Amanda Graphics, LLC
Engineering Consulting & CAD Support

2020 Annual Dam and Dike Inspection Report

Cardinal Plant
Fly Ash Dams 1, 2 & Bottom Ash Complex

CARDINAL
OPERATING COMPANY

Cardinal Operating Company
306 County Rd. 7E
Brilliant, Ohio 43913

January 10, 2021

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1/10/2021

For Cardinal Operating Company

By Amanda Graphics, LLC

Prepared for:

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1. Introduction

The Cardinal Power Plant is located at 306 County Road 7 East, Brilliant, OH, 43913, in Jefferson County. It is jointly owned by Buckeye Power, Inc. and AEP Generation Resources ("AEP") and is operated by the Cardinal Operating Company. The Cardinal Power Plant is located at 306 County Road 7 East, Brilliant, OH, 43913 County, near the town of Brilliant, Jefferson County, Ohio. Dam structures operated by the Plant include:

- Fly Ash Dam 1 (FAD 1), ODNR Dam No. 0205-009
- Fly Ash Dam 2 (FAD 2), ODNR Dam No. 0205-010, and
- The Bottom Ash Pond (BAP) Complex dam, ODNR Dam No. 0105-004.

Amanda Graphics, LLC was retained by Buckeye Power to complete the 2020 annual inspection of the dams and to perform inclinometer and survey monument readings on FAD 2 every 28-days. This scope was previously completed by AECOM and prior to that by AEP as part of their Dam Inspection and Maintenance Program (DIMP), but was assigned to Amanda Graphics, LLC starting in March, 2019.

This report was prepared by Amanda Graphics, LLC, to fulfill requirements of 40 CFR 257.83, the Ohio Department of Natural Resource (ODNR) Division of Water and to provide Cardinal Operating Company and Cardinal Plant with an evaluation of the facility. This report contains the inspection findings, observations, photographs, conclusions, and maintenance recommendations for each of the above dam facilities.

The inspections were performed by J. T. Massey-Norton, Sn Geologist, Francis Brezny, PE, and accompanied by Amanda Padamadan of Amanda Graphics, LLC. Mr. Zack Miller of the Cardinal Operating Company accompanied Amanda Graphics, LLC staff during the inspections. The FAD 1 inspection was performed on September 24, 2020 and the FAD 2 and BAP inspections were performed on October 16, 2020. On the day of the FAD 1 inspection, the weather was partly cloudy to sunny, with a high of approximately 60 degrees F.

Descriptions of Impoundments

1.1 Fly Ash Dam 1

FAD 1 is the plant's original fly ash retention dam constructed in the early 1970's. The dam is an earth and rockfill dam with a final design crest elevation of 1001.5 ft. MSL. The dam has slopes of approximately 2.5 Horizontal to 1 Vertical on both the upstream and downstream sides. When ash placement behind FAD 1 reached its maximum allowed level, Cardinal FAD 2 was constructed and began operating in the late 1980's. FAD 1 is still listed with the ODNR as an active dam. However, its reservoir area was re-permitted by the Ohio EPA as a solid waste landfill (PTI permit # 06-07993, dated May 11, 2007) for the disposal of synthetic gypsum generated by the scrubbers constructed at the Cardinal Plant to capture sulfur dioxide air emissions (See Figure 1 in Appendix E). In addition to gypsum, there are stockpiles of earthen materials (to be used in future cell construction) over a portion of FAD 1 (at substantial distance from the dam). The materials are being used as a pre-load to increase the overburden stress on the underlying ash to induce consolidation settlement prior to developing the area for the permitted landfill cell.

1.2 Fly Ash Dam 2

FAD 2 became operational in the 1980s and has been raised twice during its service life, the first raising performed in 1997, and the most recent raising being in 2013. Currently, FAD 2 has a design crest elevation of 983 feet, a maximum reservoir operating elevation of 974 feet, and a dam height of approximately 250 ft. The 2013 raising of Fly Ash Dam 2 was completed using back-to-back mechanically stabilized earth (MSE) walls which were constructed over the then-existing crest placed during the 1997 dam raising, which was made using roller-compacted concrete (RCC). The MSE walls were constructed

as back-to-back mechanically stabilized earth (MSE) walls over the RCC crest surface with installation of a vinyl sheet pile cut-off wall through the MSE backfill and RCC concrete (using a slurry trench excavation), which extends into the clay core of the dam. It is noted that the current operating pool level in the reservoir is below the base of the MSE walls. The emergency overflow spillway was raised using mass concrete to a minimum elevation of 974.5 as part of the second dam raising.

The FAD II dam has a deformation review completed every 28 days (to meet the 30-day instrumentation monitoring requirement of CCR Rule Section 257.83 (a) (1)) which includes inclinometer and survey analysis of the dam for potential deformation. The dam currently shows no signs of instability based on the 28-day deformation analyses.

The FAR II reservoir is an unlined impoundment and in accordance with CCR Part A and the District of Columbia's Circuit Court Ruling, the impoundment must either close or be retrofitted in accordance with 40 CFR 257.101 or 102. The Cardinal Operating Company has elected to close the reservoir as described in its FAR II Closure Plan and will commence closure beginning in 2021.

A plan view of FAD 2 is provided in Figure 2A of Appendix E and a general cross section of FAD 2 showing the final dam raising is presented in Figure 2B of Appendix E.

1.3 Bottom Ash Complex

The Bottom Ash Complex at the Cardinal Plant consists of a Bottom Ash Pond (BAP) and a Recirculation Pond (RCP), located at the southern end of the plant (south of the Unit 3 powerhouse) and directly west of the Ohio River. The BAP is directly north of the RCP separated by a bottom ash divider dike. Flow from the Bottom Ash Pond is directed to the RCP through an overflow conduit with an inlet elevation of approximately 665.5 ft. The overflow conduit runs through the divider dike discharging at the north end of the RCP. The overflow conduit controls the water level in the Recirculation Pond. The Bottom Ash Complex is retained by an exterior dike with a crest elevation of approximately 670 ft. The base of the pond is at elevation 648 ft. The eastern dike of the pond is against the Ohio River.

The Bottom Ash Pond Complex is an unlined impoundment and in accordance with CCR Part A and the District of Columbia's Circuit Court Ruling, the impoundment must either close or be retrofitted in accordance with 40 CFR 257.101 or 102. The Cardinal Operating Company has elected to retrofit the pond complex by segregating it into two separate ponds designed to manage CCR wastes and Low Volume Waste, respectively. The pond complex will have CCR waste removed and relined with construction beginning in 2021.

The current arrangement of BAP Complex is shown in Figure 3 of Appendix E.

2. Regulatory Requirements

This annual inspection report is completed to meet both the Federal Coal Combustion Residuals (CCR) rule and ODNR regulatory requirements. In order to comply with ODNR requirements the Dam Safety Inspection Reports for both Cardinal Fly Ash No.1 Dam (File Number 0205-009, Inspected June 16, 2014) and Cardinal Fly Ash No. 2 Dam (File Number 0205-010, Inspected November 29, 2017) were reviewed.

In addition to the ODNR requirements, the annual inspection also included the criteria specified in CCR Rule Section 257.83(b) (1) which at a minimum includes:

(i) A review of available information regarding the status and condition of the CCR unit, including, but not limited to, files available in the operating record (e.g., CCR unit design and construction information, previous periodic structural stability assessments, the results of inspections by a qualified person, and results of previous annual inspections.

(ii) A visual inspection of the CCR unit to identify signs of distress or malfunction of the CCR unit and appurtenant structures; and

(iii) A visual inspection of any hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit for structural integrity and continued safe and reliable operation.

In addition to the annual inspections, 7-day inspections and 30-day instrumentation monitoring are completed by Cardinal Operating Company and are documented in the facility operating record. Amanda Graphics, LLC is provided with and regularly reviews reports of these inspections. A report is prepared following each inspection that addresses the following:

(i) Any changes in geometry of the impounding structure since the previous annual inspection.

(ii) The location and type of existing instrumentation and the maximum recorded readings of each instrument since the previous annual inspection.

(iii) The approximate minimum, maximum, and present depth and elevation of the impounded water and CCR since the previous annual inspection.

(iv) The storage capacity of the impounding structure at the time of the inspection.

(v) The approximate volume of the impounded water and CCR at the time of the inspection.

(vi) Any appearances of an actual or potential structural weakness of the CCR unit, in addition to any existing conditions that are disrupting or have the potential to disrupt the operation and safety of the CCR unit and appurtenant structures.

(vii) Any other change(s) which may have affected the stability or operation of the impounding structure since the previous annual inspection.

3. Review of Available Information (257.83(b)(1)(i))

Amanda Graphics, LLC reviewed available information regarding the status and condition of FAD 1, FAD 2, and the BAP Complex. This information includes files available in the operating record, such as design and construction information, previous structural stability and safety factor assessments, previous 7-day inspection reports, previous 30-day inspection reports, and previous annual inspections.

The available periodic structural stability and safety factor assessments, which were completed as part of the CCR Rule and posted to the Buckeye Power's CCR Compliance Website, indicate that the impoundments meet all pertinent requirements of the CCR Rule.

The Cardinal Operating Company 7-day inspections provide a visual review of the impoundments for signs of distress, sparse vegetation, animal burrows, erosion, and other common maintenance requirements for dams. The Cardinal Operating Company 30 –day inspections are more detailed than the 7-day inspections and include water level measurements of piezometers and monitoring wells, measurement of seepage flows at dedicated monitoring locations, and a more thorough visual inspection. Additionally, slope inclinometers and deformation monuments at FAD 2 are surveyed on a 28-day frequency, separate from the 30-day dam inspections. Tiltmeters on the MSE wall at the crest of FAD 2 are read annually.

Based on our review of the 7-day and 30-day inspection reports and the 28-day deformation survey reports for the previous year, no conditions of concern have been identified at the impoundments.

No deficiencies, signs of structural weakness, or signs of disruptive conditions that would require additional investigation or remedial action were observed at the time of that inspection at any of the dams.

The RCC step section of FAD 2's emergency spillway was noted to be in fair to poor condition in which the RCC exhibited a friable/weathered state.

The bottom ash pond has two persistent wet areas/springs that have been observed for the last several years on the exterior embankment along the Ohio River. It is recommended that this area continue to be monitored to determine if the proposed retrofit liner can mitigate this seepage.

4. Inspection (257.83(b)(1)(ii))

4.1 Definitions of Visual Observations and Deficiencies

This summary of the visual observations uses terms to describe the general appearance or condition of an observed item, activity, or structure.

The terms are defined as follows:

Good: A condition or activity that is generally better than what is minimally expected or anticipated based on design criteria and maintenance performed at the facility.

Fair/Satisfactory: A condition or activity that generally meets what is minimally expected or anticipated based on design criteria and maintenance performed at the facility.

Poor: A condition or activity that is generally below what is minimally expected or anticipated based on design criteria and maintenance performed at the facility.

Minor: An observed deficiency (e.g. erosion, seepage, vegetation, etc.) where the current maintenance conditional is below what is minimally expected, but does not currently pose a threat to structural stability.

Significant: An observed deficiency (e.g. erosion, seepage, vegetation, etc.) where the current maintenance condition is below what is minimally expected, and could pose a threat to structural stability if not addressed.

Excessive: An observed deficiency (e.g. erosion, seepage, vegetation, etc.) where the current maintenance condition is below what is minimally and which the ability of the observer to properly evaluate the structure or particular area being observed or which poses a threat to structural stability.

This report also uses the definition of a “deficiency” as referenced in the CCR rule section §257.83(b)(5) Inspection Requirements for CCR Surface Impoundments. This definition has been assembled using the CCR rule preamble as well as guidance from the US Mine Safety and Health Administration (MSHA), “Qualifications for Impoundment Inspection” CI-31, 2004. These guidance documents further elaborate on the definition of deficiency. Items not defined as deficiencies are considered maintenance or items to be monitored.

A “deficiency” is some evidence that a dam has developed a problem that could impact the structural integrity of the dam. There are four general categories of deficiencies. These four categories are described below:

1. **Uncontrolled Seepage**: Uncontrolled seepage is seepage that is not behaving as the design engineer has intended. An example of uncontrolled seepage is seepage that comes through or around the embankment and is not picked up and safely carried off by a drain. Seepage that is collected by a drain can still be uncontrolled if it is not safely collected and transported. Seepage that is not clear and is turbid would also be considered as

uncontrolled. Seepage that is unable to be measured and/or observed is considered uncontrolled seepage.

Note: Wet or soft areas are not considered as uncontrolled seepage but can lead to this type of deficiency. These areas should be monitored more frequently.

2. **Displacement of the Embankment**: Displacement of the embankment is large scale movement of part of the dam. Common signs of displacement are cracks, scarps, bulges, depressions, sinkholes, and slides.
3. **Blockage of Control Features**: Blockage of Control Features is the restriction of flow at spillways, decant or pipe spillways, or drains.
4. **Erosion**: Erosion is the gradual movement of surface material by water, wind or ice. Erosion is considered a deficiency when it is more than a minor routine maintenance item.

4.2 Fly Ash Dam 1

4.2.1 Changes in Geometry since Last Inspection (257.83(b)(2)(i))

No modifications have been made to the geometry of FAD 1 since the 2019 annual inspection, beyond minor maintenance that included some clearing of brush on the right and left abutments. The geometry of the impoundment has remained essentially unchanged.

4.2.2 Changes That Effect Stability or Operation (257.83(b)(2)(vii))

Based on interviews with plant personnel and field observations there were no changes to FAD 1 since the last annual inspection that would affect the stability or operation of the impounding structure.

4.2.3 Instrumentation (257.83(b)(2)(ii))

No instrumentation data is available for Fly Ash Dam I, as the reservoir was drained and the site is now permitted to receive residual solid waste. The permit application submitted to the Ohio EPA to license this area as a residual waste landfill was approved on May 11, 2007 (Ohio EPA PTI # 06-07993).

4.2.4 Impoundment Characteristics (257.83(b)(2)(iii, iv, v))

When ash placement behind FAD 1 reached its maximum allowed level in the late 1980's, FAD 2 was constructed to the east of FAD 1 and began operating soon after. Currently, the dam is inundated on its downstream side by Fly Ash Reservoir 2 (FAR 2) and only a limited portion of the original FAD 1 dam height remains exposed above the water line.

4.2.5 Visual Inspection (257.83(b)(2)(i))

A visual inspection of FAR 1 dam was conducted to identify any signs of distress or malfunction of the impoundment and appurtenant structures. Specific items inspected included all structural elements of the dam such as inboard and outboard slopes, crest, toe (at the FAR 2 waterline), and abutment groins.

Results of the visual inspection of FAD 1 performed on September 24, 2020 are provided below (photos are presented in Appendix A):

1. The crest of the dam was in good condition, with no signs of significant erosion, rutting, or misalignment (Photo 1). The crest of the dam supports the plant's ash sluice lines along with

a heavy duty concrete roadway that is accessed by haul trucks. The roadway was in good condition.

2. No significant erosion was observed along the groin areas, areas of overgrown woody vegetation observed in 2019 have been cleared. The left groin shows no significant erosion or displacement of its rip rap (Photo 2). A close-up view of the rip rap shows that it is in good condition with no significant weathering (Photo 3).

3. A surface water drainpipe discharges near the crest of the right abutment (Photograph No. 4). The flow line is well protected with large riprap and no signs of erosion or deterioration has been noted.

4. The downstream dam surface is covered with rock fill material. No significant erosion was observed along the downstream slope of the dam. No sloughs, slumps, scarps, or other signs of slope instability were observed on the downstream slope. No seeps were observed on the downstream slope. The rock fragments are, however, continuing to weather and deteriorate in some cases, but the material is still protecting the surface of the dam. Overall, the rock fill protection is in fair condition. There are some clumps of sparse weedy/shrubby vegetation across the face of the dam (Photo 5).

Overall, the facility is in good condition with no signs of incipient or potential structural issues that would affect its stability.

4.3 Fly Ash Dam 2

4.3.1 Changes in Geometry since Last Inspection (257.83(b)(2)(i))

No modifications have been made to the geometry of FAD 2 since the 2019 annual inspection. The geometry of the impoundment has remained essentially unchanged.

4.3.2 Changes That Affect Stability or Operation (257.83(b)(2)(vii))

Based on interviews with plant personnel and field observations there were no changes to FAD 2 since the last annual inspection that would affect the stability or operation of the impounding structure. The pond stage at FAD 2, at approximate El. 968.3, has remained essentially constant since the previous annual inspection.

4.3.3 Instrumentation (257.83(b)(2)(ii))

The location and type of instrumentation at FAD 2 is shown on Figure 2A in Appendix E. The results of the measurements of various piezometers are presented in Figure 5b through 5n in Appendix E. The maximum recorded readings of each instrument since the previous annual inspection is shown in Table 1.

Table 1. FAD 2 Maximum Recorded Piezometer Readings Since the Previous Annual Inspection

Piezometer Water Level Data Fly Ash Dam 2			
Instrument	**Type**	**Location***	**Maximum Reading Since Last Annual Inspection**
P-1A	**Piezometer**	**Face of Dam, Zone IV**	**762.50**
P-2A	**Piezometer**	**Face of Dam, Zone IV**	**782.30**

P-3A	**Piezometer**		
P-3B	**Piezometer**	**Face of Dam, Zone II**	**784.30**
P-1BE	**Piezometer**	**Face of Dam, Zone IIIC**	**739.10**
P-1BW	**Piezometer**	**Face of Dam, Zone IIIC**	**731.50**
P-2BE	**Piezometer**	**Face of Dam, Zone IIIC**	**762.10**
P-2BW	**Piezometer**	**Face of Dam, Zone IIIB**	**734.80**
P-2C	**Piezometer**	**Upstream Face of Dam, Zone I**	**712.80**
P-5A	**Piezometer**	**Face of Dam, Zone IV**	**902.60**
P-8A	**Piezometer**	**Face of Dam, Zone IV**	**805.10**
P-8B	**Piezometer**	**Face of Dam, Zone IV**	**780.60**
P-9	**Piezometer**	**Face of Dam, Zone IV**	**787.80**
P-10	**Piezometer**	**Face of Dam, Zone IV**	**777.20**
P-11A	**Piezometer**	**Face of Dam, Zone IV**	**804.70**
P-11B	**Piezometer**	**Face of Dam, Zone IV**	**799.30**
MW-7	**Monitoring Well**	**Top of Dam near left groin**	**968.50**

*Locations shown in plan view in Figure 2A and profile view in Figures 6A & 6B of Appendix E.

PIEZOMETERS

A total of Sixteen (16) pneumatic piezometers and one monitoring well are installed in the foundation and throughout the dam to monitor total hydraulic head. The piezometers' locations are shown in Appendix E in plan view in Figure 2A and in cross-sections (Figures 7A-7B). Precipitation is measured at the plant and continues to be within the normal ranges measured over the last five (5) years (Appendix E, Figure 4). Historical records of the piezometer and observation borehole water elevations are presented as graphs in Figure 5 in Appendix E.

1. All piezometers showed none or a minor increase in the measured pore water pressure as a result raising the pond level on October 5, 2016 (Figure 5a). Figure 5b provides a record of pond discharge as measured at its Parshall flume (Drain No.14) versus the pond stage.
2. Water levels in the shallow, intermediate and deep foundation showed none or a minor increase corresponding to raising the pond stage that took place in October 2016 (Figures 5c & 5d).
3. Water levels along the centerline of the dam are shown in Figure 5e and are segregated into hydrographs for each clustered location (Figures 5f through 5i). Piezometer P-3B has shown some decrease in water level despite the increase in FAR 2's pool level. Water levels in the downstream shell (P-1A) and drain (P-1BW) showed none or a minor increase corresponding to raising the pond stage (Figure 5i).
4. Piezometer P-2BE, installed within the drain, reflects a higher-pressure head (about 27ft) in comparison to the western (right) P-2BW. Most piezometers showed no significant or minor increases corresponding to raising the pond stage (Figure 5j, 5l and 5m).
5. Piezometer P-2C, installed within the foundations of the dam shows no increase corresponding to raising the pond stage (Figure 5k).
6. Two standpipe type piezometers were installed in 2004 into the right bedrock abutment to monitor seepage (FA-7 & FA-8). Both piezometers are installed into the Morgantown Sandstone member, a well fractured and jointed, medium to coarse grained sandstone.

Piezometer FA-7 also forms a clustered well site with M-11 (also screened within the Morgantown Sandstone) and S-9 (screened in the overlying Connellsville Sandstone). Monitoring well M-10 is located in proximity to the dam site on the left side of the impoundment and is also screened within the Morgantown Sandstone. M-10 was drilled concurrently with the construction of the original Stage 1 dam and is used to help illustrate the following trends because of its long-term monitoring record. (Figure 5n).

7. Monitoring wells M-10 and M-11 showed an increase in static water levels coincident raising the pond level on October 5, 2016. Piezometer FA-7 monitors a 1-inch-wide open joint (observed by a borehole camera survey prior to well installation) and reflects a steady decline that closely correlates with the declines observed in the drain piezometer P-1BW, M-10 and M-11 (Figure 5n). The long-term decline before the current pond stage raising is believed to result from the progradation of the fly ash delta forming a blanket deposit and acting as a hydraulic barrier that reduces seepage from the reservoir.
8. The shallow monitoring well, S-9, is becoming more constant or slightly decreasing after raising the pond level on October 5, 2016 (Figure 5n). It is expected that S-9 may decrease due to the deposition of fly ash around the abutment area.
9. One standpipe type piezometer (MW-7) was installed in 2014 into the left abutment to monitor potential seepage through the PVC sheet pile (Figure 5n). It appears that MW-7 readings are reflective of the water pressure in the rock at the left abutment and is currently at a similar level of FAR II pool.

In general, a review of the data contained on the FAD 2 static water elevation plots indicate that the piezometers are responsive and are functioning properly. No new developing trends or issues were observed from last year's inspection. The piezometer depths are shown in cross sections in Figures 6A and 6B.

SEEPAGE COLLECTION DRAINS

A total of sixteen (16) drainage collection points were installed at the dam to monitor seepage. The discharge from the right abutment seepage as measured at the V–notched weir (Drain No. 2) has ranged from a maximum of 343 gpm and as low as 60 gpm. In 2020, the discharge was relatively constant and generally between 145 gpm decreasing over the last several months to 85 gpm (Figure 5m - Appendix E)

The most recent flow volumes are presented in tables in Appendix F, along with the locations of the seepage drains in Figure 7. Figure 5b presents historical pond discharge at the Parshall Flume (Drain No. 14) versus the pond stage. Discharge rates in 2020 have generally been within the previously observed range.

During 2018, seepage flows measured near the Emergency Spillway (drain nos. 9 thru 12) were observed to be increasing relative to previous measurements. These flows have stabilized to some degree based on the 2020 inspection and the flows were observed to be visually clear with an absence of scouring or sediment deposition. The abutment showed no signs of instability or apparent changes since the 2018 inspection.

VERTICAL AND HORIZONTAL DEFORMATION MONUMENTS

The most recent 28-day Amanda Graphics, LLC Deformation Review Report of Survey was prepared in December 2020 for vertical and horizontal deformation monuments for FAD2. The monthly surveys and reports have been prepared by Amanda Graphics, LLC beginning in March 2020. Thirty-three top of dam

monuments (29901 thru 29933) were abandoned due to the 2013 dam raising and replaced with 33 new monuments (1401 thru 1433) that were installed on top of the dam in 2014 to establish a baseline measurement for comparison to future surveys.

Vertical and horizontal deformation measurements are made for 33 top of dam monuments (1401 thru 1433), 23 face of dam monuments (i.e. 29936 thru 29958), 2 additional monuments located at the emergency spillway (i.e.29934 and 29935) and 9 additional deformation monuments on the west side of the dam (i.e. 29959 to 29966). The location of all the monuments is surveyed on a 28-day basis and the data is analyzed for deformation and stability.

In general, all horizontal movement is towards a downstream direction. Review of top of dam horizontal movement plots provided in the report indicates small movements in a southerly direction (downslope), -southeast at the center of the dam, and southeast to east along the left abutment. Downstream face monuments show small movements generally in the downstream (south) direction. The least amount of movement is observed along the east end where the RCC is more fully supported by bedrock.

Twelve tilt meters were installed at the MSW wall concrete panels (Figure 5o). The tiltmeters have detected between -0.8º to 0.6º of tilt recorded to date (Figure 5p). A majority of the locations experience so little or no change since 2018.

SLOPE INCLINOMETERS

Three slope inclinometers, SI-1, SI-2 and SI-3 were installed at the dam site as part of the 1998 dam raising project. The slope indicators are located near the alignment of the creek valley. SI-1 was installed in November 1997, and it is believed SI-2 and SI-3 were installed at a later date (date not reported in logs). Two additional slope indicators, SI-4 and SI-5 were installed in 2006 further down slope from SI-1. The latest slope indicator SI-8 was installed in June 2015 and is located to the right abutment close to the southwest corner MSE wall. Copies of the SI plots are provided in the Deformation Review Survey Report. Slope indicators measurements indicate movement generally towards the southeast with a good correlation with the surface deformation monuments.

BATHYMETRIC SURVEYS

Amanda Graphics, LLC's subcontractor Jack A. Hamilton & Associates, Inc. performed the most recent bathymetric survey in November 2020.The Pool Elevation of the FAR 2 facility at the time of the inspection was 968.3 feet above mean sea level (MSL).

The 2020 bathymetric survey shows the bottom of the Fly Ash Reservoir 2 (FAR 2) continues to increase in elevation with sluicing operations. The bottom of pond elevation decreases towards the FAD 2 with the deepest portion of FAR 2 adjacent to FAD 2 along the right abutment

In previous surveys, depressions in the ash buildup had been observed near the upstream right abutment of the dam in 2004. After review of the bathymetry, no such features are observed at the present time and the ash delta is propagating into this area in a uniform manner. The table below shows the estimated increase in ash elevation within the CCR impoundment based on bathymetric surveys of FAR II. Appendix D shows the 2020 bathymetric survey results.

Survey Date	Ash Elev.	Thickness Increase	Comment
March 3, 2004	873.7	N/A	Initial bathymetric survey
December 9, 2004	889.3	15.6ft.	from Mar 04 to Dec 04

March 29, 2005	891.8	2.5ft.	from Dec. 04 to Mar. 05
October 19, 2005	898.1	6.3ft.	from Mar. 05 to Oct. 05
October 3, 2006	906.0	7.9ft.	from Oct 05 to Oct 06
September 13, 2007	907.5	1.5ft.	from Oct 06 to Sept 07
September 3, 2008	907.4	-0.1ft.	from Sept 07 to Sept 08
August 31, 2009	909.0	1.6ft.	from Sept 08 to Aug 09
August 30, 2010	908.5	-0.5ft.	from Aug 09 to Aug 10
September 6, 2011	909.0	0.5ft.	from Aug 10 to Sept 11
October 22, 2013	908.4	-0.6 ft.	from Sept 12 to Oct 13
September 3, 2014	918.2	9.8 ft.	from Oct 13 to Sept 14
September 22, 2015	924.0	5.8 ft.	from Sept 14 to Sept 15
September 20, 2016	929.0	5.0 ft.	from Sept. 2015 to Sept. 2016
September 12, 2017	929.5	0.5 ft.	from Sept. 2016 to Sept. 2017
December 12, 2018	933.7	4.2 ft.	from Sept. 2017 to Dec. 2018
November 2019	937.8	4.1 ft.	from Dec. 2018 to Nov. 2019
November 2020	938.0	0.2 ft.	from Nov. 2019 to Nov. 2020

4.3.4 Impoundment Characteristics (257.83(b)(2)(iii, iv, v))

The approximate minimum, maximum, and present depth and elevation of the impounded water and CCR since the previous annual inspection of the FAR II CCR Surface Impoundment are provided in Table 2 below. The measurements are based on the survey completed by Jack A. Hamilton & Associates, Inc. dated November 2020. The basis for the measurements includes: the available measured water surface elevations, the November 2020 bathymetric survey data, and topographic contours above the water level from aerial photos dated March 3, 2005.

Table 2. Summary of Relevant Storage Information FAR 2

IMPOUNDMENT CHARACTERISTICS

Fly Ash Reservoir 2 (water pool elevation was approximately 968.3)

Approximate **Minimum** depth (Elevation) of impounded water since last annual inspection	14.8 ft. (El.968.4 above MSL)
Approximate **Maximum** depth (Elevation) of impounded water since last annual inspection	76.4 ft. (El. 916.6 ft. above MSL)
Approximate **Present** depth (Elevation) of impounded water since last annual inspection	14.7 ft. (El. 968.3 ft. above MSL)
Approximate **Minimum** depth (Elevation) of CCR since last annual inspection	33.9 ft.

	(El. 968.3 ft. above MSL)
Approximate **Maximum** depth (Elevation) of CCR since last annual inspection	71.1 ft. (El. 916.6 ft. above MSL)
Approximate **Present** depth (Elevation) of CCR since last annual inspection	71.1 ft (El. 916.6 ft. above MSL)
Storage capacity of impounding structure at the time of the inspection	2,068 ac-ft
Approximate volume of impounded water at the time of the inspection	1,292 ac-ft.
Approximate volume of CCR at the time of the inspection	10,140 ac-ft.

Note: All depth values in the above table are measured relative to the crest of dam, El. 983.

4.3.5 Visual Inspection (257.83(b)(2)(i))

A visual inspection of FAD 2 was conducted to identify any signs of distress or malfunction of the impoundment and associated structures. The inspection also included hydraulic structures underlying the base of the dike. Specific items inspected included all structural elements of the dam such as inboard and outboard slopes, crest, and toe; as well as the outlet structure at FAD 2 and pipe discharge structure.

Results of the visual inspection of FAD 2 performed on October 16, 2020 are provided below (photos are presented in Appendix B):

Downstream Slope of Dam and Groin Ditches

1. Overall, the downstream slope of the dam appeared to be in good condition with healthy vegetative growth (Photos 1,2, and 3). No significant signs of erosion, sloughing or bulging were observed at any location and the slopes appeared to be stable. The downstream slope and buttress (lower berm) appeared to be in good condition with good vegetative growth.
2. The left groin ditch and discharge pipe were in good condition (Photo 4). No seepage or erosion was observed
3. The right groin ditch was also observed to be in good condition along with the drainage blanket installed on the face of the dam to collect seepage (Photos 5 to 8). No significant bare, unprotected areas were observed, and the channels appear to be clean and well maintained.

Top of Dam – Emergency Spillway and Decant Structure:

1. The emergency spillway crest area consists of non-reinforced concrete material and appears to be in good shape (Photo 9).
2. The emergency spillway channel is cut through natural high ground. The channel's left slope continues to have bank seepage that is conveyed to a shallow ditch along the toe of the slope with subsequent discharge through Drain No. 12 at the mouth of the emergency spillway channel. The drain was estimated to be discharging 10 gpm and was visually clear (Photo 36). The channel abutment slopes, and floor area appeared stable with no visible signs of slumping or significant erosion (Photo 10).

3. The emergency spillway has a plain concrete overflow section at the crest that transitions along the downstream slope to the RCC steps between the concrete retaining walls. The concrete steps appeared to be in good condition while the spillway's 2-ft high RCC steps continue to weather (Photo 11). The concrete sidewalls of the spillway are in fair condition.

4. The principal spillway structure appeared to be in good condition, with no obstructions at the stop-log structure and no signs of instability on the riser or staircase. There was no visual evidence of significant differential movement of the structure/skimmer chute or steps. The principal spillway access walkway, stairways, staff gauge, and other metal structures were in good condition (Photos 16 to 18). The inundated RCC wall appeared to be in good condition and did not show any wave cut erosion. The pond water clarity allowed observation of the inundated RCC to an approximate depth of 12 to 14 and was observed to be stable with no scour erosion, slumping or wave cut erosion (Photo 19). Photo 20 provides a view of the FAR 2 pool at the time of the inspection.

Top of Dam – Mechanically Stabilized Earth Walls

1. The main longitudinal MSE wall and return walls at both left and right ends of the dam were in good condition. There are no signs of differential settlement (no displaced panels, open joints, cracking, etc.) across the length of the wall (Photos 21 to 23). There are relatively small separations at both the southwest and northeast corners of the wall, at the junction of the main longitudinal wall and the orthogonal return wall sections (Photos 12, 13 and 14). The separations are most pronounced at coping beams at the top of the walls. These separations do not appear to have any adverse effect on serviceability, and it is noted that relative movement at MSE wall corners is a relatively common occurrence. The separations observed in 2020 do not appear to have worsened relative to previous inspections.

2. Photos 25 and 26 provide a close-up view of the MSE wall showing good conditions and unobstructed drains at the base of the wall.

Seepage Collection Drains & Hydraulic Structures:

1. Drain No 1, the chimney/toe drain, was observed to be in fair condition due to the pool behind the V-notched weir having significant algae growth within the pool (Photo 27). The discharge was observed to be visually clear.

2. Drain no. 2 discharges from the right abutment drainage blanket and was observed to be visually clear. Drain No. 3 (Slag Buttress / right abutment) and Drain No. 4 (Slag Buttress / Trench in Center) typically exhibit little to no discernable discharge. Flow measurements are taken from the drains that pool at the toe and are measured by a V-notched weir (Photos 28 and 29).

3. Another V-notched weir Drain No. 15 is used to measure flow emanating from the Morgantown Sandstone along the right abutment and is also referred to as the Right Hillside Jules Verne (discharge) near 770' elevation The discharge was observed to be visually clear but the pool was overgrown with vegetation (Photo 30).

4. Drain No. 7 (West bedrock abutment 900' elevation) discharges to the right groin ditch and was observed to be visually clear (Photo 31). There was no observed scouring or sediment build up within the groin ditch at the point of discharge.

5. Drain No. 16 (right groin 6" pipe 930' elevation) drains the drainage blanket from the face of the dam and was estimated to be discharging visually clear water at 5 gpm (Photo 32).

6. Drain No. 8, (East Tributary valley abutment 905"elevation) discharges to the left groin ditch and was observed to be visually clear (Photo 33).
7. As observed in the plant's inspection reports, an area, approximately 8 ft x 8 ft, area of dead vegetation was observed on the upper half of the downstream face of the dam between the center of the dam and the left abutment (Photo 34 (133342)). No flowing seepage or erosion was observed on the day of the inspection potentially indicating that it originates as an ephemeral wet weather spring and does not represent seepage from the FAR 2 pond. The size and condition of this area has not worsened based on previous inspections and no remedial measures appear to be necessary at this time other than reseeding the area.
8. Drains Nos. 5 and 6 (West side and East side of the stilling basin) and East discharge along the energy dissipator/stilling basin structure into the downstream channel. (Photos 35 and 36).
9. At the base of the dam, the energy dissipator/stilling basin structure was observed to be in good condition with flow into the dissipator being evenly distributed within the chamber and flowing into the second distilling basin chamber with subsequent discharge to the downstream channel (Photos 37 to 40).
10. The energy dissipator structure discharges into a channel that flows through a concrete flume (NPDES Permit Outfall # 019) (Photos 41 and 42). The condition of these features was essentially the same as was observed in previous inspections.

Overall, the facility is considered to be in good condition. The impoundment is functioning as intended, with no signs of potential structural issues that would affect its stability or safe operation.

4.4 Bottom Ash Pond Complex

4.4.1 Changes in Geometry since Last Inspection (257.83(b)(2)(i))

No modifications have been made to the geometry of the BAP Complex since the 2019 annual inspection. The geometry of the impoundment has remained essentially unchanged. The water level in the pond on the day of the inspection appeared to be lower than what was observed in 2019.

4.4.2 Changes That Effect Stability or Operation (257.83(b)(2)(vii))

Based on interviews with plant personnel and field observations there were no changes to the BAP Complex since the last annual inspection that would affect the stability or operation of the impounding structure.

4.4.3 Instrumentation (257.83(b)(2)(ii))

Instrumentation at the BAP complex consists of a network of five piezometers drilled to various depths whose locations are depicted in Figure 3 of Appendix E. The water level measurements are shown in Figure 5p. Piezometers 3-S and B-0902 are located on the east perimeter road of the Recirculation Pond. Piezometer 2-N is on the west perimeter road adjacent to the Bottom Ash Pond. B-0904 and B-0905 are located on the upstream and downstream slope of the east perimeter road along the Ohio River, respectively. The maximum operating elevation of the Bottom Ash Pond is El. 670 but was substantially

lower than this on the date of the inspection. The maximum recorded readings of each instrument since the previous annual inspection is shown in Table 3 below.

Table 3. BAP Complex Maximum Recorded Instruments Reading Since the Previous Annual Inspection

Instrumentation Data Bottom Ash Pond Complex		
Instrument	**Type**	**Maximum Reading Since Last Annual Inspection**
2-N	**Piezometer**	**667.5**
3-S	**Piezometer**	**666.8**
B-0902	**Piezometer**	**665.5**
B-0904	**Piezometer**	**655.28**
B-0905	**Piezometer**	**645.11**

The piezometers are measured monthly and showed very little to no change in average piezometric head or trends relative to 2019 and earlier historical readings (shown in Appendix E Figure 5q). In general, a review of the data contained on the BAP static water elevation plot showed that all piezometers exhibited water level trends that have been historically observed, indicating no significant changes have occurred to the subsurface water levels since the previous annual inspection.

4.4.4 Impoundment Characteristics (257.83(b)(2)(iii, iv, v))

Table 4 summarizes the minimum, maximum, and present depth and elevation of the impounded water and CCR since the previous annual inspection; the storage capacity of the impounding structure at the time of the inspection; and the approximate volume of the impounded water and CCR at the time of the inspection. The Bottom Ash is dredged from the ponds as part of the Cardinal Station Operations to maintain the impoundment storage characteristics from year to year; therefore, there is little change to the summary of storage information present in Table 4 below.

Table 4. Summary of Relevant Storage Information BAP Complex

IMPOUNDMENT CHARACTERISTICS

Bottom Ash Complex (Bottom Ash Pond Elevation = 664.2 at time of bathymetric survey)

Approximate **Minimum** depth (Elevation) of impounded water since last annual inspection	6 ft. (664) ft.
Approximate **Maximum** depth (Elevation) of impounded water since last annual inspection	15 ft. (655) ft.
Approximate **Present** depth (Elevation) of impounded water since last annual inspection	6 ft. (664) ft.
Approximate **Minimum** depth (Elevation) of CCR since last annual inspection	8 ft. (664) ft.

Approximate **Maximum** depth (Elevation) of CCR since last annual inspection	11 ft. (658) ft.
Approximate **Present** depth (Elevation) of CCR since last annual inspection	11 ft. (658) ft.
Storage capacity of impounding structure at the time of the inspection	324 ac-ft.
Approximate volume of impounded water at the time of the inspection	234.5 ac-ft.
Approximate volume of CCR at the time of the inspection	89.5 ac-ft.

4.4.5 Visual Inspection (257.83(b)(2)(i))

A visual inspection of the BAP Complex was conducted to identify any signs of distress or malfunction of the impoundment and associated structures. Specific items inspected included all structural elements of the dikes such as inboard and outboard slopes, crest, and toe, as well as the outlet structure at the BAP Complex and pipe discharge structure.

Results of the visual inspection of the BAP Complex performed on October 16, 2020 are provided below (photos are presented in Appendix C):

1. The bottom ash pond and recirculation pond were observed to be in good condition. The crest of the dam was in good condition, with no signs of significant erosion, rutting, or misalignment (Photo 1).
2. The crest was observed to be in good condition with the interior slopes exhibiting minor rill erosion (Photo 2). Photo 2 also depicts excellent conditions for the protective casing, concrete pad and protective bollards for one of the pond's piezometers.
3. An example of minor rill erosion observed along the interior slopes is depicted in Photo 3.
4. The splitter dike was observed to be in good condition with the new decant structure, the former structure is, however, stockpiled on the crest waiting for removal (Photo 4). No signs of wave cut action, erosion, or slope instabilities on either inboard or outboard slopes were observed.
5. The crest along the recirculation pond was also observed to be in good condition with no significant rutting or potholing (Photo 5).
6. The PVC sheet pile wall that divides the recirculation pond showed no misalignment or separation between panels (Photo 6).
7. The sluice lines discharging into the bottom ash pond were directed into the pond as designed. No erosion, slumping or undermining of the line's supporting structures were observed (Photo 7).
8. The exterior eastern slope along the Ohio River was observed to be in good condition, with a well-established grass cover that is regularly mowed and maintained. The slope appeared to be uniform with no slumping or bulges indicative of movement (Photo 8). There were a few minor erosion rills near the crest of the slope.
9. The mature trees along the riverbank have been kept in place to mitigate bank erosion potentially caused by the river (Photo 9).
10. The two apparent seep areas observed in 2018 and 2019 were also present during the current inspection as well (see Photos 10 and 11). No flowing seepage is present, but the

areas are wet and the vegetation is discolored and the ground is soft. The first spring/wet area measured 3 ft by 4 ft long and the second spring/wet area measured 4 ft by 5 ft long. These locations are known to Cardinal Operating Company and are routinely monitored

11. The RCP downstream (eastern dike) slopes along the Ohio River has an inverted filter drain that is protected by riprap, the slopes are in good condition, with no signs of instability (Photo 12). There is minor vegetive encroachment near the bottom of the slope (Photo 13).
12. The outlet structure and discharge pipe from the RCP (NPDES Outfall 023) were unobstructed and in good condition (Photos 14 and 15).
13. Moderate gully erosion was observed along the perimeter fence at the southernmost end of the riprap slope (Photo 16).
14. The western exterior slope was observed to be in good condition showing uniform slopes with no significant erosion, slumping or bulges (Photo 17).
15. Ponded water was observed at the toe of the west embankment and has been observed in previous inspections. The ditch has a relatively flat slope, and sluice pipes run within and adjacent to it, so ponding water is also intermittently observed along its length (Photo 18).
16. The toe of the embankment has a V-shaped ditch or channel running over a portion of its length, and the water collects and is conveyed by this ditch to a drainage structure located at the northwest corner of the pond where it is discharged back into the bottom ash pond (Photo 19).

Overall, the facility is in good condition. The impoundment in functioning as intended, with no signs of potential structural issues that would affect the stability or safe operation of the impoundment.

5. Summary of Findings

5.1 Maintenance Items

The following maintenance items were identified during the visual inspection:

Fly Ash Dam 1

1. Shrubby vegetation on the downstream slope should continue to be sprayed to allow for easier/better visual inspection.

Fly Ash Dam 2

1. Silt and brush is present behind the V-notch weir of the seepage monitoring point (Drain No 15) (See Photo 30, Appendix B). The area immediately upstream of the weir should be kept clear of obstructions to ensure accurate flow measurements.
2. Consideration should be given to fill/repair cracking on the sidewalls within the emergency spillway.
3. Continue with regularly scheduled mowing and reseeding minor barren areas.

Bottom Ash Pond Complex

1. Erosion rills along the eastern and western dikes/crest and exterior slopes of the BAP and RCP should be repaired.

2. Potholes along the crest of the dike should continue to be filled as they are observed.

5.2 Items to Monitor

Fly Ash Dam 1

1. Continue to monitor erosion rills that are intermittently located along the downstream slope. Correct any features that are observed to grow in size or depth, as part of regular maintenance.

Fly Ash Dam 2

1. Continue to monitor the condition of the RCC section of the emergency spillway for signs of additional erosion or deterioration.
2. Continue to monitor the seepage areas observed on the left earthen cut sidewall of the emergency spillway and on the concrete steps of the emergency spillway for any signs of increased flow, muddy flow, or instability.
3. Continue to monitor the approximately 8 ft x 8 ft area of dead vegetation that is located on the upper half of the downstream face of the dam between the center of the dam and the left abutment for any adverse changes and for free-flowing seepage. Reseed barren areas.

Bottom Ash Pond Complex

1. Continue to monitor the apparent seepage entering the ditch at the toe of the west dike slope and monitor the slope for signs of internal erosion by seepage.
2. Continue to frequently monitor the wet spots/seepage areas on the eastern dike slope above the Ohio River. It is anticipated that these seepage areas will be mitigated once the pond has been retrofitted and liner installation has been completed.

Deficiencies

There were no deficiencies, signs of structural weakness, or signs of disruptive conditions observed at the time of the inspection that would require additional investigation or remedial action. There were no deficiencies noted during any of the periodic 7-day or 30-day inspections or indicated by a review of the dam's instrumentation.

Appendix A

Photographs – Fly Ash Dam 1

Photo No.1
FAR 1 dam crest & fly ash sluice pipelines/landfill access road.

Photo No.2
Typical view showing the left groin ditch.

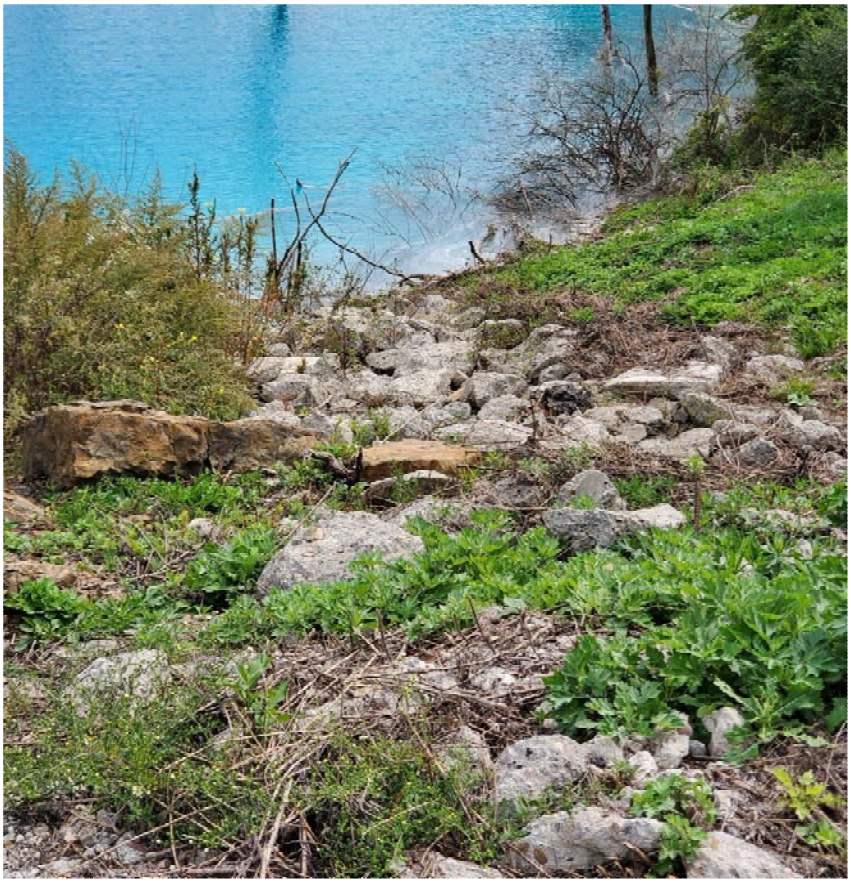


Photo No.3
Close up view showing the good condition of the rip rap placed with the groin ditch but weedy vegetation is encroaching into the ditch and left abutment

Photo No.4
Typical view showing the right grion ditch and alignment of road culvert.

Photo No.5
Typical view of FAR 1 dam face.

Appendix B

Photographs – Fly Ash Dam 2

Photo No.1
Typical view of the downstream slope of the FAR 2 dam. and the storm water diversion berm located about mid-slope.

Photo No.2
View of the storm water diversion berm located about mid-slope that diverts storm water to the right and left groin ditches.

Photo No.3
Close up view of storm water diversion berm and downstream slope showing good vegetative grass cover.

Photo No.4
Typical view of the left groin ditch and FAR 2 discharge pipe.

Photo No.5
Typical view of the right groin ditch and inverted filter drainage blanket installed to control seepage on the face of the dam.

Photo No.6
Close up view of drainage blanket adjacent to the right groin ditch.

Photo No.7
Typical view looking upslope from the bench to the top of the dam along the right groin ditch.

Photo No.8
View looking upslope from the toe of the dam showing a uniform slope, no significant erosion, bulges, slumps, or other signs of mass movement.

Photo No.9
View looking along the top of the emergency spillway showing unobstructed conditions.

Photo No.10
View of emergency spillway channel showing good conditions.

Photo No. 11
View of emergency spillway channel. Seepage is collected from the left hillside and conveyed towards the end of the channel to be discharged through Drain No. 12.

Photo No.12
View of the upper part of the spillway showing the Stage 3 massive concrete steps overlying the Stage 2 RCC (roller compacted concrete) and the right retaining wall.

Photo No.13
View of the right retaining wall and the terminal end point of the Stage 3 MSE wall showing separation at the conner post.

Photo No.14
Close up view of MSE wall corner post seen in previous photo.

Photo No.15
View looking at the top of the MSE wall corner post.

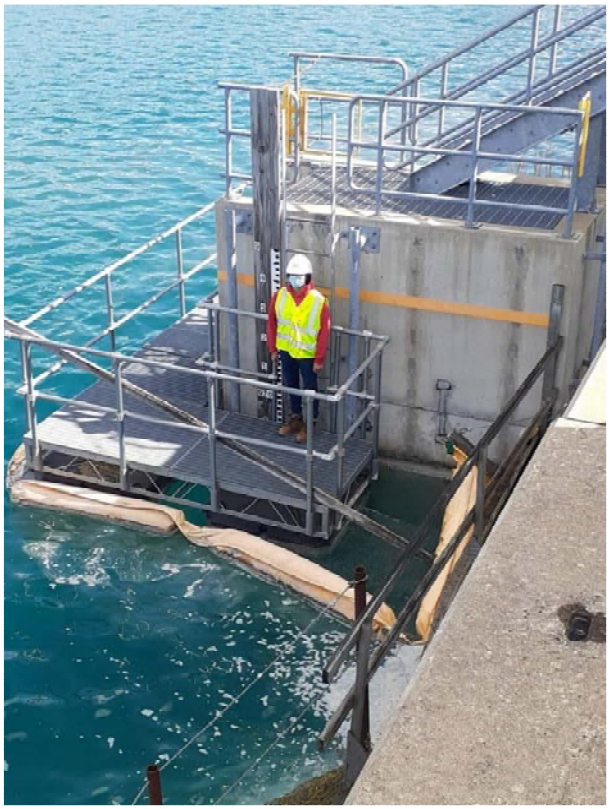


Photo No.16
Typical view of decant structure showing good conditions.

Photo No.17
View of pond effluent being discharged into the decant structure.

Photo No.18
View of staff gage to measure FAR 2 pool stage. Note the orange band that marks the maximum operating pool stage.

Photo No.19
View of the inundated RCC showing satisfactory conditions. No slumping or wave cut erosion was observed and water clarity was very good.

Photo No.20
View of the FAR 2 pond viewed from the decant structure.

Photo No.21
View of the upstream MSE wall showing good conditions towards the emergency spillway.

Photo No.22
View of the upstream MSE wall showing good conditions towards the right abutment.

Photo No.23
View of the MSE wall on the downstream side of the wall showing good conditions looking towards the right abutment.

Photo No.24
View of the MSE wall on the downstream side of the wall showing good conditions looking towards the left abutment.

Photo No.25
Close up view of the MSE wall on the downstream side of the wall showing good conditions (no cracking, spalling or misalignment).

Photo No.26
Close up view of the drainage outlet showing the animal guard and no erosion was observed.

Photo No.27
View of drain # 1 of the chimney/toe drain system with a measured discharge approximately 23 gpm.

Photo No.28
View of drains discharging into collection pool at the right groin ditch. The discharge was unobstructed and was visually clear.

Photo No.29
View of drain # 2 V-notched weir that collects all the seepage from the right abutment. See figure 5m for a graphical display of its discharge

Photo No.30
View of drain # 15 showing a V-notched weir to measure flow emanating from the Morgantown sandstone.

Photo No.31
View of drain # 7, a 12In. diameter HDPE pipe, discharging approximately 10 gpm into the right groin ditch.

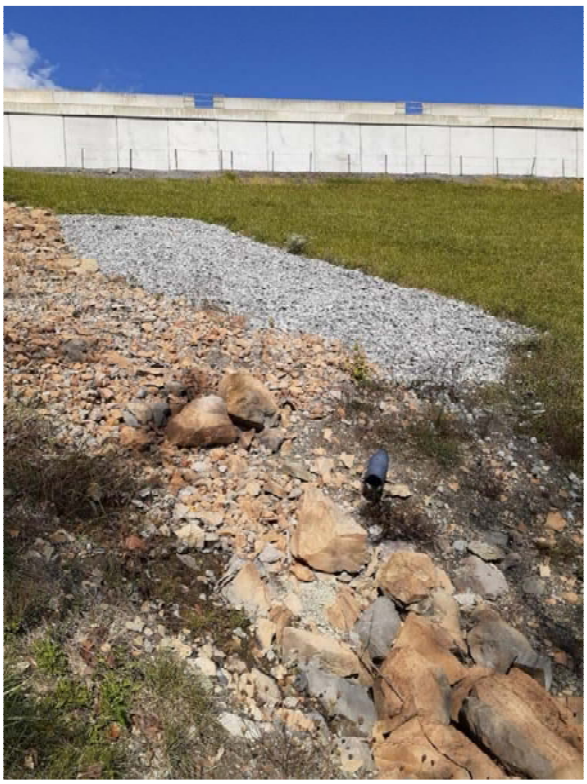


Photo No.32
View of "new" drain collecting seepage from the drainage blanket discharging into the right groin ditch. The discharge was observed to be steady at approximately 4 gpm and was visually clear.

Photo No.33
View of drain # 8 discharging approximately 5 gpm into the left groin ditch. The discharge was visually clear.

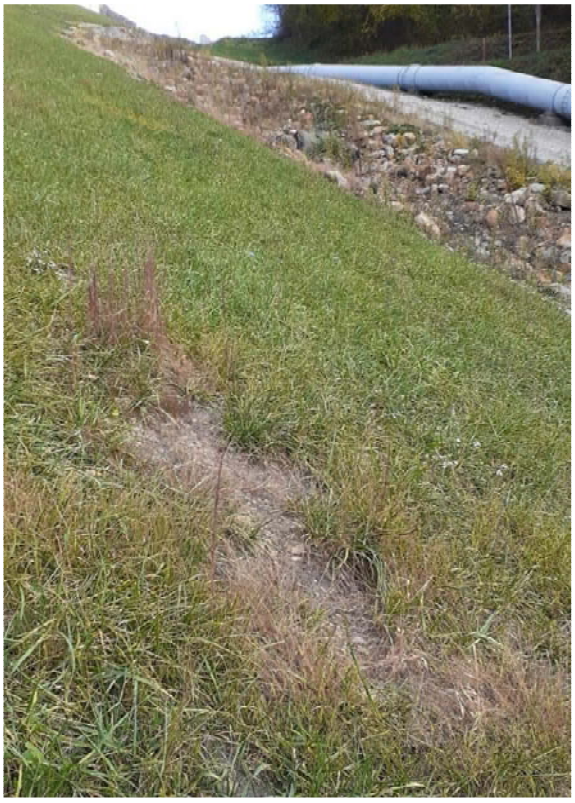


Photo No.34
View of an ephemeral wet weather spring/ bare ground during dry conditions.

Photo No.35
View of drain # 5 located along the right side of the dissipator structure showing a negligible discharge.

Photo No.36
View of drain # 6 located along the left side of the dissipator structure discharging approximately 5 gpm.

Photo No.37
View of drain # 12 located at the end of the emergency spillway channel discharging approximately 10 gpm.

Photo No.38
View of the energy dissipator structures upper chamber showing good conditions.

Photo No.39
View of Energy dissipator discharging into the main channel.

Photo No.40
View of the energy dissipator structures lower chamber showing good conditions.

Photo No.41
View of main channel showing flow towards the concrete flume.

Photo No.42
View of the concrete flume measuring flow from the FAR 2 pond (outfall # 19).

Appendix C

Photographs – Bottom Ash Complex

Photo No.1
Typical view of bottom ash pond complex.

Photo No.2

Typical view of interior slopes and crest. Excellent condition of protective casing for piezometer/ concrete pad and protective bollards.

Photo No.3
Minor erosion along splitter dike with emergent discharge along the toe of the slope into the bottom ash pond.

Photo No.4
Typical view of splitter dike crest and new decant structure. Former structure on the dike is scheduled to be removed.

Photo No.5
Typical view of crest and interior slopes along the recirculation pond.

Photo No.6
Typical view of sheet pile partition wall installed within the recirculation pond.

Photo No.7
Typical view of sluice lines discharging into the bottom ash pond. Discharge was unobstructed and was flowing freely into the pond.

Photo No.8
View of exterior slope along the Ohio River showing well established vegetative growth that is also regularly mowed.

Photo No.9
Mature trees are also being retained along the riverbank to minimize scour and erosion.

Photo No.10
View of emergent spring located approximately mid slope along the Ohio River.

Photo No.11
View of second spring also located about mid slope creating a wet area measuring 4 feet wide by 5 feet in length.

Photo No.12
View of exterior slope covered with rip rap showing good conditions (i.e. uniform slope, no erosion or bare ground exposed)

Photo No.13
Minor vegetative growth encroaching into the rip rap along the toe of the slope.

Photo No.14
Typical view of outfall structure (#01B00009023) showing good conditions.

Photo No.15
View of discharge pipe and splash apron.

Photo No.16
Moderate gully erosion along the perimeter fence at the southernmost end of the exterior slope along the Ohio River.

Photo No.17
Exterior embankment along the recirculation pond showing stable uniform slope conditions with no erosion or slumping.

Photo No.18

Emergent spring along the toe of the exterior slope. No noticeable change in from previous reports in regard to the spring location or discharge.

Photo No.19

Typical view of exterior slope and sump structure that collects seepage and discharges it back into the bottom ash pond.

Appendix D

Bathymetric Surveys

Survey Control

Horizontal Datum: NAD27 Ohio South Zone
Vertical Datum: NGVD29

Pool Elevation = 968.28

Pool Elevation = 968.22

Pool Elevation = 969.89

Legend

- Bathymetric Survey Limit
- Existing Edge of Water
- Existing Limits of Flyash (Exposed Above Pool Elevations)
- Existing Subsurface Contour (Index)
- Existing Subsurface Contour (Intermediate)
- Existing Subsurface Spot Elevation
- Existing Surface Contour (Index)
- Existing Surface Contour (Intermediate)
- Existing Surface Spot Elevation

Mapping Notes

- Existing subsurface topography shown hereon obtained from bathymetric field surveys performed in November, 2020 by *Jack A. Hamilton and Associates, Inc.*
- Existing edge of water location shown hereon was obtained from Client provided drawing: *CD-170912 FAR II Hydrographic Survey - Cardinal Plant*, dated 10-18-2017. Pool elevations shown were obtained from edge of water locations at time of field survey. Edge of water location shown along face of flyash slurry was digitized from drone orthoimagery (image date: 11/19/2019).
- Surface topography (contours shown above the water level) shown was obtained from Client provided drawing: *CD-170912 FAR II Hydrographic Survey - Cardinal Plant*, dated 10-18-2017.

Scale: 1" = 120'

0 120 240 360

STATE OF OHIO
PAUL R. HAMILTON
No. 8125
REGISTERED PROFESSIONAL SURVEYOR

PAUL R. HAMILTON P.S. #8125 — 12-11-2020 DATE

BUCKEYE POWER INC.

FAR II BATHYMETRIC SURVEY

for

AMANDA GRAPHICS, LLC

2554 Red Rock Blvd., Grove City, Ohio 43123

Location: Buckeye Power Inc., Cardinal Plant, Village of Brilliant, Jefferson County, Ohio

Jack A. HAMILTON & Associates, Inc.
342 High St., Box 471
Flushing, Ohio 43977
PH: (740) 968-4947
FAX: (740) 968-4225
www.hamiltonandassoc.com

Date: 12-11-2020 Comm.: 20009

Appendix E

Figures and Drawings

DRN BY:	CARDINAL POWER STATION	DWG NO: FIGURE 1
DATE:		AEP AMERICAN ELECTRIC POWER / AEP SERVICE CORP. 1 RIVERSIDE PLAZA COLUMBUS, OH 43215
SCALE: 1"=	FLY ASH DAM I	

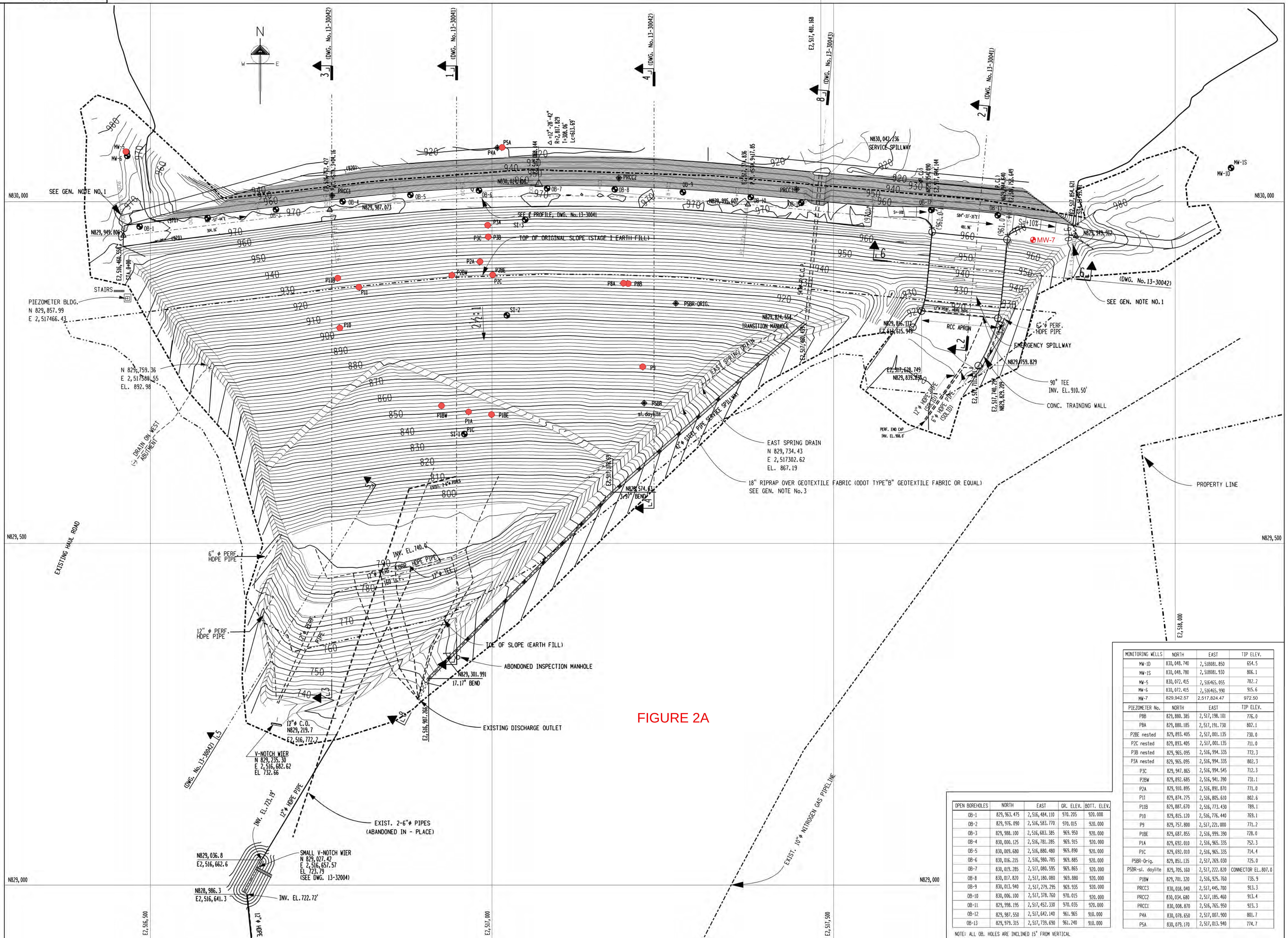


FIGURE 2A

GENERAL NOTES

1.- EXCAVATE ROCK SURFACE TO ACHIEVE A RIGHT ANGLE CONTACT WITH THE RCC.

2.- THE SOIL OVERBURDEN ON BOTH THE RIGHT & LEFT ABUTMENTS SHALL BE STRIPPED. A 2' BOTTOM ASH DRAINAGE BLANKET SHALL BE PROVIDED OVER THE ENTIRE STRIPPED AREA. ANY SEEPAGE ZONES FOUND DURING STRIPPING SHALL BE DRAINED AS NECESSARY BY A FRENCH DRAIN DAYLIGHTING INTO GROIN DITCH.

3.- ADJUST LOCATION OF GROIN DITCH AS REQUIRED TO CLEAR PIPE SUPPORTS.

LEGEND - EXISTING

- SPOT ELEVATION
- INTERMEDIATE CONTOUR
- INDEX CONTOUR
- DEPRESSION CONTOUR
- TREES AND TREELINE
- STRUCTURE AND BUILDING
- FENCE
- POLE
- ROADS
- EDGE OF WATER
- MANHOLES / CATCH BASIN
- POWER POLE
- PIPES
- TOWER

LEGEND - PROPOSED

- +(970.0') FIN. GRADE SPOT ELEV.
- 920 FIN. GRADE CONTOUR
- DRAINAGE DITCH
- INCLINED BORE HOLES
- VERTICAL BORE HOLES
- PIEZOMETER

REFERENCE DRAWINGS

13-30041 - FLY ASH DAM II RAISING PROFILE & SECTION.
13-30042 - FLY ASH DAM II RAISING SECTIONS & DETAILS SHT.1.
13-30043 - FLY ASH DAM II RAISING SECTIONS & DETAILS SHT.2.

MONITORING WELLS	NORTH	EAST	TIP ELEV.
MW-1D	830,048.740	2,518081.850	654.5
MW-1S	830,048.780	2,518081.930	806.1
MW-5	830,072.415	2,516465.055	782.2
MW-6	830,072.415	2,516465.990	915.6
MW-7	829,942.57	2,517,824.47	972.50

PIEZOMETER No.	NORTH	EAST	TIP ELEV.
P8B	829,880.385	2,517,198.101	776.0
P8A	829,880.185	2,517,191.730	802.1
P2BE nested	829,893.405	2,517,001.135	730.0
P2C nested	829,893.405	2,517,001.135	711.0
P3B nested	829,965.095	2,516,994.335	772.3
P3A nested	829,965.095	2,516,994.335	802.3
P3C	829,947.865	2,516,994.545	712.3
P2BW	829,892.685	2,516,941.390	731.1
P2A	829,910.895	2,516,891.870	771.0
P11	829,874.275	2,516,805.610	802.6
P11B	829,887.670	2,516,773.430	789.1
P10	829,815.120	2,516,776.440	769.1
P9	829,757.800	2,517,221.000	771.2
P1BE	829,687.855	2,516,999.390	728.0
P1A	829,692.010	2,516,965.335	752.3
P1C	829,692.010	2,516,965.335	714.4
P5BR-Orig.	829,851.135	2,517,269.030	725.0
P5BR-sl. daylite	829,705.160	2,517,222.820	CONNECTOR EL.807.0
P1BW	829,701.320	2,516,925.760	735.9
PRCC3	830,018.040	2,517,445.700	913.3
PRCC2	830,034.680	2,517,185.460	913.4
PRCC1	830,008.870	2,516,765.950	923.3
P4A	830,078.650	2,517,007.900	801.7
P5A	830,079.170	2,517,013.940	774.7

OPEN BOREHOLES	NORTH	EAST	GR. ELEV.	BOTT. ELEV.
OB-1	829,963.475	2,516,484.110	970.205	920.000
OB-2	829,976.090	2,516,583.770	970.015	920.000
OB-3	829,988.100	2,516,683.385	969.950	920.000
OB-4	830,000.125	2,516,781.285	969.915	920.000
OB-5	830,009.680	2,516,880.480	969.890	920.000
OB-6	830,016.215	2,516,980.785	969.885	920.000
OB-7	830,019.285	2,517,080.595	969.865	920.000
OB-8	830,017.820	2,517,180.080	969.880	920.000
OB-9	830,013.940	2,517,279.295	969.935	920.000
OB-10	830,006.100	2,517,378.760	970.015	920.000
OB-11	829,998.195	2,517,452.330	970.035	920.000
OB-12	829,987.550	2,517,642.140	961.965	910.000
OB-13	829,979.315	2,517,739.690	961.240	910.000

NOTE: ALL OB. HOLES ARE INCLINED 15° FROM VERTICAL

DATE	NO.	DESCRIPTION	APPD.
3/31/00	5	REVISED TO REFLECT AS_BUILT CONDITIONS. FINAL SUBMITTAL TO STATE	BMK
5/21/99	4	AS_BUILT: REVISED TOPO, DRAIN PIPES, ADDED TABLES, PIEZOMETERS AND OPEN BORE HOLES. REMOVED MONITORING WELLS 4, 3, 2D & 2S	HJB
6/22/98	3	REMOVED INTERMEDIATE CONTOURS. INDICATED CONCRETE TRAINING WALL & GEOTEXTILE FABRIC.	HJB
5/20/98	2	DELETED DROP MANHOLE & REV. PIPE ALIGNMENT.	HJB
4/23/98	1	REV. TOE OF DAM TO REFLECT SLIDE REPAIR. RELOCATED DROP MANHOLE & REV. PIPE BEND, 6°30' WAS 6°. ADDED UNDERDRAIN SYSTEM.	HJB
4/21/97	0	ISSUED FOR CONSTRUCTION.	HJB

REVISIONS

s:/cd/13/geo_hydro_site/30040.dgn

CARDINAL OPERATING COMPANY

CARDINAL PLANT

BRILLIANT OHIO

FLY ASH DAM II RAISING GRADING & DRAINAGE PLAN

DWG. NO. 13-30040-5

SCALE: 1"=50'

CIVIL ENGINEERING DIVISION

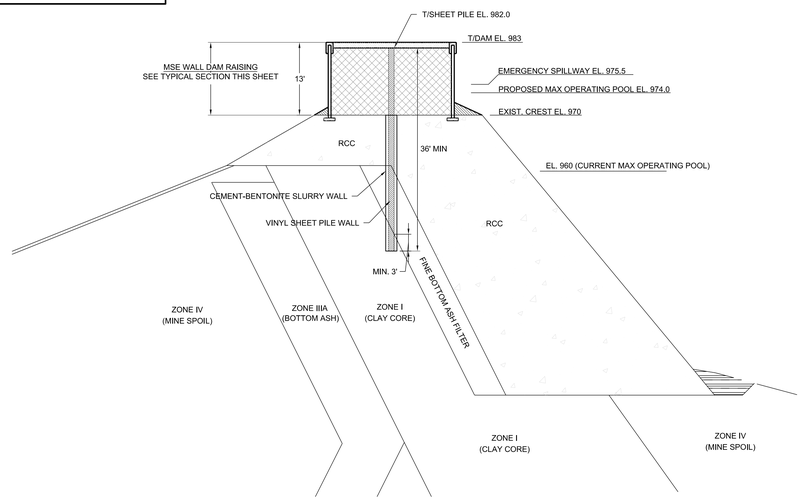
DR: RGD
CH: GJZ
ENGR. HJB
PROJ. ENGR.
DATE: 4/21/97
APPROVED BY H. Joseph Buhac

AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

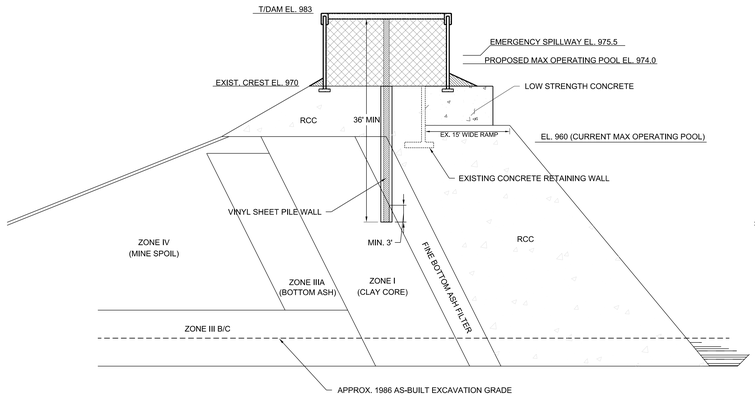
PTS No. 55689

SYSTEM DATE - 26 JAN 2005
SYSTEM TIME - 14:08:29
15th FL 0465

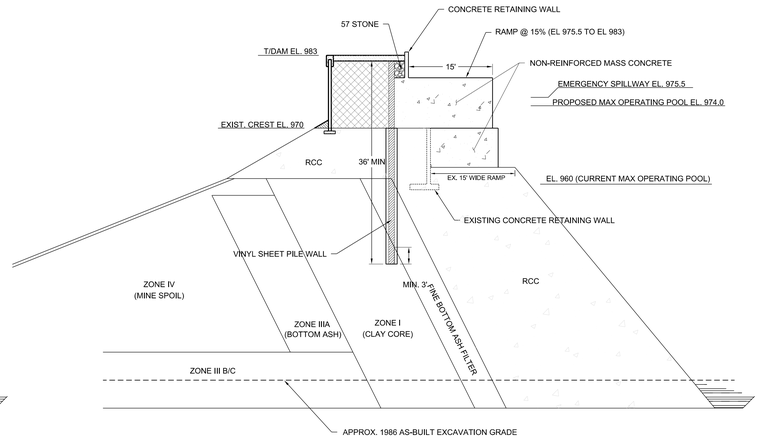
DWG. NO. 13-30087-A



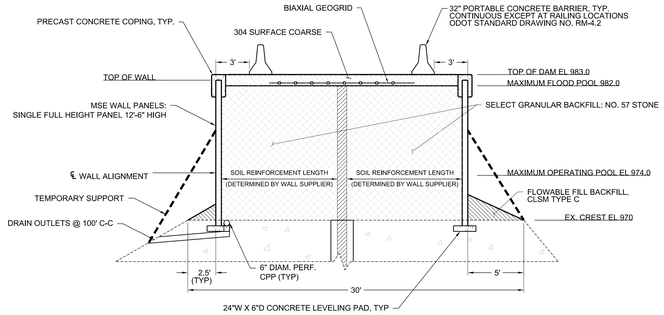
A TYPICAL SECTION - MAIN DAM
SCALE: 1" = 10'



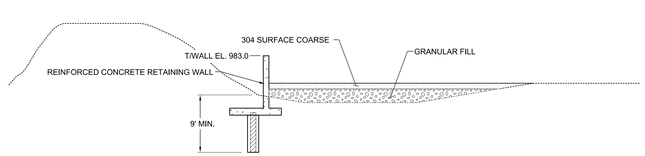
B1 SECTION THROUGH EXISTING EMERGENCY SPILLWAY RAMP
SCALE: 1" = 10'



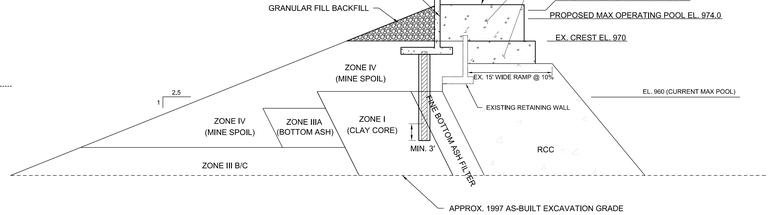
B2 SECTION THROUGH EXISTING EMERGENCY SPILLWAY RAMP
SCALE: 1" = 10'



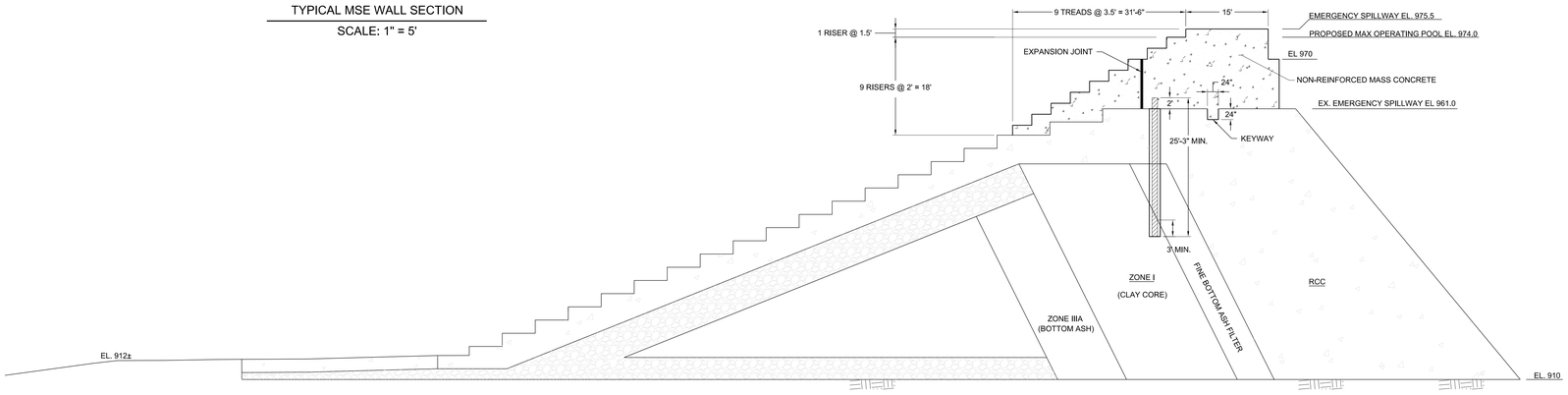
TYPICAL MSE WALL SECTION
SCALE: 1" = 5'



E SECTION E-E
SCALE: 1" = 10'



D SECTION THROUGH EXISTING EMERGENCY SPILLWAY RAMP
SCALE: 1" = 10'



C SECTION THROUGH EXISTING EMERGENCY SPILLWAY
SCALE: 1" = 10'

FIGURE 2B

S&ME, INC.
6190 ENTERPRISE COURT
DUBLIN, OH 43016
PHONE: 614-793-2226
FAX: 614-793-2410
www.smeinc.com

STATE OF OHIO · MICHAEL GILBERT ROWLAND · E-65559 · REGISTERED PROFESSIONAL ENGINEER

MICHAEL GILBERT ROWLAND | E-65559 NUMBER | SEPT 28, 2012 DATE

DATE	NO.	DESCRIPTION	APPD.
9/28/12	A	ISSUED FOR BID SSB	MGR

REVISIONS

CARDINAL OPERATING COMPANY
CARDINAL PLANT
BRILLIANT OHIO

DAM RAISING
FLY ASH RETENTION DAM II
DAM RAISING
TYPICAL SECTIONS

DWG. NO. 13-30087-A

ARCH — ELEC — MECH — STR

SCALE: AS SHOWN
DR:
CH:
QC:
DATE:
APPROVED BY:

CIVIL ENGINEERING DIVISION

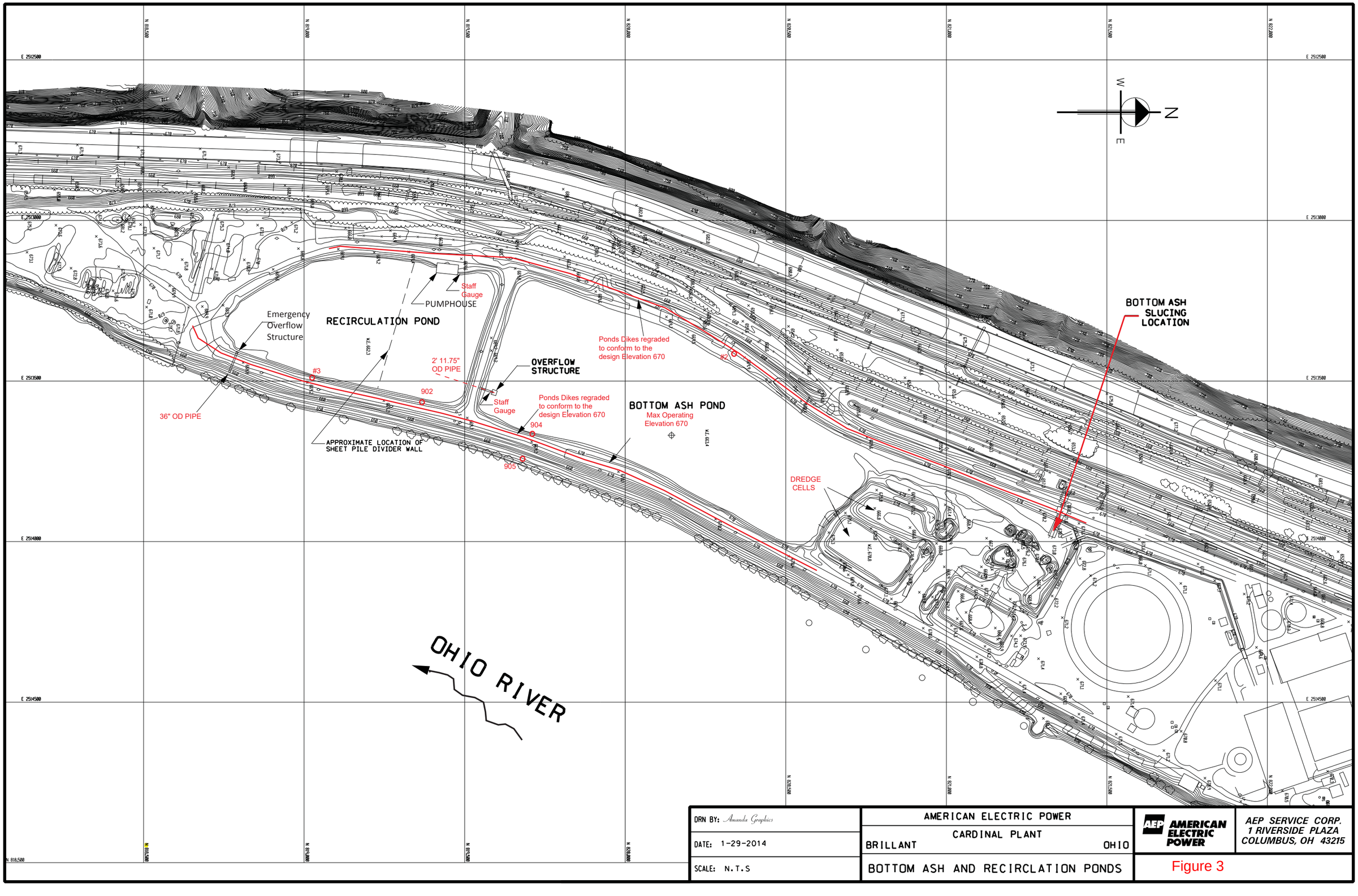
PROJECT NUMBER:	011-11497-042	DRAWN BY:	EDV
DRAWING DATE:	9/28/12	ENGINEER:	MTR
LAST UPDATED:	9/28/12	APPROVED BY:	MGR
		SCALE:	AS NOTED

S&ME

AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

IGSI092

SYSTEM DATE: DD-MMM-YYYY
SYSTEM TIME: HOURMINUTE
I56## FLR.CED



DRN BY: Amanda Graphics	AMERICAN ELECTRIC POWER CARDINAL PLANT BRILLANT OHIO	AEP AMERICAN ELECTRIC POWER AEP SERVICE CORP. 1 RIVERSIDE PLAZA COLUMBUS, OH 43215
DATE: 1-29-2014		
SCALE: N.T.S	BOTTOM ASH AND RECIRCLATION PONDS	Figure 3

Figure 4
Cardinal FAD 2

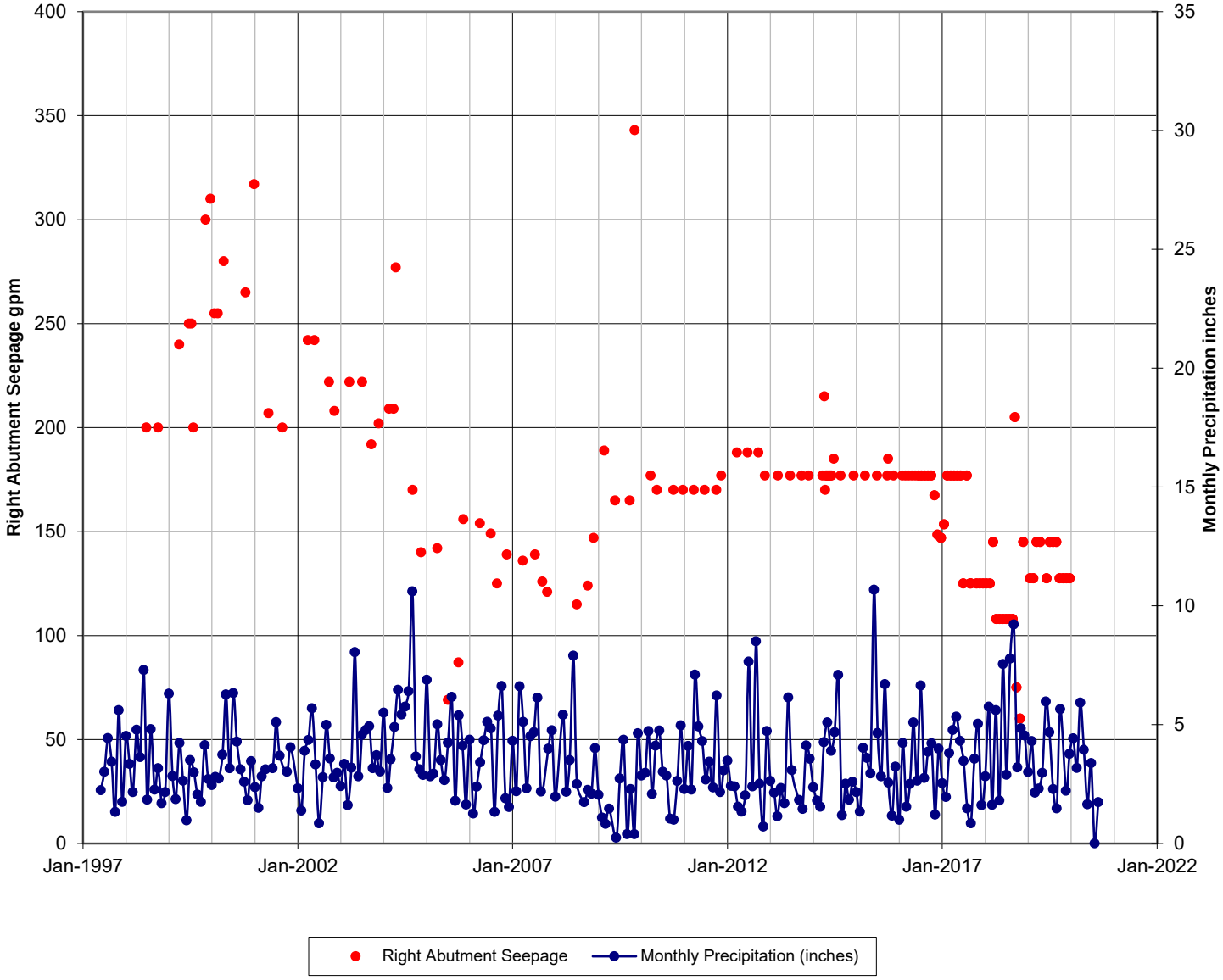


Figure 5a
Cardinal FAD 2

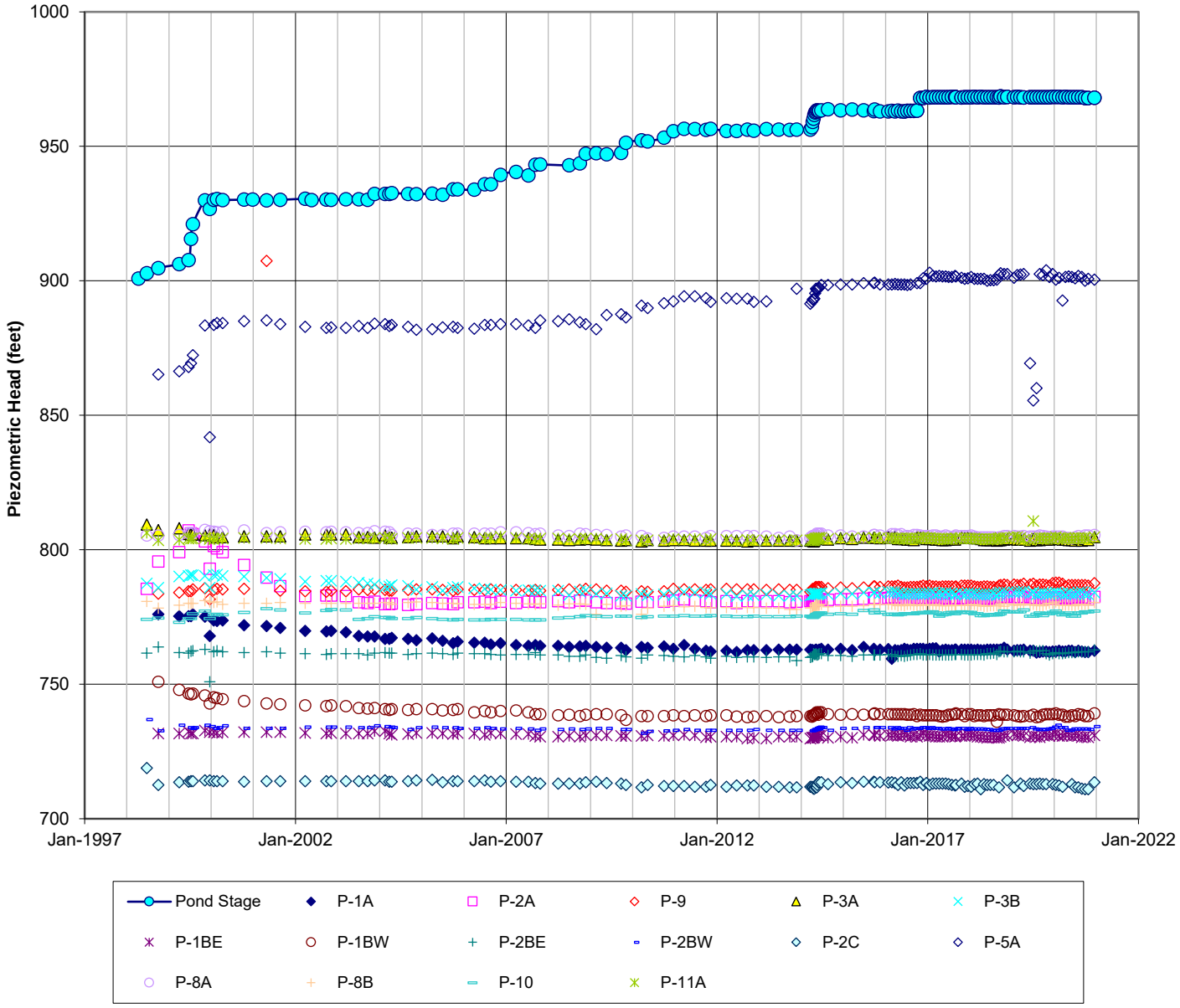


Figure 5b
Pool Stage verses Discharge
Cardinal FAD 2

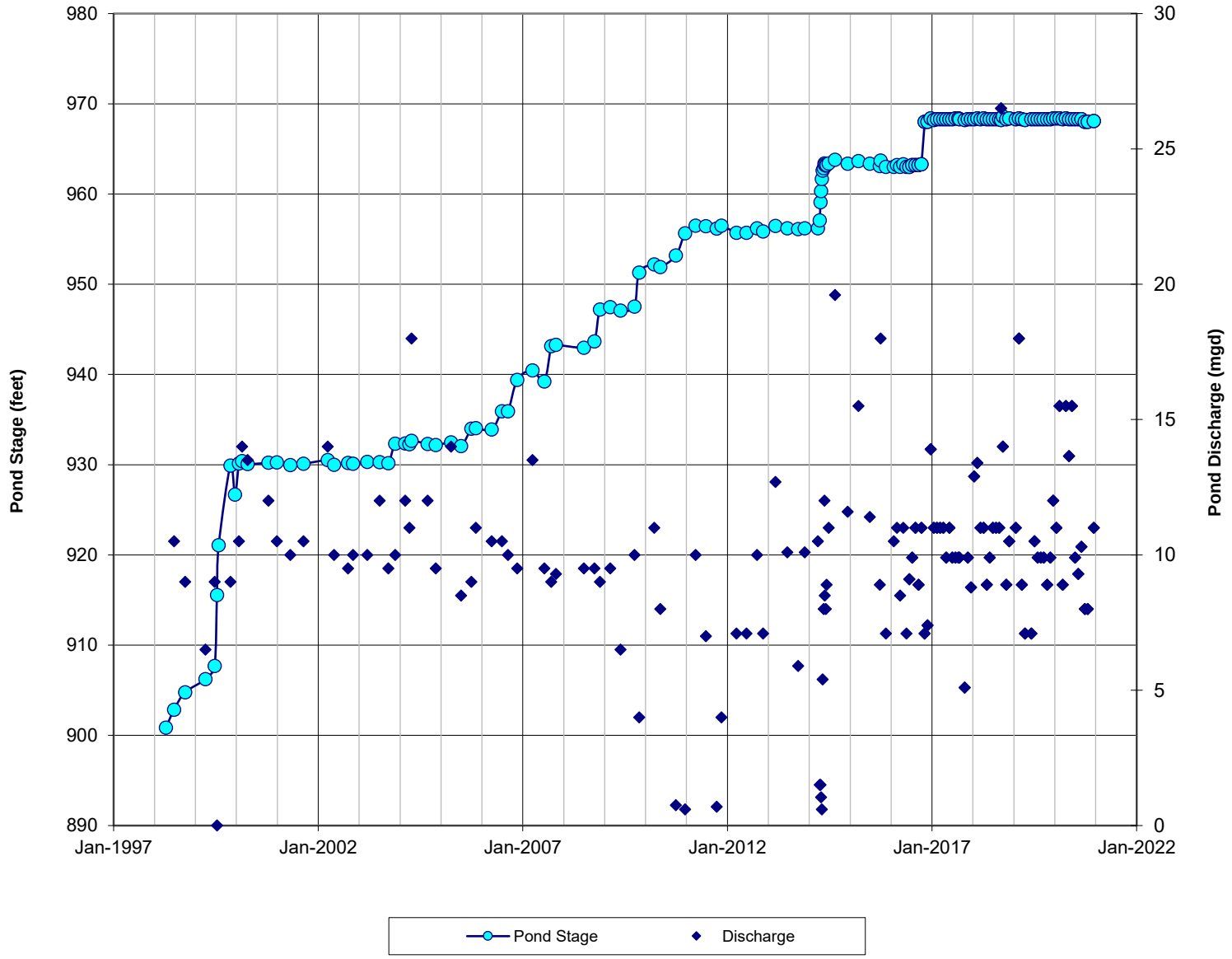


Figure 5c
Cardinal FAD 2
Right of Center
Foundation Piezometers

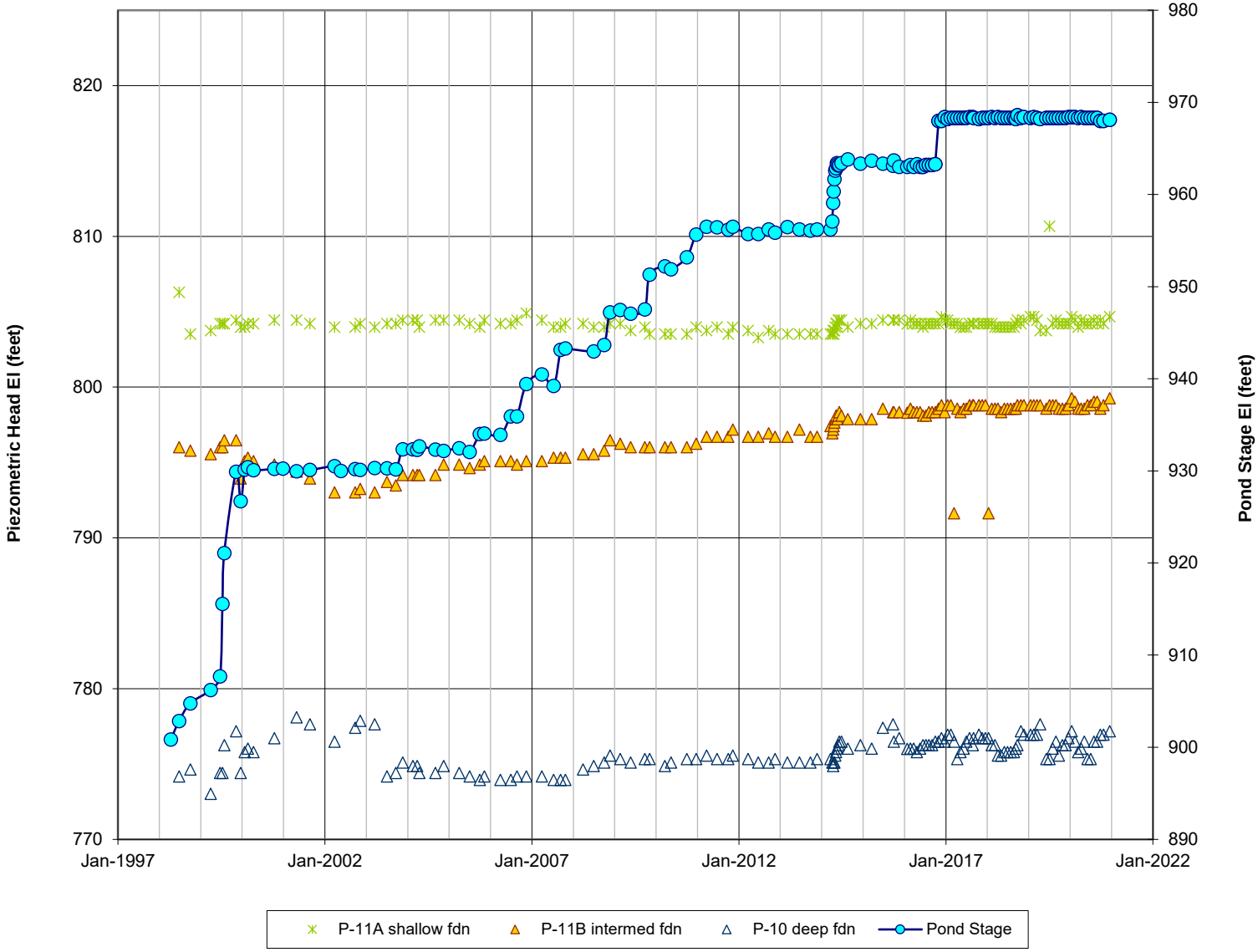


Figure 5d
Cardinal FAD 2
Left of Center
Foundation Piezometers

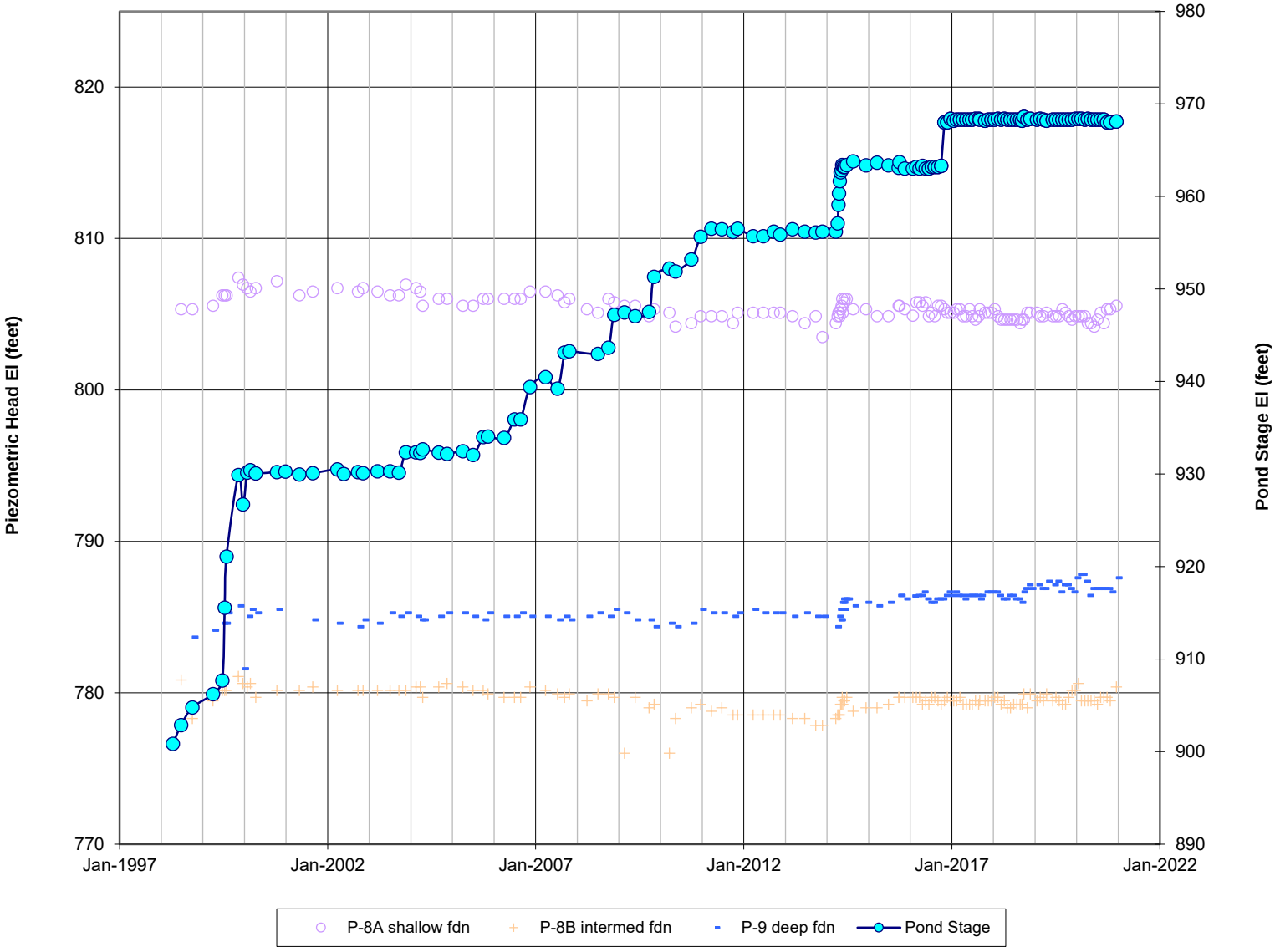


Figure 5e
Cardinal FAD 2
Centerline of Dam

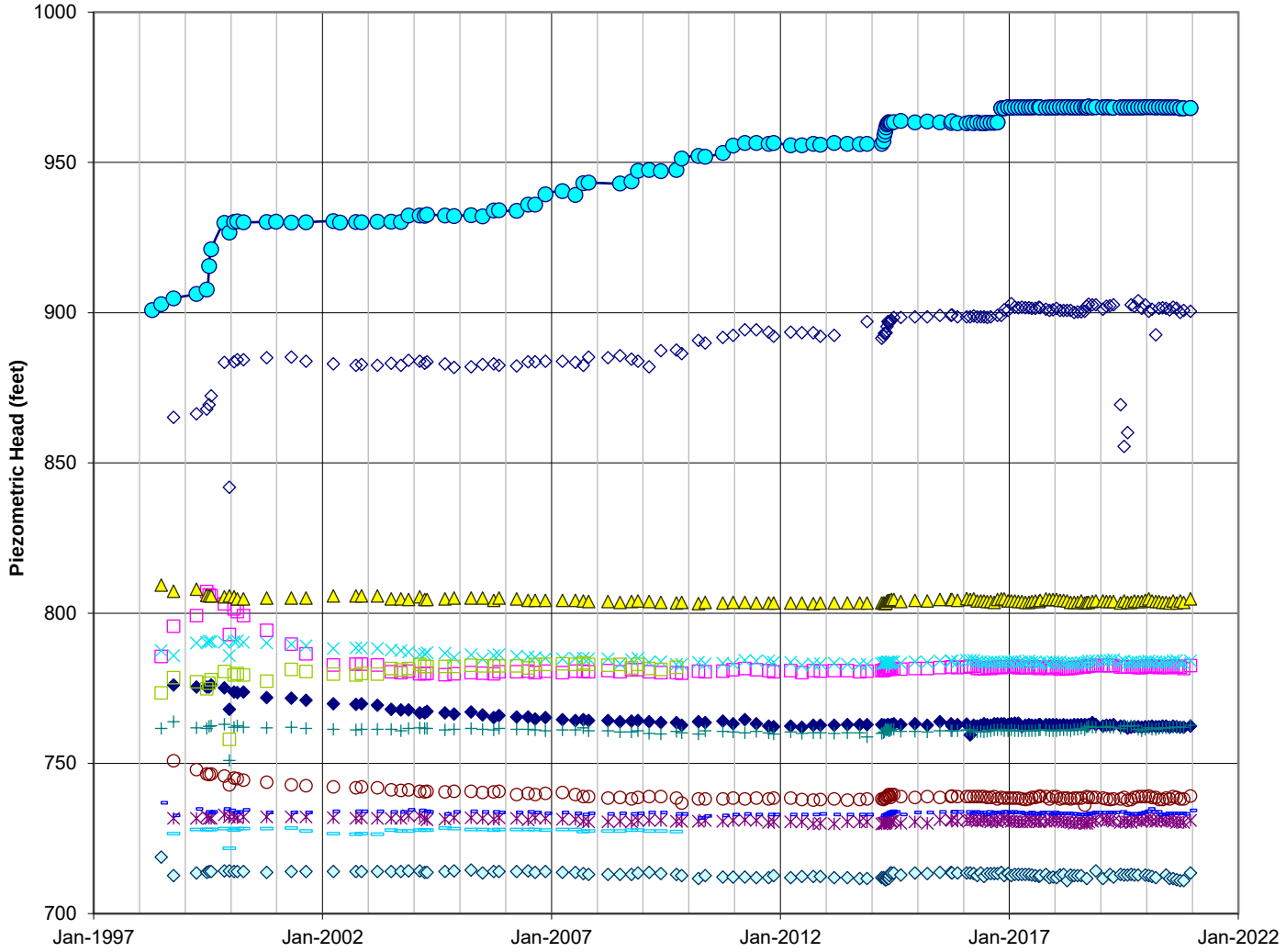


Figure 5f
Cardinal FAD 2
Centerline of Dam

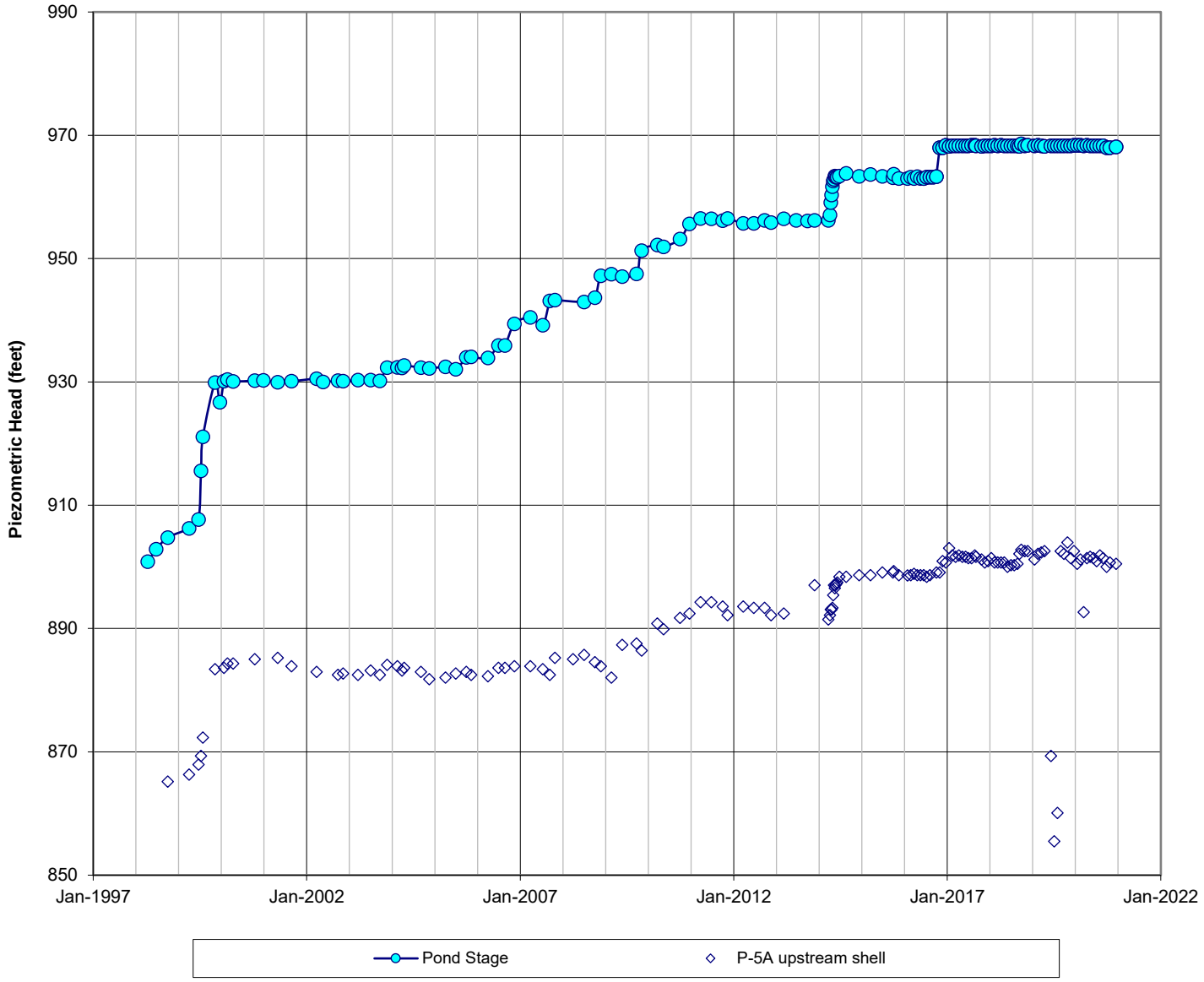


Figure 5g
Cardinal FAD 2
Centerline of Dam
Clustered Piezometer Site

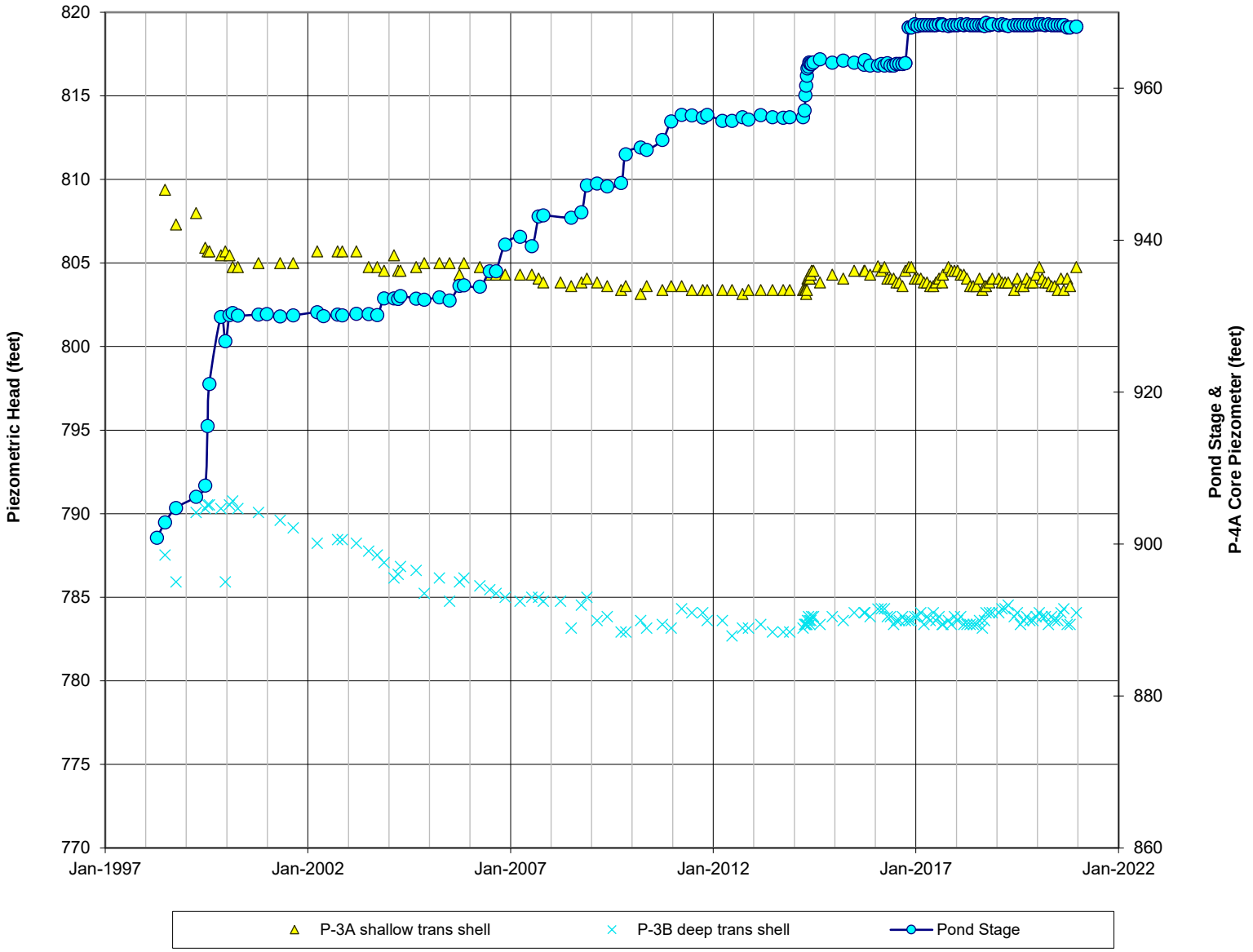


Figure 5h
Cardinal FAD 2
Centerline of Dam
Clustered Piezometer Site

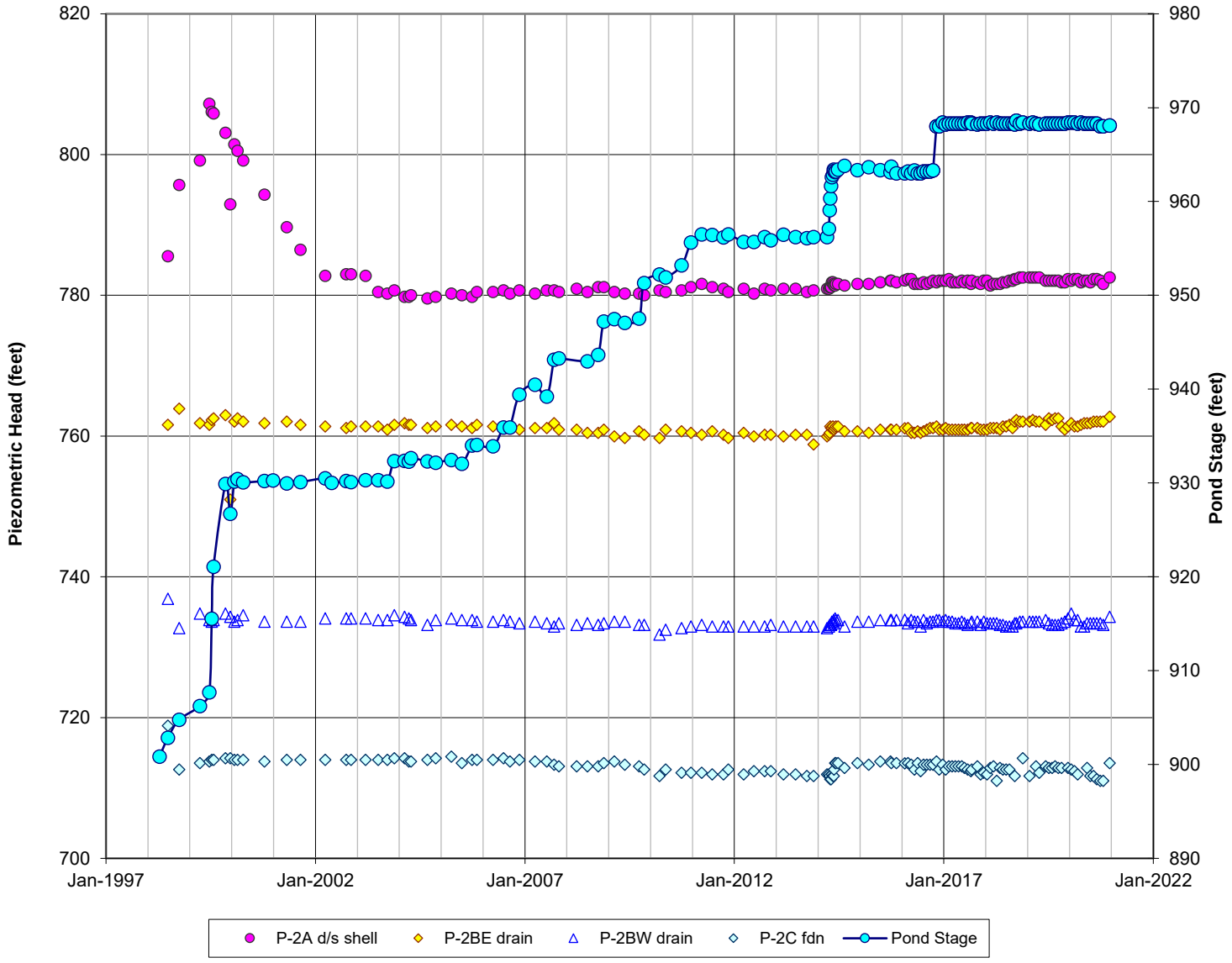


Figure 5i
Cardinal FAD 2
Centerline of Dam
Clustered Piezometer Site

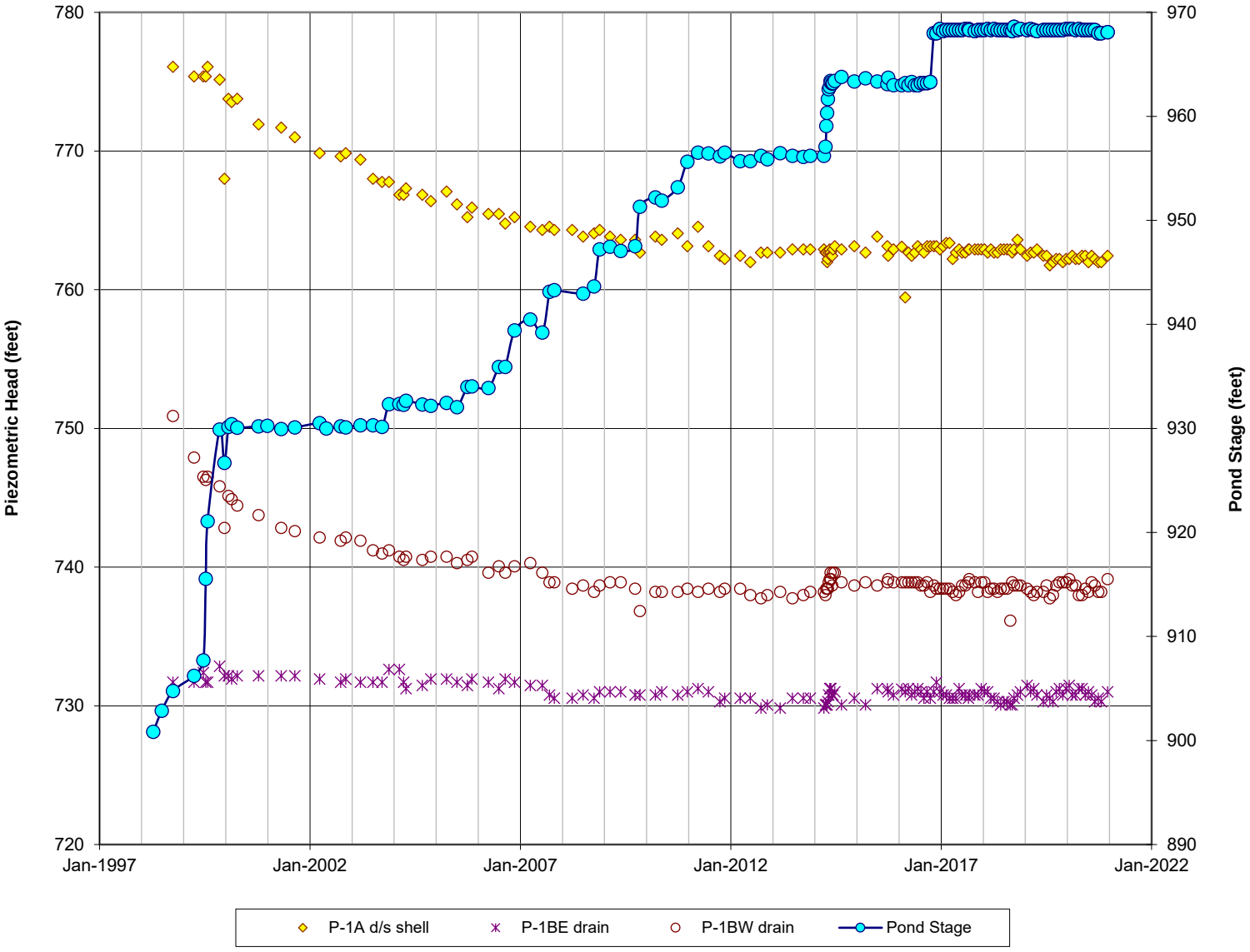


Figure 5j
Cardinal FAD 2
Centerline of Dam
Drain Piezometers

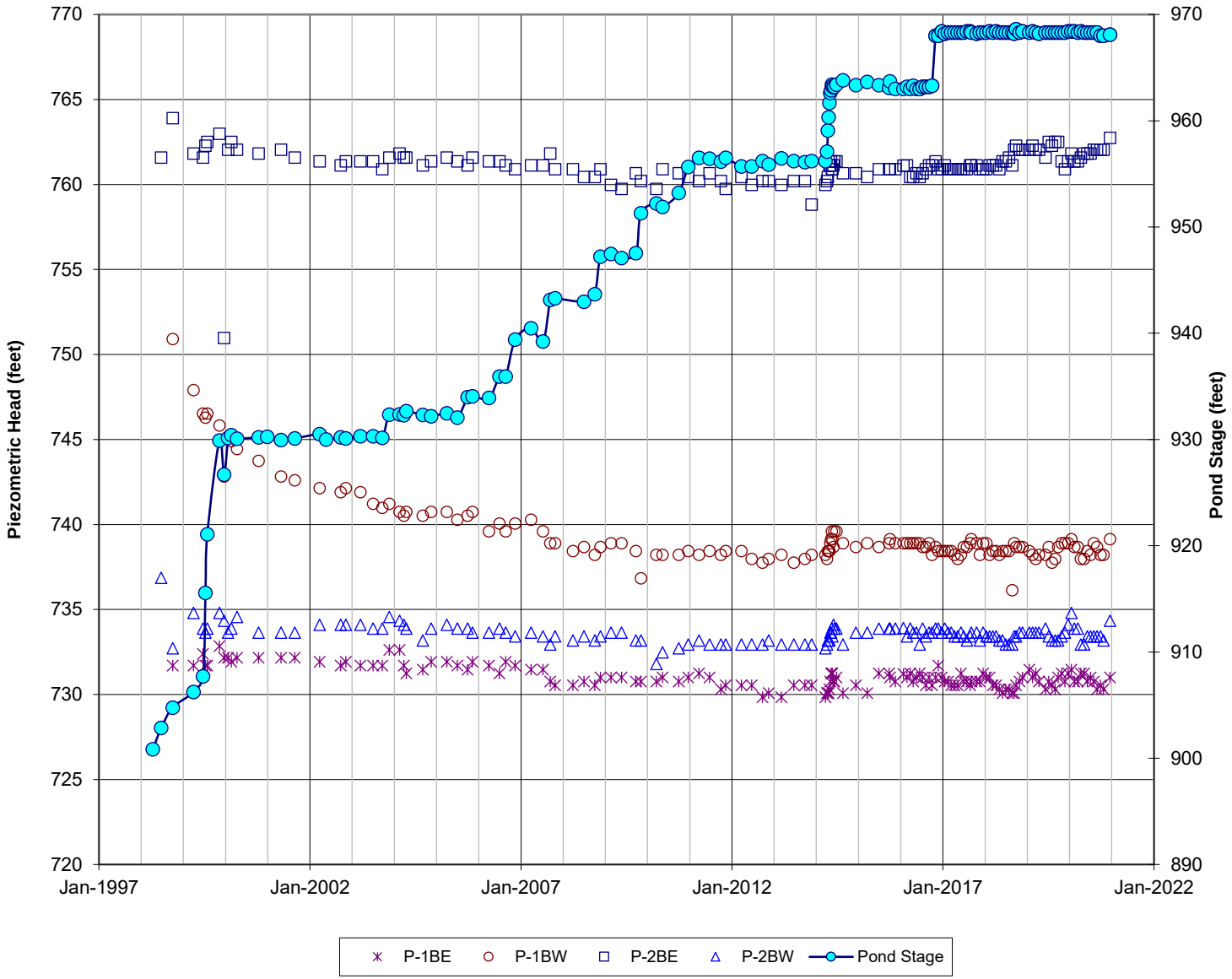


Figure 5k
Cardinal FAD 2
Centerline of Dam
Foundation Piezometers

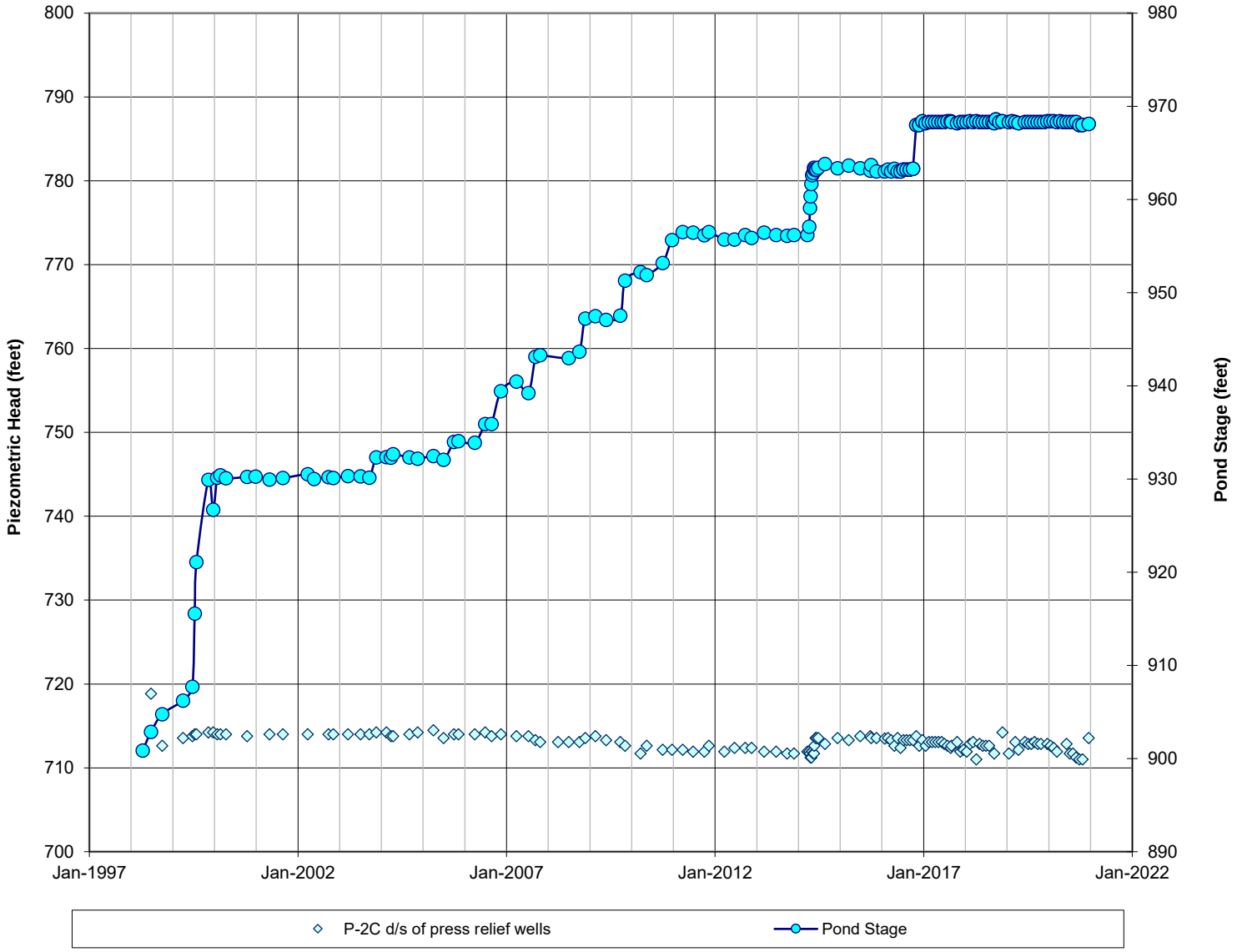


Figure 5l
Cardinal FAD 2
Centerline of Dam
Drain Piezometers & Discharge

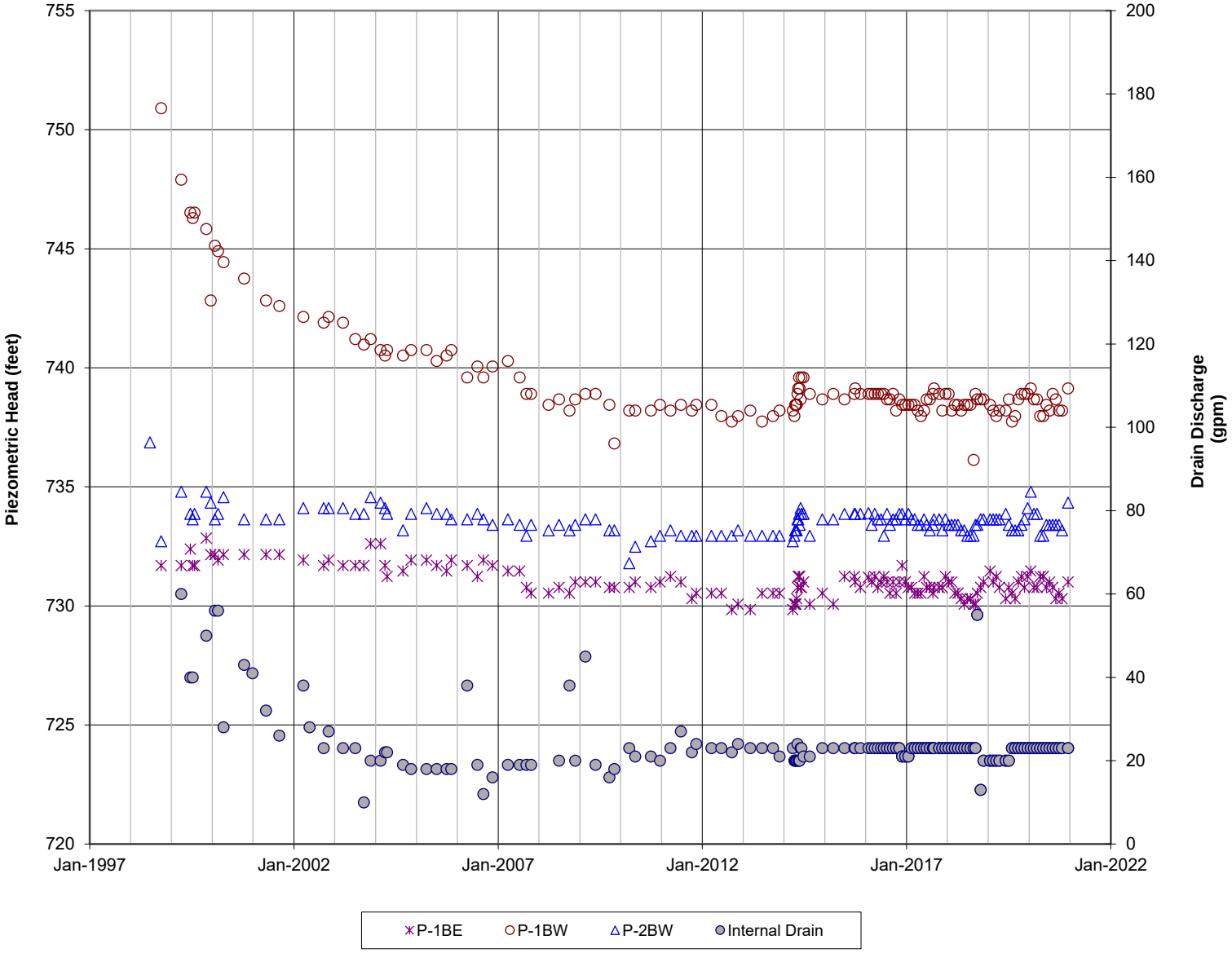


Figure 5m
Cardinal FAD 2
Centerline of Dam
Drain Piezometers & V-Notched Weir Discharge

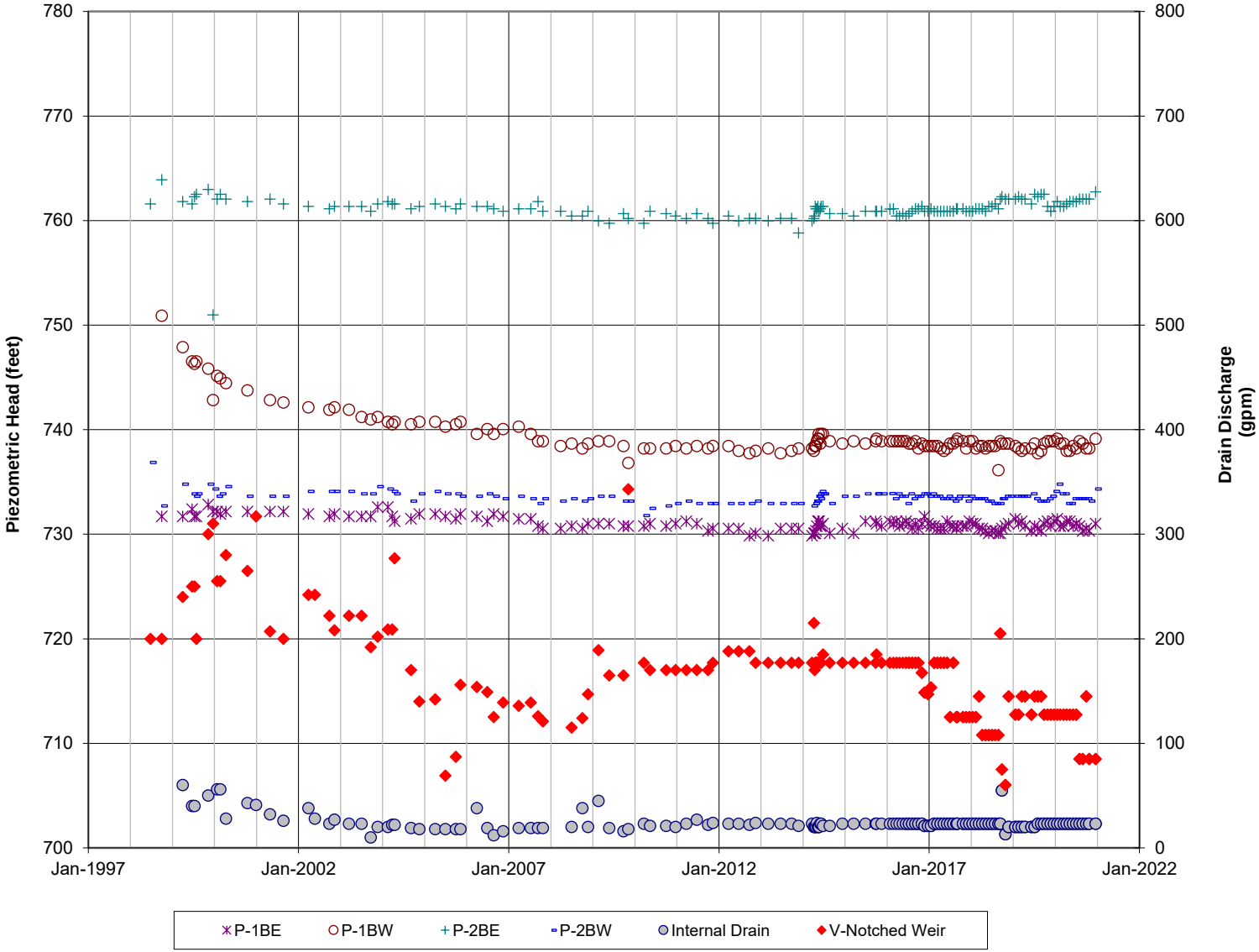
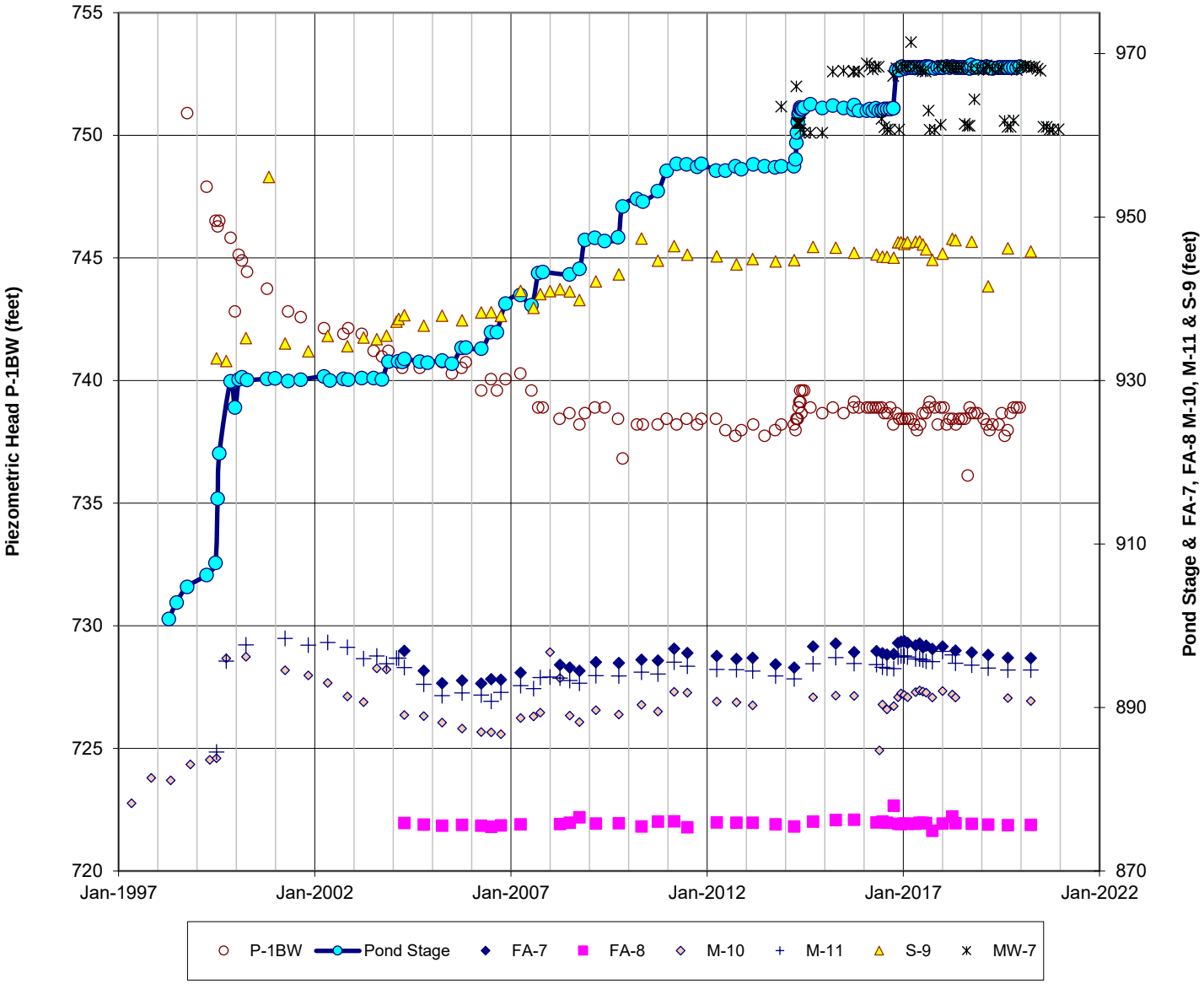
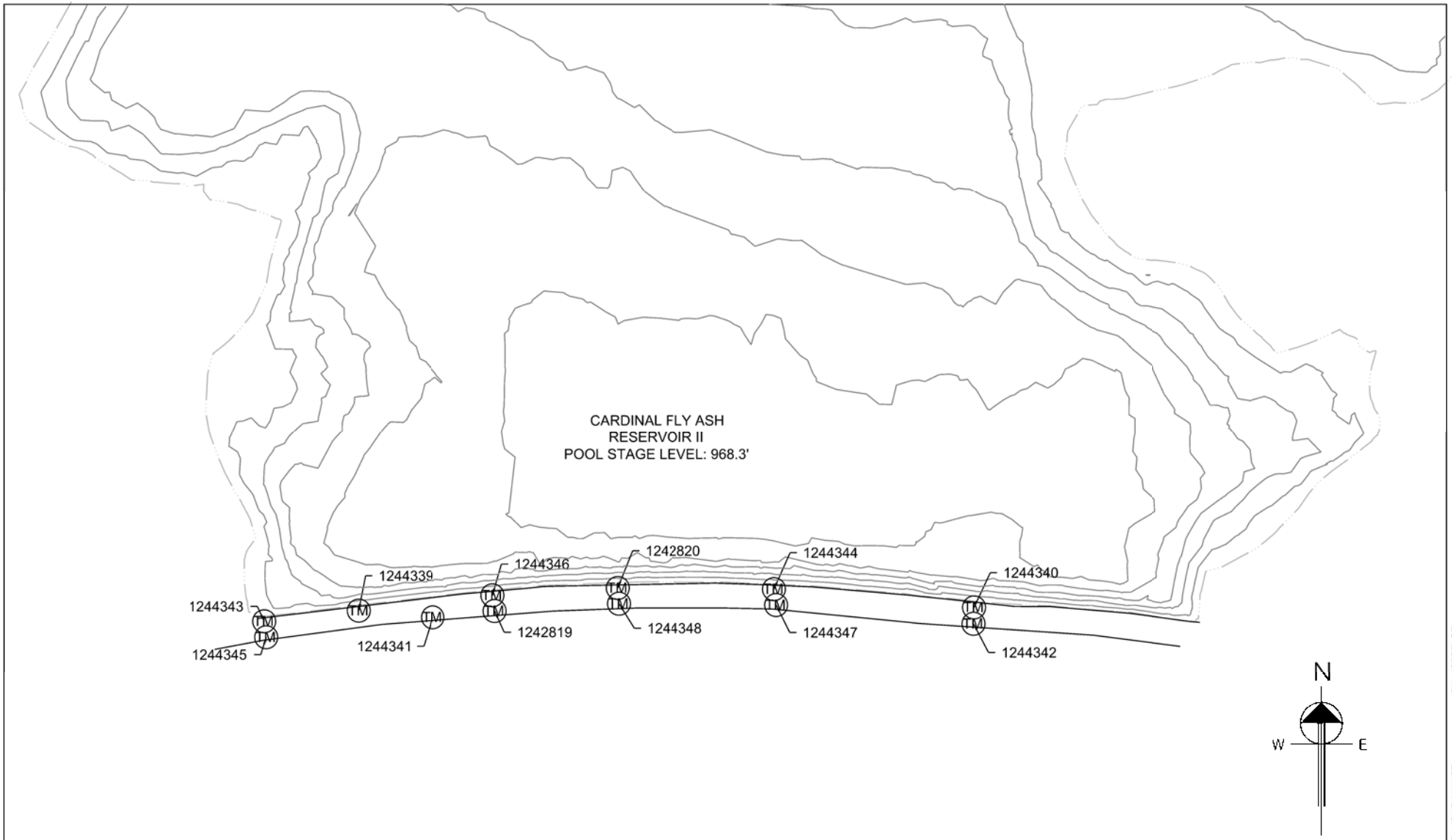


Figure 5n
Cardinal FAD 2
Centerline of Dam
Drain Piezometers & Right Abutment Piezometers





LEGEND:

(TM) APPROXIMATE TILTMETER LOCATION
= SERIAL NUMBER AS LOCATED ON WIRE

AG Engineering & Surveying

CARDINAL TILTMETER LOCATION PLAN

FIGURE 50

PLOT DATE: DD-MMM-YYYY
CROSS REFS:
PLOT TIME: HOUR:MINUTE
BY: USERPLOT

A (8.5"x11")

Figure 5p
Cardinal Far 2
Centerline of Dam
Tiltmeters at MSE Wall Concrete Pannels

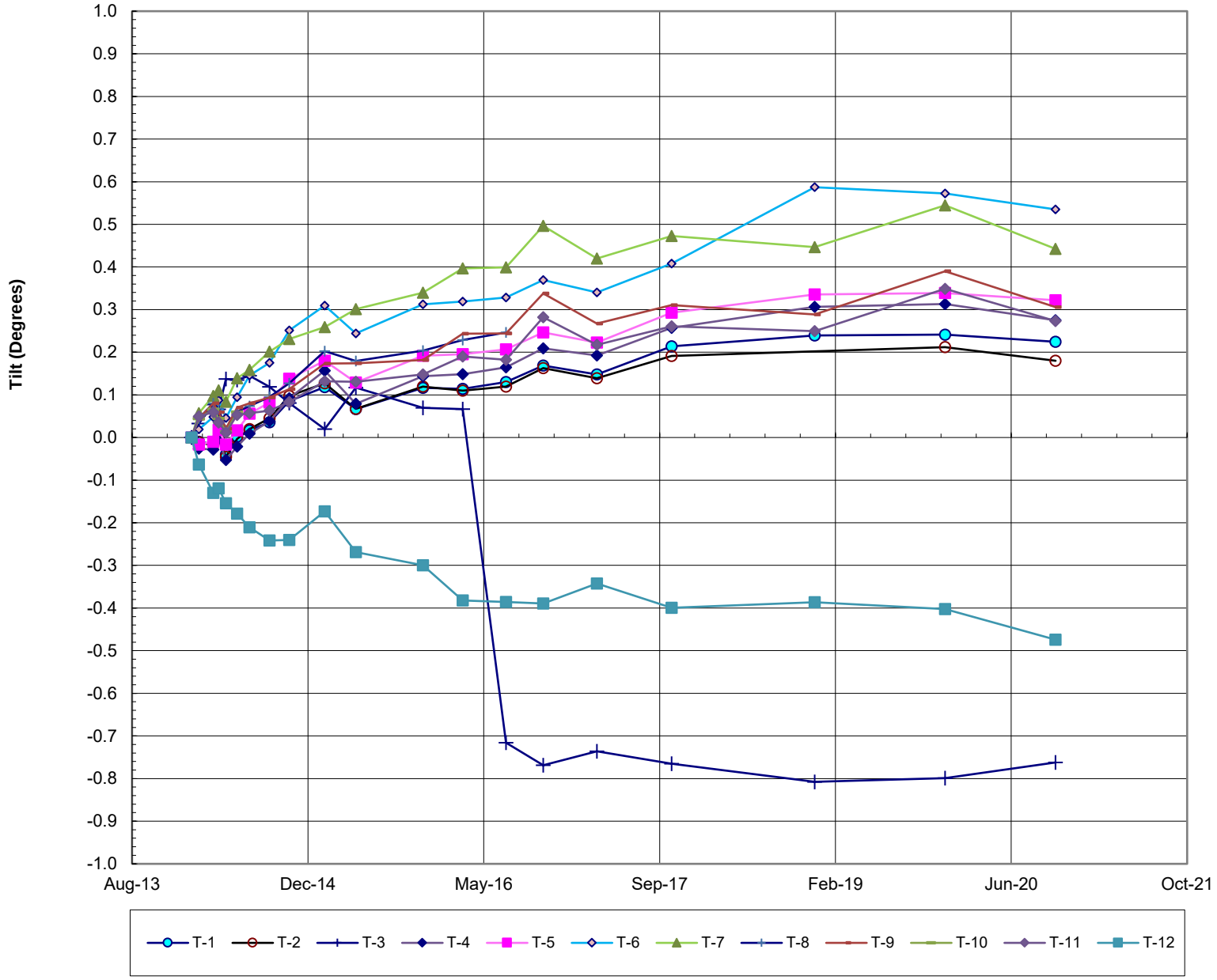
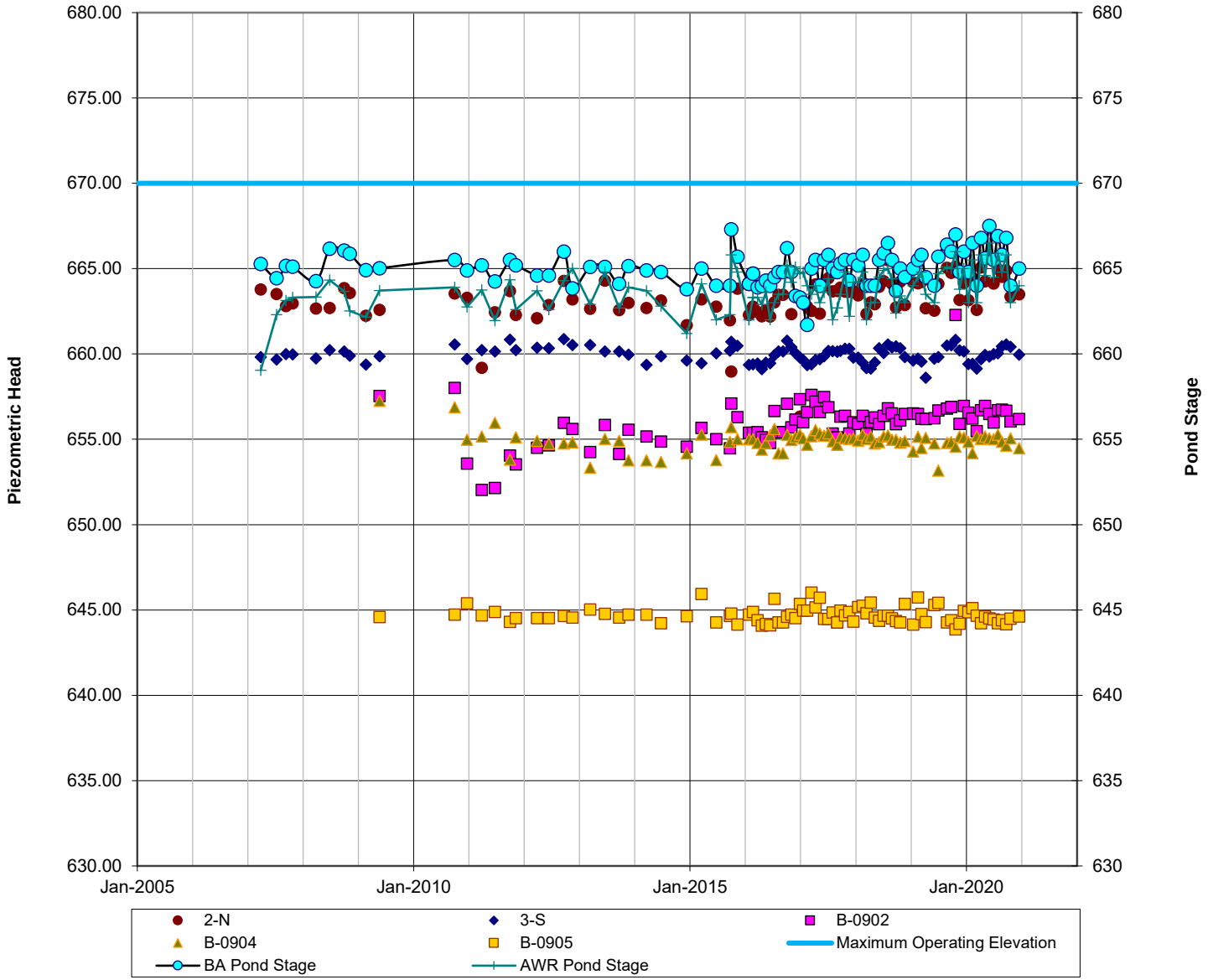
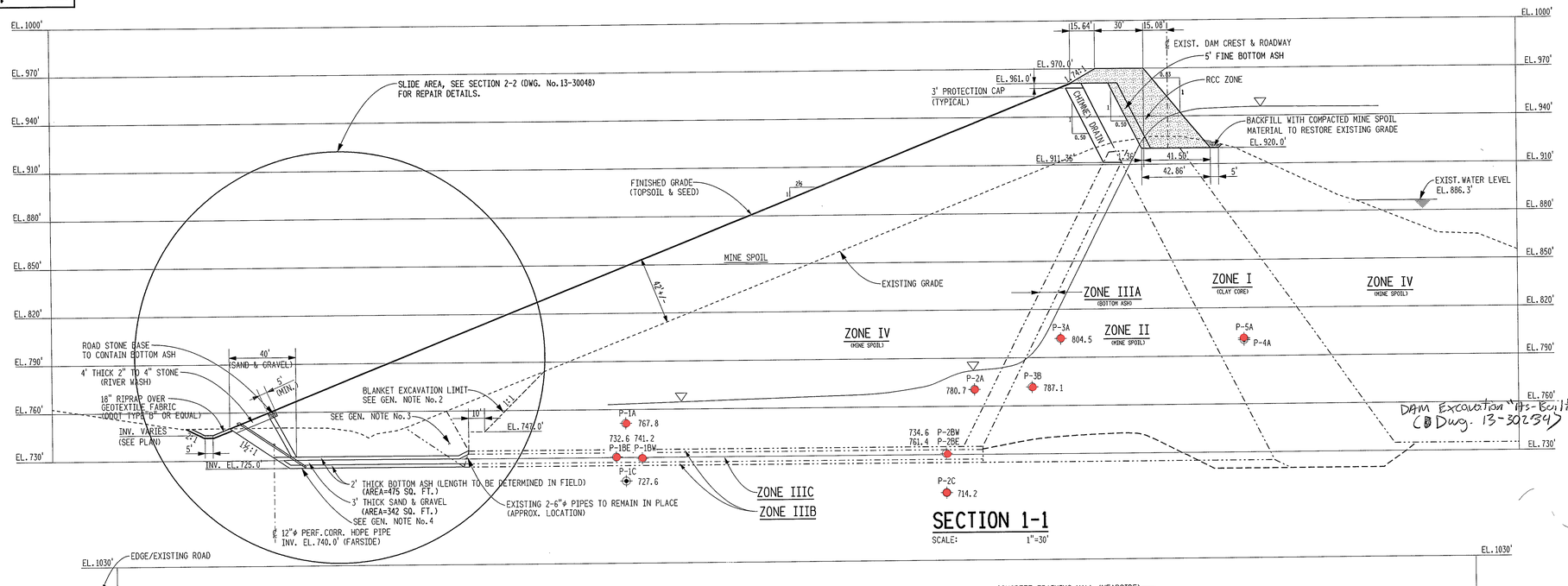


Figure 5q
Bottom Ash Pond Complex
Piezometers & Ponds Stages

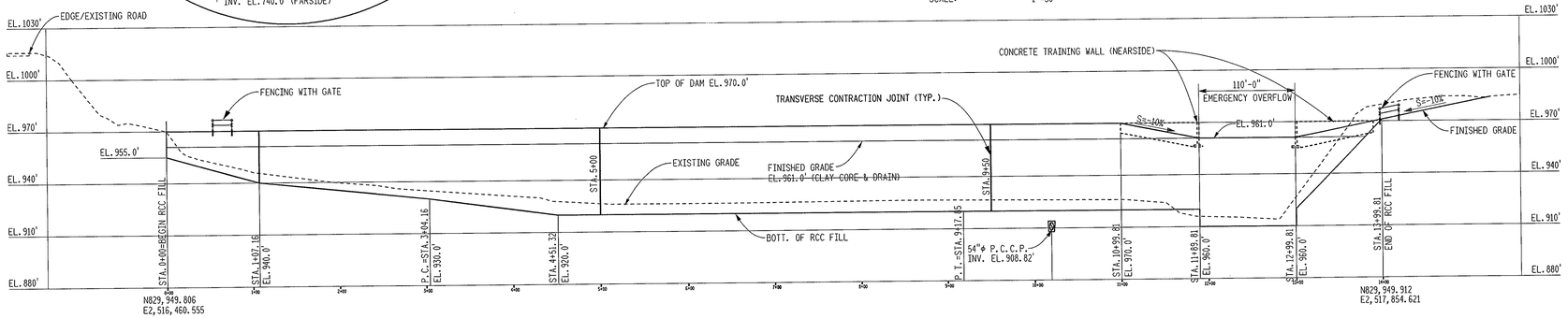


DWG. NO. 13-30041



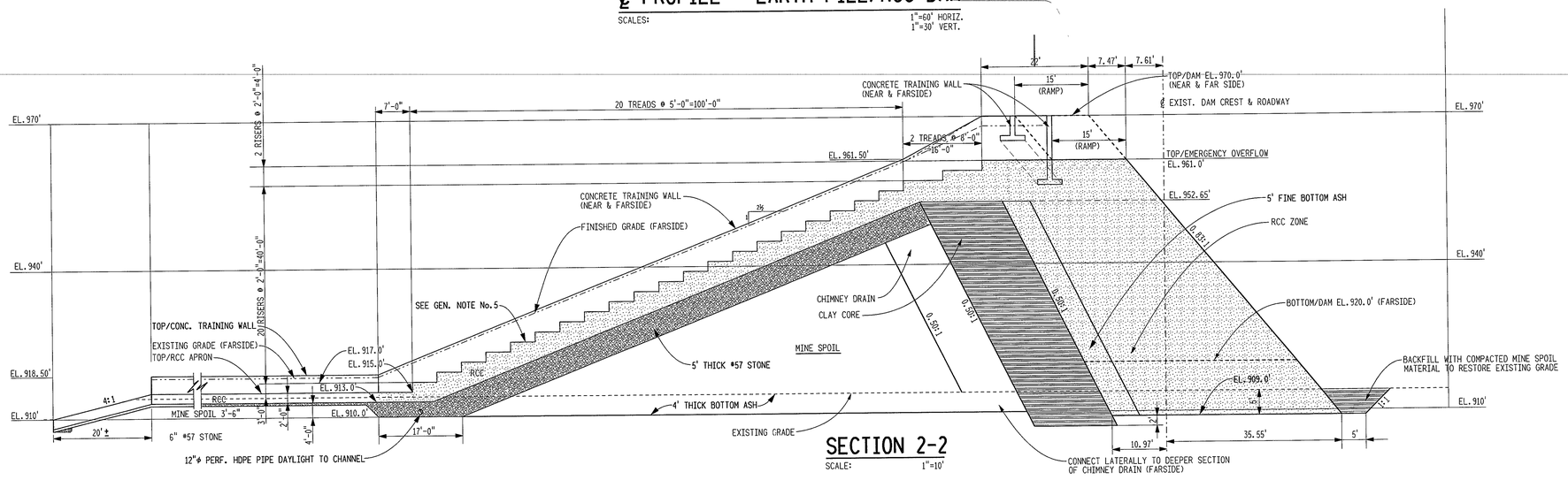
SECTION 1-1

SCALE: 1"=30'



℄ PROFILE - EARTH FILL/RCC DAM

SCALES: 1"=60' HORIZ. 1"=30' VERT.



SECTION 2-2

SCALE: 1"=10'

GENERAL NOTES

1. - FOR SECTIONS LOCATION, SEE DWG. No.13-30040.
2. - LIMIT WIDTH OF EXCAVATION SECTIONS ALONG THE TOE OF THE DAM TO 20 FEET. PROVIDE SOIL SUPPORT AS REQUIRED.
3. - REMOVE EXISTING 12"ϕ PIPE. STOCKPILE REMOVED SAND & GRAVEL MATERIAL AND RE-USE ONLY A CLEAN PORTION OF MATERIAL TO EXTEND DRAINAGE BLANKET.
4. - REMOVE SOIL OVERBURDEN & CLEAN THE SURFACE OF THE ROCK.
5. - SEAL JOINTS BETWEEN RCC AND TRAINING WALL WITH JOINT FILLER.

REFERENCE DRAWINGS

13-30040 - FLY ASH DAM II RAISING GRADING & DRAINAGE PLAN.

DATE	NO.	DESCRIPTION	APPD.
	6	REVISED TO SHOW INSTALLATION DEPTH OF PNEUMATIC PIEZOMETER. AND DAM "AS-BUILT" EXCAVATION GRADES.	
3/2000	5	REVISED TO REFLECT AS-BUILT CONDITIONS. FINAL SUBMITTAL TO STATE	
5/1999	4	AS-BUILT: REVISED TOE AREA OF SECTION 2-2	
6/23/98	3	EXTENDED CONC. TRAINING WALL REMOVED HIGHER & LOWER RCC STRENGTH FACING & ZONE, ADDED GEN. NOTE No.5. 2' DIM ON SECT."2-2" WAS 5'.	
5/20/98	2	REV. SECT.2-2. INDICATED RCC APRON & BOTTOM ASH BLANKET DRAIN THICKNESS.	
4/23/98	1	REV. SECT.1-1, SECT.2-2 & ℄ PROFILE.	
4/2/97	0	ISSUED FOR CONSTRUCTION.	

REVISIONS

s:/cd/13/geo_hydro_site/30041.dgn

CARDINAL OPERATING COMPANY

CARDINAL PLANT

BRILLIANT OHIO

FLY ASH DAM II RAISING PROFILE & SECTIONS

DWG. NO. 13-30041-6

SCALE: AS NOTED

DR: Amanda Gephart

CHI

ENGR.

PROJ. ENGR.

DATE:

APPROVED BY

CIVIL ENGINEERING DIVISION

AEP AMERICAN ELECTRIC POWER

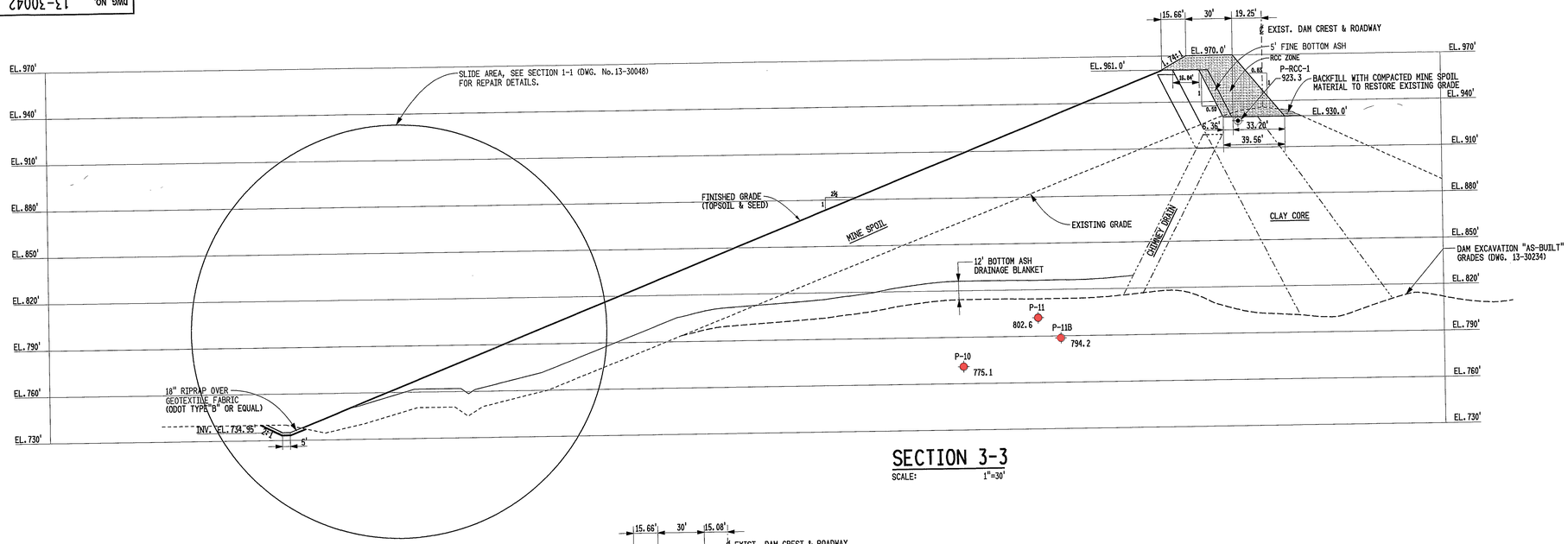
1 RIVERSIDE PLAZA COLUMBUS, OH 43215

FIGURE 6A

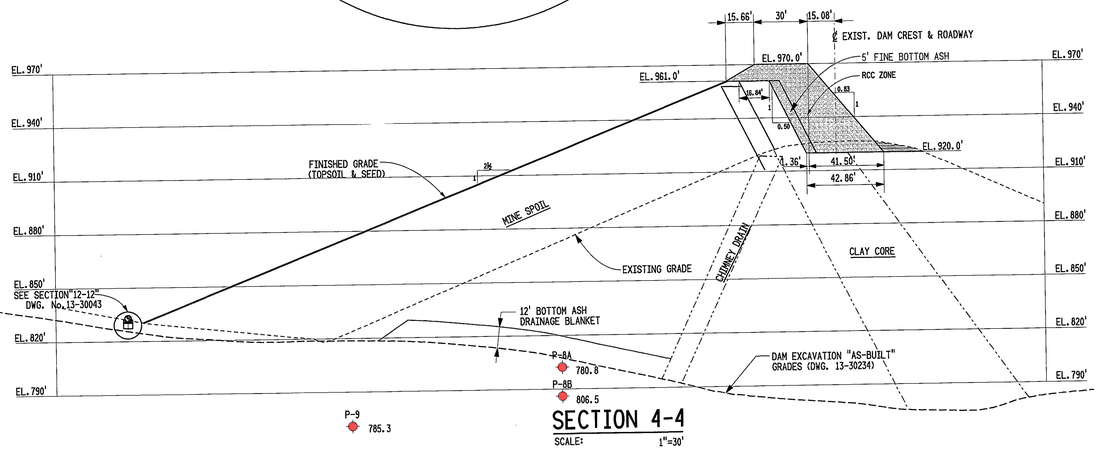
PTS No. 55689

SYSTEM DATE: 17 MAY 2004
SYSTEM TIME: 09:40:56
15th FLR. CED

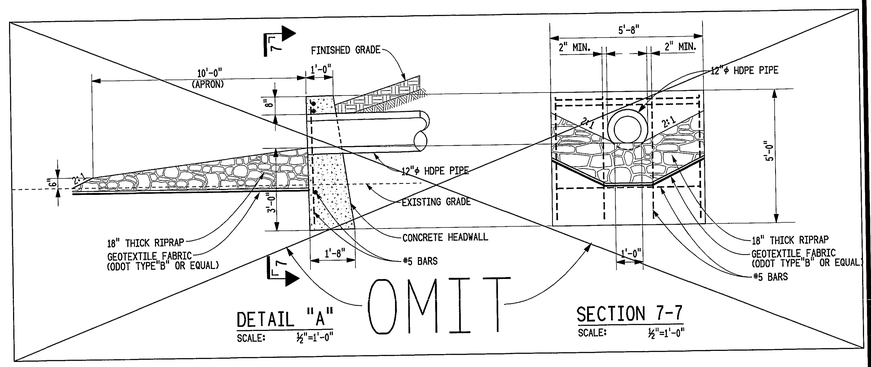
DWG. NO. 13-30042



SECTION 3-3
SCALE: 1"=30'



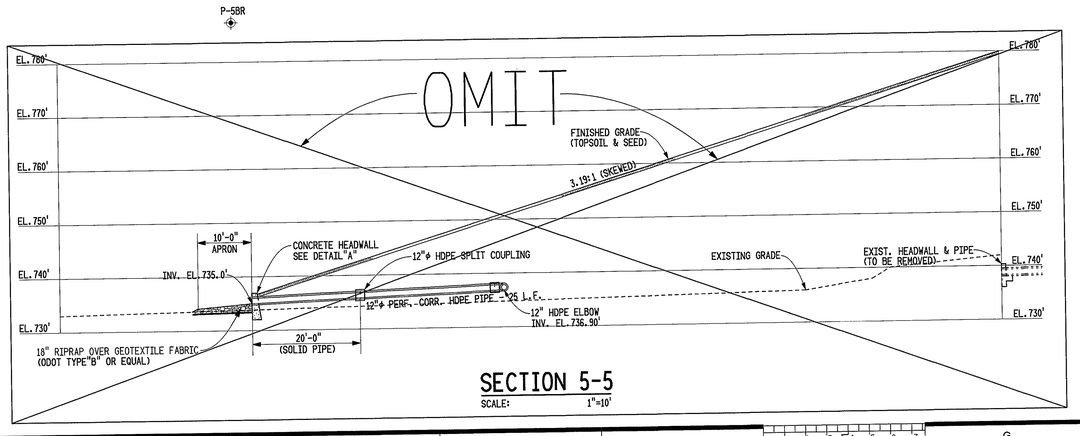
SECTION 4-4
SCALE: 1"=30'



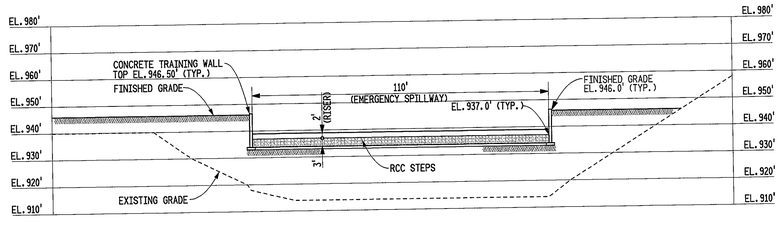
DETAIL "A"
SCALE: ½"=1'-0"

OMIT

SECTION 7-7
SCALE: ½"=1'-0"



SECTION 5-5
SCALE: 1"=10'



SECTION 6-6
SCALE: 1"=20'

FIGURE 6B

PTS No. 55689

GENERAL NOTES

1.- FOR SECTIONS LOCATION, SEE DWG. No. 13-30040.

REFERENCE DRAWINGS

13-30040 - FLY ASH DAM II RAISING GRADING & DRAINAGE PLAN.

DATE	NO.	DESCRIPTION	APP'D
4/2/97	0	ISSUED FOR CONSTRUCTION.	MKS
6/23/98	1	REV. SECTS. "3-3" & "4-4" OMITTED SECT. "5-5", "7-7" AND DETAIL "A".	MKS RCD
6/2/98	2	REMOVED HIGHER & LOWER RCC FACING & ZONE.	MKS RCD
3/31/00	3	REVISED TO REFLECT AS-BUILT CONDITIONS. FINAL SUBMITTAL TO STATE.	BMK
7/31/00	4	REVISED TO SHOW INSTALLATION DEPTH OF PNEUMATIC PIEZOMETER, AND DAM "AS-BUILT" EXCAVATION GRADES.	

REVISIONS

s:/cd/13/geo_hydro_site/30042.dgn

CARDINAL OPERATING COMPANY

CARDINAL PLANT

BRILLIANT OHIO

FLY ASH DAM II RAISING SECTIONS & DETAILS SHT.1

DWG. NO. 13-30042-4

SCALE: AS NOTED | CIVIL ENGINEERING DIVISION

ORI: Arnold Gryboski
CHI:
ENGR.:
PROJ. ENGR.:
DATE:
APPROVED BY:

AEP AMERICAN ELECTRIC POWER — 1 RIVERSIDE PLAZA COLUMBUS, OH 43215

SYSTEM DATE-18 MAY 2004
SYSTEM TIME-09:34:21
ISM= PI-0465

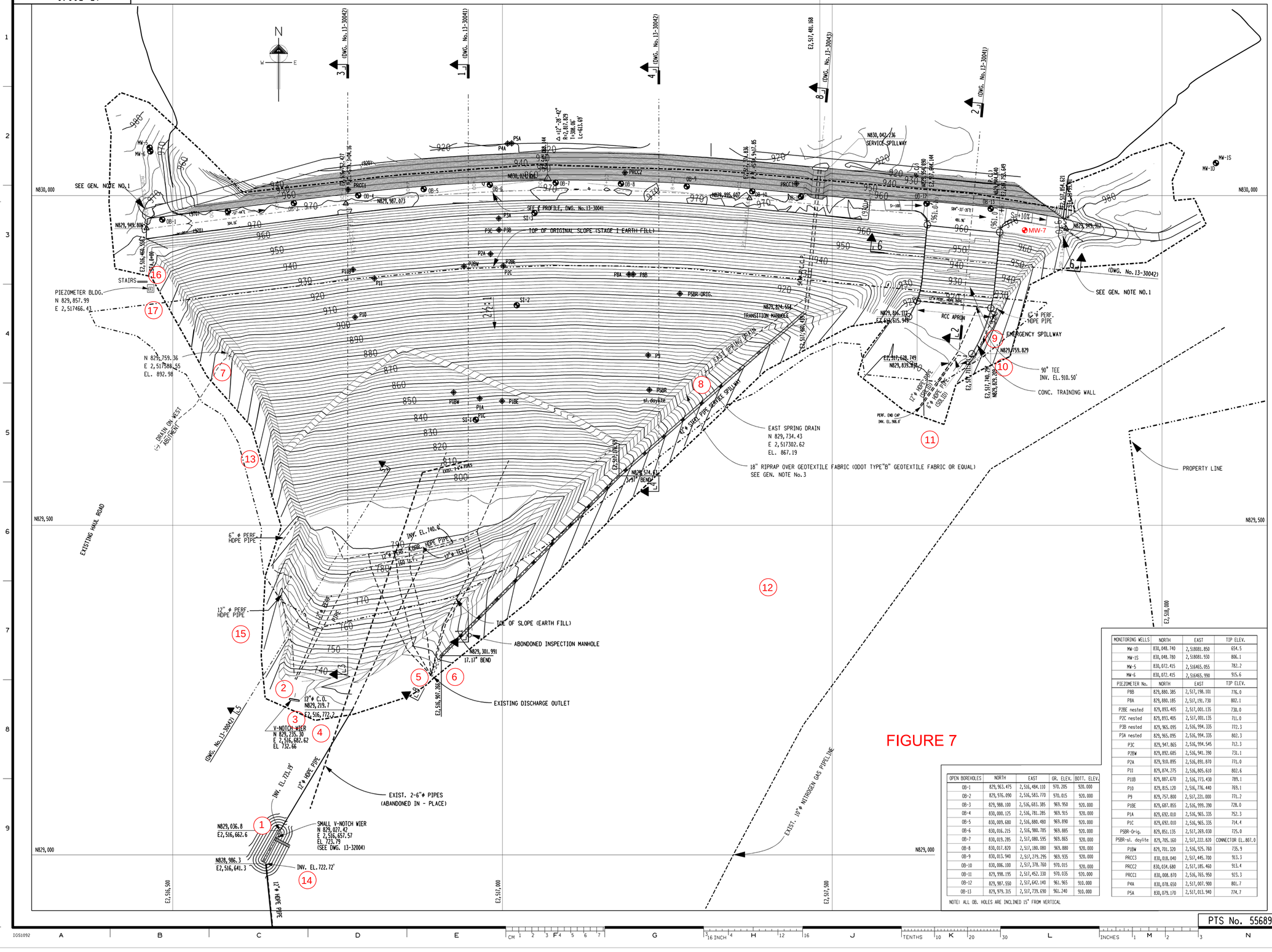
IGS1092

Appendix F

Seepage Collection Drains

	A	B	C	D	E
1	**Cardinal Fly Ash Dam II - Drains and Seepage Zones**				
2			**Date of Inspection:**	**10/23/2020**	
3	**Drain Number & Location**	**Drain Source**	**Outlet Size**	**Amount (GPM)**	**Clarity**
4	1. D/S Open Weir	Chimney / toe drain system	12" Dia.	23gpm	Clear
5	2. D/S Right Abutment	Right abutment valley	12" Dia.	85gpm	Clear
6	3. D/S Right Abutment	Slag Buttress / right abutment	12" Dia.	<1 gpm	Clear
7	4. D/S Right Abutment	Slag Buttress / Trench in Center	12" Dia.	<1 gpm	Clear
8	5. Stilling Basin / Right Side	West side of stilling basin	6" dia.	0	Clear
9	6. Stilling Basin / Left Side	East side of stilling basin	6" dia.	5.3gpm	Clear
10	7. Right Groin Ditch	West Bedrock abutment 900' elevation	12" Dia.	20.0gpm	Clear
11	8. Left Groin Ditch	East Tributary valley abutment 905"elevation	6" dia.	5.4gpm	Clear
12	9. Left D/S E/W	Emergency Spillway drainage blanket	12" Dia.	1.5gpm	Clear
13	10. Left D/S E/W	E/S Left training wall	6" dia.	1.2gpm	Clear
14	11. E/S 300' D/S Left	E/S Channel left 900" elevation	Seep Zone	<1gpm	Clear
15	12. E/S Outlet Channel	Total Seepage within Emergency Spillway	10: Dia.	10gpm	Clear
16	13. Right Abutment Hillside	Right Abutment Hillside near 920' elevation	Two - 6" dia.	<1 gpm	Clear
17	14. D/S Channel / Parshall flume	Total Flow (spillway / seepage combination)	Open Channel	8.0MGD	Clear
18	15. Right Hillside Jules Verne Weir-3	Right Hillside Jules Verne near 770' elevation	V-noch	75gpm	Clear
19	16. Right Groin Pipe-2	Right groin 6” pipe 930' elevation	6" dia.	0.3gpm	Clear
20	*17 Weir Below Piezometer Building*	*Seepage from right groin hillside*	*V-Notch*	*<0.3 gpm*	*Clear*

DWG. NO. 13-30040



GENERAL NOTES

1. - EXCAVATE ROCK SURFACE TO ACHIEVE A RIGHT ANGLE CONTACT WITH THE RCC.
2. - THE SOIL OVERBURDEN ON BOTH THE RIGHT & LEFT ABUTMENTS SHALL BE STRIPPED. A 2' BOTTOM ASH DRAINAGE BLANKET SHALL BE PROVIDED OVER THE ENTIRE STRIPPED AREA. ANY SEEPAGE ZONES FOUND DURING STRIPPING SHALL BE DRAINED AS NECESSARY BY A FRENCH DRAIN DAYLIGHTING INTO GROIN DITCH.
3. - ADJUST LOCATION OF GROIN DITCH AS REQUIRED TO CLEAR PIPE SUPPORTS.

LEGEND - EXISTING

- ~926.6 — SPOT ELEVATION
- INTERMEDIATE CONTOUR
- INDEX CONTOUR
- DEPRESSION CONTOUR
- TREES AND TREELINE
- STRUCTURE AND BUILDING
- FENCE
- POLE
- ROADS
- EDGE OF WATER
- MANHOLES / CATCH BASIN
- POWER POLE
- PIPES
- TOWER

LEGEND - PROPOSED

- +(970.0') — FIN. GRADE SPOT ELEV.
- 920 — FIN. GRADE CONTOUR
- DRAINAGE DITCH
- INCLINED BORE HOLES
- VERTICAL BORE HOLES
- PIEZOMETER

REFERENCE DRAWINGS

13-30041 - FLY ASH DAM II RAISING PROFILE & SECTION.

13-30042 - FLY ASH DAM II RAISING SECTIONS & DETAILS SHT.1.

13-30043 - FLY ASH DAM II RAISING SECTIONS & DETAILS SHT.2.

MONITORING WELLS	NORTH	EAST	TIP ELEV.
MW-1D	830,048.740	2,518081.850	654.5
MW-1S	830,048.780	2,518081.930	806.1
MW-5	830,072.415	2,516465.055	782.2
MW-6	830,072.415	2,516465.990	915.6
PIEZOMETER No.	NORTH	EAST	TIP ELEV.
P8B	829,880.385	2,517,198.101	776.0
P8A	829,880.185	2,517,191.730	802.1
P2BE nested	829,893.405	2,517,001.135	730.0
P2C nested	829,893.405	2,517,001.135	711.0
P3B nested	829,965.095	2,516,994.335	772.3
P3A nested	829,965.095	2,516,994.335	802.3
P3C	829,947.865	2,516,994.545	712.3
P2BW	829,892.685	2,516,941.390	731.1
P2A	829,910.895	2,516,891.670	771.0
P11	829,874.275	2,516,805.610	802.6
P11B	829,887.670	2,516,773.430	789.1
P10	829,815.120	2,516,776.440	769.1
P9	829,757.800	2,517,221.000	771.2
P1BE	829,687.855	2,516,999.390	728.0
P1A	829,692.010	2,516,965.335	752.3
P1C	829,692.010	2,516,965.335	714.4
PSBR-Orig.	829,851.135	2,517,269.030	725.0
PSBR-sl. daylite	829,765.160	2,517,222.820	CONNECTOR EL.807.0
P1BW	829,701.320	2,516,925.760	735.9
PRCC3	830,018.040	2,517,445.700	913.3
PRCC2	830,034.680	2,517,185.460	913.4
PRCC1	830,008.870	2,516,765.950	923.3
P4A	830,078.650	2,517,007.900	801.7
P5A	830,079.170	2,517,013.940	774.7

OPEN BOREHOLES	NORTH	EAST	GR. ELEV.	BOTT. ELEV.
OB-1	829,963.475	2,516,484.110	970.205	920.000
OB-2	829,976.090	2,516,583.770	970.015	920.000
OB-3	829,988.100	2,516,683.385	969.950	920.000
OB-4	830,000.125	2,516,781.285	969.915	920.000
OB-5	830,009.680	2,516,880.480	969.890	920.000
OB-6	830,016.215	2,516,980.785	969.885	920.000
OB-7	830,019.285	2,517,080.595	969.865	920.000
OB-8	830,017.820	2,517,180.080	969.880	920.000
OB-9	830,013.940	2,517,279.295	969.935	920.000
OB-10	830,006.100	2,517,378.760	970.015	920.000
OB-11	829,998.195	2,517,452.330	970.035	920.000
OB-12	829,987.550	2,517,642.140	961.965	910.000
OB-13	829,979.315	2,517,739.690	961.240	910.000

NOTE: ALL OB. HOLES ARE INCLINED 15° FROM VERTICAL

FIGURE 7

DATE	NO.	DESCRIPTION	APPD.
3/30/00	5	REVISED TO REFLECT AS_BUILT CONDITIONS. FINAL SUBMITTAL TO STATE	GTM/LK
5/21/99	4	AS_BUILT: REVISED TOPO, DRAIN PIPES , ADDED TABLES, PIEZOMETERS AND OPEN BORE HOLES. REMOVED MONITORING WELLS 4, 3, 2D & 2S	LMB/ #2
6/22/98	3	REMOVED INTERMEDIATE CONTOURS. INDICATED CONCRETE TRAINING WALL & GEOTEXTILE FABRIC.	LMB/ #2
5/20/98	2	DELETED DROP MANHOLE & REV. PIPE ALIGNMENT.	LMB/ #2
4/23/98	1	REV. TOE OF DAM TO REFLECT SLIDE REPAIR. RELOCATED DROP MANHOLE & REV. PIPE BEND, 6°30' WAS 6°. ADDED UNDERDRAIN SYSTEM.	LMB/ #2
4/2/97	0	ISSUED FOR CONSTRUCTION.	LMB/

REVISIONS

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CARDINAL OPERATING COMPANY

CARDINAL PLANT

BRILLIANT OHIO

FLY ASH DAM II RAISING GRADING & DRAINAGE PLAN

DWG. NO. 13-30040-5

SCALE: 1"=50' — CIVIL ENGINEERING DIVISION

DR: RPD
CH: GTM
ENGR.: LMB
PROJ. ENGR.:
DATE: 4/2/97
APPROVED BY: H. Joseph Bubac

AEP AMERICAN ELECTRIC POWER — 1 RIVERSIDE PLAZA COLUMBUS, OH 43215

PTS No. 55689

IGS1092

SYSTEM DATE: 26 JAN 2005
SYSTEM TIME: 14:08:29