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October 10, 2016
File: 175534018
Revision 0

Indiana-Kentucky Electric Corporation
3932 U.S. Route 23
P.O. Box 468
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**RE: Closure and Post-Closure Plans
Clifty Creek CCR Landfill
EPA Final Coal Combustion Residuals (CCR) Rule
Clifty Creek Station
Madison, Jefferson County, Indiana**

1.0 PURPOSE

This letter documents Stantec's certification of the EPA Final CCR Rule closure and post-closure plan for the Clifty Creek Station's CCR Landfill.

2.0 CLOSURE AND POST-CLOSURE PLAN

The closure plan describes the steps necessary to close the CCR unit at any time during the life of the unit, and is subject to the requirements described in 40 CFR 257.102(b). The post-closure plan describes the monitoring and maintenance activities to be performed during the post-closure period of the unit, and is subject to the requirements of 40 CFR 257.104(d).

3.0 SUMMARY OF FINDINGS

The EPA Final CCR Rule closure and post-closure plan is conceptual and subject to the completion of all necessary environmental reviews. It is therefore subject to change at any time. The attached closure and post-closure plan demonstrates compliance with the requirements set forth in 40 CFR 257.102(b) and 257.104(d).

4.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Stan A. Harris, being a Professional Engineer in good standing in the State of Indiana, do hereby certify, to the best of my knowledge, information, and belief:

1. that the information contained in this certification is prepared in accordance with the accepted practice of engineering;
2. that the information contained herein is accurate as of the date of my signature below;



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**RE: Closure and Post-Closure Plans
Clifty Creek CCR Landfill
EPA Final Coal Combustion Residuals (CCR) Rule
Clifty Creek Station
Madison, Jefferson County, Indiana**

3. that the closure plan for the Clifty Creek Station's CCR Landfill meets the requirements described in 40 CFR 257.102(b); and
4. that the post-closure plan for the Clifty Creek Station's CCR Landfill meets the requirements of 40 CFR 257.104(d).

SIGNATURE Stan A. Harris

DATE 10/10/16

ADDRESS: Stantec Consulting Services Inc.
11687 Lebanon Road
Cincinnati, OH 45241

TELEPHONE: (513) 842-8200

ATTACHMENT: Clifty Creek CCR Landfill Closure and Post-Closure Plans



Closure Plan

CFR 257.102(b)

CCR Landfill

Clifty Creek Station

Madison, Indiana

October 2016

Prepared by: Indiana-Kentucky Electric Corporation

3932 U.S. Route 23

Piketon, OH 45661



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Attachment A – Closure Plan submitted to Indiana Department of Environmental
Management

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1.0 OBJECTIVE

This report has been prepared to fulfill the requirements of 40 CFR 257.102(b) of the Coal Combustion Residuals (CCR) Rule to develop a Closure Plan for the Clifty Creek CCR Landfill.

2.0 DESCRIPTION OF THE CCR UNIT

The Clifty Creek Station is located on the north bank of the Ohio River near Madison, Indiana and consists of six coal-fired electric generating units; each nominally rated at 217 megawatts, that began producing electricity in 1955 to support the Department of Energy's (DOE's) Portsmouth Gaseous Diffusion Plant located near Piketon, Ohio. The Clifty Creek CCR Landfill is located approximately one mile west of the Station building.

The landfill is owned and operated by the Indian-Kentucky Electric Corporation, and has been permitted by the Indiana Department of Environmental Management (IDEM) as a Type I Restricted Waste Landfill, Permit No. FP 39-04, to accept CCR generated by the Clifty Creek Station. The landfill's leachate discharge is managed under the site's NPDES permit. The landfill facility is comprised of 109 acres of disposal area, and approximately 13 million cubic yards of air space. It is designed to be constructed in four phases.

3.0 DESCRIPTION OF CLOSURE PLAN 257.102(b)(1)(i)

[A narrative description of how the CCR unit will be closed in accordance with this section.]

The Clifty Creek Landfill will be closed in accordance with the closure plan that was developed and submitted as part of the permit application process with IDEM, as well as in accordance with 257.102(d). Once final waste grades are achieved, the landfill surface will be covered with a minimum two-foot thick infiltration layer with a permeability of no greater than 1×10^{-5} cm/sec, and soil layer that is six inches thick to support native plant growth. A copy of the landfill's approved closure plan is included in Attachment A.

4.0 CLOSURE IN PLACE 257.102(b)(1)(iii)

[If closure of the CCR unit will be accomplished by leaving the CCR in place, a description of the final cover system, designed in accordance with paragraph (d) of this section, and the methods and procedures to be used to install the final cover.]

The final cover system will be designed and constructed in accordance with the requirements of 257.102(d), and consist of a minimum two-foot thick compacted soil layer with a permeability of no greater than 1×10^{-5} cm/sec, which will be placed directly over the graded CCR material. An additional soil layer that is six inches thick, capable of supporting native plant growth will be placed over the compacted soil system. The final cover will be graded to promote surface water runoff, and then seeded and mulched to promote growth of the vegetative cover. The final cover slope will be a minimum of 2% and will convey surface water to a NPDES-permitted outfall.

5.0 CLOSURE PERFORMANCE STANDARDS 257.102(d)(1)

5.1 SECTION 257.102(d)(1)(i)

[Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated.]

The final cover system will cover the CCR material and will have a permeability that is less than or equal to the permeability of the natural subsoils and no greater than 1×10^{-5} cm/sec.

5.2 SECTION 257.102(d)(1)(ii)

[Preclude the probability of future impoundment of water, sediment, or slurry.]

The CCR landfill will be graded to a minimum slope of 2% to prevent the ponding of surface water. Surface water drainage features consisting of run-on and run-off controls and sedimentation ponds will be installed per the approved design and managed through the sites surface water management plan.

5.3 SECTION 257.102(d)(1)(iii)

[Include the measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period.]

The final cover system will be gently graded with a minimum slope of 2%. The final configuration of the landfill will meet the stability requirements necessary to prevent the sloughing or movement of the final cover system during the closure and post-closure care period.

5.4 SECTION 257.102(d)(1)(iv)

[Minimize the need for further maintenance of the CCR unit.]

The CCR landfill will be vegetated to prevent erosion. Maintenance of the final cover system will include mowing.

5.5 SECTION 257.102(d)(1)(v)

[Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.]

The landfill will be closed in a time frame consistent with recognized and generally accepted good engineering practices. There is currently no schedule for closure of this CCR unit.

6.0 DRAINING AND STABILIZING OF THE SURFACE IMPOUNDMENT 257.102(d)(2)

[The owner or operator of a CCR surface impoundment or any lateral expansion of a CCR surface impoundment must meet the requirements of paragraph (d)(2)(i) and (ii) of this section prior to installing the final cover system required under paragraph (d)(3) of this section.]

This section is not applicable to a CCR landfill.

7.0 FINAL COVER SYSTEM 257.102(d)(3)

[If a CCR unit is closed by leaving the CCR in place, the owner or operator must install a final cover system that is designed to minimize infiltration and erosion, and at a minimum, meets the requirements of paragraph (d)(3)(i) of this section, or the requirements of the alternative final cover system specified in paragraph (d)(3)(ii) of this section.

The final cover system must be designed and constructed to meet the criteria in paragraphs (d)(3)(i)(A) through (D) of this section. The design of the final cover system must be included in the written closure plan.]

The final cover system will consist of a minimum two-foot thick compacted soil layer, with a permeability of no more than 1×10^{-5} cm/sec, which will be placed directly over the graded CCR material. An additional soil layer that is six inches thick, capable of supporting native plant growth will be placed over the compacted soil system. The final cover will be graded to promote surface water runoff, and then seeded and mulched to promote growth of the vegetative cover. The final cover slope will be a minimum of 2% and to accommodate settling and subsidence and will convey surface water to a NPDES-permitted outfall.

8.0 ESTIMATE OF MAXIMUM CCR VOLUME 257.102(b)(1)(iv)

[An estimate of the maximum inventory of CCR ever on-site over the active life of the CCR unit.]

The estimated maximum amount of CCR to ever be on-site is approximately 13 million cubic yards.

9.0 ESTIMATE OF LARGEST AREA OF CCR REQUIRING COVER 257.102(b)(1)(v)

[An estimate of the largest area of CCR unit ever requiring a final cover.]

The CCR landfill will be closed in phases as the landfill reaches final waste elevation grades. The largest area of the CCR unit that may require a final cover is approximately 109 acres.

10.0 CLOSURE SCHEDULE 257.102(b)(1)(vi)

[A schedule for collecting all activities necessary to satisfy the closure criteria in the section, including an estimate of the year in which all closure activities for the CCR unit will be completed. The schedule should provide sufficient information to describe the steps that will be taken to close the CCR unit, including identification of major milestones such as coordinating with and obtaining necessary approvals and permits from other agencies, the dewatering and stabilization of the CCR surface impoundment closure, or installation of the final cover system, and the estimated timeframes to complete each step or phase of the CCR unit closure.]

The landfill will be closed in phases as it reaches final waste placement elevations. The closure schedule will be based on disposal rates into the landfill. At this time, there are currently no projected time frames on when the closure phases will occur. Required notifications and schedules will be submitted to the IDEM in manner in which satisfies this section.

Attachment A

**Attachment 17
Closure Plan
Coal Ash Landfill
Type I Restricted Waste Landfill
Clifty Creek Power Plant
Madison, Jefferson County, Indiana**

The closure plan considers the function and design of the final cover with respect to the following items:

- Type and amount of by-product;
- Proposed cell geometry;
- Cover soil characteristics;
- Sequence of filling and closure operations;
- Labor, materials and testing required for landfill closure;
- Closure cost estimate; and
- Schedule.

Type and Amount of By-product

Based on expected by-product generation values provided by AEP, approximately 1,236 tons per day (tpd) of FGD (gypsum), 297 tpd of boiler slag, 445 tpd of fly ash and 142 tpd of sludge will be generated. The proposed landfill is estimated to provide 20 years of design life.

Proposed Cell Geometry

The embankment slopes were designed to provide positive drainage while maintaining slope stability. Perimeter grading includes maximum final side slopes of 4H:1V with slope drainage berms at approximate 40-foot elevation intervals. The diversion berms collect storm water from the side slopes and discharge to reinforced surface ditches on slopes or directly to perimeter run-off ditches. The top of the landfill has a minimum constructed slope of 10 percent. The final grading plan is shown on Drawing No. 16-30500-09.

A working surface slope of at least two percent during by-product placement will be maintained to control surface ponding and facilitate surface drainage. The maximum slope of the working face is 4H:1V. Temporary diversion berms will be constructed, where necessary, along the top of the working face to reduce sheet flow and associated erosion across recently placed by-product. Drawing No. 16-30500-28 shows typical surface water controls for a working cell.

Cover Soil Characteristics

The cover soil will consist of fine-grained plastic materials capable of supporting vegetation. The final landfill geometry dictates final soil cover thickness. Soil cover thicknesses will range from a minimum 24-inch thick compacted soil component for side slopes less than 15 percent to a maximum 36-inch thick compacted soil component for the 4H:1V slopes. Six inches of topsoil will be placed on top of the compacted soil to support vegetation growth. After the final cover soils have been placed, a vegetation program will be implemented in

accordance with the Construction Quality Control Plan (Attachment 21) to stabilize the cover soils and control erosion. This program will be implemented as soon as weather permits seed bed preparation, and when seasonal conditions are suitable for the type of vegetation to be used. Once vegetation is established, expected soil erosion is less than five tons per acre. See Appendix B for support calculations.

Sequence of Filling and Closure Operations

For planning purposes, the landfill is divided into four phases, each with approximately five years of capacity. The filling sequence was designed based on several factors, including interim and final surface water controls and ease of operation. Landfill construction will begin with establishing a system of run-on diversion ditches to redirect storm water around the construction and operation area. This will facilitate structural fill placement, liner construction and leachate collection system construction. Operation of the landfill will generally progress from the east to the west. This construction sequence will direct most of the first phase's storm water to the west boiler slag pond while the water from subsequent phases will be directed to the remaining fly ash pond.

Filling is designed to begin along the northeast end of the site, nearest the plant, and will generally proceed to the southwest end of the facility. Drawing Nos. 16-30500-20 and 21 show the conceptual filling sequence. Due to the size of the facility, it is expected that a continuous cycle of cell construction, cell operation and placement of final cover soil will be implemented. The filling sequence has been designed to reduce the surface area of the working face that must remain open at the end of a phase, while waiting for the next phase to "piggyback" onto it. Other than this working face, the remainder of a phase or unit will receive final cover after the final elevation is achieved or within 15 days of receiving its final waste volume.

Geotechnical instrumentation will be installed within the hydraulically placed fly ash and foundation soils beneath the landfill. The instrumentation will be used to measure pore pressures during placement of structural fill and by-product. Based on the geotechnical data obtained during design, excess pore pressures are not expected. However, if excess pore pressures are measured, cell construction and filling sequences will be adjusted to permit pore pressure dissipation and maintain structural integrity.

Labor, Materials and Testing

Table 1 presents a list of items necessary to facilitate landfill closure.

Table 1. Items Necessary for Closure

| Item | Quantity | Units |
|---|---------------------------------|--|
| Final Cover Soil | 3,920 | Cubic yards per acre (average over entire landfill) |
| Topsoil | 807 | Cubic yards per acre (average over entire landfill) |
| Dump truck and Operator | As required | - |
| Loader and Operator | As required | - |
| Dozer and Operator | As required | - |
| Sheepsfoot roller and Operator | As required | - |
| Density Testing (Equipment and Labor) | 1 | Test per 10,000 cubic yards |
| Mulch | 1.5 | Tons per acre |
| Seed | As required by grass species | Pounds per acre |
| Rock / Filter Fabric for Ditch Construction | As required | - |

Schedule

The landfill is expected to begin operation in 2010 and the estimated year of final closure is 2030. The closure date is subject to change based on actual by-product production and sale of by-product as beneficial re-use. Final cover will be placed annually on areas that reach final grade. Table 2 provides the estimated open surface area for each year of landfill operation.

Table 2. Estimated Open Surface Area

| End of Operation Year | Open Surface Area (Acres) | Length of Surface Run-off Ditch (Feet) |
|--------------------------|------------------------------|---|
| 2010 | 10.5 | 4,660 |
| 2011 | 6.4 | 1,010 |
| 2012 | 7.2 | 700 |
| 2013 | 6.7 | 690 |
| 2014 | 4.7 | 670 |
| 2015 | 5.6 | 560 |
| 2016 | 3.4 | 380 |
| 2017 | 5.4 | 510 |
| 2018 | 4.3 | 440 |
| 2019 | 4.2 | 630 |
| 2020 | 5.7 | 440 |
| 2021 | 6.7 | 620 |
| 2022 | 4.4 | 320 |
| 2023 | 3.7 | 490 |

Table 2. Estimated Open Surface Area

| End of Operation Year | Open Surface Area (Acres) | Length of Surface Run-off Ditch (Feet) |
|-----------------------|---------------------------|--|
| 2024 | 5.2 | 570 |
| 2025 | 4.6 | 410 |
| 2026 | 5.3 | 770 |
| 2027 | 4.4 | 360 |
| 2028 | 5.3 | 450 |
| 2029 | 5.0 | 520 |
| 2030 | 13.3 | 1,680 |

The analysis indicates year 2030 will have the maximum area requiring closure. It is anticipated that closure under those conditions should be completed within approximately 20 weeks after initiation of closure related activities by a third-party contractor.

Closure Cost Estimate

The closure cost estimate for the proposed landfill modification at the Clifty Creek Power Plant includes placement of the 24 to 36-inch thick soil cover over the finished by-product surface. The final surface grades of the landfill will be contoured to divert surface run-off from the proposed embankment and drainage swales will be added as necessary. The soil cover will be graded to match the underlying waste by-product contours. Following placement, the final cover will be seeded and fertilized to stabilize the cover soils with vegetation and reduce the potential for erosion.

The estimated closure cost opinion assumes a third party would be retained to close the landfill in accordance with the provisions of this closure plan and other details provided in this application and in Title 329 IAC Article 10, Rule 30. The estimated cost also assumes the landfill embankment utilizes the entire facility closure standard as contained in 329 IAC 10-39-2(b)(3)(A). Table 3 summarizes the closure cost opinion for year 2030 which represents the greatest estimated cost in any given year during operation of the landfill. A more detailed breakdown of the cost estimates is presented in Appendix A.

Table 3. Cost Opinion Summary

| Item | Estimated Cost Per Acre for Year 2030 | Total Cost Opinion |
|----------------------------|---------------------------------------|--------------------|
| Final Cover and Vegetation | \$ 68,280 | \$ 908,124 |
| Surface Ditches | \$ 16,280 | \$ 216,524 |
| Final Cover Certifications | \$ 198 | \$ 2,633 |
| Subtotal Closure Cost | \$ 84,758 | \$ 1,127,281 |
| Contingency (10%) | \$ 8,476 | \$ 112,728 |
| Total Closure Cost Opinion | \$ 93,234 | \$ 1,240,009 |

Note: All costs expressed in terms of 2006 dollars.

In accordance with the provisions of 329 IAC 10-30-7(a)(2), AEP will record a notice on the deed that shall in perpetuity notify any potential purchaser of the landfill property that the land has been used as a solid waste landfill facility.

Engineer Certification

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete.

Signature: Dan M. Durrett Date: 12-13-06

Name: Dan M. Durrett, P.E.
Senior Project Engineer

Address: Fuller, Mossbarger, Scott and May
Engineers, Inc.
11687 Lebanon Road
Cincinnati, Ohio 45241

Telephone No.: 513/842-8250

Professional Engineer Registration No.: 10606295

Appendix A

Opinion of Closure Costs

Attachment 17
Opinion of Closure Costs
Coal Ash Landfill
Clifty Creek Plant
American Electric Power
Madison, Jefferson County, Indiana

| Item | Unit of Payment | Cost per Unit | Unit Quantity | Total Price Estimate | Contingency 10% | Total Sum |
|--|---|---------------|------------------|--|--------------------|-----------------|
| Facility Name: Clifty Creek Coal Ash Landfill | | | | | | |
| Facility Location: Madison, Indiana | | | | | | |
| Facility County: Jefferson | | | | | | |
| Total Waste Fill Acreage: 109 Acres | | | | | | |
| Total Grading Acreage: 161 Acres | | | | | | |
| Closure Year: 2030 | | | | | | |
| Acres Required for Closure: 13.3 Acres | | | | | | |
| | | | | | | |
| A. Final Cover and Vegetation | | | | | | |
| 1) Material Acquisition, Placement and Compaction | CY / Acre | \$12 | 5,490 | \$65,880 | | |
| - Material will be imported from off-site. | | | | | | |
| - quantity includes cover soil, final grading and 6-inches of topsoil. | | | | | | |
| | | | | | | |
| 2) Seeding and Mulching | Acre | \$2,400 | 1 | \$2,400 | | |
| | | | | <u>Final Cover and Vegetation - Per Acre</u> | | <u>\$68,280</u> |
| | | | | | | |
| B. Surface Ditches | | | | | | |
| 1) Run-off Surface Ditches | LF | \$100 | 1,680 | \$168,000 | | |
| - Total estimated linear footage divided by estimated exposed acreage | Subtotal Run-off Surface Ditches - Per Acre | | | \$12,632 | | |
| | | | | | | |
| 2) Diversion Berms | CY / Acre | \$12 | 304 | \$3,648 | | |
| | | | | <u>Surface Ditches - Per Acre</u> | | <u>\$16,280</u> |

Attachment 17
Opinion of Closure Costs
Coal Ash Landfill
Clifty Creek Plant
American Electric Power
Madison, Jefferson County, Indiana

| Item | Unit of | | Total Price | 10% | Total Sum |
|--|--------------|----------|-----------------|----------------|-----------------|
| | Payment | Quantity | | | |
| C. Final Cover Certification | | | | | |
| 1) -Soil Samples taken every 10,000 CY | | | | | |
| -Assume 1 soil sample obtained every 10,000 CY (total estimated samples: 8), each sample and field observations take technician one 8 hour day (includes travel time, site examination, field reports) | Hour | 8 | \$440 | | |
| 2) -1 set of Atterberg Limits, Specific Gravity, sieve, and hydrometer test per sample | set of tests | 8 | \$1,400 | | |
| 3) -Clerical services: 1/2 hour per visit | Hours | 4 | \$200 | | |
| 4) -Project Engineer to review work: 1 hour per visit | Hours | 8 | \$600 | | |
| | | | <u>\$2,640</u> | | |
| | | | <u>\$198</u> | | |
| | | | <u>\$84,758</u> | <u>\$8,476</u> | <u>\$93,234</u> |
| Total Opinion of Closure Cost Estimate - Per Acre | | | | | |
| D. Other Closure Costs | | | | | |
| 1) -Notation of Property Deed | LS | 1 | \$500 | | |
| | | | <u>\$500</u> | <u>\$50</u> | <u>\$550</u> |
| Total Opinion of Closure Cost Estimate - Per Acre in Year 2030 | | | | | |
| \$93,234 | | | | | |

- Notes:**
- The unit price opinion for final cover and vegetation and diversion berms is based on current off-site soil borrow contract pricing provided by AEP.
 - The unit price opinion for final site grading was obtained from RS Means "Heavy Construction Cost Data" 2002 item 02310-440-3310 - Finish grading on steep slopes.
 - The unit price opinion for seeding and mulching was obtained from RS Means "Heavy Construction Cost Data" 2002 item 02900-340-2400 - Hydro Seeding.
 - The unit price opinion for run-off surface ditches is based on FMSM experience.
 - CQA/CQC costs are based upon FMSM listed prices and include a technician obtaining one cover soil sample approximately every 10,000 CY for classification testing.

Appendix B

Erosion Support Calculations

ANNUAL EROSION RATE (TONS/ACRE/YEAR)

- UTILIZE RUSLEZ PROGRAM DEVELOPED BY NATIONAL RESOURCE CONSERVATION SERVICE (NRCS)

STEP 1: SELECT LOCATION

- A RUSLEZ DATA FILE FOR JEFFERSON COUNTY, INDIANA WAS LOADED FROM RUSLEZ FTP SITE

STEP 2: SELECT SOIL TYPE

- PER THE PROJECT SPECIFICATIONS, A VARIETY OF SOILS ARE ACCEPTABLE FOR FINAL COVER. THE MODEL WILL BE RUN ON EACH OF THESE SOILS:

CH, CL, MH, ML, CL-MG, SC, SM-SC

- SPECIFIED SOILS ARE IN THE USCS CLASSIFICATION SYSTEM. RUSLEZ REQUESTS THE USDA SYSTEM. CONVERT TO USDA VIA A SUPERIMPOSED TEXTURAL TRIANGLE
- | USCS | USDA |
|-------|--|
| CH | CLAY OR SILTY CLAY |
| CL | CLAY LOAM, SILTY CLAY LOAM, LOAM, OR SILT LOAM |
| MH | N/A |
| ML | SILT, SILT LOAM |
| SC | SANDY CLAY, SANDY CLAY LOAM |
| CL-MG | LOAM, SILT LOAM |

STEP 3: SET SCORE TOPOGRAPHY

- 25% SCORES w/ DIVERSION BERM
APPX. EVERY 150'

STEP 4A: SELECT BASE MANAGEMENT

- PER SPECIFICATIONS, COVER SHALL BE SEEDED
PER INDOT SPECIFICATIONS
- REFER TO INDOT SPECS - SEVERAL SEED
MIXTURES ARE SPECIFIED
- "
- FROM RUSLE 2 - SELECT OPTION FOR
"DENSE GRASS; NOT HARVESTED"

STEP 4B: N/A

STEP 4C: ADJUST MANAGEMENT IF DESIRED

- DO NOT ADJUST YIELDS
- DO NOT ADD RESIDUE %
- ROCK COVER = 0%

STEP 5: SET SUPPORTING PRACTICES

- CONTOURING - PERFECT CONTOURING, NO ROW GRADE
- STRIPS / BARRIERS = N/A
- DIVERSION / TERRACE, SED BASIN:
- SELECT "1 HILLSIDE DITCH @ 3% GRADE
AT BOTTOM OF RUSLE SLOPE"

RESULTS

SOIL TYPE COULD VARY. CHECK ALL POSSIBLE SOIL TYPES.

| <u>SOIL TYPE</u> | <u>ANNUAL SOIL EROS. RATE</u> (TONS/AC/YR) | |
|--------------------------------------|---|---|
| CLAY (> THAN 50% CLAY) | 1.3 | |
| CLAY (I-M OM, < THAN 50% CLAY) | 1.3 | |
| CLAY (M-H OM, < THAN 50% CLAY) | 1.2 | |
| SILTY CLAY (< THAN 50% CLAY) | 1.1 | |
| SILTY CLAY (I-M OM, < THAN 50% CLAY) | 1.3 | |
| SILTY CLAY (M-H OM, < THAN 50% CLAY) | 1.1 | |
| CLAY LOAM (H-OM) | 0.98 | |
| CLAY LOAM (I-M OM) | 1.3 | |
| CLAY LOAM (I-M OM, V. SLO PERM) | 1.5 | |
| CLAY LOAM (M-H OM) | 1.1 | |
| CLAY LOAM (M-H OM V. SLO PERM) | 1.3 | |
| SILTY CLAY LOAM (SCL) | - | |
| SCL (H-OM) | 1.1 | |
| SCL (I-M OM) | 1.5 | |
| SCL (I-M OM V. SLO PERM) | 1.7 | * |
| SCL (M-H OM) | 1.3 | |
| SCL (M-H OM, .37% P) | 1.5 | |
| SCL (M-H OM, V. SLO PERM) | 1.5 | |
| LOAM (H-OM) | 0.95 | |
| LOAM (I-M OM) | 1.3 | |
| LOAM (I-M OM V. SLO PERM) | 1.5 | |
| LOAM (M-H OM) | 1.1 | |
| LOAM (M-H OM V. SLO PERM) | 1.3 | |
| SELT LOAM (H-OM) | 1.1 | |
| SELT LOAM (I-M OM) | 1.4 | |
| SELT LOAM (I-M OM V. SLO PERM) | 1.7 | * |
| SELT LOAM (M-H OM V. SLO PERM) | 1.4 | |



Project CN 2005008

Sheet No. 4 of 4 Scale _____

Calculated By JDC Date 11-13-06

Checked By DMD Date 11-14-06

Fuller, Mossbarger, Scott and May Engineers, Inc.

| <u>SOIL TYPE</u> | <u>CON'T</u> | <u>ANNUAL SOIL ER RATE</u> <u>(TONS/AC/YR)</u> |
|-------------------------------|--------------|---|
| SILT LOAM (M-H OM) | | 1.2 |
| SANDY CLAY LOAM (SCLL) (H-OM) | | 0.96 |
| SALL (L-M OM) | | 1.3 |
| SALL (L-M OM) (SLOW PERM) | | 1.5 |
| SALL (M-H OM) | | 1.1 |
| SALL (M-H OM) (SLOW PERM) | | 1.3 |

- HIGHEST ANNUAL SOIL EROSION RATE = 1.7 TONS/ACRE/YR

- PER TDEM REGS, ANNUAL SOIL EROSION RATE MUST BE LESS THAN 5 TONS/ACRE/YR

1.7 TONS/ACRE/YR < 5 TONS/ACRE/YR OK



RUSLE2 Erosion Calculation Record

Info:

profiles\CN2005088_11.14.06

Inputs:

Location: Indiana\Jefferson County

Soil: silty clay loam (low-mod OM,v. slow perm)

Slope length (horiz): 150 ft

Avg. slope steepness: 25 %

Contouring: c. perfect contouring no row grade

Strips/barriers: (none)

Diversion/terrace, sediment basin: 1 hillside ditch 3% grade at bottom of RUSLE slope

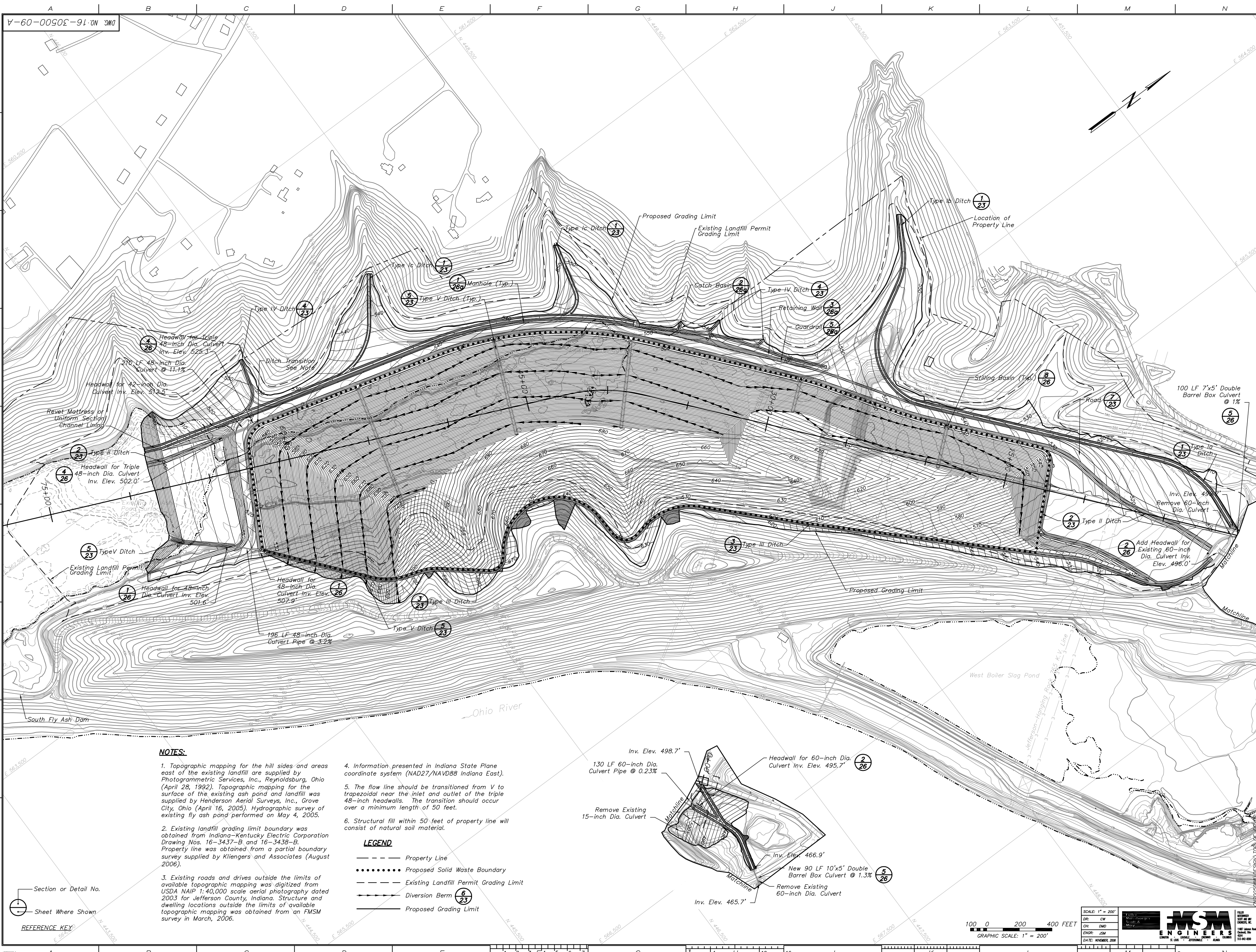
Base management: Dense grass; not harvested

Outputs:

T value: 3.0 t/ac/yr

Soil loss for cons. plan: 1.7 t/ac/yr

Attachment B



NOTES

REFERENCE DRAWINGS

| DATE | NO. | DESCRIPTION | APPD. |
|------|-----|-------------------|-------|
| | | ISSUED FOR PERMIT | |
| | | REVISIONS | |

THIS DRAWING IS THE PROPERTY OF THE AMERICAN ELECTRIC POWER SERVICE CORP. AND IS LOANED UPON CONDITION THAT IT IS NOT TO BE REPRODUCED OR COPIED, IN WHOLE OR IN PART, OR USED FOR FURNISHING INFORMATION TO ANY PERSON WITHOUT THE WRITTEN CONSENT OF THE AEP SERVICE CORP., OR FOR ANY PURPOSE DETRIMENTAL TO THEIR INTEREST, AND IS TO BE RETURNED UPON REQUEST.

INDIANA - KENTUCKY ELECTRIC CO.
CLIFTY CREEK PLANT
 MADISON INDIANA
COAL ASH LANDFILL
TOP OF COVER

DWG. NO. 16-30500-09-A
 SCALE: 1" = 200'
 CIVIL ENGINEERING DIVISION

DR: CW
 CR: DMD
 ENGR: JMW
 DATE: NOVEMBER 2006

APPROVED BY: [Signature]
 ENGR: DMD
 DATE: JAN. 2006

AEP SERVICE CORP.
 1 RIVERSIDE PLAZA
 COLUMBUS, OH 43215

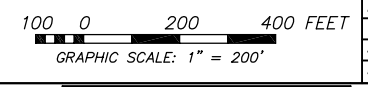
NOTES:

1. Topographic mapping for the hill sides and areas east of the existing landfill are supplied by Photogrammetric Services, Inc., Reynoldsburg, Ohio (April 28, 1992). Topographic mapping for the surface of the existing ash pond and landfill was supplied by Henderson Aerial Surveys, Inc., Grove City, Ohio (April 16, 2005). Hydrographic survey of existing fly ash pond performed on May 4, 2005.
2. Existing landfill grading limit boundary was obtained from Indiana-Kentucky Electric Corporation Drawing Nos. 16-3437-B and 16-3438-B. Property line was obtained from a partial boundary survey supplied by Klienegers and Associates (August 2006).
3. Existing roads and drives outside the limits of available topographic mapping was digitized from USDA NAIP 1:40,000 scale aerial photography dated 2003 for Jefferson County, Indiana. Structure and dwelling locations outside the limits of available topographic mapping was obtained from an FMSM survey in March, 2006.
4. Information presented in Indiana State Plane coordinate system (NAD27/NAVD88 Indiana East).
5. The flow line should be transitioned from V to trapezoidal near the inlet and outlet of the triple 48-inch headwalls. The transition should occur over a minimum length of 50 feet.
6. Structural fill within 50 feet of property line will consist of natural soil material.

LEGEND

- Property Line
- Proposed Solid Waste Boundary
- Existing Landfill Permit Grading Limit
- Diversion Berm (6/23)
- Proposed Grading Limit

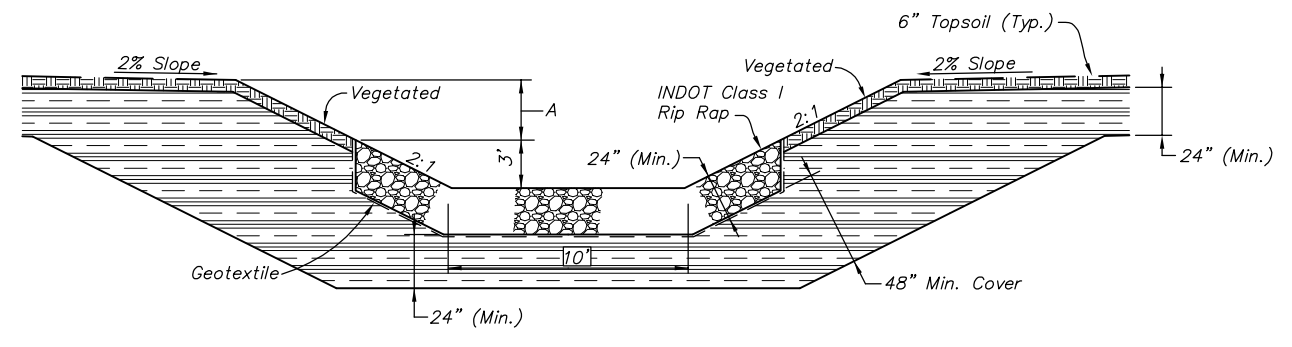
Section or Detail No.
 Sheet Where Shown
 REFERENCE KEY



SYSTEM DATE: 00-000-YYYY
 SYSTEM TIME: HOUR:MINUTE
 PLOT DATE: _____
 PLOT BY: _____

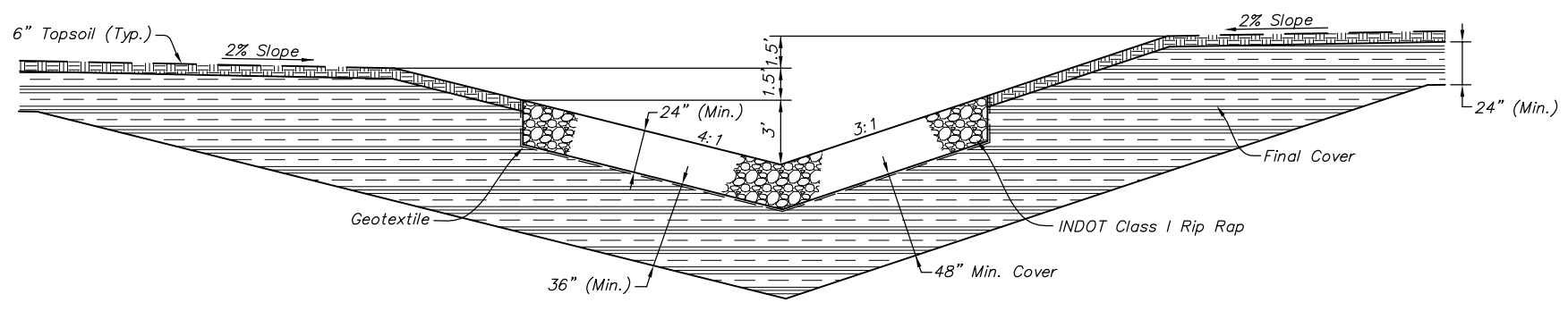
16-30500-23-A

NOTES

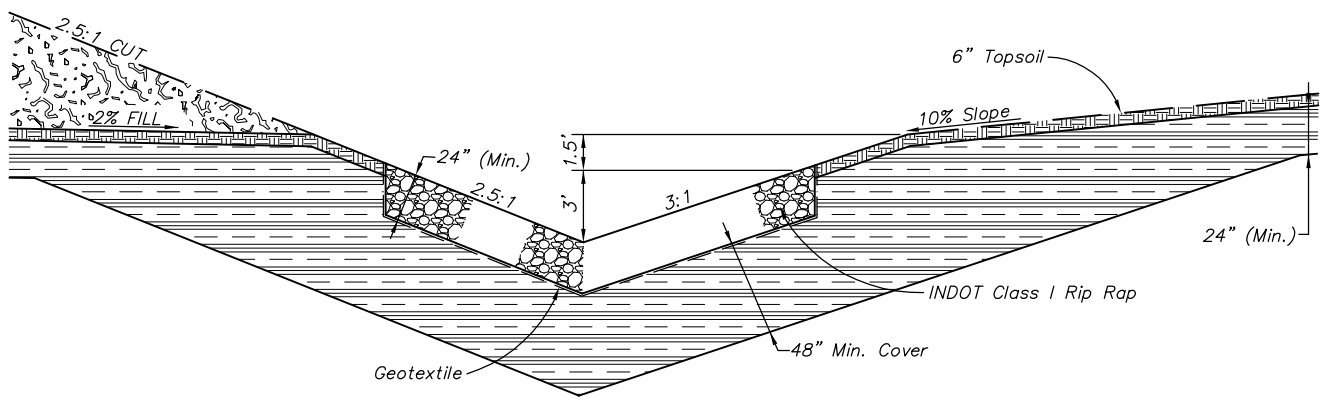


1 DETAIL - TYPE I DITCH
SCALE: 1/4" = 1'-0"

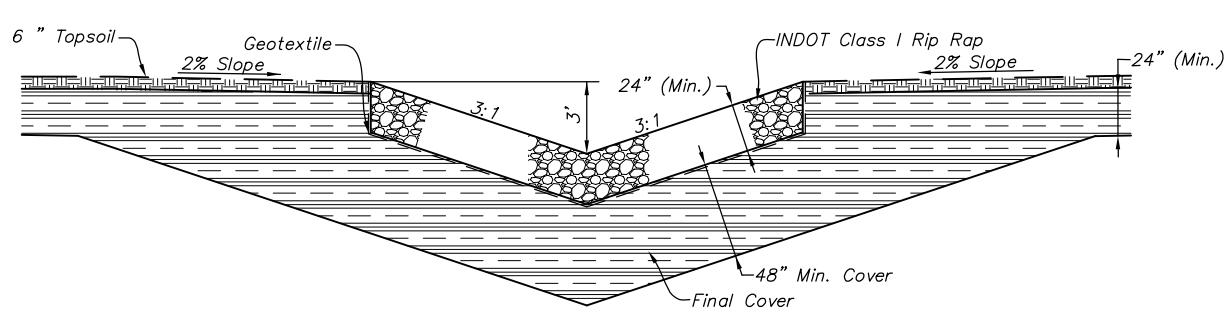
| TABLE OF DIMENSIONS | |
|---------------------|------|
| | A |
| Type 1a Ditch | 2.5' |
| Type 1b Ditch | 1.5' |
| Type 1c Ditch | 0.0' |



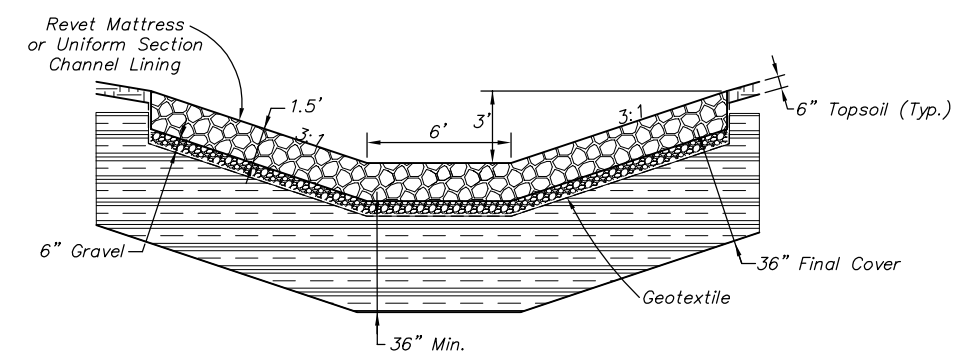
2 DETAIL - TYPE II DITCH
SCALE: 1/4" = 1'-0"



3 DETAIL - TYPE III DITCH
SCALE: 1/4" = 1'-0"

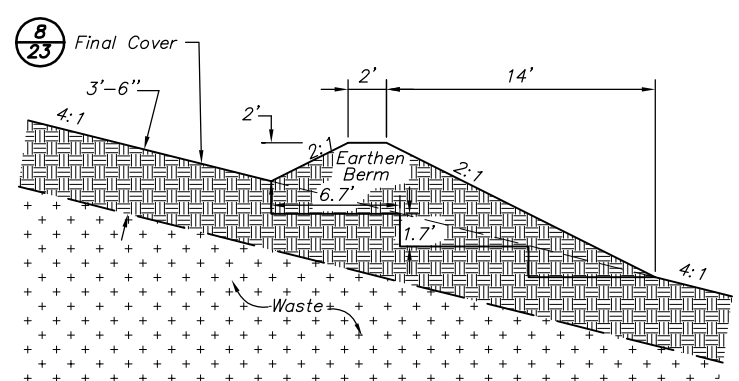


4 DETAIL - TYPE IV DITCH
SCALE: 1/4" = 1'-0"



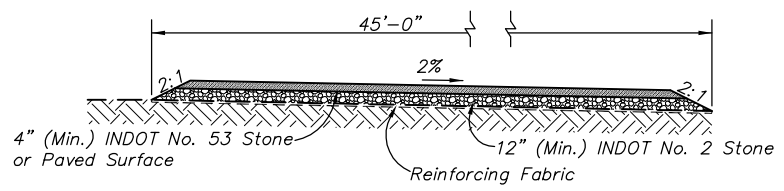
NOTES:
1. Geotextile shall be stapled in place and overlapped per manufacturer's recommendations.
2. Slopes shall be vegetated in accordance with the Technical Specifications.

5 DETAIL - TYPE V DITCH
SCALE: 1/4" = 1'-0"

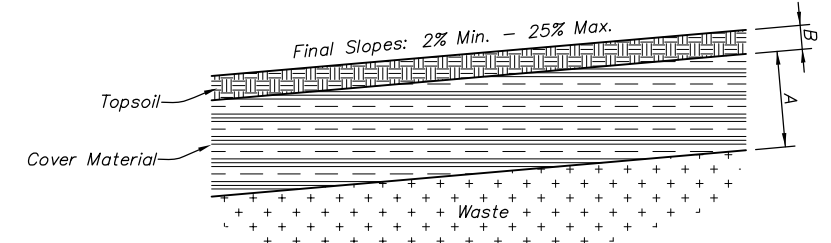


Notes:
1. Berms will be constructed at the approximate locations shown on Plans.
2. Materials and specifications for constructing the vegetative cover will apply to construction of berms.
3. Drainage channel along the berm shall be sloped at 3%.

6 DETAIL - TYPICAL DIVERSION BERM
SCALE: 1" = 5'-0"

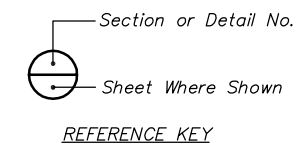


7 DETAIL - ROAD
SCALE: 1/4" = 1'-0"



8 DETAIL - FINAL COVER
SCALE: 1/2" = 1'-0"

Notes:
1. For 15 to 25% Slopes: A = 3'-0" and B = 0'-6", minimum
2. For 2% to 15% Slopes: A = 2'-0" and B = 0'-6", minimum



REFERENCE KEY

REFERENCE DRAWINGS

ISSUED FOR PERMIT

DATE NO. DESCRIPTION APPRO.
REVISIONS

INDIANA - KENTUCKY ELECTRIC CO.
CLIFTY CREEK PLANT
MADISON INDIANA
COAL ASH LANDFILL
DETAILS

DWG. NO. 16-30500-23-A

SCALE: CIVIL ENGINEERING DIVISION

DR: CH: ARCH: ENGR: DATE: APPROVED BY:

SCALE: 1" = 10'
DR: CW/M
CHK: DMO
ENGR: JSM
DATE: NOV. 2008

INDIANA - KENTUCKY ELECTRIC CO.
CLIFTY CREEK PLANT
MADISON INDIANA
COAL ASH LANDFILL
DETAILS

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

SYSTEM DATE: 00-00-00 PLOT DATE: 11-00-00
SYSTEM TIME: 00:00:00 HOUR: 00:00 MINUTE: 00:00
PLOTTER: INCH PLOTTER

Post-closure Plan

CFR 257.104(d)

CCR Landfill

Clifty Creek Station

Madison, Indiana

October 2016

Prepared by: Indiana-Kentucky Electric Corporation

3932 U.S. Route 23

Piketon, OH 45661



Table of Contents

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Attachments

Attachment A – Post-closure Plan submitted to Indiana Department of Environmental Management

1.0 OBJECTIVE

This report has been prepared to fulfill the requirements of 40 CFR 257.102(b) of the Coal Combustion Residuals (CCR) Rule to develop a Post-closure Plan for the Clifty Creek CCR Landfill.

2.0 DESCRIPTION OF THE CCR UNIT

The Clifty Creek Station is located on the north bank of the Ohio River near Madison, Indiana, and consists of six coal-fired electric generating units; each nominally rated at 217 megawatts, that began producing electricity in 1955 to support the Department of Energy's (DOE's) Portsmouth Gaseous Diffusion Plant located near Piketon, Ohio. The Clifty Creek CCR Landfill is located approximately one mile west of the Station building.

The landfill is owned and operated by the Indian-Kentucky Electric Corporation, and has been permitted by the Indiana Department of Environmental Management as a Type I Restricted Waste Landfill, Permit No. FP 39-04, to accept CCR generated by the Clifty Creek Station. The landfill's leachate discharge is managed under the site's NPDES permit. The landfill facility is comprised of 109 acres of disposal area, with a capacity of approximately 13 million cubic yards, which will be constructed in four phases.

3.0 DESCRIPTION OF THE POST-CLOSURE PLAN 257.102(b)(1)(i)

[A description of the monitoring and maintenance activities required in paragraph (b) of this section for the CCR unit, and the frequency at which these activities will be performed]

3.1 Section 257.104(b)(1)

[Maintaining the integrity and effectiveness of the final cover system including making repairs to the final cover as necessary to correct the effects of the settlement, subsidence, erosion, or other events and preventing run-on and run-off from eroding or otherwise damaging the final cover;]

Inspections are performed for the items noted below. The inspection frequencies are scheduled to properly detect any issues so that repairs can be performed before significant damage or degradation of the final cover system occurs.

- **Embankment**: The entire embankment, including top surface and side-slopes, will be inspected for slides, settlement, subsidence, displacement, and cover condition.
- **Soil Dike**: The soil dike will be inspected for slides, displacement, seepage, and erosion.
- **Cover**: The final cover will be inspected for erosion and for the condition of the vegetated cover, i.e., gaps in vegetation or presence of undesirable trees or brush. The integrity of the cover drainage system will also be inspected.

- Final Cover Surface: The Final Cover surface will be inspected for any ponding of water. Due to the design contours required to achieve the final cap grade, special attention will be focused to ensure that no settlement, subsidence, erosion, depressions or flat areas exist and that no water is allowed to pond above the cap system.
- Surface Drainage System: The surface drainage system, including channels, culverts, slope drains, etc., will be inspected for erosion, integrity of channel lining, ponding, and accumulated sediment.
- Leachate Collection Piping: The discharge pipes of the Leachate collection System at the Leachate pond will be inspected for clogging or damage routinely. Other exposed portions of the Leachate Collection System, including cleanouts, will be inspected for damage and repaired as necessary. Additionally, the Leachate Collection Pond will be inspected for general damage to the pond and perimeter berms, with repairs made as necessary. The Leachate Collection pond will also be inspected for the accumulation of sediment and managed as necessary.

Maintenance during the post-closure care period will be performed as discussed below, based upon the facility inspections described above.

- Erosion Damage Repair: Any areas exhibiting erosion will be repaired by replacing and compacting the material in-kind to design grade/specifications, and reseeding the area to the specifications. Applications of additional fertilizer, selective herbicides, rodent control measures, etc. will be implemented as necessary. The selection of fertilizers and herbicides will be made in manner to ensure their use will not impact the groundwater negatively. Follow-up monitoring of the repaired area will be conducted to ascertain the integrity of the repair.
- Security Control devices: Any portions of the security control devices installed (i.e., fencing, roadway barricades, etc...) will be inspected and repaired as necessary.
- Settlement, Subsidence, Displacement: Any areas at the closed site exhibiting evidence of settlement, subsidence, or displacement will be examined to determine the cause of the movement. If backfilling or placing additional fill material is needed to maintain the integrity of the closed structure, it will be performed in accordance with the site/closure specifications, including seeding. If the condition reoccurs or persists, or if the severity of the condition is judged to warrant it, a detailed investigation of the cause will be performed and remedial action will be taken. Similarly, any areas of the soil dike

exhibiting sliding, displacement, or seepage will be investigated and repairs will be made as necessary. Follow-up monitoring of the area will be performed to ascertain that the problem has been corrected.

- Closure Cap Surface: Any areas that show signs of ponding water on flat contours will be examined and rectified. Due to the design contours required to achieve the final cap grade, special attention will be focused on the cap surface to ensure that any areas that hold water are re-graded to promote drainage, re-seeded to promote vegetative growth, and maintained to ensure that the ponding of water does not persist.
- Surface Water Drainage System: The channel linings are designed and will be constructed to withstand the design velocities. Maintenance of the surface water drainage system will consist of removing sediment and/or undesirable vegetation from the surface water runoff control system (channels and culverts) as required. Eroded areas will be repaired by back-filling and reseeded according to the specifications. Damage to culverts and structures will result in repair or replacement as needed. The Clifty Creek Landfill will be closed periodically throughout the life of the landfill as sub phases and phases reach their final waste placement grades. Once final waste grades are achieved, the landfill surface will be covered with a minimum two-foot thick compacted soil layer with a permeability of no greater than 1×10^{-5} cm/sec, and a soil layer that is six inches thick to support native plant growth.
- Leachate Collection System: Maintenance of the leachate collection System will consist of repairing and/or replacing any damaged or eroded portions of the system and pond, cleaning of the piping, and removing leachate and sediment from the collection pond as needed.

3.2 SECTION 257.104(b)(3)

[Maintaining the groundwater monitoring system and monitoring the groundwater in accordance with the requirements of §§257.90 through 257.98.]

The groundwater monitoring system will be inspected for the general integrity of the wells, well casings and well protective casings. Any damaged portions of the monitoring wells and/or their protective casings will be replaced or repaired.

Monitoring the groundwater will be in accordance with the groundwater monitoring plan for this facility and in accordance with the requirements of §§257.90 through 257.98.

4.0 POST-CLOSURE CONTACT 257.104 (d)(1)(ii)

[The name, address, telephone number and email address of the person or office to contact about the facility during the post-closure care period.]

The name, address, telephone number, and email address of the person to contact about the facility during the post-closure period will be provided upon notification of closure.

5.0 POST-CLOSURE PLANNED USE 257.104 (d)(1)(iii)

[A description of the planned uses of the property during the post-closure period. Post-closure use of the property shall not disturb the integrity of the final cover, liner(s), or any other component of the containment system, or the function of the monitoring systems unless necessary to comply with the requirements in this subpart...]

The post-closure use of the property will be undisturbed vacant land space. The only activities occurring on the closed CCR unit will be related to the Post-Closure care activities. All other activities will be prohibited.

Attachment A

**Attachment 18
Post Closure Plan
Coal Ash Landfill
Type I Restricted Waste Landfill
Clifty Creek Power Plant
Madison, Jefferson County, Indiana**

Indiana-Kentucky Electric Corporation (IKEC) will implement a post-closure plan upon completion of landfilling activities. Post-closure activities will be continued for a period of thirty years after closure.

Post Closure Activities

Ground Water Monitoring Activities

The approved ground water monitoring plan at the facility will be continued throughout the post-closure period to assess ground water quality. Ground water monitoring will be performed in accordance with approved monitoring plan.

Planned Maintenance Activities

Upon completion, the facility will be inspected twice per year for evidence of erosion, stressed vegetation, cracking, sloughing, and adequate drainage (ponding water) with a written report on the condition of the facility submitted to IDEM. The inspection will document the condition of site features and maintenance activities related to the final cover and vegetative growth. Control of vegetative growth on vehicular access ways to monitoring wells will be maintained. Any such areas noted will be repaired as necessary to maintain the integrity of the final cover and overall drainage control systems. Vegetated areas will be mowed periodically as needed.

Responsible Contact

Contact information for the entity responsible for maintaining the site after closure whom IDEM may contact about the facility during the post-closure period is provided below:

Ray Wilson
Plant Manager
Indiana-Kentucky Electric Corporation
Clifty Creek Power Plant
Madison, Indiana

Post-Closure Cost Opinion

At the conclusion of the thirty year post-closure monitoring period, AEP will submit a certification the closure and post-closure activities at the facility have been completed in accordance with the approved closure plan and post-closure plan and that the site is in conformance with the terms of Title 329 IAC 10. A summary of the post-closure cost opinion in year 2006 dollars is presented in the following table. The detailed cost opinion derivation is presented in Appendix A.