

**OHIO VALLEY ELECTRIC CORPORATION** 

3932 U. S. Route 23 P. O. Box 468 Piketon, Ohio 45661 740-289-7200

WRITER'S DIRECT DIAL NO: 740-289-7259

June 29, 2023

### **Delivered Electronically**

Mr. Brian Rockensuess Commissioner Indiana Department of Environmental Management 100 N. Senate Avenue Mail Code 50-01 Indianapolis, IN 46204-2251

#### Re: Indiana-Kentucky Electric Corporation- Clifty Creek Station Revision to the West Boiler Slag Pond Phase 2-4 Closure Plan

Dear Mr. Rockensuess:

As required by 40 CFR 257.106(i)(4), Indiana-Kentucky Electric Corporation is providing notification to the Commissioner of the Indiana Department of Environmental Management (IDEM) that a revision has been made to the Clifty Creek Station West Boiler Slag Pond Phase 2-4 Closure Plan. The newly revised plan will be placed in the facility's operation record as well as the publicly accessible internet site, which can be viewed at http://www.ovec.com/CCRCompliance.php

If you have any questions, or require any additional information, please call me at (740) 289-7259, or you can contact Tim Fulk at (740) 897-7768.

Sincerely,

Jeremy Galloway Environmental Specialist

JDG: tlf



Stantec Consulting Services Inc. 9200 Shelbyville Road, Suite 800, Louisville KY 40222-5136

June 27, 2023

Project/File: 175531036

**Mr. Gabriel Coriell** Indiana-Kentucky Electric Corporation 3932 U.S. Route 23 P.O. Box 468 Piketon, Ohio 45661

Reference: Phases 2-4 Closure Plan Clifty Creek Station West Boiler Slag Pond Madison, Jefferson County, Indiana

Dear Mr. Coriell,

The attached Phases 2-4 closure plan for Clifty Creek Station's West Boiler Slag Pond (WBSP) was prepared by Stantec Consulting Services Inc. (Stantec) for the Indiana-Kentucky Electric Corporation (IKEC).

The initial closure and post-closure plans for the WBSP were posted on October 11, 2016 as part of the U.S. Environmental Protection Agency (EPA) final coal combustion residuals (CCR) rule demonstrations. The plans were conceptual and subject to the completion of all necessary environmental reviews. Though conceptual, they demonstrated compliance with the requirements set forth in 40 CFR 257.102(b) and 257.104(d).

IKEC, Stantec, and the Indiana Department of Environmental Management (IDEM) met in Indianapolis on December 9, 2019 to discuss the requirements for Indiana CCR surface impoundment closures. Addendum 1 was prepared for the closure of 9.2 acres of the WBSP (Phase 1) to incorporate changes requested by the state. IKEC submitted Addendum 1 on February 12, 2020 to IDEM Office of Water Quality (OWQ) and Office of Land Quality (OLQ), Waste Section. IDEM's approval of the partial closure (Phase 1) of the WBSP (SW Program ID 39-005) was received on February 3, 2021.

To address the remaining footprint of the WBSP, IKEC submitted the Phases 2-4 closure plan to IDEM on June 17, 2021. No comment has been received from IDEM on this proposed closure plan to date.

The plan was prepared in accordance with the accepted practice of engineering and accurate information at the date of its submittal to meet the requirements described in 40 CFR 257.102(b). Changes to the closure plan may be required. Revised plans will be posted at that time.

June 27, 2023 Mr. Gabriel Coriell Page 2 of 2

Reference: Phases 2-4 Closure Plan Clifty Creek Station West Boiler Slag Pond Madison, Jefferson County, Indiana

Regards,

#### STANTEC CONSULTING SERVICES INC.

Marster C. Von

Matt Vaughan Principal \*Licensed in KY, IN Phone: (502) 212-5088 matt.vaughan@stantec.com

#### stantec.com

Attachment: Stantec Consulting Services Inc. (2021). Closure Plan. Clifty Creek Station. West Boiler Slag Pond Closure. Phases 2-4. Madison, Jefferson County, Indiana. Prepared for Indiana-Kentucky Electric Corporation. June 16.

# ATTACHMENT

Closure Plan. Clifty Creek Station. West Boiler Slag Pond Closure. Phases 2-4. Stantec Consulting Services Inc. (2021)



# OHIO VALLEY ELECTRIC CORPORATION INDIANA- KENTUCKY ELECTRIC CORPORATION

3932 U. S. Route 23 P.O. Box 468 Piketon, Ohio 45661 740-289-7200

WRITER'S DIRECT DIAL NO: (740) 897-7768

June 17, 2021

Ms. Kate Garvey Office of Land Quality Indiana Department of Environmental Management Solid Waste Permits Section 100 N. Senate Avenue MC 65-45 IGCN 1101 Indianapolis, IN 46204-2205

Dear Ms. Garvey:

#### Re: Indiana-Kentucky Electric Corporation Clifty Creek Station West Boiler Slag Pond Phases 2, 3 and 4 Closure Plan

In accordance with 329 IAC 10-3-1(9), the Indiana-Kentucky Electric Corporation (IKEC) is submitting for agency review the accompanying Closure Plan for the remaining Phases (2, 3 and 4) of Clifty Creek Station's West Boiler Slag Pond (WBSP). IKEC is committed to being a good steward of the environment and to satisfying our environmental compliance obligations. We recognize the importance of maintaining a close partnership with IDEM in this endeavor, and appreciate the opportunity to submit this plan for agency review. Note that while IKEC desires to work closely with IDEM, IKEC is not waiving any of the positions it identified in its May 28, 2021 letter to Steven Thill or those identified in its June 1, 2021 Petition for Review of the Approval of the Partial Closure Plan for IKEC's WBSP.

If you have any questions or comments please contact me at (740) 897-7768.

Sincerely,

Tim Full

Tim Fulk Engineer II

TLF:gsc

Attachments





# **Closure** Plan

Clifty Creek Station West Boiler Slag Pond Closure Phases 2-4

Madison, Jefferson County, Indiana

Prepared for: Indiana-Kentucky Electric Corporation 3932 U.S. Route 23 Piketon, Ohio 45661

Design with community in mind

June 16, 2021

# **Closure Plan**

# West Boiler Slag Pond Closure Phases 2-4 Clifty Creek Station Madison, Jefferson County, Indiana

# Table of Contents

Section		Page No.
1.	Objective	1
2.	Description of the CCR Unit.2.1. Impoundment Structure2.2. Primary Spillway.2.3. WBSP Location2.4. Available Geotechnical Data	2 3 3
3.	Regulatory Overview         3.1. Regulatory Framework for Design         3.2. Description of Closure Plan - 257.102(b)(1)(i)         3.3. Closure in Place - 257.102(b)(1)(iii)         3.4. Closure Performance Standards - 257.102(d)(1)         3.4.1. Section 257.102(d)(1)(i),(iii),(iii)         3.4.2. Section 257.102(d)(1)(iv)         3.4.3. Section 257.102(d)(1)(v)         3.5. Draining and Stabilizing the Surface Impoundment.         3.5.1. Section 257.102(d)(2)(i)         3.5.2. Section 257.102(d)(2)(ii)         3.5.3. Section 257.102(d)(2)(ii)         3.5.4. Section 257.102(d)(2)(ii)         3.5.7. Section 257.102(d)(2)(ii)         3.5.8. Estimate of Maximum CCR Volume - 257.102(b)(1)(iv)         3.6. Estimate of Largest Area of CCR Requiring Cover - 257.102(b)(1)(v)         3.7. Estimate of Largest Area of CCR Requiring Cover - 257.102(b)(1)(v)         3.8. Estimate of Largest Area of CCR Requiring Cover - 257.102(b)(1)(v)	
4.	General Considerations	11
5.	Closure Plan Scope of Work5.1.Phase 25.2.Phase 35.3.Phase 45.4.Stormwater Construction Permit5.5.Construction Quality Assurance5.6.Closure Documentation	11 12 12 12 12
6.	Post-Closure Plan	13
7.	References	13

# **Table of Contents**

(Continued)

#### Section

Page No.

# List of Figures

Figure 1 Aerial View of Clifty Creek Station

# **List of Tables**

- Table 1
   Water Wells Within a Half-Mile Offset
- Table 2Proposed Closure Schedule

# **List of Appendices**

- Appendix A Acronyms and Abbreviations
- Appendix B As-Built Design Drawings
- Appendix C Boundary Survey
- Appendix D Location Figures (Water Wells and Vicinity Maps)
- Appendix E Geotechnical Data
- Appendix F Stability Analysis
- Appendix G WBSP Phases 2-4 Permit Drawings
- Appendix H Ditch Sizing Calculations
- Appendix I Final Cover Soil Loss
- Appendix J WBSP Phases 2-4 Quality Management Plan
- Appendix K Post-Closure Plan
- Appendix L Closure and Post-Closure Cost Estimate

# **Closure Plan**

# West Boiler Slag Pond Closure Phases 2-4 Clifty Creek Station Madison, Jefferson County, Indiana

# 1. Objective

Indiana-Kentucky Electric Corporation (IKEC) is submitting this Closure Plan for the Clifty Creek Station's West Boiler Slag Pond (WBSP) to the Indiana Department of Environmental Management (IDEM) Office of Water Quality (OWQ) with copies to the Office of Land Quality (OLQ), Waste Section. IKEC requests OWQ coordinate its review and comments with OLQ in a timely manner that facilitates adherence to the proposed schedule to close Phases 2-4 of the WBSP at the Clifty Creek Station.

The WBSP is an active settling facility and manages over 500 acres of stormwater and process flows from the station. The applicable National Pollution Discharge Elimination System (NPDES) Permit No. is IN0001759. IKEC previously submitted a Closure Plan for Phase 1 of the WBSP, which included regrading, capping, and closure of an inactive portion of the WBSP under the requirements of 40 CFR 257.102 of the U.S. Environmental Protection Agency's (USEPA's) Disposal of Coal Combustion Residuals (CCR) from Electric Utilities rule (EPA Final CCR Rule, 2015). The Phase 1 area lies within the WBSP clay dike, is at capacity, and has previously been repurposed as a laydown area for the station. The Phase 1 closure plan was submitted to IDEM in February 2020 and was deemed complete on October 23, 2020. The public involvement period is complete.

This closure plan details the three subsequent closure phases for the WBSP. Their design will be defined by the USEPA's EPA Final CCR Rule and the final rule amending 40 CFR 423, the Effluent Limitations, Guidelines, and Standards for the Steam Electric Power Generating Point Source Category (ELG Postponement Rule), which is addressed to modify operations at the Clifty Creek Station. Phases 2 and 3 will include design and construction of concrete CCR settling tanks and a Low Volume Waste Treatment System (LVWTS) to manage stormwater, plant process water (e.g., coal yard sumps, boiler room sumps, precipitator sumps), and landfill leachate. Phase 3 also includes construction of a new NPDES outfall. The existing NPDES permit and the authorization to discharge, as amended, from the WBSP's Outfall 002 expires on April 30, 2022 (IDEM, 2018). Construction of Phase 4 will then be initiated to close the remainder of the surface impoundment. Phase 4 includes subphases defined by the method of closure. Phase 4A will be completed by closure in place, i.e., final cover and geosynthetic cap placement. Phase 4B will be completed as closure-by-removal of material in accordance with this closure plan.

Appendix A is a list of acronyms and abbreviations.

# 2. Description of the CCR Unit

The Clifty Creek Station is located on the north bank of the Ohio River west of Madison, Indiana. It consists of six coal-fired electric generating units, each nominally rated at 217 megawatts. The station began producing electricity in 1955 to support the Department of Energy's (DOE's) Portsmouth Gaseous Diffusion Plant located near Piketon, Ohio. The WBSP is located immediately west of the station and south of Clifty Hollow Road. It was built concurrent to station construction to store sluiced CCRs. Figure 1 shows the location of the Clifty Creek Station and a general overview map of the site, including the locations of the WBSP and supporting appurtenances.

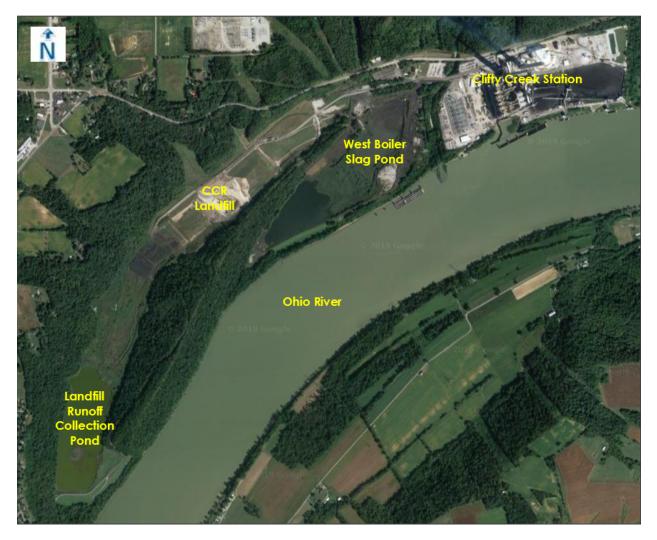


Figure 1- Aerial View of Clifty Creek Station

# 2.1. Impoundment Structure

The WBSP embankment is approximately 2,500 feet long, encompassing an estimated 80 acres with about 35 acres of surface water. The top of the dike is at an elevation of approximately 475 feet. The dike varies in height above the adjacent plant grades with

a maximum height of approximately 41 feet. FEMA (2015) Flood Insurance Study No. 18077CV000A shows that the flood stages of the Ohio River at the WBSP are approximately 463 feet and 468 feet for the 1 and 0.2 percent annual chance of flooding, respectively.

According to as-built design drawings 16-3002-5, 16-3002A-3, and 16-3033-1, the crest of the dam is 20 feet wide, the upstream slopes are 1.5H:1V (horizontal slope : vertical slope), and the downstream slopes are 2.5H:1V. The exterior toe of the dike is shown as elevation 433.0 feet with an exterior slope bench at 445.5 feet (AEPSC, 2016; Appendix B). The exterior WBSP slopes are grass covered.

#### 2.2. Primary Spillway

The WBSP's primary spillway is a 30-foot tall reinforced concrete decant-type overflow structure built 70 feet east of the southwestern abutment. The intake shaft is rectangular with a 3.25-foot by 3.25-foot interior cross section (GZA, 2009). The top of the structure is approximately elevation 458 feet (AEPSC, 2015). A 36-inch extra strength reinforced concrete pipe connects to the decant structure at elevation 433.0 feet and discharges 300 feet downstream to the Ohio River (GZA, 2009).

Flows from the WBSP are currently permitted to be discharged through Outfall 002 to the Ohio River under modified NPDES Permit No. IN0001759 effective May 1, 2018, which is administered by IDEM. The existing NPDES permit and the authorization to discharge, as amended, from the WBSP's Outfall 002 expires on April 30, 2022 (IDEM, 2018).

#### 2.3. WBSP Location

The Clifty Creek Station is in Jefferson County, Madison Township, Indiana in Township 3N, Range 10E, Section 5. The proposed four phases of closure and the post closure plan include approximately 89.6 acres. A legal description of the facility boundary is included in Appendix C.

In Appendix D, Figures 2 and 3 reflect a half-mile offset from the WBSP's waste boundary with regional water wells identified in the Indiana Department of Natural Resources (IDNR), Division of Water Well Record Database (IDNR, 2019). Figure 2 shows a plan view of the WBSP overlain on a November 2017 ESRI aerial. Figure 3 reflects the same data shown on a portion of the 7½-minute USGS topographic quadrangle map for Madison West (2019).

Six wells are shown within the half-mile offset. Available IDNR well information is provided in Appendix D. Three are a significant withdraw well permit group (registration number 01356) owned by IKEC and located upgradient of the WBSP. Two (Source ID 1 and 2A) provide water to the Clifty Creek Station. The third (Source ID 3) was abandoned in 2012 by Reynolds, Inc.

Logs for two more wells are available with UTM coordinates provided. Drilled in 1957, Wells 220019 and 22024 are owned by IKEC. Both encountered gravel and sand at depths of 58 and 60 feet, respectively. Well 22019 terminated at a bedrock depth of 130

feet. The wells were field located in 1966 and 1967. All IKEC wells are located upgradient of the WBSP.

The sixth well (registration number 219344) is owned by the State of Indiana, Clifty Falls Park and is also located upgradient of the WBSP. Completed in 1952, no UTM coordinates were provided. Comments in the IDNR file stated that drilling could not be verified. The location is estimated by township/range/section, quarter section, and county within the IDNR database and is assumed to be upgradient of the WBSP.

Well Record Reference No.	Туре	Depth (feet)	Completion Date	Location	Status
220019	Drilled to Bedrock	130	10/9/1957	Field located (1966); UTM provided	Inactive
220024	Unconsolidated	83	10/23/1957	Field located (1967); UTM provided	Inactive
01356 (1)	Significant Withdraw	122	12/25/1984	UTM provided	Active
01356 (2A)	Significant Withdraw	116	12/25/1984	UTM provided	Active
01356 (3)	Significant Withdraw	83	12/25/1984	General UTM provided	Abandoned
219344			7/20/1952	No UTM provided, NW ¼ of NW ¼ adj. to Ohio River below park.	Not present at location shown

Table 1 - Water Wells Within a Half-Mile Offset

#### 2.4. Available Geotechnical Data

Geotechnical data is available from six field explorations at the WBSP. A plan view of the borings and logs are provided in Appendix E. Appendix F contains a slope stability analysis for the WBSP Ph. 2-4 closure.

#### American Gas & Electric Service Corp. (1953)

The 1953 as-built design drawings include geotechnical borings within the Cinder Storage Area, now called the WBSP. The drawings show the embankment dimensions, generalized original ground topography, and geotechnical boring logs used as the basis of design.

The as-built base of the WBSP is 433.0 feet. Borings 3 and 4 show sandy brown clay at this elevation. Construction records reflect controlled compaction techniques using local material to reach the base grades. Borings 1 through 4 noted a silty grey clay with some sand to elevations of 401.0 feet (Boring 3) and 413.8 feet (Boring 4). In Borings 1 and 2, the sandy grey silt persists to 384.0 feet.

# Stantec (2016)

Stantec performed two geotechnical field explorations to support the safety factor demonstration under the CCR Rule. Six borings were advanced along the crest and the downstream toe of the WBSP embankment dike in 2009/2010 with a site visit in 2015 to confirm field conditions. Laboratory testing was performed to confirm field classifications (natural moisture content, hydrometer analyses, Atterberg limits), estimate shear strength

(consolidated-undrained triaxial compression testing), and permeability. Results from the explorations indicate that the dikes were constructed of lean clay with sand. A well-graded gravel was encountered in Boring B-2 at elevation 392.5 feet and in Boring B-4 at 372.5 feet. The bedrock beneath the foundation soils is weathered gray shale.

# AGES (2016)

Applied Geology and Environmental Science (AGES), Inc. was contracted by IKEC to identify upgrades in the groundwater monitoring program of the WBSP necessary for compliance with the CCR Rule. In 2015, two soil borings were advanced to supplement the existing subsurface geology information for the WBSP. Ten monitoring wells were then installed using a sonic drill rig, three upgradient and seven downgradient. Excerpts from AGES (2018) are included in Appendix E. This includes a well summary table, a generalized geologic cross section, groundwater flow maps for four sampling periods, and sample/well construction logs.

# D. W. Kozera (2019)

A field exploration was performed in 2019 to support design and construction of a material handling pad within the proposed Phase 1 closure footprint. Six borings were advanced to a depth of 30 feet below existing grade along the southeastern embankment dike of the WBSP. The logs described the material as manmade fill, consisting of boiler slag (silty sand with gravel) or lean clay. A plan view and boring logs for this exploration are included in Appendix E.

# Geotechnology (2020)

A field exploration was performed in 2020 to support design and construction of the Phase 2 closure area. Eight borings were advanced to depths ranging from 16 of 48 feet below existing grade. Seven cone penetrometer test (CPT) soundings were pushed from 4 to 36 feet below existing grade. The logs described the material as manmade fill, consisting of sand, gravel, and clay; boiler slag (coarse sand); lean clay, or shale and limestone bedrock. A plan view and boring logs for this exploration are included in Appendix E.

# Stantec (2021)

Stantec conducted a field exploration in 2021 to support design and construction of the Phase 1through 4 closure of the WBSP. Seven geotechnical borings were advanced to depths ranging from 20 to 52 feet below existing grade. The logs described the material as manmade fill, consisting of sand, gravel, and clay; boiler slag (coarse sand); lean clay, gravel, or shale bedrock. Laboratory testing of samples collected during this exploration are included in Appendix E.

# 3. **Regulatory Overview**

### 3.1. Regulatory Framework for Design

The United States EPA Final CCR Rule defines the criteria for conducting the closure of CCR units under 40 CFR 257.102.

Per the IDEM CCR Fact Sheet, Indiana coal ash surface impoundments that are subject to an NPDES permit are not regulated under IDEM's solid waste program (IDEM 2021). Once the NPDES permit is terminated, the final disposal of solid waste in the surface impoundment is subject to the closure requirements under 329 Indiana Administrative Code (IAC) 10-9-1(9)(b) and (c), which incorporates portions of the CCR Rule by reference.

This submittal is an amendment to a written closure plan (40 CFR 257.102(b)(3)) describing closure in place (40 CFR 257.102(d)) for the second, third, and fourth phases of the WBSP.

Below is a general summary of how the WBSP will be closed. The permit-level Phase 2-4 drawings are included in Appendix G. Ditch sizing calculations associated with the permit-level design for Phases 2-4 are included in Appendix H.

### 3.2. 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 WBSP is an active settling facility, managing over 500 acres of stormwater and process flows from the station. The intent is to consolidate CCR materials within the WBSP where possible and close the facility in place in accordance with the requirements found in the CCR Rule. The closure will consist of design and construction of concrete CCR settling tanks, a Low Volume Waste Treatment System (LVWTS) consisting of two lined ponds to manage stormwater, process flows from the plant and leachate from the CCR landfill (Phases 2 and 3). Construction of Phase 4 will then be initiated to close the remainder of the surface impoundment through construction of an engineered cap and closure by consolidation.

IDEM's OLQ has requested that the WBSP be closed in accordance with Type I restricted waste site (RWS) standards. Under 329 IAC 10-30-2, final cover must have:

- A maximum projected erosion rate of five tons per acre per year
- A final compacted cover of six inches of topsoil plus a minimum depth of compacted clay of 30 inches:
- Slopes not less than two percent nor greater than 33 percent.

Appendix I includes the final cover soil loss calculations. The final cover consists of a 30inch cover material layer and six inches of earthen material capable of growing and sustaining native vegetative growth. A geosynthetic membrane liner and geocomposite drainage layer is included below the cover material. The capped surface will be graded to promote surface water runoff, and then seeded and mulched to promote growth of the vegetative cover.

# 3.3. 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.]

Prior to installing the final cover system for each of the phases, the CCR unit will be drained of free water and the material within the unit will be stabilized and graded to provide a stable and suitable subgrade upon which to construct the cap. All water will be managed in the remaining open portion of the pond and discharged through the existing NPDES outfall for Phases 2 and 3. Upon completion of the LVWTS and final cover system in Phase 2 and 3, stormwater and treated process flows will be managed through a new NPDES outfall. Construction of Phase 4 will then begin construction to close the remainder of the surface impoundment through construction of an engineered cap and closure by consolidation. The existing CCRs will then be reshaped to provide a firm and stable subgrade and to achieve positive drainage for stormwater runoff.

The final closure system will consist of the following layers (from bottom to top):

- 40-mil LLDPE Flexible Membrane Liner
- Geocomposite Drainage Layer
- 30-inches of cover material
- 6-inches of vegetative cover capable of growing and sustaining native vegetative growth

The flexible geomembrane liner (FML) will have a permeability that is less than or equal to the permeability of the natural subsoils, and is no greater than 1x10<sup>-5</sup> cm/sec. The capped surface will be graded to promote surface water runoff, and then seeded and mulched to promote growth of the vegetative cover.

As part of the LVWTS construction, the primary and secondary basins will be constructed with engineered liner systems. The primary basin liner system shall consist of (from bottom to top):

- Geosynthetic Clay Liner
- 60-mil HDPE Flexible Membrane Liner
- Geotextile Fabric
- 12-inches of fill material
- Concrete work surface

The secondary basin liner system shall consist of:

- Geosynthetic Clay Liner
- 60-mil HDPE Flexible Membrane Liner
- Geotextile Fabric
- 6 inches of fill material
- 18-inches of riprap

For both the primary and secondary basin, the liner system on the side slopes shall consist of:

- Geosynthetic Clay Liner
- 60-mil HDPE Flexible Membrane Liner
- Geotextile Fabric
- 6 inches of fill material
- 18-inches of riprap

Piezometers will be installed within Phases 2-4 to monitor water levels for the closed footprint. Additional measures may be necessary to support subgrade conditioning and construction of the proposed liner and final cover systems. All pumped water will be returned to the remaining open portion of the pond to be discharged through the existing NPDES outfall.

Stormwater drainage improvements will be implemented during the final closure activities with minor grading of existing channels and construction of new channels to improve drainage of the closed pond. The final cover slope will be a minimum of two percent (2%) and will convey surface water to an NPDES-permitted outfall. Permanent stormwater ditch slopes may vary and will be sized to adequately convey anticipated design storm events.

# 3.4. Closure Performance Standards - 257.102(d)(1)

# 3.4.1. Section 257.102(d)(1)(i),(ii),(iii)

[(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 run-off to the ground or surface waters or to the atmosphere; (ii) Preclude the probability of future impoundment of water, sediment, or slurry; (iii) Include 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]

Post-closure infiltration of liquids into the waste will be controlled through the design of the site grading plan, construction of an engineered cap system, and establishment of a

stormwater management system in accordance with engineering practices. The intent of such a plan is to limit the infiltration of precipitation, cover, control, and prevent the releases of CCRs, and promote positive drainage. CCR materials will be placed and compacted in a manner to minimize settling and subsidence that could affect the integrity of the final cover system prior to cap placement.

Installation and quality control testing of the geosynthetics will be performed as specified by the manufacturer.

Stability analyses were performed as part of the EPA Final CCR Rule's design criteria demonstrations (Stantec, 2016). Additional analyses have been performed to support the proposed conveyor system at the southeastern abutment of the pond and to evaluate the perimeter dike stability to support the design grading of the Phases 2 through 4 WBSP closure area grading. These analyses are included in Appendix E.

# 3.4.2. Section 257.102(d)(1)(iv)

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

The final configuration of the impoundment will be vegetated to mitigate erosion. Maintenance of the final cover system will include regularly scheduled inspections to monitor post-closure conditions and preventative maintenance.

# 3.4.3. Section 257.102(d)(1)(v)

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

The impoundment will be closed in a time frame consistent with recognized and generally accepted good engineering practices. Refer to the schedule below for key milestone dates.

# 3.5. Draining and Stabilizing the Surface Impoundment

[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.]

# 3.5.1. Section 257.102(d)(2)(i)

# [Free liquids must be eliminated by removing liquid wastes or solidifying the remaining wastes and waste residue.]

Free liquid will be removed as part of the final closure of the CCR unit and discharged in a manner consistent with the facility's NPDES permit.

# 3.5.2. Section 257.102(d)(2)(ii)

# [Remaining waste must be stabilized sufficient to support the final cover system.]

The remaining wastes that constitute the subgrade of the final cover system will be stabilized by removal of free liquids and providing bridging material as necessary.

# 3.6. 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.]

Refer to Section 3.3 for details regarding the final cover system

### 3.7. 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 for the WBSP is approximately 3,600 acre-feet.

# 3.8. 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 proposed final cover system area for Phases 2-4 is approximately 60 acres.

# 3.9. 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.]

Phases 2-4 will begin final design and construction upon approval of this permit application. The intent is to complete construction of the Phase 2 concrete CCR settling tanks and Phase 3 Low Volume Waste Treatment System (LVWTS) by end of 2023.

Subsequent Phase 4 construction to close the remainder of the surface impoundment through construction of an engineered cap will be completed within five years of cessation of flows in accordance with the CCR Rule or when technically feasible.

USEPA (2020) has defined a closure schedule process for existing CCR surface impoundments that are considered "unlined" under the CCR Rule. Table 2 provides an approximate closure schedule to meet the required regulation.

Task	Completion Date
Phase 1 construction	End of 2022
Phase 2 and Phase 3 construction	End of 2023
Phase 4 construction	Within 5 years of cessation of flows or
	when technically feasible

Table 2 - Proposed Closure Schedule

# 4. General Considerations

General considerations for the WBSP closure are presented in the following sections. Subsequent to final closure, IKEC will address environmental concerns and permit obligations that are regulated by other IDEM divisions during the closure process. All demonstrations reflecting the WBSP's compliance with the EPA Final CCR Rule in terms of location restrictions, design criteria, operating criteria, and groundwater monitoring are available on IKEC's public website, www.ovec.com/CCRClifty.php.

Phase 2 includes the construction of a series of concrete settling tanks to manage operational boiler slag, which will serve as part of the facility's ELG compliance strategy. Phase 3 includes the construction of two geomembrane-lined ponds to treat on-going plant process flows and construction of a new NDPES outfall. Phase 4 consolidates and closes the last of the WBSP active surface impoundment.

# 5. Closure Plan Scope of Work

Phases 2-4 closure of the WBSP will require continued modification of the current pond system. The following general tasks are anticipated as part of the closure process.

# 5.1. Phase 2

Phase 2 will consist of the portion of the final cover supporting boiler slag settling tanks, pipes, and ancillary facilities for the operational changes to the process flows. It will be located at the northern end of the WBSP, located closest to the station. Appendix G provides the proposed Phase 2-4 permit drawings, including the boiler slag settling tanks, pipes, and ancillary facilities and associated details, as well as the portion of the final cover supporting these features.

# 5.2. Phase 3

A significant portion of the waste water flow from the station is planned to be treated with a separate treatment system. The system for handling this flow is termed the Low Volume Waste Treatment System and is not included in the ELG requirements. The Phase 3 area and construction activities will include two lined basins to collect this flow. The Phase 3 design of this system was based on flow rates and minimum required retention times.

### 5.3. Phase 4

Throughout Phases 2 and 3, process flows will continue to be discharged through Outfall 002 to the Ohio River under modified NPDES Permit No. IN0001759 effective May 1, 2018, which is administered by IDEM. The existing NPDES permit and the authorization to discharge, as amended, from the WBSP's Outfall 002 expires on April 30, 2022 (IDEM, 2018). Construction of Phase 4 will then be initiated to close the remainder of the surface impoundment. Phase 4 consists of two subphases defined by the closure construction anticipated within those phases.

As part of Phase 4A, an engineered cap system will be constructed over the Phase 2-4 closure area. Appendix G provides the proposed Phase 2-4 permit drawings, including the cap area and details.

As part of Phase 4B, the remaining portion of the impoundment will be closed by consolidation (closure by removal). Existing CCR material will be removed in accordance with the requirements of the Quality Management Plan (QMP). Clean fill will be imported to the site to promote positive drainage of stormwater to the existing outfall. A minimum of six inches of vegetative cover will be placed over the fill material capable of growing and sustaining native vegetative growth.

The final cap system design will accommodate settling and subsidence so to preserve the cap system's integrity.

#### 5.4. Stormwater Construction Permit

Since more than one acre will be disturbed during the pond closure activities, a Stormwater Notice of Intent (NOI) to discharge stormwater associated with construction activities will be submitted to IDEM OWQ. A Stormwater Pollution Prevention Plan (SWPPP) will be prepared and submitted as required by the NOI along with applicable permit fees. A Notice of Termination (NOT) to terminate the stormwater construction permit will be submitted upon completion of the pond closure.

#### 5.5. Construction Quality Assurance

Construction quality assurance (CQA) activities are outlined in the attached Quality Management Plan (QMP). The QMP will be finalized as part of the detailed design and prior to construction of each phase of the WBSP closure. Construction observations will

be conducted and recorded to document the closure and CQA testing. Sections of the QMP will include:

- A. Purpose and Scope
- B. Responsibility and Authority
- C. Quality Control Activities
- D. Quality Assurance Activities
- E. Product Submittals and Material Testing
- F. Project Documentation

Appendix J includes a draft QMP. This is proposed as the basis for the final plan to maintain consistency on the site.

#### 5.6. Closure Documentation

Upon completion of approved closure construction activities, a closure report will be prepared by an independent professional engineer registered in the State of Indiana to document the completed construction activities. The closure report will be submitted to IDEM OLQ and OWQ. The letter report will document the source of fill material, amount of fill material used, details regarding cap construction, and final cap elevations.

# 6. Post-Closure Plan

Post-closure care will be performed in accordance with the Post-closure Plan in Appendix K. The closed areas for Phases 2-4 will be included in the active groundwater monitoring program until the ultimate closure of the WBSP. Post-closure care for all phases will begin at that time.

Estimated Closure and Post-Closure costs are provided in Appendix L.

# 7. References

- American Electric Power Service Corporation. (2016). History of Construction. CFR 257.73(c)(1). West Boiler Slag Pond. Clifty Creek Plant. Madison, Indiana. October. Prepared for Indiana-Kentucky Electric Corporation. GERS-16-142. Columbus, Ohio.
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   5. Inspection Date: September 3, 2015. Revision 0.
- Applied Geology and Environmental Science, Inc. (2016), Revision 1.0 (2018). Coal Combustion Residuals Regulation (CCR) Monitoring Well Installation Report, Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Indiana.

- Indiana Department of Environmental Management (IDEM). Fact Sheet. Coal Combustion Residuals (Coal CCR). Office of Land Quality – Permitting Branch. Factsheet\_olq\_permits\_ccr. Accessed May 17, 2021. https://www.in.gov/idem/fact-sheets/#olq. CO0518L-1120.
- Environmental Protection Agency (2015). "Final Rule: Disposal of Coal Combustion Residuals from Electric Utilities." Federal Register, Vol. 80, No. 74, April 17.
- Federal Emergency Management Agency (FEMA) (2015). Flood Insurance Study. Jefferson County, Indiana and Incorporated Areas. Volume 1 of 1. Effective April 2. FIS No. 18077CV000A. Version No. 2.2.2.0.
- GZA GeoEnvironmental, Inc. (GZA) (2009). Task 3 Dam Assessment Report. Project #0-381. Clifty Creek Station. West Boiler Slag Pond. Madison, Indiana. September 14.
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Indiana-Kentucky Electric Corporation. www.ovec.com/CCRClifty.php

- Indiana-Kentucky Electric Corporation. (2016a). Closure Plan. CFR 257.102(b). West Boiler Slag Pond. Clifty Creek Station. Madison, Indiana. October.
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- Stantec Consulting Services Inc. (2018). Placement Above the Uppermost Aquifer Demonstration. West Boiler Slag Pond. Clifty Creek Station. Madison, Indiana. Prepared for Indiana-Kentucky Electric Corporation. Piketon, Ohio. October 12.
- Stantec Consulting Services Inc. (2016). Report of CCR Rule Stability Analyses. AEP Clifty Creek Power Plant. Boiler Slag Pond Dam and Landfill Runoff Collection Pond. Madison, Jefferson County, Indiana. Prepared for American Electric Power, Columbus, Ohio. February 16.
- USEPA (2020). A Holistic Approach to Closure Part A: Deadline to Initiate Closure [RIN 2050-AH10; FRL-XXXX-XX-OLEM]. Pre-publication copy notice. November 4. EPA-HQ-OLEM-2019-0172.

# APPENDIX A

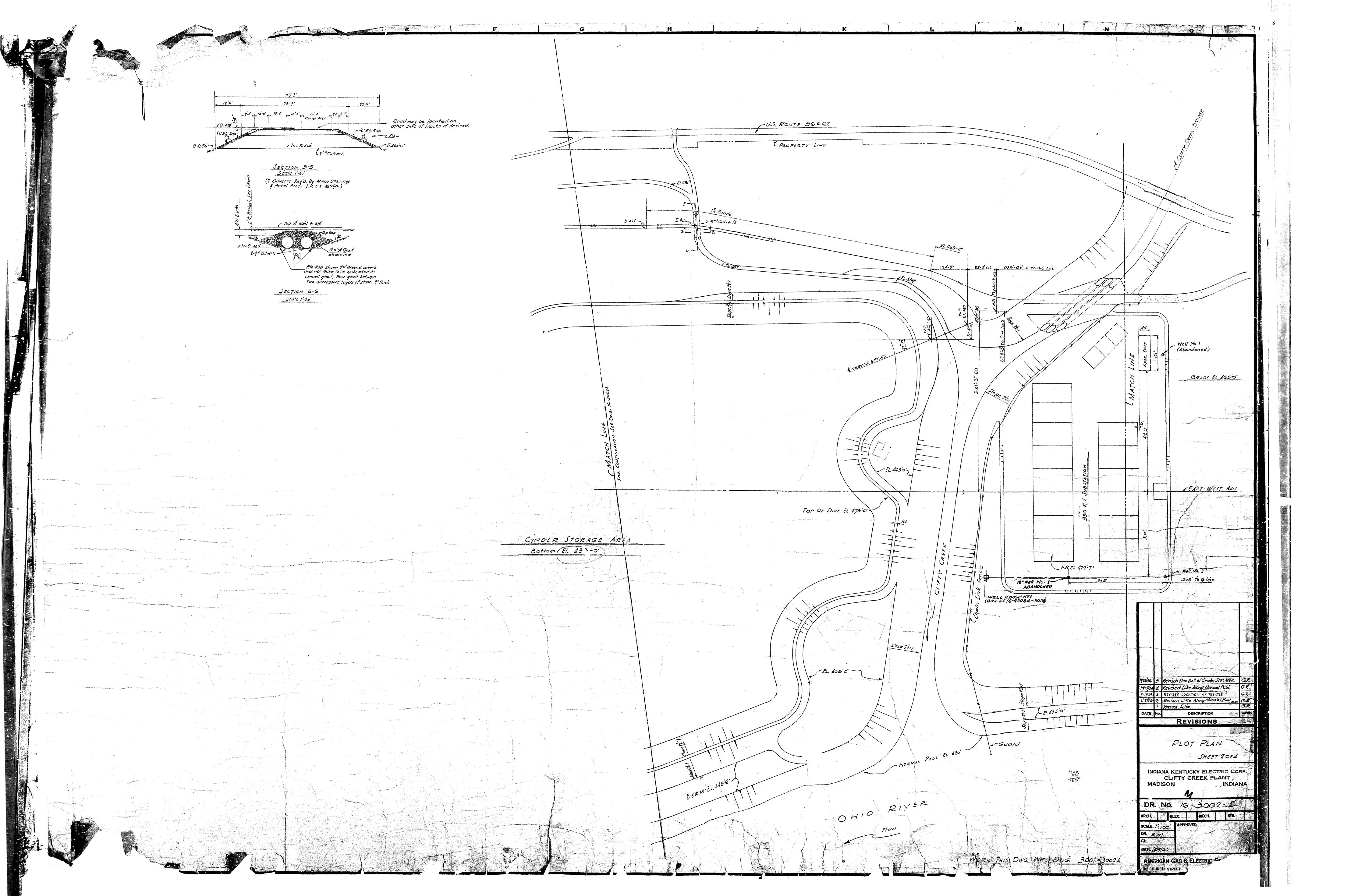
Acronyms and Abbreviations

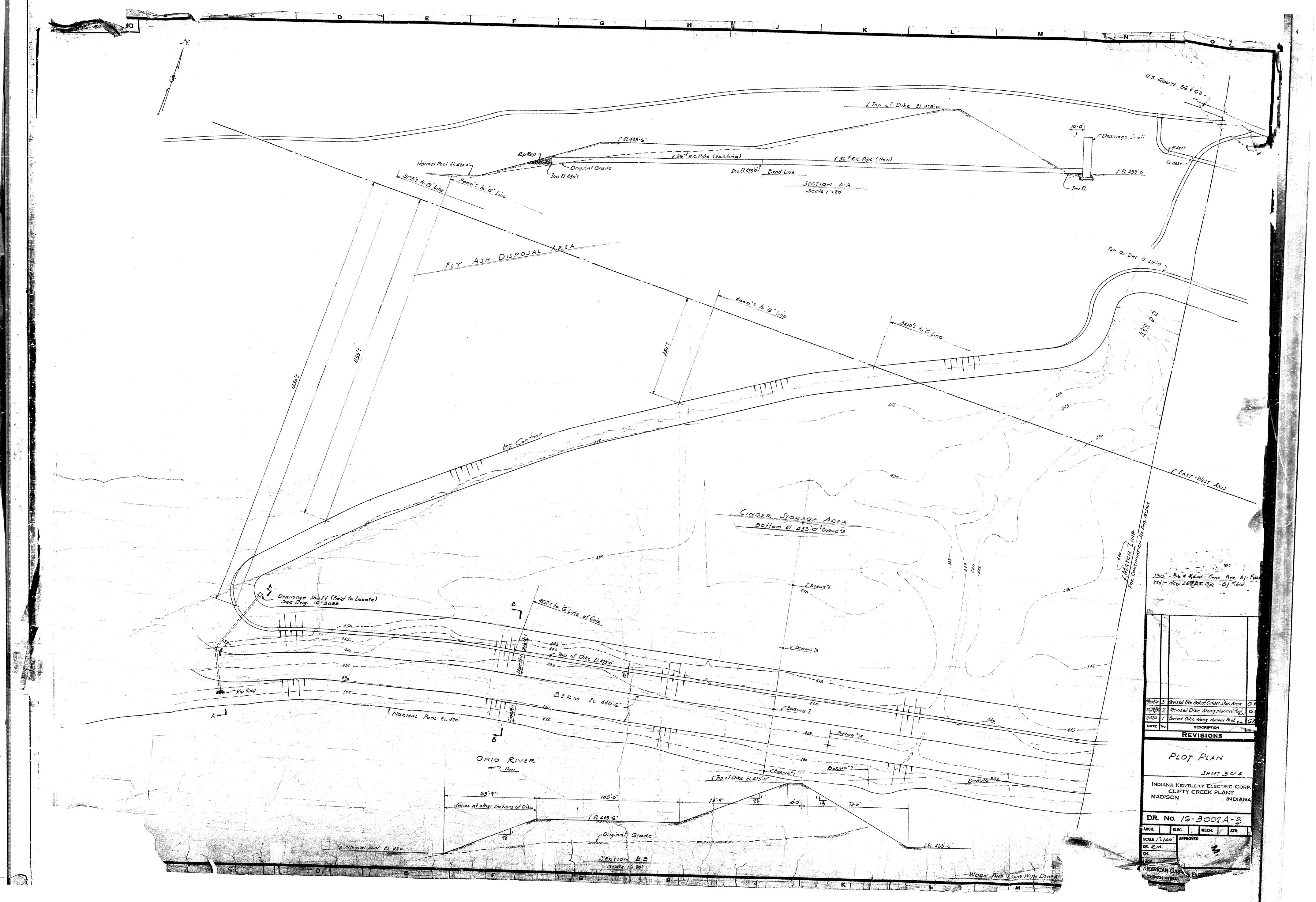
# **Acronyms and Abbreviations**

AEPSC	American Electric Power Service Corporation
AGES	Applied Geology and Environmental Science, Inc.
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
cm/sec	centimeters per second
CQA	Construction Quality Assurance
DOE	Department of Energy
ELG	Effluent Limitations, Guidelines
FML	flexible membrane liner
H:V	horizontal slope : vertical slope
IAC	Indiana Administrative Code
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
IKEC	Indiana-Kentucky Electric Corporation
LVWTS	Low-Volume Waste Treatment System
mW	megawatts
No.	number
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
OLQ	Office of Land Quality
OWQ	Office of Water Quality
QMP	Quality Management Plan
SWPPP	Stormwater Pollution Prevention Plan
UMA	uppermost aquifer
USEPA	United States Environmental Protection Agency
WBSP	West Boiler Slag Pond

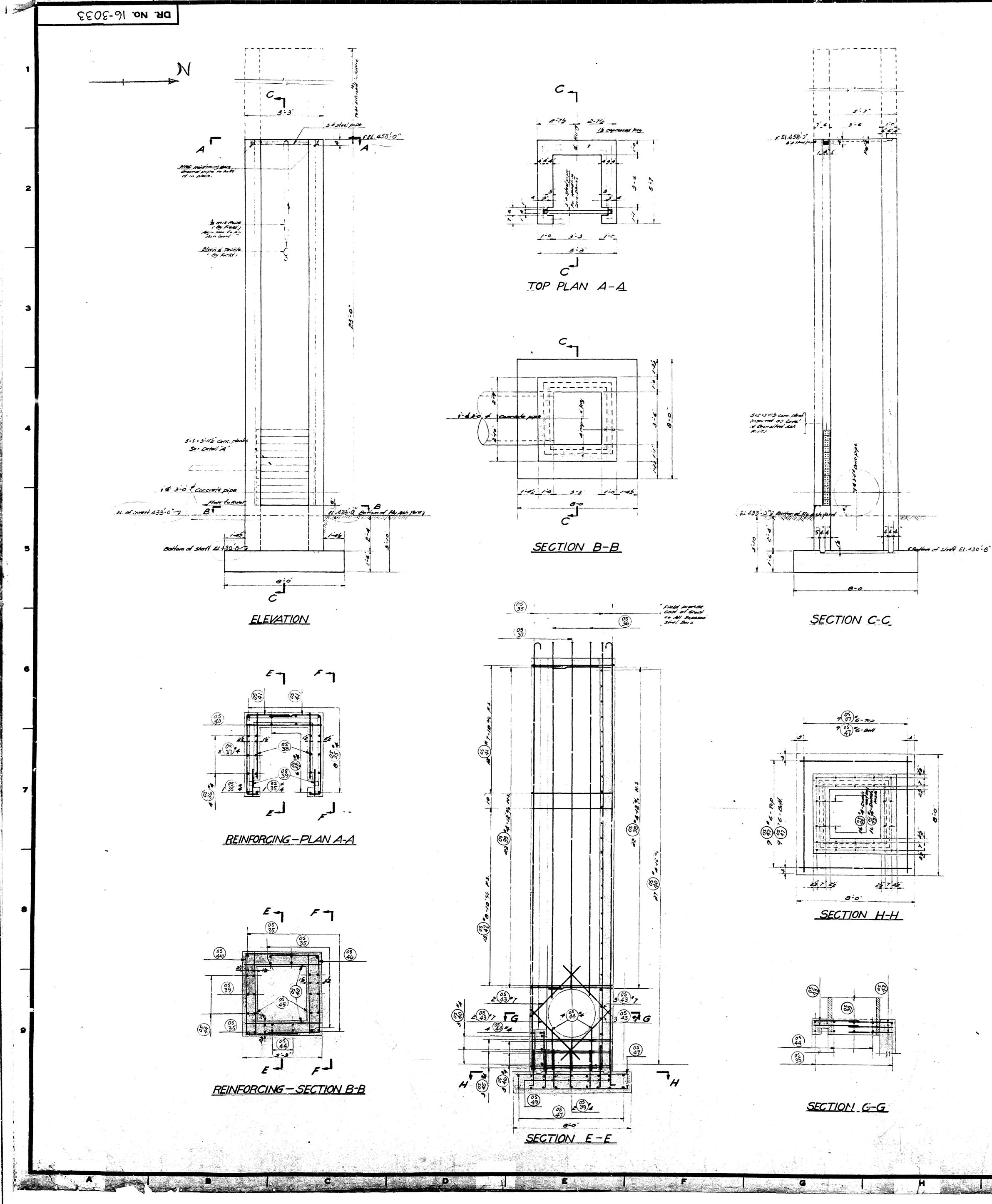
# **APPENDIX B**

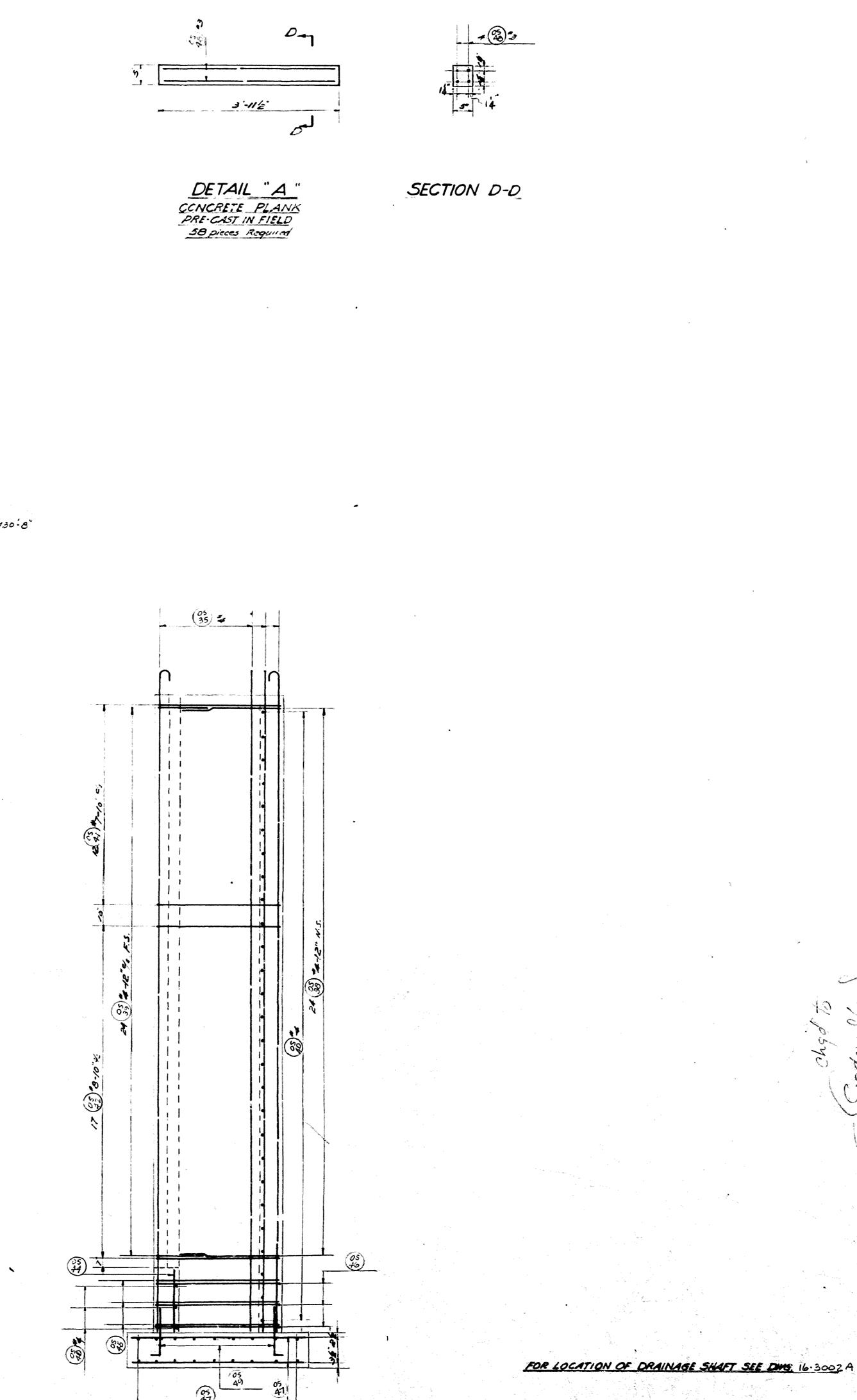
As-Built Design Drawings











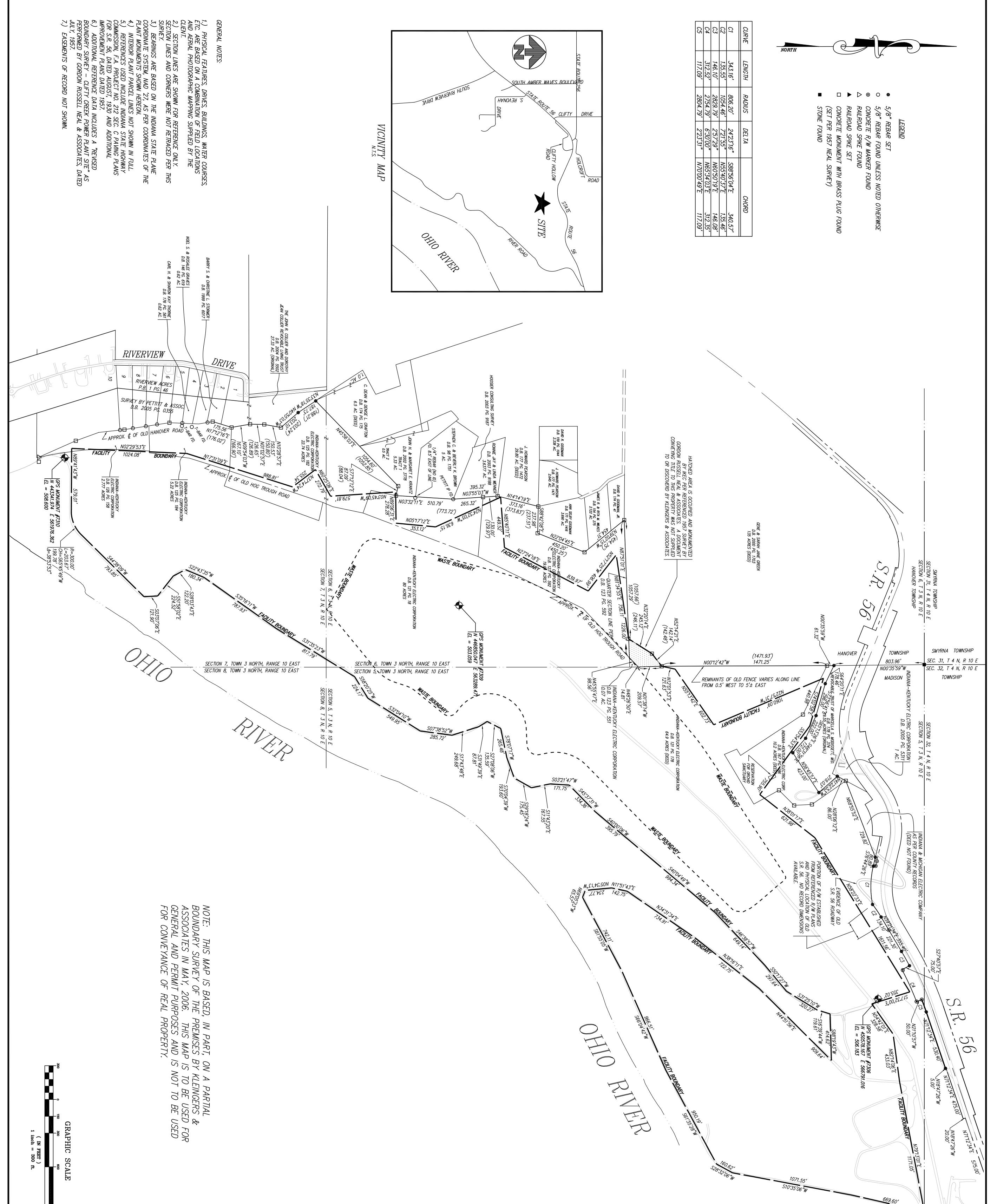
ELEVATION F-F

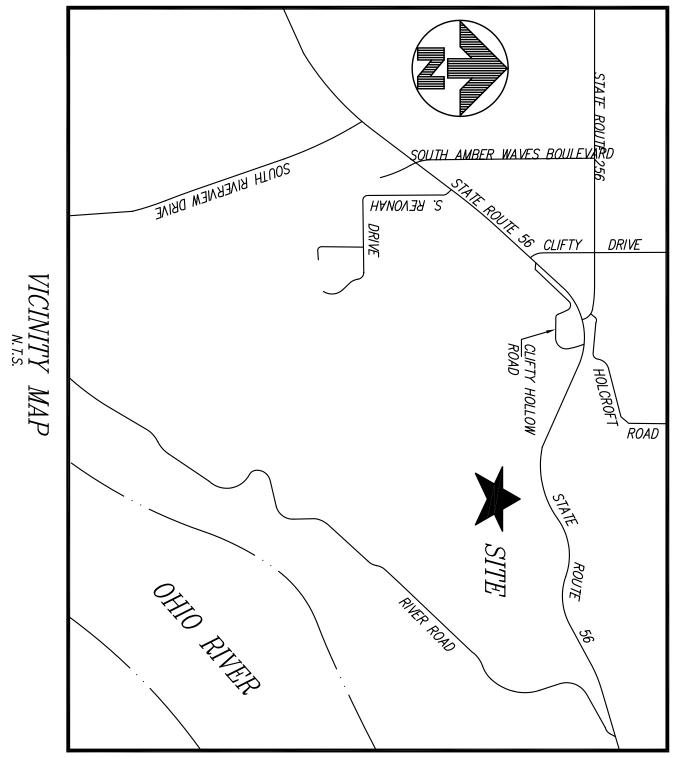
ĸ ALLO.

10-10 General Motos: and a the second and a second and ·● 《教室》》:"你不是你这个话来,我们们不是……""我不能 ેલ પ્રગ ગ ્ય પ્રહા `ann ∦क ``ê™as k स સંગ્રે 🛃 🖌 જાજ the a trip to the the 9°, 9 **3**6 ..... 5 1 a × CAS CORE BORNELLE BORNELLE MARCHITHICALLY CORE BORNELLE BORNELLE FRANCISTICALLY CORE BORNELLE BORNELLE BORNELLE BORNELLE BORNELLE CORE BORNELLE BORNELLE BORNELLE BORNELLE BORNELLE BORNELLE CORE BORNELLE BORNELLE BORNELLE BORNELLE BORNELLE BORNELLE CORE BORNELLE BORNELLE BORNELLE BORNELLE BORNELLE CORE BORNELLE BORNELLE BORNELLE BORNELLE BORNELLE BORNELLE CORE BORNELLE BORNELLE BORNELLE BORNELLE BORNELLE CORE BORNELLE BORNELLE BORNELLE BORNELLE BORNELLE BORNELLE CORE BORNELLE BORNELLE BORNELLE BORNELLE BORNELLE CORE BORNELLE BORNELLE BORNELLE BORNELLE BORNELLE BORNELLE CORE BORNELLE BORN Materiels 19 cu yd. By Fredd Concrete: 1 - 3 + pipe - 4 - 6 Long pipes REINFORCING STELL BY: FIELD and a standard and a standard a s Reference Drawings ananananan wanan menanananan (, apage, 19) - 19 koʻun ay maka Ku, Mandaddalangun (,,mayadi alay ange RS776 Reinforcing Schemute 16.3002A My Ash yerd Masta I Revised Elevations DESCRIPTION DATE No. APTO. REVISIONS ASH STORAGE YARD DRAIMAGE SHAFT MASONI & REINFORCING 1953-1954 CONSTRUCTION INDIANA KENTUCKY ELECTRIC CORP. CLIFTY CREEK PLANT MADISON INDIANA DR. NO. 16-3033 -1 ARCH. ELEC. MECH. STR. SCALE - - - - APPROVED  $G \in$ R. F.T.K. CH. M.E. DATE 4/16/54 AMERICAN GAS & ELECTRIC SERVICE CONP. N N N

# APPENDIX C

Boundary Survey

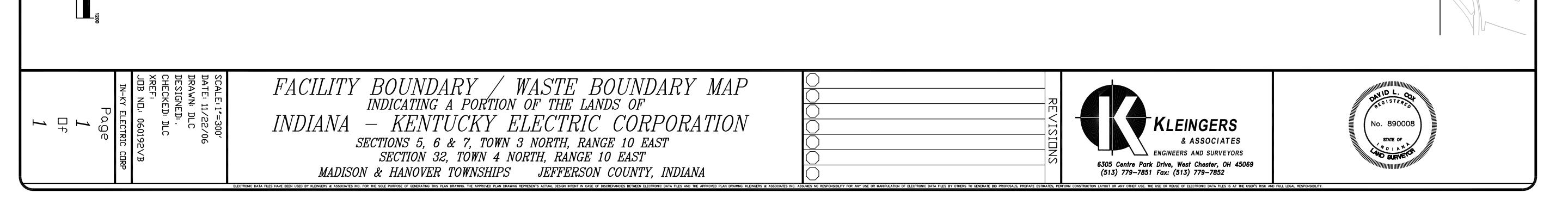




CURVE	LENGTH	RADIUS	DEL TA	9	CHORD
C1	343.16'	806.20'	24°23'16"	S88*56'04"E	340.57'
C2	135.55'	1054.46'	<b>7°21'55"</b>	N55 <b>°</b> 40'37"E	135.46'
C3	146.10'	2829.79'	<i>"62</i> ,25.7	J"61,02.09N	146.08'
C4	312.52'	2754.79'	,00,05.9	N65 <b>°</b> 34'03"E	312.35'
C5	,60 211	2804.79'	<i>" 15,23°2</i>	N70°00'49"E	117.09'

<i>C5</i>	C4	С3	C2	C1	CURVE	
117.09'	312.52'	146.10'	135.55'	343.16'	LENGTH	
2804.79'	2754.79'	2829.79'	1054.46'	806.20'	RADIUS	
2°23'31"	6"30'00"	2*57'29"	<b>7°21'55"</b>	24°23'16"	DEL TA	
N70°00'49"E	N65*34'03"E	N60°50'19"E	N55°40'37"E	S88*56'04"E	0	
117.09'	312.35'	146.08'	135.46'	340.57'	CHORD	

W"80 07





November 22, 2006

#### LEGAL DESCRIPTION INDIANA – KENTUCKY ELECTRIC CORPORATION FACILITY BOUNARY 357.74 ACRES

Situated in Section 5, Town 3 North, Range 10 East, Madison Township and in Sections 6 and 7, Town 3 North, Range 10 East, Hanover Township, Jefferson County, Indiana and being part of the lands conveyed to Indiana-Kentucky Electric Corporation and being more particularly described as follows:

Commencing at a stone found at the northwest corner of said Section 5 and the northeast corner of said Section 6;

Thence along the westerly line of Section 5 and the easterly line of Section 6, also being the line between Madison and Hanover Townships, S00°35'59"E a distance of 803.96 feet;

Thence continuing along said section line, S00°12'42"E a distance of 1471.25 feet to a concrete monument found at the true Point of Beginning;

Thence along the lines or through the lands of the Indiana-Kentucky Electric Corporation the following sixty five (65) courses:

- 1) N12°01'53"E a distance of 121.63 feet;
- 2) N55°13'42"E a distance of 602.73 feet;
- 3) N22°57'31"W a distance of 1060.09 feet;
- 4) S74°02'58"E a distance of 440.98 feet;
- 5) S53°54'53"E a distance of 755.90 feet;
- 6) N38°01'17"E a distance of 621.98 feet;
- 7) N58°22'33"E a distance of 1611.56 feet;
- 8) S17°32'00"E a distance of 355.02 feet;
- 9) N54°42'01"E a distance of 328.58 feet;
- 10) N82°14'06"E a distance of 433.03 feet;
- 11) N79°13'01"E a distance of 1171.05 feet;
- 12) S12°46'08"W a distance of 669.60 feet;
- 13) S10°35'06"W a distance of 1071.55 feet;
- 14) S28°32'06"W a distance of 160.62 feet;
- 15) S61°35'28"W a distance of 950.19 feet;
- 16) S66°04'42"W a distance of 966.51 feet;
- 17) S61°55'05"W a distance of 742.11 feet;
- 18) N69°05'23"W a distance of 65.57 feet;
- 19) N05°34'13"W a distance of 234.77 feet;

- 20) N11°51'43"E a distance of 142.75 feet; 21) N34°31'34"E a distance of 734.91 feet; 22) N38°16'11"E a distance of 722.75 feet; 23) N44°51'56"E a distance of 909.64 feet; 24) S88°19'43"W a distance of 414.62 feet; 25) S16°39'44"W a distance of 119.61 feet; 26) S31°25'10"W a distance of 320.27 feet; 27) S50°17'27"W a distance of 297.64 feet; 28) S46°38'57"W a distance of 649.14 feet; 29) S40°04'49"W a distance of 994.34 feet: 30) S40°00'06"W a distance of 395.79 feet; 31) S45°37'31"W a distance of 334.36 feet; 32) S03°21'47"W a distance of 171.75 feet; 33) S11°43'20"E a distance of 167.55 feet: 34) S29°18'24"W a distance of 175.45 feet; 35) \$70°04'39"W a distance of 193.60 feet; 36) S78°07'17"W a distance of 265.48 feet; 37) S27°08'06"W a distance of 135.59 feet; 38) S31°49'39"E a distance of 87.81 feet; 39) S17°43'48"E a distance of 249.68 feet; 40) S07°38'52"W a distance of 285.72 feet: 41) S32°04'10"W a distance of 549.95 feet; 42) S58°20'25"W a distance of 224.17 feet; 43) S31°35'23"W a distance of 817.79 feet; 44) S35°16'11"W a distance of 787.93 feet; 45) S22°43'35"W a distance of 180.34 feet; 46) S28°03'43"E a distance of 122.20 feet; 47) S51°58'02"E a distance of 224.52 feet; 48) S03°07'06"E a distance of 121.90 feet; 49) S44°38'09"W a distance of 793.85 feet; 50) Along a curve to the right, an arc distance of 203.67 feet, said curve having a central angle of 38°53'53", a radius of 300.00 feet, and a chord bearing S65°45'49"W for 199.78 feet; 51) N89°41'43"W a distance of 579.01 feet; 52) N02°29'53"E a distance of 1024.08 feet; 53) N17°31'09"E a distance of 988.81 feet; 54) N37°14'24"W a distance of 255.34 feet; 55) N60°25'06"E a distance of 272.79 feet; 56) N03°45'09"W a distance of 579.81 feet; 57) N89°06'31"E a distance of 278.28 feet; 58) N05°17'12"E a distance of 353.12 feet; 59) N24°32'05"W a distance of 636.15 feet; 60) N85°40'11"E a distance of 449.52 feet: 61) N27°24'18"E a distance of 839.97 feet; 62) N52°17'25"W a distance of 406.99 feet;
- 63) N81°34'55"E a distance of 756.11 feet;
- 64) N32°20'14"E a distance of 245.12 feet;

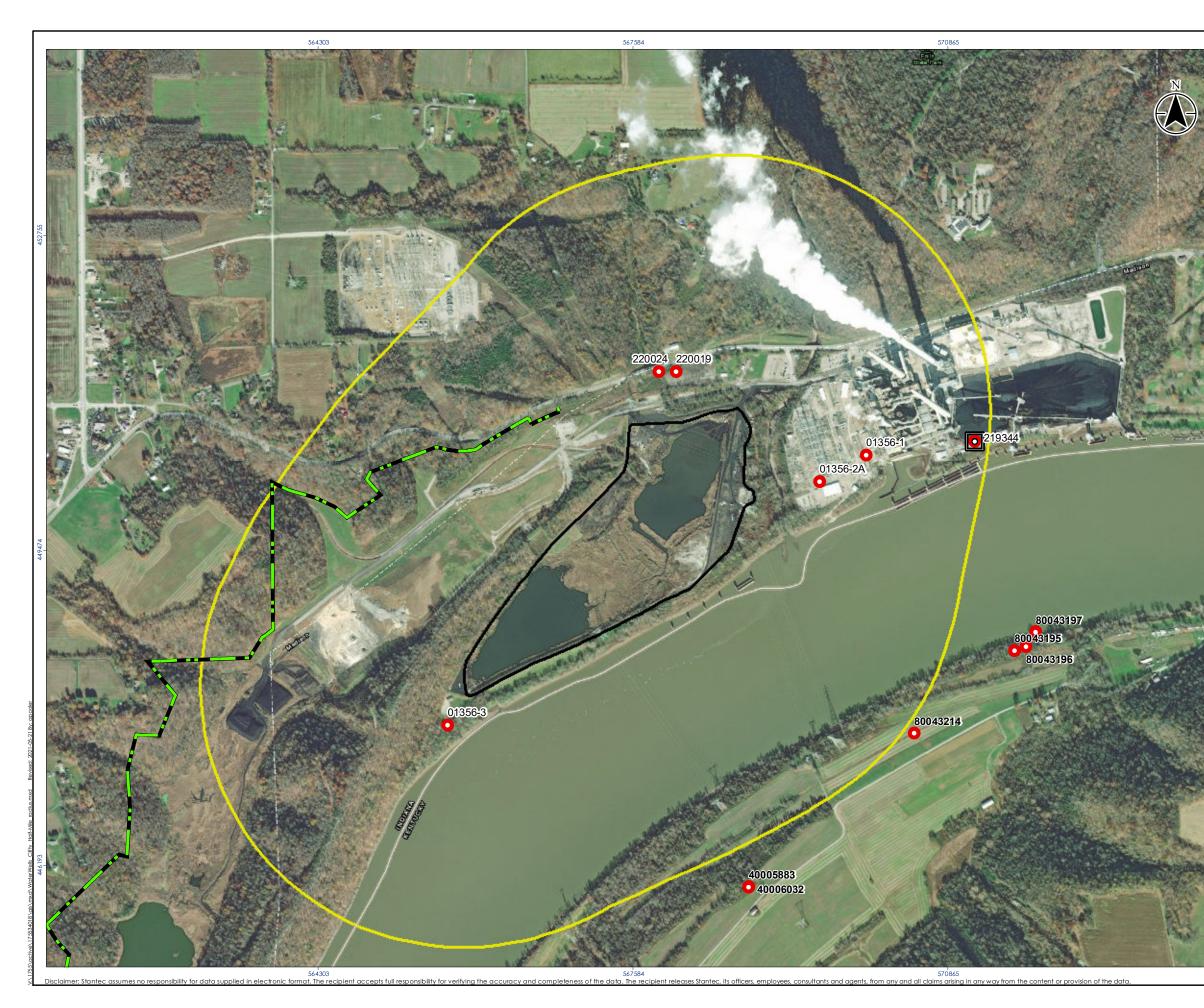
65) N52°14'21"E a distance of 142.14 feet to the Point of Beginning, containing 357.74 acres, more or less.

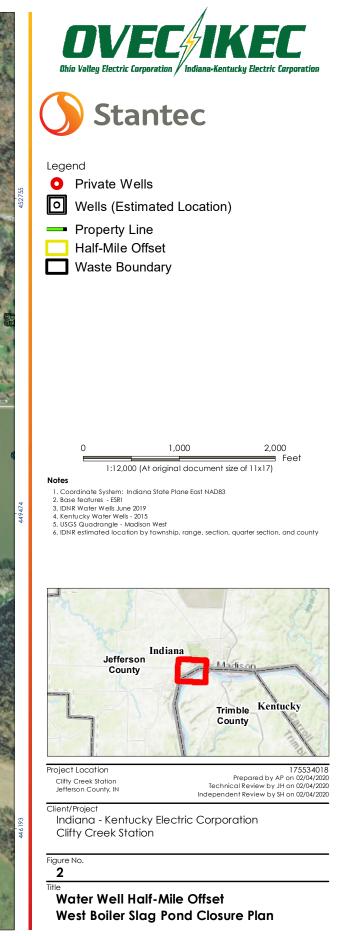
Bearings are based on the Indiana State Plane Coordinate System, NAD '27 as per the coordinates of the plant monuments provided by others.

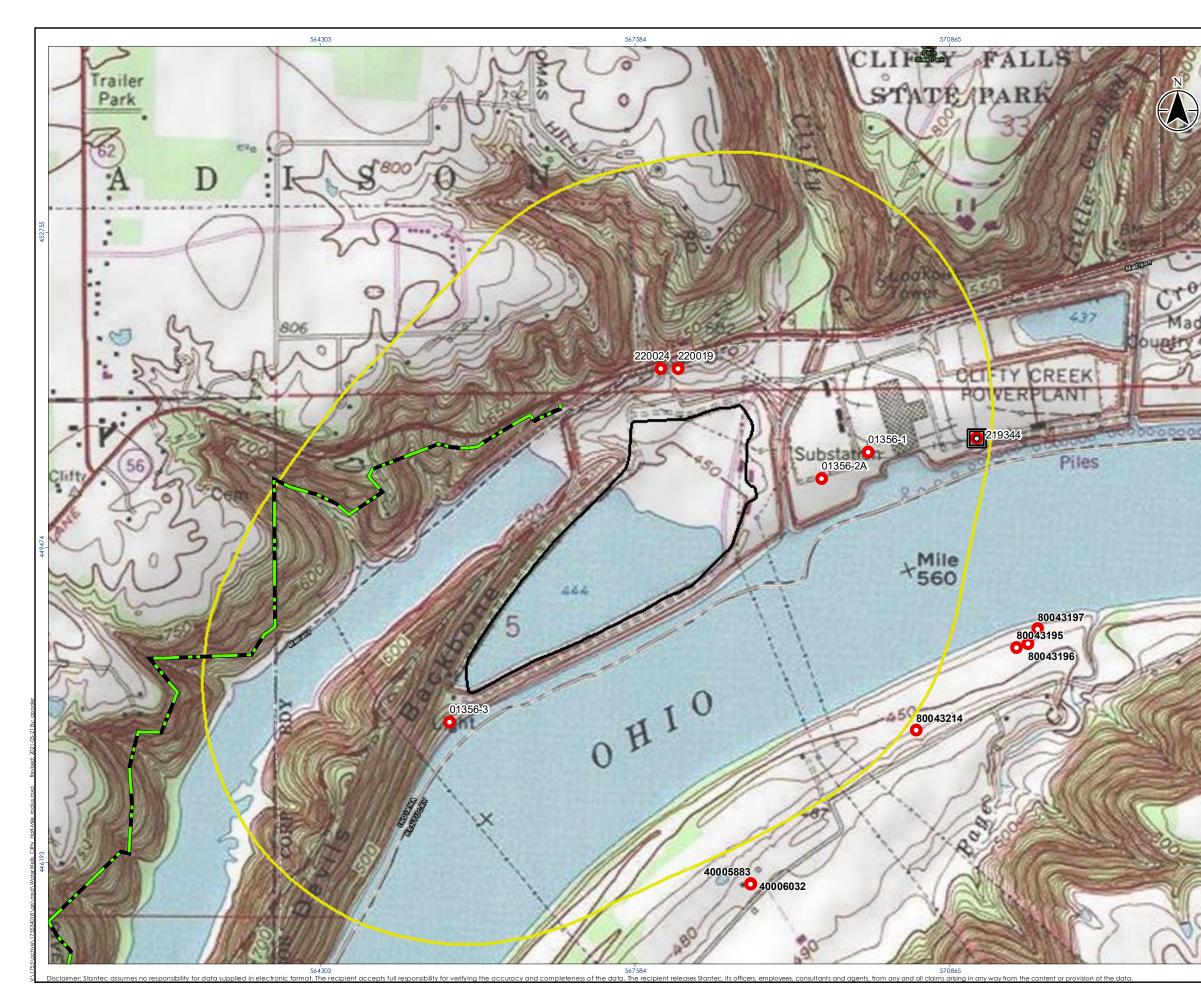
This description was prepared by Kleingers & Associates, Inc., under the direction of David L. Cox, Indiana Licensed Surveyor No. 890008 and is based on a partial survey of the subject property performed in April and May, 2006. This description is to be used for permit purposes only and is not for the conveyance of real property.

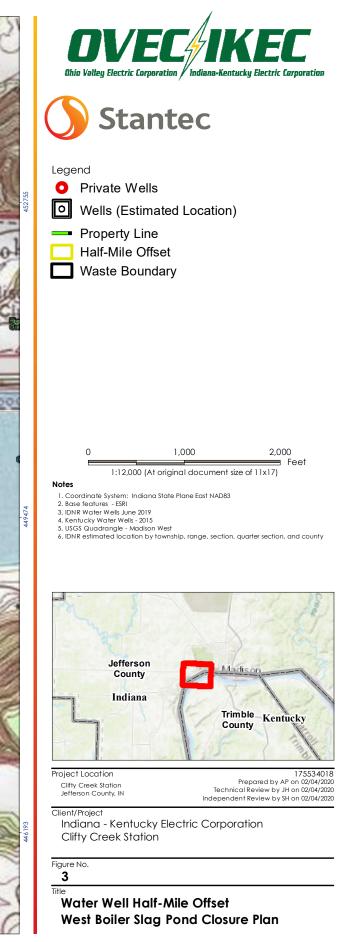
# APPENDIX D

Location Figures









### Significant Withdraw Wells within a Half-Mile Offset of the WBSP

			MWU							Source	Source	Capacity	Well	Depth	Diam		UTM	UTM		
	County	RegNo	Code	Facility	RegDate	USGS 24k Quad	Township	Range	Section	Code	ID	(GPM)	Log	(ft)	(in)	Aquifer	North	East	x	У
Significant	39	01356	EP	Indiana Kentucky Electric Corporation	12/26/84	Madison West, IN-KY	3N	10E	4	WELL	1	500		122	12	SG	4288550	637225	637221.5056	4288757.352
Withdraw	39	01356	EP	Indiana Kentucky Electric Corporation	12/26/84	Madison West, IN-KY	3N	10E	4	WELL	2A	500	383112	116	16	SG	4288465	637078	637074.5094	4288672.35
Well	39	01356	EP	Indiana Kentucky Electric Corporation	12/26/84	Madison West, IN-KY	3N	10E	4	WELL	3	500		83	6	SG	4287675	635900		

IDNR Water Well Viewer, DOW Database (accessed February 5, 2020)

### Indiana Department of Natural Resources

Reference Nur	nber	Driving direct	ions to well			Date completed
220019		WELL #2 2MI	W OF MADI	SON, INDIANA		Oct 09, 1957
Owner- Contractor	Name		Add	ress	Telephone	
Owner	INDIAN CO.	IA-KENTUCKY	ELE. MA	DISON, INDIANA		
Driller		PUMP & SUPPI NY		BOX 21266 LOUISVILLE, NTUCKY		
Operator	A. BUR	GESS	Lice	nse: null		
Construction I	Details					
Well		Use: Industry	D	Filling method: Cable Tool	Pump typ	e:
		Depth: 130.0		ump setting depth:	Water qua	-
Casing		Length: 100.0		laterial:	Diameter	
Screen		Length: 30.0	Ν	Iaterial:	Diameter	12.0 Slot size: #30
Well Capacity	Test	<b>Type of test:</b> <b>Drawdown:</b> 7.	0 ft.	Test rate: 732.0 gpm for Static water level: 51.0 f		<b>t rate:</b> gpm for hrs. <b>Drawdown</b> ft.
Grouting Info	rmation	Material: Installation M	ethod:		<pre>th: from to nber of bags used:</pre>	
Vell Abandonment		Sealing mater Installation M			<pre>th: from to nber of bags used:</pre>	
Administrativ	e	<b>County:</b> JEFF	ERSON		Township: 4N R	ange: 10E
	-	•		SE of Section 32	<b>P</b>	Topo map: MADISON WEST, IN-KY
		Grant Numbe Field located I Courthouse lo Location acce Subdivision n Ft W of EL: 1	oy: JUA cation by: pted w/o verif ame:	ication by: Ft N of SL: 250.0	on: Jun 01, 1966 on: on: Lot number: Ft E of WL:	Ft S of NL:
		Ground elevat	t <b>ion:</b> 500.0	Depth to bedrock: 130.0	Bedrock	Aquifer elevation:
		UTM Easting	: 636614.0	-	elevation: 370.0 UTM Northing:	-
Well Log		Тор	Bottom	Formation		
~		0.0	48.0	MED		
		48.0	58.0	FN SANDY MUD	)	
		58.0	65.0	CRS GRAV		
		65.0	71.0	CRS GRAV		
		71.0	79.0	CRS GRAV		
		79.0	84.0	MED SAND		
		84.0	88.0	CRS SAND		
		00.0	92.0	CDC CD AV		
		88.0	92.0	CRS GRAV		

104.0109.0FN GRAV109.0119.0MED GRAV119.0130.0MED GRAV130.0LIME	Comments	MC370;			
109.0 119.0 MED GRAV		130.0		LIME	
		119.0	130.0	MED GRAV	
104.0 109.0 FN GRAV		109.0	119.0	MED GRAV	
		104.0	109.0	FN GRAV	
100.0 104.0 GRAV		100.0	104.0	GRAV	

### Indiana Department of Natural Resources

Name NDIANA-KENTUCKY CO DIEHL PUMP & SUPPI COMPANY A. BURGESS ails Use: Industry Depth: 82.75 Length: 76.9 Length: 6.0 st Type of test: Drawdown: fi	MADI LY PO BO KENT Licens Dri Pui Ma	ISON, INDIANA DX 21266 LOUISVILLE, TUCKY	Telephone Pump typ Water qu Diameter	ality:
CO DIEHL PUMP & SUPPI COMPANY A. BURGESS ails Use: Industry Depth: 82.75 Length: 76.9 Length: 6.0 st Type of test:	MADI LY PO BO KENT Licens Dri Pui Ma	DX 21266 LOUISVILLE, TUCKY se: null illing method: Cable Tool mp setting depth: iterial:	Water qu	ality:
DIEHL PUMP & SUPPI COMPANY A. BURGESS ails Use: Industry Depth: 82.75 Length: 76.9 Length: 6.0 st Type of test:	KENT Licens Dri Pui Ma	UCKY se: null illing method: Cable Tool mp setting depth: iterial:	Water qu	ality:
Use: Industry Depth: 82.75 Length: 76.9 Length: 6.0 st Type of test:	Pu Ma	mp setting depth: aterial:	Water qu	ality:
Use: Industry Depth: 82.75 Length: 76.9 Length: 6.0 st Type of test:	Pu Ma	mp setting depth: aterial:	Water qu	ality:
Length: 6.0 st Type of test:			Diameter	
			Diameter	: 6.0 : 6.0 Slot size: #30
		<b>Test rate:</b> gpm for hrs. <b>Static water level:</b> 27.0 f		st rate: gpm for hrs. Drawdown ft.
ntion Material: Installation N	lethod:	_		
-		_		
County: JEFF	ERSON		Township: 4N R	ange: 10E
Section: SW c	of the SE of the S	E of Section 32		Горо map: MADISON WEST N-KY
Field located Courthouse lo Location acce Subdivision n	by: JNA ocation by: pted w/o verific ame:	ation by: Ft N of SL: 250.0	on: Jun 01, 1966 on: on: Lot number: Ft E of WL: J	Ft S of NL:
Ground eleva	tion: 500.0	Depth to bedrock:	Bedrock elevation:	Aquifer elevation: 423.0
UTM Easting	: 636560.0		UTM Northing:	4288800.0
Тор	Bottom	Formation		
0.0	57.0	MED		
57.0	60.0	COMM BOX		
60.0	62.0			
62.0	64.0			
64.0	67.0			
67.0	69.0	CRS GRAV		
69.0	72.0		RGE GRAV	
72.0	77.0			
	Installation M Sealing mater Installation M County: JEFF Section: SW of Grant Number Field located I Courthouse loc Location acce Subdivision n Ft W of EL: 1 Ground eleva UTM Easting Top 0.0 57.0 60.0 62.0 64.0 67.0 69.0	Installation Method:atSealing material: Installation Method:County: JEFFERSONSection: SW of the SE of the SGrant Number: Field located by: JNA Courthouse location by: Location accepted w/o verific Subdivision name: Ft W of EL: $1000.0$ Ground elevation: $500.0$ UTM Easting: $636560.0$ TopBottom $0.0$ $57.0$ $57.0$ $60.0$ $60.0$ $62.0$ $62.0$ $64.0$ $64.0$ $67.0$ $67.0$ $69.0$ $69.0$ $72.0$	Installation Method:NumntSealing material: Installation Method:Dep NumCounty: JEFFERSONCounty: JEFFERSONSection: SW of the SE of the SE of Section 32Grant Number: Field located by: JNA Courthouse location by: Location accepted w/o verification by: Subdivision name: Ft W of EL: 1000.0Ft N of SL: 250.0Ground elevation: $500.0$ Depth to bedrock: UTM Easting: $636560.0$ TopBottomFormation0.0 $57.0$ MED $57.0$ $60.0$ COMM BOX $60.0$ $62.0$ LARGE GRAVEL $62.0$ $64.0$ CRS SAND, LARG $64.0$ $67.0$ CRS GRAV $69.0$ $72.0$ MED SAND, LARG	Installation Method:Number of bags used:ntSealing material: Installation Method:Depth: from to Number of bags used:County: JEFFERSONTownship: 4N R Section: SW of the SE of the SE of Section 32Grant Number: Field located by: JNAon: Jun 01, 1966 Ourthouse location by: Icoation accepted w/o verification by: Subdivision name:Ft W of EL: 1000.0Ft N of SL: 250.0Ft W of EL: 1000.0Ft N of SL: 250.0Ft W of EL: 1000.0Depth to bedrock: elevation:Ground elevation: $500.0$ Depth to bedrock: UTM Northing:TopBottomFormation0.0 $57.0$ MED $57.0$ $60.0$ COMM BOX $60.0$ $62.0$ LARGE GRAVEL $62.0$ $64.0$ CRS SAND, LARGE GRAV $64.0$ $67.0$ CRS GRAV $69.0$ 72.0MED SAND, LARGE GRAV

MDM GRAY SAND-MUD, TRACE SOME GRAV, 57-60;

### **Record of Water Well**

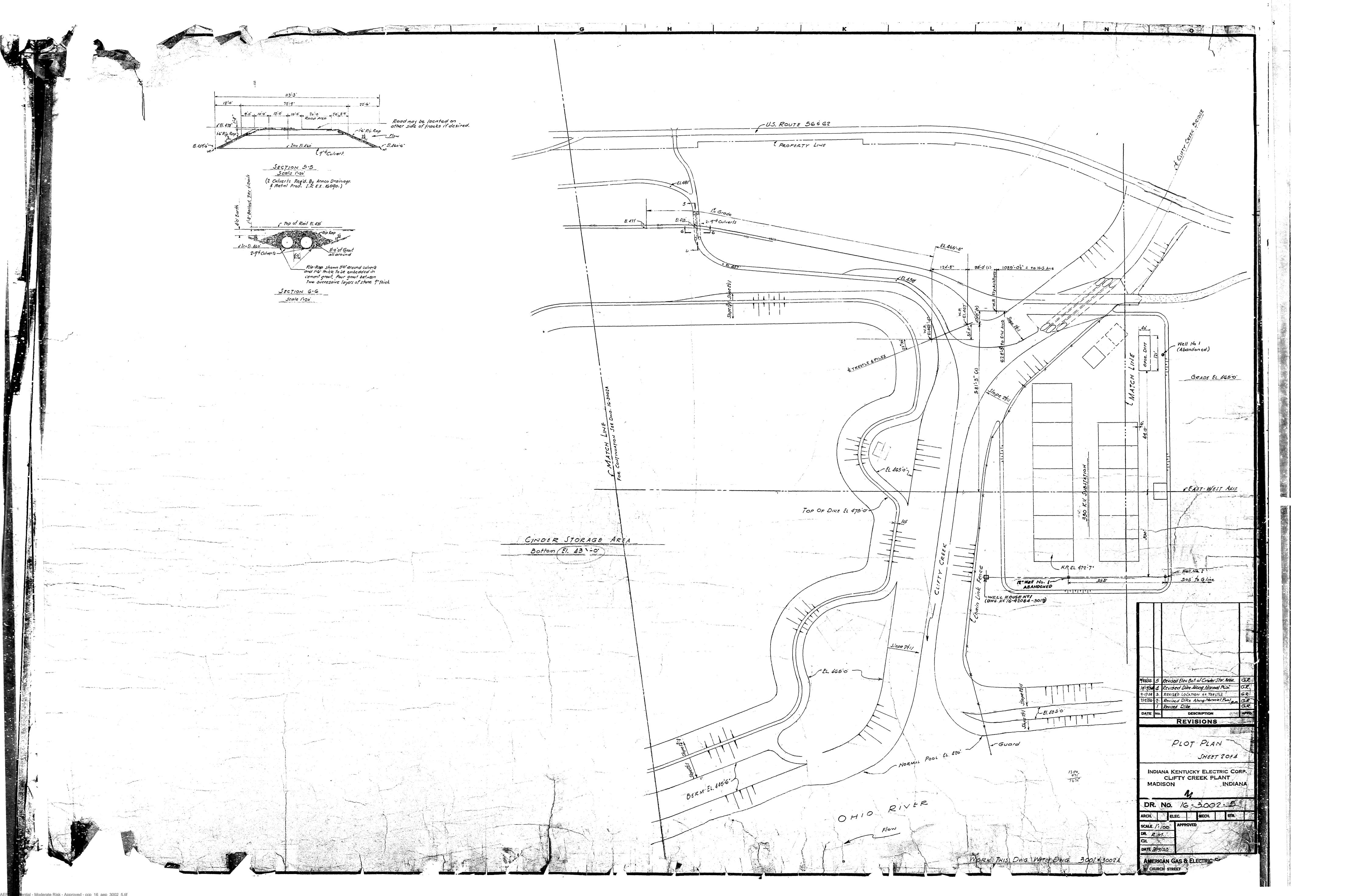
### Indiana Department of Natural Resources

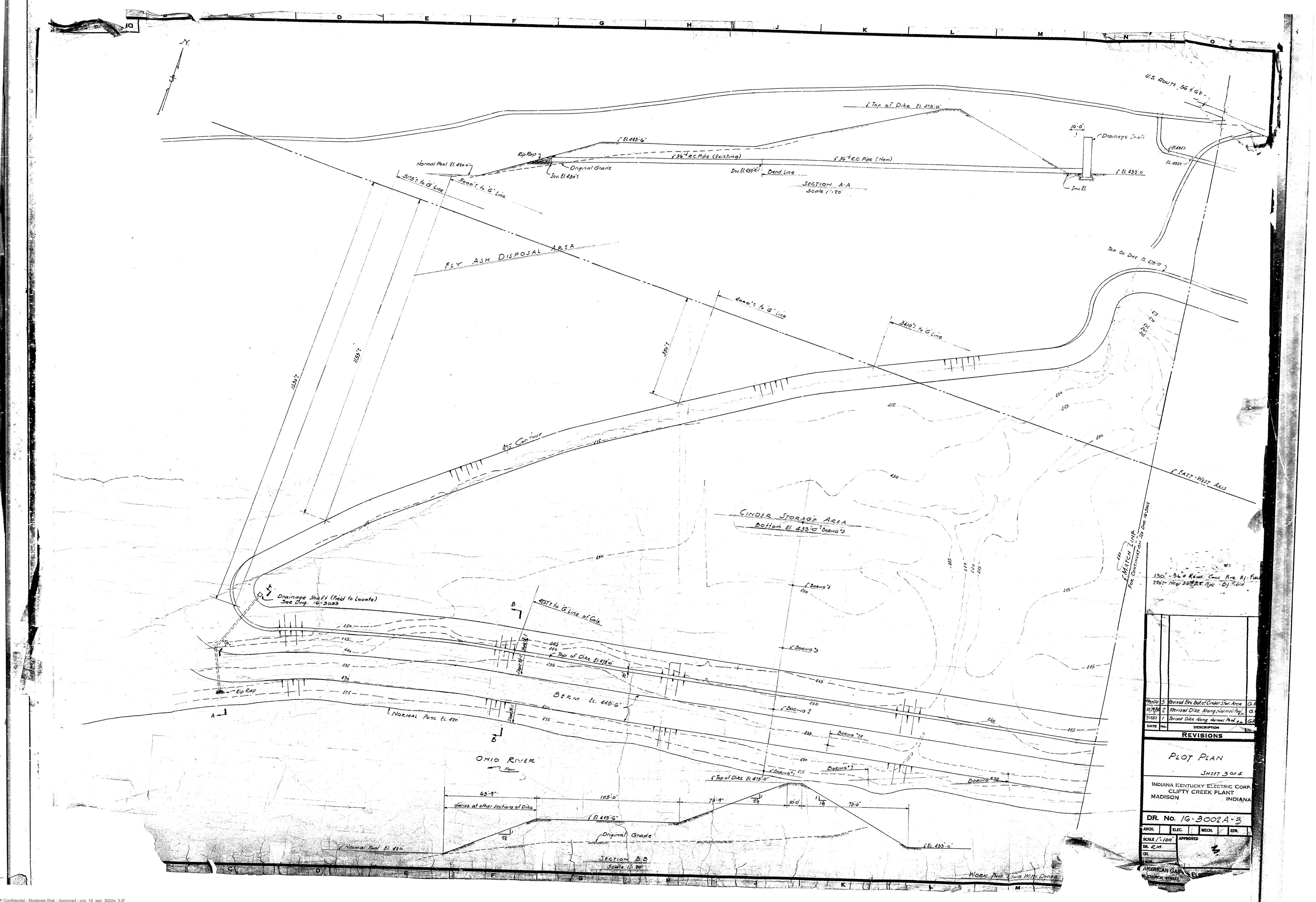
Reference Number	Driving directions to v	vell			Date completed
219344	NW 1/4 OF NW 1/4 AI	DJ TO OHIO RIVER BELOV	V PARK		Jul 20, 1952
<b>Owner-Contractor</b> Owner	<b>Name</b> St of in clifty fai		ress Telep	hone	
<b>Construction Details</b> Well	Use:	Drilling method:		Pump t	vpe:
	Depth:	Pump setting depth:		Water o	
Casing	Length:	Material:		Diamet	er:
Screen	Length:	Material:		Diamet	er: Slot size:
Well Capacity Test	Type of test:	Test rate: 14.0 gr			Test rate: gpm for hrs.
	Drawdown: ft.	Static water level	l <b>:</b> ft.	Baile	er Drawdown ft.
Grouting Information	Material:		Depth: from		
	Installation Method:		Number of	f bags used	d:
Well Abandonment	Sealing material:		Depth: from		
	Installation Method:		Number of	f bags used	d:
Administrative	<b>County:</b> JEFFERSON		Tow	nship: 3N	<b>Range:</b> 10E
	Section: of Section 4				<b>Topo map:</b> MADISON WES IN-KY
	<b>Grant Number:</b>				
	Field located by:		on:		
	<b>Courthouse location b</b>	y:	on:		
	Location accepted w/o	verification by:	on:		
	Subdivision name:		Lot	number:	
	Ft W of EL:	Ft N of SL:		of WL:	Ft S of NL:
	Ground elevation:	Depth to bedrock:		rock ation:	Aquifer elevation:
	UTM Easting:		UTI	M Northin	ıg:
Well Log	Top Bo	ottom Formation			
Comments	ABOUT THE TIME THE LARGE ELECTRIC CO	JLD NOT BE VERIFIED BY HE WELL WAS SUPPOSED O COMPLEX ON THE NW GRAPHY RIVER FLAT PU	TO HAVE BI 1/4 NW 1/4 O	EEN DRIL F 4 J U HO	LED. THERE IS NOW A

# **APPENDIX E**

Geotechnical Data

AGESC (1953)





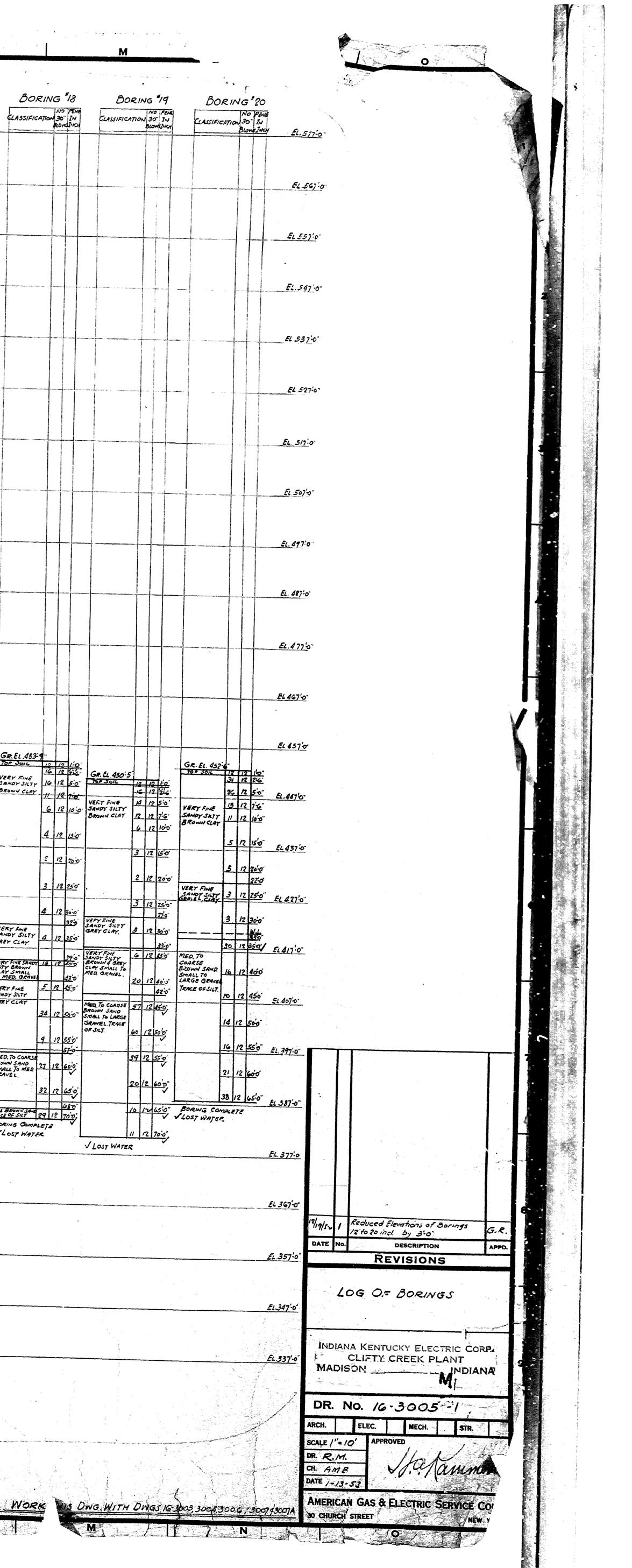


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		a. d'⊤tresseringer beginnen besternen som en so	1	13	33	MED. YELLOW & GREY SILTY SANDY CLAY		11	20-0	CLAY	Ì		2- <b>30</b> -0	SAND, OF GR	PF FINE TRACE	Э		8 # <sup>2</sup> ~ 1	SOFT SILTYGE CLAY WITH THIN SEAMS OF FINE SAND. TRACE	3_	10 30'0'	and a subscription of the	<b>Livenge</b> riger
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	EL 470:00	EL. 487'0"	
	FL 980'0		
		EL 4776	
	EL 070:0'	EL 467'0-	
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10     TRACE CLAP & 36     12     43'0'     FINE TO COARSE	VERY FINE 3 12 200 SANDY SILTY GREY CLAY	EL 401'0" JO LAROE 15 12 20'0" ROCK FRAG. 10 12 GRAVEL 15 12 20'0" ROCK FRAG. 10 12 COMMACT FAME TO COMPACT FAME	15:0       TO MED. GRAVEL       44'0       45'0'0       45'0'0       46'0       46'0       46'0       46'0       46'0       46'0       46'0       46'0       46'0       46'0       46'0       46'0       46'0       46'0       4
0 36 12 50'0' TO COARSE SAND 43'2' 0 COMPACT FINE OF CLAY, 49'4. 10 COARSE SAND OF CLAY, 49'6	<u>3 12 25'0'</u> <u>EL 400'0'</u> <u>3 12 30'9'</u>	12.397:0"	20-3     OREMALL FORMED.     48'0'     MED. TO COARSE     15 12       20-3     OREMALL TRACE     48'0'     MED. TO COARSE     MED. TO COARSE       20-3     OFSILT.     TO COARSE     312     50'0'       MED. TO COARSE     F3     12     50'0'       MED. TO COARSE     F3     12     50'0'       MED. TO COARSE     F3'0'     MED. TO COARSE BROWN       MED. TO LARGE     F1'0'     MED. TO LARGE       MED. TO COARSE     F1'1'     MED. TO LARGE       MED. TO COARSE     F1'1'     MED. TO LARGE
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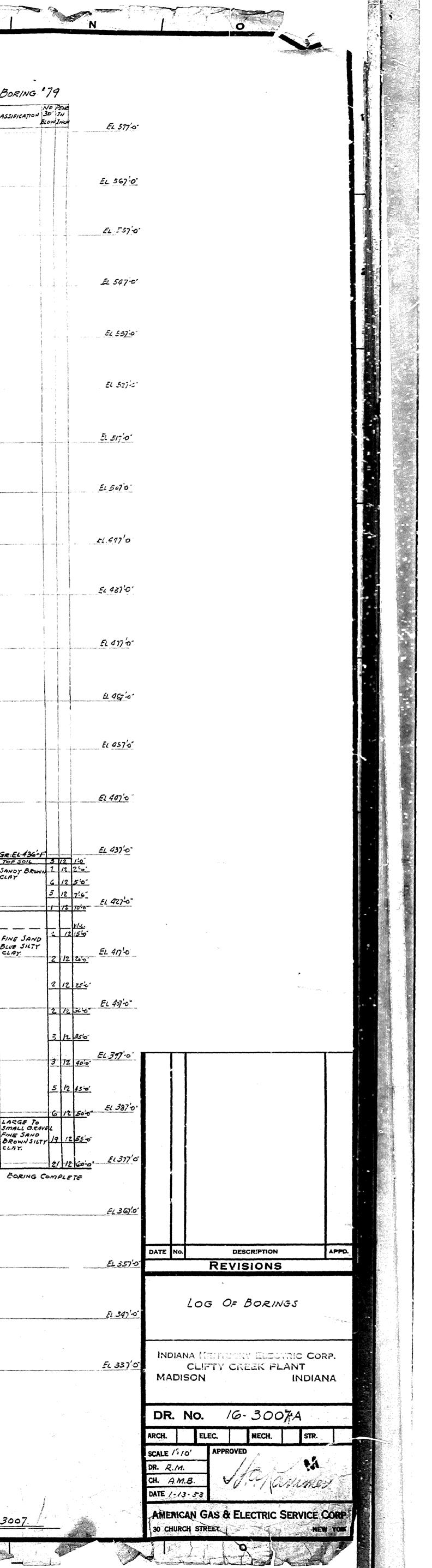
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	2	BORING *GI CLASSIFICATION BON ENCO	BORING GE BOR	C AFION 30° IM BLOW INCH CLASSIFICATION SO' IN BLOW INCH BLOW INCH BLOW INCH BLOW INCH BLOW INCH BLOW INCH BLOW INCH BLOW INCH BLO	BORING "65 CLASSIFICATION 30" IN RUDANTIACH	E BORING *66 BORING SSIFICATION BODIN BLOWING	No PENS N 30-IN CLASSIFICATION 30 IN	G <u>ORINGS - RAYMOND</u> BORING *69 BORI LASSIFICATION 30° IN BLONJ KA BLONJ KA	H <u>CONCRETE PILE CO.</u> NG <sup>4</sup> 70 BORING <sup>*</sup> 71 TOM 30 IN BLOW INCO BLOW INCO BLOW INCO CLASSIFICATION BLOW INCO BLOW INTONO B	CLASSIFICATION 30" IN CLASSIFICA BLOWING	ING #73 BORING #7 NO. ANE STION BOOTING BLOW INOT CLASSIFICATION BLOW BLOW	PENE IN ZNG VINGA VINGA KOW INC	CLASSIFICATION 30° TN BLOW ZHEN	ZING *77 BORIN NCATION 30° IN BLOW THEN HICATION BLOW THEN	M NG "78 BORING "79 NO PENE JOUN JONES BLIM JNESS CLASSIFICATION BLOW INC
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	EL 467'0' $EL 467'0'$ $EL 467'0'$ $EL 417'0'$ $EL 417'0'$ $EL 417'0'$ $EL 417'0'$ $EL 417'0'$ $EL 417'0'$	GR EL J36'-7:       SONT SUTY       SONT SUTY </th <th>GR.EL 437'0 SOFT SILTY SOFT SILTY SOFT</th> <th>5     12     25'0"     12     12       7     12     30'0"     FINE SILFY       37'0"     37'0"     ADTE A       9     12     37'0"       9     12     37'0"       9     12     37'0"       9     12     37'0"       9     12     37'0"       9     12     37'10"       9     12     37'10"       9     12     37'10"       9     12     37'10"       9     12     37'10"       9     12     37'10"       9     12     37'10"       9     12     37'10"       9     12     12       9     12     12       9     12     12       9     12     12       9     12     12       9     12     12       9     12     12       9     12     12       9     12     12       10     12     12       11     12     12       12     12     12       13     14     12       14     7     44'6"       14     7     44'6"</th> <th>25'0' GR. LI. 444'0' 10'6' 10'7' 10'6' 10'7' 10'6' 10'7' 10'6' 10'7' 10'6' 10'7' 10'6' 10'7' 10'6' 10'7'</th> <th><math display="block">\begin{array}{c} x. f(1) &amp; d = 3 \\ \hline x. f(1) &amp; d = 3 \\ \hline x. f(1) &amp; d = 3 \\ \hline x. f(1) &amp; f = 3 \\ \hline</math></th> <th>GR.EL. 47:1-17         SDET SILTY         SANDY CAMMY         21       12         HARD SILTY         SANDY CAMMY         21       12         HARD SILTY         SANDY BROWN         CLAY         17       12         SANDY BROWN         CLAY         17       12         SANDY BROWN         CLAY         17       12         SANDY BROWN         CLAY WITH         THU SEAMS OF         SANDY BROWN         SEAMOY SEAMU         SEAMOY SEAMU</th> <th></th> <th>GR. EL 689'2' TOP SOLA JAMPY SULTY DROWN CLAY DROWN CLAY DROWN CLAY DROWN CLAY DROWN CLAY DROWN CLAY DROWN CLAY DROWN CLAY STATE TOUL SAMPY SILTY 12 12 CANNON SILTY 12 12 CANNON SILTY 14 12 15'0' SAMON SILTY 16 12 20'0' BLUE CLAY 10 12 25'0' G 12 30'0 G 12 30'0 CANNON SILTY 10 12 25'0' CANNON SILTY 10 12 25'0' 10 12 25'0' CANNON SILTY 10 12 25'0' 10 12 25'</th> <th>BEOWN SANDSTONE IIIIS REFUGAL ROCK OR BOULDER GR.EL. VERYFE SANDY - BROWN LINESTO BROWN KEFUSA REFUSA C</th> <th><math display="block">\frac{264'2'}{ME}</math> <math display="block">\frac{10}{12} \frac{10}{12} \frac{12}{2} \frac{10}{0}</math> <math display="block">\frac{20}{12} \frac{10}{10} \frac{10}{0}</math> <math display="block">\frac{10}{12} \frac{10}{12} \frac{10}{10}</math> <math display="block">\frac{10}{12} \frac{10}{12} \frac{10}{10}</math> <math display="block">\frac{10}{12} \frac{10}{12} \frac{10}{10}</math> <math display="block">\frac{10}{12} \frac{10}{10}</math> <math display="block">\frac{10}{10}</math> <math display="block">\frac{10}{10}</math></th> <th></th> <th>25'0"</th> <th>L. d37'1' SOL &amp; 72 1'0' SOL &amp; 72 1'0' SOL &amp; 72 1'0' FINE 8 12 2'2" FINE SAND Y FINE 8 12 2'2" FINE SAND O 12 7'6' 14 12 10'0' SILT &amp; COMPLETE SING COMPLETE</th> <th><math display="block">\frac{7^{L}C'}{4} = \frac{12}{12} \frac{14c''}{12} = \frac{3c'}{12} = \frac</math></th>	GR.EL 437'0 SOFT SILTY SOFT	5     12     25'0"     12     12       7     12     30'0"     FINE SILFY       37'0"     37'0"     ADTE A       9     12     37'0"       9     12     37'0"       9     12     37'0"       9     12     37'0"       9     12     37'0"       9     12     37'10"       9     12     37'10"       9     12     37'10"       9     12     37'10"       9     12     37'10"       9     12     37'10"       9     12     37'10"       9     12     37'10"       9     12     12       9     12     12       9     12     12       9     12     12       9     12     12       9     12     12       9     12     12       9     12     12       9     12     12       10     12     12       11     12     12       12     12     12       13     14     12       14     7     44'6"       14     7     44'6"	25'0' GR. LI. 444'0' 10'6' 10'7' 10'6' 10'7' 10'6' 10'7' 10'6' 10'7' 10'6' 10'7' 10'6' 10'7' 10'6' 10'7'	$\begin{array}{c} x. f(1) & d = 3 \\ \hline x. f(1) & d = 3 \\ \hline x. f(1) & d = 3 \\ \hline x. f(1) & f = 3 \\ \hline$	GR.EL. 47:1-17         SDET SILTY         SANDY CAMMY         21       12         HARD SILTY         SANDY CAMMY         21       12         HARD SILTY         SANDY BROWN         CLAY         17       12         SANDY BROWN         CLAY         17       12         SANDY BROWN         CLAY         17       12         SANDY BROWN         CLAY WITH         THU SEAMS OF         SANDY BROWN         SEAMOY SEAMU         SEAMOY SEAMU		GR. EL 689'2' TOP SOLA JAMPY SULTY DROWN CLAY DROWN CLAY DROWN CLAY DROWN CLAY DROWN CLAY DROWN CLAY DROWN CLAY DROWN CLAY STATE TOUL SAMPY SILTY 12 12 CANNON SILTY 12 12 CANNON SILTY 14 12 15'0' SAMON SILTY 16 12 20'0' BLUE CLAY 10 12 25'0' G 12 30'0 G 12 30'0 CANNON SILTY 10 12 25'0' CANNON SILTY 10 12 25'0' 10 12 25'0' CANNON SILTY 10 12 25'0' 10 12 25'	BEOWN SANDSTONE IIIIS REFUGAL ROCK OR BOULDER GR.EL. VERYFE SANDY - BROWN LINESTO BROWN KEFUSA REFUSA C	$\frac{264'2'}{ME}$ $\frac{10}{12} \frac{10}{12} \frac{12}{2} \frac{10}{0}$ $\frac{20}{12} \frac{10}{10} \frac{10}{0}$ $\frac{10}{12} \frac{10}{12} \frac{10}{10}$ $\frac{10}{12} \frac{10}{12} \frac{10}{10}$ $\frac{10}{12} \frac{10}{12} \frac{10}{10}$ $\frac{10}{12} \frac{10}{10}$ $\frac{10}{10}$		25'0"	L. d37'1' SOL & 72 1'0' SOL & 72 1'0' SOL & 72 1'0' FINE 8 12 2'2" FINE SAND Y FINE 8 12 2'2" FINE SAND O 12 7'6' 14 12 10'0' SILT & COMPLETE SING COMPLETE	$\frac{7^{L}C'}{4} = \frac{12}{12} \frac{14c''}{12} = \frac{3c'}{12} = \frac$
	EL 387.5"		BORING COMPLETE FROM Y LOST WATER SNOE HAVE C BLOWS	ν.										FINE SI SILTY B CLAY.	ANOT 7 12 45'0" S 12 50'0" 5 12 50'0" 5 12 50'0" C ARGE TO S MALL G.RAVEL FINE SAND OROWN SILTT 19 11 CLAY. 10 12 50'0" CLAY. 10 12 50'0" CLAY. EORING COMPLE COMPLETE
5	9 <u>FL 357'0"</u> HETY CO-DIC 1148						F	9					WORK THIS DWG, WITH C	was. /6-3003, 3004, 3	1005, 3006 \$3007.

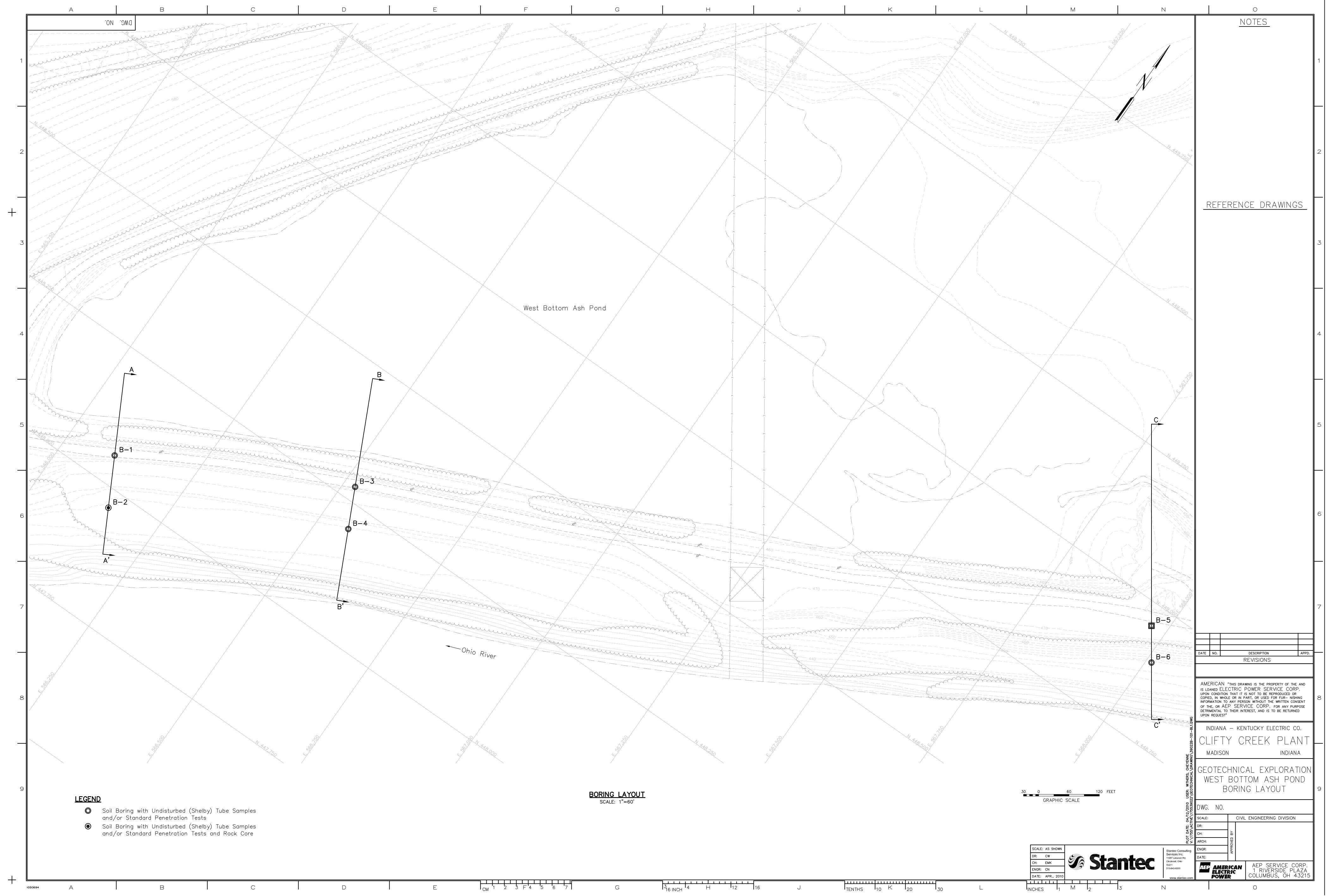
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Stantec (2016)





Page: 1 of 2

Project Number	175539022			Location	V	/est Cres	t: West Pon	d Dam
Project Name	AEP Clifty Creek /	Ash Ponds		Boring No.	B-1		Total Dept	h71.5 ft
County	Jefferson, IN			Surface Elev	vation	47	3.4 ft	
Project Type	Geotechnical Expl	oration		Date Started	11	1/3/09	Completed	d <u>11/4/09</u>
Supervisor	C. Nisingizwe Dr	iller M. We	thington	Depth to Wa	ater 4	0.0 ft	Date/Time	11/4/09
Logged By	C. Nisingizwe			Depth to Wa	ater 3	9.2 ft	Date/Time	11/13/09
Lithology		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
473.4' 0.0'	Top of Hole							
	Lean Clay With So yellowish brown w gray, damp to mo medium stiff to ve Fill	/ith light ist.	SPT-1	2.5 - 4.0	1.2	6-5-6	17	- N = 11 -
-			SPT-2	5.0 - 6.5	1.3	5-5-5	15	N = 10
-			ST-3	7.5 - 9.5	2.0		23	-
-			SPT-4	10.0 - 11.5	0.4	1-5-5	21	N = 10
-			SPT-5	12.5 - 14.0	1.3	2-2-5	17	N = 7
-			ST-6	15.0 - 17.0	2.0		20	-
-			SPT-7	17.5 - 19.0	1.5	5-6-9	19	N = 15
-			SPT-8	20.0 - 21.5	1.5	3-5-10	15	N = 15
-			SPT-9	22.5 - 24.0	1.5	3-7-7	17	N = 14
			SPT-10	25.0 - 26.5	1.2	3-3-5	17	N = 8
			SPT-11	27.5 - 29.0	1.3	3-4-8	20	N = 12
			SPT-12	30.0 - 31.5	1.4	4-4-7	19	N = 11
			SPT-13	32.5 - 34.0	1.3	2-4-5	18	N = 9
			SPT-14	35.0 - 36.5	1.1	2-5-5	17	N = 10
435.9' 37.5'			SPT-15	37.5 - 39.0	1.2	1-2-4	20	N = 6

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Page: 2 of 2

-		175539022			Location			t: West Pon	
Project I	Name	AEP Clifty Creek /	Ash Ponds		Boring No.	<u>B-1</u>		Total Dept	h 71.5 ft
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
-		Lean Clay With S yellowish brown w gray, moist to wet	/ith light	SPT-16	40.0 - 41.5	1.3	1-2-3	24	N = 5
		soft to medium sti (Continued)	ff	ST-17	42.5 - 44.5	2.0		22	
-				SPT-18	45.0 - 46.5	1.5	1-1-1	30	N = 2
				SPT-19	47.5 - 49.0	1.5	1-1-2	23	N = 3
				SPT-20	50.0 - 51.5	1.1	1-1-3	28	N = 4
				SPT-21	52.5 - 54.0	1.5	1-1-1	27	N = 2
-				SPT-22	55.0 - 56.5	1.5	1-2-2	25	N = 4
				SPT-23	57.5 - 59.0	1.1	1-1-3	28	N = 4
<b>-</b>				SPT-24	60.0 - 61.5	1.4	1-2-3	28	N = 5
				SPT-25	62.5 - 64.0	1.3	1-2-4	37	N = 6
- 405.9'	67.5'			SPT-26	65.0 - 66.5	1.2	2-2-5	34	N = 7
100.0	01.0	Gray, Weathered Augered	Shale,	SPT-27	67.5 - 69.0	0.4	50+	14	50+
- 401.9'	71.5'			SPT-28	70.0 - 71.5	0.3	50+	5	50+
-		No Refusal / Bottom of Hole							



Page: 1 of 2

Project I	Number	175539022			Location	N	/est Toe:	West Pond	Dam
Project I	Name	AEP Clifty Creek /	Ash Ponds		Boring No.	<b>B-2</b>		Total Dept	h61.0 ft
County		Jefferson, IN			Surface Elev	vation	44	4.0 ft	
Project <sup>-</sup>	Туре	Geotechnical Explo	oration		Date Started	d 1 <sup>.</sup>	1/12/09	Completed	l 11/12/09
Supervis	sor	C. Nisingizwe Dr	iller M. Wet	thington	Depth to Wa	ater 22	2.5 ft	Date/Time	11/12/09
Logged	By	C. Nisingizwe			Depth to Wa	ater N	/A	Date/Time	N/A
Litholo	ogy	_	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
444.0'	0.0'	Top of Hole							
	0.0	Lean Clay With Sa yellowish brown w moist to wet, soft stiff	vith gray,	SPT-1 SPT-2 SPT-3 ST-4 SPT-5 SPT-6	2.5 - 4.0 5.0 - 6.5 7.5 - 9.0 10.0 - 12.0 12.5 - 14.0 15.0 - 16.5	1.2 0.6 0.6 1.6 1.2 1.2	7-8-11 4-3-4 3-3-4 2-2-3 2-2-2	17 19 24 22 25 28	N = 19 N = 7 N = 7 N = 7 N = 5 N = 4
-				SPT-7	17.5 - 19.0	1.5	1-1-1	30	N = 2
-				SPT-8	20.0 - 21.5	1.5	1-2-2	32	N = 4
				ST-9	22.5 - 24.5	2.0		29	-
520/10 				SPT-10	25.0 - 26.5	1.5	2-2-2	29	N = 4
- 	30.0'			SPT-11	27.5 - 29.0	0.7	1-4-5	30	N = 9
K.GPJ FMSM-GRA		Lean Clay With Sa gray, moist to wet medium stiff		SPT-12	30.0 - 31.5	1.5	3-3-3	25	N = 6
178530022 CLIFTY CREEF				SPT-13	32.5 - 34.0	1.5	3-3-3	32	N = 6
				SPT-14	35.0 - 36.5	1.5	1-2-3	33	N = 5
STANTEC/FMSM_LEGACY				SPT-15	37.5 - 39.0	1.5	1-2-2	31	N = 4

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# **SUBSURFACE** LOG

Page: 2 of 2

	Number				Location			West Pond	
Project I	Name	AEP Clifty Creek /	Ash Ponds		Boring No.	<u>B-2</u>		Total Dept	h 61.0 ft
Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Lean Clay With S gray, moist to wet medium stiff <i>(Co</i>	, soft to	SPT-16	40.0 - 41.5	1.5	3-3-3	30	N = 6
				ST-17	42.5 - 44.5	1.5		33	
				SPT-18	45.0 - 46.5	1.5	1-1-1	35	N = 2
392.5'	51.5'			SPT-19	50.0 - 51.5	1.5	4-3-3	33	N = 6
		Gravel With Silt A gray, wet, very de							
388.5'	55.5'	Shale, gray, hard,	medium	SPT-20	55.0 - 55.5	0.4	11-50+	10	Began Core N = 50+
		bedded	medium						
000.01	04.01			45			400	01.0	
383.0'	61.0'	Bottom of Hole		45	5.5	5.5	100	61.0	
		Top of Rock = 56. Elevation (388.0')	.0'						



Page: 1 of 2

Project Numbe	r 175539022			Location	N	liddle Cre	st: West Po	nd Dam
Project Name	AEP Clifty Creek /	Ash Ponds		Boring No.	B-3		Total Dept	h71.5 ft
County	Jefferson, IN			Surface Ele	vation	47	1.6 ft	
Project Type	Geotechnical Expl	oration		Date Started	11	11/4/09 Com		11/5/09
Supervisor	C. Nisingizwe Di	riller M. We	thington	Depth to Wa	ater 4	0.0 ft	Date/Time	11/4/09
Logged By	C. Nisingizwe			Depth to Wa	ater 3	1.0 ft	Date/Time	11/13/09
Lithology		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
471.6' 0.0'	Top of Hole							
-	Lean Clay With S yellowish brown v gray, damp to mo very stiff, Fill	vith light	SPT-1	2.5 - 4.0	0.7	4-5-6	15	N = 11
-			SPT-2	5.0 - 6.5	1.1	3-4-4	17	N = 8
-			SPT-3	7.5 - 9.0	1.1	3-3-7	16	N = 10
-			ST-4	10.0 - 12.0	2.0		16	-
-			SPT-5	12.5 - 14.0	1.5	4-4-5	22	N = 9
-			SPT-6	15.0 - 16.5	1.0	3-4-6	17	N = 10
-			SPT-7	17.5 - 19.0	1.3	3-5-7	18	N = 12
-			ST-8	20.0 - 22.0	2.0		18	-
-			SPT-9	22.5 - 24.0	1.5	3-5-7	17	N = 12
- -			SPT-10	25.0 - 26.5	1.3	3-4-5	18	N = 9
IIC LOG GDT 522			SPT-11	27.5 - 29.0	1.5	6-7-8	16	N = 15
PJ FMSM-GRAPF			SPT-12	30.0 - 31.5	1.5	5-5-5	18	N = 10
			SPT-13	32.5 - 34.0	1.5	4-7-10	17	N = 17
			SPT-14	35.0 - 36.5	1.5	5-7-9	22	N = 16
434.1' 37.5'			SPT-15	37.5 - 39.0	1.5	5-7-11	20	N = 18

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Page: 2 of 2

Project I		175539022			Location			st: West Po	nd Dam
Project I	Name	AEP Clifty Creek /	Ash Ponds		Boring No.	<b>B-3</b>		Total Dept	h71.5 ft
Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Lean Clay With S to light brown, mo very stiff to very s	ist to wet,	SPT-16	40.0 - 41.5	1.5	1-2-2	24	N = 4
		(Continued)		SPT-17	42.5 - 44.0	1.5	1-2-2	23	N = 4
				SPT-18	45.0 - 46.5	1.3	2-3-3	25	N = 6
				ST-19	47.5 - 49.5	2.0		23	
				SPT-20	50.0 - 51.5	1.5	1-2-2	25	N = 4
				SPT-21	52.5 - 54.0	1.5	1-1-1	25	N = 2
				SPT-22	55.0 - 56.5	1.5	1-2-3	24	N = 5
				SPT-23	57.5 - 59.0	1.5	1-1-1	40	N = 2
				SPT-24	60.0 - 61.5	1.5	3-4-4	28	N = 8
				SPT-25	62.5 - 64.0	1.5	1-2-4	33	N = 6
				SPT-26	65.0 - 66.5	1.5	1-3-4	34	N = 7
				SPT-27	67.5 - 69.0	1.5	2-4-5	29	N = 9
400.1'	71.5'			SPT-28	70.0 - 71.5	1.5	3-3-5	31	N = 8
		No Refusal / Bottom of Hole							



Page: 1 of 2

Project N	Number	175539022			Location	M	liddle Toe	: West Pon	d Dam
Project N	Name	AEP Clifty Creek /	Ash Ponds		Boring No.	<b>B-4</b>		Total Dept	h71.5 ft
County		Jefferson, IN			Surface Elev	vation	44	4.0 ft	
Project 7	Гуре	Geotechnical Expl	oration		Date Started	d _1	1/10/09	Completed	11/11/09
Supervis	sor	C. Nisingizwe Dr	iller <u>M. We</u>	thington	Depth to Wa	ater 2	2.5 ft	Date/Time	11/10/09
Logged	Ву	C. Nisingizwe			Depth to Wa	ater 1	6.0 ft	Date/Time	11/13/09
Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
_ 444.0'	0.0'	Top of Hole							
- - -		Lean Clay With So brown to dark gra to moist, medium very stiff	y, damp	SPT-1	2.5 - 4.0	1.3	8-8-8	14	N = 16
-				SPT-2	5.0 - 6.5	1.4	6-7-8	16	N = 15 _
-				ST-3	7.5 - 9.5	2.0			-
-				SPT-4	10.0 - 11.5	1.3	3-5-6	19	N = 11
- - 429.0'	15.0'			SPT-5	12.5 - 14.0	1.0	2-3-4	22	N = 7
-		Lean Clay With S gray, moist to wet stiff		SPT-6	15.0 - 16.5	1.2	2-2-3	26	N = 5
-				ST-7	17.5 - 19.5	2.0			-
-				SPT-8	20.0 - 21.5	1.5	2-2-2	26	N = 4
-				SPT-9	22.5 - 24.0	1.5	1-2-3	27	N = 5
				SPT-10	25.0 - 26.5	1.5	2-2-4	26	N = 6
HICLOG.GDT 5/				SPT-11	27.5 - 29.0	1.5	1-2-3	27	N = 5
3PJ FMSM-GRAF				SPT-12	30.0 - 31.5	1.5	1-1-2	28	N = 3
2 CLIFTY CREEK.				SPT-13	32.5 - 34.0	1.5	1-2-2	35	N = 4
EGACY 17553002				SPT-14	35.0 - 36.5	1.5	2-4-5	31	N = 9
STANTEC/FMSM_L				ST-15	37.5 - 39.5	2.0			

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Page: 2 of 2

-		175539022			Location			: West Pon	
Project I	Name	AEP Clifty Creek /	Ash Ponds		Boring No.	<u>B-4</u>		Total Dept	h71.5 ft
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Lean Clay With S gray, moist to wet stiff <i>(Continued)</i>		SPT-16	40.0 - 41.5	1.5	2-2-2	24	N = 4
				SPT-17	42.5 - 44.0	1.2	1-2-3	33	N = 5
				SPT-18	45.0 - 46.5	1.5	2-4-4	35	N = 8
				SPT-19	47.5 - 49.0	1.2	1-2-4	31	N = 6
				SPT-20	50.0 - 51.5	1.5	2-3-4	31	N = 7
				SPT-21	52.5 - 54.0	1.5	1-2-3	30	N = 5
386.5'	57.5'			SPT-22	55.0 - 56.5	1.5	2-3-4	21	N = 7
300.5	57.5	Gravel With Silt A gray, moist, dense		SPT-23	57.5 - 59.0	1.5	10-17-22	13	N = 39
		dense		SPT-24	60.0 - 61.5	1.5	16-28-18	9	N = 46
				SPT-25	65.0 - 66.5	0.7	26-50+	12	N = 50+
372.5'	71.5'			SPT-26	70.0 - 71.5	0.7	20-22-30	9	N = 52
		No Refusal / Bottom of Hole							



Page: 1 of 2

Project N	Number	175539022			Location	E	ast Crest	: West Pond	d Dam
Project N	Name	AEP Clifty Creek /	Ash Ponds		Boring No.	B-5		Total Dept	:h71.5 ft
County		Jefferson, IN			Surface Ele	vation	46	8.7 ft	
Project 7	Гуре	Geotechnical Expl	oration		Date Started	d <u>1</u> '	1/10/09	Completed	d <u>11/10/09</u>
Supervis	sor	C. Nisingizwe Dr	iller M. We	thington	Depth to Wa	ater 4	5.0 ft	Date/Time	11/10/09
Logged	Ву	C. Nisingizwe			Depth to Wa	ater 3	3.8 ft	Date/Time	11/13/09
Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
468.7'	0.0'	Top of Hole							
-		Lean Clay With S yellowish brown w gray, damp to mo medium stiff to ve Fill	vith light ist,	SPT-1 SPT-2	2.5 - 4.0 5.0 - 6.5	1.5 1.5	6-9-10 4-4-5	15 17	N = 19 N = 9
-				ST-3	7.5 - 9.5	1.6		17	
-				SPT-4	10.0 - 11.5	1.3	6-7-8	23	N = 15
-				SPT-5	12.5 - 14.0	0.0	3-4-6		N = 10
-				SPT-6	15.0 - 16.5	1.3	1-3-4	16	N = 7
-				SPT-7	17.5 - 19.0	1.0	5-7-9	16	N = 16
-				SPT-8	20.0 - 21.5	0.6	1-2-5	18	N = 7
-				ST-9	22.5 - 24.5	1.8		19	
-				SPT-10	25.0 - 26.5	1.2	2-3-5	22	N = 8
-				SPT-11	27.5 - 29.0	1.4	1-2-5	25	N = 7
-				SPT-12	30.0 - 31.5	1.3	4-5-7	23	N = 12
- -				SPT-13	32.5 - 34.0	1.5	2-3-5	19	N = 8
- - 432.2'	36.5'			SPT-14	35.0 - 36.5	1.5	4-6-10	18	N = 16
		Lean Clay With S gray, moist, soft	and,	SPT-15	37.5 - 39.0	1.5	2-3-3	21	N = 6

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Page: 2 of 2

-		175539022			Location			West Pond	
Project I	Name	AEP Clifty Creek /	Ash Ponds		Boring No.	B-5		Total Dept	h 71.5 ft
Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Lean Clay With S gray, moist, soft <i>(Continued)</i>	and,	SPT-16	40.0 - 41.5	1.3	1-1-2	25	N = 3
		( , , , , , , , , , , , , , , , , , , ,		ST-17	42.5 - 44.5	2.0		23	
421.2'	47.5'			SPT-18	45.0 - 46.5	1.5	1-1-3	25	N = 4
<del>4</del> 21.2	47.5	Sandy Silt, light ye brown to gray, we		SPT-19	47.5 - 49.0	1.5	1-1-3	28	N = 4
		stiff		SPT-20	50.0 - 51.5	1.5	1-1-5	24	N = 6
				SPT-21	52.5 - 54.0	1.0	1-1-1	22	N = 2
				SPT-22	55.0 - 56.5	1.3	1-2-2	23	N = 4
				SPT-23	57.5 - 59.0	1.5	1-2-3	26	N = 5
				SPT-24	60.0 - 61.5	1.5	2-3-4	22	N = 7
				SPT-25	62.5 - 64.0	1.5	2-3-6	27	N = 9
				SPT-26	65.0 - 66.5	1.5	2-5-6	28	N = 11
				SPT-27	67.5 - 69.0	1.5	2-4-5	28	N = 9
397.2'	71.5'			SPT-28	70.0 - 71.5	1.5	3-5-8	30	N = 13
		No Refusal / Bottom of Hole							



Project Numb	er_175539022		Location	E	ast Toe: \	Nest Pond I	Dam
Project Name	AEP Clifty Creek / As	sh Ponds	Boring No.	B-6		Total Dept	h71.5 ft
County	Jefferson, IN		Surface Elev	vation	44	5.5 ft	
Project Type	Geotechnical Explora	ation	Date Started	1	1/19/09	Completed	11/19/09
Supervisor	C. Nisingizwe Drille	er Danny Jessie	Depth to Wa	ater 30	0.0 ft	Date/Time	11/19/09
Logged By	C. Nisingizwe		Depth to Wa	ater N	/A	Date/Time	N/A
Lithology		Overburden Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation Dept	Description	Rock Core RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
445.5' 0.0	Top of Hole						
	Lean Clay With San brown to gray, damp moist, stiff to very st	o to iff SPT-1 SPT-2 ST-3 SPT-4 SPT-4 SPT-5 SPT-6 SPT-6 SPT-8 SPT-9	2.5 - 4.0 5.0 - 6.5 7.5 - 9.5 10.0 - 11.5 12.5 - 14.0 15.0 - 16.5 17.5 - 19.5 20.0 - 21.5 22.5 - 24.0 25.0 - 26.5	<ol> <li>1.0</li> <li>1.0</li> <li>2.0</li> <li>1.2</li> <li>1.1</li> <li>1.3</li> <li>1.2</li> <li>1.5</li> <li>1.5</li> <li>1.5</li> </ol>	2-4-4 4-4-6 5-7-11 2-2-2 1-1-2 0-1-0 0-0-2 2-1-3	19 18 25 16 21 31 32 32 29 29 29	N = 8 N = 10 N = 18 N = 4 N = 3 N = 1 N = 2 N = 4 N = 4
<sup>№</sup> 418.0' 27.8	Sandy Silt, gray, mo		27.5 - 29.0	1.5	0-3-2	32	N = 5
	wet, very soft to stiff						-
PJ FMSM-GRA		SPT-12	30.0 - 31.5	1.5	0-0-3	32	N = 3
1 15538022 CLIFTY CREEK GP		SPT-13	32.5 - 34.0	1.5	0-1-2	33	N = 3
EGACY 17553922		SPT-14	35.0 - 36.5	1.5	0-0-1	35	N = 1
STANTECPHISM_L		SPT-15	37.5 - 39.0	1.5	0-0-1	30	N = 1

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Page: 2 of 2

Project I	Number	175539022		Location East Toe: West Pond Dam					
Project I	Name	AEP Clifty Creek /	Ash Ponds		Boring No.	<b>B-6</b>		Total Dept	n71.5 ft
Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Sandy Silt, gray, r wet, very soft to s <i>(Continued)</i>	noist to liff	ST-16	40.0 - 42.0	1.1		31	
		(		SPT-17	42.5 - 44.0	1.5	0-1-1	35	N = 2
				SPT-18	45.0 - 46.5	1.5	0-0-1	40	N = 1
				SPT-19	47.5 - 49.0	1.5	0-0-1	40	N = 1
				SPT-20	50.0 - 51.5	1.5	0-2-3	39	N = 5
				SPT-21	52.5 - 54.0	1.5	0-5-6	27	N = 11
				SPT-22	55.0 - 56.5	1.5	4-3-4	31	N = 7
				SPT-23	57.5 - 59.0	1.5	4-4-5	35	N = 9
				SPT-24	60.0 - 61.5	1.5	5-5-6	28	N = 11
				SPT-25	65.0 - 66.5	1.5	4-5-4	28	N = 9
374.0'	71.5'			SPT-26	70.0 - 71.5	0.0	5-5-5		N = 10
		No Refusal / Bottom of Hole							

AGES (2018)

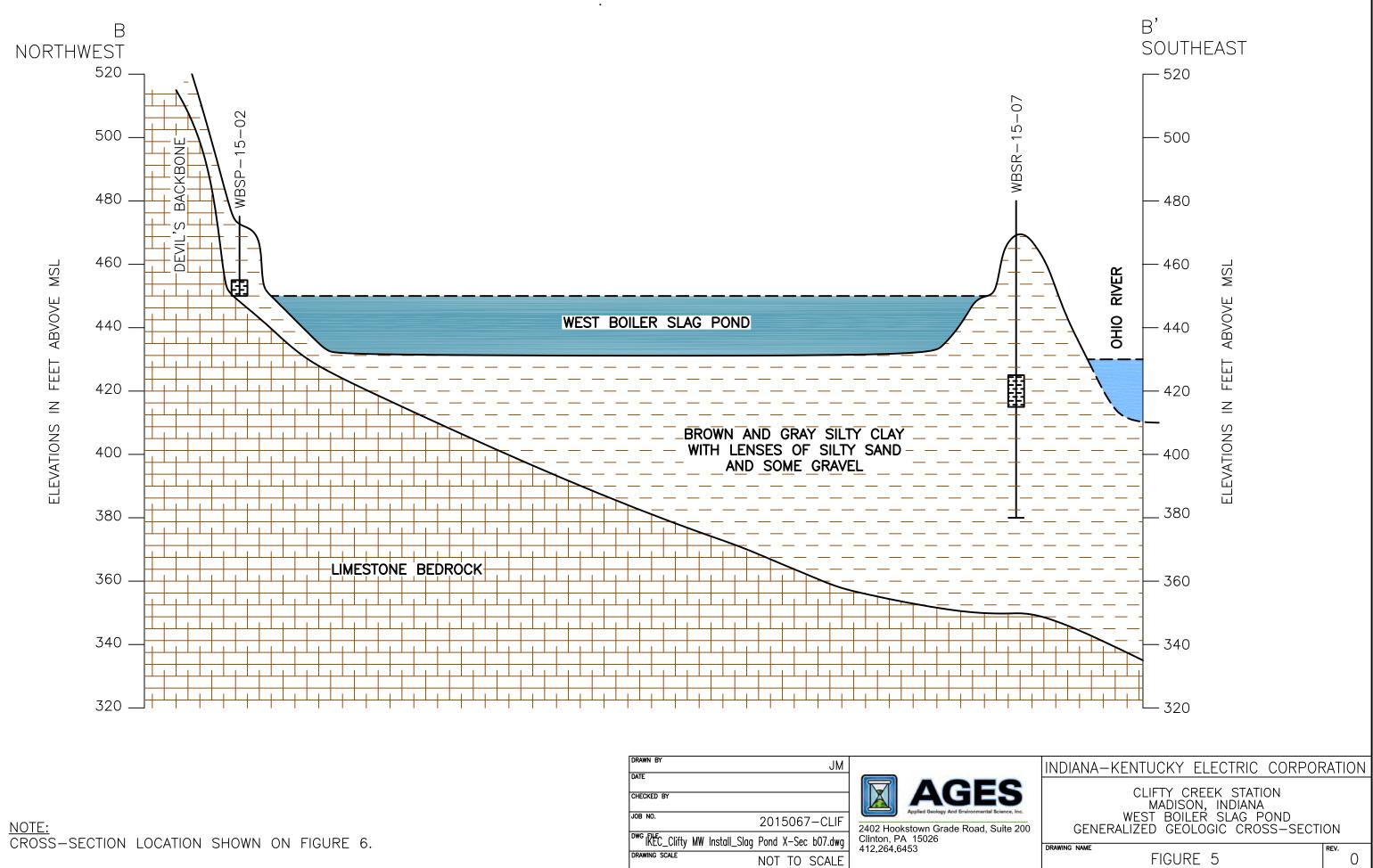
### TABLE 3 GROUNDWATER MONITORING NETWORK WEST BOILER SLAG POND CLIFTY CREEK STATION MADISON, INDIANA

Monitoring Well ID	Designation	Date of Installation	Coord	linates	Ground Elevation (ft) <sup>2</sup>	Top of Casing Elevation (ft) <sup>2</sup>	Top of Screen Elevation (ft)	Base of Screen Elevation (ft)	Total Depth From Top of
ID		Installation	Northing	Easting	Elevation (It)-	Elevation (It)-	Elevation (It)	Elevation (11)	Casing (ft)
WBSP-15-01	Upgradient	11/30/2015	449072.27	566322.12	466.93	469.36	458.93	448.93	20.43
WBSP-15-02	Upgradient	11/11/2015	449803.91	566987.30	473.83	476.76	457.83	452.83	23.93
WBSP-15-03	Upgradient	12/4/2015	451181.98	568093.60	484.91	488.03	476.91	471.91	16.12
WBSP-15-04	Downgradient	11/12/2015	450610.07	568637.65	471.17	473.71	416.17	406.17	67.54
WBSP-15-05	Downgradient	11/17/2015	450051.40	568495.72	471.90	474.42	410.90	400.90	73.52
WBSP-15-06	Downgradient	11/19/2015	449470.57	568402.50	471.28	473.51	395.78	385.78	87.73
WBSP-15-07	Downgradient	11/23/2015	448947.93	567946.39	468.82	471.31	426.82	416.82	54.49
WBSP-15-08	Downgradient	11/25/2015	448625.46	567343.24	468.56	471.06	415.76	405.76	65.30
WBSP-15-09	Downgradient	1/6/2016	448359.31	566711.13	471.21	470.69	421.21	410.21	59.48
WBSP-15-10	Downgradient	1/5/2016	448125.51	566225.21	471.21	470.69	425.21	435.21	55.48

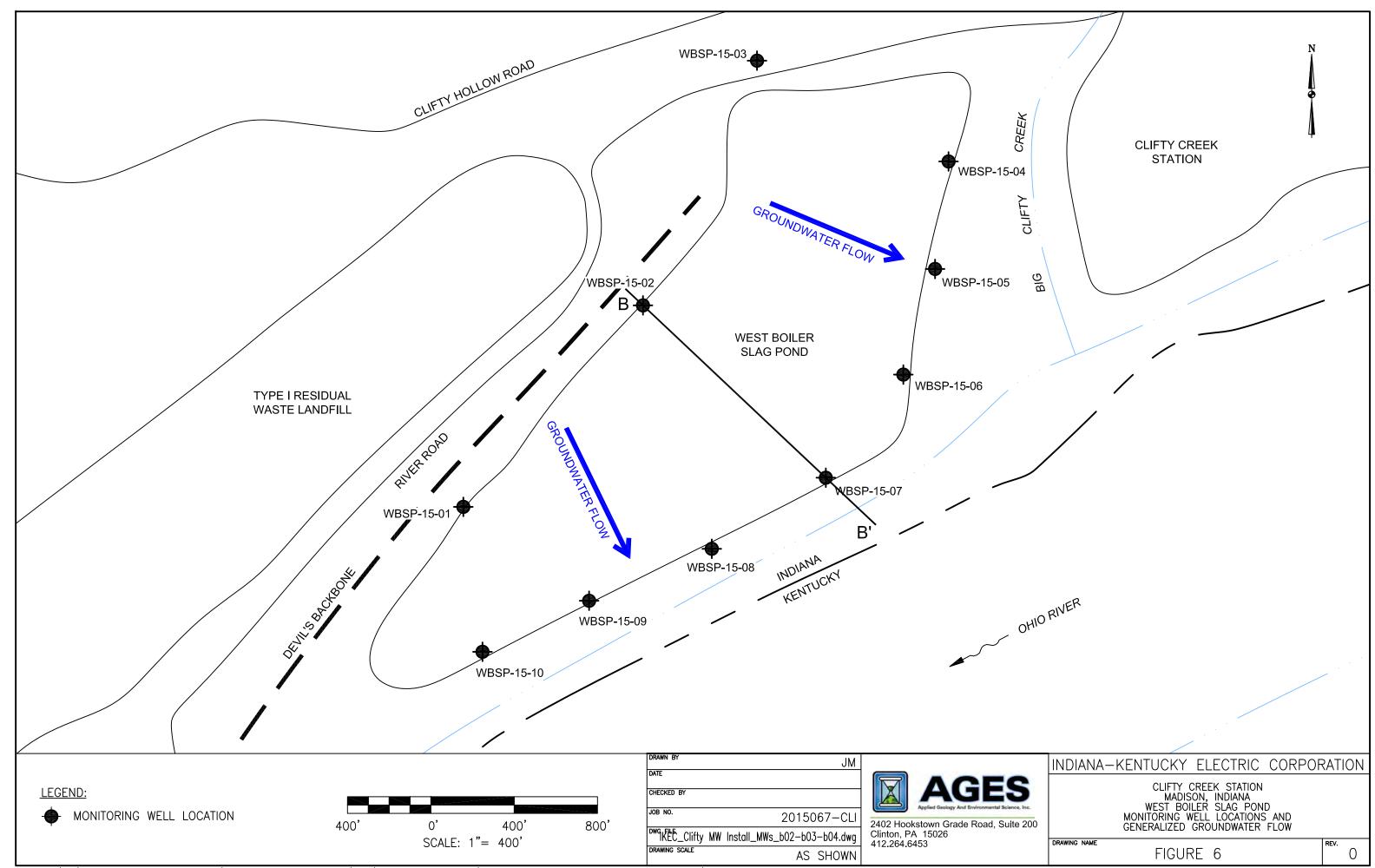
Notes:

1. The Well locations are referenced to the North American Datum (NAD83), east zone coordinate system.

2. Elevations are referenced to the North American Vertical Datum (NAVD) 1988



Plot: 10/18/2016 10:13 \_PROGRAM-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\IKEC\_Clifty MW Install\_Slag Pond X-Sec b07.dwg



Plot: 10/18/2016 10:20 \_PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\IKEC\_Clifty MW Install\_MWs\_b02-b03-b04.dwg\b04

### BORING NO. <u>WBSP-15-01</u> SAMPLE/CORE LOG

Project Number:	2015067 Clifty Creek Plant		Log Page	1	of	1
Project Location:	West Boiler Slag Pond		Drilling Co	ntractor:	Bowser Morr	ner
Drilling Date(s):	11/30/15		AGES Geo	logist:	Mike Gelles	
Drilling Method:	Roto-Sonic	Coring Device Size:	NA	Hammer	r Wt. NA	and Drop NA
Sampling Method:	NA	Borehole Diameter:	6"	Drilling	Fluid Used:	Water
Sampling Interval:	NA	Borehole Depth:	18'	Surface	Elevation:	466.93' MSL
NOTES/COMMI	ENTS:					

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	8	NA	Yellow brown silty clay, stiff, plastic, moist	N/A
10-18	8	NA	10'-15' Yellow brown silty clay, stiff, plastic, moist; 12'-14' wet; 15'18' Light gray limestone	N/A
				N/A

### WELL CONSTRUCTION LOG WELL NO. WBSP-15-01

		Protective	Casing with Locking	Cap
Project Number:	2015067	Top of Casing E		5 ft.
		Stick-up: 2.43	3 ft.	
Deciant Logation	Clifty Creek Plant – West Beiler Slee Bond	Land Surface El	evation: 466.93	<b>7</b> fr
Project Location:	West Boiler Slag Pond		evation: 400.9.	3 ft.
Installation Date(s):	11/30/15			
		Grout; Type:	Potland cement/Grou	t
Drilling Method:	Roto-Sonic			
Drilling Contractor:	Bowser Morner			
Development Date(s):	12/16/15	Borehole Diame	eter: 6	incl
	Submersible Pump,			
Development Method:	Peristaltic Pump, Bailer			
Field parameters stabiliz		Casing Diameter	r: 2 Ir	nch
Turbidity = 3.12 NTUs		Casing Material		
		Top of Seal:	2 ft*	
Volume Purged:	33 gallons	1. Star		
Static Water-Level*	16.76'			
Static water-Level*	10.70	Seal Type:	Bentonite Pellets/Chip	s
Top of Well Casing Ele	vation: 469.36'	bear type.	Sentointe Feneta, emp	5
1		No.		
Well Purpose:		8362		
Groundwater Monitorin Northing (Y): 449072.2				
Easting (X): 566322.12				
Lasting (A). 500522.12		Top of Sand/Gra	avel Pack: 6	ft*
		0058 0525		
		and the second		
Comments/Notes:				
2 inch PVC riser and scr		Top of Well Scr	reen 8	ft*
	ted well screen with an inner clean quartz sand and an outer			
layer of food-grade nylo				
inger of food grade right				
		辰代 <b>王</b> 府子		
Inspector: Michael C	ielles	Sand/Gravel Pac	ck; Type: Globa	1 #5
		18 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
CONSTRUCTIO	ON MATERIALS USED:	Screen Diameter	r: 2	Inch
		Screen Slot-Size	e: 0.010	Inch
4 Bags of Sand	1	Screen Material	: PVC	
		200		
2 Bags/Bucket	s Bentonite Pellets			
Bags Portlan	d for Grout			
		Bottom of Well	Screen 18	ft.
Bags Concre	ete/Sakrete	21. 3405 F FICT BOD		
-		Base of Borehol	e: <u>18</u>	ft.
		Total Depth of V		â
		Below Top of C	asing: 20.43	ft.

\*Indicates Depth Below Land Surface

### BORING NO. <u>WBSP-15-02</u> SAMPLE/CORE LOG

Project Number:	2015067 Clifty Creek Plant		Log Page	1	of	1
Project Location:	West Boiler Slag Pond		Drilling Co	ntractor:	Bowser Mo	rner
Drilling Date(s):	11/11/15		AGES Geo	logist:	Mike Gelles	
Drilling Method:	Roto-Sonic	Coring Device Size:	NA	Hamme	r Wt. <u>NA</u>	and Drop NA
Sampling Method:	NA	Borehole Diameter:	6"	Drilling	Fluid Used:	Water
Sampling Interval:	NA	Borehole Depth:	21'	Surface	Elevation:	473.83' MSL
NOTES/COMMI	ENTS:					

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	5	NA	Red brown silt, fine sand, black boiler slag, loose, moist	N/A
10-20	8	NA	10'-11' Red brown silt, fine sand, black boiler slag, loose, moist; 11'- 19' light brown silty clay, stiff, moist; 19'-20' light brown silty clay, stiff, rock fragments, moist	N/A
20-21	1	NA	Gray limestone	N/A
				N/A

### WELL CONSTRUCTION LOG WELL NO. WBSP-15-02

		Protective Casing wi	ith Locking Cap
Project Number:	2015067	Top of Casing Elevation: Stick-up: 2.93 ft.	476.76 ft.
	Clifty Creek Plant -	Stick-up. <u>2.95</u> It.	
Project Location:	West Boiler Slag Pond	Land Surface Elevation:	473.83 ft.
- <b>j</b>			
Installation Date(s):	11/11/15		
		Grout; Type: Portland	cement/Grout
Drilling Method:	Roto-Sonic		
Drilling Contractor:	Bowser Morner		
Development Date(s):	12/7/15	Borehole Diameter:	6 incl
Davialonmont Mathadi	Submersible Pump,		
Development Method: Field parameters stabilized	Peristaltic Pump, Bailer	Casing Diameter: 2	Inch
Turbidity = $3.69$ NTUs		Casing Diameter. 2 Casing Material: PVC	
Turbluity = 5.09 10103		Top of Seal: 2	ft*
Volume Purged:	114.5 gallons		II
Static Water-Level*	15.40'	5.00	
		Seal Type: Bentonite	Pellets/Chips
Top of Well Casing Ele	wation: 476.76'		
Well Purpose:		2510.9	
Groundwater Monitorin		3.52	
Northing (Y): 449803.9		Circle Ci	
Easting (X): 566987.3	0	Ton of Soud/Crossel Dealer	14 6*
		Top of Sand/Gravel Pack:	<u>14</u> ft*
Comments/Notes:			
2 inch PVC riser and sc	reen	Top of Well Screen	16 ft*
	ed well screen with an inner	J.S.	
	clean quartz sand and an outer		
layer of food-grade nyle	on mesh.		
		10-2	
Incorrection Michael C	7-11	Cond/Crossel Dealer Terray	C1-1-1 #5
Inspector: Michael C	Jenes	Sand/Gravel Pack; Type:	Global #5
		22.4	
CONSTRUCTIO	ON MATERIALS USED:	Screen Diameter: 2	Inch
		Screen Slot-Size: 0.010	
3 Bags of Sand	d	Screen Material: PVC	
4 Bags/Bucket	ts Bentonite Pellets	the first the second seco	
Bags Portlan	nd for Grout		
Bags Concre	ete/Sakrete	Bottom of Well Screen	ft.
		Base of Borehole:	ft.
		Total Depth of Well Below Top of Casing:	22.02 A
		Below Top of Casing:	23.93 ft.

\*Indicates Depth Below Land Surface

### BORING NO. <u>WBSP-15-03</u> SAMPLE/CORE LOG

Project Number:	2015067 Clifty Creek Plant		Log Page	1	of	1	
Project Location:	West Boiler Slag Pond		Drilling Co	ntractor:	Bowser M	orner	
Drilling Date(s):	12/4/15		AGES Geo	logist:	Mike Gell	es	
Drilling Method:	Roto-Sonic	Coring Device Size:	NA	Hammer	r Wt. N	A and Drop NA	
Sampling Method:	NA	Borehole Diameter:	6"	Drilling	Fluid Used:	Water	
Sampling Interval:	NA	Borehole Depth:	18'	Surface	Elevation:	484.91' MSL	
NOTES/COMMI	ENTS:						

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	2	NA	Brown silty clay, black boiler slag, limestone fragments, stiff, plastic, moist	N/A
10-18	8	NA	10'-13' Brown silty clay, black boiler slag, limestone fragments, stiff, plastic, moist; 13'-18' Gray, limestone, weathered, dry	N/A
				N/A

### WELL CONSTRUCTION LOG WELL NO. WBSP-15-03

Submersible Pump,         Development Method:       Peristalic Pump, Bailer         Field parameters stabilized.       Inch         Turbidity = 2.42 NTUS       Inch         Volume Purget:       14.5 gallons         Static Water-Level®       11.08°         Top of Seal:       2         Well Purpose:       Groundwater Monitoring         Groundwater Monitoring       Seal Type:         Basing (X):       568093.60         Well Purpose:       Top of Sand/Gravel Pack:         Groundwater Monitoring       Top of Sand/Gravel Pack:         Static Water-Level®       11.08°         Seal Type:       Bentonite Pellets/Chips         Groundwater Monitoring       Top of Sand/Gravel Pack:         Comments/Notes:       1         2 inch PVC riser and screen       8         1 inspector:       Michael Gelles         Inspector:       Michael Gelles         3       Bags of Sand         4       Bags Douckets Bentonite Pellets         Bags Portland for Grout       Bags Oncrete/Sakrete         Bags Oncrete/Sakrete       13         Bage of Borehole:       18			Protective Casing with	Locking Cap
Clifty Creek Plant -       Stick-orp: 3.12 ft.         Project Location:       West Builer Slag Pond         Installation Date(s):       12/415         Doilling Method:       Roto-Sonic         Dilling Method:       Roto-Sonic         Development Date(s):       12/15/15         Submersible Purps,       Borehole Diameter:       6         Trefit parameters stabilized.       Turbuity:       243 NTUs         Volume Purged:       14.5 gallom         Static Water-Level*       11.08'         Top of Well Casing Elevation:       488.03'         Well Purpose:       Groauty Statis       6         Groauter Monitoring       Top of Sand/Gravel Pack:       6       ft*         Comments/Notes:       2       Inch       Sereen Diameter:       2       Inch         Stati of Code prade nylon mesh.       Inspector:       Michael Gelles       Sereen Diameter:       2       Inch         3       Bags of Sand       4       Bags Oratid for Groat       Bottom of Well Screen       18       ft.         4       Bags Ocated Sakete       Bottom of Well Screen       13       ft.         3       Bags Of Sand       Bottom of Well Screen       18       ft.         3       Bags Or				
Clifty Creek Plant -       Land Surface Elevation: 484.91       ft.         Installation Date(s):       12/4/5       Grout; Type: Portland cement/Grout         Diffing Method:       Roto-Sonic       Grout; Type: Portland cement/Grout         Diffing Method:       Roto-Sonic       Borehole Diameter:       6       incl         Development Method:       Perivalite Pump, Builer       Ford parameter:       2       incl         Development Method:       Perivalite Pump, Builer       Turbridity = 2.42 NTUs       Seal Type: Bentonice Pollets/Chips       Top of Sand/Gravel Pack: 6       ft*	Project Number:	2015067		488.03 ft.
Project Location:       West Builer Slag Pond       Image: Contractor:       Image:		Clifty Creek Plant –	Stick up. <u>5.12</u> It.	
Diffing Methol:       Roto-Sonic         Diffing Contractor:       Bowser Momer         Development Date(s):       12/15/15         Borehole Diameter:       6         Submersible Pamp,         Development Method:       Pristallic Pump, Baller         Field parameters stabilized         Turbidity = 2.42 NTUS         Volume Purged:       14.5 gallons         Static Water-Level*       11.08'         Top of Well Casing Elevation:       488.03'         Well Purpose:       Grouwdrater Monitoring         Construct Monitoring       Top of Sand/Gravel Pack:       6       ft*         Optioner Votes:       2       ft *       Top of Well Screen       8       ft*         Dispector:       Michael Gelles       Sand/Gravel Pack:       6       ft*         Inspector:       Michael Gelles       Sand/Gravel Pack:       7pe:       Global #5         Screen Diameter:       2	Project Location:		Land Surface Elevation:	484.91 ft.
Diffing Method:       Roto-Sonic         Deriling Contractor:       Bowser Momer         Development Date(s):       12/15/15         Submersible Pump,       Casing Diameter:       2         Turbidity = 2.42 NTUs       Inch         Volume Purged:       14.5 gallons         Static Water-Level*       11.08'         Top of Well Casing Elevation:       488.03'         Well Purpose:       Groundwater Monitoring         CommentsNotes:       Top of Sand/Gravel Pack:       6       ft*         Static Vater-Level*       11.08'       Top of Well Screen       8       ft*         CommentsNotes:       2       inch       Screen Diameter:       2       inch         Static Vater-Level*       inch       Screen Diameter:       2       inch         Site Water-Level*       inch       Screen Diameter:       2       inch         CommentsNotes:       Screen Diameter:       2       inch         Improve of food-grade nylon mesh.       Screen Diameter:       2       inch         Inspector:       Michael Gelles       Screen Diameter:       2       inch         Screen Diameter:       2       inch       Screen Diameter:       2       inch         3	Installation Date(s):	12/4/15	Grout: Type: Portland.cer	nent/Grout
Drilling Contractor:       Bowser Morner         Development Date(s):       12/15/15         Submersible Pump,       Borehole Diameter:       6         Development Metod:       Pertstatic Pump, Bailer         Turbidity = 2.42 NTUs       Top of Seal:       2         Volume Purged:       14.5 gallons         Static Water-Level*       11.08'         Top of Well Casing Elevation:       488.03'         Well Purpose:       Groundwater Monitoring         Construction (Y):       51819.80         Easing (X):       588093.60         Top of Well Screen       8         Bigs of Sand       6         A       Bags of Sand         A       Bags Oncrete Slarete         Bags Oncrete/Slarete       10         Bags Oncrete/Slarete       13         Bags of Boreholic       18         Total Depth of Well       18	Drilling Method:	Roto-Sonic	Tortiand cer	licit/Grout
Development Date(s):       12/15/15         Submersible Pump,       Development Method:       Perstatile Pump, Bailer         Field parameters stabilized.       Turbitity = 2/4 PULs       Inch         Turbitity = 2/4 PULs       Top of Seal:       2       ft*         Volume Parged:       14.5 gallons       Seal Type:       Bentonite Pellets/Chips       Seal Type:       Bentonite Pellets/Chips         Static Water-Level*       11.08*       Seal Type:       Bentonite Pellets/Chips       Top of Sand/Gravel Pack:       6       ft*         Well Purpose:       Groundwater Monitoring       Monthing (Y): 451181.08       Seal Type:       Bentonite Pellets/Chips       Top of Sand/Gravel Pack:       6       ft*         Comments/Notes:       2       in the prophetics/Well Screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.       Sand/Gravel Pack:       7       ft*         Inspector:       Michael Gelles       Screen Diameter:       2       Inch         3       Bags of Sand       Screen Diameter:       2       Inch         4       Bags Portland for Grout       Bats of Borehole:       13       ft.         Bags Concrete/Satrete       Base of Borehole:       18       ft.				
Submersible Pump,         Development Method:       Pristaltic Pump, Bailer         Field parameters stabilized.       Turbitity = 2.42 NTUS         Volume Purged:       14.5 gallons         Static Water-Level®       11.08°         Top of Seal:       2         ft*         Seal Type:       Bentonite Pellets/Chips         Well Purpose:       Groundwater Monitoring         Groundwater Monitoring       Top of Sand/Gravel Pack:       6         Top of Sand/Gravel Pack:       6         2 linch PVC riser and screen       8       ft*         Top of Odd-grade nylon mesh.       Top of Well Screen       8       ft*         Inspector:       Michael Gelles       Sand/Gravel Pack:       7pre:       Global #5         Screen Diameter:       2       0.010       Inch         Screen Diameter:       2       0.010       Inch         Screen Slot-Size:       0.010       Inch       Screen Material:       PVC         A       Bags Outland for Grout       Bags Outland for Grout       Bags Outland for Grout       Bage of Borehole:       13       ft         Bage of Borehole:       18       ft       Top of Well       Screen       13       ft		12/15/15	Borehole Diameter: 6	inch
Development Method:       Perisatic Pump, Bailer         Field parameters stabilized.       Turbidity = 2.42 NTUS         Volume Purged:       14.5 gallons         Static Water-Level*       11.08'         Top of Well Casing Elevation:       488.03'         Well Purpose:       Groundwater Monitoring         Northing (Y): 451181.98       58803.60         Easting (X):       568093.60         Top of Well Casing Elevation:       6         1       1000 pre-packed well screen with an inner filter pack of 0.010 pre-packed well screen with an inner filter pack of 0.040 nm clean quarts and and an outer layer of food-grade nylon mesh.       Top of Well Screen         Inspector:       Michael Gelles       Sand/Gravel Pack; Type:       Global #5         Screen Diameter:       2       Inch         A       Bags/Orsand       Hethory       Inch         A       Bags/Orsand       Bags Orsand       Inch         A       Bags/Oracete Sakrete       Bags Oncrete/Sakrete       Base of Borehole:       18         Base of Borehole:       18       ft	•			
Field parameters stabilized.       Casing Material:       PVC         Turbidity = 2.42 NTUs       Top of Seal:       2       ft*         Static Water-Level*       11.08'       Top of Seal:       2       ft*         Static Water-Level*       11.08'       Seal Type:       Bentonite Pellets/Chips         Groundwater Monitoring       Monthing (X): 4581181.98       Seal Type:       Bentonite Pellets/Chips         Groundwater Monitoring       Top of Sand/Gravel Pack:       6       ft*         Comments/Notes:       1       1       70 of Well Screen       8       ft*         Comments/Notes:       1				
Turbidity = 2.42 NTUs       Casing Material:       PVC         Volume Purged:       14.5 gallons       Top of Seal:       2       ft*         Static Water-Level*       11.08'       Seal Type:       Bentonite Pellets/Chips         Well Purpose:       Groundwater Monitoring       Top of Sand/Gravel Pack:       6       ft*         Groundwater Monitoring (Y): 451181.98       Easting (X): 558093.60       Top of Sand/Gravel Pack:       6       ft*         Comments/Notes:       2       inch yor of Cod-grade nylon mesh.       Top of Well Screen       8       ft*         Inspector:       Michael Gelles       Sand/Gravel Pack:       7       Global #5         Screen Diameter:       2       Inch       Screen Namerial:       PVC         3       Bags of Sand       Easting:       PVC       Easting:       Inch         3       Bags of Sand       Easting:       PVC       Easting:       Easting:       Inch         4       Bags/Buckets Bentonite Pellets       Bags Ortland for Grout       Bags of Sand       Easting:       Easting:       Easting:       Easting:       Easting:       Inch         3       Bags Ortland for Grout       Bags of Sand       Easting:       Easting:       Easting:       Easting:       Easting: </td <td></td> <td></td> <td></td> <td></td>				
Volume Purged:       14.5 gallons         Static Water-Level*       11.08'         Top of Well Casing Elevation:       488.03'         Well Purpose:       Groundwater Monitoring         Northing (Y): 451181.98       Top of Sand/Gravel Pack:       6         Base of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.       Top of Well Screen       8       ft*         Inspector:       Michael Gelles       Sand/Gravel Pack; Type:       Global #5         Screen Diameter:       2       Inch         Screen Diameter:       2       0.010       Inch         Screen Namerial:       PVC       PVC       Inch         Bags Portland for Grout       Bags Concrete/Sakrete       Bags of Send       13       ft.         Method Derebole:       18       ft.       ft.       Top of Well Screen       13       ft.		zed.		Inch
Volume Purged:       14.5 gallons         Static Water-Level*       11.08'         Top of Well Casing Elevation:       488.03'         Well Purpose:       Groundwater Monitoring         Northing (Y): 451181.98       Top of Sand/Gravel Pack:       6         Basting (X):       568093.60         2 inch PVC riser and screen       Top of Well Screen       8         11 log of 0.400 mr clean quartz sand and an outer layer of food-grade nylon mesh.       Top of Well Screen       8       ft*         Inspector:       Michael Gelles       Screen Diameter:       2       Inch         3       Bags of Sand       Screen Diameter:       2       Inch         4       Bags/Buckets Bentonite Pellets       Bags Orantite Pellets       Bags Orantite Pellets       Bags Orantite Pellets       Bags Orantite Pellets       11.0         4       Bags Concrete/Sakrete       Bags of Borchole:       18       ft.	Turbidity = $2.42$ NTUs			
Static Water-Level*       11.08'         Top of Well Casing Elevation:       488.03'         Well Purpose:       Groundwater Monitoring         Northing (Y): 451181.98       488.03'         Easting (X): 568093.60       Top of Sand/Gravel Pack:       6       ft*         Comments/Notes:       100 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.       Top of Well Screen       8       ft*         Inspector:       Michael Gelles       Sand/Gravel Pack; Type:       Global #5         3       Bags of Sand       Screen Diameter:       2       inch         4       Bags/Buckets Bentonite Pellets       Bags Orand       Bags Oracrete/Sakrete       Bottom of Well Screen       13       ft.         Bags Oncrete/Sakrete       Bags of Borehole:       18       ft.			Top of Seal:	ft*
Top of Well Casing Elevation:       488.03'         Well Purpose:       Groundwater Monitoring         Northing (Y):       451181.98         Easting (X):       568093.60         Top of Sand/Gravel Pack:       6         ft*       Top of Sand/Gravel Pack:         2 inch PVC riser and screen       5         5 ft of 0.010 pre-packed well screen with an inner         filter pack of 0.40 nm clean quartz sand and an outer         layer of food-grade nylon mesh.         Inspector:       Michael Gelles         Screen Diameter:       2         a       Bags/Buckets Bentonite Pellets         Bags Portland for Grout       Bags Concrete/Sakrete         Bags Concrete/Sakrete       18	Volume Purged:	14.5 gallons		
Top of Well Casing Elevation:       488.03'         Well Purpose:       Groundwater Monitoring         Monthing (Y):       451181.98         Easting (X):       568093.60         Top of Sand/Gravel Pack:       6         filer pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.       Top of Well Screen         Inspector:       Michael Gelles         Sand/Gravel Pack; Type:       Global #5         Screen Diameter:       2         3       Bags of Sand         4       Bags/Buckets Bentonite Pellets         Bags Ordnand for Grout       Bottom of Well Screen         Bags Concrete/Sakrete       13         ft.       Total Depth of Well	Static Water-Level*	11.08'		
Well Purpose:       Groundwater Monitoring         Northing (Y): 451181.98       Easting (X): 568093.60         Easting (X): 568093.60       Top of Sand/Gravel Pack: 6 ft*         Comments/Notes:       2 inch PVC riser and screen         5 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.       Top of Well Screen         Inspector:       Michael Gelles       Sand/Gravel Pack; Type:       Global #5         CONSTRUCTION MATERIALS USED:       Screen Diameter: 2       Inch         3       Bags of Sand       Screen Naterial:       PVC         4       Bags/Buckets Bentonite Pellets       Bags Portland for Grout       Bottom of Well Screen       13       ft.         Bags of Sand       1       Nothing       Inch       Screen Naterial:       PVC       Inch         1       Bags Concrete/Sakrete       Is of borehole:       18       ft.			Seal Type: Bentonite Pel	lets/Chips
Groundwater Monitoring       Northing (Y): 451181.98         Easting (X): 568093.60       Top of Sand/Gravel Pack: 6         2 inch PVC riser and screen       Top of Well Screen         2 inch PVC riser and screen       Top of Well Screen         5 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.       Sand/Gravel Pack: Type:         Inspector:       Michael Gelles         Sand/Gravel Pack; Type:       Global #5         Screen Diameter:       2          Screen Diameter:       2          Bags of Sand          Bags Portland for Grout          Bags Concrete/Sakrete          Bags of Borehole:       13          ft.         Bags of Borehole:       18	Top of Well Casing Ele	vation: 488.03'	130	
Groundwater Monitoring       Northing (Y): 451181.98         Easting (X): 568093.60       Top of Sand/Gravel Pack: 6         2 inch PVC riser and screen       Top of Well Screen         2 inch PVC riser and screen       Top of Well Screen         5 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.       Sand/Gravel Pack: Type:         Inspector:       Michael Gelles         Sand/Gravel Pack; Type:       Global #5         Screen Diameter:       2          Screen Diameter:       2          Bags of Sand          Bags Portland for Grout          Bags Concrete/Sakrete          Bags of Borehole:       13          ft.         Bags of Borehole:       18				
Northing (Y): 451181.98         Easting (X): 568093.60         Top of Sand/Gravel Pack:         2 inch PVC riser and screen         2 inch PVC riser and screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.         Inspector:       Michael Gelles         Sand/Gravel Pack:       7 po of Well Screen         8       ft*         CONSTRUCTION MATERIALS USED:       Sand/Gravel Pack; Type:         3       Bags of Sand         4       Bags/Buckets Bentonite Pellets         Bags Portland for Grout       Bottom of Well Screen         Bags Oncrete/Sakrete       Bags of Borehole:         18       ft.				
Easting (X): 568093.60       Top of Sand/Gravel Pack: 6       ft*         Comments/Notes:       6       ft*         2 inch PVC riser and screen       Top of Well Screen       8       ft*         Top of Well Screen       8       ft*         Inspector:       Michael Gelles       Sand/Gravel Pack; Type:       Global #5         Screen Diameter:       2       0.010       Inch         Screen Material:       PVC       PVC       Inch         Bags Portland for Grout       Bags Oncrete/Sakrete       Bage of Borehole:       13       ft.         Total Depth of Well       Total Depth of Well       Total Depth of Well       Total Depth of Well				
Comments/Notes:       2 inch PVC riser and screen       6       ft*         St of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.       Top of Well Screen       8       ft*         Inspector:       Michael Gelles       Sand/Gravel Pack; Type:       Global #5         Sand/Gravel Pack; Type:       Global #5       Global #5         CONSTRUCTION MATERIALS USED:       Screen Diameter:       2       Inch         3       Bags of Sand       Material:       PVC       Inch         4       Bags/Buckets Bentonite Pellets       Bags Portland for Grout       Bottom of Well Screen       13       ft.         Bags of Sand       1       Bags of Screen       13       ft.         Total Depth of Well       Screen       18       ft.			1 / C	
Comments/Notes:       2 inch PVC riser and screen       8       ft*         5 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 nm clean quartz sand and an outer layer of food-grade nylon mesh.       Top of Well Screen       8       ft*         Inspector:       Michael Gelles       Sand/Gravel Pack; Type:       Global #5         CONSTRUCTION MATERIALS USED:       Screen Diameter:       2	Easting (X): 568093.6	0	201	
2 inch PVC riser and screen       5 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.       Top of Well Screen       8 ft*         Inspector:       Michael Gelles       Sand/Gravel Pack; Type:       Global #5         Screen Diameter:       2       Inch         3       Bags of Sand       Screen Material:       PVC         4       Bags/Buckets Bentonite Pellets       Bags Portland for Grout       Bottom of Well Screen       13 ft.         Base of Borehole:       18 ft.       ft.			Top of Sand/Gravel Pack:	<u>6</u> ft*
2 inch PVC riser and screen       5 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.       Top of Well Screen       8 ft*         Inspector:       Michael Gelles       Sand/Gravel Pack; Type:       Global #5         Screen Diameter:       2       Inch         3       Bags of Sand       Screen Material:       PVC         4       Bags/Buckets Bentonite Pellets       Bags Portland for Grout       Bottom of Well Screen       13 ft.         Base of Borehole:       18 ft.       ft.			27	
2 inch PVC riser and screen       5 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.       Top of Well Screen       8 ft*         Inspector:       Michael Gelles       Sand/Gravel Pack; Type:       Global #5         Screen Diameter:       2       Inch         3       Bags of Sand       Screen Material:       PVC         4       Bags/Buckets Bentonite Pellets       Bags Portland for Grout       Bottom of Well Screen       13 ft.         Base of Borehole:       18 ft.       ft.				
5 ft of 0.010 pre-packed well screen with an inner filter pack of 0.40 mm clean quartz sand and an outer layer of food-grade nylon mesh.         Inspector:       Michael Gelles         Sand/Gravel Pack; Type:       Global #5         Screen Diameter:       2         1       Bags of Sand         4       Bags/Buckets Bentonite Pellets         Bags Portland for Grout       Bottom of Well Screen         Bags Concrete/Sakrete       18         Total Depth of Well		raan	Top of Wall Saraan	Q fr*
filter pack of 0.40 mm clean quartz sand and an outer   layer of food-grade nylon mesh.   Inspector: Michael Gelles   Inspector: Michael Gelles   Sand/Gravel Pack; Type: Global #5    Screen Diameter: 2    Screen Diameter: 2    Screen Diameter: 2    3    Bags of Sand    4    Bags/Buckets Bentonite Pellets   Bags Portland for Grout   Bags Concrete/Sakrete   Image: Concrete/Sakrete   Total Depth of Well				<u> </u>
Iayer of food-grade nylon mesh.         Inspector:       Michael Gelles         Sand/Gravel Pack; Type:       Global #5         Screen Diameter:       2         3       Bags of Sand         4       Bags/Buckets Bentonite Pellets         Bags Portland for Grout       Bottom of Well Screen         Bags Concrete/Sakrete       13       ft.         Base of Borehole:       18       ft.         Total Depth of Well       Total Depth of Well       Total Depth of Well			2	
Inspector:       Michael Gelles         Sand/Gravel Pack; Type:       Global #5         Screen Diameter:       2         3       Bags of Sand         4       Bags/Buckets Bentonite Pellets         Bags Portland for Grout       Bottom of Well Screen         Bags Concrete/Sakrete       18         Total Depth of Well			10.00	
CONSTRUCTION MATERIALS USED:         3       Bags of Sand         4       Bags/Buckets Bentonite Pellets         Bags Portland for Grout       Screen Material:         Bags Concrete/Sakrete       Base of Borehole:       13         Total Depth of Well       Total Depth of Well	layer of 100d grade liyit			
CONSTRUCTION MATERIALS USED:         3       Bags of Sand         4       Bags/Buckets Bentonite Pellets         Bags Portland for Grout       Bottom of Well Screen 13 ft.         Bags Concrete/Sakrete       18 ft.         Total Depth of Well			\$35	
CONSTRUCTION MATERIALS USED:         3       Bags of Sand         4       Bags/Buckets Bentonite Pellets         Bags Portland for Grout       Bottom of Well Screen 13 ft.         Bags Concrete/Sakrete       18 ft.         Total Depth of Well				
3       Bags of Sand         4       Bags/Buckets Bentonite Pellets         Bags Portland for Grout       Bags Concrete/Sakrete         Bags Concrete/Sakrete       Base of Borehole:         18       ft.         Total Depth of Well	Inspector: Michael C	Gelles	Sand/Gravel Pack; Type:	Global #5
3       Bags of Sand         4       Bags/Buckets Bentonite Pellets         Bags Portland for Grout       Bags Concrete/Sakrete         Bags Concrete/Sakrete       Base of Borehole:         18       ft.         Total Depth of Well	·			
3       Bags of Sand         4       Bags/Buckets Bentonite Pellets         Bags Portland for Grout       Bags Concrete/Sakrete         Bags Concrete/Sakrete       Base of Borehole:         18       ft.         Total Depth of Well				
3       Bags of Sand         4       Bags/Buckets Bentonite Pellets         Bags Portland for Grout       Bags Concrete/Sakrete         Bags Concrete/Sakrete       Base of Borehole:         18       ft.         Total Depth of Well			a second	
3       Bags of Sand         4       Bags/Buckets Bentonite Pellets         Bags Portland for Grout       Bags Concrete/Sakrete         Bags Concrete/Sakrete       Base of Borehole:         18       ft.         Total Depth of Well				
3       Bags of Sand         4       Bags/Buckets Bentonite Pellets         Bags Portland for Grout       Bags Concrete/Sakrete         Bags Concrete/Sakrete       Base of Borehole:         18       ft.         Total Depth of Well				
3       Bags of Sand         4       Bags/Buckets Bentonite Pellets         Bags Portland for Grout       Bags Concrete/Sakrete         Bags Concrete/Sakrete       Base of Borehole:         18       ft.         Total Depth of Well	CONSTRUCTIO	ON MATERIALS USED:	1 756.6	
4       Bags/Buckets Bentonite Pellets         Bags Portland for Grout       Bottom of Well Screen         Bags Concrete/Sakrete       Base of Borehole:         18       ft.         Total Depth of Well				Inch
Bags Portland for Grout Bags Concrete/Sakrete Base of Borehole: 18 ft. Total Depth of Well	3 Bags of Sand	d	Screen Material: PVC	
Bags Portland for Grout Bags Concrete/Sakrete Base of Borehole: 18 ft. Total Depth of Well			1	
Bags Concrete/Sakrete Base of Borehole: 13 ft. Base of Borehole: 18 ft. Total Depth of Well	4 Bags/Bucket	ts Bentonite Pellets	n te the te	
Bags Concrete/Sakrete Base of Borehole: 13 ft. Base of Borehole: 18 ft. Total Depth of Well				
Bags Concrete/Sakrete Base of Borehole: 18 ft. Total Depth of Well	Bags Portlan	nd for Grout		
Base of Borehole: ft Total Depth of Well		. (0.1	Bottom of Well Screen	<u>13</u> ft.*
Total Depth of Well	Bags Concre	ete/Sakrete	Base of Borehole	18 ft.*
			Duse of Borehole.	<u> </u>
			Total Depth of Well	
			Below Top of Casing:	16.12 ft.

\*Indicates Depth Below Land Surface

### BORING NO. <u>WBSP-15-04</u> SAMPLE/CORE LOG

Project Number:	2015067		Log Page	0	of	L
Project Location:	Clifty Creek Plant West Boiler Slag Pond		Drilling Co	ntractor: Bow	/ser Morne	er
Drilling Date(s):	11/11/15-11/12/15		AGES Geol	logist: <u>Mike</u>	e Gelles	
Drilling Method:	Roto-Sonic	Coring Device Size:	NA	Hammer Wt.	NA	and Drop NA
Sampling Method:	NA	Borehole Diameter:	6"	Drilling Fluid	Used:	Water
Sampling Interval:	NA	Borehole Depth:	70'	Surface Elevat	tion:	471.17' MSL
NOTES/COMME	ENTS:					

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	8	NA	Red brown silt, fine sand, boiler slag, loose, moist	N/A
10-20	8	NA	Red brown silt, fine sand, boiler slag, loose, moist	N/A
20-30	8	NA	20'-28' Red brown silt, fine sand, boiler slag, loose, moist; 28'-30' wet	N/A
30-40	7	NA	Red brown silt, fine sand, boiler slag, loose, wet	N/A
40-50	10	NA	40'-45' Red brown silt, fine sand, boiler slag, loose, wet; 45'-47' Yellow brown clay, stiff, plastic, moist; 47'-49' Yellow brown gravel angular, fine and medium sand, wet; 49'-50' Orange brown sandy clay, fine, stiff, moist	N/A
50-60	9	NA	50'-53' Orange brown sandy clay, fine, stiff, moist; 53' – 60' Light brown sand, fine, medium, coarse, gravel angular fine, medium, coarse, large, wet	N/A
60-70	7	NA	60'-68.5' Light brown sand, fine, medium, coarse, gravel angular fine, medium, coarse, wet; 68.5' -70' light brown sand, fine, medium, coarse, black coal and peat, wet	N/A
				N/A

		Protective Casing with Locking Cap
Project Number:	2015067	Top of Casing Elevation: 473.71 f
rojeetranicen	2012007	Stick-up: 2.54 ft.
	Clifty Creek Plant –	500k up 10.
et Location:	West Boiler Slag Pond	Land Surface Elevation: 471.17 f
20000000	Hest Boner Sing Fond	
tion Date(s):	11/11/15-11/12/15	
		Grout; Type: Portland cement/ Grout
Method:	Roto-Sonic	
Contractor:	Bowser Morner	
nt Date(s):	12/9/15	Borehole Diameter: 6 i
Method:	Submersible Pump	
eters stabiliz	ed.	Casing Diameter: 2 Inch
= 0.91 NTUs		Casing Material: PVC
		Top of Seal: 2 ft*
urged:	65 gallons	
Water-Level*	50.68'	
		Seal Type: Bentonite Pellets/Chips
Casing Elev	vation: 473.71'	
Purpose:		
water Monitoring		
g(Y): 450610.0°		
(X): 568637.65		
		Top of Sand/Gravel Pack: 53 f
ts/Notes:		
/C riser and scr		Top of Well Screen 55 f
	ed well screen with an inner	
	lean quartz sand and an outer	
t food-grade nyloi	n mesh.	
t tood-grade nyloi	n mesh.	
of food-grade nyloi	n mesh.	
		Sand/Gravel Pack; Type: Global #5
		Sand/Gravel Pack; Type:Global #5
		Sand/Gravel Pack; Type:Global #5
		Sand/Gravel Pack; Type:Global #5
		Sand/Gravel Pack; Type:Global #5
Michael G	elles	
Michael G		Screen Diameter: 2 Inch
Michael G	elles	Screen Diameter: 2 Inch Screen Slot-Size: 0.010 Inch
Michael G	elles	Screen Diameter: 2 Inch
Michael G	elles	Screen Diameter: 2 Inch Screen Slot-Size: 0.010 Inch
Michael G	elles	Screen Diameter: 2 Inch Screen Slot-Size: 0.010 Inch
Michael G STRUCTIO Bags of Sand Bags/Buckets	elles ON MATERIALS USED: Bentonite Pellets	Screen Diameter: 2 Inch Screen Slot-Size: 0.010 Inch
Michael G TRUCTIO ags of Sand ags/Buckets	elles ON MATERIALS USED: Bentonite Pellets	Screen Diameter:     2     Inch       Screen Slot-Size:     0.010     Inch       Screen Material:     PVC     Inch
Michael G TRUCTIO ags of Sand ags/Buckets ags Portland	elles ON MATERIALS USED: Bentonite Pellets d for Grout	Screen Diameter: 2 Inch Screen Slot-Size: 0.010 Inch
Michael G NSTRUCTIO Bags of Sand	elles ON MATERIALS USED: Bentonite Pellets d for Grout	Screen Diameter:       2       Inch         Screen Slot-Size:       0.010       Inch         Screen Material:       PVC       Inch         Bottom of Well Screen       65
Michael G NSTRUCTIO Bags of Sand Bags/Buckets Bags Portland	elles ON MATERIALS USED: Bentonite Pellets d for Grout	Screen Diameter:     2     Inch       Screen Slot-Size:     0.010     Inch       Screen Material:     PVC     Inch
:Michael G DNSTRUCTIO Bags of Sand Bags/Buckets Bags Portland	elles ON MATERIALS USED: Bentonite Pellets d for Grout	Screen Diameter:       2       Inch         Screen Slot-Size:       0.010       Inch         Screen Material:       PVC       Inch         Bottom of Well Screen       65         Base of Borehole:       70
or: <u>Michael G</u> CONSTRUCTIO Bags of Sand Bags/Buckets Bags Portland	elles ON MATERIALS USED: Bentonite Pellets d for Grout	Screen Diameter:       2       Inch         Screen Slot-Size:       0.010       Inch         Screen Material:       PVC       Inch         Bottom of Well Screen       65

### BORING NO. <u>WBSP-15-05</u> SAMPLE/CORE LOG

Project Number:	2015067 Clifty Creek Plant		Log Page	1	of	1	
Project Location:	West Boiler Slag Pond		Drilling Co	ntractor:	Bowser Morr	ner	
Drilling Date(s):	11/13/15-11/17/15		AGES Geo	logist:	John Campbe		
Drilling Method:	Roto-Sonic	Coring Device Size:	NA	Hammer	r Wt. NA	and Drop NA	
Sampling Method:	NA	Borehole Diameter:	6"	Drilling	Fluid Used:	Water	
Sampling Interval:	NA	Borehole Depth:	71'	Surface	Elevation:	471.90' MSL	
NOTES/COMMI	NOTES/COMMENTS:						

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	8	NA	Red brown silt, fine sand, black boiler slag, loose, moist	N/A
10-20	8	NA	Red brown silt, fine sand, black boiler slag, loose, moist	N/A
20-30	6	NA	Red brown silt, fine sand, black boiler slag, loose, moist	N/A
30-40	5	NA	30'-33' Red brown silt, fine sand, black boiler slag, loose, moist; 33'- 35' brown clay, wet, loose	N/A
40-50	8	NA	40'-45' Brown clay(till), plastic, moist; 45'-50' gray clay(till), plastic, moist	N/A
50-60	9	NA	50'-59' Gray silty clay(till); sand fine, medium, coarse, and gravel subrounded fine, medium, coarse, large, little silt, very moist	N/A
60-70	5	NA	Gray to brown sand fine, medium, coarse, and gravel subrounded fine, medium, coarse, large, little silt, wet	N/A
70-71	1	NA	Gray to brown sand fine, medium, coarse, and gravel subrounded fine, medium, coarse, large, little silt, wet	N/A
				N/A

		Protective Casing with Locking Cap
		- ۲
Project Number:	2015067	Top of Casing Elevation: 474.42 ft
lojeet Nullber.	2013007	Stick-up: 2.52 ft.
	Cliffer Create Diant	$Stick-up. \underline{2.52} It.$
	Clifty Creek Plant –	
cation:	West Boiler Slag Pond	Land Surface Elevation: 471.90 ft
Deta(a)	11/12/15 11/17/15	
n Date(s):	11/13/15-11/17/15	
		Grout; Type: Portland cement/ Grout
ethod:	Roto-Sonic	
Contractor:	Bowser Morner	
ate(s):	12/16/15	Borehole Diameter: 6 in
lethod:	Submersible Pump	
ters stabiliz	ed.	Casing Diameter: 2 Inch
4.28 NTUs		Casing Material: PVC
		Top of Seal: 55 ft*
ged:	46 gallons	
ter-Level*	52.42'	10 million (1997)
	52.72	Seal Type: Bentonite Pellets/Chips
l Casing Elev	ration: 474.42'	Bentonite renets/Chips
asing Elev	vation: 474.42'	6
		8
1.0		5
arpose:		1. Ca
er Monitoring		
Y): 450051.4		2
(X): 568495.72		6
		Top of Sand/Gravel Pack: 59 ft
		2
		10 M
ts/Notes:		*
riser and scr	een	Top of Well Screen 61 ft
	ed well screen with an inner	
	lean quartz sand and an outer	
food-grade nylo		
oou-grade iiylo		
		8
or: John Cam		
John Cam	bell	Sand/Gravel Pack; Type: Global #5
		3
		9
		8
		*
STRUCTIO	N MATERIALS USED:	Screen Diameter: 2 Inch
JINUCIIU	TI MATERIALO USED.	Screen Diameter. 2 Inch
loss of C 1		
s of Sand		Screen Material: PVC
л ·	D	
gs/Buckets	Bentonite Pellets	
		X
gs Portland	l for Grout	
		Bottom of Well Screen 71
Concret	e/Sakrete	
	o, is unifere	Base of Borehole: 71
		Total Depth of Well Below Top of Casing: 73.52

### BORING NO. <u>WBSP-15-06</u> SAMPLE/CORE LOG

Project Number:	2015067 Clifty Creek Plant		Log Page	1	of	1	
Project Location:	West Boiler Slag Pond		Drilling Co	ntractor:	Bowser Mo	rner	
Drilling Date(s):	11/18/15-11/19/15		AGES Geo	logist:	John Campb	pell	
Drilling Method:	Roto-Sonic	Coring Device Size:	NA	Hammer	Wt. NA	and Drop NA	
Sampling Method:	NA	Borehole Diameter:	6"	Drilling	Fluid Used:	Water	
Sampling Interval:	NA	Borehole Depth:	90'	Surface	Elevation:	471.28' MSL	
NOTES/COMMI	NOTES/COMMENTS:						

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	7	NA	Black boiler slag and ash, loose, fill	N/A
10-20	7	NA	Black boiler slag and ash, loose, fill	N/A
20-30	6	NA	Black boiler slag and ash, loose, fill; 27'-30' wet	N/A
30-40	6	NA	Black boiler slag and ash, loose, fill, 30'-34' wet; 34'-36' brown clay, some silt, hard, damp	N/A
40-50	10	NA	40'-48' Gray silty clay, soft, very moist, moist 7'-8'; brown silty clay, firm, damp	N/A
50-60	10	NA	Gray silty clay, firm to soft, moist to very moist	N/A
60-70	10	NA	60'-65' Gray silty clay, firm, moist to very moist; 65' – 70' Gray silt, clay, firm, wet	N/A
70-80	4	NA	70' - 72' Gray silty clay, firm, moist to very moist; 72' – 74' Gray silt, clay, firm, wet; 74'-76' Gray to brown sand fine, medium, coarse, large and gravel subrounded fine, medium, coarse, large, wet	N/A
80-90	9	NA	80'-88' Gray to brown sand fine, medium, coarse, large and gravel subrounded fine, medium, coarse, large, wet; 88'- 89' Gray to brown sand fine, medium, coarse, large to sand fine, medium, wet	N/A

velopment Method: Submersible Pump id parameters stabilized. thidity = 3.44 NTUs turne Purged: 100 gallons tic Water-Level* 51.55' p of Well Casing Elevation: 473.51' seal Type: Bentonite Pellets/Chips p of Well Casing Elevation: 473.51' seal Type: Bentonite Pellets/Chips p of Well Screen 75.5 ft <sup>4</sup> Top of Sand/Gravel Pack: 73.5 ft <sup>4</sup> mments/Notes: the PVC Tiser and screen ft of 0.010 prepacked well screen with an inner er pack of 0.40 mm clean quartz sand and an outer er of food-grade nylon mesh. pector: John Campbell CONSTRUCTION MATERIALS USED: 6 Bags of Sand 2 Bags/Buckets Bentonite Pellets 12 Bags Portland for Grout Bags Concrete/Sakrete Bags of Sand 2 Bags Portland for Grout Bags Concrete/Sakrete Market Screen 85.5 ft Total Depth of Well			Protective Casing with Loc	cking Cap
Clifty Creek Plant -       Stick-up: 2.23 ft.         Land Surface Elevation:       471.28 ft.         Land Surface Elevation:       471.28 ft.         Illing Contractor:       Bowset Morner         velopment Method:       Submersible Pump         diparameters statistized.       Grout; Type:         Portland cement/ Grout       Borehole Diameter:       6         diparameters statistized.       Inch         casing Diameter:       2       Inch         casing Diameter:       2       Inch         Casing Diameter:       2       Inch         casing Diameter:       6       in         velopment Method:       Stick-up:       2         hume Purged:       100 gallons       ft         tick Water-Level*       51.55'       Seal Type:       Bentonite Pellets/Chips         stick 1/2       Murbosci:       montestand and an outer       Top of Saud/Gravel Pack:       73.5       ft         mments/Notes:       mold Screen       75.5       ft       Sand/Gravel Pack:       73.5       ft         pector:       John Campbell       Sand/Gravel Pack:       73.5       ft         Screen Jiameter:       2       Bags of Sand       Screen Slot-Size:       Inch			┓∕	
Clifty Creek Plant -       Stick-up: 2.23 ft.         Land Surface Elevation:       471.28 ft.         Land Surface Elevation:       471.28 ft.         Illing Contractor:       Bowset Morner         velopment Method:       Submersible Pump         diparameters statistized.       Grout; Type:         Portland cement/ Grout       Borehole Diameter:       6         diparameters statistized.       Inch         casing Diameter:       2       Inch         casing Diameter:       2       Inch         Casing Diameter:       2       Inch         casing Diameter:       6       in         velopment Method:       Stick-up:       2         hume Purged:       100 gallons       ft         tick Water-Level*       51.55'       Seal Type:       Bentonite Pellets/Chips         stick 1/2       Murbosci:       montestand and an outer       Top of Saud/Gravel Pack:       73.5       ft         mments/Notes:       mold Screen       75.5       ft       Sand/Gravel Pack:       73.5       ft         pector:       John Campbell       Sand/Gravel Pack:       73.5       ft         Screen Jiameter:       2       Bags of Sand       Screen Slot-Size:       Inch	Project Number:	2015067	Top of Casing Elevation:	473 51 ft
Citity Creek Plant -         jeet Location:       West Boiler Slag Pond         tallation Date(s):       11/18/15-11/19/15         illing Method:       Roto-Sonic         illing Contractor:       Bowen Morner         velopment Date(s):       12/9/15         velopment Method:       Submersible Pump         dd parameters stabilized.       Top of Seal:         offitty = 3.44 NTUs       60.5         hume Purgoal:       100 gallons         nick Water-Level*       51.55'         p of Well Casing Elevation:       473.51'         sill Purpose:       Casing Materier:       2         nandwater Monitoring       frid         ning (Y):       49470.57         sting (X):       568402.50         ning (Y):       49470.57         sting (X):       568402.50         non-backed well screen with an inner       re         pector:       John Campbell         CONSTRUCTION MATERIALS USED:       5         6       Bags of Sand         2       Bags of Sand         2 <td>roject rumber.</td> <td>2013007</td> <td></td> <td><u>-++5.51</u> It.</td>	roject rumber.	2013007		<u>-++5.51</u> It.
Location: West Boiler Slag Pond tion Dute(s): 11/18/15-11/19/15 (Method: Roto-Sonic Contractor: Bowser Momer pment Date(s): 12:9/15 pment Method: Submersible Pump ammeters stabilized. y = 3.44 NTUs Purgsdt: 100 gallons Purgsdt: 100 gallons Purgsdt: 100 gallons Purgsdt: 100 gallons Well Casing Elevation: 473.51* apose: Well Casing Elevation: 473.51* Top of Saud/Gravel Pack: 73.5 ft <sup>2</sup> Top of Saud/Gravel Pack: 73.5 ft <sup>2</sup> Top of Saud/Gravel Pack: 73.5 ft <sup>2</sup> Screen Diameter: 2 Inch Casing Material: 77.5 ft <sup>2</sup> Seal Type: Bentonite Pellets/Chips Top of Saud/Gravel Pack: 73.5 ft <sup>2</sup> Source Pack: 73.5 ft <sup>3</sup> Source Pack: 73.		Clifty Crook Plant	Stick-up. <u>2.25</u> It.	
lation Date(s):       11/18/15-11/19/15         ng Method:       Roto-Sonic         ng Contractor:       Bowser Momer         lopment Date(s):       12/9/15         lopment Date(s):       12/9/15         lopment Method:       Submersible Pump         parameters:       100 gallons         Water-Level*       51.55'         ft Well Casing Elevation:       473.51'         Purpose:       advater Monitoring         ang (X):       568402.50         nents/Notes:       rop of Sand/Gravel Pack:       73.5         rtf       Top of Well Screen       75.5         rtf       Sand/Gravel Pack; Type:       Global #5         ctor:       John Campbell       Sand/Gravel Pack; Type:       Global #5         gase of Sand       Bags Forchand for Grout       Bags of Sand       Bags of Sand         Bags Concrete/Sakrete       Bags Concrete/Sakrete       Bags of Borehole:       85.5       ft	at Location:		Land Surface Elevation	171 28 ft
Method:       Roin-Sonic         Contractor:       Bowser Morner         ment Date(s):       12/9/15         ment Method:       Submersible Pump         rameters stabilized.       Grout; Type:         y= 3.44 NTUs       Top of Seal:         Purged:       100 gallons         /ater-Level*       51.55'         Well Casing Elevation:       473.51'         rpose:       metrinic Pellets/Chips         well Casing Elevation:       473.51'         rpose:       metrinic regimeter:         water Monitoring       "VC"         g(Y):       449470.57         (X):       568402.50         Top of Sand/Gravel Pack:       73.5         ft'       Top of Sand/Gravel Pack:         VC riser and screen       75.5         ft'       Top of Well Screen         ftool-grade nylon mesh.       Sand/Gravel Pack; Type:         giotal #5       Screen Diameter:       2         ONSTRUCTION MATERIALS USED:       Serven Diameter:       2         Bags of Sand       Bags Ordinal for Grout       Botom of Well Screen       85.5       ft         Bags Oucrete/Sakrete       Bags of Borehole:       85.5       ft         Bags of Borehole:	Location:	west Boller Slag Polid		4/1.28 It.
Adehod:       Roto-Sonic         Contractor:       Bowser Momer         nent Date(s):       12/9/15         nent Method:       Submersible Pump         meters stabilized.       Casing Diameter:       2         a 344 NTUS       Inch         Casing Diameter:       2       Inch         Seal Type:       Bentonite Pellets/Chips       Seal Type:         Bentonite Pellets/Chips       Top of Sand/Gravel Pack:       73.5       ft*         INNERVCTION MATERIALS USED:       Sand/Gravel Pack; Type:       Global #5         Screen Diameter:       2       Inch         Screen Diameter:       2       Inch         Sand/Gravel Pack; Type:       Global #5       Screen Diameter:       2       Inch         Sand/Gravel Pack; Type:       Global #5 <td< td=""><td>n Data(a);</td><td>11/18/15 11/10/15</td><td></td><td></td></td<>	n Data(a);	11/18/15 11/10/15		
Aethod:       Roto-Sonic         Dottractor:       Bowser Morner         nent Method:       Submersible Pump         metters stabilized.       Submersible Pump         = 3.44 NTUS       Top of Seal:       6         'urged:       100 gallons       ft*         ell Casing Elevation:       473.51'       Seal Type:       Bentonite Pellets/Chips         obser:       ft*       Seal Type:       Bentonite Pellets/Chips         obsec:       ft*       Top of Sand/Gravel Pack:       73.5         ft       ft*       Top of Well Screen       75.5       ft*         NNSTRUCTION MATERIALS USED:       Sand/Gravel Pack:       Type:       Global #5         Bags of Sand       Bags Portland for Grout       Bags Concrete/Sakrete       Bottom of Well Screen       85.5       ft         Bags Of Dard for Grout       Bags of Borehole:       85.5       ft	In Date(s).	11/10/13-11/19/13	Grout: Type: Portland cemer	at/Grout
Contractor: <u>Bowser Morner</u> ment Date(s): <u>129/15</u> ment Method: <u>Submersible Pump</u> rameters stabilized. y = 3.44 NTUS Purged: <u>100 gallons</u> ater-Level <sup>#</sup> <u>51.55'</u> Vell Casing Elevation: <u>473.51'</u> prose: vater Monitoring (YY): 449470.57 (X): <u>558402.50</u> tats/Notes: <u>VC riser and screen</u> 0.010 pre-packed well screen with an inner sk of 0.40 mn changuage and an outer food-grade nylon mesh. r: <u>John Campbell</u> <b>ONSTRUCTION MATERIALS USED:</b> Bags/Buckets Bentonite Pellets Bags/Buckets Bentonite Pellets Bags/Duckets Bentonite Pellets Bags of Sand Bags/Duckets Bentonite Pellets Bags of Sand Bags/Duckets Bentonite Pellets Bags of Sand Bags/Duckets Bentonite Pellets Bags of Sand Bags/Duckets Bentonite Pellets Bags of Sand Bags of Borehole: <u>85.5</u> fi Base of Borehole: <u>85.5</u> fi	Method:	Poto Sonic	Grout, Type. Fortiand cemer	
priment Date(s): 129/15 priment Method: Submersible Pump arameters stabilized. ity = 3.44 NTUS e Purged: 100 gallons Water-Level* 51.55' Well Casing Elevation: 473.51' tripose: yatater Monitoring ig (Y): 4494705.75 ig (X): 568402.50 ents/Notes: PVC isre and screen if 0.010 pre-packed well screen with an inner act of 0.40 mm clean quartz sand and an outer if food-grade nylon mesh. tor: John Campbell CONSTRUCTION MATERIALS USED: Bags Of Sand Bags/Buckets Bentonite Pellets Bags Portland for Grout Bags Concrete/Sakrete Bags Concrete/Sakrete Concent Concent Bags Concrete/Sakrete Bags Concrete/				
oment Method:       Submersible Pump         rameters stabilized.       Casing Diameter:       2       Inch         Purged:       100 gallons       Top of Seal:       69.5       ft*         Atter-Level*       51.55'       Seal Type:       Bentonite Pellets/Chips         Well Casing Elevation:       473.51'       Seal Type:       Bentonite Pellets/Chips         rpose:       water Monitoring       (Y): 444970.57       Top of Sand/Gravel Pack:       73.5       ft*         rts/Notes:       ''''       Top of Well Screen       75.5       ft*         vCriser and screen       ''''''       Top of Well Screen       75.5       ft*         or:       John Campbell       Sand/Gravel Pack; Type:       Global #5         ors:       John Campbell       Screen Diameter:       2       Inch         Screen Stot-Size:       0010       PVC       Inch       Screen Material:       PVC         Bags Of Sand       Bags Ordiand for Grout       Bags Of Sand       Bags Of Well	Contractor.	Bowser Montel		
ent Method: Submersible Pump meters stabilized. = 3.44 NTUS urged: 100 gallons ter-Level* 51.55' ell Casing Elevation: 473.51' ose: tere Monitoring Y): 449470.57 ©: 568402.50 Top of Sand/Gravel Pack: 73.5 ft <sup>4</sup> Seal Type: Bentonite Pellets/Chips Seal Type: Bentonite Pellets/Chips Top of Sand/Gravel Pack: 73.5 ft <sup>4</sup> Top of Well Screen 75.5 ft <sup>4</sup> Sand/Gravel Pack: 73.5 ft <sup>4</sup> Source Notes: Criser and screen with an inner of 0.40 orm clean quartz sand and an outer od-grade nylon mesh. John Campbell Streen Diameter: 2 inch Screen Diameter: 2 inch Screen Diameter: 2 inch Screen Diameter: 2 inch Screen Naterial: <u>PVC</u> Bags of Sand Bags/Buckets Bentonite Pellets Bags Ontand for Grout Bags of Sand	ent Date(s):	12/9/15	Borehole Diameter: 6	inch
easter Stabilized.       = 3.44 NTUs       Casing Diameter: 2       Inch         rrged:       100 gallons       ft*         rrged:       51.55*       Top of Seal:       69.5       ft*         see:       473.51*       Seal Type:       Bentonite Pellets/Chips         ose:       Top of Sand/Gravel Pack:       73.5       ft         //Notes:       Top of Sand/Gravel Pack:       73.5       ft         //Notes:       Top of Well Screen       75.5       ft         John Campbell       Sand/Gravel Pack;       Type:       Global #5         NSTRUCTION MATERIALS USED:       Screen Diameter:       2       Inch         Bags of Sand       Bags Outland for Grout       Bags Concrete/Sakrete       Bottom of Well Screen       85.5       ft         Total Depth of Well       Total Depth of Well       85.5       ft				
easter Stabilized.       = 3.44 NTUs       Casing Diameter: 2       Inch         rrged:       100 gallons       ft*         rrged:       51.55*       Top of Seal:       69.5       ft*         see:       473.51*       Seal Type:       Bentonite Pellets/Chips         ose:       Top of Sand/Gravel Pack:       73.5       ft         //Notes:       Top of Sand/Gravel Pack:       73.5       ft         //Notes:       Top of Well Screen       75.5       ft         John Campbell       Sand/Gravel Pack;       Type:       Global #5         NSTRUCTION MATERIALS USED:       Screen Diameter:       2       Inch         Bags of Sand       Bags Outland for Grout       Bags Concrete/Sakrete       Bottom of Well Screen       85.5       ft         Total Depth of Well       Total Depth of Well       85.5       ft	ent Method:	Submersible Pump		
3.44 NTUs       Casing Material:       PVC         rrged:       100 gallons       Top of Seal:       69.5       ft*         ser:       Seal Type:       Bentonite Pellets/Chips       Seal Type:       Bentonite Pellets/Chips         see:       Top of Sand/Gravel Pack:       73.5       ft*         Y2:       449470.57       Top of Sand/Gravel Pack:       73.5       ft*         Y2:       449470.57       Top of Sand/Gravel Pack:       73.5       ft*         Y2:       449470.57       Top of Well Screen       75.5       ft*         Ol Op re-packed well screen with an inner of 0.40 mm clean quartz sand and an outer       Top of Well Screen       75.5       ft*         John Campbell       Sand/Gravel Pack:       Type:       Global #5         NSTRUCTION MATERIALS USED:       Bags of Sand       Screen Diameter:       2       Inch         Screen Diameter:       2       Inch       Screen Material:       PVC       Inch         Sage/Buckets Bentonite Pellets       Bags Portland for Grout       Bottom of Well Screen       85.5       ft         Bags Concrete/Sakrete       85.5       ft       Total Depth of Well       55.5       ft			Casing Diameter: 2	Inch
Purged:       100 gallons         ter-Level*       51.55'         'ell Casing Elevation:       473.51'         pose:       ater Monitoring         (Y):       449470.57         X):       568402.50         ts/Notes:       Top of Sand/Gravel Pack:       73.5         (Z):       ft*         ts/Notes:       Top of Well Screen       75.5         (Z):       ft*       Top of Well Screen       75.5         (S):       John Campbell       Sand/Gravel Pack:       73.5       ft*         Screen Diameter:       2       Inch       Screen Diameter:       2       Inch         Screen Slot-Size:       0.010       Inch       Screen Material:       PVC         Bags of Sand       Bags Portland for Grout       Bags Oncrete/Sakrete       Bottom of Well Screen       85.5       ft         Bage Concrete/Sakrete       Total Depth of Well       Total Depth of Well       Total Depth of Well				
Purged: 100 gallons ater-Level* 51.55' rell Casing Elevation: 473.51' pose: ater Monitoring (Y): 449470.57 X): 568402.50 Top of Sand/Gravel Pack: 73.5 ft Top of Well Screen 75.5 ft Criser and screen 0010 pre-packed well screen with an inner k of 0.40 mm clean quartz sand and an outer ood-grade nylon mesh. : John Campbell DNSTRUCTION MATERIALS USED: Bags of Sand Bags/Buckets Bentonite Pellets Bags Ostand Bags/Buckets Bentonite Pellets Bags Orthand for Grout Bags Concrete/Sakrete Bags Concrete/Sakrete Total Depth of Well				ft*
ter-Level*       51.55'         ell Casing Elevation:       473.51'         sose:       ater Monitoring         (Y):       49470.57         (X):       568402.50         is/Notes:       Top of Sand/Gravel Pack:       73.5         (C riser and screen       75.5         1010 pre-packed well screen with an inner cood-grade nylon mesh.       Top of Well Screen       75.5         :       John Campbell       Sand/Gravel Pack; Type:       Global #5         Screen Diameter:       2       Inch         Bags/Buckets Bentonite Pellets       Bags Portland for Grout       Bottom of Well Screen       85.5       f         Bags Concrete/Sakrete       85.5       f       Total Depth of Well       Total Depth of Well	urged:	100 gallons		
Vell Casing Elevation:       473.51'         pose:       ater Monitoring         (Y):       449470.57         X):       568402.50         Top of Sand/Gravel Pack:       73.5         ft/         0.010 pre-packed well screen with an inner ko of 0.40 mm clean quartz sand and an outer food-grade nylon mesh.         r:       John Campbell         DNSTRUCTION MATERIALS USED:         Bags of Sand         Bags/Buckets Bentonite Pellets         Bags of Sand         Bags Portland for Grout         Bags Concrete/Sakrete	. urgeu.	100 Julions		
Well Casing Elevation:       473.51'         rpose:       water Monitoring         water Monitoring       Top of Sand/Gravel Pack:         g (Y):       449470.57         (X):       568402.50         nts/Notes:       Top of Sand/Gravel Pack:         VC riser and screen       Top of Well Screen         70.010 pre-packed well screen with an inner code quarts sand and an outer food-grade nylon mesh.       Top of Well Screen         or:       John Campbell       Sand/Gravel Pack; Type:       Global #5         Screen Diameter:       2       Inch         Screen Diameter:       2       Inch         Screen Material:       PVC       Inch         Bags/Buckets Bentonite Pellets       Bags Concrete/Sakrete       Bottom of Well Screen       85.5       ft         Bags of Dorehole:       85.5       ft         Total Depth of Well       Kell       Kell       Kell	√ater-Level*	51.55'	200	
Well Casing Elevation:       473.51'         arpose:       interview         water Monitoring       ig (Y): 449470.57         ig (X): 568402.50       Top of Sand/Gravel Pack:       73.5       ft         prose:       Top of Sand/Gravel Pack:       73.5       ft         prose:       Top of Well Screen       75.5       ft         rod-grade nylon mesh.       Top of Well Screen       75.5       ft         or:       John Campbell       Sand/Gravel Pack; Type:       Global #5         CONSTRUCTION MATERIALS USED:       Screen Diameter:       2       Inch         Bags of Sand       Bags of Sand       Bags Portland for Grout       Bottom of Well Screen       85.5       ft         Bags Concrete/Sakrete       Base of Borehole:       85.5       ft			Seal Type: Bentonite Pellets	s/Chips
prose: vater Monitoring (Y): 449470.57 (X): 568402.50 Top of Sand/Gravel Pack: 73.5 ft <sup>4</sup> Top of Well Screen 75.5 ft <sup>4</sup> Top of Well Screen 75.5 ft <sup>4</sup> Sand/Gravel Pack; Type: Global #5 Sand/Gravel Pack; Type: Global #5 Screen Diameter: 2 Inch Screen Material: PVC Inch Screen Material: PVC Inch Screen Material: FVC	Vell Casing Fle	evation: 473 51'		" cmps
vater Monitoring (Y): 449470.57 (X): 568402.50       Top of Sand/Gravel Pack: 73.5       ft/         nts/Notes: VC riser and screen 0.010 pre-packed well screen with an inner sk of 0.40 mm clean quartz sand and an outer food-grade nylon mesh.       Top of Well Screen       75.5       ft/         r:       John Campbell       Sand/Gravel Pack; Type:       Global #5         ONSTRUCTION MATERIALS USED:       Screen Diameter:       2       Inch Screen Slot-Size:       Inch Screen Material:         Bags forstand       Bags Portland for Grout       Bottom of Well Screen       85.5       ft         Bags Concrete/Sakrete       Total Depth of Well       Total Depth of Well       5	ven casing Lie	475.51	25	
nch PVC riser and screen       Top of Well Screen       75.5       ft         ft of 0.010 pre-packed well screen with an inner       Top of Well Screen       75.5       ft         pector:       John Campbell       Sand/Gravel Pack; Type:       Global #5         CONSTRUCTION MATERIALS USED:       Screen Diameter:       2       0.010       Inch         6       Bags of Sand       Screen Material:       PVC       Inch         2       Bags/Buckets Bentonite Pellets       Bottom of Well Screen       85.5       ft         12       Bags Concrete/Sakrete       Bottom of Well Screen       85.5       ft         Total Depth of Well       Total Depth of Well       10       10       10			Top of Sand/Gravel Pack:	73.5 ft*
nch PVC riser and screen       Top of Well Screen       75.5       ft         ft of 0.010 pre-packed well screen with an inner       Top of Well Screen       75.5       ft         pector:       John Campbell       Sand/Gravel Pack; Type:       Global #5         CONSTRUCTION MATERIALS USED:       Screen Diameter:       2       0.010       Inch         6       Bags of Sand       Screen Material:       PVC       Inch         2       Bags/Buckets Bentonite Pellets       Bottom of Well Screen       85.5       ft         12       Bags Concrete/Sakrete       Bottom of Well Screen       85.5       ft         Total Depth of Well       Total Depth of Well       10       10       10				
of 0.010 pre-packed well screen with an inner pack of 0.40 mm clean quartz sand and an outer of food-grade nylon mesh.       Sand/Gravel Pack; Type:       Global #5         ctor:       John Campbell       Sand/Gravel Pack; Type:       Global #5         CONSTRUCTION MATERIALS USED:       Screen Diameter:       2       Inch         Bags of Sand       Bags/Buckets Bentonite Pellets       Bags Portland for Grout       Bottom of Well Screen       85.5       f         Bags Concrete/Sakrete       Total Depth of Well       Total Depth of Well       Screen       Screen <td>nents/Notes:</td> <td></td> <td></td> <td></td>	nents/Notes:			
ck of 0.40 mm clean quartz sand and an outer   food-grade nylon mesh.   yr: John Campbell   yr: John Campbell   Sand/Gravel Pack; Type: Global #5   Sand/Gravel Pack; Type: Global #5   Screen Diameter: 2 Inch Screen Slot-Size: 0.010 Inch Screen Material: PVC   Bags of Sand   Bags/Buckets Bentonite Pellets   Bags Portland for Grout   Bags Concrete/Sakrete   Bags of Borehole: 85.5 fi Total Depth of Well			Top of Well Screen	75.5 ft*
tor: John Campbell CONSTRUCTION MATERIALS USED: Bags of Sand Bags/Buckets Bentonite Pellets Bags Portland for Grout Bags Concrete/Sakrete Total Depth of Well Screen Batterial:				
ctor: John Campbell CONSTRUCTION MATERIALS USED: Bags of Sand Bags/Buckets Bentonite Pellets Bags Portland for Grout Bags Concrete/Sakrete Total Depth of Well				
CONSTRUCTION MATERIALS USED:         Bags of Sand         Bags/Buckets Bentonite Pellets         Bags Portland for Grout         Bags Concrete/Sakrete         Bags of Borehole:         85.5         fi         Total Depth of Well	of food-grade nyle	on mesh.		
CONSTRUCTION MATERIALS USED:         Bags of Sand         Bags/Buckets Bentonite Pellets         Bags Portland for Grout         Bags Concrete/Sakrete         Bags of Borehole:         85.5         fi         Total Depth of Well				
CONSTRUCTION MATERIALS USED:         Bags of Sand         Bags/Buckets Bentonite Pellets         Bags Portland for Grout         Bags Concrete/Sakrete         Bags of Borehole:         85.5         fi         Total Depth of Well			1 Charles and the second se	
CONSTRUCTION MATERIALS USED:         Bags of Sand         Bags/Buckets Bentonite Pellets         Bags Portland for Grout         Bags Concrete/Sakrete         Bags of Borehole:         85.5         fi         Total Depth of Well				<b>01 1 1</b> // -
Bags of Sand Bags/Buckets Bentonite Pellets Bags Portland for Grout Bags Concrete/Sakrete Total Depth of Well Screen Material: Olio Inch Inch Screen Materia	or: John Cam	npbell	Sand/Gravel Pack; Type:	Global #5
Bags of Sand       Screen Slot-Size:       0.010       Inch         Bags/Buckets Bentonite Pellets       Screen Material:       PVC       Inch         Bags Portland for Grout       Bottom of Well Screen       85.5       ft         Bags Concrete/Sakrete       Base of Borehole:       85.5       ft         Total Depth of Well       Total Depth of Well       Total Depth of Well       Total Depth of Well				
Bags of Sand       Screen Slot-Size:       0.010       Inch         Bags/Buckets Bentonite Pellets       Screen Material:       PVC       Inch         Bags Portland for Grout       Bottom of Well Screen       85.5       ft         Bags Concrete/Sakrete       Base of Borehole:       85.5       ft         Total Depth of Well       Total Depth of Well       Total Depth of Well       Total Depth of Well				
Bags of Sand       Screen Slot-Size:       0.010       Inch         Bags/Buckets Bentonite Pellets       Screen Material:       PVC       Inch         Bags Portland for Grout       Bottom of Well Screen       85.5       ft         Bags Concrete/Sakrete       Base of Borehole:       85.5       ft         Total Depth of Well       Total Depth of Well       Total Depth of Well			2	
Bags of Sand       Screen Slot-Size:       0.010       Inch         Bags/Buckets Bentonite Pellets       Screen Material:       PVC       Inch         Bags Portland for Grout       Bottom of Well Screen       85.5       ft         Bags Concrete/Sakrete       Base of Borehole:       85.5       ft         Total Depth of Well       Total Depth of Well       Total Depth of Well				
Bags of Sand       Screen Slot-Size:       0.010       Inch         Bags/Buckets Bentonite Pellets       Screen Material:       PVC       Inch         Bags Portland for Grout       Bottom of Well Screen       85.5       ft         Bags Concrete/Sakrete       Base of Borehole:       85.5       ft         Total Depth of Well       Total Depth of Well       Total Depth of Well	ONSTRUCTO	ON MATERIALS USED	Screen Diameter 2	Inch
Bags of Sand       Screen Material:       PVC         Bags/Buckets Bentonite Pellets       Free Point (Streen Material)       PVC         Bags Portland for Grout       Bottom of Well Screen (Streen Material)       Streen Material)         Bags Concrete/Sakrete       Bottom of Well Screen (Streen Material)       Streen (Streen Material)         Total Depth of Well       Total Depth of Well       Streen (Streen Material)				
Bags/Buckets Bentonite Pellets Bags Portland for Grout Bags Concrete/Sakrete Base of Borehole: 85.5 ft Total Depth of Well	Bags of Sand	d	1 miles	
ags Portland for Grout ags Concrete/Sakrete Bottom of Well Screen <u>85.5</u> fi Base of Borehole: <u>85.5</u> fi Total Depth of Well	- de er ban	-		
ags Portland for Grout ags Concrete/Sakrete Base of Borehole: Total Depth of Well	ags/Bucket	ts Bentonite Pellets	1990 - Contra 1990	
Bottom of Well Screen 85.5 fr Base of Borehole: 85.5 fr Total Depth of Well				
ags Concrete/Sakrete Base of Borehole: 85.5 fi Total Depth of Well	ags Portlar	nd for Grout	(二)	
Base of Borehole: 85.5 fr Total Depth of Well	-		Bottom of Well Screen	85.5 ft.*
Total Depth of Well	ags Concre		Base of Borehole	85.5 ft.*
				<u> </u>
			Total Depth of Well	
				87.73 ft.

### BORING NO. <u>WBSP-15-07</u> SAMPLE/CORE LOG

Project Number:	2015067 Clifty Creek Plant		Log Page	1	0	f	L	
Project Location:	West Boiler Slag Pond		Drilling Co	ntractor:	Bows	er Morn	er	
Drilling Date(s):	11/20/15-11/23/15		AGES Geol	logist:	John	Campbel	1	
Drilling Method:	Roto-Sonic	Coring Device Size:	NA	Hammer	r Wt.	NA	and Drop	NA
Sampling Method:	NA	Borehole Diameter:	6"	Drilling	Fluid U	Jsed:	Water	
Sampling Interval:	NA	Borehole Depth:	90'	Surface	Elevatio	on:	468.82' MS	L
NOTES/COMMENTS:								

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	10	NA	Silty clay, some sand, some fine gravel, dense, hard, slightly moist. fill	N/A
10-20	8.5	NA	Brown silty clay, sand and gravel, gray 13'-14.5', moist to very moist	N/A
20-30	10	NA	20'-28' Brown with gray silty clay, moist; 28'-30' brown silty clay, some gravel, trace sand, very moist to wet	N/A
30-40	10	NA	30'-34' Gray silt, well compacted, damp; 34'-40' brown silty clay, very hard, damp	N/A
40-50	10	NA	40'-48' Gray silt, some very fine sand lenses, some clay; 48'-50' gray silt, clay, moist	N/A
50-60	10	NA	50'-58' Gray silt, clay, moist; 58'-60' yellow brown silty clay, moist	N/A
60-70	10	NA	60'-64' Gray silt, some sand lenses, some clay; 64'-70' gray silty clay, some roots and organic matter, firm	N/A
70-80	9	NA	70'-78' Gray silty clay, some roots and organic matter, firm; 78'-80' Gray silt, some sand lenses, some clay, wet	N/A
80-90	9	NA	80'-83' Gray sandy silty, clay, wet; 83'-86' gray silty clay, hard, moist; 86'-90' gray sand, silt, wood, wet	N/A
				N/A

		Protective Casing with Locking Cap
Project Number:	2015067	Top of Casing Elevation: 471.31 ft Stick-up: 2.49 ft.
	Clifty Creek Plant -	
roject Location:	West Boiler Slag Pond	Land Surface Elevation: 468.82 ft
allation Date(s):	11/20/15-11/23/15	
lling Method:	Roto-Sonic	Grout; Type: Portland cement/ Grout
lling Contractor:	Bowser Morner	
elopment Date(s):	12/16/15	Borehole Diameter: 6 ir
clopment Date(s).	12/10/15	borenoie Diameter.
opment Method:	Submersible Pump	
arameters stabiliz	zed.	Casing Diameter: 2 Inch
dity = 2.86 NTUs		Casing Material: PVC Top of Seal: 36 ft*
ne Purged:	35.5 gallons	10p 01 Scal. <u>50</u> It <sup>~</sup>
Water-Level*	41.01'	
water-Level"	41.01	Seal Type: Bentonite Pellets/Chips
f Well Casing Elev	vation: 471.31'	
asting (X): 567946.39	9	Top of Sand/Gravel Pack: 40 ft
omments/Notes: inch PVC riser and sci	reen	Top of Well Screen 42 ft
ft of 0.010 pre-pack	ked well screen with an inner	
	clean quartz sand and an outer	
er of food-grade nylo	bii mesn.	
pector: John Cam	pbell	Sand/Gravel Pack; Type: Global #5
	<b>r</b> · · ·	
CONSTRUCTO	ON MATERIALS USED:	Screen Diameter: 2 Inch
CONSTRUCTION	jn materialo used:	Screen Diameter: <u>2</u> Inch Screen Slot-Size: 0.010 Inch
Bags of Sand	4	Screen Material: PVC
	1	
Bage/Ducleat		
	s Bentonite Pellets	
Bags/Bucket Bags Portlan	s Bentonite Pellets	Bottom of Well Screen 52
	s Bentonite Pellets d for Grout	Bottom of Well Screen 52 f
Bags Portlan	s Bentonite Pellets d for Grout	Bottom of Well Screen     52     f       Base of Borehole:     90     f
Bags Portlan	s Bentonite Pellets d for Grout	

### BORING NO. <u>WBSP-15-08</u> SAMPLE/CORE LOG

Project Number:	2015067 Clifty Creek Plant		Log Page	1	of	1	
Project Location:	West Boiler Slag Pond		Drilling Co	ntractor:	Bowser Morr	ner	
Drilling Date(s):	11/24/15-11/25/15		AGES Geo	logist:	John Campbe	ell	
Drilling Method:	Roto-Sonic	Coring Device Size:	NA	Hammer	Wt. NA	and Drop NA	
Sampling Method:	NA	Borehole Diameter:	6"	Drilling	Fluid Used:	Water	
Sampling Interval:	NA	Borehole Depth:	80'	Surface	Elevation:	468.56' MSL	
NOTES/COMMI	NOTES/COMMENTS:						

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-10	8	NA	Brown silty clay, some sand and gravel, damp, fill	N/A
10-20	9	NA	Brown silty clay, firm, damp to moist	N/A
20-30	7	NA	Brown silty clay, firm, moist	N/A
30-40	10	NA	30'-37' Brown silty clay, firm, moist; 37'-40' gray clay, stiff, slightly plastic, very moist	N/A
40-50	9	NA	40'-44.5' Gray clay, stiff, slightly plastic, very moist; 44.5'-50' Gray silt, clay, some very fine sand, wet	N/A
50-60	10	NA	50'-59' Gray silt, clay, some very fine sand, wet; 59'-60' gray silty clay, moist	N/A
60-70	8.5	NA	Gray silty and silty clay lenses intermittent, wet	N/A
70-80	9	NA	70'-76' Gray silty and silty clay lenses intermittent, wet; 76'-79' gray silty clay, firm, moist	N/A
				N/A

		Protective Casing with Locking Cap	
Project Number:	2015067	Top of Casing Elevation: 471.06	ft.
oject Location:	Clifty Creek Plant – West Boiler Slag Pond		ft.
ct Location.	west Boller Slag Folid		ι.
allation Date(s):	11/24/15-11/25/15	Grout; Type: Portland cement/ Grout	
ing Method:	Roto-Sonic		
ing Contractor:	Bowser Morner		
elopment Date(s):	12/16/15	Borehole Diameter: 6	inch
elopment Method:	Submersible Pump		
arameters stabiliz		Casing Diameter: 2 Inch	
ity = 4.96 NTUs		Casing Material: PVC	
e Purged:	89.5 gallons	Top of Seal: ft*	
Water-Level*	37.02'		
Vell Casing Ele	vation: 471.06'	Seal Type: Bentonite Pellets/Chips	
ing (X): 567343.24 nments/Notes: ch PVC riser and sc th of 0.010 pre-pace		·	ft* ft*
	clean quartz sand and an outer on mesh.	Sand/Gravel Pack; Type: Global #5	
ector: John Cam			
CONSTRUCTIO	ON MATERIALS USED:	Screen Diameter: 2 Inch	
Bags of Sand		Screen Slot-Size: 0.010 Inch Screen Material: PVC	
	ts Bentonite Pellets		
Bags Portlan			
Bags Concre		Bottom of Well Screen 62.8	ft.*
Dags Concre	Jul Duriou	Base of Borehole: 80	ft.*
		Total Depth of Well	
		Below Top of Casing: 65.3	ft.

### BORING NO. <u>WBSP-15-09</u> SAMPLE/CORE LOG

2015067		Log Page	1	of	1		
West Boiler Slag Pond	Drilling Contractor: Bowser Morner						
1/5/16-1/6/16		AGES Geo	logist:	Mike Gel	lles		
HSA	Coring Device Size:	NA	Hamme	r Wt. 16	01b.	and Drop	2ft
NA	Borehole Diameter:	4.25"	Drilling	Fluid Used	1: _	Water	
NA	Borehole Depth:	60'	Surface	Elevation:	_	471.21' MS	Ĺ
ENTS:							
	Clifty Creek Plant West Boiler Slag Pond 1/5/16-1/6/16 HSA NA NA	Clifty Creek Plant         West Boiler Slag Pond         1/5/16-1/6/16         HSA       Coring Device Size:         NA       Borehole Diameter:         NA       Borehole Depth:	Clifty Creek Plant       Drilling Co         West Boiler Slag Pond       Drilling Co         1/5/16-1/6/16       AGES Geo         HSA       Coring Device Size:       NA         NA       Borehole Diameter:       4.25"         NA       Borehole Depth:       60'	Clifty Creek Plant       Drilling Contractor:         West Boiler Slag Pond       Drilling Contractor:         1/5/16-1/6/16       AGES Geologist:         HSA       Coring Device Size:       NA         NA       Borehole Diameter:       4.25"       Drilling         NA       Borehole Depth:       60'       Surface	Clifty Creek Plant       Drilling Contractor:       Bowser M         1/5/16-1/6/16       AGES Geologist:       Mike Geologist:         HSA       Coring Device Size:       NA       Hammer Wt.       16         NA       Borehole Diameter:       4.25"       Drilling Fluid Used         NA       Borehole Depth:       60'       Surface Elevation:	Clifty Creek Plant       Drilling Contractor:       Bowser Morne         1/5/16-1/6/16       AGES Geologist:       Mike Gelles         HSA       Coring Device Size:       NA       Hammer Wt.       160lb.         NA       Borehole Diameter:       4.25"       Drilling Fluid Used:         NA       Borehole Depth:       60'       Surface Elevation:	Clifty Creek Plant       Drilling Contractor:       Bowser Morner         1/5/16-1/6/16       AGES Geologist:       Mike Gelles         HSA       Coring Device Size:       NA       Hammer Wt.       160lb.       and Drop         NA       Borehole Diameter:       4.25"       Drilling Fluid Used:       Water         NA       Borehole Depth:       60'       Surface Elevation:       471.21' MSI

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-30			Advance augers – no samples	N/A
30-32	1	4-5-7-8	Orange brown silty clay, trace fine sand, stiff, moist	N/A
32-34	1.2	3-6-8-9	Orange brown silty clay, trace fine sand, stiff, moist	N/A
34-36	1.8	3-5-8-7	Orange brown silty clay, trace fine sand, stiff, moist	N/A
36-38	1	2-3-5-7	Orange brown silty clay, trace fine sand, stiff, moist	N/A
38-40	1.6	2-3-4-6	Orange brown silty clay, trace fine sand, stiff, moist	N/A
40-42	1.5	3-3-5-6	Orange brown silty clay, trace fine sand, stiff, moist; to gray last 8"	N/A
42-44	2	3-5-7-8	42'-43' Orange brown silty clay, trace fine sand, stiff, moist; 43'-44' Gray silty clay, stiff, moist	N/A
44-46	2	3-4-4-4	44'-44.5' Gray silty clay, stiff, moist; 44.5'-46' gray silty fine sand, moist	N/A
46-48	2	1-2-2-3	46'-46.5' Gray silty fine sand, moist; 46.5'-48' gray silty clay, fine sand, stiff, plastic, moist	N/A
48-50	2	3-4-4-4	48'-49' Gray silty clay, fine sand, stiff, plastic, moist; 49'-50' Orange brown sandy clay fine, stiff, wet	N/A
50-52	2	2-4-4-4	Gray brown sandy silt, fine sand seams, wet	N/A
52-54	2	2-2-3-5	Orange brown sandy silt, fine sand seams, wet	N/A
54-56	2	3-4-5-6	Gray brown sandy silt, fine sand seams, wet	N/A
56-58	2	2-2-2-2	Gray brown sandy silt, fine sand seams, wet	N/A
58-60	2	2-2-3-3	Gray brown sandy silt, fine sand seams, wet	N/A
				N/A

		<ul> <li>Protective Casing with Locking Cap</li> </ul>
Project Number:	2015067	Top of Casing Elevation: 470.69
·		Stick-up: -0.52 ft.
	Clifty Creek Plant –	·
ject Location:	West Boiler Slag Pond	Land Surface Elevation: 471.21
llation Date(s):	1/5/16-1/6/16	
		Grout; Type: Portland cement/ Grout
ng Method:	Hollow Stem Auger	· · ·
ng Contractor:	Bowser Morner	
ent Date(s):	1/19/16	Borehole Diameter: 4.25
pment Method:	Submersible Pump	
ameters stabilize	ed.	Casing Diameter: 2 Inch
y = 3.57 NTUs		Casing Material: PVC
		Top of Seal: 44 ft*
e Purged:	74.5 gallons	
c		
Water-Level*	38.52'	
		Seal Type: Bentonite Pellets/Chips
Well Casing Elev	ation: 470.69'	· · · · · · · · · · · · · · · · · · ·
0		
Vell Purpose: Groundwater Monitoring Jorthing (Y): 448359.31	1	
sting (X): 566711.13		
		Top of Sand/Gravel Pack: 48
mments/Notes:		T (W 110 70
nch PVC riser and scre		Top of Well Screen 50
	ed well screen with an inner	
	lean quartz sand and an outer	
yer of food-grade nylor	n mesn.	
pector: Michael G		Sond/Canval Dealer Trener Clat. 1.45
ector: Witchael Gi	enes	Sand/Gravel Pack; Type: Global #5
	N MATERIALS USED:	Screen Diameter: 2 Inch
CONSTRUCTIO		Screen Slot-Size: 0.010 Inch
CONSTRUCTIO	N MATERIALS USED:	Screen Slot-Size: 0.010 Inch
DNSTRUCTIO Bags of Sand		Screen Slot-Size: 0.010 Inch
DNSTRUCTIO Bags of Sand Bags/Buckets	N MATERIALS USED: Bentonite Pellets	Screen Slot-Size: 0.010 Inch
DNSTRUCTIO Bags of Sand	N MATERIALS USED: Bentonite Pellets	Screen Slot-Size: 0.010 Inch Screen Material: PVC
DNSTRUCTIO Bags of Sand Bags/Buckets Bags Portland	N MATERIALS USED: Bentonite Pellets I for Grout	Screen Slot-Size: 0.010 Inch
CONSTRUCTIO Bags of Sand Bags/Buckets	N MATERIALS USED: Bentonite Pellets I for Grout	Screen Slot-Size:     0.010     Inch       Screen Material:     PVC       Bottom of Well Screen     60
CONSTRUCTIO Bags of Sand Bags/Buckets Bags Portland	N MATERIALS USED: Bentonite Pellets I for Grout	Screen Slot-Size: 0.010 Inch Screen Material: PVC
CONSTRUCTIO Bags of Sand Bags/Buckets Bags Portland	N MATERIALS USED: Bentonite Pellets I for Grout	Screen Slot-Size:       0.010       Inch         Screen Material:       PVC         Bottom of Well Screen       60         Base of Borehole:       60
CONSTRUCTIO Bags of Sand Bags/Buckets 0 Bags Portland	N MATERIALS USED: Bentonite Pellets I for Grout	Screen Slot-Size:     0.010     Inch       Screen Material:     PVC       Bottom of Well Screen     60

### BORING NO. <u>WBSP-15-10</u> SAMPLE/CORE LOG

Project Number:	2015067 Clifty Creek Plant		Log Page	of	l				
Project Location:	West Boiler Slag Pond		Drilling Co	Drilling Contractor: Bowser Morner					
Drilling Date(s):	1/4/16-1/5/16		AGES Geol	logist: Mike Gelles					
Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt. 160lb.	and Drop 2ft				
Sampling Method:	NA	Borehole Diameter:	4.25"	Drilling Fluid Used:	Water				
Sampling Interval:	NA	Borehole Depth:	56'	Surface Elevation:	471.21' MSL				
NOTES/COMMI	ENTS:								

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-30			Advance augers – no samples	N/A
30-32	1.5	4-8-10-11	Orange brown silty clay, trace fine sand, stiff, moist	N/A
32-34	2	4-7-9-12	Orange brown silty clay, trace fine sand, stiff, moist	N/A
34-36	1.5	4-8-10-10	Orange brown silty clay, trace fine sand, stiff, moist	N/A
36-38	1.6	4-4-5-7	36'-37' Orange brown silty clay, trace fine sand, stiff, moist; 37'-38' brown gray sandy silt, moist	N/A
38-40	2	3-3-4-4	Brown gray silty clay, stiff, moist	N/A
40-42	2	2-2-3-3	Brown gray silty clay, stiff, moist	N/A
42-44	2	2-2-3-3	Orange brown sandy clay, stiff, plastic, moist	N/A
44-46	2	1-1-2-1	Orange brown sandy clay, stiff, plastic, moist; with 3"-4" fine and medium sand seams, wet	N/A
46-48	2	1-1-1-2	Brown gray sandy clay, stiff, plastic, moist; fine and medium sand seams, wet	N/A
48-50	1	1-2-2-3	Brown gray silty clay, fine sand, wet	N/A
50-52	1.6	2-2-3-4	Brown gray silty clay, fine sand, wet	N/A
52-54	1	1-2-2-3	Brown gray silty clay, fine sand, wet	N/A
54-56	2	1-2-2-2	Brown gray silty clay, fine sand, wet	N/A
				N/A
				N/A
	1			N/A

			— Protective Casing with	Locking Cap	
Project Number:	2015067		Top of Casing Elevation: Stick-up: -0.52 ft.	470.69	ft.
roject Location:	Clifty Creek Plant – West Boiler Slag Pond		Land Surface Elevation:	471.21	ft.
Illation Date(s):	1/4/16-1/5/16				
g Method:	Hollow Stem Auger		Grout; Type: Portland ce	ment/ Grout	-
lling Contractor:	Bowser Morner				
opment Date(s):	1/20/16		Borehole Diameter: 4.2	5	inch
nent Method: ameters stabiliz	Submersible Pump		Casing Diameter: 2	Inch	
lity = 3.59 NTUs			Casing Material: PVC		
urged:	58.5 gallons		Top of Seal: 40	ft*	
Water-Level*	39.28'				
Vell Casing Elev	vation: 470.69'		Seal Type: Bentonite Pe	llets/Chips	-
	reen red well screen with an inner		Top of Sand/Gravel Pack: Top of Well Screen	44	ft*
of 0.40 mm c od-grade nylo Michael G			Sand/Gravel Pack; Type:	_Global #5	
TRUCTIC	DN MATERIALS USED:		Screen Diameter:2Screen Slot-Size:0.010Screen Material:PVC	Incl	
Bags/Buckets	s Bentonite Pellets	1			
Bags Portland	d for Grout		Bottom of Well Screen	56	ft.*
Bags Concre	te/Sakrete		Base of Borehole:	56	_ ft.*
					_
			Total Depth of Well Below Top of Casing:	55.48	ft.

### **APPENDIX D**

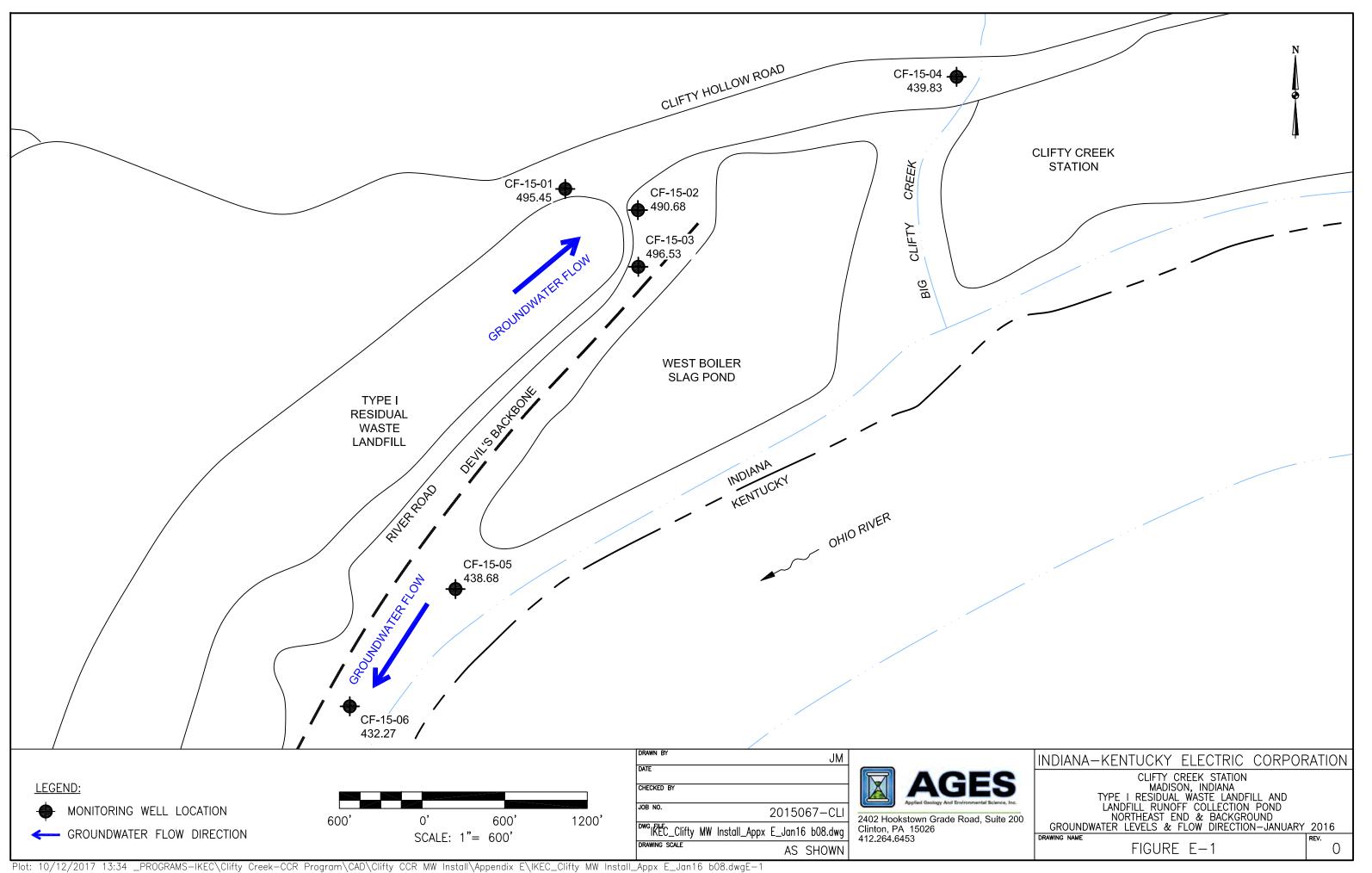
GROUNDWATER LEVELS January 2016 through May 2016

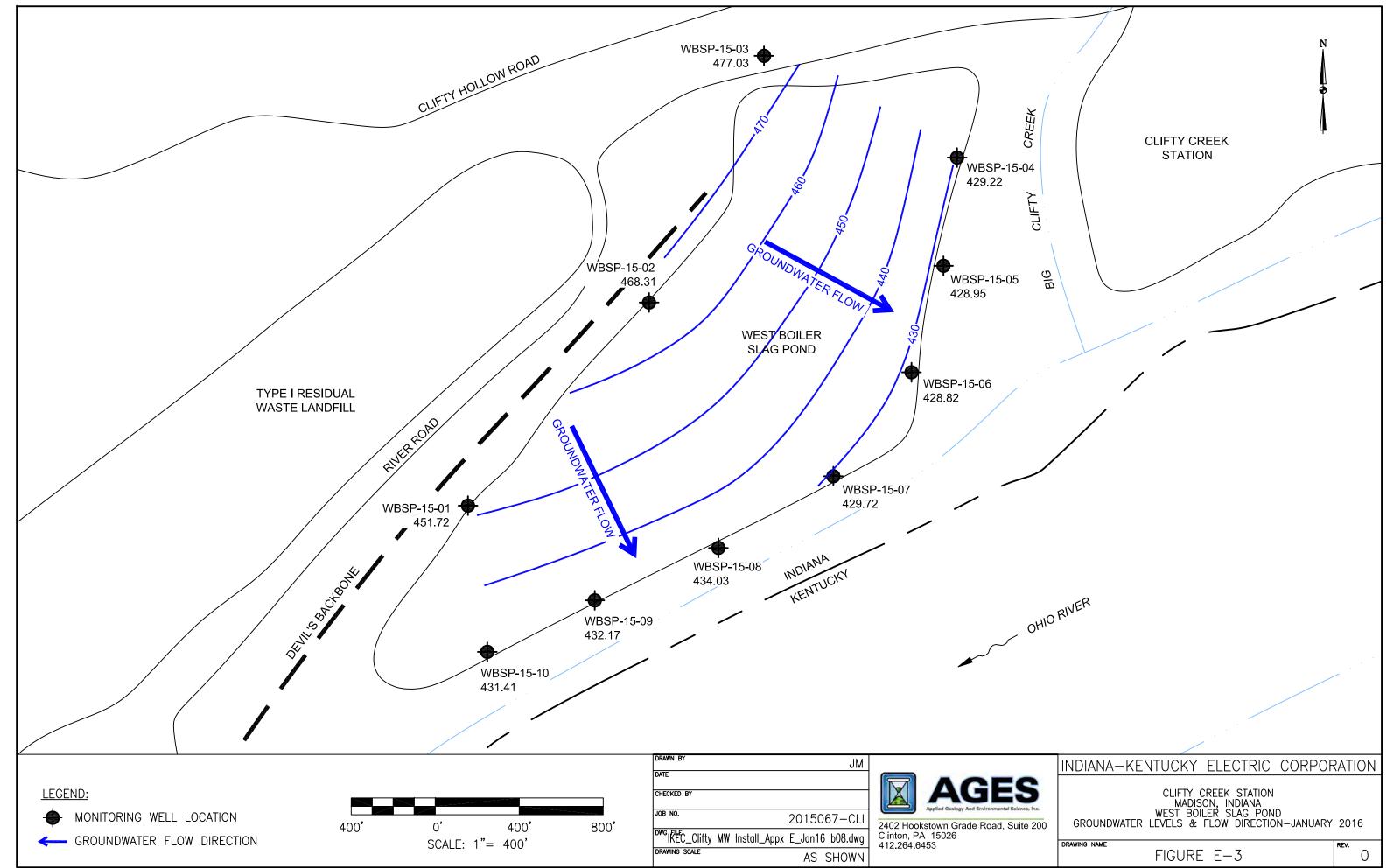
#### TABLE D-1 CLIFTY CREEK CREEK PLANT SUMMARY OF GROUNDWATER ELEVATION DATA JANUARY 2016 - MAY 2016

Monitoring Well Designation	Jan-16 Groundwater Elevation (ft)	Mar-16 Groundwater Elevation (ft)	May-16 Groundwater Elevation (ft)
LANDFILL AND LAND	OFILL RUNOFF CO	LLECTION POND	
CF-15-01	495.45	496.16	496.35
CF-15-02	490.68	490.95	490.97
CF-15-03	496.53	496.64	496.38
CF-15-04	439.83	441.19	441.27
CF-15-05	438.68	439.86	436.25
CF-15-06	432.27	437.12	429.22
CF-15-07	436.61	438.08	437.48
CF-15-08	439.48	440.54	440.88
CF-15-09	450.77	451.58	450.69
WEST BOILER SLAG	POND		
WBSP-15-01	451.72	453.01	453.27
WBSP-15-02	468.31	472.52	471.52
WBSP-15-03	477.03	477.11	477.62
WBSP-15-04	429.22	436.25	424.96
WBSP-15-05	428.95	436.12	424.84
WBSP-15-06	428.82	436.06	424.77
WBSP-15-07	429.72	430.41	430.88
WBSP-15-08	434.03	434.62	434.81
WBSP-15-09	432.17	430.39	432.21
WBSP-15-10	431.41	433.28	432.58

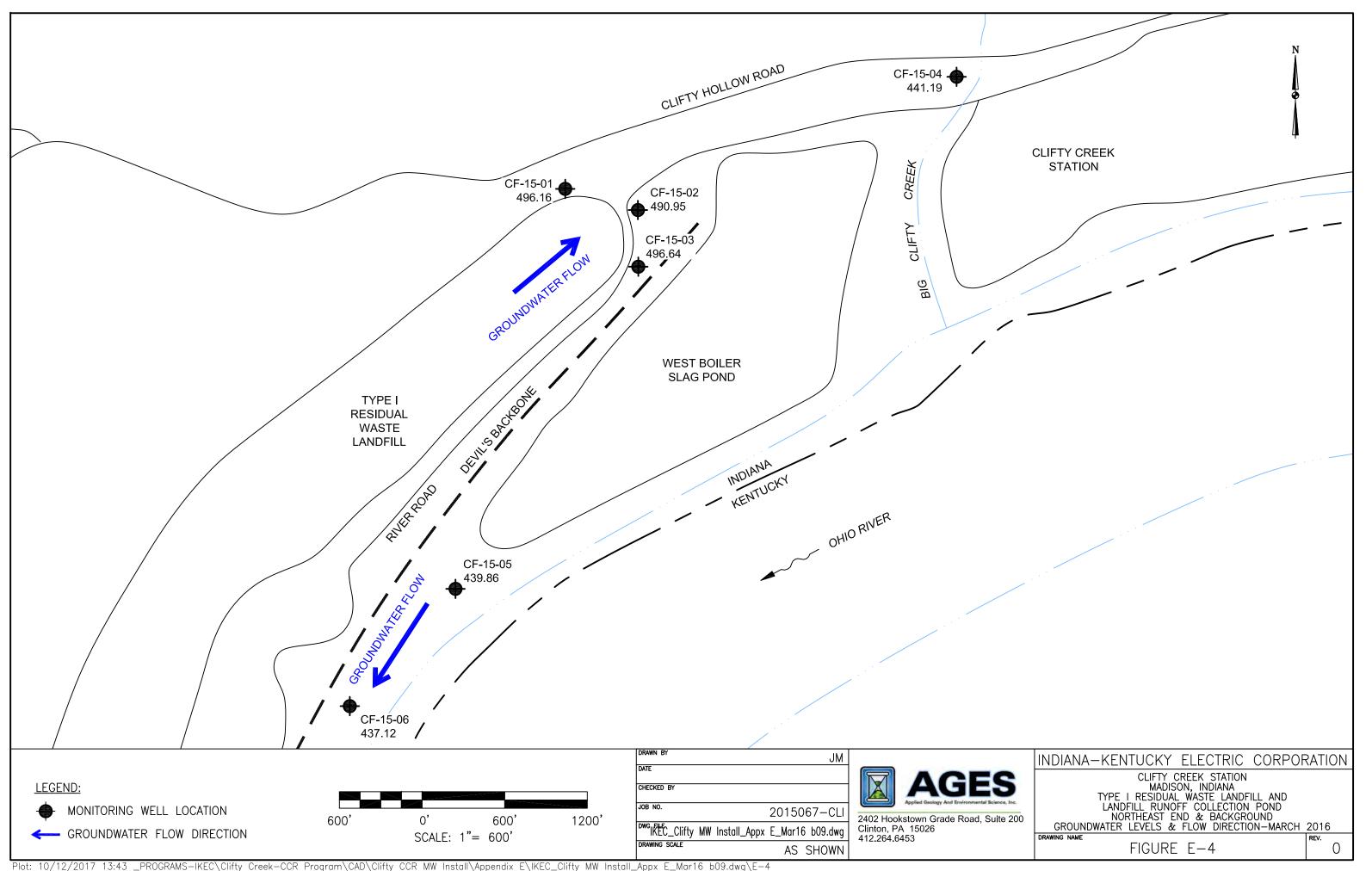
# **APPENDIX E**

## GROUNDWATER CONTOUR MAPS January 2016 through May 2016

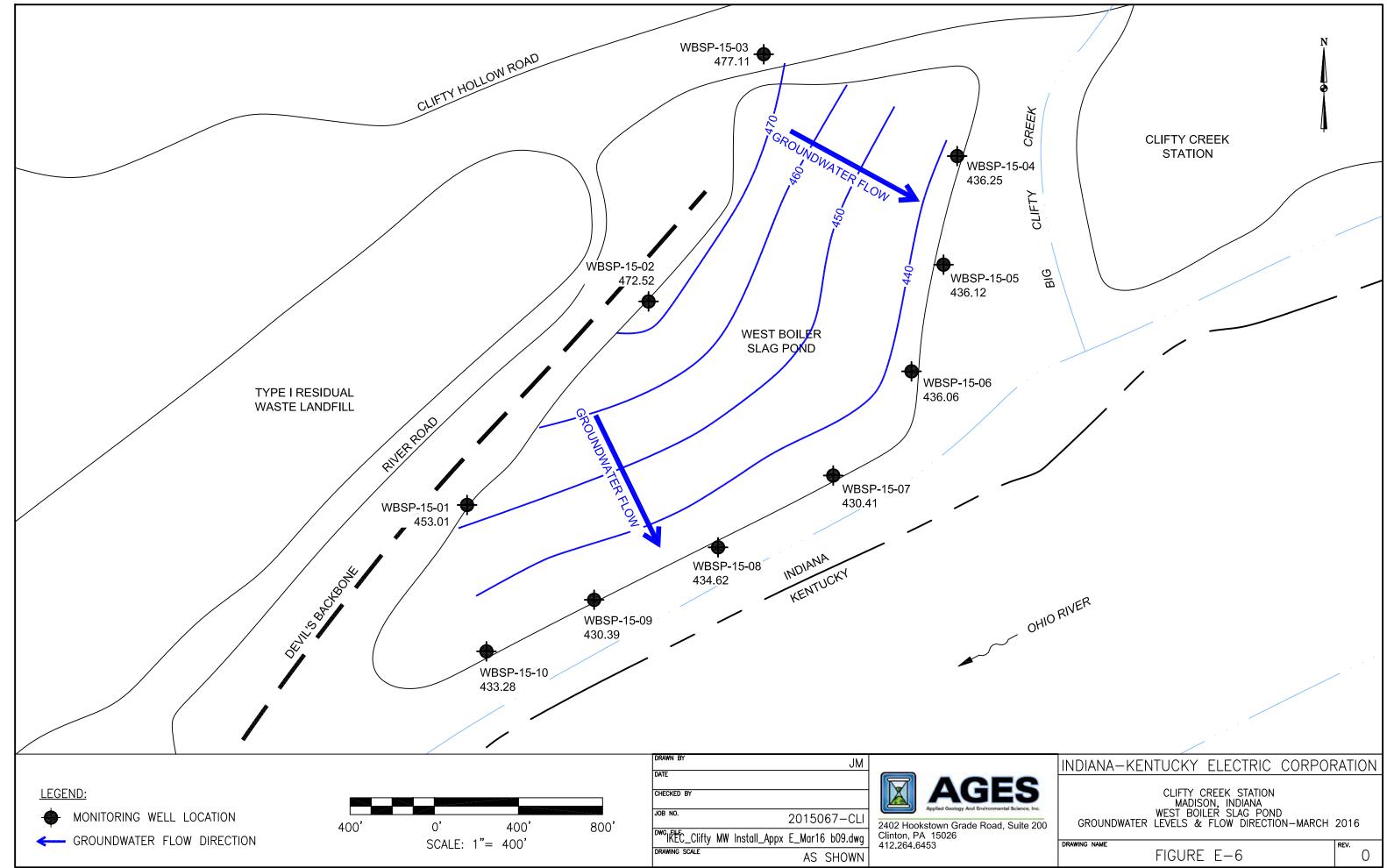




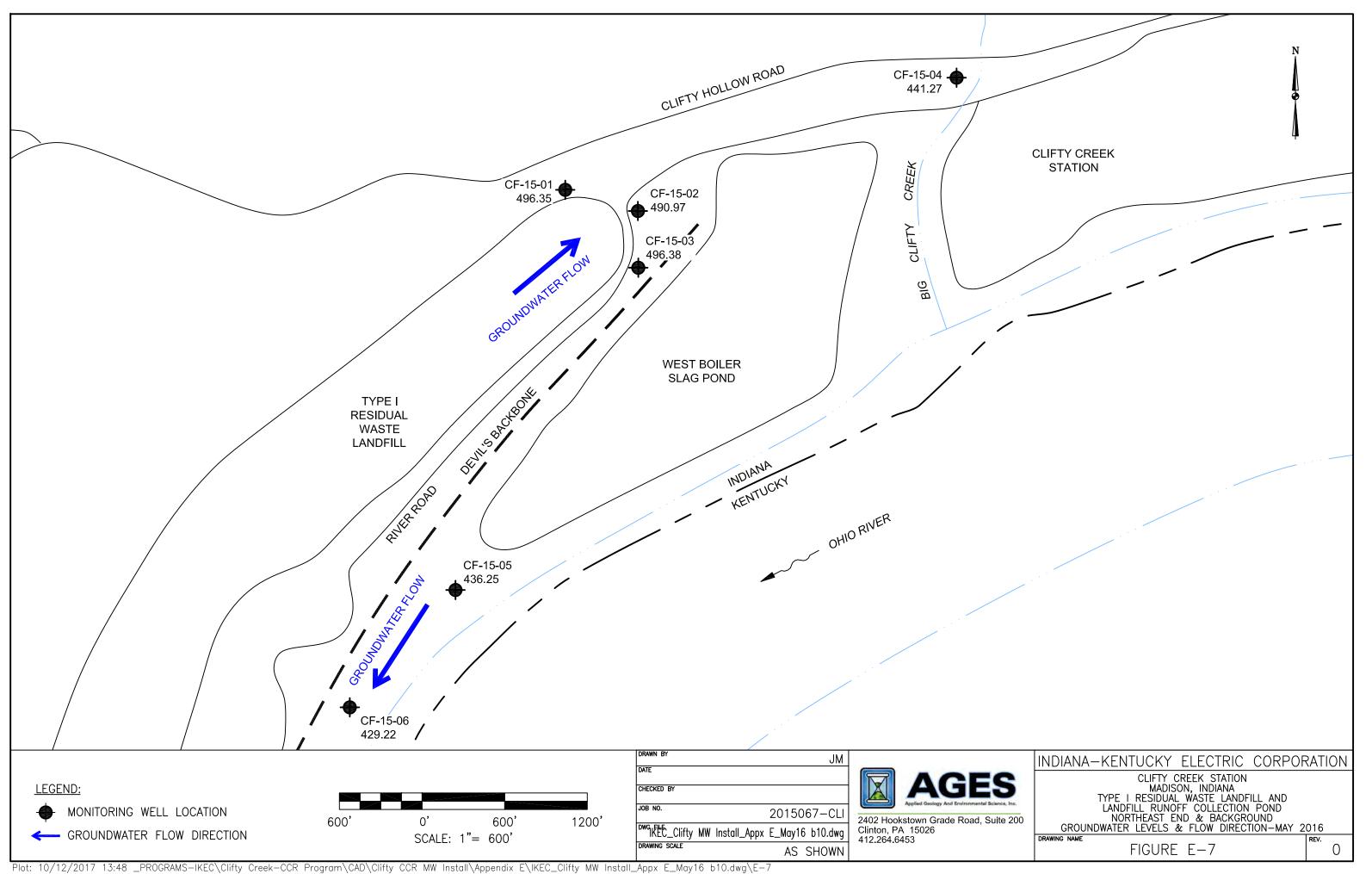
Plot: 10/18/2016 11:35 \_PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\Appendix E\IKEC\_Clifty MW Install\_Appx E\_Jan16 b08.dwg\E-3

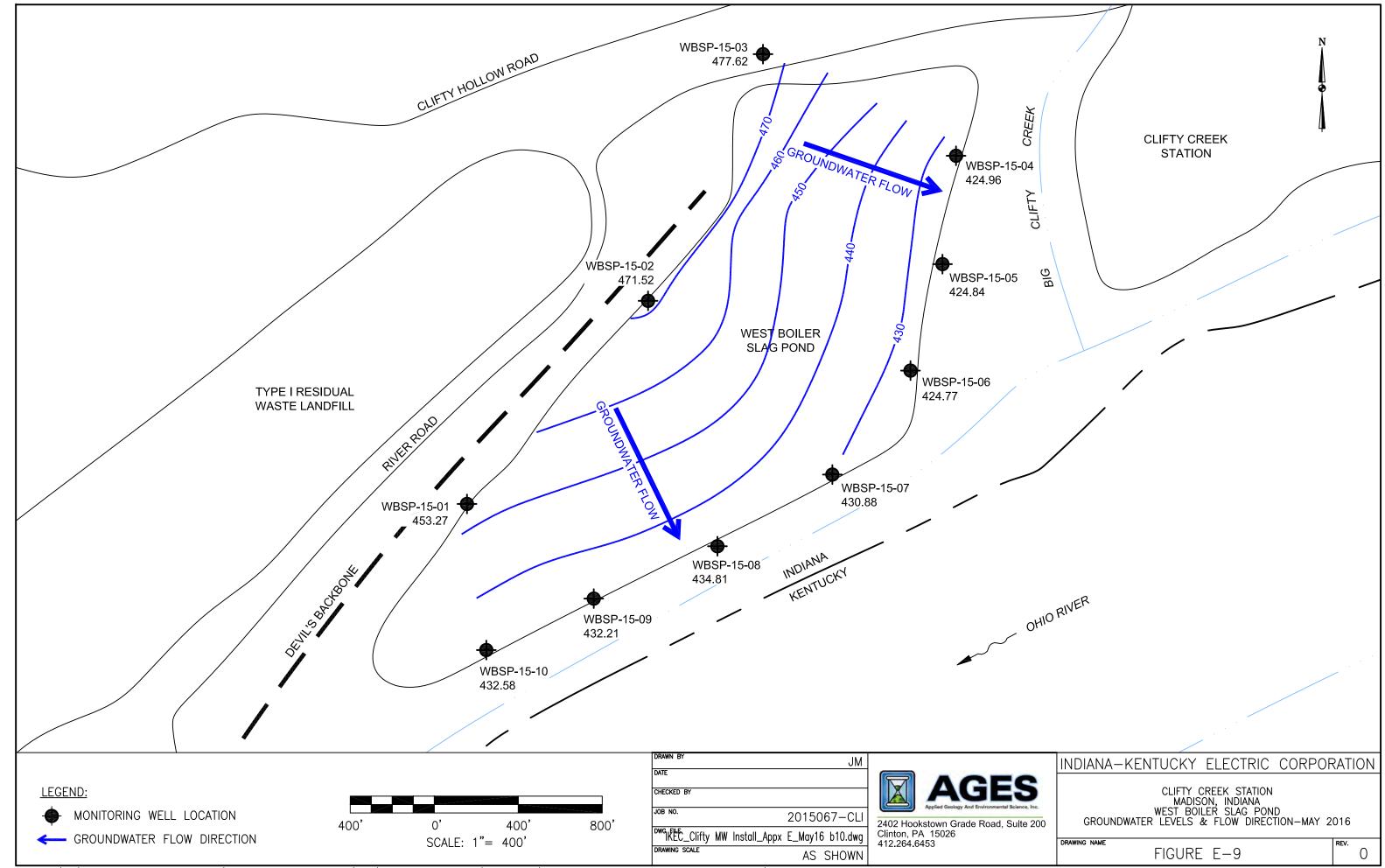


Plot: 10/12/2017 13:43 \_PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\Appendix E\IKEC\_Clifty MW Install\_Appx E\_Mar16 b09.dwg\E-4



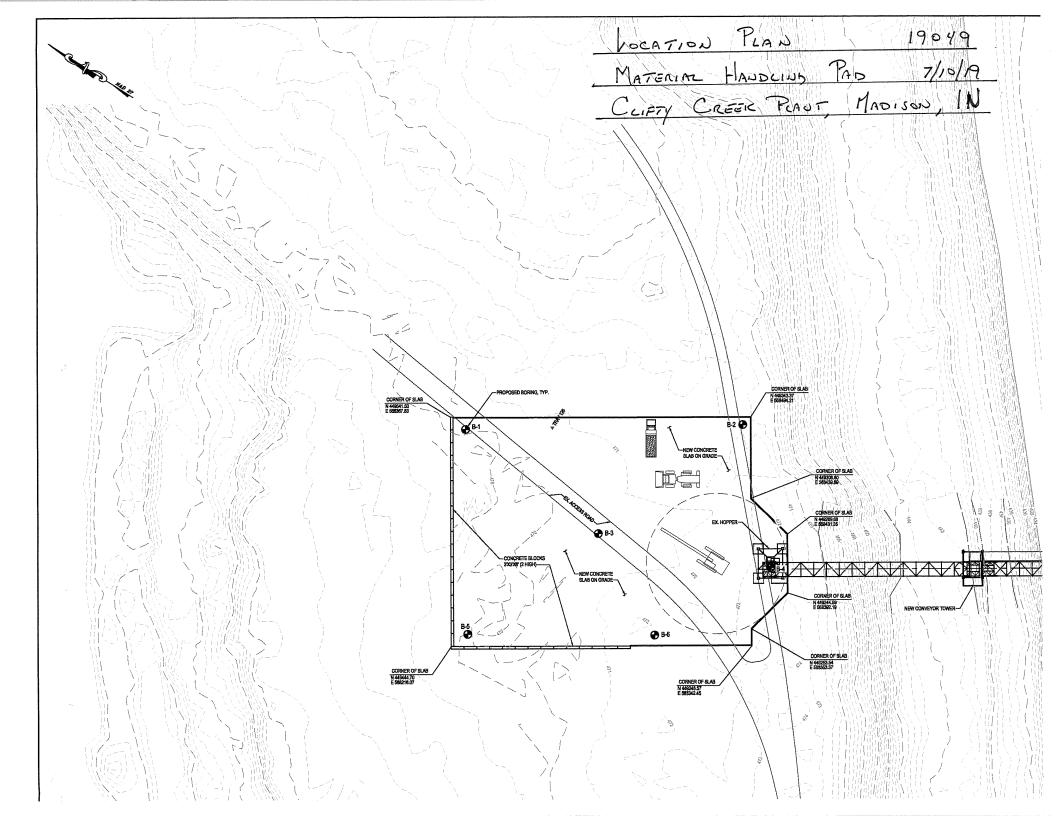
Plot: 10/18/2016 11:48 \_PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\Appendix E\IKEC\_Clifty MW Install\_Appx E\_Mar16 b09.dwg\E-6





Plot: 10/18/2016 11:52 \_PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\Appendix E\IKEC\_Clifty MW Install\_Appx E\_May16 b10.dwg\E-9

Kozera (2019)



PROFESSION Project: 0 Location: 7	Ba NAL EN Clifty ( 1335 (	Creek Clifty H on, IN	e, Mary & GEOL Plant Hollow	rland .ogists Road		NDV	VATER OBSER Depth 24.0	VATIONS Casing 23.5	LOG	Col Pag Date Date Con Drill Rig	und Surf. El. e Started e Completed tractor	1 of 1 I. (±) : 470.0 : 6-19-19	
Depth Elev. (ft) 470.0	Samples	Blow Counts	- <u>19</u> "N"	0 Water Level	05:8 Graphic	uscs	Backfilled	Upon Description	Completion	Formation dsul	Stratum	: D. Kozera Remarks	
$ \begin{array}{c} 0 - 470 \\ - \\ - \\ 5 - 465 \\ - \\ - \\ - \\ 10 - 460 \\ - \\ - \\ - \\ 15 - 455 \\ - \\ - \\ - \\ 20 - 450 \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ -$	2 3 4 5	39-29-20 4-4-4 3-2-2 2-3-12 13-23-32 21-22-22 6-3-3	8 4 15 55	Σ			Boiler slag, s moist, dark b	ilty sand, FILL, ti rown	race gravel,	Fill	A		
25 - 445 	8	2-1-3	4				Bottom of Te	est Boring @ 30.	0,				

D. W. KOZERA, INC. Baltimore, Maryland PROFESSIONAL ENGINEERS & GEOLOGISTS							TEST BORING LOG				ring No.: ntract No ge:	B2 5.: 19049 1 of 1
Project: Clifty Creek Plant Location: 1335 Clifty Hollow Road Madison, IN									Dat Dat	und Surf. E e Started e Complete itractor	: CinDrill, Inc.	
Encountered Completion Casing Pulled		6 6 6	ate -19 -19 -19 -19	T 09 09	GROL ime 9:05 9:06 9:10 0:00		VATER OBSER Depth Dry Dry Backfilled	VATIONS Casing    Upon	Caved    Completion	– Insp		: D. Ciprioni : cme 55 : 3-1/4" HSA : D. Kozera
Surf. Depth Elev. (ft) 471.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	nscs		Description		Formation	Stratum	Remarks
0+ -470 + + +	1	13-21-25 9-7-3	46 10				Boiler slag, s moist, dark b	ilty sand, FILL, tı rown	race gravel,	Fill	A	
5 <del>+</del> + 465 + +	3	3-3-3	6			Lean clay, FILL, moist, tan, gray					A-1	
+ 10 - 460  -	4	6-7-4	11									
+ 15 + + 455 +	5	6-7-7	14					LL, with trace bo	iler slag	Fill		
20 450 	6	28-23-12	35				cobbles @ 1	8.0				
25 <del>-</del> - 445 -	7	6-7-8	15									
25 - - 445 - - 30 -	8	3-5-7	12				Bottom of Te	st Boring @30.0	),			

×	D. W. KOZERA, INC. Baltimore, Maryland PROFESSIONAL ENGINEERS & GEOLOGISTS							TEST BORING LOG					ring No.: ntract Nc ge:	
	Projec Locati	ion: 1	1335 (	Creek Clifty H on, IN	follow							Date Date	und Surf. E e Started e Complete itractor	El. (±) : 470.5 : 6-19-19 ed : 6-19-19 : CinDrill, Inc.
					ate	Т	ime		VATER OBSER Depth	Casing	Caved	Drill	er	: D. Ciprioni
	Encoun Comple	etion		6	- <u>19</u> -19	1(	):20 ):25		23.5	23.0		Rig		: cme 55
	Casing	Pulled		6	- <u>19</u> -19		0:30 0:35		Backfilled	 Upon	 Completion	-	Method ector	: 3-1/4" HSA : D. Kozera
	Depth (ft)	Surf. Elev. 470.5	Samples	Blow Counts	"N" Value	Water Level	Graphic	nscs		Description		Formation	Stratum	Remarks
	0-	- 470 - -	1	12-14-12	26				Boiler slag Fl moist, dark b	LL, silty sand, tra rown	ace gravel,		A	
	5 -	- - 465 - -		18-25-25 15-16-18										
	- - 10 -	- - - 460 -	4	19-18-20	38									
		- - - - 455 -	5	15-17-18	35							Fill		
	20 -	- - - 450 -	6	15-28-28	56									
ERA.GDT 6/28/19	25 -	- - - 445 -	7	11-11-9	20	Ā								
TEST BORING LOG 19049.GPJ KOZERA.GDT 6/28/19	30 -	-	8	9-12-12	24				wet @ 28.0' Bottom of Te	st Boring @30.0	y'			
TEST B(														

D. W. KOZER Baltimore, Ma PROFESSIONAL ENGINEERS & GE Project: Clifty Creek Plan	vland TEST BOR	Page:	t No.: 19049 1 of 1 urf. El. (±) : 472.0
Location: 1335 Clifty Hollo Madison, IN		Date Com Contractor	pleted : 6-19-19 r : CinDrill, Inc.
DateEncountered6-19Completion6-19Casing Pulled6-196-196-19	11:30         Moist           11:35            11:40	asing Caved Filler Rig Drill Methor Jpon Completion Inspector	
Depth Elev. (ft) 472.0	Water B C C C C C C C C C C C C C C C C C C	scription	um Remarks
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Lean clay, FILL, wit	h gravel, moist, brown A-	1
465 3 5-6-7 13 4 5-6-8 14			
10 - 460 - 460 - 5 15 - 5 - 455 5 - 8 - 8 16	trace boiler slag be	low 10.0' Ē	
453 			
25 - - - - - 445			
25	Bottom of Test Bor	ing @ 30.0'	

	W. KOZI Baltimore, I	Maryl	and			TEST I	Boring L	.OG	Co	ring No.: ntract No. ge:	B5 : 19049 1 of 1
Location: 133	/ Creek Pl 5 Clifty Ho ison, IN								Dat Dat	und Surf. El. e Started e Completec itractor	: CinDrill, Inc.
Encountered Completion Casing Pulled	Date 6-19 6-19 6-19 6-19	9 9 9	GF Tin 13: 13: 13: 13: 13:	ne 30 35 40		ATER OBSEF Depth 23.5  Backfilled	Casing 23.5  Upon	Caved   Completion	Ins		: D. Ciprioni : cme 55 : 3-1/4" HSA : D. Kozera
Surf.         30 E           Depth (ft)         Elev.         E           0 - 470         0	Blow Counts V		Water Level	Graphic	naca n		Description		Formation	Stratum	Remarks
	6-4-6	10	XXXXXXXX			Lean clay, Fl brown	LL, with silty san	d, moist, dark		A-1	
5 - 465	3-4-6	10									
	2-1-3	4	****								
+ + 15 - 455 -	2-1-3	4							Fill		
20 - 450 -	] 11-13-16	29				Silty sand, b dark brown	oiler slag FILL, w	ith gravel,			
25 - 445 - - -	] 19-14-9	23	Ā								
25 - 445 - - - 30 - 440 8	5-4-4	8				Bottom of Te	est Boring @ 30.	0,			

D. W. KOZERA, INC. Baltimore, Maryland PROFESSIONAL ENGINEERS & GEOLOGISTS Project: Clifty Creek Plant Location: 1335 Clifty Hollow Road Madison, IN								TEST	BORING L	Pag Gro Date Date		1 of 1 El. (±) : 471.5 : 6-19-19	
Encour Comple Casing			6 6 6	ate -19 -19 -19 -19 -19	T 1- 1- 1-	GROU ime 4:30 4:35 4:40 4:45		VATER OBSEF Depth 24.8  Backfilled	VATIONS Casing 23.0  Upon	Caved   Completion	Drill Rig Drill		D. Ciprioni cme 55 3-1/4" HSA D. Kozera
Depth (ft)	Surf. Elev. 471.5	Samples	Blow Counts	"N" Value	Water Level	Graphic	nscs		Description		Formation	Stratum	Remarks
-0 - -	- - 470 -	1	24-28-32	60				Silty sand, be moist, dark b	biler slag FILL, w rown	ith gravel,		A	
- 5-	- - - - -	2	6-7-6	13									
-	- 465 - -	3	6-4-8 16-15-12	14 27									
- 10 - -	- 460												
- - 15 - -	- - - - - - - - 455	5	2-2-2	4							Eill		
- - 20 -		6	2-2-2	4									
- - 25 -	- 450 - - - - - -	7	3-4-5	9	₽								
25 - - - - - - - - - - - - - - - - - - -	- 445 - - - - -	8	2-3-4	7				Bottom of Te	est Boring @ 30.	0'		-	
t													

Geotechnology (2020)







#### **APPENDIX B – BORING INFORMATION**

Boring Logs

Well Construction Logs

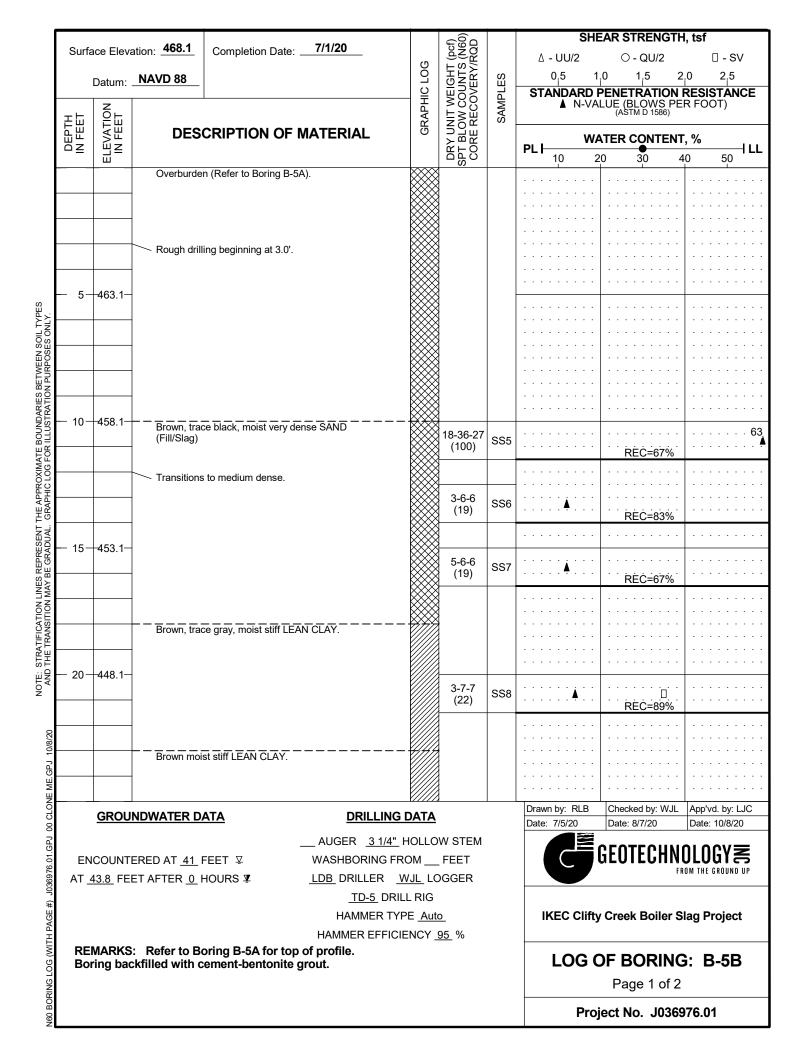
Soil Classification Sheet

**Rock Classification Sheet** 

			475.4	C/00/00		<u>с</u>		SHE	EAR STRENGTH	l, tsf
	Surfa	ace Eleva	ation: <u>475.4</u>	Completion Date:6/30/20	(5)	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS (N60) CORE RECOVERY/RQD		∆ - UU/2	○ - QU/2	🗆 - SV
		Determ	NAVD 88		Ö	RY SHT	S	0.5 1	,0 1,5 2	.0 2.5
		Datum:					L L			
		Z,			H	≥00	SAMPLES	▲ N-VA	LUE (BLOWS PE	R FOOT)
	DEPTH IN FEET	ELEVATION IN FEET	DEOC		GRAPHIC LOG	NO R	Ś		(/10111112 1000)	
		N FE	DESC	CRIPTION OF MATERIAL				WA WA	ATER CONTENT	,%
	⊔∠					L R L S		PL 10 2	0 30 4	0 50 LL
			Gray moist o	dense SAND and GRAVEL (Fill).		5-16-36				
			Reddish bro	own moist very dense SAND.		(82)	SS1			🗍
									REC=100%	
				medium dense GRAVEL, traces of sand						
			and lean cla	ay.		6-15-7	0.00			
					(H)	(35)	SS2		REC=100%	
	- 5-	470.4-								
SЦ.			weak highly	l olive brown and gray moist extremely weathered SHALE and gray medium		19-50/2"	SS3		· · · REC=88% ·	
Ň,T			strong to ve	ry strong LIMESTONE (Bedrock).						
SOIL SOIL			Interbedded	gray extremely weak to very weak fissile						
NOSE NOSE			SHALE and	light gray medium strong to very strong E. This interval is comprised of approx.						
URF URF			91% shale i	n up to 12" thick beds and approx. 9%						
SBE			limestone in Formation).	n up to 1/2" thick beds (Dillsboro		<u>93%</u> 35%	NQ4			
ARIE ZATI			Interbedded	/		35%				
INU AL	- 10-	465.4	medium stro	ong to very strong fine to coarse-grained						
BOL			weak SHAL	IMESTONE and gray extremely weak to E. This interval is comprised of approx.						
FOR			81% limesto	one in up to 5" thick beds and approx. n up to 1-1/4" thick beds (Dillsboro						
LOG			Formation).							
HIC						-				
RAP						100%				
ΞIJ						<u>100%</u> 76%	NQ5			
SEN	45	100.4				1				
PRE	- 15-	460.4-				1				
S RE			Crystallized	mineral filled vug at 15.8'.						
MAY										
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.										
CATI										
TRA										
THE										
ШЯ	— 20—	455.4-								
AND										
~										
10/8/20										
E.GPJ										
MI										
CLONE ME.		CDUI					•	Drawn by: RLB	Checked by: WJL	App'vd. by: LJC
000		GRUU	NDWATER DA	ATA DRILLING	DAIA			Date: 7/5/20	Date: 8/7/20	Date: 10/8/20
	<b>_</b>		REE WATER NO		HOLLC	W STEM			οσοτεοιινο	
J036976.01.GPJ	ENC	JOUNTE	RED DURING D	ORILLING WASHBORING FR	OM	FEET			GEOTECHNI	
32 69¥				<u>LDB</u> DRILLER <u>V</u>	<u>VJL</u> LO	OGGER			FR	OM THE GROUND UP
) 第 第				HAMMER TYP		0		IKEC Cliffy	v Creek Boiler S	lag Project
I PAC				HAMMER EFFICI						
<b>NITH</b>	RF	MARKS	: Core water	at 3.4' at completion.		<u></u> /0				
000				ement-bentonite grout.				LOG	OF BORING	G: B-1
JG LC		-		-					Page 1 of 1	
BORING LOG (WITH PAGE #)										
N60 B								Proj	ect No. J0369	76.01
z										

ſ				0/00/00		ÊÔO		SHE	EAR STRENGTH	, tsf
	Surfa	ace Eleva	ation: 451.0 Completion Date	e: <u>6/30/20</u>		DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS (N60) CORE RECOVERY/RQD		∆ - UU/2	○ - QU/2	🛛 - SV
					00	HT TS	6		,0 1,5 2	0 2,5
		Datum: .	NAVD 88		СГ		Ш		PENETRATION	
		z			<b>GRAPHIC LOG</b>	¥000	SAMPLES	▲ N-VA	LUE (BLOWS PEI (ASTM D 1586)	R FOOT)
	프늡	ELEVATION IN FEET			RA	T N N	SA		(ASTM D 1586)	
	DEPTH IN FEET	-¥⊟	DESCRIPTION OF	MATERIAL	Ū	Ч ВГ С		WA	ATER CONTENT	. %
	ΩZ	≝≓				CO PR		PL		0 50 LL
			Brown and black moist mediun	n dense SAND (Slag).	~~~					
				· ······	>>>>	8-11-10 (33)	SS1			
					>>>>	(33)			REC=78%	
			Interbedded olive brown and g	av moist extremely	£					
			weak highly weathered SHALE	and gray medium	X	9-12				
			strong to very strong LIMESTC	NE (Bedrock).	$\langle / \rangle$	-50/3"	SS2	•		
_					$\gg$	()			REC=67%	
	_				$\otimes$				REC=100%	
2	- 5-	446.0-			YM	50/1"	SS3			
<u>ب</u> ک					X					
S ON					$\langle / \rangle$					
					X			<u> </u>	REC=100%	<u> </u>
JRP(		ļi	Interbedded to irregularly bedd	ed gray extremely		50/1"	SS4			
N PI			weak to weak SHALE and light strong to very strong LIMESTC	NE. This interval is						
S INVITION LINES REFRESENT THE AFFROMMALE BOUNDARIES BETWEEN SULTTES THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.			comprised of approx. 57% sha thick beds and approx. 43% lin	le in partings to 2"		<u>90%</u> 51%	NQ5			
STR	- 10-	441.0-	thick beds (Dillsboro Formation	1).		51%				
E C C			·	, ,						
Υ Υ Υ			Gray medium strong to very str with shale partings (Dillsboro F	formation).						
			1 0 (	,						
<u>н</u> е				-		100%				
UAL.				-		<u>100%</u> 93%	NQ6			
RAD -	- 15-	436.0		-						
7 U 7 O				-						
AAB										
_ ⊻_				-						
L ANC										
¥≞ -										
⊼≓ ∵⊆	_ 20_	431.0-								
	20	431.0								
╴┠		+								
l										
3/20										
10/8/20										
GPJ										
ME										
ONE								Drawn by: RLB	Checked by: WJL	App'vd. by: LJC
0 CL		GROU	NDWATER DATA	DRILLING D	<u>ATA</u>			Date: 7/5/20	Date: 8/7/20	Date: 10/8/20
J036976.01.GPJ 00 CLONE ME.GPJ		X FR	EE WATER NOT	AUGER <u>3 1/4"</u> H0	OLLO	W STEM				
01.G	ENC		RED DURING DRILLING	WASHBORING FRO					GEOTECHNI	JLOGYZ
976.				LDB DRILLER W						OM THE GROUND UP
J036						JULI				
				TD-5 DRILL					• • • • •	
PAGE				HAMMER TYPE				IKEC Clifty	Creek Boiler S	ag Project
HL			•	HAMMER EFFICIEN		<u>95_</u> %				
Š	RE	MARKS	: Core water at 2.0' at compl	letion.						G B-3
ŏ	<b>B</b> 0		collapsed before backfilling.							
Ľ,										
RING L									Page 1 of 1	
N60 BORING LOG (WITH PAGE #)								Proi	ject No. J0369	76 01

		466.4	6/20/00		ت 1000		SHEAR STRENGTH, tsf					
Surfa	ace Eleva	ation: <u>466.1</u> Completi	on Date: <b>6/30/20</b>	(D	/RO /RO		∆ - UU/2	○ - QU/2	🗆 - SV			
	Datum <sup>.</sup>	NAVD 88		Lo C	GHT NTS ERY,	S	0.5 1	0 1,5 2	0 2.5			
				GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS (N60) CORE RECOVERY/RQD	SAMPLES						
그는				SAP		SAN		LUE (BLOWS PE (ASTM D 1586)	K1001)			
DEPTH IN FEET	VAT FEI	DESCRIPTIC	ON OF MATERIAL	Ц Б	RE FO		w	ATER CONTENT	. %			
ΩZ	ELEVATION IN FEET				E COL		PL	•	0 50 LL			
			medium dense SAND, trace		1-6-12							
		gravel (Fill).			(29)	SS1		REC=67%				
				- 🗱		-						
		Brown and gray moist of with large concrete frag	dense SAND and GRAVEL		7-30							
		Very rough drilling from	n 3.0' to 5.0'.		-50/0" ()	SS2		REC=33%				
- 5-	461.1-	Brown moist very loose fragments (Fill).	SAND, trace concrete									
		indgittorito (1 in).			3-2-2	SS3						
					(6)			REC=33%				
	+				1-1-3	SS4						
					(6)			REC=28%				
- 10-	456.1				6-30 -50/1"	SS5						
		Very rough drilling from	ist dense SAND (Fill/Slag). 1 11.0' to 12.5'.		()			REC=55%				
	-											
- 15-	451.1-											
20-	446.1-											
20												
									· · · · · · · · · · · · · · · · · · ·			
	+											
	<u>                                     </u>											
							Drawn by: RLB	Checked by: WJL	App'vd. by: LJC			
		NDWATER DATA	DRILLING				Date: 7/5/20	Date: 8/7/20	Date: 10/8/20			
		EE WATER NOT RED DURING DRILLING	AUGER <u>3 1/4"</u>					GEOTECHN	UIUUV≥			
LING									OM THE GROUND UP			
			LDB DRILLER		JGGER							
			<u>TD-5</u> DRI		•			Crook Boilor C	lag Draiact			
			HAMMER TY HAMMER EFFIC					/ Creek Boiler S	ay Froject			
RE	MARKS	: Large pieces of con	crete visible on ground su			pe						
into	o pond.	Augers kicked off at 12	2.5', pulled tooling and offs	set bori	ng to the	•	LOG	OF BORING	i: B-5A			
nor	rtn. Bori	ng backfilled with cem	ent-pentonite grout.					Page 1 of 1				
							Pro	ject No. J0369	76.01			

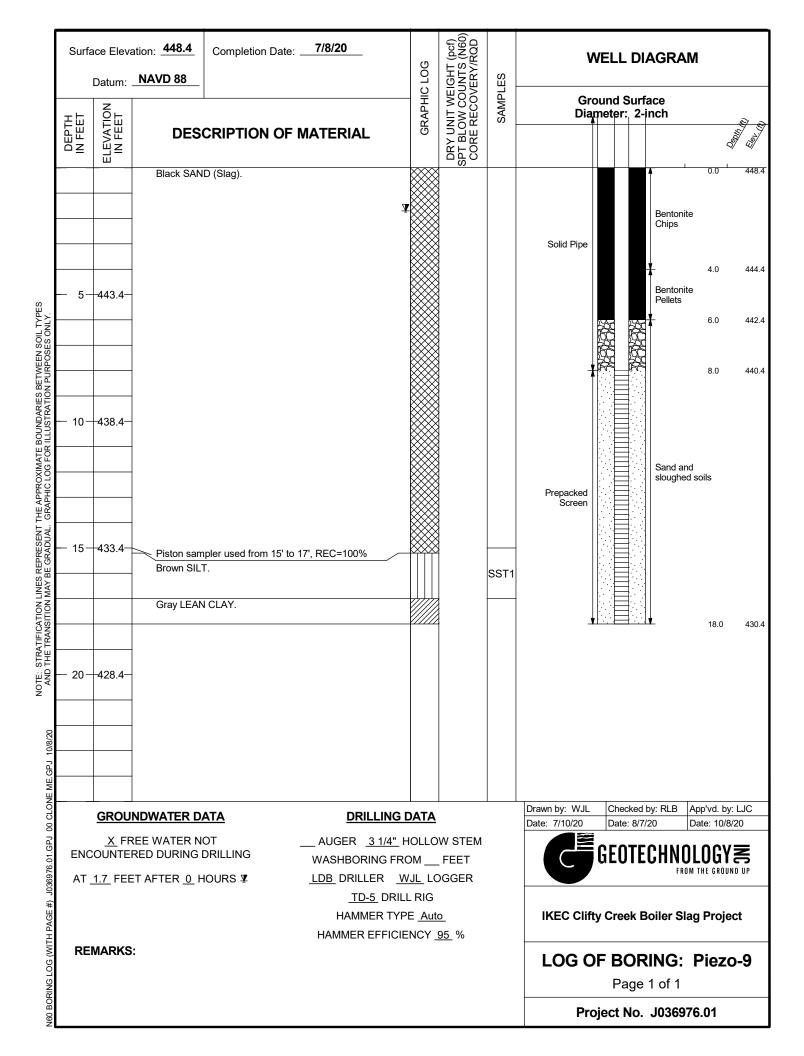


ſ	Surface Elevation: <u>468.1</u> Completion Date: <u>7/1/20</u>					£000		SHE	EAR STRENGTH	, tsf	
	Surfa	ace Elev	ation: 468.1	Completion Date:		(1)	INIT WEIGHT (pc OW COUNTS (NE RECOVERY/RQI		∆ - UU/2	○ - QU/2	🗆 - SV
		Detum	NAVD 88			Ö	GHT INTS ERY/	ŝ	0,5 1	,0 1,5 2	0 2,5
						GRAPHIC LOG		SAMPLES	STANDARD	PENETRATION I	RESISTANCE
	- F	Z L				APH H	≤00 ⊢>ш	AMI	▲ N-VA	LUE (BLOWS PEI (ASTM D 1586)	R FOOT)
	DEPTH IN FEET	ELEVATION IN FEET	DES	CRIPTION OF		GR/		S			
	ШЦ	ЧZ					DRY UN SPT BLC CORE F			ATER CONTENT	, %
		<u> </u>					٥Å٥		10 2	20 30 4	0 50
			Brown moi	st stiff LEAN CLAY. (d	continued)						<u></u> 3.25
			1					ST9			
			-							REC=100%	
			Transitions	s to soft to medium stif	4						
					1.						
	- 30-	438.1-	L		001/ 071						
) 			Augers adv	vance very easily from	30' to 35'.		WOH-1-2	SS10			
ONLY.			1				(5)		.=	REC=100%	
SES (			-								
GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONL			L								
I PUI			Gray very r trace sand	moist soft to medium s	stiff LEAN CLAY,						
TION				•							
STR	- 35-	433.1-	-								
ILLU	00										
Ч. Ч. Ч. Ч. Ч. Ч.			-					ST11	···· <b>A</b> ····	••••••••••••••••••••••••••••••••••••••	
90			-							REC=100%	
E C L											
RAPI			Gray very i	moist soft silty LEAN C	CLAY.						
·			-								
	- 40-	428.1-									
GRA	40	720.1			_		WOH/18"	9912			
Z BE			-		7	¥{////	WOI // 10	3312		REC=100%	
AMV			-								
OL			Rough drill	ling at 42.5'.							
SANS			1		7	_////					
AND THE TRANSITION MAY BE GRADUAL			-		-	¥ (////					
;≓ ;₽	- 45-	423.1-		d gray moist extremely	y weak weathered		50/3"	SS13		*** REC=100%	
A	10	120.1	SHALE and	d gray medium strong NE (Bedrock).	to very strong						
ŀ					/						
10/8/20											
J 1(			]								
E.GF			-								
NE M											
J036976.01.GPJ 00 CLONE ME.GPJ	_	GROU	NDWATER D	ΑΤΑ	DRILLING	DATA			Drawn by: RLB	Checked by: WJL	App'vd. by: LJC
00 F									Date: 7/5/20	Date: 8/7/20	Date: 10/8/20
1.GP					AUGER <u>3 1/4"</u> I					GEOTECHNI	
976.0			ERED AT 41 I		WASHBORING FR						OM THE GROUND UP
J036£	AF <u>4</u>	<u>43.8</u> FE	ET AFTER <u>0</u> I	HUUKS ¥	LDB DRILLER V		JGGER				
; (#∃					<u>TD-5</u> DRIL					<b>0</b>	
PAGE					HAMMER TYP				IKEC Clifty	/ Creek Boiler S	ag Project
ITH I	HAMMER EFFICIE			ENCY	<u>95_</u> %						
S 0	RE	REMARKS: Refer to Boring B-5A for top of profile. Boring backfilled with cement-bentonite grout.						LOG	OF BORING	6: B-5B	
G LO	201				J. 200					Page 2 of 2	
N60 BORING LOG (WITH PAGE #)										1 aye 2 01 2	
60 B(									Pro	ject No. J0369	76.01
Ż											

		ation: 448.8	Completion Date:6/30/20	ŋ	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS (N60) CORE RECOVERY/RQD		∆ - UU/2	C - QU/2	🗆 - SV
l	Datum:	NAVD 88		GRAPHIC LOG		LES		0 1,5 2 PENETRATION	
	Z					SAMPLES	STANDARD P	LUE (BLOWS PE (ASTM D 1586)	R FOOT)
DEPTH IN FEET	ELEVATION IN FEET	DES	CRIPTION OF MATERIAL	GRA		Ś			
DE	IN F				PT B COR				1, % 40 50
		Black mois	t very loose SAND (Slag).						+0 50
			, , , , , , , , , , , , , , , , , , , ,		1-1-1 (3)	SS1	<b>Å</b>	REC=50%	
								REC-30%	
					1-1-1 (3)	SS2	<b>Å</b>		
				¥₩				REC=22%	
- 5-	443.8	- Drilling mu	d added to auger stem at 5.0'.						
		Drining rite			1-1-1 (3)	SS3	<b>Å</b>	· · · · · · · · · · · ·	
					(-7			REC=17%	
					WOH-1				
		Interbedde	d gray moist extremely weak weathered		-50/3"	SS4		••• REC=80%•	
		LIMESTON	d graý medium strong to very strong IE (bedrock).		0				
- 10-	438.8				50/2"	SS5		REC=0%	
					00/2	<u>, 555</u>			
- 15-	433.8								
- 20-	-428.8								
							Drawn by: RLB	Checked by: WJL	App'vd. by: LJC
	GROU	NDWATER D	ATA DRIL	LING DATA			Date: 7/5/20	Date: 8/7/20	Date: 10/8/20
			AUGER <u></u>	<u>1/4"</u> HOLLO	W STEM			οεοτεριικί	ດເດດ∨⇒
EN	ICOUNT	ERED AT <u>4</u> F						GEOTECHN	ULUUI 5
			LDB DRILLE		GGER				
				DRILL RIG	h			Creek Boiler S	lag Project
				FFICIENCY				JICCK DUIIEI 3	nag i Tojeci
RE	MARKS	: Boring bac	kfilled with cement-bentonite g		/				
							LUG		
								Page 1 of 1	
							D	ect No. J036	

		ation: 448.4	Completion Date:7/	<mark>'20</mark>	HT (pcf) FS (N60) Y/RQD		∆ - UU/2	EAR STRENGT	🛛 - SV
		NAVD 88		GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS (N60) CORE RECOVERY/RQD	SAMPLES	STANDARD	1.0 1.5 2 PENETRATION ALUE (BLOWS PE (ASTM D 1586)	2.0 2.5 <b>RESISTANCE</b> ER FOOT)
DEPTH IN FEET	ELEVATION IN FEET	DES	CRIPTION OF MAT		PT BLOW	ŝ	PL W		Г, %   L
	ш	Black mois	st very loose coarse SAND, t	ce gravel			10 2	20 30 4	40 50
		(Slag).			1-1-2 (5)	SS1			
		Black wet (Slag).	very loose coarse SAND, tra	gravel				REC=61%	
		(Slay).			1-1-1	000			
				<b>₽</b>	(3)	SS2	<b>.</b>	REC=33%	
- 5-	-443.4								
5	443.4	Drilling mu	d added to augers at 5.0'.		WOH-1-1	SS3			
					(3)		<del>.</del>	REC=0%	
					VOH-WO	н			
					-1 ()	SS4			
								REC=0%	
- 10-	-438.4								
10	-00				WOH-1-1	SS5			
					(3)	335		REC=6%	
					1-1-1 (3)	SS6	<b>▲</b>		
								REC=6%	
- 15-	-433.4	Switched to	o mud rotary at 15.0'.						
		Owner of			2-2-1 (5)	SS7			
					(3)			REC=6%	
		Gray very	moist soft LEAN CLAY.						
	GROU	NDWATER D	ΑΤΑ	DRILLING DATA		•	Drawn by: RLB	Checked by: WJL	
				GER <u>3 1/4"</u> HOLLO	W STEM		Date: 7/5/20	Date: 8/7/20	Date: 10/8/20
EN	ICOUNT	ERED AT <u>4</u> F	EET ⊻ W	BHBORING FROM DRILLER UJL_LC	FEET			GEOTECHN	OLOGYS
				<u>TD-5</u> DRILL RIG					
				HAMMER TYPE Aut	<u>o</u>		IKEC Clift	y Creek Boiler S	Slag Project
<b>-</b>		<b>.</b>		MMER EFFICIENCY	<u>95_</u> %				
REN Bor	viARKS ing bac	: Drilling mu kfilled with c	ud at ground surface at ement-bentonite grout	completion.			LOG	OF BORIN Page 1 of 2	
							Pro	ject No. J036	976.01

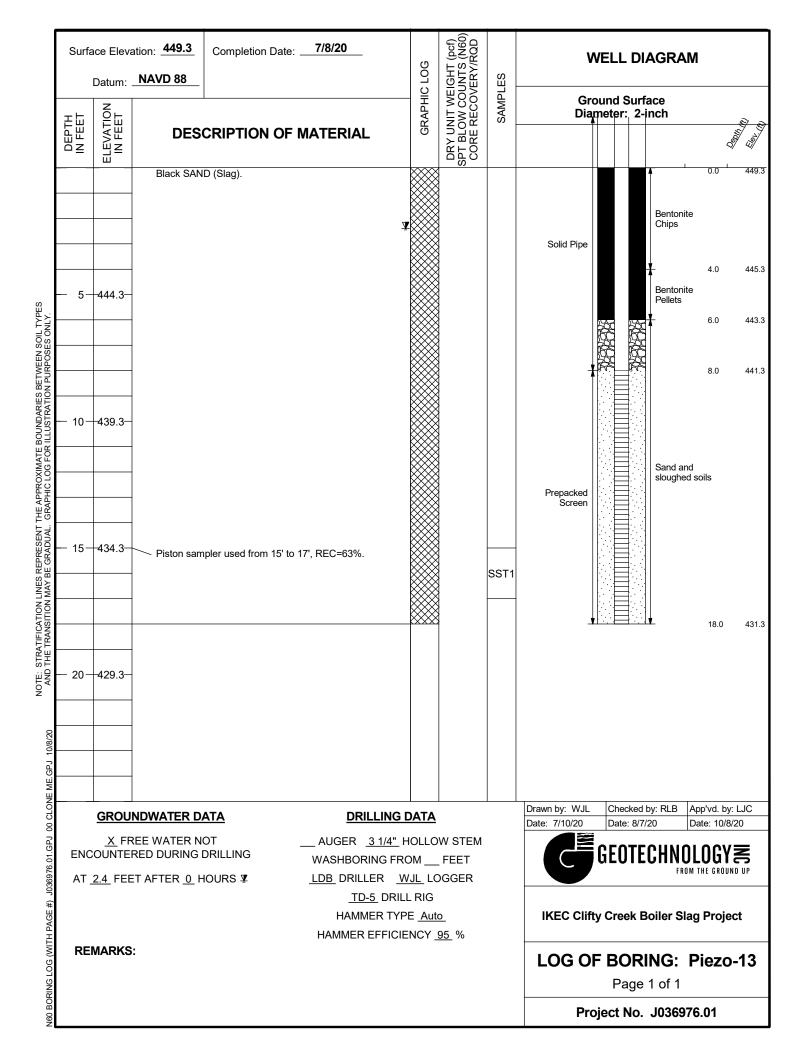
	Surfe		ation: <u>448.4</u>	Completion Date: 7/1/20	)		cf) DD()		SHE	EAR STRENGTH	, tsf
				Completion Date:7/1/20	·	Ŋ	TRONT		∆ - UU/2	○ - QU/2	🗆 - SV
		Datum:	NAVD 88			CLO		LES		0 1,5 2 PENETRATION F	
		Z		I		GRAPHIC LOG		SAMPLES	▲ N-VA	LUE (BLOWS PEI (ASTM D 1586)	R FOOT)
	DEPTH IN FEET	ATIC	DES	CRIPTION OF MATER		GR/		Ś			
		ELEVATION IN FEET					DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS (N60) CORE RECOVERY/RQD		PL		
		<u> </u>		moist soft LEAN CLAY. (continue			о VOH-WOI				
			Switched b	ack to hollow stem augers at 20.0	0'.		-2	SS8[	]	<b>H</b>	
							()	-		REC=100%	
ខ											
TYPE NLY.	- 25-	423.4-									
SOIL SES O											
RPOS								ST9			
BETV N PU										REC=0%	
ARIES RATIC								0040			
DUND,			Gray and b	rown sandstone and limestone fr	agments	000	32-50/2"	SS10		REC=100%	
TE BC			(Possible g	lium dense angular GRAVEL, so	<u></u>	For the					
LOG F			Browninee		me day.						
PHIC PHIC	- 30 -	418.4-					0 11 10				
THE A GRAI							8-11-12 (36)	SS11		<b>A</b>	
SENT.										REC=78%	
NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.			Interbedde	d gray moist extremely weak to very strong to very	ery weak		50/2"	SS12		• REC=100%	
IES RI AY BE				IE (Bedrock).							
N LIN N M/											
CATIC											
ATIFI E TRA	— 35—	413.4-									
D THE											
NOTE											
20											
10/8/20											
E.GPJ											
NE M											
00 CLONE ME.		<u>GROU</u>	NDWATER D	ATA	DRILLING I	DATA			Drawn by: RLB Date: 7/5/20	Checked by: WJL Date: 8/7/20	App'vd. by: LJC Date: 10/8/20
GPJ 0				AUGE	ER <u>3 1/4"</u> H	HOLLO	W STEM				1
	EN	ICOUNT	FERED AT <u>4</u> F	EET ⊻ WASHI	BORING FRO	ОМ	FEET			GEOTECHN	JLUGYS
J036976.01					RILLER <u>W</u>		OGGER			ΓN)	Sa THE GROUND UP
-					TD-5 DRIL						
H PAGE #)					AMMER TYP /IER EFFICIE					Creek Boiler Sl	ay Project
(WITF	RE	MARKS	: Drilling mu	id at ground surface at cor			<u></u> /0				<b>.</b>
LOG	Bor	ring bad	ckfilled with c	ement-bentonite grout.					LUG		ј. Д-у
BORING LOG (WITH										Page 2 of 2	
N60 BC									Pro	ject No. J0369	76.01



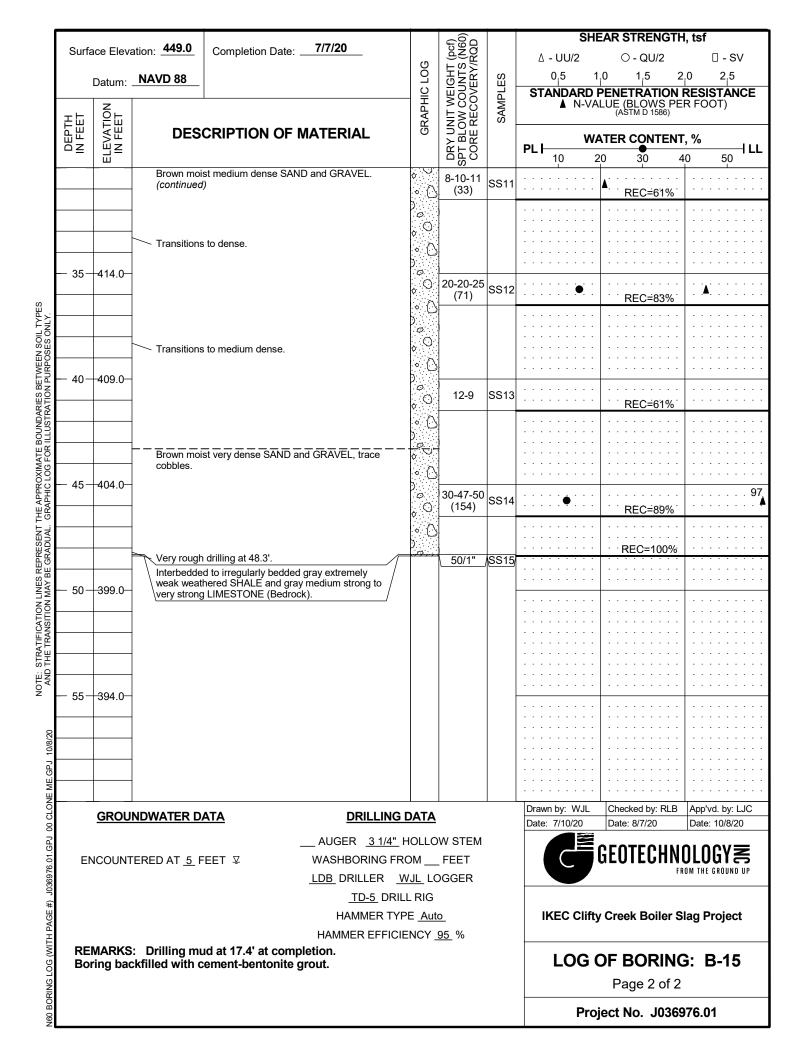
	Curf		ation: <u>464.3</u> Completion Date: <u>7/1/20</u>		cf) 2D()		SHE	EAR STRENGTH	l, tsf
	Sur			g	g) N S (N M		∆ - UU/2	○ - QU/2	🗆 - SV
		Datum:	NAVD 88	DOL C	HUT HUT HUT	ES			
	TH	ELEVATION IN FEET		GRAPHIC	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS (N60) CORE RECOVERY/RQD	SAMPLES	STANDARD I N-VA	PENETRATION I LUE (BLOWS PE (ASTM D 1586)	RESISTANCE R FOOT)
	DEPTH IN FEET		DESCRIPTION OF MATERIAL		A L ORE				
		<u> </u>	Brown and black moist medium dense SAND		1		10 2	20 30 4	0 50
			(Fill/Slag).		4-5-6 (17)	SS1		REC=72%	
			Transitions to very loose.						
					2-2-2 (6)	SS2		REC=50%	
	-	450.0							
(0)	- 5-	459.3			1-1-2 (5)	SS3	<b>X</b>	REC=50%	
TYPE(			Brown moist very loose silty SAND (Fill).						
SOIL .					WOH-1-1 (3)	SS4	<b>A</b>		
VEEN					(0)			REC=39%	
S BETV	- 10-	454.3-	Reddish brown and black moist medium dense SAND and GRAVEL (Fill/Slag).		2-10-15	005		· · · · · · · · · · · · · · · · · · ·	
ARIES RATIC					(40)	SS5		REC=78%	
OUND -LUST									
ATE B					9-15-14 (46)	SS6		▲ 	
DOXIM.	15	440.2	Black very moist medium dense silty fine to coarse						
APPR			SAND (Fill/Slag).		9-13-14 (43)	SS7			
TTHE . GR					(40)			REC=83%	
ADUA			Olive brown and brown moist LEAN CLAY with						
REPF 3E GR			limestone fragments.						
LINES MAY I	— 20-	444.3-	Rough drilling from 20' to 25'.		13-30				
VTION SITION			Interbedded to irregularly bedded gray extremely weak weathered SHALE and gray medium strong to		-50/4" ()	SS8		REC=100%	
TIFIC/			very strong LIMESTONE (Bedrock).						
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.									
NOTE: S									· · · · · · · · · · ·
∠	— 25-	439.3			50/3"	SS9		REC=100%	
20									
J 10/8/20									
E.GPJ									
NE M								Chapter 1 h: 14/1	
00 CLONE ME.GPJ		<u>GROU</u>	NDWATER DATA DRILLING	DATA			Drawn by: RLB Date: 7/5/20	Checked by: WJL Date: 8/7/20	App'vd. by: LJC Date: 10/8/20
GPJ (			AUGER <u>3 1/4"</u> H					GEOTECHN	າເທດ∧≥
J036976.01.GPJ	EN	NCOUNT	ERED AT <u>20</u> FEET ♀ WASHBORING FR						OM THE GROUND UP
			<u>LDB</u> DRILLER <u>V</u> <u>TD-5</u> DRIL		JGGEK				
\GE #)			HAMMER TYP		<u>o_</u>		IKEC Clifty	Creek Boiler S	lag Project
TH PA			HAMMER EFFICIE	ENCY	<u>95_</u> %				-
IM) DC	RE Bo	MARKS	: Auger refusal at 26.3 feet. kfilled with cement-bentonite grout.				LOG	OF BORING	6: B-11
NG LC		•	<b>v</b> • • • •					Page 1 of 1	
N60 BORING LOG (WITH PAGE #)							Proi	ject No. J0369	76.01
NG									

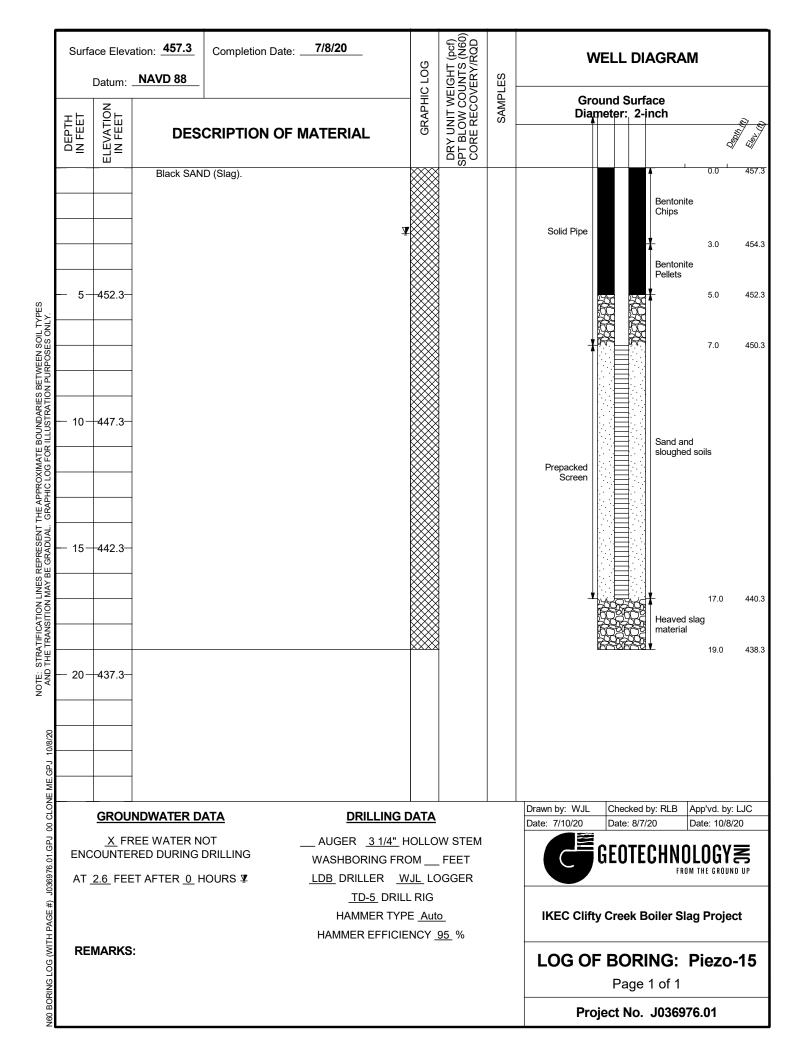
			440.2		7/6/20		D 00 00		SHE	EAR STRENGTH	l, tsf
	Surfa	ace Eleva	ation: 449.3	Completion Date:	7/6/20	0	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS (N60) CORE RECOVERY/RQD		∆ - UU/2	○ - QU/2	🗆 - SV
		Datum:	NAVD 88			GRAPHIC LOG	HO LEO	ŝ	0 <sub>.</sub> 5 1	0 1,5 2	0 2,5
						_		SAMPLES	STANDARD	PENETRATION I LUE (BLOWS PE (ASTM D 1586)	RESISTANCE
	ᆂᄔ	ELEVATION IN FEET				API	>0°	SAN	▲ N-VA	(ASTM D 1586)	R F001)
	DEPTH IN FEET	FEE	DES	CRIPTION OF	MATERIAL	L R	NU SLO N		\\//	TER CONTENT	0/_
	۵z	ΞĽ					Υ Η Η Η Η Η Η Η Η Η Η Η Η Η Η Η Η Η Η Η		PL		
		ш	Black mois	st very loose SAND, tra	ace gravel (Slag)				10 2	0 30 4	0 50
			Blackmole		loo graver (erag).		1-2-3	SS1			
							(8)		· . <del>.</del>	REC=78%	
			Transitions	s to very loose.							
							1-1-1				
							(3)	SS2	<b>.</b>	REC=67%	
0							<u> </u>			REC-07%	
ΥΡΕ̈́.	_					$\neg \bigotimes $					
son	- 5-	444.3-	Switched to	o mud rotary at 5'.		*					
OSE							WOH-1-1 (3)	SS3	<b>.</b>		
URP										REC=33%	
ION F			Black. trace	e brown, very moist ve	ery loose fine SAND.	- 💥					
IRAT			trace grave	el (Slag).			ион-моі				
							-1	SS4			>>
OR IL							()			REC=33%	
	— 10—	439.3-					1				
RAPF							WOH-1-1	SS5	▲ · · · · · · · · · · · · · · · · · · ·		
L D							(3)			REC=33%	
NOTE: STRATH-ICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.				moist very loose GRA		- 🗱	1				
H GR			(Slag).	moist very loose GRA	VEL, trace sand		}				
AY BI							1-2-1	SS6			
NUN							(5)			REC=17%	
USITIC VSITIC											
TRAN	- 15-	434.3-									
£ E E E E							1-1-2	SS7			
ADE							(5)	007		REC=39%	
ž							}				
10/8/20											
			Brown mois clay seams	st dense SAND and G	RAVEL, trace silty	0.00	i				
E.GPJ			Jay Scalls	<i>.</i>		• 🔿					
CLONE ME.			Rough drill	ing from 19.5' to 23.5'		Ø					
CLOI		GROU	NDWATER D		DRILLING	DATA			Drawn by: WJL	Checked by: RLB	App'vd. by: LJC
00 rc					AUGER <u>3 1/4"</u>		W STEM		Date: 7/10/20	Date: 8/7/20	Date: 10/8/20
01.GPJ	EN		ERED AT <u>5</u> F	FFT V	WASHBORING FR					GEOTECHN	OLOGYZ
J036976.01					<u>LDB</u> DRILLER <u>\</u>						OM THE GROUND UP
					<u></u>						
GE #)					HAMMER TY		0		IKEC Clifty	Creek Boiler S	lag Project
H PA					HAMMER EFFICI						J ,
TIW)	RE	MARKS	: Core water	r at 22.3' at compl	etion.	-					D 42
LOG	Boi	ring bad	ckfilled with c	ement-bentonite	grout.					OF BORING	D. D-13
BORING LOG (WITH PAGE #)										Page 1 of 2	
30 BO									Proj	ect No. J0369	76.01
N60											

	Surfe		ation: 449.3	Completion Date:	7/6/20		cf)		SHE	EAR STRENGTH	, tsf
	Surra					g	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS (N60) CORE RECOVERY/RQD		∆ - UU/2	0 - QU/2	0 - SV
		Datum:	NAVD 88			CLO		LES		0 1,5 2 PENETRATION I	
		ZOL		I		GRAPHIC LOG		SAMPLES	▲ N-VA	LUE (BLOWS PEI (ASTM D 1586)	R FOOT)
	DEPTH IN FEET	ELEVATION IN FEET	DES	CRIPTION OF M	ATERIAL	GR		S	\ <b>\</b> //	ATER CONTENT	0/.
	DE						DRY COR			•	, // 0 50
				st dense SAND and GR	AVEL, trace silty	0					
			ciay seams	s. (continued)		• 🔿	13-19-23 (67)	SS8		•	<b>A</b>
						0	<u> </u>			REC=83%	
						° 0					
						° ()	-				
			Very easy of	drilling from 23.5' to 25'.		Ø O					
ES						۰ <sub>(</sub> )					
L TYP DNLY.	— 25—	424.3-	Switched h	ack to augers at 25'.							
NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.			owneried b			• O	8-9-50/0" ()	SS9		REC=25%	
URPC						0					
ES BE			strong to ve	d to irregularly bedded li ery strong LIMESTONE	and gray		50/1"	SS10		REC=100%	
DARIE			Interbedde	weak to very weak SHAL d to irregularly bedded li	ght gray medium						
SUUN			extremely \	ery strong LIMESTONE weak to very weak SHAL	E. This interval is		07%				
AATE			│ \ thick beds	of approx. 82 % limesto and approx. 18% shale i			<u>97%</u> 52%	NQ11			
SOXIN CLOG	- 30-	419.3-		boro Formation). to gray medium strong to	verv strong fine-		I				
E APPI			to coarse-g	grained crystalline LIMES shale partings (Dillsbord	STOŃE,						
L. GF			Water stair	ned joints at 28.1', 28.2' aning from 28.2' to 29.3'.			Í				
ESEN			· · · · · · · · · · · · · · · · · · ·	ing nom 20.2 to 20.0.							
REPR SE GR							-				
INES MAY B							-				
I NOI							9 <u>4%</u> 74%	NQ12			
FICAT											
TRATI HE TF	- 35-	414.3-	strong to very	d to irregularly bedded li ery strong fossiliferous fi	ne-grained		-				
TE: S			SHALE. Th	NE and gray extremely w his interval is comprised	of approx. 70%						
.ON			│	n up to 2.5" thick beds a to 3.5" thick beds (Dills)	boro Formation).		l				
			Water stair	ned joints at 34.8' and 35	5.8'						
10/8/20											
ME.G											
00 CLONE ME.GPJ				ATA					Drawn by: WJL	Checked by: RLB	App'vd. by: LJC
		GRUU	NDWATER D		DRILLING I				Date: 7/10/20	Date: 8/7/20	Date: 10/8/20
J036976.01.GPJ			ERED AT <u>5</u> F		_ AUGER <u>3 1/4"</u> F WASHBORING FRO					GEOTECHNI	)LOGYZ
6976.(					LDB DRILLER <u>W</u>						OM THE GROUND UP
BORING LOG (WITH PAGE #)					HAMMER TYP				IKEC Clifty	Creek Boiler S	ag Project
AITH P.	DE		. Com	at 00 21 at a main 1-4	HAMMER EFFICIE	NCY_	<u>95_</u> %				
V) 90	Boi	ring bac	ckfilled with c	r at 22.3' at complet ement-bentonite gr	out.				LOG	OF BORING	6: B-13
ING L										Page 2 of 2	
0 BOR									Proi	ect No. J0369	76.01
N60											



ſ	C. unf	Surface Elevation: <u>449.0</u> Completion Date: <u>7/7/20</u>		7/7/20		cf) [60) DD		SHE	AR STRENGTH	, tsf
					ŋ	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS (N60) CORE RECOVERY/RQD		∆ - UU/2	○ - QU/2	🗆 - SV
		Datum:	NAVD 88		C LO	ER	ES		0 1.5 2	
ŀ		z			GRAPHIC LOG	NOS NOS NOS	SAMPLES	STANDARD I	PENETRATION F LUE (BLOWS PER (ASTM D 1586)	RESISTANCE R FOOT)
	ΞΞ	ELEVATION IN FEET			RAF	REVINIT	SA		(ASTM D 1586)	
	DEPTH IN FEET	N FE	DESCRIPTION OF	MATERIAL		γ Γ BL ORE		PL WA	TER CONTENT	, %  LL
						E S S			0 30 4	0 50
			Black moist very loose SAND and	d Gravel (Slag).		1-1-2	SS1	••••••••••		
						(5)				
ľ						1-1-1 (3)	SS2	<b>▲</b>	REC=44%	
				_						
ŀ	- 5-	444.0-	Drilling mud added to augers at 5	5.0'. ¥		1-1-1	000			
თ						(3)	SS3	•	<sup></sup> REC≓50% <sup>.</sup>	
ILYPE ILY.			Black very moist very loose fine s	SAND, trace gravel						
SOL			(Slag).			1-1-1	SS4	<b>A</b> · · · · · · · · · · ·		· · · · · · · · · · ·
POSE						(3)			REC=33%	
BUR I PUR	- 10-	439.0-								
ATION						WOH-1-1 (3)	SS5	<b>▲</b>		
NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ON IY.			Black very moist very loose SAN							
BOU			(Slag).			1-1-1	SS6	· · · · · · · · · ·		
AATE 5 FOF						(3)	330	<b>•</b>		
NXOXIN C LOO	- 15-	434.0-								
APPF	10	101.0	Piston sampler used from 15' to '	17'.			SST7			
GR.							0017			
SENT										
EPRE GRA			Reddish brown moist stiff LEAN							
ES RI V BE										
N LIN	- 20-	429.0	Brown moist soft to medium stiff			3-2-2	SS8	•		[
SITIC						(6)	000		REC=100%	
TRAN			Brown moist medium stiff LEAN	CLAT, Some gravel.			ST9	-	••••••	
STRA THE								· · · · · · · · · · ·	REC=42%	
AND										
ž.	- 25-	424.0-	Brown moist medium dense GRA trace lean clay.	VEL with sand,		7-6-3				
·			liace lear clay.			(14)	SS10		. • REC=78% ·	
10/8/20										
			Rough Drilling from 27.5' to 48'.		<u>e</u>					
AE.GF			Brown moist medium dense SAN	ID and GRAVEL.	0 0					
ONE N					C o					Apple 5
00 CLONE ME.GPJ		<u>GROU</u>	NDWATER DATA	DRILLING [	DATA			Drawn by: WJL Date: 7/10/20	Checked by: RLB Date: 8/7/20	App'vd. by: LJC Date: 10/8/20
				AUGER <u>3 1/4"</u> H	IOLLO	W STEM				
J036976.01.GPJ	E١	NCOUNT	ERED AT <u>5</u> FEET ♀	WASHBORING FRO	ОМ	FEET			GEOTECHNO	
36976				LDB DRILLER W	<u>/JL_</u> LC	GGER			FRI	OM THE GROUND UP
				<u>TD-5</u> DRILI	L RIG					
AGE				HAMMER TYP				IKEC Clifty	Creek Boiler Sl	ag Project
HTI'				HAMMER EFFICIE	NCY _	<u>95_</u> %				
N) D(	RE	MARKS	: Drilling mud at 17.4' at comp kfilled with cement-bentonite	pletion. arout.				LOG	OF BORING	6: B-15
JG LC				· · · · · ·					Page 1 of 2	
N60 BORING LOG (WITH PAGE #)								_	_	
N60 E								Proj	ect No. J0369	76.01







## SOIL CLASSIFICATION SHEET

## NON COHESIVE SOILS (Silt, Sand, Gravel and Combinations)

Density		Particle Siz	ze Identification	
Very Loose	<ul> <li>4 blows/ft. or less</li> </ul>	Boulders	- 8 inch diameter or more	
Loose	<ul> <li>5 to 10 blows/ft.</li> </ul>	Cobbles	- 3 to 8 inch diameter	
Medium Dense	- 11 to 30 blows/ft.	Gravel	- Coarse - 3/4 to 3 inches	
Dense	- 31 to 50 blows/ft.		- Fine - 3/16 to 3/4 inches	
Very Dense	- 51 blows/ft. or more			
·		Sand	- Coarse - 2mm to 5mm (dia. of pencil lead)	
Relative Propert	ies		- Medium - 0.45mm to 2mm	
Descriptive Terr	n Percent		(dia. of broom straw	')
Trace	1 – 10		- Fine - 0.075mm to 0.45mm	-
Little	11 – 20		(dia. of human hair)	
Some	21 – 35	Silt	- 0.005mm to 0.075mr	n
And	36 – 50		(Cannot see particle	es)

### COHESIVE SOILS (Clay, Silt and Combinations)

		Unconfined Compressive
<b>Consistency</b>	Field Identification	Strength (tons/sq. ft.)
Very Soft	Easily penetrated several inches by fist	Less than 0.25
Soft	Easily penetrated several inches by thumb	0.25 – 0.5
Medium Stiff	Can be penetrated several inches by thumb with moderate effort	0.5 – 1.0
Stiff	Readily indented by thumb but penetrated only with great effort	1.0 – 2.0
Very Stiff	Readily indented by thumbnail	2.0 - 4.0
Hard	Indented with difficulty by thumbnail	Over 4.0

<u>Classification</u> on logs are made by visual inspection.

<u>Standard Penetration Test</u> – Driving a 2.0" O.D., 1 3/8" I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30 inches. It is customary to drive the spoon 6 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the tests are recorded for each 6 inches of penetration on the drill log (Example – 6/8/9). The standard penetration test results can be obtained by adding the last two figures (i.e. 8+9=17 blows/ft.). Refusal is defined as greater than 50 blows for 6 inches or less penetration.

<u>Strata Changes</u> – In the column "Soil Descriptions" on the drill log, the horizontal lines represent strata changes. A solid line (\_\_\_\_\_) represents an actually observed change; a dashed line (\_\_\_\_) represents an estimated change.

<u>Groundwater</u> observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.



## **ROCK CLASSIFICATION SHEET**

## **ROCK WEATHERING**

<u>Descriptions</u> Unweathered	<u>Field Identification</u> No visible sign of rock material weathering, perhaps slight discoloration on major discontinuity surfaces.
Weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than it its fresh condition.
Highly Weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Residual Soil	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact with bedding planes visible, and the soil has not been significantly transported.

## **ROCK STRENGTH**

		Uniaxial Compressive
<b>Descriptions</b>	Field Identification	Strength (psi)
Extremely Weak	Indented by thumbnail	40-150
Very Weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife.	150-700
Weak	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer.	700-4,000
Medium Strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single blow of a geological hammer.	4,000-7,000
Strong	Specimen requires more than one blow of a geological hammer to fracture.	7,000-15,000
Very Strong	Specimen requires many blows with a geological hammer to fracture.	15,000-36,000
Extremely Strong	Specimen can only be chipped with geological hammer.	>36,000

## **BEDDING**

Descriptive Term	Bed Thickness
Massive	> 4 ft.
Thick	2 to 4 ft.
Medium	2 in. to 2 ft.
Thin	< 2 in.



## **APPENDIX C – ROCK CORE PHOTOGRAPHS**

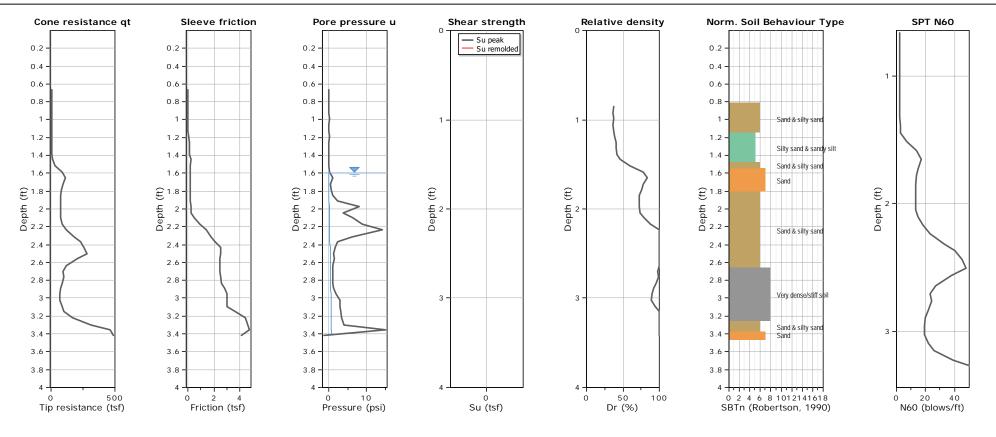


## **APPENDIX D – CPT SOUNDING INFORMATION**

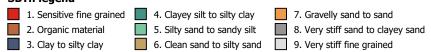
Geotechnical Engineers 11816 Lackland Road St. Louis, Missouri

#### Project: IKEC Clifty Creek Boiler Slag Project

#### Location: Madison, Indiana



#### SBTn legend

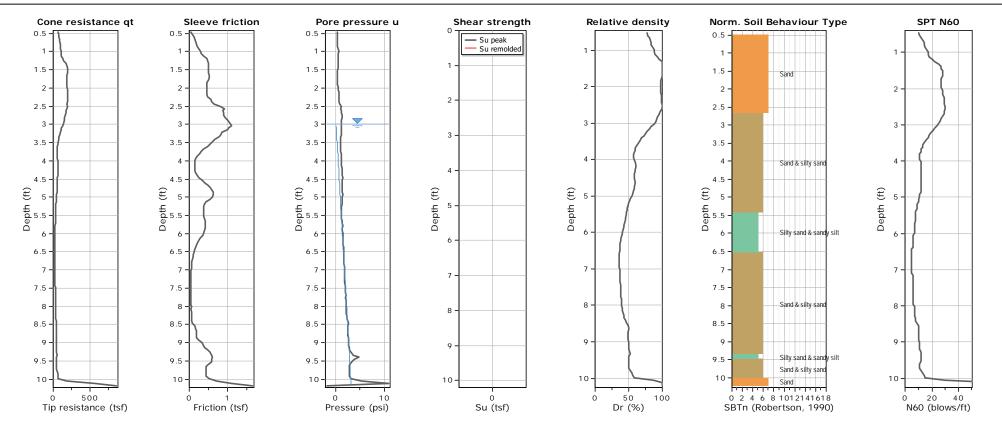


### CPT-2A Total depth: 3.42 ft, Date: 7/22/2020 Cone Type: 15cm2 Cone Operator: DWJ

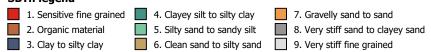
Geotechnical Engineers 11816 Lackland Road St. Louis, Missouri

#### Project: IKEC Clifty Creek Boiler Slag Project

#### Location: Madison, Indiana



#### SBTn legend



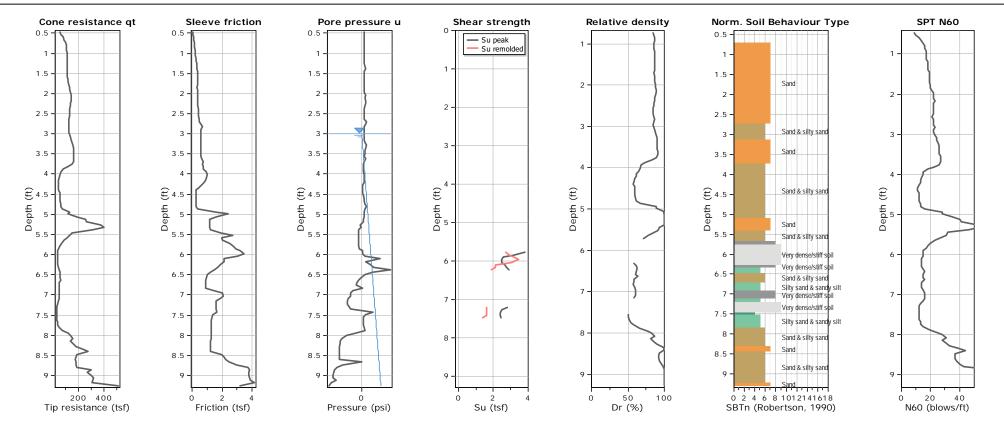
## CPT-4 Total depth: 10.18 ft, Date: 7/22/2020

Cone Type: 15cm2 Cone Operator: DWJ

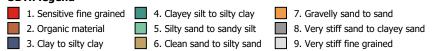
Geotechnical Engineers 11816 Lackland Road St. Louis, Missouri

#### Project: IKEC Clifty Creek Boiler Slag Project

#### Location: Madison, Indiana



#### SBTn legend



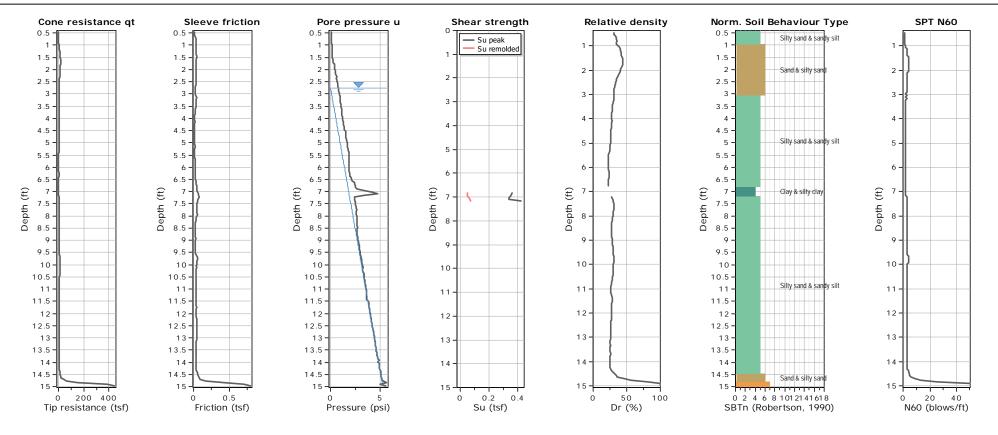
CPT-6 Total depth: 9.26 ft, Date: 7/22/2020

Cone Type: 15cm2 Cone Operator: DWJ

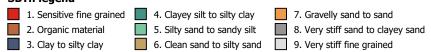
Geotechnical Engineers 11816 Lackland Road St. Louis, Missouri

#### Project: IKEC Clifty Creek Boiler Slag Project

#### Location: Madison, Indiana



#### SBTn legend



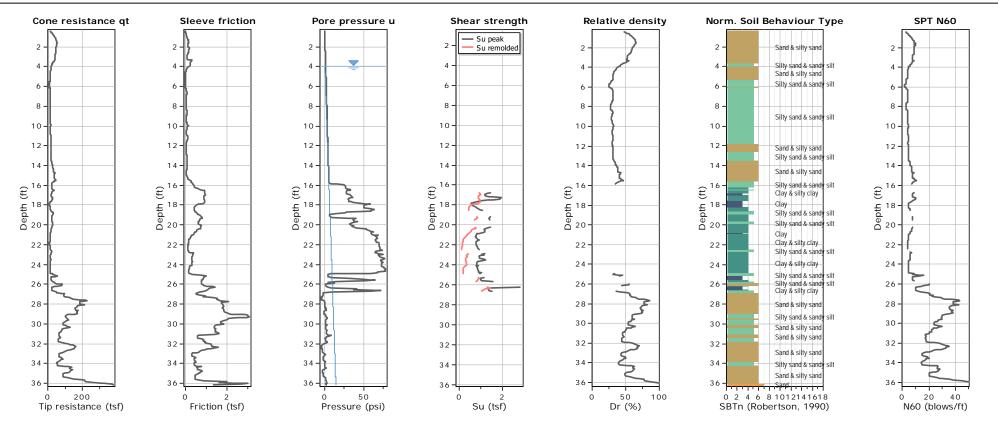
## **CPT-8**

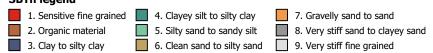
Total depth: 14.97 ft, Date: 7/22/2020 Cone Type: 15cm2 Cone Operator: DWJ

Geotechnical Engineers 11816 Lackland Road St. Louis, Missouri

#### Project: IKEC Clifty Creek Boiler Slag Project

#### Location: Madison, Indiana





### CPT-10 Total depth: 36.16 ft, Date: 7/22/2020 Cone Type: 15cm2

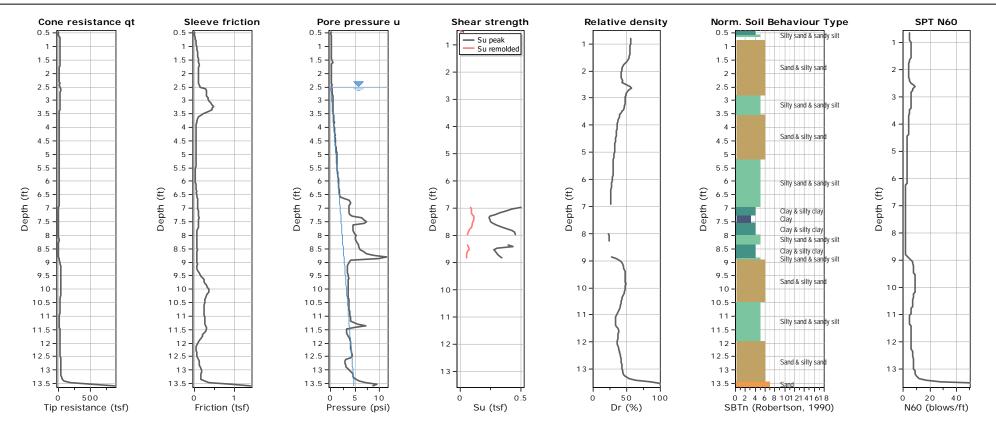
Cone Operator: DWJ

1

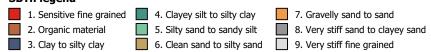
Geotechnical Engineers 11816 Lackland Road St. Louis, Missouri

#### Project: IKEC Clifty Creek Boiler Slag Project

#### Location: Madison, Indiana



#### SBTn legend



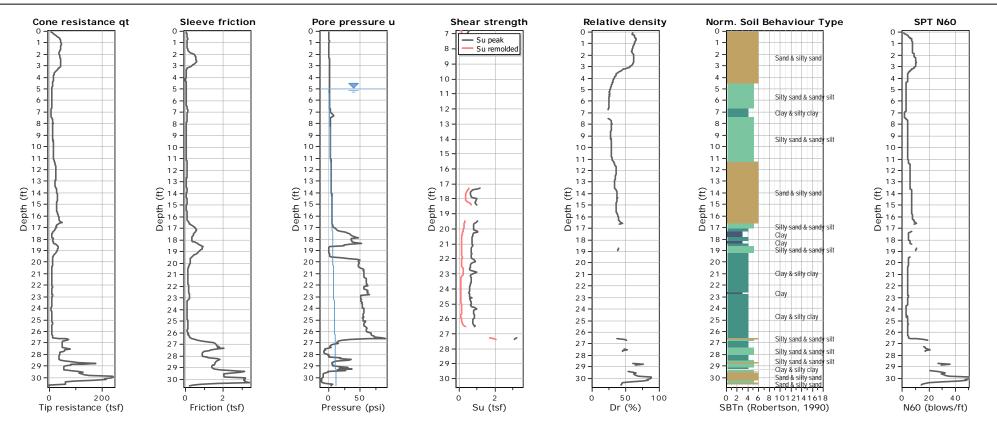
### CPT-12 Total depth: 13.59 ft, Date: 7/22/2020 Cone Type: 15cm2

Cone Operator: DWJ

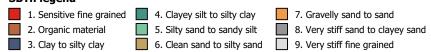
Geotechnical Engineers 11816 Lackland Road St. Louis, Missouri

#### Project: IKEC Clifty Creek Boiler Slag Project

#### Location: Madison, Indiana

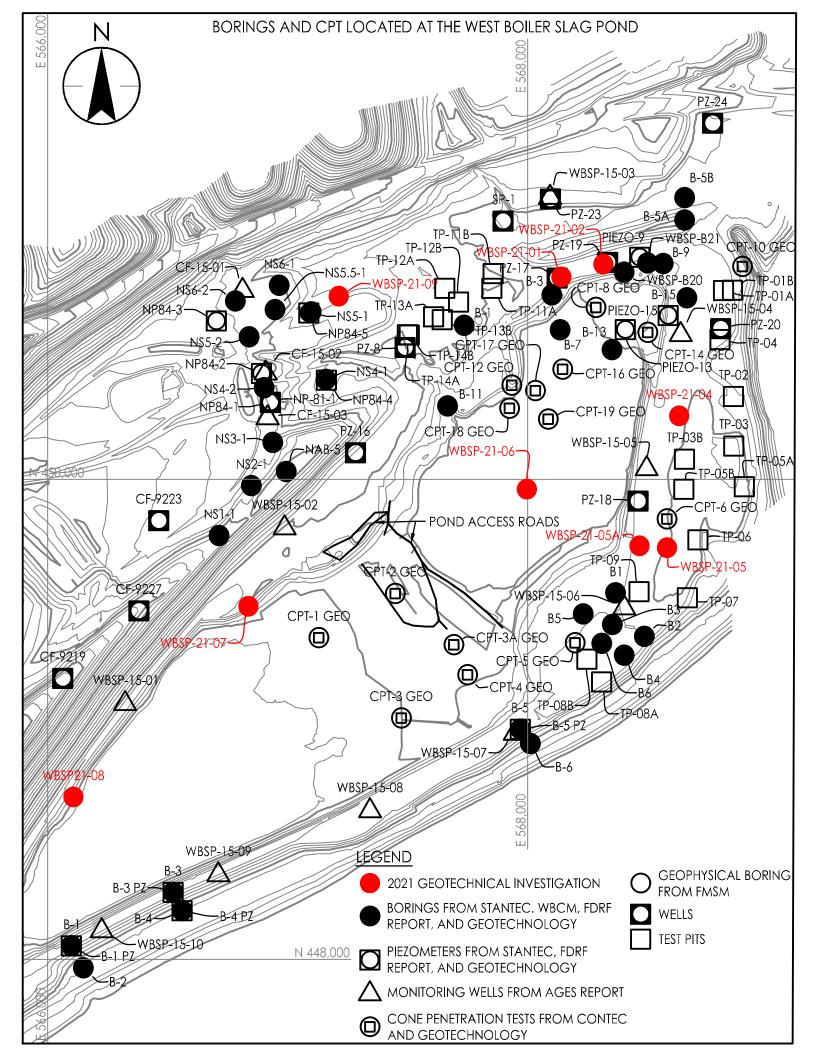


#### SBTn legend



### CPT-14 Total depth: 30.72 ft, Date: 7/22/2020 Cone Type: 15cm2 Cone Operator: DWJ

Stantec (2021)





Client Bo	orehole l	dentification_WBSP-21-	01				Stantec Bor	ing No.	VBSP-21-01
Client		IKEC			Boring Locat	ion 4	50842.148 N	N; 568139	.505 E
Project N	Number	175539026			Surface Elev	vation 4	76.7 ft E	Elevation [	Datum NAVD88
Project N	Name	Clifty Creek WBSP and	d LRCP	Closure	Date Started	2	/23/21 0	Completed	d 2/23/21
Project	Location	Clifty Creek Power Plan	it, Madis	son, IN	Depth to Wa	ter N	/A C	0ate/Time	N/A
Logged	by B.⊦	lerries			Depth to Wa	ter N	/A C	0ate/Time	N/A
Drilling C	Contracto	or Stantec Consulting	Service	es Inc.	Drill Rig Typ	e and ID	CME 55 T	rack Rig #	#711
Overbur	den Drill	ing and Sampling Tools	(Type a	and Size)	4.25" HSA,	2" Split	Spoon w/o l	iners, 3" S	Shelby Tubes
Rock Dri	illing and	Sampling Tools (Type a	and Siz	e) N/A					
Sampler	Hamme	er Type Automatic	Weigh	nt 140	lb Drop	30 in	Effic	iency	88 % (Avg.)
Borehole	e Azimut	h N/A (Vertical)	_		Borehole In	clination	(from Vertio	cal)	Vertical
Litholo	gy	Ove	erburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	
Elevation	Depth	•	ock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	Remarks
476.7	0.0	Top of Hole							
		SAND (SW), CCR, da brown and black, mois	st,	SPT-1	0.0 - 1.5	1.4	3-11-19		
-		medium dense to den with fine grained grave							
-		with the graned grave	51	007.0		1.0	47 04 04		Gravel=10 %, Sand=78%,
				SPT-2	1.5 - 3.0	1.2	17-21-21		Fines=12%,
-									Gs=2.86
_				SPT-3	3.0 - 4.5	1.3	4-14-17		
-	FC			SPT-4	4.5 - 6.0	1.3	4-4-3		-
471.1	5.6	FAT CLAY (CH), light				_			
		brown, moist, medium	n stiff		00		0.00.05		
469.2	7.5	to very stiff, trace sand and gravel	L	SPT-5	6.0 - 7.5	1.3	3-23-35		
409.2	<i>C.1</i>	$\neg$ -at 6.0', stiff/hard $\neg$ -at 6.5', gray to light gr	rav 「						Gravel=1%,
-		gravel and cobbles un		SPT-6	7.5 - 9.0	1.2	4-7-8	16	Sand=16%, Fines=83%,
-		7.5' LEAN CLAY (CL), ligh	]						Gs=2.68, LL=30,
		brown with orange and		SPT-7	9.0 - 10.5	1.3	5-4-4		PI=14
F		red mottling, moist, medium stiff to stiff							
-									
				SPT-8	10.5 - 12.0	1.3	2-2-4		
-	107								
464.0	12.7	GRAVELLY CLAY (CL		SPT-9	12.0 - 13.5	1.5	2-9-10		
		gray with orange and							
 		brown, moist, hard, low plasticity, trace sand	W	SPT-10	13.5 - 15.0	1.5	5-9-8		
		-							



Client		IKEC			Boring Locat	tion 4	50842.148	N; 568139.5	505 E
Project	Number	175539026			Surface Elev	ation 4	76.7 ft	Elevation Da	atum NAVD88
Lithol	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	Remarks
		GRAVELLY CLAY gray with orange a brown, moist, harc plasticity, trace sar (Continued)	and d, low nd	SPT-11	15.0 - 16.5	1.5	8-15-11		
458.7	18.0	-at 16.5', gravel ar cobbles from 16.5 ─ 18.0'		SPT-12	16.5 - 18.0	0.8	9-13-11		
		FAT CLAY (CH), yellowish brown w moist, firm, trace g	ith tan, gravel	SPT-13	18.0 - 19.5	1.3	3-5-6		
455.7	21.0			SPT-14	19.5 - 21.0	0.9	2-6-8		
		Bottom of Hole Borehole was bac	kfilled with	a mixture	of cement-be	entonite	grout from t	the bottom o	of hole to the
		Borehole was bac ground surface us	kfilled with ing a tremi	a mixture e pipe.	of cement-be	entonite	grout from t	the bottom o	of hole to the
		Borehole was bac	kfilled with ing a tremi	a mixture e pipe.	of cement-be	entonite	grout from t	the bottom o	of hole to the
		Borehole was bac	kfilled with ing a tremi	a mixture e pipe.	of cement-be	entonite	grout from t	the bottom o	of hole to the



Client Bo	orehole l	dentification WBSP-2	1-02				Stantec Bo	ring No. <b>\</b>	NBSP-21-02
Client		IKEC			Boring Locat	tion 4	50896.522 I	N; 568315	5.112 E
Project I	Number	175539026			Surface Elev	/ation 4	75.1 ft E	Elevation I	Datum NAVD88
Project I	Name	Clifty Creek WBSP a	Ind LRCF	<sup>o</sup> Closure	Date Started	2	/23/21 (	Complete	d 2/23/21
Project	Location	Clifty Creek Power Pla	ant, Madi	son, IN	Depth to Wa	iter N	/A [	Date/Time	e N/A
Logged	by B.⊢	lerries			Depth to Wa	iter N	/A [	Date/Time	N/A
Drilling (	Contracto	or Stantec Consultin	ng Service	es Inc.	Drill Rig Typ	e and ID	CME 55 T	rack Rig	#711
Overbur	den Drill	ing and Sampling Tool	ls (Type a	and Size)	4.25" HSA,	2" Split	Spoon w/o	liners, 3" :	Shelby Tubes
Rock Dr	illing and	Sampling Tools (Type	e and Siz	e) N/A					
Sampler	r Hamme	er Type Automatic	Weigł	nt 140	lb Drop	30 in	Effic	iency	88 % (Avg.)
Borehole	e Azimut	h N/A (Vertical)	)		Borehole In	clination	(from Verti	cal)	Vertical
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	Remarks
475.1	0.0	Top of Hole							
_		SAND WITH GRAV (SW), CCR, dark br and black, moist, mo dense	own	SPT-1	0.0 - 1.5	1.5	6-13-2		
- 472.9	2.2			SPT-2	1.5 - 3.0	1.1	1-2-3		
-		LEAN CLAY (CL), b moist, soft, some gra		011-2	1.0 - 0.0	1.1	1-2-5		Gravel=2%,
-		-at 3.2', high plastici	ty	SPT-3	3.0 - 4.5	1.3	WH-WH- WH	22	Sand=10%, Fines=88%, Gs=2.66, LL=34, PI=16
_		-at 5.5', cobble and	aravel	SPT-4	4.5 - 6.0	1.4	1-4-4		
468.6	6.5	until 6.0'		SPT-5	6.0 - 7.5	1.4	5-12-18		
467.6	7.5	GRAVELLY CLAY ( gray, moist, firm	CL),		0.0 - 7.5	1.4	5-12-10		
-		FAT CLAY (CH), olir brown, moist, hard, gravel with blue, cot and gravel from 7.5	some obles	SPT-6	7.5 - 9.0	1.5	6-13-12		
-		8.2'		SPT-7	9.0 - 10.5	0.1	8-18-15		
- 463.1	12.0	-at 10.5', brown and gravel	trace	SPT-8	10.5 - 12.0	1.4	4-8-10		
_		SILTY CLAY WITH (CL-ML), orange bro moist, firm		SPT-9	12.0 - 13.5	1.5	3-5-4		Sand-27%
 463.1 -				SPT-10	13.5 - 15.0	1.1	3-5-4	19	Sand=27%, Fines=73%, Gs=2.72, LL=24, PI=7



Client		IKEC			Boring Locat	tion 4	50896.522	N; 568315.	112 E
	Number	175539026			Surface Elev				atum NAVD88
Lithol	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	Remarks
		SILTY CLAY WITI (CL-ML), orange b moist, firm <i>(Cont</i>	orown,	SPT-11	15.0 - 16.5	1.5	2-3-4		
				SPT-12	16.5 - 18.0	1.5	8-5-5		
455.6	19.5			SPT-13	18.0 - 19.5	0.9	4-6-6		
		Borehole was bac ground surface us	skfilled with sing a tremi	a mixture e pipe.	of cement-be	entonite ç	grout from	the bottom o	of hole to the



Client Bo	orehole l	dentification WBSP-2	21-04				Stantec Bor	ring No. <b>\</b>	NBSP-21-04
Client		IKEC			Boring Locat	tion 4	50263.32 N	, 568630.	955 E
Project I	Number	175539026			Surface Elev	/ation 4	71.9 ft E	Elevation I	Datum NAVD88
Project I	Name	Clifty Creek WBSP	and LRCF	Closure	Date Started	2	/24/21 0	Complete	d 2/24/21
Project	Location	Clifty Creek Power P	lant, Madi	son, IN	Depth to Wa	iter 2	6.0 ft E	Date/Time	2/24/21
Logged	by B.H	lerries			Depth to Wa	iter N	/A [	Date/Time	N/A
Drilling (	Contracto	or Stantec Consult	ing Service	es Inc.	Drill Rig Typ	e and ID	CME 55 T	rack Rig	#711
Overbur	den Drill	ing and Sampling Too	ols (Type a	and Size)	4.25" HSA,	2" Split	Spoon w/o l	iners, 3" S	Shelby Tubes
Rock Dr	illing and	d Sampling Tools (Ty	pe and Siz	e) N/A		-			
Sampler	r Hamme	er Type Automatic	Weigł	nt 140	lb Drop	30 in	Effic	iency	88 % (Avg.)
Borehole					Borehole In				Vertical
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	Remarks
471.9	0.0	Top of Hole							
_		SAND (SW), CCR, brown, brown and	dark black	SPT-1	0.0 - 1.5	1.0	2-4-4		
		moist, loose to den	ise,						
-		little to some grave	: <b> </b>	SPT-2	1.5 - 3.0	1.2	10-16-19		
-									Gravel=4%, Sand=90%,
-				SPT-3	3.0 - 4.5	1.5	13-18-14		Fines=6%,
_		-at 4.5', very dense	•	SPT-4	4.5 - 6.0	1.5	14-33-33		Gs=2.82
_				011-4	4.0 - 0.0	1.0	14-00-00		
				SPT-5	6.0 - 7.5	1.5	32-33-23		
-		-at 7.5', medium de	ense	SPT-6	7.5 - 9.0	1.5	4-7-7		
-		-at 9.0', very dense	and						
-		some orange until		SPT-7	9.0 - 10.5	1.1	6-25-27		-
-					405 400	4.5	40.04.00		
		-at 11.5', little yello	w from	SPT-8	10.5 - 12.0	1.5	10-21-29		
		11.5' to 11.6'		SPT-9	12.0 - 13.5	1.5	14-20-29		
-									Gravel=6%,
-				SPT-10	13.5 - 15.0	1.4	15-17-16		Sand=84%, Fines=10%,
-									Gs=2.95
-				SPT-11	15.0 - 16.5	1.5	14-14-19		
_							40.04.04		
1				SPT-12	16.5 - 18.0	1.3	12-21-21		
				SPT-13	18.0 - 19.5	1.5	11-16-15		
					10.0 - 19.0	1.0	11-10-13		
									4/14/2



Client B	orehole l	dentification WBSP-	21-04				Stantec Bor	ing No. 🛛	VBSP-21-04
Client		IKEC			Boring Locat	tion 4	50263.32 N;	568630.9	955 E
Project l	Number	175539026			Surface Elev	vation 4	71.9 ft E	levation [	Datum NAVD88
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	Remarks
		SAND (SW), CCR brown, brown and moist, loose to der	black,	SPT-14	19.5 - 21.0	1.5	12-16-20		
		little to some grave (Continued)		SPT-15	21.0 - 22.5	1.5	11-18-28		
				SPT-16	22.5 - 24.0	1.5	14-21-17		
		-at 24.0', medium o	dense	SPT-17	24.0 - 25.5	1.5	8-9-9		
		-at 25.5', black sar gravel begins -at 26.0', wet	ndy	SPT-18	25.5 - 27.0	1.5	9-6-6		
				SPT-19	27.0 - 28.5	1.5	4-4-6		
				ST-1	28.5 - 30.5	0.8	300 PSI		
				SPT-20	30.5 - 32.0	1.4	3-3-4		Gravel=6%, Sand=85%, Fines=9%, Gs=2.90
				SPT-21	32.0 - 33.5	1.4	4-4-6		
437.1	34.8			SPT-22	33.5 - 35.0	1.5	3-3-4		
		LEAN CLAY (CL), with brown, moist t soft, low plasticity	gray o wet,	SPT-23	35.0 - 36.5	1.5	2-2-4		
		-silt with little plasti from 40.0' to 42.0'	city	ST-2	40.0 - 42.0	2.0	50 PSI		Sand=8%,
		1011 10.0 10 12.0		01-2	40.0 - 42.0	2.0	50 F 51		Fines=92%
				ST-3	45.0 - 47.0	1.8	400 PSI		

Stantec Consulting Services Inc.



		dentification WBSF			Daviasi	lian	-	oring No. WBS	
Client		IKEC			Boring Locat		-	N; 568630.955 I	
-	Number	175539026	1		Surface Elev			Elevation Datu	m NAVD88
Litholo			Overburden	Sample #	Depth	Rec. Ft	Press.(psi)	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft	Rec. %	Depth	Remarks
		LEAN CLAY (CL with brown, mois soft, low plasticity (Continued)	t to wet,						
				ST-4	50.0 - 52.0	1.6	600 PSI		
419.9	52.0								
		No Refusal / Bottom of Hole							
		Borehole was ba ground surface u	ickfilled with Ising a tremi	a mixture e pipe.	of cement-be	ntonite	grout from	the bottom of h	ole to the



TVA RO BORING LOG CLIFTY\_BORINGS\_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 4/14/21

Client B	orehole	dentification WBSP-	21-05				Stantec Bo		WBSP-21-05
Client		IKEC			Boring Locat	tion 4	49714.499		
	Number	175539026			Surface Elev				Datum NAVD88
-		Clifty Creek WBSP	and LRCP	Closure		_		Completed	
-		Clifty Creek Power F			Depth to Wa			Date/Time	
Logged					Depth to Wa			Date/Time	
		or Stantec Consult	ina Service	es Inc.	Drill Rig Typ				
-		ing and Sampling To	•		• • •				
		d Sampling Tools (Ty						,.	<b>,</b>
	-	er Type Automatic	•	nt 140		30 in	Effi	ciency	88 % (Avg.)
Borehole			•		Borehole In				Vertical
Lithold			, Overburden	Sample #	Depth	Rec. Ft.	Blows/	,	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Press.(psi) Rec. %	Depth	Remarks
475.3	0.0	Top of Hole							
		SAND WITH GRA (SW), CCR, dark t with black, moist, l very dense	orown	SPT-1	0.0 - 1.5	1.4	4-8-9		
473.7	1.6	FAT CLAY (CH), g little black, moist, s trace to little boiler	soft,	SPT-2	1.5 - 3.0	1.4	3-2-2		
472.3	3.0	No Refusal / Bottom of Hole Borehole was bac	<filled td="" with<=""><td>auger cut</td><td>ttings.</td><td></td><td><u> </u></td><td></td><td></td></filled>	auger cut	ttings.		<u> </u>		



Client Bo	orehole l	dentification WBSP-	21-05A				Stantec Bor	ring No. 🚺	NBSP-21-05A
Client		IKEC			Boring Locat	tion 4	49722.618	N; 568465	5.789 E
Project I	Number	175539026			Surface Elev	/ation 4	71.8 ft E	Elevation [	Datum NAVD88
Project I	Name	Clifty Creek WBSP	and LRCF	Closure	Date Started	2	/25/21 0	Completed	d 2/26/21
Project	Location	Clifty Creek Power F	Plant, Madi	son, IN	Depth to Wa	iter 2	7.0 ft E	Date/Time	2/25/21
Logged	by B.⊦	lerries			Depth to Wa	ter N	/A [	Date/Time	N/A
Drilling (	Contracto	or Stantec Consult	ting Service	es Inc.	Drill Rig Typ	e and ID	CME 55 T	rack Rig #	#711
Overbur	den Drill	ing and Sampling To	ols (Type a	and Size)	4.25" HSA,	2" Split	Spoon w/o l	iners, 3" S	Shelby Tubes
Rock Dr	illing and	d Sampling Tools (Ty	/pe and Siz	e) N/A					
Sampler	Hamme	er Type Automatic	Weigh	nt 140	lb Drop	30 in	Effic	iency	88 % (Avg.)
Borehole	e Azimut	h N/A (Vertica	al)		Borehole In	clination	(from Vertio	cal)	Vertical
Litholo	уgy		Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	Remarks
471.8	0.0	Top of Hole	dork						
-		SAND (SW), CCR brown and black, r	moist,	SPT-1	0.0 - 1.5	1.2	2-2-4		
_		loose to very dens little to some grave							
		e te eente gratt		SPT-2	1.5 - 3.0	1.5	13-21-28		
_				SPT-3	3.0 - 4.5	1.5	10-16-19		
-					0.0 1.0	1.0			
_				SPT-4	4.5 - 6.0	1.5	11-13-12		
_									Gravel=4%,
-				SPT-5	6.0 - 7.5	1.2	9-14-19		Sand=83%, Fines=13%,
-					75 00		0 40 44		Gs=2.90
_				SPT-6	7.5 - 9.0	1.4	9-10-14		
				SPT-7	9.0 - 10.5	1.4	14-17-22		
_									-
-				SPT-8	10.5 - 12.0	1.5	17-21-24		
_									Gravel=8%,
_				SPT-9	12.0 - 13.5	1.5	23-36-33		Sand=82%, Fines=10%,
-						4.5	00 00 07		Gs=2.85
				SPT-10	13.5 - 15.0	1.5	20-30-37		
				SPT-11	15.0 - 16.5	1.5	20-37-27		
-				SPT-12	16.5 - 18.0	1.5	20-28-19		
-									
				SPT-13	18.0 - 19.5	1.5	10-12-14		



Client		dentification WBSP-			Boring Locat		49722.618 N		VBSP-21-05A .789 E
Project	Number	175539026			Surface Elev				Datum_NAVD88
Lithol	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	Remarks
		SAND (SW), CCR brown and black, r loose to very dens	noist, e, with	SPT-14 SPT-15	19.5 - 21.0 21.0 - 22.5	1.5 1.5	11-15-17 10-21-21		Gravel=6%, Sand 87%, Fines=7%, Gs=2.87
		little to some grave (Continued)	el	SPT-16	22.5 - 24.0	1.5	10-11-15		00 2.01
				SPT-17	24.0 - 25.5	1.5	10-16-13		Gravel=3%,
				SPT-18	25.5 - 27.0	1.5	9-11-9		Sand= 86%, Fines=11%, Gs=2.91
		-at 27.0', wet		SPT-19	27.0 - 28.5	1.5	5-6-4		
				SPT-20	28.5 - 30.0	1.5	2-1-2		
				SPT-21	30.0 - 31.5	1.5	3-4-4		
439.8	32.0	LEAN CLAY (CL),	dark	SPT-22	31.5 - 33.0	1.5	3-7-10		
		brown, moist, firm low plasticity, som with silt, trace grav	e silt to	SPT-23	33.0 - 34.5	1.5	5-11-17		
				ST-1	35.0 - 37.0	2.0	300-PSI	44	Gs=2.63, DD=74.8 pcf
				ST-2	40.0 - 42.0	2.0	700-PSI		
				ST-3	45.0 - 47.0	1.5	250-PSI	25	Sand=12%, Fines=88%, Gs=2.70, LL=2 PI=10, DD=87 pcf

Stantec Consulting Services Inc.



Client		IKEC			Boring Locat	tion 4	49722 618	N; 568465.	789 F	
Project I	 Number	175539026			Surface Elev			Elevation D		VD88
Lithold	-		Overburden	Sample #	Depth	Rec. Ft.	Blows/	NMC %		
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Press.(psi) Rec. %	Depth	Rem	narks
		LEAN CLAY (CL brown, moist, firn low plasticity, so with silt, trace gr (Continued)	m to stiff, me silt to							
419.8	52.0			ST-4	50.0 - 52.0	2.0	300-PSI			
		No Refusal / Bottom of Hole								
		Borehole was ba ground surface o	ackfilled with using a tremi	a mixture e pipe.	of cement-be	ntonite (	grout from t	the bottom	of hole to	the
		Borehole was ba ground surface o	ackfilled with using a tremi	a mixture e pipe.	of cement-be	ntonite (	grout from t	the bottom	of hole to	the
		Borehole was ba ground surface o	ackfilled with using a tremi	a mixture e pipe.	of cement-be	entonite (	grout from t	the bottom	of hole to	the
		Borehole was ba ground surface o	ackfilled with using a tremi	a mixture e pipe.	of cement-be	entonite (	grout from t	the bottom	of hole to	the
		Borehole was ba ground surface o	ackfilled with using a tremi	a mixture e pipe.	of cement-be	entonite (	grout from t	the bottom	of hole to	the



Client Bo	orehole l	dentification WBSP-	21-06				Stantec Bor	ring No. <b>\</b>	NBSP-21-06
Client		IKEC			Boring Locat	tion 4	49958.925 N	N; 567996	6.535 E
Project N	lumber	175539026			Surface Elev	/ation 4	48.7 ft E	Elevation [	Datum NAVD88
Project N	Vame	Clifty Creek WBSP	and LRCF	<sup>o</sup> Closure	Date Started	I 3,	/1/21 0	Completed	d 3/1/21
Project	Location	Clifty Creek Power F	Plant, Madi	son, IN	Depth to Wa	ter 4	.0 ft 🛛 🖸	Date/Time	3/1/21
Logged I	by B.⊢	lerries			Depth to Wa	ter N	/A [	Date/Time	e N/A
Drilling C	Contracto	or Stantec Consult	ing Service	es Inc.	Drill Rig Typ	e and ID	CME 55 T	rack Rig a	#711
Overburg	den Drilli	ing and Sampling To	ols (Type a	and Size)	4.25" HSA,	2" Split	Spoon w/o l	iners, 3" S	Shelby Tubes
Rock Dri	illing and	Sampling Tools (Ty	pe and Siz	e) N/A					
Sampler	Hamme	er Type Automatic	Weigł	nt 140	lb Drop	30 in	Effic	iency	88 % (Avg.)
Borehole	e Azimut	h N/A (Vertica	 I)		Borehole In	clination	(from Vertio	cal)	Vertical
Litholo	gy		Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	Remarks
448.7	0.0	Top of Hole							
-		SAND WITH GRA (SW), CCR, dark b		SPT-1	0.0 - 1.5	1.0	1-1-1		-
-		and black, moist, v loose to loose		SPT-2	1.5 - 3.0	0.6	1-1-1		-
-		10050 10 10050							Gravel=14%,
-		-at 4.0', wet		SPT-3	3.0 - 4.5	1.1	1-1-1		Sand=78%, Fines=8%,
_		-at 4.0, wet		ST-1	4.5 - 6.5	0.0	50-PSI		Gs=2.82 –
-									-
-				ST-2	6.5 - 8.5	0.0			-
-									-
-				SPT-4	8.5 - 10.0	0.7	1-WH-WH		-
									_
				SPT-5	10.0 - 12.5	0.4	1-1-1		
_				007.0					_
_				SPT-6	12.5 - 14.0	1.3	1-1-3		-
				SPT-7	14.0 - 15.5	0.2	WH-WH-1		_
432.9	15.8	SILTY SAND WITH		SPT-8	15.5 - 17.0	1.4	WH-WH-1		-
431.7	17.0	¬ GRAVEL (SM), CO	R L		10.0 - 17.0	1.4	•••••		-
		(boiler slag with fly gray with black, we		SPT-9	17.0 - 18.5	1.5	WH-WH- WH		-
		loose	, <b>,</b>	ST-3	18.5 - 20.5	2.0	50-PSI	33	Gs=2.66,
431.7		SANDY SILT WITH GRAVEL (ML), CC			10.0 - 20.0	2.0	50 <b>-</b> F 51	00	DD=87.7 pcf _
427.3	21.4	_ ash), gray and dar	k gray,	SPT-10	20.5 - 22.0	1.5	2-4-6		-
		\wet, very soft							-
		FAT CLAY (CH), b with light brown an	d little						-
		orange, moist, me stiff to very stiff	dium						-



Client B	orehole l	dentification WBSP-2	21-06				Stantec Bor	ring No. V	VBSP-21-06
Client		IKEC			Boring Locat	tion 4	49958.925 N	N; 567996	5.535 E
Project I	Number	175539026			Surface Elev	vation 4	48.7 ft E	Elevation [	Datum NAVD88
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	Remarks
		FAT CLAY (CH), bi with light brown and orange, moist, med stiff to very stiff <i>(Continued)</i> -at 27.5', gray and to some sand	d little dium	ST-4 SPT-11	25.0 - 27.0 27.0 - 28.5	1.6 1.5	300-PSI 1-2-5	23	Gs=2.72, DD=103.2 pcf
-				ST-5	30.0 - 31.7	1.6	300-PSI		
-		-at 31.7', some gra starting at this dept rounded		SPT-12	31.7 - 33.2	1.2	3-4-6		
-				SPT-13	35.0 - 36.5	1.5	2-1-8		
- - -		-at 40.9', gravelly s from 40.9' to 41.3'	and	SPT-14	40.0 - 41.5	1.1	8-11-15	14	Gravel=27%, Sand=36%, Fines=37%, Gs=2.71, LL=24, PI=7
-  -				SPT-15	45.0 - 46.5	0.1	5-7-6		
- - <u>398.7</u>	50.0								Gravel=44%, Sand=48%, Fines=8%,
397.2	51.5	POORLY GRADED	ND _	SPT-16	50.0 - 51.5	1.5	11-12-32		Gs=2.71
- 398.7 - - - - - - -		(GP), gray with tan orange, moist to we dense, subangular rounded No Refusal / Bottom of Hole	et, very						



Client Bo	orehole l	dentification WBSP-21	-07				Stantec Bor	ing No.	VBSP-21-07
Client		IKEC			Boring Locat	ion 4	49470.783 N	N; 566835	.777 E
Project I	Number	175539026			Surface Elev	vation 4	65.6 ft E	levation [	Datum NAVD88
Project I	Name	Clifty Creek WBSP ar	nd LRCP	Closure	Date Started	2/	/26/21 0	completed	2/27/21
Project	Location	Clifty Creek Power Pla	nt, Madi	son, IN	Depth to Wa	ter 1	7.3 ft D	)ate/Time	2/26/21
Logged	by B.F	lerries			Depth to Wa	ter N	/A C	)ate/Time	N/A
Drilling (	Contracto	or Stantec Consulting	g Service	es Inc.	Drill Rig Typ	e and ID	CME 55 T	rack Rig #	¥711
Overbur	den Drill	ing and Sampling Tools	s (Type a	and Size)	4.25" HSA,	2" Split	Spoon w/o l	iners, 3" S	Shelby Tubes
Rock Dr	illing and	d Sampling Tools (Type	and Siz	e) N/A					
	-	er Type Automatic	Weigh	·	lb Drop	30 in	Effic	iency	88 % (Avg.)
Borehole			_ •				(from Vertio		Vertical
Litholo	ogy		Verburden	Sample #	Depth	Rec. Ft.	Blows/	NMC %	
Elevation	Depth	Description F	Rock Core	RQD	Run	Rec. Ft.	Press.(psi) Rec. %	Depth	Remarks
465.6	0.0	Top of Hole							
465.1	0.5	CLAY (CL-CH), stoc	kpile	SPT-1	0.0 - 1.5	1.5	2-4-9		
-		SILTY SAND (SM), g with little brown, mois medium dense, trace some clay	st,	SPT-2	1.5 - 3.0	1.3	6-8-10	37	Gravel=5%, Sand=65%, Fines=30%,
461.8	3.8	-at 3.0', less silt and \brown	more	SPT-3	3.0 - 4.5	1.5	8-7-4		Gs=2.59
_		GRAVEL (GW), CCF dark gray with black, moist, loose		SPT-4	4.5 - 6.0	0.0	1-2-2		
458.1	7.5	-at 6.0', silty material		SPT-5	6.0 - 7.5	0.4	3-3-3		
457.6	8.0	LEAN CLAY (CL), br		SPT-6	7.5 - 9.0	1.5	2-1-2		Crough=E <sup>0</sup> /
_		SILTY SAND (SM), c brown to black, mois very loose to loose, v coal pieces	st,	SPT-7	9.0 - 10.5	1.3	2-2-3		Gravel=5%, Sand=62%, Fines=33%, Gs=2.63
-		-lean clay from 9.8' t 10.0'		SPT-8	10.5 - 12.0	1.0	1-2-3		
452.6	13.0	-roots from 10.3' to 1 at 10.5', with clay.		SPT-9	12.0 - 13.5	1.3	2-3-2		
452.6 - - - - 448.3		SAND (SW), CCR, d brown with black, mo loose, some gravel		SPT-10	13.5 - 15.0	1.0	3-3-5		
-				SPT-11	15.0 - 16.5	0.0	7-7-6		
- 448.3	17.3			SPT-12	16.5 - 18.0	1.4	2-1-1		
-		SILTY SAND (SM), brown, moist to wet, loose, trace to some -from 19.0' to 19.5', r		SPT-13	18.0 - 19.5	1.0	3-1-3	16	Gravel=8%, Sand=70%, Fines=22%, Gs=2.69



Client		IKEC			Boring Loca	tion 4	49470.783		777 E
	 Number	175539026			Surface Elev	-			Datum NAVD88
Litholo			Overburden	Sample #	Depth	Rec. Ft.	Blows/	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Press.(psi) Rec. %	Depth	Remarks
444.6	21.0	with ash $_{-}$ -from 19.5' to 21.0	l', roots	SPT-14	19.5 - 21.0	0.1	4-6-5		
		SAND (SW), CCR brown with black a some orange, moi	and ist,	SPT-15	21.0 - 22.5	0.7	3-4-2		
441.6	24.0	loose, trace grave	l	SPT-16	22.5 - 24.0	1.5	2-1-1		
		FLY ASH (ML), CO layered with black stiff to very stiff, sil	, wet,	SPT-17	24.0 - 25.5	1.5	5-8-11	41	Sand=24%, Fines=76%, Gs=2.80
				SPT-18	25.5 - 27.0	1.5	11-5-7		
437.6	28.0	FAT CLAY (CH), I		ST-1	27.0 - 29.0	2.0	100-PSI	23	Gravel=3%, Sand=31%, Fines=66%, Gs=2.73
		to hard		SPT-19	29.0 - 31.5	1.2	4-6-8		
431.2	34.4			SPT-20		0.1	50/1"		
		-BEDROCK, SHAI WITH CHERT, gra yellow Auger Refusal / Bottom of Hole							
		Borehole was bac ground surface us	kfilled with ing a tremi	a mixture e pipe.	of cement-be	entonite	grout from th	ne bottom	of hole to the



Client Bo	orehole l	dentification WBSP-	21-08				Stantec Bor	ring No. <b>\</b>	NBSP-21-08
Client		IKEC			Boring Locat	tion 4	48675.992 N	• _	
Project N	Number	175539026			Surface Elev	/ation 4	51.3 ft E	Elevation I	Datum NAVD88
Project	Name	Clifty Creek WBSP	and LRCF	Closure	Date Started	2	/27/21 0	Complete	d 2/27/21
Project	Location	Clifty Creek Power F	Plant, Madi	son, IN	Depth to Wa	iter 7	.0 ft D	Date/Time	2/27/21
Logged	by B.⊢	lerries			Depth to Wa	iter N	I/A C	Date/Time	e N/A
Drilling (	Contracto	or Stantec Consult	ing Service	es Inc.	Drill Rig Typ	e and ID	CME 55 T	rack Rig	#711
Overbur	den Drill	ing and Sampling To	ols (Type a	and Size)	4.25" HSA,	2" Split	Spoon w/o l	iners, 3" S	Shelby Tubes
Rock Dr	illing and	d Sampling Tools (Ty	pe and Siz	e) N/A					
Sampler	r Hamme	er Type Automatic	Weigh	nt 140	lb Drop	30 in	Effic	iency	88 % (Avg.)
Borehole	e Azimut	h N/A (Vertica	al)		Borehole In	clination	(from Vertio	cal)	Vertical
Litholo	рду		Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	Remarks
451.3	0.0	Top of Hole SAND WITH GRA (SW), CCR, dark b	orown	SPT-1	0.0 - 1.5	1.1	1-1-1		
-		and black, moist, lo some roots from g surface to approxir 4.5'	round	SPT-2	1.5 - 3.0	0.3	WH-WH-1		-
_				SPT-3	3.0 - 4.5	1.4	3-2-1		
_				SPT-4	4.5 - 6.0	0.9	1-1-2		-
- 444.0	7.3	∼-at 7.0', wet		SPT-5	6.0 - 7.5	1.5	3-3-3		
421		LEAN CLAY (CL), brown, moist, med to stiff, low to med plasticity, trace sar	lium stiff ium	SPT-6	7.5 - 9.0	1.4	4-6-6		
VA RO BORING LOG. CULTY_BORINGS, LOS. GPT 4/44				ST-1	9.0 - 11.0	1.7	50-PSI	26	Sand=15%, Fines=85%, Gs=2.72, LL=29, PI=9
INGS_LOGS.GPJ FMS									
TVA RO BORING									



Client		dentification WBSF			Boring Locat	tion 1	48675.992		<b>VBSP-21-08</b>
					Surface Elev				
	Number _	175539026					Blows/		Datum NAVD88
Litholo Elevation		Description	Overburden Rock Core	Sample #	Depth Run	Rec. Ft. Rec. Ft.	Press.(psi) Rec. %	NMC %	Remarks
Elevation	Depth	Description	ROCK COLE	RQD	Run	Rec. Fl.	Rec. %	Depth	Remarks
		LEAN CLAY (CL) brown, moist, me to stiff, low to me plasticity, trace sa (Continued)	dium stiff dium	ST-2	15.0 - 17.0	2.0	100-PSI		Gravel=1%, Sand=14%, Fines=85%, Gs=2.71
<u>431.6</u> 431.1	19.7 20.2	BEDROCK		SPT-7	<u> 20.0 - 20.2</u>	0.2	50/2"		
		Auger Refusal / Bottom of Hole			20.0 20.2	0.2			
		Borehole was bao ground surface u	ckfilled with sing a tremi	a mixture e pipe.	of cement-be	ntonite (	grout from t	he bottom	of hole to the



		dentification WBSP-	21-00					• _	NBSP-21-09
Client		IKEC			Boring Locat	tion <u>4</u>	50762.229	N; 567212	2.578 E
Project I	Number	175539026			Surface Elev	vation 4	84.9 ft	Elevation I	Datum_NAVD88
Project I	Name	Clifty Creek WBSP	and LRCP	<sup>o</sup> Closure	Date Started	3	/8/21	Complete	d <u>3/8/21</u>
Project	Location	Clifty Creek Power F	Plant, Madi	son, IN	Depth to Wa	iter 5	.0 ft I	Date/Time	3/8/21
Logged	by_B.⊢	lerries			Depth to Wa	iter N	/A	Date/Time	N/A
Drilling (	Contracto	or Stantec Consul	ting Service	es Inc.	Drill Rig Typ	e and ID	CME 55 1	Frack Rig ;	#711
Overbur	den Drill	ing and Sampling To	ols (Type a	and Size)	4.25" HSA,	2" Split	Spoon w/o	liners, 3" S	Shelby Tubes
Rock Dr	illing and	I Sampling Tools (Ty	/pe and Siz	e) N/A					
Sample	r Hamme	er Type Automatic	Weigh	nt <u>140</u>	lb Drop	30 in	Effic	ciency _	88 % (Avg.)
Borehole	e Azimut	h N/A (Vertica	al)		Borehole In	clinatior	(from Verti	cal)	Vertical
Litholo	ogy		Overburden	Sample #	Depth	Rec. Ft.	Blows/ Press.(psi)	NMC %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Depth	Remarks
484.9 484.7	0.0								
\ <b>+U+.</b> L/		\TOPSOIL SILTY SAND (SM)		SPT-1	0.0 - 1.5		1-3-3		
		to dark brown, mo medium dense, tra -at 0.4', gravel sea 0.2'	ist, ace clay	SPT-2	1.5 - 3.0		4-7-10		
479.9	5.0	0.2							
		SAND (SP), gravis brown, moist to we dense, some grav to little clay, with c pieces of about 1/	et, very el, trace oal	SPT-3 SPT-4	5.0 - 6.5 7.5 - 9.0		13-25-28 6-6-7		
		3". -at 10.0', fine sanc	l for 0.4'	SPT-5	10.0 - 11.5		1-2-3		
472.2	12.7	FAT CLAY (CH), g brown, moist, firm sand and gravel		SPT-6	12.5 - 14.0		3-5-8		
469.0	15.9			SPT-7	15.0 - 15.9		16-50/5"		
		Auger Refusal / Bottom of Hole Borehole was bac ground surface us	kfilled with	a mixture e pipe.	of cement-be	entonite (	grout from t	he bottom	of hole to the

## **APPENDIX F**

Slope Stability Analysis



#### West Boiler Slag Pond Phases 2-4 Perimeter Dike Stability

Closure Plan West Boiler Slag Pond Clifty Creek Station Madison, Jefferson County, Indiana

April 16, 2021

Prepared for:

Indiana-Kentucky Electric Corporation (IKEC)

Prepared by:

Stantec Consulting Services Inc.

## **Table of Contents**

1.0	INTRODUCTION		1
2.0	GLOBAL SLOPE STAB	LITY ANALYSES	1
2.1	LOAD CASES, GROUNE	WATER CONDITIONS, AND DESIGN CRITERIA	2
	2.1.2 Long-Term Hi	gh Water	.2
	2.1.3 Seismic (Pseu	udo-static)	.3
	2.1.4 Post-Earthqua	ake	.3
2.2	SECTION GEOMETRY		3
	2.2.1 Station 105+0	0	.4
	2.2.2 Station 122+0	0	.4
2.3		S	
2.4	ANALYSIS RESULTS		6
3.0	CONCLUSION		7
			_
4.0	LIMITATIONS		7
5.0	REFERENCES		8
0.0			J

#### LIST OF TABLES

Table 2.1: Evaluated Load Cases	2
Table 2.2: Soil Borings and CPTs used for Stratigraphy Definition	4
Table 2.3: Material Parameters for Slope Stability Analysis	
Table 2.4: Computed Slope Stability Factors of Safety	6

#### LIST OF ATTACHMENTS

ATTACHMENT A SLOPE STABILITY ANALYSES OUTPUTS

INTRODUCTION

## **1.0 INTRODUCTION**

The Clifty Creek Generating Station's West Boiler Slag Pond Dam (WBSP), owned and operated by the Indiana Kentucky Electric Corporation (IKEC), is located in Jefferson County, Indiana. The facility is bordered in the south by the Ohio River, on the east by Big Clifty Creek and in the northwest by a bedrock outcrop known as the Devil's Backbone. The WBSP served as a settling facility for sluiced bottom ash produced by the generating plant. In addition to the process flows from the power plant, approximately 510 acres drains to the facility. The WBSP will no longer receive bottom ash and closure documentation is being prepared.

Stantec Consulting Services, Inc. (Stantec) was contracted by the IKEC to prepare construction design documents to support the closure of the WBSP. The purpose of this report is to present the results of slope stability analyses of Phases 2-4 of the WBSP closure. Closure will be executed by excavating, filling and grading existing bottom ash in the pond to create positive drainage and will include the installation of a cover system. The cover system, from top to bottom, will consist of 6 inches of topsoil, 2.5 feet of cover soil, a geocomposite drainage layer, and a 40-mil thickness linear low-density polyethylene (LLDPE) flexible membrane liner (FML) overlying the in-place bottom ash coal combustion residual (CCR) material.

This report documents the information reviewed from previous field explorations and laboratory testing and geotechnical engineering analyses performed by Stantec to support the closure requirements. The scope of work includes the following:

- Existing documentation review
- Slope stability analyses of sections 105+00, 122+00 in long-term, long-term high water, and seismic loading conditions

## 2.0 GLOBAL SLOPE STABILITY ANALYSES

The global slope stability was evaluated using conventional, limit equilibrium, method of slices analysis as implemented in the SLOPE/W module of GeoStudio 2021. Spencer's method was selected for the analyses as this method includes all interslice forces and satisfies both moment and force equilibrium. A slope stability analysis includes a search for the most critical slip surface, corresponding to the lowest factor of safety. Several options are available in SLOPE/W to facilitate the search for the critical failure surface. In the analyses presented in this report, potential circular failure surfaces were generated using the "entry and exit" method. Considering shallow, surficial failures pose little risk to the overall stability of the slopes, and are usually considered as a potential maintenance issue, a minimum slip surface depth of 3 feet was specified in the analyses to force the evaluation on the deeper potential failure surfaces.

When a soil at the entry of a potential failure surface is assigned with a cohesion value (c>0) in a slope stability analysis, tensile stresses are often computed between the slices in this area. In the field, tensile

#### WEST BOILER SLAG POND PHASES 2-4 PERIMETER DIKE STABILITY

#### GLOBAL SLOPE STABILITY ANALYSES

stresses result in the opening of a tension crack, reducing the lateral stresses to zero. Because tension results in a stabilizing force at the head of the sliding mass, it is unconservative to have tensile stresses between the slices in a slope stability analysis. A tension crack line was used in the analysis to eliminate the tensile inter-slice forces. Multiple iterations were performed to define the appropriate tension crack line.

# 2.1 LOAD CASES, GROUNDWATER CONDITIONS, AND DESIGN CRITERIA

Global slope stability analyses were performed on the final grading of the Phases 2-4 WBSP closure. The evaluated load cases, along with the target factors of safety, are summarized in Table 2.1. Target factors of safety were selected per criteria presented in the Indian Administrative Code (Table 1 of 329 IAC 10-15-8). If the slope were to fail, it would cause major environmental impact due to material being released into the Ohio River. There is small uncertainty of soil strengths with the laboratory testing performed (discussed in Stantec 2016). Therefore, the minimum factors of safety used for these analyses were 1.5 for static conditions and 1.3 for seismic, post-earthquake conditions.

Slope	Load Case	Analysis	Target Factor of Safety
	Long-term	Drained, effective stress	1.5
	High River Long- Term	Drained, effective stress	1.5
Perimeter Dike	Seismic (Pseudo- static)	Undrained, total stress	1.0
Slope Stability	Seismic (Post- Earthquake)	Residual strengths for liquefied CCR material Undrained, total stress reduced 20% for non- liquefied soils	1.3

#### Table 2.1: Evaluated Load Cases

#### 2.1.1 Long-Term

This analysis was performed to evaluate the stability of the final grading under the long-term, drained condition after excess pore pressures have dissipated. Drained, effective stress strength parameters were used in the analysis. A long-term piezometric line was applied to the slope stability models assumed to be five feet below the lowest point of the proposed closure liner.

#### 2.1.2 Long-Term High Water

This analysis was performed to evaluate the stability of the embankment dike under a sustained highwater condition in the Ohio River. Drained, effective strength parameters were used in the analysis. The high water piezometric line was assigned based on an anticipated 500-yr storm water surface elevation of



#### WEST BOILER SLAG POND PHASES 2-4 PERIMETER DIKE STABILITY

#### GLOBAL SLOPE STABILITY ANALYSES

469.7 feet in the Ohio River. Because the riverside slope is subjected to an external stabilizing pressure from water, only the pond side slope is being analyzed under this loading case.

#### 2.1.3 Seismic (Pseudo-static)

This analysis was performed to evaluate the stability of the embankment dike and final grading under seismic loading from a design earthquake event. Undrained, pseudo-static strength parameters were assigned to the low permeability materials in the analysis. Groundwater was assumed to be at the long-term water level.

The US Geological Survey (USGS) Unified Hazard Tool was used to determine the site's peak ground acceleration (PGA) corresponding to a seismic event with a return period of 2,475 years and a peak rock acceleration at the site of 0.0882 g was obtained. Haynes-Griffin and Franklin (1984) recommended that half of the peak rock acceleration be used as the seismic coefficient in the pseudo-static slope stability analysis. Based on that, a seismic coefficient of 0.0441 (= $0.5 \times 0.0882$ ) was selected. The selected seismic coefficient was rounded and a horizontal seismic coefficient of 0.045 was used in SLOPE/W. The program calculates seismic force (=column weight x seismic coefficient) and applies to each column in the sliding mass.

Note that the pseudo-static stability analysis should only be considered as an index of the seismic resistance available in a structure not subject to build-up of pore pressure from shaking. A pseudo-static factor of safety greater than 1.0 is very strong evidence that there would be little or no damage to the dam from an earthquake (FEMA 2005).

Groundwater was assumed to be at the long-term water level which was assumed to be 5 feet below the proposed closure liner.

#### 2.1.4 Post-Earthquake

This analysis was performed to evaluate the stability of the Bottom Ash (CCR) material within the WBSP for purposes of evaluating response to the design seismic event and to evaluate the potential for a release of CCR offsite. The assumption for performing this analysis is that the saturated very loose Bottom Ash (CCR) deposits will undergo pore pressure build-up and liquefy during the design seismic event. A post-earthquake, residual strength (in the form of Residual Shear Strength ratio as discussed in Section 2.3) was applied to the saturated Bottom Ash and Fly Ash (CCR) layers. Undrained, total stress strength parameters were reduced by 20% and applied to non-liquifiable soils to account for potential strength loss due to earthquake shaking.

Groundwater was assumed to be at the long-term water level which was assumed to be 5 feet below the proposed closure liner.

## 2.2 SECTION GEOMETRY

Two representative cross sections were selected for slope stability analyses: Sta. 105+00 and Sta. 122+00, along the alignment of Phases 2-4. Locations of the selected cross sections are shown in the drawings. The subsurface profiles



#### GLOBAL SLOPE STABILITY ANALYSES

#### modeled in the analyses for each cross section were selected based on historical data from previous explorations and the Stantec 2021 geotechnical explorations. Soil borings and CPTs selected for definition of the subsurface lithology for each cross section are shown in

Table 2.2 below.

Cross Section	Soil Boring	СРТ
105+00	Stantec B-1, B-2, WBSP- 21-08, and AGES WBSP- 15-10	N/A
122+00	Stantec B-5, B-6, AGES WBSP-15-07	CPT-3-GEO, CPT-3A-GEO

#### Table 2.2: Soil Borings and CPTs used for Stratigraphy Definition

#### 2.2.1 Station 105+00

This section is located in Phase 4B in the southwest end of the WBSP and extends from north to south until it reaches the Ohio River. This section was selected to evaluate the stability of the existing embankment dike adjacent to the closure by removal area of the site and is the critical perimeter dike section when the Ohio River reaches the 500-yr storm water surface elevation.

#### 2.2.2 Station 122+00

This section is located in Phase 4A in the south end of the WBSP and extends from north to south until it reaches the Ohio River. This section was selected to evaluate the stability of the final grading along the existing embankment dike with modified CCR pond grading.

## 2.3 MATERIAL PROPERTIES

Material strength parameters used in the stability analyses of this study are summarized in **Error! Reference source not found.** below. These parameters were selected based on the field exploration results, reviewed historical geotechnical information, and engineering judgement. Further refinements to these parameters are anticipated as the 2021 laboratory testing results become available.



#### WEST BOILER SLAG POND PHASES 2-4 PERIMETER DIKE STABILITY

#### GLOBAL SLOPE STABILITY ANALYSES

	Unit	Drained Shear	Strengths	Undrained Shear Strengths	Residual Strength
Material	Weight	Effective Friction Angle φ'	Effective Cohesion c'	Su	Sr
	(pcf)	(deg.)	(psf)	(psf)	(psf)
Embankment	129	27 <sup>1</sup>	500 <sup>1</sup>	1250 <sup>2</sup>	-
Lean Clay with Sand	119	27 <sup>1</sup>	300 <sup>1</sup>	1000 <sup>2</sup>	-
Gravel with Silt and Sand	130	35 <sup>3</sup>	0 <sup>3</sup>	-	-
Bottom Ash (CCR)	115	28 <sup>4</sup>	0 4	-	S <sub>r</sub> / σ <sub>vc</sub> ' = 0.04 <sup>5</sup>
Sandy Silt/Silty Sand	125	30 <sup>3</sup>	0 <sup>3</sup>	-	-
Fat Clay	119	27 <sup>6</sup>	300 <sup>6</sup>	1000 <sup>6</sup>	-
Compacted Clay Fill	130	27 <sup>7</sup>	300 7	1250 <sup>7</sup>	-
Compacted CCR Fill	115	31 <sup>8</sup>	0 8	-	-
Cover Soil	125	27 <sup>9</sup>	300 <sup>9</sup>	1000 <sup>9</sup>	-

#### Table 2.3: Material Parameters for Slope Stability Analysis

Notes:

<sup>1</sup> Based on a review of the CU test data included in the 2016 report.

<sup>2</sup> Based on available CPT and SPT data. Use 80% of the strength for post-earthquake.

<sup>3</sup> Values derived in the 2016 report. Use 80% of the strength for post-earthquake.

<sup>4</sup> Values derived in the 2016 report.

<sup>5</sup> Residual strength of liquefied soil based on SPT data for post-earthquake.

<sup>6</sup> Use Lean Clay values. Will update once 2021 laboratory test results become available.

<sup>7</sup> Use Lean Clay and Embankment values.

<sup>8</sup> Based on typical compacted CCR values from past experience. Use 80% of the strength for postearthquake.

<sup>9</sup> Use Lean Clay values.

Soil strength parameters were derived in the Stantec February 2016 CCR Rule Stability Analyses report and were amended for the current analyses based on further review of the 2016 testing and the 2021 field exploration. The 2016 parameters were developed using CU triaxial test data for the Embankment Fill and Lean Clay with Sand soils. Drained and undrained shear strengths for the Bottom Ash (CCR) material were taken from SPT correlations for very loose deposits. Strength parameters for the proposed Cover Soil were taken to be identical to the parameters of the Lean Clay with Sand soil and its unit weight was selected based on preliminary standard Proctor testing data of a potential borrow source soil. Undrained shear strength parameters for coarse-grained (or cohesionless) material were taken to be identical to the drained shear strength parameters.



#### WEST BOILER SLAG POND PHASES 2-4 PERIMETER DIKE STABILITY

#### GLOBAL SLOPE STABILITY ANALYSES

The residual strength of liquefied Bottom Ash (CCR) layers for post-earthquake evaluations was estimated by selecting a conservative Residual Shear Strength ratio,  $\tau/\sigma$  (Shear Strength/Effective Overburden Stress Ratio)) of 0.04 based on correlations between corrected SPT blow counts and the Residual Shear Strength Ratio (Idriss and Boulanger, 2008). Based on the SPT blowcounts from existing boring data, a representative SPT (N<sub>1</sub>)<sub>60-cs</sub> value of 3 was used to select the Residual Shear Strength ratio for the Bottom Ash (CCR).

## 2.4 ANALYSIS RESULTS

The computed factors of safety of slope stability for the Phase 2-4 WBSP closure grading under the evaluated loading conditions are summarized in **Error! Reference source not found.**, along with the target factors of safety according to the established design criteria for the project. The computed output plots, depicting the predicted critical failure surfaces, are presented in Attachment A.

Sta.			Computed Slope Stability Factor of Safety	Target Factor of Safety
	Dike - Pond Side	Long Term	2.60	1.5
	Dike - Riverside	Long Term	2.83	1.5
Sta. 105+00	Dike - Pond Side	Long Term High Water	2.07	1.5
	Dike - Pond Side	Seismic (Pseudo-Static)	1.33	1.0
	Dike - Riverside	Seismic (Pseudo-Static)	1.48	1.0
	Dike - Pond Side	Long Term	2.79	1.5
	Dike - Riverside	Long Term	2.62	1.5
	Dike - Pond Side	Long Term High Water	2.07	1.5
Sta. 122+00	Dike - Pond Side	Seismic (Pseudo-Static)	1.67	1.0
	Dike - Riverside	Seismic (Pseudo-Static)	1.63	1.0
	Dike - Pond Side	Seismic (Post-earthquake)	1.69	1.3
	Dike - Riverside	Seismic (Post-earthquake)	1.59	1.3

Table 2.4: Computed Slope Stabilit	ty Factors of Safety
------------------------------------	----------------------



CONCLUSION

## 3.0 CONCLUSION

The calculated factors of safety for the analyzed cases meet the minimum factors of safety required by 329 IAC 10-15-8. This analysis is based on the information discussed in this report and the interpretation of the subsurface conditions encountered at the site. No warranties can be made regarding the continuity of conditions. If future design changes are made, Stantec should be notified so that such changes can be reviewed, and the analysis amended as necessary.

## 4.0 LIMITATIONS

This report was prepared by Stantec Consulting Services, Inc. (Stantec) for IKEC. Stantec's professional services have been performed using a degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No other warranty, express or implied, is made as to the professional advice included in this report. This geotechnical report has been prepared for IKEC and is to be used solely for the design of the proposed Phases 2 through 4 Closure for the West Boiler Slag Pond at the Clifty Creek Station in Jefferson County, Indiana and may not contain sufficient information for use by other parties.

The recommendations provided in this geotechnical report are based upon our understanding of the described project information and our interpretation of available published information and previous field and laboratory investigations. We have made our recommendations based upon experience with similar subsurface conditions. The recommendations apply to the specific project discussed in this report; therefore, any change in the configuration of the proposed design or any change to the site grades should be provided to us so that we can review our conclusions and recommendations and make any necessary modifications.

The recommendations provided in this report are based upon the assumption that the necessary geotechnical observations and testing during construction will be performed by our firm during the entire duration of the construction. The field observation services are considered a continuation of the geotechnical investigation and are essential to verify that the actual soil conditions are as expected. This also provides for the procedure whereby IKEC may be advised of unexpected or changed conditions that would require modifications of our original recommendations.

7

REFERENCES

## 5.0 **REFERENCES**

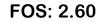
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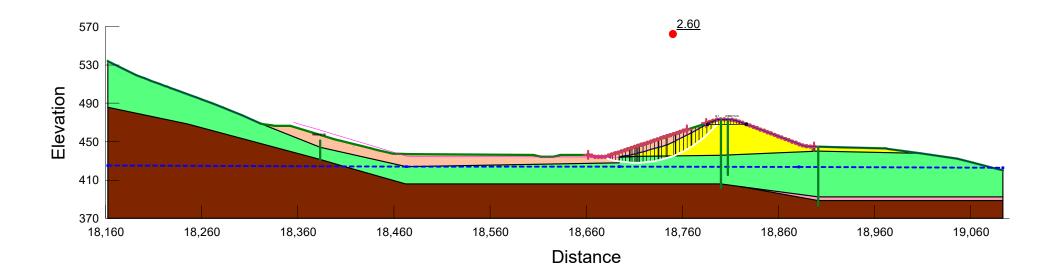
## **ATTACHMENT A** SLOPE STABILITY ANALYSES OUTPUTS

Name: Long Term Pond Side Method: Spencer

Slip Surface: Entry and Exit



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Line
	Bedrock	Bedrock (Impenetrable)				1
	Embankment (Drained)	Mohr-Coulomb	129	500	27	1
	Fill (Drained)	Mohr-Coulomb	130	300	27	1
	Gravel with Silt and Sand	Mohr-Coulomb	130	0	35	1
	Lean Clay with Sand (Drained)	Mohr-Coulomb	119	300	27	1

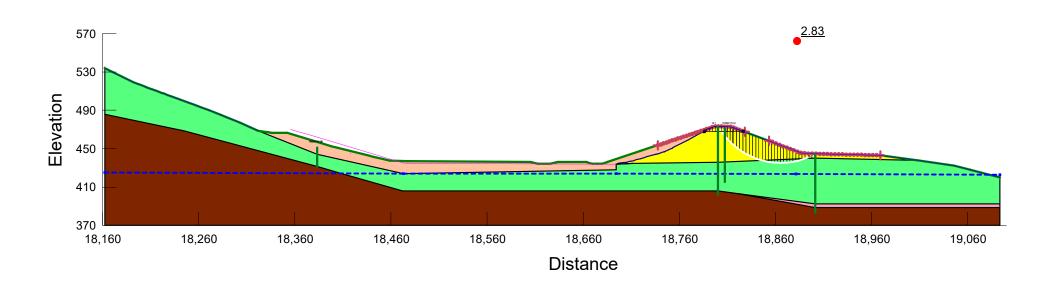


Name: Long Term Riverside Method: Spencer

Slip Surface: Entry and Exit

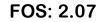


Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Line
	Bedrock	Bedrock (Impenetrable)				1
	Embankment (Drained)	Mohr-Coulomb	129	500	27	1
	Fill (Drained)	Mohr-Coulomb	130	300	27	1
	Gravel with Silt and Sand	Mohr-Coulomb	130	0	35	1
	Lean Clay with Sand (Drained)	Mohr-Coulomb	119	300	27	1

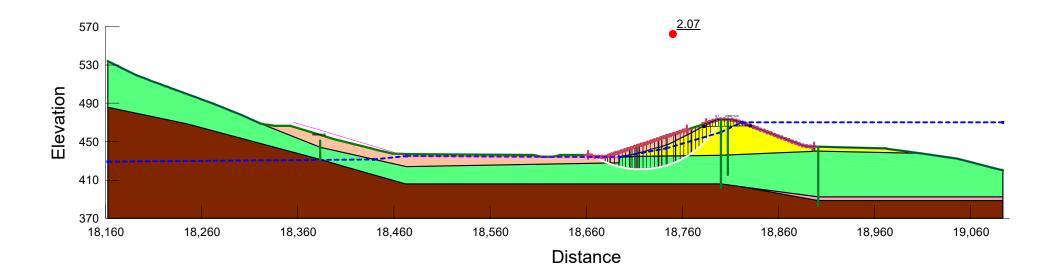


Name: Long Term Pond Side High water Method: Spencer

Slip Surface: Entry and Exit



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Line
	Bedrock	Bedrock (Impenetrable)				1
	Embankment (Drained)	Mohr-Coulomb	129	500	27	1
	Fill (Drained)	Mohr-Coulomb	130	300	27	1
	Gravel with Silt and Sand	Mohr-Coulomb	130	0	35	1
	Lean Clay with Sand (Drained)	Mohr-Coulomb	119	300	27	1

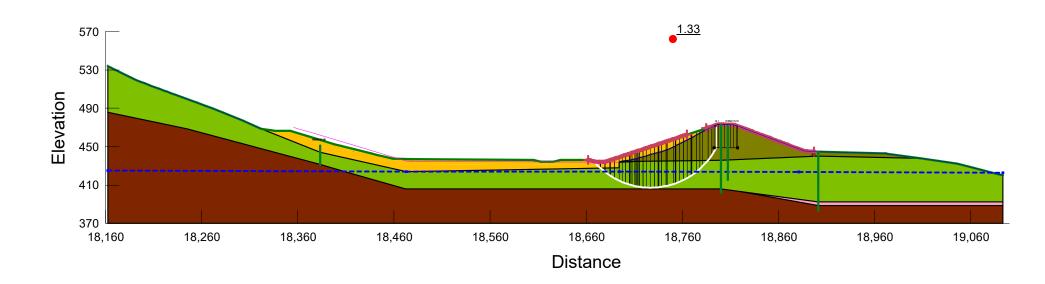


Name: Seismic Pond Side (Drained & Undrained) Method: Spencer

Slip Surface: Entry and Exit

FOS: 1.33 Horz Seismic Coef.: 0.045

Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Cohesion (psf)	Piezometric Line
	Bedrock	Bedrock (Impenetrable)					1
	Embankment (Undrained)	Undrained (Phi=0)	129			1,250	1
	Fill (Undrained)	Undrained (Phi=0)	130			1,250	1
	Gravel with Silt and Sand	Mohr-Coulomb	130	0	35		1
	Lean Clay with Sand (Undrained)	Undrained (Phi=0)	119			1,000	1

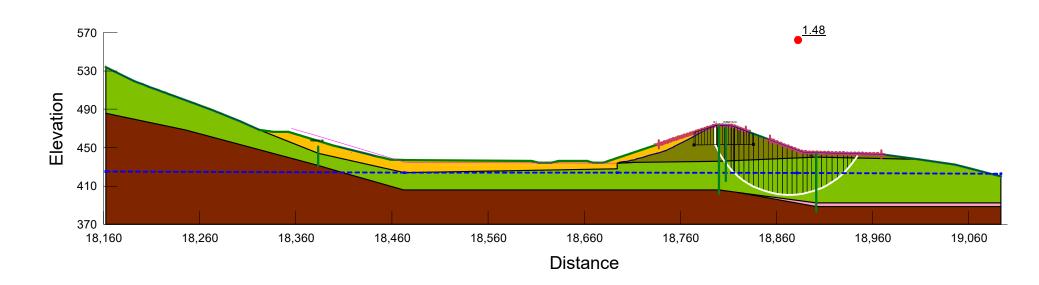


Name: Seismic Riverside (Drained & Undrained) Method: Spencer

Slip Surface: Entry and Exit

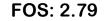
FOS: 1.48 Horz Seismic Coef.: 0.045

Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Cohesion (psf)	Piezometric Line
	Bedrock	Bedrock (Impenetrable)					1
	Embankment (Undrained)	Undrained (Phi=0)	129			1,250	1
	Fill (Undrained)	Undrained (Phi=0)	130			1,250	1
	Gravel with Silt and Sand	Mohr-Coulomb	130	0	35		1
	Lean Clay with Sand (Undrained)	Undrained (Phi=0)	119			1,000	1



Name: Long Term Pond Side Method: Spencer

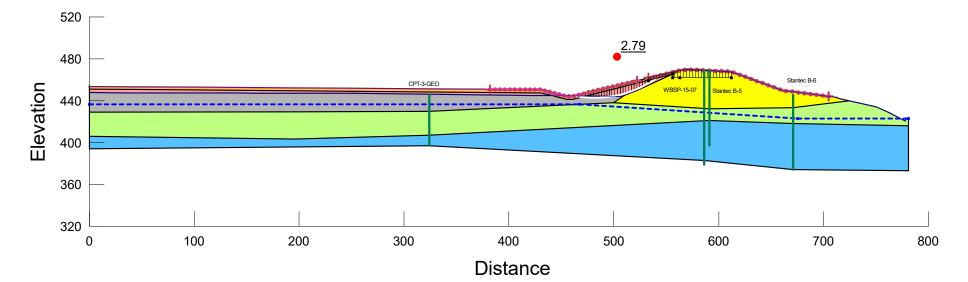
Slip Surface: Entry and Exit



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Line
	Bottom Ash	Mohr-Coulomb	115	0	28	1
	CCR Fill	Mohr-Coulomb	115	0	31	1
	Cover Soil (Drained)	Mohr-Coulomb	125	300	27	1
	Embankment Fill (Drained)	Mohr-Coulomb	129	500	27	1
	Lean Clay with Sand (Drained)	Mohr-Coulomb	119	300	27	1
	Sandy Silt	Mohr-Coulomb	125	0	30	1

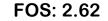
Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.

No warranties can be made regarding the continuity of subsurface conditions.



Name: Long Term Riverside Method: Spencer

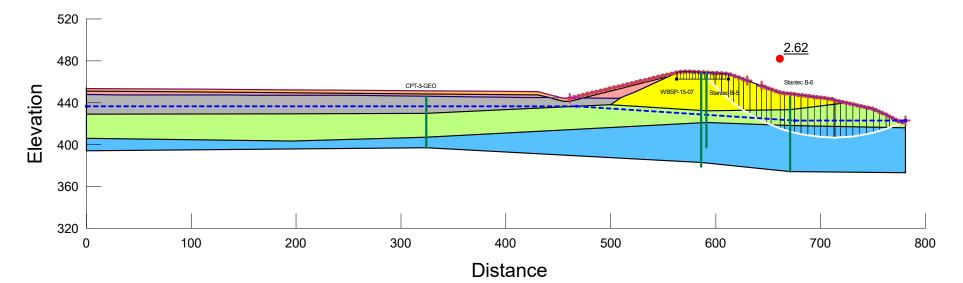
Slip Surface: Entry and Exit



Color	Name	Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Line
	Bottom Ash	Mohr-Coulomb	115	0	28	1
	CCR Fill	Mohr-Coulomb	115	0	31	1
	Cover Soil (Drained)	Mohr-Coulomb	125	300	27	1
	Embankment Fill (Drained)	Mohr-Coulomb	129	500	27	1
	Lean Clay with Sand (Drained)	Mohr-Coulomb	119	300	27	1
	Sandy Silt	Mohr-Coulomb	125	0	30	1

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.

No warranties can be made regarding the continuity of subsurface conditions.



Color

Name

Bottom Ash

CCR Fill

Cover Soil (Drained)

(Drained)

500

Embankment Fill

Model

Mohr-Coulomb

Mohr-Coulomb

Mohr-Coulomb

Mohr-Coulomb 129

600

Unit

(pcf)

115

115

125

Weight

Effective

(psf)

0

0

300

500

Cohesion Friction Line

28

31

27

27

700

800

Angle (°)

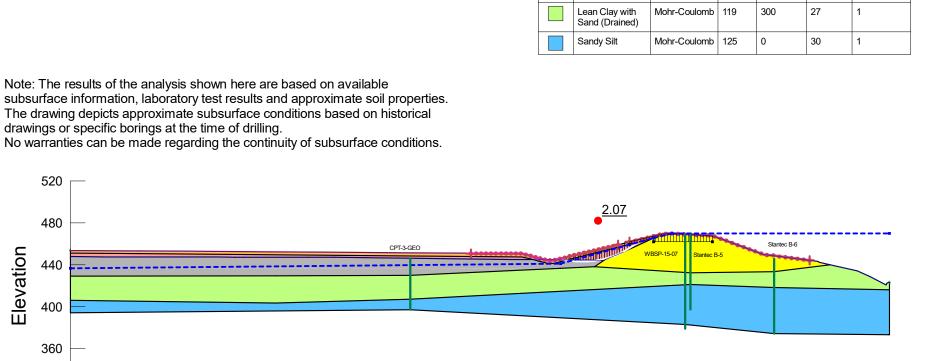
Effective Piezometric

1

1

1

1



Name: Long Term Pond Side High water **Method: Spencer** 

Slip Surface: Entry and Exit

Elevation

320

0

100



200

Distance

400

300

Name: Seismic Pond Side (Drained & Undrained) Method: Spencer

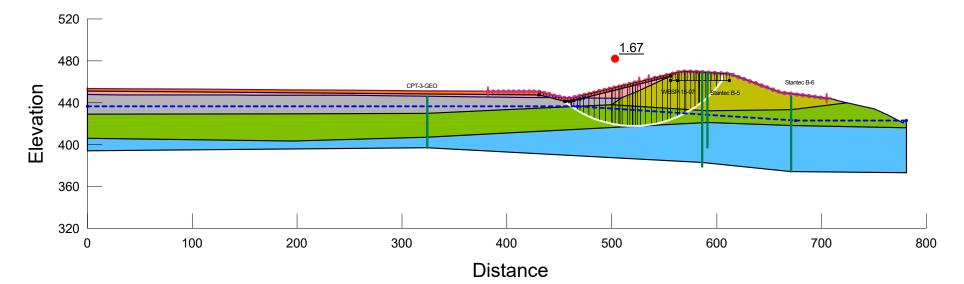
Slip Surface: Entry and Exit

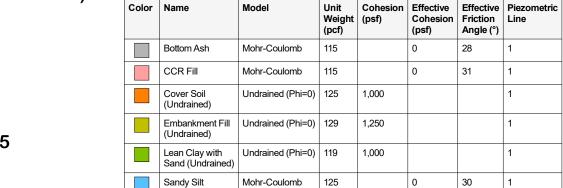
FOS: 1.67 Horz Seismic Coef.: 0.045

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Line
	Bottom Ash	Mohr-Coulomb	115		0	28	1
	CCR Fill	Mohr-Coulomb	115		0	31	1
	Cover Soil (Undrained)	Undrained (Phi=0)	125	1,000			1
	Embankment Fill (Undrained)	Undrained (Phi=0)	129	1,250			1
	Lean Clay with Sand (Undrained)	Undrained (Phi=0)	119	1,000			1
	Sandy Silt	Mohr-Coulomb	125		0	30	1

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.

No warranties can be made regarding the continuity of subsurface conditions.





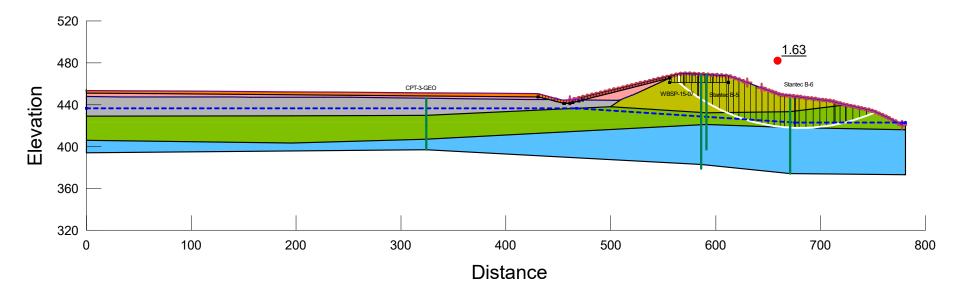
Name: Seismic Riverside (Drained & Undrained) Method: Spencer

Slip Surface: Entry and Exit

FOS: 1.63 Horz Seismic Coef.: 0.045

Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.

No warranties can be made regarding the continuity of subsurface conditions.



Color

Name

Bottom Ash

Strength) CCR Fill

Strength)

Bottom Ash (Residual

Cover Soil (Reduced

Embankment Fill (Reduced Strength) Lean Clay with Sand

(Reduced Strength)

Model

Mohr-Coulomb

Mohr-Coulomb

Undrained (Phi=0)

Undrained (Phi=0)

Undrained (Phi=0) 129

SHANSEP

Unit

(pcf)

115

115

115

125

119

Weight

Cohesion

(psf)

800

1,000

800

Tau/Sigma

Ratio

0.04

Effective

Cohesion

(psf)

0

0

Effective

Friction

28

31

Angle (°)

Piezometric

Line

1

1

1

1

1

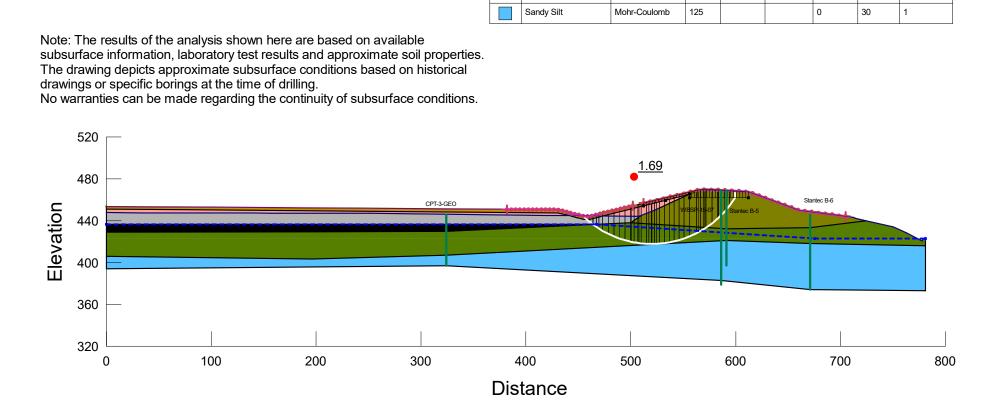
1

Name: Post Earthquake Pond Side

FOS: 1.69

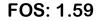
Slip Surface: Entry and Exit

**Method: Spencer** 



Name: Post Earthquake Riverside Method: Spencer

Slip Surface: Entry and Exit



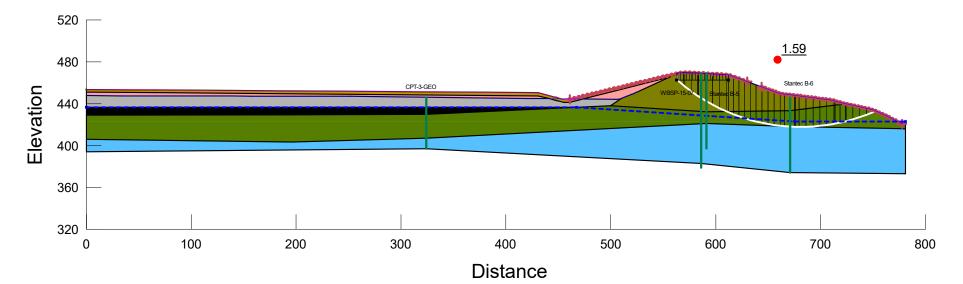
Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Tau/Sigma Ratio	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Line
	Bottom Ash	Mohr-Coulomb	115			0	28	1
	Bottom Ash (Residual Strength)	SHANSEP	115		0.04			1
	CCR Fill	Mohr-Coulomb	115			0	31	1
	Cover Soil (Reduced Strength)	Undrained (Phi=0)	125	800				1
	Embankment Fill (Reduced Strength)	Undrained (Phi=0)	129	1,000				1
	Lean Clay with Sand (Reduced Strength)	Undrained (Phi=0)	119	800				1
	Sandy Silt	Mohr-Coulomb	125			0	30	1

Note: The results of the analysis shown here are based on available

subsurface information, laboratory test results and approximate soil properties.

The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling.

No warranties can be made regarding the continuity of subsurface conditions.



## APPENDIX G

WBSP Phases 2-4 Permit Drawings

# PERMIT DRAWINGS **PHASES 2 - 4** WEST BOILER SLAG POND CLOSURE & LOW VOLUME WASTE TREATMENT SYSTEM **CLIFTY CREEK STATION** JEFFERSON COUNTY, MADISON TOWNSHIP, INDIANA

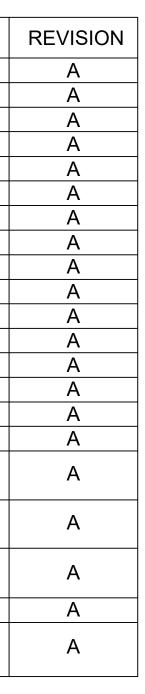
# **INDEX OF SHEETS**

SHEET NO.	DRAWING NO.	DESCRIPTION
1	P-WBSP2-001-CVR	COVER SHEET
2	P-WBSP2-101-OVR	OVERVIEW / SEQUENCING PLAN
3	P-WBSP2-102-EC1	EXISTING CONDITIONS
4	P-WBSP2-103-FG1	FINAL GRADE PLAN
5	P-WBSP2-104-OP1	EXISTING AND PROPOSED OUTFALL PLANS AND PROFILE
6	P-WBSP2-105-EPSC	EROSION PREVENTION AND SEDIMENT CONTROL PLAN
7	P-WBSP2-106-SM1	STORMWATER MANAGEMENT PLAN
8	P-WBSP2-301-PF1	PROFILES - PROJECT BASELINE
9	P-WBSP2-302-PF2	PROFILES - EAST, WEST STORMWATER, AND OVERFLOW DITCHES
10	P-WBSP2-304-XS1	CROSS SECTIONS - PROJECT BASELINE
11	P-WBSP2-305-XS2	CROSS SECTIONS - PROJECT BASELINE
12	P-WBSP2-501-DT1	DETAILS
13	P-WBSP2-503-DT2	DETAILS
14	P-WBSP2-504-DT3	DETAILS
15	SB101	FOUNDATION PLAN, RECYCLE AND SETTLING TANKS
16	SB102	FOUNDATION SECTION & DETAILS, RECYCLE & SETTLING TANKS
17	SB103	STRUCTURAL FOUNDATIONS, BSHS PCM AND TRANSFORMERS FOUNDATION PLAN, SECTIONS AND DETAILS
18	SB104	STRUCTURAL FOUNDATIONS, CAUSTIC AND COAGULANT TANK PLAN AND SECTIONS
19	SB105	STRUCTURAL FOUNDATIONS, CHEM FEED BUILDING PLAN AND SECTION
20	SB109	FOUNDATION PLAN, TRENCH SETTLING TANK
21	SB110	FOUNDATION PLAN, TRENCH SETTLING TANK SECTIONS AND DETAILS

PREPARED FOR



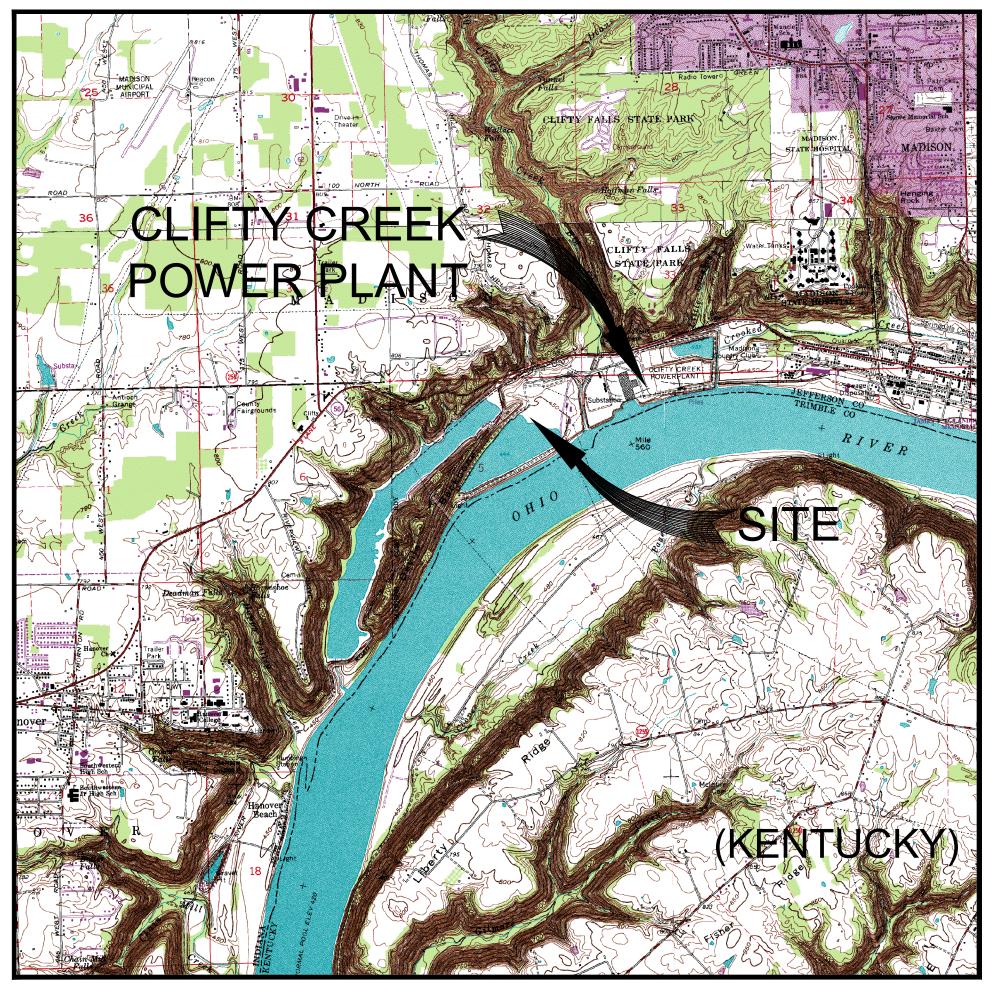
**PIKETON, OHIO** 



PREPARED BY



Stantec Consulting Services Inc. 11687 Lebanon Rd. Cincinnati, Ohio 45241-2012 Tel. 513.842.8200 Fax 513.842.8250 www.stantec.com



VICINITY MAP

.25 0 .5 GRAPHIC SCALE

**ISSUED FOR PERMIT** 

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AS SHOWN Drawing No. P-WBSP2-001-CVR

## COVER SHEET

Client/Project OHIO VALLEY ELECTRIC CORPORATION INDIANA-KENTUCKY ELECTRIC CORPORATION PHASE 2 - 4 WBSP CLOSURE AND LVWTS CLIFTY CREEK STATION MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Scale





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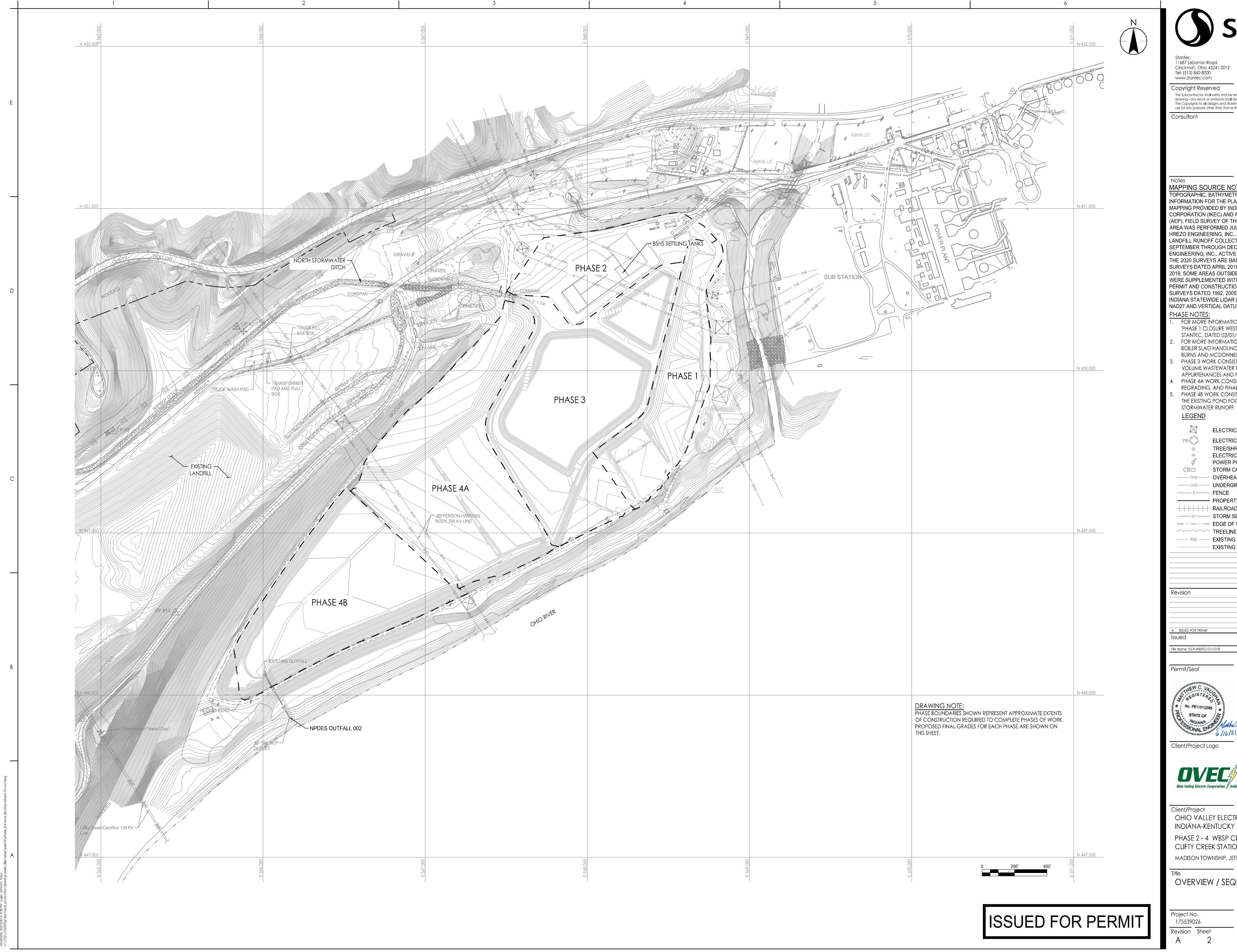
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1''=200' Drawing No. P-WBSP2-101-OVR

# OVERVIEW / SEQUENCING PLAN

Scale

CLIFTY CREEK STATION MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

INDIANA-KENTUCKY ELECTRIC CORPORATION PHASE 2 - 4 WBSP CLOSURE AND LVWTS

Client/Project OHIO VALLEY ELECTRIC CORPORATION



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NO. PE11012285 STATE OF MOIANA SONAL ENGINEERING	
t/Project Logo	

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CB□	STORM CATCH BASIN
OHE	OVERHEAD ELECTRIC
UGE	UNDERGROUND ELECTRIC
X	FENCE
	PROPERTY LINE
+++++++++++++++++++++++++++++++++++++++	RAILROAD TRACKS
ST	STORM SEWER
	EDGE OF WATER
$\frown$	TREELINE
—— 450 ——	EXISTING INDEX CONTOUR
	EXISTING INTERMEDIATE CONTOUR

PHASE 4B THE EXISTIN	IG, AND FINAL CAP PLACEMENT. WORK CONSISTS OF CLOSURE BY REMOVAL WIT NG POND FOOTPRINT AND REGRADING FOR NTER RUNOFF.
	-
$\bowtie$	ELECTRIC TOWER
РВ	ELECTRIC PULLBOX
÷	TREE/SHRUB
-0-	ELECTRIC POLE
ф	POWER POLE

STANTEC, DATED 03/01/2021. FOR MORE INFORMATION ON THE PHASE 2 DESIGN, SEE THE

BURNS AND MCDONNELL.

PHASE NOTES: FOR MORE INFORMATION ON THE PHASE 1 DESIGN, SEE THE 'PHASE 1 CLOSURE WEST BOILER SLAG POND' DRAWINGS BY

BOILER SLAG HANDLING SYSTEM DESIGN DRAWINGS BY

PHASE 3 WORK CONSISTS OF CONSTRUCTION OF THE LOW

VOLUME WASTEWATER TREATMENT SYSTEM AND

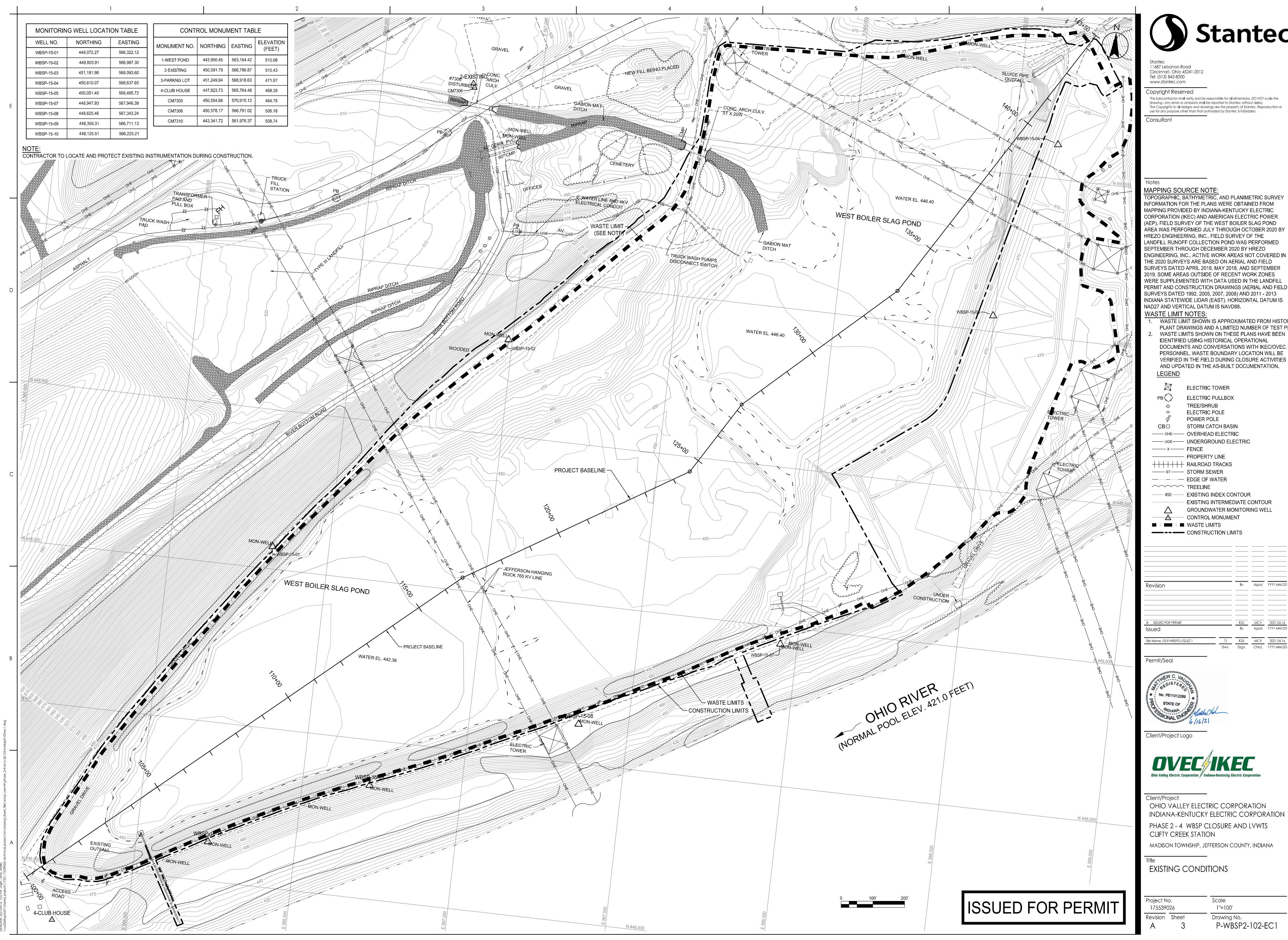
APPURTENANCES AND FINAL CAP CONSTRUCTION. PHASE 4A WORK CONSISTS OF CLOSURE-IN-PLACE,

ENGINEERING, INC.. ACTIVE WORK AREAS NOT COVERED IN THE 2020 SURVEYS ARE BASED ON AERIAL AND FIELD SURVEYS DATED APRIL 2018, MAY 2018, AND SEPTEMBER 2019. SOME AREAS OUTSIDE OF RECENT WORK ZONES WERE SUPPLEMENTED WITH DATA USED IN THE LANDFILL PERMIT AND CONSTRUCTION DRAWINGS (AERIAL AND FIELD SURVEYS DATED 1992, 2005, 2007, 2008) AND 2011 - 2013 INDIANA STATEWIDE LIDAR (EAST). HORIZONTAL DATUM IS NAD27 AND VERTICAL DATUM IS NAVD88.

MAPPING SOURCE NOTE: TOPOGRAPHIC, BATHYMETRIC, AND PLANIMETRIC SURVEY INFORMATION FOR THE PLANS WERE OBTAINED FROM MAPPING PROVIDED BY INDIANA-KENTUCKY ELECTRIC CORPORATION (IKEC) AND AMERICAN ELECTRIC POWER (AEP). FIELD SURVEY OF THE WEST BOILER SLAG POND AREA WAS PERFORMED JULY THROUGH OCTOBER 2020 BY HREZO ENGINEERING, INC.. FIELD SURVEY OF THE LANDFILL RUNOFF COLLECTION POND WAS PERFORMED SEPTEMBER THROUGH DECEMBER 2020 BY HREZO

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Consultant



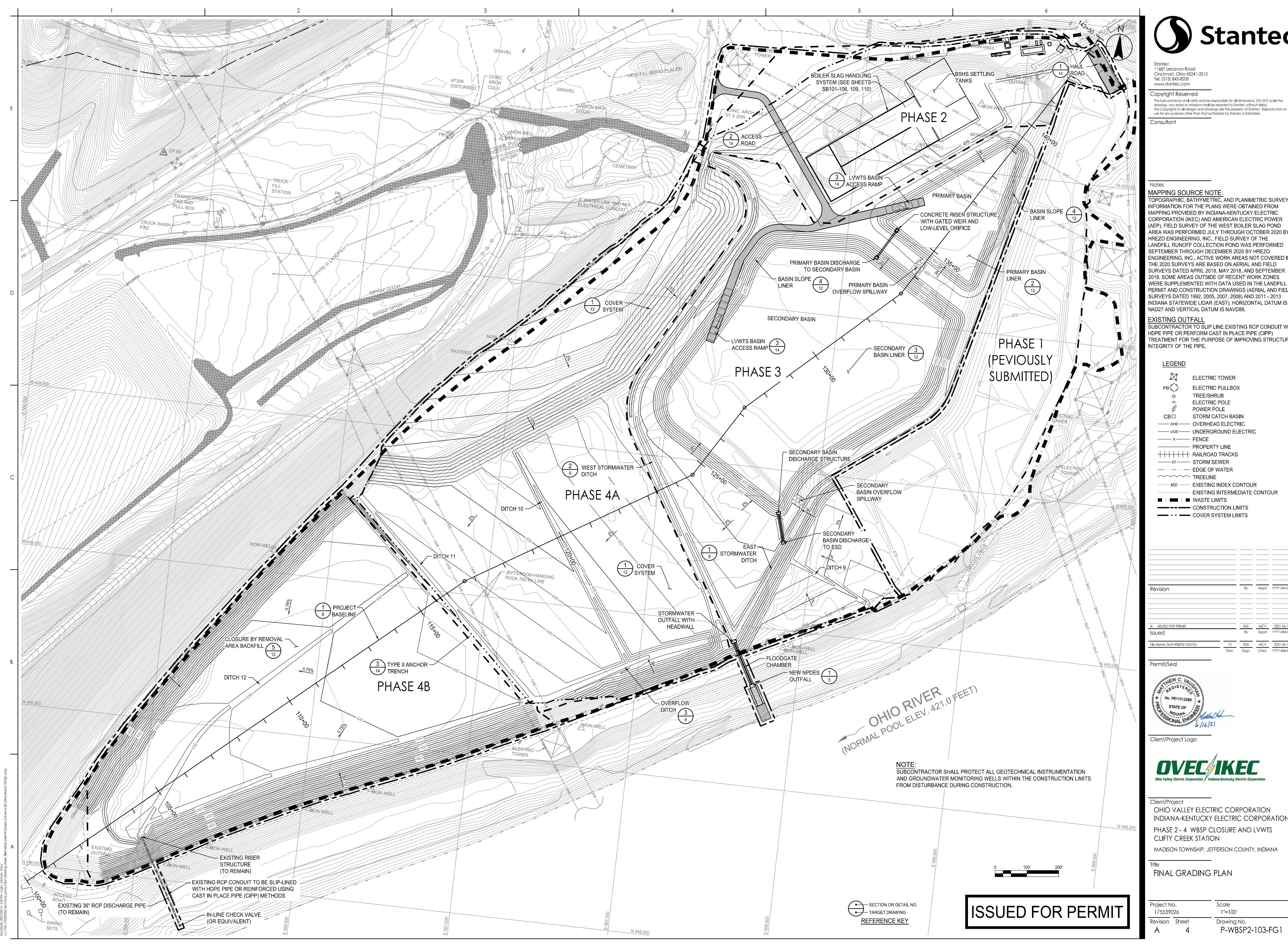
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EXISTING INTERM GROUNDWATER I CONTROL MONUN WASTE LIMITS CONSTRUCTION L	MONITOR MENT		
sion	By 	Appd 	YYYY.MM.DD 

<u> </u>	
∍в	ELECTRIC PULLBOX
÷	TREE/SHRUB
-0-	ELECTRIC POLE
$\phi$	POWER POLE
CB□	STORM CATCH BASIN
	OVERHEAD ELECTRIC
— UGE——	UNDERGROUND ELECTRIC
X	FENCE
	PROPERTY LINE
	RAILROAD TRACKS
ST	STORM SEWER
· · · · <u> </u>	EDGE OF WATER
$\sim$	TREELINE
— 450 ——	EXISTING INDEX CONTOUR
	EXISTING INTERMEDIATE CONTOUR
$\triangle$	GROUNDWATER MONITORING WELL
$\overline{\Delta}$	CONTROL MONUMENT
	WASTE LIMITS
	CONSTRUCTION LIMITS

WASTE LIMIT SHOWN IS APPROXIMATED FROM HISTORIC PLANT DRAWINGS AND A LIMITED NUMBER OF TEST PITS. WASTE LIMITS SHOWN ON THESE PLANS HAVE BEEN DOCUMENTS AND CONVERSATIONS WITH IKEC/OVEC PERSONNEL. WASTE BOUNDARY LOCATION WILL BE VERIFIED IN THE FIELD DURING CLOSURE ACTIVITIES

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Drawing No. P-WBSP2-103-FG1

MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

INDIANA-KENTUCKY ELECTRIC CORPORATION

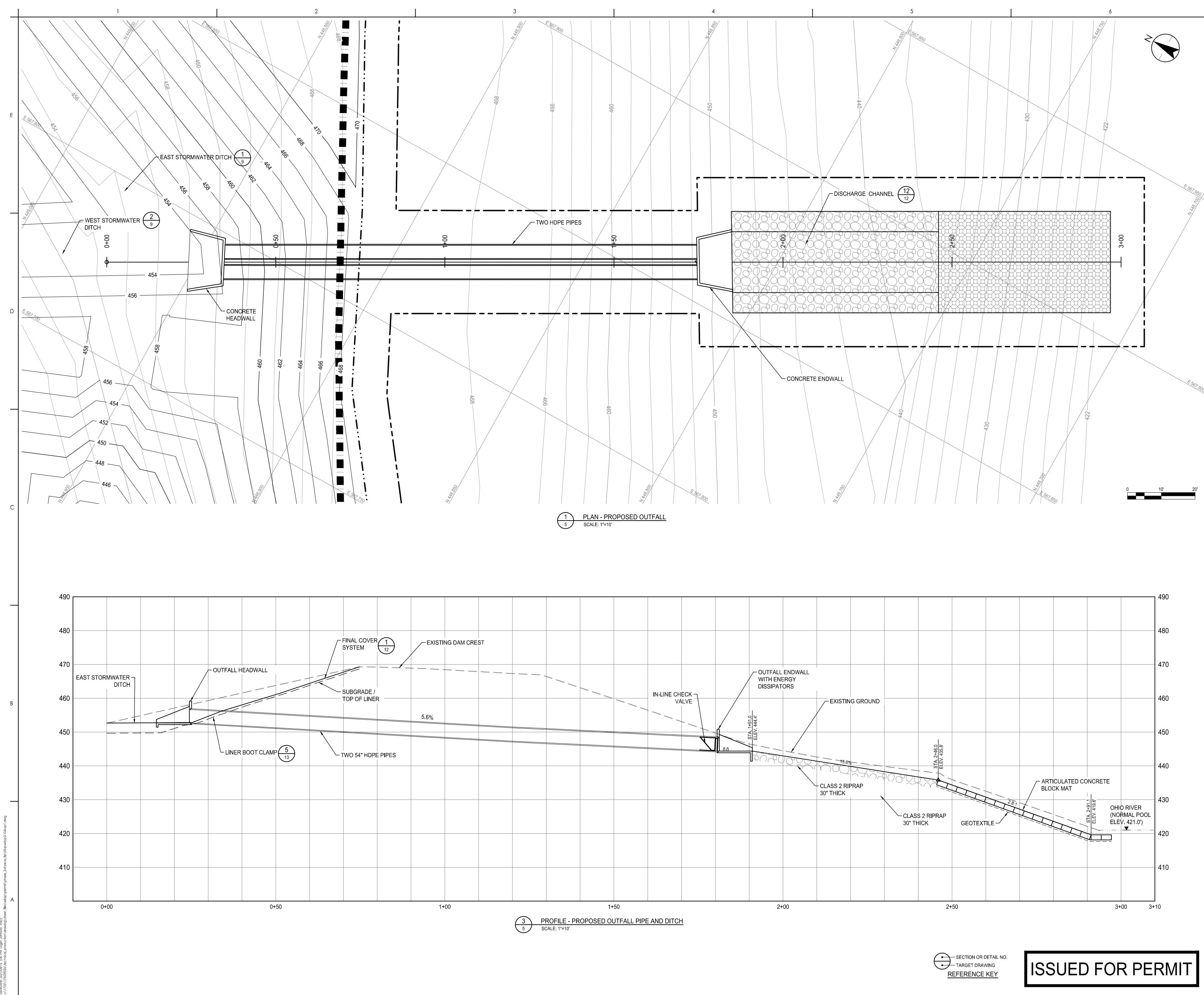
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~	
- <u>-</u> -	ELECTRIC POLE
φ	POWER POLE
CB□	STORM CATCH BASIN
OHE	OVERHEAD ELECTRIC
— UGE——	UNDERGROUND ELECTRIC
X	FENCE
	PROPERTY LINE
+ + + + + +	RAILROAD TRACKS
ST	STORM SEWER
	EDGE OF WATER
$\sim\sim\sim$	TREELINE
— 450 ——	EXISTING INDEX CONTOUR
	EXISTING INTERMEDIATE CONTOUR
	WASTE LIMITS
	CONSTRUCTION LIMITS
_ · ·	COVER SYSTEM LIMITS

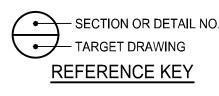
	TO SLIP LINE EXISTING RCP CONDUIT WITH RFORM CAST IN PLACE PIPE (CIPP)
	THE PURPOSE OF IMPROVING STRUCTURAL
RITY OF THE	E PIPE.
LEGEND	
<b>e</b>	
$\bowtie$	ELECTRIC TOWER
РВ	ELECTRIC PULLBOX
Ð	TREE/SHRUB
-0-	ELECTRIC POLE
ф	POWER POLE
CB	STORM CATCH BASIN
OHE	OVERHEAD ELECTRIC

AEP). FIELD SURVEY OF THE WEST BOILER SLAG POND AREA WAS PERFORMED JULY THROUGH OCTOBER 2020 BY ANDFILL RUNOFF COLLECTION POND WAS PERFORMED NGINEERING, INC.. ACTIVE WORK AREAS NOT COVERED IN URVEYS DATED APRIL 2018, MAY 2018, AND SEPTEMBER 2019. SOME AREAS OUTSIDE OF RECENT WORK ZONES VERE SUPPLEMENTED WITH DATA USED IN THE LANDFILL ERMIT AND CONSTRUCTION DRAWINGS (AERIAL AND FIELD SURVEYS DATED 1992, 2005, 2007, 2008) AND 2011 - 2013 NDIANA STATEWIDE LIDAR (EAST). HORIZONTAL DATUM IS

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Title

## EXISTING AND PROPOSED OUTFALL PLANS AND PROFILE

Scale

PHASE 2 - 4 WBSP CLOSURE AND LVWTS CLIFTY CREEK STATION MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Client/Project OHIO VALLEY ELECTRIC CORPORATION INDIANA-KENTUCKY ELECTRIC CORPORATION





File Name: 05-P-WBSP2-104-OP1

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POWER POLE STORM CATCH BASIN CB□ ----- OVERHEAD ELECTRIC ------ UNDERGROUND ELECTRIC ——×—— FENCE ------ PROPERTY LINE ++++ RAILROAD TRACKS — ··· — EDGE OF WATER 450 ----- EXISTING INDEX CONTOUR - EXISTING INTERMEDIATE CONTOUR 🔳 🗆 💷 🗉 🖬 WASTE LIMITS ----- CONSTRUCTION LIMITS 

ELECTRIC TOWER

ELECTRIC PULLBOX

TREE/SHRUB ELECTRIC POLE

LEGEND	

K.

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MAPPING SOURCE NOTE: TOPOGRAPHIC, BATHYMETRIC, AND PLANIMETRIC SURVEY INFORMATION FOR THE PLANS WERE OBTAINED FROM MAPPING PROVIDED BY INDIANA-KENTUCKY ELECTRIC CORPORATION (IKEC) AND AMERICAN ELECTRIC POWER (AEP). FIELD SURVEY OF THE WEST BOILER SLAG POND AREA WAS PERFORMED JULY THROUGH OCTOBER 2020 BY HREZO ENGINEERING, INC.. FIELD SURVEY OF THE LANDFILL RUNOFF COLLECTION POND WAS PERFORMED SEPTEMBER THROUGH DECEMBER 2020 BY HREZO ENGINEERING, INC.. ACTIVE WORK AREAS NOT COVERED IN THE 2020 SURVEYS ARE BASED ON AERIAL AND FIELD SURVEYS DATED APRIL 2018, MAY 2018, AND SEPTEMBER 2019. SOME AREAS OUTSIDE OF RECENT WORK ZONES WERE SUPPLEMENTED WITH DATA USED IN THE LANDFILL PERMIT AND CONSTRUCTION DRAWINGS (AERIAL AND FIELD SURVEYS DATED 1992, 2005, 2007, 2008) AND 2011 - 2013 INDIANA STATEWIDE LIDAR (EAST). HORIZONTAL DATUM IS NAD27 AND VERTICAL DATUM IS NAVD88.

Notes

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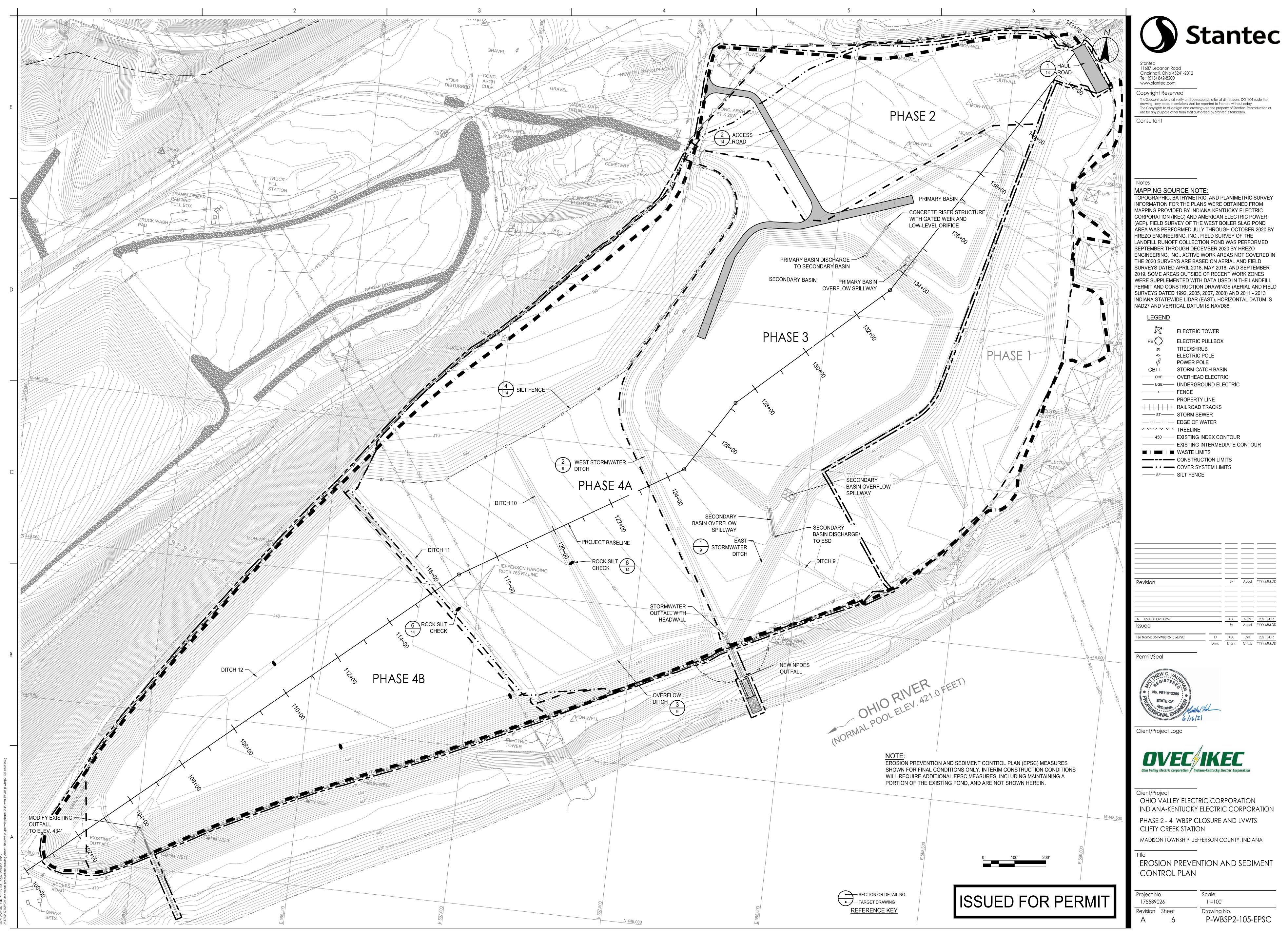
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Drawing No. P-WBSP2-105-EPSC

# EROSION PREVENTION AND SEDIMENT

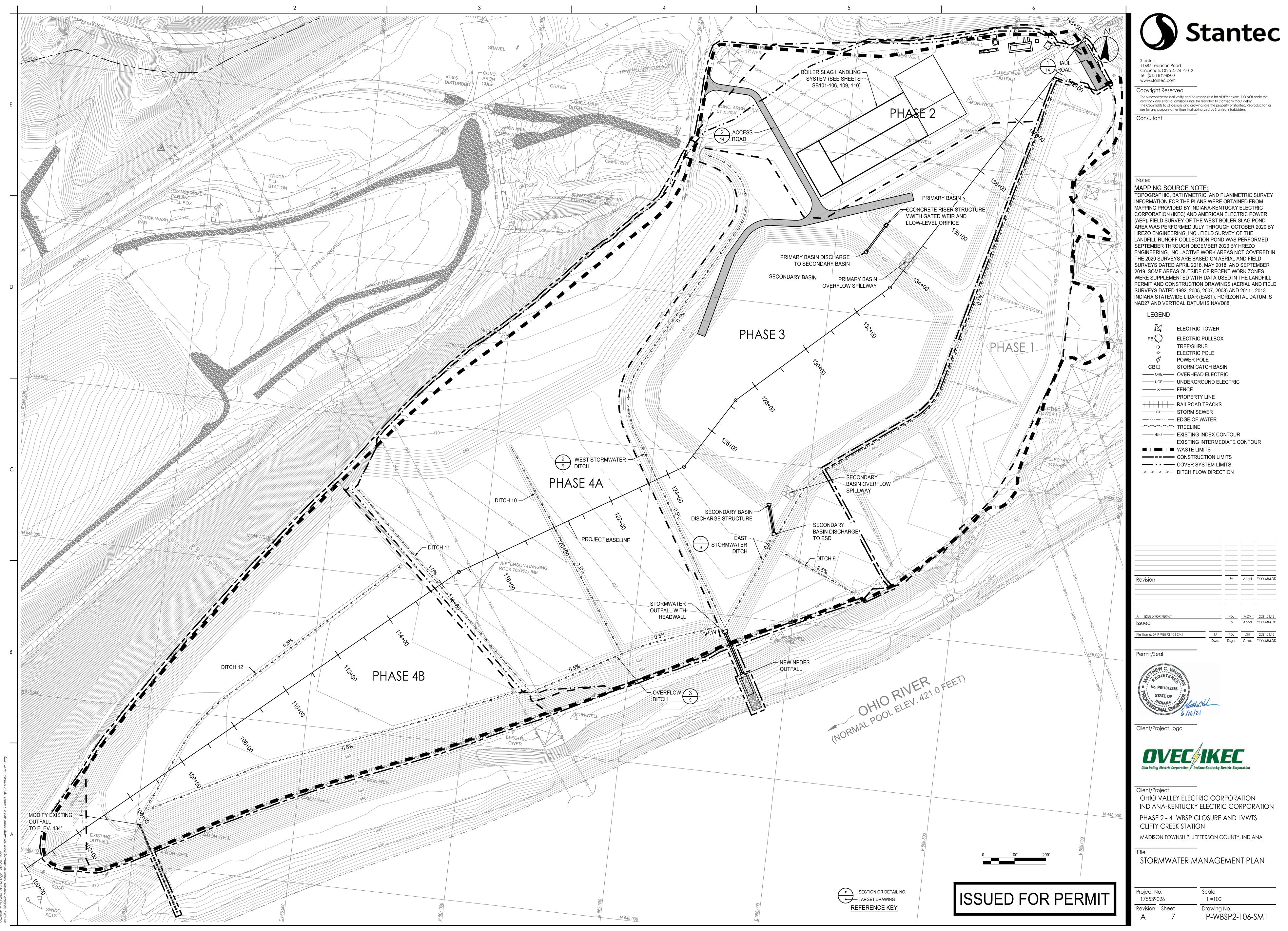
MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

INDIANA-KENTUCKY ELECTRIC CORPORATION

ANDFILL RUNOFF COLLECTION POND WAS PERFORMED URVEYS DATED APRIL 2018, MAY 2018, AND SEPTEMBEF 2019. SOME AREAS OUTSIDE OF RECENT WORK ZONES VERE SUPPLEMENTED WITH DATA USED IN THE LANDFILL SURVEYS DATED 1992, 2005, 2007, 2008) AND 2011 - 2013 INDIANA STATEWIDE LIDAR (EAST). HORIZONTAL DATUM IS

OPOGRAPHIC, BATHYMETRIC, AND PLANIMETRIC SURVEY FORMATION FOR THE PLANS WERE OBTAINED FROM AEP). FIELD SURVEY OF THE WEST BOILER SLAG POND AREA WAS PERFORMED JULY THROUGH OCTOBER 2020 BY NGINEERING, INC.. ACTIVE WORK AREAS NOT COVERED IN PERMIT AND CONSTRUCTION DRAWINGS (AERIAL AND FIELD

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Drawing No. P-WBSP2-106-SM1

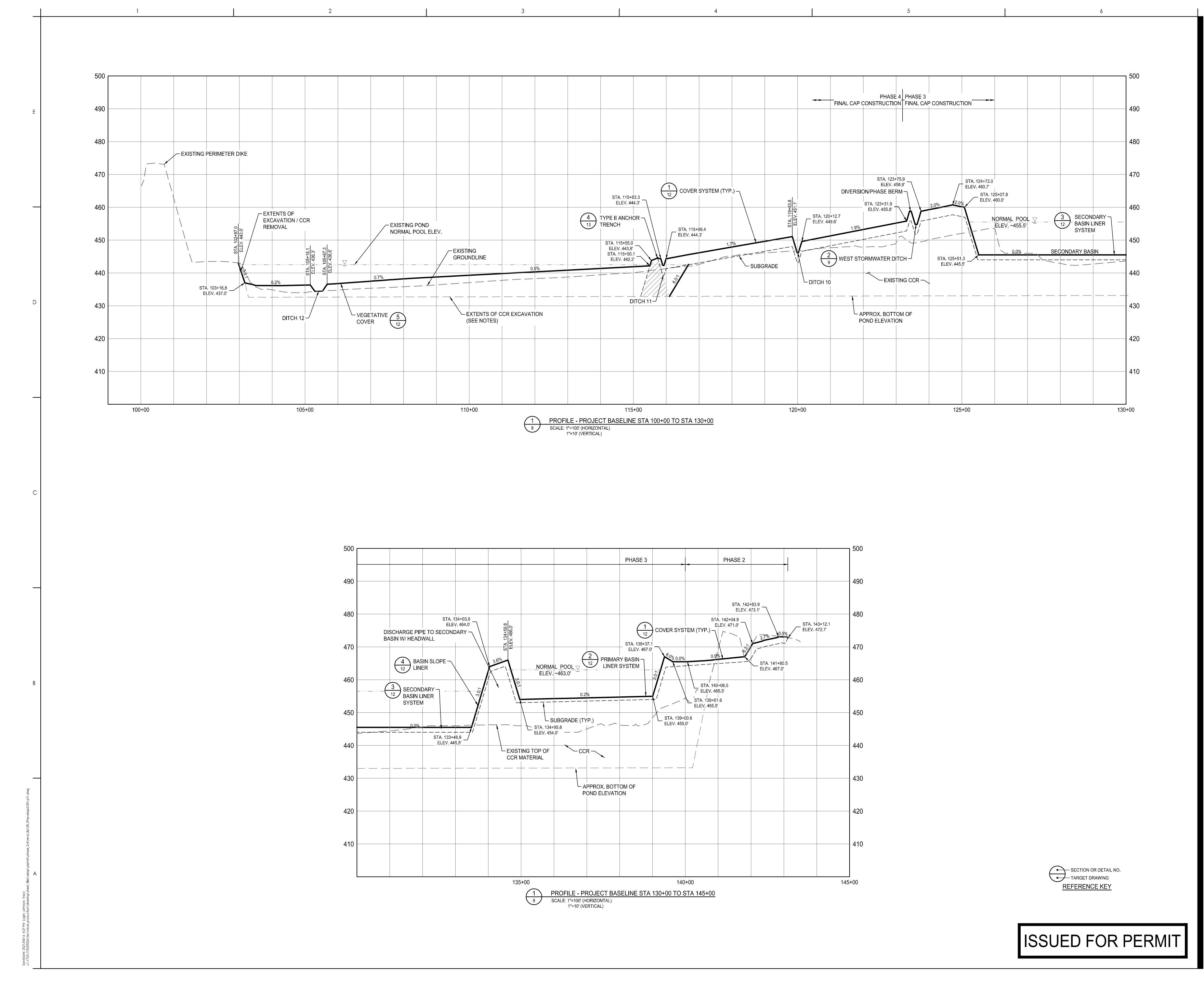
INDIANA-KENTUCKY ELECTRIC CORPORATION

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EXISTING INTERMEDIATE CONTOUR

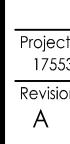
AREA WAS PERFORMED JULY THROUGH OCTOBER 2020 BY ANDFILL RUNOFF COLLECTION POND WAS PERFORMED NGINEERING, INC.. ACTIVE WORK AREAS NOT COVERED IN URVEYS DATED APRIL 2018, MAY 2018, AND SEPTEMBEF VERE SUPPLEMENTED WITH DATA USED IN THE LANDFILL PERMIT AND CONSTRUCTION DRAWINGS (AERIAL AND FIELD INDIANA STATEWIDE LIDAR (EAST). HORIZONTAL DATUM IS

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# Client/Project

OHIO VALLEY ELECTRIC CORPORATION INDIANA-KENTUCKY ELECTRIC CORPORATION PHASE 2 - 4 WBSP CLOSURE AND LVWTS CLIFTY CREEK STATION MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA Title



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# as shown Drawing No. P-WSBP2-301-PF1

## PROFILES - PROJECT BASELINE

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BOTTOM SURFACE ELEVATION IS BASED ON HISTORIC DRAWING NUMBER 16-3002A-3. AFTER ALL VISIBLE CCR IS REMOVED, AN ADDITIONAL 6 INCHES OF SOIL WILL BE EXCAVATED.

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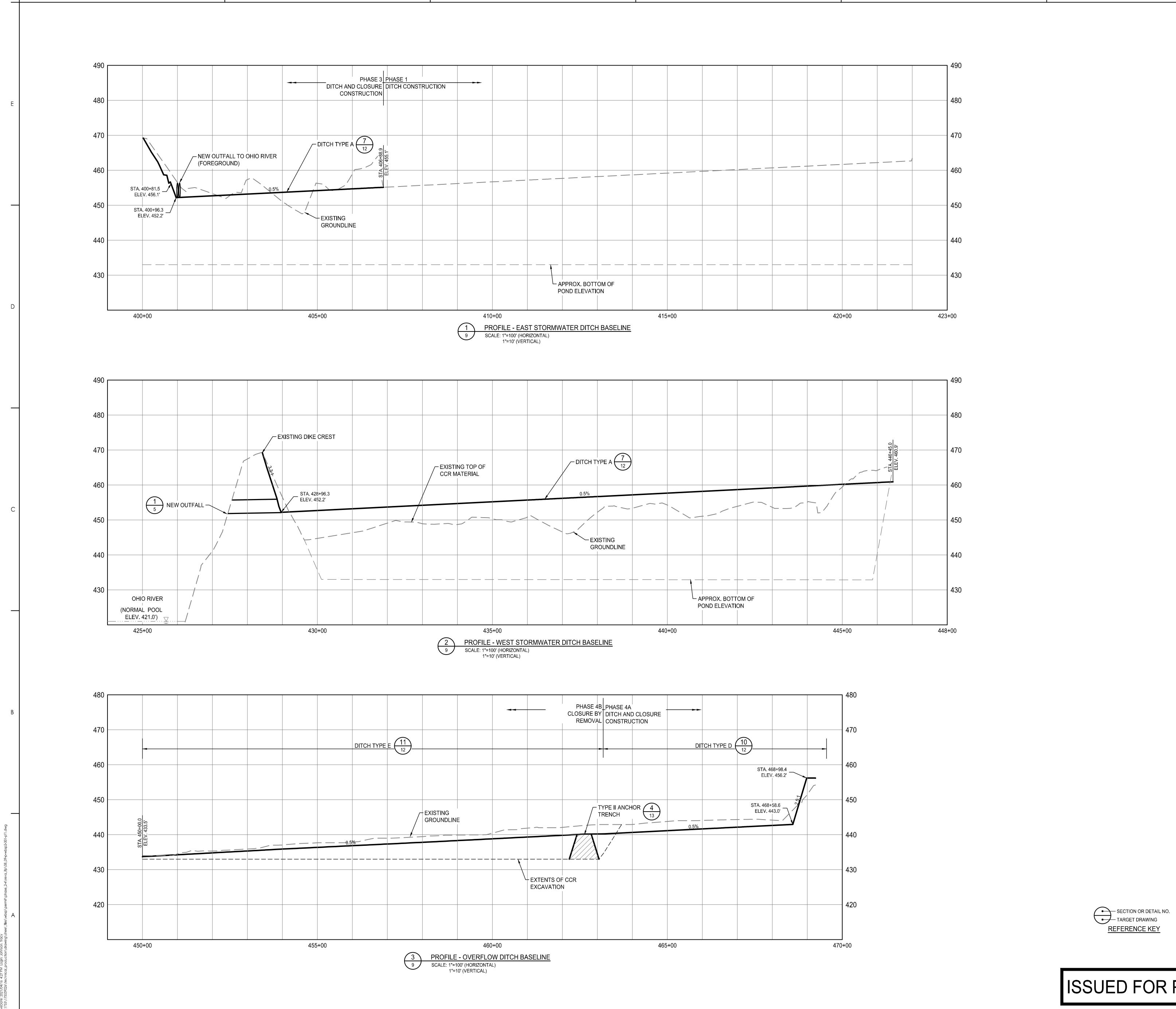
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### Title PROFILE - EAST, WEST STORWATER, AND OVERFLOW DITCHES

Scale

Client/Project OHIO VALLEY ELECTRIC CORPORATION INDIANA-KENTUCKY ELECTRIC CORPORATION PHASE 2 - 4 WBSP CLOSURE AND LVWTS CLIFTY CREEK STATION MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA



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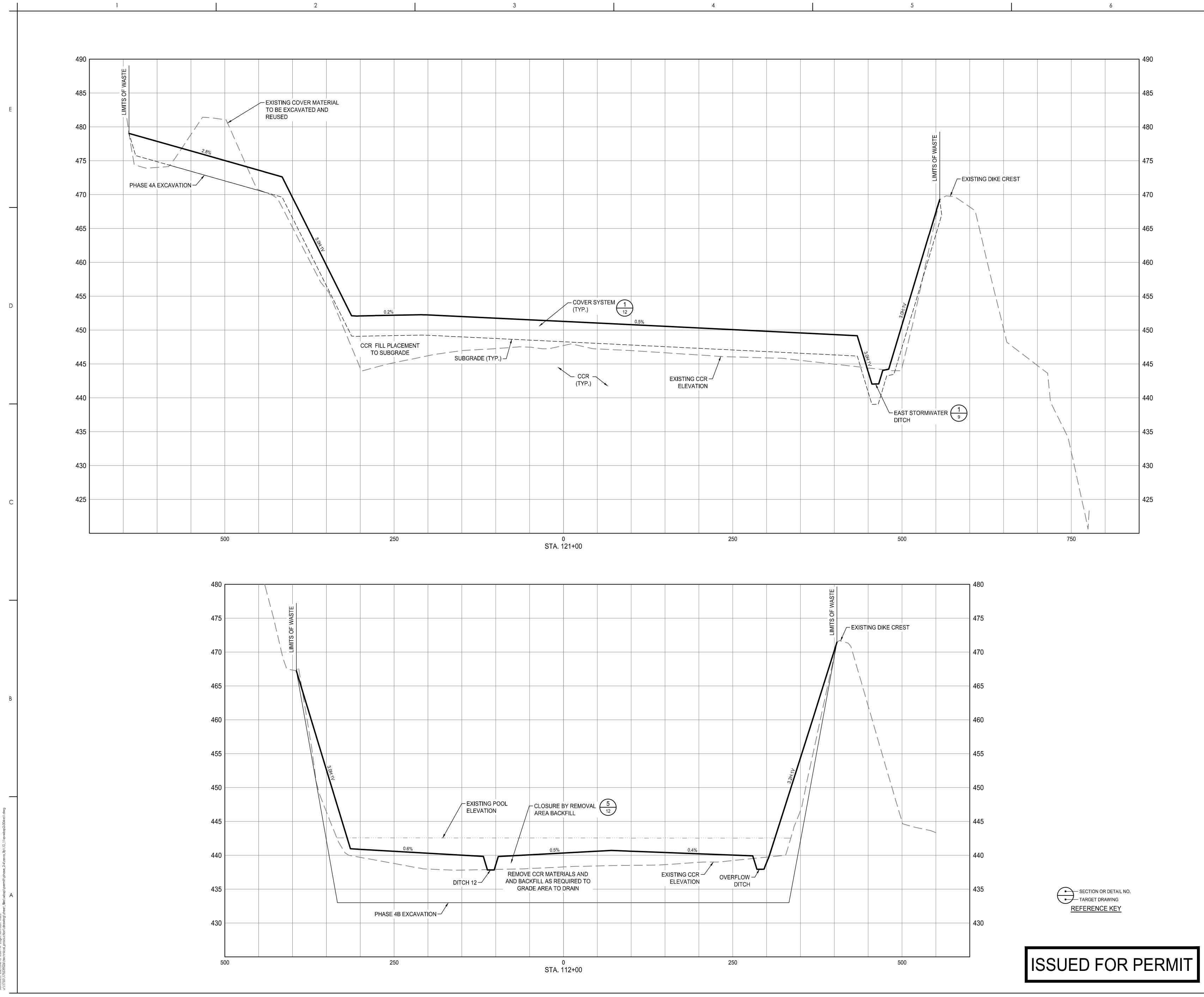
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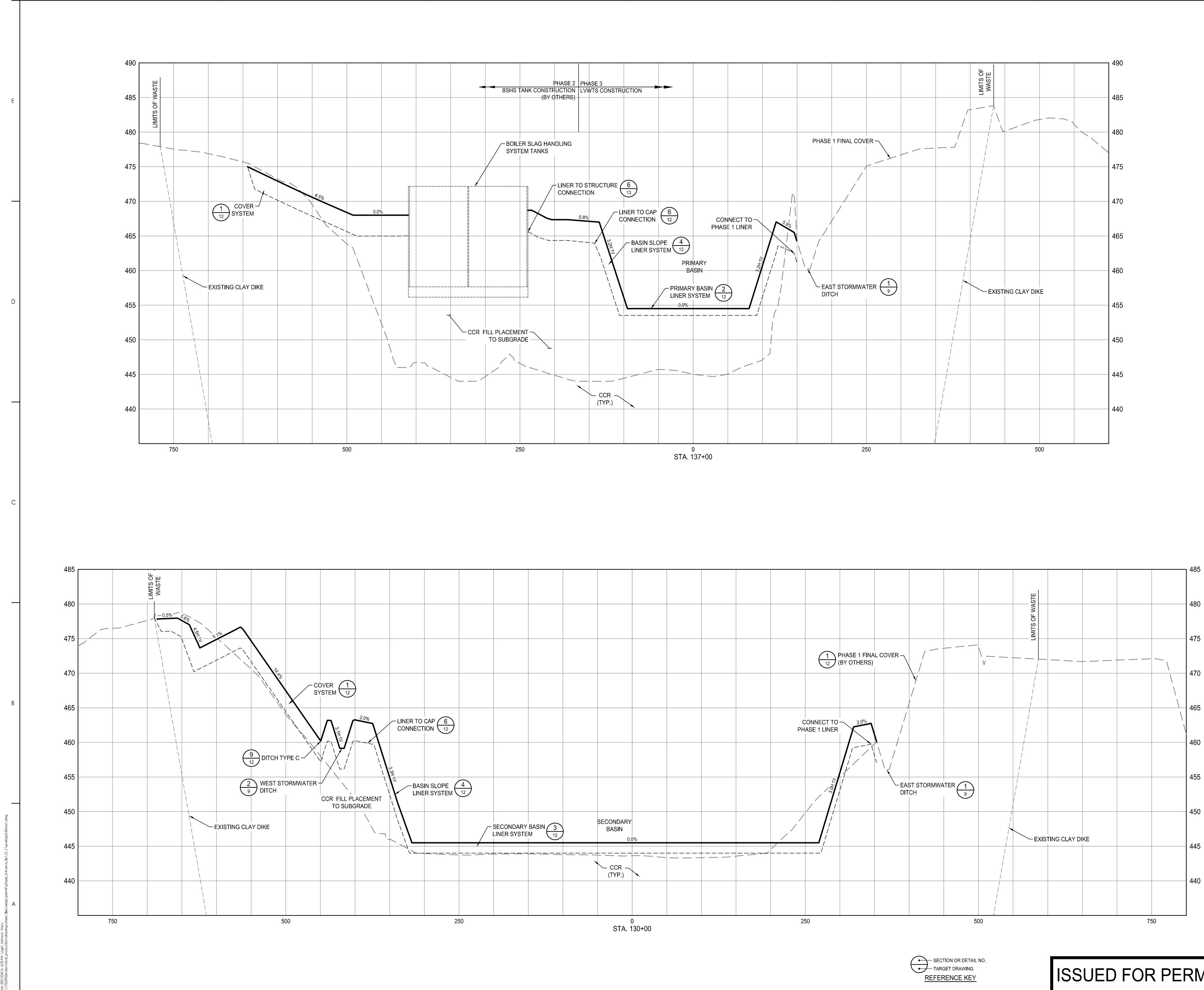
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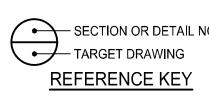
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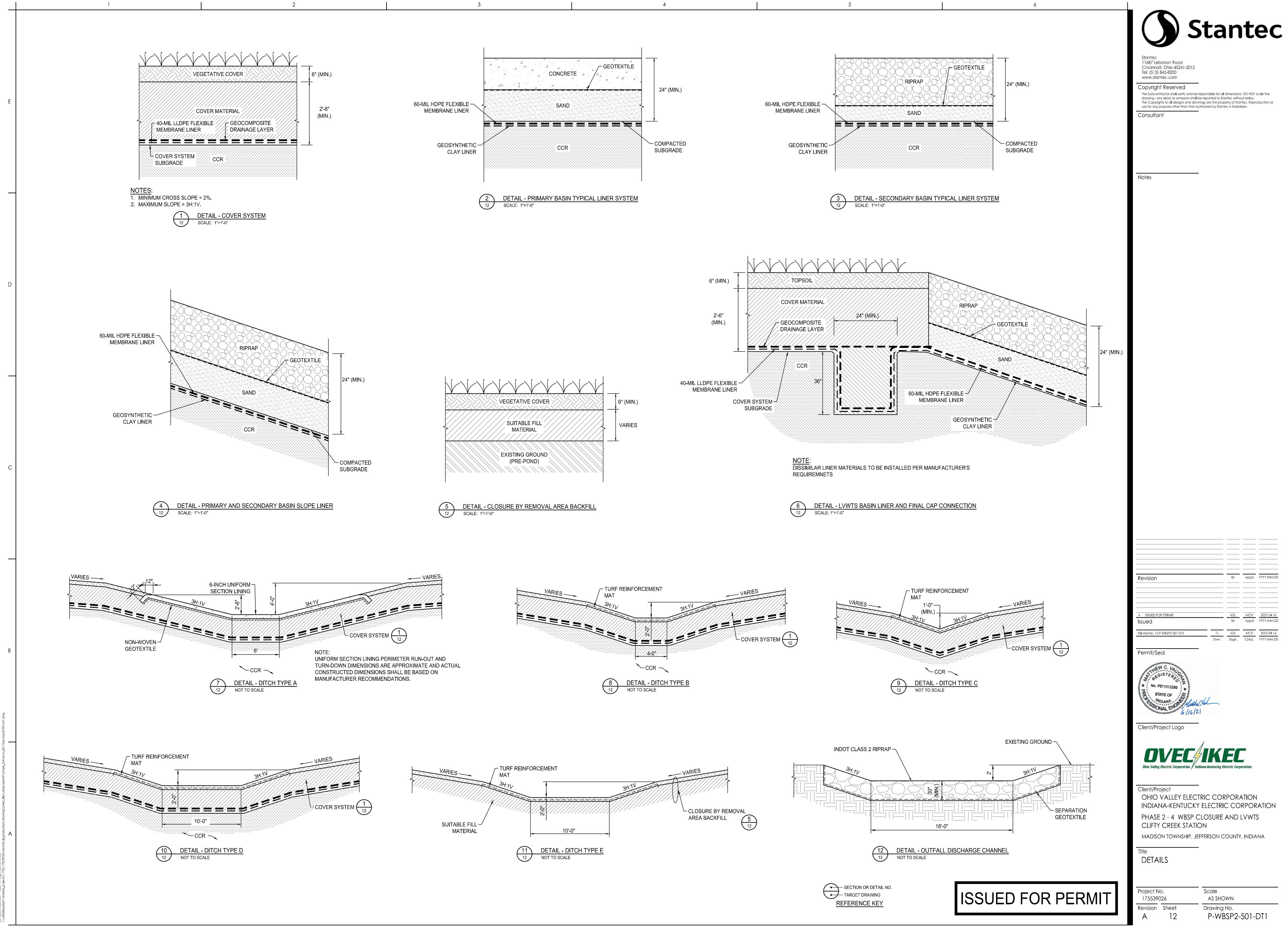
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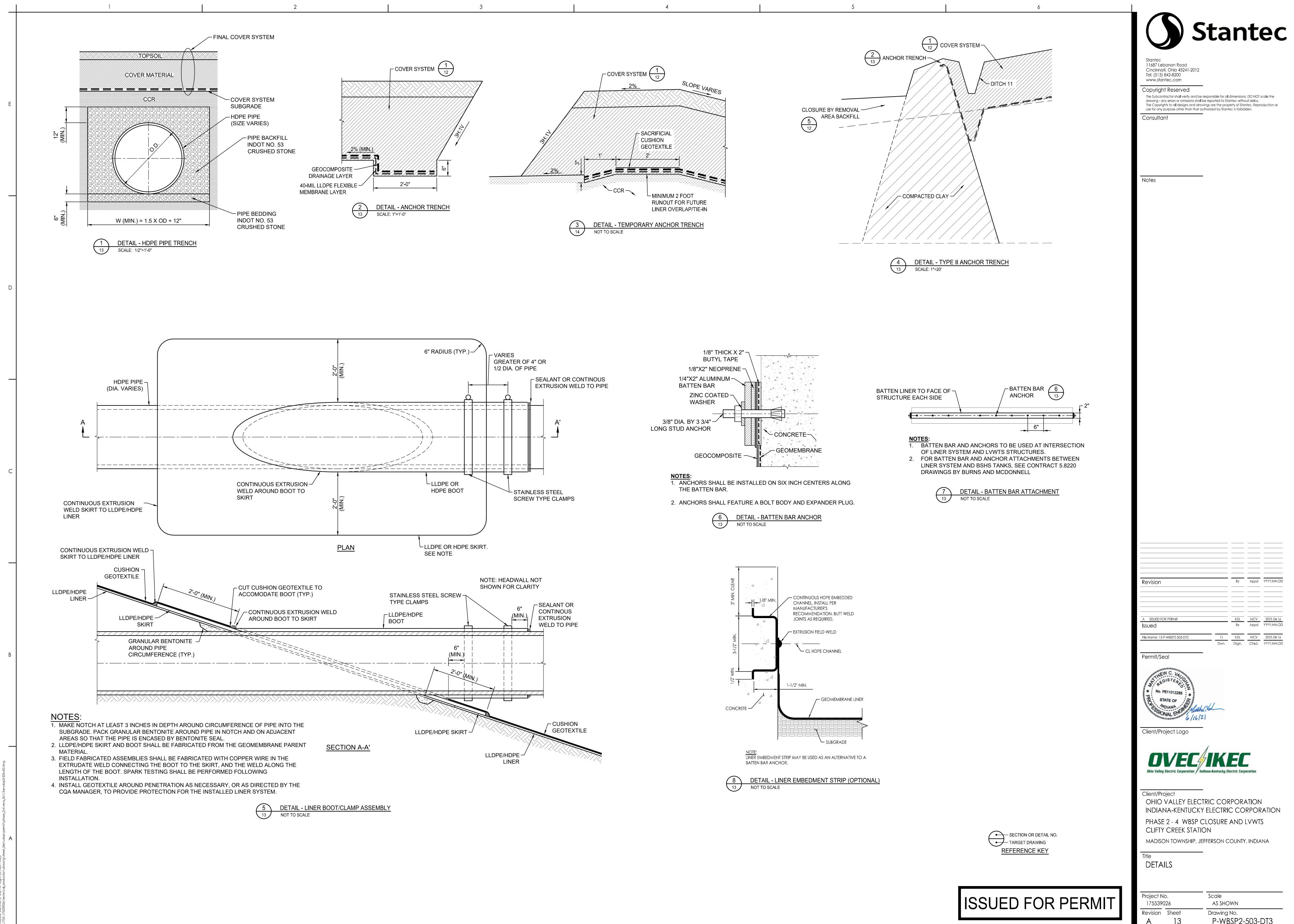
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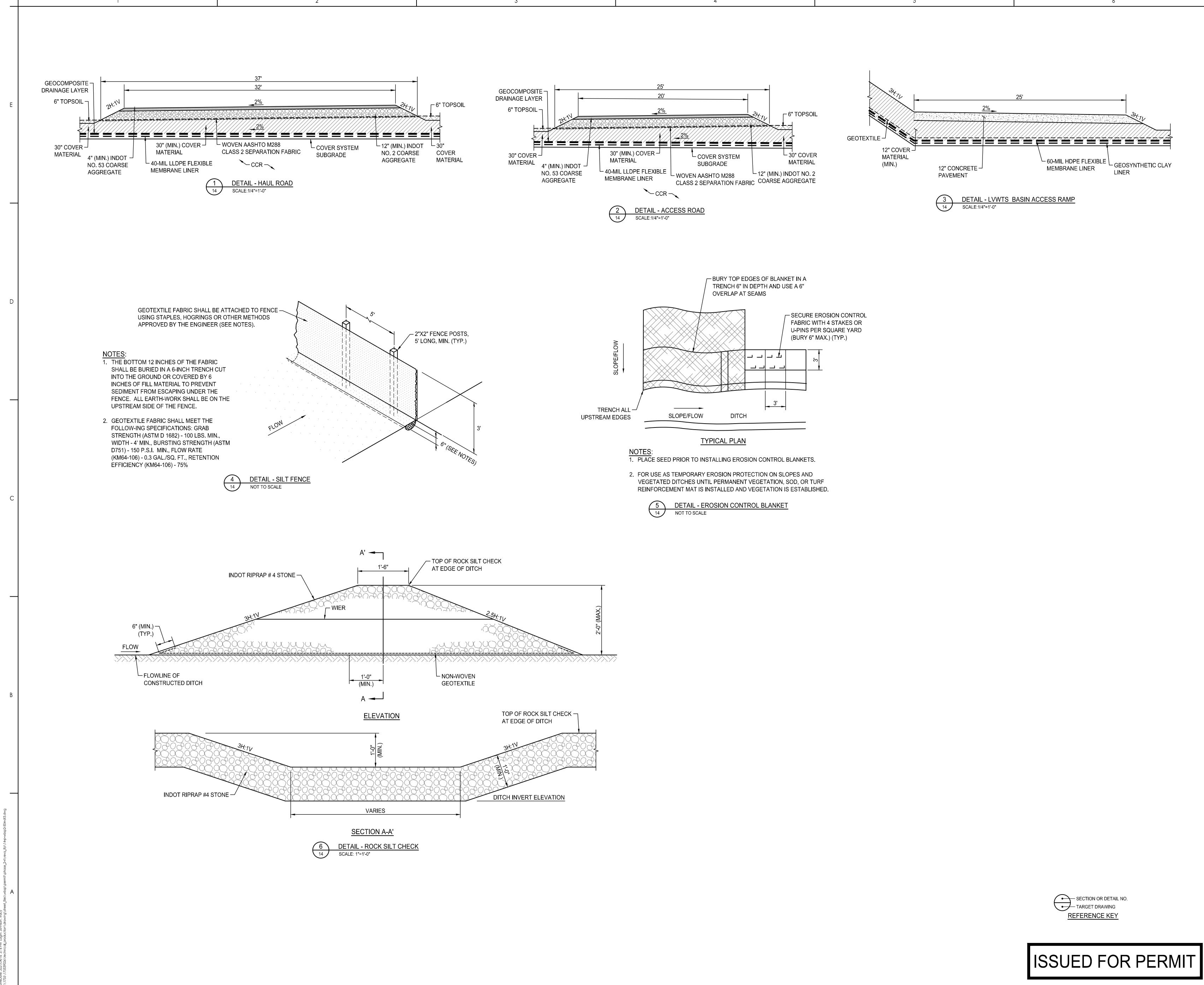


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INDIANA-KENTUCKY ELECTRIC CORPORATION MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

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# as shown Drawing No. P-WBSP2-504-DT4

## DETAILS

Title

Client/Project OHIO VALLEY ELECTRIC CORPORATION INDIANA-KENTUCKY ELECTRIC CORPORATION PHASE 2 - 4 WBSP CLOSURE AND LVWTS CLIFTY CREEK STATION MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

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File Name: 14-P-WBSP2-504-DT3

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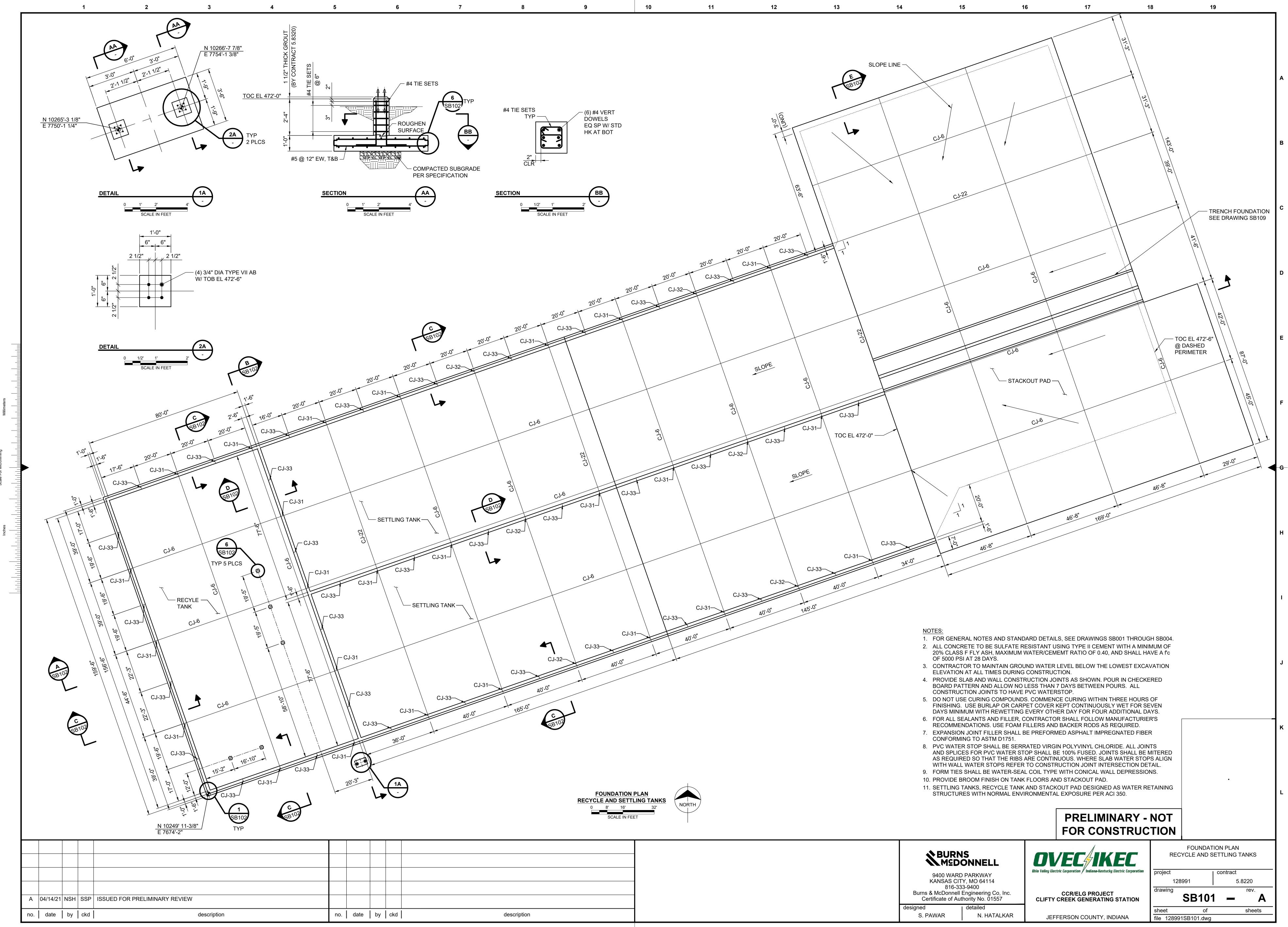
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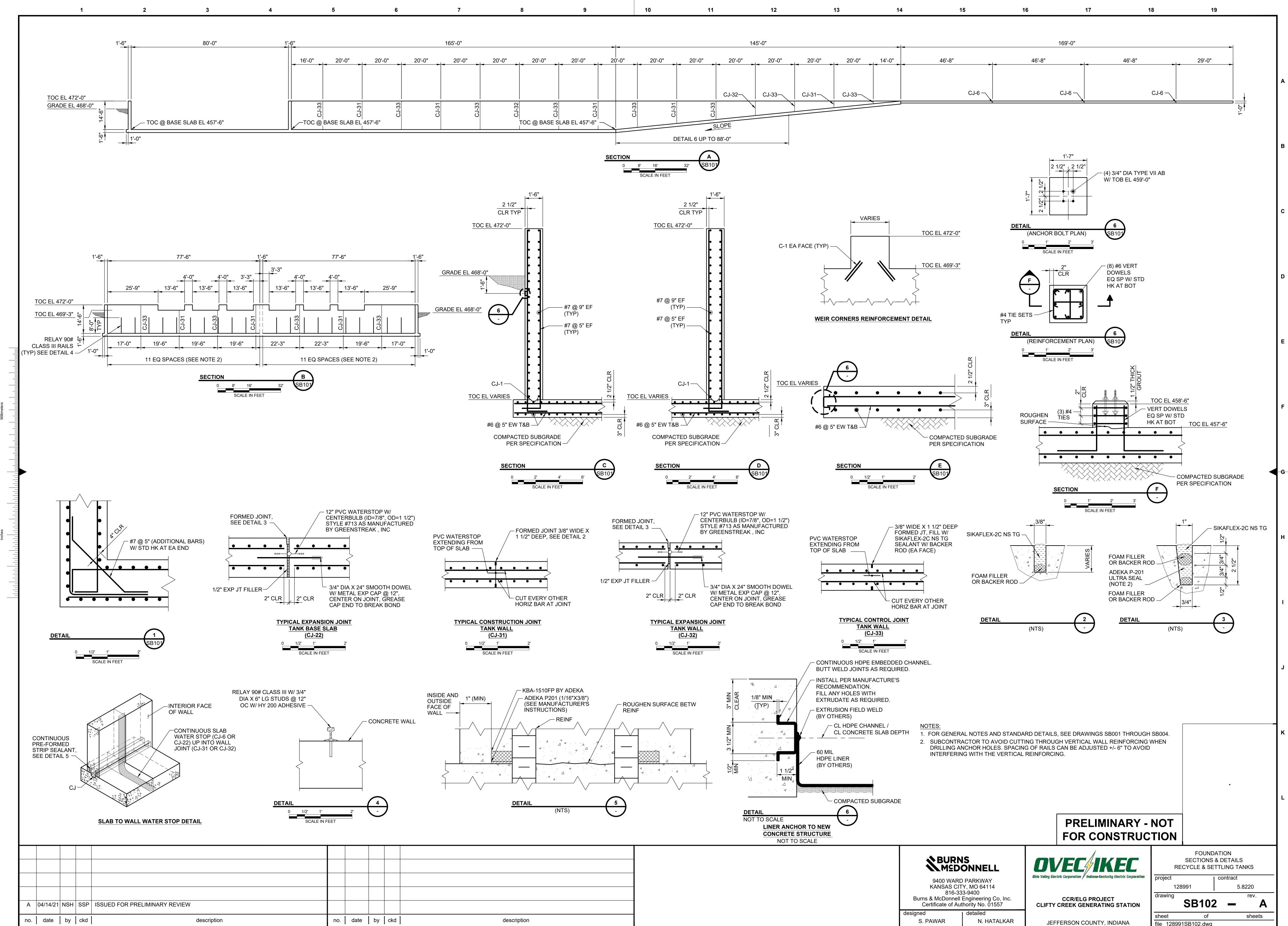
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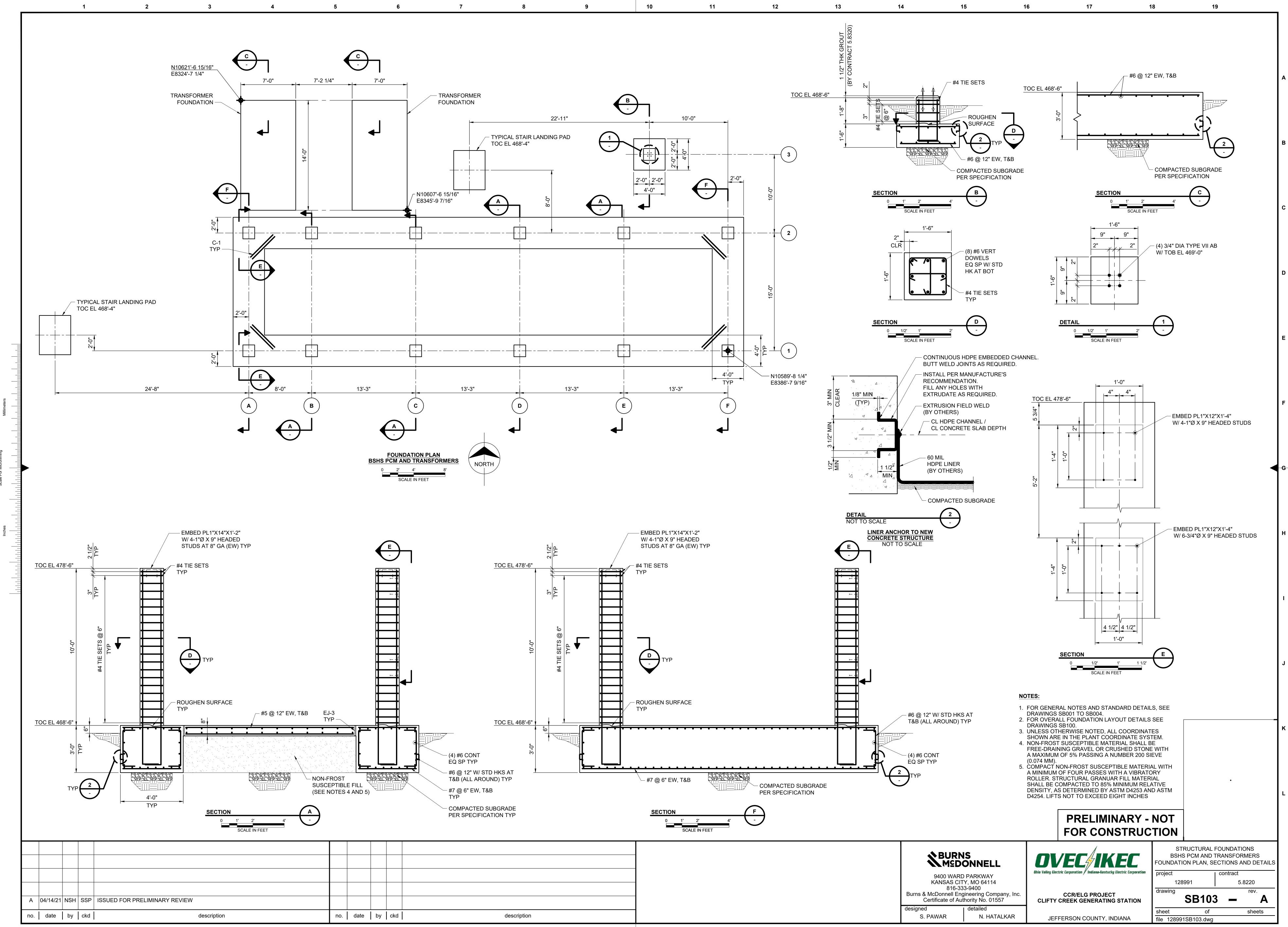
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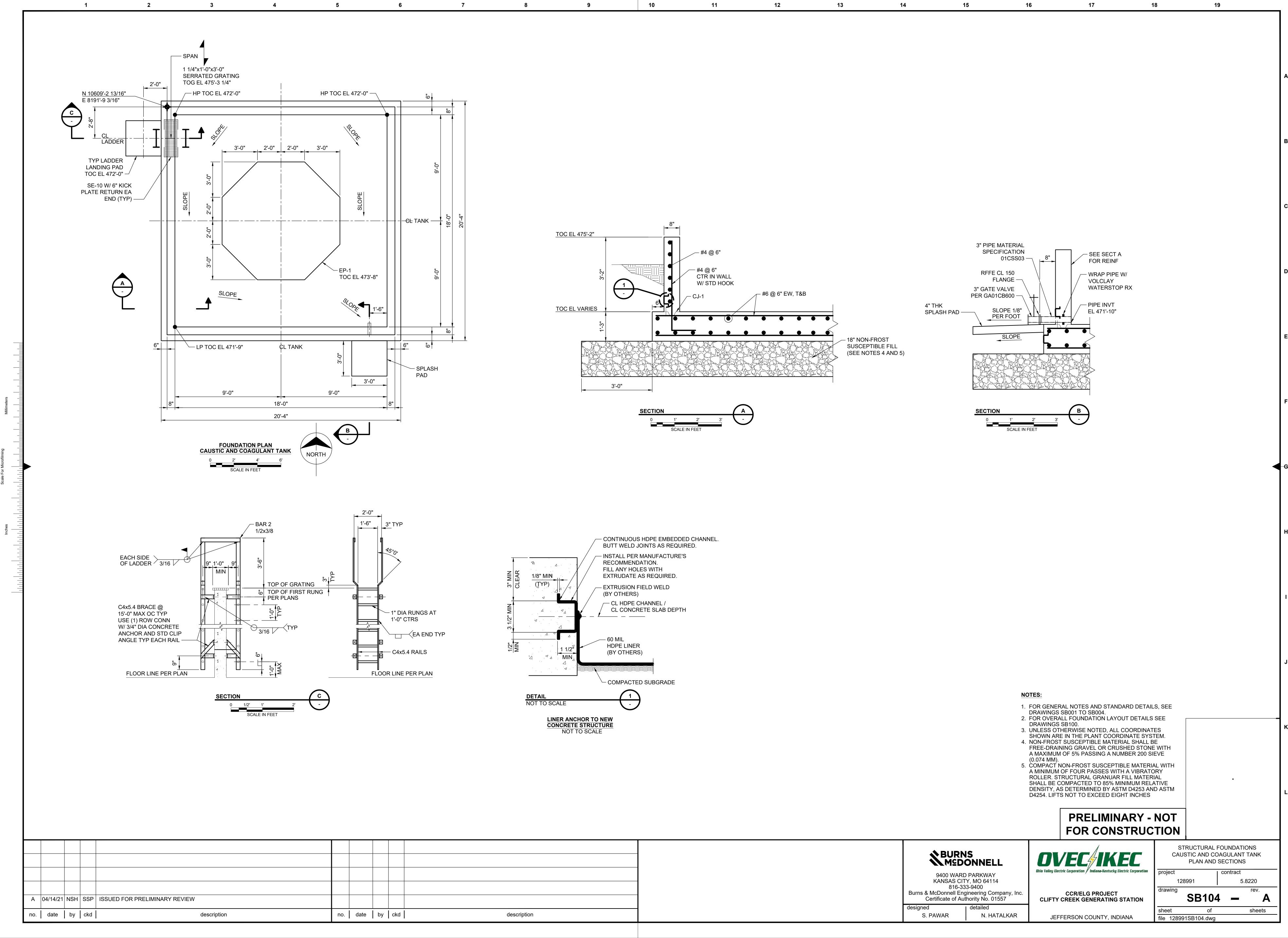
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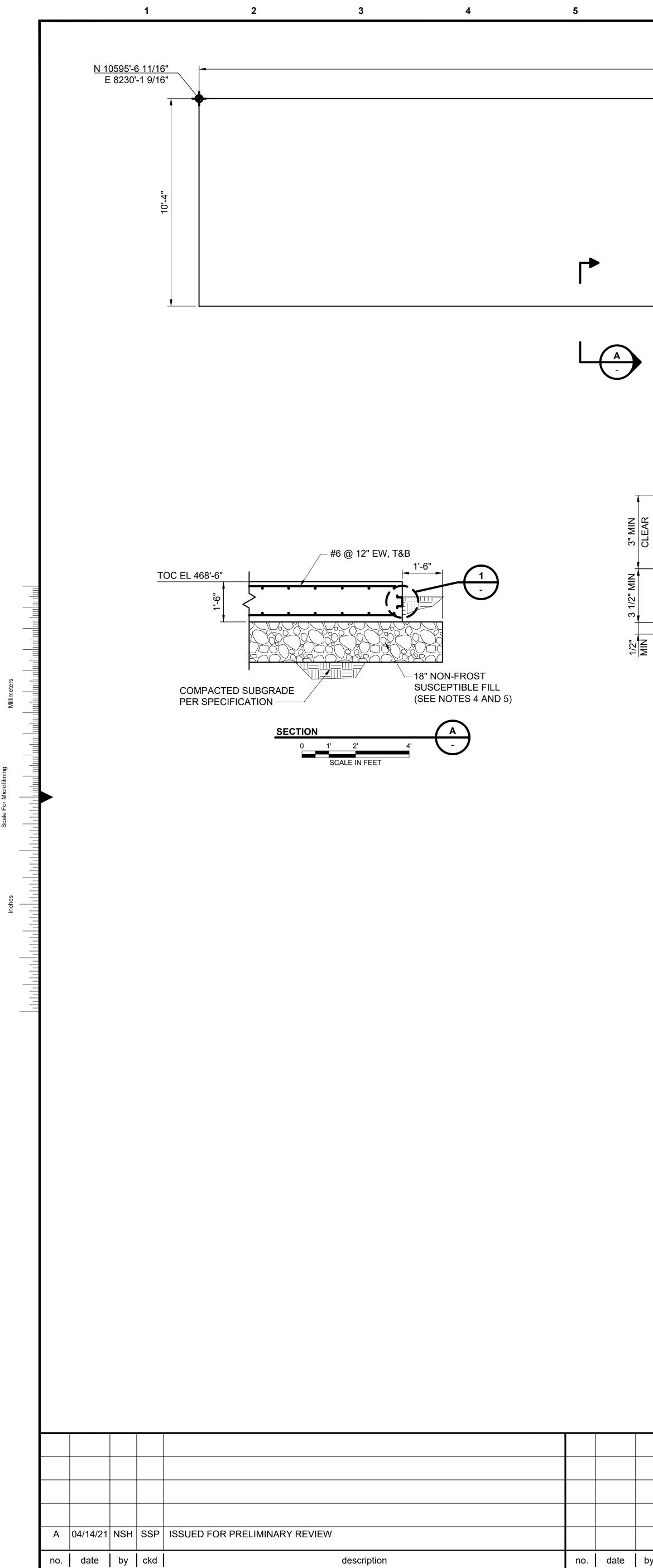
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		— CONTINUOUS HDPE E BUTT WELD JOINTS A	EMBEDDED CHANNEL. AS REQUIRED.			

- INSTALL PER MANUFACTURE'S

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CL CONCRETE SLAB DEPTH

RECOMMENDATION.

(BY OTHERS)

\_\_\_\_\_

HDPE LINER

(BY OTHERS)

- 60 MIL

FILL ANY HOLES WITH

- EXTRUSION FIELD WELD

/--- CL HDPE CHANNEL /

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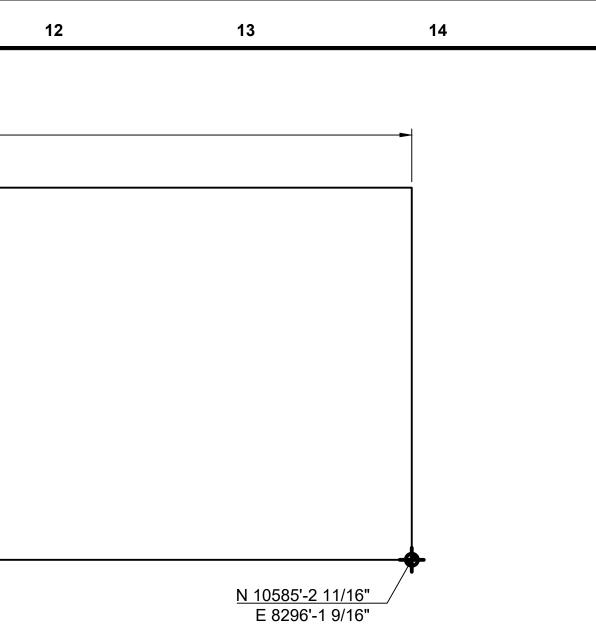
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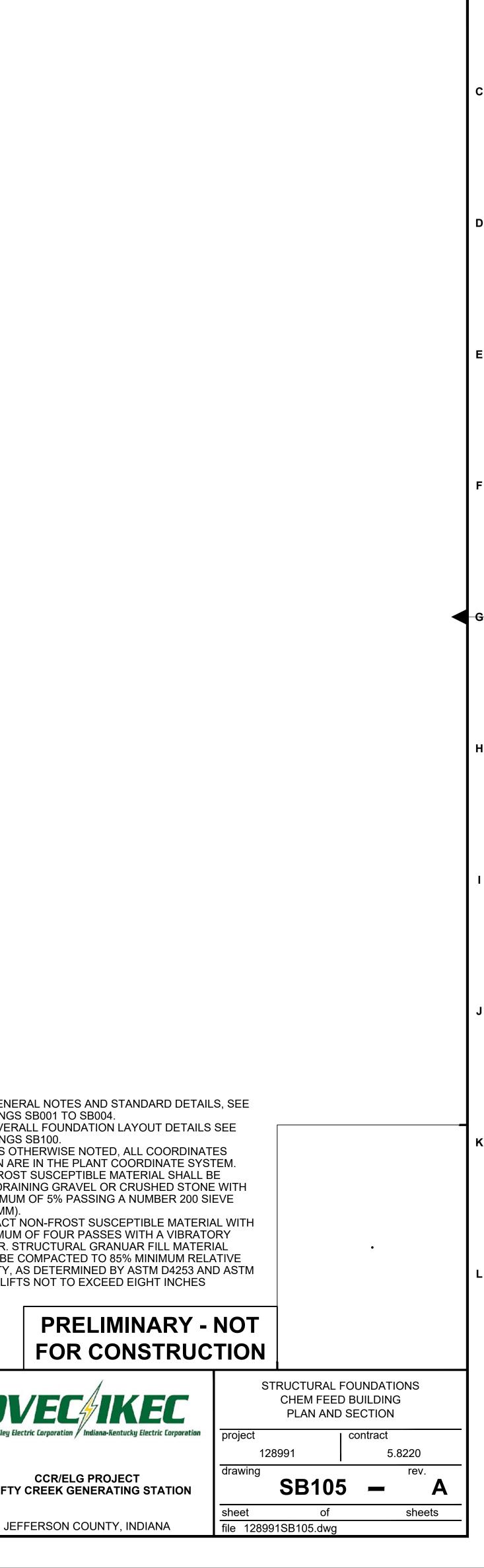


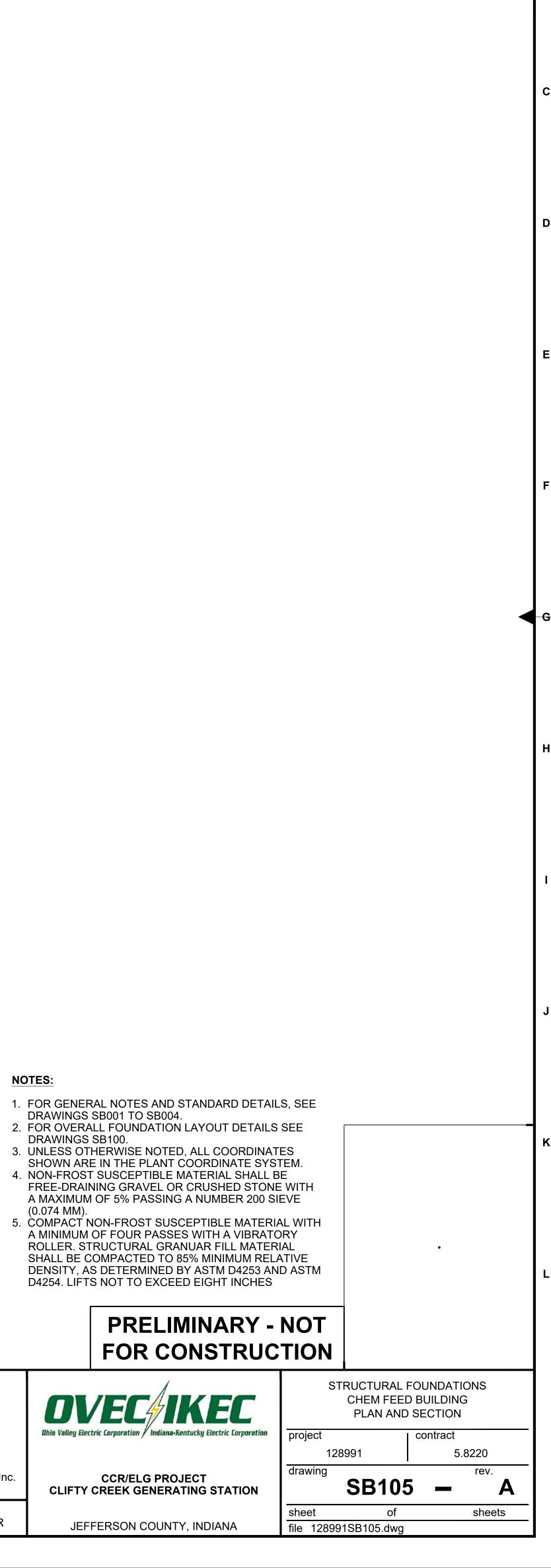
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#### NOTES:

- DRAWINGS SB001 TO SB004.

- 4. NON-FROST SUSCEPTIBLE MATERIAL SHALL BE (0.074 MM).
- D4254. LIFTS NOT TO EXCEED EIGHT INCHES







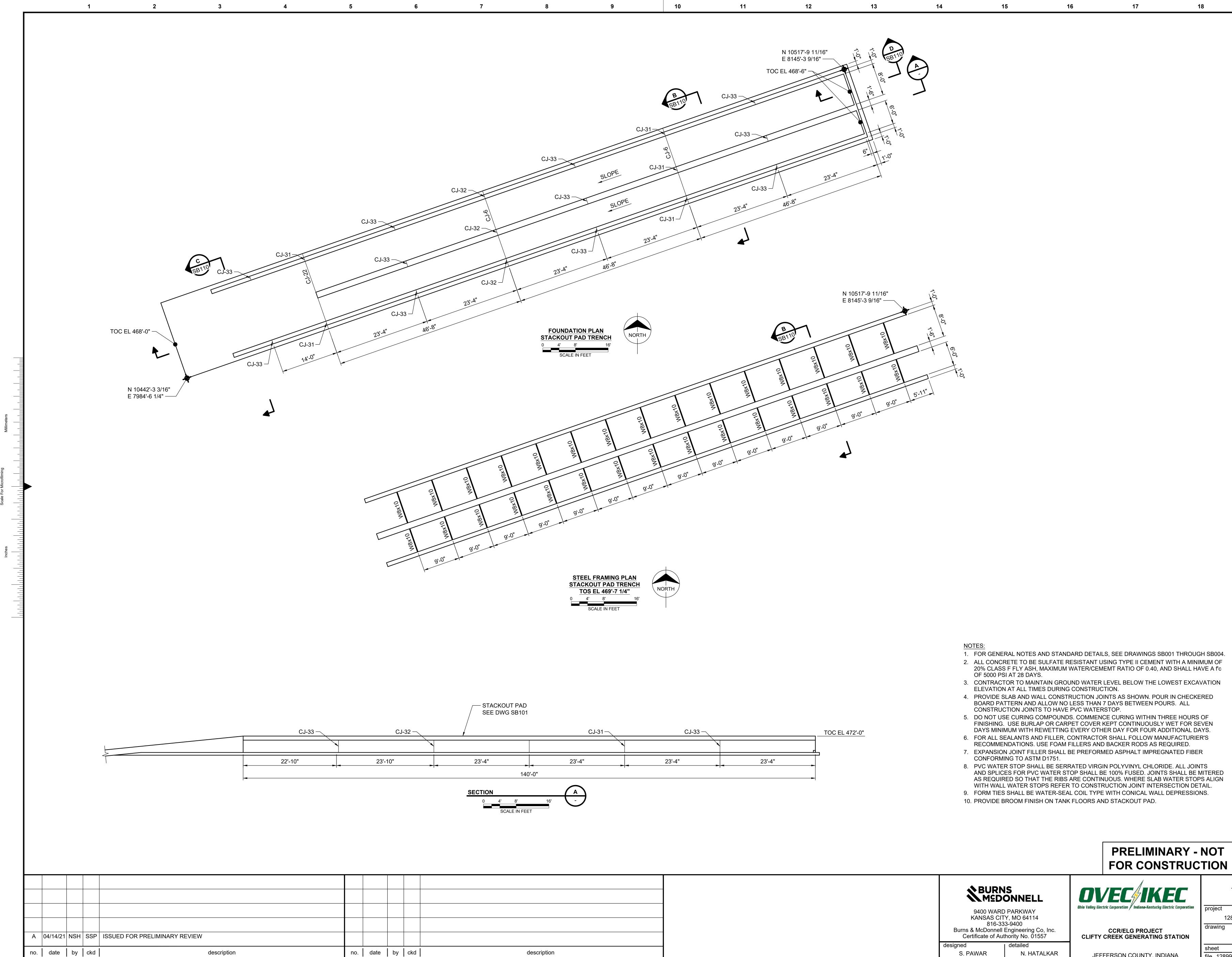
Burns & McDonnell Engineering Company, Inc. Certificate of Authority No. 01557

detailed

N. HATALKAR

designed

S. PAWAR



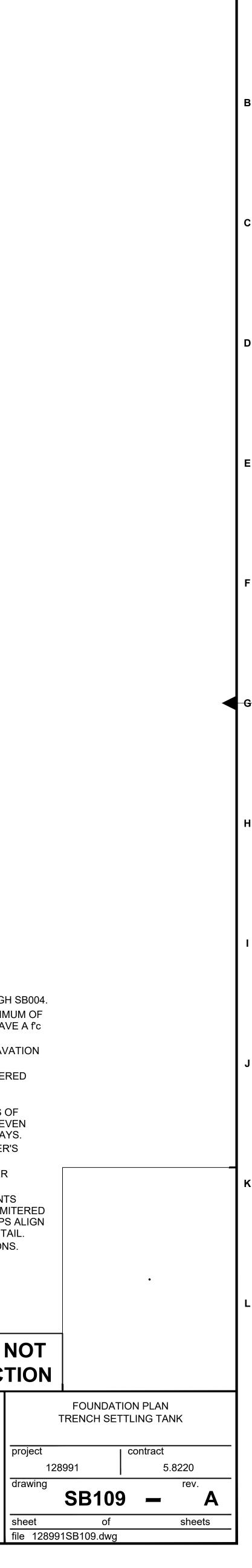
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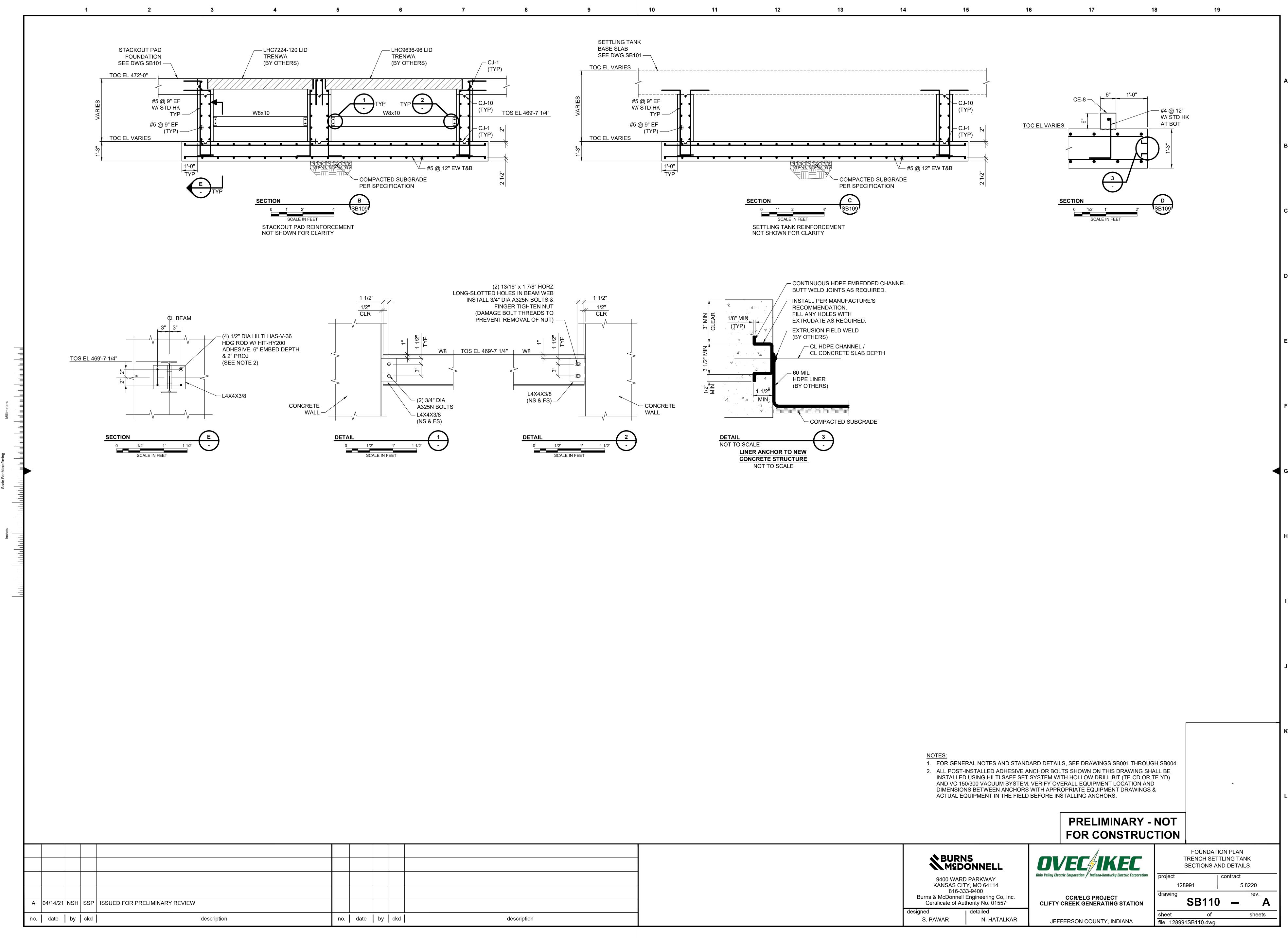


- 1. FOR GENERAL NOTES AND STANDARD DETAILS, SEE DRAWINGS SB001 THROUGH SB004.
- 20% CLASS F FLY ASH, MAXIMUM WATER/CEMEMT RATIO OF 0.40, AND SHALL HAVE A fc
- 3. CONTRACTOR TO MAINTAIN GROUND WATER LEVEL BELOW THE LOWEST EXCAVATION
- 4. PROVIDE SLAB AND WALL CONSTRUCTION JOINTS AS SHOWN. POUR IN CHECKERED BOARD PATTERN AND ALLOW NO LESS THAN 7 DAYS BETWEEN POURS. ALL
- 5. DO NOT USE CURING COMPOUNDS. COMMENCE CURING WITHIN THREE HOURS OF FINISHING. USE BURLAP OR CARPET COVER KEPT CONTINUOUSLY WET FOR SEVEN DAYS MINIMUM WITH REWETTING EVERY OTHER DAY FOR FOUR ADDITIONAL DAYS.
- 6. FOR ALL SEALANTS AND FILLER, CONTRACTOR SHALL FOLLOW MANUFACTURIER'S
- 7. EXPANSION JOINT FILLER SHALL BE PREFORMED ASPHALT IMPREGNATED FIBER
- 8. PVC WATER STOP SHALL BE SERRATED VIRGIN POLYVINYL CHLORIDE. ALL JOINTS AND SPLICES FOR PVC WATER STOP SHALL BE 100% FUSED. JOINTS SHALL BE MITERED AS REQUIRED SO THAT THE RIBS ARE CONTINUOUS. WHERE SLAB WATER STOPS ALIGN WITH WALL WATER STOPS REFER TO CONSTRUCTION JOINT INTERSECTION DETAIL.

JEFFERSON COUNTY, INDIANA

S. PAWAR





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## **APPENDIX H**

Ditch Sizing Calculations

Ohio Valley Electric Corporation / Indiana-Kentucky Electric Corporation Madison Township, Indiana

Clifty Creek Station Phase 2-4 Closure – West Boiler Slag Pond



#### Hydrologic and Hydraulic Analysis Ditch Sizing Calculations

#### Purpose:

• Calculations to determine sizing of drainage ditches on the final grade closure plan

#### <u>Methods:</u>

PCSWMM was used to size and model the stormwater ditch network and simulate the peak discharges in the ditches. The model was simulated using the Curve Number Infiltration method and dynamic wave flow routing.

#### Table 1 - Design Standards and References

Parameter	Design Standard/Method/Source
Design Storm	25-Year, 24-Hour Recurrence Interval
Curve Number	TR-55, SCS CN methodology
Rainfall Temporal Distribution	Soil Conservation Service (SCS) Type II (USDA, 1986)
Rainfall Intensity	NOAA Atlas 14 Precipitation Frequency Data Server
Subbasin Area	Delineation based on Permit Drawings Dated 04.16.2021

#### Parameters:

#### Climatological Data:

The 25-year, 24-hour storm was used to determine ditch capacity. Peak rainfall depths for the design storm were taken from NOAA Atlas 14 Precipitation Frequency Data Server specific to the geographic location of the Clifty Creek Plant. The selected Point Precipitation depth is shown in Table 1. An SCS Type II temporal distribution was used to model the rainfall hyetograph over the 24-hour duration.

#### Table 1 - NOAA Atlas 14 PFDS Rainfall Depths

Storm Return	Rainfall
Interval and	depth
Duration	(inches)
25-year, 24-hour	5.30

#### Watershed Delineation:

Subcatchment delineations were completed in PCSWMM based on the permit design final grade surface. Table 2 provides a breakdown of the subcatchment areas. Subcatchment delineations are shown in Appendix A

#### **Curve Numbers**

The NRCS curve number method was used to estimate infiltration during the design storm event. A composite curve number was generated for the watershed using SCS hydrologic soil group data and land use data determined from aerial imagery. Curve number values for each land use and soil type combination were assigned based on the values published in Tables 2-2a through 2-2d in TR-55 (NRCS, 1986). To model the final closed conditions, land uses of "Meadow" (CN = 78) was assumed for the cap liner system and land use of "Open spaces – Fair" (CN = 84) was assumed for regraded areas around the cap. A summary of curve numbers used in this analysis is provided in Table 2

Subbasin	Area (acres)	Composite Curve Number
Primary_Basin	3.44	92
	12.41	89
S6	0.49	84
S7	1.29	80
SB12	11.88	83
SB23A	12.73	90
SB24	9.38	79
SB25_2	3.28	85
SB26	6.82	76
Secondary_Basin	13.79	95
WBAP_01	0.06	78
WBAP_02	0.05	78
WBAP_03	1.23	79
WBAP_05	1.46	78
WBAP_06	0.41	79
WBAP_07	0.6	81
WBAP_08	0.51	81
WBAP_09	0.84	79
WBAP_1	0.39	80
WBAP_10	0.95	80
WBAP_11	1	80
WBAP_12	0.44	79
WBAP_13	2.23	78
WBAP_14	0.99	79
WBAP_15	1.19	78
WBAP_16	0.6	78
WBAP_17	1.19	80
WBAP_19	1.71	78
WBAP_2	0.24	80

#### Table 2 – Subbasin Drainage Areas and Curve Numbers

Subbasin	Area (acres)	Composite Curve Number
WBAP_20	1.2	78
WBAP_21	8.63	77
WBAP_22	0.32	78
WBAP_23	0.93	78
WBAP_24	5.46	78
WBAP_25	4.54	77
WBAP_3	4.5	80
WBAP_4	8.11	78
WBAP_5	1.44	79
WBAP_6	3.17	79
WBAP_7	0.76	79
WBAP_8	3.6	82
WBAP_9	4	80
WBAP_CL_01	0.87	85
WBAP_CL_02	0.88	83
WBAP_CL_03	5.33	85
WBAP_CL_04	1.1	78
WBAP_CL_05	4.01	85
WBAP_CL_06	4.31	83
WBAP_CL_08	2.18	80
WBAP_CL_09	1.2	84
WBAP_CL_1	1.65	78
WBAP_CL_3	1.79	78
WBAP_CL_4	1.27	78

#### Calculations/Results:

Peak Discharges were calculated in the dynamic PCSWMM model. Peak discharges for each ditch type are shown in the table below

Ditch	Peak 25-year Q (cfs)
West Stormwater Ditch	184.02
East Stormwater Ditch	77.92
Overflow Ditch	119.5
Ditch 10	58.92
Ditch 11	39.2
Ditch 12	44.66

Table 3 – Peak	Discharge	Calculations
----------------	-----------	--------------

Peak discharges were used to calculate normal depth in the final cover ditches. Ditches were sized to convey the peak discharge accordingly.

#### Methods:

Hydraulic calculations were performed to determine minimum ditch size required to convey the peak discharges. Manning's equation was used to estimate flow depth in each ditch. The peak flow calculated was used to size all ditches.

Vest Stormwater Ditc Normal Depth - Ti	2	<u> </u>	ear, 24-hour sto 
* E	▼ ▼ 3	z	
	-		
User	r Input		
Discharge (cfs)	Q	184.02	
Bottom Width (ft)	В	6	
Side Slope 1 (ft/ft)	Z <sub>1</sub>	3	
Side Slope 2 (ft/ft)	Z <sub>2</sub>	3	
Channel Slope (ft/ft) S <sub>o</sub> 0.0050			
Manning's Roughness n 0.017			
Evaluate I	Normal Depth		-
Normal D	epth Output		
Normal Depth (ft)	Y	2.04	
Calculated Flow (cfs)	Qc	184.0	
Flow Area (ft <sup>2</sup> )	Α	24.8	
Wetted Perimeter (ft)	Pw	18.9	
Hydraulic Radius (ft)	R <sub>H</sub>	1.31	
Top Width (ft)	тw	18	
Average Velocity (ft/s)	VAvg	7.42	
Specific Energy (ft)	E	2.90	
Froude Number	FN	1.12	

The maximum estimated depth in the channel is 2.04 feet and is less than the design depth of 4 feet.

East Stormwater Ditc	h Calculations	s – 25-ye	ar, 24-hour storm
Normal Depth - Trapezoidal Channel			
	∇ ¥ 3	z	
User	r Input		-
Discharge (cfs)	Q	77.92	1
Bottom Width (ft)	В	6	r
Side Slope 1 (ft/ft)	Z <sub>1</sub>	3	
Side Slope 2 (ft/ft)	Z <sub>2</sub>	3	
Channel Slope (ft/ft)	S <sub>o</sub>	0.0050	
Manning's Roughness	n	0.017	
Evaluate I	Normal Depth		
Normal D	epth Output		1
Normal Depth (ft)	Y	1.33	
Calculated Flow (cfs)	Qc	77.9	
Flow Area (ft <sup>2</sup> )	Α	13.3	
Wetted Perimeter (ft)	Pw	14.4	
Hydraulic Radius (ft)	R <sub>H</sub>	0.92	
Top Width (ft)	тw	14	
Average Velocity (ft/s)	VAvg	5.87	
Specific Energy (ft)	E	1.86	
Froude Number	FN	1.06	

The maximum estimated depth in the channel is 1.33 feet and is less than the design depth of 4 feet.

· · · ·	Overflow Ditch Calculations – 25-year, 24-hour storm			
Normal Depth - Trapezoidal Channel				
Y B B				
Use	r Input		-	
Discharge (cfs)	Q	119.5	-	
Bottom Width (ft)	В	10		
Side Slope 1 (ft/ft)	Z <sub>1</sub>	3	-	
Side Slope 2 (ft/ft)	Z <sub>2</sub>	3	-	
Channel Slope (ft/ft)	S <sub>o</sub>	0.0050		
Manning's Roughness	n	0.03		
Evaluate Normal Depth				
Normal D	epth Output		-	
Normal Depth (ft)	Y	1.83		
Calculated Flow (cfs)	Qc	119.5		
Flow Area (ft <sup>2</sup> )	Α	28.4		
Wetted Perimeter (ft)	Pw	21.6		
Hydraulic Radius (ft)	R <sub>H</sub>	1.31		
Top Width (ft)	TW	21		
Average Velocity (ft/s)	VAvg	4.21		
Specific Energy (ft)	E	2.11		
Froude Number	FN	0.64		

The maximum estimated depth in the channel is 1.83 feet and is less than the design depth of 2 feet.

Ditch 10 Calculations – 25-year, 24-hour storr			rm
Normal Depth - Trapezoidal Channel			
User	r Input		
Discharge (cfs)	Q	58.92	
Bottom Width (ft)	В	4	
Side Slope 1 (ft/ft)	<b>Z</b> <sub>1</sub>	3	
Side Slope 2 (ft/ft)	Z <sub>2</sub>	3	
Channel Slope (ft/ft)	S <sub>o</sub>	0.0100	
Manning's Roughness	n	0.03	
Evaluate Normal Depth			
Normal D	epth Output		
Normal Depth (ft)	Y	1.48	
Calculated Flow (cfs)	Qc	58.9	
Flow Area (ft <sup>2</sup> )	Α	12.4	
Wetted Perimeter (ft)	Pw	13.3	
Hydraulic Radius (ft)	R <sub>H</sub>	0.93	
Top Width (ft)	тw	13	
Average Velocity (ft/s)	VAvg	4.74	
Specific Energy (ft)	E	1.82	
Froude Number	FN	0.85	

The maximum estimated depth in the channel is 1.48 feet and is less than the design depth of 2 feet.

	Ditch 11 Calculations – 25-year, 24-hour storr Normal Depth - Trapezoidal Channel			
Y B Z				
Use	r Input			
Discharge (cfs)	Q	39.2		
Bottom Width (ft)	В	4		
Side Slope 1 (ft/ft)	Z <sub>1</sub>	3		
Side Slope 2 (ft/ft) Z <sub>2</sub> 3				
Channel Slope (ft/ft)	S <sub>o</sub>	0.0050		
Manning's Roughness	n	0.03	_	
Evaluate Normal Depth				
Normal D	epth Output			
Normal Depth (ft)	Y	1.43	-	
Calculated Flow (cfs)	Qc	39.2	-	
Flow Area (ft <sup>2</sup> )	Α	11.9		
Wetted Perimeter (ft)	Pw	13.1		
Hydraulic Radius (ft)	R <sub>H</sub>	0.91		
Top Width (ft)	тw	13		
Average Velocity (ft/s)	V <sub>Avg</sub>	3.30		
Specific Energy (ft)	E	1.60		
Froude Number	FN	0.60		

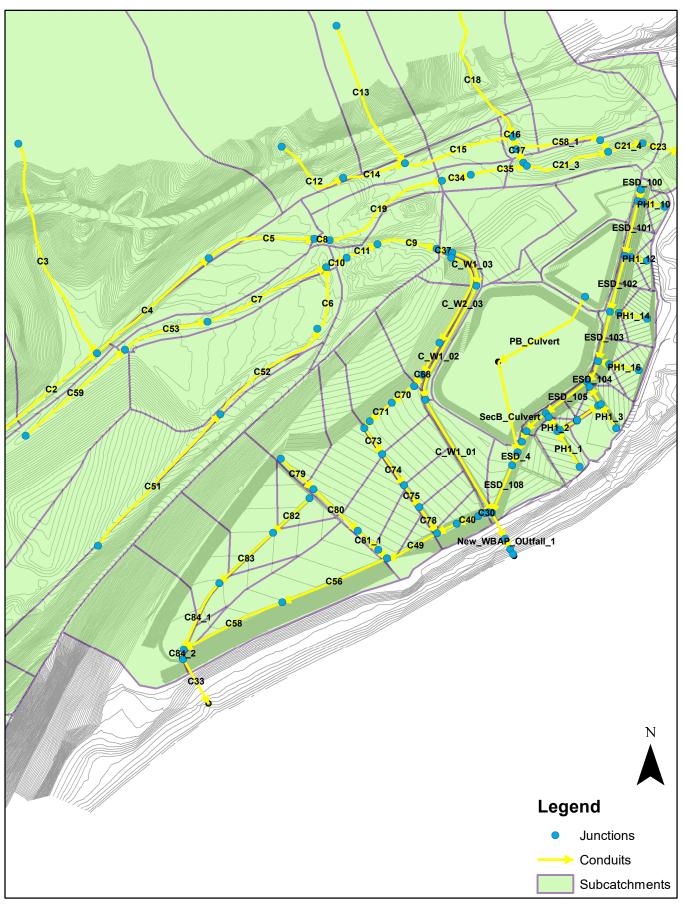
The maximum estimated depth in the channel is 1.43 feet and is less than the design depth of 2 feet.

Ditch 12 Calculations – 25-year, 24-hour storn			n
Normal Depth - 1	Normal Depth - Trapezoidal Channel		
Y Z			
User	r Input		
Discharge (cfs)	Q	44.66	
Bottom Width (ft)	В	10	
Side Slope 1 (ft/ft)	Z <sub>1</sub>	3	
Side Slope 2 (ft/ft)	Z <sub>2</sub>	3	
Channel Slope (ft/ft)	So	0.0050	
Manning's Roughness	n	0.03	
Evaluate Normal Depth			
Normal Depth Output			
Normal Depth (ft)	Y	1.07	
Calculated Flow (cfs)	Qc	44.7	
Flow Area (ft <sup>2</sup> )	Α	14.2	
Wetted Perimeter (ft)	Pw	16.8	
Hydraulic Radius (ft)	R <sub>H</sub>	0.85	
Top Width (ft)	тw	16	
Average Velocity (ft/s)	VAvg	3.14	
Specific Energy (ft)	E	1.23	
Froude Number	FN	0.60	

The maximum estimated depth in the channel is 1.07 feet and is less than the design depth of 2 feet.

<u>References:</u>			
NOAA. (2013). NOAA Atlas 14 Point Precipita 2015, from <u>http://dipper.nws.noaa.g</u> c			
USDA. (1986). Urban Hydrology for Small Wat Agriculture.	ersheds, TR-55. United States Department of		
Indiana Department of Transportation – 2013 Design Manual, Chapter 202 Hydrology, Revision Date Feb. 2014			
Attachments:			
Attachment A: Final Grade Subbasin Boundaries			
Calculation Performed by: Stantec Consulting Services Inc.			
Prepared by: Brenton Newswanger	Reviewed by: Nick Mueller		
Revisions:R0			

#### **Appendix A - Subbasin Boundaries**



## **APPENDIX I**

Final Cover Soil Loss

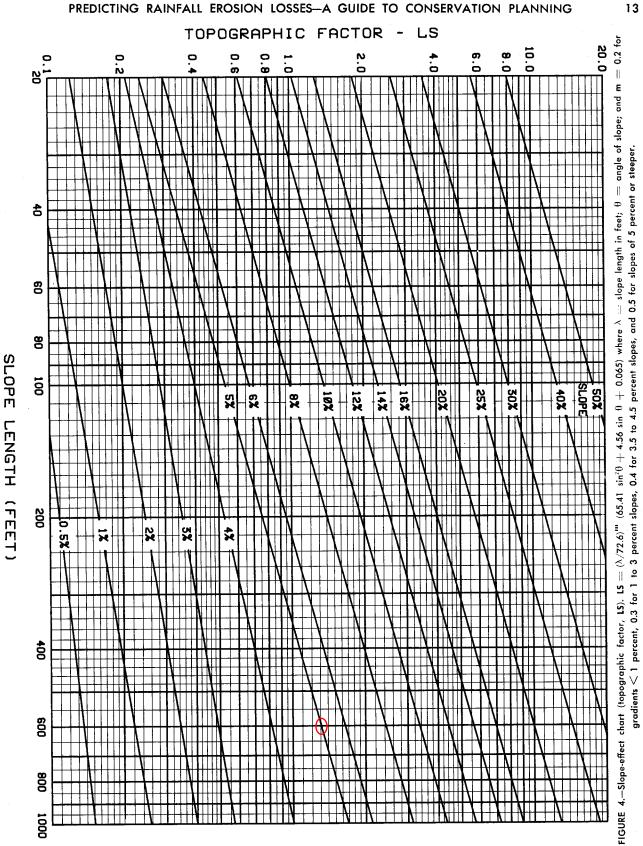


175539026 Clifty Creek Station Madison, Jefferson County, Indiana

The Universal Soil Loss Equation (USLE) is:	
A = (R)(LS)(P)(K)(C)	_
where:       A = soil loss in tons/acre/year,         R = rainfall erosion index,         LS = slope length and steepness factor,         P = erosion control practice factor,         K = soil erodibility factor, and         C = vegetative cover factor.	
Under 329 IAC 10-30-2, the final cover must have a maximum erosion rate of five tons per acre per year. Therefore, A $\leq$ 5.0 tons/acre/year.	
R = 180 (southeastern Indiana in Figure 54) LS = 0.34	
for a 275-foot distance at 2.5% slope (such as a drainage channel). Assuming bare earth prior to riprap/geotextile placement.	
(USDA, AH537, 1981 - attached) $P = 1.00$ $K = 0.43$	
C = 0.01       Fig 54. Map of Indiana showing rainfall intensity values (R factor).         (Indiana State Board of Health, 1986       1 - https://www.agry.purdue.edu/soils_judging/new_manual/ch6-water.html         – memorandum attached)       1 - https://www.agry.purdue.edu/soils_judging/new_manual/ch6-water.html	
A = (180)(0.34)(1.00)(0.43)(0.01) = 0.26 tons/acre/year for a slope length of 275 feet at 2.5%	
For Phases 2, 3, and 4, the steepest slope (excluding the 2.3:1 and 3:1 ditch sideslopes) is 2.5% with a maximum flow path of approximately 275 feet (less than the above calculation). The longest flow path on the surface is roughly 1,900 feet with a slope of 0.5%.	_
	_
	_

Designed by: E Clare

N Mueller



#### STATE BOARD OF HEALTH

INDIANAPOLIS

#### OFFICE MEMORANDUM

3/2 Form 4336

DATE: January 3, 1986

THRU:

Bruce Palin

TO: James E. Traylor Technical Support Branch

FROM: Duane Leith Engineering Section

SUBJECT: Guideline for the Evaluation of the Erosion Potential of Landfill Covers

> Sanitary landfill covers should be designed for erosion control in order to avoid later exposure of the refuse and infiltration into the refuse. The design standards which are used can be controlling factors for the size and steepness of a landfill and are therefore often the basis for deciding when a landfill will have to close. It is therefore important to have reasonable and defensible standards. The most recent guidance available to staff in this regard is a memo by Mr. Larry Dunbar dated October 17, 1984, entitled "Evaluation of Design of Final Cover for Landfills." Certain publications recently available to staff and conversations with staff of the Soil Conservation Service have led to the conclusion that the guidance contained herein would be more appropriate than the previously-mentioned memo.

> The Governor's Soil Resource Study Commission has proposed goals for erosion and sediment reduction as set forth in their report "Indiana's Erosion and Sedimentation Situation." Briefly, these goals are to reduce erosion on all land to an average annual rate denoted as "T" or the tolerable limit, which prevents depletion of the soil resource and to control all off-site sedimentation by application of best available technology. "T" is the rate at which the soil replaces itself. It is based on factors such as soil depth, texture, and permeability; its value is a matter of judgment rather than being quantifiable. The value of "T" is reported to range between two and five plus tons/acre/year. A value of five tons/acre/year is recommended as a standard under this guideline with an exception as noted.

The currently accepted method for determining the erosion potential of landfill covers is found in Agriculture Handbook 537 Predicting Rainfail Erosion Losses," which is available from SCS offices. Application of the Universal Soil Loss Equation (USLE) from Agriculture Handbook 537 is conducted as follows:

A = RKLSCP, where:

A is the average soil loss in tons per acre calculated on an annual basis for landfill design.

WENd

R is the rainfall and runoff factor as obtained from the map Figure 1, inserted between pages 6 and 7 of the handbook, copy is attached to this document. This value ranges from 130 to 225 depending on location.

K is the soil erodibility factor as obtained from Figure 3 on page 11 of the handbook (copy attached), for the composition, structure and permeability of the surface soil as replaced over the landfill. This generally ranges from .30 to .50. If the soil source or characteristics are unknown, it has been recommended that a value of 0.43 be used for landfills.1

LS is the combined topographic factor for the length and slope which can be found from Table 3 on page 12, or the chart on page 13 of the handbook, copies of which are attached. Most landfills will have irregular convex slopes. The LS value for irregular slopes is determined by the procedures specified on page 16 of the handbook. The slope is divided into successive equal length segments of uniform slope. The LS factor is obtained for each segment at its respective slope and at a length equal to the total slope length. This LS factor is then adjusted by the "fraction of soil loss" figures shown under the column M = 0.5 in Table 4 on page 15 of the handbook, copies attached. Alternatively, this figure can be obtained from the equation

Soil loss fraction =  $1^{m+1} - (1-1)^{m+1}$ 

NIII+I

where: i = segment sequence number, m = slope length exponentof 0.5 for slopes greater than or equal to five percent.N = the number of equal length segments into which the slope wasdivided. The sum of the adjusted LS values is the LS value tobe used for the entire slope.

C is the cover and management factor which can be found from Table 10 on page 32 of the handbook, or the copy attached. For properly prepared and seeded landfill covers which will be maintained in sod, use a value of 0.01. If a different vegetative cover is planned, adjust the value to reflect the anticipated conditions using Tables 5 through 12 of the handbook. A value of C lower than 0.01 should be allowed only with very intensive specifications regarding cover preparation, fertilization, seeding, and management. In order to establish high productivity, staff of the Soil Conservation Service discussed fertilization rates of 1,000 lbs/acre and contractor prices for fertilization, mulching, and seeding of \$700 to \$1,000 per acre.

<sup>1</sup> Verbal compunication with Mr. Raymond Sinclair of the Soil Conservation Service on October 7, 1985. P is the supporting practices factor. For landfills, the value of P is 1.00, unless the site is to be used as cropland. Use the figures from Table 13 on page 35 and Table 14 on page 36 of the handbook as required for landfills used for cropland.

Sample calculation:

M is 800 ft. at 6% N is 200 ft. at 30% A is 300 ft. at 4% B is 100 ft. at 10% C is 100 ft. at 25% N Cross Section Thru Landfill

To determine A values for slopes A, B, C, and M, N:

For slopes A, B, and C

- R = 175, for Marion County location on the rainfall and runoff map.
- K = 0.43, assumed typical value since actual soil samples have not been tested.
- 3. LS determination:

Total Slope Length	Segment	Slope	LS Value from Figure 4	Adjustment Factor from Table 4	Revised LS Value
500 ft (5	A1 A2	42 43	.76 .76	.09	.07 .12
segments	A3	45	.76	. 21	.16
of 100 ft	B4	10%	3.06	.25	.77
each)	C5	253	13.20	.28	3.70
					otal 4.82

4. C = 0.01, from grass sod, well maintained.

5. P = 1.0, since it is not tilled cropland.

Following the USLE: A = RKLSCP

 $A = 175 \times .43 \times 4.82 \times .01 \times 1.00$ , for slope A, B, C

A = 3.63 tons per acre

Since A is less than or equal to five tons per acre, this slope is acceptable.

#### For slopes M and N

1000 ft	MJ	62	2.13	.09	. 19
(5	M2	6%	2.13	.16	. 34
segments	M3	6%	2.13	. 21	.45
of 200 ft	MA	62	2.13	.25	.53
each)	M5	30%	25.57	. 28	7.16
					Total 8.67

4-

 $A = 175 \times .43 \times 8.67 \times .01 \times 1.00$ , for slope MN

A = 6.52 tons per acre

Since A is greater than five tons per acre, this slope is not acceptable.

It has been suggested that a possible way for a facility to have a cover with an A value higher than five would be to increase the cover depth on the lower slopes. The increased depth can allow for the formation of gullies which can then be stone-lined or similarly stabilized. Whether the increased A value should be allowed and the calculation of the necessary depth increase is not within the scope of this guidance. Erosion control is not the only factor to be considered in cover design. Other factors, such as prevention of ponding, slope stability, drainage, and feasibility of maintenance, will need to be considered.

In conclusion, it is recommended that sanitary landfill covers be designed for an A value not greater than five tons/acre/year, as determined by the Universal Soil Loss Equation from Agriculture Handbook 537. It is further recommended that a K value of 0.43 be used in calculating the A value for typical landfill soils.

References and documents.

- 1. Predicting Rainfall Erosion Losses, 1978, Agricultural Handbook 537. U.S.D.A.
- 2. Indiana's Erosion and Sediment Situation, 1984, Governor's Soil Resources Study Commission.
- Cre Creat Albert 3. Dunbar, Larry, Office Memo to Engineering Staff. October 17, 1984.
  - Design and Construction of Covers for Solid Waste Landfills, 1979, EPA .600/2-79-165, U.S. EPA.

Guideline No.

Comment period ends

# **APPENDIX J**

WBSP Phases 2-4 Quality Management Plan (QMP)



#### Construction Quality Management Plan (QMP)

West Boiler Slag Pond Closure Phases 2-4 and Low Volume Waste Treatment System

Clifty Creek Plant Jefferson County, Madison, Indiana

Issued for Bid - 60% Design

Prepared for:

Indiana-Kentucky Electric Corporation

Prepared by:

Stantec Consulting Services Inc.

May 21, 2021

## Abbreviations

CCR	Coal Combustion Residuals
СМ	Construction Manager
CQA	Construction Quality Assurance
CQC	Construction Quality Control
EDC	Engineering during Construction
EOR	Engineer of Record
EM	Engineering Manager
FR	Field Representative
FTP	File Transfer Protocol
IKEC	Indiana-Kentucky Electric Corporation
LVWTS	Low Volume Wastewater Treatment System
NCR	Nonconformance Reports
OD	Observed Deficiency
POD	Plan of the Day
QMP	Quality Management Plan
RFI	Request for Information
WBSP	West Boiler Slag Pond

## **Table of Contents**

1.0		CTION	
1.1		Ξ	
1.2		F WORK	
1.3		JCTION QUALITY CONTROL AND QUALITY ASSURANCE	
1.4	SURVEY I	REQUIREMENTS	3
1.5	LIMITATIC	DNS	3
1.6	WORKING	G ON ASH	3
2.0	ORGANIZ	ATION AND RESPONSIBILITIES	4
2.1	PROGRAM	M ROLES AND RESPONSIBILITIES	4
	2.1.1	Owner	.4
	2.1.2	Engineer of Record (EOR)	
	2.1.3	CQA Manager	
	2.1.4	Contractor	
	2.1.5	Subcontractor	
2.2	STOP WO	PRK AUTHORITY	5
3.0	QUALITY	ASSURANCE	5
3.1	QUALITY	ASSURANCE TEAM	6
	3.1.1	Roles and Responsibilities	.6
	3.1.2	Materials Testing	
3.2	QUALITY	ASSURANCE DAILY FIELD OBSERVATIONS	8
	3.2.1	General	
	3.2.2	Conformance Verification	.8
4.0		CONTROL	
4.1	SURVEY I	REQUIREMENTS	9
4.2	CQC EXE	CUTION AND PLAN PREPARATION1	0
4.3	CQC PLA	N REQUIREMENTS	0
4.4	TESTING	SCHEDULE	1
4.5	SUBMITT	ALS AND REQUEST FOR INFORMATION	1
	4.5.1	Submittals	
	4.5.2	Request for Information	1
4.6	MEETING	S	1
	4.6.1	Orientation Meeting	1
	4.6.2	Daily Meetings	2
	4.6.3	Weekly Meetings	
	4.6.4	Additional Meetings	2
5.0	QUALITY	MANAGEMENT DOCUMENTATION	2
5.1	PROJECT	DOCUMENTATION	2

# Stantec

5.2	CQA D	OCUMENTATION	14
	5.2.1	CQA Daily Field Report	14
	5.2.2		14
	5.2.3		
	5.2.4	• • • • • • • • • • • • • • • • • • • •	
	5.2.5	Nonconformance Reports	15
5.3		AND TECHNICAL SPECIFICATIONS REVISIONS	
5.4	CQC D	OCUMENTATION	16
	5.4.1	CQC Daily Report	16
LIST	OF TABL	ES	
Table	e 5-1. Rep	porting Responsibility	13
LIST	OF FIGU	RES	
Figur	e 1-1. Ge	neral Program Structure for CQC/CQA Program	2
LIST	OF APPE	NDICES	



Introduction

## **1.0 INTRODUCTION**

## 1.1 PURPOSE

The purpose of the Construction Quality Management Plan (QMP) is to promote quality of the constructed work. It consists of three main components, namely, Construction Quality Control (CQC), Construction Quality Assurance (CQA), and Engineering during Construction (EDC). The CQC activities are the Subcontractor's responsibility. The CQA activities are an audit process, performed by the CQA Team, to make sure that the Subcontractor's CQC plan is implemented and on track. EDC activities consist primarily of reviewing and responding to Subcontractor submittals and requests for information (RFIs), and general design support throughout construction.

This Construction QMP provides guidance to the project team and establishes assessment, reporting, and documentation procedures to be implemented throughout the project. Where conflict arises between the requirements of this QMP and the contract documents, the most stringent requirements shall govern.

This QMP describes the CQC and CQA management structure, personnel requirements, and minimum project requirements. This QMP also serves as an outline to develop site-specific protocols based on conditions encountered during the work.

## 1.2 SCOPE OF WORK

This Construction QMP has been prepared for the West Boiler Slag Pond (WBSP) Closure Phases 2-4 and Low Volume Wastewater Treatment System (LVWTS) project.

This project is the final three of four total phases of closure at the WBSP. Phases 2-4 generally consist of the following activities:

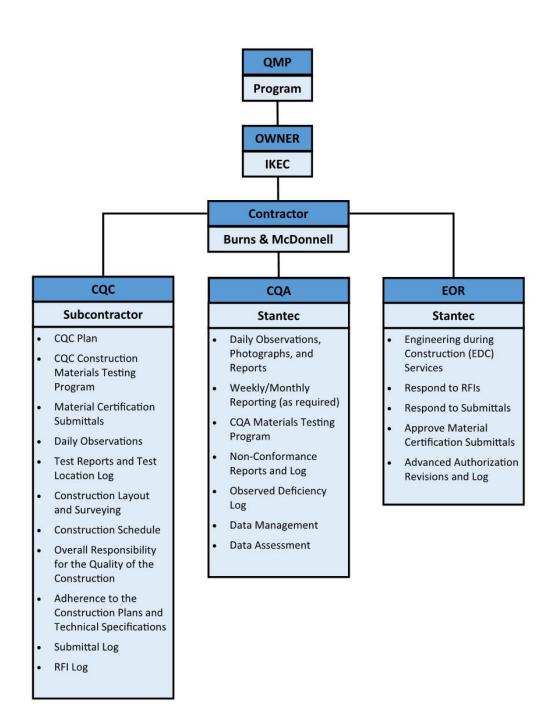
- Grading existing coal combustion residuals (CCR) to proposed subgrade elevations.
- Constructing settling tanks and the primary and secondary treatment basins.
- Constructing drainage ditches and a new outfall.
- Installing a final cover system consisting of an LLDPE geomembrane, geocomposite drainage layer, and cover soil.
- Constructing access roads and ramps.

## 1.3 CONSTRUCTION QUALITY CONTROL AND QUALITY ASSURANCE

The QMP establishes the requirements for CQC and CQA. It outlines roles, responsibilities, CQC and CQA activities, and establishes project processes and procedures. The CQC/CQA Program structure is shown below as Figure 1-1.



Introduction



#### Figure 1-1. General Program Structure for CQC/CQA Program



Introduction

## 1.4 SURVEY REQUIREMENTS

The Subcontractor shall provide construction layout services to execute the work according to the contract documents. Final as-built surveys and CQC surveys will be conducted by the Subcontractor and may be supplemented with surveys conducted by the Owner, Contractor, CQA Manager, or identified representative. As-built surveys shall be performed under the supervision of a professional surveyor licensed in the state of Indiana.

## 1.5 LIMITATIONS

The QMP does not include any facility elements outside the limits of construction designated on the Plans for Construction.

## 1.6 WORKING ON ASH

The Subcontractor shall be aware that there are inherent risks associated with working on CCR, including but not limited to, soft bearing conditions and unstable slopes. failures and instabilities may occur on apparently firm surfaces when loaded, or during active drawdown and dewatering. It is the Subcontractor's responsibility to actively manage their equipment and personnel to safely execute the work. the Subcontractor shall provide an access and excavation work plan that outlines their means and methods for working on CCR surfaces. The plan shall include sequencing of work and note the equipment and materials used.

Subcontractor is responsible for maintaining the stability of the CCR surfaces and perimeter dikes during construction. Subcontractor shall develop a monitoring plan detailing the type of monitoring to be performed (visual, installation of geotechnical instrumentation, or other methods). The plan shall also include, at a minimum, the potential for sloughing or instability of the perimeter dikes due to groundwater levels, how the risks will be mitigated, and how progressive failures along the perimeter dikes will be reduced and mitigated. the monitoring plan shall be submitted to the owner and their representative for review and approval.

The Subcontractor is responsible for all site safety and near surface ash stability at the site and shall follow all OSHA, Contractor, and owner safety requirements including but not limited to man on the ground exclusion zones. Furthermore, the Subcontractor shall provide to the owner a slope stability analysis prepared by a Registered Engineer in the State of Indiana for all excavations 10-feet or greater located outside of the exclusion zones or as directed by the Contractor. All evaluated excavations will require a minimum factor of safety of 1.3. The Subcontractor shall also prepare and provide to the owner for review a plan outlining all exclusion zones to include, but not limited to, barriers, setbacks, signage, and guidelines for entry.



Organization and Responsibilities

## 2.0 ORGANIZATION AND RESPONSIBILITIES

## 2.1 PROGRAM ROLES AND RESPONSIBILITIES

The major participants in the project are listed below along with a description of their roles. An organizational chart is provided in Figure 1-1.

#### 2.1.1 Owner

The plant and its ancillary functions are owned and operated by the Indiana-Kentucky Electric Corporation (IKEC). The Owner will administer communication with any regulatory agencies, including any related permit modifications. The Owner has contracted with the Contractor to serve as the Construction Manager (CM) who shall approve any design and/or QMP revisions.

#### 2.1.1.1 Construction Manager (CM)

The Construction Manager (CM) is responsible for coordinating with the Subcontractor regarding contractual issues, including scope, budget, and schedule. In addition, the CM will provide daily oversight of the construction activities. The CM has the authority to stop work that is not in conformance with the Plans for Construction and Technical Specifications. The CM is responsible for tracking submittals and RFIs. The CM will then distribute the submittals and RFIs, as needed, to the appropriate party.

In addition, the CM or qualified representative shall perform at least monthly inspections of the WBSP facility. These inspections shall include observations of all outslopes for indications of slope instability including tension cracks, sloughs, and excessive seepage. These inspections shall be documented and retained within the project records. Any suspect site conditions shall be promptly reported to the Owner.

#### 2.1.2 Engineer of Record (EOR)

The Engineer of Record (EOR) is responsible for development of the technical components of the project. During field implementation, the Engineer will provide support to the CQA Team for construction observation and CQA services.

Specific examples of Engineer responsibilities include responding to technical RFIs and submittals, supporting the CQA team, and review of field-testing data.

#### 2.1.3 CQA Manager

The Construction Quality Assurance (CQA) Manager shall be responsible for the execution of the CQA program and related documentation as outlined in the QMP for all work performed. The CQA Manager shall be a Professional Engineer licensed in the state of Indiana.

#### 2.1.4 Contractor

The Prime Contractor (Contractor) holds the Engineering, Procurement, and Construction contract directly with the Owner. The Contractor is responsible for coordinating the design, procurement, and construction work to complete the project. The Subcontractor (CQC Team), CQA Team and Engineer are contracted with the Prime Contractor for execution of the project.



**Quality Assurance** 

### 2.1.5 Subcontractor

The Subcontractor is responsible for execution of the work in accordance with the contract documents. The Subcontractor is solely responsible for field implementation activities, including instrumentation and monitoring. The Subcontractor will collaborate with the CM to propose adjustments (if needed) to the scope of work depending on encountered conditions. Review and approval of scope of work adjustments shall be made by the Engineer.

Specific examples of Subcontractor responsibilities include, but are not limited to, data collection and providing that data to the Owner; development and implementation of the CQC Plan, including development of applicable procedures, processes, and work plans; reporting in accordance with the Technical Specifications; CQC materials testing; quantity tracking; conformance to the Technical Specifications; and structure and ground movement monitoring data collection and reporting.

#### 2.1.5.1 Construction Quality Control Manager

The Subcontractor's CQC Manager shall have a minimum of five years of construction experience and be a full-time on-site employee of the Subcontractor. The Subcontractor CQC Manager is responsible for the Subcontractor's tests, inspections, processes, and related actions during and after construction execution to evaluate that both the actual products used, and the completed construction comply with the requirements of the Plans for Construction and Technical Specifications. The CQC Manager shall report to the Subcontractor's principal officers and the CM.

## 2.2 STOP WORK AUTHORITY

The EOR, CQA Manager, CM, and CQC Manager may exercise stop work authority when concerns related to quality are identified. In situations where personnel safety is concerned, any project personnel may stop work at any time.

## 3.0 QUALITY ASSURANCE

Construction Quality Assurance (CQA) is the responsibility of the Contractor, Engineer, and CQA Team. CQA includes assessments, observations, and reporting to document that the implementation of the work performed by the Subcontractor meets the requirements of the Plans for Construction and Technical Specifications. The CQA Team functions as the field representative for the Engineer through performance of assessments, verifications, and observations. Specific CQA responsibilities are listed as follows:

- Daily field report of construction activities including photographs.
- Noting observed deficiencies (ODs) during construction that require correction.
- Reviewing applicable Subcontractor submittals and Requests for Information (RFIs) related to quality for adherence to project requirements.
- Reviewing test data for compliance with project requirements and specifications.
- Performing assessments of the Subcontractor CQC Plan to ensure adherence to the QMP.



**Quality Assurance** 

- Reviewing the Subcontractor documentation deliverables for conformance with project requirements.
- Periodic material testing to audit CQC test results.
- Reporting of test results.
- Special testing requested by the Owner.

## 3.1 QUALITY ASSURANCE TEAM

#### 3.1.1 Roles and Responsibilities

The CQA Team serves as observers of field implementation of the construction documents and to provide CQA documentation. The CQA Team is responsible for the execution of the CQA Plan and related documentation as outlined herein. Individual roles and responsibilities for the CQA Team members are defined below. Personnel assignments are subject to change, if qualification requirements are met and approved by IKEC.

#### 3.1.1.1 Construction Quality Assurance (CQA) Manager

A professional engineer licensed in the State of Indiana shall be designated as the CQA Manager. The CQA Manager shall be responsible for administering the CQA program and advising the CQA Team.

The CQA Manager will be responsible for the following tasks:

- Observing conformance with the QMP by reviewing and documenting project records and activities;
- Managing overall implementation of the CQA program;
- Evaluating the testing results of the CQC program;
- Evaluating work for conformance with the project plans and specifications and notifying the CM if work is non-compliant with the contract documents;
- Managing the documentation of all CQA activities;
- Reviewing progress of the work and reports prepared by the Subcontractor as part of the CQC Plan;
- Verify the appropriate test standards are used for the methods to conduct assessments and field and laboratory testing for CQA testing;
- Evaluating and auditing the results of CQC and CQA assessments and testing; and
- Review daily field reports prior to submittal to the CM and EOR.



**Quality Assurance** 

#### 3.1.1.2 Construction Quality Assurance (CQA) Supervisor

The Construction Quality Assurance (CQA) Supervisor provides oversight for the CQA Field Representative(s) on site. The CQA Supervisor is familiar with the materials to be used, the observations and testing to be done, and the functional intent of the QMP. The CQA Supervisor has responsibility for:

- Coordination of the periodic CQA construction testing in the field;
- Coordination of other testing with a commercial laboratory (as needed);
- Provides support to field CQA staff;
- Plans and directs the activities of CQA field representative(s); and
- Reviews Daily Field Reports.

In conjunction with their staff, the CQA Supervisor reviews daily field reports and directives, and reports to the CQA Manager any situation where the Plans for Construction and Technical Specifications do not appear to be appropriate for the conditions encountered.

The CQA Supervisor reviews Nonconformance Reports and has authority to stop work due to adverse quality conditions or potentially unsafe work practices. The CQA Supervisor reports to the CQA Manager. The CQA Supervisor will be on-site an average of one day per month for the duration of construction, or as necessary to observe key construction activities to support the CQA team.

#### 3.1.1.3 Construction Quality Assurance (CQA) Field Representative (FR)

The Construction Quality Assurance Field Representative (CQA FR) staff shall consist of qualified personnel working under the direct supervision of the CQA Manager and CQA Supervisor. The CQA Supervisor will be responsible for the day-to-day coordination and management of the CQA FRs.

The CQA FR is responsible for performing quality assurance in the field, and for performing observations of conformance with the Plans for Construction and Technical Specifications. The CQA FR will document the results of the required CQA observations and testing and inform responsible personnel about unsatisfactory items. The CQA FR is also responsible for documenting that corrective actions are taken to resolve the conditions. For defective work, the site-specific CQA FR will initiate a Nonconformance Report and submit the report to the CQA Supervisor.

The duties of the CQA FR are listed below:

- Daily observations of construction activities to verify conformance with project Plans for Construction and Technical Specifications;
- Observe on-site testing performed by CQC team members;
- Perform periodic on-site CQA testing to verify CQC procedures and test results;
- Coordinate required sampling with commercial laboratory for other quality control testing (as needed);



#### **Quality Assurance**

- Prepare and submit daily field report of observations, testing results, and photographs;
- Conduct periodic inspection of specific construction items;
- Instrumentation monitoring (as needed);
- Verification that testing is performed and that results meet the Technical Specifications;
- Verification of Subcontractor's CQC surveying;
- Reporting of nonconformances; and
- Reporting of observed deficiencies.

#### 3.1.2 Materials Testing

The CQA Team will perform selected CQA sampling and material testing to audit CQC procedures and test results. The material testing schedule is included in Attachment A. The schedule specifies the anticipated types and minimum number of tests for each material subject to testing and required frequency of testing. The CQA Manager or identified representative is responsible for reviewing the material testing and results and manufacturer's supplied information for conformance to the Technical Specifications.

## 3.2 QUALITY ASSURANCE DAILY FIELD OBSERVATIONS

#### 3.2.1 General

The CQA Team shall review the Plans for Construction and Technical Specifications for each day's construction activities. After observation of the day's activities, they shall document whether the work that was observed has been done in accordance with the Plans for Construction and Technical Specifications. The CQA Team's observation of work serves as an audit function. It is not to be considered a verification that all work performed was in accordance with the Plans for Construction and Technical Specifications. That responsibility remains with the CQC Team.

Daily observations are to be documented in a CQA daily field report.

Any suspect conditions shall be promptly reported to the CM. Each observation shall be documented on the Daily Field Report form for inclusion with the project records.

#### 3.2.2 Conformance Verification

Conformance verification shall consist of observing and documenting testing performed by the Subcontractor to ensure that the required tests and evaluation of materials and construction products are performed. The CQA Team shall confirm that testing is performed at frequencies specified in this QMP. The CQA Team shall perform periodic testing to verify the results of the Subcontractor. Additional or supplementary conformance testing may be added at the discretion of the CQA Manager. Results shall be reviewed by the CQA Manager to assess conformance with project requirements. Copies of all conformance results shall be included on a CQC testing log and with the project records.



Quality Control

The NCR process shall be used, as needed, to immediately report deficiencies, remediation required, and resolution to the Contractor and Engineer. NCRs may be submitted to the CQA Manager by the CQA Team or Subcontractor. The CM will maintain a log as a record of the non-conformances encountered and the final resolution. A detailed description of the NCR process is provided in Subsection 5.2.5.

# 4.0 QUALITY CONTROL

Construction Quality Control (CQC) and overall construction/material quality is the responsibility of the Subcontractor. CQC includes establishing procedures and work plans, performing observations, documenting construction processes and performance, and performing materials testing to demonstrate the quality of the constructed elements. Specific CQC items are as follows:

- Ensuring that the Subcontractor's work complies in all respects to the Plans for Construction, Technical Specifications, other contract documents, and any approved changes to the contract documents.
- Developing the CQC Plan.
- Developing work plans, procedures, and submittals related to the work.
- Preparing a daily log of observations and activities.
- Providing data collected during this project to the Contractor.
- Demonstrating the means and methods for complying with the Plans for Construction and the Technical Specifications.
- Performing construction staking and layout.
- Performing construction materials quality control testing and reporting.
- Maintaining an updated construction schedule with CQC/CQA hold point milestones represented.
- Maintaining calibrations on measuring and testing equipment.
- Providing final as-built surveys and drawings.
- Testing logs, timely submittal of required deliverables, reporting nonconforming conditions to the Engineer, and data management.

## 4.1 SURVEY REQUIREMENTS

The Subcontractor shall provide field layout services for the purposes of executing the work according to the contract documents. The work shall be laid out and constructed to the elevations shown in the Plans for Construction and in accordance with the Technical Specifications. Tolerances shall be as defined in the Technical Specifications.

Final as-built surveys and CQC surveys will be conducted by the Subcontractor and may be supplemented with surveys conducted by the Contractor or identified representative.



**Quality Control** 

## 4.2 CQC EXECUTION AND PLAN PREPARATION

The Subcontractor shall prepare a CQC Plan meeting the requirements of this QMP and the project specifications. The CQC Plan must be approved by the Contractor, CM, and Engineer prior to the start of construction. The Subcontractor shall execute CQC activities in accordance with the approved CQC Plan.

## 4.3 CQC PLAN REQUIREMENTS

The Subcontractor is responsible for establishing and maintaining a CQC Plan for the project to ensure that the project is executed, and items are installed in accordance with the Plans for Construction and Technical Specifications. The objective of the CQC Plan is to provide a framework where a quality product will be produced. The details of the CQC system will be described in the CQC Plan document, which will establish procedures to ensure uniformity and provide a standard by which comparisons can be made.

The CQC Plan shall include, at a minimum, the following to cover all operations, both on-site and off-site, including work by subcontractors and suppliers:

- Organizational Structure: Chart showing the CQC organizational structure, including line of authority.
- Personnel: Names and qualifications, in resume format, for each person in the QC organization.
- Duties, Responsibilities, and Authorities: Duties, responsibilities, and authorities of each person in the QC organization.
- Outside Organizations: List of outside organizations, such as consulting engineering firms, that will be employed by the Subcontractor and a description of services these firms will provide, including decision-making authority (if any).
- Scope of Work: Scope, including testing laboratory information and accreditations and materials testing schedule.
- Submittals: Procedures for reviewing, approving, and managing submittals. Include the name(s) of the person(s) in the QC organization authorized to prepare required submittals, and the initial submittal of the submittal register as specified in the section entitled "Submittal Procedures."
- Completing Rework Items: Procedures for addressing nonconformance, deficient, and rework items.
- Measuring and Testing Equipment: Copies of current certifications for monitoring and testing equipment.
- Documentation Procedures: Documentation procedures, including proposed report/forms formats.
- Training Requirements: Documentation of personnel trained in specifics of the CQC Plan.
- Work Plans and Quality Process Documents.



**Quality Control** 

## 4.4 TESTING SCHEDULE

It is the responsibility of the Subcontractor to perform tests specified in the Technical Specifications and verify that control measures are adequate to provide a product that conforms to the requirements of the project documents. A material testing schedule outlining minimum CQC and CQA testing frequencies is included in Attachment A. The schedule specifies the anticipated types and minimum number of tests for each material subject to testing. The CQC Manager or identified representative is responsible for verifying that material testing and results conform to the Technical Specifications. The Subcontractor shall maintain a log of all CQC material test results.

## 4.5 SUBMITTALS AND REQUEST FOR INFORMATION

#### 4.5.1 Submittals

Subcontractor submittals shall be provided to the CM, consistent with the requirements of the Technical Specifications. For material submittals, the Subcontractor shall review and certify that the material conforms to the Plans for Construction and Technical Specifications prior to submittal to the CM.

#### 4.5.2 Request for Information

The Subcontractor shall communicate issues such as constructability, discrepancies in the plans, and requests for Engineer support during field implementation, etc., using the RFI form. RFIs shall be submitted by the Subcontractor to the CM. The CM routes the RFI to the Engineer. The Engineer will prepare a response to the RFI and submit it to the CM. The CM then sends the completed RFI response to the Subcontractor.

The CM, or representative, shall document each RFI in an RFI log and in the project records. The RFI log will be maintained by the CM, or representative, and will be reviewed at the weekly project progress meetings. The Subcontractor is encouraged to engage the Engineer and the Engineering Team prior to RFI submittal in efforts to streamline the RFI process. The Engineer has seven calendar days upon receipt of the RFI to provide a response to the CM. If a quicker response is required by the Subcontractor, this should be noted in the RFI and in the correspondence to the CM.

Any changes to the project that result from the RFI process shall be documented and communicated to the CQA Team and the Subcontractor. Communications shall include discussion of the issue that led to the RFI, the intent of the RFI response, and any resulting changes to the project.

It should be noted that, because of the nature of the project, the RFI process may not be suitable for some of the day-to-day adjustments that will be necessary. Instead, daily collaboration between the CM, Engineer, and Subcontractor field staff will be essential to successfully meet the intent of the project. Such daily adjustments shall be documented in both the CQC daily field report and the CQA daily field report.

## 4.6 MEETINGS

#### 4.6.1 Orientation Meeting

An orientation meeting (i.e., kickoff meeting) shall be held before field implementation of the QMP. At a minimum, those present will include the CM, the Contractor, the Subcontractor's PM, the CQC Manager,



**Quality Management Documentation** 

the CQA Manager, CQA FR, IDEM, and others as needed. This meeting will include a review of the project document objectives, quality management processes, hold points, and special project requirements. The Subcontractor will prepare meeting minutes and distribute them for review. The Owner shall notify the IDEM permit manager 10 working days prior to the meeting.

Other kickoff meetings may be required before the start of discrete phases of the work.

#### 4.6.2 Daily Meetings

Daily plan-of-the-day (POD) meetings related to safety and construction activities for the day's work shall be conducted by the CM or designated representative. Attendees shall include the CQA FR and the CQC Manager. Other key participants from IKEC, the Engineer, and the Subcontractor will be included in these meetings as appropriate.

#### 4.6.3 Weekly Meetings

The CM will hold weekly on-site meetings with the project team during active construction. Portions of these meeting will be allotted to discuss quality and engineering. Those present shall include the CM; CQA FR; and the CQC Manager and on-site representative. Other key participants from IKEC, the Engineer, Contractor, and the Subcontractor will be included in these meetings as appropriate.

The primary purpose of the weekly meetings shall be to confirm that all parties involved with field activities are familiar with the design, required procedures, and associated quality objectives, along with any issues (e.g., safety, environmental) related to field implementation. Topics to be addressed at this meeting shall include a review of the schedule, any outstanding RFIs, outstanding change orders, status of Subcontractor submittals, and quality issues. The CM, or representative, shall provide minutes of each meeting for inclusion in the project records.

#### 4.6.4 Additional Meetings

Other on-site meetings will be organized to address site-specific issues that need quick resolution but are not conducive to the weekly or other regularly scheduled meetings or that require specific personnel to be present and to work through specific issues as they arise. Such meetings will be documented on the CQC and CQA daily field reports.

## 5.0 QUALITY MANAGEMENT DOCUMENTATION

## 5.1 **PROJECT DOCUMENTATION**

Project CQA documentation shall be obtained and maintained by the CQA Manager and copied to the Engineer during all phases of field implementation. Project CQC documentation shall be obtained and maintained by the CM or identified representative and copied to the Engineer. The Subcontractor is required to submit all data collected, both raw and processed, to the Contractor. Transfer of these data should be through Procore.

Distribution of the project documentation shall be in accordance with Table 5-1.



**Quality Management Documentation** 

Item	Originator	Primary Recipients	Secondary Recipients
Daily CQA Report	CQA FR	CQA Supervisor	CM, EOR, CQA Manager, Subcontractor
Daily CQC Report	CQC Team	СМ	CQA Manager, EOR
Request for Information (RFI): Submittal	Subcontractor	СМ	EOR CQA Manager
Request for Information (RFI): Approval and RFI Log	СМ	EOR	CQA Supervisor CQA Manager
Observed Deficiency Log	CQA FR, CQA Supervisor	CM, CQA Manager	Subcontractor
Nonconformance Reports and Log	CQA Supervisor, CQA Manager	CM, EOR	Subcontractor
Subcontractor Submittals	Subcontractor	СМ	EOR, CQA Supervisor
Subcontractor Submittal Approval and Log	Subcontractor	СМ	EOR, CQA Manager
CQC Testing Results and Log	CQC Team	СМ	CQA Manager, EOR
CQC Correspondence and Log	Subcontractor	СМ	CQA Manager, EOR
Design Revisions and Log	EOR	CQA Manager	Subcontractor, CM
Subcontractor Daily Production Report	Subcontractor	СМ	EOR
Weekly Meeting Minutes	СМ	All Present	N/A
Construction Certification Report	CQA Manager	EOR	СМ

Table 5-1.	Reporting	Responsibility
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Quality Management Documentation

## 5.2 CQA DOCUMENTATION

The CQA documentation shall include, but is not limited to, the following:

- Daily field report;
- RFI responses;
- ODs;
- NCRs;
- CQA correspondence (i.e., memos, letters);
- Photographic documentation; and
- Plans for Construction and Technical Specifications revisions and log.

#### 5.2.1 CQA Daily Field Report

The CQA Team shall maintain daily field reports to document daily observations, investigations, and analyses of the construction, as well as to document the progress of the work. These reports shall include photographic documentation, where applicable. The CM will provide daily tracking of quantities, consistent with the Subcontractor pay items (hard quantities, standby hours tracked separately by CM). This daily tracking will allow independent assessment of the Subcontractor quantities in the team's daily field report.

#### 5.2.2 Photographs

The CQA Team shall maintain a photographic record of the field implementation, documenting the progress of project construction. For the purpose of construction, photographs will be taken as needed to document processes, procedures, and any deficiencies or nonconformance, and will provide a photographic record for inclusion in the project record. Each photograph shall have the date recorded, the name of the person taking the photo (if by someone other than the daily field report author), and the location of photographs. This information shall be noted in the daily field report or the photographic log.

#### 5.2.3 Material Testing Reports

CQA material testing reports will be compiled and distributed to the project team. Daily summaries and offsite test CQA results will be included in the CQA Daily Field Report. Reports shall include CQA testing results for both laboratory and field testing.

#### 5.2.4 Observed Deficiencies (ODs)

Observed Deficiencies (ODs) shall identify and document deficiencies in quality, workmanship, materials, equipment, or supplies and unauthorized deviations from Plans for Construction or the Technical Specifications. The OD log is used to track and rectify deficient events that do not need to be escalated to the NCR level. The following procedures shall be used to document ODs:



**Quality Management Documentation** 

- When the Subcontractor, Engineer, or CM notices an observed deficiency, the CQA FR records it in the corresponding CQA daily report.
- The CQA Supervisor will enter the OD into the Observations tool in Procore along with the following information: referenced daily report number, observed date, deficiency description, reference to the corresponding requirement (if applicable), hold point (if applicable), and responsible party.
- The CQA Team, CM, and the Subcontractor will work to establish a resolution and corresponding timeframe for the OD.
- Once a corrective action for the OD has been agreed upon by all involved parties, it will be implemented by the responsible party (if necessary).
- After the OD is verified to be resolved, the CQA FR will record it in the corresponding CQA daily report.
- The CQA Supervisor will enter the following information into the Observations tool in Procore: referenced daily report number, the resolved date, and corrective action description.
- The Observations tool in Procore will be maintained by the CQA Supervisor for tracking the status of OD events.

#### 5.2.5 Nonconformance Reports

Nonconformance Reports (NCRs) shall identify, report, and document a nonconforming event in quality, workmanship, materials, equipment, or supplies and unauthorized deviations from Plans for Construction or the Technical Specifications. The following procedures shall be used to report nonconformance:

- When a nonconformance is observed, whether by the Engineer, Subcontractor, or CM, the CQA FR prepares an NCR that describes deficiencies noted (including time, actions, locations, etc.) and references to the corresponding requirements. Additionally, a list of corrective actions is identified for the Subcontractor to complete, or meet, to the satisfaction of the Engineer.
- The NCR form is then routed to the Engineer for assessment, with a disposition on the installed work/materials that need to be replaced, if any. The form is then routed to the CM for finalization.
- The CM then routes the NCR package to the Engineer for final review and signature and returns it to the CM, if acceptable. Once that process is complete, the CM issues the NCR to the Subcontractor.
- The Subcontractor provides a list of proposed corrective actions on the form and returns it to the CM for processing and issuance to the CQA Manager. If the proposed corrective action is acceptable, the CQA Manager signs the NCR and includes a list of required documentation to be provided by the Subcontractor to confirm completion of the corrective action. The NCR is then returned to the CM for processing and issued to the Engineer for final approval and signature. The form is then routed to the CM for issuance to the Subcontractor for implementation. If the proposed corrective action is not deemed acceptable, the CQA Manager returns the form to the CM with additional comments for issuance to the Subcontractor for review and revision.



**Quality Management Documentation** 

- The process is repeated until the Subcontractor's proposed corrective actions are acceptable to the CQA Manager.
- On completion of the rework identified as deficient or nonconforming, the CQA Manager will conduct a reassessment of the items noted in the NCR. If the reworked items are found acceptable, it will be so noted on the NCR. If, however, the items are still not acceptable to the CQA Manager, the items will be rejected and must be reworked before it is resubmitted for further assessment.
- The CM and the CQA Manager will periodically review the status of NCRs and will work with the Subcontractor to establish a timetable for the final resolution of all deficiencies.
- A Nonconformance Log will be maintained by the CM for tracking the status of nonconforming items.

## 5.3 PLANS AND TECHNICAL SPECIFICATIONS REVISIONS

Periodically during construction, changes to the Plans for Construction and/or Technical Specifications may be required. These changes will be reviewed and drafted by the Engineer and approved by the Engineer prior to field implementation. Any deviations and changes to the Plans for Construction and Specifications require review and concurrence from the Contractor. The revisions will be included on a revision log and in the project records.

## 5.4 CQC DOCUMENTATION

The CQC documentation shall include, but not be limited to, the following:

- CQC Daily Field Report;
- Field Observation Logs and Test Data Sheets;
- Subcontractor Submittals and Shop Drawings;
- Material Conformance Test Results;
- Construction Problem and Solution Reports;
- Photographic Documentation;
- Design and/or Specification Modifications; and
- Meeting Minutes.

#### 5.4.1 CQC Daily Report

The CQC report shall include a summary of work performed for the day; CQC tests performed; test results; and a "remarks" section that will contain pertinent information, including significant observations, problems encountered during field implementation, and delays encountered. The following CQC data is to be provided in the report:



**Quality Management Documentation** 

- Date.
- Weather.
- Quantities of material received on-site with corresponding delivery tickets.
- Quantities of materials used.
- List of CQC tests performed.
- Remarks section outlining any issues, delays, etc., that were encountered during the day.
- Updated drawings, mapping, and graphical representations of field work.
- Quantities of materials and/or debris to be hauled off-site and disposed of at locations not owned, operated, or maintained by the Owner, including proper chain of custody, required haul tickets, and scale tickets.
- Daily hold points.
- Photographs of daily construction activities.

In addition to this reporting, refer to the Technical Specifications for more detailed requirements.



# ATTACHMENT A

Material Testing Schedule

#### Materials Testing Schedule

MATERIAL	PROPERTY	TEST	VALUE	QC FREQUENCY	QA FREQUENCY
Concrete			4.500 mil		1 / 200 CY placed. Also review QC
Cast-in-Place Concrete	Compressive Strength	ASTM C39	4,500 psi	1 / 50 CY placed or 1 / day whichever is more frequent	aboratory reports
	Entrained Air Content	ASTM C231	2.5 - 6.0 %	1 / delivery	Observe Only
	Slump	ASTM C143	3 ± 1	1 / delivery	Observe Only
CCR Fill					
	Standard Proctor	ASTM D698	laboratory test	1 / change in material	Review laboratory reports
			Min. 85%, within 2% of optimum moisture		
	Field Density and Moisture	ASTM D6938	content	5 / acre per lift	1 / acre per lift
Phase 4 CCR Removal Verification					
		Visual	Visual observations and use of the Munsell Soil Color Chart will be used to confirm that all visible CCR has been excavated from	Observations will include taking	Observations at each point on a staked 100'x100' grid across the footprint. Observations will include taking
	CCR Removal Verification	Observation	the footprint. <sup>3</sup>	photographs and describing soil color. <sup>3</sup>	photographs and describing soil color. <sup>3</sup>
Geosynthetic Clay Liner (GCL)					
GCL	Bentonite Mass/Area	ASTM D5993	≥ 0.75	1 / 40,000 SF	Review Only
	Average Peel Strength	ASTM D6496	3.5 lbs/in minimum	1 / 100,000 SF	Review Only
	Average Tensile Strength	ASTM D6768	45 lb/in minimum	1 / 100,000 SF	Review Only
	Permeability	ASTM D5887	less than or equal to 5 x 10^-9 cm/sec	Per LOT	Review Only
	Large scale direct shear testing	ASTM D5321	laboratory test	1 test per material interface	review laboratory reports provided by CQC Manager

#### Materials Testing Schedule

MATERIAL	PROPERTY	TEST	VALUE	QC FREQUENCY	QA FREQUENCY
Flexible Membrane Liner (FML)					
40 mil LLDPE Geomembrane	Large scale direct shear testing	ASTM D5321	laboratory test	1 test per material interface	review laboratory reports provided by CQC Manager
	Seam Properties - Shear Strength	ASTM D6392	Fusion - 60 lbs/in , Extrusion - 60 lbs/in	Cut 1 sample / 500 linear feet of weld	1 / destructive test sample provided by CQC Manager
	Seam Properties - Peel Strength	ASTM D6392	Fusion - 50 lbs/in , Extrusion - 44 lbs/in	Cut 1 sample / 500 linear feet of weld	1 / destructive test sample provided by CQC Manager
	Trial Welds	ASTM D6392	Fusion: 50 lbs/in peel; 60 lbs/in shear Extrusion: 44 lbs/in peel; 60 lbs/in shear	2 / operator / machine / day (morning and mid-shift, max 4 hr work intervals)	Observation Only
	Vacuum Testing	ASTM D5641	Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.	1 / extrusion weld and repair location	Observation Only
	Air Pressure Testing	ASTM D5820	Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes	1 / wedge weld and repair location	Observation Only
60 mil HDPE Geomembrane	Large scale direct shear testing	ASTM D5321	laboratory test	1 test per material interface	review laboratory reports provided by CQC Manager
	Seam Properties - Shear Strength	ASTM D6392	Fusion - 120 lbs/in , Extrusion - 120 lbs/in	Cut 1 sample / 500 linear feet of weld	1 / destructive test sample provided by CQC Manager
	Seam Properties - Peel Strength	ASTM D6392	Fusion - 91 lbs/in , Extrusion - 78 lbs/in	Cut 1 sample / 500 linear feet of weld	1 / destructive test sample provided by CQC Manager
	Trial Welds	ASTM D6392	Fusion: 91 lbs/in peel; 120 lbs/in shear Extrusion: 78 lbs/in peel; 120 lbs/in shear	2 / operator / machine / day (morning and mid-shift, max 4 hr work intervals)	Observation Only
	Vacuum Testing	ASTM D5641	Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.	1 / extrusion weld and repair location	Observation Only
	Air Pressure Testing	ASTM D5820	Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes	1 / wedge weld and repair location	Observation Only

#### Materials Testing Schedule

MATERIAL	PROPERTY	TEST	VALUE	QC FREQUENCY	QA FREQUENCY
Soils Cover Soil	Soil Classification	ASTM D2487	CL, CH, MH, or ML, CL-ML, SC, or SM-SC according to the Unified Soil Classification System, or a combination of these groups	1 / source / change in material	Review laboratory reports
	Standard Proctor	ASTM D698	laboratory test	1 / source / change in material	Review laboratory reports
	Field Density and Moisture	ASTM D6938	Min. 92%, within 2% of optimum moisture content	5 / acre / lift	1 / acre / lift
Vegetative Cover	Soil Classification	ASTM D5268	Soils used for vegetative cover shall conform to the requirements set forth in ASTM D5268, unless otherwise approved based on the soils ability to sustain vegetation	1 / source / change in material	Review laboratory reports
	Agronomic Testing	-	laboratory test	1 / 10 acres	Review laboratory reports
Clay Berm Soil	Soil Classification	ASTM D2487	CL, CH, MH, or ML, CL-ML, SC, or SM-SC according to the Unified Soil Classification System, or a combination of these groups	1 / source / change in material	Review laboratory reports
	Standard Proctor	ASTM D698	laboratory test	1 / source / change in material	Review laboratory reports
	Field Density and Moisture	ASTM D6938	Min. 95%, within 2% of optimum moisture content	5 / acre / lift	1 / acre / lift
Anchor Trench Backfill	Standard Proctor	ASTM D698	laboratory test	1 / source / change in material	Review laboratory reports
	Field Density and Moisture	ASTM D6938	Compact each layer of material with at least three passes of a vibratory plate compactor with in-place moisture within -2% to +2% of optimum moisture content		1 / 500 linear feet of trench

3 of 4

#### **Materials Testing Schedule**

MATERIAL	PROPERTY	TEST	VALUE	QC FREQUENCY	QA FREQUENCY
Utility/Pipe Trench Backfill	Standard Proctor	ASTM D698	laboratory test	1 / source / change in material	Review laboratory reports
	Field Density and Moisture	ASTM D6938	Min. 95%, within 2% of optimum moisture content	1 / 100 linear feet of trench	1 / 500 linear feet of trench
HDPE Pipe					
HDPE Gravity Pipe	Low Pressure Air Test	ASTM F1417	Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air	1 / pipe run	Observation Only
Slide Gates					
Slide Gates	Leak Testing	AWWA C560	AWWA Standard for Cast-Iron Slide Gates	1 / slide gate	Observation Only
Materials Delivered to Site					
	Defects	Visual Observation	no defects	1 / material delivery	1 / material delivery
	Conformance to Submittals	Visual Observation	conforms to plans	1 / material delivery	1 / material delivery

4 of 4

Notes:

(1) Testing frequency may be adjusted as directed by the CQA Manager

(2) This table does not include all required quality control testing. The Subontractor shall be solely responsible for the proper implementation of its Quality Control Program.

(3) Once CCR removal verification procedures are completed and documented, an additional 6 inches of soil will be excavated across the footprint.

# APPENDIX K

Post Closure Plan

# **Post-closure Plan**

CFR 257.104(d)

West Boiler Slag Pond

**Clifty Creek Station** 

Madison, Indiana

April 2021

Prepared by: Indiana-Kentucky Electric Corporation

3932 U.S. Route 23

Piketon, OH 45661



# **Table of Contents**

1.0	OBJECTIVE	1
2.0	DESCRIPTION OF THE CCR UNIT	1
3.0	DESCRIPTION OF THE POST-CLOSURE PLAN 257.104(d)(1)(i)	1
4.0	POST-CLOSURE CONTACT 257.104(d)(1)(ii)	3
5.0	POST-CLOSURE PLANNED USE 257.104(d)(1)(iii)	3

#### 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 Station's West Boiler Slag Pond.

#### 2.0 DESCRIPTION OF THE CCR UNIT

The Clifty Creek Station is located on the shore 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 West Boiler Slag Pond is located immediately west of the Station and south of Clifty Hollow Rd. Upon commencing operation, the Clifty Creek Station began sluicing CCRs into the West Boiler Slag Pond for purposes of storage.

The West Boiler Slag Pond embankment is approximately 2,500 feet long, and encompasses approximately 75 acres, with about 35 acres of surface water. The top of the dike is located at elevation 475 feet, and varies in height above the adjacent plant grades, with a maximum height of approximately 41 feet.

#### 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 <u>CCR unit, and the frequency at which these activities will be performed</u>]

#### 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 harm occurs.

- <u>Embankment</u>: The waste embankment will be inspected for slides, settlement, subsidence, displacement, and cover condition (see below).
- <u>Final Cover Surface</u>: The Final Cover surface will be inspected for any ponding of water or flat areas. 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. Condition of the vegetation will be observed for maintenance needs (i.e., gaps in vegetation, presence of undesirable trees or brush).

• <u>Stormwater Management System</u>: The stormwater management system, including channels, culverts, slope drains, etc., will be inspected for erosion, integrity of channel lining, ponding, and accumulated sediment.

Maintenance during the post-closure care period will be performed as discussed below following the facility inspections.

- <u>Embankment:</u> Embankments will be inspected for slides, settlement, subsidence, displacement, and cover condition. Any areas exhibiting any such conditions will be repaired by reworking, replacing and/or compacting the material to design grade/specifications.
- <u>Erosion Damage Repair</u>: Any areas exhibiting erosion will be repaired by reworking, replacing and/or compacting the material to design grade/specifications, and reseeding the area. Applications of additional fertilizer, selective herbicides, rodent control measures, etc. will be implemented as necessary. The selection of fertilizers and herbicides, will strive to minimize their impact on groundwater. Follow-up monitoring of the repaired area will be conducted.
- <u>Settlement, Subsidence, Displacement</u>: 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 initially is judged to warrant it, a detailed investigation of the cause will be performed and remedial action will be performed. Repairs will be made as necessary. Follow-up monitoring of the area will be performed.
- <u>Closure Cap Surface</u>: Any areas that show signs of ponding water or flat contours will be observed and addressed. Due to the design contours required to achieve the final cap grade, special attention will be focused on the cap surface to promote drainage, reseeded to support vegetative growth, and maintained to minimize the ponding of water.
- <u>Stormwater Drainage System</u>: The channel linings are specified for design velocities. Maintenance of the stormwater management system will consist of removing sediment build up and/or undesirable vegetation from the stormwater management system's channels, culverts, and sediment basins as required. Eroded areas will be repaired by back-filling and reseeding in accordance with the specifications. Damage to culverts will be repaired; structure replacement will be performed if needed.

• Primary and Secondary Treatment Basins: Maintenance of the treatment basins will primarily consist of periodic inspections of the discharge structures and piping to ensure proper operation. Accumulated sediment will be removed from the basins as needed to maintain capacity requirements.

#### 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 observed 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 in-kind.

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, except for commercial purposes, such as the barge loading facility located on the southeastern corner or industrial uses associated with Clifty Creek Station processes. The activities occurring on the closed CCR unit will be related to the Post-Closure care activities and access to the barge loading facility. All other activities will be prohibited.



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

October 11, 2016 File: 175534018 Revision 0

Indiana-Kentucky Electric Corporation 3932 U.S. Route 23 P.O. Box 468 Piketon, Ohio 45661

#### RE: Closure and Post-Closure Plans West Boiler Slag Pond 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 plans for the Indiana-Kentucky (IKEC) Clifty Creek Station's West Boiler Slag Pond.

#### 2.0 CLOSURE AND POST-CLOSURE PLAN

The closure plans describe the steps necessary to close the CCR units 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 plans describe 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 plans are conceptual and subject to the completion of all necessary environmental reviews. They are therefore subject to change at any time. The attached closure and post-closure plans demonstrate 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;



October 11, 2016 Page 2 of 2

- RE: Closure and Post-Closure Plans West Boiler Slag Pond EPA Final Coal Combustion Residuals (CCR) Rule Clifty Creek Station Madison, Jefferson County, Indiana
  - 3. that the closure plan for the IKEC Clifty Creek Station's West Boiler Slag Pond meets the requirements described in 40 CFR 257.102(b); and
  - 4. that the post-closure plan for the IKEC Clifty Creek Station's West Boiler Slag Pond meets the requirements of 40 CFR 257.104(d).

DATE 10/11/16

SIGNATURE

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

TELEPHONE: (513) 842-8200

ATTACHMENT: Clifty Creek West Boiler Slag Pond Closure and Post-Closure Plans



Design with community in mind

# APPENDIX L

Closure and Post-Closure Cost Estimate

Oninian of Classers Costs				
Opinion of Closure Costs				
West Boiler Slag Pond				
Clifty Creek Plant				
Indiana-Kentucky Electric Corporation				
Madison, Jefferson County, Indiana				
Facility Name:	Clift	y Creek We	st Boiler	Slag Pond
Facility Location:	Mad	lison, Indian	a	
Facility County:	Jeff	erson		
Total Waste Fill Acreage:		89.6	Acres	
Total Grading Acreage:		93.9	Acres	
Closure Year:		2020-2025		
Phase 2 - 4 Acreage for Closure		80.4	Acres	
(Based on MSW Landfill Closure Plan State Form 50391, Sections III and VI.)				
III. LABOR, MATERIALS, & TESTING (Provide a listing of items necessary to clo	ose the facility.	For items th	hat will v	arv depending upor
the number of acres to be closed, the quantities should be indicated on a per-a	cre basis.			
A. Item	В	. Quantity	C.	Units (per acre)
Geosynthetic materials (geomembrane, geotextile, geocomposite drainage layer)		73.9	\$	88,761.60
Uncompacted 30-inch soil layer		73.9	\$	35,717.53
6-inch vegetative soil layer		73.9	\$	12,524.64
Vegetative cover		73.9	\$	3,288.19
Surveying		73.9	\$	850.00
Engineering certification		73.9	\$	1,392.86
Additional items				#DEEI
		ump sump		#REF!
Deed notation V. COST PER ACRE FOR FINAL COVER & VEGETATION	1	ump sump	\$	10,000.00
Deed notation	1	ump sump		10,000.00
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C. Cost per Acre for Acquisition and Placement of Geosynthetic Materials			
1. Acquisition			
a. Quantity of material needed per acre (square yards, yd <sup>2</sup> )		4,840	
b. Purchase and install geomembrane (\$/yd²)	\$	5.67	
c. Purchase and install nonwoven geotextile (\$/yd <sup>2</sup> )	\$	2.19	
d. Purchase and install composite drainage layer (\$/yd <sup>2</sup> )	\$	7.38	
e. Delivery unit cost (\$/yd²) (if applicable)	\$	-	
f. Acquisition cost (\$/acre)	\$	73,761.60	[1a * (1b+1c+1d)
2. Placement			
Placement cost (\$/acre) (if applicable and not included in purchasing unit cost)	\$	-	
3. Testing and QA/QC			
a. Fingerprinting, destructive (shear and peel tests) & nondestructive seam test (\$/acre)	\$	10,000.00	
b. Other testing (\$/acre)	\$	5,000.00	
c. Testing cost (\$/acre) (if applicable)	\$	15,000.00	[3a + 3b
I. TOTAL COST, GEOSYNTHETIC LAYERS (\$/acre)	\$	88,761.60	[1f + 2 +3c
0. Cost per Acre for Acquisition & Placement of Topsoil			
1. Acquisition		007	
a. Quantity of topsoil needed per acre (yd <sup>3</sup> /acre)		807	
b. Excavation unit cost ( $\frac{4}{y}$ ) (if obtained onsite)		N/A	
c. Purchase unit cost $(\$/yd^3)$ (if obtained offsite)	\$	7.61	
d. Delivery unit cost (\$/yd <sup>3</sup> ) (if obtained offsite)	\$	5.50	
e. Acquisition cost (\$/yd <sup>3</sup> )	\$	10,579.77	[1a * (1c+1d)
2. Placement			
a. Spreading unit cost (\$/yd <sup>3</sup> )	\$	2.41	
b. Placement cost (\$/acre)	\$	1,944.87	[1a * 2a
3. Topsoil Cost (\$/acre)	\$	12,524.64	[1e + 2b
Cost per Acre to Establish Vegetation			
1. Vegetation			
a. Seeding unit cost (\$/acre)			
b. Fertilization unit cost (\$/acre)			
c. Mulching unit cost (\$/acre)			
d. Vegetation Establishment Cost (\$/acre)	\$	3,288.19	[1a + 1b + 1c
G. Cost per Acre to Certify Closure			
1. Registered Professional Engineer			
a. Initial review of closure plan (hours)		80	
b. Total number of inspections		30	
c. Inspection time required (hours/visit)		24	
d. Total inspection time (hours)		720	[1b * 1c
e. Prepare final documentation (hours)		240	
f. Total engineer time (hours)		1,040	[1a + 1d + 1e
g. Engineer unit labor cost (\$/hour)	\$	120.00	
h. Professional engineer cost (\$)	φ \$	124,800.00	[1f * 1g
i. Area of site permitted for filling (acres)	φ	89.6	[11 19
		00.0	
j. Closure Certification Cost (\$/acre)	\$	1,392.86	[1h/1i]

H. Other Costs per Acre for Final Cover and Vegetation		
1. Other Costs (\$/acre)	850	soil thickness survey
I. Total of Items B through F (must not be less than \$5,000/acre)		
WBSP Closure	\$ 140,291.96	per acre
VI. OTHER CLOSURE COSTS (total facility basis, not per acre)		
A. Notation of Property Deed	\$ 10,000.00	
B. Other Costs - such as drainage feature, installation of gas vents, etc.		
Activity	Cost	
Phase 2 BSHS Settling Tanks	\$ 69,000,000.00	
Phase 3 Primary and Secondary Basins	\$ 10,990,000.00	
C. Total	\$ 80,000,000.00	[A + B]
VII. CLOSURE COST ESTIMATE	\$ 90,367,575.84	[(Acreage * VI) + VI.C]
10% Contingency (per IDEM)	\$ 9,036,757.58	
Total	\$ 99,404,333.43	
VIII. ADDITIONAL INFORMATION REQUIRED FOR FACILITIES PROVIDING FINA A. Will Closure Financial Assurance be Provided on an Incremental Basis?	NCIAL ASSURANCE ON AN IN No	CREMENTAL BASIS

West Boiler Slag Pond Clifty Creek Plant Indiana-Kentucky Electric Corporation Madison, Jefferson County, Indiana       Clifty Creek West Boiler Slag Pond Madison, Jefferson         Facility Location: Facility Location: Facility Location: Facility Cortex       Clifty Creek West Boiler Slag Pond Madison, Indiana Jefferson         Facility Location: Facility Location: Facility Location: Facility County: Total Waste Fill Acreage: Closure Year: Phase 2 - A Acreage for Closure Besed on MW Landhil Closure Plan State Form 50391, Section VI.)       Sector Sector 80.4       Acres 2020-2025 80.4         A Cost for Semi-Annual Inspections and Reports       .       .       .         1. Inspector       .       .       .         .       Inspector time required (hours/insp)       .       .         .       .       .       .       .         .       .       .       .       .         .       .       .       .       .         .       .       .       .       .         .       .       .       .       .       .         .       .       .       .       .       .       .         .       .       .       .       .       .       .       .         .       .       .       .       .       .       . <td< th=""><th>()ninion of Post-Closura Costs</th><th></th><th></th><th></th></td<>	()ninion of Post-Closura Costs			
Clifty Creek Plant Indiana-Kentucky Electric Corporation Madison, Jefferson County, Indiana Facility Location: Facility Location: A Number of inspections and Reports 1. Inspection a. Number of inspections during post-closure period facility fac	Opinion of Post-Closure Costs			
Indiana-Kentucky Electric Corporation         Madison, Jefferson County, Indiana         Facility Location:         Facility County:         Facility County:         Total Waste Fill Acreage:         Cost or Yaar         Dial Waste Fill Acreage:         Cost or Sami Annual Inspections and Reports         1. Inspector         a. Number of inspections during post-closure period (semi-annual inspections for 30 years       60         b. Inspector line required (hours/insp.)       30         c. Inspector line required (hours/insp.)       30         c. Inspector line required (hours/insp.)       5         c. Annober of reports during post-closure period       60         b. Cost for Proparation       60         c. Cost for Proport S(s)       \$         d. Inspection cost (%)       \$         a. Number of reports (Auring post-closure period       60         b. Cost per report (S)       \$         c. Report cost       \$         d. Inspection cost (%)       \$         a. Womber of reports (Auring post-closure period       60         b. Cost for Maintenance of Final Cover and Vegetation/Vegetation Control       1         c. Report cost       \$       3,00,000.00       [2a* 2t         a. Total Cost for placeme				
Madison, Jefferson County, Indiana         Facility Jocation:         Facility Location:         Total Wasto Fill Acraage:         Total Grading Acraage:         Closure Year:         Phase 2 - 4 Acraage for Closure         (Based on MSW Landfill Closure Plan State Form 50391, Section VI)         A. Cost for Semi-Annual Inspections and Reports         1. Inspection         a. Number of inspections during post-closure period (semi-annual inspections for 30 years         b. Inspector time required (hours/insp)         c. Across 100.00         c. Inspector time required (hours/insp)         a. Number of reports during post-closure period         b. Inspector time post (f)         c. Acrost for Ports during post-closure period         a. Number of reports (g)         c. Report cost         c. Report cost         c. Report cost         c. Report cost         c. Total Cost, INSPECTIONS AND REPORTS (s)         s. Total permitted fill acreage         a. Other he closure pin (a 200 MC 10: 2.3 (c)(5)(A))         b. Total permitted fill acrea	Clifty Creek Plant			
Facility Location:       Clifty Croek West Boller Slag Pond Madison, Indiana Jefferson         Facility County:       2020-2025         Total Waste Fill Acreage:       2020-2025         Coster year:       2020-2025         Phase 2 - 4 Acreage for Closure (gased on MSW Landhil Closure Plan State Form 50391, Section VI.)       Acress         A Cost for Semi-Annual Inspections and Reports       .         1. Inspection       80.4         a. Number of inspections during post-closure period (semi-annual inspections for 30 years b. Inspector time tabor cost (§/hour)       60         b. Inspector time tabor cost (§/hour)       \$ 90.00         c. Report Preparation       8         a. Number of reports during post-closure period       60         b. Cost per report (\$)       \$ 5000.00         c. Report Preparation       8         a. TortAL COST, INSPECTIONS AND REPORTS (\$)       \$ 462,000.00         c. Report Cost       \$ 300,000.00         c. Report Maintenance - The cost for over maintenance and vegetation shall be 10% of the cost per are calculated for final cover and vegetation in the closure pin (23) (40.102.32) (45)((5),(5),(3),(3),(3),(3),(3),(3),(3),(3),(3),(3	Indiana-Kentucky Electric Corporation			
Facility Location:       Madison, Indiana Jefferson         Total Wasto Fill Acreage:       33,5         Total Grading Acreage:       33,5         Reset on MSW Landhill Closure Plan State Form 50391, Section VI.)       Acres         A Cost for Semi-Annual Inspections and Reports       -         1. Inspection       80,0         a. Number of inspections during post-closure period (semi-annual inspections for 30 years       60         b. Inspector time required (hours/insp.)       30         c. Inspector time labor cost (\$/hour)       \$ 90.00         d. Inspection cost (\$)       \$ 162,000.00         a. Number of reports during post-closure period       60         b. Cost per report (\$)       \$ 300,000.00         c. Report Preparation       -         a. Number of reports during post-closure period       60         b. Cost per report (\$)       \$ 300,000.00         c. Report Cost       \$ 300,000.00         c. Report Cost for placement of final Cover and Vegetation/Vegetation Control         1. Final Cover Maintenance - The cost for over maintenance and vegetation shall be 10% of the cost per are calculated for final cover and vegetation (0.10* cost given in Item VILL of the closure pla	Madison, Jefferson County, Indiana			
Facility Location:       Madison, Indiana Jefferson         Total Wasto Fill Acreage:       33,5         Total Grading Acreage:       33,5         Reset on MSW Landhill Closure Plan State Form 50391, Section VI.)       Acres         A Cost for Semi-Annual Inspections and Reports       -         1. Inspection       80,0         a. Number of inspections during post-closure period (semi-annual inspections for 30 years       60         b. Inspector time required (hours/insp.)       30         c. Inspector time labor cost (\$/hour)       \$ 90.00         d. Inspection cost (\$)       \$ 162,000.00         a. Number of reports during post-closure period       60         b. Cost per report (\$)       \$ 300,000.00         c. Report Preparation       -         a. Number of reports during post-closure period       60         b. Cost per report (\$)       \$ 300,000.00         c. Report Cost       \$ 300,000.00         c. Report Cost for placement of final Cover and Vegetation/Vegetation Control         1. Final Cover Maintenance - The cost for over maintenance and vegetation shall be 10% of the cost per are calculated for final cover and vegetation (0.10* cost given in Item VILL of the closure pla	Facility Name:	Cli	fty Creek Wes	t Boiler Slag Pond
Facility County: Total Watse Fill Acreage: Closure Year: Phase 2 - 4 Acreage for Closure (Based on MSW Landfill Closure Plan State Form 50391, Section VI.) A Cost for Semi-Annual Inspections and Reports 1. Inspector line required (hours/insp) 6. Inspector line required (hours/insp) 6. Inspector line required (hours/insp) 6. Inspector line required (hours/insp) 7. Inspector line required (hours/insp) 6. Inspector of reports during post-closure period (semi-annual inspections for 30 years 6. Inspector line required (hours/insp) 7. Inspector line required (hours/insp) 7. Inspector line required (hours/insp) 7. Inspector line required (hours/insp) 7. Inspector time tabor cost (S/hour) 7. Report Preparation 8. Number of reports during post-closure period 8. Cost per report (\$) 7. Report Cost 7. Report Cost 7. Report Cost 7. Report Cost 7. Total COST, INSPECTIONS AND REPORTS (\$) 8. Cost for Maintenance of Final Cover and Vegetation/Vegetation shall be 10% of the cost per are calculated for final cover and vegetation in the closure plan (329 IAC 10-23.3(c)(5)(A)) 8. Total permitted fill acreage 8.0.6 6. Total Cost Maintenance of Final Cover and Vegetation Cover 8. Job of Cost for placement of final cover and Vegetation Cover 8. Job of Cost for placement of final cover and Vegetation Cover 8. Job of Cost for placement of final cover and Vegetation Cover 8. Job of Cost for placement of final cover and Vegetation Cover 8. Job of Cost for placement of final cover and Vegetation Cover 9. Job of Cost for placement of final Cover and Vegetation Cover 9. Job of Cost for placement of final Cover and Vegetation Cover 9. Job of Cost for placement of final Cover and Vegetation Cover 9. Job of Cost for placement of final Cover and Vegetation Cover 9. Job of Cost for placement of final Cover and Vegetation Cover 9. Job of Cost for placement of final Cover and Vegetation Cover 9. Job of Cost for placement of final Cover and Vegetation Cover 9. Job of Cost for lacent Cost for Maintenance of F	-		-	-
Total Grading Acreage:       9.3.9       Acreas         Closure Year:       2020-2025       80.4         Phase 2 + 4 Acreage for Closure       80.4       Acreas         (Based on MSW Landfill Closure Plan State Form 50391, Section VI.)       Acreas       Acreas         Access       80.4       Acreas       Acreas         1. Inspection       60       .       .         a. Number of inspections and Reports       30       .       .         b. Inspector time required (hours/insp)       30       .       .         c. Inspector time required (hours/insp)       5       90.00       [1a * 1b * 10]         C. Report Preparation       8       5.000.00       [2a * 2b]         a. Number of reports during post-closure period       60       .       .         b. Cost per report (\$)       \$       5.000.00       [2a * 2b]         c. Report cost       \$       300,000.00       [2a * 2b]         J. TOTAL COST, INSPECTIONS AND REPORTS (\$)       \$       462,000.00       [1d + 2d]         a. 10% of cost for placement of final cover and Vegetation/Vegetation shall be 10% of the cost per are calculated for final cover and vegetation (b.10 * cost given in Item VII.J of the closure plan (329 IAC 10-23-3(c)(5/A)).       .       3.571.75         b. Total permitted fill acreage<	Facility County:	Je	fferson	
Closure Year.       2020-2025         Phase 2 - 4 Acreage for Closure       80.4         Resed on MSW Landfill Closure Plan State Form 50391, Section VI.)       Acres         A. Cost for Semi-Annual Inspections and Reports       60         1. Inspection       30         a. Number of inspections during post-closure period (semi-annual inspections for 30 years 60       50.000         c. Inspector time required (hours/insp)       30         c. Inspector time labor cost (\$/hour)       \$ 90.00         d. Inspection cost (\$)       \$ 162,000.00         a. Number of reports during post-closure period       60         b. Cost per report (\$)       \$ 5,000.00         c. Report Cost       \$ 300.00.00         d. Inspection       \$ 300.00.00         a. Number of reports during post-closure period       \$ 5,000.00         b. Cost per report (\$)       \$ 462,000.00       [1d + 2d         c. Report cost       \$ 300.000.00       [2a * 2d         d. Total Cost, INSPECTIONS AND REPORTS (\$)       \$ 462,000.00       [1d + 2d         b. Total permitted fill acreage       89.6       6         c. Total Cost for placement of final cover and Vegetation Control       \$ 3,571.75       5         b. Total permitted fill acreage       89.6       6         c. Total Cost, Mai	Total Waste Fill Acreage:		89.6	Acres
Phase 2 - 4 Acreage for Closure       80.4       Acres         (Based on MSW Landfill Closure Plan State Form 50391, Section VI.)       80.4       Acres         A Cost for Semi-Annual Inspections and Reports       60       5.         1. Inspection       30       60         a. Number of inspections during post-closure period (semi-annual inspections for 30 years 0.       60       5.         b. Inspector time required (hours/insp.)       30       60       60         c. Inspector time labor cost (\$/hour)       \$ 90.00       1a* 1b* 10         c. Report Preparation       60       5.       5.000.00         a. Number of reports during post-closure period       60       5.       5.         b. Cost per report (\$)       \$ 5.000.00       [2a * 2t]       7.         c. Report Cost       \$ 300,000.00       [2a * 2t]       7.         J. Total Cost, INSPECTIONS AND REPORTS (\$)       \$ 462,000.00       [1d + 2c]         B. Cost for Maintenance of Final Cover and Vegetation Control       1.       Final Cover Maintenance of Tinal Cover and Vegetation [22]       1.         A. Total Cost, INSPECTIONS AND REPORTS (\$)       \$ 462,000.00       [1d + 2c]       1.         b. Total permited fill acreage       89.6       .       .         c. Total Cost, Maintenance of Final Cover and Veget	Total Grading Acreage:		93.9	Acres
(Based on MSW Landfill Closure Plan State Form 50391, Section VI.)  A. Cost for Semi-Annual Inspections and Reports  I. Inspection  a. Number of inspections during post-closure period (semi-annual inspections for 30 years 60  b. Inspector time tadprotect (Shour) \$ 90.00  c. Inspector time labor cost (Shour) \$ 90.00  c. Report Preparation  a. Number of reports during post-closure period 60  b. Cost per report (S) \$ 5.000.00  c. Report cost (Shour) \$ 5.000.00  c. Report cost (Shour) \$ 5.000.00  c. Report cost (Shour) \$ 462,000.00  c. Report cost (Shour) \$ 3.000,000  c. Report cost (Shour) \$ 462,000.00  c. Report cost (Shour) \$ 462,000.00  c. Report cost (Shour) \$ 3.000,000  c. Report cost (Shour) \$ 3.000,000  c. Report cost (Shour) \$ 3.000,000  c. Report cost (Shour) \$ 462,000.00  c. Total Cost, INSPECTIONS AND REPORTS (Shour) \$ 462,000.00  c. Total Cost, Maintenance - The cost for cover maintenance and vegetation shall be 10% of the cost per are calculated for final cover and vegetation (0.10 * cost given in Item VII.1 of the closure plan) \$ 3.571.75  b. Total perimitted fill acceage \$ 89.6  c. Total Cost, Maintenance of Final Cover and Vegetation Cover \$ 3.20,029.07  c. Moving frequency (visils/30 years) \$ 60  b. Area to be moved (access/shit) \$ 93.9  c. Moving frequency (visils/30 years) \$ 296.63  c. Moving indicast (Share) \$ 296.			2020-2025	
A. Cost for Semi-Annual Inspections and Reports  1. Inspection  a. Number of inspections during post-closure period (semi-annual inspections for 30 years b. Inspector time required (hours/insp) c. Inspector time labor cost (\$/hour) g 90.00 (d. Inspection cost (\$) g 162,000.00 (1a*1b*1c  C. Cost for Semi-Annual Inspections of (Semi-annual inspections for 30 years b. Inspector time required (hours/insp) 30 (d. Inspector time labor cost (\$/hour) 3 (d. Inspector time labor cost (\$/hour) 3 (d. Inspector time labor cost (\$/hour) 3 (fa*1b*1c  C. Cost for Semi-Annual Inspections and Reports  A. Number of reports during post-closure period 6 (fa*1b*1c  C. Cost for Leachate Treatment and Disposal  A. Number of reports (S)  C. Set for Maintenance of Final Cover and Vegetation/Vegetation control  A. Final Cover Maintenance of Final Cover and Vegetation Shall be 10% of the cost per are calculated for final cover and vegetation is hall be 10% of the cost per are calculated for final cover and vegetation is hall be 10% of the cost per are calculated for final cover and vegetation (0.10 * cost given in Item VII.1 of the closure plan)  A. Total Cost, Maintenance of Final Cover and Vegetation Cover  A. Total Cost, Maintenance of Final Cover and Vegetation Cover  A. Total Cost (S/acre)  A. Total Cost (S/acre)  A. Total Cost (S/acre)  A. Total moving cost (S/acre)  A. Total moving cost (S/acre)  A. Total Cost (S/acre)	5		80.4	Acres
1. Inspection         a. Number of inspections during post-closure period (semi-annual inspections for 30 years 60         b. Inspector time required (hours/insp)         30         c. Inspector time labor cost (\$/hour)         g. Inspector time labor cost (\$/hour)         a. Number of reports during post-closure period         a. Number of reports during post-closure period         a. Number of reports during post-closure period         b. Cost per report (\$)         c. Report cost         3. TOTAL COST, INSPECTIONS AND REPORTS (\$)         S. TotAL COST, INSPECTIONS AND REPORTS (\$)         S. Cost for Maintenance of Final Cover and Vegetation/Vegetation Control         1. Final Cover Maintenance - The cost for cover maintenance and vegetation shall be 10% of the cost per are calculated for final cover and vegetation (0.10 * cost given in Item VIL) of the closure plan (329 IAC 10-23-3(c)(5)(A)).         a. 10% of cost for placement of final cover and Vegetation Cover       \$ 3,571.75         b. Total permitted fill acreage       89.6         c. Total Cost, Maintenance of Final Cover and Vegetation Cover       \$ 320,029.07         b. Total permitted fill acreage       \$ 296.63         c. Mowing frequency (visits/30 years)       60         b. Area to be mowed (acres/visit)       \$ 93.9         c. Mowing frequency (visits/30 years)       60         b. Area to b	(Based on MSW Landfill Closure Plan State Form 50391, Section VI.)			
a. Number of inspections during post-closure period (semi-annual inspections for 30 years 60 b. Inspector time required (hours/insp) 30 c. Inspector time labor cost (\$/hour) \$ 90.00 d. Inspection cost (\$) \$ 162,000.00 [1a*1b*16 <b>2. Report Preparation</b> a. Number of reports during post-closure period 60 b. Cost per report (\$) \$ 5,000.00 c. Report cost \$ 300,000.00 [2a*28 <b>3. TOTAL COST, INSPECTIONS AND REPORTS (\$) \$ 462,000.00</b> [1d + 26 <b>B. Cost for Maintenance of Final Cover and Vegetation/Vegetation Control</b> <b>1. Final Cover Maintenance -</b> The cost for cover maintenance and vegetation shall be 10% of the cost per are calculated for final cover and vegetation (0.10* cost given in Item VII.1 of the closure plan) \$ 3,571.75 b. Total permitted fill acreage 89.6 c. Total Cost, Maintenance of Final Cover and Vegetation Cover \$ 320,020.77 [1a*11 <b>2. Vegetation Control Costs</b> a. Mowing frequency (visits/30 years) 60 b. Area to be mowed (acres/visit) 93.9 c. Moving unit cost (\$/acre) \$ 1,671,213.42 [2a*2b*2c] d. Total nowing cost (\$/acre) \$ 1,671,213.42 [2a*2b*2c] a. Other (\$) - specify below (weed control for well access, etc.) \$ 1,991,242.49 [1c+2] <b>3. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION \$ 1,991,242.49</b> [1c+2] <b>C. Cost for Leachate Treatment and Disposal</b> N/A	A. Cost for Semi-Annual Inspections and Reports			
b. Inspector time required (hours/insp)       30         c. Inspector time labor cost (\$/hour)       \$ 90.00         d. Inspection cost (\$)       \$ 162,000.00       [1a*1b*16]         2. Report Preparation       60         a. Number of reports during post-closure period       60         b. Cost per report (\$)       \$ 300,000.00       [2a*22]         3. TOTAL COST, INSPECTIONS AND REPORTS (\$)       \$ 462,000.00       [1d+2c         B. Cost for Maintenance of Final Cover and Vegetation/Vegetation Control       1         1. Final Cover Maintenance of Final Cover and Vegetation (0.10 * cost given in Item VII.1 of the closure plan (329 IAC 10-23-3(c)(5)(A)).       a. 10% of cost for placement of final cover and vegetation (0.10 * cost given in Item VII.1 of the closure plan)       \$ 3,571.75         b. Total permitted fill acreage       89.6       2         c. Total Cost, Maintenance of Final Cover and Vegetation Cover       \$ 320,029.07       [1a*1t*1t*1t*10]         2. Vegetation Control Costs       8       60       5       296.63         c. Total Cost, Maintenance of Final Cover and Vegetation Cover       \$ 320,029.07       [1a*1t*1t*10]         2. Vegetation Control Costs       8       60       5       296.63         d. Total mowing cost (\$)       \$ 1,671,213.42       [2a*2b*2c       2       2         d. Total mowing cost (\$)	1. Inspection			
b. Inspector time required (hours/insp)       30         c. Inspector time labor cost (\$/hour)       \$ 90.00         d. Inspection cost (\$)       \$ 162,000.00       [1a*1b*16]         2. Report Preparation       60         a. Number of reports during post-closure period       60         b. Cost per report (\$)       \$ 300,000.00       [2a*22]         3. TOTAL COST, INSPECTIONS AND REPORTS (\$)       \$ 462,000.00       [1d+2c         B. Cost for Maintenance of Final Cover and Vegetation/Vegetation Control       1         1. Final Cover Maintenance of Final Cover and Vegetation (0.10 * cost given in Item VII.1 of the closure plan (329 IAC 10-23-3(c)(5)(A)).       a. 10% of cost for placement of final cover and vegetation (0.10 * cost given in Item VII.1 of the closure plan)       \$ 3,571.75         b. Total permitted fill acreage       89.6       2         c. Total Cost, Maintenance of Final Cover and Vegetation Cover       \$ 320,029.07       [1a*1t*1t*1t*10]         2. Vegetation Control Costs       8       60       5       296.63         c. Total Cost, Maintenance of Final Cover and Vegetation Cover       \$ 320,029.07       [1a*1t*1t*10]         2. Vegetation Control Costs       8       60       5       296.63         d. Total mowing cost (\$)       \$ 1,671,213.42       [2a*2b*2c       2       2         d. Total mowing cost (\$)	a. Number of inspections during post-closure period (semi-annual inspections for 30 years		60	
c. Inspector time labor cost (\$/hour)       \$ 90.00         d. Inspection cost (\$)       \$ 162,000.00       [1a*1b*1c         2. Report Preparation       60         a. Number of reports during post-closure period       60         b. Cost per report (\$)       \$ 300,000.00         c. Report cost       \$ 300,000.00         c. Total Cost, INSPECTIONS AND REPORTS (\$)       \$ 462,000.00         l. Final Cover Maintenance - The cost for cover maintenance and vegetation shall be 10% of the cost per are calculated for final cover and vegetation (0.10 * cost given in Item VII.1 of the closure plan)         b. Total permitted fill acreage       \$ 35,51.75         c. Total Cost, Maintenance of Final Cover and Vegetation Cover       \$ 320,029.07			30	
d. Inspection cost (\$)       \$ 162,000.00       [1a * 1b * 1c         2. Report Preparation       60         a. Number of reports during post-closure period       60         b. Cost per report (\$)       \$ 3,00,000.00         c. Report cost       \$ 300,000.00         1. Final Cost, INSPECTIONS AND REPORTS (\$)       \$ 462,000.00         1. Final Cover Maintenance of Final Cover and Vegetation/Vegetation Control         1. Final Cover Maintenance - The cost for cover maintenance and vegetation shall be 10% of the cost per are calculated for final cover and vegetation (0.10 * cost given in Item VII.) of the closure plan (329 IAC 10-23-3(c)(5)(A)).         a. 10% of cost for placement of final cover and vegetation (0.10 * cost given in Item VII.) of the closure plan         the closure plan)       \$ 3,571.75         b. Total permitted fill acreage       89.6         c. Total Cost, Maintenance of Final Cover and Vegetation Cover       \$ 320,029.07         b. Area to be mowed (acres/visit)       93.9         c. Mowing Init cost (\$/sacre)       \$ 296.63         d. Total mowing cost (\$)       \$ 1,671,213.42       [2a * 2b * 2c         e. Other (\$) - specify below (weed control for well access, etc.)       \$ 1,671,213.42       [2d + 2e * 2c * 2c         d. Total COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION       \$ 1,671,213.42       [2d + 2e * 2c * 2c * 2c * 2c * 2c		\$	90.00	
a. Number of reports during post-closure period 60 b. Cost per report (\$) \$ 5,000.00 c. Report cost \$ 300,000.00 [2a * 2t 3. TOTAL COST, INSPECTIONS AND REPORTS (\$) \$ 462,000.00 [1d + 2c B. Cost for Maintenance of Final Cover and Vegetation/Vegetation Control 1. Final Cover Maintenance - The cost for cover maintenance and vegetation shall be 10% of the cost per are calculated for final cover and vegetation in the closure plan (329 IAC 10-23-3(c)(5)(A)). a. 10% of cost for placement of final cover and vegetation (0.10 * cost given in Item VII.I of the closure plan) \$ 3,571.75 b. Total permitted fill acreage 89.6 c. Total Cost, Maintenance of Final Cover and Vegetation Cover \$ 320,029.07 [1a * 1t 2. Vegetation Control Costs a. Mowing frequency (visits/30 years) 60 b. Area to be mowed (acres/visit) 93.9 c. Mowing unit cost (\$/acre) \$ 296.63 d. Total mowing cost (\$) e. Other (\$) - specify below (weed control for well access, etc.) \$ f. Vegetation Control Costs \$ 1,671,213.42 [2a * 2b * 2c e. Other (\$) - specify below (meed control for well access, etc.) \$ f. Vegetation Control Costs \$ 1,671,213.42 [2d + 2e 3. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION \$ 1,991,242.49 [1c + 20] C. Cost for Leachate Treatment and Disposal N/A			162,000.00	[1a * 1b * 1c
a. Number of reports during post-closure period 60 b. Cost per report (\$) \$ 5,000.00 c. Report cost \$ 300,000.00 [2a * 2t 3. TOTAL COST, INSPECTIONS AND REPORTS (\$) \$ 462,000.00 [1d + 2c B. Cost for Maintenance of Final Cover and Vegetation/Vegetation Control 1. Final Cover Maintenance - The cost for cover maintenance and vegetation shall be 10% of the cost per are calculated for final cover and vegetation in the closure plan (329 IAC 10-23-3(c)(5)(A)). a. 10% of cost for placement of final cover and vegetation (0.10 * cost given in Item VII.I of the closure plan) \$ 3,571.75 b. Total permitted fill acreage 89.6 c. Total Cost, Maintenance of Final Cover and Vegetation Cover \$ 320,029.07 [1a * 1t 2. Vegetation Control Costs a. Mowing frequency (visits/30 years) 60 b. Area to be mowed (acres/visit) 93.9 c. Mowing unit cost (\$/acre) \$ 296.63 d. Total mowing cost (\$) e. Other (\$) - specify below (weed control for well access, etc.) \$ f. Vegetation Control Costs \$ 1,671,213.42 [2a * 2b * 2c e. Other (\$) - specify below (meed control for well access, etc.) \$ f. Vegetation Control Costs \$ 1,671,213.42 [2d + 2e 3. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION \$ 1,991,242.49 [1c + 20] C. Cost for Leachate Treatment and Disposal N/A	2. Report Preparation			
b. Cost per report (\$) c. Report cost 5 5,000.00 c. Report cost 5 300,000.00 [2a*24 3. TOTAL COST, INSPECTIONS AND REPORTS (\$) 6 462,000.00 [1d + 26 6 6. Cost for Maintenance of Final Cover and Vegetation/Vegetation Control 7. Final Cover Maintenance - The cost for cover maintenance and vegetation shall be 10% of the cost per are calculated for final cover and vegetation in the closure plan (329 IAC 10-23-3(c)(5)(A)). a. 10% of cost for placement of final cover and vegetation (0.10 * cost given in Item VII.I of the closure plan) 5. Total permitted fill acreage 69.6 c. Total Cost, Maintenance of Final Cover and Vegetation Cover 5 320,029.07 [1a * 1t 2. Vegetation Control Costs a. Mowing frequency (visits/30 years) b. Area to be mowed (acres/visit) c. Mowing unit cost (\$/acre) 5 296.63 d. Total mowing cost (\$) 6. Other (\$) - specify below (weed control for well access, etc.) 5 c. Cost for Leachate Treatment and Disposal N/A			60	
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1. Final Cover Maintenance - The cost for cover maintenance and vegetation shall be 10% of the cost per are calculated for final cover and vegetation in the closure plan (329 IAC 10-23-3(c)(5)(A)).         a. 10% of cost for placement of final cover and vegetation (0.10 * cost given in Item VII.I of the closure plan)       \$ 3,571.75         b. Total permitted fill acreage       89.6         c. Total Cost, Maintenance of Final Cover and Vegetation Cover       \$ 320,029.07         2. Vegetation Control Costs       60         a. Mowing frequency (visits/30 years)       60         b. Area to be mowed (acres/visit)       93.9         c. Mowing unit cost (\$/acre)       \$ 296.63         d. Total mowing cost (\$)       \$ 1,671,213.42       [2a * 2b * 2c         e. Other (\$) - specify below (weed control for well access, etc.)       \$ 1,671,213.42       [2d + 2e         3. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION       \$ 1,991,242.49       [1c + 2t	3. TOTAL COST, INSPECTIONS AND REPORTS (\$)	\$	462,000.00	[1d + 2c
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the closure plan)       \$ 3,571.75         b. Total permitted fill acreage       89.6         c. Total Cost, Maintenance of Final Cover and Vegetation Cover       \$ 320,029.07         [1a * 1t         2. Vegetation Control Costs         a. Mowing frequency (visits/30 years)         b. Area to be mowed (acres/visit)         c. Mowing unit cost (\$/acre)         c. Mowing cost (\$)         e. Other (\$) - specify below (weed control for well access, etc.)         f. Vegetation Control Costs         3. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION         \$ 1,991,242.49         [1c + 2)         C. Cost for Leachate Treatment and Disposal	<ul> <li>B. Cost for Maintenance of Final Cover and Vegetation/Vegetation Control</li> <li>1. Final Cover Maintenance - The cost for cover maintenance and vegetation shall be 10% of the cover maintenance and vegetation shall be 10% of the cover maintenance and vegetation shall be 10% of the cover maintenance and vegetation shall be 10% of the cover maintenance and vegetation shall be 10% of the cover maintenance and vegetation shall be 10% of the cover maintenance and vegetation shall be 10% of the cover maintenance and vegetation shall be 10% of the cover maintenance and vegetation shall be 10% of the cover maintenance and vegetation shall be 10% of the cover maintenance and vegetation shall be 10% of the cover maintenance and vegetation shall be 10% of the cover maintenance and vegetation shall be 10% of the cover maintenance and vegetation shall</li></ul>			
c. Total Cost, Maintenance of Final Cover and Vegetation Cover       \$ 320,029.07       [1a * 1t         2. Vegetation Control Costs       60         a. Mowing frequency (visits/30 years)       60         b. Area to be mowed (acres/visit)       93.9         c. Mowing unit cost (\$/acre)       \$ 296.63         d. Total mowing cost (\$)       \$ 1,671,213.42       [2a * 2b * 2c         e. Other (\$) - specify below (weed control for well access, etc.)       \$ -       -         f. Vegetation Control Costs       \$ 1,671,213.42       [2d + 2e         3. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION       \$ 1,991,242.49       [1c + 2t         C. Cost for Leachate Treatment and Disposal       N/A       N/A	<ul> <li>B. Cost for Maintenance of Final Cover and Vegetation/Vegetation Control</li> <li>1. Final Cover Maintenance - The cost for cover maintenance and vegetation shall be 10% ovegetation in the closure plan (329 IAC 10-23-3(c)(5)(A)).</li> </ul>			
2. Vegetation Control Costs         a. Mowing frequency (visits/30 years)         b. Area to be mowed (acres/visit)         c. Mowing unit cost (\$/acre)         c. Mowing unit cost (\$/acre)         d. Total mowing cost (\$)         e. Other (\$) - specify below (weed control for well access, etc.)         f. Vegetation Control Costs         3. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION         s. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION         s. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION         s. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION         s. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION         s. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION         s. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION         s. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION         s. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION         s. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION         s. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION	<ul> <li>B. Cost for Maintenance of Final Cover and Vegetation/Vegetation Control</li> <li>1. Final Cover Maintenance - The cost for cover maintenance and vegetation shall be 10% of vegetation in the closure plan (329 IAC 10-23-3(c)(5)(A)).</li> <li>a. 10% of cost for placement of final cover and vegetation (0.10 * cost given in Item VII.I of</li> </ul>	of the	e cost per are c	
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b. Area to be mowed (acres/visit)       93.9         c. Mowing unit cost (\$/acre)       \$ 296.63         d. Total mowing cost (\$)       \$ 1,671,213.42       [2a * 2b * 2c]         e. Other (\$) - specify below (weed control for well access, etc.)       \$ -       -         f. Vegetation Control Costs       \$ 1,671,213.42       [2d + 2c]         State of the control Costs         N/A	<ul> <li>B. Cost for Maintenance of Final Cover and Vegetation/Vegetation Control</li> <li>1. Final Cover Maintenance - The cost for cover maintenance and vegetation shall be 10% of vegetation in the closure plan (329 IAC 10-23-3(c)(5)(A)). <ul> <li>a. 10% of cost for placement of final cover and vegetation (0.10 * cost given in Item VII.I of the closure plan)</li> <li>b. Total permitted fill acreage</li> <li>c. Total Cost, Maintenance of Final Cover and Vegetation Cover</li> </ul> </li> </ul>	of the \$	e cost per are c 3,571.75 89.6	alculated for final cover and
c. Mowing unit cost (\$/acre)       \$ 296.63         d. Total mowing cost (\$)       \$ 1,671,213.42       [2a * 2b * 2c]         e. Other (\$) - specify below (weed control for well access, etc.)       \$ -         f. Vegetation Control Costs       \$ 1,671,213.42       [2d + 2e]         TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION         N/A	<ul> <li>B. Cost for Maintenance of Final Cover and Vegetation/Vegetation Control</li> <li>1. Final Cover Maintenance - The cost for cover maintenance and vegetation shall be 10% of vegetation in the closure plan (329 IAC 10-23-3(c)(5)(A)). <ul> <li>a. 10% of cost for placement of final cover and vegetation (0.10 * cost given in Item VII.I of the closure plan)</li> <li>b. Total permitted fill acreage</li> <li>c. Total Cost, Maintenance of Final Cover and Vegetation Cover</li> </ul> </li> <li>2. Vegetation Control Costs</li> </ul>	of the \$	e cost per are c 3,571.75 89.6 320,029.07	alculated for final cover and
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f. Vegetation Control Costs       \$ 1,671,213.42       [2d + 2e         3. TOTAL COST FOR MAINTENANCE OF FINAL COVER AND VEGETATION       \$ 1,991,242.49       [1c + 2e         C. Cost for Leachate Treatment and Disposal       N/A	<ul> <li>B. Cost for Maintenance of Final Cover and Vegetation/Vegetation Control</li> <li>1. Final Cover Maintenance - The cost for cover maintenance and vegetation shall be 10% of vegetation in the closure plan (329 IAC 10-23-3(c)(5)(A)).</li> <li>a. 10% of cost for placement of final cover and vegetation (0.10 * cost given in Item VII.I of the closure plan)</li> <li>b. Total permitted fill acreage</li> <li>c. Total Cost, Maintenance of Final Cover and Vegetation Cover</li> <li>2. Vegetation Control Costs <ul> <li>a. Mowing frequency (visits/30 years)</li> <li>b. Area to be mowed (acres/visit)</li> <li>c. Mowing unit cost (\$/acre)</li> </ul> </li> </ul>	of th \$ \$	e cost per are c 3,571.75 89.6 320,029.07 60 93.9 296.63	alculated for final cover and
C. Cost for Leachate Treatment and Disposal N/A	<ul> <li>B. Cost for Maintenance of Final Cover and Vegetation/Vegetation Control</li> <li>1. Final Cover Maintenance - The cost for cover maintenance and vegetation shall be 10% of vegetation in the closure plan (329 IAC 10-23-3(c)(5)(A)).</li> <li>a. 10% of cost for placement of final cover and vegetation (0.10 * cost given in Item VII.I of the closure plan)</li> <li>b. Total permitted fill acreage</li> <li>c. Total Cost, Maintenance of Final Cover and Vegetation Cover</li> <li>2. Vegetation Control Costs <ul> <li>a. Mowing frequency (visits/30 years)</li> <li>b. Area to be mowed (acres/visit)</li> <li>c. Mowing unit cost (\$/acre)</li> <li>d. Total mowing cost (\$)</li> </ul> </li> </ul>	of th \$ \$ \$	e cost per are c 3,571.75 89.6 320,029.07 60 93.9 296.63	alculated for final cover and
$\cdot$	<ul> <li>B. Cost for Maintenance of Final Cover and Vegetation/Vegetation Control</li> <li>1. Final Cover Maintenance - The cost for cover maintenance and vegetation shall be 10% of vegetation in the closure plan (329 IAC 10-23-3(c)(5)(A)). <ul> <li>a. 10% of cost for placement of final cover and vegetation (0.10 * cost given in Item VII.I of the closure plan)</li> <li>b. Total permitted fill acreage</li> <li>c. Total Cost, Maintenance of Final Cover and Vegetation Cover</li> </ul> </li> <li>2. Vegetation Control Costs <ul> <li>a. Mowing frequency (visits/30 years)</li> <li>b. Area to be mowed (acres/visit)</li> <li>c. Mowing unit cost (\$/acre)</li> </ul> </li> <li>d. Total mowing cost (\$)</li> <li>e. Other (\$) - specify below (weed control for well access, etc.)</li> </ul>	of th \$ \$ \$ \$ \$	e cost per are c 3,571.75 89.6 320,029.07 60 93.9 296.63 1,671,213.42	alculated for final cover and [1a * 1b [2a * 2b * 2c
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$\cdot$	<ul> <li>B. Cost for Maintenance of Final Cover and Vegetation/Vegetation Control</li> <li>1. Final Cover Maintenance - The cost for cover maintenance and vegetation shall be 10% of vegetation in the closure plan (329 IAC 10-23-3(c)(5)(A)). <ul> <li>a. 10% of cost for placement of final cover and vegetation (0.10 * cost given in Item VII.I of the closure plan)</li> <li>b. Total permitted fill acreage</li> <li>c. Total Cost, Maintenance of Final Cover and Vegetation Cover</li> </ul> </li> <li>2. Vegetation Control Costs <ul> <li>a. Mowing frequency (visits/30 years)</li> <li>b. Area to be mowed (acres/visit)</li> <li>c. Mowing unit cost (\$/acre)</li> <li>d. Total mowing cost (\$)</li> <li>e. Other (\$) - specify below (weed control for well access, etc.)</li> <li>f. Vegetation Control Costs</li> </ul> </li> </ul>	of th \$ \$ \$ \$ \$ \$ \$	e cost per are c 3,571.75 89.6 320,029.07 60 93.9 296.63 1,671,213.42	alculated for final cover and [1a * 1b [2a * 2b * 2c [2d + 2e
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E. Cost for Groundwater Water Monitoring and Well Maintenance			
1. Monitoring Well Maintenance Labor Cost			
a. Maintenance frequency (visits/30 years)		60	
b. Number of monitoring wells needing maintenance per visit		2	(estimated)
c. Maintenance time required (hours/well)		4	(000000000)
d. Unit labor cost (\$/hour)	\$	81.00	
e. Monitoring well maintenance labor cost (\$)	\$	38,880.00	[1a * 1b * 1c * 1d]
2. Monitoring Well Parts and Sampling Equipment Replacement Cost		0	
a. Number of wells needing replacement during post-closure period	4	0	
<ul> <li>b. Existing monitoring well abandonment unit cost (\$)</li> <li>Now monitoring well construction unit cost (\$)</li> </ul>	\$	-	(drilling charged by fact)
c. New monitoring well construction unit cost (\$)	\$ \$	-	(drilling charged by foot)
d. Monitoring well replacement cost (\$)	Ş	- -	
e. Number of pumps/bailers needing replacement during post-closure period	ć	5	
f. Pump/bailer unit cost (\$/pump)	\$ \$	2,000.00	[2e * 2f
<ul> <li>g. Pump/bailer replacement cost (\$)</li> <li>h. Monitoring Maintenance and Pump/bailer Replacement Cost (\$)</li> </ul>	ې \$	10,000.00 48,880.00	[1e + 2d + 2g
	T	,	[0]
3. Cost for Groundwater Monitoring			
a. Number of required monitoring wells		10	
b. Monitoring frequency (semi-annual sampling for 30 years)		60	
c. Sampling cost (\$/well)	\$	1,100.00	
d. Laboratory testing cost (\$/well)	\$	400.00	
e. Statistical Analyses and Report (\$/well)	\$	300.00	
d. Groundwater Monitoring Cost (\$)	\$	1,080,000.00	[3a * 3b * (3c+3d+3e)
4. TOTAL, GROUNDWATER MONITORING AND WELL MAINTENANCE COST	\$	1,128,880.00	[2h + 3d
F. Cost for Methane Monitoring and Maintenance		N/A	
G. Cost for Drainage and Erosion Control Maintenance			
-		60	
1. Drainage and erosion control maintenance frequency (visits/30 years)	Ś	60 500.00	
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> </ol>	\$	500.00	[1 * 2
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> </ol>	\$ \$	500.00 30,000.00	[1 * 2
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> </ol>	\$	500.00 30,000.00 10	[1 * 2
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> <li>Unit labor cost</li> </ol>	\$ \$	500.00 30,000.00 10 140.00	-
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> </ol>	\$	500.00 30,000.00 10	[1 * 4 * 5
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> <li>Unit labor cost</li> <li>Total labor costs (\$)</li> </ol>	\$ \$ \$	500.00 30,000.00 10 140.00 84,000.00	[1 * 4 * 5
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> <li>Unit labor cost</li> <li>Total labor costs (\$)</li> <li>TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST</li> </ol>	\$ \$ \$	500.00 30,000.00 10 140.00 84,000.00	[1 * 4 * 5
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> <li>Unit labor cost</li> <li>Total labor costs (\$)</li> <li>TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST</li> <li>H. Cost for Access Control and Benchmark Maintenance</li> </ol>	\$ \$ <b>\$</b>	500.00 30,000.00 10 140.00 84,000.00	[1 * 4 * 5 [3 + 6
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> <li>Unit labor cost</li> <li>Total labor costs (\$)</li> <li>TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST</li> <li>H. Cost for Access Control and Benchmark Maintenance</li> <li>Fencing material cost (\$)</li> </ol>	\$ \$ <b>\$</b> \$	500.00 30,000.00 10 140.00 84,000.00	[1 * 4 * 5 [3 + 6
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> <li>Unit labor cost</li> <li>Total labor costs (\$)</li> <li>TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST</li> <li>H. Cost for Access Control and Benchmark Maintenance</li> <li>Fencing material cost (\$)</li> <li>Total labor costs (\$)</li> </ol>	\$ \$ <b>\$</b> \$ \$	500.00 30,000.00 10 140.00 84,000.00 <b>114,000.00</b>	[1 * 4 * 5 [3 + 6
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> <li>Unit labor cost</li> <li>Total labor costs (\$)</li> <li>TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST</li> <li>H. Cost for Access Control and Benchmark Maintenance</li> <li>Fencing material cost (\$)</li> <li>Total labor costs (\$)</li> <li>Benchmark maintenance cost (if applicable (\$)</li> </ol>	\$ \$ <b>\$</b> \$ \$ \$	500.00 30,000.00 10 140.00 84,000.00	[1 * 4 * 5 [3 + 6
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> <li>Unit labor cost</li> <li>Total labor costs (\$)</li> <li>TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST</li> <li>H. Cost for Access Control and Benchmark Maintenance</li> <li>Fencing material cost (\$)</li> <li>Total labor costs (\$)</li> <li>Benchmark maintenance cost (if applicable (\$)</li> <li>Other (\$)</li> </ol>	\$ \$ <b>\$</b> \$ \$	500.00 30,000.00 10 140.00 84,000.00 <b>114,000.00</b>	[1 * 4 * 5 [3 + 6 Facility is fenced
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> <li>Unit labor cost</li> <li>Total labor costs (\$)</li> <li>TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST</li> <li>H. Cost for Access Control and Benchmark Maintenance</li> <li>Fencing material cost (\$)</li> <li>Total labor costs (\$)</li> <li>Benchmark maintenance cost (if applicable (\$)</li> <li>Other (\$)</li> </ol>	\$ \$ <b>\$</b> \$ \$ \$ \$ \$	500.00 30,000.00 10 140.00 84,000.00 114,000.00 - - 5,000.00 -	[1 * 4 * 5 [3 + 6 Facility is fenced
<ul> <li>2. Cost for materials to repair per visit</li> <li>3. Total material cost (\$)</li> <li>4. Maintenance time required per visit (hours)</li> <li>5. Unit labor cost</li> <li>6. Total labor costs (\$)</li> <li>7. TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST</li> <li>H. Cost for Access Control and Benchmark Maintenance</li> <li>4. Fencing material cost (\$)</li> <li>7. Total labor costs (\$)</li> <li>8. Benchmark maintenance cost (if applicable (\$)</li> <li>9. Other (\$)</li> <li>10. TOTAL, ACCESS CONTROL/BENCHMARK MAINTENANCE COST</li> </ul>	\$ \$ <b>\$</b> \$ \$ \$ \$ \$ \$	500.00 30,000.00 10 140.00 84,000.00 114,000.00 - - 5,000.00 -	[1 * 4 * 5] [3 + 6] Facility is fenced
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> <li>Unit labor cost</li> <li>Total labor costs (\$)</li> <li>TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST</li> <li>H. Cost for Access Control and Benchmark Maintenance</li> <li>Fencing material cost (\$)</li> <li>Total labor costs (\$)</li> <li>Benchmark maintenance cost (if applicable (\$)</li> <li>Other (\$)</li> <li>TOTAL, ACCESS CONTROL/BENCHMARK MAINTENANCE COST</li> </ol>	\$ \$ <b>\$</b> \$ \$ \$ \$ \$ \$	500.00 30,000.00 10 140.00 84,000.00 114,000.00 - - 5,000.00 -	[1 * 4 * 5 [3 + 6 Facility is fenced
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> <li>Unit labor cost</li> <li>Total labor costs (\$)</li> <li>TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST</li> <li>H. Cost for Access Control and Benchmark Maintenance</li> <li>Fencing material cost (\$)</li> <li>Total labor costs (\$)</li> <li>Benchmark maintenance cost (if applicable (\$)</li> <li>Other (\$)</li> <li>TOTAL, ACCESS CONTROL/BENCHMARK MAINTENANCE COST</li> <li>I. Optional - Maintenance of dike(s) required for facilities constructed in floodplain/floodw</li> <li>J. Other costs - Costs not included in the above items should be listed here. They may</li> </ol>	\$ \$ <b>\$</b> \$ \$ \$ \$ \$ \$	500.00 30,000.00 10 140.00 84,000.00 114,000.00 - - 5,000.00 -	[1 * 4 * 5 [3 + 6 Facility is fenced
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> <li>Unit labor cost</li> <li>Total labor costs (\$)</li> <li>TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST</li> <li>H. Cost for Access Control and Benchmark Maintenance</li> <li>Fencing material cost (\$)</li> <li>Total labor costs (\$)</li> <li>Benchmark maintenance cost (if applicable (\$)</li> <li>Other (\$)</li> <li>TOTAL, ACCESS CONTROL/BENCHMARK MAINTENANCE COST</li> <li>I. Optional - Maintenance of dike(s) required for facilities constructed in floodplain/floodw</li> <li>J. Other costs - Costs not included in the above items should be listed here. They may include such items as access road maintenance, lift station power costs, etc. Please enter</li> </ol>	\$ \$ <b>\$</b> \$ \$ \$ <b>\$</b> \$ <b>\$</b>	500.00 30,000.00 10 140.00 84,000.00 114,000.00 - - 5,000.00 - 5,000.00	[1 * 4 * 5 [3 + 6] Facility is fenced
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> <li>Unit labor cost</li> <li>Total labor costs (\$)</li> <li>TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST</li> <li>H. Cost for Access Control and Benchmark Maintenance</li> <li>Fencing material cost (\$)</li> <li>Total labor costs (\$)</li> <li>Benchmark maintenance cost (if applicable (\$)</li> <li>Other (\$)</li> <li>TOTAL, ACCESS CONTROL/BENCHMARK MAINTENANCE COST</li> <li>I. Optional - Maintenance of dike(s) required for facilities constructed in floodplain/floodw</li> <li>J. Other costs - Costs not included in the above items should be listed here. They may</li> </ol>	\$ \$ <b>\$</b> \$ \$ \$ \$ \$ \$	500.00 30,000.00 10 140.00 84,000.00 114,000.00 - - 5,000.00 - 5,000.00	[1 * 4 * 5 [3 + 6 Facility is fenced
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> <li>Unit labor cost</li> <li>Total labor costs (\$)</li> <li>TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST</li> <li>H. Cost for Access Control and Benchmark Maintenance</li> <li>Fencing material cost (\$)</li> <li>Total labor costs (\$)</li> <li>Benchmark maintenance cost (if applicable (\$)</li> <li>Other (\$)</li> <li>TOTAL, ACCESS CONTROL/BENCHMARK MAINTENANCE COST</li> <li>I. Optional - Maintenance of dike(s) required for facilities constructed in floodplain/floodw</li> <li>J. Other costs - Costs not included in the above items should be listed here. They may include such items as access road maintenance, lift station power costs, etc. Please enter</li> </ol>	\$ \$ <b>\$</b> \$ \$ \$ <b>\$</b> \$ <b>\$</b>	500.00 30,000.00 10 140.00 84,000.00 114,000.00 - - 5,000.00 - 5,000.00	[1 * 4 * 5 [3 + 6 Facility is fenced [4 + 7 + 8 + 9
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> <li>Unit labor cost</li> <li>Total labor costs (\$)</li> <li>TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST</li> <li>H. Cost for Access Control and Benchmark Maintenance</li> <li>Fencing material cost (\$)</li> <li>Total labor costs (\$)</li> <li>Benchmark maintenance cost (if applicable (\$)</li> <li>Other (\$)</li> <li>TOTAL, ACCESS CONTROL/BENCHMARK MAINTENANCE COST</li> <li>I. Optional - Maintenance of dike(s) required for facilities constructed in floodplain/floodw</li> <li>Other costs - Costs not included in the above items should be listed here. They may include such items as access road maintenance, lift station power costs, etc. Please enter "N/A" if you do not have additional costs to place here.</li> </ol>	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	500.00 30,000.00 10 140.00 84,000.00 114,000.00 - - 5,000.00 - 5,000.00	[1 * 4 * 5] [3 + 6] Facility is fenced [4 + 7 + 8 + 9] [4 + 7 + 8 + 9]
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> <li>Unit labor cost</li> <li>Total labor costs (\$)</li> <li>TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST</li> <li>H. Cost for Access Control and Benchmark Maintenance</li> <li>Fencing material cost (\$)</li> <li>Total labor costs (\$)</li> <li>Benchmark maintenance cost (if applicable (\$)</li> <li>Other (\$)</li> <li>TOTAL, ACCESS CONTROL/BENCHMARK MAINTENANCE COST</li> <li>I. Optional - Maintenance of dike(s) required for facilities constructed in floodplain/floodw</li> <li>J. Other costs - Costs not included in the above items should be listed here. They may include such items as access road maintenance, lift station power costs, etc. Please enter</li> </ol>	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	500.00 30,000.00 10 140.00 84,000.00 114,000.00 - 5,000.00 - 5,000.00 A	[1 * 2] $[1 * 4 * 5]$ $[3 + 6]$ Facility is fenced. [4 + 7 + 8 + 9] $[4 + 7 + 8 + 9]$ $[4 + 7 + 8 + 9]$
<ol> <li>Drainage and erosion control maintenance frequency (visits/30 years)</li> <li>Cost for materials to repair per visit</li> <li>Total material cost (\$)</li> <li>Maintenance time required per visit (hours)</li> <li>Unit labor cost</li> <li>Total labor costs (\$)</li> <li>TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST</li> </ol> H. Cost for Access Control and Benchmark Maintenance 4. Fencing material cost (\$) 7. Total labor costs (\$) 8. Benchmark maintenance cost (if applicable (\$) 9. Other (\$) 10. TOTAL, ACCESS CONTROL/BENCHMARK MAINTENANCE COST I. Optional - Maintenance of dike(s) required for facilities constructed in floodplain/floodw J. Other costs - Costs not included in the above items should be listed here. They may include such items as access road maintenance, lift station power costs, etc. Please enter "N/A" if you do not have additional costs to place here. K. TOTAL POST-CLOSURE COST	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	500.00 30,000.00 10 140.00 84,000.00 114,000.00 - 5,000.00 - 5,000.00 - 5,000.00 - 3,701,122.49	[1*4*5] [3+6] Facility is fenced [4+7+8+9] [4+7+8+9]