Five-Year Periodic Structural Stability Assessment

Fly Ash Reservoir II
Brilliant, Ohio

October 2026

Prepared For:

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

Prepared By:

TRC
1382 West Ninth Street, Suite 400
Cleveland, Ohio 44113

TABLE OF CONTENTS

1.0 Objective 1

2.0 Name and Description of the CCR Surface Impoundment 1

3.0 Stable Foundation and Abutments [257.73(d)(1)(i)] 2

4.0 Slope Protection [257.73(d)(1)(ii)] 2

5.0 Embankment Construction [257.73(d)(1)(iii)] 3

6.0 Vegetation Control [257.73(d)(1)(iv)] 3

7.0 Spillway System [257.73(d)(1)(v)] 3

7.1 Service Spillway 4

7.2 Emergency Spillway 4

8.0 Buried Hydraulic Structures [257.73(d)(1)(vi)] 4

9.0 Sudden Drawdown [257.73(d)(1)(vii)] 5

10.0 Conclusions and Recommendations 5

11.0 Limitations 5

12.0 Certification 7

13.0 References 8

1.0 Objective

This report was prepared by TRC Engineers, Inc. (TRC) to fulfill requirements of 40 CFR 257.73(d) and document whether the design, construction, operations, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices. The initial structural stability assessment was completed and uploaded to the operating record on October 9, 2016. This is the second 5-year periodic assessment as required per 40 CFR 257.73(d); the first 5-year periodic assessment was completed in October 2021.

To develop the periodic assessment review, TRC performed the following scope:

- Reviewed historical documents including the initial Structural Stability Assessment prepared by American Electric Power (2016), Initial Safety Factor Assessment (S&ME, 2015),
- Reviewed 2025 Annual Dam and Dike Inspection Report (TRC, 2025),
- Reviewed 28-Day Dam Deformation Surveys (TRC, 2026),
- Reviewed the Initial Safety Factor Assessment (S&ME, 2015),
- Developed observations related to the updated structural stability assessment review.

2.0 Name and Description of the CCR Surface Impoundment

The Cardinal Power Plant (Plant) is located in Wells Township, Jefferson County, near the town of Brilliant in eastern Ohio. The Plant is owned by Buckeye Power, Inc. Cardinal Operating Company (Operator) operates the Plant. The Plant previously utilized the Fly Ash Reservoir II (FAR II) surface impoundment for storing coal combustion residuals (CCR). The FAR II is subject to the requirements of the United States Environmental Protection Agency's (USEPA) final CCR rule Title 40 Code of Federal Regulations (40 CFR) Part 257.73.

The FAR II is a valley filled dam whose current configuration is the result of the original earth fill dam and two separate raisings. The original earth fill dam (Stage 1) consisted of an approximate 180-foot high, arched earth embankment incorporating a zoned cross section. The Stage 1 dam was approximately 70 feet wide by approximately 1,055 feet long at the crest with a top of berm elevation of approximately 925 feet National Geodetic Vertical Datum of 1929 (NGVD). The maximum operating pool that could be achieved with the original configuration was approximately 913 feet NGVD. In 1997, the Stage 1 FAR II was raised, referred to as Stage 2. The Stage 2 dam was approximately 237 feet high with an approximate 30-foot wide crest. In 2013, the dam was raised 13 feet using back-to-back mechanically stabilized earth (MSE) walls, bringing the FAR II into its current configuration, Stage 3. The principal features of the Stage 3 typical section are the MSE wall structures and a vinyl sheet pile wall that provides seepage cutoff for the probable maximum flood (PMF) event by extending through the MSE backfill into the existing clay core.

The Operator ceased sluicing fly ash into the impoundment in July 2021 and is nearing completion of closing FAR II, in accordance with the Closure Plan and the Permit to Install issued by the Ohio Environmental Protection Agency.

3.0 Stable Foundation and Abutments [257.73(d)(1)(i)]

Was the facility designed for and constructed on stable foundations and abutments? Describe any foundation improvements required as part of construction.

During design and construction of the Stage 1 dam, the overburden was observed to be saturated and appeared to be heterogeneous, with some material having a softer consistency than that of the samples tested with the geotechnical explorations. Therefore, the overburden material was determined to be unsuitable for the foundation material and based on our understanding was removed in the area beneath the dam and along the valley slopes up to approximately elevation 800 feet NGVD.

Based on the design drawings, a foundation key was constructed along the centerline of the dam. The key was excavated 6 to 8 feet into the bedrock beneath the dam and along the valley slopes up to approximately elevation 800 feet NGVD.

At the abutment locations, a cut that extended to bedrock was made. The trimmed faces were oriented so that the upstream core of the dam intersects the abutments at right angles. This symmetrical configuration resulted in balanced seating of the clay core against the bedrock which reduces interface seepage and minimizes the potential for cracking of the core.

A grout curtain was provided in the abutments of the dam. The dam was arched in the upstream direction and camber was provided to compensate for settlement. Slope protection consisted of roller compacted concrete (RCC) Facing for Stage 2 construction in the upstream and grass and riprap on the downstream for Stage 1 and 2 slopes with riprap in the groin of the dam. Stage 3 construction did not require additional slope protection. Based on recent subsurface investigations, the density and description of the foundation materials appear to be adequate for this CCR unit.

Foundation and abutment performance is monitored through foundation and embankment piezometers, abutment and bedrock piezometers and monitoring wells (FA-7, FA-8, M-10, M-11 and S-9), 28-day deformation surveys, and slope inclinometers. Per TRC's 2025 Annual Dam and Dike Inspection (ADDI) Report (October 8, 2025) and TRC's May 2026 Deformation Report, foundation piezometer levels and slope-inclinometer movements remain within historical ranges and the tolerances expected for earthen dams of similar size and age, with no substantial new pattern or trend, and abutment seepage discharge was visually clear. Consistent with the prior 2021 periodic structural stability assessment and the 2015 Initial Safety Factor Assessment, the foundations and abutments are considered stable, and no further action must be taken at this time, other than to continue regularly scheduled inspections, maintenance, and monitoring.

TRC performed a site visit on August 14, 2025, as part of the annual dike and dam inspection for the facility. Based on the observations made during the site visit, the conditions modeled in the slope stability analysis (S&ME, 2015) accurately and conservatively reflect the conditions of the FAR II. Ther outlet features for the FAR II appeared in good working order and functioning as designed.

4.0 Slope Protection [257.73(d)(1)(ii)]

Describe the slope protection measures on the upstream and downstream slopes.

Slope protection consisted of RCC Facing for the upstream Stage 2 face and grass on the downstream Stage 1 and 2 slopes with riprap in the groin of the dam. Stage 3 slope protection is provided by the concrete MSE wall panels. Based on conversations with the Operator, erosion identified during weekly

inspections is repaired within a timely period in accordance with the Operating and Maintenance Plan.

Per TRC's 2025 ADDI Report, based on the August 14, 2025, inspection, the downstream slope of the dam appeared in good condition with established vegetative growth, and no significant signs of erosion, sloughing, or bulging, indicating the slope protection is performing as intended. The riprap protection remains effective overall, though localized areas of the left groin area require additional riprap due to rock degradation.

Noticeable separations were observed at the southwest and southeast corners of the MSE wall - at the junctions, and most pronounced at coping beams. The separation had increased by 1/8 inch over the past year per the Operator's measurements. In 2026, Cardinal secured the MSE walls and installed a metal band around the corners to prevent separation and continues regular monitoring.

5.0 Embankment Construction [257.73(d)(1)(iii)]

Describe the specifications for compaction and/or recent boring to give a relative comparison of density.

The design drawings indicate that the embankment materials were to be compacted to a minimum of 100% of the maximum dry density as determined by Standard Proctor (ASTM D698) method or 90% of the maximum dry density as determined by Modified Proctor (ASTM D1557). Previous soil borings drilled by others through the embankment for design of the Stage 3 dam indicate that the material is stiff based on the results of the Standard Penetration Tests (SPT) (ASTM D1586) and representative of compacted earthen materials. Daily field reports, compaction quality assurance testing, or other as-built documentation were not available for TRC's review as part of this assessment.

Since the completion of Stage 3 construction, the FAR II has undergone deformation monitoring as referenced above, which indicates that the embankment continues to perform within expected deformation tolerances, consistent with adequately compacted fill.

6.0 Vegetation Control [257.73(d)(1)(iv)]

Describe the maintenance plan for vegetative cover.

The downstream Stage 1 and 2 slopes are protected by established grass cover, while the upstream face is protected RCC and MSE wall panels for Stages 2 and 3, respectively. Per TRC's 2025 ADDI Report, the downstream slope exhibited healthy vegetation growth. Maintenance recommended for the dam included regularly scheduled mowing and reseeding of minor barren areas, and removal of vegetation from the east groin ditch and from Drain #15 to maintain flow.

7.0 Spillway System [257.73(d)(1)(v)]

Describe the spillway system and its capacity to pass the Inflow Design Flood as per its Hazard Classification.

The spillway system consists of a primary weir box and pipe for normal operations and an open channel spillway to pass flood events. The CCR unit has a high Hazard rating and is designed to safely pass the PMF flood without overtopping the dam crest.

7.1 Service Spillway

The existing service spillway is a vertical concrete shaft structure with a side opening for effluent discharge via a weir. This vertical concrete shaft connects into a sloping concrete shaft structure on the upstream face of the FAR II dam with one side opening, four feet wide. The sloping concrete shaft discharges into a 54-inch diameter pre-stressed concrete cylinder pipe (PCCP), designed for 200 feet of internal hydraulic pressure and 200 feet of overburden pressure. During most operating conditions, discharge through the service spillway is controlled by the weir flow over the side openings in the shaft. The bottom of the sloping concrete shaft and the entire 54-inch concrete pipe was constructed within bedrock during the 1997 raising. Stop logs were formerly utilized to maintain settling action and control the operating pool level. The CCR unit has a high Hazard rating and therefore is designed for a probable maximum flood, which is defined as 26.5 inches of rain for a 6-hour period based on Hydrometeorological Report 51 by the National Weather Service. The facility can pass this flood without overtopping the dam crest utilizing the service spillway and the emergency spillway.

Per TRC's 2025 ADDI Report, the principal spillway structure appears to be in good condition, with no obstructions at the stop-log structure and no signs of instability on the riser or staircase, and no visual evidence of significant differential movement of the structure, skimmer chute, or steps. The principal spillway access walkway, stairways, and other metal structures were in good condition.

7.2 Emergency Spillway

During the 2013 construction, the existing emergency spillway was raised using a concrete gravity section in conjunction with reinforced concrete retaining walls. The new walls direct the flow into the existing spillway outlet channel. In accordance with State of Ohio dam safety requirements for Class 1 dams, the new emergency spillway was designed to pass the design PMF without overtopping the dam. The new spillway features a 108-foot-long by 15-foot-wide concrete control section, weir, positioned at an approximate elevation 975.5 feet NGVD, or 1.5 feet above the maximum operating pool. The retaining walls are located above elevation 975.5 and will consequently not be exposed to a continuous pool reducing corrosion concerns. Based on the flood routing, the calculated peak discharge from the dam is 913 cubic feet per second at a maximum pool elevation of 977.1 feet NGVD.

Per TRC's 2025 ADDI Report, the emergency spillway channel abutment slopes and floor area appear stable with no visible signs of slumping or significant erosion. The concrete retaining sidewalls along the spillway were in fair/satisfactory condition, with cracking observed away from the wall joints, and a minor amount of spalling along the cracks. The cracking had not increased relative to the 2024 inspection photos, no displacement of the concrete was observed, and it did not appear to adversely affect the function of the wall. The spillway's two-foot high RCC steps were noted to be in poor condition and to continue to weather. The cracking and spalling of the concrete retaining sidewalls and the conditional of the RCC steps were identified as items to monitor for additional erosion or deterioration.

8.0 Buried Hydraulic Structures [257.73(d)(1)(vi)]

Describe the condition of the sections of any hydraulic structure that is buried beneath and/or in the embankment.

The principal outlet pipe from FAR II passes though the dam near the southwestern side of the dam. The portion of the outlet pipe that passes through the embankment is a 54-inch diameter pre-stressed concrete cylinder pipe (PCCP), designed for 200 feet of internal hydraulic pressure and 200 feet of overburden pressure. The entire 54-inch diameter concrete pipe was constructed within bedrock during

the 1997 raising. No performance issues have been reported by the Operator or previous operators with the outlet pipe that would indicate plugging or failure of the pipe. Given that this portion of pipe is reinforced concrete, structural integrity is not considered to be an issue at this time. In general, reinforced concrete pipes have a long service life under a range of conditions and is an appropriate design for this application.

9.0 Sudden Drawdown [257.73(d)(1)(vii)]

If the downstream slope is susceptible to inundation, discuss the stability due to a sudden drawdown.

The downstream slope of the FAR II is not expected to be inundated from adjacent water bodies, such as a river, stream or lake. Therefore, a sudden drawdown assessment to evaluate the structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body is not required.

10.0 Conclusions and Recommendations

Upon the review of available documentation as previously discussed it can be concluded that the FAR II Dam continues to meet of 40 CFR 257.73(d). Overall, the foundation and abutments appear to be stable, appropriate slope protection measures are in place and are maintained as needed, the available data suggests the embankment is of adequate density, vegetative overgrowth is cleared and maintained in a timely manner, the spillways can control a PMF, and buried structures are in acceptable condition. TRC recommends a few extra measures be taken after review of the inspection reports and the deformation report.

1. Continue to perform inspections and monitor the dam for erosion and ensure the erosion protection measures are performing satisfactorily, such as the condition of the vegetation and riprap within the letdown. Repair areas of erosion and erosion protection measures, as necessary and as quickly as feasible, as part of routine maintenance.

2. Continue to monitor the emergency spillway, specifically the weathering of the 2-foot high RCC steps and the cracking and spalling on the concrete retaining side walls, for additional erosion or deterioration.

3. Continue to monitor the separations at the southwest and southeast corners of the MSE Wall.

4. Continue to monitor the slope inclinometers and piezometers.

11.0 Limitations

The observations, assessment, and recommendations presented in this Report are based on our limited scope of work reviewing relevant historic reports (including annual inspections reports), the conditions at the time of the August 14, 2025, site visit for the TRC 2025 Annual Inspection Report, the monitoring data collected during TRC's monthly deformation assessments, and the design information available at the time of this investigation, as applicable to the Cardinal FAR II Dam. This work has been performed in accordance with our authorized scope of work and is based on the level of effort and investigative techniques using that degree of care and skill ordinarily exercised under similar conditions by reputable members of the profession practicing in the same or similar locality at the time of service. No other

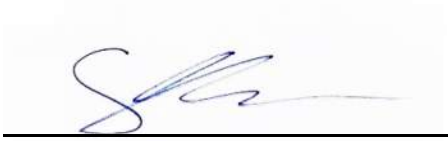
warranties, expressed or implied, are made or intended by this Report. These services were intended to provide an indication of the current, observable conditions of the dam at the time of the visual observations on the date indicated in this Report. Such a limited visual review does not account for other non-visible, hidden, subsurface or material condition analyses, and the professional services rendered are not guaranteed to be a representation by TRC of inaccessible and unobservable site conditions or actual conditions subsequent to the date of TRC's site visit. Therefore, the evaluations, conclusions, recommendations and opinions provided in this Report are subject to change as a result of future natural or manmade processes and as a result of an additional comprehensive, intrusive investigation and engineering analyses beyond TRC's visual observations. TRC is not responsible for any conclusions or opinions drawn by others from the data included herein, nor are the recommendations specifically presented in this Report intended for use or reliance as construction specifications.

12.0 Certification

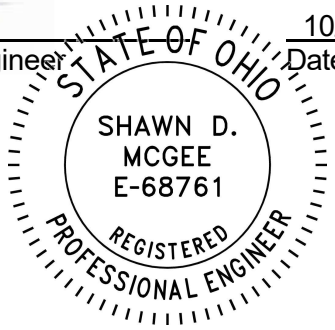
I, the undersigned Ohio Professional Engineer, hereby certify that I am familiar with the technical requirements of 40 CFR 257 Subpart D. I also certify that the information contained in this document was conducted in accordance with 40 CFR 257.73(d)(3) based on the currently available data reviewed, and that the information reviewed is, to the best of my knowledge, accurate and correct.

For the purpose of this document, “certify” and “certification” shall be interpreted and construed to be a “statement of professional opinion.” The certification is understood and intended to be an expression of my professional opinion as a Licensed Professional Engineer, based upon knowledge, information, and belief. The statement(s) of professional opinion are not and shall not be interpreted or construed to be a guarantee or a warranty of the analysis herein.

Shawn D. McGee, P.E.	PE.68761
Name	Engineer License Number



	10/06/2026
Signature of Professional Engineer	Date



13.0 References

TRC Engineers, Inc., 2025. 2025 Annual Dam and Dike Inspection Report: Cardinal Power Plant, Brilliant, OH. October 8, 2025.

TRC Engineers, Inc., 2024. 2024 Annual Dam and Dike Inspection Report: Cardinal Power Plant, Brilliant, OH. October 8, 2024.

Amanda Graphics, 2023. 2023 Annual Dam and Dike Inspection Report: Cardinal Power Plant, Brilliant, OH. September, 25, 2023.

TRC Engineers, Inc., 2026. 28-Day Dam Deformation Survey: Cardinal Plant Fly Ash Dam. June 3, 2026.

S&ME, 2015. Safety Factor Assessment for the Fly Ash Reservoir II Dam at the Cardinal Power Plant.

TRC Engineers, Inc., 2021. Five-Year Periodic Structural Stability Assessment – Fly Ash Reservoir II, Brilliant, OH. October 2021.

American Electric Power Service Corporation. 2016. Structural Stability Assessment – CFR 257.73(d): Fly Ash Reservoir II – Cardinal Plant, Brilliant, Ohio. October 2016.