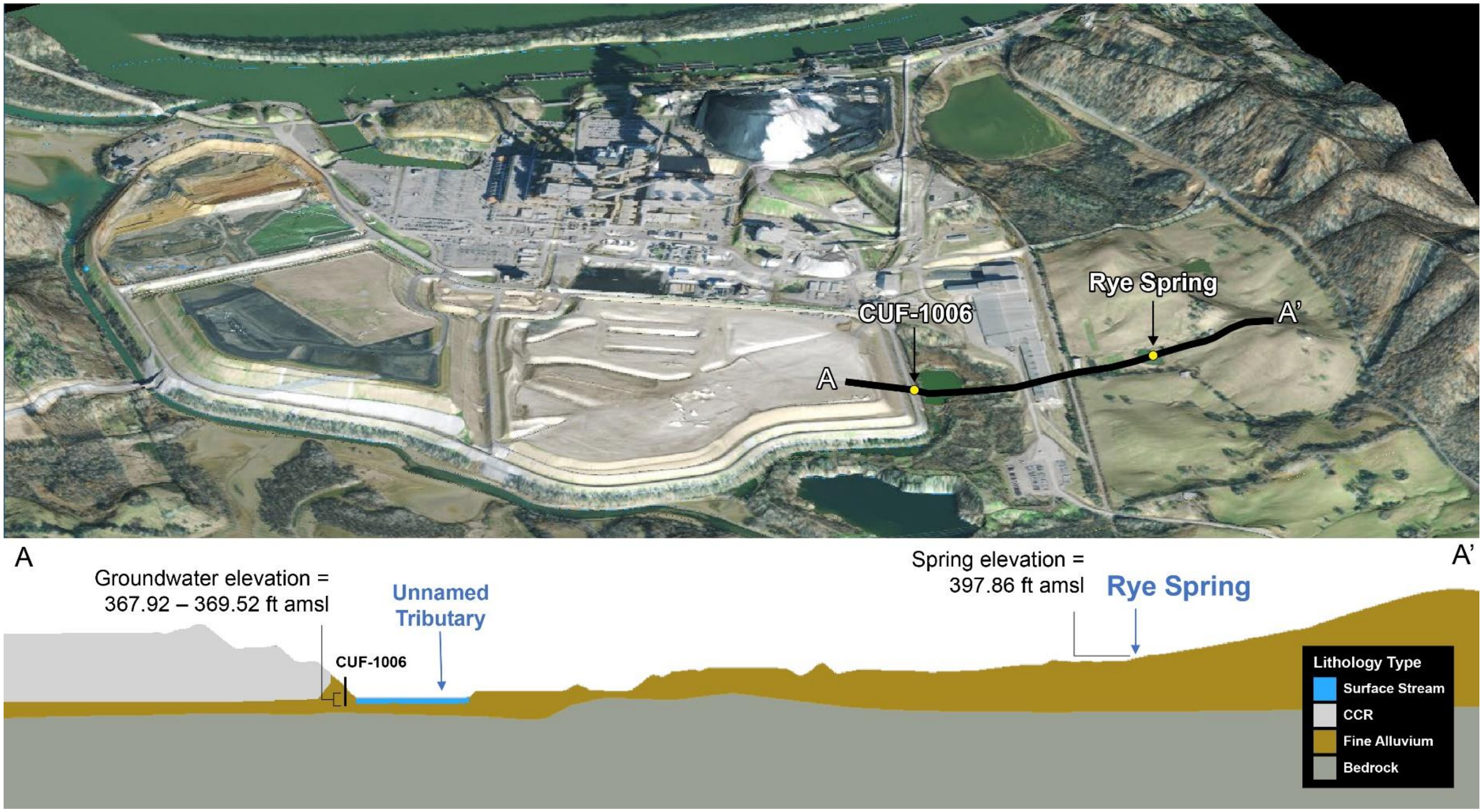

Figure H.10-5 – Comparison of elevation of groundwater at CUF-1006 with elevation of Rye Spring

6.0 CONCLUSIONS

The owners of 13 parcels located within the AOI south/southeast of the CUF Plant were contacted for information regarding the presence of wells or springs on their property resulting in the positive identification of one spring on parcel 123 005.00 (Rye Spring). No other wells or springs were identified within the AOI. Access to sample the spring was granted by the parcel owner. On January 4, 2023, the spring was sampled.

Evaluating water quality results associated with Upper Wells Creek, monitoring wells included in the CUF monitoring program, and other historical groundwater monitoring data, boron, chloride, and sulfate concentrations reported in CUFPV-002 (Rye Spring) are similar to historical background concentrations and do not indicate a connection with CCR management units at the CUF Plant. In addition, the measured discharge location of Rye Spring is well above groundwater elevations measured in monitoring wells associated with the CUF Plant. Based on this information, the boron, chloride, and sulfate concentrations reported in Rye Spring are not attributable to CCR management activities at the CUF Plant. Therefore, the second aliquot from CUFPV-002 was not analyzed and as outlined in the IP, a letter informing the parcel owner of the results of the sampling was delivered to the parcel owner. Based on the overall results of the WUS, current and historical CCR management associated with the CUF Plant have not affected water supply wells or springs located downgradient of the CUF Plant.

7.0 REFERENCES

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TABLES

Table H.10-1 – CUF Plant Area Public Water Service Providers
Cumberland Fossil Plant

Public Water Supply Provider	Service Area in Relation to CUF Plant	Does Service Area Extend into Survey Area (Yes/No)	Water Source/Intake Location	Distance of Source/Intake from CUF Plant Survey Area
Cumberland City Water Department	Entire survey area	Yes	Purchases water from City of Erin Water Department	3.7 miles northeast (upstream)
City of Erin Water Department	Provides water to Cumberland City Water Department	Yes (via Cumberland City Water Dept.)	Cumberland River/Yellow Creek confluence	3.7 miles northeast (upstream)
City of Dover Water Department	Connected to City of Erin system for emergency purposes only	No	Cumberland River	10.5 miles northwest (downstream)

Table H.10-2 – CUF Plant Parcel Data Inside Survey Area
Cumberland Fossil Plant

ASSIGNED WELL ID	OWNER	PARCEL ADDRESS	PARCEL ID	STEWART COUNTY GIS WATER SERVICE DESIGNATION	RECENT AERIAL PHOTOGRAPH REVIEW NOTES	POTENTIAL PRIVATE WELLS/SPRINGS IDENTIFIED ON PARCEL AND INSIDE STUDY AREA	TDEC WELL LOG NUMBER	TDEC WELL LOG WELL DEPTH (feet below ground surface)	TVA/LAW ENGINEERING REPORT WELL ID	INCLUDE PARCEL IN DOOR-TO-DOOR SURVEY (YES/NO)
	FEDERAL PROPERTY	CUMBERLAND CITY RD 815	123 001.00	Public	CUF PLANT	0	20050917 (listed as "industrial use")	202	None	YES
CUFPV-002	RYE CASS S II	OLD HWY 149 344	123 005.00	Public	a house and several small buildings	1			Rye Spring	YES
	GEORGIA-PACIFIC GYPSUM III	TEMPLE DR 150	140 001.01	Public		0			None	YES
	STEWART/HOUSTON INDUSTRIAL	INDUSTRIAL PARK RD	140 002.00	Public		0			None	YES
	SIMPSON LEVI RYE CASS	INDUSTRIAL PARK RD	140 002.02	Public		0			None	YES
	COMMERCIAL INSULATING GLASS CO	INDUSTRIAL PARK RD 476	140 002.03	Public		0			None	YES
	R J CORMAN RAILROAD CO	INDUSTRIAL PARK RD	140 002.04	Public		0			None	YES
	TN CRYOGENICS LLC	INDUSTRIAL PARK RD 468	140 002.05	Public		0			None	YES
	HOUSTON CO MANUF LLC A TN	TEMPLE DR 136	140 002.07	Public		0			None	YES
	RYE S RYE II & MATTHEW H, SETH W	HWY 149 E	140 003.00	Public		0			None	YES
	STEWART/HOUSTON INDUSTRIAL	INDUSTRIAL PARK RD	140 012.00	Public		0			None	YES
	PITTS CHRISTOPHER R	INDUSTRAIL PARK RD	140 012.01	Public		0			None	YES
	PITTS CHRISTOPHER R	WELLS CREEK	140 013.00	Public		0			None	YES
	FEDERAL PROPERTY	WILDLIFE RD 631	074 015.01	Individual	vacant parcel - no buildings visible	0				
CUFPV-001	MFM REAL ESTATE LLC	CUMBERLAND CITY RD 1204	119 021.00	Public	house and outbuilding present just inside Survey Area boundary	1	20023996	600	None	
	MFM REAL ESTATE LLC	CUMBERLAND CITY RD 1170	119 022.00	Public		0			None	
	YOUNG SCARLET ADAMS	CUMBERLAND CITY RD 1184	119 022.01	Public		0			None	
	CROSS CREEK PARTNERSHIP	CUMBERLAND CITY RD	119 022.02	Individual	vacant parcel - no buildings visible	0			None	
	DOWNING JONATHAN	CUMBERLAND CITY RD 1142	119 022.03	Public		0			None	
	BERLIN MARK A	SCOTTS CHAPEL RD 114	119 026.02	Public		0			None	
	MANNERS FRED M	SCOTTS CHAPEL RD	119 026.03	Public		0			None	
	GIONTA JOSEPH	SCOTTS CHAPEL RD 130	119 030.00	Public		0			None	
	GODBOLDT SHAY V	SCOTTS CHAPEL RD 146	119 030.03	Public		0			None	
	HUMPHREY TI-NEA	DOWNS RD 347	119 030.05	Public		0			None	
	SMITH NATHAN M	SCOTTS CHAPEL RD 135	119 037.01	Public		0			None	
	ALEXANDER THOMAS RICHARD	SCOTTS CHAPEL RD 211 221	119 037.02	Public		0			None	
	HAMILTON PAMELA	CUMBERLAND CITY RD 1139	119 039.00	Public		0			None	
	HAMILTON PAMELA	CUMBERLAND CITY RD 1135	119 039.01	Public		0			None	
	SMITH NATHAN M	SCOTTS CHAPEL RD	119 039.02	Public		0			None	
	DORTCH SHAWN KEVIN	CUMBERLAND CITY RD 1118	119 040.00	Public		0			None	
	PAXTON MIKE	CUMBERLAND CITY 1134	119 040.01	Public		0			None	
	LEMONS MARY (LE)	CUMBERLAND CITY RD	119 040.02	Public		0			None	
	ARRINGTON GEORGE	CUMBERLAND CITY RD 1100	119 040.03	Public		0			None	
	SANDERS JACOB L	CUMBERLAND CITY 1107	119 042.00	Public		0			None	
	BUTTERMORE ELIZABETH P	CUMBERLAND CITY RD 1111	119 042.01	Public		0			None	
	TIPTON RICHARD L M MILLER	WILDCAT CREEK RD	120 009.00	Individual	vacant parcel - no buildings visible	0			None	
	LEHMAN JUDITH GAYE ET VIR WAYNE	RIVERSBEND RD	120 010.00	Individual	vacant parcel - no buildings visible	0			None	
	HAMBY FARMS LLC	RIVERSBEND RD	120 011.05	Individual	vacant parcel - no buildings visible	0			None	
	HAMBY FARMS LLC	RIVERSBEND RD	120 011.07	Individual	vacant parcel - no buildings visible	0			None	
	MOORE CLEO N	RIVERSBEND RD	120 012.00	Individual	vacant parcel - no buildings visible	0			None	
	HAMBY FARMS LLC	RIVERSBEND RD	120 014.00	Individual	vacant parcel - no buildings visible	0			None	
	FEDERAL PROPERTY	CUMBERLAND CITY RD	123 001.01	Public	CUF PLANT	0			None	
	RYE CASS S II	OLD HWY 149	123 005.01	Public		0			None	
	NULTY STEPHANIE	WATTS AVE 123	123 009.01	Public		0			None	
	MATADI JAI LLC	CUMBERLAND CITY RD 606	123F A 001.00	Public		0			None	
	MATADI JAI LLC	CUMBERLAND CITY RD	123F A 002.00	Public		0			None	
	TAYLOR PHILLIP	CUMBERLAND CITY RD	123F A 003.00	Public		0			None	
	TAYLOR PHILLIP G	CUMBERLAND CITY RD	123F A 004.00	Public		0			None	
	HARDIN BRENDA STAVELY	CUMBERLAND CITY RD	123F A 004.01	Public		0			None	
	LOUISVILLE AND	CUMBERLAND CITY RD	123F A 004.03	Public		0			None	
	STINSON HARVEY J	CUMBERLAND CITY RD	123F A 006.00	Public		0			None	
	FEDERAL PROPERTY	CUMBERLAND CITY RD	123F A 007.00	Public		0			None	
	MCGEE JAMES	CUMBERLAND CITY RD 613	123K A 001.00	Public		0			None	
	BOYD DENNIS E	CUMBERLAND CITY RD 613	123K A 001.01	Public		0			None	
	PATTERSON JOHN G	RUSSELL ST 102	123K A 002.00	Public		0			None	
	PATTERSON JOHN G	CUMBERLAND CITY RD 607	123K A 003.00	Public		0			None	
	URBAS JOHN E	CUMBERLAND CITY RD 609	123K A 003.01	Public		0			None	
	WALLACE SYDNEY B	LANDISS AVE	123K A 004.00	Public		0			None	
	DURARD RICKY J	LANDISS AVE 203	123K A 005.00	Public		0			None	
	SCHAEFFER CHARLES B JR	CONGER ST 202	123K A 006.00	Public		0			None	
	FROST FRANK F	CONGER ST 206	123K A 007.00	Public		0			None	
	KIZER ROBERT	CONGER ST 302	123K A 007.01	Public		0			None	
	PATTERSON JOHN	CONGER ST	123K A 008.00	Public		0			None	
	DONALDSON A PRESTON JR	RUSSELL ST	123K A 009.00	Public		0			None	
	CHURCH SALEM	RUSSELL ST	123K A 010.00	Public		0			None	
	CHURCH SALEM	RUSSELL ST	123K A 011.00	Public		0			None	
	CEMETERY DUNBAR	RUSSELL ST	123K A 012.00	Public		0			None	
	PATTERSON JOHN	RUSSELL ST 119	123K A 013.00	Public		0			None	
	DURARD RICKY J	RUSSELL ST	123K A 014.00	Public		0			None	

Table H.10-2 – CUF Plant Parcel Data Inside Survey Area
Cumberland Fossil Plant

ASSIGNED WELL ID	OWNER	PARCEL ADDRESS	PARCEL ID	STEWART COUNTY GIS WATER SERVICE DESIGNATION	RECENT AERIAL PHOTOGRAPH REVIEW NOTES	POTENTIAL PRIVATE WELLS/SPRINGS IDENTIFIED ON PARCEL AND INSIDE STUDY AREA	TDEC WELL LOG NUMBER	TDEC WELL LOG WELL DEPTH (feet below ground surface)	TVA/LAW ENGINEERING REPORT WELL ID	INCLUDE PARCEL IN DOOR-TO-DOOR SURVEY (YES/NO)
	MCCLELLAN MOSE H III	MCCRACKEN AVE	123K A 014.01	Public		0			None	
	DURARD RICKY J	RUSSELL ST 113	123K A 015.00	Public		0			None	
	RAY LLOYD G	LANDISS AVE 207	123K A 016.00	Public		0			None	
	RAY LLOYD G	LANDISS AVE 205 209	123K A 017.00	Public		0			None	
	VERTREES JAMES A	HWY 434	123K B 001.00	Public		0			None	
	VERTREES JAMES A	CUMBERLAND CITY RD	123K B 001.01	Public		0			None	
	VERTREES JAMES A	BRADLEY ST	123K B 002.00	Public		0			None	
	GILBERT ELSA	CUMBERLAND CITY RD 405	123K B 003.00	Public		0			None	
	HOWELL ROBERT G	STACKER ST 108	123K B 004.00	Public		0			None	
	VERTREES JAMES A	STACKER ST 105	123K B 005.00	Public		0			None	
	BRUNSON MARY	CUMBERLAND CITY RD	123K B 006.00	Public		0			None	
	BRUNSON MARY	CUMBERLAND CITY RD 301	123K B 007.00	Public		0			None	
	VERTREES JAMES A	WALLACE ST 102	123K B 008.00	Public		0			None	
	COLLETT DANE SCOTT	STACKER ST 106	123K B 009.00	Public		0			None	
	SPIERS CLAYTON A JR	STACKER ST	123K B 010.00	Public		0			None	
	WOOTEN ELIZABETH	STACKER ST	123K B 011.00	Public		0			None	
	WOOTEN ELIZABETH	STACKER ST 121	123K B 012.00	Public		0			None	
	GILLIAM PHILIP WAYNE	MCCRACKEN AVE 202	123K B 013.00	Public		0			None	
	MILLER HUGH WOODROW	MCCRACKEN AVE	123K B 014.00	Public		0			None	
	HEMBREE JEWEL	WALLACE ST	123K B 014.01	Public		0			None	
	TOWN OF CUMBERLAND CITY	THOMAS AVE 215	123K B 015.00	Public		0			None	
	PULLEY HERBERT	THOMAS AVE 209	123K B 016.00	Public		0			None	
	DUNLAP LOTTIE	THOMAS AVE 203	123K B 017.00	Public		0			None	
	DUNLAP EDDIE L	CONGER ST 402	123K B 017.01	Public		0			None	
	DUNLAP DAVID E	CONGER ST 401	123K B 018.00	Public		0			None	
	BLACK MARY SUE	CONGER ST	123K B 019.00	Public		0			None	
	KIRTLAND DORA ETALS	CONGER ST 305	123K B 020.00	Public		0			None	
	SKELTON BRIAN	CONGER ST 303	123K B 021.00	Public		0			None	
	SKELTON JULIUS	CONGER ST	123K B 022.00	Public		0			None	
	HAYES TERRY G	CONGER ST 207	123K B 023.00	Public		0			None	
	HESTAND TIMOTHY F	CONGER ST 203	123K B 024.00	Public		0			None	
	GILLAM WANDA J	MCCRACKEN AVE 212	123K B 025.00	Public		0			None	
	HEMBREE JEWEL	MCCRACKEN AVE	123K B 026.00	Public		0			None	
	BELLAR LUCILLE	MARTIN AVE	123K B 027.00	Public		0			None	
	BELLAR HARTWELL S	MARTIN AVE 208	123K B 028.00	Public		0			None	
	SHORT SANDRA S	MARTIN AVE 212	123K B 029.00	Public		0			None	
	CHURCH CUMBERLAND	BRADLEY ST 111	123K B 030.00	Public		0			None	
	BRYANT JOHN R	BRADLEY ST 204	123K B 031.00	Public		0			None	
	LYNN SANDRA K	LANDISS AVE 116	123K B 032.00	Public		0			None	
	MULVEY MARILYN E HAYNES	CUMBERLAND CITY RD	123K C 001.00	Public		0			None	
	WELLS FARGO BANK	WALLACE ST	123K C 002.00	Public		0			None	
	ROBY WARNER SCOTT	WALLACE ST	123K C 003.00	Public		0			None	
	WALLACE E F HEIRS	DOUGHERTY ST	123K C 003.01	Public		0			None	
	STEVENS WILLIAM A	DOUGHERTY ST	123K C 004.00	Public		0			None	
	JEFFRES MAGGIE	DOUGHERTY ST	123K C 005.00	Public		0			None	
	CURTIS CHARLES M	DOUGHERTY ST	123K C 006.00	Public		0			None	
	CURTIS CHARLES M	WALLACE ST 219	123K C 007.00	Public		0			None	
	CURTIS CHARLES M	DOUGHERTY ST	123K C 008.00	Public		0			None	
	TUTT JOSEPH W	WALLACE ST 111	123K C 009.00	Public		0			None	
	SPENCER ROBERT G	CUMBERLAND CITY RD 205	123K C 010.00	Public		0			None	
	CURTIS CHARLES M	DOUGHERTY ST	123K D 001.00	Public		0			None	
	STEVENS WILLIAM A	DOUGHERTY ST	123K D 002.00	Public		0			None	
	PATTERSON LARRY H	DOUGHERTY ST	123K D 003.00	Public		0			None	
	SMITH DANIEL T	PULLEY ST 504	123K D 004.00	Public		0			None	
	SMITH DANIEL	DOUGHERTY ST	123K D 005.00	Public		0			None	
	SELF LEE	DOUGHERTY ST	123K D 006.00	Public		0			None	
	BRYANT JOHN	DOUGHERTY ST	123K D 007.00	Public		0			None	
	TALMAGE SHIRLEY ALLENE (LT)	BASS AVE 208	123K D 008.00	Public		0			None	
	RIVER MARINE SERVICES INC	HWY 434	123K D 009.00	Public		0			None	
	TOWN OF CUMBERLAND CITY	MAIN ST 107	123K D 010.00	Individual	tiny parcel with small building	0			None	
	STONE SHERMAN	MAIN ST 112	123K D 011.00	Public		0			None	
	WALKER NICHOLAS R	MAIN ST 118	123K D 012.00	Public		0			None	
	TALMAGE SHIRLEY ALLENE (LT)	BASS AVE	123K D 013.00	Public		0			None	
	ASHLEY SANDRA MARIE	PULLEY ST 304	123K D 014.00	Public		0			None	
	RUMBLE HARRY C	PULLEY ST	123K D 015.00	Public		0			None	
	HUDSON MARY L	PULLEY ST 502	123K D 016.00	Public		0			None	
	LEWIS JAMES R III	PULLEY ST 508	123K D 017.00	Public		0			None	
	LEWIS MARY CLO	PULLEY ST 598	123K D 018.00	Public		0			None	
	YOUNG SCARLET ADAMS	PULLEY ST 600	123K D 018.01	Public		0			None	
	YOUNG MARK R	PULLEY ST 610	123K D 019.00	Public		0			None	
	GAETA CANDIDO C	DOUGHERTY ST 235	123K D 020.00	Public		0			None	
	STEWART CO	PULLEY ST	123K E 001.00	Public		0			None	
	HUDSON VERNECE D	PULLEY ST 509	123K E 002.00	Public		0			None	
	SYKES LARRY W	PARCHMAN AVE 110 112	123K E 003.00	Public		0			None	
	PERIGO WANDA FAYE	PULLEY ST 309	123K E 006.00	Public		0			None	

Table H.10-2 – CUF Plant Parcel Data Inside Survey Area
Cumberland Fossil Plant

ASSIGNED WELL ID	OWNER	PARCEL ADDRESS	PARCEL ID	STEWART COUNTY GIS WATER SERVICE DESIGNATION	RECENT AERIAL PHOTOGRAPH REVIEW NOTES	POTENTIAL PRIVATE WELLS/SPRINGS IDENTIFIED ON PARCEL AND INSIDE STUDY AREA	TDEC WELL LOG NUMBER	TDEC WELL LOG WELL DEPTH (feet below ground surface)	TVA/LAW ENGINEERING REPORT WELL ID	INCLUDE PARCEL IN DOOR-TO-DOOR SURVEY (YES/NO)
	BRYANT JOHN	BASS AVE 211	123K E 007.00	Public		0			None	
	NEIGHBORS CHARLES WALKER	BASS AVE 207	123K E 008.00	Public		0			None	
	NEIGHBORS CHARLES W	MAIN ST	123K E 008.01	Public		0			None	
	BARBER ALICIA	BASS ST 201	123K E 009.00	Public		0			None	
	COTTRELL SCOTTY	EDLIN AVE 112	123K E 010.00	Public		0			None	
	CEMETERY CUMBERLAND	EDLIN AVE	123K E 011.00	Public		0			None	
	MURPHY DARLENE R ETALS	MAIN ST 302	123K E 012.00	Public		0			None	
	FINCH CHARLES R	PARCHMAN 102	123K E 013.00	Public		0			None	
	BURGIN EVALEE ANN	PARCHMAN AVE 107	123K E 014.00	Public		0			None	
	CONNERS DARIN G	MCINTOSH AVE 122	123K E 017.00	Public		0			None	
	STEVENS WILLIAM	JACKSON AVE	123K G 003.00	Public		0			None	
	FELTS CHRISTOPHER S	JACKSON AVE 531	123K G 004.00	Public		0			None	
	PRIMM TOYO	JACKSON AVE	123K G 005.00	Public		0			None	
	DOWDY HERBERT A	CONGER ST	123K G 006.00	Public		0			None	
	DONALDSON BRAD	CONGER ST 533	123K G 007.00	Public		0			None	
	STEVENS WILLIAM A	JACKSON AVE 507	123K G 008.00	Public		0			None	
	STEVENS WILLIAM A	CONGER ST	123K G 009.00	Public		0			None	
	STEVENS DANIEL A	THOMAS AVE 227	123K G 010.00	Public		0			None	
	NORTON WILMA L	DOUGHERTY ST 302	123K G 011.00	Public		0			None	
	CUMBERLAND CITY	THOMAS AVE	123K G 012.00	Public		0			None	
	VAUGHN HART	DOUGHERTY ST 316	123K G 020.00	Public		0			None	
	CLEMENTS FRED ETUX GARNET	ROLLING HILLS DR 119	124 011.00	Individual	house present on parcel but outside Survey Area	0			None	
	SCHMIDT COREY C	ROLLING HILLS DR	124 012.00	Individual	vacant parcel - no buildings visible	0			None	
	PULLEY HOWARD	ROLLING HILLS DR	124 013.00	Individual	vacant parcel - no buildings visible	0			None	
	PULLEY HOWARD	ROLLING HILLS DR	124 014.00	Individual	vacant parcel - no buildings visible	0			None	
CUFPV-003	LEWIS FRANCIS MARIE	ROLLING HILLS DR 215	124 016.00	Individual	house present adjacent to well W7 and near spring S5	2			S5 (spring) & W7 (well)	
CUFPV-004	FEDERAL PROPERTY	OLD SCOTT RD 359	124 058.00	Individual	vacant parcel - no buildings visible	1	16100901 16100937 16100942 16100982 16101042 97004299 98000373	360 360 380 300 300 255 310	None	
CUFPV-005	PULLEY TRENT DANIEL	OLD SCOTT RD 359	124 058.01	Individual	house present adjacent to well W4	1			W4 (well)	
CUFPV-006	FEDERAL PROPERTY	OLD SCOTT RD 245	124 059.00	Individual	small building present at approximate location of well W3	1			W3 (well)	
	CEMETERY SCOTT	OLD SCOTT RD	124 060.00	Individual	possible cemetery - no buildings present	0			None	
	CEMETERY GRAVEYARD HILL	OLD SCOTT RD	124 061.00	Individual	possible cemetery - no buildings present	0			None	
	RYE G P & SIMPSON L C	OLD SCOTT RD	140 001.00	Individual	vacant parcel - no buildings visible	0			None	
	TWT ACQUISITION LLC	INDUSTRIAL PARK RD 211	140 012.03	Public		0			None	
						TOTAL = 7				

Table H.10-3 – TDEC Well Logs Located Inside Survey Area
Cumberland Fossil Plant

Parcel Identification Number	TDEC Well Log Number(s)	Comments
124 58.00	16100901 16100937 16100942 16101042 97004299 98000373	The latitude/longitude coordinates for these wells are identical (latitude 36°22'30" and longitude 87°40'0") and are approximately 90 feet outside of the Survey Area. This entire parcel appears to be pasture or forested land.
123 001.00	20050917	The latitude/longitude coordinates for this well are approximately 1500 feet west of the plant stacks. The well log lists the well use as "industrial". Based on information provided in Section 3.3.1 of the EIP, this log is related to an industrial well owned by Synthetic Materials, that is reportedly no longer in use.
119 021.00	20023996	Although the latitude/longitude coordinates for this well are approximately 15 feet outside the Survey Area, structures on this parcel straddle the Survey Area boundary. Private wells are typically constructed near the building(s) they serve.

Table H.10-4 – Parcels Inside CUF Plant Survey Area with Likely Private Water Source
Cumberland Fossil Plant

Assigned Well ID	Parcel ID	Potential Private Wells/Springs on Parcel and Inside Study Area	TDEC Well Log Number	TVA or Law Engineering Report Well ID	Stewart County Parcel Data – Water Source Listing	Recent Aerial Photograph Review Notes
CUFPV-001	119 021.00	1	20023996	None	Public	House and outbuilding present just inside Survey Area boundary
CUFPV-002	123 005.00	1	-	Rye Spring	Public	House and several small buildings present
CUFPV-003	124 016.00	2	-	S5 (spring) & W7 (well)	Individual	House present adjacent to well W7 and near spring S5
CUFPV-004	124 058.00	1	16100901* 16100937* 16100942* 16100982* 16101042* 97004299* 98000373*	None	Individual	Vacant parcel - no buildings visible
CUFPV-005	124 058.01	1	-	W4 (well)	Individual	House present adjacent to well W4
CUFPV-006	124 059.00	1	-	W3 (well)	Individual	Small building present at approximate location of well W3

*These TDEC well log records have the same latitude/longitude coordinates.

Table H.10-5 – Parcels Identified for Water Use Survey
Cumberland Fossil Plant

Exhibit H.10-3 Map Label	Parcel ID	Owner	Parcel Address	Potential Private Wells/Springs Identified
1	123 001.00	FEDERAL PROPERTY	CUMBERLAND CITY RD 815	No
2	140 001.01	GEORGIA-PACIFIC GYPSUM III	TEMPLE DR 150	No
3	123 005.00	RYE CASS S II	OLD HWY 149 344	Yes (Rye Spring)
4	140 003.00	RYE S RYE II & MATTHEW H, SETH	HWY 149 E	No
5	140 013.00	PITTS CHRISTOPHER R	WELLS CREEK	No
6	140 002.02	SIMPSON LEVI RYE CASS	INDUSTRIAL PARK RD	No
7	140 012.01	PITTS CHRISTOPHER R	INDUSTRIAL PARK RD	No
8	140 002.04	R J CORMAN RAILROAD CO	INDUSTRIAL PARK RD	No
9	140 002.00	STEWART/HOUSTON INDUSTRIAL	INDUSTRIAL PARK RD	No
10	140 002.07	HOUSTON CO MANUF LLC A TN	TEMPLE DR 136	No
11	140 002.05	TN CRYOGENICS LLC	INDUSTRIAL PARK RD 468	No
12	140 002.03	COMMERCIAL INSULATING GLASS	INDUSTRIAL PARK RD 476	No
13	140 012.00	STEWART/HOUSTON INDUSTRIAL	INDUSTRIAL PARK RD	No

Table H.10-6
SUMMARY OF SURVEYS COMPLETED
WATER SUPPLY WELL SURVEY
CUMBERLAND FOSSIL PLANT
CUMBERLAND CITY, TN

Exhibit H.11-3 Map Label	Parcel ID	Owner	Parcel Address	Owner Mailing Address				Dwelling Building (YES/NO)	Comments	Status
1	123 001.00	FEDERAL PROPERTY	CUMBERLAND CITY RD 815	*** EXEMPT PROPERTY ***				YES	CUF Plant - Plant manager reported no well on this parcel	survey complete
2	140 001.01	GEORGIA-PACIFIC GYPSUM III LLC ATTN: PROPERY TAX	TEMPLE DR 150	PO BOX 105681	ATLANTA	GA	30303	YES	owner reported no well on this parcel	survey complete
3	123 005.00	RYE CASS S II	OLD HWY 149 344	4210 WEST MAIN STREET	ERIN	TN	37061	YES	spring located on property	spring to be sampled
4	140 003.00	RYE S RYE II & MATTHEW H, SETH	HWY 149 E	4210 WEST MAIN STREET	ERIN	TN	37061	NO	owner reported no well on this parcel	survey complete
5	140 013.00	PITTS CHRISTOPHER R ETUX GAYE W	WELLS CREEK	23 PITTS LOOP	ERIN	TN	37061	NO	owner reported no well on this parcel	survey complete
6	140 002.02	SIMPSON LEVI RYE CASS	INDUSTRIAL PARK RD	4210 W MAIN STREET	ERIN	TN	37061	NO	owner reported no well on this parcel	survey complete
7	140 012.01	PITTS CHRISTOPHER R	INDUSTRIAL PARK RD	23 PITTS LOOP	ERIN	TN	37061	NO	owner reported no well on this parcel	survey complete
8	140 002.04	R J CORMAN RAILROAD CO	INDUSTRIAL PARK RD	PO BOX 788	NICHOLASVILLE	KY	40356	NO	owner reported no well on this parcel	survey complete
9	140 002.00	STEWART/HOUSTON INDUSTRIAL	INDUSTRIAL PARK RD	PO BOX 100	CUMBERLAND CITY	TN	37050	YES (none in Area of Interest)	owner reported no well on this parcel	survey complete
10	140 002.07	HOUSTON COUNTY MANUFACTURING OF TENNESSEE LLC	TEMPLE DR 136	1161 NEW HIGHWAY 7	COLUMBIA	TN	38401	YES	owner reported no well on this parcel	survey complete
11	140 002.05	TN CRYOGENICS LLC	INDUSTRIAL PARK RD 468	468 INDUSTRAIL PARK RD	CUMBERLAND CITY	TN	37050	YES	owner reported no well on this parcel	survey complete
12	140 002.03	COMMERCIAL INSULATING GLASS CO	INDUSTRIAL PARK RD 476	1299 ST CHARLES ROCK RD	BRIDGETON	MO	63044	YES	owner reported no well on this parcel	survey complete
13	140 012.00	STEWART/HOUSTON INDUSTRIAL	INDUSTRIAL PARK RD	PO BOX 100	CUMBERLAND CITY	TN	37050	YES (none in Area of Interest)	owner reported no well on this parcel	survey complete

TABLE H.10-7 - SUMMARY OF PROPERTIES WITH WELL/SPRING IDENTIFIED
WATER SUPPLY WELL SURVEY
Cumberland Fossil Plant
CUmberland City, Tennessee

CUFPV Identification Number	Parcel ID	Owner	Well/Spring Present	Number of Wells/Springs	Well/Spring Used for Potable Water	Access Agreement	Number of Wells/Springs Sampled	Sample Collection Date	Sampling Event Comments
CUFPV-002	123 005.00	RYE CASS S II	Yes (spring)	1	No	Yes	1	4-Jan-23	

Table H.10-8a - Summary of Historical Surface Water Analytical Data
Cumberland Fossil Plant

Sample Location	Sample Date	Sample ID	Sample Type	Boron	Calcium	Chloride	Fluoride	Magnesium	Potassium	Sodium	Sulfate
				ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Rye Spring	11-Jan-94	CUF-RS-0194	Normal Environmental Sample	<500	110,000	9,000	400	5,800	700	5,500	43,000
	5-Apr-94	CUF-RS-0494	Normal Environmental Sample	<500	110,000	9,000	400	5,800	700	5,300	45,000
	19-Jul-94	CUF-RS-0794	Normal Environmental Sample	<500	120,000	10,000	200	6,100	800	5,100	43,000
	31-Jan-95	CUF-RS-0195	Normal Environmental Sample	<500	110,000	7,000	300	6,500	500	5,100	19,000
	13-Jul-95	CUF-RS-0795	Normal Environmental Sample	<500	110,000	9,000	400	6,100	700	4,900	48,000
	17-Jan-96	CUF-RS-0196	Normal Environmental Sample	<500	120,000	7,000	400	6,000	700	5,000	43,000
	24-Jul-96	CUF-RS-0796	Normal Environmental Sample	<500	100,000	9,000	300	5,300	900	5,300	44,000
	16-Jan-97	CUF-RS-0197	Normal Environmental Sample	<500	110,000	7,000	300	5,400	800	5,000	56,000
	23-Jul-97	CUF-RS-0797	Normal Environmental Sample	<500	110,000	8,000	<100	5,700	500	5,000	51,000
	29-Jan-98	CUF-RS-0198	Normal Environmental Sample	<500	100,000	8,000	300	5,400	400	5,300	42,000
	29-Jan-98	CUF-RS-0198-DUP	Field Duplicate Sample	<500	110,000	8,000	300	5,600	400	5,300	45,000
	15-Jul-98	CUF-RS-0798	Normal Environmental Sample	<200	110,000	8,000	300	5,700	1,000	5,200	55,000
	25-Jan-99	CUF-RS-0199	Normal Environmental Sample	<200	100,000	12,000	200	5,400	800	4,700	72,000
	21-Jul-99	CUF-RS0799	Normal Environmental Sample	<200	110,000	10,000	400	6,100	1,400	5,100	66,000
	19-Jan-00	CUF-RS0100	Normal Environmental Sample	80	100,000	11,000	300	7,200	3,900	5,400	54,000
	11-Jul-00	CUF-RS-0700	Normal Environmental Sample	<200	140,000	39,000	440	13,000	42,000	7,200	22,000
	11-Jul-00	CUF-RS-0700-DUP	Field Duplicate Sample	<200	130,000	38,000	440	12,000	42,000	7,200	20,000
	29-Jan-01	CUF-RS0101	Normal Environmental Sample	210	120,000	10,000	270	7,100	1,000	5,900	67,000
	10-Jul-01	CUF-RS0701	Normal Environmental Sample	200	110,000	11,000	300	6,600	1,700	4,900	51,000
	16-Jan-02	CUF-RS0102	Normal Environmental Sample	290	92,000	14,000	320	6,500	3,900	3,600	44,000
	9-Jul-02	CUF-RS0702	Normal Environmental Sample	<200	70,000	22,000	820	8,500	24,000	5,700	38,000
	29-Jan-03	CUF-RS0103	Normal Environmental Sample	<200	95,000	13,000	320	6,000	4,900	5,000	48,000
	23-Jul-03	CUF-RS0703	Normal Environmental Sample	200	53,000	18,000	550	7,100	21,000	5,000	22,000
	26-Jan-04	CUF-RS-0104	Normal Environmental Sample	<200	110,000	12,000	260	5,800	300	5,900	47,000
	26-Jan-04	CUF-RS-0104-DUP	Field Duplicate Sample	<200	110,000	12,000	260	5,900	300	5,500	49,000
	14-Jul-04	CUF-RS0704	Normal Environmental Sample	<200	120,000	11,000	260	6,700	<100	4,000	50,000
	19-Jan-05	CUF-RS0105	Normal Environmental Sample	<200	120,000	11,000	240	6,400	2,100	7,400	45,000
	12-Jul-05	CUF-RS0705	Normal Environmental Sample	<200	120,000	9,800	280	6,100	1,800	6,000	45,000
	25-Jan-06	CUF-RS0106	Normal Environmental Sample	<200	110,000	9,600	270	5,800	900	8,600	49,000
	19-Jul-06	CUF-RS0706	Normal Environmental Sample	<200	120,000	8,900	270	6,700	1,300	5,600	46,000
	23-Jan-07	CUF-RS0107	Normal Environmental Sample	<200	110,000	6,600	230	5,900	1,600	3,500	49,000
	11-Jul-07	CUF-RS0707	Normal Environmental Sample	<200	120,000	7,400	250	6,500	2,500	5,400	46,000
	23-Jan-08	CUF-RS0108	Normal Environmental Sample	<200	120,000	7,400	230	6,300	1,200	7,000	48,000
	16-Jul-08	CUF-RS-0708	Normal Environmental Sample	<200	140,000	9,000	200	13,000	8,200	6,200	30,000
	21-Jan-09	CUF-RS-0109	Normal Environmental Sample	260	130,000	8,000	220	6,600	1,100	6,600	52,000
	13-Apr-09	CUF-RS-0409	Normal Environmental Sample	-	-	-	380	-	-	-	-
	22-Jul-09	CUF-RS-0709	Normal Environmental Sample	2,200	420,000	9,700	260	16,000	6,200	26,000	38,000
	7-Oct-09	CUF-RS-1009	Normal Environmental Sample	<200	130,000	9,600	260	6,800	1,700	6,300	50,000
	14-Jan-10	CUF-RS0110	Normal Environmental Sample	320	130,000	8,800	260	6,800	4,400	6,600	52,000
	7-Apr-10	CUF-RS-0410	Normal Environmental Sample	970	210,000	10,000	210	10,000	28,000	18,000	51,000
	22-Jul-10	CUF-RS0710	Normal Environmental Sample	<200	130,000	8,600	230	9,400	5,900	6,200	51,000
	27-Oct-10	CUF-RS-1010	Normal Environmental Sample	270	130,000	15,000	220	11,000	11,000	6,800	68,000
	19-Jan-11	CUF-RS-0111	Normal Environmental Sample	<200	130,000	9,200	200	6,800	710	6,500	55,000 J
	4-Apr-11	CUF-RS-0411	Normal Environmental Sample	280	110,000	7,800	190	5,900	500 UJ	5,900	51,000
	27-Jul-11	CUF-RS-0711	Normal Environmental Sample	<200	110,000	7,300	230	5,700	780	6,100	48,000
	4-Oct-11	CUF-RS-1011	Normal Environmental Sample	<200	110,000	7,400	230	5,900	800	5.6 5.6e+006	50,000
	10-Jan-12	CUF-RS-0112	Normal Environmental Sample	<200	120,000	6,500	260	6,300	1,200	6,000	52,000
	18-Apr-12	CUF-RS-0412	Normal Environmental Sample	-	-	-	220	-	-	-	-
	18-Jul-12	CUF-RS-0712	Normal Environmental Sample	-	-	-	290	-	-	-	-
	17-Oct-12	CUF-RS-1012	Normal Environmental Sample	<200	120,000	7,900	360	6,200	1,100	5,400	57,000
	14-Jan-13	CUF-RS-0113	Normal Environmental Sample	-	-	-	220	-	-	-	-
	3-Apr-13	CUF-RS-0413	Normal Environmental Sample	<200	110,000	11,000	310	6,000	1,100	5,700	57,000
	2-Jul-13	CUF-RS-0713	Normal Environmental Sample	-	-	-	220	-	-	-	-
	9-Oct-13	CUF-RS1013	Normal Environmental Sample	-	110,000	6,700	<400	5,570	806	5,220	57,100
	22-Jan-14	CUF-RS0114	Normal Environmental Sample	-	-	-	276	-	-	-	-
	22-Jan-14	CUF-RS-0114	Normal Environmental Sample	-	-	-	276	-	-	-	-
	8-Apr-14	CUF-RS-0414	Normal Environmental Sample	-	-	-	182	-	-	-	-
	22-Jul-14	CUF-RS-0714	Normal Environmental Sample	-	-	-	221	-	-	-	-
	9-Oct-14	CUF-RS1014	Normal Environmental Sample	-	-	-	230	-	-	-	-
	14-Jan-15	CUF-RS-0115	Normal Environmental Sample	-	-	-	200	-	-	-	-
	14-Apr-15	CUF-RS-0415	Normal Environmental Sample	-	-	-	207	-	-	-	-
	21-Jul-15	CUF-RS0715	Normal Environmental Sample	-	-	-	256	-	-	-	-
	21-Oct-15	CUF-RS-1015	Normal Environmental Sample	-	-	-	259	-	-	-	-
	26-Jan-16	CUF-RS-0116	Normal Environmental Sample	-	-	-	231	-	-	-	-
	13-Apr-16	CUF-RS-0416	Normal Environmental Sample	-	-	-	232	-	-	-	-
Wells Creek (Upgradient)	11-Jan-94	CUF-WCUP-0194	Normal Environmental Sample	<500	49,000	5,000	200	3,900	900	2,700	9,000
	5-Apr-94	CUF-WCUP-0494	Normal Environmental Sample	<500	47,000	5,000	200	3,500	1,000	2,500	8,000
	19-Jul-94	CUF-WCUP-0794	Normal Environmental Sample	<500	56,000	7,000	<100	4,300	2,800	3,200	7,000
	31-Jan-95	CUF-WCUP-0195	Normal Environmental Sample	<500	56,000	3,000	100	5,100	900	2,500	7,000
	13-Jul-95	CUF-WCUP-0795	Normal Environmental Sample	<500	55,000	5,000	200	4,400	1,200	2,800	7,000
	13-Jul-95	CUF-WCUP-0795-DUP	Field Duplicate Sample	<500	57,000	5,000	200	4,500	1,100	2,800	7,000
	17-Jan-96	CUF-WCUP-0196	Normal Environmental Sample	<500	53,000	6,000	200	4,200	900	2,600	11,000
	24-Jul-96	CUF-WCUP-0796	Normal Environmental Sample	<500	53,000	5,000	<100	4,100	1,700	4,200	8,000
	16-Jan-97	CUF-WCUP-0197	Normal Environmental Sample	<500	46,000	6,000	<100	3,400	1,000	3,000	10,000
	23-Jul-97	CUF-WCUP-0797	Normal Environmental Sample	<500	56,000	5,000	<100	4,600	1,200	2,800	6,000
	29-Jan-98	CUF-WCUP-0198	Normal Environmental Sample	<500	54,000	5,000	<100	4,400	1,000	3,100	7,000
	15-Jul-98	CUF-WCUP-0798	Normal Environmental Sample	<200	47,000	4,000	<100	3,800	1,400	2,500	8,000
	25-Jan-99	CUF-WCUP-0199	Normal Environmental Sample	<200	39,000	5,000	<100	3,100	1,200	2,500	11,000
	21-Jul-99	CUF-WCUP-0799	Normal Environmental Sample	<200	57,000	5,000	<100	4,500	900	3,300	8,000
	19-Jan-00	CUF-WCUP-0100	Normal Environmental Sample	<200	50,000	5,900	100	4,300	1,100	3,500	8,000
	19-Jan-00	CUF-WCUP-0100-DUP	Field Duplicate Sample	<200	49,000	5,100	100	4,300	1,100	3,400	8,000
	11-Jul-00	CUF-WCUP-0700	Normal Environmental Sample	<200	58,000	7,100	100	4,900	1,200	3,900	7,000
	29-Jan-01	CUF-WCUP-0101	Normal Environmental Sample	240	60,000	9,000	100	5,500	1,100	4,000	9,000
	10-Jul-01	CUF-WCUP-0701	Normal Environmental Sample	230	51,000	6,000	110	4,400	1,300	3,400	7,000
	16-Jan-02	CUF-WCUP-0102	Normal Environmental Sample	410	58,000	5,600	<100	5,000	930	1,800	7,000
	16-Jan-02	CUF-WCUP-0102-DUP	Field Duplicate Sample	340	56,000	5,200	<100	4,800	930	1,800	7,000
	9-Jul-02	CUF-WCUP-0702	Normal Environmental Sample	<200	62,000	4,400	100	5,200	790	3,200	5,900
	29-Jan-03	CUF-WCUP-0103	Normal Environmental Sample	<200	51,000	7,700	110	4,000	1,000	4,000	5,700
	23-Jul-03	CUF-WCUP-0703	Normal Environmental Sample	300	57,000	4,800	<100	4,600	1,100	3,100	7,300
	23-Jul-03	CUF-WCUP-0703-DUP	Field Duplicate Sample	200	56,000	4,700	100	4,500	1,100	3,100	7,100
	26-Jan-04	CUF-WCUP-0104	Normal Environmental Sample	<200	38,000	4,100	<100	2,900	700	1,900	6,100
	14-Jul-04	CUF-WCUP-0704	Normal Environmental Sample	<200	58,000	4,800	100	4,600	1,100	1,500	5,100
	19-Jan-05	CUF-WCUP-0105	Normal Environmental Sample	<200	48,000	4,800	<100	3,800	2,300	3,300	7,000
	12-Jul-05	CUF-WCUP-0705	Normal Environmental Sample	<200	58,000	4,300	110	4,300	1,900	3,800	6,000
	12-Jul-05	CUF-WCUP-0705-DUP	Field Duplicate Sample	<200	57,000	4,500	100	4,300	1,900	3,500	6,000
	25-Jan-06	CUF-WCUP-0106	Normal Environmental Sample	<200	39,000	4,600	100	2,900	1,200	4,800	7,200
	19-Jul-06	CUF-WCUP-0706	Normal Environmental Sample	<200	57,000	5,800	110	4,700	1,300	3,200	6,000
	23-Jan-07	CUF-WCUP-0107	Normal Environmental Sample	<200	43,000	3,400	<100	3,200	1,000	<100	7,000
	11-Jul-07	CUF-WCUP-0707	Normal Environmental Sample	<200	46,000	3,400	<100	3,700	2,900	3,000	<5,000
	11-Jul-07	CUF-WCUP-0707-DUP	Field Duplicate Sample	<200	46,000	3,400	<100	3,700	2,700	2,900	<5,000
	23-Jan-08	CUF-WCUP-0108	Normal Environmental Sample	<200	51,000	3,600	<100	4,400	1,700	2,800	6,300
	16-Jul-08	CUF-WC(UP)-0708	Normal Environmental Sample	<200	54,000	4,300	<100	4,300	1,200	3,400	5,900
	21-Jan-09	CUF-WC(UP)-0109	Normal Environmental Sample	<200	54,000	4,300	<100	4,400	1,200	3,600	6,600
	13-Apr-09	CUF-WCUP-0409	Normal Environmental Sample	-	-	-	210	-	-	-	-
	22-Jul-09	CUF-WC UP-0709	Normal Environmental Sample	<200	54,000	5,300	<100	4,400	1,400	3,600	5,600
	7-Oct-09	CUF-WC(UP)-1009	Normal Environmental Sample	<200	60,000	5,100	<100	4,900	1,600	3,700	5,900

See last page for notes.

Table H.10-8a - Summary of Historical Surface Water Analytical Data
Cumberland Fossil Plant

Sample Location	Sample Date	Sample ID	Sample Type	Boron ug/L	Calcium ug/L	Chloride ug/L	Fluoride ug/L	Magnesium ug/L	Potassium ug/L	Sodium ug/L	Sulfate ug/L
Wells Creek (Upgradient)	14-Jan-10	CUF-WCUP-0110	Normal Environmental Sample	<200	55,000	4,700	<100	4,700	600	3,400	6,300
	7-Apr-10	CUF-WCUP-0410	Normal Environmental Sample	<200	49,000	4,900	<100	3,600	970	3,300	5,600
	22-Jul-10	CUF-WCUP-0710	Normal Environmental Sample	<200	54,000	5,500	<100	4,400	1,200	3,800	6,100
	27-Oct-10	CUF-WCUP-1010	Normal Environmental Sample	<200	58,000	5,200	<100	4,900	1,400	4,000	6,000
	27-Oct-10	CUF-WCUP-1010-DUP	Field Duplicate Sample	<200	55,000	5,200	<100	4,800	1,400	3,900	6,000
	19-Jan-11	CUF-WCUP-0111	Normal Environmental Sample	<200	57,000	7,500	<100	4,700	790	4,400	7,500 J
	4-Apr-11	CUF-WCUP-0411	Normal Environmental Sample	<200	45,000	5,800	<100	3,500	1,100	3,400	6,700
	27-Jul-11	CUF-WCUP-0711	Normal Environmental Sample	<200	53,000	5,800	<100	4,400	1,600	4,100	6,700
	4-Oct-11	CUF-WCUP-0711-DUP	Field Duplicate Sample	<200	54,000	6,100	<100	4,600	1,200	3,700	7,600
	4-Oct-11	CUF-WCUP-1011	Normal Environmental Sample	<200	57,000	6,200	<100	4,800	1,200	3,800	7,600
	10-Jan-12	CUF-WCUP-0112	Normal Environmental Sample	<200	54,000	5,000	<100	4,200	1,100	3,400	7,200
	18-Apr-12	CUF-WCUP-0412	Normal Environmental Sample	-	-	-	<100	-	-	-	-
	18-Jul-12	CUF-WCUP-0712	Normal Environmental Sample	-	-	-	<100	-	-	-	-
	18-Jul-12	CUF-WCUP-0712-DUP	Field Duplicate Sample	-	-	-	<100	-	-	-	-
	17-Oct-12	CUF-WCUP-1012	Normal Environmental Sample	<200	57,000	5,700	<100	4,900	1,200	3,500	6,600
	14-Jan-13	CUF-WCUP-0113	Normal Environmental Sample	-	-	-	<100	-	-	-	-
	3-Apr-13	CUF-WCUP-0413	Normal Environmental Sample	<200	46,000	9,800	120	3,400	900	2,800	8,700
	3-Apr-13	CUF-WCUP-0413-DUP	Field Duplicate Sample	<200	42,000	3,600	<100	3,300	970	2,700	7,000
	2-Jul-13	CUF-WCUP-0713	Normal Environmental Sample	-	-	-	<100	-	-	-	-
	9-Oct-13	CUF-WCUP-1013	Normal Environmental Sample	-	56,600	5,500	<400	4,580	1,430	3,220	7,900
	22-Jan-14	CUF-UP-0114-DUP	Field Duplicate Sample	-	-	-	104	-	-	-	-
	22-Jan-14	CUF-WCUP-0114	Normal Environmental Sample	-	-	-	101	-	-	-	-
	22-Jan-14	CUF-WC-UP-0114	Normal Environmental Sample	-	-	-	101	-	-	-	-
	22-Jan-14	CUF-WCUP-0114-DUP	Field Duplicate Sample	-	-	-	104	-	-	-	-
	8-Apr-14	CUF-WC-UP-0414	Normal Environmental Sample	-	-	-	<100	-	-	-	-
	22-Jul-14	CUF-WC-UP-0714	Normal Environmental Sample	-	-	-	<100	-	-	-	-
	8-Oct-14	CUF-WCUP-1014	Normal Environmental Sample	-	-	-	<100	-	-	-	-
	14-Jan-15	CUF-WCUP-0115	Normal Environmental Sample	-	-	-	<100	-	-	-	-
	14-Apr-15	CUF-WCUP-0415	Normal Environmental Sample	-	-	-	100	-	-	-	-
	14-Apr-15	CUF-WCUP-0415-DUP	Field Duplicate Sample	-	-	-	<100	-	-	-	-
	21-Jul-15	CUF-WCUP-0715	Normal Environmental Sample	-	-	-	<100	-	-	-	-
	21-Oct-15	CUF-WCUP-1015	Normal Environmental Sample	-	-	-	<100	-	-	-	-
	26-Jan-16	CUF-WCUP-0116	Normal Environmental Sample	-	-	-	<100	-	-	-	-
	13-Apr-16	CUF-WCUP-0416	Normal Environmental Sample	-	-	-	<100	-	-	-	-

Notes:

Please note that units have been converted automatically in this table, and significant figures may not have been maintained.

15.2	Measured concentration did not exceed the indicated standard.
<0.03	Analyte was not detected at a concentration greater than the laboratory reporting limit.
ID	identification
J	quantitation is approximate due to limitations identified during data validation
U*	result should be considered "not detected" because it was detected in an associated field or laboratory blank at a similar level
UJ	This compound was not detected, but the reporting or detection limit should be considered estimated due to a bias identified during data validation.
ug/L	micrograms per Liter

Table H.10-8b - Summary of Groundwater Analytical Results
Cumberland Fossil Plant

					Total Metals				Dissolved Metals				Anions		
					Calcium	Magnesium	Potassium	Sodium	Calcium	Magnesium	Potassium	Sodium	Chloride	Fluoride	Sulfate
Sample Location	Sample Date	Sample ID	Sample Depth	Sample Type	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
	9-Nov-16	CUF-GW-011-11092016	26 ft	Normal Environmental Sample	27,000	-	-	-	-	-	-	-	1,330	150	1,120
	23-Jan-17	CUF-GW-011-01232017	26 ft	Normal Environmental Sample	25,000	-	-	-	24,800	-	-	-	1,650	141 U*	1,930 U*
	7-Feb-17	CUF-GW-011-02072017	26 ft	Normal Environmental Sample	25,000	-	-	-	24,600	-	-	-	1,440	150	1,520
	7-Mar-17	CUF-GW-011-03072017	26 ft	Normal Environmental Sample	24,400	-	-	-	25,000	-	-	-	1,130 U*	137 U*	1,080 J
	4-Apr-17	CUF-GW-011-04042017	26 ft	Normal Environmental Sample	28,800	-	-	-	-	-	-	-	1,670	149	1,970
	2-May-17	CUF-GW-011-05022017	26 ft	Normal Environmental Sample	24,300	-	-	-	-	-	-	-	1,650	156	1,900
	30-May-17	CUF-GW-011-05302017	26 ft	Normal Environmental Sample	24,100	-	-	-	-	-	-	-	1,520	147	1,370
	11-Jul-17	CUF-GW-011-07112017	26 ft	Normal Environmental Sample	25,900	-	-	-	-	-	-	-	1,460	185	1,580
	26-Jul-17	CUF-GW-011-07262017	26 ft	Normal Environmental Sample	24,600	-	-	-	-	-	-	-	1,440	150	1,340
	16-Aug-17	CUF-GW-011-08162017	26 ft	Normal Environmental Sample	26,000	-	-	-	-	-	-	-	1,440	147	1,060
	29-Aug-17	CUF-GW-011-08292017	26 ft	Normal Environmental Sample	25,800	-	-	-	-	-	-	-	1,540	155	1,260
	2-Oct-17	CUF-GW-011-10022017	26 ft	Normal Environmental Sample	24,700	-	-	-	-	-	-	-	1,560	130	1,110
	18-Oct-17	CUF-201	26 ft	Normal Environmental Sample	25,500	-	-	-	-	-	-	-	1,550	222	1,020
	25-Jan-18	CUF-201-0118	26 ft	Normal Environmental Sample	25,300	-	-	-	-	-	-	-	1,300	146	1,390
	5-Apr-18	CUF-201-0418	26 ft	Normal Environmental Sample	26,300	-	-	-	-	-	-	-	2,100	<100	1,520
	30-May-18	CUF-GW-011-05302018	26 ft	Normal Environmental Sample	23,400	-	-	-	-	-	-	-	1,500	140	1,550
	19-Jun-18	CUF-GW-011-06192018	26 ft	Normal Environmental Sample	25,900	-	-	-	-	-	-	-	1,060 J	114	1,260 J
	10-Jul-18	CUF-GW-011-07102018	26 ft	Normal Environmental Sample	25,300	-	-	-	-	-	-	-	984 J	130	1,140
	31-Jul-18	CUF-GW-011-07312018	26 ft	Normal Environmental Sample	25,500	-	-	-	-	-	-	-	1,410	94 J	1,470
	20-Aug-18	CUF-GW-011-08202018	26 ft	Normal Environmental Sample	25,000	-	-	-	-	-	-	-	1,650	97.8 J	1,680
	17-Jan-19	CUF-GW-011-01172019	26 ft	Normal Environmental Sample	25,200	3,380	630	3,100	-	-	-	-	1,570	149	1,700
	24-Jan-19	201-0119	26 ft	Normal Environmental Sample	22,600	-	-	-	-	-	-	-	1,760	145	1,150
CUF-201	5-Feb-19	CUF-GW-011-02052019	26 ft	Normal Environmental Sample	23,700	3,410	720	3,550	-	-	-	-	1,620	134	1,030
	10-Apr-19	CUF-201	26 ft	Normal Environmental Sample	24,700	-	-	-	-	-	-	-	1,730	107	1,960 U*
	7-May-19	CUF-GW-011-05072019	26 ft	Normal Environmental Sample	24,400 J	3,570 J	570 J	3,100	-	-	-	-	1,780	113	2,160
	29-Jul-19	CUF-GW-011-07292019	26 ft	Normal Environmental Sample	23,900	3,650	476 J	3,270	-	-	-	-	1,290	88.9 J	1,280
	8-Oct-19	CUF-GW-011-10082019	26 ft	Normal Environmental Sample	25,900	3,780	580	4,120	-	-	-	-	1,440	104	1,280 U*
	28-Jan-20	CUF-GW-011-01282020	26 ft	Normal Environmental Sample	23,200	3,090	551	2,860	-	-	-	-	1,700	122	1,560 J
	10-Mar-20	CUF-GW-011-03102020	26 ft	Normal Environmental Sample	24,700	3,440	499 J	2,790	-	-	-	-	1,720	<26.3	1,730
	9-Apr-20	CUF-201-0420	26 ft	Normal Environmental Sample	24,100	-	-	-	-	-	-	-	1,900	141	1,750 J
	28-Jul-20	CUF-GW-011-07282020	26 ft	Normal Environmental Sample	24,200	3,660	549	3,240	-	-	-	-	1,540	100 J	1,280
	10-Sep-20	CUF-GW-011-09102020	26 ft	Normal Environmental Sample	25,800	3,510	496 J	3,150	-	-	-	-	1,460	126	1,330 J
	6-Oct-20	CUF-201-1020	26 ft	Normal Environmental Sample	25,100	-	-	-	-	-	-	-	1,230 J	95.5 J	739 J
	19-Jan-21	CUF-GW-CUF-201-01192021	26 ft	Normal Environmental Sample	24,200	3,300	535	2,810	-	-	-	-	1,790	159 U*	1,690 J
	2-Mar-21	CUF-GW-CUF-201-03022021	26 ft	Normal Environmental Sample	24,700	3,370	526	2,880	-	-	-	-	1,650	129	1,470
	14-Apr-21	CUF-GW-201-04142021	26 ft	Normal Environmental Sample	24,900	-	-	-	-	-	-	-	1,690	105	1,270
	15-Jul-21	CUF-GW-CUF-201-07152021	26 ft	Normal Environmental Sample	25,500	3,440	555	3,200	-	-	-	-	1,790	112 U*	1,350
	17-Aug-21	CUF-GW-CUF-201-08172021	26 ft	Normal Environmental Sample	23,400	3,450	539	3,240	-	-	-	-	1,470	180	1,180
	14-Oct-21	CUF-GW-CUF-201-10142021	26 ft	Normal Environmental Sample	25,200	-	-	-	-	-	-	-	1,640 J	150	1,310
	19-Jan-22	CUF-GW-CUF-201-01192022	26 ft	Normal Environmental Sample	22,500	3,420	510	2,880	-	-	-	-	1,590	106 U*	1,610
	2-Mar-22	CUF-GW-CUF-201-03022022	26 ft	Normal Environmental Sample	23,900	3,370	559	2,940	-	-	-	-	1,710	126	1,850
	14-Apr-22	CUF-GW-CUF-201-04142022	26 ft	Normal Environmental Sample	24,900	-	-	-	-	-	-	-	1,740	110 U*	2,220
	12-Jul-22	CUF-GW-CUF-201-07122022	26 ft	Normal Environmental Sample	25,300	3,640	572	3,130	-	-	-	-	1,640	104	1,850
	23-Aug-22	CUF-GW-CUF-201-08232022	26 ft	Normal Environmental Sample	23,800	3,520	563	3,280	-	-	-	-	1,540	95.1 U*	1,300 U*
	20-Oct-22	CUF-GW-CUF-201-10202022	26 ft	Normal Environmental Sample	25,600 J	-	-	-	-	-	-	-	<713	88.4 J	<756
	9-Nov-16	CUF-GW-012-11092016	18 ft	Normal Environmental Sample	61,100	-	-	-	-	-	-	-	1,450	196	15,600
	24-Jan-17	CUF-GW-012-01242017	18 ft	Normal Environmental Sample	61,900	-	-	-	-	-	-	-	1,550	191 U*	17,000
	6-Feb-17	CUF-GW-012-02062017	18 ft	Normal Environmental Sample	62,200	-	-	-	-	-	-	-	1,330	212	17,600
	7-Mar-17	CUF-GW-012-03072017	18 ft	Normal Environmental Sample	63,700	-	-	-	-	-	-	-	1,220 U*	218 U*	14,700
	4-Apr-17	CUF-GW-012-04042017	18 ft	Normal Environmental Sample	75,500	-	-	-	-	-	-	-	1,430	203	16,600
	2-May-17	CUF-GW-012-05022017	18 ft	Normal Environmental Sample	67,800	-	-	-	-	-	-	-	1,360	215	16,100
CUF-202	30-May-17	CUF-GW-012-05302017	18 ft	Normal Environmental Sample	60,800	-	-	-	-	-	-	-	1,290	195	15,100
	11-Jul-17	CUF-GW-012-07112017	18 ft	Normal Environmental Sample	60,200	-	-	-	-	-	-	-	1,430	265	16,600
	26-Jul-17	CUF-GW-012-07262017	18 ft	Normal Environmental Sample	62,500	-	-	-	-	-	-	-	1,440	215	15,800
	17-Aug-17	CUF-GW-012-08172017	18 ft	Normal Environmental Sample	62,500	-	-	-	-	-	-	-	1,520	216	16,200
	29-Aug-17	CUF-GW-012-08292017	18 ft	Normal Environmental Sample	63,500	-	-	-	-	-	-	-	1,540	216	17,100
	2-Oct-17	CUF-GW-012-10022017	18 ft	Normal Environmental Sample	60,700	-	-	-	-	-	-	-	1,740	184	14,600
	18-Oct-17	CUF-202	18 ft	Normal Environmental Sample	61,600	-	-	-	-	-	-	-	1,670	311	15,200

See last page for notes.

Table H.10-8b - Summary of Groundwater Analytical Results
Cumberland Fossil Plant

					Total Metals				Dissolved Metals				Anions		
					Calcium	Magnesium	Potassium	Sodium	Calcium	Magnesium	Potassium	Sodium	Chloride	Fluoride	Sulfate
Sample Location	Sample Date	Sample ID	Sample Depth	Sample Type	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
CUF-202	25-Jan-18	CUF-202-0118	18 ft	Normal Environmental Sample	65,100	-	-	-	-	-	-	-	1,350	170	16,400
	5-Apr-18	CUF-202-0418	18 ft	Normal Environmental Sample	63,300	-	-	-	-	-	-	-	1,530	178	17,200
	30-May-18	CUF-GW-012-05302018	18 ft	Normal Environmental Sample	60,100	-	-	-	-	-	-	-	1,280	222	15,600
	19-Jun-18	CUF-GW-012-06192018	18 ft	Normal Environmental Sample	66,900	-	-	-	-	-	-	-	978 J	184	12,500 J
	10-Jul-18	CUF-GW-012-07102018	18 ft	Normal Environmental Sample	60,700	-	-	-	-	-	-	-	819 J	164	11,900
	31-Jul-18	CUF-GW-012-07312018	18 ft	Normal Environmental Sample	63,900	-	-	-	-	-	-	-	1,420	178	16,800
	21-Aug-18	CUF-GW-012-08212018	18 ft	Normal Environmental Sample	58,300	-	-	-	-	-	-	-	1,520	161	17,300
	17-Jan-19	CUF-GW-012-01172019	18 ft	Normal Environmental Sample	60,100	6,560	1,100	1,930	-	-	-	-	1,300	201	17,100
	24-Jan-19	202-0119	18 ft	Normal Environmental Sample	61,400	-	-	-	-	-	-	-	1,420	201	15,900
	5-Feb-19	CUF-GW-012-02052019	18 ft	Normal Environmental Sample	59,500	6,530	1,090	1,940	-	-	-	-	1,310	201	17,700
	10-Apr-19	CUF-202	18 ft	Normal Environmental Sample	64,000	-	-	-	-	-	-	-	1,430	175	17,000
	7-May-19	CUF-GW-012-05072019	18 ft	Normal Environmental Sample	63,200 J	7,310 J	1,070 J	2,030	-	-	-	-	1,410	167	17,400
	30-Jul-19	CUF-GW-012-07302019	18 ft	Normal Environmental Sample	60,800	7,470	1,120	1,960	-	-	-	-	1,430	150	17,100
	8-Oct-19	CUF-GW-012-10082019	18 ft	Normal Environmental Sample	64,800	7,420	1,210	2,140	-	-	-	-	1,390	137	16,800
	28-Jan-20	CUF-GW-012-01282020	18 ft	Normal Environmental Sample	63,500	7,200	1,110	2,040	-	-	-	-	1,380	181	16,500
	10-Mar-20	CUF-GW-012-03102020	18 ft	Normal Environmental Sample	62,700	6,860	975	1,890	-	-	-	-	1,370	118	17,300
	9-Apr-20	CUF-202-0420	18 ft	Normal Environmental Sample	62,700	-	-	-	-	-	-	-	1,280	188	16,000
	28-Jul-20	CUF-GW-012-07282020	18 ft	Normal Environmental Sample	60,700	7,380	1,100	1,960	-	-	-	-	1,430	125 J	17,100
	9-Sep-20	CUF-GW-012-09092020	18 ft	Normal Environmental Sample	62,500	6,890	1,130	1,870	-	-	-	-	1,360	164	17,000
	6-Oct-20	CUF-202-1020	18 ft	Normal Environmental Sample	64,600	-	-	-	-	-	-	-	1,400	170	16,600
	19-Jan-21	CUF-GW-CUF-202-01192021	18 ft	Normal Environmental Sample	63,500	6,750	1,090	1,920	-	-	-	-	1,870	223 U*	19,000 J
	2-Mar-21	CUF-GW-CUF-202-03022021	18 ft	Normal Environmental Sample	64,900	6,820	1,070	2,210	-	-	-	-	1,390	157	18,400
	14-Apr-21	CUF-GW-202-04142021	18 ft	Normal Environmental Sample	63,800	-	-	-	-	-	-	-	1,390	143	17,800
	15-Jul-21	CUF-GW-CUF-202-07152021	18 ft	Normal Environmental Sample	62,700	6,790	1,090	1,880	-	-	-	-	1,570	156 U*	19,500
	17-Aug-21	CUF-GW-CUF-202-08172021	18 ft	Normal Environmental Sample	58,600	7,110	1,150	1,880	-	-	-	-	1,670	208	19,500
	14-Oct-21	CUF-GW-CUF-202-10142021	18 ft	Normal Environmental Sample	64,900	-	-	-	-	-	-	-	1,510 J	188	18,000
	18-Jan-22	CUF-GW-CUF-202-01182022	18 ft	Normal Environmental Sample	59,100	7,080	1,020	1,980	-	-	-	-	1,470	152	19,000
	2-Mar-22	CUF-GW-CUF-202-03022022	18 ft	Normal Environmental Sample	60,000	6,790	1,050	1,900	-	-	-	-	1,410	193	21,700
	14-Apr-22	CUF-GW-CUF-202-04142022	18 ft	Normal Environmental Sample	63,000	-	-	-	-	-	-	-	1,430	189 U*	20,600
	12-Jul-22	CUF-GW-CUF-202-07122022	18 ft	Normal Environmental Sample	64,600	7,210	1,130	1,980	-	-	-	-	1,480	149	20,000
	23-Aug-22	CUF-GW-CUF-202-08232022	18 ft	Normal Environmental Sample	60,800	7,110	1,170	2,020	-	-	-	-	1,440	215 U*	19,400
	20-Oct-22	CUF-GW-CUF-202-10202022	18 ft	Normal Environmental Sample	69,700 J	-	-	-	-	-	-	-	<713	130	17,000
CUF-1006	6-Aug-21	CUF-GW-CUF-1006-08062021	30 ft	Normal Environmental Sample	552,000	16,400	3,350	52,700	-	-	-	-	490,000	139 J	914,000
	20-Aug-21	CUF-GW-CUF-1006-08202021	30 ft	Normal Environmental Sample	612,000	16,700	3,710	49,900	-	-	-	-	541,000	342	954,000
	12-Oct-21	CUF-GW-CUF-1006-10122021	30 ft	Normal Environmental Sample	509,000	16,800	3,960	55,000	-	-	-	-	456,000	196 J	903,000
	27-Jan-22	CUF-GW-CUF-1006-01272022	30 ft	Normal Environmental Sample	621,000	15,100	4,040	46,800	-	-	-	-	602,000	211 J	813,000
	8-Mar-22	CUF-GW-CUF-1006-03082022	30 ft	Normal Environmental Sample	480,000	18,200	3,610	57,100	-	-	-	-	648,000	220 J	509,000
	18-Apr-22	CUF-GW-CUF-1006-04182022	30 ft	Normal Environmental Sample	576,000	20,200	3,210	55,400	586,000	20,200	3,290	55,800	516,000	316 U*	727,000
	25-Aug-22	CUF-GW-CUF-1006-08252022	30 ft	Normal Environmental Sample	487,000	19,400	3,320	59,800	-	-	-	-	561,000	316 U*	635,000
	18-Oct-22	CUF-GW-CUF-1006-10182022	30 ft	Normal Environmental Sample	529,000	16,700	3,610	51,500	-	-	-	-	475,000 J	73.6 J	716,000

Notes:

Please note that units have been converted automatically in this table, and significant figures may not have been maintained.

15.2	Measured concentration did not exceed the indicated standard.
<0.03	Analyte was not detected at a concentration greater than the laboratory reporting limit.
ft	feet
ID	identification
J	quantitation is approximate due to limitations identified during data validation
U*	result should be considered "not detected" because it was detected in an associated field or laboratory blank at a similar level
ug/L	micrograms per Liter

Table H.10-8c - Summary of Pore Water Analytical Results
Cumberland Fossil Plant

					Calcium	Chloride	Fluoride	Magnesium	Potassium	Sodium	Sulfate
Sample Location	**Sample Date**	**Sample ID**	**Sample Depth**	**Sample Type**	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
CUF-TW01	5-Jun-19	CUF-PW-TW01-20190605	51.3 ft	Normal Environmental Sample	575,000	17,200	3,810	-	-	-	1,670,000
	2-Mar-21	CUF-PW-TW01-03022021	51.3 ft	Normal Environmental Sample	642,000	26,100	912	6,000	40,300	69,500	1490000
	13-Apr-21	CUF-PW-TW01-04132021	51.3 ft	Normal Environmental Sample	660,000	26,200	874	5,670	41,900	51,600	1,560,000
CUF-TW03	4-Jun-19	CUF-PW-TW03-20190604	66.3 ft	Normal Environmental Sample	349,000 J	73,200	506	-	-	-	1,850,000
	2-Mar-21	CUF-PW-TW03-03022021	66.3 ft	Normal Environmental Sample	232,000	99,800	238 J	321 J	265,000	182,000	964,000
	13-Apr-21	CUF-PW-TW03-04132021	66.3 ft	Normal Environmental Sample	332,000	107,000	261	349 J	274,000	183,000	966,000
CUF-TW05	4-Jun-19	CUF-PW-TW05-20190604	56.3 ft	Normal Environmental Sample	900,000	781,000	198 J	-	-	-	1,100,000
	3-Mar-21	CUF-PW-TW05-03032021	56.3 ft	Normal Environmental Sample	769,000	587,000	78.1 J	1,890	74,500	64,600	1,160,000
	14-Apr-21	CUF-PW-TW05-04142021	56.3 ft	Normal Environmental Sample	754,000	579,000	73.8 J	1,900	76,900	64,600	1,150,000
CUF-TW07	6-Jun-19	CUF-PW-TW07-20190606	93.3 ft	Normal Environmental Sample	356,000	236,000	71.7 J	-	-	-	657,000
	4-Mar-21	CUF-PW-TW07-03042021	93.3 ft	Normal Environmental Sample	91,200	60,300	195	3,760	14,900	17,300	138,000
	15-Apr-21	CUF-PW-TW07-04152021	93.3 ft	Normal Environmental Sample	496,000	391,000	<65	446 J	106,000	53,300	844,000
CUF-TW08	6-Jun-19	CUF-PW-TW08-20190606	83.3 ft	Normal Environmental Sample	396,000	104,000	173 J	-	-	-	1,160,000
	4-Mar-21	CUF-PW-TW08-03042021	83.3 ft	Normal Environmental Sample	317,000 J	132,000	84.3 J	1,740	68,500 J	82,100 J	1,110,000
	14-Apr-21	CUF-PW-TW08-04142021	83.3 ft	Normal Environmental Sample	413,000	116,000	219 J	438 J	71,200	88,400	1,010,000
CUF-TW09	5-Jun-19	CUF-PW-TW09-20190605	90 ft	Normal Environmental Sample	358,000	282,000	71.2 J	-	-	-	1,270,000
	3-Mar-21	CUF-PW-TW09-03032021	90 ft	Normal Environmental Sample	335,000	249,000	71.6 J	<82.7	220,000	305,000	1,320,000
	15-Apr-21	CUF-PW-TW09-04152021	90 ft	Normal Environmental Sample	320,000	251,000	66.1 J	<82.7	219,000	312,000	1,240,000

Notes:

Please note that units have been converted automatically in this table, and significant figures may not have been maintained.

15.2	Measured concentration did not exceed the indicated standard.
<0.03	Analyte was not detected at a concentration greater than the laboratory reporting limit.
ft	feet
ID	identification
J	quantitation is approximate due to limitations identified during data validation
ug/L	micrograms per Liter

Stantec

EXHIBITS

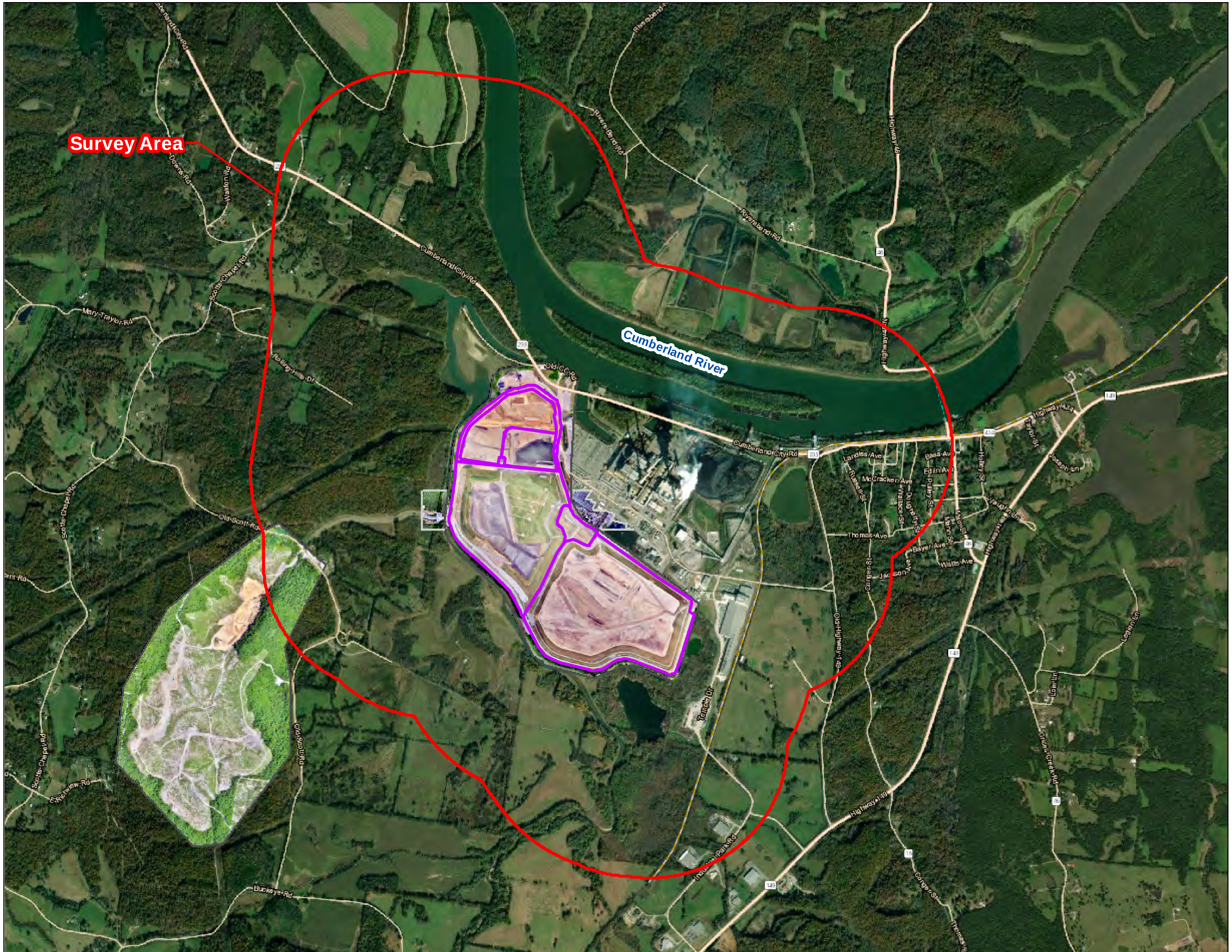

Exhibit No.

H.10-1

Title

Water Use Survey Area

Client/Project 175568209

Tennessee Valley Authority
Cumberland Fossil Plant

Project Location

Stewart County, Tennessee

Prepared by LB on 2023-01-23
Technical Review by CHH on 2023-01-23
Internal Review by CF on 2023-01-23

N

0 2,000 4,000 Feet

(At original document size of 11x17)
1:24,000

Legend

- Survey Area (1/2 Mile)
- CUF Plant CCR Management Units
- 2021 Imagery Boundary
- 2022 Imagery Boundary

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet

2. Background: Imagery Provided by TVA (5/21/2021 and 5/12/2022) and Esri World Imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Esri, HERE, Garmin, (c) OpenStreetMap contributors

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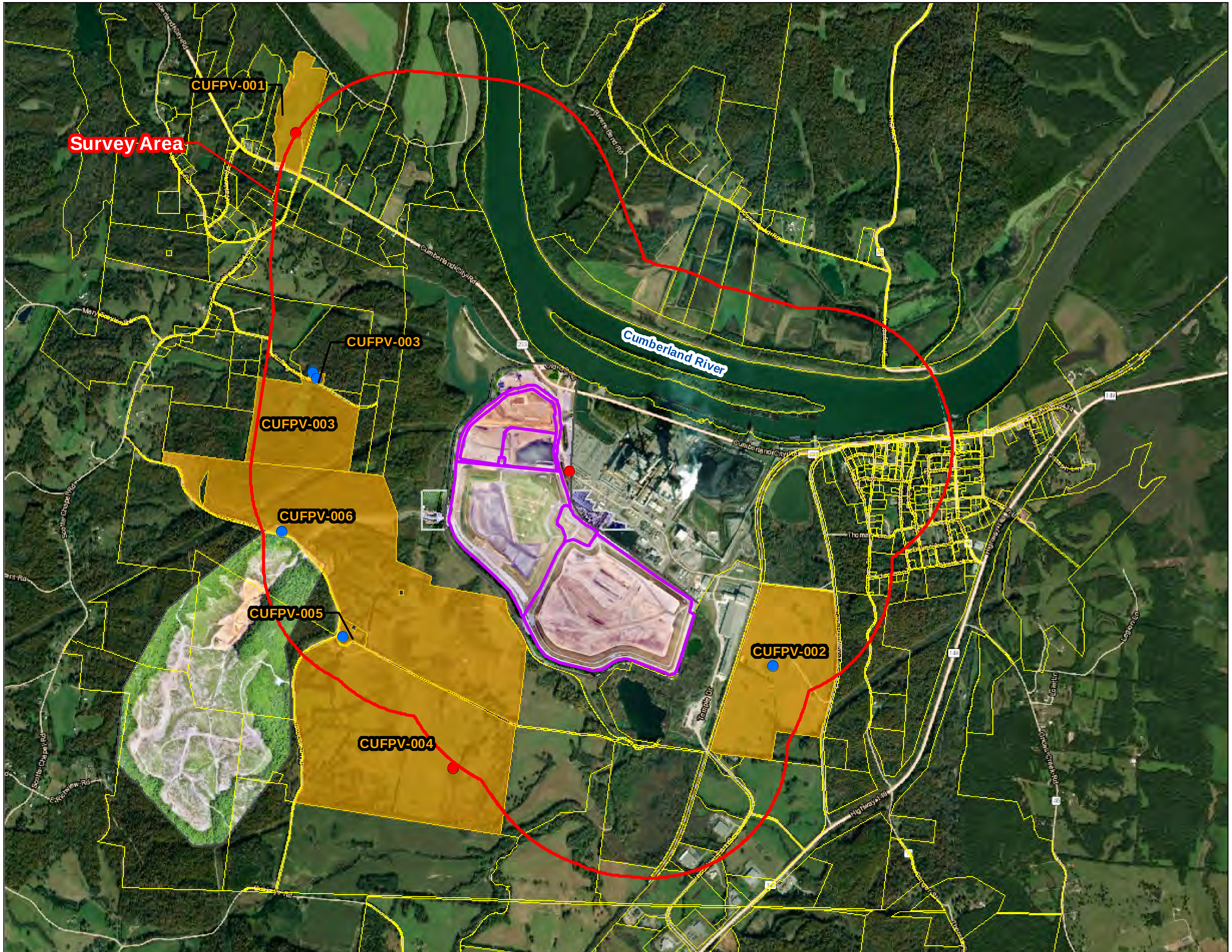

Exhibit No.

H.10-2

Title

Parcels in Survey Area with Potential Wells or Springs

Client/Project 175568209

Tennessee Valley Authority
Cumberland Fossil Plant

Project Location
Stewart County, Tennessee

Prepared by LB on 2023-01-23
Technical Review by CHH on 2023-01-23
Internal Review by CF on 2023-01-23

N

0 2,000 4,000 Feet

(At original document size of 11x17)
1:24,000

Legend

- Well or Spring Location Based on Historical Report
- TDEC Well Logs
- Parcels with Potential Wells and/or
- Survey Area (1/2
- CUF Plant CCR Management
- Parcel
- 2021 Imagery
- 2022 Imagery

CUFPV-### Assigned ID for Parcel with Potential Well and/or Spring

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Background: Imagery Provided by TVA (5/21/2021 and 5/12/2022) and Esri World Imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Esri, HERE, Garmin, (c) OpenStreetMap contributors

Stantec

TVA

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Exhibit No.

H.10-3

Title

Parcels in Area of Interest and Hydrogeologically Downgradient of CUF Plant CCR Management Units

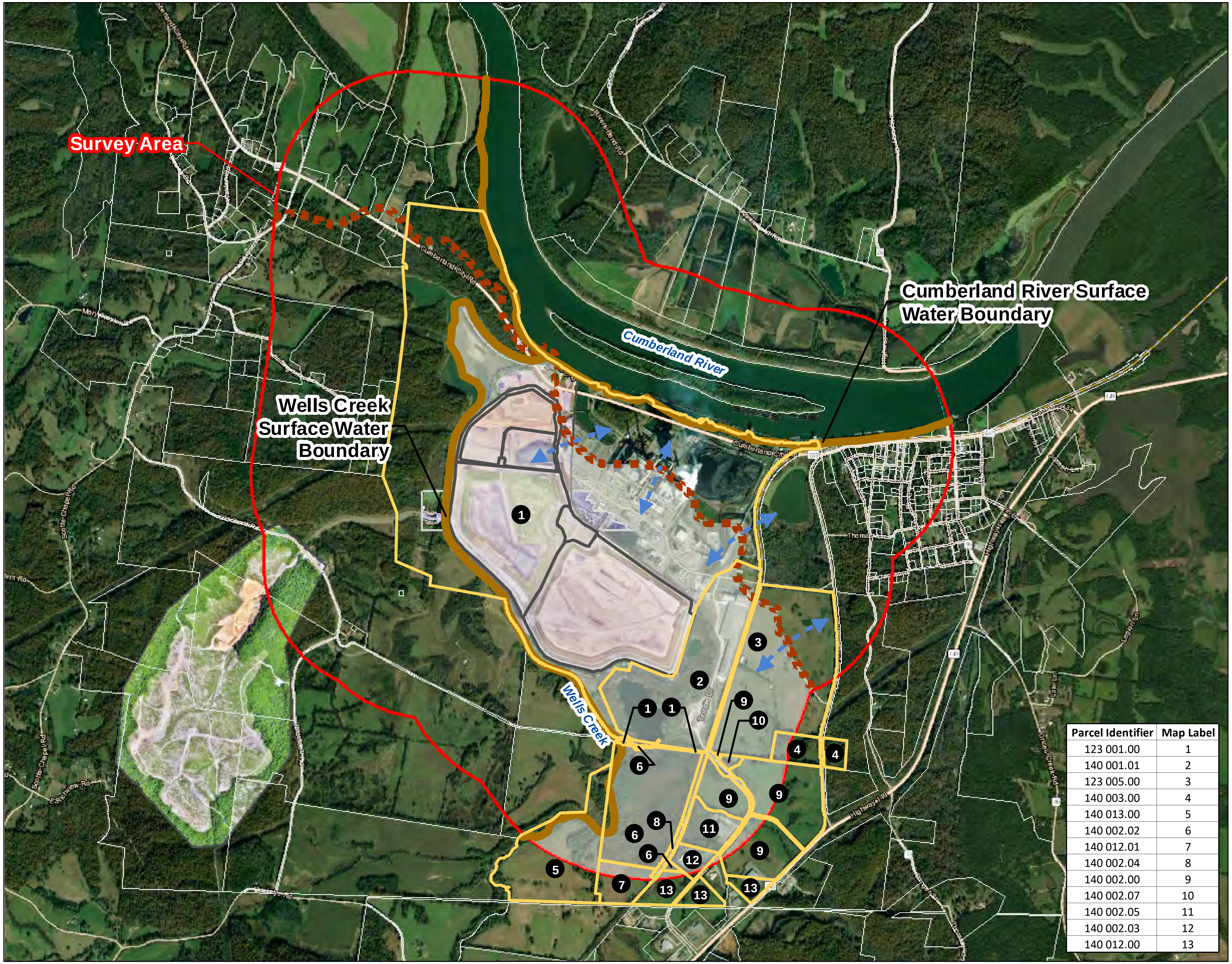
Client/Project 175568209

Tennessee Valley Authority
Cumberland Fossil Plant

Project Location

Stewart County, Tennessee

Prepared by LB on 2023-01-23
Technical Review by CHH on 2023-01-23
Internal Review by CF on 2023-01-23



Parcel Identifier	Map Label
123 001.00	1
140 001.01	2
123 005.00	3
140 003.00	4
140 013.00	5
140 002.02	6
140 012.01	7
140 002.04	8
140 002.00	9
140 002.07	10
140 002.05	11
140 002.03	12
140 012.00	13

N

0 2,000 4,000 Feet

(At original document size of 11x17)
1:24,000

Legend

- General Groundwater/Surface Water Flow Direction
- Hydrogeological Divide
- Surface Stream that Bounds Groundwater Flow
- Water Use Survey Area of Interest
- Survey Area (1/2 Mile)
- CUF Plant CCR Management Units
- Parcel
- Parcel Identified for Water Use Survey
- 2021 Imagery Boundary
- 2022 Imagery Boundary
- # Parcel Identifier

Notes

1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Background: Imagery Provided by TVA (5/21/2021 and 5/12/2022) and Esri World Imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Esri, HERE, Garmin, (c) OpenStreetMap contributors

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ATTACHMENT A

Postcards

Tennessee Valley Authority
c/o Stantec Consulting Services Inc.
601 Grassmere Park, Suite 22
Nashville, TN 37211

As the legal owner of parcel # 123 001.00, TVA is requesting your assistance in answering the following questions:

1. Does a water supply well and/or spring exist on your parcel (circle one)? **Yes** **No**

2. If you answered yes to 1., is the water supply well or spring used for any of the following uses:

☐ Drinking Water ☐ Irrigation ☐ Water for livestock

☐ Other ____________________

Form completed by (signature): Wm T Patt

Form completed by (printed name): William T. Patterson

Date signed: 6/23/2023

Contact Telephone Number: 931-622-3767

Contact email: wtpatterson@tva.gov

Owners Mailing Address: 815 Cumberland City Rd. Cumberland City TN 37050

If you have any questions, please contact us at **tvainfo@tva.gov**. For more information, go to **tva.gov/watersurvey**

Tennessee Valley Authority
c/o Stantec Consulting Services Inc.
601 Grassmere Park, Suite 22
Nashville, Tennessee 37211

As the legal owner of the parcel # 140 002.00 (INDUSTRIAL PARK RD), TVA is requesting your assistance answering the following questions:

1. Are you currently receiving drinking water from Cumberland City Utilities?
   (circle one) **YES** **NO**
2. Does a private water supply well and/or spring exist on your parcel?
   (circle one) **YES** **NO**
3. If you answered YES to 2., is the water supply well or spring for any of the following uses:
   ☐ Drinking Water ☐ Irrigation ☐ Water or Livestock
   ☐ Other ____________________

Form completed by (signature): Renae Roby

Form completed by (printed name): Renae Roby

Date signed: 10/25/22

Contact Telephone Number: 931-206-2815

Contact Email: renaeroby@yahoo.com

Owner's Mailing Address: PO Box 100, Cumberland City TN 37050

If you have any questions, please contact us at **tvainfo@tva.gov**.
For more information, go to **tva.gov/watersurvey**.

As the legal owner of the parcel # 140 002.04 (INDUSTRIAL PARK RD), TVA is requesting your assistance answering the following questions:

1. Are you currently receiving drinking water from Cumberland City Utilities?
   (circle one) **YES** **NO**
2. Does a private water supply well and/or spring exist on your parcel?
   (circle one) **YES** **NO**
3. If you answered YES to 2., is the water supply well or spring for any of the following uses:
   ☐ Drinking Water ☐ Irrigation ☐ Water or Livestock
   ☐ Other ______________________________

Form completed by (signature): Katherine Byrd

Form completed by (printed name): Katherine Byrd

Date signed: 10/11/22

Contact Telephone Number: 859-881-2389

Contact Email: Katherine.Byrd@rjcorman.com

Owner's Mailing Address: ______________________________

If you have any questions, please contact us at **tvainfo@tva.gov**.
For more information, go to **tva.gov/watersurvey**.

As the legal owner of the parcel # 140 002.05 (INDUSTRIAL PARK RD 468), TVA is requesting your assistance answering the following questions:

1. Are you currently receiving drinking water from Cumberland City Utilities?
   (circle one) YES NO
2. Does a private water supply well and/or spring exist on your parcel?
   (circle one) YES NO
3. If you answered YES to 2., is the water supply well or spring for any of the following uses:
   ☐ Drinking Water ☐ Irrigation ☐ Water or Livestock
   ☐ Other

Form completed by (signature):

Form completed by (printed name): GLENN LONGEY

Date signed: 6 OCT 2022

Contact Telephone Number: 931-827-2779

Contact Email: glongey@tncryogenics.com

Owner's Mailing Address: 468 INDUSTRIAL PARK RD CUMBERLAND CITY, TN 37050

If you have any questions, please contact us at **tvainfo@tva.gov**.
For more information, go to **tva.gov/watersurvey**.

NASHVILLE TN 370

8 OCT 2022 PM 5

ENERGY ACTION MONTH

MAILED FROM ZIP CODE 37203

Tennessee Valley Authority
c/o Stantec Consulting Services Inc.
601 Grassmere Park, Suite 22
Nashville, Tennessee 37211

37211-368122

NASHVILLE TN 370

28 OCT 2022 AM 2 L

ENERGY
ACTION
MONTH

MAILED FROM ZIP CODE 37203

Tennessee Valley Authority
c/o Stantec Consulting Services Inc.
601 Grassmere Park, Suite 22
Nashville, Tennessee 37211

37211-368122

As the legal owner of the parcel # 140 012.00 (INDUSTRIAL PARK RD), TVA is requesting your assistance answering the following questions:

1. Are you currently receiving drinking water from Cumberland City Utilities? (circle one) **YES** **NO**
2. Does a private water supply well and/or spring exist on your parcel? (circle one) **YES** **NO**
3. If you answered YES to 2., is the water supply well or spring for any of the following uses:
   ☐ Drinking Water ☐ Irrigation ☐ Water or Livestock
   ☐ Other ____________________

Form completed by (signature): Renae
Form completed by (printed name): Renae
Date signed: 10/25/22
Contact Telephone Number: 931-206-2815
Contact Email: renaeroby@yahoo.com
Owner's Mailing Address: PO Box 100, Cumberland City TN 37050

If you have any questions, please contact us at **tvainfo@tva.gov**.
For more information, go to **tva.gov/watersurvey**.

ATTACHMENT B

Well Survey

TVA TENNESSEE VALLEY AUTHORITY

Water Supply Well Survey

	Survey Team No.	Property ID No.
Property Owner: Cass Rye GPS Coordinates: Person being interviewed: Cass Rye (931-206-1712) Date: 11·14·22 Property Address: 344 Old Hwy 149 cassrye@gmail.com	Tim Hancock	123.005.00
1. Is there a well or spring on the property?	YES	NO
2. If yes, how many wells or springs are on the property (list number)?	One Spring, no wells	
a. Location(s) Adjacent to the pond closest to the Railroad Tracks		
3. Is this for drinking water, irrigation or livestock use or any other use? Livestock drink & water directly from the pond	Drinking Livestock	Irrigation Other
a. If used for livestock, what type of livestock uses? Cattle, non-registered.		
b. If used for irrigation what is being irrigated?(lawn, crops, etc.)		
c. List any other use:		
4. When was the last time water from the well or spring was used?	Daily	
5. Does the water supply on the property have a pump and is it operational?	Pump? YES/NO	Oper.? YES/NO
6. How deep is the well or wells?	NA	
a. When was the well installed?	NA	
7. Is the well is in bedrock?	YES NA	NO
a. Has your well been tested? If so, when and what for? Owner was not willing to share past test results	YES	NO
8. Is your residence or property connected to municipal water or sewer?	Water YES/NO	Sewer YES/NO
9. Do you have a septic system on the property? If yes, where? 2 septic systems, one next to the house & one by the RV hookup	YES	NO
10. Have any odors been detected in your water?	YES	NO

Spring is surrounded by fence panels to protect it from the cattle.

11. Has any discoloration in the water or staining in your sinks, tubs, etc. been observed?	YES NA NO
12. Where on the property is the well or spring located? Next to the pond by the Railroad Tracks	
13. Can we walk over and see the location? (right of entry must be signed) Interview done via telephone	YES NO
14. Would you be willing to allow us to return at a day and time of your choosing to take a sample of your water for testing?	YES NO
15. Are there any animals or pets on the property we need to be aware of? Cattle - keep fences closed & a dog on the property but in an invisible fence by the house.	YES NO
16. Do you treat your drinking water with reverse osmosis, filtration or a water softening unit? (circle one)	YES NA NO
Interviewer: Was the Access Letter provided? Signed? see comments	Provided YES/NO Signed YES/NO

Notes: owner was informed that results may be made public & he said he is fine with that.

Mark the well(s), spring(s) and/or septic system on a map and draw a diagram of these locations relative to other buildings.	YES NO
Describe the location where the water supply can be accessed for sampling. Make sure you note if there is a sampling location located upflow (before) any water treatment sytem (if present).	
Is there a spigot at the wellhead or outside the house that can be used for sampling? If yes, describe location:	NA
Is a drillers tag or TDEC inspection tag present? If yes, record tag number here:	YES NA NO
Did you provide a business card with TVA contact information for follow up questions from the property owner? Owner has our contact info.	YES NO

The property owner agreed to allowing TVA & TDEC to enter the property & test the spring but refused to sign an access agreement, stating he would not sign any agreement with TVA & was adamant about this. There is some history with TVA condemning his father & grandfathers land which left a "bad taste" with his family.

He said I 'have his word' that we can sample & that should be "good enough" & then gave me the following access instructions:

- come through the gate on 149, gate code is 1122.
- you have 18 seconds from entering the code to drive through. Press the buttons directly & not "sideways"
- make sure the gate closes behind you but do not force it or you will strip the gears.
- Please call before we come out so he can let his family know.

TVA TENNESSEE VALLEY AUTHORITY

Water Supply Well Survey

	Survey Team No.	Property ID No.
Property Owner: Georgia Pacific Gypsum III LLC GPS Coordinates: NA Person being interviewed: Dave Sundberg, Plant Manager Date: 10/28/22, Via telephone 931-827-4594 Property Address: 150 Temple Drive	-NA- Tim Hancock	140 001.01
1. Is there a well or spring on the property?	YES	NO
2. If yes, how many wells or springs are on the property (list number)?		
a. Location(s)		
3. Is this for drinking water, irrigation or livestock use or any other use?	Drinking Livestock	Irrigation Other
a. If used for livestock, what type of livestock uses?		
b. If used for irrigation what is being irrigated?(lawn, crops, etc.)		
c. List any other use:		
4. When was the last time water from the well or spring was used?		
5. Does the water supply on the property have a pump and is it operational?	Pump? YES/NO	Oper.? YES/NO
6. How deep is the well or wells?		
a. When was the well installed?		
7. Is the well is in bedrock?	YES	NO
a. Has your well been tested? If so, when and what for?	YES	NO
8. Is your residence or property connected to municipal water or sewer?	Water YES/NO	Sewer YES/NO
9. Do you have a septic system on the property? If yes, where?	YES	NO
10. Have any odors been detected in your water?	YES	NO

11. Has any discoloration in the water or staining in your sinks, tubs, etc. been observed?	YES	NO
12. Where on the property is the well or spring located?		
13. Can we walk over and see the location? (right of entry must be signed)	YES	NO
14. Would you be willing to allow us to return at a day and time of your choosing to take a sample of your water for testing?	YES	NO
15. Are there any animals or pets on the property we need to be aware of?	YES	NO
16. Do you treat your drinking water with reverse osmosis, filtration or a water softening unit? (circle one)	YES	NO
Interviewer: Was the Access Letter provided? Signed?	Provided YES/NO	Signed YES/NO

Notes:

Mark the well(s), spring(s) and/or septic system on a map and draw a diagram of these locations relative to other buildings.	YES	NO
Describe the location where the water supply can be accessed for sampling. Make sure you note if there is a sampling location located upflow (before) any water treatment sytem (if present).		
Is there a spigot at the wellhead or outside the house that can be used for sampling? If yes, describe location:		
Is a drillers tag or TDEC inspection tag present? If yes, record tag number here:	YES	NO
Did you provide a business card with TVA contact information for follow up questions from the property owner?	YES	NO

Notes: I called the plant due to no response to date from our letters. Dave Sundberg returned my call, leaving a message indicating that to their knowledge, no wells or springs exist on the property.

TVA TENNESSEE VALLEY AUTHORITY

Water Supply Well Survey

	Survey Team No.	Property ID No.
Property Owner: Commercial Insulating Glass Co. GPS Coordinates: Person being interviewed: Ken Smith, Plant Manager Date: 11.14.22 Property Address: 476 Industrial Park Road. Interview by phone: 931-827-2011 or 931-516-4650	NA Tim Hancock	140 002. 03
1. Is there a well or spring on the property?	YES	NO
2. If yes, how many wells or springs are on the property (list number)?		
a. Location(s)		
3. Is this for drinking water, irrigation or livestock use or any other use?	Drinking Livestock	Irrigation Other
a. If used for livestock, what type of livestock uses?		
b. If used for irrigation what is being irrigated?(lawn, crops, etc.)		
c. List any other use:		
4. When was the last time water from the well or spring was used?		
5. Does the water supply on the property have a pump and is it operational?	Pump? YES/NO	Oper.? YES/NO
6. How deep is the well or wells?		
a. When was the well installed?		
7. Is the well is in bedrock?	YES	NO
a. Has your well been tested? If so, when and what for?	YES	NO
8. Is your residence or property connected to municipal water or sewer?	Water YES/NO	Sewer YES/NO
9. Do you have a septic system on the property? If yes, where?	YES	NO
10. Have any odors been detected in your water?	YES	NO

11. Has any discoloration in the water or staining in your sinks, tubs, etc. been observed?	YES	NO
12. Where on the property is the well or spring located?		
13. Can we walk over and see the location? (right of entry must be signed)	YES	NO
14. Would you be willing to allow us to return at a day and time of your choosing to take a sample of your water for testing?	YES	NO
15. Are there any animals or pets on the property we need to be aware of?	YES	NO
16. Do you treat your drinking water with reverse osmosis, filtration or a water softening unit? (circle one)	YES	NO
Interviewer: Was the Access Letter provided? Signed?	Provided YES/NO	Signed YES/NO

Notes:

Mark the well(s), spring(s) and/or septic system on a map and draw a diagram of these locations relative to other buildings.	YES	NO
Describe the location where the water supply can be accessed for sampling. Make sure you note if there is a sampling location located upflow (before) any water treatment sytem (if present).		
Is there a spigot at the wellhead or outside the house that can be used for sampling? If yes, describe location:		
Is a drillers tag or TDEC inspection tag present? If yes, record tag number here:	YES	NO
Did you provide a business card with TVA contact information for follow up questions from the property owner?	YES	NO

After several messages & contacting the head office in Sarasota, Florida, Ken Smith the plant manager called me back & informed me there are no wells or springs on the property.

TENNESSEE VALLEY AUTHORITY

Water Supply Well Survey

	Survey Team No.	Property ID No.
Property Owner: Houston County Mfg. of Tennessee, LLC GPS Coordinates: Person being interviewed: Vicki Phillips, Registered Agent Date: 11/9/22 Phone: 615-306-6347 Property Address: 136 Temple Drive	NA Tim Hancock	140 002. 07
1. Is there a well or spring on the property?	YES	NO
2. If yes, how many wells or springs are on the property (list number)?		
a. Location(s)		
3. Is this for drinking water, irrigation or livestock use or any other use?	Drinking Livestock	Irrigation Other
a. If used for livestock, what type of livestock uses?		
b. If used for irrigation what is being irrigated?(lawn, crops, etc.)		
c. List any other use:		
4. When was the last time water from the well or spring was used?		
5. Does the water supply on the property have a pump and is it operational?	Pump? YES/NO	Oper.? YES/NO
6. How deep is the well or wells?		
a. When was the well installed?		
7. Is the well is in bedrock?	YES	NO
a. Has your well been tested? If so, when and what for?	YES	NO
8. Is your residence or property connected to municipal water or sewer?	Water YES/NO	Sewer YES/NO
9. Do you have a septic system on the property? If yes, where?	YES	NO
10. Have any odors been detected in your water?	YES	NO

11. Has any discoloration in the water or staining in your sinks, tubs, etc. been observed?	YES	NO
12. Where on the property is the well or spring located?		
13. Can we walk over and see the location? (right of entry must be signed)	YES	NO
14. Would you be willing to allow us to return at a day and time of your choosing to take a sample of your water for testing?	YES	NO
15. Are there any animals or pets on the property we need to be aware of?	YES	NO
16. Do you treat your drinking water with reverse osmosis, filtration or a water softening unit? (circle one)	YES	NO
Interviewer: Was the Access Letter provided? Signed?	Provided YES/NO	Signed YES/NO

Notes:

Mark the well(s), spring(s) and/or septic system on a map and draw a diagram of these locations relative to other buildings.	YES	NO
Describe the location where the water supply can be accessed for sampling. Make sure you note if there is a sampling location located upflow (before) any water treatment sytem (if present).		
Is there a spigot at the wellhead or outside the house that can be used for sampling? If yes, describe location:		
Is a drillers tag or TDEC inspection tag present? If yes, record tag number here:	YES	NO
Did you provide a business card with TVA contact information for follow up questions from the property owner?	YES	NO

On 11/9/22, I spoke with Vicki Phillips by telephone. Vicki is the Registered Agent / owner of the property that they purchased in July of last year. She told me there are no wells or springs on the property

Contact information:

Vicki Phillips
615-306-6347
2506 Old Natchez Trace
Franklin, TN 37069

TVA TENNESSEE VALLEY AUTHORITY

Water Supply Well Survey

	Survey Team No.	Property ID No.
Property Owner: Christopher Pitts	N/A Harrison Foster	140 012.01
GPS Coordinates: N/A		
Person being interviewed: Chris Pitts		
Date: 11-1-2022 via telephone 931-289-2585		
Property Address: Industrial Park Road		
1. Is there a well or spring on the property?	YES	NO
2. If yes, how many wells or springs are on the property (list number)?		
a. Location(s)		
3. Is this for drinking water, irrigation or livestock use or any other use?	Drinking Livestock	Irrigation Other
a. If used for livestock, what type of livestock uses?		
b. If used for irrigation what is being irrigated?(lawn, crops, etc.)		
c. List any other use:		
4. When was the last time water from the well or spring was used?		
5. Does the water supply on the property have a pump and is it operational?	Pump? YES/NO	Oper.? YES/NO
6. How deep is the well or wells?		
a. When was the well installed?		
7. Is the well is in bedrock?	YES	NO
a. Has your well been tested? If so, when and what for?	YES	NO
8. Is your residence or property connected to municipal water or sewer?	Water YES/NO	Sewer YES/NO
9. Do you have a septic system on the property? If yes, where?	YES	NO
10. Have any odors been detected in your water?	YES	NO

11. Has any discoloration in the water or staining in your sinks, tubs, etc. been observed?	YES	NO
12. Where on the property is the well or spring located?		
13. Can we walk over and see the location? (right of entry must be signed)	YES	NO
14. Would you be willing to allow us to return at a day and time of your choosing to take a sample of your water for testing?	YES	NO
15. Are there any animals or pets on the property we need to be aware of?	YES	NO
16. Do you treat your drinking water with reverse osmosis, filtration or a water softening unit? (circle one)	YES	NO
Interviewer: Was the Access Letter provided? Signed?	Provided YES/NO	Signed YES/NO

Notes:

Mark the well(s), spring(s) and/or septic system on a map and draw a diagram of these locations relative to other buildings.	YES	NO
Describe the location where the water supply can be accessed for sampling. Make sure you note if there is a sampling location located upflow (before) any water treatment sytem (if present).		
Is there a spigot at the wellhead or outside the house that can be used for sampling? If yes, describe location:		
Is a drillers tag or TDEC inspection tag present? If yes, record tag number here:	YES	NO
Did you provide a business card with TVA contact information for follow up questions from the property owner?	YES	NO

Notes: I Called Chris due to No Response to our Postcards.
Mr. Pitts indicated that He Had Received the Postcards,
And that He Did Not Have A well or Spring on the Property.

TENNESSEE VALLEY AUTHORITY

Water Supply Well Survey

	Survey Team No.	Property ID No.
Property Owner: Chr[illegible]pher Pitts	N/A Harrison Foster	140 013.00
GPS Coordinates: N/A		
Person being interviewed: Chris Pitts		
Date: 11-1-2022 via telephone 931-289-2585		
Property Address: Wells Creek		
1. Is there a well or spring on the property?	YES	NO
2. If yes, how many wells or springs are on the property (list number)?		
a. Location(s)		
3. Is this for drinking water, irrigation or livestock use or any other use?	Drinking Livestock	Irrigation Other
a. If used for livestock, what type of livestock uses?		
b. If used for irrigation what is being irrigated?(lawn, crops, etc.)		
c. List any other use:		
4. When was the last time water from the well or spring was used?		
5. Does the water supply on the property have a pump and is it operational?	Pump? YES/NO	Oper.? YES/NO
6. How deep is the well or wells?		
a. When was the well installed?		
7. Is the well is in bedrock?	YES	NO
a. Has your well been tested? If so, when and what for?	YES	NO
8. Is your residence or property connected to municipal water or sewer?	Water YES/NO	Sewer YES/NO
9. Do you have a septic system on the property? If yes, where?	YES	NO
10. Have any odors been detected in your water?	YES	NO

11. Has any discoloration in the water or staining in your sinks, tubs, etc. been observed?	YES	NO
12. Where on the property is the well or spring located?		
13. Can we walk over and see the location? (right of entry must be signed)	YES	NO
14. Would you be willing to allow us to return at a day and time of your choosing to take a sample of your water for testing?	YES	NO
15. Are there any animals or pets on the property we need to be aware of?	YES	NO
16. Do you treat your drinking water with reverse osmosis, filtration or a water softening unit? (circle one)	YES	NO
Interviewer: Was the Access Letter provided? Signed?	Provided YES/NO	Signed YES/NO

Notes:

Mark the well(s), spring(s) and/or septic system on a map and draw a diagram of these locations relative to other buildings.	YES	NO
Describe the location where the water supply can be accessed for sampling. Make sure you note if there is a sampling location located upflow (before) any water treatment sytem (if present).		
Is there a spigot at the wellhead or outside the house that can be used for sampling? If yes, describe location:		
Is a drillers tag or TDEC inspection tag present? If yes, record tag number here:	YES	NO
Did you provide a business card with TVA contact information for follow up questions from the property owner?	YES	NO

Notes: I Called Chris due to No Response to our Postcards. Mr. Pitts indicated that He Had Received the Postcards, And that He Did Not Have A well or Spring on the Property. He informed that he gets All of His water Supply From the City of Erin.

TVA TENNESSEE VALLEY AUTHORITY

Water Supply Well Survey

	Survey Team No.	Property ID No.
Property Owner: Cass Rye, Levi Simpson	Tim Hancock	140.002.02
GPS Coordinates:		
Person being interviewed: Cass Rye (931-206-1712)		
Date: 11.14.22		
Property Address: Industrial Park Road		
1. Is there a well or spring on the property?	YES	NO
2. If yes, how many wells or springs are on the property (list number)?		
a. Location(s)		
3. Is this for drinking water, irrigation or livestock use or any other use?	Drinking Livestock	Irrigation Other
a. If used for livestock, what type of livestock uses?		
b. If used for irrigation what is being irrigated?(lawn, crops, etc.)		
c. List any other use:		
4. When was the last time water from the well or spring was used?		
5. Does the water supply on the property have a pump and is it operational?	Pump? YES/NO	Oper.? YES/NO
6. How deep is the well or wells?		
a. When was the well installed?		
7. Is the well is in bedrock?	YES	NO
a. Has your well been tested? If so, when and what for?	YES	NO
8. Is your residence or property connected to municipal water or sewer?	Water YES/NO	Sewer YES/NO
9. Do you have a septic system on the property? If yes, where?	YES	NO
10. Have any odors been detected in your water?	YES	NO

11. Has any discoloration in the water or staining in your sinks, tubs, etc. been observed?	YES	NO
12. Where on the property is the well or spring located?		
13. Can we walk over and see the location? (right of entry must be signed)	YES	NO
14. Would you be willing to allow us to return at a day and time of your choosing to take a sample of your water for testing?	YES	NO
15. Are there any animals or pets on the property we need to be aware of?	YES	NO
16. Do you treat your drinking water with reverse osmosis, filtration or a water softening unit? (circle one)	YES	NO
Interviewer: Was the Access Letter provided? Signed?	Provided YES/NO	Signed YES/NO

Notes:

Mark the well(s), spring(s) and/or septic system on a map and draw a diagram of these locations relative to other buildings.	YES	NO
Describe the location where the water supply can be accessed for sampling. Make sure you note if there is a sampling location located upflow (before) any water treatment sytem (if present).		
Is there a spigot at the wellhead or outside the house that can be used for sampling? If yes, describe location:		
Is a drillers tag or TDEC inspection tag present? If yes, record tag number here:	YES	NO
Did you provide a business card with TVA contact information for follow up questions from the property owner?	YES	NO

I spoke with Cass Rye by telephone & he confirmed there are no wells or springs on this property.

TVA TENNESSEE VALLEY AUTHORITY

Water Supply Well Survey

	Survey Team No.	Property ID No.
Property Owner: MAtthew H., Seth Rye GPS Coordinates: Person being interviewed: CAss Rye- Father Date: 11·14·22 931-206-1712 Property Address: E. ~~E~~ Hwy 149	Tim Hancock	140.003.00
1. Is there a well or spring on the property? Property used for Cattle farming	YES	NO
2. If yes, how many wells or springs are on the property (list number)?		
a. Location(s)		
3. Is this for drinking water, irrigation or livestock use or any other use?	Drinking Livestock	Irrigation Other
a. If used for livestock, what type of livestock uses?		
b. If used for irrigation what is being irrigated?(lawn, crops, etc.)		
c. List any other use:		
4. When was the last time water from the well or spring was used?		
5. Does the water supply on the property have a pump and is it operational?	Pump? YES/NO	Oper.? YES/NO
6. How deep is the well or wells?		
a. When was the well installed?		
7. Is the well is in bedrock?	YES	NO
a. Has your well been tested? If so, when and what for?	YES	NO
8. Is your residence or property connected to municipal water or sewer?	Water YES/NO	Sewer YES/NO
9. Do you have a septic system on the property? If yes, where?	YES	NO
10. Have any odors been detected in your water?	YES	NO

11. Has any discoloration in the water or staining in your sinks, tubs, etc. been observed?	YES	NO
12. Where on the property is the well or spring located?		
13. Can we walk over and see the location? (right of entry must be signed)	YES	NO
14. Would you be willing to allow us to return at a day and time of your choosing to take a sample of your water for testing?	YES	NO
15. Are there any animals or pets on the property we need to be aware of?	YES	NO
16. Do you treat your drinking water with reverse osmosis, filtration or a water softening unit? (circle one)	YES	NO
Interviewer: Was the Access Letter provided? Signed?	Provided YES/NO	Signed YES/NO

Notes:

Mark the well(s), spring(s) and/or septic system on a map and draw a diagram of these locations relative to other buildings.	YES	NO
Describe the location where the water supply can be accessed for sampling. Make sure you note if there is a sampling location located upflow (before) any water treatment sytem (if present).		
Is there a spigot at the wellhead or outside the house that can be used for sampling? If yes, describe location:		
Is a drillers tag or TDEC inspection tag present? If yes, record tag number here:	YES	NO
Did you provide a business card with TVA contact information for follow up questions from the property owner?	YES	NO

I spoke w Cass Rye, father of the owners who has been involved with this property for generations & he confirmed there are no wells or springs on the property. Land is used for grazing cattle.

ATTACHMENT C

Water Use Survey Field Sampling Summary and Methodology

Attachment H.10-C – Water Use Survey Field Sampling Summary and Methodology

TDEC Commissioner's Order:
Environmental Assessment Report
Cumberland Fossil Plant
Cumberland City, Tennessee

August 14, 2023

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

Prepared by:

Stantec Consulting Services Inc.
Lexington, Kentucky

Revision Record

Revision	Description	Date
1	Addresses August 9, 2022 TDEC Review Comments and Issued for TDEC	January 26, 2023
2	Addresses May 16, 2023 TDEC Review Comments and Issued for TDEC	August 14, 2023

ATTACHMENT H.10-C – WATER USE SURVEY FIELD SAMPLING SUMMARY AND METHODOLOGY

Sign-off Sheet

This document entitled Attachment H.10-C – Water Use Survey Field Sampling Summary and Methodology was prepared by Stantec Consulting Services Inc. ("Stantec") for the account of Tennessee Valley Authority (the "Client"). The material in this report reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document. The opinions in the report are based on conditions and information existing at the time of publication and do not take into account any subsequent changes. In preparing the report, Stantec relied in part upon data and information supplied to it by the Client.

Prepared by Jamie Snider

Jamie Snider, PG, Geologist

Reviewed by Stuart Gross

Stu Gross, PG, Senior Project Manager

Approved by Carole M. Farr

Carole M. Farr, PG, Senior Principal Geologist

Table of Contents

Abbreviations

CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
COC	Chain-of-Custody
CUF Plant	Cumberland Fossil Plant
DO	Dissolved Oxygen
EAR	Environmental Assessment Report
EIP	Environmental Investigation Plan
ENV	Environmental
EnvStds	Environmental Standards, Inc.
FSP	Field Sampling Personnel
IDW	Investigation Derived Waste
mg/L	Milligrams per Liter
NTU	Nephelometric Turbidity Units
ORP	Oxidation Reduction Potential
Pace	Pace Analytical Services, LLC
QAPP	Quality Assurance Project Plan
QC	Quality Control
SAP	Sampling and Analysis Plan
Stantec	Stantec Consulting Services Inc.
TDEC	Tennessee Department of Environment and Conservation
TDEC Order	Commissioner’s Order No. OGC15-0177
TI	Technical Instruction
TVA	Tennessee Valley Authority
WUS	Water Use Survey

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec), on behalf of the Tennessee Valley Authority (TVA), prepared this *Field Sampling Summary and Methodology* to summarize field activities conducted to support the Water Use Survey (WUS) at TVA's Cumberland Fossil Plant (CUF Plant) in Cumberland City, Tennessee.

The purpose of the WUS was to identify and sample usable private water supply wells and surface water sources being used for domestic purposes within ½-mile of the CUF Plant boundary.

The data will be included in the Environmental Assessment Report (EAR) in support of fulfilling the requirements for the Tennessee Department of Environment and Conservation (TDEC) issued Commissioner's Order OGC15-0177 (TDEC Order) to TVA (TDEC 2015). The TDEC Order sets forth a "process for the investigation, assessment, and remediation of unacceptable risks" at TVA's coal ash disposal sites in Tennessee.

The WUS activities were performed in general accordance with the following documents developed by TVA to support fulfilling the requirements of TDEC Order:

- *Environmental Investigation Plan (EIP)* (Stantec 2018a)
- *Water Use Survey Sampling and Analysis Plan (SAP)* (Stantec 2018b)
- *Water Use Survey Implementation Plan* (Stantec 2021)
- *EIP Quality Assurance Project Plan (QAPP)* (Environmental Standards, Inc. [EnvStds] 2018).

The SAP was implemented in accordance with TVA- and TDEC-approved Programmatic and Project-specific changes. Field documentation for work performed under the SAP was reviewed for variations in scope and procedures, and the findings are provided in Section 3.5.

Quality Assurance oversight on field data acquisition protocols, sampling practices, and data review were performed by EnvStds under direct contract to TVA.

2.0 OBJECTIVE AND SCOPE

The primary objective of the WUS was to identify and sample usable private water supply wells and surface water sources within ½-mile of the CUF Plant boundary. This area is referred to herein as the Survey Area and is illustrated on Exhibit H.10-1 of Appendix H.10 of the EAR. The sampling was conducted to evaluate if CCR constituents associated with the CUF Plant operations may have affected the water supply wells or surface water supplies within the Survey Area.

The approach for the WUS was to:

- Identify usable private water supply wells and surface water sources within the Survey Area
- Collect water samples from identified usable private water supply wells and surface water sources having the greatest likelihood of being downgradient of the CUF Plant CCR management units.

Using this approach, one spring, known as Rye Spring, was identified for sampling. Details of the sampling are presented in the following sections.

3.0 FIELD ACTIVITIES

Rye Spring was sampled on January 4, 2023. Prior to initiating field activities, TVA conducted environmental reviews and obtained access as necessary to complete the field work.

Sampling activities were implemented in conformance with guidance and specifications listed in TVA's Environmental (ENV) Technical Instructions (TIs), the SAP, and the QAPP, except as noted in the Variations section of this report. As part of TVA's commitment to generate representative and reliable data, oversight of centralized data management were performed by EnvStds under direct contract with TVA. EnvStds also provided quality reviews of field documentation.

During the sampling, Stantec conducted the following field activities:

- Collected one surface water sample from one spring location (Rye Spring)
- Collected quality control (QC) samples for laboratory analysis
- Shipped collected samples via FedEx to Pace Analytical Services, LLC (Pace).

Water sampling was performed in general accordance with the SAP.

Details on each activity are presented in the following sections. The spring location is shown on Exhibit H.10-C-1. Tabulated information collected during the WUS, including a summary of water samples collected and analytical results are provided in Tables H.10-C-1 and H.10-C-2, respectively.

3.1 DOCUMENTATION

Stantec maintained field documentation in general accordance with TVA ENV-TI-05.80.03, *Field Record Keeping*, the SAP, and the QAPP. Field activities and data were primarily recorded on Plant-specific field forms. Health and safety forms were completed in accordance with TVA and Stantec health and safety requirements.

Deviations from the SAP, TIs, or QAPP were documented and are summarized in the Variations section of this report. Chain-of-Custody (COCs) forms were completed in accordance with TVA ENV-TI-05.80.02*: Sample Labeling and Custody*.

3.1.1 Field Forms

Stantec used program-specific field forms to record field observations and data for specific activities. Field forms used during the WUS included:

- *Daily Field Activity Log*

- *Equipment Calibration Form*
- *Water Use Survey Sampling Form*
- *Chain-of-Custody (COC).*

3.1.1.1 Daily Field Activity Log

Stantec field sampling personnel (FSP) recorded field activities, observations, and data on a *Daily Field Activity Log* to chronologically document the field program. Deviations from the SAP or QAPP are summarized in the Variations section of this report.

3.1.1.2 Equipment Calibration Form

Stantec FSP performed daily calibration of the water quality meter and turbidity meter when used and documented the results on an *Equipment Calibration Form*. Calibration results were including temperature, turbidity, specific conductance, pH, dissolved oxygen (DO), and oxidation-reduction potential (ORP) were documented on the form to verify that the field instruments' sensors were operating within acceptance criteria. Refer to Section 3.2.2 for additional details on equipment calibration procedures.

3.1.1.3 Water Use Survey Sampling Form

Stantec FSP recorded the purge flow rate, volume of water purged, temperature, pH, specific conductance, DO, ORP, turbidity, color of water, and other observations during water purging and sampling activities in accordance with the SAP and TVA ENV-TI-05.80.40, *Surface Water Sampling*. Field measurements were recorded on a *Water Use Survey Sampling Form*. The form also documents the time intervals between measurement of field parameters and water quality parameter measurements until the purging requirements were met.

3.1.1.4 Chain of Custody

Stantec FSP logged each water sample collected during the WUS field activities on a *COC*. Information on the *COC* included the sample ID, sample location, type of sample, sampling date, and sample custody record. *COCs* were completed in general accordance with TVA *ENV-TI-05.80.02: Sample Labeling and Custody* and reviewed by the laboratory manager.

3.1.2 Equipment Calibration

Field instruments used to collect, generate, or measure water quality parameters were calibrated each day prior to use as specified in the SAP, QAPP, and TVA ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde.* Afternoon calibration verification was performed to evaluate if the instrument remained within acceptance criteria during use. Temperature and barometric pressure instrument readings were verified using a calibrated National Institute of Standards and Technology traceable thermometer and National Weather Service (via mesowest.utah.edu) barometric pressure readings for Clarksville Outlaw Field, Clarksville, Tennessee. Additional details regarding equipment calibration were recorded on an *Equipment Calibration Form*, as described in Section 3.1.1.2.

3.1.3 Photographs

In addition to documentation of field activities described above, photographs were taken to document the WUS. A photographic log of Rye Spring is provided in Attachment A.

3.2 WATER SAMPLING METHODS

The following sections present water sampling procedures used in the WUS.

3.2.1 Water Purging & Sampling

On January 4, 2023, analytical and field duplicate water samples were collected from one spring (Rye Spring) in general accordance with the SAP (Stantec 2018a). Rye Spring consisted of a small pool of water where discharge from the spring briefly accumulated prior to flowing down a channel to a nearby pond.

Rye Spring was purged using a peristaltic pump with new, non-dedicated tubing using purging and sampling techniques as specified in TVA ENV-TI-05.80.40, *Surface Water Sampling*.

During the purging process, water quality field parameters including pH, specific conductance, temperature, ORP, and DO were measured using a calibrated water quality meter (YSI ProPlus with flow-through cell) and recorded on a field form. Turbidity was measured and recorded using a calibrated turbidimeter (Hach 2100Q). Field parameters were measured and recorded on a Water Use Survey Sampling Form during purging until purging requirements were met as specified in the SAP and/or applicable TI. Well purging was considered complete after 15 minutes of purging or when three consecutive readings were within the following stabilization limits:

- pH – ±0.1 Standard Units
- Specific Conductance – ±3% microSiemens per centimeter
- Turbidity – Less than 5 Nephelometric Turbidity Units (NTUs) or ±10% for values above 5 NTUs
- DO – Less than 0.5 milligrams per liter (mg/L) or ±10% for values above 0.5 mg/L.

After approximately 15 minutes of purging, the final field parameter results were recorded, purging was discontinued, and a sample was collected as specified in the SAP.

Laboratory-provided, pre-preserved sample containers were filled directly from the pump discharge line. FSP wore new, clean nitrile gloves when handling sample containers and did not touch the interior of containers or container caps. When filling sample bottles, care was taken to minimize sample aeration (i.e., water was directed down the inner walls of the sample bottle) and to avoid overfilling and diluting preservatives. Each sample bottle was capped before filling the next bottle.

Sample containers were labeled and handled in accordance with TVA ENV-TI-05.80.02, *Sample Labeling and Custody*. FSP secured caps on each bottle, attached a custody seal across the cap, and placed the bottles in a cooler on ice within 15 minutes of collection. QC samples were collected in accordance with TVA ENV-TI-05.80.04, *Field Sampling Quality Control*. One water sample, one field duplicate, one field blank, one tubing blank, and one matrix spike/matrix spike duplicate were collected and submitted for analysis.

Two separate aliquots of water were collected from Rye Spring. As outlined in the Implementation Plan (Stantec 2021), the first aliquot was submitted for laboratory analysis of boron (total and dissolved), chloride and sulfate. The dissolved boron sample was filtered by the laboratory.

The second aliquot was held until results of the first aliquot were available; however, the second aliquot was not analyzed based on the evaluation provided in Appendix H.10 of the EAR.

A list of the water samples collected for analysis and the water analytical data are provided in Tables H.10-C-1 and H.10-C-2, respectively.

3.3 INVESTIGATION DERIVED WASTE

Investigation derived waste (IDW) generated during the WUS included:

- Purge water
- Used calibration solutions
- Decontamination fluids
- Personal protective equipment (PPE)
- General trash.

IDW was handled in general accordance with TVA ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination* and TVA ENV-TI-05.80.40, *Surface Water Sampling* (purge water); the SAP, the CUF Plant-specific waste management plan; and local, state, and federal regulations. Transportation and disposal of IDW was coordinated with TVA Plant facility management. Purge water was discharged onto the ground surface downgradient of the spring location. Used calibration solutions and decontamination fluids were managed as authorized by CUF Plant facility management and in general accordance with the SAP. Used disposable PPE (e.g., nitrile gloves) and general trash were placed in garbage bags and disposed of in a municipal waste dumpster.

3.4 SAMPLE SHIPMENT

Samples were packed and transported under COC procedures as specified in TVA ENV-TI-05.80.06, *Handling and Shipping of Samples*. The samples were shipped via FedEx to Pace in Minneapolis, Minnesota.

Pace submitted sample receipt forms to EnvStds for review and confirmation.

3.5 VARIATIONS

The proposed scope and procedures for the WUS were outlined in the SAP, QAPP, and applicable TVA TIs, as detailed in the sections above. Variations in scope or procedures discussed with TVA, changes based on field conditions, or additional field sampling performed to complete the scope of work in the SAP are described in the following sections. As discussed below, these variations do not impact the overall usability and representativeness of the dataset provided in this *Field Sampling Summary and Methodology* for the WUS at the CUF Plant.

3.5.1 Variations in Scope

No variations in scope were documented during field activities.

3.5.2 Variations in Procedure

No variations in procedures occurred during field activities. However, though not specifically mentioned in the SAP, TVA ENV-TI-05.80.40 *Surface Water Sampling* was also used to guide sample collection.

4.0 SUMMARY

The data presented in this report are from implementation of the WUS at the CUF Plant. The scope of work for the WUS investigation included:

- Collected one surface water sample from one spring location (Rye Spring)
- Collected QC samples for laboratory analysis
- Shipped collected samples via FedEx to Pace for analysis.

A water sample summary and analytical results are presented in in Tables H.10-C-1 and H.10-C-2, respectively.

The data collected during the WUS are usable for reporting and evaluation in the EAR and meet the objectives of the TDEC Order EIP. The complete dataset from this event will be evaluated along with data collected under other TDEC Order SAPs, as well as data collected under other State and CCR programs. This evaluation will be provided in the CUF Plant EAR.

5.0 REFERENCES

Environmental Standards, Inc. (2018). *Quality Assurance Project Plan for the Tennessee Valley Authority Cumberland Fossil Plant Environmental Investigation.* Revision 2. Prepared for Tennessee Valley Authority (TVA). January 2018.

Stantec Consulting Services Inc. (Stantec). (2018a). *Environmental Investigation Plan, Cumberland Fossil Plant.* Revision 3. Prepared for Tennessee Valley Authority. June 25, 2018.

Stantec. (2018b). *Water Use Survey Sampling and Analysis Plan, Cumberland Fossil Plant.* Revision 3. Prepared for Tennessee Valley Authority. June 25, 2018.

Stantec. (2021). *Water Use Survey Implementation Plan.* Revision 1. Prepared for Tennessee Valley Authority. February 22, 2021.

Tennessee Department of Environment and Conservation. (2015). Commissioner's Order No. OGC15-0177.

Tennessee Valley Authority (TVA). ENV-TI-05.80.02, *Sample Labeling and Custody*.

TVA. ENV-TI-05.80.03, *Field Record Keeping.*

TVA. ENV-TI-05.80.04, *Field Sampling Quality Control.*

TVA. ENV-TI-05.80.05, *Field Sampling Equipment Cleaning and Decontamination*.

TVA. ENV-TI-05.80.06, *Handling and Shipping of Samples.*

TVA. ENV-TI-05.80.40, *Surface Water Sampling*.

TVA. ENV-TI-05.80.46, *Field Measurement Using a Multi-Parameter Sonde*.

TABLES

Table 1 - Summary of Water Samples
Cumberland Fossil Plant

			Analysis			
Location ID	**Sample ID**	**Sample Type**	**Total Boron**	**Dissolved Boron**	**Anions**	**Field Parameters**
CUFPV-002	CUF-WS-CUFPV-002-20230104	Normal Environmental Sample	X	X	X	X
	CUF-WS-DUP01-20230104	Field Duplicate	X	X	X	

Notes

Anions	EPA 300_0/SW846 9056
ID	identification
Total and Dissolved Boron	EPA 200_8

Stantec

Table 2 - Water Analytical Results
Cumberland Fossil Plant

Sample Location		**CUFPV-002**	
Sample Date		**4-Jan-23**	**4-Jan-23**
Sample ID		**CUF-WS-CUFPV-002-20230104**	**CUF-WS-DUP01-20230104**
Parent Sample ID			**CUF-WS-CUFPV-002-20230104**
Sample Type	**Units**	**Normal Environmental Sample**	**Field Duplicate Sample**
Metals			
Total Boron	ug/L	20.3	18.3
Dissolved Boron	ug/L	18.7	16.8
Anions			
Chloride	mg/L	6.5	6.6
Sulfate	mg/L	55.3	55.4
Field Parameters			
Dissolved Oxygen	%	58.7	-
Dissolved Oxygen	mg/L	5.81	-
Flow Rate	gal/min	280	-
ORP	mV	267.1	-
pH (field)	SU	7.03	-
Specific Cond. (Field)	uS/cm	591.0	-
Temperature, Water (C)	DEG C	14.7	-
Turbidity, field	NTU	28.1	-

Notes:

-	Parameter not analyzed / not available.
ID	Identification
%	percent
DEG C	degrees Celsius
gal/min	gallons per minute
mg/L	milligrams per Liter
mV	milliVolts
NTU	Nephelometric Turbidity Unit
ORP	Oxidation Reduction Potential
SU	Standard Units
ug/L	micrograms per Liter
uS/cm	microSiemens per centimeter

EXHIBIT

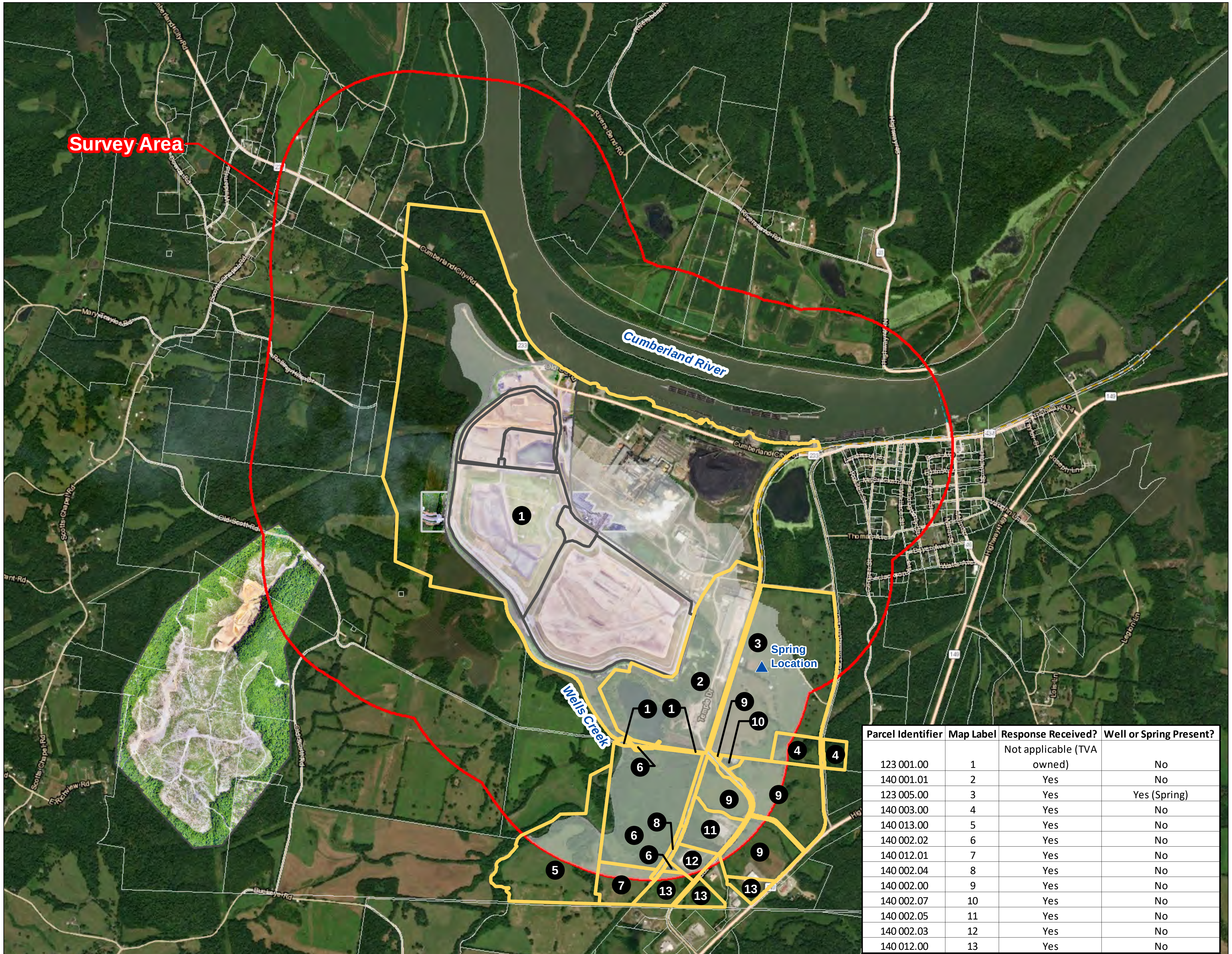
Exhibit No.
H.10-1

Title
Parcels in Area of Interest and Well/Spring Location

Client/Project 175568209
Tennessee Valley Authority
Cumberland Fossil Plant

Project Location
Stewart County, Tennessee

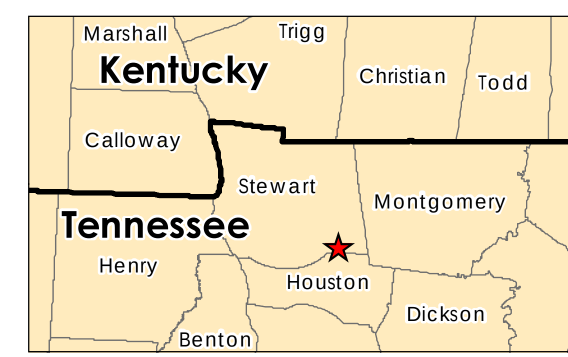
Prepared by LB on 2022-12-06
Technical Review by CHH on 2022-12-06
Internal Review by CF on 2022-12-06



(At original document size of 11x17)
1:24,000

Parcel Identifier	Map Label	Response Received?	Well or Spring Present?
123 001.00	1	Not applicable (TVA owned)	No
140 001.01	2	Yes	No
123 005.00	3	Yes	Yes (Spring)
140 003.00	4	Yes	No
140 013.00	5	Yes	No
140 002.02	6	Yes	No
140 012.01	7	Yes	No
140 002.04	8	Yes	No
140 002.00	9	Yes	No
140 002.07	10	Yes	No
140 002.05	11	Yes	No
140 002.03	12	Yes	No
140 012.00	13	Yes	No

Legend
- Spring Location
- Water Use Survey Area of Interest
- Survey Area (1/2 Mile)
- CUF Plant CCR Management Units
- Parcel
- Parcel Identified for Water Use Survey
- 2021 Imagery Boundary
- 2022 Imagery Boundary
- Parcel Identifier



Notes
1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Background: Imagery Provided by TVA (5/21/2021 and 5/12/2022) and Esri World Imagery
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Esri, HERE, Garmin, (c) OpenStreetMap contributors

U:\TVA-EIP\175568209_CUF_Phase2\gis\mxd\EAR\H.11-1_CUF_AOI_Parcels_WellSpringLocation.mxd Revised: 2022-12-06 By: mbough

ATTACHMENT H.10-C-A
Photographic Log

Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil Plant	Site Location:	Cumberland City, Tennessee

Photograph ID: 1 **Photo Location:** CUFPV-002 **Photo Date:** 1/4/2023 **Comments:** Rye Spring prior to sampling.	
Photograph ID: 2 **Photo Location:** CUFPV-002 **Photo Date:** 1/4/2023 **Comments:** The area where Rye Spring was sampled.	

Client:	Tennessee Valley Authority	Project:	TDEC Order
Site Name:	Cumberland Fossil Plant	Site Location:	Cumberland City, Tennessee

Photograph ID: 3

Photo Location:
CUFPV-002

Photo Date:
1/4/2023

Comments:
Rye Spring after sampling.

ATTACHMENT D

Laboratory Analytical Results

Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

January 09, 2023

Kim Kesler-Arnold
Stantec Consulting Services Inc.
27280 Haggerty Road
Suite C-11
Farmington, MI 48331

RE: Project: Cumberland Fossil Plant (CUF)
Pace Project No.: 10638993

Dear Kim Kesler-Arnold:

Enclosed are the analytical results for sample(s) received by the laboratory on January 06, 2023. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:

- Pace Analytical Services - Minneapolis

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Martha Hansen
martha.hansen@pacelabs.com
(612)607-6451
Project Manager

Enclosures

cc: Environmental Standards, Inc., Environmental Standards, Inc.
Cassidy Sutherland, Stantec
Michael Winkler, Stantec
Brigid Zvirbulis, Stantec

Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

CERTIFICATIONS

Project:	Cumberland Fossil Plant (CUF)
Pace Project No.:	10638993

Pace Analytical Services, LLC - Minneapolis MN

1700 Elm Street SE, Minneapolis, MN 55414
A2LA Certification #: 2926.01*
1800 Elm Street SE, Minneapolis, MN 55414--Satellite Air Lab
Alabama Certification #: 40770
Alaska Contaminated Sites Certification #: 17-009*
Alaska DW Certification #: MN00064
Arizona Certification #: AZ0014*
Arkansas DW Certification #: MN00064
Arkansas WW Certification #: 88-0680
California Certification #: 2929
Colorado Certification #: MN00064
Connecticut Certification #: PH-0256
EPA Region 8 Tribal Water Systems+Wyoming DW Certification #: via MN 027-053-137
Florida Certification #: E87605*
Georgia Certification #: 959
GMP+ Certification #: GMP050884
Hawaii Certification #: MN00064
Idaho Certification #: MN00064
Illinois Certification #: 200011
Indiana Certification #: C-MN-01
Iowa Certification #: 368
Kansas Certification #: E-10167
Kentucky DW Certification #: 90062
Kentucky WW Certification #: 90062
Louisiana DEQ Certification #: AI-03086*
Louisiana DW Certification #: MN00064
Maine Certification #: MN00064*
Maryland Certification #: 322
Michigan Certification #: 9909
Minnesota Certification #: 027-053-137*
Minnesota Dept of Ag Approval: via MN 027-053-137
Minnesota Petrofund Registration #: 1240*
Mississippi Certification #: MN00064
Missouri Certification #: 10100
Montana Certification #: CERT0092
Nebraska Certification #: NE-OS-18-06
Nevada Certification #: MN00064
New Hampshire Certification #: 2081*
New Jersey Certification #: MN002
New York Certification #: 11647*
North Carolina DW Certification #: 27700
North Carolina WW Certification #: 530
North Dakota Certification (A2LA) #: R-036
North Dakota Certification (MN) #: R-036
Ohio DW Certification #: 41244
Ohio VAP Certification (1700) #: CL101
Ohio VAP Certification (1800) #: CL110*
Oklahoma Certification #: 9507*
Oregon Primary Certification #: MN300001
Oregon Secondary Certification #: MN200001*
Pennsylvania Certification #: 68-00563
Puerto Rico Certification #: MN00064
South Carolina Certification #:74003001
Tennessee Certification #: TN02818
Texas Certification #: T104704192*
Utah Certification #: MN00064*
Vermont Certification #: VT-027053137
Virginia Certification #: 460163*
Washington Certification #: C486*
West Virginia DEP Certification #: 382
West Virginia DW Certification #: 9952 C
Wisconsin Certification #: 999407970
Wyoming UST Certification #: via A2LA 2926.01
USDA Permit #: P330-19-00208
*Please Note: Applicable air certifications are denoted with an asterisk (*).

Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

SAMPLE SUMMARY

Project: Cumberland Fossil Plant (CUF)
Pace Project No.: 10638993

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10638993001	**CUF-WS-CUFPV-002-20230104**	Water	01/04/23 13:20	01/06/23 08:50
10638993002	**CUF-WS-DUP01-20230104**	Water	01/04/23 00:00	01/06/23 08:50
10638993003	**CUF-WS-FB01-20230104**	Water	01/04/23 14:40	01/06/23 08:50
10638993004	**CUF-WS-TUB01-20230104**	Water	01/04/23 18:20	01/06/23 08:50

Pace Analytical Services, LLC
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Minneapolis, MN 55414
(612)607-1700

SAMPLE ANALYTE COUNT

Project: Cumberland Fossil Plant (CUF)
Pace Project No.: 10638993

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
10638993001	**CUF-WS-CUFPV-002-20230104**	EPA 200.8	NN2	1	PASI-M
		EPA 200.8	NN2	1	PASI-M
		EPA 300.0	AR3	2	PASI-M
10638993002	**CUF-WS-DUP01-20230104**	EPA 200.8	NN2	1	PASI-M
		EPA 200.8	NN2	1	PASI-M
		EPA 300.0	AR3	2	PASI-M
10638993003	**CUF-WS-FB01-20230104**	EPA 200.8	NN2	1	PASI-M
		EPA 200.8	NN2	1	PASI-M
		EPA 300.0	AR3	2	PASI-M
10638993004	**CUF-WS-TUB01-20230104**	EPA 200.8	NN2	1	PASI-M
		EPA 200.8	NN2	1	PASI-M
		EPA 300.0	AR3	2	PASI-M

PASI-M = Pace Analytical Services - Minneapolis

Pace Analytical
www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

PROJECT NARRATIVE

Project:	Cumberland Fossil Plant (CUF)
Pace Project No.:	10638993

Method: **EPA 200.8**
Description: 200.8 MET ICPMS
Client: TVA_Stantec
Date: January 09, 2023

General Information:
4 samples were analyzed for EPA 200.8 by Pace Analytical Services Minneapolis. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Sample Preparation:
The samples were prepared in accordance with EPA 200.8 with any exceptions noted below.

Initial Calibrations (including MS Tune as applicable):
All criteria were within method requirements with any exceptions noted below.

Continuing Calibration:
All criteria were within method requirements with any exceptions noted below.

Internal Standards:
All internal standards were within QC limits with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

PROJECT NARRATIVE

Project:	Cumberland Fossil Plant (CUF)
Pace Project No.:	10638993

Method: **EPA 200.8**
Description: 200.8 MET ICPMS, Lab Filtered
Client: TVA_Stantec
Date: January 09, 2023

General Information:
4 samples were analyzed for EPA 200.8 by Pace Analytical Services Minneapolis. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Sample Preparation:
The samples were prepared in accordance with EPA 200.8 with any exceptions noted below.

Initial Calibrations (including MS Tune as applicable):
All criteria were within method requirements with any exceptions noted below.

Continuing Calibration:
All criteria were within method requirements with any exceptions noted below.

Internal Standards:
All internal standards were within QC limits with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

PROJECT NARRATIVE

Project: Cumberland Fossil Plant (CUF)
Pace Project No.: 10638993

Method: **EPA 300.0**
Description: 300.0 IC Anions
Client: TVA_Stantec
Date: January 09, 2023

General Information:
4 samples were analyzed for EPA 300.0 by Pace Analytical Services Minneapolis. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

This data package has been reviewed for quality and completeness and is approved for release.

Pace Analytical
www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: Cumberland Fossil Plant (CUF)
Pace Project No.: 10638993

Sample: CUF-WS-CUFPV-002-20230104 **Lab ID: 10638993001** Collected: 01/04/23 13:20 Received: 01/06/23 08:50 Matrix: Water

Comments: • Well ID : Rye Spring

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8 Pace Analytical Services - Minneapolis								
Boron	**20.3**	ug/L	10.0	4.5	1	01/06/23 11:34	01/06/23 19:19	7440-42-8	
200.8 MET ICPMS, Lab Filtered	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8 Pace Analytical Services - Minneapolis								
Boron, Dissolved	**18.7**	ug/L	10.0	4.5	1	01/06/23 11:34	01/06/23 18:03	7440-42-8	
300.0 IC Anions	Analytical Method: EPA 300.0 Pace Analytical Services - Minneapolis								
Chloride	**6.5**	mg/L	1.2	0.39	1		01/07/23 00:50	16887-00-6	
Sulfate	**55.3**	mg/L	1.2	0.43	1		01/07/23 00:50	14808-79-8	

Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: Cumberland Fossil Plant (CUF)
Pace Project No.: 10638993

Sample: CUF-WS-DUP01-20230104 **Lab ID: 10638993002** Collected: 01/04/23 00:00 Received: 01/06/23 08:50 Matrix: Water

Comments: • Well ID : Rye Spring

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8 Pace Analytical Services - Minneapolis								
Boron	**18.3**	ug/L	10.0	4.5	1	01/06/23 11:34	01/06/23 18:33	7440-42-8	
200.8 MET ICPMS, Lab Filtered	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8 Pace Analytical Services - Minneapolis								
Boron, Dissolved	**16.8**	ug/L	10.0	4.5	1	01/06/23 11:34	01/06/23 18:48	7440-42-8	
300.0 IC Anions	Analytical Method: EPA 300.0 Pace Analytical Services - Minneapolis								
Chloride	**6.6**	mg/L	1.2	0.39	1		01/07/23 02:03	16887-00-6	
Sulfate	**55.4**	mg/L	1.2	0.43	1		01/07/23 02:03	14808-79-8	

Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: Cumberland Fossil Plant (CUF)
Pace Project No.: 10638993

Sample: CUF-WS-FB01-20230104 **Lab ID: 10638993003** Collected: 01/04/23 14:40 Received: 01/06/23 08:50 Matrix: Water

Comments: • Well ID : Rye Spring

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8 Pace Analytical Services - Minneapolis								
Boron	ND	ug/L	10.0	4.5	1	01/06/23 11:34	01/06/23 18:39	7440-42-8	
200.8 MET ICPMS, Lab Filtered	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8 Pace Analytical Services - Minneapolis								
Boron, Dissolved	ND	ug/L	10.0	4.5	1	01/06/23 11:34	01/06/23 18:54	7440-42-8	
300.0 IC Anions	Analytical Method: EPA 300.0 Pace Analytical Services - Minneapolis								
Chloride	ND	mg/L	1.2	0.39	1		01/07/23 02:17	16887-00-6	
Sulfate	ND	mg/L	1.2	0.43	1		01/07/23 02:17	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: Cumberland Fossil Plant (CUF)
Pace Project No.: 10638993

Sample: CUF-WS-TUB01-20230104 **Lab ID: 10638993004** Collected: 01/04/23 18:20 Received: 01/06/23 08:50 Matrix: Water

Comments: • Well ID : Rye Spring

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8 Pace Analytical Services - Minneapolis								
Boron	ND	ug/L	10.0	4.5	1	01/06/23 11:34	01/06/23 18:42	7440-42-8	
200.8 MET ICPMS, Lab Filtered	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8 Pace Analytical Services - Minneapolis								
Boron, Dissolved	ND	ug/L	10.0	4.5	1	01/06/23 11:34	01/06/23 18:58	7440-42-8	
300.0 IC Anions	Analytical Method: EPA 300.0 Pace Analytical Services - Minneapolis								
Chloride	ND	mg/L	1.2	0.39	1		01/07/23 02:32	16887-00-6	
Sulfate	ND	mg/L	1.2	0.43	1		01/07/23 02:32	14808-79-8	

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QUALITY CONTROL DATA

Project: Cumberland Fossil Plant (CUF)
Pace Project No.: 10638993

QC Batch: 861649
QC Batch Method: EPA 200.8
Analysis Method: EPA 200.8
Analysis Description: 200.8 MET
Laboratory: Pace Analytical Services - Minneapolis
Associated Lab Samples: 10638993001, 10638993002, 10638993003, 10638993004

METHOD BLANK: 4551433 Matrix: Water
Associated Lab Samples: 10638993001, 10638993002, 10638993003, 10638993004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Boron	ug/L	ND	10.0	4.5	01/06/23 19:13	

LABORATORY CONTROL SAMPLE: 4551434

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	100	101	101	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 4551435 4551436

Parameter	Units	10638993001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	20.3	100	100	119	118	98	98	70-130	1	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALITY CONTROL DATA

Project: Cumberland Fossil Plant (CUF)
Pace Project No.: 10638993

QC Batch: 861667 | Analysis Method: EPA 200.8
QC Batch Method: EPA 200.8 | Analysis Description: 200.8 MET Dissolved
Laboratory: Pace Analytical Services - Minneapolis
Associated Lab Samples: 10638993001, 10638993002, 10638993003, 10638993004

METHOD BLANK: 4551549 Matrix: Water
Associated Lab Samples: 10638993001, 10638993002, 10638993003, 10638993004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Boron, Dissolved	ug/L	ND	10.0	4.5	01/06/23 17:57	

LABORATORY CONTROL SAMPLE: 4551550

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron, Dissolved	ug/L	100	104	104	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 4551551 4551552

Parameter	Units	10638993001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron, Dissolved	ug/L	18.7	100	100	117	117	98	99	70-130	0	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALITY CONTROL DATA

Project: Cumberland Fossil Plant (CUF)
Pace Project No.: 10638993

QC Batch: 861716 | Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 | Analysis Description: 300.0 IC Anions
Laboratory: Pace Analytical Services - Minneapolis
Associated Lab Samples: 10638993001, 10638993002, 10638993003, 10638993004

METHOD BLANK: 4551955 Matrix: Water
Associated Lab Samples: 10638993001, 10638993002, 10638993003, 10638993004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	ND	1.2	0.39	01/07/23 03:15	
Sulfate	mg/L	ND	1.2	0.43	01/07/23 03:15	

LABORATORY CONTROL SAMPLE: 4551956

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	50	50.6	101	90-110	
Sulfate	mg/L	50	51.8	104	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 4551957 4551958

Parameter	Units	10638993001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	6.5	50	50	57.2	57.6	101	102	80-120	1	20	
Sulfate	mg/L	55.3	50	50	102	102	94	94	80-120	0	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALIFIERS

Project: Cumberland Fossil Plant (CUF)
Pace Project No.: 10638993

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Reported results are not rounded until the final step prior to reporting. Therefore, calculated parameters that are typically reported as "Total" may vary slightly from the sum of the reported component parameters.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Cumberland Fossil Plant (CUF)
Pace Project No.: 10638993

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10638993001	**CUF-WS-CUFPV-002-20230104**	EPA 200.8	861649	EPA 200.8	861714
10638993002	**CUF-WS-DUP01-20230104**	EPA 200.8	861649	EPA 200.8	861714
10638993003	**CUF-WS-FB01-20230104**	EPA 200.8	861649	EPA 200.8	861714
10638993004	**CUF-WS-TUB01-20230104**	EPA 200.8	861649	EPA 200.8	861714
10638993001	**CUF-WS-CUFPV-002-20230104**	EPA 200.8	861667	EPA 200.8	861715
10638993002	**CUF-WS-DUP01-20230104**	EPA 200.8	861667	EPA 200.8	861715
10638993003	**CUF-WS-FB01-20230104**	EPA 200.8	861667	EPA 200.8	861715
10638993004	**CUF-WS-TUB01-20230104**	EPA 200.8	861667	EPA 200.8	861715
10638993001	**CUF-WS-CUFPV-002-20230104**	EPA 300.0	861716		
10638993002	**CUF-WS-DUP01-20230104**	EPA 300.0	861716		
10638993003	**CUF-WS-FB01-20230104**	EPA 300.0	861716		
10638993004	**CUF-WS-TUB01-20230104**	EPA 300.0	861716		

Chain-of-Custody/Analytical Request Document
Legal Document - All relevant fields must be complete and accurate

v01

TVA

Program(s): CCR ☐ RI ☐ WIM ☐ State Compliance ☑ Consent Decree ☐ Interim GW ☐

Cooler No: of 2 Page No: 1 of 1
COC No: COC_CUF_20230104_1A
Task Code: CUF_WUS_20230104
Edit Task? ✓

Lab Information:
Lab Name: Pace Minneapolis
Lab Address: 1700 Elm Street SE - Ste 200 Minneapolis, MN 55414
Lab PM: Martha Hansen, Martha.Hansen@pacelabs.com, 612-607-6451
Lab PO:

Project Information:
Site Name: Cumberland Fossil Plant (CUF)
Site Address: 815 Cumberland City Rd, Cumberland City, TN 37050
Site PM: Dominic Norman, dcnorman0@tva.gov, 775-762-8807

Sampler Information:
Sampling Company: STANTEC
Sampling Company Address: 601 Grassmere Park Road, Nashville, TN 37211
Sampler Name: TV, AW
Team Number: 1
Turn-Around Time: 5 Business Days

Send EDD/Hard Copy to: tva_deliverables@envstd.com

ITEM #	SAMPLE ID	SAMPLE LOCATION	MATRIX CODE	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	COMMENTS LAB SAMPLE ID	CUF_CCR/STATE_ANIONS_ALK (Filter? N; Preservative None)	CUF_CCR/STATE_METALS (Filter? N; Preservative HNO3)	CUF_CCR/STATE_METALS_DISS (Filter? N; Preservative HNO3)	
1	CUF-WS-CUFPV-002-20230104	Rye Spring	SW	N	01/04/2023	1320	18	Hold bottles noted on sample labels, M[illegible]	X	X	X	001
2	CUF-WS-DUP01-20230104	Rye Spring	SW	FD	01/04/2023	NA	6	Hold bottles noted on sample labels	x	x	x	002
3	CUF-WS-FB01-20230104	Rye Spring	WQ	FB	01/04/2023	1440	4	Hold bottles noted on sample labels	x	x	x	003
4	CUF-WS-TUB01-20230104	Rye Spring	WQ	TB	01/04/2023	1820	4	Hold bottles noted on sample labels	x	x	x	004
5												
6												
7												
8												
9												
10												
11												
12												
13												

TV 1/5/23

TV 1/5/23

WO#: 10638993
10638993

Additional Comments/Special Instructions:
Additional volume collected should be used for MS/MSDs. Dissolved metals samples should be lab filtered.

Manually Edit Sample IDs? ✓

RELINQISHED BY	AFFILIATION	DATE	TIME	ACCEPTED BY	AFFILIATION	DATE	TIME
VanEgtern, Trenton (Digitally signed by VanEgtern, Trenton Date: 2023.01.05 11:09:36 -06'00')	Stantec	01/05/2023	12:00	Evan Quist[illegible]	Pace	1-6-23	8:50

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME	SIGNATURE
FedEx	Trenton VanEgtern	VanEgtern, Trenton (Digitally signed by VanEgtern, Trenton Date: 2023.01.05 11:09:54 -06'00')

Sample Receipt Conditions

Temperature In °C	Sample on Ice?	Sample Intact?	Trip Blank?
2.1	☑Yes ☐No	☑Yes ☐No	☐Yes ☑No
☐Yes ☐No	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No

Chain-of-Custody/Analytical Request Document
Legal Document - All relevant fields must be complete and accurate

v01

TVA

Program(s): CCR ☐ RI ☐ WIM ☐ State Compliance ☑ Interim GW ☐ Consent Decree ☐

Cooler No: of 2 **Page No:** 1 of 1
COC No: COC_CUF_20230104_1A
Task Code: CUF_WUS_20230104
Edit Task? ✓

Lab Information:

Lab Name:	Pace Minneapolis
Lab Address:	1700 Elm Street SE - Ste 200 Minneapolis, MN 55414
Lab PM:	Martha Hansen Martha.Hansen@pacelabs.com 612-607-6451
Lab PO:	

Project Information:

Site Name:	Cumberland Fossil Plant (CUF)
Site Address:	815 Cumberland City Rd Cumberland City, TN 37050
Site PM:	Dominic Norman dcnorman0@tva.gov 775-762-8807

Sampler Information:

Sampling Company:	STANTEC
Sampling Company Address:	601 Grassmere Park Road Nashville, TN 37211
Sampler Name:	TV, AW
Team Number:	1
Turn-Around Time:	5 Business Days

Send EDD/Hard Copy to: tva_deliverables@envstd.com

ITEM #	SAMPLE ID	SAMPLE LOCATION	MATRIX CODE	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	COMMENTS LAB SAMPLE ID	CUF_CCR/STATE_ANIONS_ALK (Filter? N; Preservative: None)	CUF_CCR/STATE_METALS (Filter? N; Preservative: HNO3)	CUF_CCR/STATE_METALS_DISS (Filter? N; Preservative: HNO3)
1	CUF-WS-CUFPV-002-20230104	Rye Spring	SW	N	01/04/2023	1320	18	Hold bottles noted on sample labels, MS…	X	X	X
2	CUF-WS-DUP01-20230104	Rye Spring	SW	FD	01/04/2023	NA	6	Hold bottles noted on sample labels	X	X	X
3	CUF-WS-FB01-20230104	Rye Spring	WQ	FB	01/04/2023	1440	4	Hold bottles noted on sample labels	X	X	X
4	CUF-WS-TUB01-20230104	Rye Spring	WQ	TB	01/04/2023	1820	4	Hold bottles noted on sample labels	X	X	X
5											
6											
7											
8											
9											
10											
11											
12											
13											

TV 1/5/23

TV 1/5/23

Additional Comments/Special Instructions:
Additional volume collected should be used for MS/MSDs. Dissolved metals samples should be lab filtered.

Manually Edit Sample IDs? ✓

RELINQUISHED BY	AFFILIATION	DATE	TIME	ACCEPTED BY	AFFILIATION	DATE	TIME
VanEgtern, Trenton (Digitally signed by VanEgtern, Trenton Date: 2023.01.05 11:09:36 -06'00')	Stantec	01/05/2023	12:00	[signature]	Pace	1-6-23	8:30

SHIPPING METHOD: (Select Appropriate)	SAMPLER NAME	SIGNATURE
FedEx	Trenton VanEgtern	VanEgtern, Trenton (Digitally signed by VanEgtern, Trenton Date: 2023.01.05 11:09:54 -06'00')

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
2.1 / 3.1	☑Yes ☐No	☑Yes ☐No	☐Yes ☑No

Sample Condition Upon Receipt - ESI Tech Specs

Client Name: TVA

Project #: WO#: 10638993
PM: MKH Due Date: 01/20/23
CLIENT: Stantec-MI

Courier: ☑ FedEx ☐ UPS ☐ USPS ☐ Client ☐ Pace ☐ SpeeDee ☐ Commercial ☑ See Exceptions ENV-FRM-MIN4-0142

Tracking Number: 5405 1815 3639

Custody Seal on Cooler/Box Present? ☑ Yes ☐ No Seals Intact? ☑ Yes ☐ No Biological Tissue Frozen? ☐ Yes ☐ No ☑ N/A

Packing Material: ☐ Bubble Wrap ☐ Bubble Bags ☑ None ☐ Other Temp Blank? ☐ Yes ☑ No

Thermometer: ☑ T1 (0461) ☐ T2 (1336) ☐ T3 (0459) ☐ T4 (0254) ☐ T5 (0178) ☐ T6 (0235) ☐ T7 (0042) ☐ T8 (0775) ☐ 01339252/1710

Type of Ice: ☑ Wet ☐ Blue ☐ Dry ☐ None ☐ Melted

Temp should be above freezing to 6 °C Cooler temp Read w/Temp Blank: ______ °C	Average Corrected Temp (no temp blank only): ______ °C
Correction Factor: True Cooler Temp Corrected w/temp blank: ______ °C	☑ See Exceptions ENV-FRM-MIN4-0142 ☐ 1 Container

USDA Regulated Soil: (☑ N/A, water sample/other: ____________)

Date/Initials of Person Examining Contents: EC 1-6-23

Did samples originate in a quarantine zone within the United States: AL, AR, AZ CA, FL, GA, ID, LA, MS, NC, NM, NY, OK, OR, SC, TN, TX, or VA (check maps)? ☐ Yes ☐ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☐ No

If Yes to either question, fill out a Regulated Soil Checklist (ENV-FRM-MIN4-0154) and include with SCUR/COC paperwork.

Location (Check one): ☐ Duluth ☑ Minneapolis ☐ Virginia				**COMMENTS**
Chain of Custody Present and Filled Out?	☑ Yes	☐ No		1.
Chain of Custody Relinquished?	☑ Yes	☐ No		2.
Sampler Name and/or Signature on COC?	☑ Yes	☐ No	☐ N/A	3.
Samples Arrived within Hold Time?	☑ Yes	☐ No		4.
Short Hold Time Analysis (<72 hr)?	☐ Yes	☑ No		5. ☐ Fecal Coliform ☐ HPC ☐ Total Coliform/E.coli ☐ BOD/cBOD ☐ Hex Chrom ☐ Turbidity ☐ Nitrate ☐ Nitrite ☐ Orthophos ☐ Other ______
Rush Turn Around Time Requested?	☑ Yes	☐ No		6. 5 days
Sufficient Sample Volume?	☑ Yes	☐ No		7.
Triple Volume Provided for MS/MSD (if more than 10 samples)?	☐ Yes	☐ No	☑ N/A	
Correct Containers Used?	☑ Yes	☐ No		8.
-Pace Containers Used?	☑ Yes	☐ No		
Containers Intact?	☑ Yes	☐ No		9.
Field Filtered Volume Received for Dissolved Tests?	☐ Yes	☐ No	☑ N/A	10. Is sediment visible in the dissolved container? ☐ Yes ☐ No
Is sufficient information available to reconcile the samples to the COC? Matrix: ☑ Water ☐ Soil ☐ Oil ☐ Other	☑ Yes	☐ No		11. **If no, write ID/Date/Time of container below:** ☐ See Exceptions ENV-FRM-MIN4-0142
All containers needing acid/base preservation have been checked?	☑ Yes	☐ No	☐ N/A	12. Sample # 001-004
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO3, H2SO4, <2pH, NaOH >9 Sulfide, NaOH>10 Cyanide)	☑ Yes	☐ No	☐ N/A	☐ NaOH ☑ HNO3 ☐ H2SO4 ☐ Zinc Acetate
Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxins/PFAS (*If adding preservative to a container, it must be added to associated field and equipment blanks--verify with PM first.)	☐ Yes	☐ No	☑ N/A	Positive for Residual Chlorine? ☐ Yes ☐ No ☐ See Exceptions ENV-FRM-MIN4-0142 **pH Paper Lot #** Residual Chlorine / 0-6 Roll: 208422 / 0-6 Strip / 0-14 Strip
Extra labels present on soil VOA or WIDRO containers?	☐ Yes	☐ No	☑ N/A	13. ☐ See Exceptions ENV-FRM-MIN4-0142
Headspace in VOA Vials (greater than 6mm)?	☐ Yes	☐ No	☑ N/A	
3 Trip Blanks Present?	☐ Yes	☐ No	☑ N/A	14.
Trip Blank Custody Seals Present?	☐ Yes	☐ No	☑ N/A	Pace Trip Blank Lot # (if purchased): ______

Temp Log: Temp must be maintained at <6°C during login, record temp every 20 mins		
Opened Time: 9:30	Temp: 2.1/3.1 °C	Corrected Temp: 2.1/3.1 °C
Time:	put in cooler	
Time:	Temp:	Corrected Temp:

CLIENT NOTIFICATION/RESOLUTION Field Date Required? ☐ Yes ☐ No

Person Contacted: ______ Date/Time: ______

Comments/Resolution: No analytes listed on COC. Samples logged per MAG list on file.

Project Manager Review: ______ Date: 1/6/23

NOTE: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e., out of hold, incorrect preservative, out of temp, incorrect containers).

Labeled By: EC / ED Line: 2

Workorder #: ____________________

No Temp Blank					
Read Temp		**Corrected Temp**		**Average temp**	
2.1		2.1		2.1	
1.6		1.6			
1.9		1.9			
2.9		2.9			

PM Notified of Out of Temp Cooler? ☐ Yes ☐ No

If yes, indicate who was contacted, date and time.
If no, indicate reason why.

____

Multiple Cooler Project? ☐ Yes ☐ No

If anything is OVER 6.0° C, you MUST document containers in this section HERE

Tracking Number	Temperature
5405 1815 3639	2.1
5405 1825 1832	3.1

Out of Temp Sample ID	Container Type	# of Containers

pH Adjustment Log for Preserved Samples										
Sample ID	**Type Of Preserve**	**pH Upon Receipt**	**Date Adjusted**	**Time Adjusted**	**Amount Added (mL)**	**Lot # Added**	**pH After**	**In Compliance After Addition?**		**Initials**
								☐ Yes	☐ No	
								☐ Yes	☐ No	
								☐ Yes	☐ No	
								☐ Yes	☐ No	
								☐ Yes	☐ No	
								☐ Yes	☐ No	
								☐ Yes	☐ No	
								☐ Yes	☐ No	

Comments:

____

____

____