Amanda Graphics, LLC
Engineering Consulting & CAD Support

2022 Annual Landfill Inspection Report

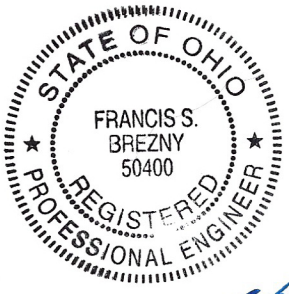
Cardinal Plant

2022 CCR Landfill Inspection Report

CARDINAL OPERATING COMPANY

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

January, 2023



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1/6/2023

Prepared for:

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1. Introduction

This report was prepared by Amanda Graphics, LLC, to fulfill requirements of 40 CFR 257.84 and to provide Cardinal Operating Company and Buckeye Power, Inc. with an evaluation of the FAR I Residual Waste Landfill, located at the Cardinal Power Plant. The Cardinal Power Plant is located at 306 County Road 7 East, Brilliant, OH, 43913, in Jefferson County. Generating Units 1, 2 and 3 are owned by Buckeye Power. The power plant is managed and operated by Cardinal Operating Company.

Amanda Graphics, LLC completed the annual inspection in accordance with the CCR Rule requirements and prepared the following Cardinal Plant CCR Landfill Annual Inspection report.

The annual inspection was previously completed by AECOM in 2018 and 2019. The 2020 and 2021 annual inspections were completed by Amanda Graphics, LLC staff, J.T. Massey-Norton (Sn. Geologist), accompanied by Amanda Padamadan under the supervision of Francis S. Brezny (PE). Mr Nicholas Kasper C.P.G. of Buckeye Power, Mr. E. Randy Sims P.E. and Mr. Zachary Miller both of whom are employees of the Cardinal Operating Company and are directly responsible for the management of the CCR landfill. The site inspection was performed on September 22nd, 2022. Weather conditions were good, ranging from cloudy to partly sunny as the day progressed with temperatures reaching into the mid 70°F.

This report contains inspection findings, observations, photographs, conclusions, and maintenance recommendations. An aerial survey was performed by Jack A. Hamilton & Assoc., Inc. on Nov 19th, 2022(Appendix A.) A field photographic log identifying typical conditions and any items that need correction or requiring additional monitoring is provided in Appendix B.

2. Facility Description

2.1 Permit History

The Cardinal Plant FAR I Residual Waste Landfill was constructed under Permit to Install (PTI) No. 06-07993, issued on May 11, 2007 by the Ohio Environmental Protection Agency (Ohio EPA). The landfill's initial purpose was to dispose of flue gas desulfurization (FGD) gypsum material produced as a byproduct of the power plant's flue gas scrubber system and solids from the wastewater treatment plant (WWTP). As operational changes have been made at the plant, the landfill also receives fly ash, bottom ash, and other minor residual solid wastes (i.e.: cooling tower sediment).

The agency approved an alteration to the PTI on June 29, 2007, that incorporated several revisions to the Quality Assurance/Quality Control (QA/QC) Plan. A second alteration (Alteration No. 2) was approved on September 2, 2008, addressing re-sequencing plans and revisions to the preloading plans for Cells 3, 4, 5 and 6. In addition to Alterations No. 1 and 2, a modification to PTI No. 06-07993 was approved by Ohio

EPA on August 10, 2011. The modification included revising the approved limits of waste by partially expanding as well as retracting the limits of waste in both the vertical and horizontal directions. The PTI modification also included the retention of the six-existing groundwater monitoring wells at the facility.

In 2020, The Cardinal Operating Company obtained two additional permit alterations. On October 27th, 2020, the Ohio EPA approved an alteration to receive an additional residual solid waste stream, dry fly ash. On December 24th, 2020, the Ohio EPA also approved a permit alteration to install pretreatment settling tanks to manage the landfill leachate once the FAR II impoundment initiate closure. On July 18th, 2022, Ohio EPA approved an alteration for the Landfill to receive Cooling Tower Sediment.

2.2 Landfill Components

The 129.45-acre landfill consists of two phases and six cells. Phase 1 consists of Cells 1 and 2 which overlie the bench area between FAR I and a bedrock highwall that is located around a portion of the facility's perimeter on its north and west sides. Cells 1 and 2 are constructed over bedrock near the highwall interfacing with the mine spoil berm of FAR I. Phase 2 consists of Cells 3, 4, 5, and 6. Figure 1 depicts the 2022 survey for Cells 1 and 3 and Figure 2 represents the general facility layout (Appendix A).

Cell 1 and Cell 3 (the northernmost cells of the landfill) are the only currently active cells at the facility; Cells 2, 4, 5, and 6 are inactive. Cell 1 is approximately 23 acres in size and is bound by two features - the highwall to the south and the mine spoil berm/bench to the north. The bench area of Cell 1 was constructed and certified in 2007 and 2008. A portion of the highwall area (approximately 60 ft. in height) was built and certified.

Cell 3 is approximately 21.25 acres in area and is bound by the termination berm and landfill haul road to the north and east, the interphase berm to the west, and the Cell 3/Cell 4 inter-cell berm on the south. Cell 3 is built over a part of the former ash pond with a 10 ft. thick layer of bottom ash and a soil cover layer.

At the time of this inspection Cells 2, 4, 5, and 6 are still in pre-construction condition. Earthen materials are being stockpiled in these cells to be used in future construction.

2.2.1 Active Placement Areas

The active placement areas during this landfill inspection include Cell 1 and Cell 3. During the past year, there has been very little placement in Cells 1 and 3 due to sales of the gypsum byproduct material. Gypsum is continuing to be reclaimed from Cell 1 for beneficial utilization. In order to continue the reclamation of gypsum from Cell 1, Cell 3 has been the primary cell for receiving other wastes, including dry fly ash and wastewater treatment plant solids.

2.2.2 Closed Areas

Closed areas include a small portion of Cell 1 (approximately one acre) that was closed in 2009.

2.2.3 Inactive Areas

As mentioned in section 2.2, Cells 2, 4, 5, and 6 are in pre-construction condition. Earthen and granular drainage materials are being stockpiled in these cells to be used in future construction. The stockpiles are graded to promote positive drainage and stormwater is discharged to a permitted NPDES outfall.

2.2.4 Leachate Collection System

The leachate collection system (LCS) at FAR I Residual Waste Landfill was constructed in 2007. The LCS is constructed of granular drainage materials embedded with collection pipes connected to risers extending through the CCR fill. The landfill's LCS is graded to drain to the east side of the landfill where the leachate is then routed into collection manholes which are connected by a transmission pipe, becoming progressively larger from 24” diameter in the north to 36” diameter at the south end. The transmission pipe discharges to a collection sump and is no longer discharged to the FAR 2 pond. On the date of the inspection, the leachate effluent was observed to be flowing freely into the concrete sump without obstruction and was visually clear. The effluent is then pumped to pretreatment settling tanks, prior to discharging to a permitted NPDES outfall.

2.2.5 Subsurface Drainage Collection System

A subsurface drainage layer (SDL) was incorporated in the landfill design to prevent uplift conditions to the landfill liner. The system consists of a 2-foot thick (minimum) layer of free-draining material (the SDL), a geotextile placed above the SDL as a separator, 6” diameter perforated HDPE subsurface drainage pipes, 6” diameter solid HDPE transmission pipes. The subsurface drainage pipes also discharge into the leachate collection sump, and is pretreated in the settling tanks, prior to discharging to a permitted NPDES outfall.

2.3 Constructed and Available Capacity

The constructed storage capacities of Cell 1 and Cell 3 are 2.04 million cubic yards and 2.89 million cubic yards, respectively. The total permitted waste volume of the landfill is 18.95 million cubic yards. The total permitted area of the landfill is approximately 129.45 acres and the currently constructed area of the landfill is approximately 44.28 acres (Cell 1 and Cell 3). There is approximately 43.6 ft vertical feet between the as-built limit of waste to the permitted limited design grades for both cells. Therefore, the as-built volume is less than the permitted volume.

3. Regulatory Requirements

The Annual inspection report is completed to meet CCR regulatory requirements specified in CCR Rule Section 257.84(b)(1). These requirements include at a minimum:

(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., the results of inspections by a qualified person, and results of previous annual inspections); and

(ii) A visual inspection of the CCR unit to identify signs of distress or malfunction of the CCR unit.

In addition to the annual inspections, 7-day inspections per CCR Rule Section 257.84(a)(1) are completed by Cardinal Operating Company and are documented in the facility operating record per § 257.105(g)(5) .

Once the annual inspection has been completed, the CCR Rule Section 257.84(b)(2) requires the qualified professional engineer to prepare a report following each inspection that addresses the following:

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

(ii) The approximate volume of CCR contained in the unit at the time of the inspection.

(iii) 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

(iv) Any other change(s) which may have affected the stability or operation of the CCR unit since the previous annual inspection.

4. Review of Available Information 257.84(b)(1)(i)

Pursuant to CCR Rule Section 257.84(b)(1)(i), prior to completing the visual inspection, Amanda Graphics, LLC has reviewed available information regarding the status and condition of the landfill, which includes files available in the operating record, such as design and construction information, previous 7 day inspection reports, and previous annual inspections. This information was referenced prior to and during the inspection (if needed).

Cardinal Operating Company personnel complete an inspection of the landfill facility every 7-days. This includes a visual inspection of the landfill components including the active areas, final cover area, culverts, drainage berms/ditches, leachate collection system, leachate pond, leachate pumps, and haul roads. The inspections are completed to comply with the requirements of § 257.84 of the CCR Rule. Amanda Graphics, LLC was provided access to and has reviewed the 7-day inspection reports from January 1, to December 28, 2022. These reports have noted no significant deficiencies or maintenance items.

5. Inspection (257.84(b)(1)(ii))

5.1 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. These 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 expected, 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.

A “deficiency” is some evidence that a landfill has developed a problem that could impact the structural integrity of the landfill. 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 observe it 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**: Displacement of berms, embankments, or waste masses is large scale movement of part of the structure. Common signs of displacement are cracks, scraps, bulges, depressions, sinkholes, and slides.

3. **Blockage of Control Features**: Blockage of Control Features is the restriction of flow at spillways, pipes or pipe outfalls, 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.

Results of the visual inspection performed on September 22nd, 2022 are summarized below.

5.2 FAR I Residual Waste Landfill Inspection Findings

The overall site layout in plan view is shown in Appendix A. The site inspection began in the southwest corner of the landfill's Cell 1 area progressing along the highwall. The inspection then observed the condition of the active fill areas of both cells progressing to the closed and capped portions/perimeter berms of the landfill. As previously noted, Cells 4, 6, 5, and 2 have not been constructed but have been used to stockpile fill materials for future construction activities. A photographic log of the facility site conditions at the time of the September 22nd, 2022 inspection is included in Appendix B.

Areas where no activity was taking place were observed to be in excellent condition and were protected using a polymeric dust suppressant which had been sprayed on the surface (Photo 1). No fugitive dust was observed on the date of the inspection at any location. The temporary slopes within the active waste placement areas were also observed to be in excellent condition exhibiting uniform slopes, no erosion, slumping or other signs of instability or displacement.

The bedrock highwall located along the western perimeter of Cell 1 appeared to be stable with no significant rock overhangs, rockfall or other signs of instability. The bedrock highwall is composed of alternating sequences of thin to thick bedded limestone interbedded with shale and siltstone reaching a height of 60 ft. No ponded water or uncontrolled seepage flows were observed at the base of the highwall, suggesting that the seepage collection system is functioning as intended. (Photo 2).

The active fill areas within Cells 1and 3 were observed to be well maintained and in excellent condition. Cell 1 did not exhibit any ponded water or erosion within the cell and appeared to be well graded to promote drainage to the LCS's risers (also referred to as chimney drains). The riser structures (exposed on account of the excavation activities) were surrounded and protected by a layer of CCR to prevent impact from heavy equipment (Photo 3). FGD gypsum is actively being excavated from Cell 1 for beneficial utilization (Photo 4). Dry fly ash is actively being landfilled in Cell 3.

All areas in Cell 1 with protective vegetative cover established such as the closed portion of the landfill and berms had a healthy grass stand but did exceed 12 inches in most areas. The northern closed area was in excellent condition. No erosion or animal burrows were observed, and the slopes were uniform (i.e., no slumping or bulging) and appeared to be well drained. No standing water was observed or soft/wet areas on the surface (Photo 5). There was a minor disturbance of the soil cap near the crest in Cell 1 where a backhoe operator created an unintentional excavation of the soil cap. The depth of the excavation was

measured to be 2.3 ft deep and approximately 4.5 ft long (Photos 6 and 7). Cardinal reported repair of the unintentional excavation and soil cap in October 2022.

A monitoring well located at the toe of the slope in Cell 1 was observed to be in excellent condition. The concrete well pad was not cracked or undermined, protective bollards were adequately spaced, and the casing protector was locked (Photo 8).

All areas in Cell 3 with protective vegetative cover established such as the closed portion of the landfill and berms had a healthy grass stand but did exceed 12 inches in most areas. No erosion, animal burrows, slumping or other signs of slope instability were observed (Photo 9).

In Cell 3, the perimeter ditch was observed vary from poor to good conditions. Poor conditions were observed along the northern most end of Cell 3 between the active fill and the soil cover cap (Photos 10 and 11). The perimeter ditch within this area did not have well defined slopes used to contain runoff from the active fill area. Ponded water within the ditch was observed in the vicinity of the former access road into Cell 3 (Photos 12 and 13). The remainder of the ditch along Cell 3 was observed to be in good condition showing well defined channel slopes with good alignment, unobstructed flow and no scouring or erosion along the toe of the active fill area (Photo 14). Cardinal reported repair of the Cell 3 perimeter ditch by adding clay and regrading the berm in October 2022.

Minor ponding of water was observed at the upstream end of culverts at the former access road and current access road into Cell 3. There is sediment deposition along with a vegetative mat that is partially blocking drainage at both culverts (Photos 15 to 18). Cardinal reported clean-out of the culverts in December 2022.

The pedestal for settlement profiler No.1 and associated piping was observed to be in excellent condition (Photo 19). Settlement profiler No. 2 also shows excellent conditions along with the LCS manhole (i.e., no cracking, concrete spalling or exposed rebar) (Photo 20). Photo 21 shows the excellent condition of the manhole’s interior. The landfill's leachate was observed to be flowing freely into the manhole.

The interim berm between Cell 3 and the landfill's undeveloped cells was observed to be in good condition with the slope terminating at a crest which forms a temporary ditch along the perimeter of the cell to convey contact storm water to the LCS. The interim slope is constructed with a temporary cover soil in which an established vegetation was observed to be in good condition. The slope appeared to be uniform and free of displacement or other signs of instability (Photo 22). The stockpiles within the future undeveloped landfill cells shows an orderly excavation of these fill materials (Photo 23). The stockpiles are well graded to promote drainage.

The mowing operation was on going at the time of the inspection using a tractor with a pull behind mower (Photo 24). Mowing operations were observed to occur in three large areas where rutting and water ponding has resulted (Photo 25). These areas will require a minor amount of regrading to reestablish the swale and reseeding (Photos 26 and 27).

The leachate collection sump structure was observed to be in good condition and with leachate flowing freely into the concrete sump on the date of the inspection (Photos 28 and 29).

The leachate effluent is then discharged to pretreatment settling tanks in which temperature and effluent levels are monitored (Photo 30).

5.2.1 Changes in Geometry since Last Inspection 257.84(b)(2)(i)

No significant changes have been made to the FAR I Residual Waste Landfill facility since the 2021 inspection. The landfill was maintained during operations by placing dust suppressant on inactive slopes, mowing the vegetative cover, and other maintenance requirements, as necessary. The landfill has a maximum permitted elevation of approximately 1,180 feet above mean sea level (MSL), and the current maximum landfill elevation is approximately 1,110 feet above MSL.

5.2.2 CCR Landfill Volume 257.84(b)(2)(ii)

The plant is currently pursuing beneficial utilization of gypsum and successfully excavates and reclaims the byproduct for beneficial use. For the year 2022, Cardinal had a net disposal (total disposed versus reclaimed) of approximately 62,226 cubic yards of CCR and non-CCR waste streams.

The total volume of waste material contained in the Cardinal Plant CCR Landfill has increased to approximately 2.3 million cubic yards.

5.2.3 Changes That Affect Stability or Operation 257.84(b)(2)(iii)

No appearances of actual or potential structural weakness of the CCR unit were identified during the 2022 inspection. No existing conditions were identified that were or had the potential to disrupt the operation and safety of the FAR I Residual Waste landfill. No deficiencies or disrupting conditions that would require immediate measures to remedy were identified in the inspection.

5.2.4 CCR Landfill Changes 257.84(b)(2)(iv)

The current survey indicates that all areas of active placement within Cells 1 and 3 have surface elevation that lies below the permitted top of waste grade.

6. Conclusions

The landfill's earthen berms, and open, closed, and inactive areas appear to be in good to excellent condition. The active disposal area of the landfill was in good condition with no evidence of significant erosion or water ponding. The vegetative growth along the downstream slopes of the earthen berms was in excellent condition. The closed areas of the landfill appeared to be stable and well maintained. The discharge structures and pipes were in excellent condition.

7. Recommendations – General Maintenance and Monitoring Conditions

7.1 Overall

1. Continue to mow all vegetated berms on a regular basis to prevent the growth of excess woody plants and brush.
2. Continue to complete regular maintenance of minor erosion rills and use the polymer as needed for erosion control and fugitive dust control.
3. Continue to complete weekly inspections and submit inspection reports to the operating record.

7.2 Open Areas

1. Continue to monitor the leachate collection system and spring drain collection system for unobstructed flow.
2. The perimeter ditch along the toe of the active slope needs to be elevated and regraded to maintain an unobstructed flow. Cardinal reported regrading was completed in October 2022, prior to issuance of this report.
3. Continue all current maintenance and fill placement practices. Additional precautions should be implemented when placing CCR fill around the 6 monitoring wells at the north end of Cell 3.

7.3 Closed Areas

1. Continue current maintenance practices including but not limited to continuing to maintain the vegetative cover height at 6 inches or less and continue the 7-day inspections of the area.
2. Equipment operators need to be trained to prevent rutting with subsequent ponding of water from mowing operations.

8. Recommendations – Remedial Actions/Repairs

8.1 Open Areas

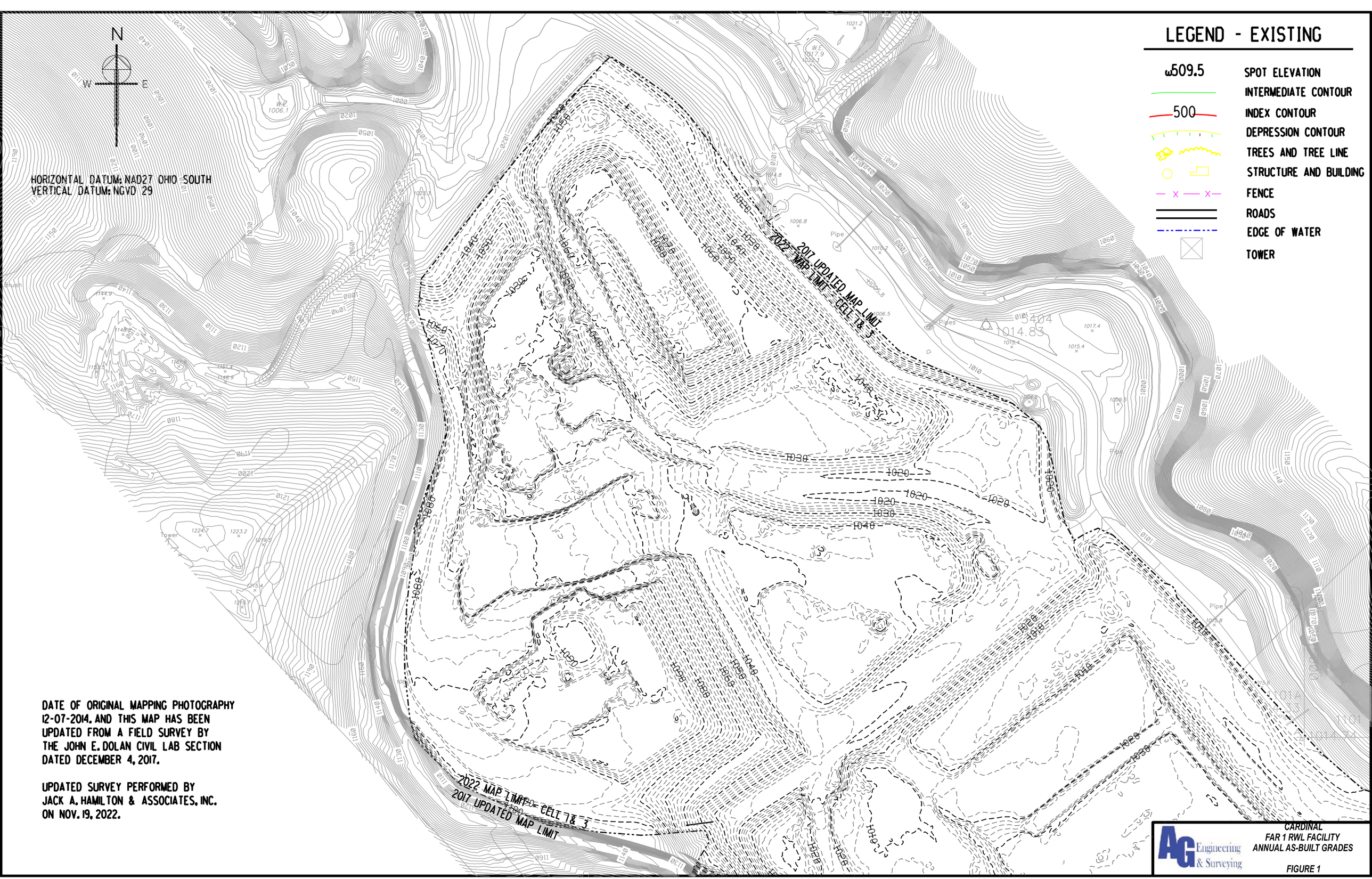
1. There were no deficiencies, signs of structural weakness, or signs of disruptive conditions observed at the time of the inspection that would require additional investigation or remedial action.

8.2 Closed Areas

1. 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.

Appendix A

Aerial Survey



DATE OF ORIGINAL MAPPING PHOTOGRAPHY 12-07-2014. AND THIS MAP HAS BEEN UPDATED FROM A FIELD SURVEY BY THE JOHN E. DOLAN CIVIL LAB SECTION DATED DECEMBER 4, 2017.

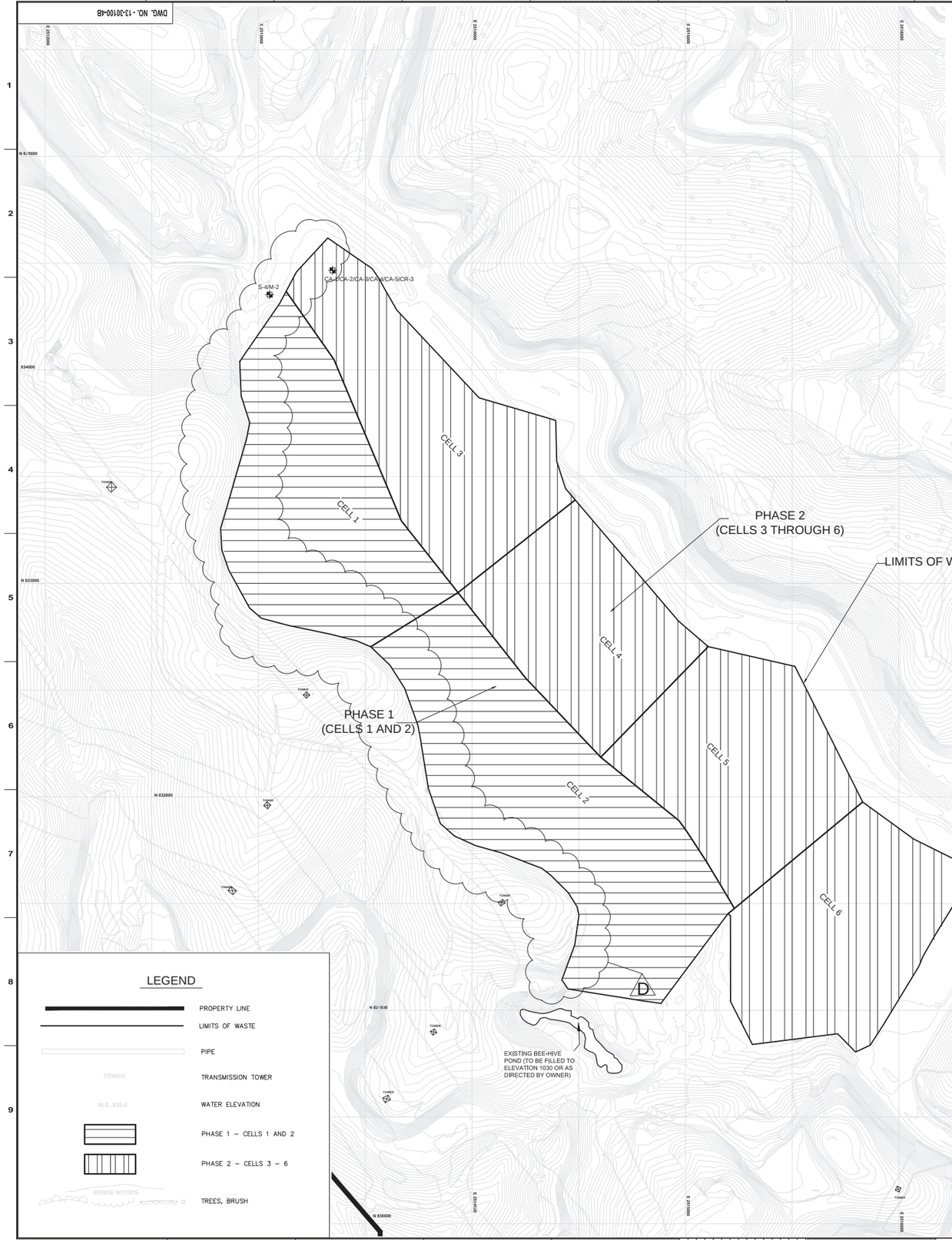
UPDATED SURVEY PERFORMED BY JACK A. HAMILTON & ASSOCIATES, INC. ON NOV. 19, 2022.

AG Engineering & Surveying

CARDINAL
FAR 1 RWL FACILITY
ANNUAL AS-BUILT GRADES

FIGURE 1

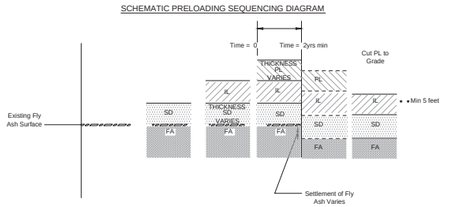
DWG. NO. - 13-30100-4B



LEGEND

- PROPERTY LINE
- LIMITS OF WASTE
- PIPE
- TOWER — TRANSMISSION TOWER
- W.E. 836.6 — WATER ELEVATION
- PHASE 1 – CELLS 1 AND 2
- PHASE 2 – CELLS 3 – 6
- DENSE WOODS — TREES, BRUSH

SCHEMATIC PRELOADING SEQUENCING DIAGRAM



SCHEMATIC LEGEND

- FA (FLY ASH)
- SD (SUBSURFACE DRAINAGE / CONTOURING FILL LAYER)
- PL (PRELOAD LAYER)
- IL (ISOLATION LAYER)

CELL #	AREA (ACRE)	WASTE VOLUME (CY)
1	23.03	2,042,000
2	31.65	3,049,000
3	21.25	2,894,000
4	15.68	4,083,000
5	18.66	4,602,000
6	19.18	2,273,000
TOTAL	129.45	18,943,000

VOLUMES GIVEN ABOVE REPRESENT VOLUMES DETERMINED FROM THE SERIES 6 CONSTRUCTION STAGING AND OPERATION DRAWINGS.

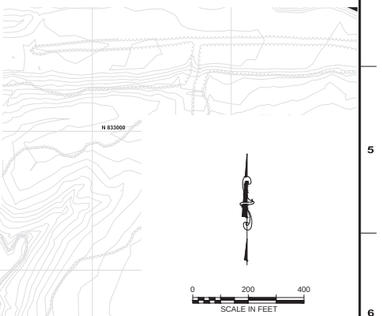
D

PHASE 1 CONSTRUCTION

1. IMPROVE EXISTING ACCESS ROADS AND CONSTRUCT LAY DOWN AREAS, STAGING AREAS, AND EROSION CONTROL STRUCTURES.
2. EXCAVATE EXISTING MINE SPOIL FROM PHASE 1 AREA. (SEE SHEET 4C FOR GRADING PLAN)
3. PROCESS MINE SPOIL FOR PLACEMENT AS ISOLATION LAYER MATERIAL FOR PHASE 1, PHASE 2, AND AS REPLACED SUBGRADE MATERIAL.
4. STOCKPILE PROCESSED MATERIAL IN PHASE 1 AREA OR ANOTHER DESIGNATED AREA.
5. PLACE PRELOAD IN PHASE 2 CELLS.
6. PLACE SUBGRADE MATERIAL ABOVE EXCAVATED AREA (SEE SHEET 4D FOR GRADING PLAN).
7. CONSTRUCT PHASE 1 SUBSURFACE DRAINAGE LAYER ABOVE SUBGRADE (MINIMUM 2 FEET THICK) (SEE SHEET 4E).
8. PLACE GEOTEXTILE ABOVE SUBSURFACE DRAINAGE LAYER AS SEPARTOR.
9. CONSTRUCT CONTOURING FILL LAYER (SEE SHEET 4F).
10. CONSTRUCT PHASE 1 ISOLATION LAYER (MINIMUM 5 FEET THICK) (SEE SHEET 4G).
11. CONSTRUCT PHASE 1 RECOMPACTED SOIL LINER ABOVE ISOLATION LAYER (MINIMUM 1.5 FEET THICK) (SEE SHEET 4I).
12. PLACE GEOMEMBRANE ABOVE RECOMPACTED SOIL LINER (PVC LINER).
13. PLACE GEOTEXTILE AS CUSHION ABOVE GEOMEMBRANE.
14. CONSTRUCT TEMPORARY LEACHATE PIPING ACROSS FAR 1 BENEATH BOTTOM OF PHASE 2 ISOLATION LAYER (SEE SHEETS 6A AND 7B).
15. CONSTRUCT LEACHATE MANAGEMENT SYSTEM COLLECTION MANHOLES, TRANSMISSION PIPING AND SAMPLING STRUCTURE.
16. CONSTRUCT PHASE 1 LEACHATE MANAGEMENT LAYER (MINIMUM 1 FOOT THICK)) AND PLACE GEOTEXTILE AS SEPARATOR AND FILTER ABOVE AND BELOW LAYER (SEE SHEET 4J).
17. PLACE PROTECTIVE COVER (MINIMUM 3 FEET THICK) ABOVE LEACHATE COLLECTION LAYER.
18. CONSTRUCT INTERPHASE BERM AND TEMPORAY LINER SYSTEM TERMINATION BETWEEN PHASE 1 AND PHASE 2.
19. BEGIN PHASE 1 WASTE PLACEMENT OPERATIONS (SEE SHEET 4K).
20. AS WASTE REACHES FINAL GRADES, BEGIN FINAL COVER PLACEMENT IN ACCORDANCE WITH FINAL COVER CONSTRUCTION STAGING AND OPERATION STAGES. (SEE SHEET 6B AND 6C).

PHASE 2 CONSTRUCTION

1. CONSTRUCT PHASE 2 SUBSURFACE DRAINAGE LAYER ABOVE EXISTING FAR 1 COVER (MINIMUM 2 FEET THICK) (SEE SHEET 4E).
2. PLACE GEOTEXTILE ABOVE SUBSURFACE DRAINAGE LAYER AS SEPARATOR.
3. CONSTRUCT CONTOURING FILL LAYER (SEE SHEET 4F).
4. CONSTRUCT PHASE 2 ISOLATION LAYER (MINIMUM 5 FEET THICK) (SEE SHEET 4G).
5. PLACE TEMPORY GEOTEXTILE LOCATOR AND CONSTRUCT MINESPOIL PRELOAD IN PHASE 2 CELLS (SEE SHEET 4H).
6. REMOVE PRELOAD AND GEOTEXTILE LOCATOR. REESTABLISH BASE GRADE AND FILL AND RECOMPACT SURFACE TO ISOLATION LAYER MINIMUM REQUIREMENTS (SEE SCHEMATIC PRELOADING PLACING DIAGRAM ON THE LEFT).
7. CONSTRUCT PHASE 2 RECOMPACTED SOIL LINER (MINIMUM 1.5 FEET THICK) ABOVE RECOMPACTED ISOLATION LAYER (SEE SHEET 4I).
8. PLACE GEOMEMBRANE ABOVE RECOMPACTED SOIL LINER (PVC LINER).
9. PLACE GEOTEXTILE AS CUSHION ABOVE GEOMEMBRANE.
10. CONSTRUCT PHASE 2 LEACHATE MANAGEMENT LAYER (MINIMUM 1 FOOT THICK) AND PLACE GEOTEXTILE AS SEPARATOR AND FILTER ABOVE. ABANDON OR REMOVE PREVIOUS TEMPORARY LEACHATE PIPING AFTER CONNECTION OF PHASE 2 PERMANENT PIPING.
11. PLACE PROTECTIVE COVER (MINIMUM 3 FEET THICK) ABOVE LEACHATE COLLECTION LAYER. REMOVE PORTION OF INTER PHASE BERM ABOVE PROTECTIVE COVER.
12. BEGIN PHASE 2 WASTE PLACEMENT OPERATIONS (SEE SHEET 4K).
13. AS WASTE REACHES FINAL GRADES, BEGIN FINAL COVER PLACEMENT IN ACCORDANCE WITH FINAL COVER CONSTRUCTION STAGING AND OPERATION STAGES. (SEE SHEET 6D THRIUGH 6G AND 4M FOR FINAL GRADES).



DATE	NO.	DESCRIPTION	APPD.
	D	PTI MODIFICATION NO. 1	
NOV 17 2003	C	REVISED - NOD 2 RESPONSE	DGB
MAY 25 2006	B	REVISED - NOD 1 RESPONSE	DGB
OCT 24 2005	A	ISSUED FOR PERMIT	DGB

REVISIONS

CARDINAL OPERATING COMPANY

CARDINAL PLANT

BRILLIANT OHIO

TITLE:

CARDINAL FAR 1
RESIDUAL WASTE LANDFILL
GENERAL DEVELOPMENT

DWG. NO. 13-30100-4B-D

SCALE:
DR:
CH:
ENGR.
PROJ. ENGR.
DATE:

CIVIL ENGINEERING DIVISION

APPROVED/DATE

AEP AMERICAN ELECTRIC POWER

1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

SIGNATURE

DATE

DRAWING 4B OF 39

O.E.P.A. DRAWING NO. 4B

FIGURE 2

IGS1092

SYSTEM DATE- SYSTEM TIME- 15th PLACED

Appendix B

Landfill Inspection Photographs

Photo 1
Typical view of a slope protected with a dust suppressant.

Photo 2
Typical view showing good conditions along the length and height of the highwall.

Photo 3
View of Cell 1 showing excellent conditions of the FGD

Photo 4
Typical view showing the reclamation of FGD gypsum for beneficial reutilization.

Photo 5
Typical view of Cell 1 looking eastward showing excellent conditions. No erosion, animal borrows, slumping or other signs of slope instability were observed.

Photo 6
View of a divot created by a backhoe operator error

Photo 7
The depth of the divot was measured to be 2.3 ft which was brought to the attention of the landfill supervisor.

Photo 8
Typical view showing excellent conditions for a monitoring well located near the toe of Cell 1. No deterioration of the concrete pad was observed. Protective bollards and a locked casing protector were also observed to be in excellent conditions.

Photo 9
Typical view of Cell 3 looking westward showing excellent conditions. No erosion, animal borrows, slumping or other signs of slope instability were observed.

Photo 10
View of perimeter ditch in Cell 3 between the active fill slope and the cover cap showing poor conditions.

Photo 11
Southward looking view of the perimeter ditch in Cell 3 between the active fill slope and the cover cap showing poor conditions.

Photo 12
View of perimeter ditch in the area of the former access road into Cell 3. The area needs to be filled and the ditch needs to be reestablished to provide positive drainage in the area.

Photo 13
Ponding along the perimeter ditch in Cell 3 between the active fill slope and the cover cap in the area shown in Photo 12

Photo 14
View of the perimeter ditch along Cell 3 showing satisfactory conditions in alignment, unobstructive flow and no erosion or ponding of water.

Photo 15
Minor ponding in front of the culvert for the former access road into Cell 3.

Photo 16
Close up view of the culvert shown in Photo 15 showing sediment deposition and vegetative mat buildup at the upstream end of the culvert.

Photo 17
Typical view of access road into Cell 3 showing excellent vegetative growth along the slopes and the centerline of the drainage ditch at the toe of the slope

Photo 18
Close up view of the culvert shown in Photo 17 showing sediment deposition and vegetative mat buildup at the upstream end of the culvert beneath the current access road into Cell 3.

Photo 19
Typical view of the settlement profiler No. 1 concrete pedestal and associated piping showing good conditions.

Photo 20
Typical view showing excellent conditions of the settlement profiler No. 2 concrete pedestal and the manhole for the leachate collection pipe. Vegetation is well established and is being maintained to allow access to both the manhole and settlement profiler.

Photo 21
Typical view showing excellent conditions of the manhole's interior for the leachate collection pipe. No spalling, cracking or noticeable deterioration of the concrete was observed. Leachate was flowing freely along the base of the manhole.

Photo 22
Typical view showing excellent conditions of the interim slope between Cells 1 and 3 and future cell. The slope is uniform with no erosion or slumping and has an excellent vegetative cover.

Photo 23
Typical view of showing the orderly excavation of stockpiles within located within the landfill's future cells.

Photo 24
Typical view of the tractor and pull behind mower being used to control vegetation on grassed covered slopes. In general, the mowing operation has provided very good control in keeping a healthy grass covered soil cap on permanently closed areas and interim slopes.

Photo 25
Mowing operations need to be curtailed along flat lying areas (grassed covered swales) adjacent to the toe of Cell 3. Three large areas of rutting and water ponding were observed and will require regrading to reestablish drainage and seeding.

Photo 26
Close up view of rutting and subsequent ponding of water along the toe of Cell 3.

Photo 27
Damage to soil grassed areas due to mowing along stockpiled areas.

Photo 28
Typical view of the leachate collection sump showing excellent conditions.

Photo 29
View of the leachate collection sumps interior showing unobstructed flow of leachate into the sump.

Photo 30
Typical view of the leachate collection tanks. The leachate is discharged to the Ohio River via an NPDES permitted outfall.