2023 Annual Groundwater Monitoring Report for Fly Ash Reservoir (FAR) II Cardinal Operating Company – Cardinal Upland Disposal Facility (Rev. 1) 306 County Road 7E Brilliant, Ohio

February 27, 2024

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OHIO'S ELECTRIC COOPERATIVES
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February 28, 2024

Cardinal Operating Company
306 County Road 7E
Brilliant, Ohio 43913

Subject: FAR II CCR 2023 Annual Groundwater Report – Revision 1

The 2023 Annual Groundwater Report for FAR II was uploaded to the Facility Operating Record on January 31st, 2024.

After upload, it was determined that the concentrations entered for monitoring well CA-0623A were entered incorrectly on Table 4-8.

Table 4-8 has been revised with the correct concentrations for CA-0623A and the report has been re-issued as Revision 1.

Any additional questions, please contact CCRQuestions@ohioec.org

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Executive Summary

Cox-Colvin & Associates, Inc. (Cox-Colvin) has prepared this 2023 Annual Groundwater Monitoring Report (Report) for the Fly Ash Reservoir II (FAR II), an existing coal combustion residual (CCR) unit at the Cardinal Plant in Brilliant, Ohio. This report has been prepared in accordance with §257.90(e) of the Federal Coal Combustion Residuals Rules ("CCR Rules", 40 CFR Subpart D), which requires owners and/or operators of existing CCR landfills and surface impoundments to prepare a groundwater monitoring and corrective action report no later than January 31, annually. This report summarizes groundwater monitoring activities conducted pursuant to the CCR Rules from January 1, 2023, through December 31, 2023.

In 2023, seven pre-existing monitoring wells were added to its groundwater monitoring network to monitor potential impacts to the Shallow Aquifer. Eight background monitoring events were conducted in the first half of 2023 to establish background conditions. The first compliance sampling event was conducted in October 2023.

In the Morgantown Aquifer, SSIs above background concentrations were observed for the following constituents and wells:

- Boron: FA-8, M-10, M-11, M-21, M-22, M-23, M-1004, M-2000, M-GS-3, M-GS-3R
- Calcium: M-12
- pH[1]: M-12, M-14, M-15

In accordance with §257.95 of the CCR Rules, assessment monitoring at FAR II was initiated in May 2018 after an SSI over groundwater background levels was first detected. FAR II remained in an assessment monitoring program from May 2018 through January 2019. In February 2019, it transitioned to a corrective action program following detection of statistically significant levels (SSLs) of groundwater contamination above groundwater protection standards (GWPSs). In accordance with §257.98(a)(1)(i) of the CCR Rules, assessment monitoring continues to be conducted as part of the corrective actions being performed. FAR II was operating under an assessment monitoring program (§257.95 of the CCR Rules) at the start of the 2023 annual reporting period and remained in the assessment monitoring program throughout the 2023 annual reporting period.

Statistical evaluations of two assessment monitoring events of the Morgantown Aquifer were completed during this annual reporting period – the second semiannual event of 2022

[1] Unlike other monitored constituents that are compared to only a UPL, pH is compared to both a UPL and an LPL when evaluating potential SSIs. In this context, a statistically significant decrease (SSD) of pH values below the LPL is included as a potential "SSI" for consistency with the language and requirements of the CCR Rule.

(October 2022)[2] and the first semiannual event of 2023 (April 2023). SSLs above GWPSs were identified for the following constituents and wells:

- Lithium: FA-8, M-11
- Molybdenum: FA-8, M-11

Statistical analysis of the October semi-annual sampling event of 2023 for both the Shallow and Morgantown Aquifer will be completed in 2024 and presented in next year's Annual Groundwater Monitoring Report.

Assessment of corrective measures for the lithium and molybdenum SSLs was initiated on February 7, 2019, and completed on July 9, 2019, with a revised version posted to the public website on November 30, 2020. The public meeting for the assessment of corrective measures was held on September 4, 2019, in Steubenville, Ohio.

A remedy was selected on October 27, 2020. Remedial activities were initiated in 2021 and are ongoing pursuant to §257.98 of the CCR Rules.

[2] Although samples were collected in October 2022, evaluation of the laboratory results was performed in 2023 and discussion of the evaluation is, therefore, included in this annual report. The October 2022 sampling results were included in the 2022 Annual Groundwater Monitoring Report.

1.0 Introduction

Cox-Colvin & Associates, Inc. (Cox-Colvin) has prepared this 2023 Annual Groundwater Monitoring Report for the Fly Ash Reservoir II (FAR II) at the Cardinal Plant in Brilliant, Ohio (Figure 1-1). This report has been prepared in accordance with §257.90(e) of the Federal Coal Combustion Residuals Rule ("CCR Rules", 40 CFR Subpart D), which requires owners and/or operators of existing CCR landfills and surface impoundments to prepare a groundwater monitoring and corrective action report no later than January 31, annually. This report summarizes groundwater monitoring activities conducted pursuant to the CCR Rules from January 1, 2023, through December 31, 2023.

1.1 Site Summary

The Site is located one mile west and south of Brilliant, Ohio in Jefferson County and is operated by Cardinal Operating Company (Cardinal). Located along the Ohio River, the generating plant consists of three coal-powered units with an 1,800-megawatt (MW) capacity. Units 1 and 2 began operation in 1967 and Unit 3 began operation in 1977. Each generating unit is equipped with an electrostatic precipitator (ESP) for removal of fly ash particulate matter, a selective catalytic reduction (SCR) system for removal of nitrogen oxide, and flue gas desulfurization (FGD) systems for removal of sulfur dioxide (Geosyntec 2017).

1.2 CCR Unit Description

FAR II is an existing wet fly ash disposal reservoir that is located approximately one mile north of the Site and immediately east of the FAR I Residual Solid Waste (RSW) Landfill. The reservoir is contained within Blockhouse Hollow (also referred to as Blockhouse Run in references and drawings) by Fly Ash Dam (FAD) 2 and the decommissioned FAD I. FAR II received sluiced fly ash from the generating units' ESPs and collected stormwater and leachate from the FAR I RSW Landfill. FAR II has a permitted discharge through the National Pollutant Discharge Elimination System (NPDES) Outfall 019 (Geosyntec 2017).

As of July 2021, FAR II no longer receives waste streams and is presently undergoing closure.

1.3 Regional Physiographic Setting

The Site is underlain by horizontal sequences of lower Permian and upper Pennsylvanian sedimentary rock. The Conemaugh Group, 500 feet (ft) thick in Jefferson County, consists of shale, sandstone, limestone, claystone, and coal. This group includes the Morgantown Sandstone underlain by the Elk Lick Limestone, the Skelly Limestone and Shale, the Ames Limestone, and the Cow Run Sandstone (Geosyntec 2017). Above the current grade of FAR II lies the Monongahela Group, which consists of shale, sandstone,

limestone, coal, claystone, and siltstone. Overlying the Monongahela Group, at approximately 1,250 feet in elevation, is the Permian-age Dunkard Group (Geosyntec 2017).

1.3.1 Shallow Aquifer

Based on monitoring well data in the vicinity of FAR II, the Uppermost Aquifer is the Shallow Aquifer. The Shallow Aquifer consists of sandstone and limestone units within the Connellsville Sandstone, Summerfield Limestone, and Bellaire Sandstone, along with mine voids in the Pittsburgh No. 8 Coal and fill materials deposited during historical surface mining (Cox-Colvin 2023a). Hydraulic conductivity of the Shallow Aquifer ranges from $1x10^{-1}$ to $1x10^{-4}$ cm/sec (Geosyntec 2016). The Shallow Aquifer lies above a shale aquitard that has very low conductivity values, in the range of $1x10^{-7}$ to $1x10^{-9}$ cm/sec (Geosyntec 2017).

Groundwater flow in the Shallow Aquifer is generally towards FAR II in all locations except those in close proximity to FAD 2. The CCR Unit and associated Shallow Aquifer monitoring wells are shown in Figure 1-2.

1.3.2 Morgantown Aquifer

A second aquifer, the Morgantown Sandstone, lies beneath the shale aquitard. Hydraulic conductivity values of the Morgantown Sandstone are in the range of $1x10^{-1}$ to $1x10^{-6}$ cm/sec and tend to be driven by interconnected fracture flow. As noted above, FAR II is positioned within a former stream valley and is partially incised into the Morgantown Sandstone. The Morgantown Sandstone, therefore, also comprises an Uppermost Aquifer.

In the vicinity of FAR II, groundwater in the Morgantown Sandstone generally flows southwest and east from a highland area northwest of FAR II before turning southerly toward the Ohio River. The CCR Unit and associated Morgantown Sandstone aquifer monitoring wells are shown in Figures 1-3.

A second shale aquitard lies beneath the Morgantown Sandstone, separating it from the Cow Run Sandstone. Groundwater in the Cow Run Sandstone is generally too saline to be usable (total dissolved solids [TDS] concentrations often exceed 15,000 mg/L).

2.0 Groundwater Monitoring System

FAR II's groundwater monitoring network was designed to comply with 40 CFR 257.91. The groundwater monitoring network utilizes monitoring wells initially installed as part of a separate site-wide hydrogeologic investigation and is used to monitor groundwater quality in the uppermost aquifers at the Site. As previously mentioned, the groundwater monitoring network was recently updated in June 2023 to monitor the Shallow Aquifer. Monitoring well construction and soil boring logs are provided in the Groundwater Monitoring System Report (Cox-Colvin 2023a).

2.1 Shallow Aquifer

The FAR II Shallow Aquifer groundwater monitoring network consists of 7 monitoring wells, as shown in Figure 1-2. Four upgradient monitoring wells (CA-0623A, S-15, S-22, and S-1005) are used to measure background conditions and three downgradient monitoring wells (S-9, S-21, and S-23) are used as compliance wells.

2.2 Morgantown Aquifer

The FAR II Morgantown Aquifer groundwater monitoring network consists of 23 monitoring wells, as shown in Figure 1-3. Five upgradient monitoring wells (CA-0622A, M-12, M-1302, M-6, and M-GS-5) are used to measure background conditions and eighteen downgradient monitoring wells (FA-8, M-10, M-1003, M-1004, M-11, M-13, M-1309, M-14, M-15, M-16, M-21, M-22, M-23, M-8, M-GS-1, M-GS-2, M-GS-3R, and M-GS-4) are used as compliance wells. Additionally, monitoring well M-2000 was installed in 2019 as a delineation well to facilitate characterization of the nature and extent of a previously identified release. Although it has been sampled semi-annually as part of the corrective measures program, it is not part of the groundwater monitoring system used for assessment monitoring.

3.0 Groundwater Monitoring Program

In accordance with §257.95 of the CCR Rules, assessment monitoring at FAR II was initiated in May 2018 after an SSI in boron concentrations above background levels was detected in the Morgantown Aquifer. As discussed in Section 4.3 concentrations of constituents in groundwater remain above background levels.

FAR II remained in an assessment monitoring program from May 2018 through January 2019. In February 2019, it transitioned to a corrective action program following detection of statistically significant levels (SSLs) of lithium and molybdenum in the Morgantown Aquifer above their respective groundwater protection standards (GWPSs). In accordance with §257.98(a)(1)(i) of the CCR Rules, assessment monitoring continues to be conducted as part of the corrective action program. Concentrations of lithium and molybdenum in groundwater remain above their respective GWPSs, and FAR II remained in the corrective action program through 2023.

In 2023, the Shallow Aquifer was added to the FAR II groundwater monitoring program and background concentrations for Appendix III and Appendic IV constituents established (Cox-Colvin 2023b). The initial round of groundwater sampling for compliance purposes occurred in October 2023. The results of that comparison are discussed in Section 4.3.

3.1 Statistical Analysis Plan

Evaluation of analytical data is performed in accordance with the Statistical Analysis Plan (Geosyntec 2020b), which describes a logic process regarding the statistical analysis of groundwater data collected in compliance with the Federal CCR Rules. No revisions were made to the Statistical Analysis Plan during 2023.

3.2 Monitoring Frequency

In accordance with §257.95(d)(1) of the CCR Rules, monitoring wells are sampled semi-annually for constituents listed in Appendix III of the CCR Rules. Additionally, annual sampling of all Appendix IV constituents is performed, along with semiannual sampling of those constituents in Appendix IV that were detected during the annual sampling of all Appendix IV constituents.

In September 2021, a demonstration was made that an alternative monitoring frequency may be appropriate (Cox-Colvin 2021). The purpose of the alternative monitoring frequency, which is optional, is to permit semiannual monitoring of all Appendix IV parameters, rather than only those that were previously detected during annual monitoring. The alternative monitoring frequency results in more, rather than less, analysis of groundwater quality. All Appendix IV parameters were analyzed during both 2023 sampling events.

There was no suspension of groundwater monitoring requirements at FAR II under §257.90(g) of the CCR Rules.

4.0 Key Actions Completed

The sections below summarize key actions completed in 2023 with respect to CCR Rules groundwater monitoring and corrective actions at FAR II.

4.1 Groundwater Elevation and Flow

Prior to sampling, a synoptic round of groundwater level measurements was collected from the compliance and background monitoring wells. Potentiometric surface maps for the Shallow Aquifer are presented as Figures 4-1 through 4-9. Potentiometric surface maps for the Morgantown Sandstone aquifer, based on groundwater elevations measured during the April and October 2023 sampling events, are presented in Figures 4-10 and 4-11.

The Shallow Aquifer potentiometric maps demonstrate that groundwater tends to follow the topography inward toward FAR II. Groundwater flow rate calculations for the Shallow Aquifer background sampling events and the initial (Fall) semi-annual sample event are summarized in Tables 4-1 and 4-2, respectively.

The Morgantown Aquifer potentiometric maps demonstrate that groundwater near FAR II generally flows southeast towards the Ohio River. Groundwater flow rate calculations for the Morgantown Aquifer for the first (Spring) semi-annual sampling event and the second (Fall) semi-annual sampling event are summarized in Tables 4-3 and 4-4, respectively.

4.2 Groundwater Sampling

Groundwater samples from both the Shallow Aquifer and the Morgantown Sandstone aquifer were collected in 2023. Tables 4-5 and 4-6 contain summaries of the Shallow Aquifer groundwater samples and Morgantown Aquifer groundwater samples, respectively. Details of the sampling events are presented below.

4.2.1 Shallow Aquifer

Eight rounds of background samples were collected from the Shallow Aquifer between February and June 2023. The initial (Fall) semi-annual sampling event for the Shallow Aquifer occurred in October 2023. In December 2023, monitor well S-9 was resampled. A total of 65 samples were collected from the Shallow Aquifer (Table 4-5). The results of the background sampling event and the initial (Fall) semi-annual sampling event are presented on Tables 4-7 and 4-8, respectively.

4.2.2 Morgantown Aquifer

The first (Spring) semi-annual monitoring event of 2023 was completed in April 2023 and the second (Fall) semi-annual monitoring event of 2023 was completed in October 2023.

A total of 46 samples from the Morgantown Aquifer were collected (Table 4-6). Analytical results for the Spring and Fall events are presented on Tables 4-9 and 4-10, respectively.

4.3 Data Evaluation

Data evaluations performed in 2023 consisted of the following:

- Comparison of Fall 2022 monitoring data (Morgantown Aquifer) to GWPSs for Appendix IV constituents[3]
- Comparison of Spring 2023 monitoring data (Morganton Aquifer) to background levels for Appendix III constituents
- Comparison of Spring 2023 monitoring data (Morgantown Aquifer) to GWPSs for Appendix IV constituents

Comparison of Fall 2023 monitoring data to background levels for Appendix III constituents and GWPSs for Appendix IV constituents is ongoing and will be included in the 2024 annual report.

The current Appendix III background standards for the Shallow Aquifer and the Morgantown Sandstone aquifer are provided on Table 4-11 and 4-12, respectively. The current Appendix IV GWPS for the Shallow Aquifer and the Morgantown Sandstone aquifer are provided on Table 4-13 and 4-14 respectively.

4.3.1 Background Levels

Presented below is a discussion of the background concentrations for Shallow Aquifer and the Morgantown Sandstone aquifer.

4.3.1.1 Shallow Aquifer

Appendix III constituent[4] background levels for the Shallow Aquifer were established in October 2023 (Cox-Colvin 2023b).

Background concentrations of Appendix IV constituents for the Shallow Aquifer were established in October 2023 following the completion of eight background sampling events (Cox-Colvin 2023b). Appendix IV background concentrations are used while

[3] Although samples were collected in October 2022, evaluation of the laboratory results was performed in 2023 and discussion of the evaluation is, therefore, included in this annual report. The October 2022 sampling results were included in the 2022 Annual Groundwater Monitoring Report.
[4] "Appendix III" and "Appendix IV" constituents refer to those constituents listed in the respective appendices of the CCR Rules.

determining GWPS values. Because the Appendix IV background levels are based upon upper threshold limits (UTLs), as opposed to UPLs, direct comparison of individual laboratory results to Appendix IV background levels is not appropriate. Instead, statistical evaluation is performed (using confidence bands) to determine whether GWPSs are exceeded, as discussed below.

4.3.1.2 Morgantown Aquifer

Appendix III constituent background levels for the Morgantown Sandstone aquifer were most recently updated in August 2023 (Cox-Colvin 2023c).

During the 2023 groundwater monitoring, SSIs above background concentrations were observed for the following constituents and wells:

- Boron: FA-8, M-10, M-11, M-21, M-22, M-23, M-1004, M-GS-3, M-GS-3R
- Calcium: M-12
- pH[5]: M-12, M-14, M-15

Background concentrations of Appendix IV constituents for the Morgantown Aquifer were also updated in August 2023. Appendix IV background concentrations are used while determining GWPS values. Because the Appendix IV background levels are based upon upper threshold limits (UTLs), as opposed to UPLs, direct comparison of individual laboratory results to Appendix IV background levels is not appropriate. Instead, statistical evaluation is performed (using confidence bands) to determine whether GWPSs are exceeded, as discussed below.

4.3.2 Groundwater Protection Standards

A GWPS was established for each Appendix IV parameter in accordance with the United States Environmental Protection Agency's Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance (EPA 2009) and the Site's Statistical Analysis Plan (Geosyntec 2020b). The established GWPSs were determined to be the greater value of the background concentration and the maximum contaminant level (MCL) for each Appendix IV parameter. If an MCL was not available, values were obtained from §257.95(h)(2) of the CCR Rules. The current GWPSs for the Shallow Aquifer and the Morgantown Sandstone aquifer are presented in Tables 4-13 and 4-14, respectively.

[5] Unlike other monitored constituents that are compared to only a UPL, pH is compared to both a UPL and an LPL when evaluating potential SSIs. In this context, a statistically significant decrease (SSD) of pH values below the LPL is included as a potential "SSI" for consistency with the language and requirements of the CCR Rule.

4.3.2.1 Shallow Aquifer

Statistical evaluation of the October 2023 monitoring data is ongoing and will be discussed in the 2024 annual groundwater monitoring report.

4.3.2.2 Morgantown Aquifer

A statistical evaluation of the second 2022 semi-annual event assessment monitoring data was completed in March 2023 and included an evaluation of SSLs for Appendix IV parameters. SSLs were observed for the following constituents and wells:

- Lithium: FA-8, M-11
- Molybdenum: FA-8, M-11

A statistical evaluation of the first 2023 semi-annual event assessment monitoring data was completed in September 2023 and included an evaluation of SSLs for Appendix IV parameters. SSLs were observed for the following constituents and wells.

- Lithium: FA-8, M-11
- Molybdenum: FA-8, M-11

An alternate source was not identified for the SSLs. These SSLs were identified during previous sampling events and are being addressed through the corrective measures process outlined in Section 4.6, below.

Statistical evaluation of the October 2023 assessment monitoring data is ongoing and will be discussed in the 2024 annual groundwater monitoring report.

4.4 Corrective Actions

Following detection of lithium and molybdenum SSLs at FA-8 and M-11, a Notification of Exceedance of Groundwater Protection Standards was published to the public internet site on February 7, 2019, in accordance with 40 CFR 257.105(h) (Buckeye Power 2019). Monitoring well installation and sampling efforts to characterize the nature and extent of the release were described in the Groundwater Characterization Report, Cardinal Site – Fly Ash Reservoir II (Geosyntec 2019b). An Assessment of Corrective Measures (ACM) Report was completed in July 2019 in accordance with 40 CFR 257.96 and published to the public internet site (Geosyntec 2019a). The ACM report listed four potential corrective measures that may be appropriate for addressing the elevated lithium and molybdenum concentrations in Site groundwater. A public meeting was held on September 4, 2019, in Steubenville, Ohio where the selection of potential corrective measures outlined in the ACM Report were reviewed and discussed.

The conclusions of the ACM and public comments resulted in the selection of closure of the FAR II unit with long-term monitoring as the selected remedial approach as detailed in the Remedy Selection Report, Cardinal Site – Fly Ash Reservoir II (Geosyntec 2020a).

On July 13, 2021, Cardinal issued a notice of intent to close the FAR II CCR Unit (Buckeye Power 2021). The notice stated that the unit had ceased receiving waste streams and was initiating closure in place, in accordance with the Closure Plan and the Permit to Install issued by the Ohio EPA. The closure activities will include dewatering the FAR II, grading the CCR, and installation of a final cover system. The final cover system is designed to meet the requirements of §257.102(d)(3) of the CCR Rules.

Closure is currently underway in accordance with §257.100 through §257.102 of the CCR Rules. The groundwater monitoring system will continue to be maintained during the post-closure care period defined in §257.104(c) of the CCR Rules.

5.0 Problems Encountered and Resolutions

Monitoring well CA-0622A was purged dry during the April 2023 and October 2203 detection monitoring events and samples could not be collected due to insufficient recovery. Monitoring well M-12 could not be sampled during the October 2023 event due to pump malfunctions. And M-6 was not sampled due to sampling error and was collected in January 2024. Because CA-0622A, M-6, and M-12 are upgradient (background) wells, and not a downgradient (compliance) monitoring wells, the failure to collect samples from them will not result in a failure to identify an SSI.

No alternative source demonstrations under either §257.94(e)(2) or §257.95(g)(3)(ii) of the CCR Rules were performed during 2023.

6.0 Projected Key Activities

It is anticipated that FAR II will remain in the corrective measures program in 2024. The following activities are projected for FAR II:

- The 2023 Annual Groundwater Monitoring Report will be entered into the facility's operating record and posted to the public internet site.
- A statistical evaluation of the October 2023 assessment monitoring event will be completed.
- Two semi-annual groundwater assessment monitoring program events will be conducted.
- A statistical evaluation of the first semiannual assessment monitoring event of 2024 will be completed.
- Implementation of the selected remedy will continue.
- The 2024 Annual Groundwater Monitoring Report will be prepared for submittal in January 2025.

7.0 References

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Figures

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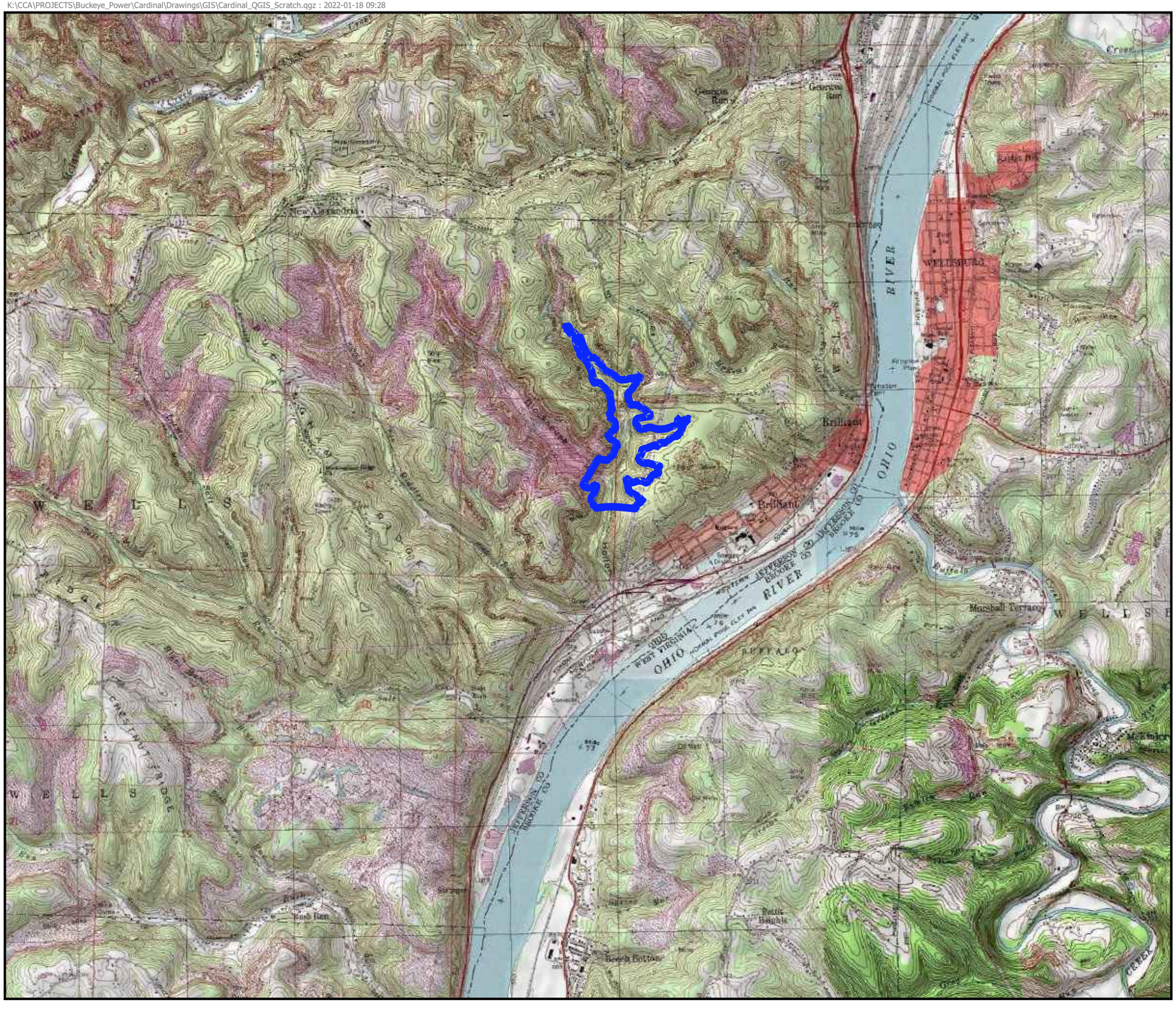

Legend

Fly Ash Reservoir (FAR) II

USGS Topographical Map

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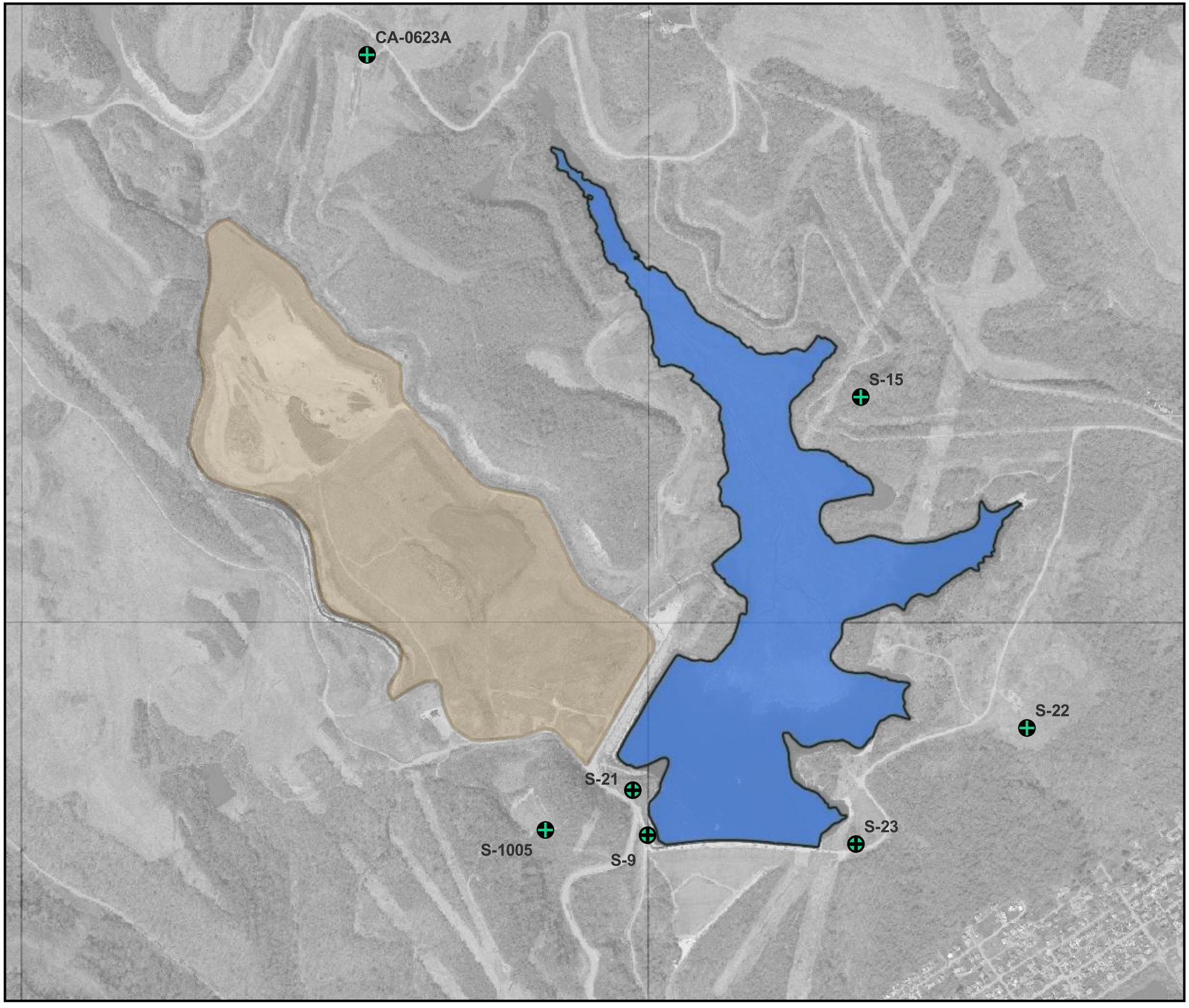
Cox-Colvin & ASSOCIATES, INC.
ENVIRONMENTAL SERVICES

Figure

1-1

Site Location Map
Fly Ash Reservoir (FAR) II
Cardinal Plant
Brilliant, Ohio

K:\CCA\PROJECTS\Buckeye_Power\Cardinal\Drawings\GIS\Cardinal_Potentiometric.qgz (GWMP FAR II Fig 4-2 Shallow Wells copy) : 2023-06-26 15:34



Legend

- Fly Ash Reservoir 2 (FAR II)
- FAR I Residual Solid Waste (RSW) Landfill

FAR II Shallow Aquifer Monitoring Wells

- Downgradient (Compliance)
- Upgradient (Background)

Although S-23 is presently upgradient of FAR II, it is considered a down-gradient well for purposes of compliance monitoring based upon potentiometric data collected prior to the start of dewatering activities.

N

0 500 1,000 1,500 2,000 ft

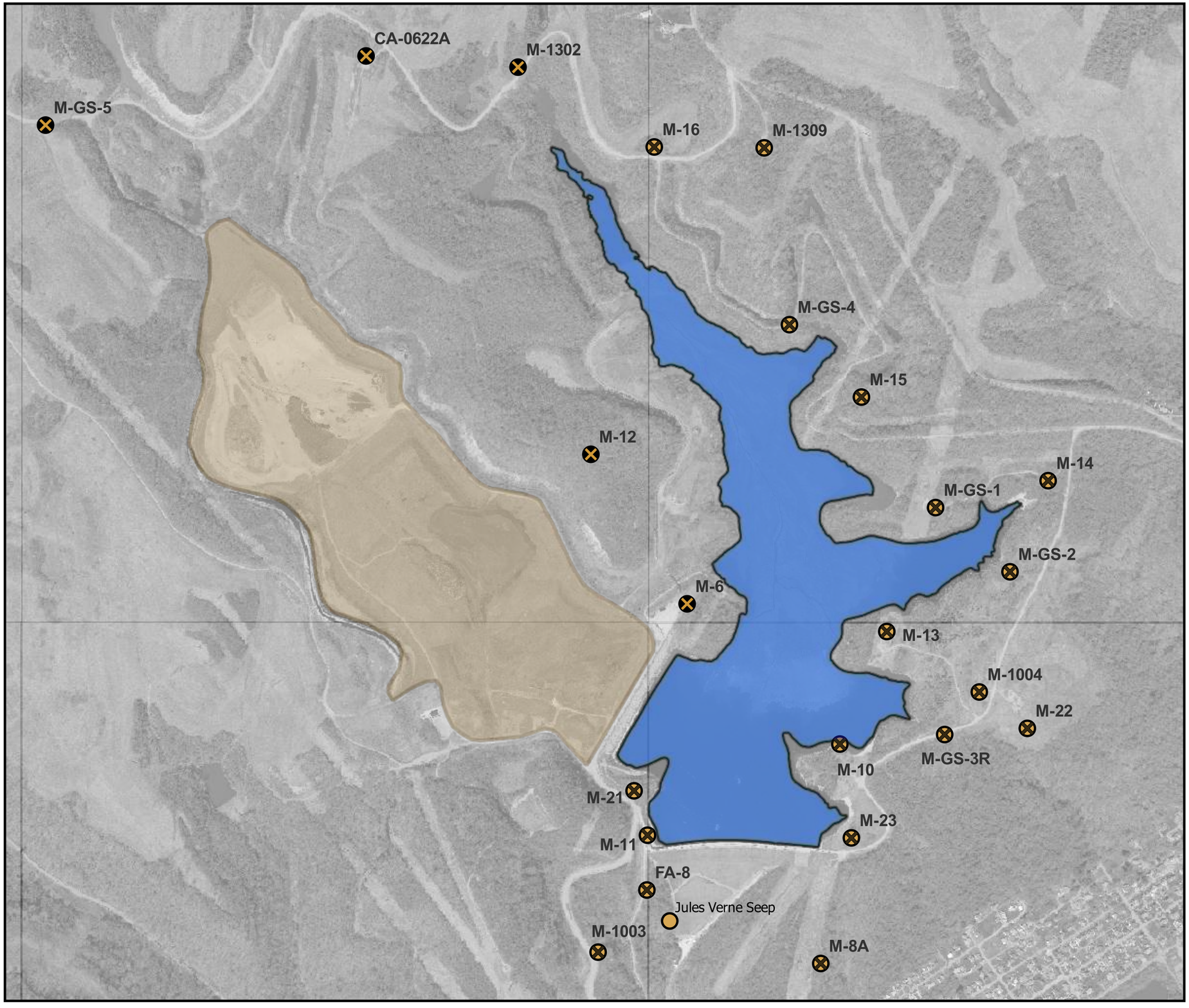
Cox-Colvin & ASSOCIATES, INC. ENVIRONMENTAL SERVICES

Figure

1-2

Shallow Aquifer Monitoring Wells
Fly Ash Reservoir (FAR) II
Cardinal Upland Disposal Facility
Brilliant, Ohio

K:\CCA\PROJECTS\Buckeye_Power\Cardinal\Drawings\GIS\Cardinal_Potentiometric.qgz (GWMP FAR II Fig 4-1 Morgantown Wells) : 2023-06-26 15:34



Legend

- Fly Ash Reservoir 2 (FAR II)
- FAR I Residual Solid Waste (RSW) Landfill

FAR II Morgantown Sandstone Monitoring Wells

- Downgradient (Compliance)
- Upgradient (Background)
- Seep 1 (Jules Verne Seep - Not a Well)

N

0 500 1,000 1,500 2,000 ft

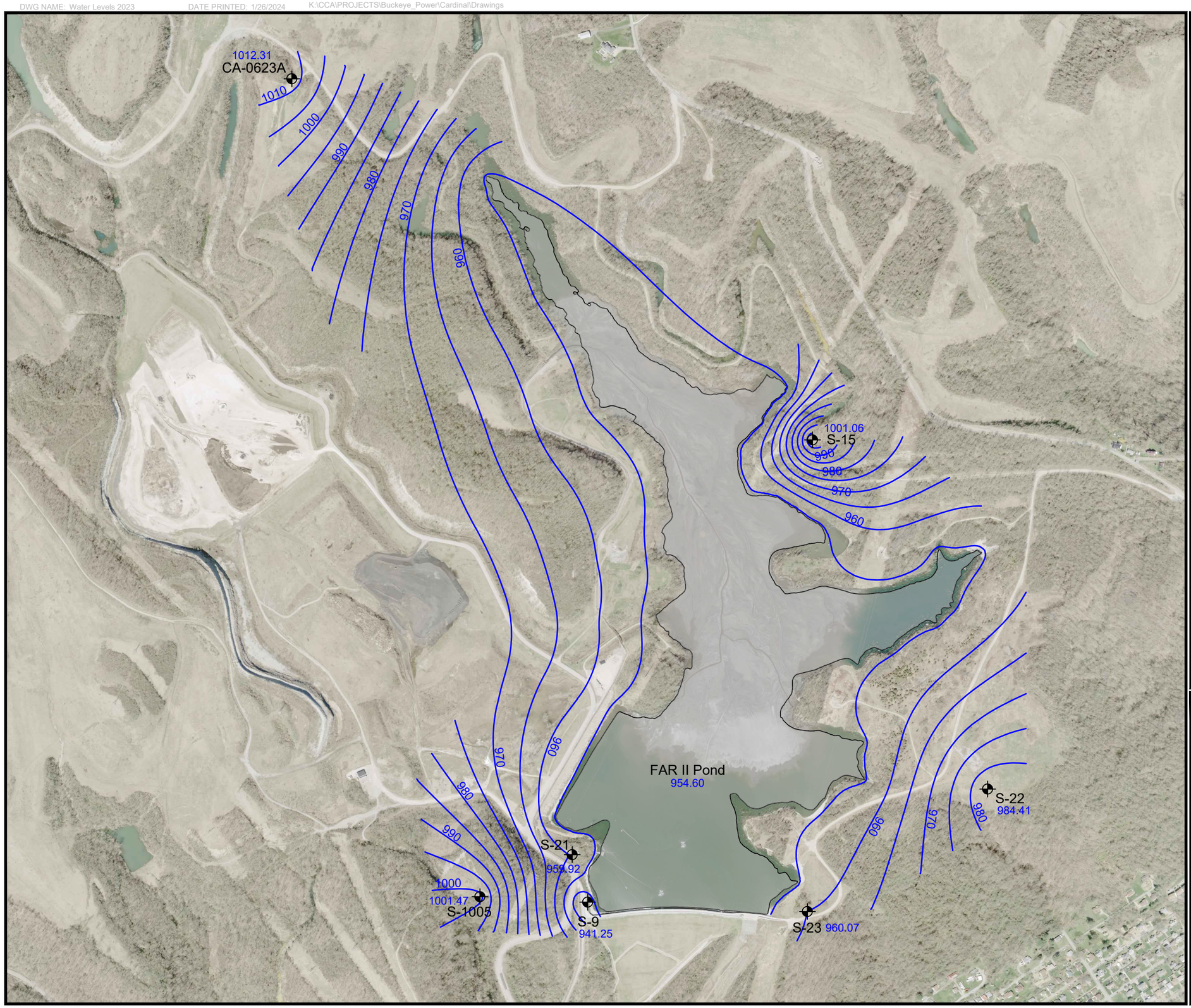
Cox-Colvin & ASSOCIATES, INC. ENVIRONMENTAL SERVICES

Figure

1-3

Morgantown Sandstone Monitoring Wells
Fly Ash Reservoir (FAR) II
Cardinal Upland Disposal Facility
Brilliant, Ohio

DWG NAME: Water Levels 2023 DATE PRINTED: 1/26/2024 K:\CCA\PROJECTS\Buckeye_Power\Cardinal\Drawings



Legend

- FAR II Monitor Well
- 990 Approximate Groundwater Elevation Contour
- 1012.31 Groundwater Elevation on February 1, 2023
- Fly Ash Reservoir (FAR) II

Source of Aerial Photograph: Ohio Statewide Imagery Program, 2020.

N

Scale

0' 362.5' 725' 1450'

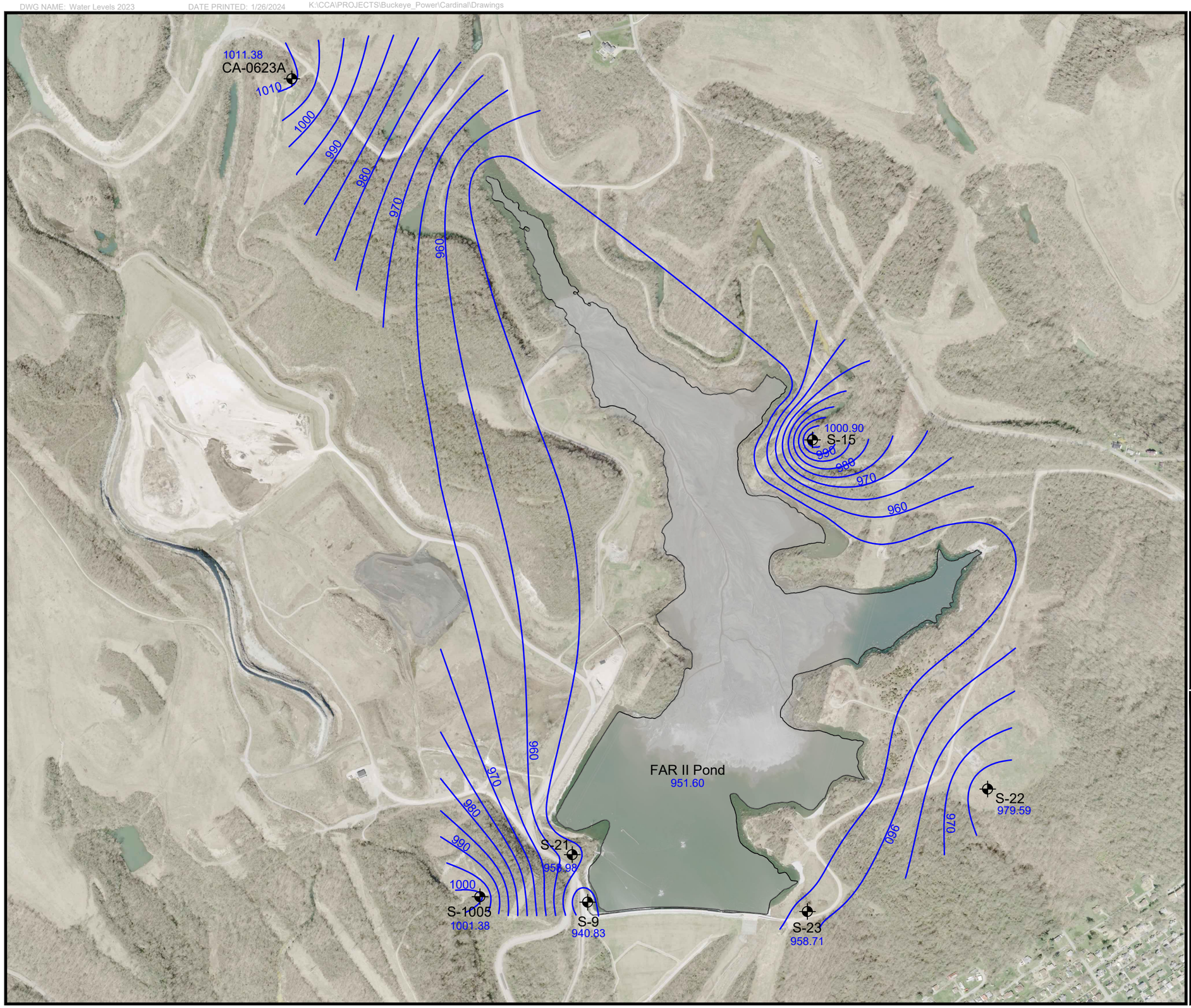
Cox-Colvin & ASSOCIATES, INC. ENVIRONMENTAL SERVICES

Figure

4-1

Potentiometric Surface Map - Shallow Aquifer - February 1, 2023, Fly Ash Reservoir (FAR) II, Cardinal Plant, Brilliant, Ohio

DWG NAME: Water Levels 2023 DATE PRINTED: 1/26/2024 K:\CCA\PROJECTS\Buckeye_Power\Cardinal\Drawings



Legend

- FAR II Monitor Well
- 990 Approximate Groundwater Elevation Contour
- 1011.38 Groundwater Elevation on February 20, 2023
- Fly Ash Reservoir (FAR) II

Source of Aerial Photograph: Ohio Statewide Imagery Program, 2020.

N

Scale

0' 362.5' 725' 1450'

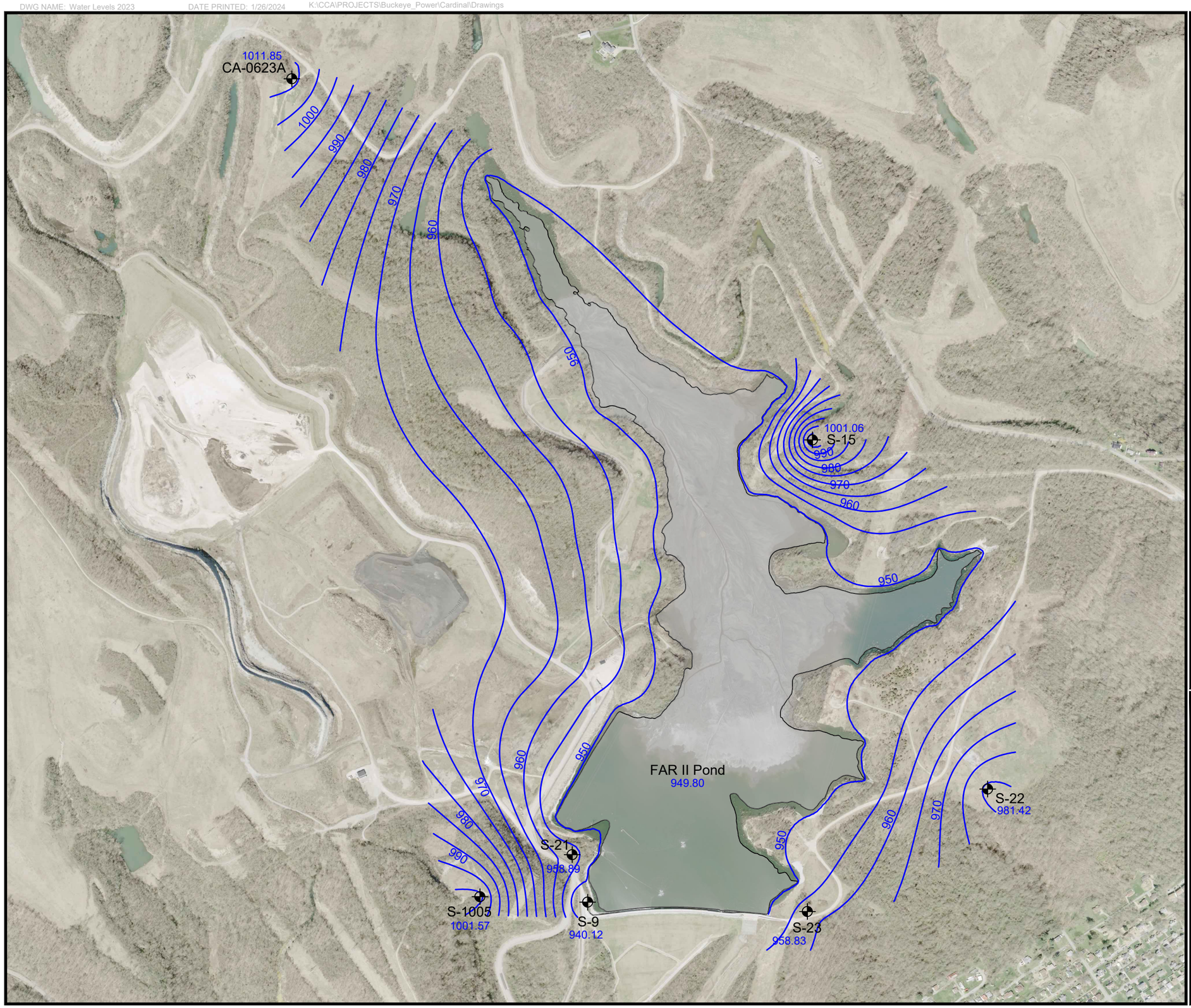
Cox-Colvin & ASSOCIATES, INC. ENVIRONMENTAL SERVICES

Figure

4-2

Potentiometric Surface Map - Shallow Aquifer - February 20, 2023, Fly Ash Reservoir (FAR) II, Cardinal Plant, Brilliant, Ohio

DWG NAME: Water Levels 2023 DATE PRINTED: 1/26/2024 K:\CCA\PROJECTS\Buckeye_Power\Cardinal\Drawings



Legend

- FAR II Monitor Well
- 990 Approximate Groundwater Elevation Contour
- 1011.85 Groundwater Elevation on March 13, 2023
- Fly Ash Reservoir (FAR) II

Source of Aerial Photograph: Ohio Statewide Imagery Program, 2020.

N

Scale

0' 362.5' 725' 1450'

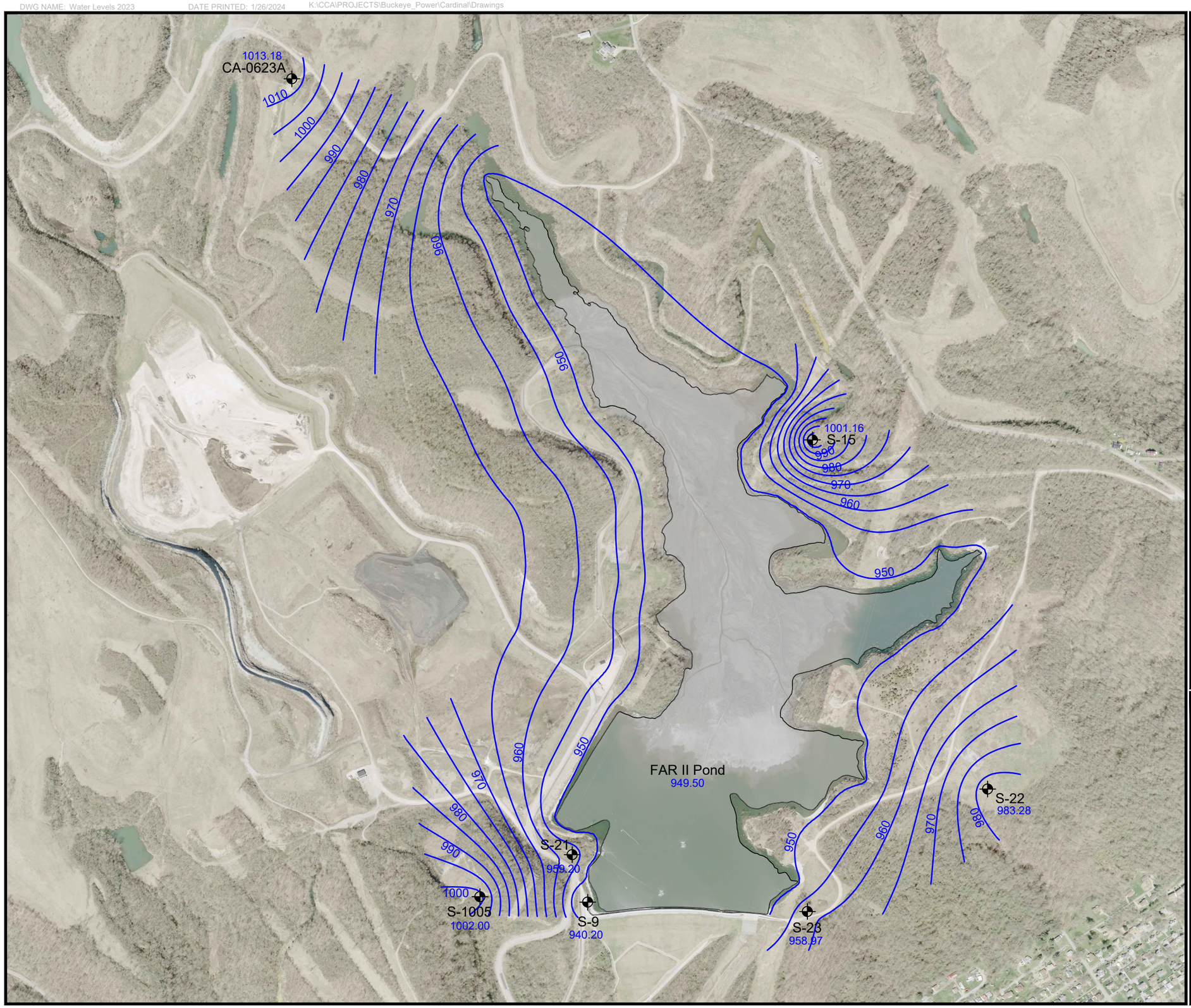
Cox-Colvin & ASSOCIATES, INC. ENVIRONMENTAL SERVICES

Figure

4-3

Potentiometric Surface Map - Shallow Aquifer - March 13, 2023, Fly Ash Reservoir (FAR) II, Cardinal Plant, Brilliant, Ohio

DWG NAME: Water Levels 2023 DATE PRINTED: 1/26/2024 K:\CCA\PROJECTS\Buckeye_Power\Cardinal\Drawings



Legend

- FAR II Monitor Well
- 990 Approximate Groundwater Elevation Contour
- 1013.18 Groundwater Elevation on April 3, 2023
- Fly Ash Reservoir (FAR) II

Source of Aerial Photograph: Ohio Statewide Imagery Program, 2020.

N

Scale

0' 362.5' 725' 1450'

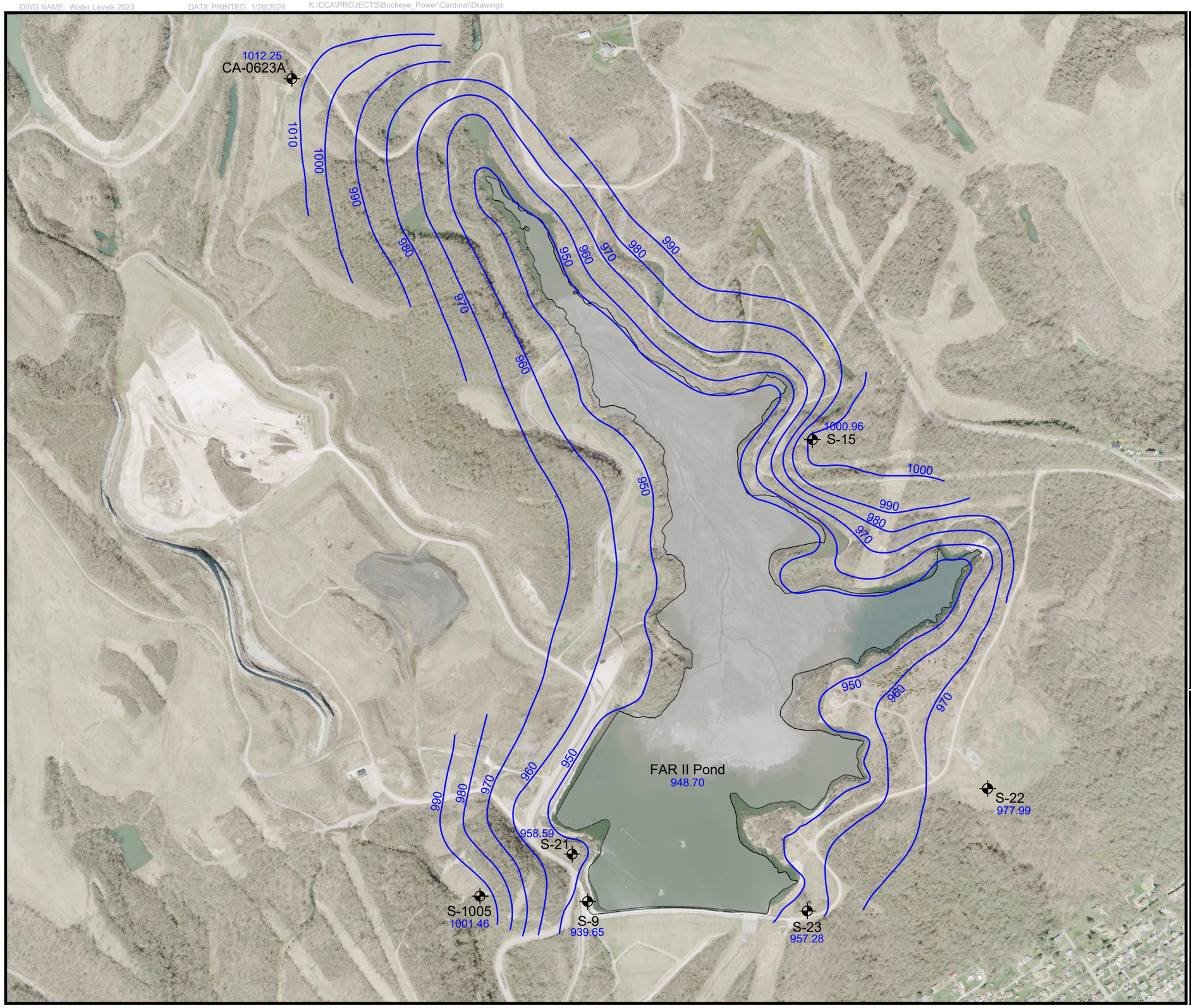
Cox-Colvin & ASSOCIATES, INC. ENVIRONMENTAL SERVICES

Figure

4-4

Potentiometric Surface Map - Shallow Aquifer - April 3, 2023, Fly Ash Reservoir (FAR) II, Cardinal Plant, Brilliant, Ohio

DWG NAME: Water Levels 2023 DATE PRINTED: 1/26/2024 K:\CCA\PROJECTS\Buckeye_Power\Cardinal\Drawings



Legend

- FAR II Monitor Well
- 990 Approximate Groundwater Elevation Contour
- 1012.25 Groundwater Elevation on April 24, 2023
- Fly Ash Reservoir (FAR) II

Source of Aerial Photograph: Ohio Statewide Imagery Program, 2020.

N

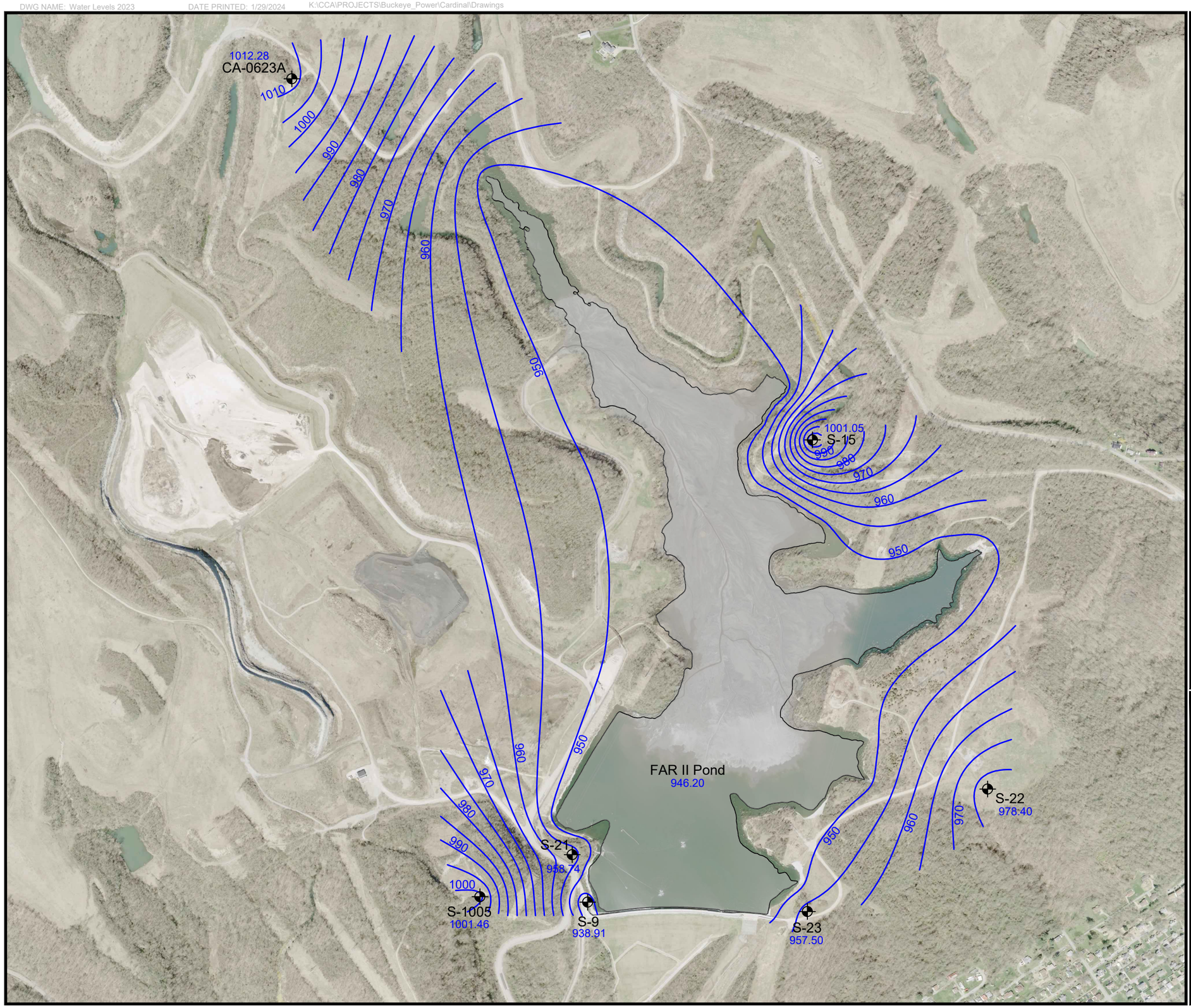
Scale
0' 362.5' 725' 1450'

Cox-Colvin & ASSOCIATES, INC.
ENVIRONMENTAL SERVICES

Figure
4-5

Potentiometric Surface Map - Shallow Aquifer - April 24, 2023,
Fly Ash Reservoir (FAR) II,
Cardinal Plant,
Brilliant, Ohio

DWG NAME: Water Levels 2023 DATE PRINTED: 1/29/2024 K:\CCA\PROJECTS\Buckeye_Power\Cardinal\Drawings



Legend

- FAR II Monitor Well
- 990 Approximate Groundwater Elevation Contour
- 1012.28 Groundwater Elevation on May 16, 2023
- Fly Ash Reservoir (FAR) II

Source of Aerial Photograph: Ohio Statewide Imagery Program, 2020.

N

Scale

0' 362.5' 725' 1450'

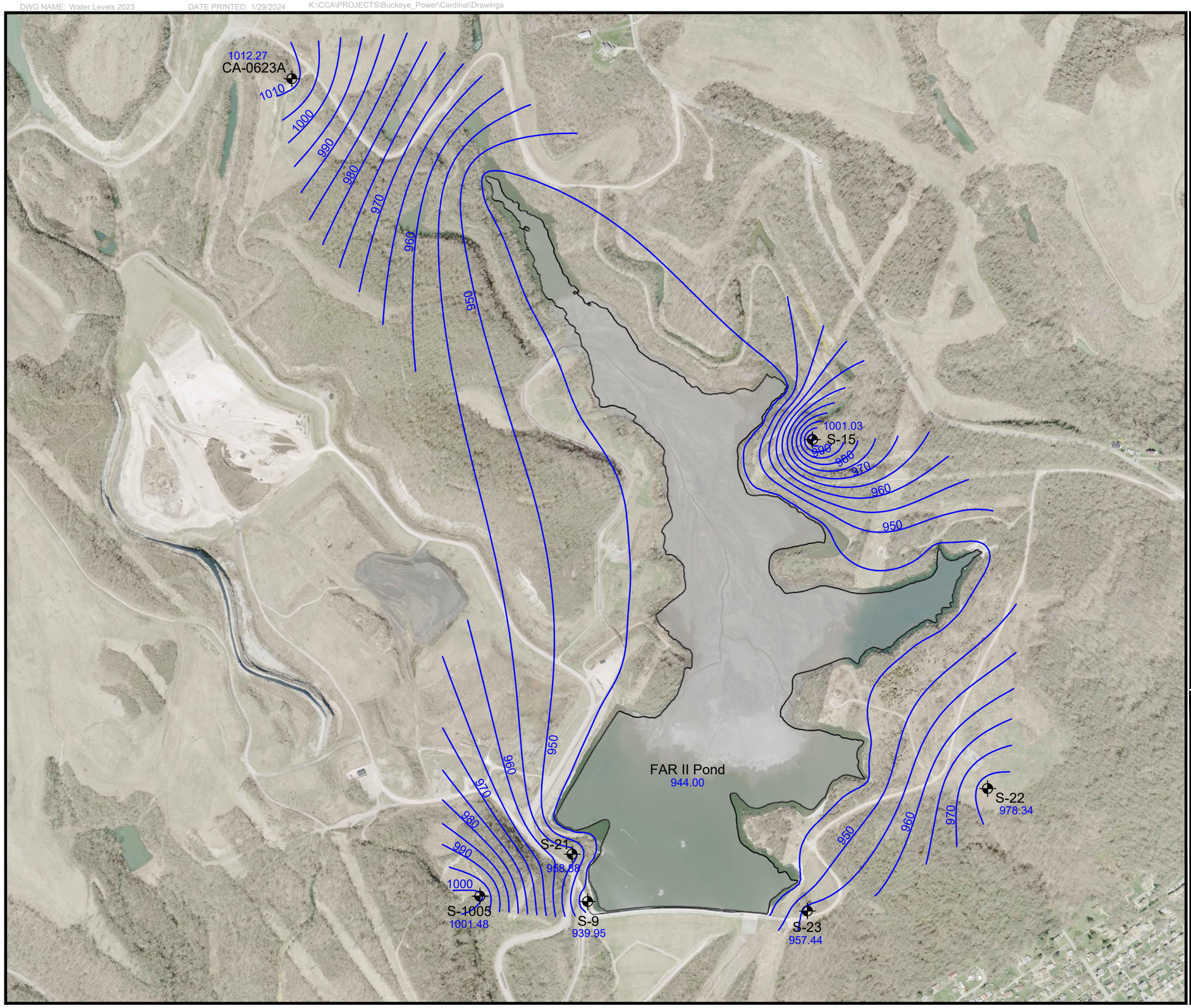
Cox-Colvin & ASSOCIATES, INC. ENVIRONMENTAL SERVICES

Figure

4-6

Potentiometric Surface Map - Shallow Aquifer - May 16, 2023, Fly Ash Reservoir (FAR) II, Cardinal Plant, Brilliant, Ohio

DWG NAME: Water Levels 2023 DATE PRINTED: 1/29/2024 K:\CCA\PROJECTS\Buckeye_Power\Cardinal\Drawings



Legend

- FAR II Monitor Well
- 990 Approximate Groundwater Elevation Contour
- 1012.27 Groundwater Elevation on June 5, 2023
- Fly Ash Reservoir (FAR) II

Source of Aerial Photograph: Ohio Statewide Imagery Program, 2020.

N

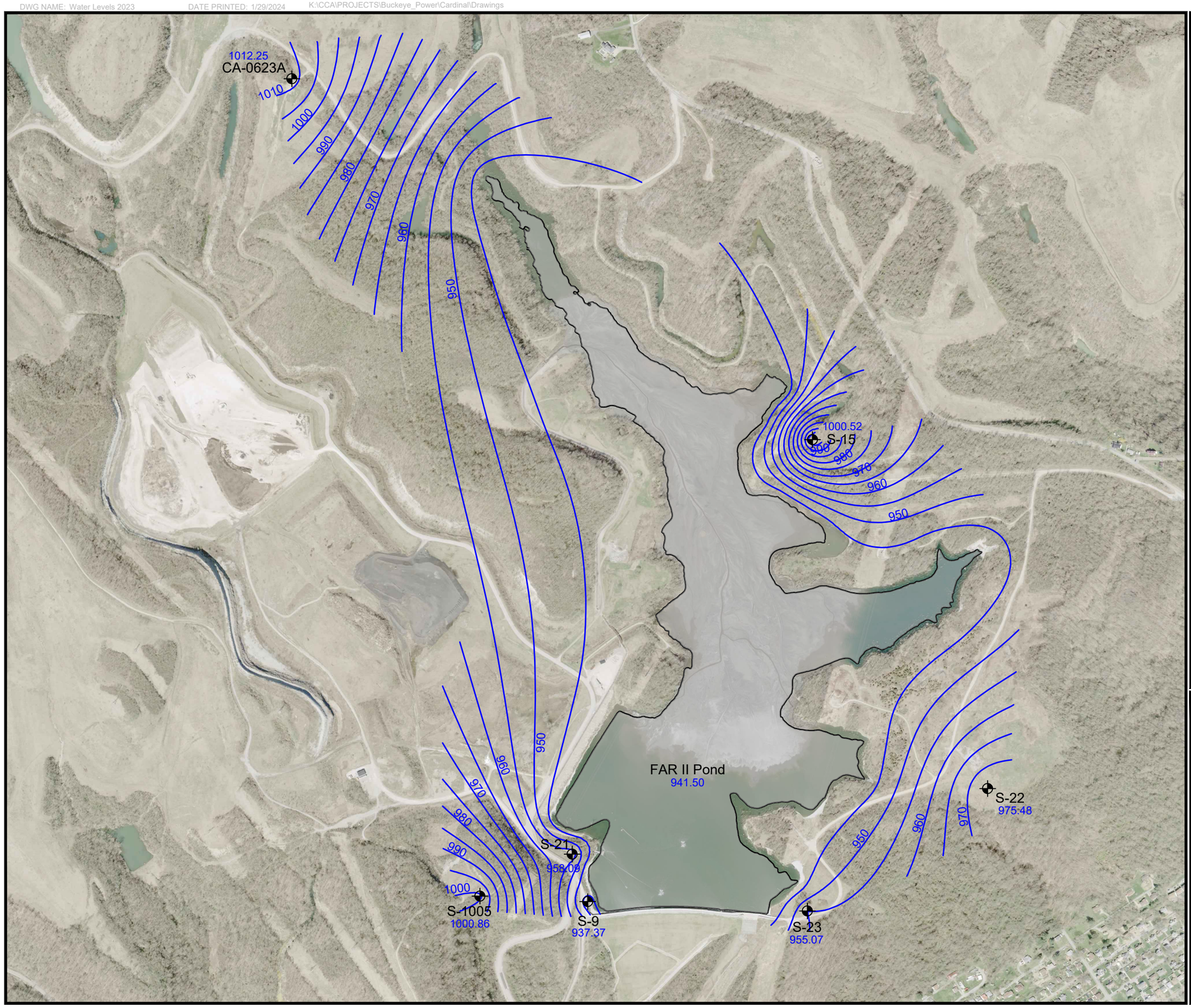
Scale
0' 362.5' 725' 1450'

Cox-Colvin & ASSOCIATES, INC. ENVIRONMENTAL SERVICES

Figure
4-7

Potentiometric Surface Map - Shallow Aquifer - June 5, 2023,
Fly Ash Reservoir (FAR) II,
Cardinal Plant,
Brilliant, Ohio

DWG NAME: Water Levels 2023 DATE PRINTED: 1/29/2024 K:\CCA\PROJECTS\Buckeye_Power\Cardinal\Drawings



Legend

- FAR II Monitor Well
- 990 Approximate Groundwater Elevation Contour
- 1012.25 Groundwater Elevation on June 26, 2023
- Fly Ash Reservoir (FAR) II

Source of Aerial Photograph: Ohio Statewide Imagery Program, 2020.

N

Scale

0' 362.5' 725' 1450'

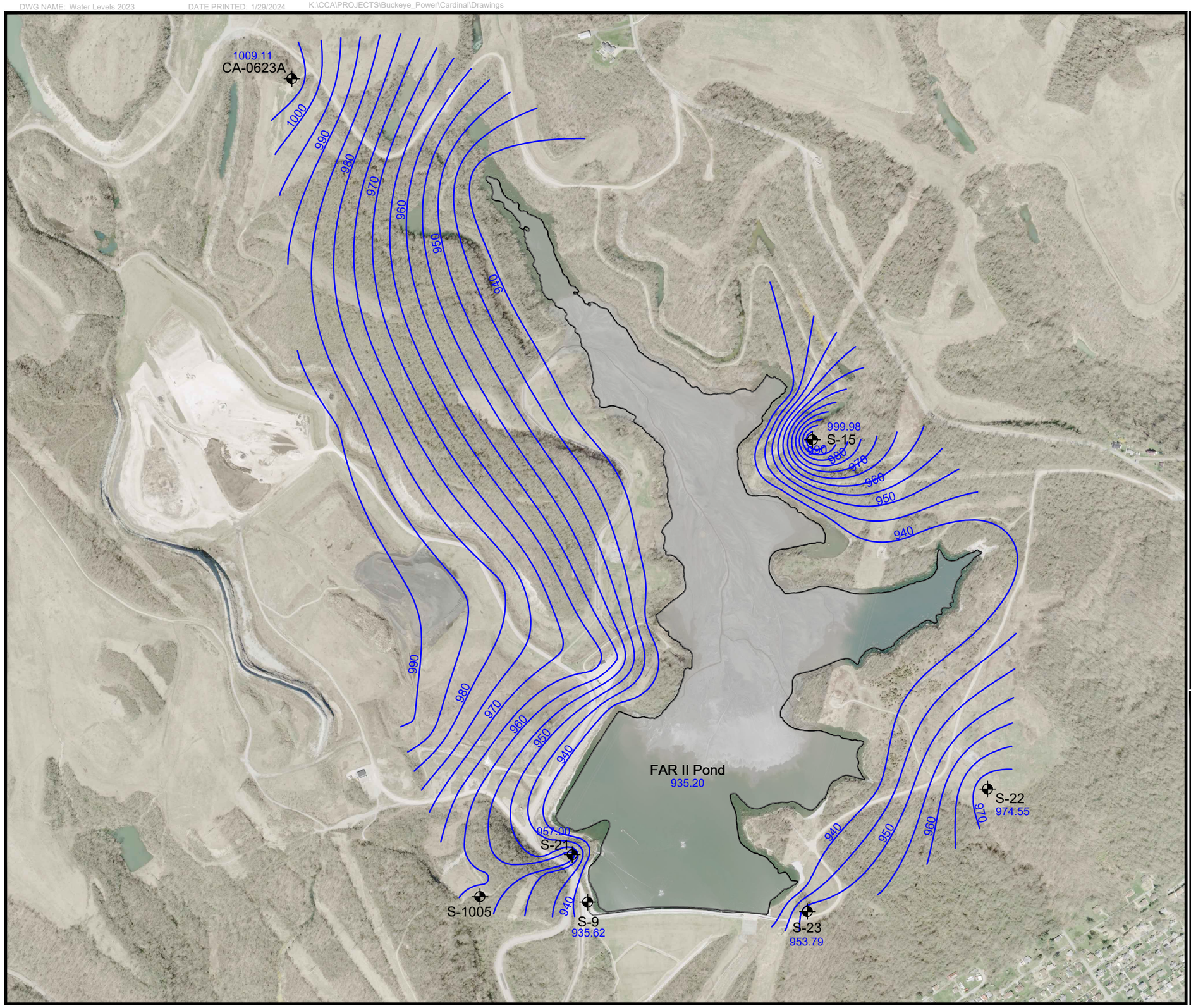
Cox-Colvin & ASSOCIATES, INC. ENVIRONMENTAL SERVICES

Figure

4-8

Potentiometric Surface Map - Shallow Aquifer - June 26, 2023, Fly Ash Reservoir (FAR) II, Cardinal Plant, Brilliant, Ohio

DWG NAME: Water Levels 2023 DATE PRINTED: 1/29/2024 K:\CCA\PROJECTS\Buckeye_Power\Cardinal\Drawings



Legend

- FAR II Monitor Well
- 990 Approximate Groundwater Elevation Contour
- 1009.11 Groundwater Elevation on October 9, 2023
- Fly Ash Reservoir (FAR) II

Source of Aerial Photograph: Ohio Statewide Imagery Program, 2020.

N

Scale
0' 362.5' 725' 1450'

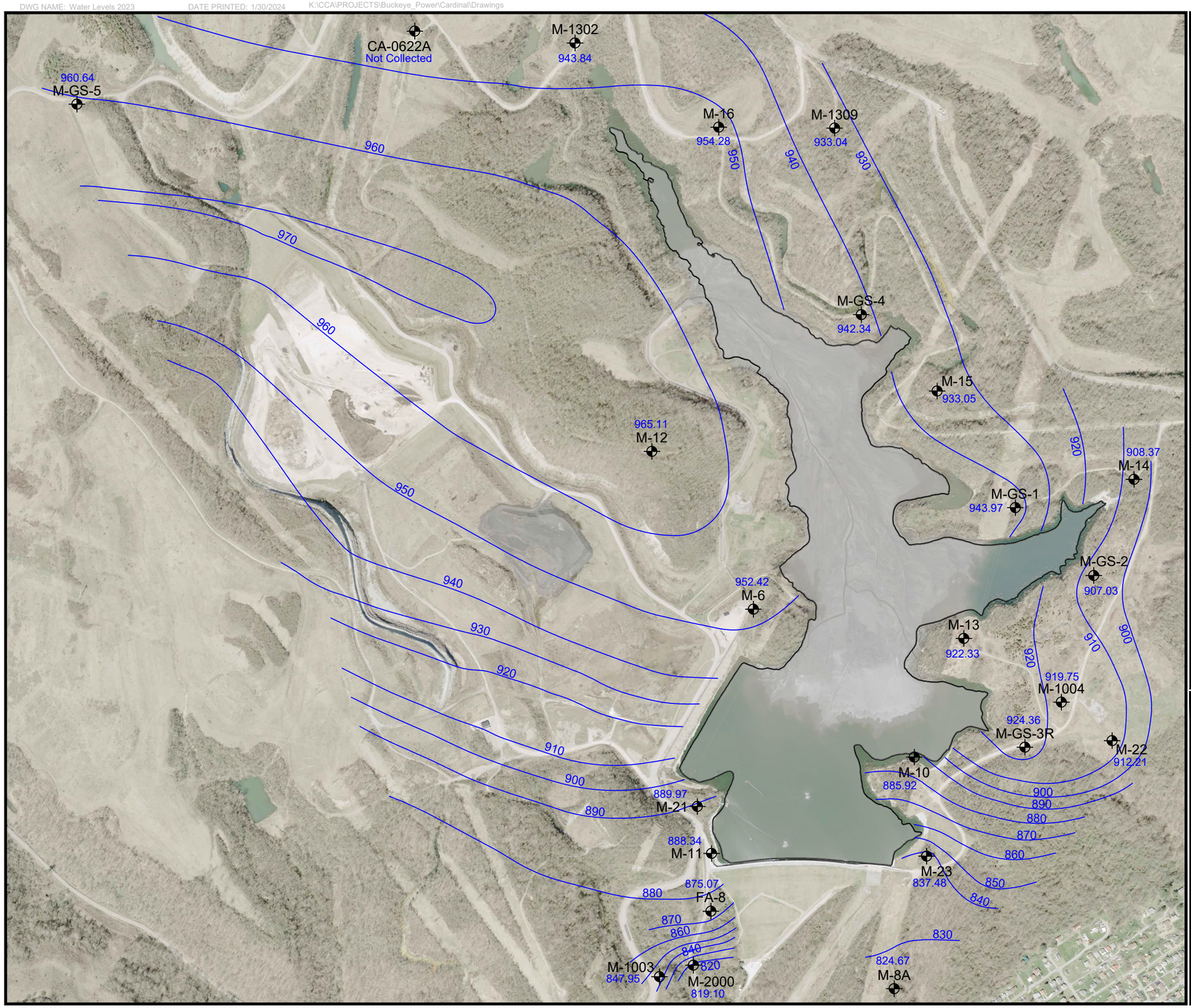
Cox-Colvin & ASSOCIATES, INC. ENVIRONMENTAL SERVICES

Figure

4-9

Potentiometric Surface Map - Shallow Aquifer - October 9, 2023, Fly Ash Reservoir (FAR) II, Cardinal Plant, Brilliant, Ohio

DWG NAME: Water Levels 2023 DATE PRINTED: 1/30/2024 K:\CCA\PROJECTS\Buckeye_Power\Cardinal\Drawings



Legend

- FAR II Monitor Well
- 900 Approximate Groundwater Elevation Contour
- 908.37 Groundwater Elevation on April 10, 2023
- Fly Ash Reservoir (FAR) II

Source of Aerial Photograph: Ohio Statewide Imagery Program, 2020.

N

Scale
0' 362.5' 725' 1450'

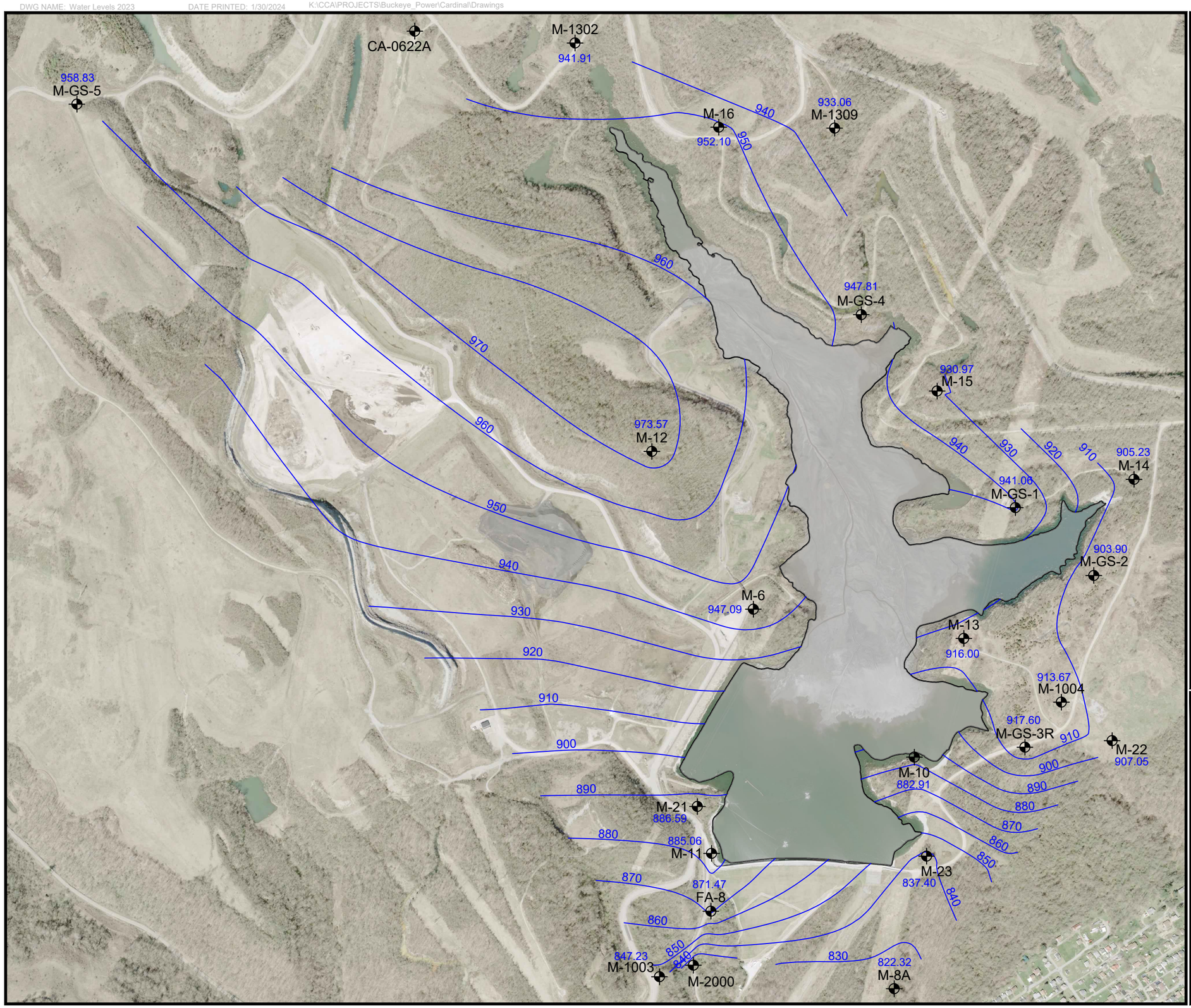
Cox-Colvin & ASSOCIATES, INC. ENVIRONMENTAL SERVICES

Figure

4-10

Potentiometric Surface Map - Morgantown Sandstone - April 10, 2023,
Fly Ash Reservoir (FAR) II,
Cardinal Plant,
Brilliant, Ohio

DWG NAME: Water Levels 2023 DATE PRINTED: 1/30/2024 K:\CCA\PROJECTS\Buckeye_Power\Cardinal\Drawings



Legend

- FAR II Monitor Well
- 900 Approximate Groundwater Elevation Contour
- 908.37 Groundwater Elevation on April 10, 2023
- Fly Ash Reservoir (FAR) II

Source of Aerial Photograph: Ohio Statewide Imagery Program, 2020.

N

Scale

0' 362.5' 725' 1450'

Cox-Colvin & ASSOCIATES, INC. ENVIRONMENTAL SERVICES

Figure

4-11

Potentiometric Surface Map - Morgantown Sandstone - October 9, 2023,
Fly Ash Reservoir (FAR) II,
Cardinal Plant,
Brilliant, Ohio

Tables

Table 4-1. Shallow Aquifer Flow Calculations February to June 2023, Fly Ash Reservoir (FAR) II, Cardinal Plant, Brilliant, Ohio

Program	Groundwater Zone	Well	Hydraulic Location[1]	Depth to Water (ft)	Potentiometric Elevation[3] (ft)	Hydraulic Gradient[2] (ft/ft)	Hydraulic Conductivity[4] (cm/sec)			Effective Porosity	Groundwater Velocity (ft/day)			Well Diameter[5] (in.)	Residence Time[6] (days)		
							Low	Representative	High		Low	Representative	High		Low	Representative	High
February 1, 2023																	
FAR II CCR	Shallow Aquifer	CA-0623A	Upgradient	150.41	1162.79	0.03589	0.0001	0.005	0.10	0.32	0.0318	**1.59**	31.79	6	0.016	**0.31**	15.73
FAR II CCR	Shallow Aquifer	S-9	Downgradient	39.31	980.56	0.07143	0.0001	0.005	0.10	0.32	0.0633	**3.16**	63.27	8	0.011	**0.21**	10.54
FAR II CCR	Shallow Aquifer	S-15	Upgradient	73.27	1074.33	0.12048	0.0001	0.005	0.10	0.32	0.1067	**5.34**	106.73	6	0.005	**0.09**	4.68
FAR II CCR	Shallow Aquifer	S-21	Downgradient	58.48	1018.4	0.03086	0.0001	0.005	0.10	0.32	0.0273	**1.37**	27.34	8	0.024	**0.49**	24.38
FAR II CCR	Shallow Aquifer	S-22	Upgradient	23.6	1008.01	0.03257	0.0001	0.005	0.10	0.32	0.0289	**1.44**	28.85	6	0.017	**0.35**	17.33
FAR II CCR	Shallow Aquifer	S-23	Downgradient	26.58	986.65	0.02451	0.0001	0.005	0.10	0.32	0.0217	**1.09**	21.71	6	0.023	**0.46**	23.03
FAR II CCR	Shallow Aquifer	S-1005	Upgradient	129.41	1130.88	0.08021	0.0001	0.005	0.10	0.32	0.0711	**3.55**	71.06	6	0.007	**0.14**	7.04
February 20, 2023																	
FAR II CCR	Shallow Aquifer	CA-0623A	Upgradient	151.34	1162.72	0.03550	0.0001	0.005	0.10	0.32	0.0314	**1.57**	31.44	6	0.016	**0.32**	15.90
FAR II CCR	Shallow Aquifer	S-9	Downgradient	39.73	980.56	0.07143	0.0001	0.005	0.10	0.32	0.0633	**3.16**	63.27	8	0.011	**0.21**	10.54
FAR II CCR	Shallow Aquifer	S-15	Upgradient	73.43	1074.33	0.13245	0.0001	0.005	0.10	0.32	0.1173	**5.87**	117.33	6	0.004	**0.09**	4.26
FAR II CCR	Shallow Aquifer	S-21	Downgradient	59.42	1018.4	0.02778	0.0001	0.005	0.10	0.32	0.0246	**1.23**	24.61	8	0.027	**0.54**	27.09
FAR II CCR	Shallow Aquifer	S-22	Upgradient	28.42	1008.01	0.02937	0.0001	0.005	0.10	0.32	0.0260	**1.30**	26.02	6	0.019	**0.38**	19.22
FAR II CCR	Shallow Aquifer	S-23	Downgradient	27.94	986.65	0.02041	0.0001	0.005	0.10	0.32	0.0181	**0.90**	18.08	6	0.028	**0.55**	27.66
FAR II CCR	Shallow Aquifer	S-1005	Upgradient	129.5	1130.88	0.07614	0.0001	0.005	0.10	0.32	0.0674	**3.37**	67.45	6	0.007	**0.15**	7.41
March 13, 2023																	
FAR II CCR	Shallow Aquifer	CA-0623A	Upgradient	150.87	1162.72	0.03823	0.0001	0.005	0.10	0.32	0.0339	**1.69**	33.86	6	0.015	**0.30**	14.77
FAR II CCR	Shallow Aquifer	S-9	Downgradient	40.44	980.56	0.07463	0.0001	0.005	0.10	0.32	0.0661	**3.31**	66.11	8	0.010	**0.20**	10.08
FAR II CCR	Shallow Aquifer	S-15	Upgradient	73.27	1074.33	0.13245	0.0001	0.005	0.10	0.32	0.1173	**5.87**	117.33	6	0.004	**0.09**	4.26
FAR II CCR	Shallow Aquifer	S-21	Downgradient	59.51	1018.4	0.02857	0.0001	0.005	0.10	0.32	0.0253	**1.27**	25.31	8	0.026	**0.53**	26.34
FAR II CCR	Shallow Aquifer	S-22	Upgradient	26.59	1008.01	0.03683	0.0001	0.005	0.10	0.32	0.0326	**1.63**	32.63	6	0.015	**0.31**	15.32
FAR II CCR	Shallow Aquifer	S-23	Downgradient	27.82	986.65	0.02667	0.0001	0.005	0.10	0.32	0.0236	**1.18**	23.62	6	0.021	**0.42**	21.17
FAR II CCR	Shallow Aquifer	S-1005	Upgradient	129.31	1130.88	0.08475	0.0001	0.005	0.10	0.32	0.0751	**3.75**	75.07	6	0.007	**0.13**	6.66
April 3, 2023																	
FAR II CCR	Shallow Aquifer	CA-0623A	Upgradient	149.54	1162.72	0.03911	0.0001	0.005	0.10	0.32	0.0346	**1.73**	34.64	6	0.014	**0.29**	14.43
FAR II CCR	Shallow Aquifer	S-9	Downgradient	40.36	980.56	0.07463	0.0001	0.005	0.10	0.32	0.0661	**3.31**	66.11	8	0.010	**0.20**	10.08
FAR II CCR	Shallow Aquifer	S-15	Upgradient	73.17	1074.33	0.13636	0.0001	0.005	0.10	0.32	0.1208	**6.04**	120.79	6	0.004	**0.08**	4.14
FAR II CCR	Shallow Aquifer	S-21	Downgradient	59.2	1018.4	0.02941	0.0001	0.005	0.10	0.32	0.0261	**1.30**	26.05	8	0.026	**0.51**	25.59
FAR II CCR	Shallow Aquifer	S-22	Upgradient	24.73	1008.01	0.03759	0.0001	0.005	0.10	0.32	0.0333	**1.67**	33.30	6	0.015	**0.30**	15.01
FAR II CCR	Shallow Aquifer	S-23	Downgradient	27.68	986.65	0.03086	0.0001	0.005	0.10	0.32	0.0273	**1.37**	27.34	6	0.018	**0.37**	18.29
FAR II CCR	Shallow Aquifer	S-1005	Upgradient	128.88	1130.88	0.08523	0.0001	0.005	0.10	0.32	0.0755	**3.77**	75.50	6	0.007	**0.13**	6.62
April 24, 2023																	
FAR II CCR	Shallow Aquifer	CA-0623A	Upgradient	150.45	1162.72	0.03520	0.0001	0.005	0.10	0.32	0.0312	**1.56**	31.18	6	0.016	**0.32**	16.03
FAR II CCR	Shallow Aquifer	S-9	Downgradient	40.91	980.56	0.02618	0.0001	0.005	0.10	0.32	0.0232	**1.16**	23.19	8	0.029	**0.57**	28.75
FAR II CCR	Shallow Aquifer	S-15	Upgradient	73.37	1074.33	0.16129	0.0001	0.005	0.10	0.32	0.1429	**7.14**	142.88	6	0.003	**0.07**	3.50
FAR II CCR	Shallow Aquifer	S-21	Downgradient	59.81	1018.4	0.01946	0.0001	0.005	0.10	0.32	0.0172	**0.86**	17.23	8	0.039	**0.77**	38.68
FAR II CCR	Shallow Aquifer	S-22	Upgradient	30.02	1008.01	0.01732	0.0001	0.005	0.10	0.32	0.0153	**0.77**	15.34	6	0.033	**0.65**	32.60
FAR II CCR	Shallow Aquifer	S-23	Downgradient	29.37	986.65	0.01938	0.0001	0.005	0.10	0.32	0.0172	**0.86**	17.17	6	0.029	**0.58**	29.13
FAR II CCR	Shallow Aquifer	S-1005	Upgradient	129.42	1130.88	0.04132	0.0001	0.005	0.10	0.32	0.0366	**1.83**	36.60	6	0.014	**0.27**	13.66
May 16, 2023																	
FAR II CCR	Shallow Aquifer	CA-0623A	Upgradient	150.44	1162.72	0.03922	0.0001	0.005	0.10	0.32	0.0347	**1.74**	34.74	6	0.014	**0.29**	14.39
FAR II CCR	Shallow Aquifer	S-9	Downgradient	129.42	1130.88	0.08197	0.0001	0.005	0.10	0.32	0.0726	**3.63**	72.61	8	0.009	**0.18**	9.18
FAR II CCR	Shallow Aquifer	S-15	Upgradient	73.28	1074.33	0.12712	0.0001	0.005	0.10	0.32	0.1126	**5.63**	112.61	6	0.004	**0.09**	4.44
FAR II CCR	Shallow Aquifer	S-21	Downgradient	59.66	1018.4	0.04149	0.0001	0.005	0.10	0.32	0.0368	**1.84**	36.76	8	0.018	**0.36**	18.14
FAR II CCR	Shallow Aquifer	S-22	Upgradient	29.61	1008.01	0.03210	0.0001	0.005	0.10	0.32	0.0284	**1.42**	28.44	6	0.018	**0.35**	17.58
FAR II CCR	Shallow Aquifer	S-23	Downgradient	29.15	986.65	0.04630	0.0001	0.005	0.10	0.32	0.0410	**2.05**	41.01	6	0.012	**0.24**	12.19
FAR II CCR	Shallow Aquifer	S-1005	Upgradient	41.65	980.56	0.08547	0.0001	0.005	0.10	0.32	0.0757	**3.79**	75.71	6	0.007	**0.13**	6.60
June 5, 2023																	
FAR II CCR	Shallow Aquifer	CA-0623A	Upgradient	150.45	1162.72	0.04065	0.0001	0.005	0.10	0.32	0.0360	**1.80**	36.01	6	0.014	**0.28**	13.89
FAR II CCR	Shallow Aquifer	S-9	Downgradient	40.61	980.56	0.07407	0.0001	0.005	0.10	0.32	0.0656	**3.28**	65.62	8	0.010	**0.20**	10.16
FAR II CCR	Shallow Aquifer	S-15	Upgradient	59.52	1074.33	0.10638	0.0001	0.005	0.10	0.32	0.0942	**4.71**	94.24	6	0.005	**0.11**	5.31
FAR II CCR	Shallow Aquifer	S-21	Downgradient	59.52	1018.4	0.03759	0.0001	0.005	0.10	0.32	0.0333	**1.67**	33.30	8	0.020	**0.40**	20.02
FAR II CCR	Shallow Aquifer	S-22	Upgradient	29.67	1008.01	0.03448	0.0001	0.005	0.10	0.32	0.0305	**1.53**	30.55	6	0.016	**0.33**	16.37
FAR II CCR	Shallow Aquifer	S-23	Downgradient	29.21	986.65	0.04762	0.0001	0.005	0.10	0.32	0.0422	**2.11**	42.18	6	0.012	**0.24**	11.85
FAR II CCR	Shallow Aquifer	S-1005	Upgradient	129.4	1130.88	0.08547	0.0001	0.005	0.10	0.32	0.0757	**3.79**	75.71	6	0.007	**0.13**	6.60
June 26, 2023																	
FAR II CCR	Shallow Aquifer	CA-0623A	Upgradient	150.47	1162.72	0.04049	0.0001	0.005	0.10	0.32	0.0359	**1.79**	35.86	6	0.014	**0.28**	13.94
FAR II CCR	Shallow Aquifer	S-9	Downgradient	43.19	980.56	0.06993	0.0001	0.005	0.10	0.32	0.0619	**3.10**	61.95	8	0.011	**0.22**	10.76
FAR II CCR	Shallow Aquifer	S-15	Upgradient	73.81	1074.33	0.16667	0.0001	0.005	0.10	0.32	0.1476	**7.38**	147.64	6	0.003	**0.07**	3.39
FAR II CCR	Shallow Aquifer	S-21	Downgradient	60.31	1018.4	0.03759	0.0001	0.005	0.10	0.32	0.0333	**1.67**	33.30	8	0.020	**0.40**	20.02
FAR II CCR	Shallow Aquifer	S-22	Upgradient	32.53	1008.01	0.03058	0.0001	0.005	0.10	0.32	0.0271	**1.35**	27.09	6	0.018	**0.37**	18.46
FAR II CCR	Shallow Aquifer	S-23	Downgradient	31.58	986.65	0.03333	0.0001	0.005	0.10	0.32	0.0295	**1.48**	29.53	6	0.017	**0.34**	16.93
FAR II CCR	Shallow Aquifer	S-1005	Upgradient	130.02	1130.88	0.08065	0.0001	0.005	0.10	0.32	0.0714	**3.57**	71.44	6	0.007	**0.14**	7.00

K:\CCA\PROJECTS\Buckeye_Power\Cardinal\FAR II\Annual Groundwater and Corrective Measures Reports\2023\Tables\[Table 4-1 - Shallow Aquifer FAR II Background GW Flow.xlsx]Sheet1

[1] *Groundwater Monitoring Network Evaluation; Cardinal Site – Fly Ash Reservoir II, Brilliant, Ohio* prepared by Geosyntec Consultants in September 2016 (Revised February 2017).

[2] Hydraulic gradient was calculated from potentiometric surface maps.

[3] Elevations datum is National Geodetic Vertical Datum of 1929 (NGVD29).

[4] Low and high conductivity values are from the 2017 Groundwater Monitoring Network Evaluation, with a representative value chosen within this range that is consistent with previous velocity calculations.

[5] Well diameter represents the diameter of the borehole (sandpack).

[6] Residence time is an estimation of how long it would take groundwater to travel a distance equivalent to the well diameter at the calculated velocity.

Table 4-2. Shallow Aquifer Groundwater Flow Calculations October 2023, Fly Ash Reservoir (FAR) II, Cardinal Plant, Brilliant, Ohio

Program	Groundwater Zone	Well	Hydraulic Location[1]	Depth to Water (ft)	Potentiometric Elevation[3] (ft)	Hydraulic Gradient[2] (ft/ft)	Hydraulic Conductivity[4] (cm/sec)			Effective Porosity	Groundwater Velocity (ft/day)			Well Diameter[5] (in.)	Residence Time[6] (days)		
							Low	Representative	High		Low	Representative	High		Low	Representative	High
FAR II CCR	Shallow Aquifer	CA-0623A	Upgradient	153.61	1009.11	0.03856	0.0001	0.005	0.10	0.32	0.0342	**1.71**	34.16	6	0.015	**0.29**	14.64
FAR II CCR	Shallow Aquifer	S-9	Downgradient	44.94	935.62	0.10638	0.0001	0.005	0.10	0.32	0.0942	**4.71**	94.24	8	0.007	**0.14**	7.07
FAR II CCR	Shallow Aquifer	S-15	Upgradient	74.35	999.98	0.14354	0.0001	0.005	0.10	0.32	0.1272	**6.36**	127.15	6	0.004	**0.08**	3.93
FAR II CCR	Shallow Aquifer	S-21	Downgradient	61.40	957.00	0.07143	0.0001	0.005	0.10	0.32	0.0633	**3.16**	63.27	8	0.011	**0.21**	10.54
FAR II CCR	Shallow Aquifer	S-22	Upgradient	33.46	974.55	0.03284	0.0001	0.005	0.10	0.32	0.0291	**1.45**	29.09	6	0.017	**0.34**	17.19
FAR II CCR	Shallow Aquifer	S-23	Downgradient	32.86	953.79	0.01984	0.0001	0.005	0.10	0.32	0.0176	**0.88**	17.58	6	0.028	**0.57**	28.45
FAR II CCR	Shallow Aquifer	S-1005	Upgradient	-	-	-	0.0001	0.005	0.10	0.32	-	-	-	6	-	-	-

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Measurements and calculations represent conditions on October 9, 2023.

- A water level could not be collected from this well

[1] *Groundwater Monitoring Network Evaluation; Cardinal Site – Fly Ash Reservoir II, Brilliant, Ohio* prepared by Geosyntec Consultants in September 2016 (Revised February 2017).

[2] Hydraulic gradient was calculated from a potentiometric surface.

[3] Elevations datum is National Geodetic Vertical Datum of 1929 (NGVD29).

[4] Low and high conductivity values are from the 2017 Groundwater Monitoring Network Evaluation, with a representative value chosen within this range that is consistent with previous velocity calculations.

[5] Well diameter represents the diameter of the borehole (sandpack).

[6] Residence time is an estimation of how long it would take groundwater to travel a distance equivalent to the well diameter at the calculated velocity.

Table 4-3. Morgantown Sandstone Groundwater Flow Calculations April 2023, Fly Ash Reservoir (FAR) II, Cardinal Plant, Brilliant, Ohio

Program	Groundwater Zone	Well	Hydraulic Location[1]	Depth to Water (ft)	Potentiometric Elevation[3] (ft)	Hydraulic Gradient[2] (ft/ft)	Hydraulic Conductivity[4] (cm/sec)			Effective Porosity	Groundwater Velocity (ft/day)			Well Diameter[5] (in.)	Residence Time[6] (days)		
							Low	Representative	High		Low	Representative	High		Low	Representative	High
FAR II CCR	Morgantown Sandstone	CA-0622A	Upgradient	-	-	-	1.E-06	1.E-04	1.E-01	0.32	-	-	-	6	-	-	-
FAR II CCR	Morgantown Sandstone	FA-8	Downgradient	45.96	875.07	0.0831	1.E-06	1.E-04	1.E-01	0.32	0.0007	**0.07**	73.63	6	0.007	**6.79**	679.11
FAR II CCR	Morgantown Sandstone	M-6	Upgradient	58.15	952.42	0.0192	1.E-06	1.E-04	1.E-01	0.32	0.0002	**0.02**	17.01	3	0.015	**14.69**	1469.42
FAR II CCR	Morgantown Sandstone	M-8A	Downgradient	68.53	824.67	0.0188	1.E-06	1.E-04	1.E-01	0.32	0.0002	**0.02**	16.62	6	0.030	**30.08**	3007.54
FAR II CCR	Morgantown Sandstone	M-10	Downgradient	97.19	885.92	0.0411	1.E-06	1.E-04	1.E-01	0.32	0.0004	**0.04**	36.42	3	0.007	**6.86**	686.49
FAR II CCR	Morgantown Sandstone	M-11	Downgradient	91.87	888.34	0.0042	1.E-06	1.E-04	1.E-01	0.32	0.0000	**0.00**	3.74	3	0.067	**66.82**	6681.52
FAR II CCR	Morgantown Sandstone	M-12	Upgradient	225.55	965.11	0.0073	1.E-06	1.E-04	1.E-01	0.32	0.0001	**0.01**	6.49	6	0.077	**77.10**	7710.01
FAR II CCR	Morgantown Sandstone	M-13	Downgradient	68.81	922.33	0.0044	1.E-06	1.E-04	1.E-01	0.32	0.0000	**0.00**	3.89	6	0.129	**128.63**	12863.50
FAR II CCR	Morgantown Sandstone	M-14	Downgradient	79.84	908.37	0.0649	1.E-06	1.E-04	1.E-01	0.32	0.0006	**0.06**	57.48	6	0.009	**8.70**	869.93
FAR II CCR	Morgantown Sandstone	M-15	Downgradient	141.23	933.05	0.0115	1.E-06	1.E-04	1.E-01	0.32	0.0001	**0.01**	10.16	6	0.049	**49.23**	4922.69
FAR II CCR	Morgantown Sandstone	M-16	Downgradient	114.27	954.28	0.0396	1.E-06	1.E-04	1.E-01	0.32	0.0004	**0.04**	35.11	6	0.014	**14.24**	1424.30
FAR II CCR	Morgantown Sandstone	M-21	Downgradient	128.64	889.97	0.0013	1.E-06	1.E-04	1.E-01	0.32	0.0000	**0.00**	1.16	6	0.433	**432.74**	43274.01
FAR II CCR	Morgantown Sandstone	M-22	Downgradient	95.83	912.21	0.0270	1.E-06	1.E-04	1.E-01	0.32	0.0002	**0.02**	23.87	6	0.021	**20.94**	2094.32
FAR II CCR	Morgantown Sandstone	M-23	Downgradient	148.42	837.48	0.0764	1.E-06	1.E-04	1.E-01	0.32	0.0007	**0.07**	67.65	6	0.007	**7.39**	739.15
FAR II CCR	Morgantown Sandstone	M-1003	Downgradient	87.93	847.95	0.2944	1.E-06	1.E-04	1.E-01	0.32	0.0026	**0.26**	260.83	6	0.002	**1.92**	191.70
FAR II CCR	Morgantown Sandstone	M-1004	Downgradient	88.54	919.75	0.0023	1.E-06	1.E-04	1.E-01	0.32	0.0000	**0.00**	2.00	6	0.251	**250.61**	25061.30
FAR II CCR	Morgantown Sandstone	M-1302	Upgradient	86.88	943.84	0.0179	1.E-06	1.E-04	1.E-01	0.32	0.0002	**0.02**	15.86	6	0.032	**31.52**	3152.09
FAR II CCR	Morgantown Sandstone	M-1309	Downgradient	239.05	933.04	0.0211	1.E-06	1.E-04	1.E-01	0.32	0.0002	**0.02**	18.70	6	0.027	**26.74**	2673.68
FAR II CCR	Morgantown Sandstone	M-GS-1	Downgradient	47.9	943.97	0.0496	1.E-06	1.E-04	1.E-01	0.32	0.0004	**0.04**	43.96	6	0.011	**11.37**	1137.42
FAR II CCR	Morgantown Sandstone	M-GS-2	Downgradient	83.78	907.03	0.0345	1.E-06	1.E-04	1.E-01	0.32	0.0003	**0.03**	30.59	6	0.016	**16.34**	1634.42
FAR II CCR	Morgantown Sandstone	M-GS-3R	Downgradient	77.08	924.36	0.0464	1.E-06	1.E-04	1.E-01	0.32	0.0004	**0.04**	41.09	6	0.012	**12.17**	1216.92
FAR II CCR	Morgantown Sandstone	M-GS-4	Downgradient	86.39	942.34	0.0257	1.E-06	1.E-04	1.E-01	0.32	0.0002	**0.02**	22.78	6	0.022	**21.95**	2195.06
FAR II CCR	Morgantown Sandstone	M-GS-5	Upgradient	78.9	960.64	0.0119	1.E-06	1.E-04	1.E-01	0.32	0.0001	**0.01**	10.50	6	0.048	**47.62**	4762.49

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Measurements and calculations represent conditions on April 10, 2023. No depth to water readings were collected at CA-0622A.

- A water level could not be collected from this well

[1] *Groundwater Monitoring Network Evaluation; Cardinal Site – Fly Ash Reservoir II, Brilliant, Ohio* prepared by Geosyntec Consultants in September 2016 (Revised February 2017).

[2] Hydraulic gradient was calculated from a potentiometric surface using GDAL software tools (https://gdal.org/programs/gdaldem.html).

[3] Elevations datum is National Geodetic Vertical Datum of 1929 (NGVD29).

[4] Low and high conductivity values are from the 2017 Groundwater Monitoring Network Evaluation, with a representative value chosen within this range that is consistent with previous velocity calculations.

[5] Well diameter represents the diameter of the borehole (sandpack).

[6] Residence time is an estimation of how long it would take groundwater to travel a distance equivalent to the well diameter at the calculated velocity.

Table 4-4. Morgantown Sandstone Groundwater Flow Calculations October 2023, Fly Ash Reservoir (FAR) II, Cardinal Plant, Brilliant, Ohio

Program	Groundwater Zone	Well	Hydraulic Location[1]	Depth to Water (ft)	Potentiometric Elevation[3] (ft)	Hydraulic Gradient[2] (ft/ft)	Hydraulic Conductivity[4] (cm/sec)			Effective Porosity	Groundwater Velocity (ft/day)			Well Diameter[5] (in.)	Residence Time[6] (days)		
							Low	Representative	High		Low	Representative	High		Low	Representative	High
FAR II	Morgantown Sandstone	CA-0622A	Upgradient	-	-	-	1.E-06	1.E-04	1.E-01	0.32	-	-	-	6	-	-	
FAR II	Morgantown Sandstone	FA-8	Downgradient	49.56	871.47	0.1225	1.E-06	1.E-04	1.E-01	0.32	0.0011	**0.11**	108.51	6	0.005	**4.61**	460.77
FAR II	Morgantown Sandstone	M-6	Upgradient	63.48	947.09	0.0475	1.E-06	1.E-04	1.E-01	0.32	0.0004	**0.04**	42.08	6	0.012	**11.88**	1188.30
FAR II	Morgantown Sandstone	M-8A	Downgradient	70.88	822.32	0.0260	1.E-06	1.E-04	1.E-01	0.32	0.0002	**0.02**	23.05	6	0.022	**21.69**	2169.32
FAR II	Morgantown Sandstone	M-10	Downgradient	100.2	882.91	0.0520	1.E-06	1.E-04	1.E-01	0.32	0.0005	**0.05**	46.03	3	0.005	**5.43**	543.11
FAR II	Morgantown Sandstone	M-11	Downgradient	95.15	885.06	0.0527	1.E-06	1.E-04	1.E-01	0.32	0.0005	**0.05**	46.69	3	0.005	**5.35**	535.44
FAR II	Morgantown Sandstone	M-12	Upgradient	217.09	973.57	0.0293	1.E-06	1.E-04	1.E-01	0.32	0.0003	**0.03**	25.92	6	0.019	**19.29**	1928.91
FAR II	Morgantown Sandstone	M-13	Downgradient	75.14	916	0.0333	1.E-06	1.E-04	1.E-01	0.32	0.0003	**0.03**	29.53	6	0.017	**16.93**	1693.33
FAR II	Morgantown Sandstone	M-14	Downgradient	82.98	905.23	0.0306	1.E-06	1.E-04	1.E-01	0.32	0.0003	**0.03**	27.09	6	0.018	**18.46**	1845.98
FAR II	Morgantown Sandstone	M-15	Downgradient	143.31	930.97	0.0288	1.E-06	1.E-04	1.E-01	0.32	0.0003	**0.03**	25.50	6	0.020	**19.61**	1960.85
FAR II	Morgantown Sandstone	M-16	Downgradient	116.45	952.1	0.0583	1.E-06	1.E-04	1.E-01	0.32	0.0005	**0.05**	51.67	6	0.010	**9.68**	967.62
FAR II	Morgantown Sandstone	M-21	Downgradient	132.02	886.59	0.0359	1.E-06	1.E-04	1.E-01	0.32	0.0003	**0.03**	31.80	6	0.016	**15.72**	1572.50
FAR II	Morgantown Sandstone	M-22	Downgradient	100.99	907.05	0.0707	1.E-06	1.E-04	1.E-01	0.32	0.0006	**0.06**	62.62	6	0.008	**7.98**	798.48
FAR II	Morgantown Sandstone	M-23	Downgradient	148.5	837.4	0.0839	1.E-06	1.E-04	1.E-01	0.32	0.0007	**0.07**	74.30	6	0.007	**6.73**	672.99
FAR II	Morgantown Sandstone	M-1003	Downgradient	88.65	847.23	0.0308	1.E-06	1.E-04	1.E-01	0.32	0.0003	**0.03**	27.26	6	0.018	**18.34**	1833.93
FAR II	Morgantown Sandstone	M-1004	Downgradient	94.62	913.67	0.0215	1.E-06	1.E-04	1.E-01	0.32	0.0002	**0.02**	19.01	4.87	0.021	**21.35**	2134.66
FAR II	Morgantown Sandstone	M-1302	Upgradient	88.81	941.91	0.0151	1.E-06	1.E-04	1.E-01	0.32	0.0001	**0.01**	13.42	6	0.037	**37.26**	3726.42
FAR II	Morgantown Sandstone	M-1309	Downgradient	239.03	933.06	0.0259	1.E-06	1.E-04	1.E-01	0.32	0.0002	**0.02**	22.91	6	0.022	**21.82**	2182.13
FAR II	Morgantown Sandstone	M-GS-1	Downgradient	50.81	941.06	0.0589	1.E-06	1.E-04	1.E-01	0.32	0.0005	**0.05**	52.17	6	0.010	**9.58**	958.49
FAR II	Morgantown Sandstone	M-GS-2	Downgradient	86.91	903.9	0.0423	1.E-06	1.E-04	1.E-01	0.32	0.0004	**0.04**	37.48	6	0.013	**13.34**	1334.14
FAR II	Morgantown Sandstone	M-GS-3R	Downgradient	83.84	917.6	0.0400	1.E-06	1.E-04	1.E-01	0.32	0.0004	**0.04**	35.43	6	0.014	**14.11**	1411.11
FAR II	Morgantown Sandstone	M-GS-4	Downgradient	80.92	947.81	0.0109	1.E-06	1.E-04	1.E-01	0.32	0.0001	**0.01**	9.65	6	0.052	**51.81**	5180.51
FAR II	Morgantown Sandstone	M-GS-5	Upgradient	80.71	958.83	0.0260	1.E-06	1.E-04	1.E-01	0.32	0.0002	**0.02**	23.03	6	0.022	**21.71**	2170.94

Measurements and calculations represent conditions on October 9, 2023.

- A water level could not be collected from this well

[1] *Groundwater Monitoring Network Evaluation; Cardinal Site – Fly Ash Reservoir II, Brilliant, Ohio* prepared by Geosyntec Consultants in September 2016 (Revised February 2017).

[2] Hydraulic gradient was calculated from potentiometric surface map.

[3] Elevations datum is National Geodetic Vertical Datum of 1929 (NGVD29).

[4] Low and high conductivity values are from the 2017 Groundwater Monitoring Network Evaluation, with a representative value chosen within this range that is consistent with previous velocity calculations.

[5] Well diameter represents the diameter of the borehole (sandpack).

[6] Residence time is an estimation of how long it would take groundwater to travel a distance equivalent to the well diameter at the calculated velocity.

Table 4-5. Summary of Shallow Aquifer Groundwater Samples, Fly Ash Reservoir (FAR) II, Cardinal Plant, Brilliant, Ohio

Well Name	Type of Well	Sample Date	Constituents Analyzed	Purpose
CA-0623A	Background	2/2/2023	Appendix III and Appendix IV	Background Assessment
CA-0623A	Background	2/20/2023	Appendix III and Appendix IV	Background Assessment
CA-0623A	Background	3/13/2023	Appendix III and Appendix IV	Background Assessment
CA-0623A	Background	4/3/2023	Appendix III and Appendix IV	Background Assessment
CA-0623A	Background	4/24/2023	Appendix III and Appendix IV	Background Assessment
CA-0623A	Background	5/15/2023	Appendix III and Appendix IV	Background Assessment
CA-0623A	Background	6/5/2023	Appendix III and Appendix IV	Background Assessment
CA-0623A	Background	6/26/2023	Appendix III and Appendix IV	Background Assessment
CA-0623A	Background	10/10/2023	Appendix III and Appendix IV	Compliance Assessment
S-1005	Background	2/2/2023	Appendix III and Appendix IV	Background Assessment
S-1005	Background	2/20/2023	Appendix III and Appendix IV	Background Assessment
S-1005	Background	3/15/2023	Appendix III and Appendix IV	Background Assessment
S-1005	Background	4/5/2023	Appendix III and Appendix IV	Background Assessment
S-1005	Background	4/24/2023	Appendix III and Appendix IV	Background Assessment
S-1005	Background	5/16/2023	Appendix III and Appendix IV	Background Assessment
S-1005	Background	6/5/2023	Appendix III and Appendix IV	Background Assessment
S-1005	Background	6/26/2023	Appendix III and Appendix IV	Background Assessment
S-1005	Background	10/11/2023	Appendix III and Appendix IV	Compliance Assessment
S-15	Background	2/1/2023	Appendix III and Appendix IV	Background Assessment
S-15	Background	2/20/2023	Appendix III and Appendix IV	Background Assessment
S-15	Background	3/14/2023	Appendix III and Appendix IV	Background Assessment
S-15	Background	4/3/2023	Appendix III and Appendix IV	Background Assessment
S-15	Background	4/25/2023	Appendix III and Appendix IV	Background Assessment
S-15	Background	5/15/2023	Appendix III and Appendix IV	Background Assessment
S-15	Background	6/6/2023	Appendix III and Appendix IV	Background Assessment
S-15	Background	6/27/2023	Appendix III and Appendix IV	Background Assessment
S-15	Background	10/10/2023	Appendix III and Appendix IV	Compliance Assessment
S-21	Downgradient	2/2/2023	Appendix III and Appendix IV	Background Assessment
S-21	Downgradient	2/21/2023	Appendix III and Appendix IV	Background Assessment
S-21	Downgradient	3/15/2023	Appendix III and Appendix IV	Background Assessment
S-21	Downgradient	4/4/2023	Appendix III and Appendix IV	Background Assessment
S-21	Downgradient	4/24/2023	Appendix III and Appendix IV	Background Assessment
S-21	Downgradient	5/16/2023	Appendix III and Appendix IV	Background Assessment
S-21	Downgradient	6/6/2023	Appendix III and Appendix IV	Background Assessment
S-21	Downgradient	6/26/2023	Appendix III and Appendix IV	Background Assessment
S-21	Downgradient	10/12/2023	Appendix III and Appendix IV	Compliance Assessment
S-22	Background	2/1/2023	Appendix III and Appendix IV	Background Assessment
S-22	Background	2/20/2023	Appendix III and Appendix IV	Background Assessment
S-22	Background	3/14/2023	Appendix III and Appendix IV	Background Assessment
S-22	Background	4/4/2023	Appendix III and Appendix IV	Background Assessment
S-22	Background	4/25/2023	Appendix III and Appendix IV	Background Assessment
S-22	Background	5/16/2023	Appendix III and Appendix IV	Background Assessment
S-22	Background	6/6/2023	Appendix III and Appendix IV	Background Assessment
S-22	Background	6/27/2023	Appendix III and Appendix IV	Background Assessment
S-22	Background	10/13/2023	Appendix III and Appendix IV	Compliance Assessment
S-23	Downgradient	2/2/2023	Appendix III and Appendix IV	Background Assessment
S-23	Downgradient	2/21/2023	Appendix III and Appendix IV	Background Assessment
S-23	Downgradient	3/14/2023	Appendix III and Appendix IV	Background Assessment
S-23	Downgradient	4/4/2023	Appendix III and Appendix IV	Background Assessment
S-23	Downgradient	4/25/2023	Appendix III and Appendix IV	Background Assessment
S-23	Downgradient	5/15/2023	Appendix III and Appendix IV	Background Assessment
S-23	Downgradient	6/6/2023	Appendix III and Appendix IV	Background Assessment
S-23	Downgradient	6/27/2023	Appendix III and Appendix IV	Background Assessment
S-23	Downgradient	10/12/2023	Appendix III and Appendix IV	Compliance Assessment
S-9	Downgradient	2/2/2023	Appendix III and Appendix IV	Background Assessment
S-9	Downgradient	2/21/2023	Appendix III and Appendix IV	Background Assessment
S-9	Downgradient	3/14/2023	Appendix III and Appendix IV	Background Assessment
S-9	Downgradient	4/4/2023	Appendix III and Appendix IV	Background Assessment
S-9	Downgradient	4/25/2023	Appendix III and Appendix IV	Background Assessment
S-9	Downgradient	5/15/2023	Appendix III and Appendix IV	Background Assessment
S-9	Downgradient	6/5/2023	Appendix III and Appendix IV	Background Assessment
S-9	Downgradient	6/26/2023	Appendix III and Appendix IV	Background Assessment
S-9	Downgradient	10/11/2023	Appendix III and Appendix IV	Compliance Assessment
S-9	Downgradient	12/6/2023	Chloride	Compliance Assessment (Resample)

K:\CCA\PROJECTS\Buckeye_Power\Cardinal\FAR II\Annual Groundwater and Corrective Measures Reports\2023\Tables\[Table 4-5 - Shallow Aquifer Sample Summary.xlsx]Yearly_Sampling_Summary

NA - Well Counld not be sampled during one or both events due to lack of water or obstructions.

Table 4-6. Summary of Morgantown Sandstone Groundwater Samples, Fly Ash Reservoir (FAR) II, Cardinal Plant, Brilliant, Ohio

Well Name	Type of Well	Sample Date	Constituents Analyzed	Purpose
CA-0622A	Upgradient	NA	Appendix III and IV	Assessment monitoring program
FA-8	Downgradient	4/13/2023	Appendix III and IV	Assessment monitoring program
FA-8	Downgradient	10/11/2023	Appendix III and IV	Assessment monitoring program
M-6	Upgradient	4/20/2023	Appendix III and IV	Assessment monitoring program
M-6	Upgradient	NA	Appendix III and IV	Assessment monitoring program
M-8A	Downgradient	4/17/2023	Appendix III and IV	Assessment monitoring program
M-8A	Downgradient	10/13/2023	Appendix III and IV	Assessment monitoring program
M-10	Downgradient	4/25/2023	Appendix III and IV	Assessment monitoring program
M-10	Downgradient	10/19/2023	Appendix III and IV	Assessment monitoring program
M-11	Downgradient	4/25/2023	Appendix III and IV	Assessment monitoring program
M-11	Downgradient	10/12/2023	Appendix III and IV	Assessment monitoring program
M-12	Upgradient	4/12/2023	Appendix III and IV	Assessment monitoring program
M-12	Upgradient	NA	Appendix III and IV	Assessment monitoring program
M-13	Downgradient	4/17/2023	Appendix III and IV	Assessment monitoring program
M-13	Downgradient	10/17/2023	Appendix III and IV	Assessment monitoring program
M-14	Downgradient	4/19/2023	Appendix III and IV	Assessment monitoring program
M-14	Downgradient	10/17/2023	Appendix III and IV	Assessment monitoring program
M-15	Downgradient	4/20/2023	Appendix III and IV	Assessment monitoring program
M-15	Downgradient	10/10/2023	Appendix III and IV	Assessment monitoring program
M-16	Downgradient	4/11/2023	Appendix III and IV	Assessment monitoring program
M-16	Downgradient	10/10/2023	Appendix III and IV	Assessment monitoring program
M-21	Downgradient	4/17/2023	Appendix III and IV	Assessment monitoring program
M-21	Downgradient	10/12/2023	Appendix III and IV	Assessment monitoring program
M-22	Downgradient	4/19/2023	Appendix III and IV	Assessment monitoring program
M-22	Downgradient	10/12/2023	Appendix III and IV	Assessment monitoring program
M-22	Downgradient	10/12/2023	Appendix III and IV	Assessment monitoring program (Duplicate)
M-23	Downgradient	4/17/2023	Appendix III and IV	Assessment monitoring program
M-23	Downgradient	10/12/2023	Appendix III and IV	Assessment monitoring program
M-1003	Downgradient	4/18/2023	Appendix III and IV	Assessment monitoring program
M-1003	Downgradient	10/17/2023	Appendix III and IV	Assessment monitoring program
M-1004	Downgradient	4/18/2023	Appendix III and IV	Assessment monitoring program
M-1004	Downgradient	10/12/2023	Appendix III and IV	Assessment monitoring program
M-1302	Upgradient	4/11/2023	Appendix III and IV	Assessment monitoring program
M-1302	Upgradient	10/10/2023	Appendix III and IV	Assessment monitoring program
M-1309	Downgradient	4/11/2023	Appendix III and IV	Assessment monitoring program
M-1309	Downgradient	10/10/2023	Appendix III and IV	Assessment monitoring program
M-2000	Downgradient	4/18/2023	Appendix III and IV	Corrective Action Program
M-2000	Downgradient	10/11/2023	Appendix III and IV	Corrective Action Program
M-GS-1	Downgradient	4/20/2023	Appendix III and IV	Assessment monitoring program
M-GS-1	Downgradient	10/17/2023	Appendix III and IV	Assessment monitoring program
M-GS-2	Downgradient	4/19/2023	Appendix III and IV	Assessment monitoring program
M-GS-2	Downgradient	10/17/2023	Appendix III and IV	Assessment monitoring program
M-GS-3R	Downgradient	4/18/2023	Appendix III and IV	Assessment monitoring program
M-GS-3R	Downgradient	4/18/2023	Appendix III and IV	Assessment monitoring program (Duplicate)
M-GS-3R	Downgradient	10/12/2023	Appendix III and IV	Assessment monitoring program
M-GS-4	Downgradient	4/21/2023	Appendix III and IV	Assessment monitoring program
M-GS-4	Downgradient	10/19/2023	Appendix III and IV	Assessment monitoring program
M-GS-5	Upgradient	4/11/2023	Appendix III and IV	Assessment monitoring program
M-GS-5	Upgradient	10/10/2023	Appendix III and IV	Assessment monitoring program

K:\CCA\PROJECTS\Buckeye_Power\Cardinal\FAR II\Annual Groundwater and Corrective Measures Reports\2023\Tables\[Table 4-6 - Morgantown Sample Summary.xlsx]Yearly_Sampling_Summary

NA - Well Counld not be sampled during one or both events due to lack of water or obstructions.

Table 4-7. Background Analytical Results for the Shallow Aquifer in 2023, Fly Ash Rerservoir (FAR) II, Cardinal Plant, Brilliant, Ohio.

Well Name		CA-0623A	CA-0623A	CA-0623A	CA-0623A	CA-0623A	CA-0623A	CA-0623A	CA-0623A
Well Type		Background	Background	Background	Background	Background	Background	Background	Background
Sample Name		CA-0623A	CA-0623A	CA-0623A	CA-0623A	CA-0623A	CA-0623A	CA-0623A	CA-0623A
Sample Date		2/2/2023	2/20/2023	3/13/2023	4/3/2023	4/24/2023	5/15/2023	6/5/2023	6/26/2023
Laboratory	Concentration	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Test America	Pace Analytical	Pace Analytical	Pace Analytical
Lab ID	Units	50336680007	50338063001	50339794001	50341391001	50343332005	50345209001	50346961001	50348223001
APPENDIX III CONSTITUENTS									
Boron	MG/L	**0.451**	**0.463**	**0.458**	**0.492**	**0.504**	**0.472**	**0.479**	**0.501**
Calcium	MG/L	**1.42**	**1.02**	**1.24**	**1.09**	NA	**1.1**	**0.958**	**1.04**
Chloride	MG/L	**24.9**	**22.2**	**20.2**	**20.8**	**17.3**	**14**	**14**	**13.7**
Fluoride	MG/L	**2.6**	**2.6**	**2.5**	**2.5**	**2.7**	**2.6**	**2.2**	**2.2**
Sulfate	MG/L	**21.6**	**20.2**	**22.5**	**19.3**	**20.7**	**19.1**	**18.9**	**11.9**
Total Dissolved Solids	MG/L	**644**	**629**	**629**	**631**	**613**	**637**	**596**	**628**
pH	SU	**8.95**	**8.75**	**8.57**	**9**	**9.15**	**8.87**	**8.61**	**8.63**
APPENDIX IV CONSTITUENTS									
Antimony	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Arsenic	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Barium	MG/L	**0.0231**	**0.0226**	**0.0221**	**0.024**	**0.023**	**0.0229**	**0.0234**	**0.0223**
Beryllium	MG/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Cadmium	MG/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium	MG/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Fluoride	MG/L	**2.6**	**2.6**	**2.5**	**2.5**	**2.7**	**2.6**	**2.2**	**2.2**
Lead	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Lithium	MG/L	**0.0215**	**0.0206**	**0.0257**	**0.0228**	**0.0202**	**0.0203**	**0.0216**	**0.0227**
Mercury	MG/L	< 5.2E-7	< 5.2E-7	< 5.1E-7	< 5.1E-7	< 5.1E-7	< 5.1E-7	< 5.1E-7	< 5.2E-7
Molybdenum	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Selenium	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Thallium	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Combined Radium	pCi/L	**0.33**	**0.0507**	**0.535**	**0.3**	**0.684**	**0.332**	**0.1568**	**1.175**

Table 4-7. Background Analytical Results for the Shallow Aquifer in 2023, Fly Ash Rerservoir (FAR) II, Cardinal Plant, Brilliant, Ohio.

Well Name		S-1005	S-1005	S-1005	S-1005	S-1005	S-1005	S-1005	S-1005
Well Type		Background	Background	Background	Background	Background	Background	Background	Background
Sample Name		S-1005	S-1005	S-1005	S-1005	S-1005	S-1005	S-1005	S-1005
Sample Date		2/2/2023	2/20/2023	3/15/2023	4/5/2023	4/24/2023	5/16/2023	6/5/2023	6/26/2023
Laboratory	Concentration	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical
Lab ID	Units	50336680006	50338063002	50339794006	50341391007	50343332003	50345209007	50346961002	50348223002
APPENDIX III CONSTITUENTS									
Boron	MG/L	**0.422**	**0.414**	**0.415**	**0.417**	**0.521**	**0.441**	**0.452**	**0.403**
Calcium	MG/L	**359**	**330**	**329**	**321**	**363**	**361**	**349**	**339**
Chloride	MG/L	**1.3**	**1**	**1.3**	**4.7**	**5.3**	**1.5**	**1.6**	**2.2**
Fluoride	MG/L	**2.2**	**0.39**	**0.64**	**0.53**	**2.5**	**1.9**	**1.6**	**1.4**
Sulfate	MG/L	**4470**	**3360**	**3390**	**2700**	**6130**	**3970**	**4180**	**4430**
Total Dissolved Solids	MG/L	**6160**	**4970**	**4890**	**4420**	**6620**	**5960**	**6310**	**6400**
pH	SU	**3.17**	**3.33**	**3.35**	**3.44**	**3.35**	**3.31**	**3.29**	**3.19**
APPENDIX IV CONSTITUENTS									
Antimony	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Arsenic	MG/L	**0.0742**	**0.0388**	**0.0454**	**0.034**	**0.0854**	**0.0687**	**0.0742**	**0.0786**
Barium	MG/L	**0.0061**	**0.0063**	**0.0057**	**0.0067**	**0.0063**	**0.0063**	**0.006**	**0.0059**
Beryllium	MG/L	**0.0294**	**0.0215**	**0.0209**	**0.0154**	**0.0344**	**0.0275**	**0.0322**	**0.0268**
Cadmium	MG/L	**0.00077**	**0.00034**	**0.00035**	**0.00018**	**0.00068**	**0.00084**	**0.00091**	**0.0013**
Chromium	MG/L	**0.0339**	**0.0237**	**0.0225**	**0.0185**	**0.0318**	**0.031**	**0.0344**	**0.0372**
Cobalt	MG/L	**0.155**	**0.0897**	**0.0939**	**0.0641**	**0.208**	**0.149**	**0.142**	**0.155**
Fluoride	MG/L	**2.2**	**0.39**	**0.64**	**0.53**	**2.5**	**1.9**	**1.6**	**1.4**
Lead	MG/L	**0.0025**	**0.00094**	**0.00096**	**0.00076**	**0.0018**	**0.0023**	**0.0011**	**0.0017**
Lithium	MG/L	**0.647**	**0.498**	**0.523**	**0.434**	**0.662**	**0.63**	**0.685**	**0.641**
Mercury	MG/L	**0.00000179**	**0.00000141**	**0.0000011**	**0.0000011**	**0.00000181**	**0.00000679**	**0.00000126**	< 2.6E-6
Molybdenum	MG/L	< 0.0025	< 0.005	< 0.005	< 0.005	< 0.01	< 0.005	< 0.01	< 0.005
Selenium	MG/L	**0.0307**	**0.0422**	**0.0167**	**0.0437**	**0.0242**	**0.0232**	**0.06**	**0.0104**
Thallium	MG/L	**0.0011**	< 0.0005	< 0.0005	< 0.0005	**0.00099**	**0.00077**	**0.00074**	**0.00079**
Combined Radium	pCi/L	**0.7121**	**1.0149**	**1.075**	**1.871**	**1.5316**	**0.932**	**1.116**	**0.9416**

Table 4-7. Background Analytical Results for the Shallow Aquifer in 2023, Fly Ash Rerservoir (FAR) II, Cardinal Plant, Brilliant, Ohio.

Well Name		S-15	S-15	S-15	S-15	S-15	S-15	S-15	S-15
Well Type		Background	Background	Background	Background	Background	Background	Background	Background
Sample Name		S-15	S-15	S-15	S-15	S-15	S-15	S-15	S-15
Sample Date		2/1/2023	2/20/2023	3/14/2023	4/3/2023	4/25/2023	5/15/2023	6/6/2023	6/27/2023
Laboratory	Concentration	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical
Lab ID	Units	50336680001	50338063003	50339794002	50341391002	50343332004	50345209002	50346961006	50348223005
APPENDIX III CONSTITUENTS									
Boron	MG/L	**0.171**	**0.188**	**0.167**	**0.141**	**0.214**	**0.162**	**0.178**	**0.178**
Calcium	MG/L	**269**	**273**	**270**	**268**	**280**	**268**	**260**	**259**
Chloride	MG/L	**65.8**	**66.6**	**62.6**	**42.1**	**56.9**	**55.4**	**56.1**	**56.6**
Fluoride	MG/L	**0.62**	**0.53**	**0.63**	**0.31**	**0.64**	**0.54**	**0.62**	**0.56**
Sulfate	MG/L	**1290**	**1150**	**1250**	**1010**	**1040**	**1060**	**1100**	**1100**
Total Dissolved Solids	MG/L	**1890**	**1890**	**1920**	**808**	**1870**	**1890**	**1910**	**1850**
pH	SU	**4.74**	**4.48**	**4.7**	**5.17**	**4.53**	**4.51**	**4.71**	**4.82**
APPENDIX IV CONSTITUENTS									
Antimony	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Arsenic	MG/L	**0.0186**	**0.0182**	**0.0163**	**0.0171**	**0.0165**	**0.0155**	**0.0164**	**0.0159**
Barium	MG/L	**0.0137**	**0.0117**	**0.0111**	**0.0104**	**0.0111**	**0.0101**	**0.0099**	**0.0103**
Beryllium	MG/L	**0.0033**	**0.0033**	**0.0027**	**0.0013**	**0.0029**	**0.0024**	**0.0024**	**0.002**
Cadmium	MG/L	**0.00026**	**0.00024**	**0.0002**	**0.00014**	**0.00019**	**0.00018**	**0.00017**	**0.00019**
Chromium	MG/L	**0.0039**	**0.0036**	**0.0031**	**0.0021**	**0.0038**	**0.0025**	**0.0026**	**0.0027**
Cobalt	MG/L	**0.039**	**0.0406**	**0.0332**	**0.0206**	**0.038**	**0.0316**	**0.032**	**0.0327**
Fluoride	MG/L	**0.62**	**0.53**	**0.63**	**0.31**	**0.64**	**0.54**	**0.62**	**0.56**
Lead	MG/L	**0.0016**	**0.0013**	**0.001**	**0.00088**	**0.00095**	**0.00084**	< 0.0005	**0.00084**
Lithium	MG/L	**0.102**	**0.0899**	**0.108**	**0.0805**	**0.0936**	**0.0863**	**0.0919**	**0.0864**
Mercury	MG/L	**0.00000823**	**0.00000378**	**0.00000394**	**0.00000249**	**0.00000484**	**0.00000395**	**0.00000282**	**0.00000331**
Molybdenum	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Selenium	MG/L	**0.0032**	**0.0066**	**0.0019**	**0.0029**	**0.0017**	**0.0017**	**0.0044**	**0.00096**
Thallium	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Combined Radium	pCi/L	**1.416**	**1.531**	**1.783**	**1.628**	**1.453**	**1.102**	**1.3463**	**1.02**

Table 4-7. Background Analytical Results for the Shallow Aquifer in 2023, Fly Ash Rerservoir (FAR) II, Cardinal Plant, Brilliant, Ohio.

Well Name		S-21	S-21	S-21	S-21	S-21	S-21	S-21	S-21
Well Type		Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient
Sample Name		S-21	S-21	S-21	S-21	S-21	S-21	S-21	S-21
Sample Date		2/2/2023	2/21/2023	3/15/2023	4/4/2023	4/24/2023	5/16/2023	6/6/2023	6/26/2023
Laboratory	Concentration	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical
Lab ID	Units	50336680005	50338063007	50339794007	50341391006	50343332007	50345209006	50346961004	50348223003
APPENDIX III CONSTITUENTS									
Boron	MG/L	**0.695**	**0.722**	**0.723**	**0.721**	**0.725**	**0.672**	**0.678**	**0.624**
Calcium	MG/L	**384**	**386**	**389**	**386**	**380**	**394**	**362**	**374**
Chloride	MG/L	**7.1**	**6.9**	**8**	**6.7**	**5.5**	**7**	**6.5**	**6.7**
Fluoride	MG/L	**0.079**	**0.06**	**0.097**	**0.11**	< 0.05	**0.15**	**0.1**	**0.12**
Sulfate	MG/L	**1130**	**1060**	**1140**	**1000**	**1000**	**975**	**968**	**973**
Total Dissolved Solids	MG/L	**1930**	**1960**	**924**	**1980**	**1940**	**1960**	**1870**	**1930**
pH	SU	**6.8**	**6.67**	**6.78**	**6.92**	**7.04**	**6.86**	**6.56**	**6.67**
APPENDIX IV CONSTITUENTS									
Antimony	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Arsenic	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Barium	MG/L	**0.0276**	**0.0293**	**0.0268**	**0.0265**	**0.0287**	**0.0231**	**0.0302**	**0.0224**
Beryllium	MG/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Cadmium	MG/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium	MG/L	< 0.001	**0.0011**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt	MG/L	**0.00056**	**0.00076**	**0.0006**	**0.00056**	**0.00068**	< 0.0005	**0.00091**	< 0.0005
Fluoride	MG/L	**0.079**	**0.06**	**0.097**	**0.11**	< 0.05	**0.15**	**0.1**	**0.12**
Lead	MG/L	< 0.0005	**0.0005**	< 0.0005	< 0.0005	< 0.0005	< 0.0005	**0.00092**	< 0.0005
Lithium	MG/L	**0.0526**	**0.0572**	**0.064**	**0.0479**	**0.0488**	**0.0405**	**0.0398**	**0.0394**
Mercury	MG/L	**0.0000175**	**0.00000988**	**0.00000766**	**0.00000629**	**0.0000068**	**0.00000376**	**0.00000507**	**0.00000395**
Molybdenum	MG/L	**0.0223**	**0.0222**	**0.0225**	**0.024**	**0.0225**	**0.0216**	**0.0211**	**0.0205**
Selenium	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Thallium	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Combined Radium	pCi/L	**0.83**	**0.4581**	**0.5798**	**0.64**	**0.952**	**0.6834**	**0.4899**	**0.2362**

Table 4-7. Background Analytical Results for the Shallow Aquifer in 2023, Fly Ash Rerservoir (FAR) II, Cardinal Plant, Brilliant, Ohio.

Well Name		S-22	S-22	S-22	S-22	S-22	S-22	S-22	S-22
Well Type		Background	Background	Background	Background	Background	Background	Background	Background
Sample Name		S-22	S-22	S-22	S-22	S-22	S-22	S-22	S-22
Sample Date		2/1/2023	2/20/2023	3/14/2023	4/4/2023	4/25/2023	5/16/2023	6/6/2023	6/27/2023
Laboratory	Concentration	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical
Lab ID	Units	50336680002	50338063004	50339794003	50341391003	50343332006	50345209004	50346961007	50348223006
APPENDIX III CONSTITUENTS									
Boron	MG/L	**0.035**	**0.0343**	**0.033**	**0.0335**	**0.0329**	**0.03**	**0.0311**	**0.0295**
Calcium	MG/L	**402**	**418**	**419**	**416**	**403**	**417**	**387**	**362**
Chloride	MG/L	**2.7**	**2.4**	**2.7**	**1.4**	**2.1**	**2.4**	**2.6**	**2.4**
Fluoride	MG/L	< 0.05	**0.067**	**0.086**	**0.1**	**0.11**	**0.13**	**0.063**	**0.08**
Sulfate	MG/L	**900**	**866**	**925**	**807**	**806**	**798**	**694**	**762**
Total Dissolved Solids	MG/L	**1520**	**1530**	**1590**	**1520**	**1470**	**1550**	**1510**	**1460**
pH	SU	**6.95**	**6.75**	**6.83**	**6.82**	**7.00**	**6.93**	**6.83**	**6.87**
APPENDIX IV CONSTITUENTS									
Antimony	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Arsenic	MG/L	**0.0022**	**0.00065**	**0.001**	**0.0013**	**0.00051**	**0.0012**	< 0.0005	< 0.0005
Barium	MG/L	**0.0238**	**0.0173**	**0.0173**	**0.0211**	**0.0171**	**0.0195**	**0.016**	**0.0148**
Beryllium	MG/L	**0.00013**	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Cadmium	MG/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium	MG/L	**0.0024**	< 0.001	**0.0011**	**0.0014**	**0.0011**	**0.0015**	< 0.001	< 0.001
Cobalt	MG/L	**0.005**	**0.0014**	**0.0021**	**0.0033**	**0.0014**	**0.003**	**0.0012**	**0.0012**
Fluoride	MG/L	< 0.05	**0.067**	**0.086**	**0.1**	**0.11**	**0.13**	**0.063**	**0.08**
Lead	MG/L	**0.004**	**0.00093**	**0.0016**	**0.0018**	**0.00077**	**0.0021**	< 0.0005	**0.00063**
Lithium	MG/L	**0.0391**	**0.0442**	**0.0521**	**0.0355**	**0.0296**	**0.0177**	**0.0188**	**0.0183**
Mercury	MG/L	**0.00000828**	**0.00000161**	**0.00000218**	**0.00000475**	**0.00000192**	**0.00000337**	**0.00000084**	**0.00000094**
Molybdenum	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	**0.00067**
Selenium	MG/L	**0.00062**	**0.00056**	< 0.0005	**0.00056**	< 0.0005	**0.0005**	< 0.0005	< 0.0005
Thallium	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Combined Radium	pCi/L	**0.944**	**0.16148**	**0.652**	**0.6655**	**0.363**	**0.649**	**0.937**	**0.678**

Table 4-7. Background Analytical Results for the Shallow Aquifer in 2023, Fly Ash Rerservoir (FAR) II, Cardinal Plant, Brilliant, Ohio.

Well Name		S-23	S-23	S-23	S-23	S-23	S-23	S-23	S-23
Well Type		Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient
Sample Name		S-23	S-23	S-23	S-23	S-23	S-23	S-23	S-23
Sample Date		2/2/2023	2/21/2023	3/14/2023	4/4/2023	4/25/2023	5/15/2023	6/6/2023	6/27/2023
Laboratory	Concentration	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical
Lab ID	Units	50336680003	50338063005	50339794004	50341391004	50343332001	50345209003	50346961005	50348223007
APPENDIX III CONSTITUENTS									
Boron	MG/L	**0.0877**	**0.0888**	**0.0805**	**0.0806**	**0.0807**	**0.0754**	**0.077**	**0.0723**
Calcium	MG/L	**65.8**	**59.5**	**71**	**69**	**70.2**	**71.8**	**71.3**	**71.6**
Chloride	MG/L	**6.4**	**6**	**5.9**	**5.6**	**5.8**	**5.5**	**5.2**	**5.4**
Fluoride	MG/L	**0.073**	< 0.05	**0.1**	**0.12**	**0.12**	**0.11**	**0.075**	**0.092**
Sulfate	MG/L	**14.5**	**14.9**	**16.8**	**16.5**	**18.7**	**18.1**	**22.3**	**23.8**
Total Dissolved Solids	MG/L	**304**	**332**	**1350**	**315**	**305**	**336**	**347**	**348**
pH	SU	**7.32**	**7.2**	**7.42**	**7.56**	**7.3**	**7.25**	**7.16**	**7.21**
APPENDIX IV CONSTITUENTS									
Antimony	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Arsenic	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Barium	MG/L	**0.241**	**0.24**	**0.235**	**0.236**	**0.23**	**0.233**	**0.221**	**0.213**
Beryllium	MG/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Cadmium	MG/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium	MG/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Fluoride	MG/L	**0.073**	< 0.05	**0.1**	**0.12**	**0.12**	**0.11**	**0.075**	**0.092**
Lead	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Lithium	MG/L	**0.0166**	**0.0149**	**0.0195**	**0.0137**	**0.0119**	**0.0122**	**0.0129**	**0.0141**
Mercury	MG/L	< 5E-7	< 5E-7	< 5E-7	< 5E-7	< 5E-7	< 5E-7	< 5E-7	< 5E-7
Molybdenum	MG/L	**0.0018**	**0.00092**	**0.001**	**0.00075**	**0.0029**	**0.0029**	**0.0022**	**0.0015**
Selenium	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Thallium	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Combined Radium	pCi/L	**0.984**	**0.285**	**0.955**	**0.666**	**0.787**	**0.561**	**0.604**	**0.685**

Table 4-7. Background Analytical Results for the Shallow Aquifer in 2023, Fly Ash Rerservoir (FAR) II, Cardinal Plant, Brilliant, Ohio.

Well Name		S-9	S-9	S-9	S-9	S-9	S-9	S-9	S-9
Well Type		Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient
Sample Name		S-9	S-9	S-9	S-9	S-9	S-9	S-9	S-9
Sample Date		2/2/2023	2/21/2023	3/14/2023	4/4/2023	4/25/2023	5/16/2023	6/5/2023	6/26/2023
Laboratory	Concentration	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical
Lab ID	Units	50336680004	50338063006	50339794005	50341391005	50343332002	50345209005	50346961003	50348223004
APPENDIX III CONSTITUENTS									
Boron	MG/L	**0.443**	**0.444**	**0.449**	**0.454**	**0.491**	**0.441**	**0.456**	**0.474**
Calcium	MG/L	**200**	**179**	**226**	**222**	**222**	**216**	**208**	**215**
Chloride	MG/L	**95.3**	**97.8**	**101**	**88.8**	**92.1**	**98**	**96.2**	**100**
Fluoride	MG/L	**0.2**	**0.19**	**0.21**	**0.2**	**0.23**	**0.17**	**0.18**	**0.19**
Sulfate	MG/L	**707**	**687**	**705**	**636**	**641**	**589**	**587**	**599**
Total Dissolved Solids	MG/L	**1310**	**1360**	**340**	**1340**	**1320**	**1360**	**1300**	**1360**
pH	SU	**7.13**	**6.97**	**7.2**	**7.29**	**7.16**	**7.16**	**7.02**	**7.01**
APPENDIX IV CONSTITUENTS									
Antimony	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Arsenic	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Barium	MG/L	**0.023**	**0.0217**	**0.0246**	**0.0227**	**0.0216**	**0.0216**	**0.0222**	**0.0221**
Beryllium	MG/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Cadmium	MG/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium	MG/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt	MG/L	**0.0024**	**0.0013**	**0.0031**	**0.0013**	**0.00095**	**0.00069**	**0.00067**	**0.00071**
Fluoride	MG/L	**0.2**	**0.19**	**0.21**	**0.2**	**0.23**	**0.17**	**0.18**	**0.19**
Lead	MG/L	**0.002**	**0.0015**	**0.0027**	**0.00078**	**0.00056**	< 0.0005	**0.00063**	< 0.0005
Lithium	MG/L	**0.0225**	**0.0251**	**0.033**	**0.0268**	**0.0216**	**0.0165**	**0.0182**	**0.0214**
Mercury	MG/L	**0.00000176**	**0.00000096**	**0.00000297**	**0.00000099**	**0.00000114**	< 5E-7	< 5E-7	< 5E-7
Molybdenum	MG/L	**0.00065**	< 0.0005	**0.00052**	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Selenium	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Thallium	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Combined Radium	pCi/L	**0.852**	**0.918**	**1.39**	**1.783**	**0.875**	**0.887**	**2.303**	**0.513**

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Table 4-8. Analytical Results for the Shallow Aquifer in October and December 2023, Fly Ash Rerservoir (FAR) II, Cardinal Plant, Brilliant, Ohio.

Well Name		CA-0623A	S-1005	S-15	S-21	S-22	S-23	S-9	S-9
Well Type		Background	Background	Background	Downgradient	Background	Downgradient	Downgradient	Downgradient
Sample Name		CA-0623A	S-1005	S-15	S-21	S-22	S-23	S-9	S-9
Sample Date		10/10/2023	10/11/2023	10/10/2023	10/12/2023	10/13/2023	10/12/2023	10/11/2023	12/6/2023
Laboratory	Concentration	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical
Lab ID	Units	50356478008	50356478001	50356478009	50356478011	50356505005	50356505006	50356478013	50361158001
APPENDIX III CONSTITUENTS									
Boron	MG/L	**0.48**	**0.42**	**0.16**	**0.47**	**0.03**	**0.08**	**0.4**	NA
Calcium	MG/L	**1.04**	**358**	**260**	**373**	**390**	**62.7**	**233**	NA
Chloride	MG/L	**19.7**	**6.2**	**46.3**	**6.2**	**2.5**	**4.8**	**117**	**102**
Fluoride	MG/L	**2.2**	**0.62**	**0.27**	**0.1**	**0.07**	**0.07**	**0.2**	NA
Sulfate	MG/L	**21.5**	**3660**	**1000**	**858**	**863**	**17.4**	**673**	NA
Total Dissolved Solids	MG/L	**613**	**6330**	**1760**	**1990**	**1620**	**338**	**1510**	NA
pH	SU	**8.68**	**3.12**	**4.43**	**6.70**	**6.89**	**7.50**	**7.18**	NA
APPENDIX IV CONSTITUENTS									
Antimony	MG/L	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	NA
Arsenic	MG/L	< 0.0005 U	**0.04**	**0.02**	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	NA
Barium	MG/L	**0.02**	**0.01**	**0.01**	**0.02**	**0.02**	**0.22**	**0.02**	NA
Beryllium	MG/L	< 0.0001 U	**0.02**	**0.00087**	< 0.0001 U	< 0.0001 U	< 0.0001 U	< 0.0001 U	NA
Cadmium	MG/L	< 0.0001 U	**0.00033**	**0.00012**	< 0.0001 U	< 0.0001 U	< 0.0001 U	< 0.0001 U	NA
Chromium	MG/L	< 0.001 U	**0.02**	**0.0022**	< 0.001 U	< 0.001 U	< 0.001 U	< 0.001 U	NA
Cobalt	MG/L	< 0.0005 U	**0.09**	**0.02**	< 0.0005 U	**0.0014**	< 0.0005 U	**0.00071**	NA
Fluoride	MG/L	**2.1**	**0.62**	**0.27**	**0.1**	**0.07**	**0.07**	**0.2**	NA
Lead	MG/L	< 0.0005 U	**0.00079**	**0.00088**	< 0.0005 U	< 0.0005 U	< 0.0005 U	**0.00081**	NA
Lithium	MG/L	**0.02**	**0.54**	**0.08**	**0.05**	**0.02**	< 0.01 U	**0.02**	NA
Mercury	MG/L	< 5E-7 U	**0.00000191**	**0.00000317**	**0.00000475**	**0.00000162**	< 5E-7 U	**0.00000072**	NA
Molybdenum	MG/L	< 0.0005 U	< 0.01 U	**0.00056**	**0.01**	**0.00062**	**0.00062**	< 0.0005 U	NA
Selenium	MG/L	< 0.0005 U	**0.02**	**0.0014**	< 0.0005 U	**0.00065**	< 0.0005 U	< 0.0005 U	NA
Thallium	MG/L	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	NA
Combined Radium	pCi/L	**0.19**	**1.63**	**0.85**	**0.94**	**0.44**	**0.25**	**0.91**	NA

Table 4-9. Morgantown Sandstone Analytical Results for April 2023, Fly Ash Rerservoir (FAR) II, Cardinal Plant, Brilliant, Ohio.

Well Name		CA-0622A	FA-8	M-6	M-8A	M-10	M-11	M-12	M-13	M-14
Well Type		Background	Downgradient	Background	Donwgradient	Donwgradient	Donwgradient	Background	Donwgradient	Donwgradient
Sample Name		CA-0622A*	FA-8	M-6	M-8A	M-10	M-11	M-12	M-13	M-14
Sample Date			4/13/2023	4/20/2023	4/17/2023	4/25/2023	4/25/2023	4/12/2023	4/17/2023	4/19/2023
Laboratory	Concentration	NA	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical
Lab ID	Units	NA	50342281001	50342939001	50342691003	50343326001	50343326002	50342048004	50342691005	50342933002
APPENDIX III CONSTITUENTS										
Boron	MG/L	NA	**5.13**	**0.253**	**0.0324**	**0.521**	**5.38**	**0.319**	**0.276**	**0.211**
Calcium	MG/L	NA	**230**	**13.4**	**101**	**11.3**	**254**	**450**	**6.99**	**1.2**
Chloride	MG/L	NA	**35.6**	**46.1**	**7**	**14.9**	**28.9**	**88.1**	**3.3**	**5.9**
Fluoride	MG/L	NA	**0.62**	**1.2**	**0.13**	**0.74**	**0.53**	**1.4**	**1.9**	< 0.05
Sulfate	MG/L	NA	**792**	**21.8**	**99.1**	**131**	**828**	**1600**	**24.4**	< 0.25
Total Dissolved Solids	MG/L	NA	**1410**	**794**	**436**	**697**	**1350**	**2600**	**490**	**354**
pH	SU	NA	**7.33**	**8.19**	**7.29**	**7.91**	**7.55**	**6.36**	**8.42**	**9.64**
APPENDIX IV CONSTITUENTS										
Antimony	MG/L	NA	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Arsenic	MG/L	NA	**0.0115**	**0.0046**	**0.0011**	< 0.0005	**0.0083**	**0.006**	< 0.0005	< 0.0005
Barium	MG/L	NA	**0.0286**	**0.445**	**0.107**	**0.075**	**0.0256**	**0.0209**	**0.0916**	**0.0141**
Beryllium	MG/L	NA	< 0.0001	**0.0014**	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Cadmium	MG/L	NA	< 0.0001	**0.00016**	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium	MG/L	NA	< 0.001	**0.0082**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt	MG/L	NA	**0.0019**	**0.0054**	< 0.0005	< 0.0005	**0.0014**	**0.0496**	< 0.0005	< 0.0005
Fluoride	MG/L	NA	**0.62**	**1.2**	**0.13**	**0.74**	**0.53**	**1.4**	**1.9**	< 0.05
Lead	MG/L	NA	**0.00051**	**0.0245**	**0.0014**	**0.00066**	< 0.0005	< 0.0005	**0.00054**	< 0.0005
Lithium	MG/L	NA	**0.194**	**0.0231**	< 0.01	**0.0218**	**0.177**	**0.156**	**0.0131**	< 0.01
Mercury	MG/L	NA	**0.00000222**	**0.000008**	< 5E-7	**0.0000149**	< 5E-7	**0.00000333**	**0.00000066**	< 5E-7
Molybdenum	MG/L	NA	**0.265**	**0.0012**	< 0.0005	**0.0018**	**0.256**	< 0.0005	< 0.0005	< 0.0005
Selenium	MG/L	NA	< 0.0005	**0.0026**	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Thallium	MG/L	NA	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Combined Radium	pCi/L	NA	**0.729**	**6.22**	**0.789**	**1.99**	**0.455**	**0.121**	**1.55**	**0.482**

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* Groundwater could not be sampled from this well during the event

Table 4-9. Analytical Results for April 2023, Fly Ash Rerservoir (FAR) II, Cardinal Plant, Brilliant, Ohio.

Well Name		M-15	M-16	M-21	M-22	M-23	M-1003	M-1004	M-1302
Well Type		Donwgradient	Donwgradient	Donwgradient	Donwgradient	Donwgradient	Donwgradient	Donwgradient	Background
Sample Name		M-15	M-16	M-21	M-22	M-23	M-1003	M-1004	M-1302
Sample Date		4/20/2023	4/11/2023	4/17/2023	4/19/2023	4/17/2023	4/18/2023	4/18/2023	4/11/2023
Laboratory	Concentration	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical
Lab ID	Units	50342933004	50342048003	50342691006	50342933001	50342691004	50342691007	50342691002	50342048001
APPENDIX III CONSTITUENTS									
Boron	MG/L	**0.248**	**0.187**	**3.67**	**3.31**	**0.716**	**0.143**	**2.82**	**0.276**
Calcium	MG/L	**1.62**	**2.37**	**230**	**168**	**106**	**87.7**	**108**	**3.73**
Chloride	MG/L	**58.8**	**11.3**	**50.5**	**41.4**	**15.4**	**8.5**	**36.1**	**31**
Fluoride	MG/L	**0.27**	**0.36**	**0.13**	**0.44**	**0.59**	**0.19**	**1.4**	**2**
Sulfate	MG/L	**2.2**	**263**	**850**	**356**	**1540**	**171**	**301**	**46.7**
Total Dissolved Solids	MG/L	**577**	**794**	**1640**	**891**	**3200**	**533**	**802**	**683**
pH	SU	**9.25**	**9.17**	**7.06**	**7.33**	**7.18**	**7.74**	**7.53**	**9.03**
APPENDIX IV CONSTITUENTS									
Antimony	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Arsenic	MG/L	**0.0013**	< 0.0005	**0.00087**	< 0.0005	**0.0007**	< 0.0005	**0.0011**	< 0.0005
Barium	MG/L	**0.0406**	**0.0333**	**0.0112**	**0.0216**	**0.0075**	**0.0699**	**0.0393**	**0.105**
Beryllium	MG/L	< 0.0001	< 0.0001	**0.00042**	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Cadmium	MG/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium	MG/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt	MG/L	< 0.0005	< 0.0005	**0.0019**	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Fluoride	MG/L	**0.27**	**0.36**	**0.13**	**0.44**	**0.59**	**0.19**	**1.4**	**2**
Lead	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Lithium	MG/L	< 0.01	**0.0145**	**0.0805**	**0.0453**	**0.0559**	**0.0108**	**0.0211**	**0.013**
Mercury	MG/L	< 5.1E-7	< 5E-7	< 5E-7	< 5E-7	< 5E-7	< 5E-7	< 5E-7	< 1E-6
Molybdenum	MG/L	< 0.0005	< 0.0005	**0.0206**	**0.0533**	< 0.0005	< 0.0005	**0.01**	< 0.0005
Selenium	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Thallium	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Combined Radium	pCi/L	**1.64**	**0.499**	**0.387**	**0.619**	**1.69**	**3.95**	**1.04**	**0.276**

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* Groundwater could not be sampled from this well during the event

Table 4-9. Analytical Results for April 2023, Fly Ash Rerservoir (FAR) II, Cardinal Plant, Brilliant, Ohio.

Well Name		M-1309	M-2000	M-GS-1	M-GS-2	M-GS-3R	M-GS-3R	M-GS-4	M-GS-5
Well Type		Downgradient	Corrective Measures	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Background
Sample Name		M-1309	M-2000	M-GS-1	M-GS-2	M-GS-3R	M-GS-3R DUP	M-GS-4	M-GS-5
Sample Date		4/11/2023	4/18/2023	4/20/2023	4/19/2023	4/18/2023	4/18/2023	4/21/2023	4/11/2023
Laboratory	Concentration	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical
Lab ID	Units	50342048002	50342691001	50342942003	50342634001	50342634002	50342634003	50342938001	50342049003
APPENDIX III CONSTITUENTS									
Boron	MG/L	**0.264**	**5.38**	**0.25**	**0.22**	**2.94**	**2.94**	**0.204**	**0.303**
Calcium	MG/L	**3.36**	**213**	**9.06**	**4.38**	**177**	**179**	**2.83**	**3.82**
Chloride	MG/L	**41.7**	**40.6**	**24.7**	**24.4**	**52**	**52.5**	**11.9**	**73.5**
Fluoride	MG/L	**1**	**0.45**	**0.82**	**1.4**	**0.091**	**0.14**	**0.58**	**5.9**
Sulfate	MG/L	**68.1**	**825**	**58.5**	**97.8**	**457**	**459**	**18**	**501**
Total Dissolved Solids	MG/L	**668**	**1300**	**625**	**645**	**1060**	**1080**	**488**	**1430**
pH	SU	**8.94**	**7.64**	**7.95**	**8.01**	**7.27**	NA	**8.74**	**8.59**
APPENDIX IV CONSTITUENTS									
Antimony	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Arsenic	MG/L	**0.0014**	**0.0014**	< 0.0005	**0.0047**	**0.0035**	**0.0037**	**0.0021**	**0.0065**
Barium	MG/L	**0.0323**	**0.0239**	**0.0841**	**0.0245**	**0.0206**	**0.0217**	**0.0222**	**0.102**
Beryllium	MG/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Cadmium	MG/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium	MG/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt	MG/L	< 0.0005	**0.0011**	< 0.0005	< 0.0005	**0.0017**	**0.0018**	< 0.0005	< 0.0005
Fluoride	MG/L	**1**	**0.45**	**0.82**	**1.4**	**0.091**	**0.14**	**0.58**	**5.9**
Lead	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	**0.00059**	**0.00067**	< 0.0005	< 0.0005
Lithium	MG/L	**0.0136**	**0.175**	**0.0159**	**0.0163**	**0.0312**	**0.0297**	< 0.01	**0.0219**
Mercury	MG/L	**0.00000207**	< 5E-7	< 5E-7	< 5E-7	**0.00000088**	**0.00000104**	**0.00000064**	< 5E-7
Molybdenum	MG/L	**0.0012**	**0.196**	< 0.0005	**0.0058**	**0.0428**	**0.0446**	**0.0026**	**0.0019**
Selenium	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Thallium	MG/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Combined Radium	pCi/L	**0.378**	**1.25**	**1.16**	**0.651**	**1.07**	**0.852**	**0.566**	**1.46**

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* Groundwater could not be sampled from this well during the event

Table 4-10. Morgantown Sandstone Sampling Results: October 2023, Fly Ash Reservoir (FAR) II, Cardinal Plant, Brilliant, Ohio

Well Name		CA-0622A	FA-8	M-6	M-8	M-10	M-11	M-12	M-13	M-14
Well Type		Background	Downgradient	Background	Downgradient	Downgradient	Downgradient	Background	Downgradient	Downgradient
Sample Name		CA-0622A*	FA-8	M-6*	M-8	M-10	M-11	M-12*	M-13	M-14
Sample Date		10/10/2023	10/11/2023		10/13/2023	10/19/2023	10/12/2023	10/11/2023	10/17/2023	10/17/2023
Laboratory	Concentration	NA	Pace Analytical	NA	Pace Analytical	Pace Analytical	Pace Analytical	NA	Pace Analytical	Pace Analytical
Lab ID	Units	NA	50356478002	NA	50356505007	50357050001	50356505004	NA	50356917001	50356917002
APPENDIX III CONSTITUENTS										
Boron	MG/L	NA	**5.22**	NA	**0.03**	**0.49**	**5.26**	NA	**0.27**	**0.22**
Calcium	MG/L	NA	**259**	NA	**96.2**	**8.24**	**247**	NA	**6.84**	**0.57**
Chloride	MG/L	NA	**28.7**	NA	**6.8**	**14.1**	**26.5**	NA	**2.9**	**1.5**
Fluoride	MG/L	NA	**0.38**	NA	**0.09**	**0.74**	**0.5**	NA	**1.9**	**0.76**
Sulfate	MG/L	NA	**767**	NA	**97.8**	**122**	**765**	NA	**23.8**	**0.65**
Total Dissolved Solids	MG/L	NA	**1400**	NA	**436**	**725**	**1480**	NA	**539**	**378**
pH	SU	NA	**7.44**	NA	**6.48**	**7.84**	**7.53**	NA	**7.82**	**9.05**
APPENDIX IV CONSTITUENTS										
Antimony	MG/L	NA	< 0.0005 U	NA	< 0.0005 U	< 0.0005 U	< 0.0005 U	NA	< 0.0005 U	< 0.0005 U
Arsenic	MG/L	NA	**0.01**	NA	**0.0011**	< 0.0005 U	**0.01**	NA	< 0.0005 U	< 0.0005 U
Barium	MG/L	NA	**0.02**	NA	**0.11**	**0.07**	**0.03**	NA	**0.09**	**0.01**
Beryllium	MG/L	NA	< 0.0001 U	NA	< 0.0001 U	< 0.0001 U	< 0.0001 U	NA	**0.0001**	< 0.0001 U
Cadmium	MG/L	NA	< 0.0001 U	NA	< 0.0001 U	**0.0013**	< 0.0001 U	NA	< 0.0001 U	< 0.0001 U
Chromium	MG/L	NA	< 0.001 U	NA	< 0.001 U	< 0.001 U	< 0.001 U	NA	< 0.001 U	< 0.001 U
Cobalt	MG/L	NA	**0.0011**	NA	< 0.0005 U	< 0.0005 U	**0.0018**	NA	< 0.0005 U	< 0.0005 U
Fluoride	MG/L	NA	**0.38**	NA	**0.09**	**0.74**	**0.5**	NA	**1.9**	**0.76**
Lead	MG/L	NA	< 0.0005 U	NA	< 0.0005 U	**0.0042**	< 0.0005 U	NA	**0.00056**	< 0.0005 U
Lithium	MG/L	NA	**0.17**	NA	< 0.01 U	**0.02**	**0.17**	NA	**0.01**	< 0.01 U
Mercury	MG/L	NA	**0.00000074**	NA	< 5E-7 U	**0.0000031**	< 5E-7 U	NA	**0.00000075**	< 5E-7 U
Molybdenum	MG/L	NA	**0.25**	NA	< 0.0005 U	**0.0017**	**0.24**	NA	< 0.0005 U	< 0.0005 U
Selenium	MG/L	NA	< 0.0005 U	NA	< 0.0005 U	< 0.0005 U	< 0.0005 U	NA	< 0.0005 U	< 0.0005 U
Thallium	MG/L	NA	< 0.0005 U	NA	< 0.0005 U	< 0.0005 U	< 0.0005 U	NA	< 0.0005 U	< 0.0005 U
Combined Radium	pCi/L	NA	**0.4**	NA	**0.51**	**0.56**	**0.61**	NA	**1.28**	**0.45**

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* Groundwater could not be sampled from this well during the event

Table 4-10. Morgantown Sandstone Sampling Results: October 2023, Fly Ash Reservoir (FAR) II, Cardinal Plant, Brilliant, Ohio

Well Name		M-15	M-16	M-21	M-22	M-22	M-23	M-1003	M-1004
Well Type		Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient	Downgradient
Sample Name		M-15	M-16	M-21	M-22	M-22 DUP	M-23	M-1003	M-1004
Sample Date		10/10/2023	10/10/2023	10/12/2023	10/12/2023	10/12/2023	10/13/2023	10/17/2023	10/12/2023
Laboratory	Concentration	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical
Lab ID	Units	50356478003	50356478007	50356478010	50356505001	50356505002	50356505008	50356917003	50356505003
APPENDIX III CONSTITUENTS									
Boron	MG/L	**0.25**	**0.19**	**3.36**	**3.18**	**3.14**	**0.64**	**0.14**	**2.46**
Calcium	MG/L	**1.61**	**2.49**	**185**	**155**	**152**	**101**	**92.3**	**109**
Chloride	MG/L	**24.6**	**10.8**	**50.4**	**41.9**	**41.6**	**14.4**	**8.9**	**36.1**
Fluoride	MG/L	**1.3**	**0.36**	**0.12**	**0.56**	**0.56**	**0.58**	**0.19**	**1.2**
Sulfate	MG/L	**6.9**	**270**	**884**	**387**	**383**	**1510**	**172**	**326**
Total Dissolved Solids	MG/L	**564**	**810**	**1700**	**902**	**886**	**3210**	**572**	**886**
pH	SU	**9.01**	**7.58**	**6.80**	**7.00**	NA	**7.05**	**7.30**	**7.24**
APPENDIX IV CONSTITUENTS									
Antimony	MG/L	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U
Arsenic	MG/L	**0.0012**	< 0.0005 U	**0.0017**	< 0.0005 U	< 0.0005 U	**0.0019**	< 0.0005 U	**0.0015**
Barium	MG/L	**0.04**	**0.03**	**0.01**	**0.02**	**0.02**	**0.01**	**0.08**	**0.03**
Beryllium	MG/L	< 0.0001 U	< 0.0001 U	**0.00058**	< 0.0001 U	< 0.0001 U	< 0.0001 U	< 0.0001 U	< 0.0001 U
Cadmium	MG/L	< 0.0001 U	< 0.0001 U	< 0.0001 U	< 0.0001 U	< 0.0001 U	< 0.0001 U	< 0.0001 U	< 0.0001 U
Chromium	MG/L	< 0.001 U	< 0.001 U	< 0.001 U	< 0.001 U	< 0.001 U	< 0.001 U	< 0.001 U	< 0.001 U
Cobalt	MG/L	< 0.0005 U	< 0.0005 U	**0.0012**	**0.0009**	**0.00098**	**0.00076**	< 0.0005 U	< 0.0005 U
Fluoride	MG/L	**1.3**	**0.36**	**0.12**	**0.56**	**0.56**	**0.58**	**0.19**	**1.2**
Lead	MG/L	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U
Lithium	MG/L	< 0.01 U	**0.01**	**0.08**	**0.04**	**0.04**	**0.05**	**0.01**	**0.02**
Mercury	MG/L	**0.000000593**	< 5E-7 U	< 5E-7 U	< 5E-7 U	< 5E-7 U	**0.00000103**	< 5E-7 U	**0.00000077**
Molybdenum	MG/L	< 0.0005 U	< 0.0005 U	**0.02**	**0.05**	**0.05**	< 0.0005 U	< 0.0005 U	**0.01**
Selenium	MG/L	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U
Thallium	MG/L	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U
Combined Radium	pCi/L	**0.95**	**0.22**	**0.45**	**0.67**	**0.92**	**3.86**	**2.77**	**1.14**

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* Groundwater could not be sampled from this well during the event

Table 4-10. Morgantown Sandstone Sampling Results: October 2023, Fly Ash Reservoir (FAR) II, Cardinal Plant, Brilliant, Ohio

Well Name		M-1302	M-1309	M-2000	M-GS-1	M-GS-2	M-GS-3R	M-GS-4	M-GS-5
Well Type		Background	Downgradient	Corrective Measures	Downgradient	Downgradient	Downgradient	Downgradient	Background
Sample Name		M-1302	M-1309	M-2000	M-GS-1	M-GS-2	M-GS-3R	M-GS-4	M-GS-5
Sample Date		10/10/2023	10/10/2023	10/11/2023	10/17/2023	10/17/2023	10/12/2023	10/19/2023	10/10/2023
Laboratory	Concentration	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical	Pace Analytical
Lab ID	Units	50356478006	50356478004	50356478005	50356927001	50356927002	50356504001	50357061004	50356464002
APPENDIX III CONSTITUENTS									
Boron	MG/L	**0.29**	**0.28**	**4.94**	**0.28**	**0.24**	**2.56**	**0.2**	**0.3**
Calcium	MG/L	**3.1**	**2.89**	**225**	**9.43**	**6.63**	**165**	**3.36**	**4.07**
Chloride	MG/L	**30.9**	**40.7**	**37.5**	**26.2**	**13.4**	**51.1**	**11.3**	**61.9**
Fluoride	MG/L	**2.3**	**1.1**	**0.36**	**0.76**	**1.5**	**0.17**	**0.52**	**5.4**
Sulfate	MG/L	**34.2**	**59.3**	**807**	**55.3**	**107**	**482**	**8.2**	**607**
Total Dissolved Solids	MG/L	**718**	**670**	**1400**	**597**	**678**	**1030**	**499**	**1490**
pH	SU	**8.80**	**8.78**	**7.41**	**7.75**	**7.76**	**7.19**	**8.87**	**8.47**
APPENDIX IV CONSTITUENTS									
Antimony	MG/L	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U
Arsenic	MG/L	< 0.0005 U	**0.0018**	**0.0014**	< 0.0005 U	**0.01**	**0.0021**	**0.0028**	**0.01**
Barium	MG/L	**0.11**	**0.03**	**0.02**	**0.08**	**0.02**	**0.02**	**0.03**	**0.08**
Beryllium	MG/L	< 0.0001 U	< 0.0001 U	< 0.0001 U	< 0.0001 U	< 0.0001 U	< 0.0001 U	**0.00011**	< 0.0001 U
Cadmium	MG/L	< 0.0001 U	< 0.0001 U	< 0.0001 U	< 0.0001 U	< 0.0001 U	< 0.0001 U	< 0.0001 U	< 0.0001 U
Chromium	MG/L	< 0.001 U	< 0.001 U	< 0.001 U	< 0.001 U	< 0.001 U	**0.01**	**0.01**	< 0.001 U
Cobalt	MG/L	< 0.0005 U	< 0.0005 U	**0.001**	< 0.0005 U	< 0.0005 U	**0.0013**	**0.0014**	< 0.0005 U
Fluoride	MG/L	**2.3**	**1.1**	**0.36**	**0.76**	**1.5**	**0.17**	**0.52**	**5.4**
Lead	MG/L	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	**0.0024**	< 0.0005 U
Lithium	MG/L	**0.01**	**0.01**	**0.18**	**0.02**	**0.01**	**0.03**	< 0.01 U	**0.02**
Mercury	MG/L	< 5.2E-7 U	**0.00000213**	< 5E-7 U	< 5E-7 U	< 5E-7 U	**0.00000127**	**0.00000808**	< 5E-7 U
Molybdenum	MG/L	< 0.0005 U	**0.0012**	**0.19**	< 0.0005 U	**0.01**	**0.04**	**0.0021**	**0.0019**
Selenium	MG/L	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U
Thallium	MG/L	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U	< 0.0005 U
Combined Radium	pCi/L	**0.68**	**0.67**	**1.98**	**0.29**	**0.42**	**0.3**	**0.22**	**1.28**

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* Groundwater could not be sampled from this well during the event

Table 4-11. Shallow Aquifer Background Well Upper Prediction Limits,
Cardinal Upland Disposal Facility, FAR II, Brilliant, Ohio

	Concentration Units	Upper Prediction Limit
APPENDIX III CONSTITUENTS		
Boron	MG/L	0.521
Calcium	MG/L	419
Chloride	MG/L	66.6
Fluoride	MG/L	2.7
pH*	SU	3.17 / 9.15
Sulfate	MG/L	6130
Total Dissolved Solids	MG/L	6620

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* Both Upper Prediction Limit and Lower Prediction Limit

Table 4-12. Morgantown Sandstone Background Well Upper Prediction Limits,
Cardinal Upland Disposal Facility, FAR II, Brilliant, Ohio

	Concentration Units	Upper Prediction Limit
APPENDIX III CONSTITUENT		
Boron	MG/L	0.404
Calcium	MG/L	384
Chloride	MG/L	4900
Fluoride	MG/L	6.6
pH*	SU	6.40 / 9.24
Sulfate	MG/L	1770
Total Dissolved Solids	MG/L	7250

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* Both Upper Prediction Limit and Lower Prediction Limit

Table 4-13. Shallow Aquifer Groundwater Protection Standards (GWPS),
Cardinal Upland Disposal Facility, FAR II, Brilliant, Ohio

	Concentration Units	MCL	CCR Rules § 257.95(h)(2)	Background Upper Tolerance Limit	FAR II GWPS
APPENDIX IV CONSTITUENTS					
Antimony	mg/L	0.006	-	0.0005	0.006
Arsenic	mg/L	0.01	-	0.0854	0.0854
Barium	mg/L	2	-	0.024	2
Beryllium	mg/L	0.004	-	0.0344	0.0344
Cadmium	mg/L	0.005	-	0.0013	0.005
Chromium	mg/L	0.1	-	0.0372	0.1
Cobalt	mg/L	-	0.006	0.208	0.208
Fluoride	mg/L	4	-	2.7	4
Lead	mg/L	-	0.015	0.004	0.015
Lithium	mg/L	-	0.04	0.685	0.685
Mercury	mg/L	0.002	-	0.00000828	0.002
Molybdenum	mg/L	-	0.1	0.01	0.1
Radium 226 and 228 Combined	pCi/L	5	-	1.888	5
Selenium	mg/L	0.05	-	0.06	0.06
Thallium	mg/L	0.002	-	0.0011	0.002

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Table 4-14. Morgantown Sandstone Groundwater Protection Standards (GWPS), Fly Ash Reservoir (FAR) II, Cardinal Plant, Brilliant, Ohio

	Concentration Units	MCL	CCR Rules § 257.95(h)(2)	Backgorund Limit	FAR II GWPS
APPENDIX IV CONSTITUENTS					
Antimony	MG/L	0.006	-	0.0005	0.006
Arsenic	MG/L	0.01	-	0.0414	0.0414
Barium	MG/L	2	-	1.41	2
Beryllium	MG/L	0.004	-	0.0025	0.004
Cadmium	MG/L	0.005	-	0.0005	0.005
Chromium	MG/L	0.1	-	0.0197	0.1
Cobalt	MG/L	-	0.006	0.0404	0.0404
Fluoride	MG/L	4	-	6.6	6.6
Lead	MG/L	-	0.015	0.0463	0.0463
Lithium	MG/L	-	0.04	0.164	0.164
Mercury	MG/L	0.002	-	0.0000263	0.002
Molybdenum	MG/L	-	0.1	0.0601	0.1
Radium, Combined	pCi/L	5	-	15.76	15.76
Selenium	MG/L	0.05	-	0.0029	0.05
Thallium	MG/L	0.002	-	0.0005	0.002

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MCL = Maximum Contaminant Level

GWPS is the higher value of either the background limit or the MCL. If an MCL is not available, values from the CCR Rules are used.

Background values are based upon statistical upper threshold limit (UTL) calculations.

UTLs are intended for comparison to confidence bands, not individual observations.