OVEC IKEC

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 30, 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 1 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 revisions have been made to the Clifty Creek Station West Boiler Slag Pond Phase I 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

Stantec Consulting Services Inc.
10200 Alliance Road Suite 300, Cincinnati OH 45242-4754

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: Phase 1 Closure Plan
Clifty Creek Station
West Boiler Slag Pond
Madison, Jefferson County, Indiana

Dear Mr. Coriell,

The attached Phase 1 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. Attachment 1 includes the February 2020 submittal. Supplemental information requested by IDEM OLQ are included in Attachment 2 dated July 1st, October 12th, and October 14th, 2020. Attachment 3 includes the IDEM approval for CCR partial closure of the WBSP (SW Program ID 39-005).

The attached Phase 1 closure 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.

Reference: Phase 1 Closure Plan
Clifty Creek Station
West Boiler Slag Pond
Madison, Jefferson County, Indiana

Regards,

STANTEC CONSULTING SERVICES INC.

Jacqueline Harmon P.E.*
Principal
*Licensed in OH, IN
Phone: (513) 842-8200
jacqueline.harmon@stantec.com

stantec.com

Attachments:

Attachment 1. Stantec Consulting Services Inc. (2020). Closure Plan (Addendum 1). Clifty Creek Station. West Boiler Slag Pond. Phase 1 Closure. Madison, Jefferson County, Indiana. Prepared for Indiana-Kentucky Electric Corporation. February 7.

Attachment 2. Stantec Consulting Services Inc. (2020). Request for Additional Information No. 1. Closure Plan (Addendum 1). Clifty Creek Station. West Boiler Slag Pond. Phase 1 Closure. Madison, Jefferson County, Indiana. Prepared for Indiana-Kentucky Electric Corporation. June 30.

Indiana-Kentucky Electric Corporation (2020). West Boiler Slag Closure Plan – Revision to RAI #1 Response. SW Program ID 39-005. October 12.

Indiana-Kentucky Electric Corporation (2020). Adjacent Landowner/Occupant Affidavit. State Form 51872 (8-04) Indiana Department of Environmental Management. Phase 1 Closure – Clifty Creek Station West Boiler Slag Closure Plan. October 14.

Attachment 3. Indiana Department of Environmental Management (2021). Approval of CCR Partial Closure/Post-Closure Plan. West Boiler Slag Pond. Jefferson County. SW Program ID 39-005. Undated. Received February 3.

ATTACHMENT 1

Closure Plan (Addendum 1). Clifty Creek Station. West Boiler Slag Pond. Phase 1 Closure. *Stantec Consulting Services Inc. (2020).*

OVEC/IKEC

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

February 12, 2020

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
Phase I Closure Plan

In accordance with 329 IAC 10-3-1(9), the Indiana-Kentucky Electric Corporation (IKEC) is submitting for agency review the accompanying Partial Closure Plan for Clifty Creek Station's West Boiler Slag Pond (WBSP). It is IKEC's intent to proceed with closure activities of the WBSP in a phased approach. The accompanying plan addresses Phase 1 of the closure activities. Subsequent phases are subject to the submission, and approval of additional closure plan documents by the Indiana Department of Environmental Management.

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

Sincerely,

Tim Fulk

Tim Fulk
Engineer II

TLF:klr

Attachments

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

February 7, 2020
File: 175534018

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

RE: Closure Plan (Addendum 1)
West Boiler Slag Pond
Phase 1 Closure
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 amended closure plan (Addendum 1) plan for the Indiana-Kentucky (IKEC) Clifty Creek Station's West Boiler Slag Pond.

2.0 CLOSURE PLAN

The closure plan describes the steps necessary to close the CCR unit at any time during the life of the unit and is subject to the requirements described in 40 CFR 257.102(b).

3.0 SUMMARY OF FINDINGS

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

4.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Jacqueline S. Harmon, 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; and
3. that the amended closure plan (Addendum 1) for the IKEC Clifty Creek Station's West Boiler Slag Pond meets the requirements described in 40 CFR 257.102(b).

RE: **Closure Plan (Addendum 1)**
West Boiler Slag Pond
Phase 1 Closure
EPA Final Coal Combustion Residuals (CCR) Rule
Clifty Creek Station
Madison, Jefferson County, Indiana

SIGNATURE Jacqueline S. Harmon DATE 2/7/2020

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

TELEPHONE: (513) 842-8200

ATTACHMENT: Clifty Creek West Boiler Slag Pond Closure Plan (Addendum 1)

JACQUELINE S. HARMON
REGISTERED
No. 10911138
STATE OF
INDIANA
PROFESSIONAL ENGINEER

Jacqueline S. Harmon 2/7/2020

Closure Plan (Addendum 1)

Clifty Creek Station

West Boiler Slag Pond

Phase 1 Closure

Madison, Jefferson County, Indiana

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

February 7, 2020

Design with community in mind

Closure Plan
(Addendum 1)

West Boiler Slag Pond
Phase 1 Closure
Clifty Creek Station
Madison, Jefferson County, Indiana

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Closure Plan
(Addendum 1)

West Boiler Slag Pond
Phase 1 Closure
Clifty Creek Station
Madison, Jefferson County, Indiana

1. Objective

Indiana-Kentucky Electric Corporation (IKEC) is submitting this Closure Plan (Addendum 1) 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 Phase 1 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 is preparing to regrade, cap, and close an inactive portion of the WBSP (Phase 1) 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). This area lies within the WBSP clay dike, is at capacity, and has previously been repurposed as a laydown area for the station.

Three subsequent closure phases for the WBSP are also outlined. Their design will be defined further as the USEPA's final rule amending 40 CFR 423, the Effluent Limitations, Guidelines, and Standards for the Steam Electric Power Generating Point Source Category (ELG Postponement Rule) is addressed to modify operations at the Clifty Creek Station. This will include design and construction of concrete CCR settling tanks and lined ponds to manage stormwater and leachate from the CCR landfill (Phases 2 and 3). 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 would then begin construction to close the remainder of the surface impoundment.

The closure design includes consolidation of CCRs and closure in place, filling and regrading the pond area and installing an engineered cap system. Water levels within each phase would be lowered and monitored using wellpoints, sumps, and piezometers. Phase 1 is an inactive 9.2 acres on the east side of the WBSP. The remaining 80.4 acres will be subdivided into three phases. Phase 2 includes construction of a series of settling basins to manage operational boiler slag and serving as part of the facility's ELG Compliance Strategy. Phase 3 will be the construction of two geomembrane-lined ponds as a stormwater sedimentation pond and a leachate collection pond for the CCR landfill. Discharge from the WBSP will cease prior to April 30, 2022. Phase 4 then consolidates and closes the last of the WBSP active surface impoundment. Addendums to this closure plan will be provided for Phases 2, 3, and 4 as they are designed.

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 constructed 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.

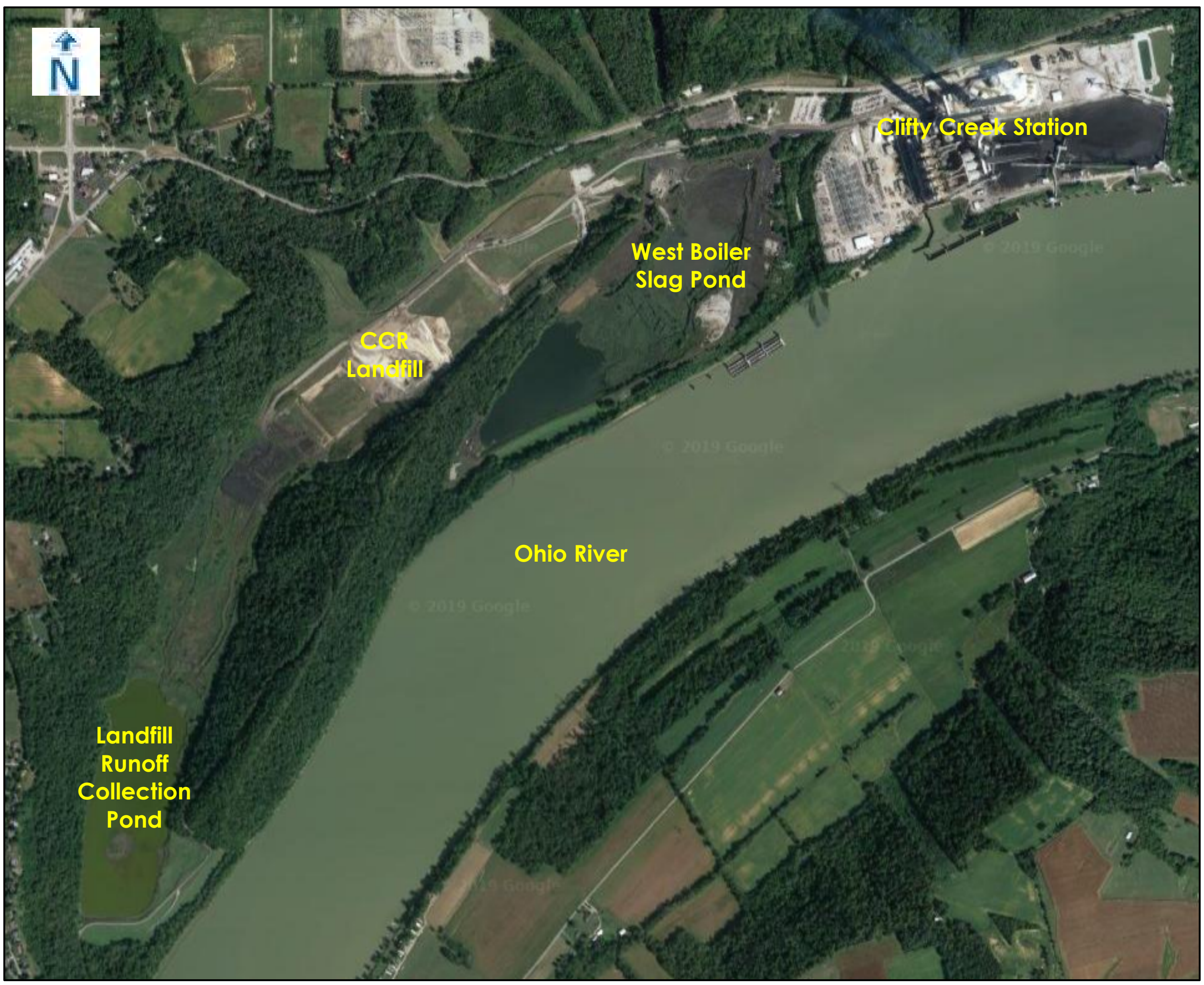


Figure 1- Aerial View of Clifty Creek Station

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 elevation 475 feet. The dike varies in height above the adjacent plant grades with a maximum height of approximately 41 feet. FEMA (2015) shows that the flood stages of the Ohio River at the WBSP are 464 feet and 469.5 feet for the 1 and 0.2 percent annual chance of flooding.

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. 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. 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.

Table 1 - Water Wells Within a Half-Mile Offset

Well Record Reference No.	Type	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

2.4. Available Geotechnical Data

Geotechnical data is available from four field explorations at the WBSP. A plan view of the borings and logs are provided in Appendix E.

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.

2.5. Hydrogeology

AGES, Inc., the station's hydrogeologist of record, has prepared a summary of the hydrogeologic conditions at the WBSP. Appendix F includes a narrative, plan view of the monitoring well network, geologic cross sections, and plan views showing groundwater levels and flow direction. As part of the CCR Rule, a monitoring network of 10 wells was installed and developed at the WBSP during late 2015. Routine water sampling began in 2016.

AGES prepared a Monitoring Well Installation Report (AGES, 2018) which indicated that:

> "Soil and well borings indicated that a layer of gray silt with fine sand, becoming more coarse-grained further to the north & northeast…is the uppermost aquifer beneath the WBSP." (AGES, 2018).

Based on information presented in the AGES report, and for the purpose of this demonstration, the uppermost aquifer (UMA) was identified as an interval of gray silt with sand and coarse-grained alluvium.

The estimated elevations representing the top of the UMA were subtracted from the estimated base of the CCR unit at each certified monitoring well location to represent the separation of the base of the CCR unit from the top of the UMA. Within the extent of the WBSP, the estimated separation between the base of the CCR unit and the UMA was greater than five (5) feet (Stantec, 2018).

3. Regulatory Overview

3.1. Regulatory Framework for Design

In Indiana, coal ash surface impoundments that are subject to an NPDES permit are not regulated under IDEM's solid waste program. 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) 10-3-1(9). Effective December 10, 2016, IDEM adopted by reference a portion of the USEPA CCR regulation governing CCR surface impoundments (329 IAC 10-9-1(b) and (c)) (IDEM, CO0518L).

The EPA Final CCR Rule defines the criteria for conducting the closure of CCR units under 40 CFR 257.102. 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 first phase of the WBSP. The plan will be amended as needed to address the three subsequent phases to meet the pending ELG regulations. Below is a general summary of how the WBSP will be closed. The permit-level Phase 1 drawings are included in Appendix G.

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 within the WBSP where possible, grade stored CCR as structural fill, and close the facility in place. The closure will consist of dewatering the unit through an NPDES-permitted outfall, grading, and construction of an engineered cap.

IDEM's OLQ has requested that the WBSP be closed in accordance with Type I restricted solid waste (RSW) 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:
    - two feet for slopes less than or equal to 15 percent
    - three feet for slopes greater than 15 but less than 25 percent, and
    - four feet for slopes greater than 25 percent
- Slopes not less than two percent nor greater than 33 percent.

Appendix H includes the final cover soil loss calculations. The final cover consists of a two-foot soil infiltration layer and six inches of earthen material capable of growing and sustaining native vegetative growth. Within the drainage channels, the soil infiltration layer is thickened to four feet. If the selected borrow materials are not sufficiently impermeable, or if there is not a sufficient quantity, then a synthetic geomembrane will be included in the final cap design. The capped surface will be graded to promote surface water runoff, and then seeded and mulched to promote growth of the vegetative cover.

An alternative to the final cover system as specified in 257.102 (d)(3)(ii) is included for Phase 1. At the southeast corner and along the proposed eastern access road, concrete may be used in lieu of a portion of the earthen material to create a working access road and material handling area to support an anticipated conveyor system. The conveyor will be used to load barges as part of CCR repurposing.

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 closure system, the CCR unit will be pumped to remove surface water, drawing down the phreatic level within the ash to facilitate construction. All water will be managed in the remaining open portion of the pond and discharged through the existing NPDES outfall. A CCR berm will be constructed to define the edge of the closure phase. 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 a flexible geomembrane liner (FML), that will have a permeability that is less than or equal to the permeability of the natural subsoils, and is no greater than $1x10^{-5}$ cm/sec. A portion of the FML will extend over the phase's CCR berm. FML will be installed directly over the graded CCR material followed by a 2.5 or 4.5-foot thick soil fill consisting of a 24- or 48-inch soil infiltration layer and 6-inches of earthen material capable of growing and sustaining native vegetative growth. The capped surface will be graded to promote surface water runoff, and then seeded and mulched to promote growth of the vegetative cover.

An alternative to the final cover system as specified in 257.102 (d)(3)(ii) is identified in certain areas of Phase 1. Concrete may be used in lieu of a portion of the earthen material to create a working access road and material handling area.

Piezometers will be installed along the western edge of Phase 1 to monitor water levels within the closed footprint. Wellpoints and sump pumps will be added as needed to draw the in-situ water levels down within Phase 1 during the phased closure process. 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.

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. Both analyses are included in Appendix I.

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

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

The impoundment will be vegetated to prevent 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. Phase 1 will begin final design and construction upon approval of this permit application. The intent is to complete construction of the Phase 1 cap in 2020.

Three subsequent closure phases for the WBSP are anticipated. The design will be defined further as the USEPA's final rule amending 40 CFR 423, the Effluent Limitations, Guidelines, and Standards for the Steam Electric Power Generating Point Source Category (ELG Postponement Rule) is addressed to modify operations at the Clifty Creek Station. This will include design and construction of concrete CCR settling tanks and lined ponds to manage stormwater and leachate from the CCR landfill (Phases 2 and 3). 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 would then begin construction to close the remainder of the surface impoundment.

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.]

The final closure system will consist of an FML, that will have a permeability that is less than or equal to the permeability of the natural subsoils, and is no greater than $1x10^{-5}$

cm/sec. The geomembrane will be installed directly over the graded CCR material followed by a 2.5- or 4.5-foot thick soil fill consisting of a 24- or 48-inch soil infiltration layer and 6 inches of earthen material capable of growing and sustaining native vegetative growth. The capped surface will be graded to promote surface water runoff, and then seeded and mulched to promote growth of the vegetative cover. The final cover slope will be a minimum of two percent (2%). A stormwater management system will convey surface water to a NPDES-permitted outfall.

An alternative to the final cover system as specified in 257.102 (d)(3)(ii) is outlined for Phase 1. Concrete may be used in lieu of a portion of the earthen material to create a working access road and material handling area.

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 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 largest area of the CCR unit ever requiring a final cover is approximately 89.6 acres. Following completion of Phase 1, this area will decrease to 80.4 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.]

Phase 1 will begin final design and construction upon approval of this permit application. The intent is to complete construction of the cap and the conveyor/material handling pad in 2020.

USEPA (2020) has defined a closure schedule process for existing CCR surface impoundments that are considered "unlined" under the CCR Rule. Phases 2, 3, and 4 are in design now to maintain the necessary operational pool levels needed for achieving permitted discharge thresholds through settlement. Table 2 provides an approximate closure schedule to meet the required regulation. Addendums to this closure plan will be provided to IDEM for review and approval as design is finalized.

Table 2 - Proposed Closure Schedule

Task	Date
Phases 2, 3, and 4 - Design	Ongoing
Phase 1 construction	Summer 2020
Phase 2 construction	Spring 2021
Phase 3 construction	Fall 2021
Phase 4 construction begins	Spring 2022
Boiler slag retrofit complete	April 1, 2022
NPDES permit no. IN0001759 expires	April 30, 2022
WBSP closure completion deadline (USEPA-proposed)	October 15, 2023

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.

The recommended design approach will include installing an engineered cap system over an approximately 9.2-acre area on the east side of the WBSP where the pond is at grade and inactive. The remaining 80.4 acres will be subdivided into three phases. Phase 2 includes construction of a series of concrete settling basins to manage operational boiler slag, which will serve as part of the facility's ELG compliance strategy. Phase 3 will be the construction of two geomembrane-lined ponds as a stormwater sedimentation pond and a leachate collection pond for the CCR landfill. Discharge from the WBSP will cease prior to April 30, 2022. Phase 4 then consolidates and closes the last of the WBSP active surface impoundment.

A CCR berm will be constructed on the west boundary of the proposed capped area to define Phase 1. The capped area will grade toward the active pond and tie into the existing dike forming the eastern perimeter of the WBSP. Work to be completed through the closure process includes:

1. Construct the CCR berm at the western edge of Phase 1.
2. Regrade the existing CCRs to drain westward toward the active pond.
3. Construct the engineered cap system over the Phase 1 footprint. FML will extend over the CCR berm at the western edge.
4. Construct stormwater collection conveyance channels/piping.

5. Construct piezometers within the western edge of Phase 1 to monitor water levels.
6. Establish wellpoints or sumps as needed to further draw down the water levels within the closed Phase 1 footprint.
7. Establish the access road and vegetation on the site.
8. Notification of completion of Phase 1 final closure to the IDEM OWQ and OLQ.

5. Closure Plan Scope of Work

Phase 1 closure of the WBSP will require modification of the current pond system. The following general tasks are anticipated as part of the closure process.

5.1. CCR Berm

A CCR berm will be constructed to form the western boundary of the sediment contained within Phase 1. The dike will regrade the existing CCR material to create a stable limit for the cover system. Additional CCR will be placed and compacted in lifts.

5.2. Cap System

An engineered cap system will be constructed over Phase 1 closure area. Appendix G provides the proposed Phase 1 permit drawings, including the cap area and details.

The engineered cap will consist of the following materials, listed in order of construction (from bottom to top):

- 24 or 48 inches of compacted soil with a maximum permeability of $1x10^{-5}$ cm/sec.
- 6 inches of soil capable of sustaining vegetation and reasonably free from deleterious matter that would prevent the formation of a suitable seedbed.

If the selected borrow materials are not sufficiently impermeable, or if there is not a sufficient quantity, then a synthetic geomembrane (FML) will be included in the final cap design. This alternative cap system will consist of the following materials, listed in order of construction (bottom to top):

- 40-mil geomembrane
- Geocomposite drainage layer
- 30 or 54 inches of cover soil, of which the top 6 inches are capable of supporting vegetation

An alternative to the final cover system as specified in 257.102 (d)(3)(ii) is anticipated for portions of Phase 1. Concrete may be used in lieu of a portion of the earthen material to create a working access road and material handling area. A cushion fabric and minimum 12-inch cover material is anticipated beneath the concrete to protect the geomembrane.

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

5.3. 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.

5.4. Construction Quality Assurance

The construction quality assurance (CQA) plan 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 CQA plan will include:

A. Purpose and Scope

B. Responsibility and Authority

C. Quality Control Activities

D. Product Submittals and Material Testing

E. Project Documentation

Appendix J includes a draft CQA plan based on the Clifty Creek Station's existing CCR Landfill permit. This is proposed as the basis for the final plan to maintain consistency on the site.

5.5. 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 (IKEC, 2016). A copy of the publicly available document is included as Appendix K. The closed Phase 1 area 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.

American Electric Power Service Corporation (AEPSC) (2015). *2015 Dam and Dike Inspection Report. GERS-15-018*. Clifty Creek Plant. Madison, Indiana. October 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.

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.

Indiana Department of Environmental Management (IDEM). *Fact Sheet. Coal Combustion Residuals (Coal Ash).* Office of Land Quality – Permitting Branch. CO0518L.

Indiana Department of Environmental Management (IDEM). (2018). Letter from Jerry Dittmer, OWQ to J. Michael Brown, IKEC. Re: NPDES Permit No. IN0001759, Permit Modification. IKEC – Clifty Creek Station. Madison, IN – Jefferson County. April 10. VFC No. 82625441.

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.

Indiana-Kentucky Electric Corporation. (2016b). *Post-Closure Plan. CFR 257.104(d). West Boiler Slag Pond. Clifty Creek Station. Madison, Indiana.* October.

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

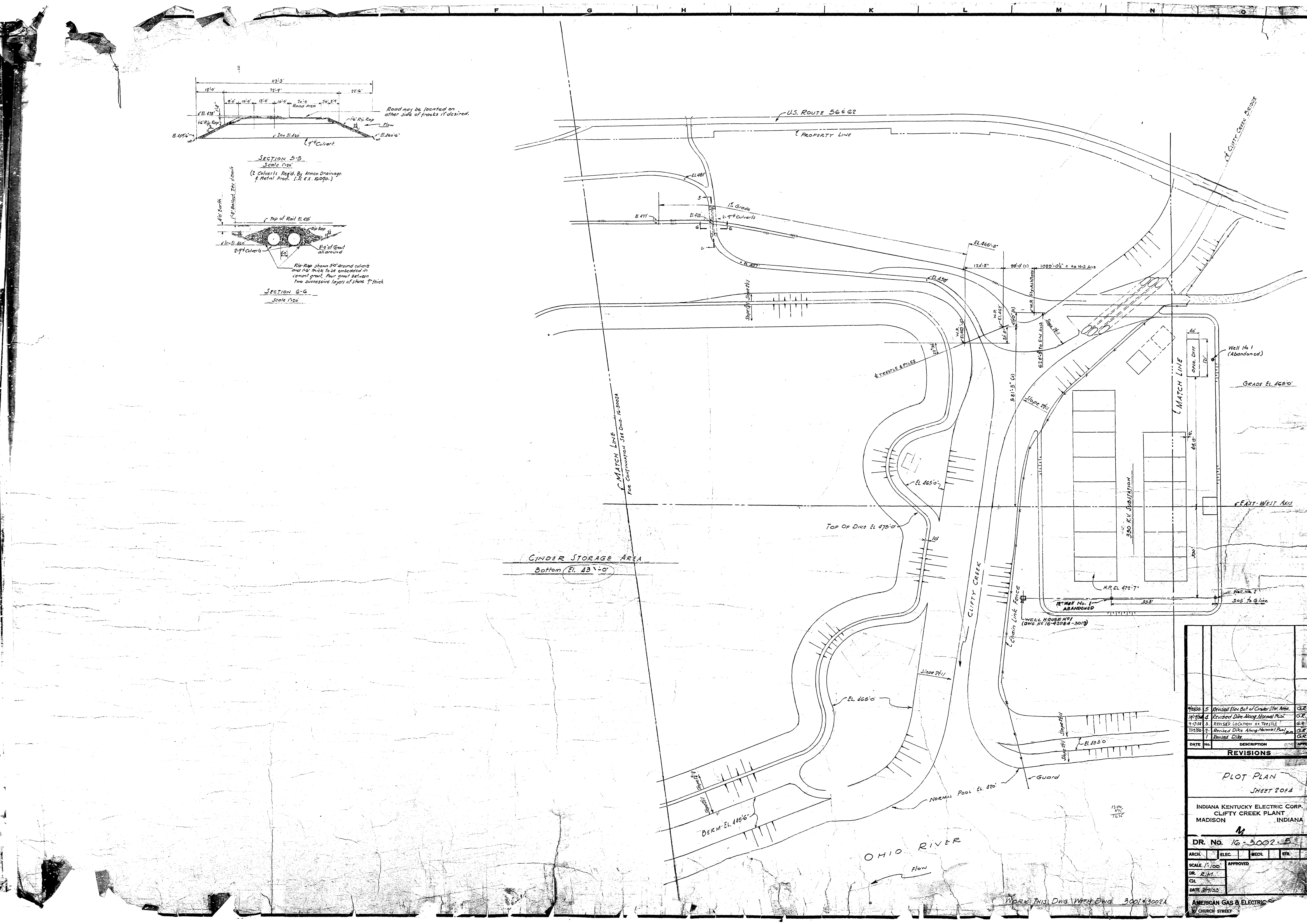
Acronyms and Abbreviations

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
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
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



Date	No.	Description	Appd.
11/25/54	5	Revised Elev. Bot. of Cinder Stor. Area	G.R.
10/19/54	4	Revised Dike Along Normal Pool	G.R.
9-17-54	3	Revised Location of Trestle	G.R.
7/12/54	2	Revised Dike Along Normal Pool	G.R.
	1	Revised Dike	G.R.

REVISIONS

PLOT PLAN

SHEET 2 OF 4

INDIANA KENTUCKY ELECTRIC CORP.
CLIFTY CREEK PLANT
MADISON INDIANA

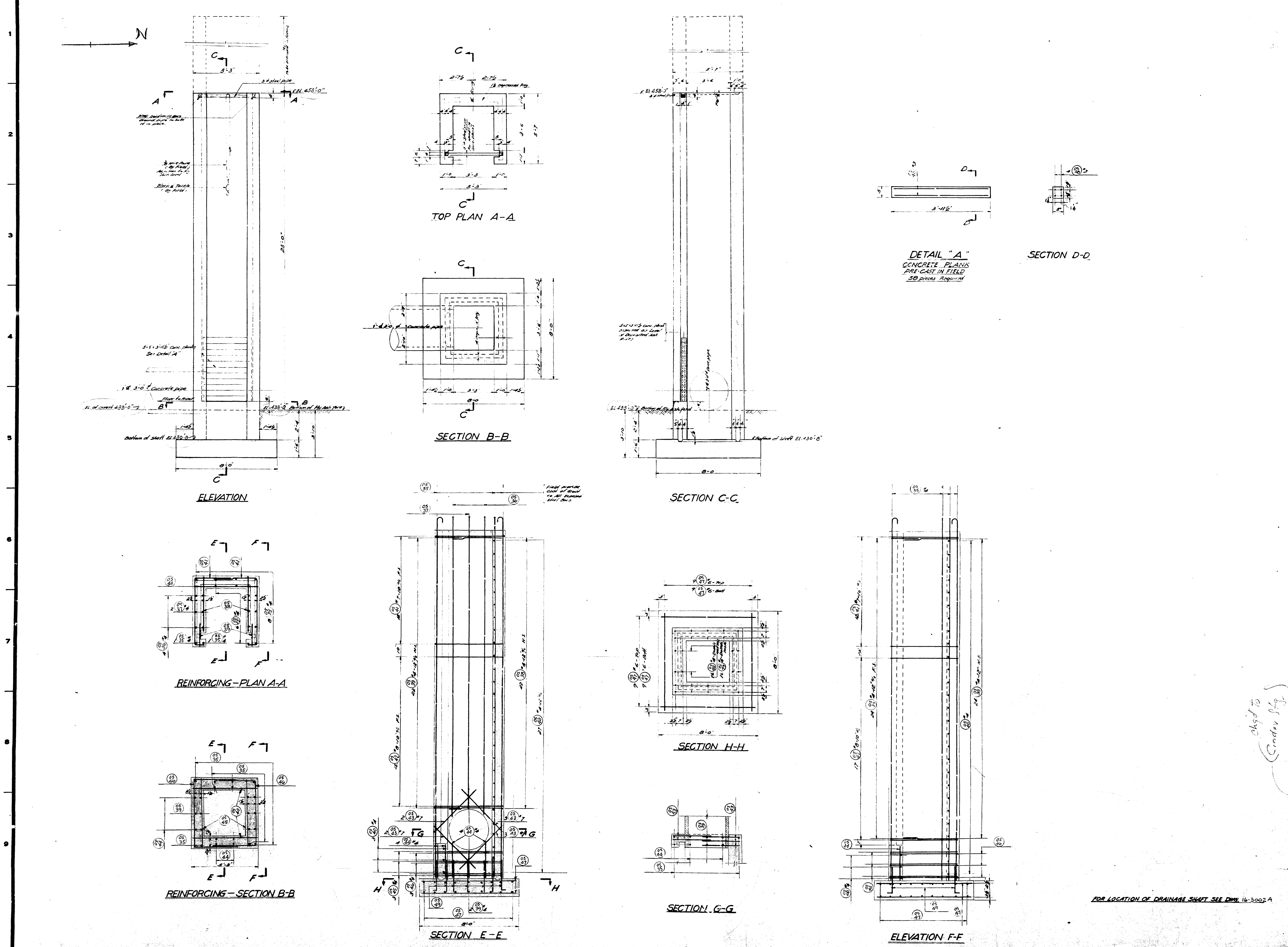
DR. No. 16-3002-5

ARCH. | ELEC. | MECH. | STR.

SCALE 1" = 100'
APPROVED
DR. R.M.
CH.
DATE 8/19/53

AMERICAN GAS & ELECTRIC S[...]
30 CHURCH STREET

N.
U.S. Route 56 & 62
Top of Dike El. 475.0
El. 445.6
Rip Rap
Normal Pool El. 420.0
Original Grade
Inv. El. 430
36" R.C. Pipe (Existing)
36" R.C. Pipe (New)
Inv. El. 433.0
Bend Line
Drainage Shaft
El. 433.0
Inv. El.
SECTION A-A
Scale 1" = 20'
5175' to G Line
5000' to G Line
FLY ASH DISPOSAL AREA
4000' to G Line
3410' to G Line
Top of Dike El. 475.0
East-West Axis
Contour
CINDER STORAGE AREA
Bottom El. 433.0 Borings
Match Line
For Continuation See Dwg. 16-3002
130' - 36" Reinf. Conc. Pipe By Field
220' - New 36" R.C. Pipe By Field
Drainage Shaft (Field to Locate)
See Dwg. 16-3003
457' to G Line of Cols.
Top of Dike El. 475.0
Rip Rap
Berm El. 445.6
Normal Pool El. 420
Boring 2
Boring 7
Ohio River
Flow
Top of Dike El. 475.0
63'-9"
105'-0"
73'-9"
10'-0"
73'-0"
Varies at other sections of Dike
El. 445.6
Original Grade
Normal Pool El. 420
El. 433.0
SECTION B-B
Scale 1" = 20'
Work This Dwg. With Dwgs.
Revised Elev. Bott. of Cinder Stor. Area
Revised Dike Along Normal Pool
Revised Dike Along Normal Pool
DATE
No.
DESCRIPTION
REVISIONS
PLOT PLAN
SHEET 3 OF 4
INDIANA KENTUCKY ELECTRIC CORP.
CLIFTY CREEK PLANT
MADISON INDIANA
DR. No. 16-3002A-3
ARCH.
ELEC.
MECH.
STR.
SCALE 1" = 100'
APPROVED
DR. R.M.
CH.
AMERICAN GAS & ELECTRIC
30 CHURCH STREET



General Notes:

Materials

Concrete: 19 cu yd. By Field

pipes 1 - 3" ⌀ pipe - 4'-6 Long

REINFORCING STEEL By: FIELD

Reference Drawings

RS 776 Reinforcing Schedule

16-3002A Fly Ash yard

DATE	No.	DESCRIPTION	APPD.
10/25/54	1	Revised Elevations	G.R.

REVISIONS

ASH STORAGE YARD
DRAINAGE SHAFT
MASONRY & REINFORCING

1953-1954 CONSTRUCTION

INDIANA KENTUCKY ELECTRIC CORP.
CLIFTY CREEK PLANT.
MADISON INDIANA

DR. No. 16-3033 -1

ARCH.		ELEC.		MECH.		STR.	

SCALE 3/8" = 1'-0"
DR. F.T.K.
CH. M.E.
DATE 4/16/54
APPROVED G.R.

AMERICAN GAS & ELECTRIC SERVICE CORP.
30 CHURCH STREET NEW YORK

APPENDIX C

Boundary Survey

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) S70°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.

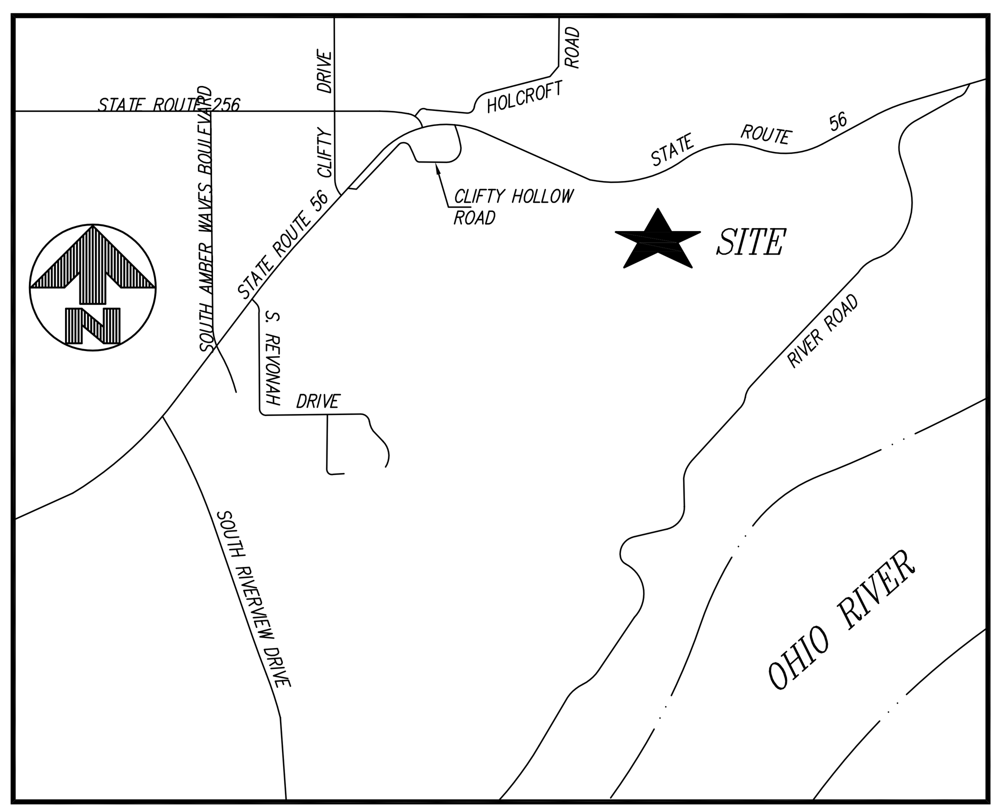
This description was prepared by Kleingers & Associates, Inc., under the direction of David L. Cox, Indiana Licensed Surveyor No. 890008 and is based on a partial survey of the subject property performed in April and May, 2006. This description is to be used for permit purposes only and is not for the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

LEGEND

- ● 5/8" REBAR SET
- ○ 5/8" REBAR FOUND UNLESS NOTED OTHERWISE
- ◎ CONCRETE R/W MARKER FOUND
- △ RAILROAD SPIKE FOUND
- ▲ RAILROAD SPIKE SET
- □ CONCRETE MONUMENT WITH BRASS PLUG FOUND (SET PER 1957 NEAL SURVEY)
- ■ STONE FOUND

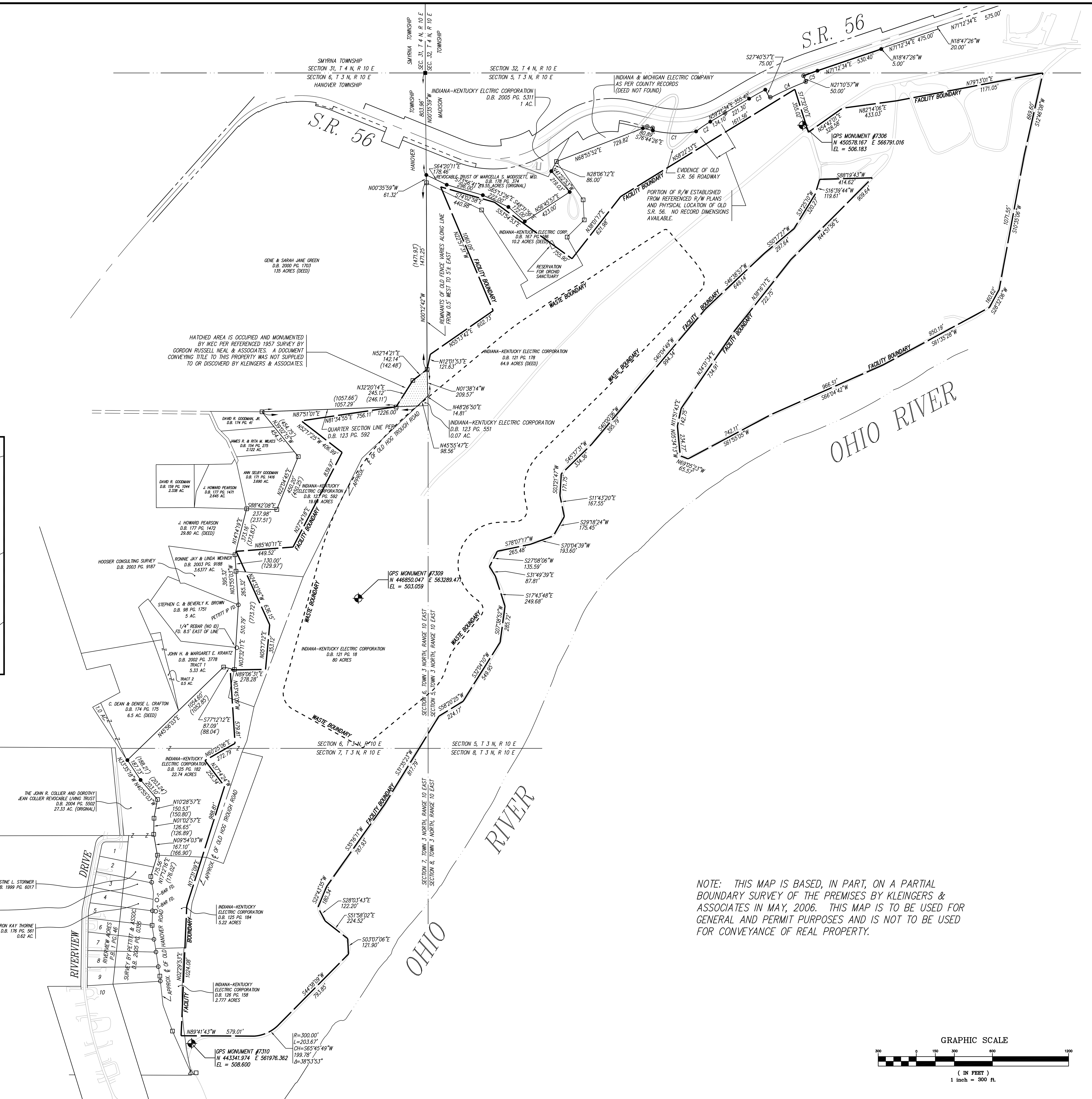
NORTH

CURVE	LENGTH	RADIUS	DELTA	CHORD	
C1	343.16'	806.20'	24°23'16"	S88°56'04"E	340.57'
C2	135.55'	1054.46'	7°21'55"	N55°40'37"E	135.46'
C3	146.10'	2829.79'	2°57'29"	N60°50'19"E	146.08'
C4	312.52'	2754.79'	6°30'00"	N65°34'03"E	312.35'
C5	117.09'	2804.79'	2°23'31"	N70°00'49"E	117.09'



VICINITY MAP

N.T.S.



GENERAL NOTES:

1.) PHYSICAL FEATURES, DRIVES, BUILDINGS, WATER COURSES, ETC. ARE BASED ON A COMBINATION OF FIELD LOCATIONS AND AERIAL PHOTOGRAPHIC MAPPING SUPPLIED BY THE CLIENT.
2.) SECTION LINES ARE SHOWN FOR REFERENCE ONLY. SECTION LINES AND CORNERS WERE NOT RETRACED PER THIS SURVEY.
3.) BEARINGS ARE BASED ON THE INDIANA STATE PLANE COORDINATE SYSTEM, NAD '27, AS PER COORDINATES OF THE PLANT MONUMENTS SHOWN HEREON.
4.) INTERIOR PLANT PARCEL LINES NOT SHOWN IN FULL.
5.) REFERENCES USED INCLUDE INDIANA STATE HIGHWAY COMMISSION, F.A. PROJECT NO. 212 SEC. C PAVING PLANS FOR S.R. 56, DATED AUGUST, 1930 AND ADDITIONAL IMPROVEMENT PLANS DATED 1957.
6.) ADDITIONAL REFERENCE DATA INCLUDES A "REVISED BOUNDARY SURVEY – CLIFTY CREEK POWER PLANT SITE" AS PERFORMED BY GORDON RUSSELL NEAL & ASSOCIATES, DATED JULY, 1957.
7.) EASEMENTS OF RECORD NOT SHOWN.

NOTE: THIS MAP IS BASED, IN PART, ON A PARTIAL BOUNDARY SURVEY OF THE PREMISES BY KLEINGERS & ASSOCIATES IN MAY, 2006. THIS MAP IS TO BE USED FOR GENERAL AND PERMIT PURPOSES AND IS NOT TO BE USED FOR CONVEYANCE OF REAL PROPERTY.

GRAPHIC SCALE

300 0 150 300 600 1200

(IN FEET)
1 inch = 300 ft.

FACILITY BOUNDARY / WASTE BOUNDARY MAP

INDICATING A PORTION OF THE LANDS OF

INDIANA – KENTUCKY ELECTRIC CORPORATION

SECTIONS 5, 6 & 7, TOWN 3 NORTH, RANGE 10 EAST
SECTION 32, TOWN 4 NORTH, RANGE 10 EAST
MADISON & HANOVER TOWNSHIPS JEFFERSON COUNTY, INDIANA

KLEINGERS & ASSOCIATES
ENGINEERS AND SURVEYORS
6305 Centre Park Drive, West Chester, OH 45069
(513) 779-7851 Fax: (513) 779-7852

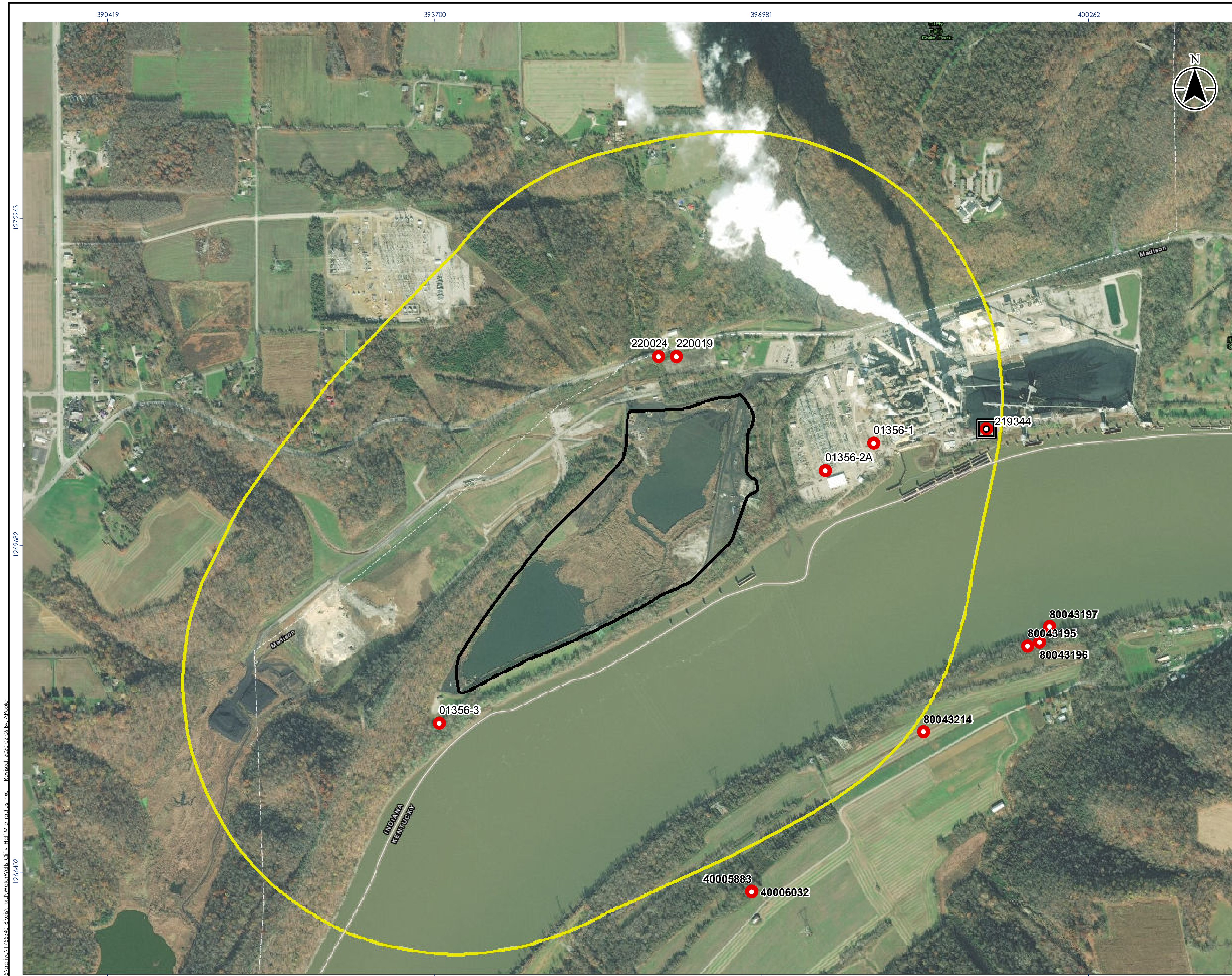
REVISIONS

SCALE: 1"=300'
DATE: 11/22/06
DRAWN: DLC
DESIGNED: .
CHECKED: DLC
XREF:
JOB NO.: 060192VB

IN-KY ELECTRIC CORP

APPENDIX D

Location Figures



OVEC IKEC
Ohio Valley Electric Corporation
Indiana-Kentucky Electric Corporation

Stantec

Legend

- Private Wells
- Wells (Estimated Location)
- Half-Mile Offset
- Waste Boundary

0 1,000 2,000 Feet

1:12,000 (At original document size of 11x17)

Notes

1. Coordinate System: Indiana State Plane East NAD83
2. Base features - ESRI
3. IDNR Water Wells June 2019
4. Kentucky Water Wells - 2015
5. USGS Quadrangle - Madison West
6. IDNR estimated location by township, range, section, quarter section, and county

Project Location

Clifty Creek Station
Jefferson County, IN

175534018
Prepared by AP on 02/04/2020
Technical Review by JH on 02/04/2020
Independent Review by SH on 02/04/2020

Client/Project

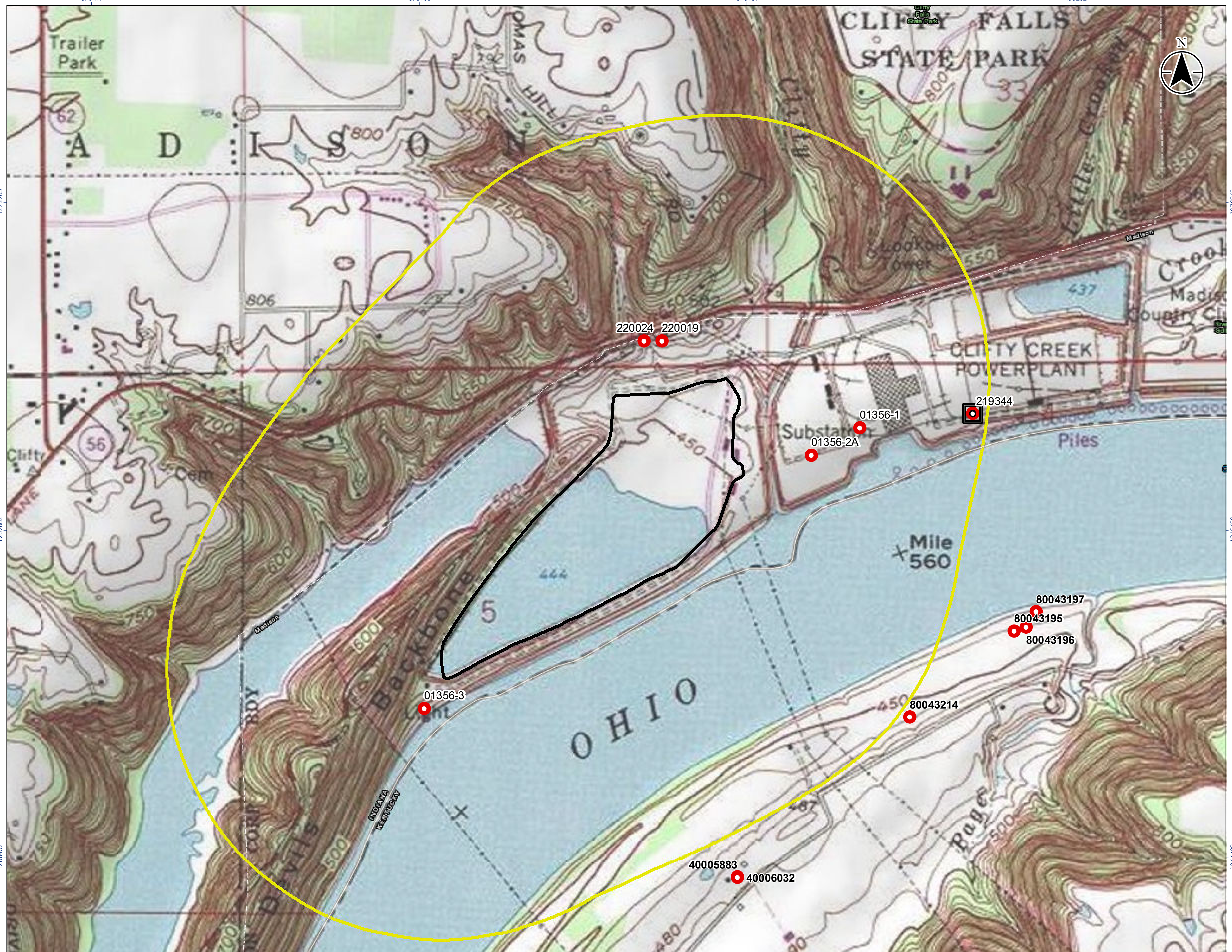
Indiana - Kentucky Electric Corporation
Clifty Creek Station

Figure No.

2

Title

Water Well Half-Mile Offset
West Boiler Slag Pond Closure Plan



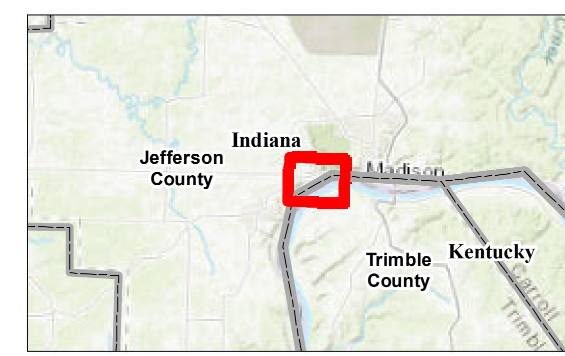
OVEC IKEC
Ohio Valley Electric Corporation
Indiana-Kentucky Electric Corporation

Stantec

Legend
- Private Wells
- Wells (Estimated Location)
- Half-Mile Offset
- Waste Boundary

0 1,000 2,000 Feet
1:12,000 (At original document size of 11x17)

Notes
1. Coordinate System: Indiana State Plane East NAD83
2. Base features - ESRI
3. IDNR Water Wells June 2019
4. Kentucky Water Wells - 2015
5. USGS Quadrangle - Madison West
6. IDNR estimated location by township, range, section, quarter section, and county



Project Location
Clifty Creek Station
Jefferson County, IN

175534018
Prepared by AP on 02/04/2020
Technical Review by JH on 02/04/2020
Independent Review by SH on 02/04/2020

Client/Project
Indiana - Kentucky Electric Corporation
Clifty Creek Station

Figure No.
3

Title
Water Well Half-Mile Offset
West Boiler Slag Pond Closure Plan

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

	County	RegNo	MWU Code	Facility	RegDate	USGS 24k Quad	Township	Range	Section	Source Code	Source ID	Capacity (GPM)	Well Log	Depth (ft)	Diam (in)	Aquifer	UTM North	UTM East	x	y
Significant Withdraw Well	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
	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
	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)

Record of Water Well

Indiana Department of Natural Resources

Reference Number	Driving directions to well	Date completed
220019	WELL #2 2MI W OF MADISON, INDIANA	Oct 09, 1957

Owner-Contractor	Name	Address	Telephone
Owner	INDIANA-KENTUCKY ELE. CO.	MADISON, INDIANA	
Driller	DIEHL PUMP & SUPPLY COMPANY	PO BOX 21266 LOUISVILLE, KENTUCKY	
Operator	A. BURGESS	License: null	

Construction Details

Well	**Use:** Industry	**Drilling method:** Cable Tool	**Pump type:**
	Depth: 130.0	**Pump setting depth:**	**Water quality:**
Casing	**Length:** 100.0	**Material:**	**Diameter:** 12.0
Screen	**Length:** 30.0	**Material:**	**Diameter:** 12.0 **Slot size:** #30

Well Capacity Test	**Type of test:**	**Test rate:** 732.0 gpm for hrs.	**BailTest rate:** gpm for hrs.
	Drawdown: 7.0 ft.	**Static water level:** 51.0 ft.	**Bailer Drawdown** ft.

Grouting Information	**Material:**	**Depth:** from to
	Installation Method:	**Number of bags used:**

Well Abandonment	**Sealing material:**	**Depth:** from to
	Installation Method:	**Number of bags used:**

Administrative

County: JEFFERSON		**Township:** 4N **Range:** 10E	
Section: SW of the SE of the SE of Section 32			**Topo map:** MADISON WEST, IN-KY
Grant Number:			
Field located by: JUA		**on:** Jun 01, 1966	
Courthouse location by:		**on:**	
Location accepted w/o verification by:		**on:**	
Subdivision name:		**Lot number:**	
Ft W of EL: 1000.0	**Ft N of SL:** 250.0	**Ft E of WL:**	**Ft S of NL:**
Ground elevation: 500.0	**Depth to bedrock:** 130.0	**Bedrock elevation:** 370.0	**Aquifer elevation:**
UTM Easting: 636614.0		**UTM Northing:** 4288800.0	

Well Log

Top	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
88.0	92.0	CRS GRAV
92.0	100.0	S&G

100.0	104.0	GRAV
104.0	109.0	FN GRAV
109.0	119.0	MED GRAV
119.0	130.0	MED GRAV
130.0		LIME

Comments MC370;

Record of Water Well

Indiana Department of Natural Resources

Reference Number	**Driving directions to well**	**Date completed**
220024	2MI. W OF MADISON, INDIANA#1 (RESORT WELL) -RECREATION @ POWER PLANT	Oct 23, 1957

Owner-Contractor	**Name**	**Address**	**Telephone**
Owner	INDIANA-KENTUCKY ELE. CO	MADISON, INDIANA	
Driller	DIEHL PUMP & SUPPLY COMPANY	PO BOX 21266 LOUISVILLE, KENTUCKY	
Operator	A. BURGESS	License: null	

Construction Details

Well	**Use:** Industry	**Drilling method:** Cable Tool	**Pump type:**
	Depth: 82.75	**Pump setting depth:**	**Water quality:**
Casing	**Length:** 76.9	**Material:**	**Diameter:** 6.0
Screen	**Length:** 6.0	**Material:**	**Diameter:** 6.0 **Slot size:** #30

Well Capacity Test	**Type of test:**	**Test rate:** gpm for hrs.	**BailTest rate:** gpm for hrs.
	Drawdown: ft.	**Static water level:** 27.0 ft.	**Bailer Drawdown** ft.

Grouting Information	**Material:**	**Depth:** from to
	Installation Method:	**Number of bags used:**

Well Abandonment	**Sealing material:**	**Depth:** from to
	Installation Method:	**Number of bags used:**

Administrative

County: JEFFERSON

Township: 4N **Range:** 10E

Section: SW of the SE of the SE of Section 32

Topo map: MADISON WEST, IN-KY

Grant Number:

Field located by: JNA **on:** Jun 01, 1966

Courthouse location by: **on:**

Location accepted w/o verification by: **on:**

Subdivision name: **Lot number:**

Ft W of EL: 1000.0 **Ft N of SL:** 250.0 **Ft E of WL:** **Ft S of NL:**

Ground elevation: 500.0 **Depth to bedrock:** **Bedrock elevation:** **Aquifer elevation:** 423.0

UTM Easting: 636560.0 **UTM Northing:** 4288800.0

Well Log

Top	Bottom	Formation
0.0	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 SAND, LARGE GRAV
67.0	69.0	CRS GRAV
69.0	72.0	MED SAND, LARGE GRAV
72.0	77.0	CRS SAND, LARGE GRAV

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

Record of Water Well

Indiana Department of Natural Resources

Reference Number	**Driving directions to well**	**Date completed**
219344	NW 1/4 OF NW 1/4 ADJ TO OHIO RIVER BELOW PARK	Jul 20, 1952

Owner-Contractor	**Name**	**Address**	**Telephone**
Owner	ST OF IN CLIFTY FALLS PARK		

Construction Details

Well	**Use:**	**Drilling method:**	**Pump type:**
	Depth:	**Pump setting depth:**	**Water quality:**
Casing	**Length:**	**Material:**	**Diameter:**
Screen	**Length:**	**Material:**	**Diameter: Slot size:**

Well Capacity Test	**Type of test:**	**Test rate:** 14.0 gpm for hrs.	**BailTest rate:** gpm for hrs.
	Drawdown: ft.	**Static water level:** ft.	**Bailer Drawdown** ft.

Grouting Information	**Material:**	**Depth:** from to
	Installation Method:	**Number of bags used:**

Well Abandonment	**Sealing material:**	**Depth:** from to
	Installation Method:	**Number of bags used:**

Administrative	**County:** JEFFERSON		**Township:** 3N **Range:** 10E	
	Section: of Section 4			**Topo map:** MADISON WEST, IN-KY
	Grant Number:			
	Field located by:		**on:**	
	Courthouse location by:		**on:**	
	Location accepted w/o verification by:		**on:**	
	Subdivision name:		**Lot number:**	
	Ft W of EL:	**Ft N of SL:**	**Ft E of WL:**	**Ft S of NL:**
	Ground elevation:	**Depth to bedrock:**	**Bedrock elevation:**	**Aquifer elevation:**
	UTM Easting:		**UTM Northing:**	

Well Log

Top	Bottom	Formation

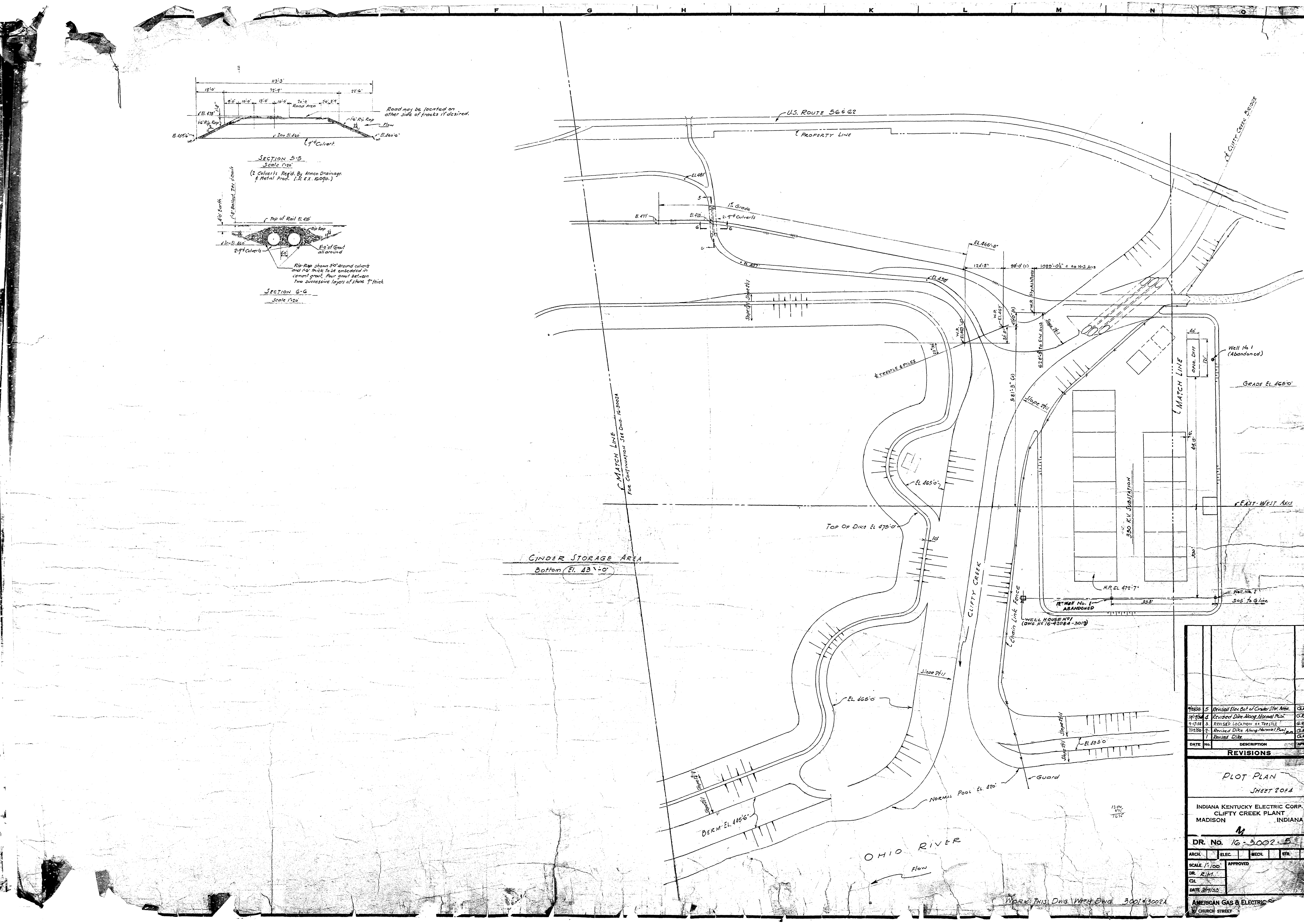
Comments

S&G: DRILLING COULD NOT BE VERIFIED BY GATEMAN WHO WORKED AT THE PACK AT ABOUT THE TIME THE WELL WAS SUPPOSED TO HAVE BEEN DRILLED. THERE IS NOW A LARGE ELECTRIC CO COMPLEX ON THE NW 1/4 NW 1/4 OF 4 J U HORTON IN KENTUCKY ELECTRIC CO. TOPOGRAPHY RIVER FLAT PUMP CAPACITY; 20 STAGE HORSEPOWER; 10 KIND ELECTRIC:

APPENDIX E

Geotechnical Data

AGESC (1953)



DATE	No.	DESCRIPTION	APPD.
10/25/54	5	Revised Elev. Bot. of Cinder Stor. Area	G.R.
10/19/54	4	Revised Dike Along Normal Pool	G.R.
9-17-54	3	REVISED LOCATION OF TRESTLE	G.R.
7/12/54	2	Revised Dike Along Normal Pool	G.R.
	1	Revised Dike	G.R.

REVISIONS

PLOT PLAN

SHEET 2 OF 4

INDIANA KENTUCKY ELECTRIC CORP.
CLIFTY CREEK PLANT
MADISON INDIANA

DR. No. 16-3002-5

ARCH. | ELEC. | MECH. | STR.

SCALE 1" = 100'
DR. R.M.
CH.
DATE 8/19/53
APPROVED

AMERICAN GAS & ELECTRIC S...
30 CHURCH STREET


N.
U.S. Route 56 & 62
Top of Dike El. 475·0'
10'·0"
Drainage Shaft
El. 445·6"
Rip Rap
36" R.C. Pipe (Existing)
36" R.C. Pipe (New)
Normal Pool El. 420·0'
Original Grade
Inv. El. 430'
Inv. El. 433·0'
Bend Line
El. 433·0
Inv. El.
SECTION A-A
Scale 1" = 20'
5175' to 'G' Line
5000' to 'G' Line
FLY ASH DISPOSAL AREA
Top of Dike El. 475·0
4000' to 'G' Line
3410' to 'G' Line
1153'
Contour
East-West Axis
CINDER STORAGE AREA
Bottom El. 433·0' Boring's
Match Line
For Continuation See Dwg. 16-3003
130' - 36" Reinf. Conc. Pipe By Field
220' - New 36" R.C. Pipe By Field
Drainage Shaft (Field to Locate)
See Dwg. 16-3003
457' to 'G' Line of Cols.
Top of Dike El. 475·0'
Boring's
Boring 2
Berm El. 445·6"
Rip Rap
Normal Pool El. 420'
OHIO RIVER
Flow
Top of Dike El. 475·0'
63'·9"
105'·0
73'·9"
10'·0
73'·0"
Varies at other sections of Dike
El. 445·6"
Original Grade
Normal Pool El. 420
El. 433'·0"
SECTION B-B
Scale 1" = 30'
Work This Dwg. With Dwgs.
A
B
10/21/54 | 3 | Revised Elev. Bot. of Cinder Stor. Area | G.R.
10/19/54 | 2 | Revised Dike Along Normal Pool | G.R.
7/12/54 | 1 | Revised Dike Along Normal Pool | G.R.
DATE | No. | DESCRIPTION
REVISIONS
PLOT PLAN
Sheet 3 of 4
INDIANA KENTUCKY ELECTRIC CORP.
CLIFTY CREEK PLANT
MADISON INDIANA
DR. No. 16-3002A-3
ARCH. ELEC. MECH. STR.
SCALE 1" = 100'
APPROVED
DR. R.M.
CH.
AMERICAN GAS & ELECTRIC
30 CHURCH STREET

DR. No. 16-3005

WORK THIS DWG. WITH DWGS 16-3003, 3004, 3006, 3007 & 3007A

DATE	No.	DESCRIPTION	APPD.
12/19/52	1	Reduced Elevations of Borings 12 to 20 incl. by 3'-0"	G.R.

REVISIONS

LOG OF BORINGS

INDIANA KENTUCKY ELECTRIC CORP.
CLIFTY CREEK PLANT
MADISON ______ INDIANA

DR. No. 16-3005-1

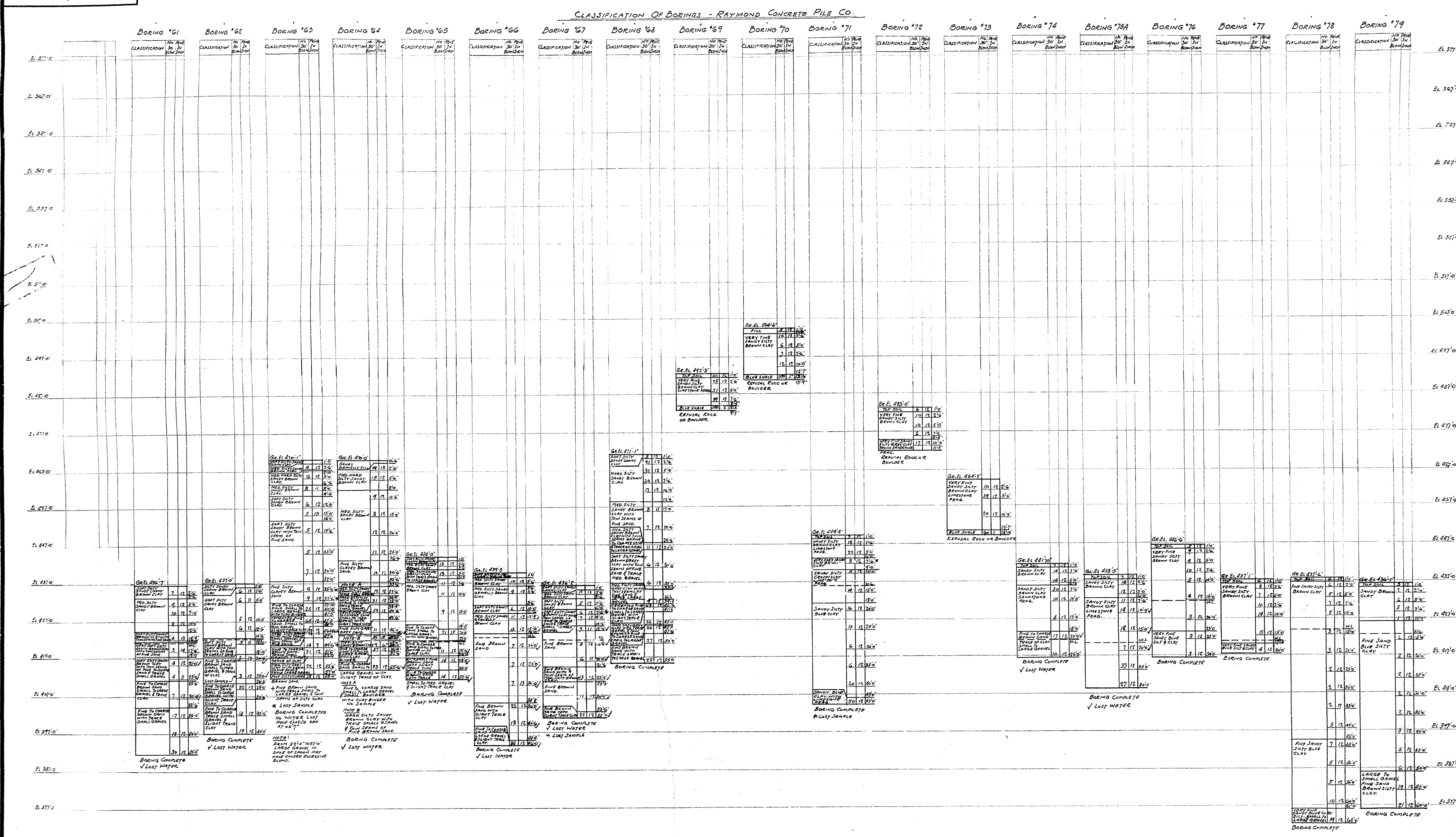
ARCH. | ELEC. | MECH. | STR.

SCALE 1" = 10'
DR. R.M.
CH. AMB
DATE 1-13-53
APPROVED

AMERICAN GAS & ELECTRIC SERVICE CO.
30 CHURCH STREET NEW Y[ORK]

DR. NO. 16-3007A

CLASSIFICATION OF BORINGS - RAYMOND CONCRETE PILE CO.



WORK THIS DWG. WITH DWGS. 16-3003, 3004, 3005, 3006 & 3007

DATE	No.	DESCRIPTION	APPD.

REVISIONS

LOG OF BORINGS

INDIANA KENTUCKY ELECTRIC CORP.
CLIFTY CREEK PLANT
MADISON INDIANA

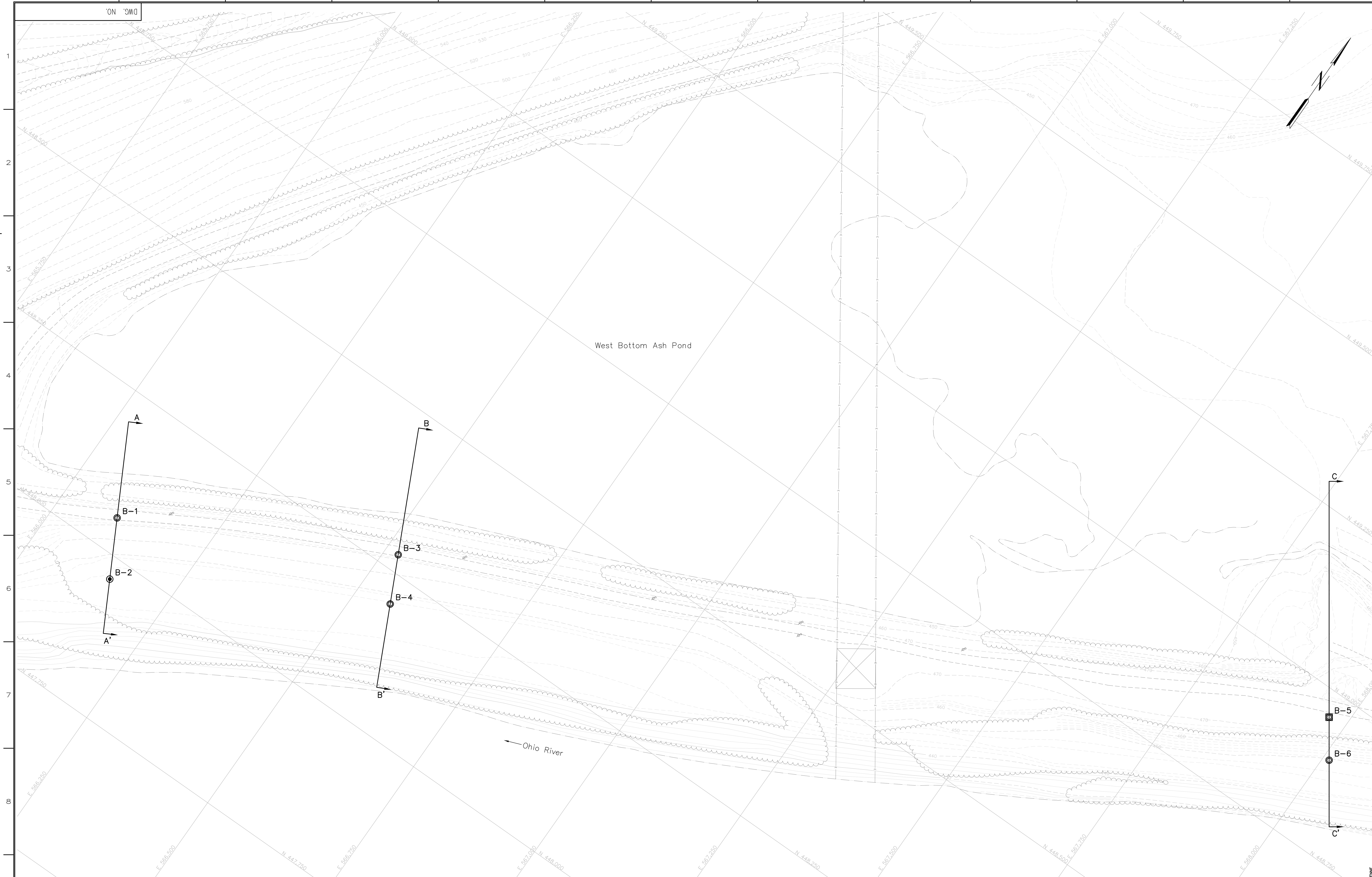
DR. No. 16-3007A

ARCH. | ELEC. | MECH. | STR.

SCALE 1"=10'
DR. R.M.
CH. A.M.B.
DATE 1-13-53
APPROVED

AMERICAN GAS & ELECTRIC SERVICE CORP.
30 CHURCH STREET NEW YORK

Stantec (2016)



LEGEND

- Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests
- Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests and Rock Core

BORING LAYOUT
SCALE: 1"=60'

30 0 60 120 FEET
GRAPHIC SCALE

NOTES

REFERENCE DRAWINGS

DATE	NO.	DESCRIPTION	APPD.

REVISIONS

INDIANA – KENTUCKY ELECTRIC CO.

CLIFTY CREEK PLANT

MADISON INDIANA

GEOTECHNICAL EXPLORATION WEST BOTTOM ASH POND BORING LAYOUT

DWG. NO.

SCALE: | CIVIL ENGINEERING DIVISION
DR:
CH:
ARCH:
ENGR:
DATE:
APPROVED BY

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

PLOT DATE: 04/12/2010 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539022\GEOTECHNICAL\DRAWING\390228-101-BL1.DWG

SCALE:	AS SHOWN
DR:	CW
CH:	EMK
ENGR:	CN
DATE:	APR., 2010

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241
513-842-8200
www.stantec.com

Project Number	175539022	Location	West Crest: West Pond Dam		
Project Name	AEP Clifty Creek / Ash Ponds	Boring No.	**B-1**	Total Depth	71.5 ft
County	Jefferson, IN	Surface Elevation	473.4 ft		
Project Type	Geotechnical Exploration	Date Started	11/3/09	Completed	11/4/09
Supervisor	C. Nisingizwe Driller M. Wethington	Depth to Water	40.0 ft	Date/Time	11/4/09
Logged By	C. Nisingizwe	Depth to Water	39.2 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 Sand, light yellowish brown with light gray, damp to moist, medium stiff to very stiff, Fill		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

STANTEC/FMSM_LEGACY 175539022 CLIFTY CREEK.GPJ FMSM-GRAPHIC LOG.GDT 5/20/10

Stantec

SUBSURFACE LOG

Project Number	175539022	Location	West Crest: West Pond Dam		
Project Name	AEP Clifty Creek / Ash Ponds	Boring No.	**B-1**	Total Depth	71.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Lean Clay With Sand, light yellowish brown with light gray, moist to wet, very soft to medium stiff *(Continued)*		SPT-16	40.0 - 41.5	1.3	1-2-3	24	N = 5
				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
				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
				SPT-26	65.0 - 66.5	1.2	2-2-5	34	N = 7
405.9'	67.5'								
		Gray, Weathered Shale, Augered		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							

STANTEC/FMSM_LEGACY 175539022 CLIFTY CREEK.GPJ FMSM-GRAPHIC LOG.GDT 5/20/10

Project Number	175539022	Location	West Toe: West Pond Dam
Project Name	AEP Clifty Creek / Ash Ponds	Boring No.	**B-2** Total Depth 61.0 ft
County	Jefferson, IN	Surface Elevation	444.0 ft
Project Type	Geotechnical Exploration	Date Started	11/12/09 Completed 11/12/09
Supervisor	C. Nisingizwe Driller M. Wethington	Depth to Water	22.5 ft Date/Time 11/12/09
Logged By	C. Nisingizwe	Depth to Water	N/A Date/Time N/A

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
444.0'	0.0'	Top of Hole							
		Lean Clay With Sand, light yellowish brown with gray, moist to wet, soft to very stiff		SPT-1	2.5 - 4.0	1.2	7-8-11	17	N = 19
				SPT-2	5.0 - 6.5	0.6	4-3-4	19	N = 7
				SPT-3	7.5 - 9.0	0.6	3-3-4	24	N = 7
				ST-4	10.0 - 12.0	1.6		22	
				SPT-5	12.5 - 14.0	1.2	2-2-3	25	N = 5
				SPT-6	15.0 - 16.5	1.2	2-2-2	28	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	
				SPT-10	25.0 - 26.5	1.5	2-2-2	29	N = 4
				SPT-11	27.5 - 29.0	0.7	1-4-5	30	N = 9
414.0'	30.0'								
		Lean Clay With Sand, gray, moist to wet, soft to medium stiff		SPT-12	30.0 - 31.5	1.5	3-3-3	25	N = 6
				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
				SPT-15	37.5 - 39.0	1.5	1-2-2	31	N = 4

Project Number	175539022	Location	West Toe: West Pond Dam
Project Name	AEP Clifty Creek / Ash Ponds	Boring No.	B-2
		Total Depth	61.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Lean Clay With Sand, gray, moist to wet, soft to medium stiff *(Continued)*		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
388.5'	55.5'	Gravel With Silt And Sand, gray, wet, very dense		SPT-20	55.0 - 55.5	0.4	11-50+	10	Began Core N = 50+
383.0'	61.0'	Shale, gray, hard, medium bedded		45	5.5	5.5	100	61.0	

Bottom of Hole

Top of Rock = 56.0'
Elevation (388.0')

Project Number	175539022	Location	Middle Crest: West Pond Dam
Project Name	AEP Clifty Creek / Ash Ponds	Boring No.	**B-3**
		Total Depth	71.5 ft
County	Jefferson, IN	Surface Elevation	471.6 ft
Project Type	Geotechnical Exploration	Date Started	11/4/09
		Completed	11/5/09
Supervisor	C. Nisingizwe	Driller	M. Wethington
Depth to Water	40.0 ft	Date/Time	11/4/09
Logged By	C. Nisingizwe		
Depth to Water	31.0 ft	Date/Time	11/13/09

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
471.6'	0.0'	Top of Hole						
		Lean Clay With Sand, light yellowish brown with light gray, damp to moist, stiff to very stiff, Fill	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
			SPT-11	27.5 - 29.0	1.5	6-7-8	16	N = 15
			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

STANTEC/FMSM_LEGACY 175539022 CLIFTY CREEK.GPJ FMSM-GRAPHIC LOG.GDT 5/20/10

Project Number	175539022	Location	Middle Crest: West Pond Dam		
Project Name	AEP Clifty Creek / Ash Ponds	Boring No.	**B-3**	Total Depth	71.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Lean Clay With Sand, gray to light brown, moist to wet, very stiff to very stiff *(Continued)*		SPT-16	40.0 - 41.5	1.5	1-2-2	24	N = 4
				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							

Stantec

SUBSURFACE LOG

Project Number	175539022	Location	Middle Toe: West Pond Dam
Project Name	AEP Clifty Creek / Ash Ponds	Boring No.	**B-4** Total Depth 71.5 ft
County	Jefferson, IN	Surface Elevation	444.0 ft
Project Type	Geotechnical Exploration	Date Started	11/10/09 Completed 11/11/09
Supervisor	C. Nisingizwe Driller M. Wethington	Depth to Water	22.5 ft Date/Time 11/10/09
Logged By	C. Nisingizwe	Depth to Water	16.0 ft Date/Time 11/13/09

Lithology Elevation	Depth	Description	Overburden Sample # / Rock Core RQD	Depth Run	Rec. Ft. Rec. Ft.	Blows Rec. %	Mois.Cont. % Run Depth	Remarks
444.0'	0.0'	Top of Hole						
		Lean Clay With Sand, brown to dark gray, damp to moist, medium stiff to very stiff	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
			SPT-5	12.5 - 14.0	1.0	2-3-4	22	N = 7
429.0'	15.0'							
		Lean Clay With Sand, gray, moist to wet, soft to 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
			SPT-11	27.5 - 29.0	1.5	1-2-3	27	N = 5
			SPT-12	30.0 - 31.5	1.5	1-1-2	28	N = 3
			SPT-13	32.5 - 34.0	1.5	1-2-2	35	N = 4
			SPT-14	35.0 - 36.5	1.5	2-4-5	31	N = 9
			ST-15	37.5 - 39.5	2.0		--	

STANTEC/FMSM_LEGACY 175539022 CLIFTY CREEK.GPJ FMSM-GRAPHIC LOG.GDT 5/20/10

Stantec

SUBSURFACE LOG

Project Number	175539022	Location	Middle Toe: West Pond Dam
Project Name	AEP Clifty Creek / Ash Ponds	Boring No.	**B-4**
		Total Depth	71.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Lean Clay With Sand, gray, moist to wet, soft to stiff *(Continued)*		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
		Gravel With Silt And Sand, gray, moist, dense to very dense		SPT-23	57.5 - 59.0	1.5	10-17-22	13	N = 39
				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							

STANTEC/FMSM_LEGACY 175539022 CLIFTY CREEK.GPJ FMSM-GRAPHIC LOG.GDT 5/20/10

Stantec

SUBSURFACE LOG

Project Number	175539022	Location	East Crest: West Pond Dam
Project Name	AEP Clifty Creek / Ash Ponds	Boring No.	**B-5** Total Depth 71.5 ft
County	Jefferson, IN	Surface Elevation	468.7 ft
Project Type	Geotechnical Exploration	Date Started	11/10/09 Completed 11/10/09
Supervisor	C. Nisingizwe Driller M. Wethington	Depth to Water	45.0 ft Date/Time 11/10/09
Logged By	C. Nisingizwe	Depth to Water	33.8 ft Date/Time 11/13/09

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
468.7'	0.0'	Top of Hole							
		Lean Clay With Sand, light yellowish brown with light gray, damp to moist, medium stiff to very stiff, Fill		SPT-1	2.5 - 4.0	1.5	6-9-10	15	N = 19
				SPT-2	5.0 - 6.5	1.5	4-4-5	17	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 Sand, gray, moist, soft		SPT-15	37.5 - 39.0	1.5	2-3-3	21	N = 6

STANTEC/FMSM_LEGACY 175539022 CLIFTY CREEK.GPJ FMSM-GRAPHIC LOG.GDT 5/20/10

Stantec

SUBSURFACE LOG

Project Number	175539022	Location	East Crest: West Pond Dam		
Project Name	AEP Clifty Creek / Ash Ponds	Boring No.	**B-5**	Total Depth	71.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Lean Clay With Sand, gray, moist, soft *(Continued)*		SPT-16	40.0 - 41.5	1.3	1-1-2	25	N = 3
				ST-17	42.5 - 44.5	2.0		23	
				SPT-18	45.0 - 46.5	1.5	1-1-3	25	N = 4
421.2'	47.5'								
		Sandy Silt, light yellowish brown to gray, wet, soft to stiff		SPT-19	47.5 - 49.0	1.5	1-1-3	28	N = 4
				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							

SUBSURFACE LOG

Project Number	175539022	Location	East Toe: West Pond Dam		
Project Name	AEP Clifty Creek / Ash Ponds	Boring No.	**B-6**	Total Depth	71.5 ft
County	Jefferson, IN	Surface Elevation	445.5 ft		
Project Type	Geotechnical Exploration	Date Started	11/19/09	Completed	11/19/09
Supervisor	C. Nisingizwe Driller Danny Jessie	Depth to Water	30.0 ft	Date/Time	11/19/09
Logged By	C. Nisingizwe	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
445.5'	0.0'	Top of Hole							
		Lean Clay With Sand, brown to gray, damp to moist, stiff to very stiff		SPT-1	2.5 - 4.0	1.0	2-4-4	19	N = 8
				SPT-2	5.0 - 6.5	1.0	4-4-6	18	N = 10
				ST-3	7.5 - 9.5	2.0		25	
				SPT-4	10.0 - 11.5	1.2	5-7-11	16	N = 18
				SPT-5	12.5 - 14.0	1.1	2-2-2	21	N = 4
				SPT-6	15.0 - 16.5	1.3	1-1-2	31	N = 3
				ST-7	17.5 - 19.5	1.2		32	
				SPT-8	20.0 - 21.5	1.5	0-1-0	32	N = 1
				SPT-9	22.5 - 24.0	1.5	0-0-2	29	N = 2
				SPT-10	25.0 - 26.5	1.5	2-1-3	29	N = 4
418.0'	27.5'	Sandy Silt, gray, moist to wet, very soft to stiff		SPT-11	27.5 - 29.0	1.5	0-3-2	32	N = 5
				SPT-12	30.0 - 31.5	1.5	0-0-3	32	N = 3
				SPT-13	32.5 - 34.0	1.5	0-1-2	33	N = 3
				SPT-14	35.0 - 36.5	1.5	0-0-1	35	N = 1
				SPT-15	37.5 - 39.0	1.5	0-0-1	30	N = 1

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SUBSURFACE LOG

Project Number	175539022	Location	East Toe: West Pond Dam
Project Name	AEP Clifty Creek / Ash Ponds	Boring No.	**B-6**
		Total Depth	71.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Sandy Silt, gray, moist to wet, very soft to stiff *(Continued)*		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

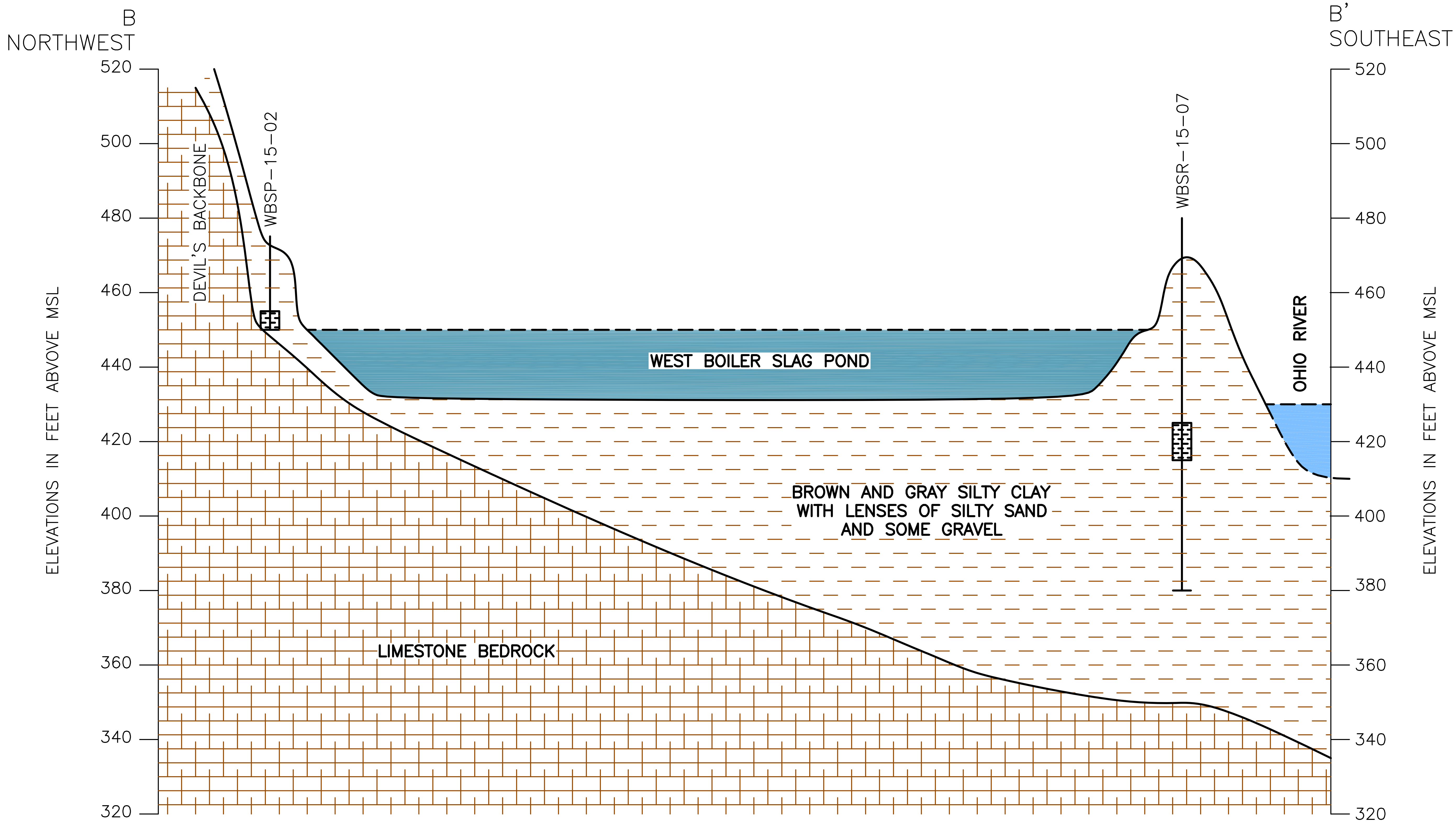
No Refusal /
Bottom of Hole

AGES (2018)

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

Monitoring Well ID	Designation	Date of Installation	Coordinates		Ground Elevation (ft)²	Top of Casing Elevation (ft)²	Top of Screen Elevation (ft)	Base of Screen Elevation (ft)	Total Depth From Top of Casing (ft)
			Northing	Easting					
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



NOTE:
CROSS-SECTION LOCATION SHOWN ON FIGURE 6.

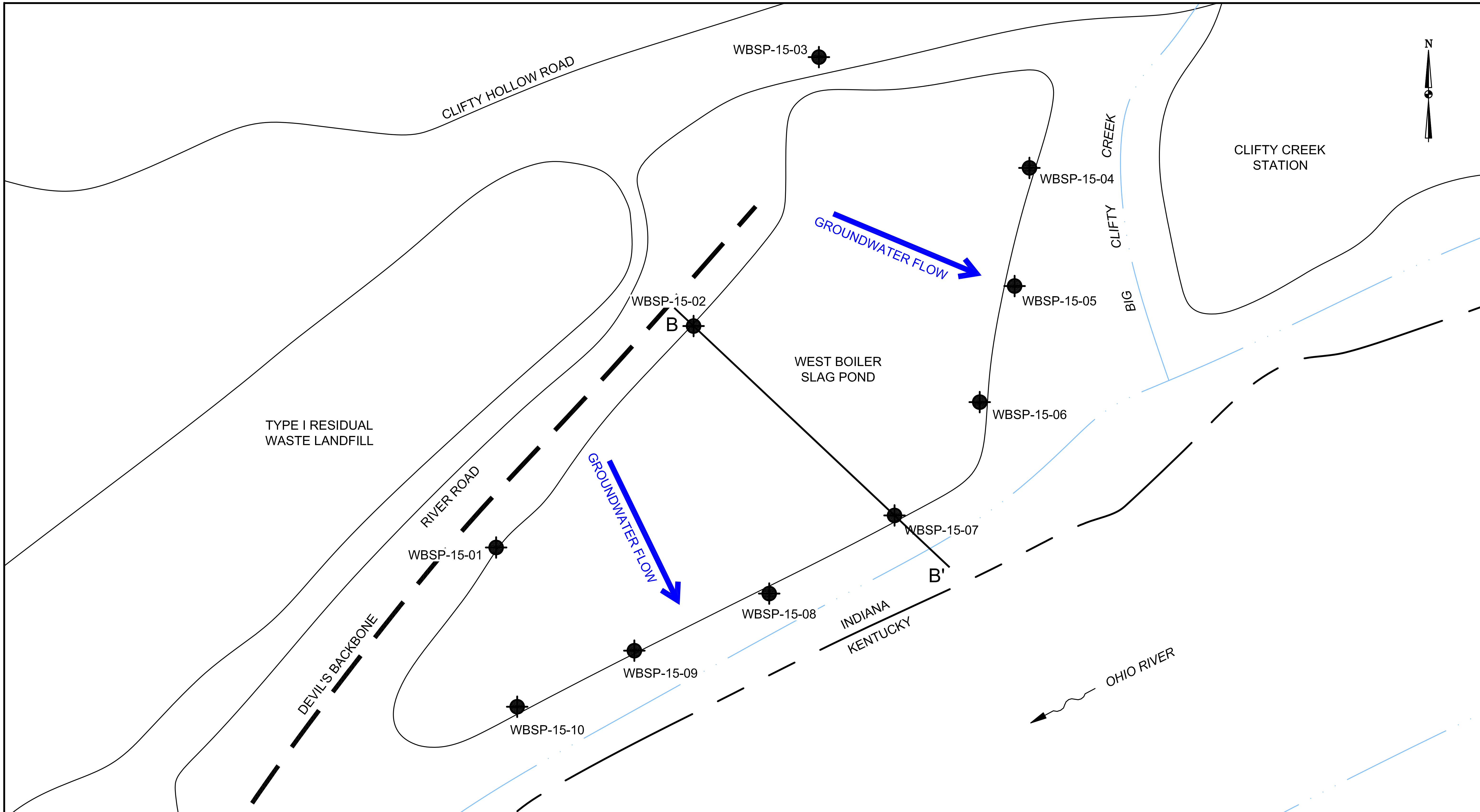
DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067-CLIF
DWG FILE	IKEC_Clifty MW Install_Slag Pond X-Sec b07.dwg
DRAWING SCALE	NOT TO SCALE

AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GENERALIZED GEOLOGIC CROSS-SECTION

DRAWING NAME: FIGURE 5
REV. 0



LEGEND:

MONITORING WELL LOCATION

400' 0' 400' 800'

SCALE: 1"= 400'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067–CLI
DWG FILE	IKEC_Clifty MW Install_MWs_b02-b03-b04.dwg
DRAWING SCALE	AS SHOWN

AGES
Applied Geology And Environmental Science, Inc.
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
MONITORING WELL LOCATIONS AND
GENERALIZED GROUNDWATER FLOW

DRAWING NAME: FIGURE 6

REV. 0

BORING NO. _ ____WBSP-15-01 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/30/15	AGES Geologist:	Mike 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:	18’	Surface Elevation:	466.93’ MSL		

NOTES/COMMENTS:

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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-01

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/30/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Submersible Pump, Peristaltic Pump, Bailer
Field parameters stabilized.
Turbidity = 3.12 NTUs

Volume Purged: 33 gallons

Static Water-Level* 16.76’

Top of Well Casing Elevation: 469.36’

Well Purpose:
Groundwater Monitoring
Northing (Y): 449072.27
Easting (X): 566322.12

Comments/Notes:
2 inch PVC riser and screen
10 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

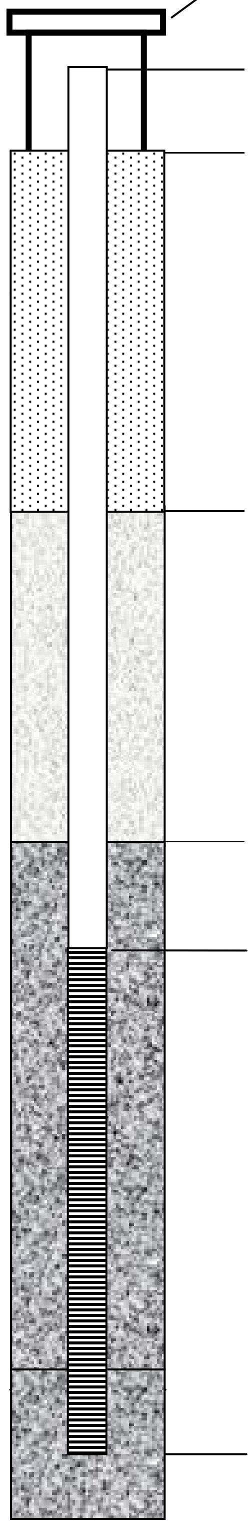
CONSTRUCTION MATERIALS USED:

4 Bags of Sand

2 Bags/Buckets Bentonite Pellets

____ Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 469.36 ft.
Stick-up: 2.43 ft.

Land Surface Elevation: 466.93 ft.

Grout; Type: Potland cement/Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 6 ft*

Top of Well Screen 8 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 18 ft.*

Base of Borehole: 18 ft.*

Total Depth of Well Below Top of Casing: 20.43 ft.

*Indicates Depth Below Land Surface

BORING NO. _ ____WBSP-15-02 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/11/15	AGES Geologist:	Mike 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:	21’	Surface Elevation:	473.83’ MSL		

NOTES/COMMENTS:

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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-02

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/11/15

Drilling Method: Roto-Sonic

Drilling Contractor: Bowser Morner

Development Date(s): 12/7/15

Development Method: Submersible Pump, Peristaltic Pump, Bailer

Field parameters stabilized.

Turbidity = 3.69 NTUs

Volume Purged: 114.5 gallons

Static Water-Level*: 15.40’

Top of Well Casing Elevation: 476.76’

Well Purpose:
Groundwater Monitoring

Northing (Y): 449803.91

Easting (X): 566987.30

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.

Inspector: Michael Gelles

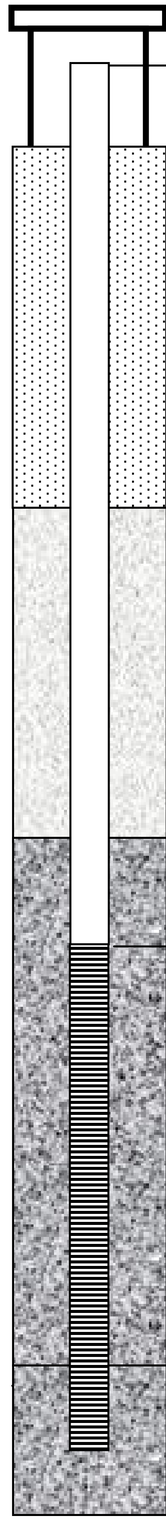
CONSTRUCTION MATERIALS USED:

3 Bags of Sand

4 Bags/Buckets Bentonite Pellets

____ Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 476.76 ft.
Stick-up: 2.93 ft.

Land Surface Elevation: 473.83 ft.

Grout; Type: Portland cement/Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 14 ft*

Top of Well Screen 16 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 21 ft.*

Base of Borehole: 21 ft.*

Total Depth of Well
Below Top of Casing: 23.93 ft.

*Indicates Depth Below Land Surface

BORING NO. _ ____WBSP-15-03 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	12/4/15	AGES Geologist:	Mike 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:	18’	Surface Elevation:	484.91’ MSL

NOTES/COMMENTS:

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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-03

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 12/4/15

Drilling Method: Roto-Sonic

Drilling Contractor: Bowser Morner

Development Date(s): 12/15/15

Development Method: Submersible Pump, Peristaltic 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

Easting (X): 568093.60

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.

Inspector: Michael Gelles

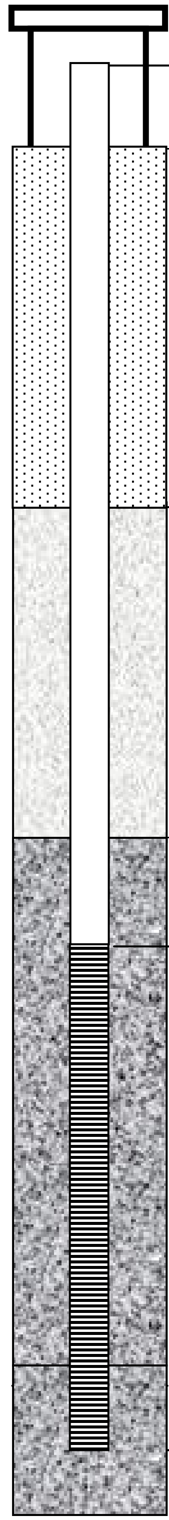
CONSTRUCTION MATERIALS USED:

3 Bags of Sand

4 Bags/Buckets Bentonite Pellets

_____ Bags Portland for Grout

_____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 488.03 ft.

Stick-up: 3.12 ft.

Land Surface Elevation: 484.91 ft.

Grout; Type: Portland cement/Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch

Casing Material: PVC

Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 6 ft*

Top of Well Screen 8 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch

Screen Slot-Size: 0.010 Inch

Screen Material: PVC

Bottom of Well Screen 13 ft.*

Base of Borehole: 18 ft.*

Total Depth of Well Below Top of Casing: 16.12 ft.

*Indicates Depth Below Land Surface

BORING NO. _ ____WBSP-15-04 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/11/15-11/12/15	AGES Geologist:	Mike 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 Elevation:	471.17’ MSL

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, 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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-04

Project Number:	2015067
Project Location:	Clifty Creek Plant – West Boiler Slag Pond
Installation Date(s):	11/11/15-11/12/15
Drilling Method:	Roto-Sonic
Drilling Contractor:	Bowser Morner
Development Date(s):	12/9/15
Development Method:	Submersible Pump

Field parameters stabilized.
Turbidity = 0.91 NTUs

Volume Purged:	65 gallons
Static Water-Level*	50.68’
Top of Well Casing Elevation:	473.71’

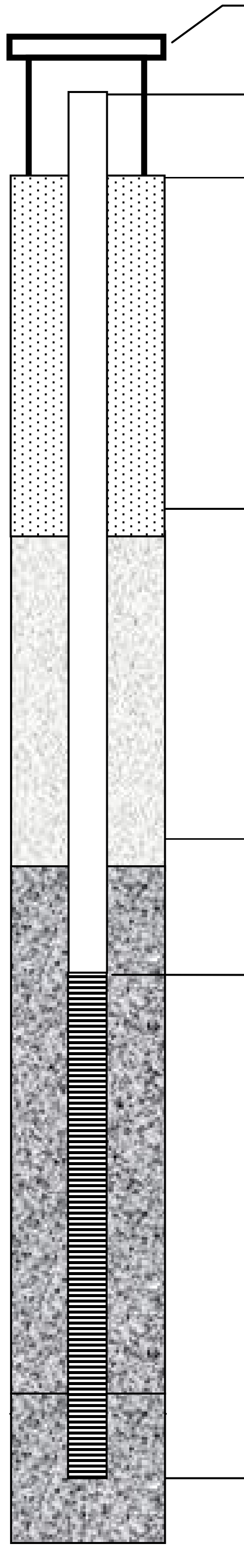
Well Purpose:
Groundwater Monitoring
Northing (Y): 450610.07
Easting (X): 568637.65

Comments/Notes:
2 inch PVC riser and screen
10 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

CONSTRUCTION MATERIALS USED:

5	Bags of Sand
2	Bags/Buckets Bentonite Pellets
12	Bags Portland for Grout
	Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 473.71 ft.
Stick-up: 2.54 ft.

Land Surface Elevation: 471.17 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 53 ft*

Top of Well Screen 55 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 65 ft.*

Base of Borehole: 70 ft.*

Total Depth of Well Below Top of Casing: 67.54 ft.

*Indicates Depth Below Land Surface

BORING NO. _ ____WBSP-15-05 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/13/15-11/17/15	AGES Geologist:	John Campbell

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:	71’	Surface Elevation:	471.90’ MSL		

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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-05

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/13/15-11/17/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 4.28 NTUs

Volume Purged: 46 gallons

Static Water-Level* 52.42’

Top of Well Casing Elevation: 474.42’

Well Purpose:
Groundwater Monitoring
Northing (Y): 450051.40
Easting (X): 568495.72

Comments/Notes:
2 inch PVC riser and screen
10 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: John Campbell

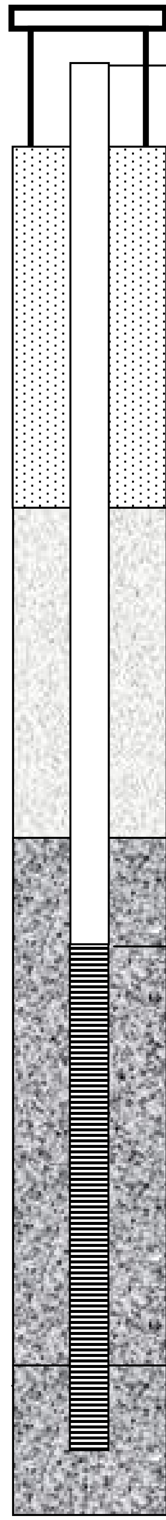
CONSTRUCTION MATERIALS USED:

6 Bags of Sand

2 Bags/Buckets Bentonite Pellets

18 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 474.42 ft.
Stick-up: 2.52 ft.

Land Surface Elevation: 471.90 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 55 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 59 ft*

Top of Well Screen 61 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 71 ft.*

Base of Borehole: 71 ft.*

Total Depth of Well
Below Top of Casing: 73.52 ft.

*Indicates Depth Below Land Surface

BORING NO. _ ____WBSP-15-06 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/18/15-11/19/15	AGES Geologist:	John Campbell

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/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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-06

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/18/15-11/19/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/9/15

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 3.44 NTUs

Volume Purged: 100 gallons

Static Water-Level* 51.55’

Top of Well Casing Elevation: 473.51’

Well Purpose:
Groundwater Monitoring
Northing (Y): 449470.57
Easting (X): 568402.50

Comments/Notes:
2 inch PVC riser and screen
10 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: John Campbell

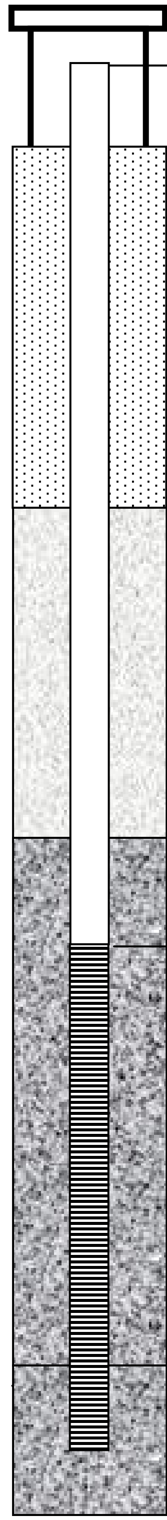
CONSTRUCTION MATERIALS USED:

6 Bags of Sand

2 Bags/Buckets Bentonite Pellets

12 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 473.51 ft.
Stick-up: 2.23 ft.

Land Surface Elevation: 471.28 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 69.5 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 73.5 ft*

Top of Well Screen 75.5 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 85.5 ft.*

Base of Borehole: 85.5 ft.*

Total Depth of Well
Below Top of Casing: 87.73 ft.

*Indicates Depth Below Land Surface

BORING NO. _ ____WBSP-15-07 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/20/15-11/23/15	AGES Geologist:	John Campbell

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:	468.82’ MSL

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
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-07

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/20/15-11/23/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 2.86 NTUs

Volume Purged: 35.5 gallons

Static Water-Level* 41.01’

Top of Well Casing Elevation: 471.31’

Well Purpose:
Groundwater Monitoring
Northing (Y): 448947.93
Easting (X): 567946.39

Comments/Notes:
2 inch PVC riser and screen
10 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: John Campbell

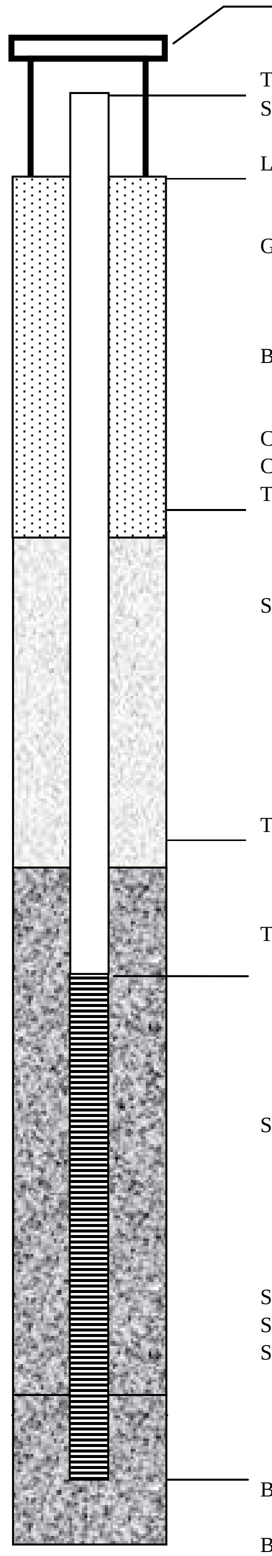
CONSTRUCTION MATERIALS USED:

6 Bags of Sand

14 Bags/Buckets Bentonite Pellets

12 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 471.31 ft.
Stick-up: 2.49 ft.

Land Surface Elevation: 468.82 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 36 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 40 ft*

Top of Well Screen 42 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 52 ft.*

Base of Borehole: 90 ft.*

Total Depth of Well
Below Top of Casing: 54.49 ft.

*Indicates Depth Below Land Surface

BORING NO. _ ____WBSP-15-08 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/24/15-11/25/15	AGES Geologist:	John Campbell

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/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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-08

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/24/15-11/25/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 4.96 NTUs

Volume Purged: 89.5 gallons

Static Water-Level* 37.02'

Top of Well Casing Elevation: 471.06'

Well Purpose:
Groundwater Monitoring
Northing (Y): 448625.46
Easting (X): 567343.24

Comments/Notes:
2 inch PVC riser and screen
10 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: John Campbell

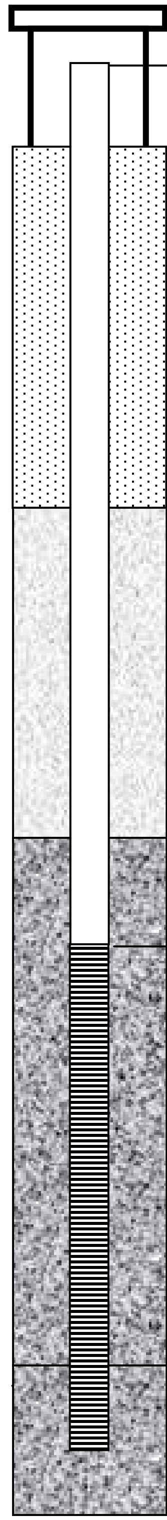
CONSTRUCTION MATERIALS USED:

8 Bags of Sand

4 Bags/Buckets Bentonite Pellets

12 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 471.06 ft.
Stick-up: 2.5 ft.

Land Surface Elevation: 468.56 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 46.5 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 50.5 ft*

Top of Well Screen 52.8 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 62.8 ft.*

Base of Borehole: 80 ft.*

Total Depth of Well
Below Top of Casing: 65.3 ft.

*Indicates Depth Below Land Surface

BORING NO. _ ____WBSP-15-09 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	1/5/16-1/6/16	AGES Geologist:	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:	60’	Surface Elevation:	471.21’ MSL

NOTES/COMMENTS: ______________________________

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

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-09

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 1/5/16-1/6/16

Drilling Method: Hollow Stem Auger
Drilling Contractor: Bowser Morner

Development Date(s): 1/19/16

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 3.57 NTUs

Volume Purged: 74.5 gallons

Static Water-Level* 38.52’

Top of Well Casing Elevation: 470.69’

Well Purpose:
Groundwater Monitoring
Northing (Y): 448359.31
Easting (X): 566711.13

Comments/Notes:
2 inch PVC riser and screen
10 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

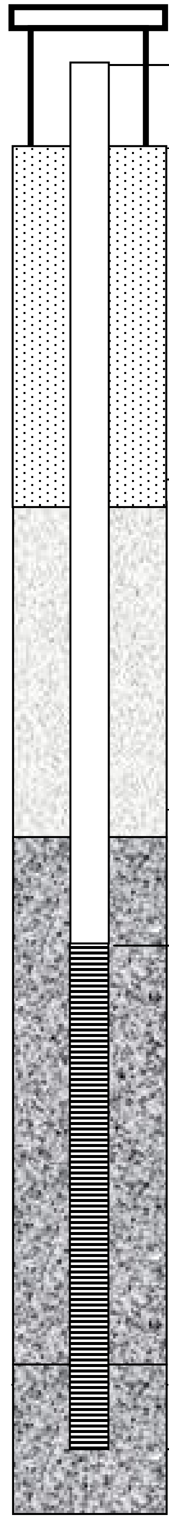
CONSTRUCTION MATERIALS USED:

7 Bags of Sand

2 Bags/Buckets Bentonite Pellets

10 Bags Portland for Grout

___ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 470.69 ft.
Stick-up: -0.52 ft.

Land Surface Elevation: 471.21 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 4.25 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 44 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 48 ft*

Top of Well Screen 50 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 60 ft.*

Base of Borehole: 60 ft.*

Total Depth of Well
Below Top of Casing: 59.48 ft.

*Indicates Depth Below Land Surface

BORING NO. _____WBSP-15-10 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	1/4/16-1/5/16	AGES Geologist:	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/COMMENTS:

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
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-10

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 1/4/16-1/5/16

Drilling Method: Hollow Stem Auger
Drilling Contractor: Bowser Morner

Development Date(s): 1/20/16

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 3.59 NTUs

Volume Purged: 58.5 gallons

Static Water-Level* 39.28'

Top of Well Casing Elevation: 470.69'

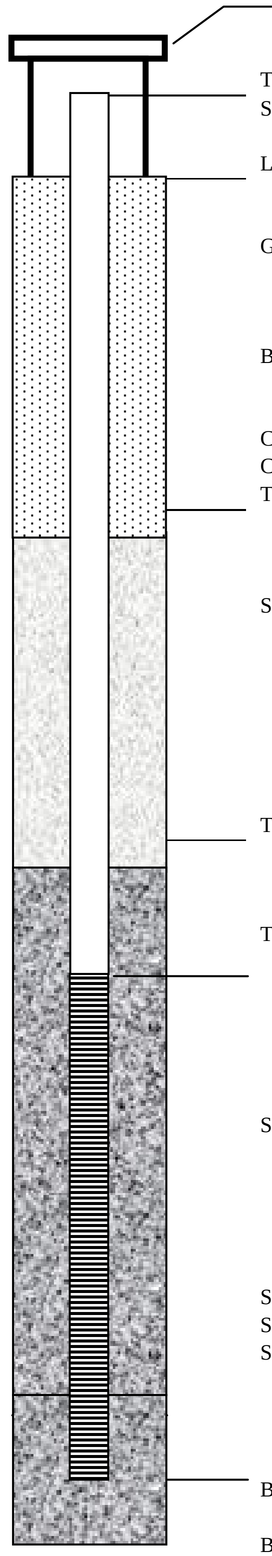
Well Purpose:
Groundwater Monitoring
Northing (Y): 448125.51
Easting (X): 566225.21

Comments/Notes:
2 inch PVC riser and screen
10 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

CONSTRUCTION MATERIALS USED:

8.5	Bags of Sand
2	Bags/Buckets Bentonite Pellets
10	Bags Portland for Grout
	Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 470.69 ft.
Stick-up: -0.52 ft.

Land Surface Elevation: 471.21 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 4.25 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 40 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 44 ft*

Top of Well Screen 46 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 56 ft.*

Base of Borehole: 56 ft.*

Total Depth of Well
Below Top of Casing: 55.48 ft.

*Indicates Depth Below Land Surface

APPENDIX D

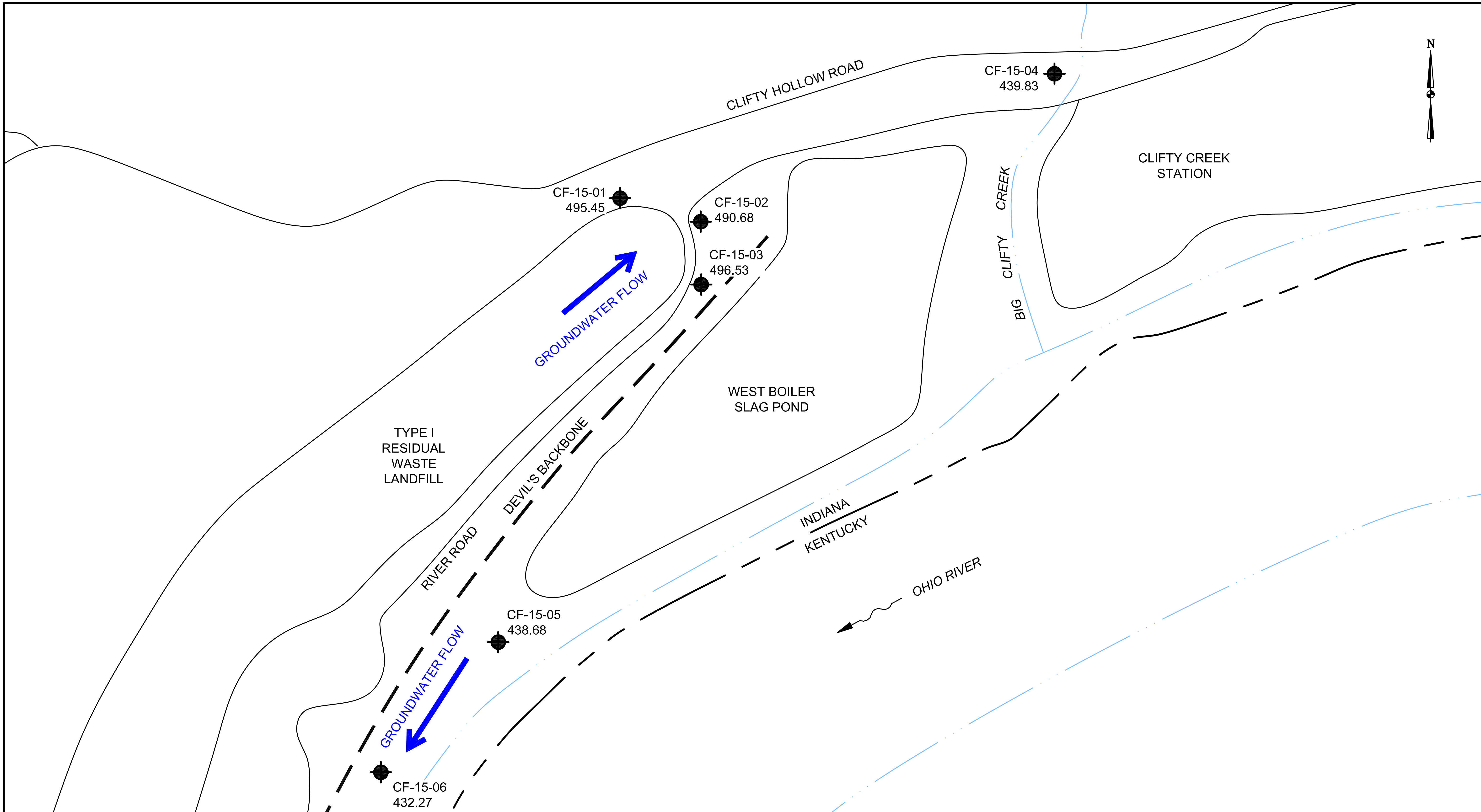
GROUNDWATER LEVELS
January 2016 through May 2016

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 LANDFILL RUNOFF COLLECTION 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



LEGEND:

MONITORING WELL LOCATION

GROUNDWATER FLOW DIRECTION

600' 0' 600' 1200'

SCALE: 1"= 600'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067–CLI
DWG FILE	IKEC_Clifty MW Install_Appx E_Jan16 b08.dwg
DRAWING SCALE	AS SHOWN

AGES
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2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

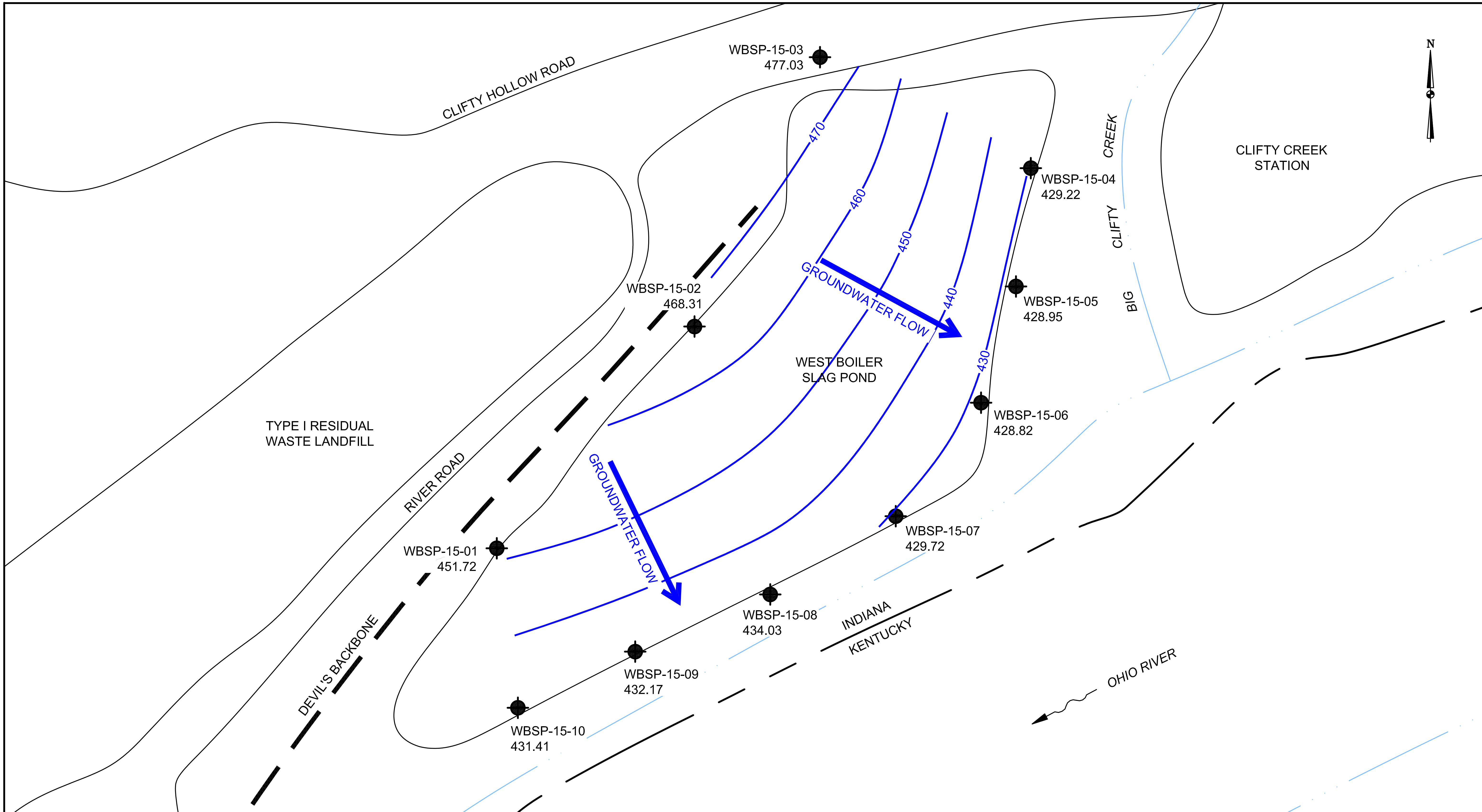
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
NORTHEAST END & BACKGROUND
GROUNDWATER LEVELS & FLOW DIRECTION–JANUARY 2016

DRAWING NAME: FIGURE E–1

REV. 0

Plot: 10/12/2017 13:34 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\Clifty CCR MW Install\Appendix E\IKEC_Clifty MW Install_Appx E_Jan16 b08.dwgE–1



LEGEND:

- MONITORING WELL LOCATION
- GROUNDWATER FLOW DIRECTION

400' 0' 400' 800'

SCALE: 1"= 400'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067–CLI
DWG FILE	IKEC_Clifty MW Install_Appx E_Jan16 b08.dwg
DRAWING SCALE	AS SHOWN

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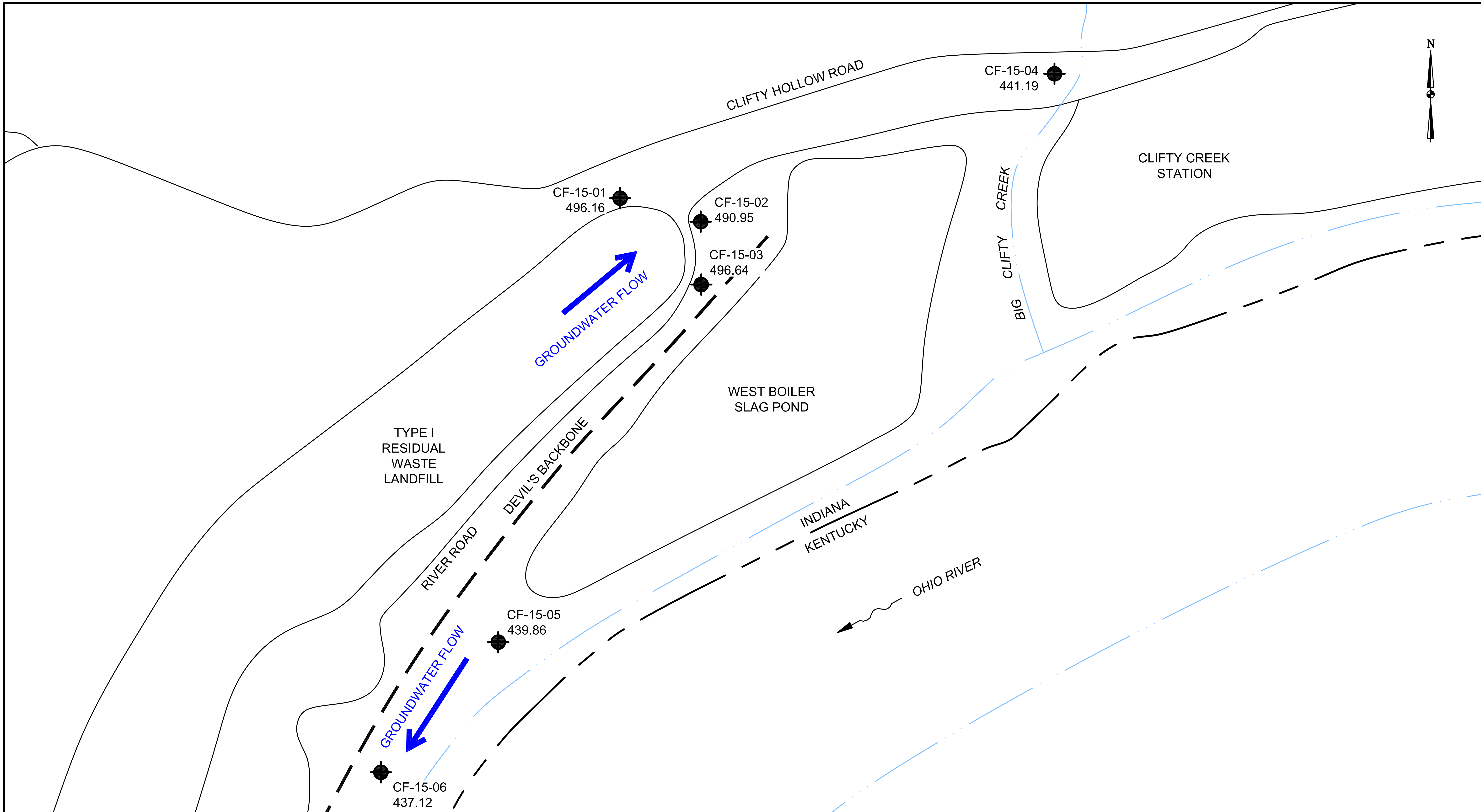
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GROUNDWATER LEVELS & FLOW DIRECTION–JANUARY 2016

DRAWING NAME: FIGURE E–3 | REV. 0

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



LEGEND:
- MONITORING WELL LOCATION
- GROUNDWATER FLOW DIRECTION

600' 0' 600' 1200'
SCALE: 1"= 600'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067–CLI
DWG FILE	IKEC_Clifty MW Install_Appx E_Mar16 b09.dwg
DRAWING SCALE	AS SHOWN

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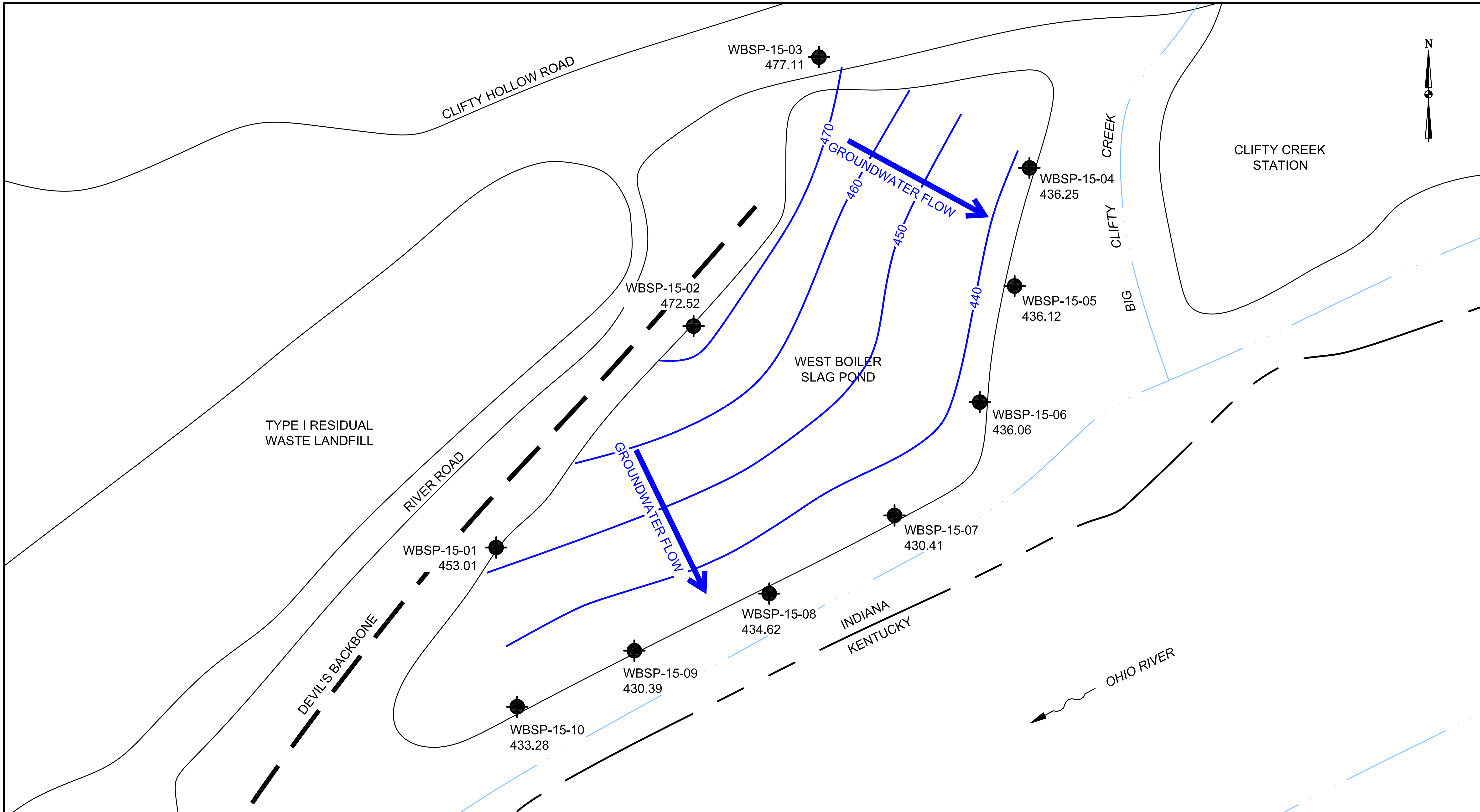
INDIANA–KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
NORTHEAST END & BACKGROUND
GROUNDWATER LEVELS & FLOW DIRECTION–MARCH 2016

DRAWING NAME: FIGURE E–4
REV. 0

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



LEGEND:

MONITORING WELL LOCATION

GROUNDWATER FLOW DIRECTION

400' 0' 400' 800'

SCALE: 1"= 400'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067–CLI
DWG FILE	IKEC_Clifty MW Install_Appx E_Mar16 b09.dwg
DRAWING SCALE	AS SHOWN

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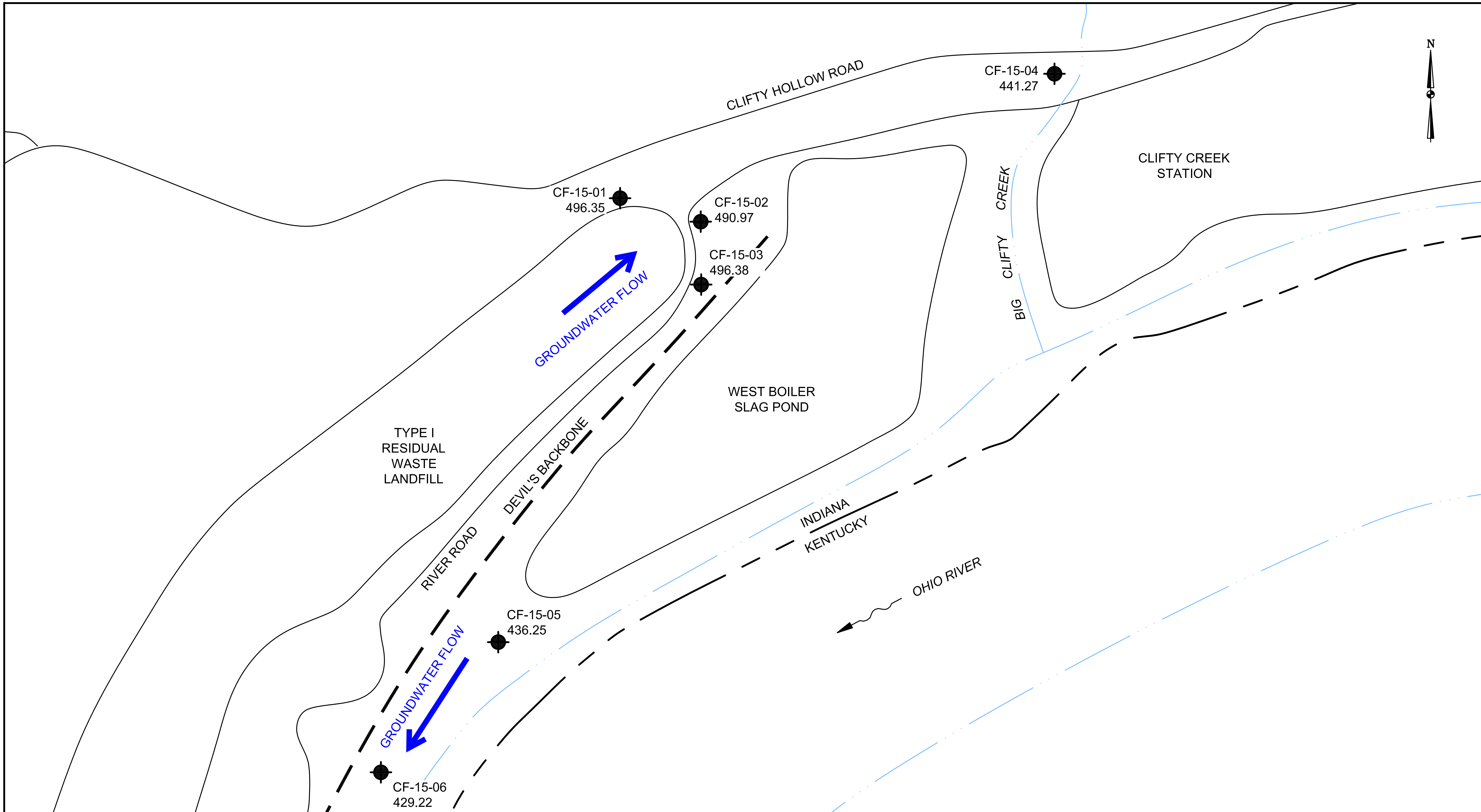
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GROUNDWATER LEVELS & FLOW DIRECTION–MARCH 2016

DRAWING NAME	REV.
FIGURE E-6	0

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



LEGEND:

MONITORING WELL LOCATION

GROUNDWATER FLOW DIRECTION

600' 0' 600' 1200'

SCALE: 1"= 600'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067–CLI
DWG FILE	IKEC_Clifty MW Install_Appx E_May16 b10.dwg
DRAWING SCALE	AS SHOWN

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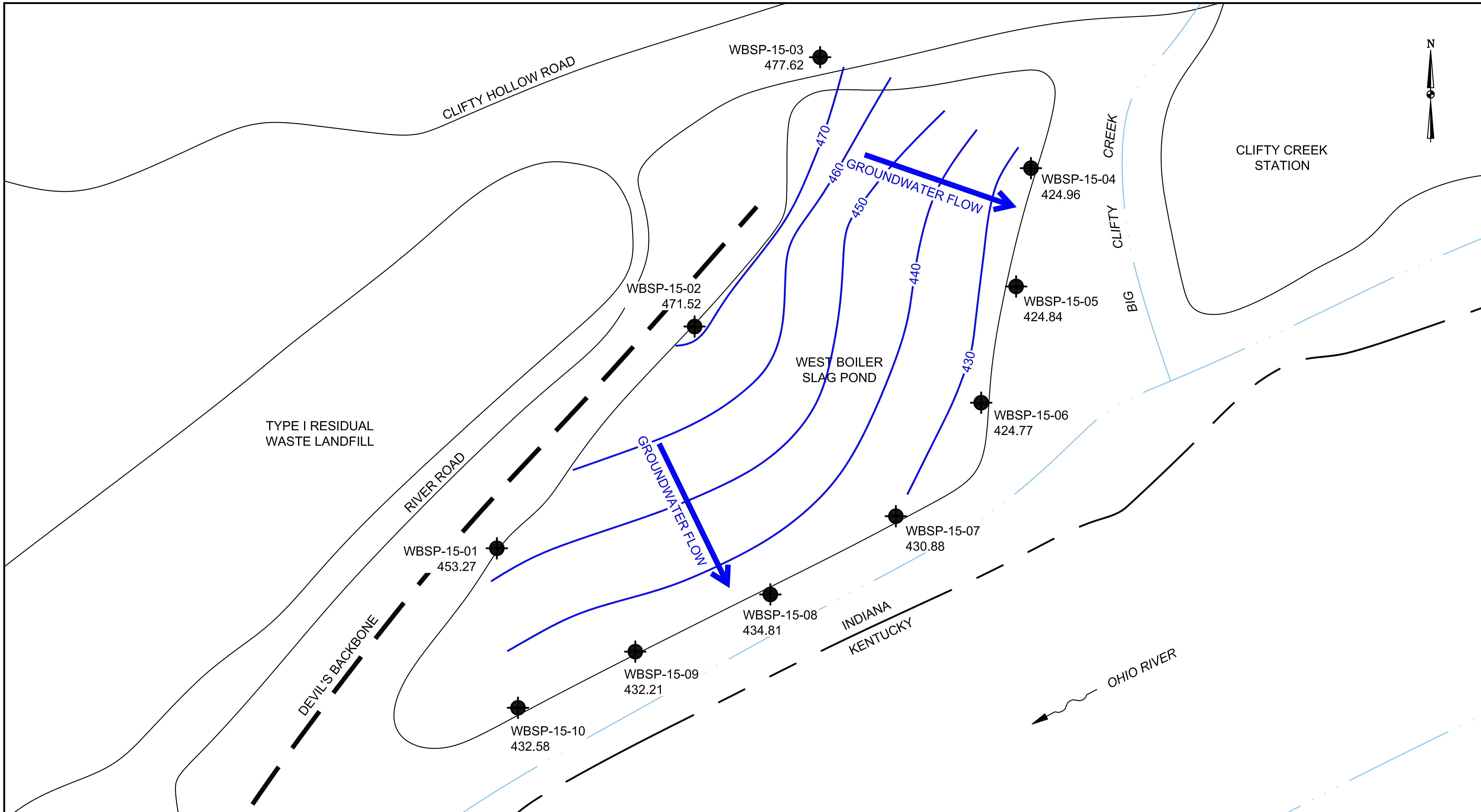
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
NORTHEAST END & BACKGROUND
GROUNDWATER LEVELS & FLOW DIRECTION–MAY 2016

DRAWING NAME: FIGURE E-7

REV. 0

Plot: 10/12/2017 13:48 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\Clifty CCR MW Install\Appendix E\IKEC_Clifty MW Install_Appx E_May16 b10.dwg\E-7



LEGEND:

MONITORING WELL LOCATION

GROUNDWATER FLOW DIRECTION

400' 0' 400' 800'

SCALE: 1"= 400'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2015067–CLI
DWG FILE	IKEC_Clifty MW Install_Appx E_May16 b10.dwg
DRAWING SCALE	AS SHOWN

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INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GROUNDWATER LEVELS & FLOW DIRECTION–MAY 2016

DRAWING NAME: FIGURE E–9

REV. 0

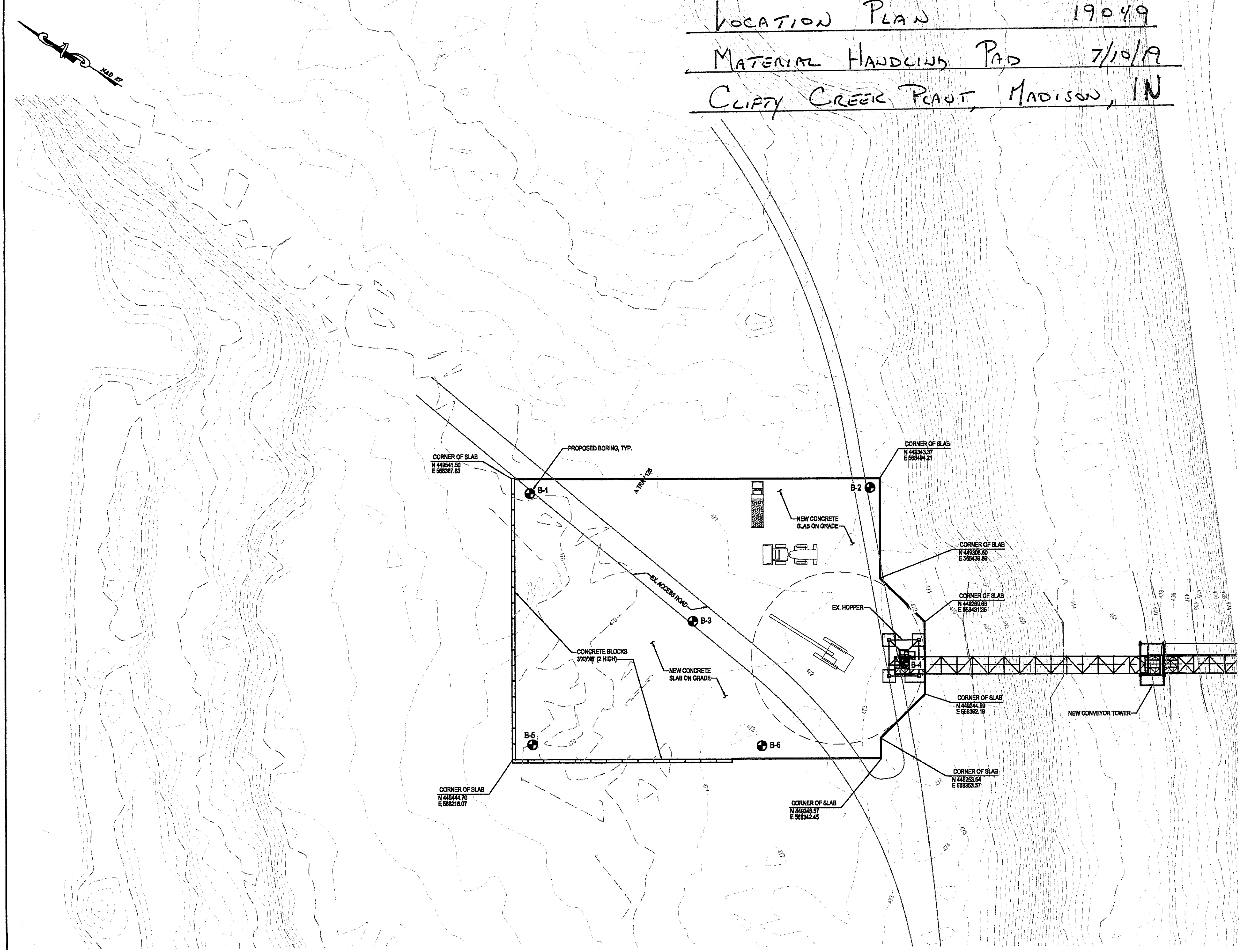
Plot: 10/18/2016 11:52 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\Clifty CCR MW Install\Appendix E\IKEC_Clifty MW Install_Appx E_May16 b10.dwg\E–9

Kozera (2019)

Location Plan 19049

Material Handling Pad 7/10/19

Clifty Creek Plant, Madison, IN



D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B1
Contract No.: 19049
Page: 1 of 1

Project: Clifty Creek Plant
Location: 1335 Clifty Hollow Road
Madison, IN

Ground Surf. El. (±) : 470.0
Date Started : 6-19-19
Date Completed : 6-19-19
Contractor : CinDrill, Inc.
Driller : D. Ciprioni
Rig : cme 55
Drill Method : 3-1/4" HSA
Inspector : D. Kozera

	GROUNDWATER OBSERVATIONS				
	Date	Time	Depth	Casing	Caved
Encountered	6-19	08:00	24.0	23.5	---
Completion	6-19	08:05	---	---	---
Casing Pulled	6-19	08:10	---	---	---
	6-19	08:30	Backfilled	Upon	Completion

Depth (ft)	Surf. Elev. 470.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0	470							Boiler slag, silty sand, FILL, trace gravel, moist, dark brown	Fill	A	
		1	39-29-20	49							
		2	4-4-4	8							
5	465										
		3	3-2-2	4							
		4	2-3-12	15							
10	460										
		5	13-23-32	55							
15	455										
		6	21-22-22	44							
20	450										
		7	6-3-3	6	∇						
25	445										
								wet @ 28.0'			
		8	2-1-3	4							
30	440							Bottom of Test Boring @ 30.0'			

TEST_BORING_LOG 19049.GPJ KOZERA.GDT 7/9/19

D. W. KOZERA, INC.
Baltimore, Maryland

PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B2
Contract No.: 19049
Page: 1 of 1

Project: Clifty Creek Plant
Location: 1335 Clifty Hollow Road
Madison, IN

Ground Surf. El. (±) : 471.0
Date Started : 6-19-19
Date Completed : 6-19-19
Contractor : CinDrill, Inc.
Driller : D. Ciprioni
Rig : cme 55
Drill Method : 3-1/4" HSA
Inspector : D. Kozera

	GROUNDWATER OBSERVATIONS				
	Date	Time	Depth	Casing	Caved
Encountered	6-19	09:05	Dry	---	---
Completion	6-19	09:06	Dry	---	---
Casing Pulled	6-19	09:10	---	---	---
	6-19	10:00	Backfilled	Upon	Completion

Depth (ft)	Surf. Elev. 471.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0								Boiler slag, silty sand, FILL, trace gravel, moist, dark brown	Fill	A	
	470	1	13-21-25	46							
		2	9-7-3	10							
5								Lean clay, FILL, moist, tan, gray	Fill	A-1	
	465	3	3-3-3	6							
		4	6-7-4	11							
10	460										
		5	6-7-7	14				Lean clay, FILL, with trace boiler slag			
15	455							cobbles @ 18.0'			
		6	28-23-12	35							
20	450										
		7	6-7-8	15							
25	445										
		8	3-5-7	12							
30								Bottom of Test Boring @30.0'			

TEST_BORING_LOG 19049.GPJ KOZERA.GDT 6/28/19

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B3
Contract No.: 19049
Page: 1 of 1

Project: Clifty Creek Plant
Location: 1335 Clifty Hollow Road
Madison, IN

Ground Surf. El. (±) : 470.5
Date Started : 6-19-19
Date Completed : 6-19-19
Contractor : CinDrill, Inc.
Driller : D. Ciprioni
Rig : cme 55
Drill Method : 3-1/4" HSA
Inspector : D. Kozera

	GROUNDWATER OBSERVATIONS				
	Date	Time	Depth	Casing	Caved
Encountered	6-19	10:20	23.5	23.0	---
Completion	6-19	10:25	---	---	---
Casing Pulled	6-19	10:30	---	---	---
	6-19	10:35	Backfilled	Upon	Completion

Depth (ft)	Surf. Elev. 470.5	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0	470							Boiler slag FILL, silty sand, trace gravel, moist, dark brown	Fill	A	
		1	12-14-12	26							
		2	18-25-25	50							
5	465	3	15-16-18	34							
		4	19-18-20	38							
10	460										
		5	15-17-18	35							
15	455										
		6	15-28-28	56							
20	450										
					∇						
		7	11-11-9	20							
25	445										
								wet @ 28.0'			
		8	9-12-12	24							
30								Bottom of Test Boring @30.0'			

TEST_BORING_LOG 19049.GPJ KOZERA.GDT 6/28/19

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B4
Contract No.: 19049
Page: 1 of 1

Project: Clifty Creek Plant
Location: 1335 Clifty Hollow Road
Madison, IN

Ground Surf. El. (±) : 472.0
Date Started : 6-19-19
Date Completed : 6-19-19
Contractor : CinDrill, Inc.
Driller : D. Ciprioni
Rig : cme 55
Drill Method : 3-1/4" HSA
Inspector : D. Kozera

GROUNDWATER OBSERVATIONS

	Date	Time	Depth	Casing	Caved
Encountered	6-19	11:30	Moist	---	---
Completion	6-19	11:35	---	---	---
Casing Pulled	6-19	11:40	---	---	---
	6-19	11:45	Backfilled	Upon	Completion

Depth (ft)	Surf. Elev. 472.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0								Lean clay, FILL, with gravel, moist, brown	Fill	A-1	
	470	1	12-14-16	30							
		2	6-6-4	10							
5											
	465	3	5-6-7	13							
		4	5-6-8	14							
10								trace boiler slag below 10.0'			
	460										
		5	5-8-8	16							
15											
	455										
		6	6-7-7	14							
20											
	450										
		7	5-7-8	15							
25											
	445										
		8	5-5-8	13							
30								Bottom of Test Boring @ 30.0'			

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B5
Contract No.: 19049

Project: Clifty Creek Plant
Location: 1335 Clifty Hollow Road
Madison, IN

Ground Surf. El. (±)	470.0
Date Started	6-19-19
Date Completed	6-19-19
Contractor	CinDrill, Inc.
Driller	D. Ciprioni
Rig	cme 55
Drill Method	3-1/4" HSA
Inspector	D. Kozera

GROUNDWATER OBSERVATIONS

	Date	Time	Depth	Casing	Caved
Encountered	6-19	13:30	23.5	23.5	---
Completion	6-19	13:35	---	---	---
Casing Pulled	6-19	13:40	---	---	---
	6-19	13:45	Backfilled	Upon	Completion

Depth (ft)	Surf. Elev. 470.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0	470							Lean clay, FILL, with silty sand, moist, dark brown	Fill	A-1	
		1	6-4-6	10							
		2	3-4-6	10							
5	465										
		3	3-4-3	7							
		4	2-1-3	4							
10	460										
		5	2-1-3	4							
15	455										
								Silty sand, boiler slag FILL, with gravel, dark brown			
		6	11-13-16	29							
20	450										
					∇						
		7	19-14-9	23							
25	445										
		8	5-4-4	8							
30	440							Bottom of Test Boring @ 30.0'			

D. W. KOZERA, INC.
Baltimore, Maryland

PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B6
Contract No.: 19049
Page: 1 of 1

Project: Clifty Creek Plant
Location: 1335 Clifty Hollow Road
Madison, IN

Ground Surf. El. (±) : 471.5
Date Started : 6-19-19
Date Completed : 6-19-19
Contractor : CinDrill, Inc.
Driller : D. Ciprioni
Rig : cme 55
Drill Method : 3-1/4" HSA
Inspector : D. Kozera

GROUNDWATER OBSERVATIONS

	Date	Time	Depth	Casing	Caved
Encountered	6-19	14:30	24.8	23.0	---
Completion	6-19	14:35	---	---	---
Casing Pulled	6-19	14:40	---	---	---
	6-19	14:45	Backfilled	Upon	Completion

Depth (ft)	Surf. Elev. 471.5	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0								Silty sand, boiler slag FILL, with gravel, moist, dark brown	Fill	A	
	470	1	24-28-32	60							
		2	6-7-6	13							
5	465	3	6-4-8	14							
		4	16-15-12	27							
10	460										
		5	2-2-2	4							
15	455										
		6	2-2-2	4							
20	450										
		7	3-4-5	9	▽						
25	445										
		8	2-3-4	7							
30								Bottom of Test Boring @ 30.0'			

APPENDIX F

Hydrogeology

Evaluation of Hydrogeology at the West Boiler Slag Pond
Clifty Creek Station
February 2020

As requested by the Indiana-Kentucky Electric Corporation (IKEC), AGES has prepared this summary of hydrogeologic conditions at the West Boiler Slag Pond (WBSP) at the Clifty Creek Station in Madison, Indiana. To comply with the Coal Combustion Residual (CCR) regulation, a total of 10 monitoring wells were installed and developed at the WBSP in November/December 2015, including three (3) background wells (WBSP-15-01, WBSP-15-02 and WBSP-15-03) and seven (7) downgradient wells (WBSP-15-04 through WBSP-15-10) (Figure 1). Boring and construction logs for the wells are included in Attachment A. Since 2016, routine water level measurements have been collected from all 10 wells at the WBSP under the CCR Program.

Summary of Site Geology

Based on information acquired during the investigative work described above, it was determined the WBSP is underlain by alluvial deposits consisting of layers of silty clay, sandy silt and silty sand ranging from approximately 18 feet below ground surface (bgs) on the northwest side of the WBSP to at least 90 feet bgs on the southeast side of the WBSP (closest to the Ohio River). Three (3) cross-sections through the WBSP (Figures 2 through 4) were developed using data from the site. The locations of the cross-sections are shown on Figure 1.

As shown on Figures 2 through 4, the WBSP is surrounded by a clay dike and is underlain a continuous silty clay layer present immediately beneath the bottom of WBSP, which is encountered at an approximate elevation of 433 feet mean sea level (msl). The silty clay layer extends downward to elevations ranging from 425 feet msl (8 feet below the bottom of the WBSP) to 413 feet msl (20 feet below the bottom of the WBSP). Below the continuous silty clay layer, a layer of silt with fine sand that is gray to brown in color is encountered. The silt with fine sand overlays another layer of silty clay that extends downward to the limestone bedrock.

Based on permeability testing conducted by Stantec Consulting Services, Inc. (Stantec), the hydraulic conductivity of the continuous silty clay underlying the WBSP is extremely low, ranging on the order of 10^{-9} centimeters per second (cm/sec) to 10^{-6} cm/sec. The mean hydraulic conductivity of the silt with fine sand is 1.4×10^{-2} cm/sec based on slug testing conducted during the CCR program.

Designation of Uppermost Aquifer

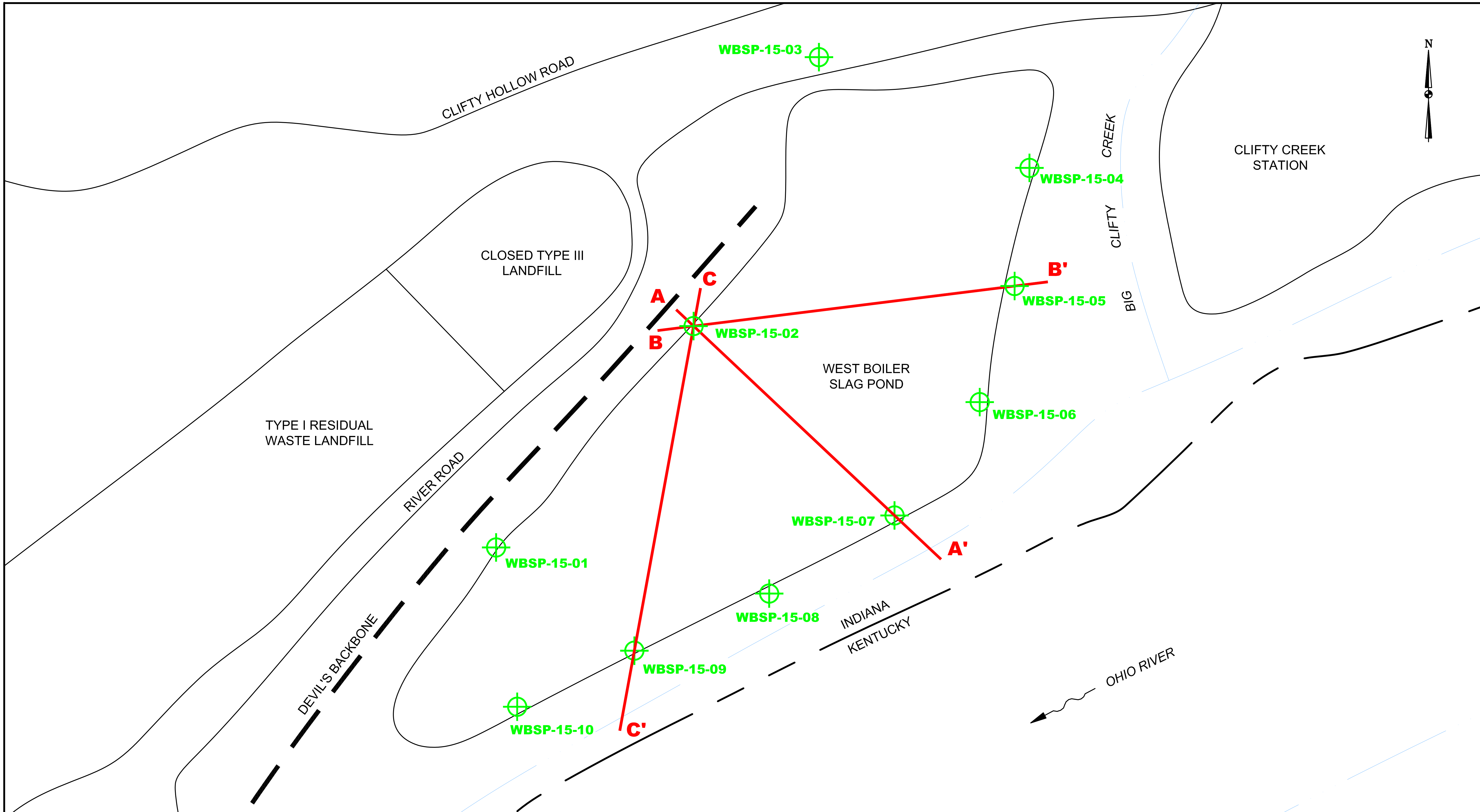
The Indiana Department of Environmental Management (IDEM) defines an aquifer as a “natural underground layer, often of sand or gravel that has the ability to receive, store, and transmit water.” Based on its thickness and permeability, the silt with fine sand is the uppermost unit that meets this definition; this unit has therefore been designated as the uppermost aquifer at the WBSP. This uppermost aquifer (silt with fine sand) is separated from the bottom of the WBSP by 8 to 20 feet of a relatively impermeable silty clay, which acts as an aquitard that hydraulically separates the bottom of the WBSP from the uppermost aquifer.

Groundwater Flow at the WBSP

A summary of groundwater levels from wells at the WBSP collected from 2016 through 2019 is included in Attachment B. Groundwater flow maps for March and October 2019 are presented in Figures 5 and 6. Background wells WBSP-15-01, WBSP-15-02 and WBSP-15-03 were installed to obtain background groundwater quality. Due to the presence of the large limestone ridge east of the WBSP (the Devil's Backbone), these wells are screened approximately 20 to over 40 feet above the uppermost aquifer. Groundwater elevation data from these wells was therefore not used directly in the development of groundwater flow directions for the site. The Ohio River is locked with extensive flood control measures in place. Although the river elevation can vary, the typical pool elevation for the river is 420 feet msl based on public records.

As shown in Figures 5 and 6, groundwater in the uppermost aquifer at the site typically flows toward the southeast, eventually discharging to the Ohio River. The uppermost aquifer (silt with fine sand) is under confined conditions, with the overlying silty clay acting as the confining layer. This is evidenced by the potentiometric surface of groundwater in the unit, which is above the top of the uppermost aquifer.

FIGURES



LEGEND:

MONITORING WELL LOCATION

400' 0' 400' 800'

SCALE: 1"= 400'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2019195–CLIFTY
DWG FILE	2019195_IKEC_Clifty_MW Locs_WBSP.dwg
DRAWING SCALE	AS SHOWN

AGES
Applied Geology And Environmental Science, Inc.

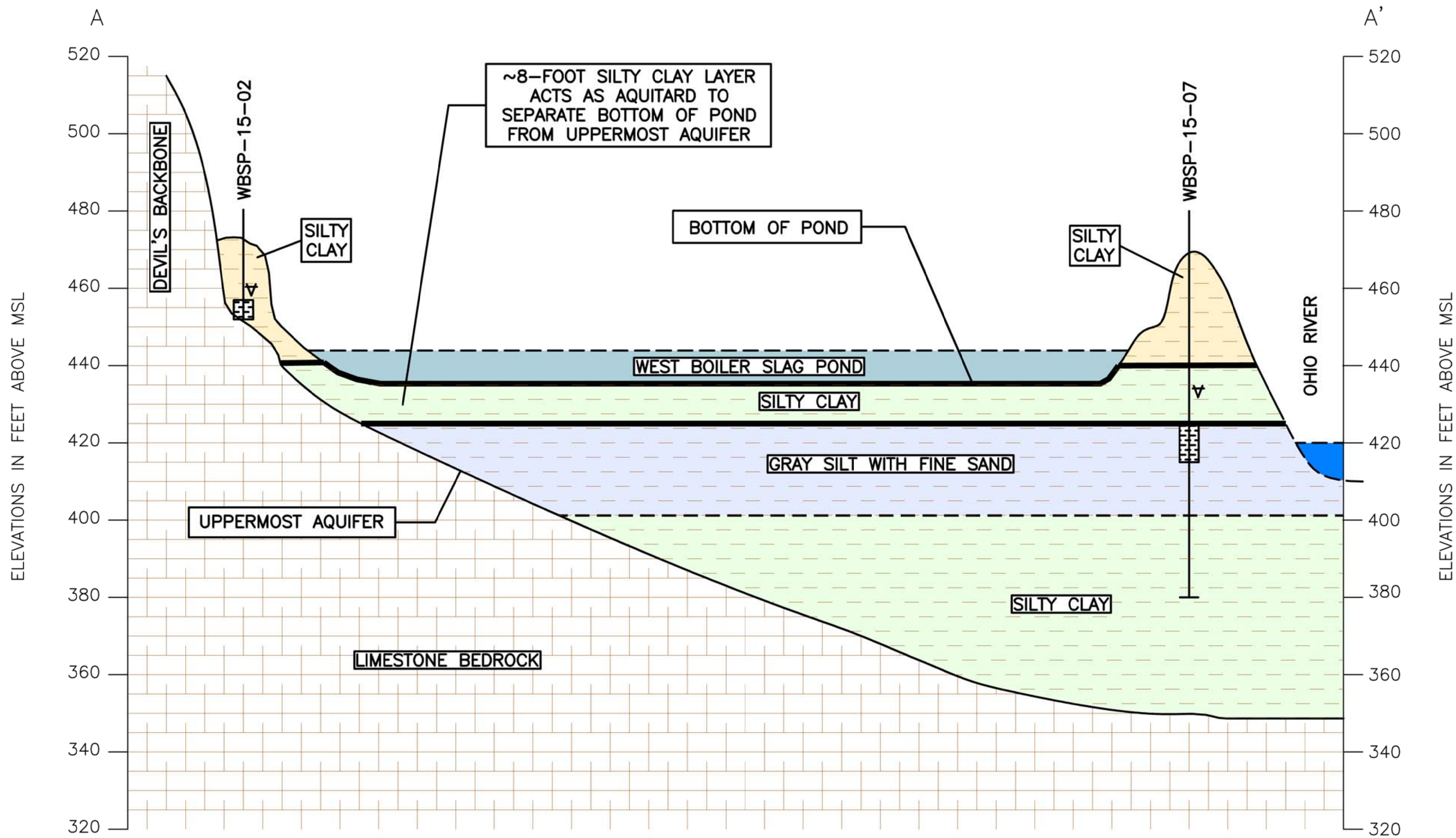
2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
MONITORING WELL LOCATION MAP

DRAWING NAME: FIGURE 1

REV. 0



NOTE:

1) CROSS-SECTION LOCATION SHOWN ON FIGURE 1.

2) HORIZONTAL DISTANCE NOT TO SCALE.

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2019195-CLIFTY
DWG FILE	2019195_IKEC_Clifty_WBSP X-Sec A-A'.dwg
DRAWING SCALE	NOT TO SCALE

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412.264.6453

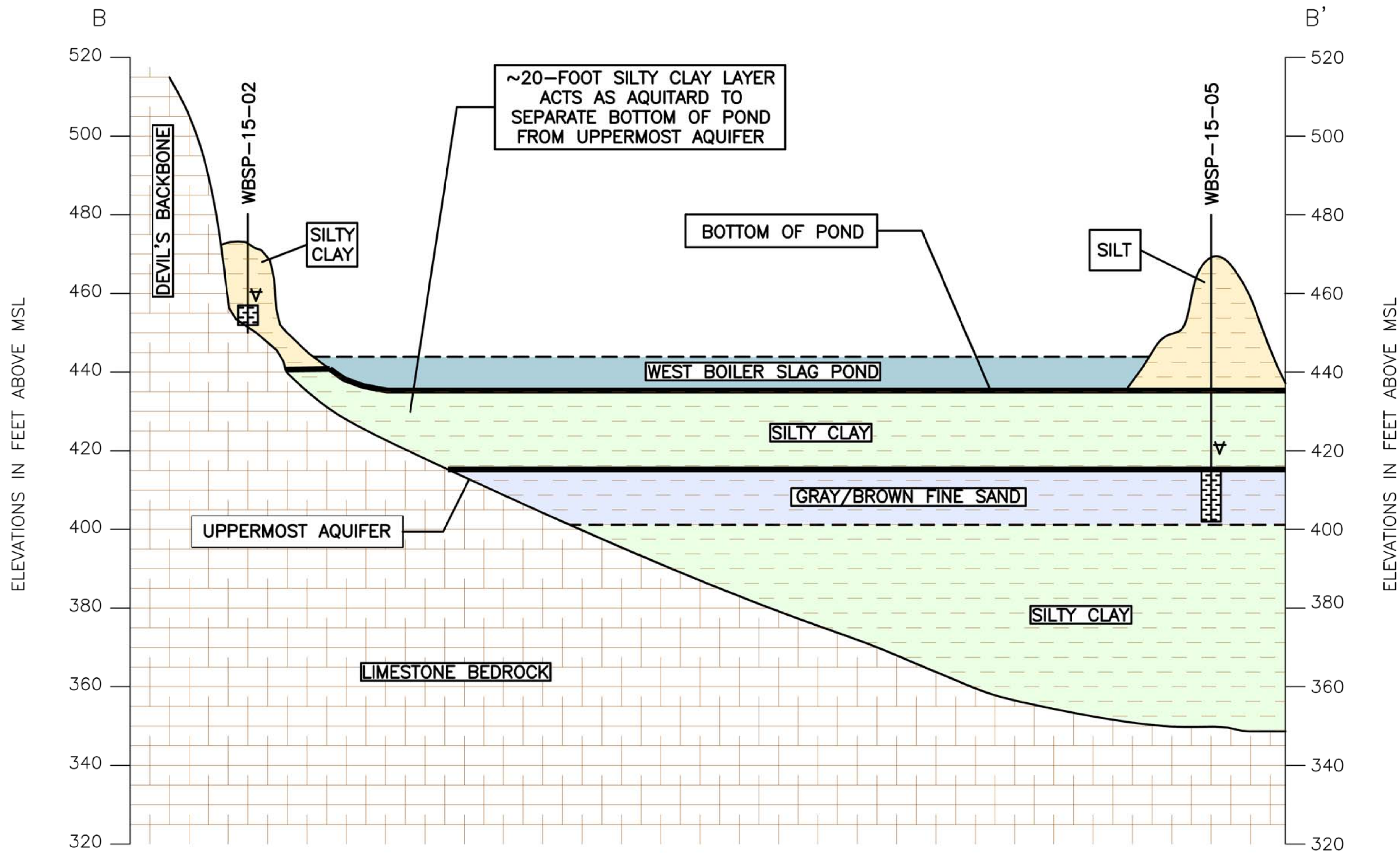
INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GENERALIZED GEOLOGIC CROSS-SECTION A-A'

DRAWING NAME: FIGURE 2

REV. 0

Plot: 02/10/2020 11:55 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\2019195_WBSP\2019195_IKEC_Clifty_WBSP X-Sec A-A'.dwg



NOTE:
1) CROSS-SECTION LOCATION SHOWN ON FIGURE 1.
2) HORIZONTAL DISTANCE NOT TO SCALE.

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2019195-CLIFTY
DWG FILE	2019195_IKEC_Clifty_WBSP X-Sec B-B'.dwg
DRAWING SCALE	NOT TO SCALE

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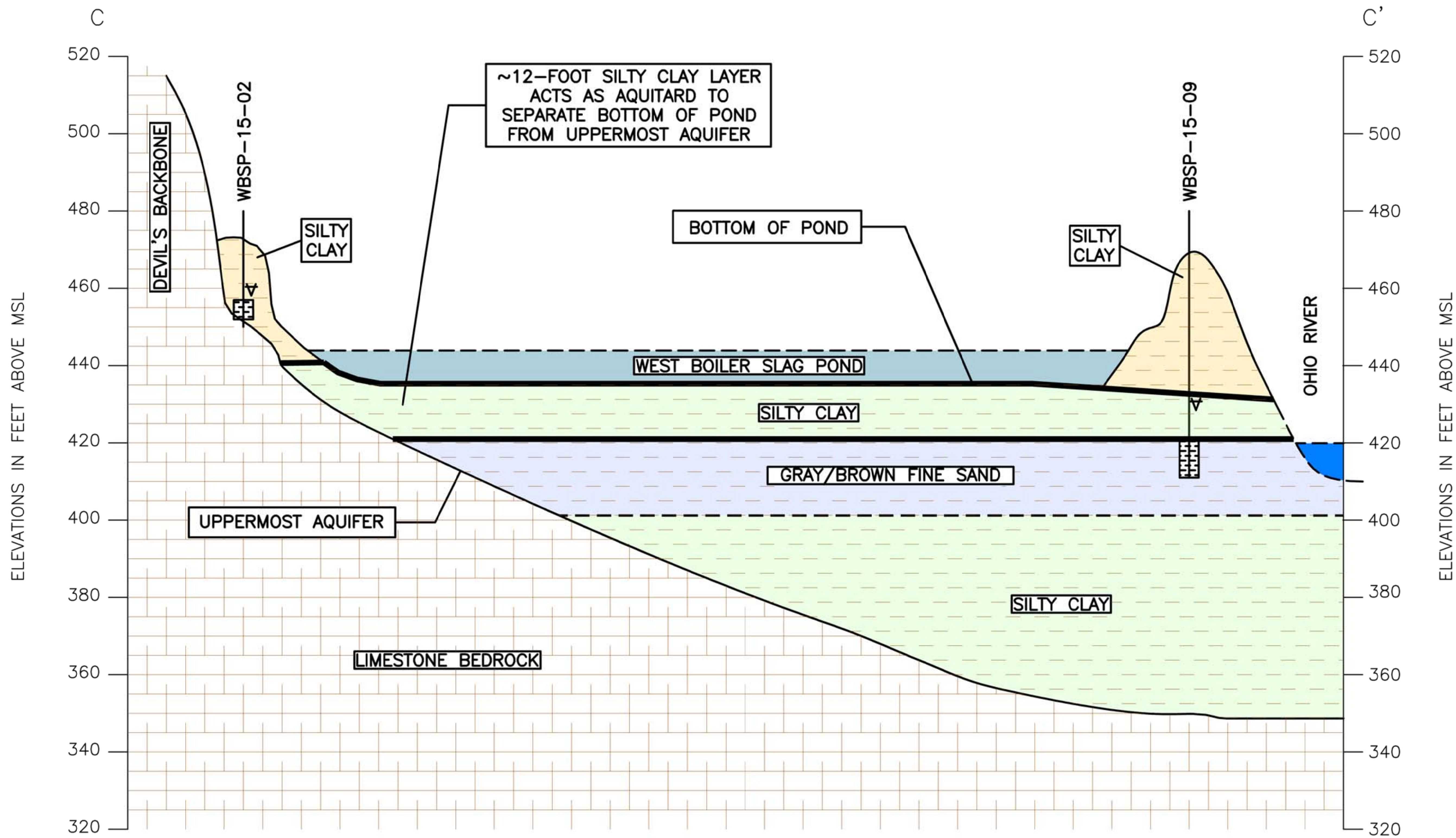
CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GENERALIZED GEOLOGIC CROSS-SECTION B-B'

DRAWING NAME: FIGURE 3
REV. 0

Plot: 02/10/2020 12:14 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\2019195_WBSP\2019195_IKEC_Clifty_WBSP X-Sec B-B'.dwg



NOTE:
1) CROSS-SECTION LOCATION SHOWN ON FIGURE 1.
2) HORIZONTAL DISTANCE NOT TO SCALE.

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2019195-CLIFTY
DWG FILE	2019195_IKEC_Clifty_WBSP X-Sec C-C'.dwg
DRAWING SCALE	NOT TO SCALE

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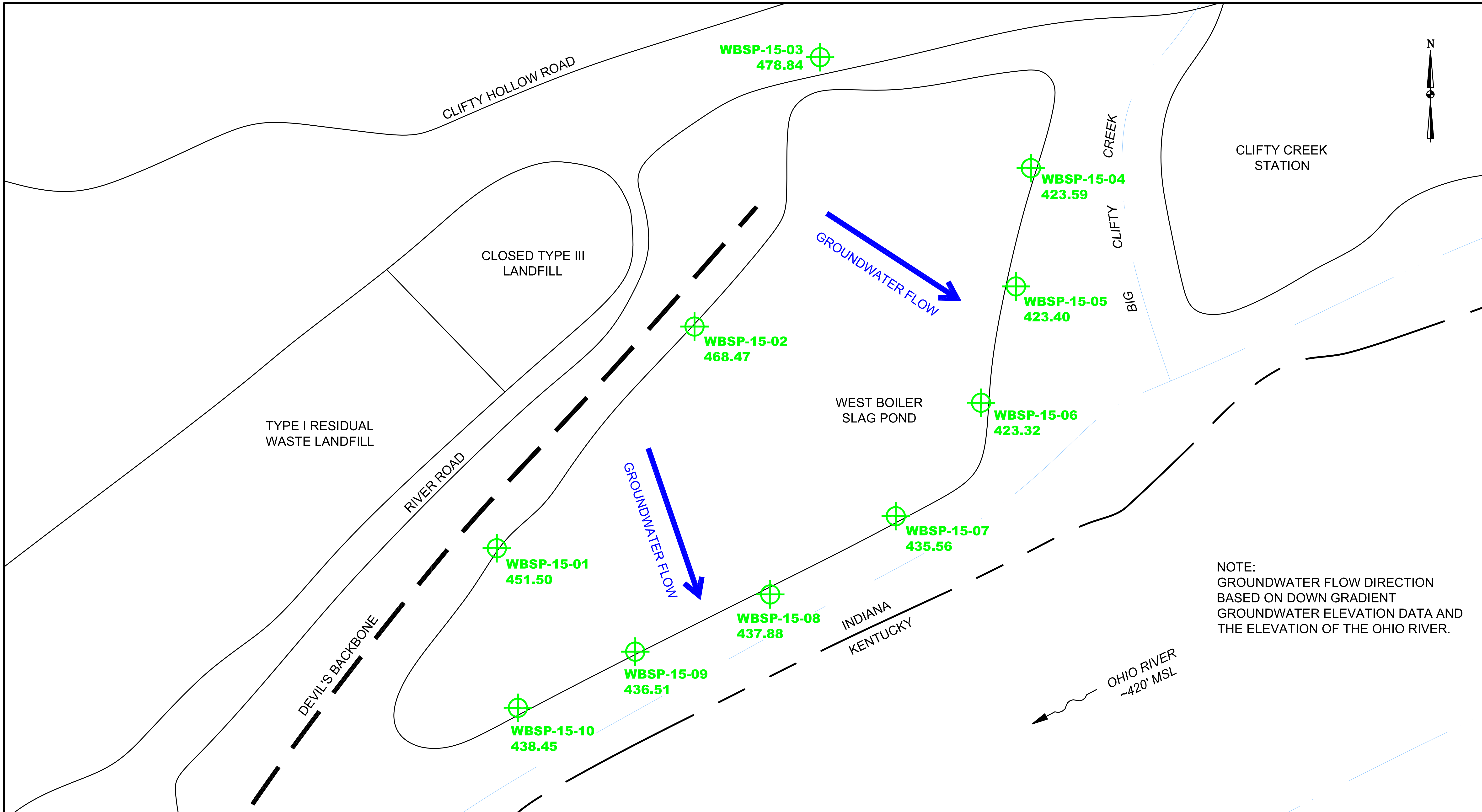
INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GENERALIZED GEOLOGIC CROSS-SECTION C-C'

DRAWING NAME: FIGURE 4
REV. 0

Plot: 02/10/2020 12:30 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\2019195_WBSP\2019195_IKEC_Clifty_WBSP X-Sec C-C'.dwg



NOTE:
GROUNDWATER FLOW DIRECTION BASED ON DOWN GRADIENT GROUNDWATER ELEVATION DATA AND THE ELEVATION OF THE OHIO RIVER.

LEGEND:
- MONITORING WELL LOCATION
- GROUNDWATER FLOW DIRECTION

400' 0' 400' 800'
SCALE: 1"= 400'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2019195–CLIFTY
DWG FILE	2019195_IKEC_Clifty_WBSP GW Flow_MAR19_WBSP.dwg
DRAWING SCALE	AS SHOWN

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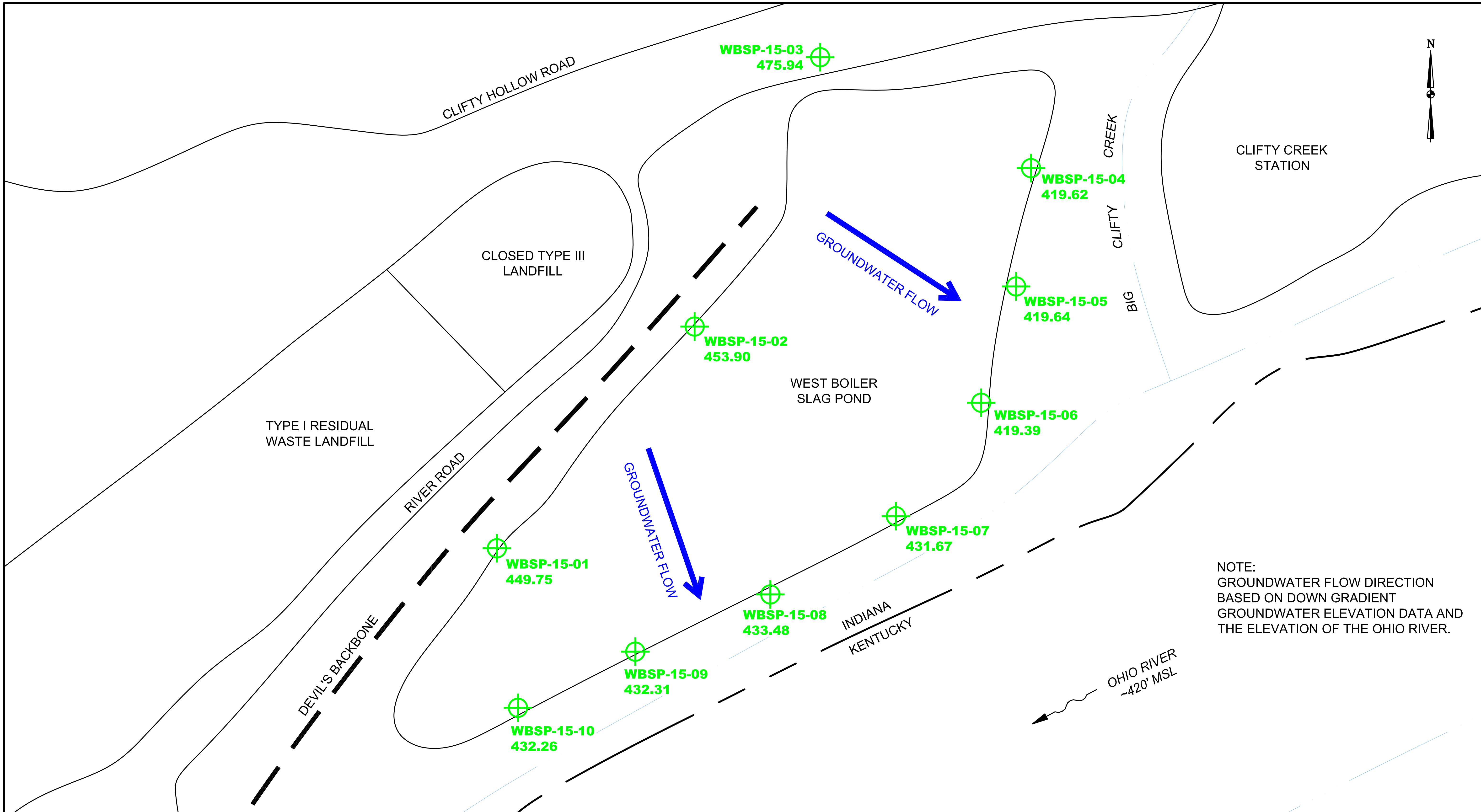
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GROUNDWATER LEVELS AND FLOW DIRECTION
MARCH 2019

DRAWING NAME: FIGURE 5
REV. 0

Plot: 01/20/2020 15:13 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\2019195_WBSP\2019195_IKEC_Clifty_WBSP GW Flow_MAR19_WBSP.dwg\MAR19



LEGEND:

MONITORING WELL LOCATION

GROUNDWATER FLOW DIRECTION

400' 0' 400' 800'

SCALE: 1"= 400'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2019195–CLIFTY
DWG FILE	2019195_IKEC_Clifty_WBSP GW Flow_OCT19_WBSP.dwg
DRAWING SCALE	AS SHOWN

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INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GROUNDWATER LEVELS AND FLOW DIRECTION
OCTOBER 2019

DRAWING NAME: FIGURE 6

REV. 0

Plot: 01/20/2020 15:16 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\2019195_WBSP\2019195_IKEC_Clifty_WBSP GW Flow_OCT19_WBSP.dwg\OCT19

TABLE

Groundwater Elevations
West Boiler Slag Pond
2016-2019

	Jan-16	Mar-16	May-16	Jul-16	Aug-16	Nov-16	Feb-17	Jun-17	Aug-17	Mar-18	Oct-18	Mar-19	Jun-19	Oct-19
Monitoring Well Designation	**Groundwater Elevation (ft)**	**Groundwater Elevation (ft)**	**Groundwater Elevation (ft)**	**Groundwater Elevation (ft)**	**Groundwater Elevation (ft)**	**Groundwater Elevation (ft)**	**Groundwater Elevation (ft)**	**Groundwater Elevation (ft)**	**Groundwater Elevation (ft)**	**Groundwater Elevation (ft)**	**Groundwater Elevation (ft)**	**Groundwater Elevation (ft)**	**Groundwater Elevation (ft)**	**Groundwater Elevation (ft)**
WBSP-15-01	451.72	453.01	453.27	449.97	450.26	449.72	450.90	450.64	449.88	469.36	450.21	451.50	455.00	449.75
WBSP-15-02	468.31	472.52	471.52	457.52	462.38	454.37	462.67	462.60	455.24	476.76	459.58	468.47	470.10	453.90
WBSP-15-03	477.03	477.11	477.62	476.00	477.04	474.52	477.06	476.33	474.83	488.03	476.91	478.84	480.65	475.94
WBSP-15-04	429.22	436.25	424.96	420.14	420.57	420.19	422.41	420.57	419.90	473.71	424.69	423.59	433.47	419.62
WBSP-15-05	428.95	436.12	424.84	417.06	420.46	420.09	422.29	420.44	419.75	474.42	424.52	423.40	433.46	419.64
WBSP-15-06	428.82	436.06	424.77	419.96	420.40	420.06	422.28	420.39	419.68	473.51	424.52	423.32	433.21	419.39
WBSP-15-07	429.72	430.41	430.88	431.07	430.49	428.99	428.53	430.53	430.42	471.31	431.85	435.56	442.61	431.67
WBSP-15-08	434.03	434.62	434.81	434.53	433.99	433.55	433.57	434.48	434.47	471.06	435.37	437.88	444.42	433.48
WBSP-15-09	432.17	430.39	432.21	427.79	430.33	429.38	432.53	432.08	432.59	470.69	432.67	436.51	443.25	432.31
WBSP-15-10	431.41	433.28	432.58	431.95	432.19	431.59	432.25	432.61	431.94	470.69	432.46	438.45	443.20	432.26

ATTACHMENT

BORING NO. _____WBSP-15-01__
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/30/15	AGES Geologist:	Mike 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:	18'	Surface Elevation:	466.93' MSL		

NOTES/COMMENTS:

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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-01

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/30/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Submersible Pump, Peristaltic Pump, Bailer
Field parameters stabilized.
Turbidity = 3.12 NTUs

Volume Purged: 33 gallons

Static Water-Level* 16.76’

Top of Well Casing Elevation: 469.36’

Well Purpose:
Groundwater Monitoring
Northing (Y): 449072.27
Easting (X): 566322.12

Comments/Notes:
2 inch PVC riser and screen
10 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

CONSTRUCTION MATERIALS USED:

4 Bags of Sand

2 Bags/Buckets Bentonite Pellets

______ Bags Portland for Grout

______ Bags Concrete/Sakrete

Top of Casing Elevation: 469.36 ft.
Stick-up: 2.43 ft.

Land Surface Elevation: 466.93 ft.

Grout; Type: Potland cement/Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 6 ft*

Top of Well Screen 8 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 18 ft.*

Base of Borehole: 18 ft.*

Total Depth of Well Below Top of Casing: 20.43 ft.

*Indicates Depth Below Land Surface

BORING NO. WBSP-15-02
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/11/15	AGES Geologist:	Mike 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:	21’	Surface Elevation:	473.83’ MSL

NOTES/COMMENTS:

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, boiler slag, loose, moist	N/A
10-20	8	NA	10’-11’ Red brown silt, fine sand, 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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-02

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/11/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/7/15

Development Method: Submersible Pump, Peristaltic Pump, Bailer
Field parameters stabilized.
Turbidity = 3.69 NTUs

Volume Purged: 114.5 gallons

Static Water-Level* 15.40’

Top of Well Casing Elevation: 476.76’

Well Purpose:
Groundwater Monitoring
Northing (Y): 449803.91
Easting (X): 566987.30

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.

Inspector: Michael Gelles

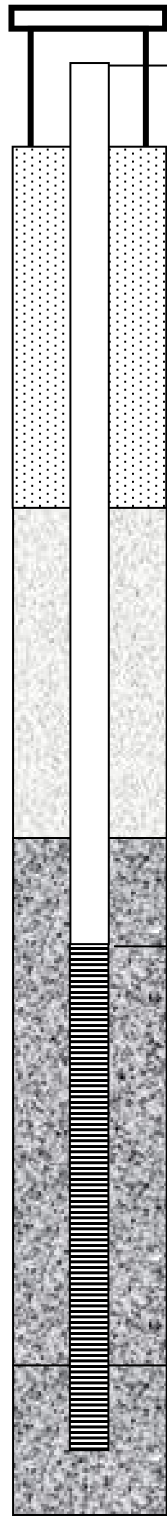
CONSTRUCTION MATERIALS USED:

3 Bags of Sand

4 Bags/Buckets Bentonite Pellets

______ Bags Portland for Grout

______ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 476.76 ft.
Stick-up: 2.93 ft.

Land Surface Elevation: 473.83 ft.

Grout; Type: Portland cement/Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 14 ft*

Top of Well Screen 16 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 21 ft.*

Base of Borehole: 21 ft.*

Total Depth of Well Below Top of Casing: 23.93 ft.

*Indicates Depth Below Land Surface

BORING NO. WBSP-15-03
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	12/4/15	AGES Geologist:	Mike 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:	18’	Surface Elevation:	484.91’ MSL

NOTES/COMMENTS:

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, limestone fragments, stiff, plastic, moist; 13’-18’ Gray, limestone, weathered, dry	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-03

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 12/4/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/15/15

Development Method: Submersible Pump, Peristaltic 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
Easting (X): 568093.60

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.

Inspector: Michael Gelles

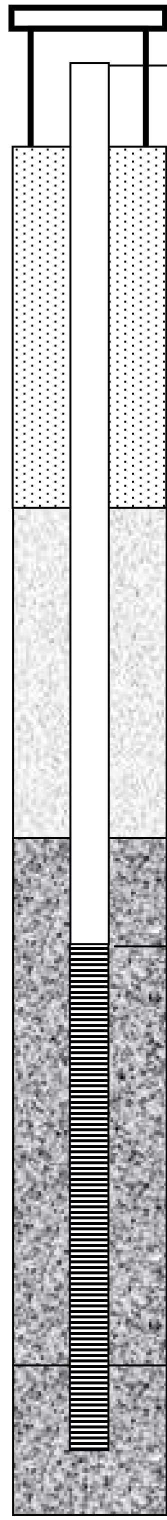
CONSTRUCTION MATERIALS USED:

3 Bags of Sand

4 Bags/Buckets Bentonite Pellets

______ Bags Portland for Grout

______ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 488.03 ft.
Stick-up: 3.12 ft.

Land Surface Elevation: 484.91 ft.

Grout; Type: Portland cement/Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 6 ft*

Top of Well Screen 8 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 13 ft.*

Base of Borehole: 18 ft.*

Total Depth of Well Below Top of Casing: 16.12 ft.

*Indicates Depth Below Land Surface

BORING NO. _ ____WBSP-15-04 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/11/15-11/12/15	AGES Geologist:	Mike 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 Elevation:	471.17’ MSL

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, 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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-04

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/11/15-11/12/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/9/15

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 0.91 NTUs

Volume Purged: 65 gallons

Static Water-Level* 50.68’

Top of Well Casing Elevation: 473.71’

Well Purpose:
Groundwater Monitoring
Northing (Y): 450610.07
Easting (X): 568637.65

Comments/Notes:
2 inch PVC riser and screen
10 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

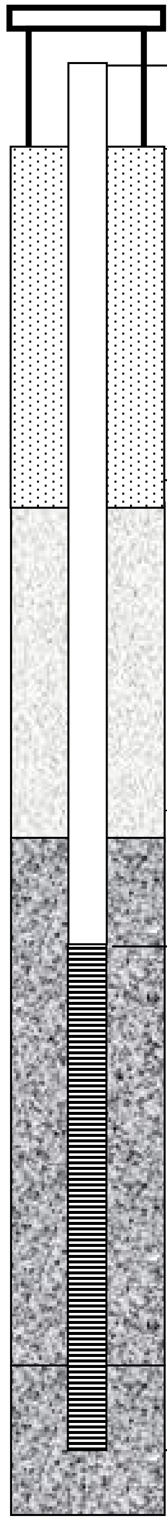
CONSTRUCTION MATERIALS USED:

5 Bags of Sand

2 Bags/Buckets Bentonite Pellets

12 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 473.71 ft.
Stick-up: 2.54 ft.

Land Surface Elevation: 471.17 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 53 ft*

Top of Well Screen 55 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 65 ft.*

Base of Borehole: 70 ft.*

Total Depth of Well
Below Top of Casing: 67.54 ft.

*Indicates Depth Below Land Surface

BORING NO. _ ____WBSP-15-05 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/13/15-11/17/15	AGES Geologist:	John Campbell

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:	71’	Surface Elevation:	471.90’ MSL		

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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-05

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/13/15-11/17/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 4.28 NTUs

Volume Purged: 46 gallons

Static Water-Level* 52.42’

Top of Well Casing Elevation: 474.42’

Well Purpose:
Groundwater Monitoring
Northing (Y): 450051.40
Easting (X): 568495.72

Comments/Notes:
2 inch PVC riser and screen
10 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: John Campbell

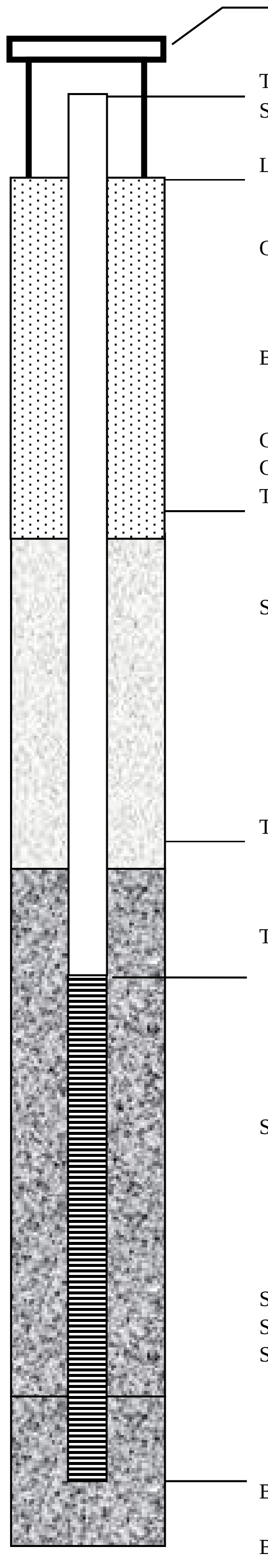
CONSTRUCTION MATERIALS USED:

6 Bags of Sand

2 Bags/Buckets Bentonite Pellets

18 Bags Portland for Grout

___ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 474.42 ft.
Stick-up: 2.52 ft.

Land Surface Elevation: 471.90 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 55 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 59 ft*

Top of Well Screen 61 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 71 ft.*

Base of Borehole: 71 ft.*

Total Depth of Well
Below Top of Casing: 73.52 ft.

*Indicates Depth Below Land Surface

BORING NO. _ ____WBSP-15-06 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/18/15-11/19/15	AGES Geologist:	John Campbell

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/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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-06

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/18/15-11/19/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/9/15

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 3.44 NTUs

Volume Purged: 100 gallons

Static Water-Level* 51.55’

Top of Well Casing Elevation: 473.51’

Well Purpose:
Groundwater Monitoring
Northing (Y): 449470.57
Easting (X): 568402.50

Comments/Notes:
2 inch PVC riser and screen
10 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: John Campbell

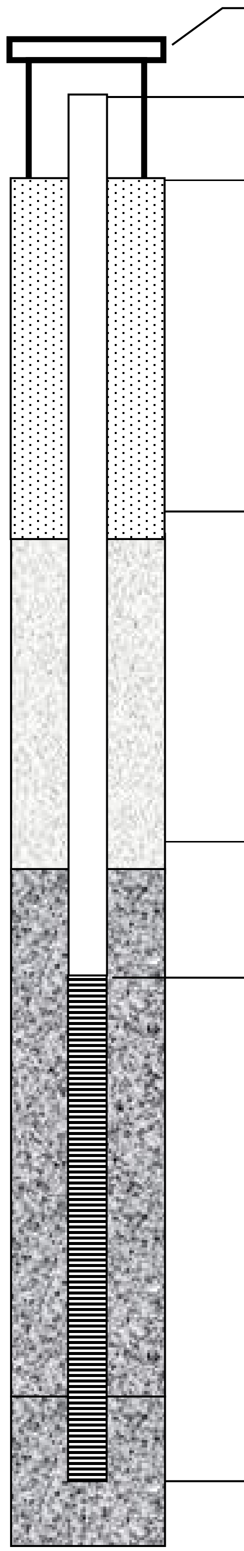
CONSTRUCTION MATERIALS USED:

6 Bags of Sand

2 Bags/Buckets Bentonite Pellets

12 Bags Portland for Grout

_____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 473.51 ft.
Stick-up: 2.23 ft.

Land Surface Elevation: 471.28 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 69.5 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 73.5 ft*

Top of Well Screen 75.5 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 85.5 ft.*

Base of Borehole: 85.5 ft.*

Total Depth of Well
Below Top of Casing: 87.73 ft.

*Indicates Depth Below Land Surface

BORING NO. _____WBSP-15-07 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/20/15-11/23/15	AGES Geologist:	John Campbell

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:	468.82’ MSL

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
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-07

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/20/15-11/23/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 2.86 NTUs

Volume Purged: 35.5 gallons

Static Water-Level* 41.01’

Top of Well Casing Elevation: 471.31’

Well Purpose:
Groundwater Monitoring
Northing (Y): 448947.93
Easting (X): 567946.39

Comments/Notes:
2 inch PVC riser and screen
10 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: John Campbell

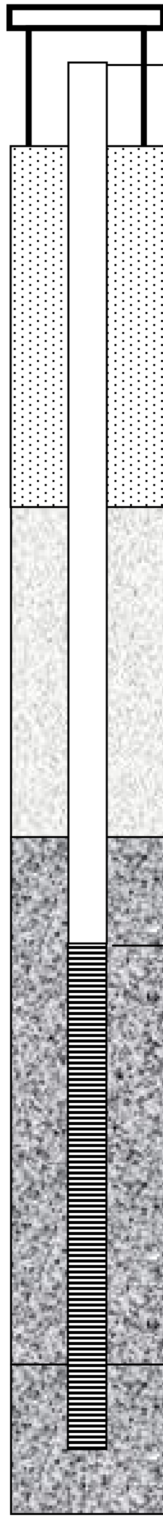
CONSTRUCTION MATERIALS USED:

6 Bags of Sand

14 Bags/Buckets Bentonite Pellets

12 Bags Portland for Grout

Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 471.31 ft.
Stick-up: 2.49 ft.

Land Surface Elevation: 468.82 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 36 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 40 ft*

Top of Well Screen 42 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 52 ft.*

Base of Borehole: 90 ft.*

Total Depth of Well
Below Top of Casing: 54.49 ft.

*Indicates Depth Below Land Surface

BORING NO. _____WBSP-15-08 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/24/15-11/25/15	AGES Geologist:	John Campbell

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/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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-08

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/24/15-11/25/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 4.96 NTUs

Volume Purged: 89.5 gallons

Static Water-Level* 37.02'

Top of Well Casing Elevation: 471.06'

Well Purpose:
Groundwater Monitoring
Northing (Y): 448625.46
Easting (X): 567343.24

Comments/Notes:
2 inch PVC riser and screen
10 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: John Campbell

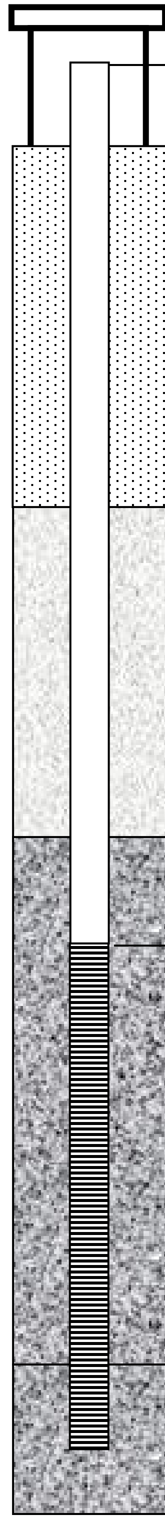
CONSTRUCTION MATERIALS USED:

8 Bags of Sand

4 Bags/Buckets Bentonite Pellets

12 Bags Portland for Grout

___ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 471.06 ft.
Stick-up: 2.5 ft.

Land Surface Elevation: 468.56 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 46.5 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 50.5 ft*

Top of Well Screen 52.8 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 62.8 ft.*

Base of Borehole: 80 ft.*

Total Depth of Well Below Top of Casing: 65.3 ft.

*Indicates Depth Below Land Surface

BORING NO. _ ____WBSP-15-09 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	1/5/16-1/6/16	AGES Geologist:	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:	60’	Surface Elevation:	471.21’ MSL

NOTES/COMMENTS: ____________________

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

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-09

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 1/5/16-1/6/16

Drilling Method: Hollow Stem Auger
Drilling Contractor: Bowser Morner

Development Date(s): 1/19/16

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 3.57 NTUs

Volume Purged: 74.5 gallons

Static Water-Level* 38.52’

Top of Well Casing Elevation: 470.69’

Well Purpose:
Groundwater Monitoring
Northing (Y): 448359.31
Easting (X): 566711.13

Comments/Notes:
2 inch PVC riser and screen
10 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

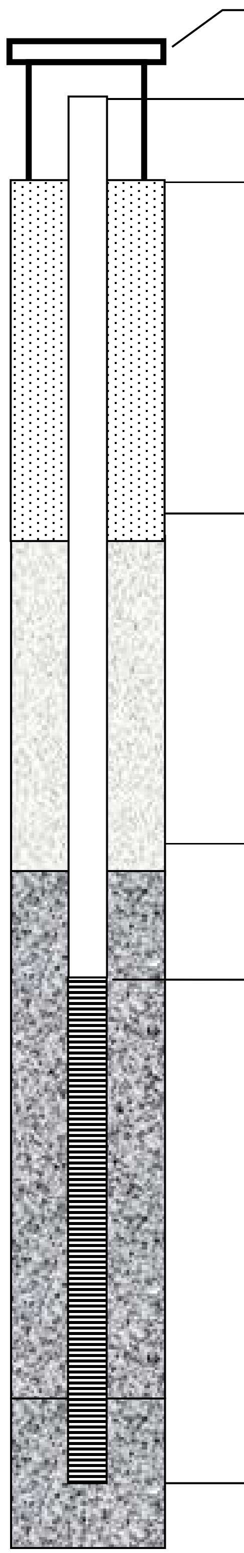
CONSTRUCTION MATERIALS USED:

7 Bags of Sand

2 Bags/Buckets Bentonite Pellets

10 Bags Portland for Grout

___ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 470.69 ft.
Stick-up: -0.52 ft.

Land Surface Elevation: 471.21 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 4.25 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 44 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 48 ft*

Top of Well Screen 50 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 60 ft.*

Base of Borehole: 60 ft.*

Total Depth of Well
Below Top of Casing: 59.48 ft.

*Indicates Depth Below Land Surface

BORING NO. _ ____WBSP-15-10 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1	of	1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner		
Drilling Date(s):	1/4/16-1/5/16	AGES Geologist:	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/COMMENTS:

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
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-10

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 1/4/16-1/5/16

Drilling Method: Hollow Stem Auger

Drilling Contractor: Bowser Morner

Development Date(s): 1/20/16

Development Method: Submersible Pump

Field parameters stabilized.

Turbidity = 3.59 NTUs

Volume Purged: 58.5 gallons

Static Water-Level*: 39.28’

Top of Well Casing Elevation: 470.69’

Well Purpose:

Groundwater Monitoring

Northing (Y): 448125.51

Easting (X): 566225.21

Comments/Notes:

2 inch PVC riser and screen

10 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

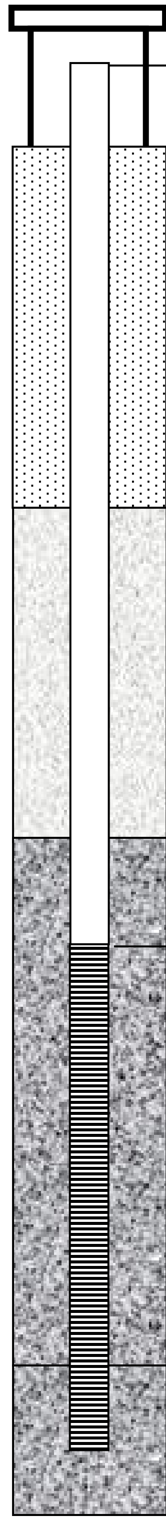
CONSTRUCTION MATERIALS USED:

8.5 Bags of Sand

2 Bags/Buckets Bentonite Pellets

10 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 470.69 ft.

Stick-up: -0.52 ft.

Land Surface Elevation: 471.21 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 4.25 inch

Casing Diameter: 2 Inch

Casing Material: PVC

Top of Seal: 40 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 44 ft*

Top of Well Screen 46 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch

Screen Slot-Size: 0.010 Inch

Screen Material: PVC

Bottom of Well Screen 56 ft.*

Base of Borehole: 56 ft.*

Total Depth of Well Below Top of Casing: 55.48 ft.

*Indicates Depth Below Land Surface

APPENDIX G

WBSP Phase 1 Permit Drawings

PERMIT DRAWINGS

PHASE 1 CLOSURE
WEST BOILER SLAG POND
CLIFTY CREEK STATION
JEFFERSON COUNTY, MADISON TOWNSHIP, INDIANA

PREPARED FOR

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INDIANA-KENTUCKY ELECTRIC CORPORATION
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PIKETON, OHIO

INDEX OF SHEETS

DRAWING NO.	DESCRIPTION	REVISION
01	COVER SHEET	A
02	WASTE LIMIT	A
03	CLOSURE PHASES	A
04	EXISTING CONDITIONS AND BASELINE LAYOUT	A
05	PHASE 1 SUBGRADE PLAN	A
06	PHASE 1 FINAL GRADE PLAN	A
07	PHASE 1 EROSION CONTROL PLAN	A
08	PROFILE - PROJECT BASELINE	A
09	CROSS SECTIONS - PROJECT BASELINE	A
10	DETAILS	A

PREPARED BY

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Cincinnati, Ohio
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Fax 513.842.8250
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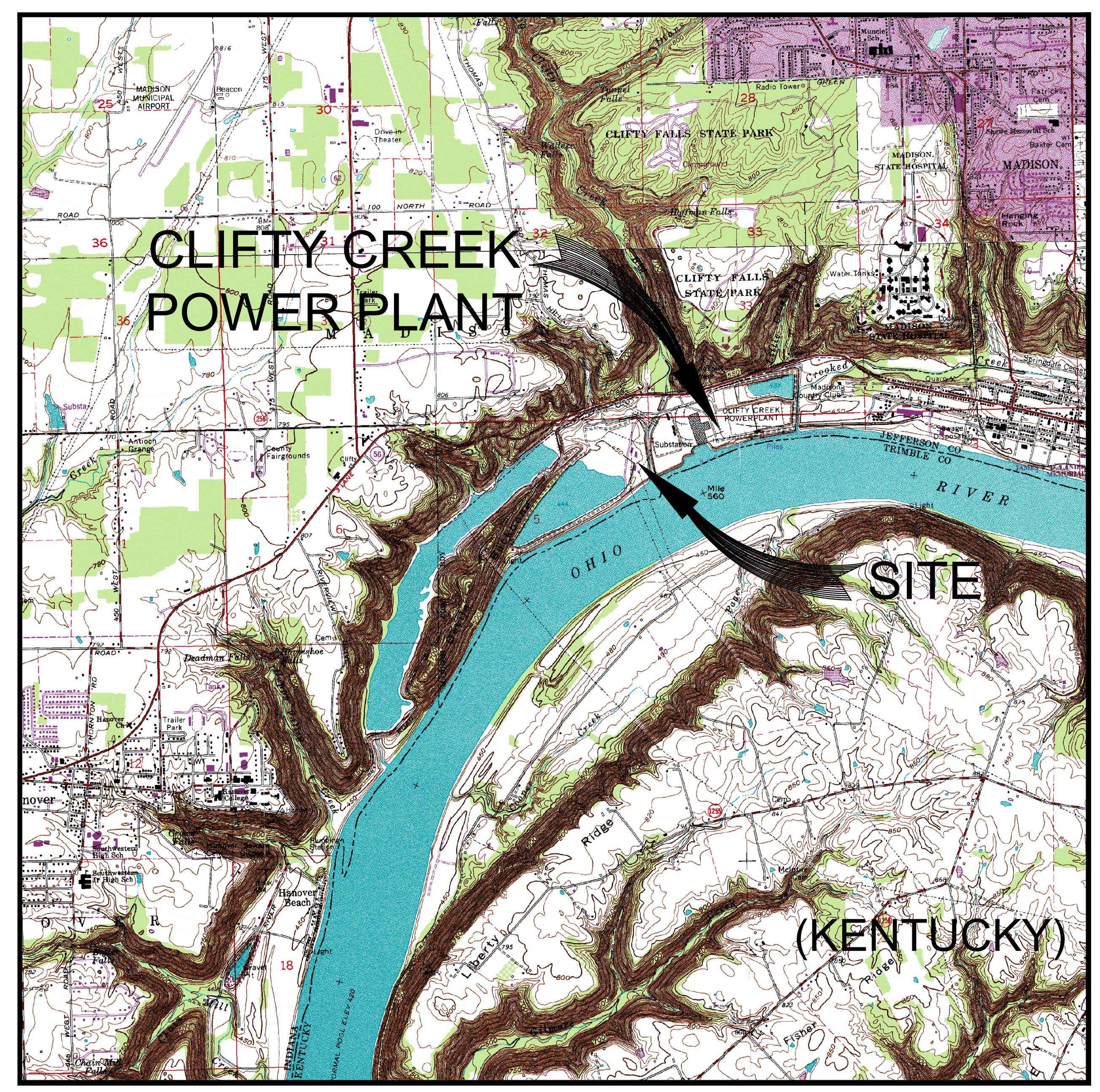

VICINITY MAP

.25 0 .5 1 MILE
GRAPHIC SCALE

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OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION
PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
COVER SHEET

Project No.	Scale
175539026	AS SHOWN

Revision	Sheet	Drawing No.
A	1 of 10	

WASTE LIMIT NOTE:
WASTE BOUNDARY LOCATION WILL BE VERIFIED IN THE FIELD DURING CLOSURE ACTIVITIES AND UPDATED IN THE AS-BUILT DOCUMENTATION.

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LEGEND
- ELECTRIC TOWER
- PB ELECTRIC PULLBOX
- TREE/SHRUB
- ELECTRIC POLE
- POWER POLE
- CB STORM CATCH BASIN
- OHE OVERHEAD ELECTRIC
- UGE UNDERGROUND ELECTRIC
- X FENCE
- PROPERTY LINE
- RAILROAD TRACKS
- ST STORM SEWER
- EDGE OF WATER
- TREELINE
- 450 EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOR

	By	Appd	YYYY.MM.DD
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Revision	By	Appd	YYYY.MM.DD
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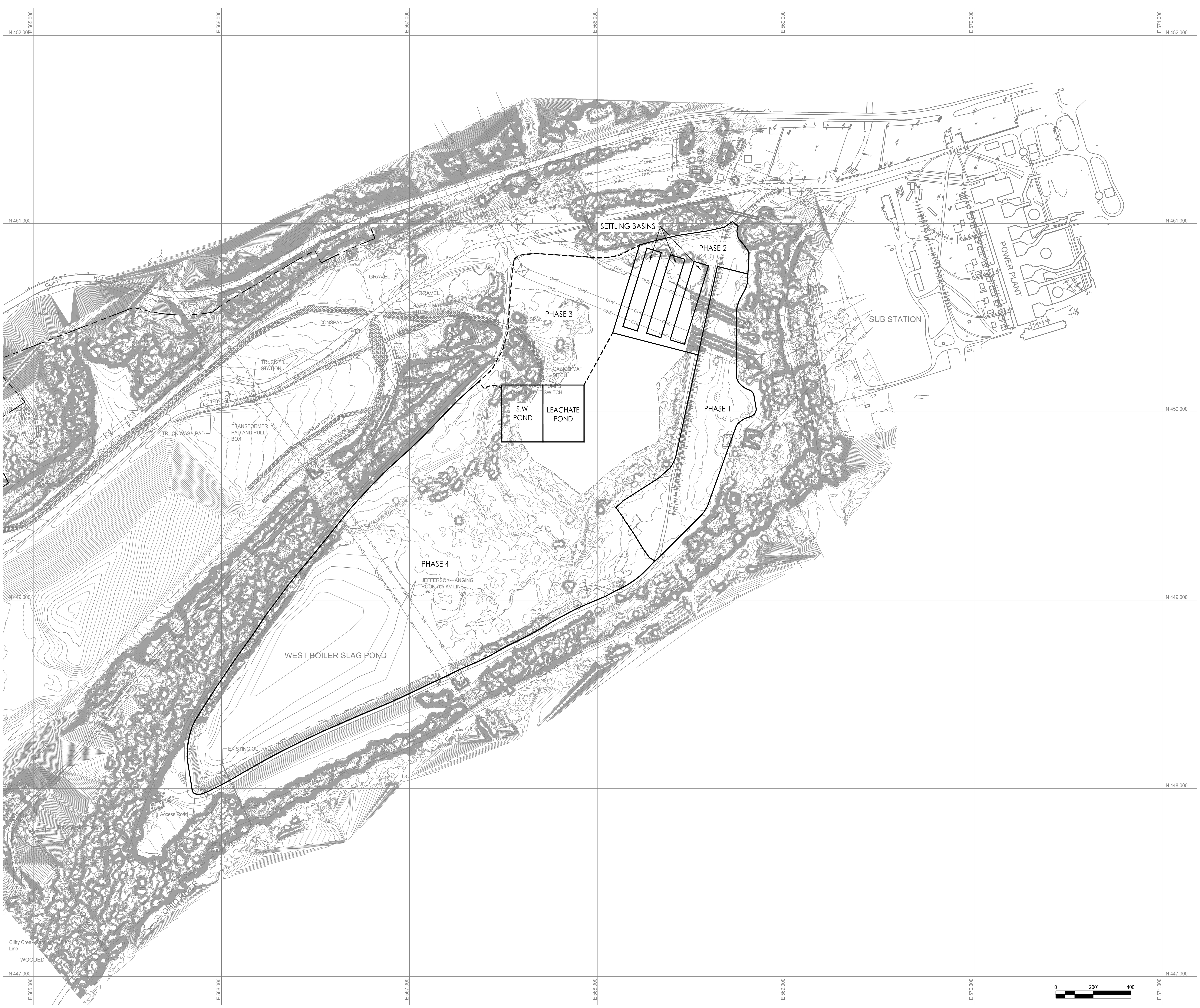
PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION

MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
WASTE LIMIT

Project No.	Scale
175539026	1"=200'

Revision	Sheet	Drawing No.
A	2 of 10	



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LEGEND

ELECTRIC TOWER
PB ELECTRIC PULLBOX
TREE/SHRUB
ELECTRIC POLE
POWER POLE
CB STORM CATCH BASIN
OHE OVERHEAD ELECTRIC
UGE UNDERGROUND ELECTRIC
X FENCE
PROPERTY LINE
RAILROAD TRACKS
ST STORM SEWER
EDGE OF WATER
TREELINE
450 EXISTING INDEX CONTOUR
EXISTING INTERMEDIATE CONTOR

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INDIANA-KENTUCKY ELECTRIC CORPORATION
PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
CLOSURE PHASES

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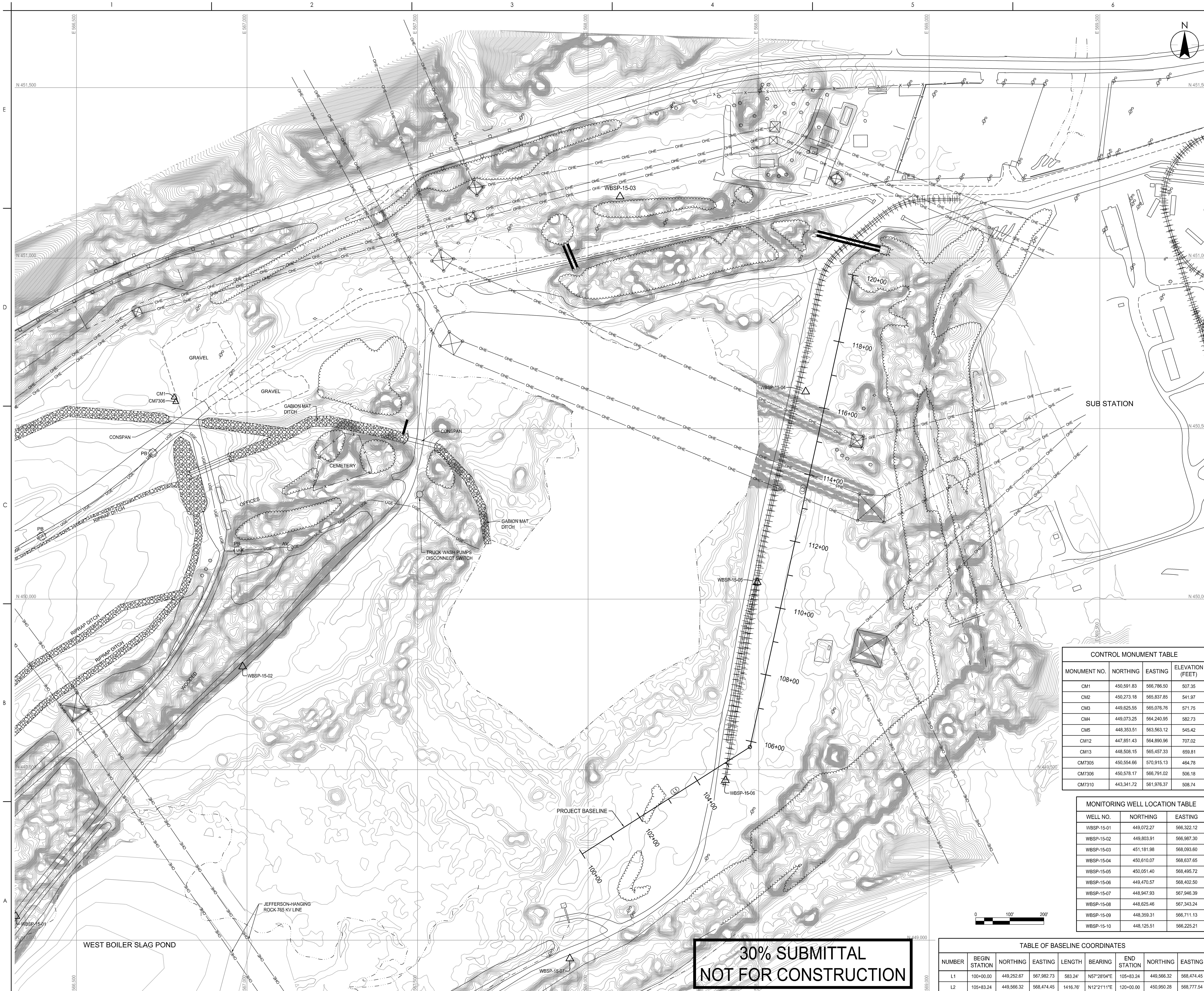
Project No. 175539026
Scale 1"=200'
Revision A
Sheet 3 of 10
Drawing No.



CONTROL MONUMENT TABLE

MONUMENT NO.	NORTHING	EASTING	ELEVATION (FEET)
CM1	450,591.83	566,786.50	507.35
CM2	450,273.18	565,837.85	541.97
CM3	449,625.55	565,076.76	571.75
CM4	449,073.25	564,240.95	582.73
CM5	448,353.51	563,563.12	545.42
CM12	447,851.43	564,890.96	707.02
CM13	448,508.15	565,457.33	659.81
CM7305	450,554.66	570,915.13	464.78
CM7306	450,578.17	566,791.02	506.18
CM7310	443,341.72	561,976.37	508.74

MONITORING WELL LOCATION TABLE

WELL NO.	NORTHING	EASTING
WBSP-15-01	449,072.27	566,322.12
WBSP-15-02	449,803.91	566,987.30
WBSP-15-03	451,181.98	568,093.60
WBSP-15-04	450,610.07	568,637.65
WBSP-15-05	450,051.40	568,495.72
WBSP-15-06	449,470.57	568,402.50
WBSP-15-07	448,947.93	567,946.39
WBSP-15-08	448,625.46	567,343.24
WBSP-15-09	448,359.31	566,711.13
WBSP-15-10	448,125.51	566,225.21

TABLE OF BASELINE COORDINATES

NUMBER	BEGIN STATION	NORTHING	EASTING	LENGTH	BEARING	END STATION	NORTHING	EASTING
L1	100+00.00	449,252.67	567,982.73	583.24'	N57°28'04"E	105+83.24	449,566.32	568,474.45
L2	105+83.24	449,566.32	568,474.45	1416.76'	N12°21'11"E	120+00.00	450,950.28	568,777.54

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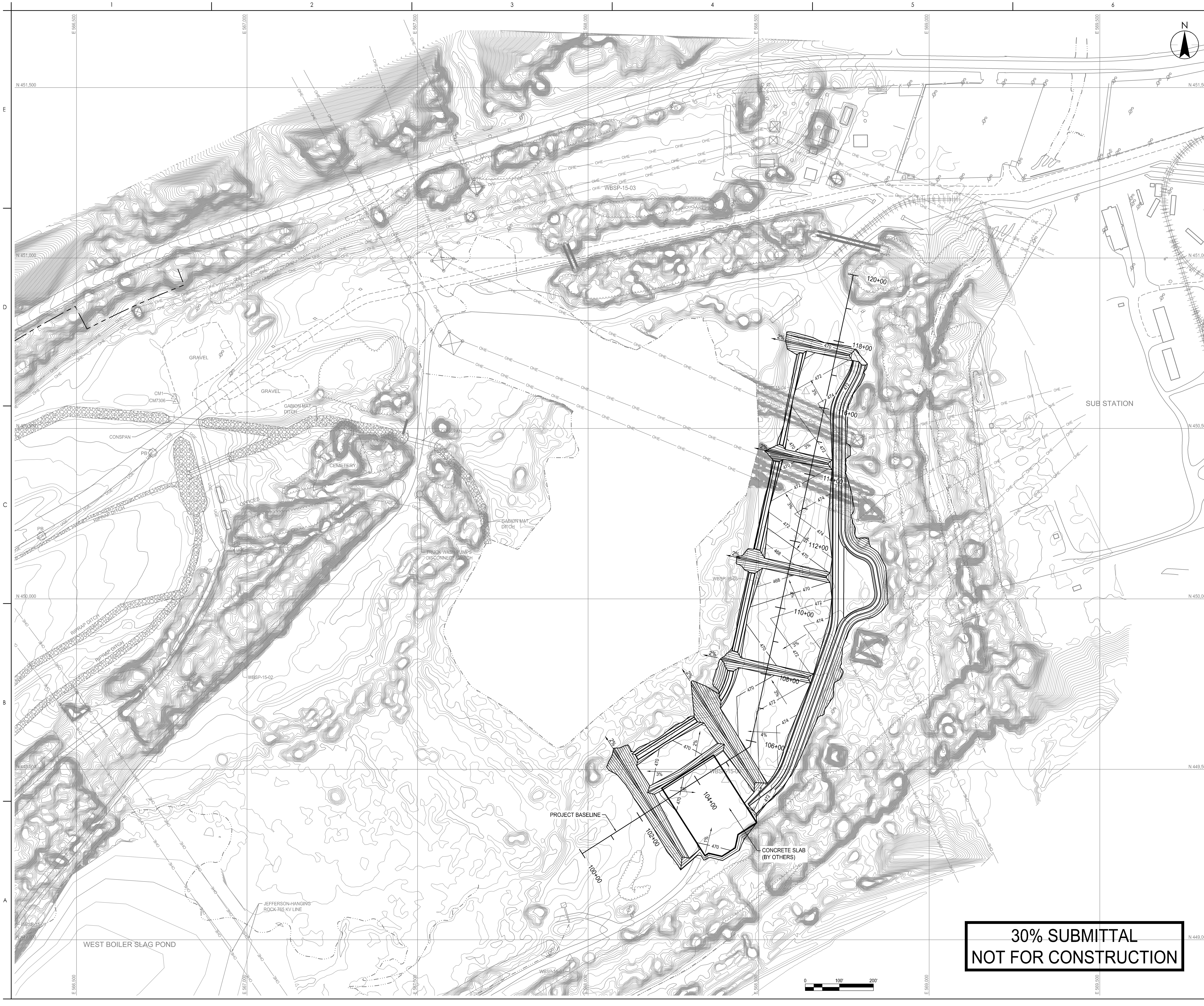
INDIANA-KENTUCKY ELECTRIC CORPORATION

PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION

MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
EXISTING CONDITIONS AND PROJECT BASELINE LAYOUT

Project No. 175539026
Scale 1"=100'
Revision A
Sheet 4 of 10
Drawing No.



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NOTE:
EXISTING RAILROAD TRACKS, DRAINAGE PIPES, AND OTHER FEATURES SHALL BE DEMOLISHED FROM WITHIN THE PROJECT LIMITS.

LEGEND

- ELECTRIC TOWER
- PB ELECTRIC PULLBOX
- TREE/SHRUB
- ELECTRIC POLE
- POWER POLE
- CB STORM CATCH BASIN
- OHE OVERHEAD ELECTRIC
- UGE UNDERGROUND ELECTRIC
- X FENCE
- PROPERTY LINE
- RAILROAD TRACKS
- ST STORM SEWER
- EDGE OF WATER
- TREELINE
- 450 EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOR
- 450 PROPOSED SUBGRADE INDEX CONTOUR
- PROPOSED SUBGRADE INTERMEDIATE CONTOUR
- GROUNDWATER MONITORING WELL
- CONTROL MONUMENT

Revision	By	Appd	YYYY.MM.DD
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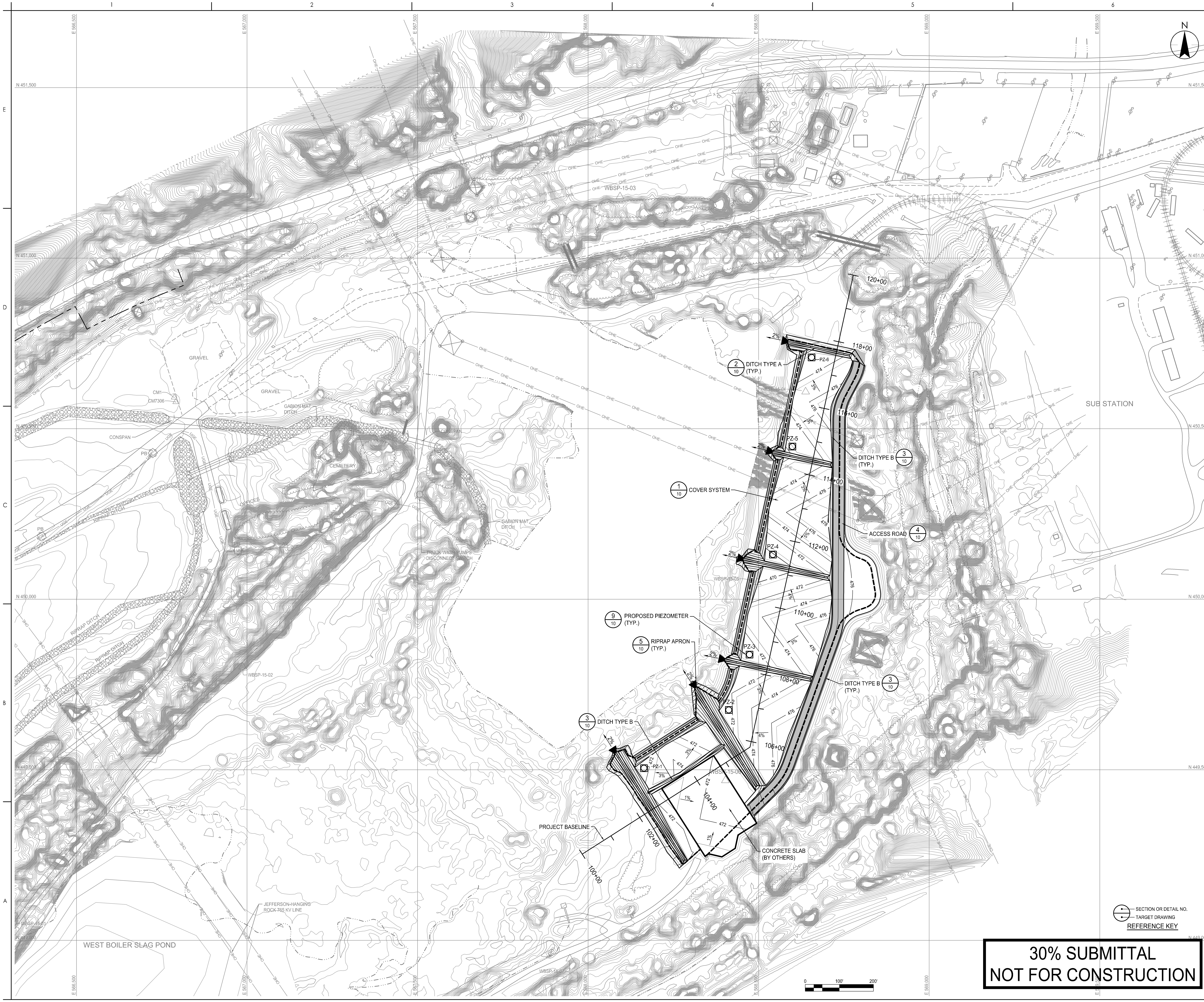
PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION

MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
PHASE 1 SUBGRADE PLAN

Project No. 175539026
Scale 1" = 100'
Revision A
Sheet 5 of 10
Drawing No.



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NOTE:
BASEMAP HAS BEEN MODIFIED TO REFLECT A MERGE OF EXISTING CONDITIONS AND SUBGRADE DESIGN CONTOURS.

LEGEND

- ELECTRIC TOWER
- PB ELECTRIC PULLBOX
- TREE/SHRUB
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- PROPERTY LINE
- RAILROAD TRACKS
- ST STORM SEWER
- EDGE OF WATER
- TREELINE
- 450 EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOR
- 450 PROPOSED FINAL GRADE INDEX CONTOUR
- PROPOSED FINAL GRADE INTERMEDIATE CONTOUR
- GROUNDWATER MONITORING WELL
- PROPOSED PIEZOMETER
- CONTROL MONUMENT
- LIMITS OF COVER SYSTEM

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Revision	By	Appd	YYYY.MM.DD
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PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION

MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
PHASE 1 FINAL GRADE PLAN

Project No.	Scale
175539026	1" = 100'

Revision	Sheet	Drawing No.
A	6 of 10	

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NOTES:
1. BASEMAP HAS BEEN MODIFIED TO REFLECT A MERGE OF EXISTING CONDITIONS AND SUBGRADE / FINAL GRADE DESIGN CONTOURS.
2. THE EROSION CONTROL PLAN MEASURES SHOWN SHALL BE CONSIDERED THE MINIMUM; SUPPLEMENTAL MEASURES SHALL BE PROVIDED BY THE CONTRACTOR AS FIELD CONDITIONS DICTATE OR AS DIRECTED BY THE ENGINEER, OWNER, OR ANY REGULATORY AUTHORITY.

LEGEND
- ELECTRIC TOWER
- PB ELECTRIC PULLBOX
- TREE/SHRUB
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- RAILROAD TRACKS
- ST STORM SEWER
- EDGE OF WATER
- TREELINE
- 450 EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOR
- GROUNDWATER MONITORING WELL
- CONTROL MONUMENT

0			
Revision	By	Appd	YYYY.MM.DD
A			
Issued	By	Appd	YYYY.MM.DD

File Name: 07_39026C-101-ER1	TJ	KDL	JSH	2020.01.13
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INDIANA-KENTUCKY ELECTRIC CORPORATION

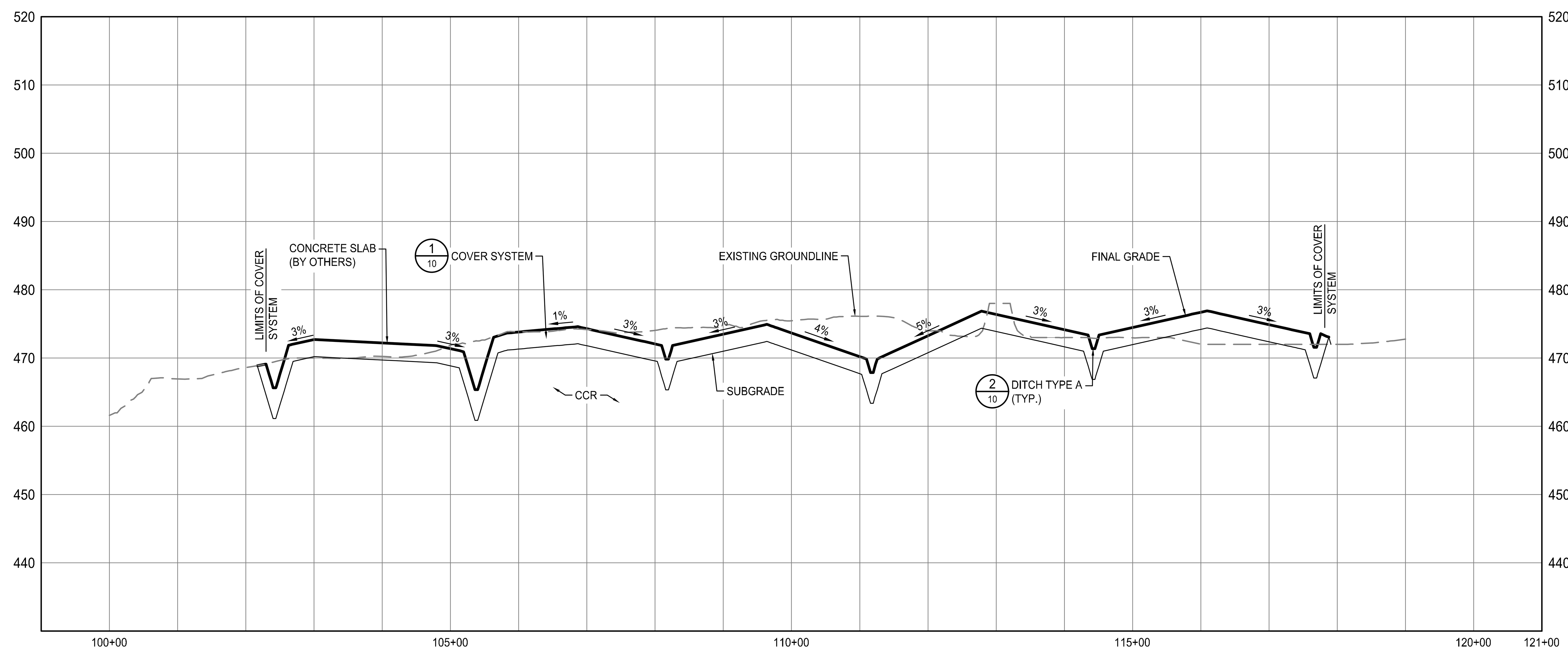
PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION

MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
PHASE 1 EROSION CONTROL PLAN

Project No.	Scale
175539026	1" = 100'

Revision	Sheet	Drawing No.
A	7 of 10	



1
8
PROFILE - PROJECT BASELINE
SCALE: 1"=100' (HORIZONTAL)
1"=10' (VERTICAL)

SECTION OR DETAIL NO.
TARGET DRAWING
REFERENCE KEY

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PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
PROFILE - PROJECT BASELINE

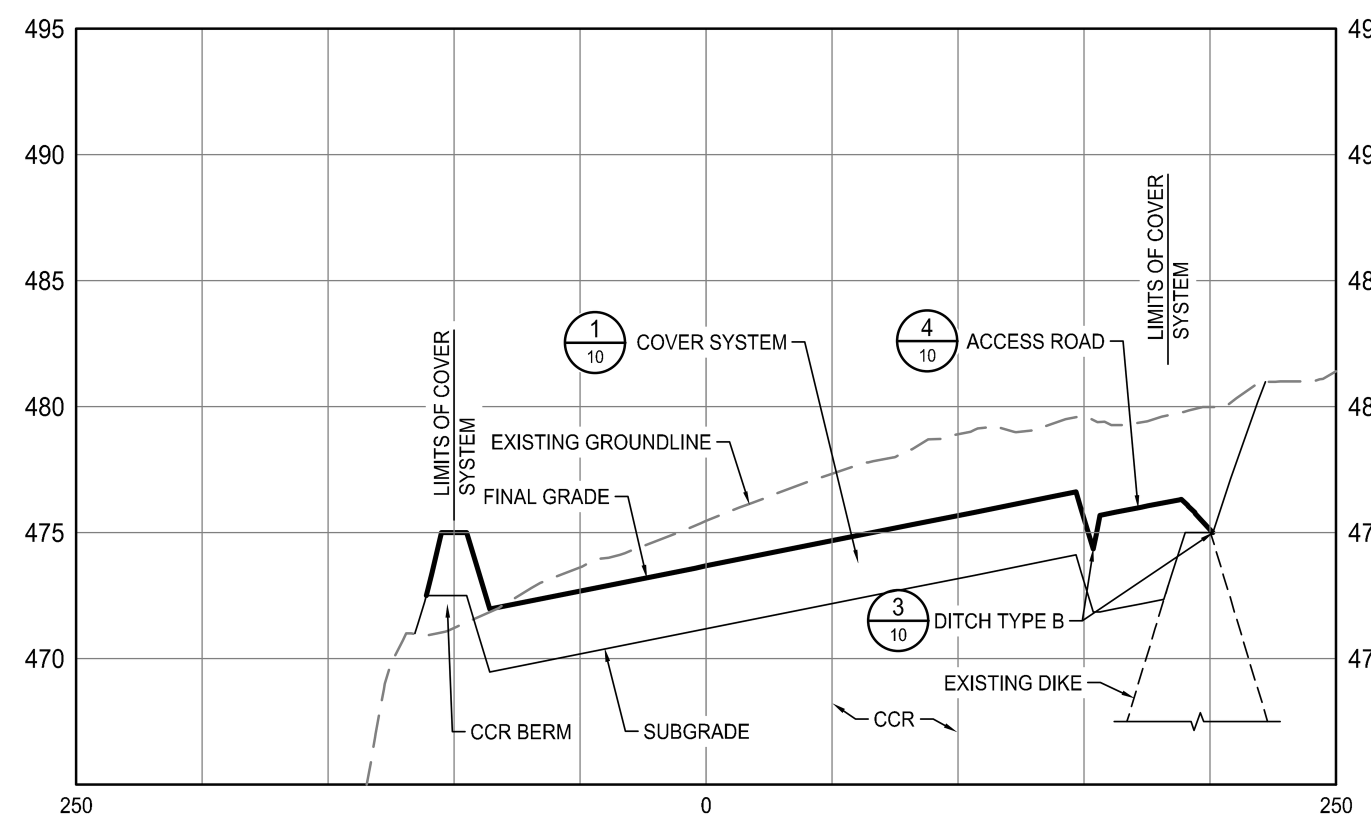
Project No.
175539026

Scale
AS SHOWN

Revision
A

Sheet
8 of 10

Drawing No.



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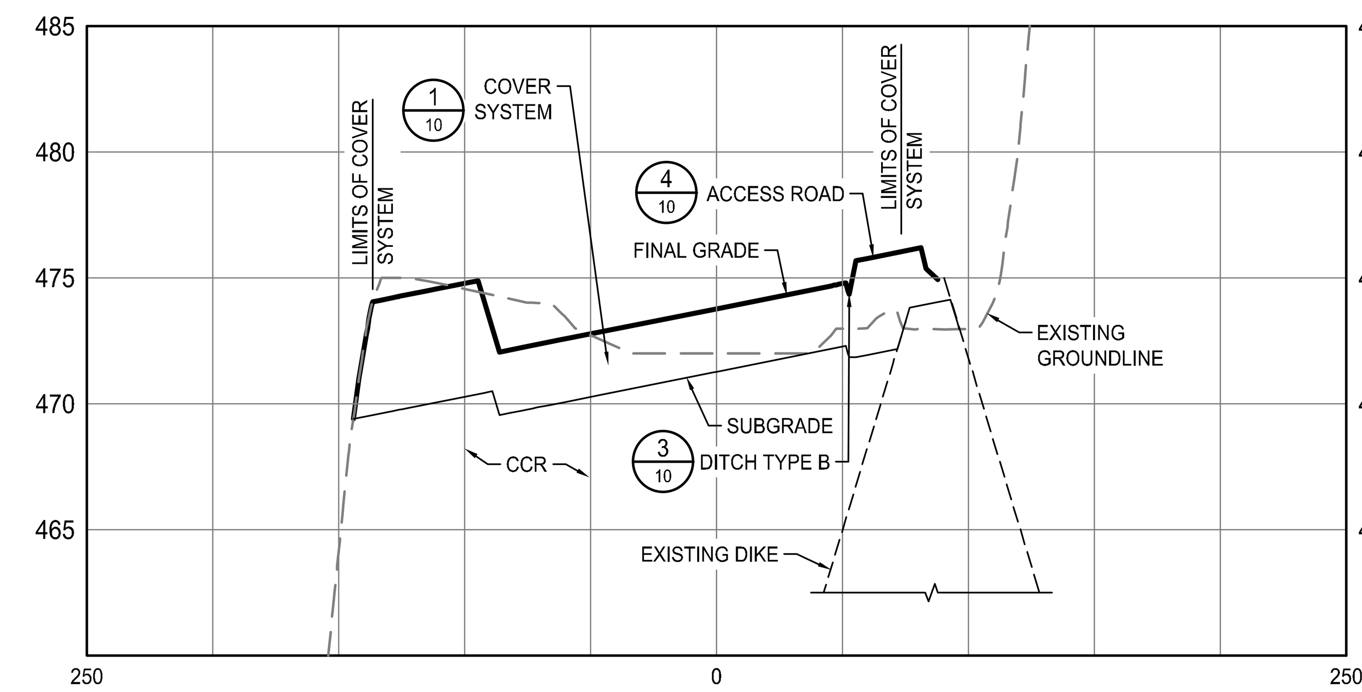
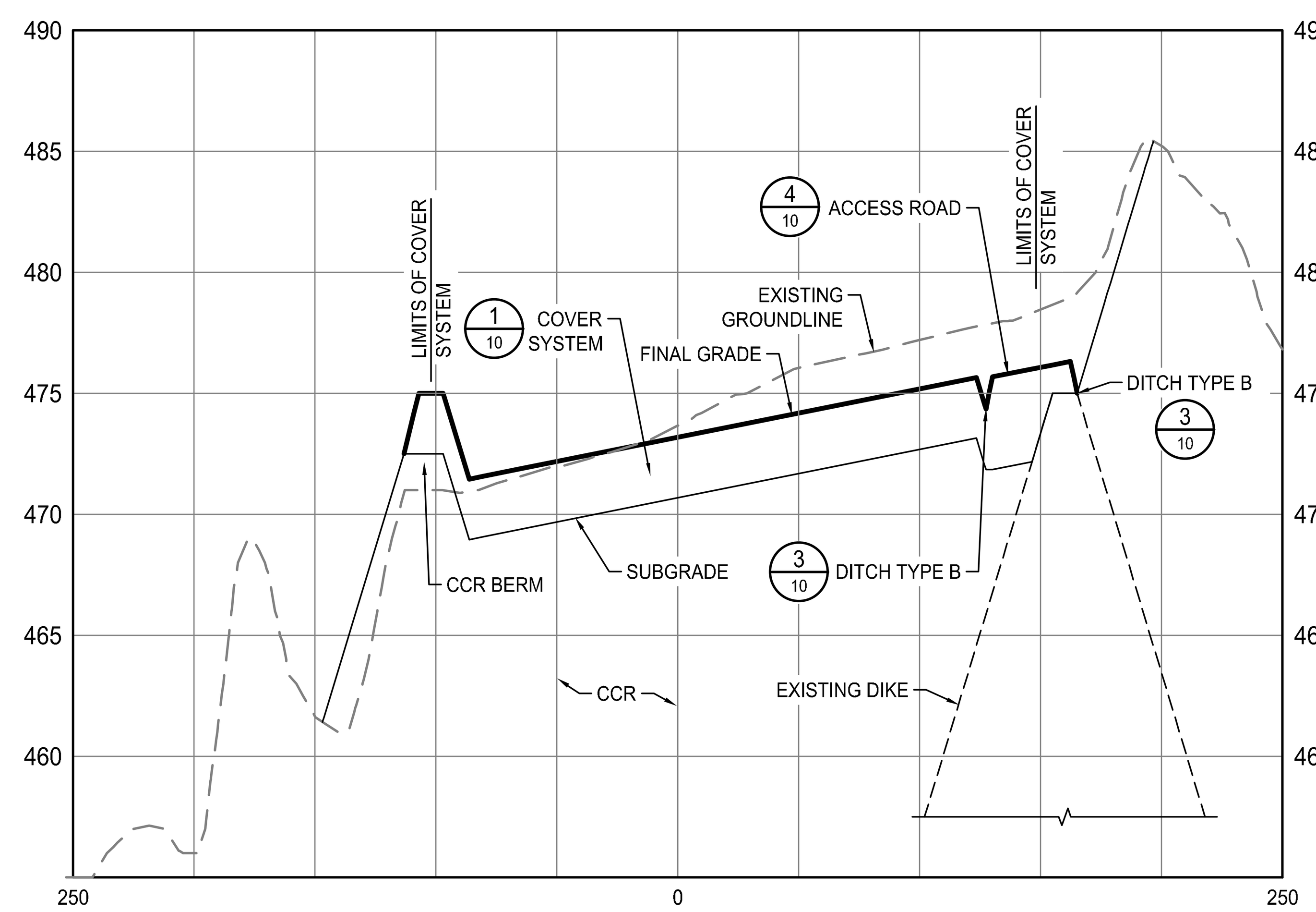


STA. 117+50



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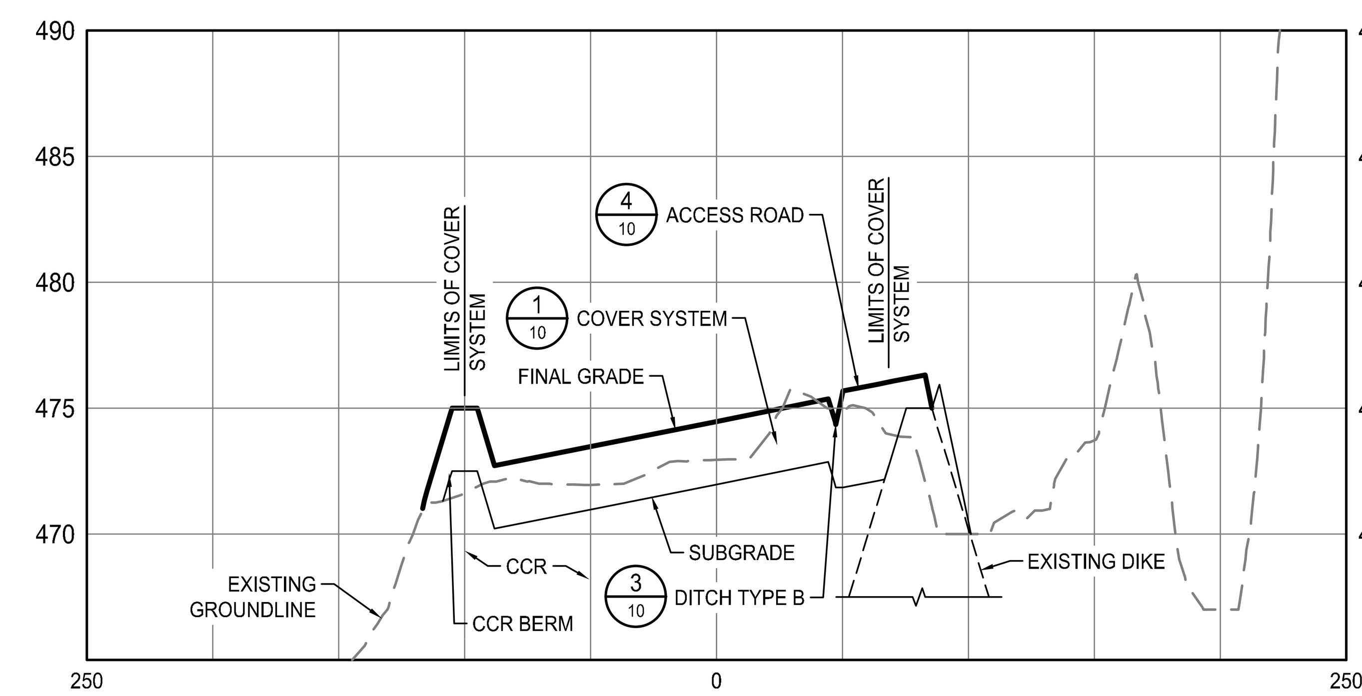

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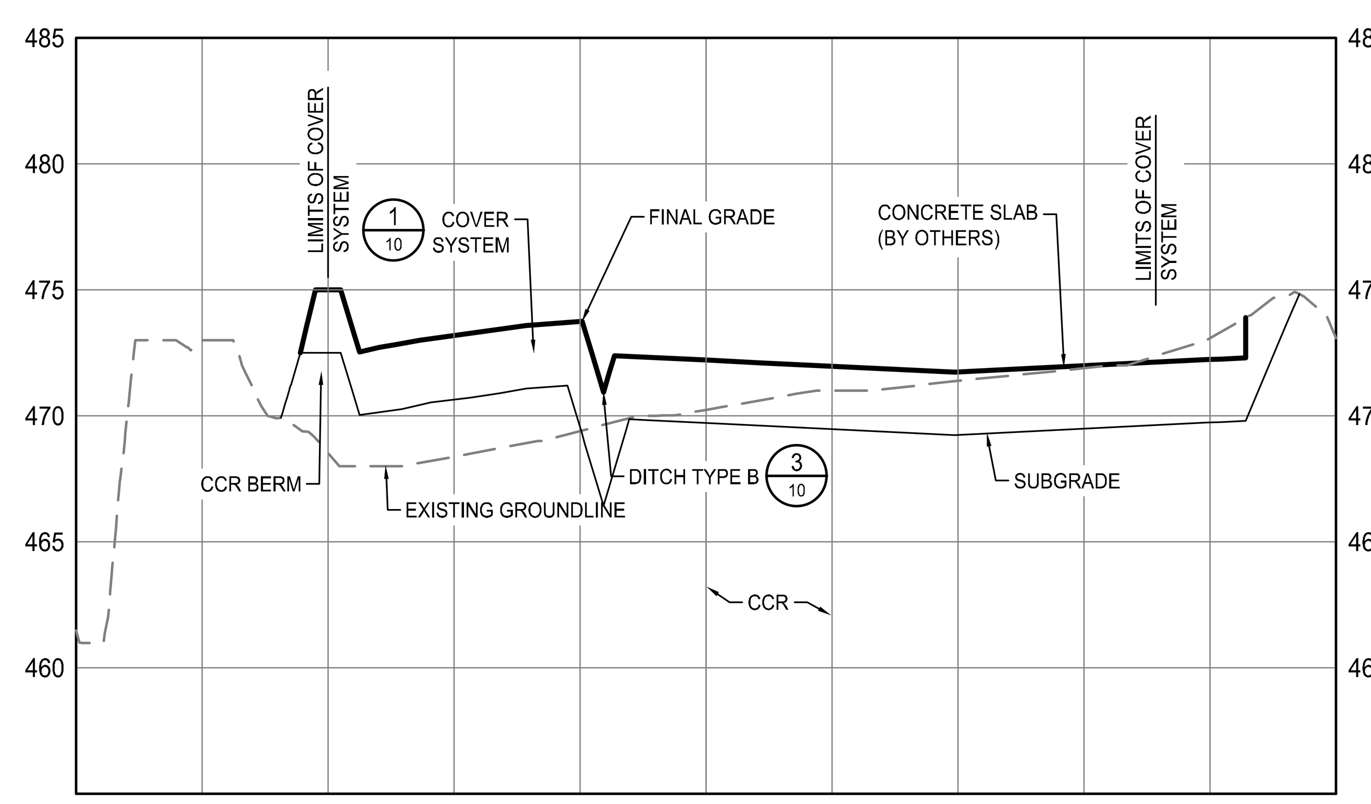

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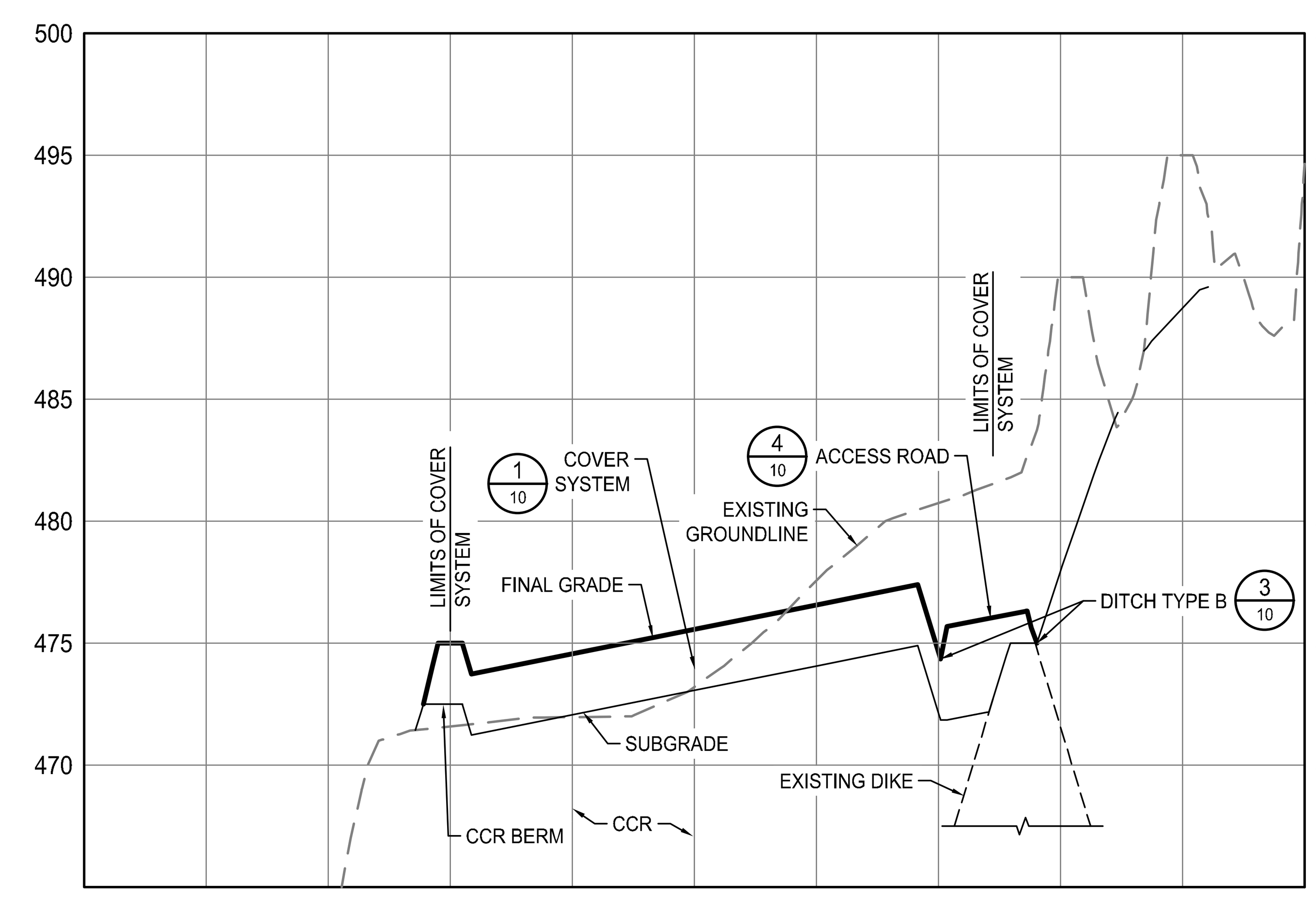

STA. 112+50

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Client/Project Logo

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INDIANA-KENTUCKY ELECTRIC CORPORATION

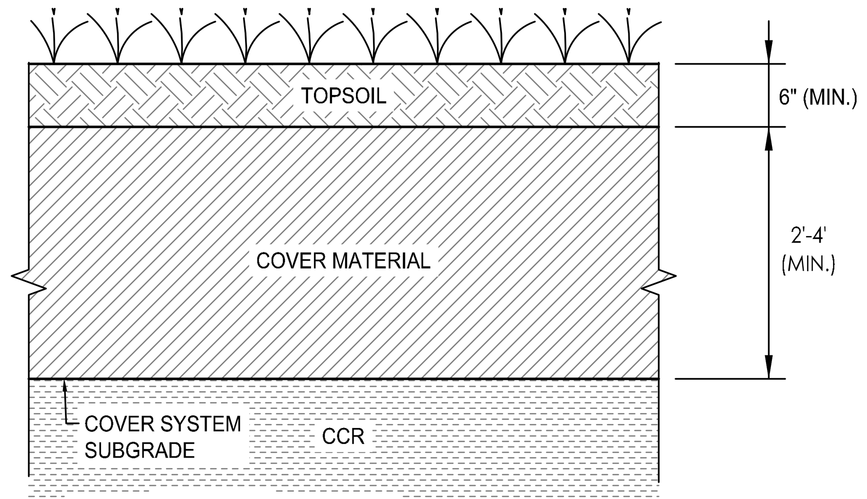
PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION

MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
CROSS SECTIONS - PROJECT BASELINE

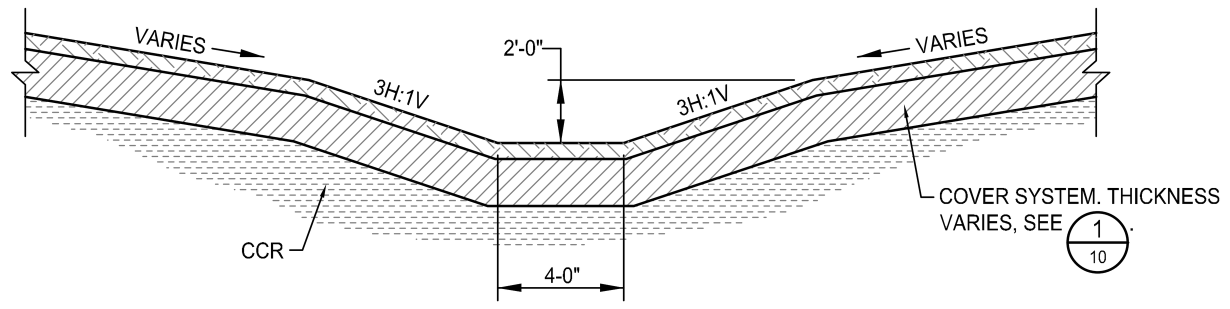
Project No.	Scale
175539026	AS SHOWN

Revision	Sheet	Drawing No.
A	9 of 10	

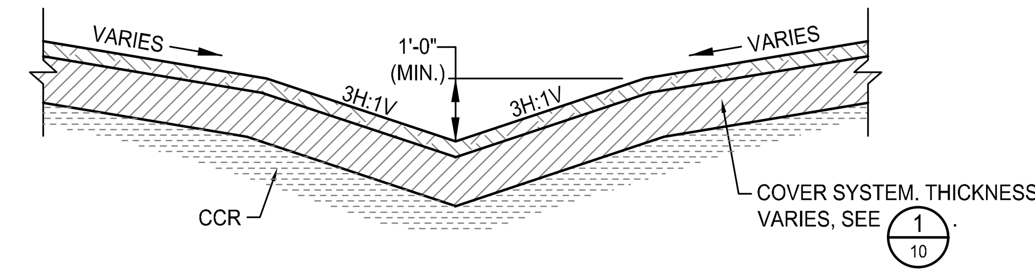


NOTES:
1. MINIMUM CROSS SLOPE = 3%.
2. MAXIMUM SLOPE = 3H:1V.
3. COVER MATERIAL THICKNESS SHALL BE 2' (MIN.) FOR SLOPES LESS THAN OR EQUAL TO 15% AND 4' (MIN.) FOR SLOPES GREATER THAN 25%.
4. THE COMPACTED COVER MATERIAL SHALL HAVE A PERMEABILITY LESS THAN OR EQUAL TO THE PERMEABILITY OF THE NATURAL SUBSOILS, OR NO GREATER THAN $1X10^{-5}$ CM/SEC, WHICHEVER IS LESS. IF MATERIAL OF SUFFICIENT QUALITY/QUANTITY CANNOT BE FOUND, THEN A 40-MIL LLDPE FLEXIBLE MEMBRANE LINER (AND CUSHION GEOTEXTILE) SHALL BE INSTALLED BETWEEN THE SUBGRADE AND COVER MATERIAL.

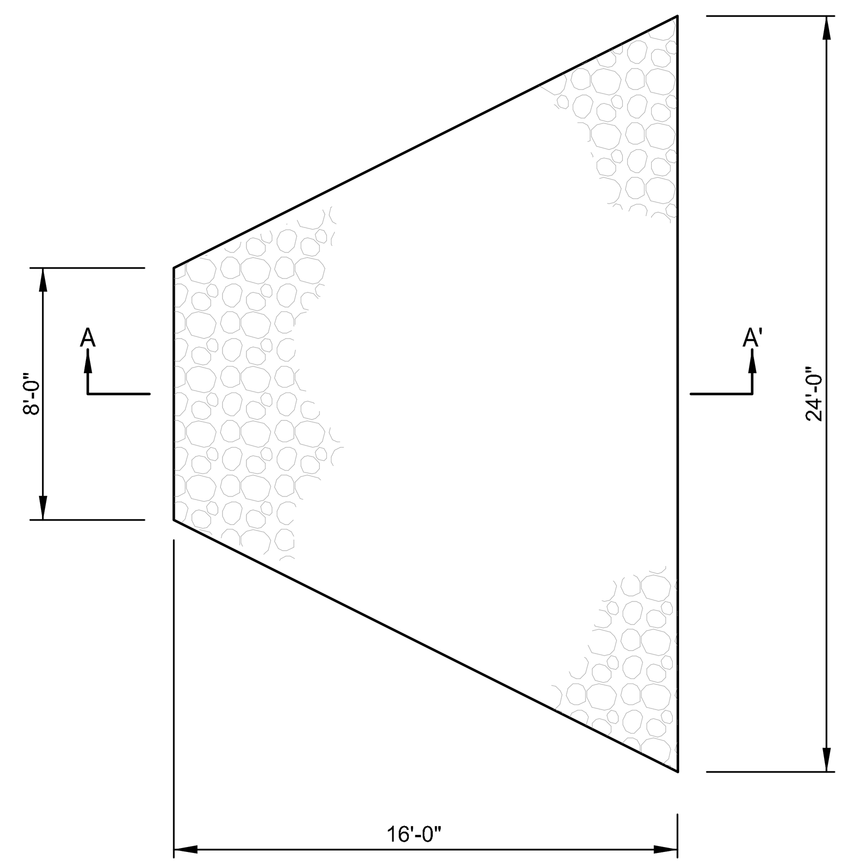
1 / 10 DETAIL - COVER SYSTEM
SCALE: 1"=1'-0"



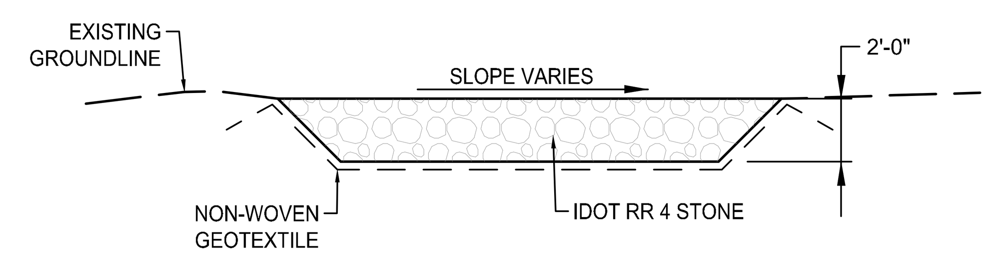
2 / 10 DETAIL - DITCH TYPE A
NOT TO SCALE



3 / 10 DETAIL - DITCH TYPE B
NOT TO SCALE



PLAN

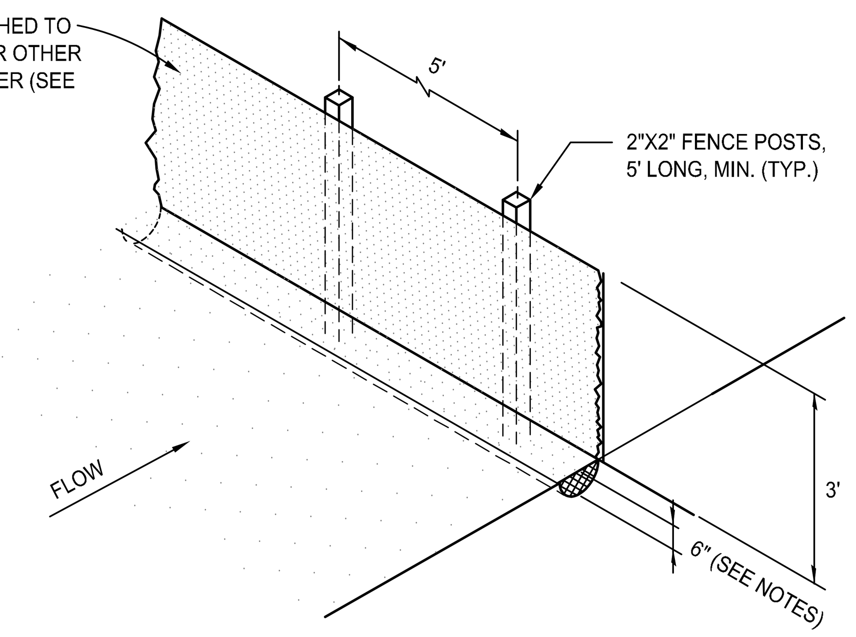


SECTION A-A'

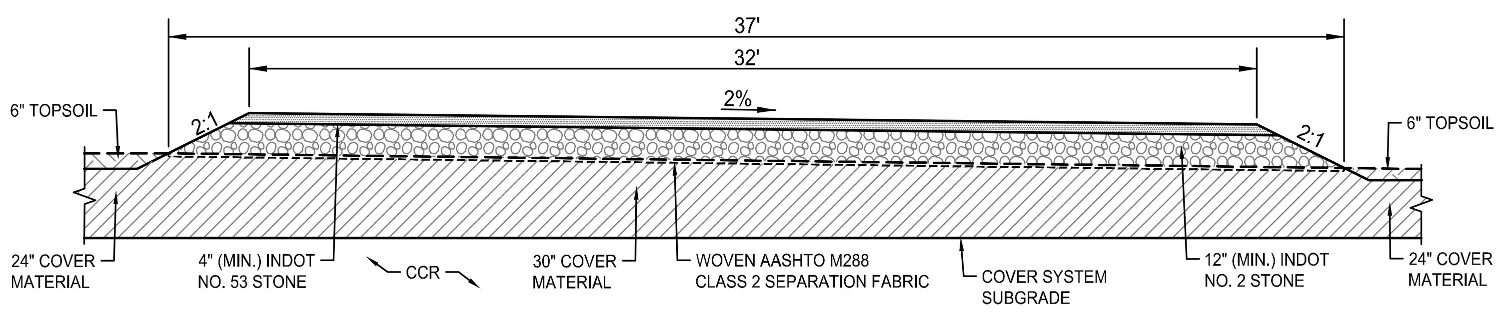
5 / 10 DETAIL - RIPRAP APRON
SCALE: 1/4"=1'-0"

GEOTEXTILE FABRIC SHALL BE ATTACHED TO FENCE USING STAPLES, HOGRINGS OR OTHER METHODS APPROVED BY THE ENGINEER (SEE NOTES).

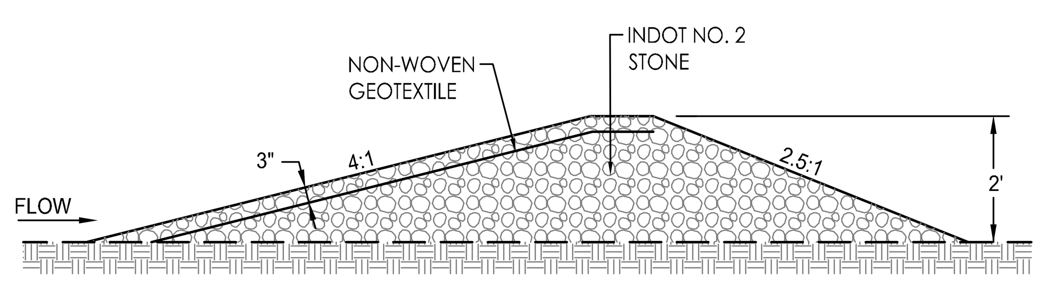
NOTES:
1. THE BOTTOM 12 INCHES OF THE FABRIC SHALL BE BURIED IN A 6-INCH TRENCH CUT INTO THE GROUND OR COVERED BY 6 INCHES OF FILL MATERIAL TO PREVENT SEDIMENT FROM ESCAPING UNDER THE FENCE. ALL EARTH-WORK SHALL BE ON THE UPSTREAM SIDE OF THE FENCE.
2. GEOTEXTILE FABRIC SHALL MEET THE FOLLOW-ING SPECIFICATIONS: GRAB STRENGTH (ASTM D 1682) - 100 LBS. MIN., WIDTH - 4' MIN., BURSTING STRENGTH (ASTM D751) - 150 P.S.I. MIN., FLOW RATE (KM64-106) - 0.3 GAL./SQ. FT., RETENTION EFFICIENCY (KM64-106) - 75%



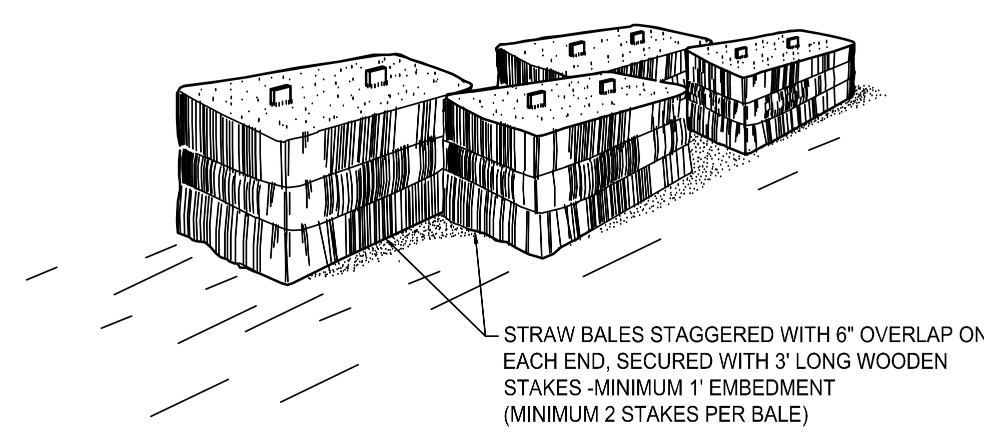
6 / 10 DETAIL - SILT FENCE
NOT TO SCALE



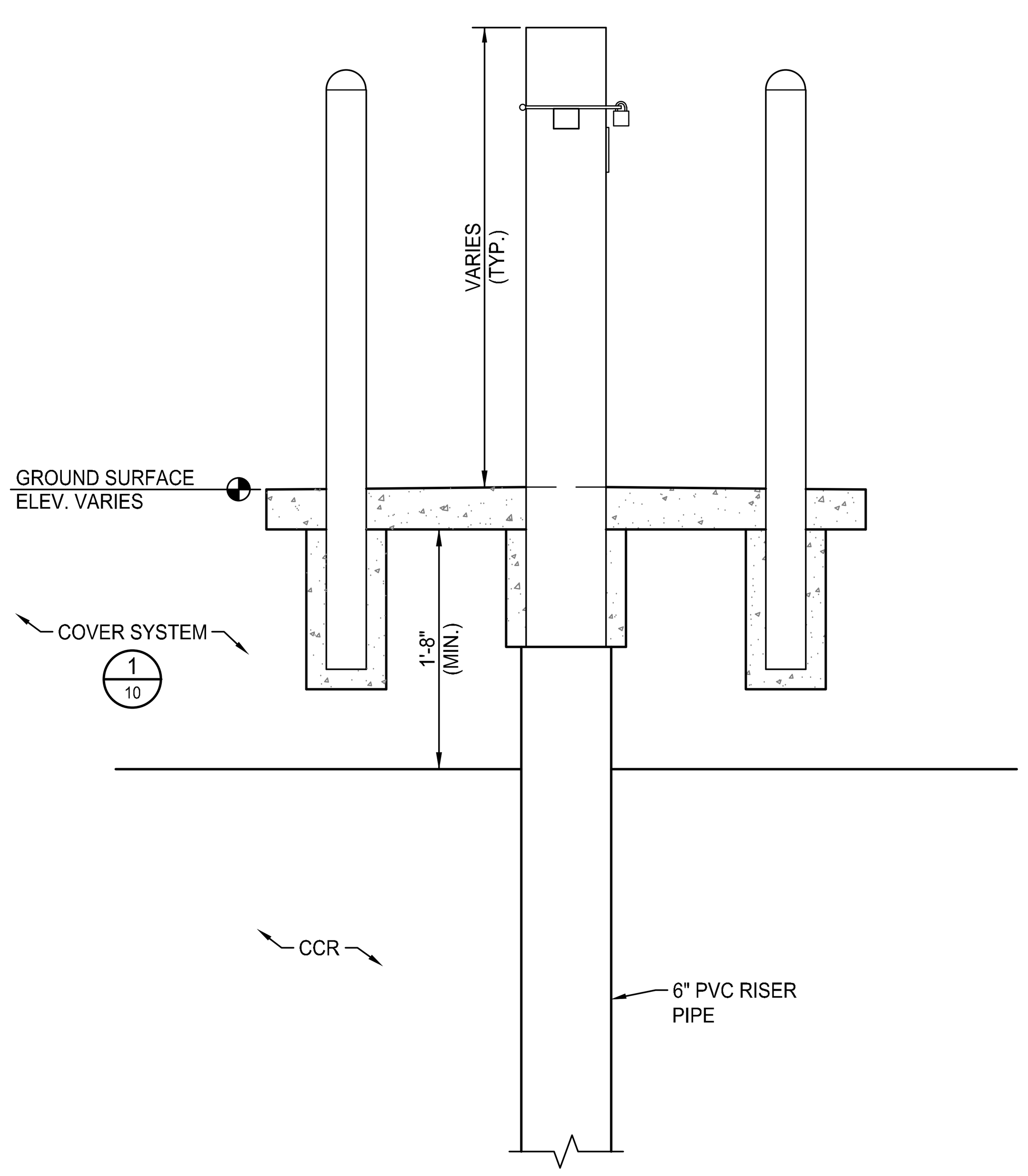
4 / 10 DETAIL - ACCESS ROAD
SCALE: 1/4"=1'-0"



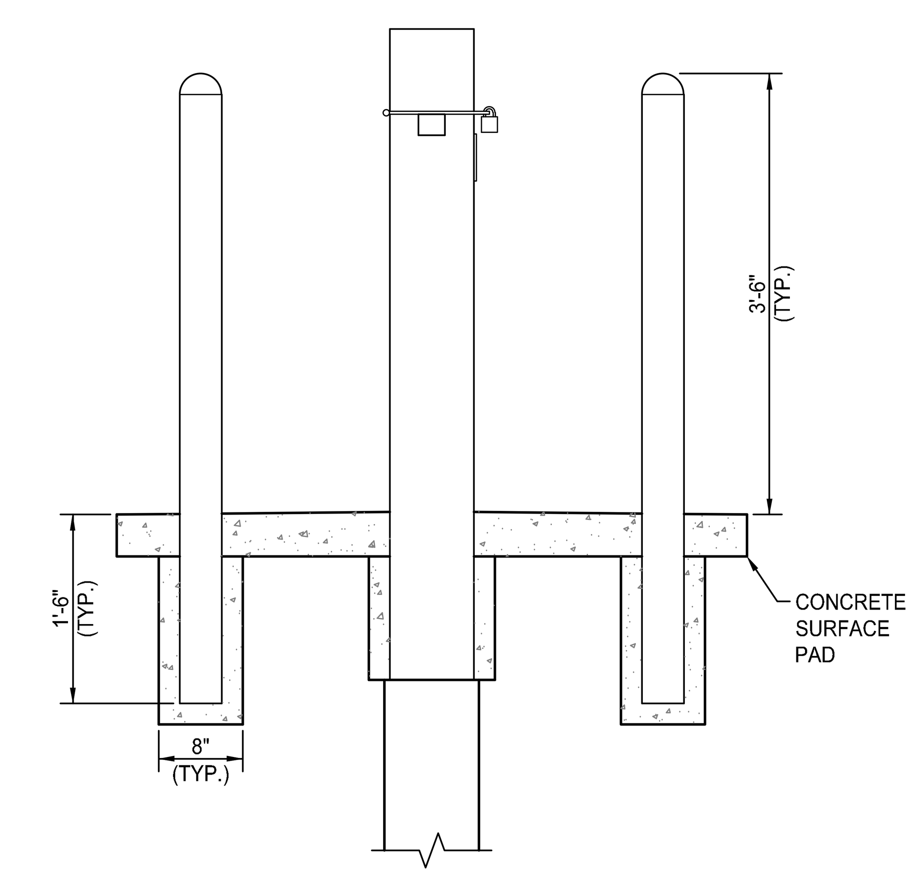
7 / 10 DETAIL - ROCK CHECK DAM
SCALE: 1/2"=1'-0"



8 / 10 DETAIL - SILT CONTROL BALES
NOT TO SCALE



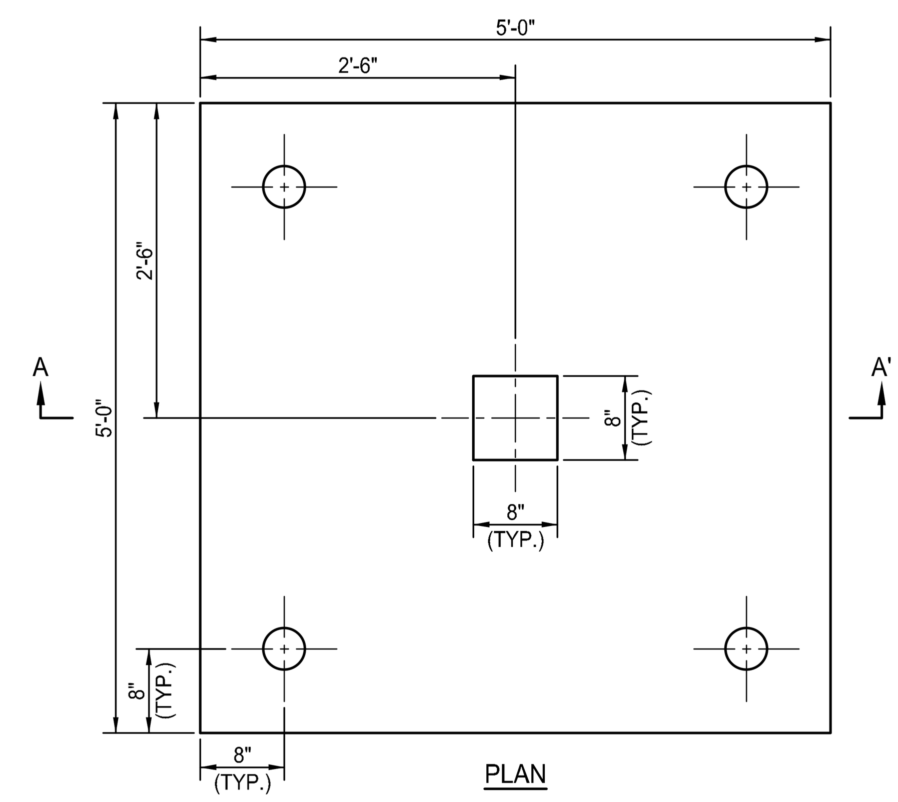
COVER PENETRATION



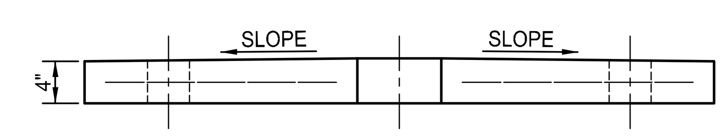
CONCRETE PAD

NOTES:
1. PROTECTIVE BOLLARDS TO BE FILLED WITH 3000 PSI CONCRETE AND CONE-TAPER THE TOP.
2. DRILL 3/16" DIAMETER VENT HOLE, 2 INCHES BELOW TOP OF PVC RISER.
3. NEW PROTECTIVE COVERS DO NOT REQUIRE PAINTING.
4. POSITION PROTECTIVE COVER WITH HINGE AT SAME ELEVATION AS TOP OF PVC RISER. FILL INSIDE OF PROTECTIVE COVER WITH CEMENT GROUT TO SAME LEVEL AS CONCRETE PAD.
5. DRILL 3/16" DIAMETER WEEP HOLE AT TOP OF GROUT INSIDE PROTECTIVE COVER.

9 / 10 DETAIL - PROPOSED PIEZOMETER
SCALE: 1"=1'-0"



PLAN



SECTION A-A'

NOTES:
1. SLOPE CONCRETE PAD SURFACE TO PREVENT PONDING WATER.
2. PLACE WIRE MESH 2 INCHES MINIMUM FROM ALL CONCRETE EDGES.

CONCRETE SURFACE PAD

SECTION OR DETAIL NO.
TARGET DRAWING
REFERENCE KEY

30% SUBMITTAL
NOT FOR CONSTRUCTION

Stantec

Stantec
11687 Lebanon Road
Cincinnati, Ohio 45241-2012
Tel: (513) 842-8200
www.stantec.com

Consultant

Notes

Revision	By	Appd	YYYY.MM.DD
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Issued	By	Appd	YYYY.MM.DD
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File Name: 10_39026C-501-D01	TJ	KDL	JSH	2020.01.13
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Permit/Seal

Client/Project Logo

OVEC IKEC

Client/Project
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION
PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
DETAILS

Project No. 175539026
Scale AS SHOWN
Revision A
Sheet 10 of 10
Drawing No.

APPENDIX H

Final Cover Soil Loss

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 ≤ 5.0 tons/acre/year.

R = 180 (southeastern Indiana in Figure 1)

LS = 1.3
for a 600-foot distance at 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
(Indiana State Board of Health, 1986 – memorandum attached)

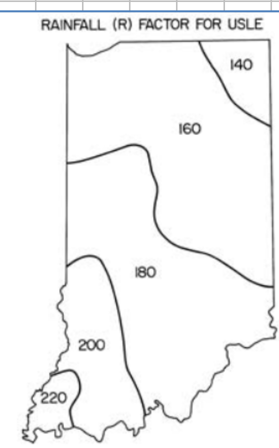


Fig 54. Map of Indiana showing rainfall intensity values (R factor).

1 - https://www.agry.purdue.edu/soils_judging/new_manual/ch6-water.html

A = (180)(1.3)(1.00)(0.43)(0.01) = 1.0 tons/acre/year for a slope length of 600 feet at 5%.

For Phase 1, the steepest slope (excluding the 3:1 ditch sideslopes) is 5% with a maximum flow path of approximately 175 feet (less than the above calculation). The longest flow path on the surface is roughly 250 feet with a slope of 3%.

Designed by: J Harmon Checked by: J Swindler

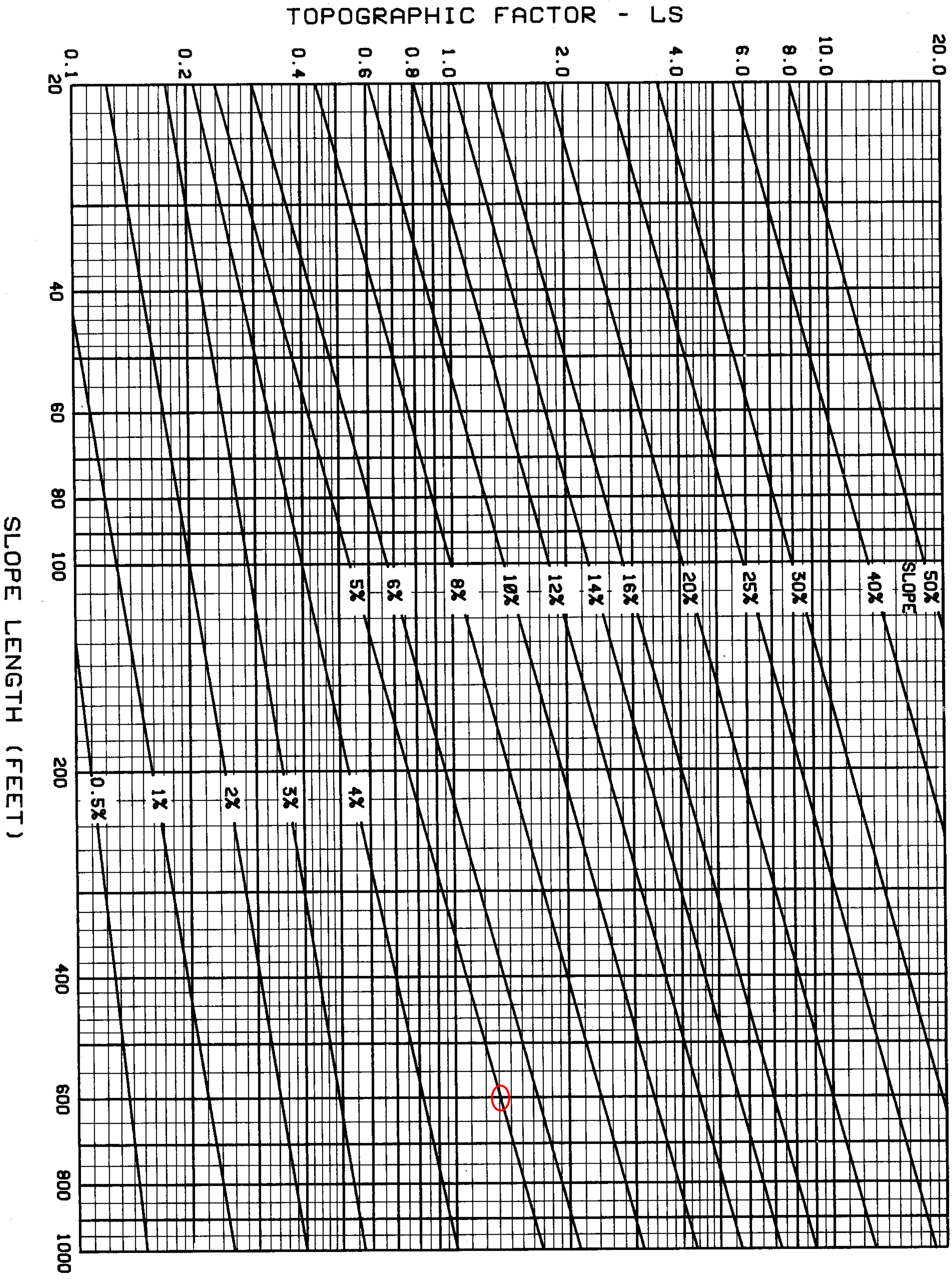


FIGURE 4.—Slope-effect chart (topographic factor, LS). LS = $(\lambda/72.6)^m$ $(65.41 \sin^2\theta + 4.56 \sin\theta + 0.065)$ where λ = slope length in feet; θ = angle of slope; and m = 0.2 for gradients < 1 percent, 0.3 for 1 to 3 percent slopes, 0.4 for 3.5 to 4.5 percent slopes, and 0.5 for slopes of 5 percent or steeper.

State Form 4336

STATE BOARD OF HEALTH

INDIANAPOLIS

OFFICE MEMORANDUM

DATE: January 3, 1986

TO: James E. Traylor
Technical Support Branch

THRU: Bruce Palin

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 Rainfall 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.

MPNY
14

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

$$\text{Soil loss fraction} = \frac{i^{m+1} - (i-1)^{m+1}}{N^{m+1}}$$

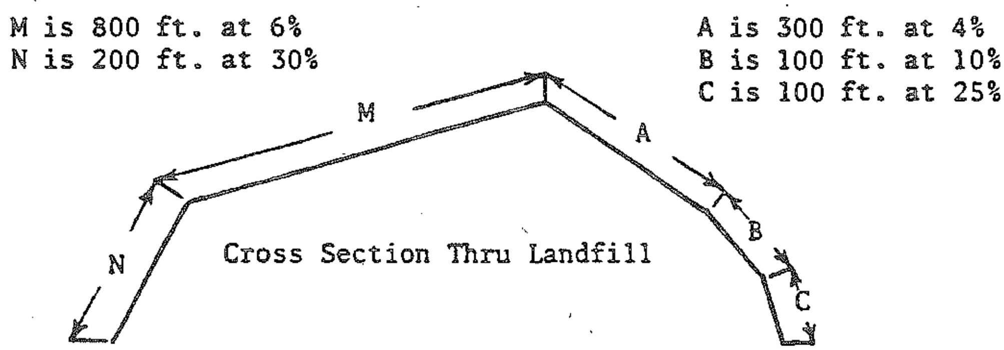
where: i = segment sequence number, m = slope length exponent of 0.5 for slopes greater than or equal to five percent. N = the number of equal length segments into which the slope was divided. The sum of the adjusted LS values is the LS value to be used for the entire slope.

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.

[1] Verbal communication 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:



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

<u>For slopes A, B, and C</u>

1. R = 175, for Marion County location on the rainfall and runoff map.

2. 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	A1	4%	.76	.09	.07
(5	A2	4%	.76	.16	.12
segments	A3	4%	.76	.21	.16
of 100 ft	B4	10%	3.06	.25	.77
each)	C5	25%	13.20	.28	3.70
					Total 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 x .43 x 4.82 x .01 x 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	M1	6%	2.13	.09	.19
(5	M2	6%	2.13	.16	.34
segments	M3	6%	2.13	.21	.45
of 200 ft	M4	6%	2.13	.25	.53
each)	M5	30%	25.57	.28	7.16
				Total	8.67

A = 175 x .43 x 8.67 x .01 x 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.

3. Dunbar, Larry, Office Memo to Engineering Staff, October 17, 1984.

4. Design and Construction of Covers for Solid Waste Landfills, 1979, EPA 600/2-79-165, U.S. EPA.

CrF Crosby silt loam

By [illegible] silty clay loam

Guideline No. ________________

Comment period ends ____________________.

APPENDIX I

Stability Analyses

Stantec (2016)

Table 13 Summary of Computed Factors of Safety for the West Boiler Slag Pond Dam, 2015 CCR Mandate

Headwater Pool	Drainage	Incipient Motion	Seismic Load Case	Acceptance Criteria	Factor of Safety		
					A-A'	B-B'	C-C'
Normal Pool Elevation (448 feet)	Drained	Downstream	No	1.50	2.30	2.44	2.30
Normal Pool Elevation (448 feet)		Upstream		1.50	1.88	1.63	2.73
50% PMF Elevation(462.8 feet)		Downstream		1.40	2.30	2.44	2.18
50% PMF Elevation (462.8 feet)		Upstream		1.40	2.13	1.95	3.88
Normal Pool Elevation (448 feet)	Undrained	Downstream	Yes	1.00	1.35	1.30	1.53
Normal Pool Elevation (448 feet)		Upstream		1.00	1.34	1.30	2.25

Table 14 Summary of Computed Factors of Safety for the Landfill Runoff Collection Pond Dam, 2015 CCR Mandate

Headwater Pool	Drainage	Incipient Motion	Seismic Load Case	Acceptance Criteria	Factor of Safety	
					D-D'	E-E'
Normal Pool Elevation (485 feet)	Drained	Downstream	No	1.50	1.85	1.99
Normal Pool Elevation (485 feet)		Upstream		1.50	2.73	3.51
PMF Elevation Surcharge (501.4 feet)		Downstream		1.40	1.81	1.99
PMF Elevation Surcharge (501.4 feet)		Upstream		1.40	3.47	4.51
Normal Pool Elevation (485 feet)	Undrained	Downstream	Yes	1.00	1.42	1.64
Normal Pool Elevation (485 feet)		Upstream		1.00	1.94	2.28

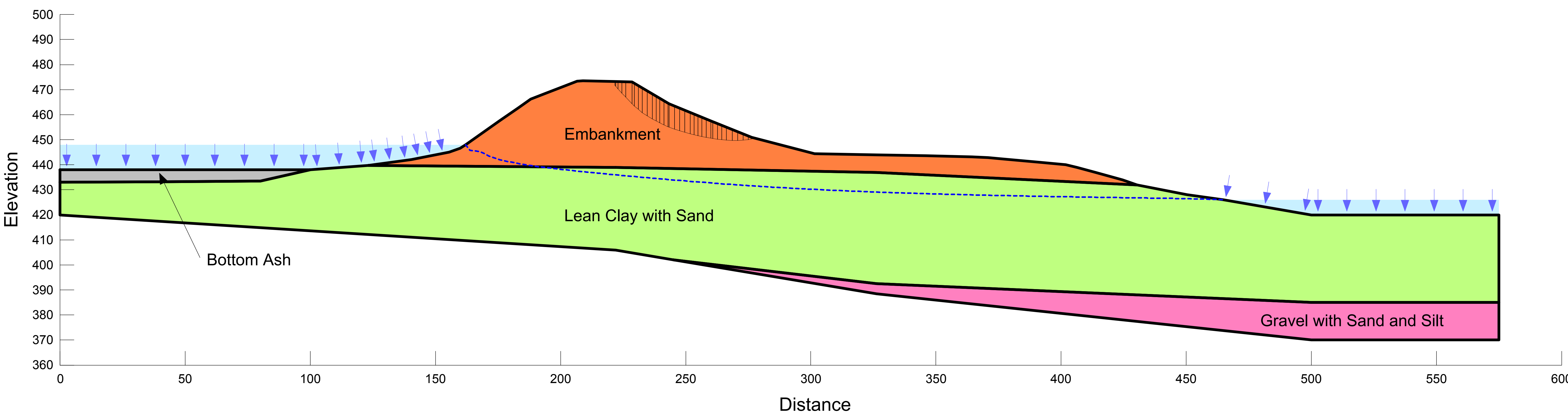
Factor of Safety = 2.30

American Electric Power (AEP)
Clifty Creek West Boiler Slag Pond Dam
Madison, Indiana
CCR Mandate

L01_Normal Pool, Downstream Slope Failure
Normal Pool Elevation: 448 Feet
Drained Static Strengths
Incipient Motion in the Downstream Direction
Section A-A'

Material	Unit Weight (pcf)	**Drained Strength Parameters** Phi (deg.)	Cohesion (psf)
Embankment (Drained)	130	33.2	165
Lean Clay with Sand (Drained)	119	27.2	160
Gravel With Silt and Sand (Drained)	130	35	0
Bottom Ash (Drained)	115	28	0

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.



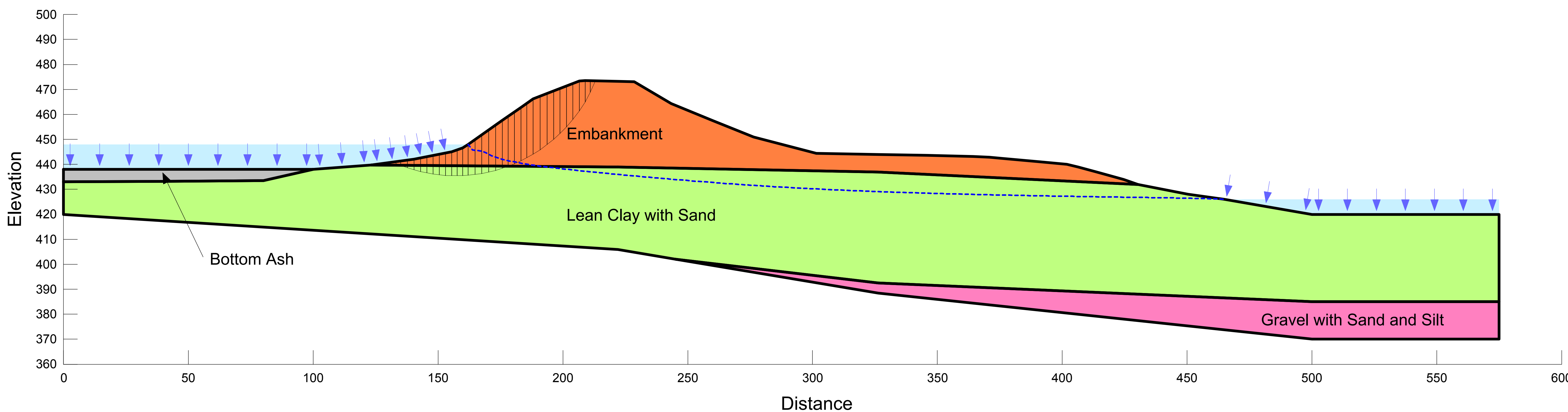
Factor of Safety = 1.88

American Electric Power (AEP)
Clifty Creek West Boiler Slag Pond Dam
Madison, Indiana
CCR Mandate

Material	Unit Weight (pcf)	Drained Strength Parameters Phi (deg.)	Cohesion (psf)
Embankment (Drained)	130	33.2	165
Lean Clay with Sand (Drained)	119	27.2	160
Gravel With Silt and Sand (Drained)	130	35	0
Bottom Ash (Drained)	115	28	0

L02_Normal Pool, Upstream Slope Failure
Normal Pool Elevation: 448 Feet
Drained Static Strengths
Incipient Motion in the Upstream Direction
Section A-A'

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.



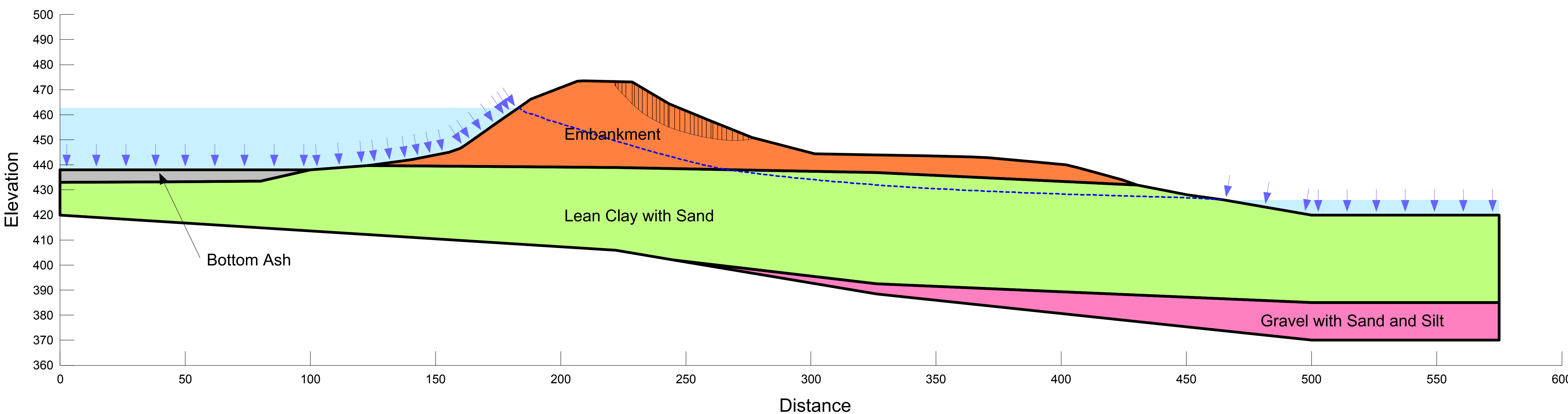
Factor of Safety = 2.30

American Electric Power (AEP)
Clifty Creek West Boiler Slag Pond Dam
Madison, Indiana
CCR Mandate

L03_50% PMF Pool, Downstream Slope Failure
50% PMF Pool Elevation: 462.8 Feet
Drained Static Strengths
Incipient Motion in the Downstream Direction
Section A-A'

Material	Unit Weight (pcf)	Drained Strength Parameters Phi (deg.)	Cohesion (psf)
Embankment (Drained)	130	33.2	165
Lean Clay with Sand (Drained)	119	27.2	160
Gravel With Silt and Sand (Drained)	130	35	0
Bottom Ash (Drained)	115	28	0

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.



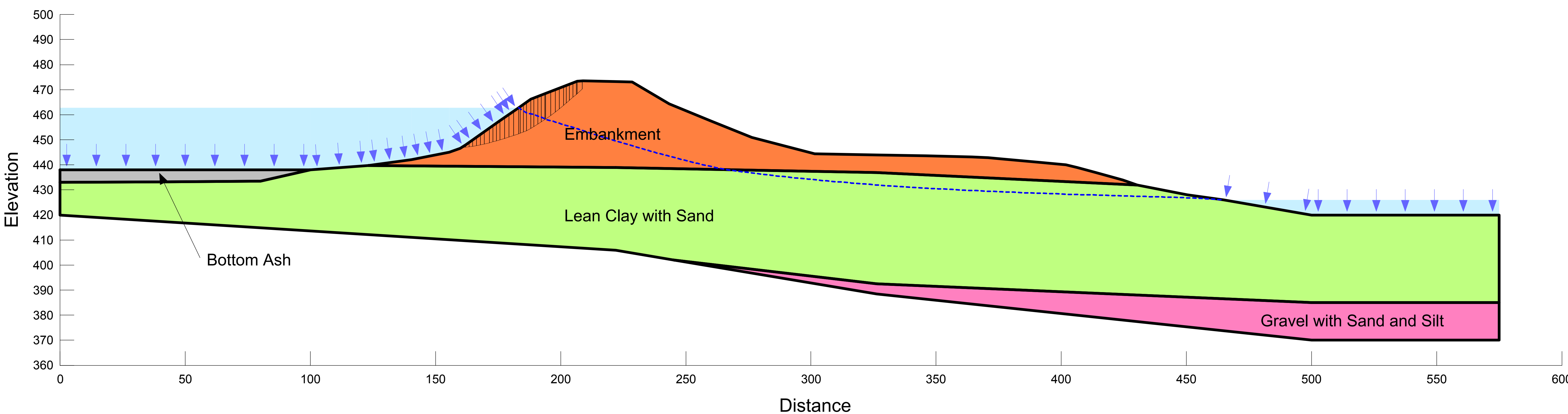
Factor of Safety = 2.13

American Electric Power (AEP)
Clifty Creek West Boiler Slag Pond Dam
Madison, Indiana
CCR Mandate

L04_50% PMF Pool, Upstream Slope Failure
50% PMF Pool Elevation: 462.8 Feet
Drained Static Strengths
Incipient Motion in the Upstream Direction
Section A-A'

Material	Unit Weight (pcf)	**Drained Strength Parameters** Phi (deg.)	Cohesion (psf)
Embankment (Drained)	130	33.2	165
Lean Clay with Sand (Drained)	119	27.2	160
Gravel With Silt and Sand (Drained)	130	35	0
Bottom Ash (Drained)	115	28	0

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.



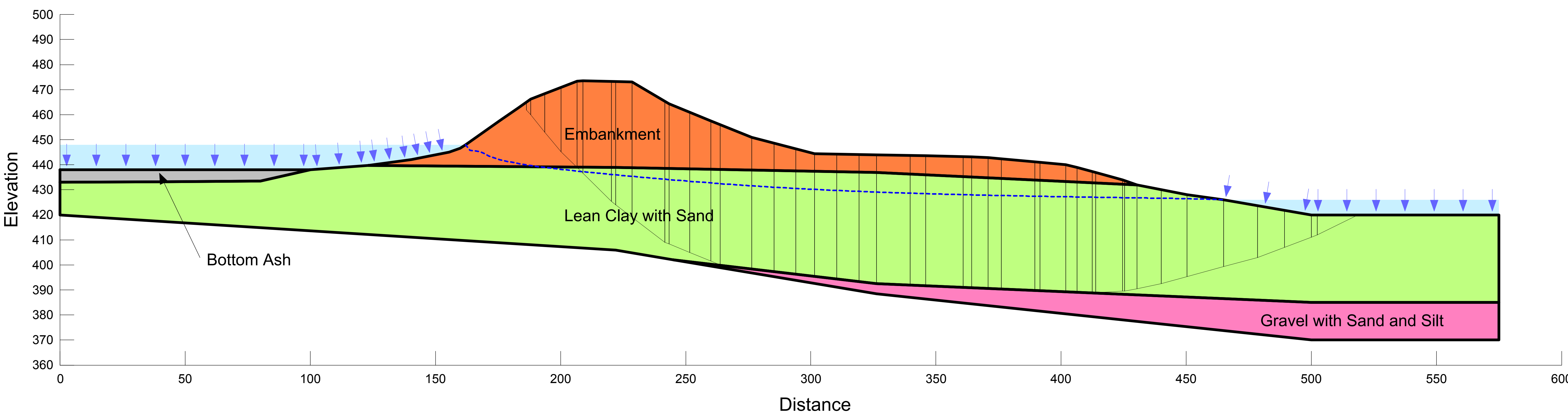
Factor of Safety = 1.35

American Electric Power (AEP)
Clifty Creek West Boiler Slag Pond Dam
Madison, Indiana
CCR Mandate

L05_Seismic_Normal Pool, Downstream Slope Failure
Normal Pool Elevation: 448 Feet
Undrained Static Strengths
Incipient Motion in the Downstream Direction
Horizontal Acc: 0.085g
Section A-A'

Material	Unit Weight (pcf)	Drained Strength Parameters Phi (deg.)	Drained Strength Parameters Cohesion (psf)	Undrained Strength Parameters Phi (deg.)	Undrained Strength Parameters Cohesion (psf)
Embankment (Seismic Undrained)	130	33.2	165	13	600
Lean Clay with Sand (Seismic Undrained)	119	27.2	160	5	1200
Gravel With Silt and Sand (Seismic Undrained)	130	35	0	35	0
Bottom Ash (Seismic Undrained)	115	28	0	28	0

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.



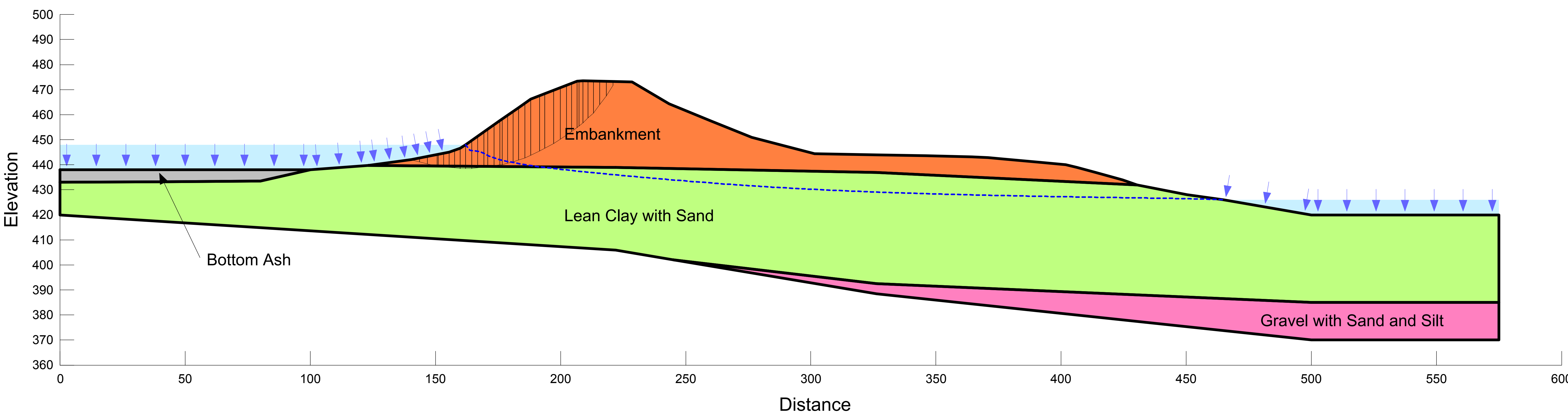
Factor of Safety = 1.34

American Electric Power (AEP)
Clifty Creek West Boiler Slag Pond Dam
Madison, Indiana
CCR Mandate

L06_Seismic_Normal Pool, Upstream Slope Failure
Normal Pool Elevation: 448 Feet
Undrained Static Strengths
Incipient Motion in the Upstream Direction
Horizontal Acc: 0.085g
Section A-A'

		Drained Strength Parameters		**Undrained Strength Parameters**	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)	Phi (deg.)	Cohesion (psf)
Embankment (Seismic Undrained)	130	33.2	165	13	600
Lean Clay with Sand (Seismic Undrained)	119	27.2	160	5	1200
Gravel With Silt and Sand (Seismic Undrained)	130	35	0	35	0
Bottom Ash (Seismic Undrained)	115	28	0	28	0

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.



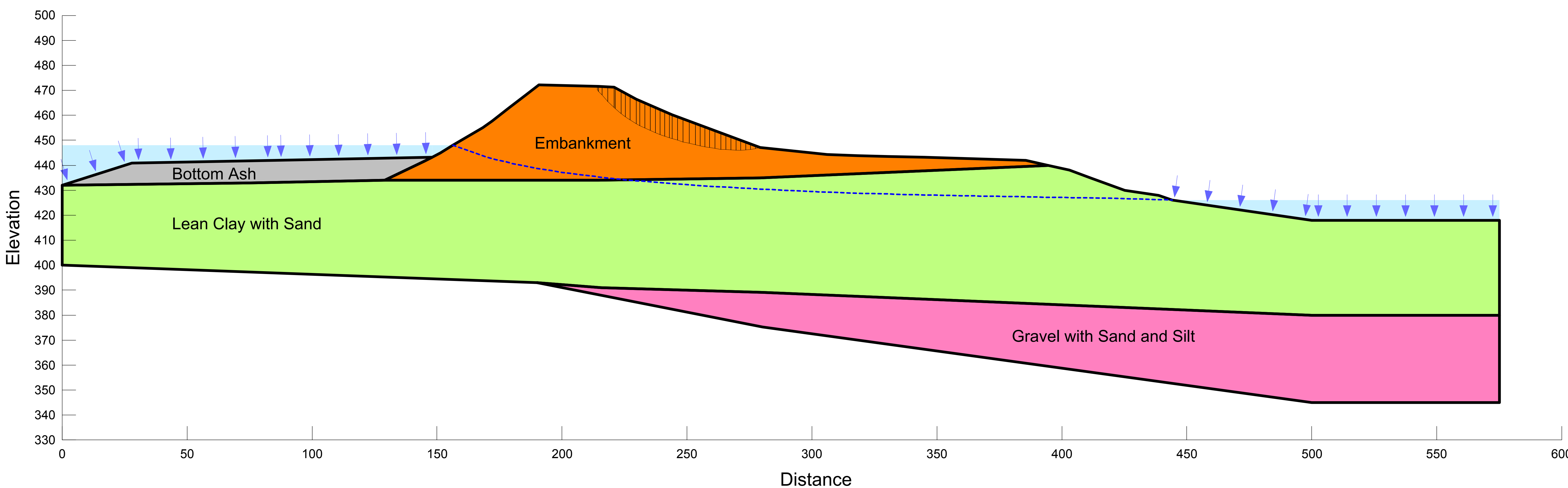
Factor of Safety = 2.44

American Electric Power (AEP)
Clifty Creek West Boiler Slag Pond Dam
Madison, Indiana
CCR Mandate

L01_Normal Pool, Downstream Slope Failure
Normal Pool Elevation: 448 Feet
Drained Static Strengths
Incipient Motion in the Downstream Direction
Section B-B'

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.

Material	Unit Weight (pcf)	**Drained Strength Parameters** Phi (deg.)	Cohesion (psf)
Embankment (Drained)	130	33.2	165
Lean Clay With Sand (Drained)	119	27.2	160
Gravel With Silt And Sand (Drained)	130	35	0
Bottom Ash (Drained)	115	28	0



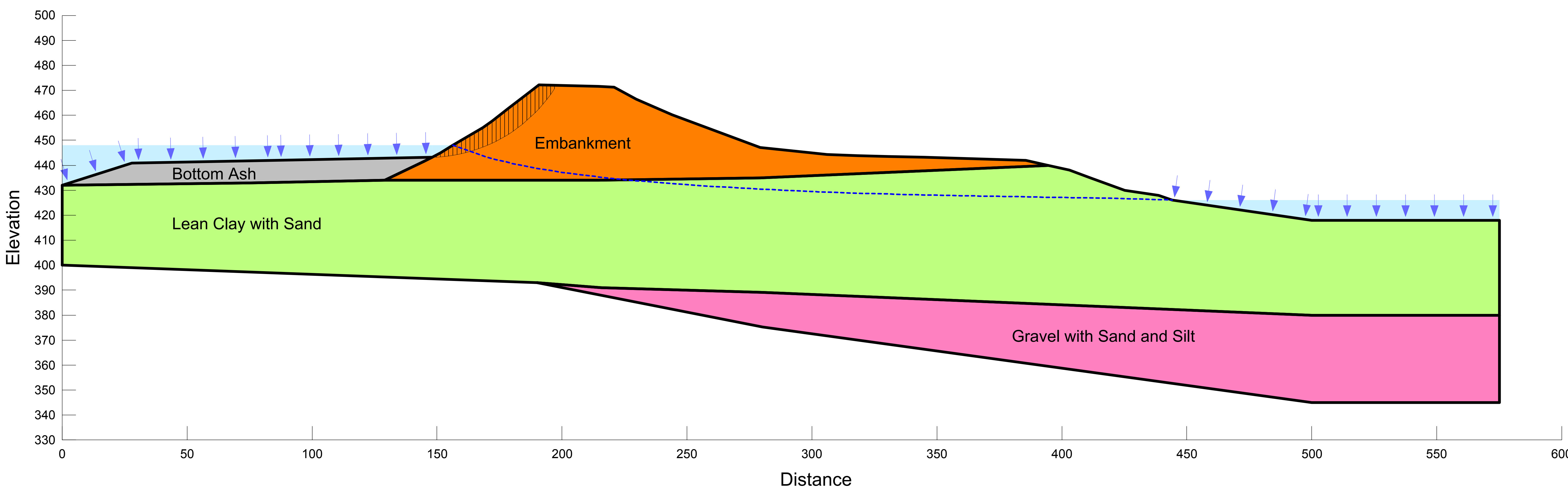
Factor of Safety = 1.63

American Electric Power (AEP)
Clifty Creek West Boiler Slag Pond Dam
Madison, Indiana
CCR Mandate

L02_Normal Pool, Upstream Slope Failure
Normal Pool Elevation: 448 Feet
Drained Static Strengths
Incipient Motion in the Upstream Direction
Section B-B'

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.

Material	Unit Weight (pcf)	Drained Strength Parameters Phi (deg.)	Cohesion (psf)
Embankment (Drained)	130	33.2	165
Lean Clay With Sand (Drained)	119	27.2	160
Gravel With Silt And Sand (Drained)	130	35	0
Bottom Ash (Drained)	115	28	0



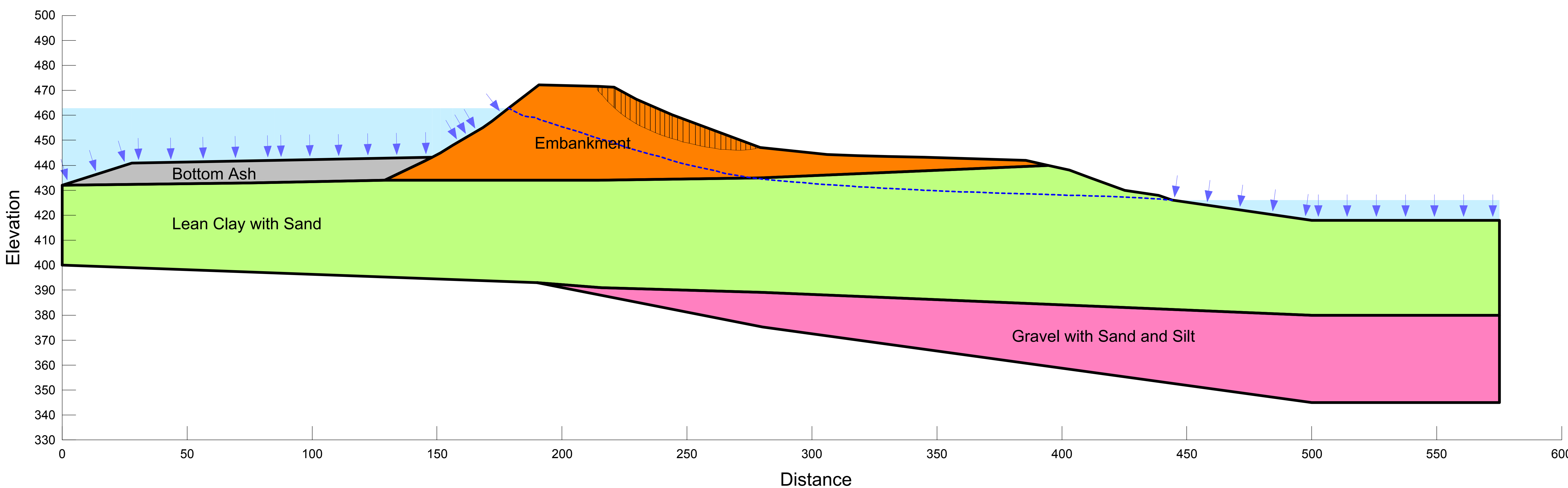
Factor of Safety = 2.44

American Electric Power (AEP)
Clifty Creek West Boiler Slag Pond Dam
Madison, Indiana
CCR Mandate

L03_50% PMF Pool, Downstream Slope Failure
50% PMF Pool Elevation: 462.8 Feet
Drained Static Strengths
Incipient Motion in the Downstream Direction
Section B-B'

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.

Material	Unit Weight (pcf)	**Drained Strength Parameters** Phi (deg.)	Cohesion (psf)
Embankment (Drained)	130	33.2	165
Lean Clay With Sand (Drained)	119	27.2	160
Gravel With Silt And Sand (Drained)	130	35	0
Bottom Ash (Drained)	115	28	0



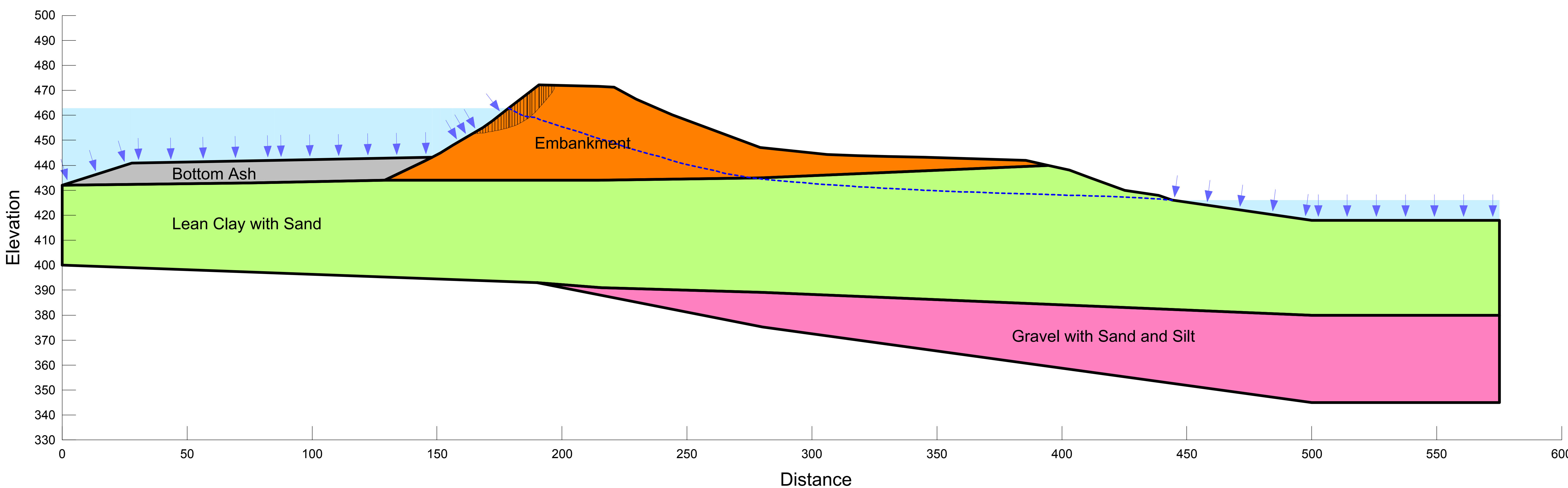
Factor of Safety = 1.95

American Electric Power (AEP)
Clifty Creek West Boiler Slag Pond Dam
Madison, Indiana
CCR Mandate

L04_50% PMF Pool, Upstream Slope Failure
50% PMF Pool Elevation: 462.8 Feet
Drained Static Strengths
Incipient Motion in the Upstream Direction
Section B-B'

Material	Unit Weight (pcf)	Drained Strength Parameters Phi (deg.)	Cohesion (psf)
Embankment (Drained)	130	33.2	165
Lean Clay With Sand (Drained)	119	27.2	160
Gravel With Silt And Sand (Drained)	130	35	0
Bottom Ash (Drained)	115	28	0

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.



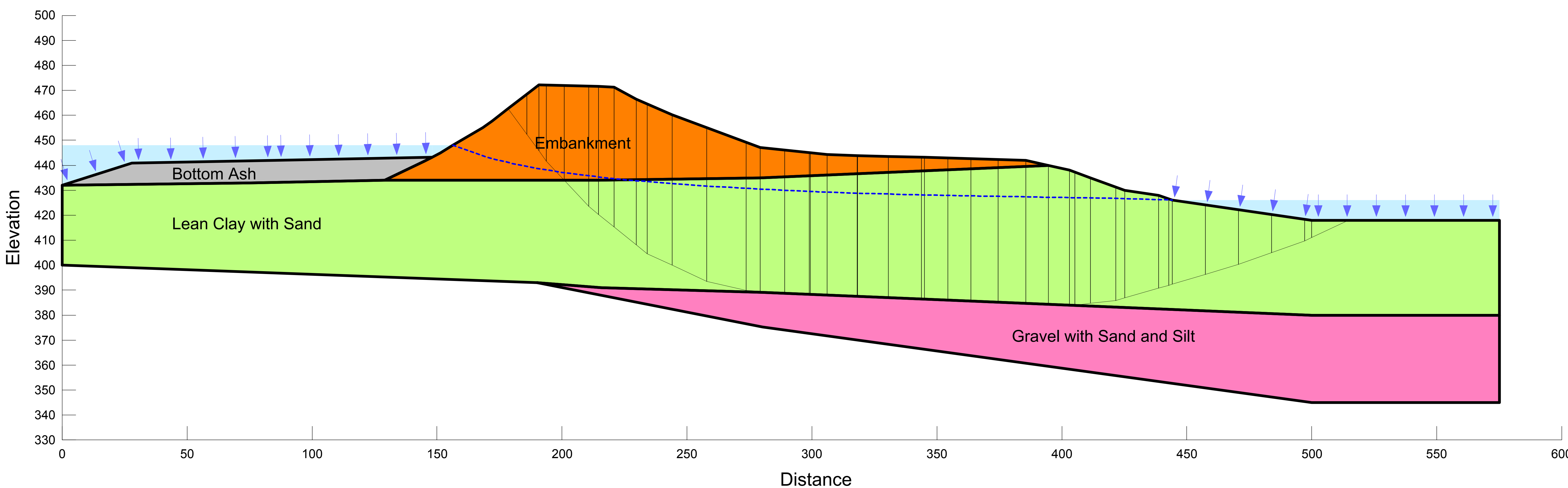
Factor of Safety = 1.30

American Electric Power (AEP)
Clifty Creek West Boiler Slag Pond Dam
Madison, Indiana
CCR Mandate

L05_Seismic_Normal Pool, Downstream Slope Failure
Normal Pool Elevation: 448 Feet
Undrained Static Strengths
Incipient Motion in the Downstream Direction
Horizontal Acc: 0.085g
Section B-B'

Material	Unit Weight (pcf)	**Drained Strength Parameters** Phi (deg.)	Cohesion (psf)	**Undrained Strength Parameters** Phi (deg.)	Cohesion (psf)
Embankment (Seismic Undrained)	130	33.2	165	13	600
Lean Clay With Sand (Seismic Undrained)	119	27.2	160	5	1200
Gravel With Silt And Sand (Seismic Undrained)	130	35	0	35	0
Bottom Ash (Seismic Undrained)	115	28	0	28	0

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.



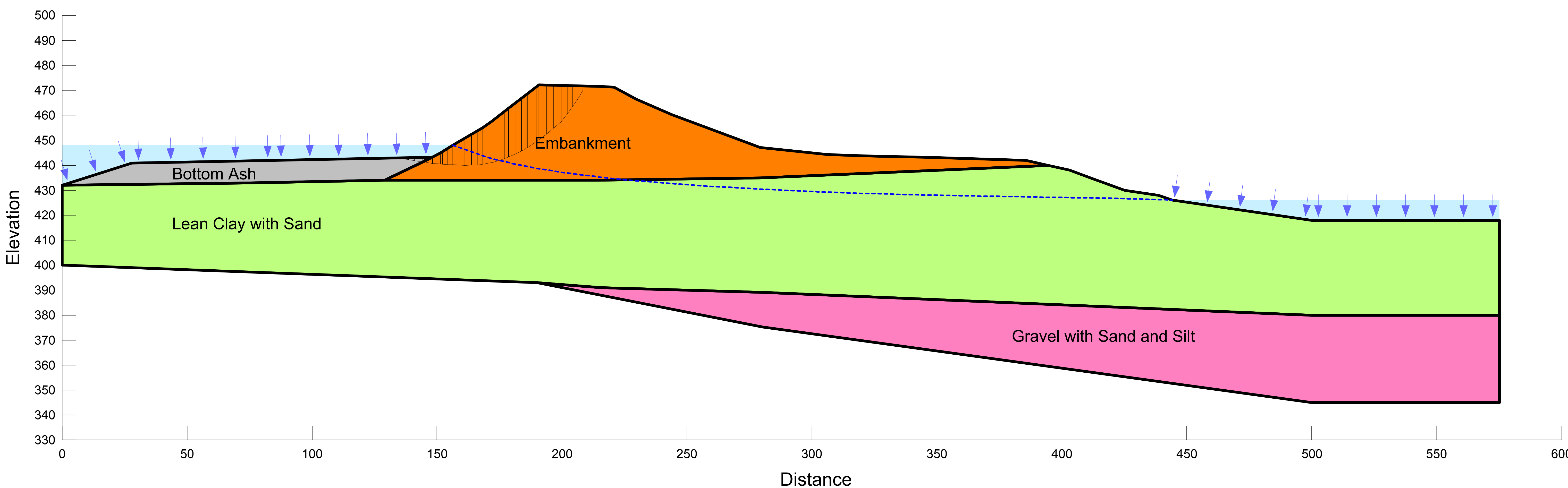
Factor of Safety = 1.30

American Electric Power (AEP)
Clifty Creek West Boiler Slag Pond Dam
Madison, Indiana
CCR Mandate

L06_Seismic_Normal Pool, Upstream Slope Failure
Normal Pool Elevation: 448 Feet
Undrained Static Strengths
Incipient Motion in the Upstream Direction
Horizontal Acc: 0.085g
Section B-B'

Material	Unit Weight (pcf)	Drained Strength Parameters Phi (deg.)	Drained Strength Parameters Cohesion (psf)	Undrained Strength Parameters Phi (deg.)	Undrained Strength Parameters Cohesion (psf)
Embankment (Seismic Undrained)	130	33.2	165	13	600
Lean Clay With Sand (Seismic Undrained)	119	27.2	160	5	1200
Gravel With Silt And Sand (Seismic Undrained)	130	35	0	35	0
Bottom Ash (Seismic Undrained)	115	28	0	28	0

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.



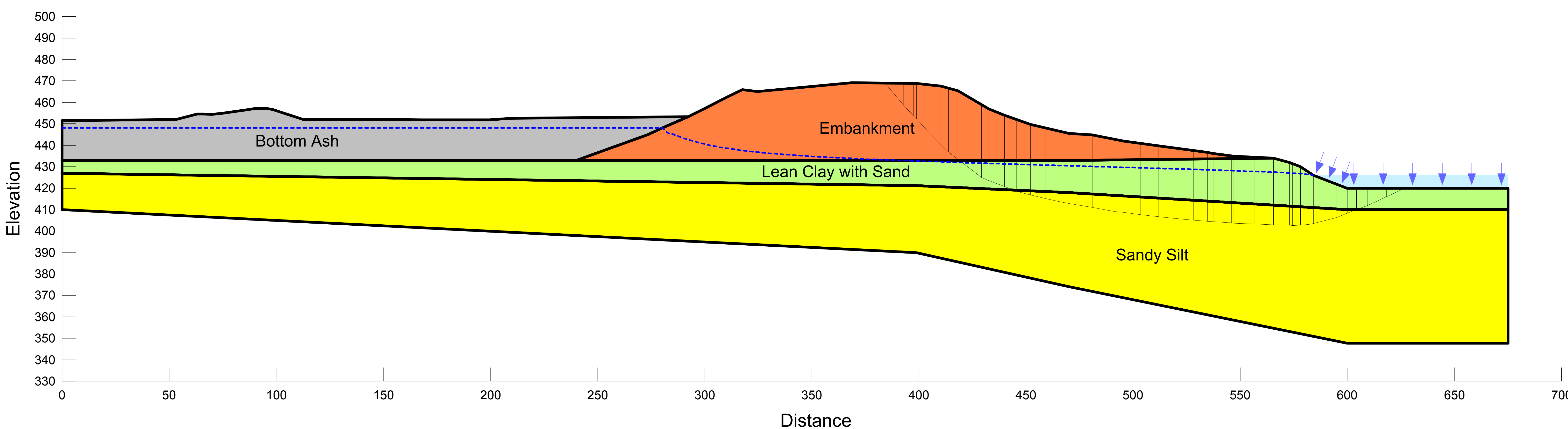
American Electric Power (AEP)
Clifty Creek West Boiler Slag Pond Dam
Madison, Indiana
CCR Mandate

Factor of Safety = 2.30

L01_Normal Pool, Downstream Slope Failure
Normal Pool Elevation: 448 Feet
Drained Static Strengths
Incipient Motion in the Downstream Direction
Section C-C'

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.

Material	Unit Weight (pcf)	**Drained Strength Parameters** Phi (deg.)	Cohesion (psf)
Embankment (Drained)	130	33.2	165
Lean Clay with Sand (Drained)	119	27.2	160
Sandy Silt (Drained)	130	30	0
Bottom Ash (Drained)	115	28	0



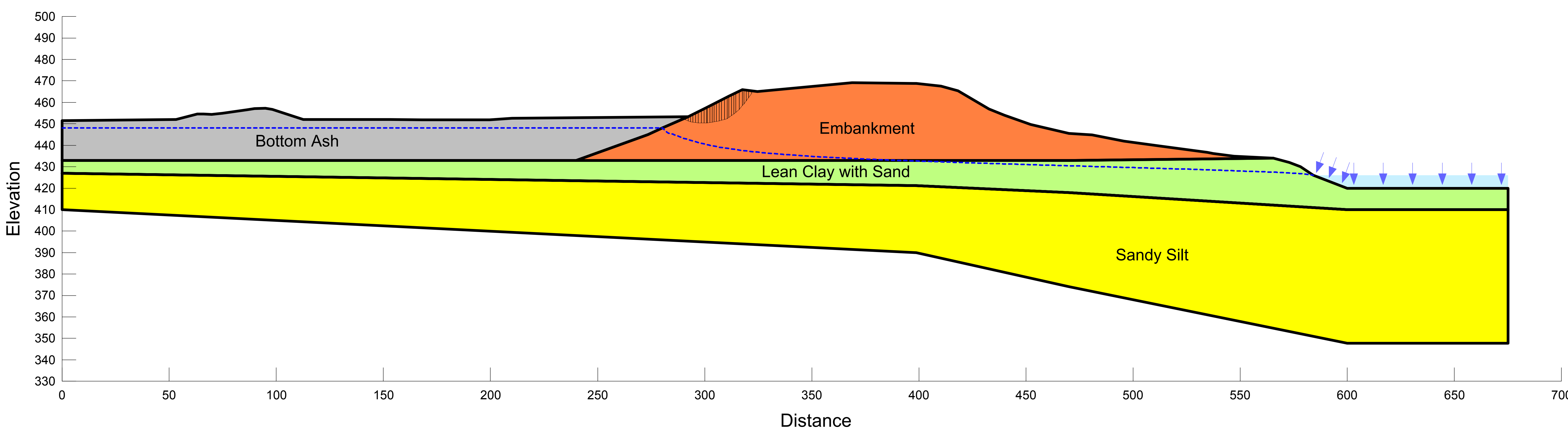
American Electric Power (AEP)
Clifty Creek West Boiler Slag Pond Dam
Madison, Indiana
CCR Mandate

Factor of Safety = 2.73

L02_Normal Pool, Upstream Slope Failure
Normal Pool Elevation: 448 Feet
Drained Static Strengths
Incipient Motion in the Upstream Direction
Section C-C'

Material	Unit Weight (pcf)	Drained Strength Parameters Phi (deg.)	Cohesion (psf)
Embankment (Drained)	130	33.2	165
Lean Clay with Sand (Drained)	119	27.2	160
Sandy Silt (Drained)	130	30	0
Bottom Ash (Drained)	115	28	0

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.



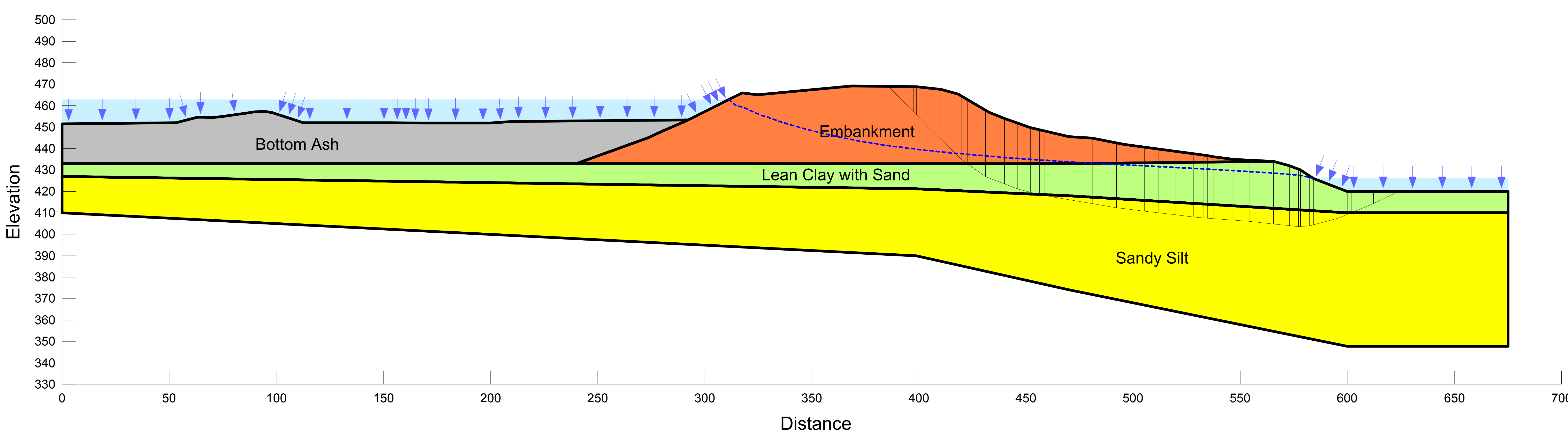
Factor of Safety = 2.18

American Electric Power (AEP)
Clifty Creek West Boiler Slag Pond Dam
Madison, Indiana
CCR Mandate

L03_50% PMF Pool, Downstream Slope Failure
50% PMF Pool Elevation: 462.8 Feet
Drained Static Strengths
Incipient Motion in the Downstream Direction
Section C-C'

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.

Material	Unit Weight (pcf)	Drained Strength Parameters Phi (deg.)	Cohesion (psf)
Embankment (Drained)	130	33.2	165
Lean Clay with Sand (Drained)	119	27.2	160
Sandy Silt (Drained)	130	30	0
Bottom Ash (Drained)	115	28	0



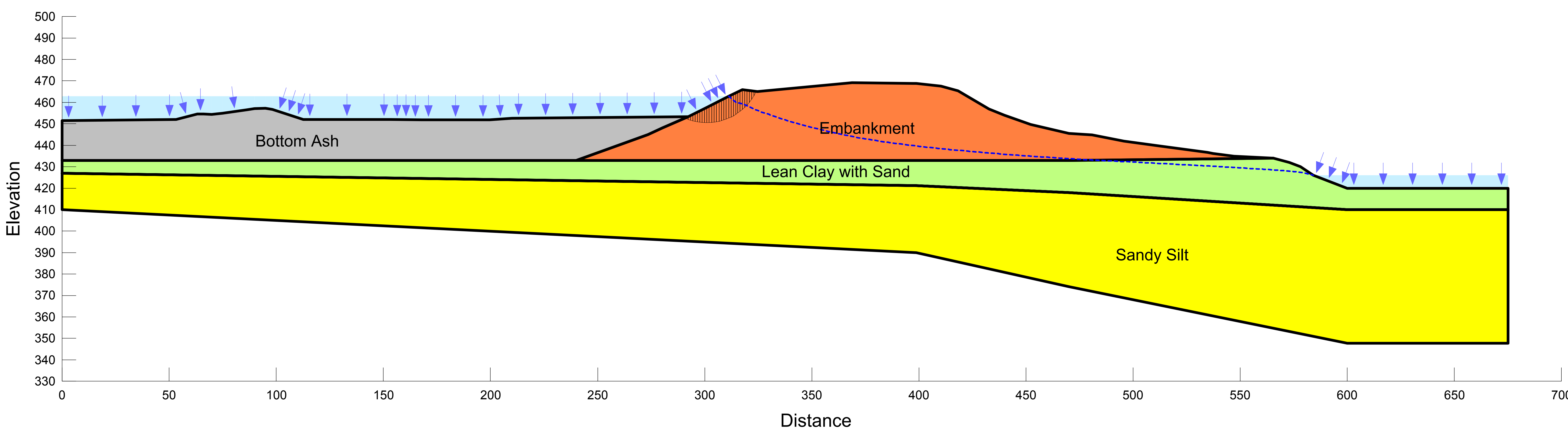
American Electric Power (AEP)
Clifty Creek West Boiler Slag Pond Dam
Madison, Indiana
CCR Mandate

Factor of Safety = 3.88

L04_50% PMF Pool, Upstream Slope Failure
50% PMF Pool Elevation: 462.8 Feet
Drained Static Strengths
Incipient Motion in the Upstream Direction
Section C-C'

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.

Material	Unit Weight (pcf)	Drained Strength Parameters Phi (deg.)	Cohesion (psf)
Embankment (Drained)	130	33.2	165
Lean Clay with Sand (Drained)	119	27.2	160
Sandy Silt (Drained)	130	30	0
Bottom Ash (Drained)	115	28	0



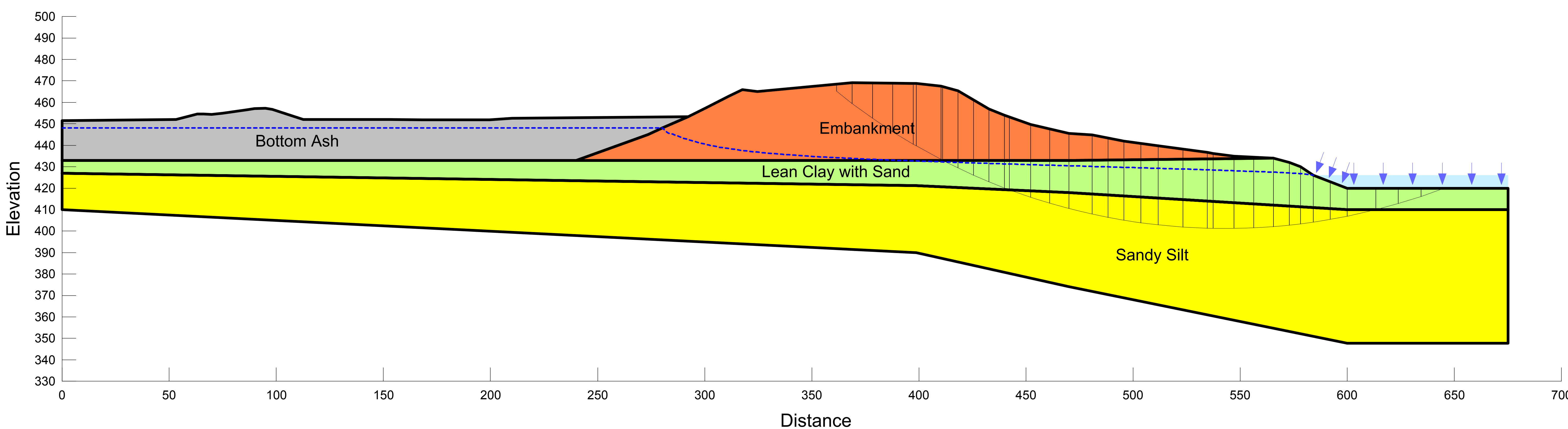
American Electric Power (AEP)
Clifty Creek West Boiler Slag Pond Dam
Madison, Indiana
CCR Mandate

Factor of Safety = 1.53

L05_Seismic_Normal Pool, Downstream Slope Failure
Normal Pool Elevation: 448 Feet
Undrained Static Strengths
Incipient Motion in the Downstream Direction
Horizontal Acc: 0.085g
Section C-C'

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.

		Drained Strength Parameters		**Undrained Strength Parameters**	
Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)	Phi (deg.)	Cohesion (psf)
Embankment (Seismic Undrained)	130	33.2	165	13	600
Lean Clay with Sand (Seismic Undrained)	119	27.2	160	5	1200
Sandy Silt (Seismic Undrained)	130	30	0	30	0
Bottom Ash (Seismic Undrained)	115	28	0	28	0



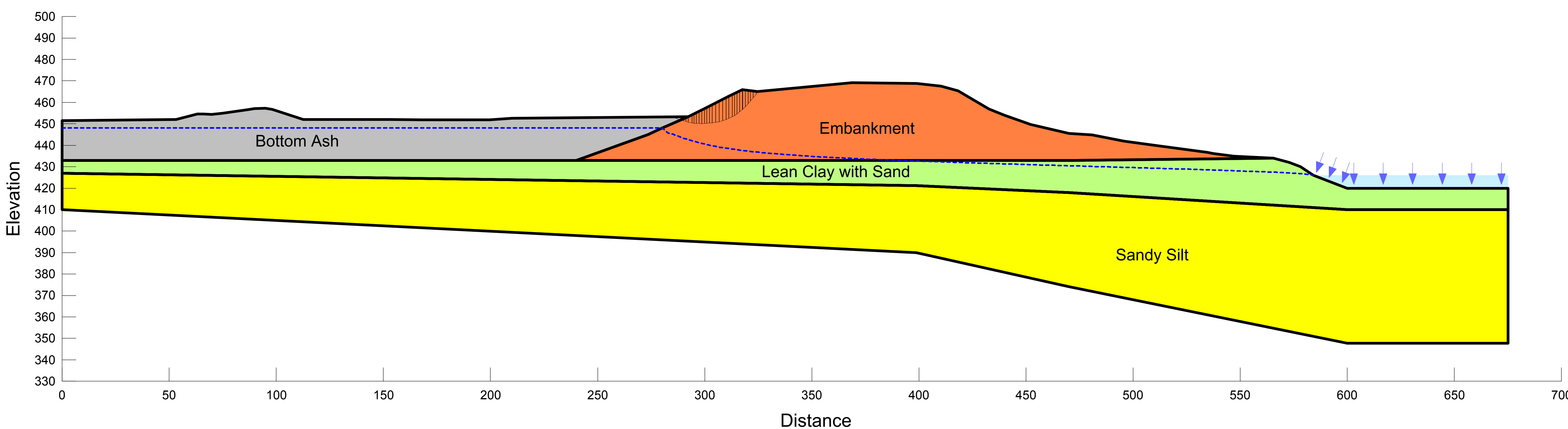
American Electric Power (AEP)
Clifty Creek West Boiler Slag Pond Dam
Madison, Indiana
CCR Mandate

Factor of Safety = 2.25

L06_Seismic_Normal Pool, Upstream Slope Failure
Normal Pool Elevation: 448 Feet
Undrained Static Strengths
Incipient Motion in the Upstream Direction
Horizontal Acc: 0.085g
Section C-C'

Material	Unit Weight (pcf)	Drained Strength Parameters Phi (deg.)	Drained Strength Parameters Cohesion (psf)	Undrained Strength Parameters Phi (deg.)	Undrained Strength Parameters Cohesion (psf)
Embankment (Seismic Undrained)	130	33.2	165	13	600
Lean Clay with Sand (Seismic Undrained)	119	27.2	160	5	1200
Sandy Silt (Seismic Undrained)	130	30	0	30	0
Bottom Ash (Seismic Undrained)	115	28	0	28	0

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.



Stantec (2020)

Barge Loading Station Slope Stability

Closure Plan
(Addendum 1)
West Boiler Slag Pond
Clifty Creek Station
Madison, Jefferson County, Indiana

January 17, 2020

Prepared for:

Indiana-Kentucky Electric Corporation
Piketon, Ohio

Prepared by:

Stantec Consulting Services, Inc.
Cincinnati, Ohio

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LIST OF APPENDICES

1.0 OVERVIEW

A barge loading system is planned to be constructed by Continental Building Products near the southern portion of the Phase 1 Closure construction (near Station 104+00 of 30 percent submittal). The barge loading system consists of a 180-foot by 235-foot concrete pad at the top of slope which is used for storage and loading of the material. A crawler excavator loads material onto a conveyor system, which moves material from the storage area to barges on the Ohio River. The conveyor system is supported by a hopper tower at the top of the slope, a conveyor tower located along the slope, and a loading barge in the Ohio River. Details are provided in the barge loading station drawings (WBCM 2019, included in Appendix A).

Slope stability analyses are required to evaluate the slopes for the planned closure configuration with added loads of the barge loading system. Drained, undrained, and seismic analyses were performed on representative cross sections, as discussed below.

2.0 SLOPE STABILITY ANALYSIS

2.1 SOFTWARE

Slope stability was evaluated using conventional, limit equilibrium methods as implemented by GeoStudio SLOPE/W 2019 software. Slope stability was evaluated using Spencer’s solution procedure. The “optimization” feature in SLOPE/W was used to consider the possible effects of localized changes in the failure surface.

2.2 CROSS SECTIONS

A cross section was developed at the location of the proposed barge loading system. The ground surface was created based on mapping provided by American Electric Power which was drone surveyed on September 23, 2019.

Previous slope stability analyses were performed at the West Boiler Slag Pond for the Federal CCR Rule in 2016 (Stantec 2016). Three cross sections were analyzed at the West Boiler Slag Pond, A-A’, B-B’, and C-C’. Section C-C’ is located closest to the proposed barge loading system. The subsurface profile for Section C-C’ in Stantec (2016) was assumed to be similar for the new cross section along the barge loading system. Historical borings were reviewed to confirm similar material types and depths.

Two cross sections were analyzed considering different loading conditions, one that passes through the hopper tower and the conveyor tower, and one that does not pass through these towers. Both cross sections include loading from the material storage and the crawler excavator.

2.3 LOADS

Based on the barge loading station drawings (WBCM 2019), loading from the following components of the proposed barge loading system were modelled: material storage, the crawler excavator, the hopper tower, and the conveyor tower. The following sections describe how these loads were applied to the analysis model.

2.3.1 Material Storage

According to the barge loading station drawings (WBCM 2019), the maximum height of the material is 15 feet. The material unit weight is defined as 80 pcf. The material storage is located over a 133-foot by 180-foot area on the concrete pad. To account for this loading, a 15-foot tall, 80 pcf surcharge load was modeled on the concrete pad for 133 feet (according to the orientation indicated in WBCM (2019)).

2.3.2 Crawler Excavator

The barge loading station drawings (WBCM 2019) indicate the crawler excavator model is the Liebherr R974C. The weight of the excavator was determined by information provided by the manufacturer (included in Appendix A). The maximum weight of the excavator is approximately 290 kips. According to WBCM (2019), the excavator should be supported by 20-foot by 25-foot timber mats. Therefore, a pressure of 580 psf applied to the ground surface was calculated. This was modeled as a 5.8-foot tall, 100 pcf surcharge for 25 feet in the analysis cross section.

2.3.3 Hopper Tower

The total load of the hopper tower is defined in WBCM (2019) as 124 kips. The hopper tower is supported by concrete spread footings near the ground surface. This load is assumed to be spread along the footprint of the foundations, which is approximately 27 feet by 31 feet. Therefore, a pressure of 148 psf applied to the ground surface was calculated. This was modelled as a 1.48-foot tall, 100 pcf surcharge for 27 feet in the cross section.

2.3.4 Conveyor Tower

The conveyor tower is supported by four piles extending to a tip elevation of 370 feet (approximately 70 feet in length per D.W. Kozera (2019)). The maximum combined load of the four piles is 245 kips as provided by WBCM (2020). The piles are spaced at 20 feet (in and out of the slope) by 15 feet (along the slope). Because the loading piles transfer the loads throughout the subsurface profile, a surcharge load was not used to model the loading. Instead, the load was added through increasing the unit weight of the soil in the area of the piles.

An area of 15 feet by 70 feet was modelled in the soil below the location of the conveyor tower. The unit weight in this area was increased by 12 pcf (245 kips over a 15-foot by 20-foot by 70-foot volume). It should be noted that the piles may provide increased shear resistance to the stability of the slope.

However, the strength of the soils in this area were not increased to be conservative. The area of increased unit weight is shown in the outputs of the slope stability analyses in Appendix B.

2.4 GROUNDWATER CONDITIONS

The normal pool elevation for the West Boiler Slag Pond was reported as 448 feet in Stantec (2016). This elevation was confirmed by Clifty Creek personnel and used as the normal water level for this analysis. The high water level was reported as 462.8 feet in Stantec (2016), corresponding to the 50 percent PMF elevation. This level was used for analyses as the high water level, as it was assumed that the water level within the West Boiler Slag Pond would not increase above this level after the final cover system is constructed.

The tailwater is the elevation in the model corresponds to the elevation of the Ohio River. According to the NOAA river level gage at Clifty Creek Station, the low stage elevation is 420 feet (NOAA 2020). This elevation was used for the normal and high water models. The lower elevation was considered conservative, as pooled water at the toe would provide weight to resist slope failure. Sensitivity analysis was performed to confirm that higher Ohio River levels would result in higher factors of safety.

The groundwater was modelled as a piezometric line in GeoStudio. Seepage analyses were performed in Stantec (2016). The piezometric line for these analyses were modelled similarly to the results of the seepage analyses in Stantec (2016).

2.5 CASES

For both cross sections, six analysis cases were considered to represent possible scenarios which the slope may encounter. Cases 1 and 2 considered drained static conditions under normal and high water levels. Cases 3 and 4 considered undrained static conditions under normal and high water levels. Cases 5 and 6 considered seismic conditions under normal and high water levels. For cases 5 and 6, a horizontal acceleration of 0.0884 g was used. This value was obtained from USGS Unified Hazard Tool at the location of the barge loading system (USGS 2020).

For each of the cases, it was assumed that failure of the riverbank would not lead to failure of the dike system resulting in the release of boiler slag. Therefore, shallow failure surfaces of the riverbank were not considered.

2.6 MATERIAL PARAMETERS

As discussed in Section 2.2, the subsurface profile at Section C-C’ in Stantec (2016) was considered to be similar for the new cross section along the barge loading system. Table 1 presents the material parameters used in Stantec (2016) for Section C-C’. These material properties were developed based on information obtained from borings advanced along Section C-C’. Laboratory testing was performed on disturbed and undisturbed samples obtained from these borings and included classification testing, triaxial testing, permeability testing, and moisture-density testing.

Table 1. Material Parameters from Stantec (2016)

Material	Unit Weight (pcf)	Drained Shear Strengths		Undrained Shear Strengths	
		ϕ' (deg.)	c' (psf)	ϕ (deg.)	c (psf)
Embankment	130	33.2	165	13	600
Lean Clay with Sand	119	27.2	160	5	1,200
Boiler Slag	115	28	0	28	0
Silty Sand	130	30	0	30	0

For these analyses, the concrete pad, compacted soil below the concrete, and the cover soil were conservatively assigned the same material parameters as the embankment material, with the exception of the unit weight of the concrete pad. The unit weight of the concrete pad was increased to 150 pcf.

In the undrained stability analyses, the contribution of suction pressures to shearing resistance is effectively neglected by specifying composite drained-undrained strength envelopes. The shearing resistance at a given normal stress is then the lesser value of strength computed with the drained or undrained strength parameters. This was modeled in GeoStudio using the “bilinear” option for material model. The undrained materials strengths were used in the seismic analyses.

2.7 ACCEPTANCE CRITERIA

Minimum values for the factors of safety are outlined in the Indiana 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 required factors of safety used for these analyses were 1.5 for static conditions and 1.3 for seismic conditions.

2.8 RESULTS

Table 2 presents the results of the slope stability results. Outputs of the slope stability analysis are included in Appendix B.

Table 2. Slope Stability Results

Case	Soil Strengths	Groundwater Condition	Minimum Required Factor of Safety	Calculated Factor of Safety	
				Including Towers	Not Including Towers
1	Drained	Normal	1.5	2.13	2.13
2	Drained	High	1.5	2.05	2.05
3	Undrained	Normal	1.5	1.82	1.83
4	Undrained	High	1.5	1.79	1.87
5	Seismic Undrained	Normal	1.3	1.34	1.34
6	Seismic Undrained	High	1.3	1.32	1.37

3.0 CONCLUSION

The calculated factors of safety for the six 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 REFERENCES

Whitney, Bailey, Cox, and Magnani, LLC (WBCM) (2019). "Barge Loading Station at Indiana-Kentucky Electric Corporation (IKEC)." 100% Design Submission Drawings. Prepared for Continental Building Products. May.

D.W. Kozera, Inc. (2019). "Geotechnical Engineering Study, Clifty Creek Plant Conveyor Tower Foundation, IKEC Power Plant, Madison, Indiana." Prepared for Whitney, Bailey, Cox, and Magnani, LLC, Baltimore, Maryland. May 10.

National Oceanic and Atmospheric Administration (NOAA) (2020). Ohio River at Clifty Creek. National Weather Service. Advanced Hydrologic Prediction Service. Ohio River Forecast Center. Accessed January 14. http://water.weather.gov/ahps2/hydrograph.php?gage=clfi3&wfo=lmk

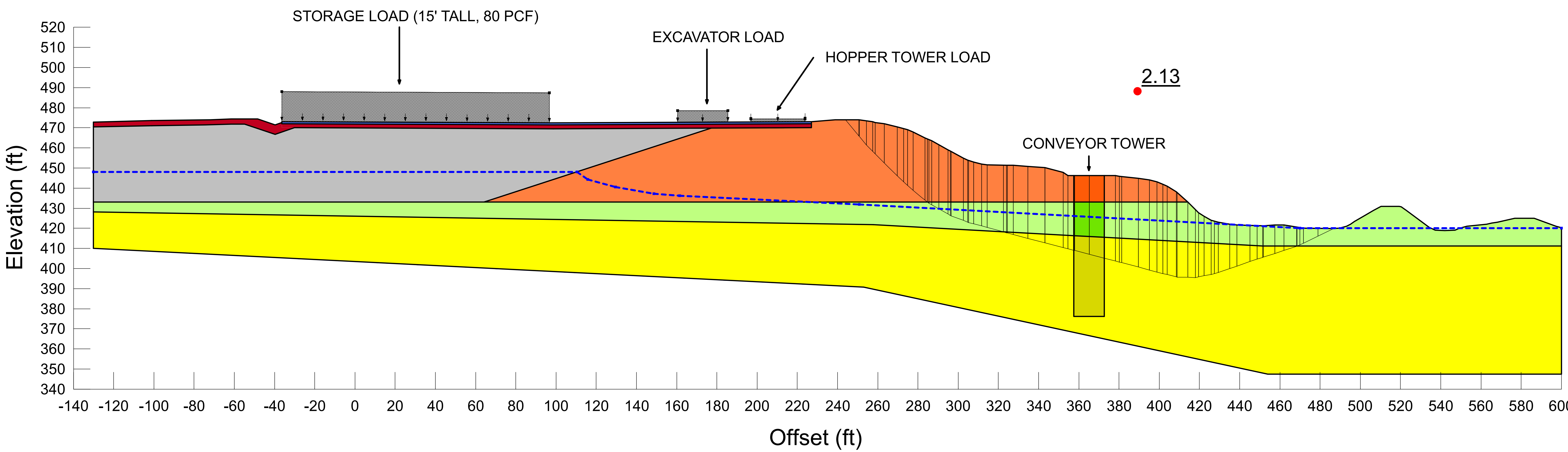
Stantec (2016). "Report of CCR Rule Stability Analyses, AEP Clifty Creek Power Plant, Boiler Slag Pond Dam and Landfill Runoff Collection Pond." Prepared for American Electric Power, Columbus, Ohio. February 16.

United States Geological Survey (USGS) (2020). Unified Hazard Tool. Earthquake Hazards Program. Latitude = 38.733157, Longitude = -85.427305. Accessed January 14. https://earthquake.usgs.gov/hazards/interactive/

Whitney, Bailey, Cox, and Magnani, LLC (WBCM) (2020). "Clifty Creek Temporary Barge Loading, Conveyor Truss Tower Pile Loads." January 13.

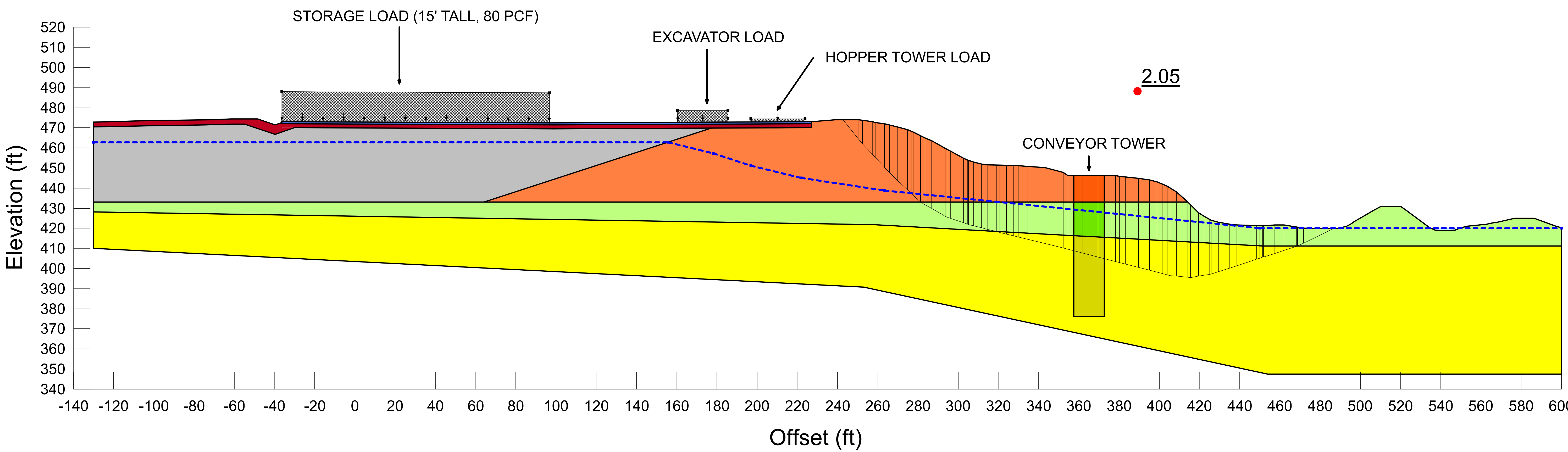
Clifty Creek Station	**Slope Stability Analysis – FS = 2.13**	Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.
West Boiler Slag Pond	L01_drained_normal_water Drained Static Stengths Headwater = 448.0 ft, Tailwater = 420.0 ft	
Barge Loading Station Cross Section (Including Towers)		

Material	Unit Weight (pcf)	***Drained Strength Parameters*** Phi (deg.)	Cohesion (psf)
Concrete (Drained)	150	33.2	165
Compacted Clay/Cover (Drained)	130	33.2	165
Boiler Slag (Drained)	115	28	0
Embankment (Drained)	130	33.2	165
Embankment Piles (Drained)	142	33.2	165
Lean Clay with Sand (Drained)	119	27.2	160
Lean Clay with Sand Piles (Drained)	131	27.2	160
Sandy Silt (Drained)	130	30	0
Sandy Silt Piles (Drained)	142	30	0



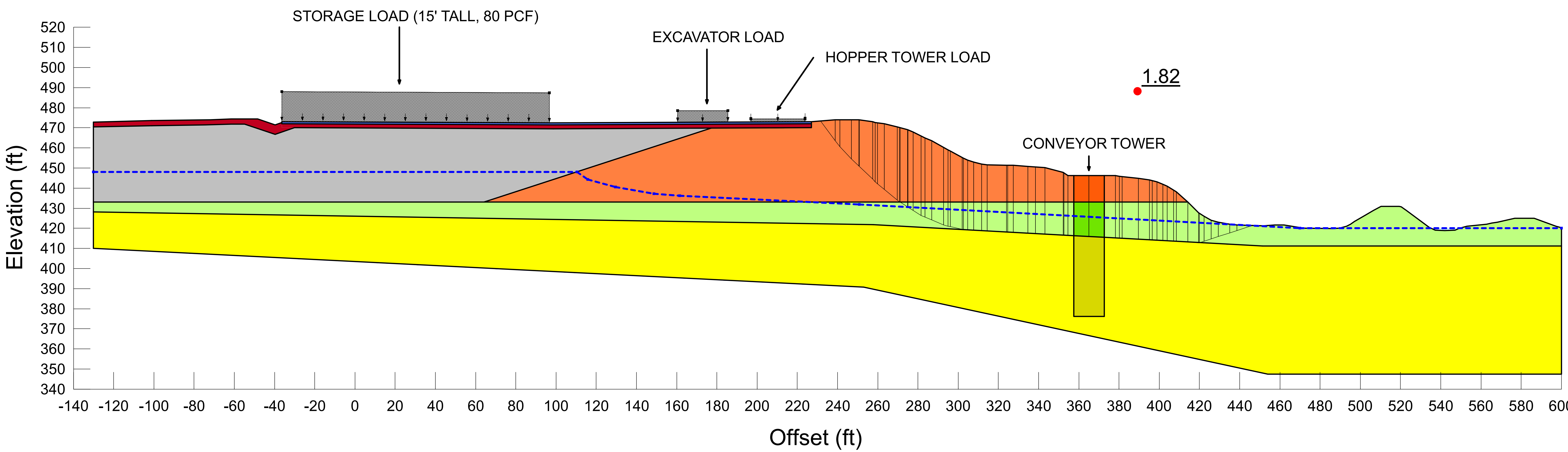
Clifty Creek Station	**Slope Stability Analysis – FS = 2.05**	Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.
West Boiler Slag Pond	L02_drained_high_water Drained Static Stengths Headwater = 462.8 ft, Tailwater = 420.0 ft	
Barge Loading Station Cross Section (Including Towers)		

Material	Unit Weight (pcf)	*Drained Strength Parameters* Phi (deg.)	Cohesion (psf)
Concrete (Drained)	150	33.2	165
Compacted Clay/Cover (Drained)	130	33.2	165
Boiler Slag (Drained)	115	28	0
Embankment (Drained)	130	33.2	165
Embankment Piles (Drained)	142	33.2	165
Lean Clay with Sand (Drained)	119	27.2	160
Lean Clay with Sand Piles (Drained)	131	27.2	160
Sandy Silt (Drained)	130	30	0
Sandy Silt Piles (Drained)	142	30	0



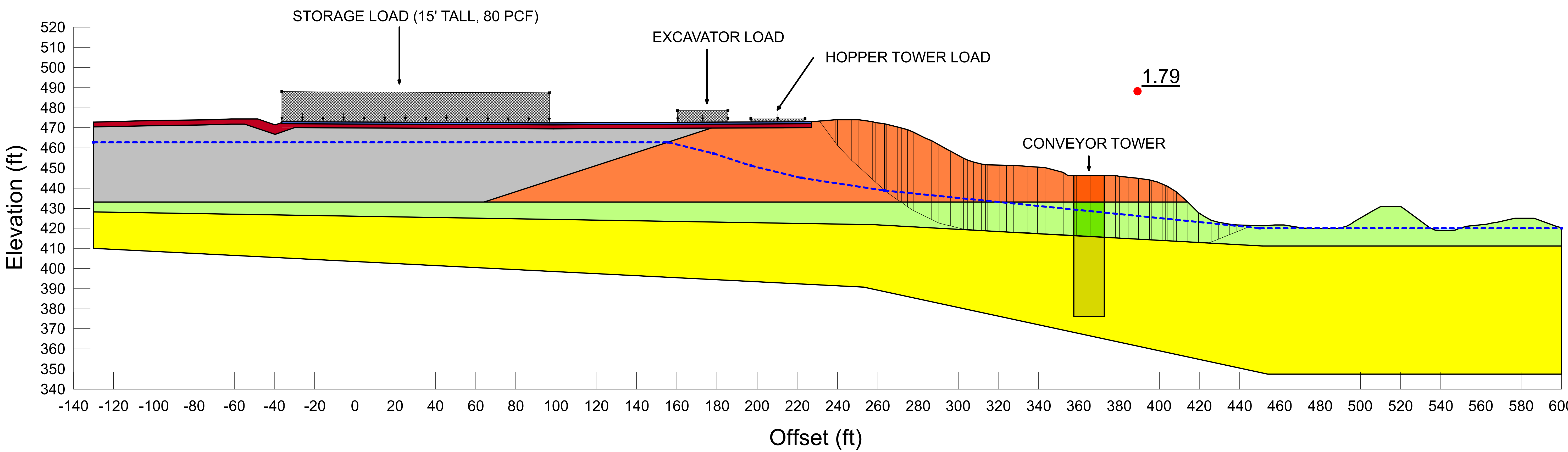
Clifty Creek Station	**Slope Stability Analysis – FS = 1.82**	Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.
West Boiler Slag Pond	L03_undrained_normal_water Undrained Static Stengths Headwater = 448.0 ft, Tailwater = 420.0 ft	
Barge Loading Station Cross Section (Including Towers)		

Material	Unit Weight (pcf)	***Drained Strength Parameters*** Phi (deg.)	Cohesion (psf)	***Undrained Strength Parameters*** Phi (deg.)	Cohesion (psf)
Concrete (Undrained)	150	33.2	165	13	600
Compacted Clay/Cover (Undrained)	130	33.2	165	13	600
Boiler Slag (Undrained)	115	28	0	28	0
Embankment (Undrained)	130	33.2	165	13	600
Embankment Piles (Undrained)	142	33.2	165	13	600
Lean Clay with Sand (Undrained)	119	27.2	160	5	1200
Lean Clay with Sand Piles (Undrained)	131	27.2	160	5	1200
Sandy Silt (Undrained)	130	30	0	30	0
Sandy Silt Piles (Undrained)	142	30	0	30	0



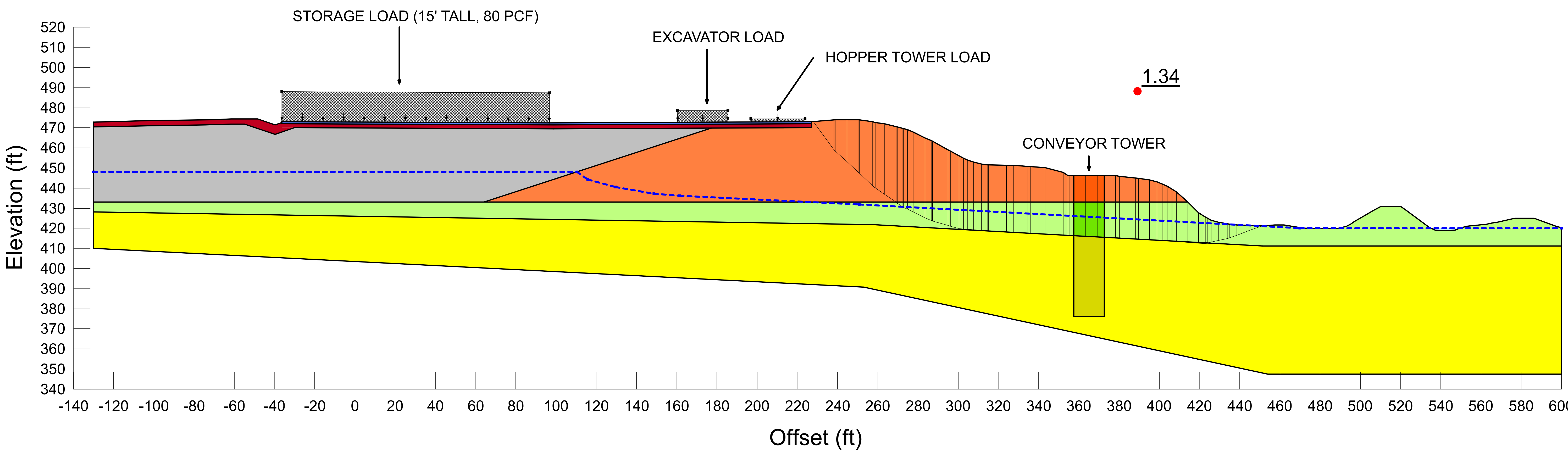
Clifty Creek Station	**Slope Stability Analysis – FS = 1.79**	Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.
West Boiler Slag Pond	L04_undrained_high_water Undrained Static Stengths Headwater = 462.8 ft, Tailwater = 420.0 ft	
Barge Loading Station Cross Section (Including Towers)		

Material	Unit Weight (pcf)	*Drained Strength Parameters* Phi (deg.)	Cohesion (psf)	*Undrained Strength Parameters* Phi (deg.)	Cohesion (psf)
Concrete (Undrained)	150	33.2	165	13	600
Compacted Clay/Cover (Undrained)	130	33.2	165	13	600
Boiler Slag (Undrained)	115	28	0	28	0
Embankment (Undrained)	130	33.2	165	13	600
Embankment Piles (Undrained)	142	33.2	165	13	600
Lean Clay with Sand (Undrained)	119	27.2	160	5	1200
Lean Clay with Sand Piles (Undrained)	131	27.2	160	5	1200
Sandy Silt (Undrained)	130	30	0	30	0
Sandy Silt Piles (Undrained)	142	30	0	30	0



Clifty Creek Station	**Slope Stability Analysis – FS = 1.34**	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.
West Boiler Slag Pond	L05_seismic_undrained_normal_water Undrained Seismic Stengths (Horizontal Acceleration = 0.0884) Headwater = 448.0 ft, Tailwater = 420.0 ft	
Barge Loading Station Cross Section (Including Towers)		

Material	Unit Weight (pcf)	***Drained Strength Parameters*** Phi (deg.)	Cohesion (psf)	***Seismic Undrained Strength Parameters*** Phi (deg.)	Cohesion (psf)
Concrete (Seismic Undrained)	150	33.2	165	13	600
Compacted Clay/Cover (Seismic Undrained)	130	33.2	165	13	600
Boiler Slag (Seismic Undrained)	115	28	0	28	0
Embankment (Seismic Undrained)	130	33.2	165	13	600
Embankment Piles (Seismic Undrained)	142	33.2	165	13	600
Lean Clay with Sand (Seismic Undrained)	119	27.2	160	5	1200
Lean Clay with Sand Piles (Seismic Undrained)	131	27.2	160	5	1200
Sandy Silt (Seismic Undrained)	130	30	0	30	0
Sandy Silt Piles (Seismic Undrained)	142	30	0	30	0



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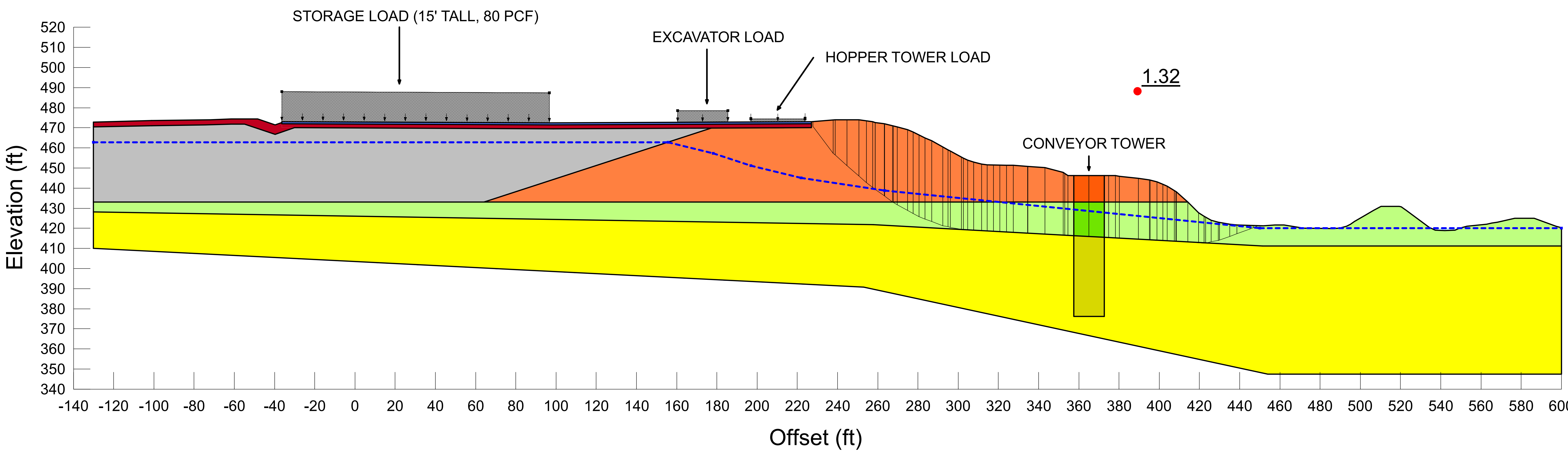
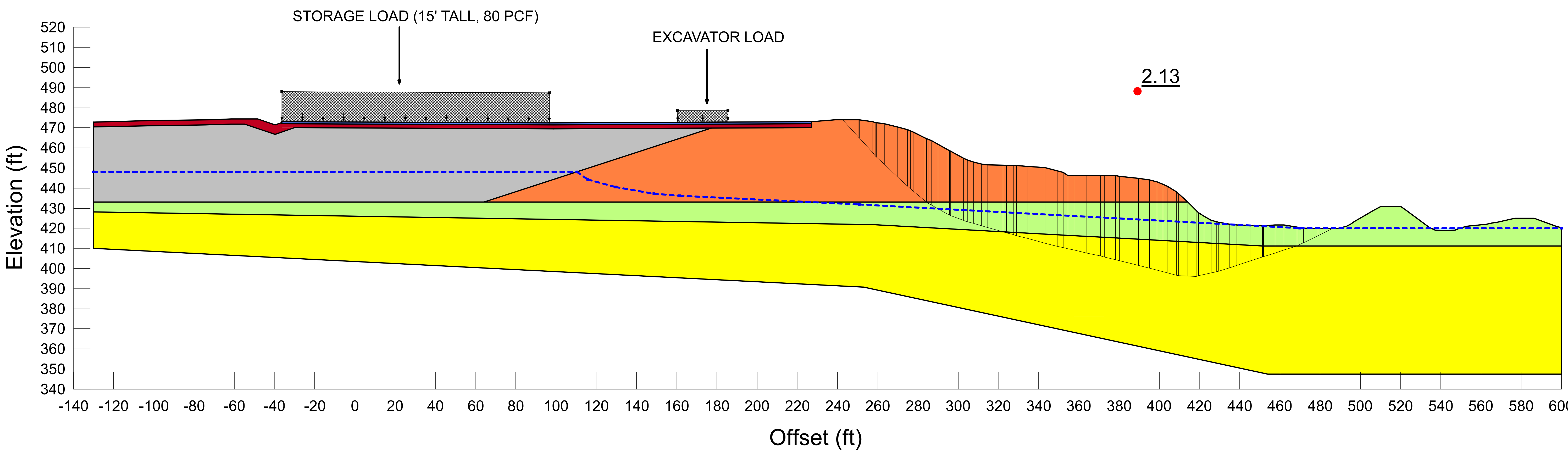
Clifty Creek Station	**Slope Stability Analysis – FS = 1.32**	Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.
West Boiler Slag Pond	L06_seismic_undrained_high_water Undrained Seismic Stengths (Horizontal Acceleration = 0.0884) Headwater = 462.8 ft, Tailwater = 420.0 ft	
Barge Loading Station Cross Section (Including Towers)		

Material	Unit Weight (pcf)	*Drained Strength Parameters* Phi (deg.)	Cohesion (psf)	*Seismic Undrained Strength Parameters* Phi (deg.)	Cohesion (psf)
Concrete (Seismic Undrained)	150	33.2	165	13	600
Compacted Clay/Cover (Seismic Undrained)	130	33.2	165	13	600
Boiler Slag (Seismic Undrained)	115	28	0	28	0
Embankment (Seismic Undrained)	130	33.2	165	13	600
Embankment Piles (Seismic Undrained)	142	33.2	165	13	600
Lean Clay with Sand (Seismic Undrained)	119	27.2	160	5	1200
Lean Clay with Sand Piles (Seismic Undrained)	131	27.2	160	5	1200
Sandy Silt (Seismic Undrained)	130	30	0	30	0
Sandy Silt Piles (Seismic Undrained)	142	30	0	30	0



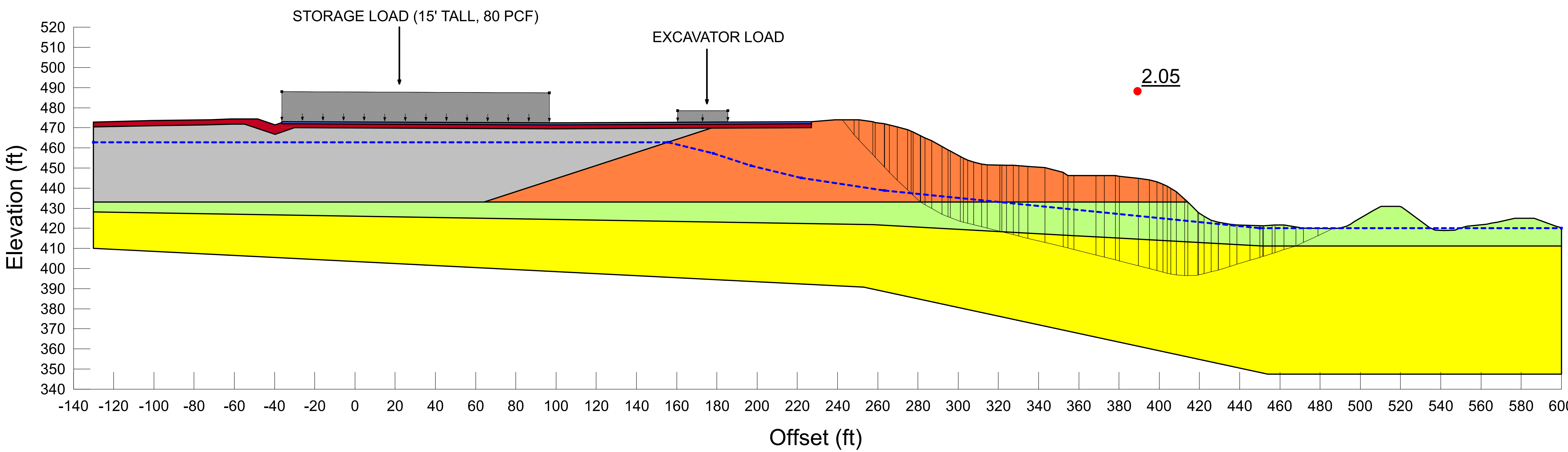
Clifty Creek Station	**Slope Stability Analysis – FS = 2.13**	Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.
West Boiler Slag Pond	L01_drained_normal_water Drained Static Stengths Headwater = 448.0 ft, Tailwater = 420.0 ft	
Barge Loading Station Cross Section (Not Including Towers)		

Material	Unit Weight (pcf)	*Drained Strength Parameters* Phi (deg.)	Cohesion (psf)
Concrete (Drained)	150	33.2	165
Compacted Clay/Cover (Drained)	130	33.2	165
Boiler Slag (Drained)	115	28	0
Embankment (Drained)	130	33.2	165
Lean Clay with Sand (Drained)	119	27.2	160
Sandy Silt (Drained)	130	30	0



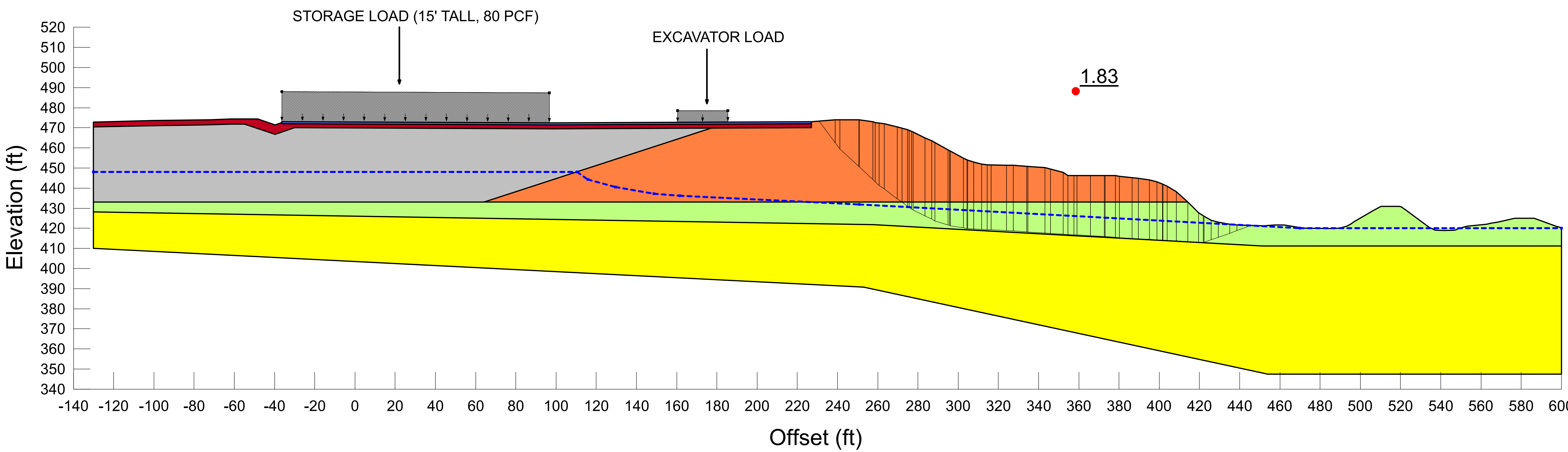
Clifty Creek Station	**Slope Stability Analysis – FS = 2.05**	Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.
West Boiler Slag Pond	L02_drained_high_water Drained Static Stengths Headwater = 462.8 ft, Tailwater = 420.0 ft	
Barge Loading Station Cross Section (Not Including Towers)		

Material	Unit Weight (pcf)	Phi (deg.)	Cohesion (psf)
		Drained Strength Parameters	
Concrete (Drained)	150	33.2	165
Compacted Clay/Cover (Drained)	130	33.2	165
Boiler Slag (Drained)	115	28	0
Embankment (Drained)	130	33.2	165
Lean Clay with Sand (Drained)	119	27.2	160
Sandy Silt (Drained)	130	30	0



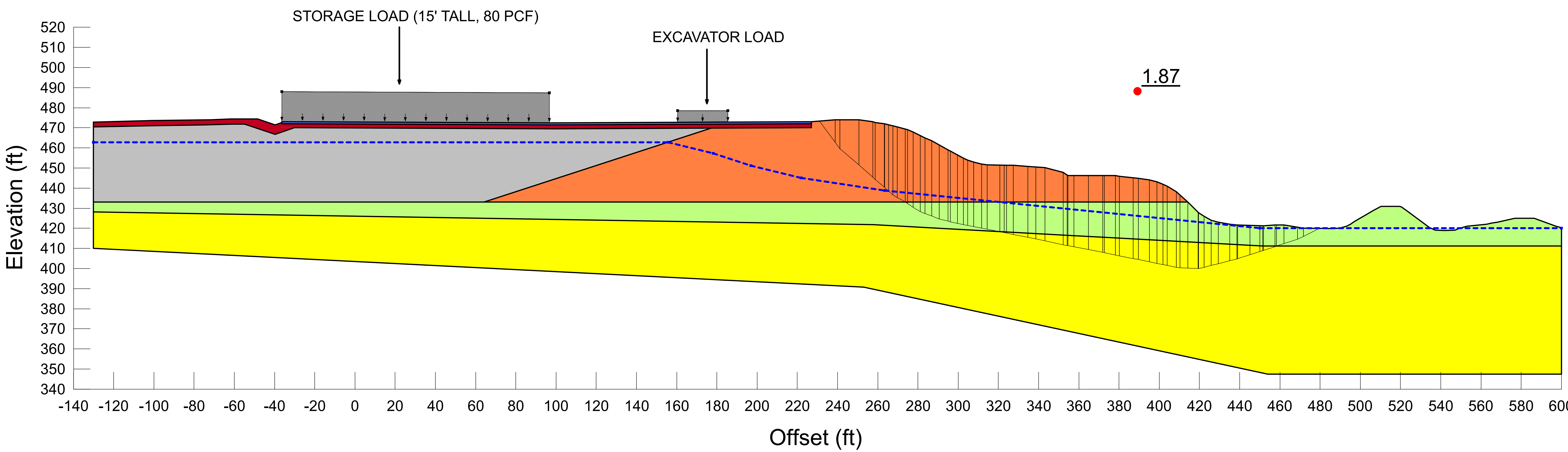
Clifty Creek Station	**Slope Stability Analysis – FS = 1.83**	Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.
West Boiler Slag Pond	L03_undrained_normal_water Undrained Static Stengths Headwater = 448.0 ft, Tailwater = 420.0 ft	
Barge Loading Station Cross Section (Not Including Towers)		

Material	Unit Weight (pcf)	*Drained Strength Parameters* Phi (deg.)	Cohesion (psf)	*Undrained Strength Parameters* Phi (deg.)	Cohesion (psf)
Concrete (Undrained)	150	33.2	165	13	600
Compacted Clay/Cover (Undrained)	130	33.2	165	13	600
Boiler Slag (Undrained)	115	28	0	28	0
Embankment (Undrained)	130	33.2	165	13	600
Lean Clay with Sand (Undrained)	119	27.2	160	5	1200
Sandy Silt (Undrained)	130	30	0	30	0



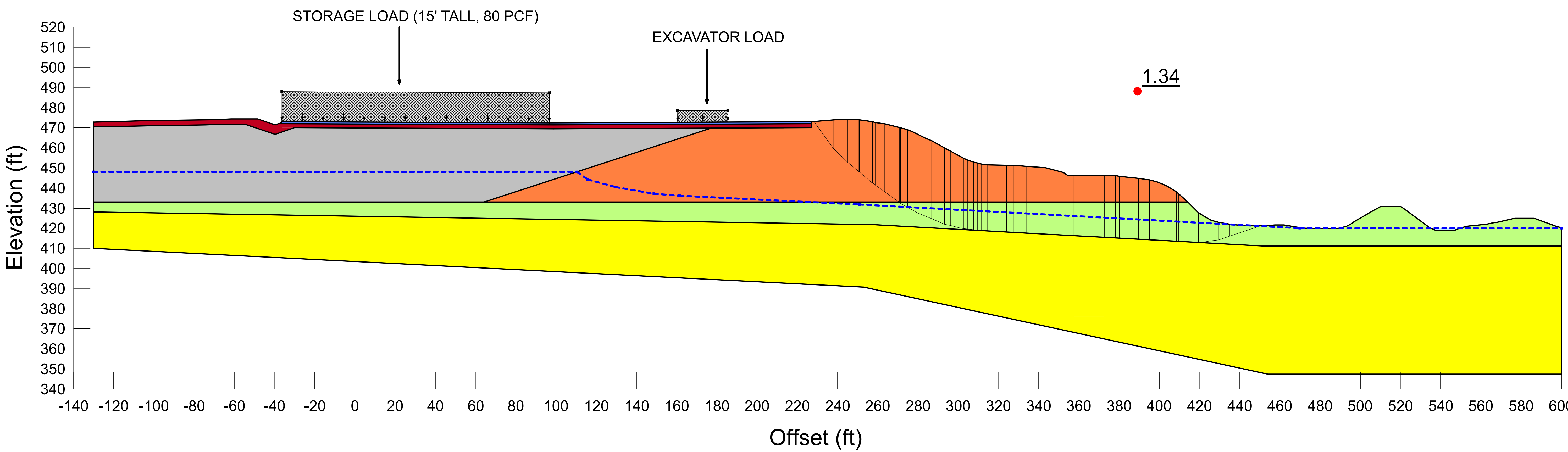
Clifty Creek Station	**Slope Stability Analysis – FS = 1.87**	Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.
West Boiler Slag Pond	L04_undrained_high_water Undrained Static Stengths Headwater = 462.8 ft, Tailwater = 420.0 ft	
Barge Loading Station Cross Section (Not Including Towers)		

Material	Unit Weight (pcf)	*Drained Strength Parameters* Phi (deg.)	Cohesion (psf)	*Undrained Strength Parameters* Phi (deg.)	Cohesion (psf)
Concrete (Undrained)	150	33.2	165	13	600
Compacted Clay/Cover (Undrained)	130	33.2	165	13	600
Boiler Slag (Undrained)	115	28	0	28	0
Embankment (Undrained)	130	33.2	165	13	600
Lean Clay with Sand (Undrained)	119	27.2	160	5	1200
Sandy Silt (Undrained)	130	30	0	30	0



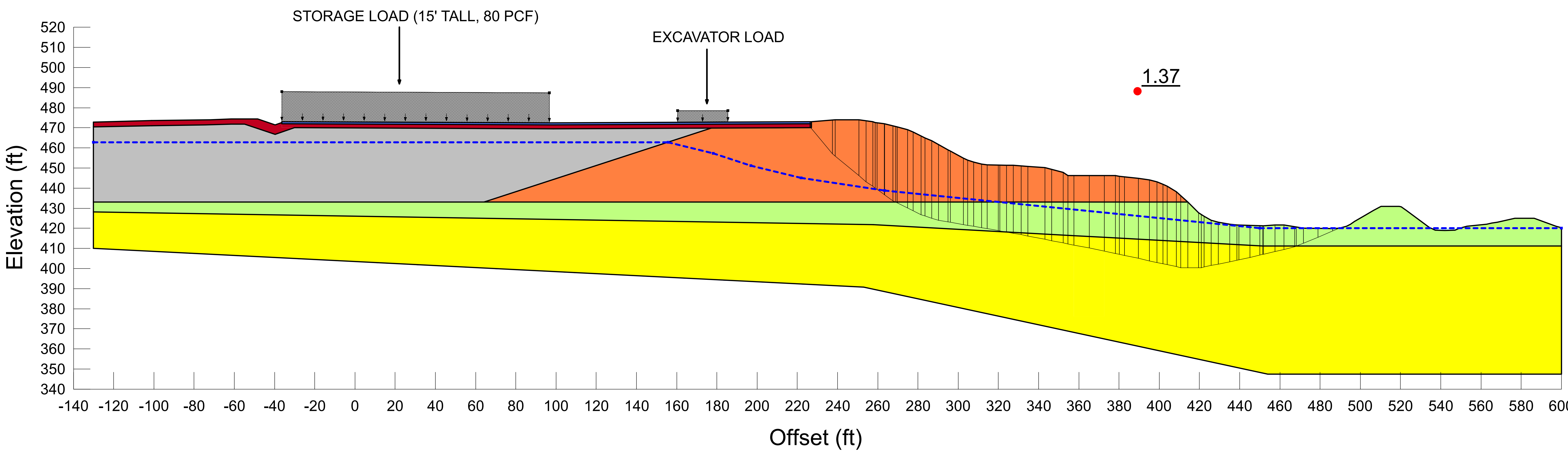
Clifty Creek Station	**Slope Stability Analysis – FS = 1.34**	Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.
West Boiler Slag Pond	L05_seismic_undrained_normal_water Undrained Seismic Stengths (Horizontal Acceleration = 0.0884) Headwater = 448.0 ft, Tailwater = 420.0 ft	
Barge Loading Station Cross Section (Not Including Towers)		

Material	Unit Weight (pcf)	*Drained Strength Parameters* Phi (deg.)	Cohesion (psf)	*Seismic Undrained Strength Parameters* Phi (deg.)	Cohesion (psf)
Concrete (Seismic Undrained)	150	33.2	165	13	600
Compacted Clay/Cover (Seismic Undrained)	130	33.2	165	13	600
Boiler Slag (Seismic Undrained)	115	28	0	28	0
Embankment (Seismic Undrained)	130	33.2	165	13	600
Lean Clay with Sand (Seismic Undrained)	119	27.2	160	5	1200
Sandy Silt (Seismic Undrained)	130	30	0	30	0



Clifty Creek Station	**Slope Stability Analysis – FS = 1.37**	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.
West Boiler Slag Pond	L06_seismic_undrained_high_water Undrained Seismic Stengths (Horizontal Acceleration = 0.0884) Headwater = 462.8 ft, Tailwater = 420.0 ft	
Barge Loading Station Cross Section (Not Including Towers)		

Material	Unit Weight (pcf)	*Drained Strength Parameters* Phi (deg.)	Cohesion (psf)	*Seismic Undrained Strength Parameters* Phi (deg.)	Cohesion (psf)
Concrete (Seismic Undrained)	150	33.2	165	13	600
Compacted Clay/Cover (Seismic Undrained)	130	33.2	165	13	600
Boiler Slag (Seismic Undrained)	115	28	0	28	0
Embankment (Seismic Undrained)	130	33.2	165	13	600
Lean Clay with Sand (Seismic Undrained)	119	27.2	160	5	1200
Sandy Silt (Seismic Undrained)	130	30	0	30	0



APPENDIX J

CQA Plan (DRAFT)

Construction Quality Control/Quality Assurance Plan (Draft)
West Boiler Slag Pond
(Type I Restricted Waste Landfill)
Clifty Creek Power Plant
Madison, Jefferson County, Indiana

1. Purpose and Scope

This document is a site-specific construction quality control/quality assurance (CQC/CQA) plan that addresses the construction of the structural fill, flexible membrane liner, drainage geocomposite, coal combustion residuals (CCR) placement, soil cover, geotextiles, drainage control structures, erosion and sediment control, and instrumentation for the proposed facility.

This plan defines acceptable construction materials, authority of the Owner as well as the responsibilities of designated quality control/quality assurance (QC/QA) personnel. The plan should be considered to represent the minimum CQC/CQA requirements.

2. Responsibility and Authority

A tabulation summarizing personnel responsibilities and related QC/QA activities is presented as Appendix A of this attachment.

2.1. Permitting Agency

The West Boiler Slag Pond (WBSP) will be closed as a Type I Restricted Waste Landfill under a permit issued by the Indiana Department of Environmental Management (IDEM).

2.2. Quality Control Manager and Testing Laboratory

A qualified, licensed professional engineer in Indiana designated as the quality control manager (QC Manager) will be responsible for management of construction monitoring, testing, and preparation of related documentation as outlined herein. The quality control team (QC Team) shall include qualified personnel working under the direct supervision of the QC Manager. QC Team personnel should be familiar with the CCR stream process, the proper CCR placement protocols as well as the functional intent of the respective design components. The QC Manager shall designate appropriate test standards and methods for the QC testing designated herein or as outlined in project requirements. The QC Manager shall be responsible for review of all QC data for conformance with project requirements, collection of documentation, generation of QC related reports, and communications with contractors, engineering consultants, regulatory authorities and Owner representatives.

2.3. Owner

The Owner is Indiana-Kentucky Electric Corporation (IKEC). The Owner shall be responsible for overall management of operations, including construction administration, contracting, waste disposal, and retaining the services of qualified engineering consultants as required during the life of the facility. The Owner will approve all design revisions and administer related permit modifications. The Owner shall designate one representative to serve as the Construction Manager. The Construction Manager may be an employee of the Owner or an independent contractor.

3. Quality Control Activities

3.1. Project Meetings

During liner and geosynthetics construction, project meetings shall be arranged by the Construction Manager. The primary purpose of these project meetings will be to verify that all parties involved with construction operations are familiar with the design, construction procedures, associated QC and QA requirements, as well as safety issues. Project safety issues will be the responsibility of designated safety professionals.

A CQA/CQC preconstruction meeting will be held prior to construction operations. The Owner, Construction Manager, QC Manager, IDEM, and the primary contractor will be in attendance. The IDEM permit manager will be notified 10 working days prior to the preconstruction meeting.

3.2. Modifications

General construction and QA modifications may be executed following approval of the Owner and the QC Manager. Proposed modifications shall be developed by the QC Manager and submitted to the Owner for review and comment, and to IDEM for approval of proposed modifications prior to incorporation into the closure design. Documentation of project modifications shall be submitted to IDEM following each phase of construction for inclusion within their project records.

3.3. Contractor Submittals

Contractor submittals will be reviewed and approved by the QC Team prior to delivery and/or use of the respective construction materials. Submittals include manufacturer data and certifications that supplied materials meet or exceed project specifications, material samples, pre-qualification test results, and construction work plans. Minimum required submittals are outlined within this plan.

3.4. Conformance Testing

Conformance testing consists of periodic testing of materials or construction products to verify conformance with project requirements. Conformance testing will be conducted by the QC Team as required by this plan and/or at the direction of the QC Manager. A tabulation of the project conformance testing schedule, including minimum test frequencies is presented as Appendix B to this attachment.

3.5. Field Observations and Testing

Construction related field observations, testing and related documentation will be performed by the QC Team in accordance with the requirements provided in this plan.

CCR processing management and oversight of related CQA/CQC protocols will be the responsibility of the Construction Manager. In addition, the Construction Manager 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.

3.6. IDEM Record Keeping and Reporting Requirements

3.6.1. Documentation

Complete CQA/CQC documentation shall be maintained and organized by the QC Manager and Construction Manager during each phase of liner and final cover construction. The documentation should include the items outlined within this plan in addition to the following items:

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

IDEM will be notified of variances or changes from the sampling program and tests analyses presented in this attachment.

3.6.2. Construction Reports

At the completion of each phase and/or cell units of construction, the QC Manager and Construction Manager shall prepare and submit to IDEM a construction progress report which documents construction procedures, observations, and tests performed.

4. Structural Fill

4.1. General

Structural fill refers to all CCRs placed to achieve liner system subgrade elevations as shown on the approved permit drawings or as directed by the Construction Manager.

Structural fill shall meet the following requirements:

1. Be constructed with CCRs (fly ash, boiler slag or gypsum), soil, or rock that are free of organic or other deleterious materials.

   - CCRs may be obtained from plant operations or excavated from on-site ponds or landfills.

   - Rock used as structural fill shall contain no particles greater than 12-inches in any dimension.

   - Soil and rock may be obtained from on-site excavations or off-site borrow sources.

2. Be placed in approximate horizontal lifts and compacted as follows:

   - The initial lift of CCRs or soil shall be of a sufficient thickness to create a stable working platform over the existing ash pond surface. The thickness of the bridging lift shall be kept to a minimum and shall not exceed three feet unless otherwise approved by the QC Manager. Remaining lifts of CCRs or soil shall be placed in eight-inch loose lifts.

   - Material shall be compacted to at least 95 percent of standard Proctor density as determined by ASTM D 698. Moisture control shall be as necessary to facilitate compaction and dust control. Compaction equipment shall consist of tamping foot, sheepsfoot, steel drum or pneumatic tire rollers as appropriate for the material being placed or as specified by the QC Manager.

   - Rock shall be placed in placed in maximum 12-inch loose lifts and compacted with at least three passes of a vibratory tamping foot roller.

4.2. Structural Fill CQA/CQC

The QC Manager or QC Team personnel shall:

1. Verify the surface on which structural fill is to be placed has been stripped and is free of organic, vegetative and deleterious materials; soft areas have been stabilized; and proof rolling has been performed.

2. Coordinate sampling and testing of borrow soils and CCRs proposed for use as structural fill. Minimum testing requirements are presented in Appendix B.

3. Monitor fill placements and compaction operations to:

   - Document that fill is placed in uniform lifts as required by this plan;

   - Document compaction and moisture content are as required by this plan. Frequency of testing is presented in Appendix B of this attachment.

5. Flexible Membrane Liner

5.1. General

The flexible membrane liner (FML) system will consist of a 40-mil thick PVC or a 40-mil thick LLDPE membrane with material properties defined in Appendix B of this attachment.

5.2. Storage and Deployment

Liner materials shall be unloaded and stored in accordance with manufacturer recommendations. The contractor shall generate a material inventory log during unloading of material shipments to the project site.

A conceptual panel layout shall be developed by the QC Manager. Panels should be deployed with the longer side panel seams oriented generally parallel to the principle slope direction. Panel layout and deployed conditions should minimize the number of end seams located along perimeter slopes. End panel seams shall be positioned a minimum of twenty (20) feet beyond the perimeter berm slope intersection with interior pond floor grades.

Deployed membrane shall be provided with sufficient slack in material not to generate pre-stress conditions. Excessive pre-stress is typically indicated by tension on the liner during cooler ambient periods.

Deployed panels shall be temporarily anchored in accordance with manufacturer recommendations and the anchoring methodology shall account for prevailing as well as inclement weather conditions.

5.3. Placement

Prior to the placement of FML over the graded CCR/structural layer, the finished surface of the structural fill shall be rolled with a smooth drum roller and the surface approved by the QC Manager. Installation and placement of FML panels shall be in accordance with Manufacturer recommendations and the liner specifications.

5.4. Seaming

Roll goods deployed in the field are referred to as panels. Panels will be seamed to form continuous lined areas. Production seaming methodology and equipment shall be conducive to the following:

- Digital welding temperature monitoring,
- Forming uniform bonds by applying constant heat and pressure to the seam area,
- Controlling liner surface tension,
- Providing uniform dry, and clean seaming surfaces, and
- Providing adequate and consistent overlap between adjacent panels.

Production seaming shall be accomplished through dual wedge fusion seaming methods or adhesive bonding. Dual wedge welding or seaming shall provide a continuous air channel between two (dual) seams. All production seaming, repairs, patches, and capped areas shall be tested through non-destructive methods for 100% of seam length.

When applicable, fillet extrusion welding shall be performed on repairs, pipe boots connections, and in general, any area where dual wedge fusion welding is not practical. All extrusion welds shall be continuously tested using a vacuum box or other approved non-destructive test method.

All patched areas shall have a minimum dimension of 6-inches and provide minimum 1-inch radius at corners. When applicable, all extrusion weld zones shall be cleaned and ground in accordance with manufacturer recommendations prior to initiating welding.

Panel corner intersections and “T-Joints” shall be capped and non-destructively tested.

5.4.1. Trial Seams

Trial seams shall be performed on maximum four work hour intervals. Trial seams consist of seaming runs performed under the same conditions and by the same personnel that will be executing the production seaming. All trial seams shall be tested in the field following manufacturer recommendations prior to approval of the respective seaming device and seamer for that work shift. Test seams failing to meet prior requirements shall result in the subject apparatus being tagged appropriately and not used for production seaming until satisfactory test seams are demonstrated.

5.4.2. Destructive Seam Testing

Destructive samples of production seaming shall be obtained on maximum intervals of one sample per 500 linear feet of seam. Destructive samples are cut directly from the seamed panels. Destructive samples shall be tested to verify seam conformance to project requirements. All destructive sampling points shall be repaired in accordance with project requirements and repairs shall be non-destructively tested.

5.5. FML CQA/CQC Requirements

The QC Manager shall record daily observations relative to the condition of FML rolls delivered to the site, FML panel sampling locations, FML seam and repair operations, and general FML placement operations. These observations shall be compiled with the project records.

Laboratory quality control testing of the FML will include destructive and non-destructive tests of samples in accordance with the bottom liner specifications and manufacturer recommendations. The frequency of FML sampling/testing shall be as shown in the testing schedule or stated in the bottom liner specifications.

5.6. Protection

The deployed FML shall be protected from damage during landfill construction and general operations. Under no condition shall vehicles or heavy equipment traverse lined areas without the appropriate minimum thickness of soil cover.

6. Geocomposite Drainage System

6.1. General

Overlying the flexible membrane liner (FML) will be the geocomposite drainage layer.

6.2. Geocomposite Installation

1. Geocomposite shall be deployed as the drainage layer over the FML on all slopes or as directed by the QC Manager.

2. Geocomposite shall consist of a geonet meeting the requirements of Appendix B with a non-woven geotextile on both sides. The geotextile shall meet the requirements of Section 9 of this plan.

3. Storage and handling shall conform to the manufacturer's recommendations.

4. Panels shall be oriented parallel to the slope. Successive panels shall be overlapped a minimum of four inches in the direction of flow and shall be secured by using self locking ties. Geotextile coverings shall be "shingled" in the direction of flow at all joints.

5. In the corners of sided slopes, where overlaps between rolls are staggered, an additional layer of geocomposite shall be installed from the top to the bottom of the slope.

6. Geocomposite shall be covered with a minimum of two feet of final cover soil within 15 days of deployment.

6.3. Geocomposite Drainage System CQA/CQC Requirements

1. Prior to delivery, manufacturer and supplier certifications shall be submitted to the QC Manager indicating that all materials meet, or exceed, the minimum properties established in this section. Certifications shall be accompanied by supporting quality assurance and quality control testing.

2. Conformance testing of geocomposite shall be performed in accordance with the schedule and procedures identified in Appendix B and every time a change in source(s) occurs.

3. Pipe suppliers, geotextile manufacturers, and geocomposite manufacturers shall submit certified material specification, delivery tickets and QC documentation to show that the supplied material meets the project requirements.

4. Construction monitoring and field acceptance of geocomposite deployment shall be documented by the QC Manager or QC Team representative.

7. Coal Combustion Residuals

7.1. General

The design disposal material stream consists of CCRs, which include synthetic gypsum, bottom ash, boiler slag, and fly ash materials. These materials will be obtained directly from plant operations or excavated from on-site disposal ponds or landfills. CCR materials will be comingled during closure operations.

7.2. Placement and Compaction

1. CCR transport within the limits of the pond phase shall be performed in accordance with methodologies approved by the QC Manager. A minimum FML cover thickness of six feet shall be maintained along all ground transport routes.

2. Following approval of each area by the QC Manager, CCR shall be dumped and bladed in place in maximum 12-inch loose lifts. Lifts shall be oriented roughly horizontal.

3. Frozen materials shall not be placed.

4. CCR shall be initially compacted by at least three passes of a steel drum or pneumatic tire roller, or other approved compaction methodology. The minimum operating weight of the compactor shall be 25,000 pounds and the vibratory system, if provided, shall provide a low amplitude centrifugal force of 50,000 pounds. Modifications to the compaction methodology shall be developed by the QC Manager based on field observations and testing.

5. Moisture of the CCR shall be as necessary to facilitate compaction and control dusting.

6. The sequence of filling shall maintain positive drainage at all times. The fill sequence shall be performed in a manner that reduces the potential for uncontrolled sediment runoff and adequately controls runoff from CCR disposal areas.

7.3. CCR CQA/CQC Requirements

1. CCR placement and compaction methods may be evaluated through the construction of conformance test pads on site to further refine lift thickness and necessary compactive effort.

2. Construction Manager shall document materials being placed, compactive effort applied, and observations relative to embankment performance. Field conformance testing including periodic in-place density testing may be performed to further document compaction.

8. Soil Cover

8.1. General

1. The final cover as shown on the drawings shall consist of soils that classify as CH, CL, MH, ML, CL-ML, SC or SM-SC according to the Unified Soil Classification System. The material shall not contain rock fragments with the largest dimension exceeding three inches. Soil may be obtained from on-site excavations or off-site borrow sources.

2. Final cover shall be placed in approximately eight-inch loose lifts and compacted to at least 92% of standard Proctor as determined by ASTM D 698.

3. Moisture shall be as necessary to facilitate compaction and control dusting.

4. The upper six-inch zone of the cover system shall consist of topsoil or soil capable of sustaining vegetation. Topsoil should be tracked in place with dozer equipment. Dozer tracks should be perpendicular to the final slope.

8.2. Soil Cover CQA/CQC Requirements

1. Conformance testing schedule and procedures for soil cover are provided in Appendix B.

2. No soil may be placed as final cover until approved by the QC Manager.

3. A QC Team representative shall observe and document placement of soil cover.

9. Geotextile

9.1. General

1. Geotextile fabric applications for the project include filtration between the final cover soil and the FML, separation of the coarse aggregates from the soil subgrade along perimeter access roadways, filtration applications beneath designated riprap lined drainage ditches, FML cushion as part of the final cover system.

2. Geotextile shall be polyester or polypropylene fabric meeting the minimum requirements in Appendix B.

3. Geotextile shall be protected from direct sunlight, ultraviolet rays, temperature greater that 140 degrees Fahrenheit, mud, dirt, dust and debris. During storage, geotextile shall be wrapped in a heavy-duty protective covering.

4. Installation shall be in accordance with manufacturer's recommendations.

5. Surfaces to receive geotextile shall be prepared to a relatively smooth condition, free of obstructions, depressions, and debris.

6. Geotextile shall be placed with the long dimension parallel with the centerline of ditch and road, and/or parallel to embankment slopes, as applicable. Geotextile shall be laid smooth, and free of tension, stress, folds, wrinkles, or creases.

7. On slopes 4H:1V and greater, adjacent strips of geotextile or reinforcing fabric shall be joined by stitching together continuously. All stitched seam strengths shall be greater than 90 percent of the grab tensile strength of the geotextile as determined by ASTM D 1682.

8. On slopes less than 4H:1V overlapping in the slope direction may be used. Overlaps shall be a minimum of two feet.

9. Geotextile shall be covered with soil or other materials within 15 days of deployment.

9.2. Geotextile CQA/CQC Requirements

1. Prior to delivery, manufacturer certifications shall be submitted to the QC Manager indicating that all materials meet, or exceed, the minimum properties established in the section. Certifications shall be accompanied by supporting quality assurance and quality control testing.

2. Conformance testing schedule and procedures are provided in Appendix B.

3. The QC Team shall monitor geotextile deployment and covering operations to document that these activities were conducted in accordance with project requirements and manufacturer recommendations for the subject application as well as industry practice.

10. Concrete Structures

10.1. General

1. Pre-cast concrete structures and related components shall meet the requirements of applicable sections of "Standard Specifications", Indiana Department of Transportation, current edition. Modifications to these standards as required on the project shall be included within shop drawings submitted to the QC Manager for review and approval.

10.2. Concrete Structure CQA/CQC Requirements

1. Material submittals and shop drawings shall be reviewed and approved by the QC Manager prior to delivery.

2. A QC Team representative shall observe all precast structures upon delivery. Any structures showing signs of shipment damage or non-conformance to design or project specifications shall be replaced.

3. The QC Team shall observe and document the subgrade and backfill methods for drainage structures.

11. Erosion and Sediment Control

Basic sediment and erosion control structures are presented on the permit drawings for the project. The Construction Manager shall periodically observe these structures as well as overall site drainage conditions. Appropriate adjustments to site drainage and related sediment control structures shall be made as necessary based on current site conditions during facility construction and operations.

Observations relative to sedimentation control, maintenance, and modifications shall be documented within project records by the QC Manager.

12. Instrumentation

12.1. General

The proposed field instrumentation consists of a system of piezometers installed post construction. This section of the CQA/CQC plan provides the minimum system testing requirements.

1. The Owner shall develop a quality control system that documents each test, calibration, and installation activity. Each instrument shall have a QC document, consisting of a single form or booklet, which documents any and all activities performed on the instrument. The form shall, at a minimum, contain:

    a. instrument type, model number, and project instrument number;

    b. manufacturer's name and serial number;

    c. date tested and calibrated by the manufacturer (with the manufacturer's test form and certifications of test equipment attached);

    d. date received at the project site and person who received the instrument;

    e. verification of no apparent damage in shipping;

    f. verification of the proper lead wire type and length (if applicable);

    g. date of pre-installation testing;

    h. measurements made during the pre-installation testing;

    i. signatures of the person that performed the pre-installation testing and the QC Team representative monitoring pre-installation testing; and

    j. description of any deficiencies and any action taken to address the deficiencies.

2. When the instrument is installed, this form, shall follow the instrument into the field and be updated to show:

    a. date and time of installation;

b. conditions encountered during the installation;

c. results of testing conducted during installation;

d. signature of person in charge of the installation and testing; and

e. as-built instrument location.

3. When lead wires for vibrating wire instruments are connected to the terminal box, the form shall be updated to reflect the date and time of the connection, the manual read value prior to the connection, and the signature of the person recording the values. Following each activity, a copy of the form shall be submitted to the Owner.

4. After installations are completed, an operation and maintenance report shall be prepared. This report will document operation and maintenance activities, including malfunctions, damages, replacements, etc. Manufacturer instructions and schedules will be provided for the testing, maintenance and monitoring of each sensor and data logger. The report shall be cumulative to include all records to date.

12.2. Instrumentation CQA/CQC Requirements

Prior to and during instrumentation installation, the QC Manager or a QC Team representative shall:

1. Review complete and up to date Quality Control Documents for each instrument installed and operating.

2. Review instrument readings as landfill construction progresses.

13. Seeding and Mulching

13.1. General

Seeding and mulching activities include preparing the seedbed, fertilizing, seeding and mulching vegetative cover soils of the landfill, as well as other areas disturbed due to construction and operation of the landfill facility.

Seeding and mulching activities will be performed on surfaces that have achieved final grade per approved permit plans. Vegetation will begin as soon as practicable. The upper six inches of the final cover will consist of topsoil or soil capable of sustaining vegetation. Topsoil will be spread over the area to be seeded prior to the application of seed and soil amendments. Seed, mulch, and mulch anchoring methods will be in accordance the Indiana Department of Transportation “Standard Specifications”, current edition. Fertilizer and lime application rates will be in accordance with local Natural Resources Conservation Service (NRCS) recommendations. Throughout the construction, operation, and post-closure care period of the landfill facility, seeded and vegetated areas will be maintained, and damage will be repaired.

13.2. Seeding and Mulching CQA/CQC Requirements

Prior to seeding and mulching operations, the QC Manager shall:

1. Review fertilizer/lime application rate testing in accordance with the local NRCS recommendations. Testing laboratories will be approved by the QC Manager. Testing will be performed once per year for each borrow source or visual change in material.

2. Observe seedbed preparation, fertilizer and lime application, seeding and mulching activities to confirm appropriate vegetation procedures per the project requirements. Appropriate personnel will perform necessary maintenance.

Attachment 21
Appendix A

Clifty Creek West Boiler Slag Pond Quality Control Task Summary(1) - DRAFT			
Task	**Responsible Personnel(4)**	**Task Description/Itemization**	**Minimum Frequency/ Notes(2)**
A. General Site and Construction Tasks			
QC Testing	QC Manager	-Designate appropriate test standards and methods to maintain quality standards outlined in the Technical Specifications.	As needed
		-Review all QC data for conformance with project standards and specifications.	As needed
		-Collection and maintenance of all QC documentation.	As needed
		-Generation of all QC-related reports.	As needed
		-Notify the IDEM Contact of designated construction events.	As needed
Project Meetings	Construction Manager	-Organize meetings as necessary to ensure construction related personnel are familiar with design, construction procedures, and QA/QC requirements.	As needed
Contractor Submittals	QC Manager (QC Team)	-Approval of contractor submittals a minimum of 10 days before materials arrive on site.	As needed
Site Inspections	Construction Manager	-Site observations of outslopes for indications of slope failure and/or instability.	monthly
B. Structural Fill/Subgrade			
Subgrade Inspection	QC Manager	-Verify exposed subgrade inspections per current QC Plan occur.	As needed
Subgrade Elevations	QC Manager	-Confirm proper subgrade elevations prior to placement of liner.	As needed
Subgrade / Structural Fill density & moisture content testing	QC Manager	-Confirm that minimum number of subgrade and structural fill density and moisture content tests are performed per testing schedule. Confirm proofroll in applicable areas.	As needed
Borrow Materials	QC Manager	-Confirm minimum number of conformance tests performed on borrow material.	As needed
		-Coordinate borrow conformance sampling with contractor.	

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Appendix A

Clifty Creek West Boiler Slag Pond Quality Control Task Summary[1] - DRAFT			
Task	**Responsible Personnel[4]**	**Task Description/Itemization**	**Minimum Frequency/ Notes[2]**
C. Flexible Membrane Liner (FML)			
Submittals	QC Manager	-Approval of material samples and certified material specifications a minimum of 10 days prior to product arrival on site	1/manufacturer/ year
		-Approval of installation layout proposed by Contractor per current QC Plan	1/installation plan
		-Approval of qualified field installation supervisor and/or master seamer per current QC Plan	1/field installation supervisor and/or master seamer
Conformance Testing	QC Manager	-Collection, organization and maintenance of delivery tickets and all available documentation that each roll delivered to the site meet or exceed project specifications	Each delivery
		-Verification of conformance testing/results per current QC Plan	Each delivery
Installation	QC Team	-Verify storage of geomembranes prior to deployment performed per project specifications and manufacturer/industry standards	Prior to Installation
		-Observation and documentation of subgrade preparation performed per project specifications and manufacturer/industry standards prior to geomembrane layout	Prior to Installation
		-Monitor and document all geomembrane deployment, field seaming and repair operations performed per project requirements, manufacturer recommendations and industry standard practice	Prior to Installation
		-Observation and documentation of anchor trench earthwork performed per project specifications	Prior to Installation

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Appendix A

Clifty Creek West Boiler Slag Pond Quality Control Task Summary(1) - DRAFT			
Task	**Responsible Personnel(4)**	**Task Description/Itemization**	**Minimum Frequency/ Notes(2)**
E. CCB Material			
Subgrade Preparation	QC Manager OR Construction Manager	-Monitor subgrade (subsequent CCR lift) preparation to verify conformance with project specifications	Daily
CCR Placement	QC Manager OR Construction Manager	-Verify disposal methodology, compactive effort, and response of materials to equipment loading	Daily
CCR Placement Observations	QC Team AND/OR Construction Manager	-Report and document any site conditions which increase potential of water infiltration/contact with the CCR after placement	Daily
F. Soil Cover			
Submittals	QC Manager	-Approve pre-qualification testing of materials -Approve soil classification, proctor, and permeability testing	Prior to placement Prior to placement
Conformance Testing	QC Manager	-Verify minimum conformance testing per current QC Plan	Varies, see testing schedule

Clifty Creek West Boiler Slag Pond Quality Control Task Summary[(1)] - DRAFT			
Task	**Responsible Personnel[(4)]**	**Task Description/Itemization**	**Minimum Frequency/ Notes[(2)]**
I. Geotextiles			
Submittals	QC Manager	-Approval of material samples and certified material specifications	Each delivery
Conformance Testing	QC Manager	-Collection, organization and maintenance of delivery tickets and all available documentation that supplied materials meet or exceed project specifications -Verification of minimum conformance tests	 1/manufacturer/ year
Installation	QC Team	-Monitor geotextile deployment and covering operations -Documentation that operations performed per project requirements, manufacturer recommendations, and industry practice	During placement During placement
J. Geocomposite			
Submittals	QC Manager	-Approval of material samples and certified material specifications	Prior to delivery
Conformance Testing	QC Manager	-Collection, organization and maintenance of delivery tickets and all available documentation that supplied materials meet or exceed project specifications -Verification of minimum conformance tests	Each delivery 1/manufacturer/ year
Installation	QC Team	-Monitor geocomposite deployment and covering operations -Documentation that operations performed per project requirements, manufacturer recommendations, and industry practice	Daily Daily
K. Erosion and Sediment Control			
Site Inspections and Evaluations	Construction Manager	-Periodic erosion and sediment control structure inspections and overall site drainage evaluations -Adjustments to site drainage and structures as necessary, based upon prevalent site conditions -Documentation of sediment control observations and modifications	1/month As needed 1/month

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Appendix A

Clifty Creek West Boiler Slag Pond Quality Control Task Summary(1) - DRAFT			
Task	**Responsible Personnel(4)**	**Task Description/Itemization**	**Minimum Frequency/ Notes(2)**
L. CQA/CQC Documentation			
Documentation	QC Manager AND Construction Manager	-Overall organization and maintenance of CQA/CQC documentation of items outlined above as well as those designated in the CQA/CQC Plan	1/quarter
M. Instrumentation			
Quality Control Documents	QC Manager AND Construction Manager	-review Quality Control Document for each instrument	1/quarter
		-review instrument readings	1/quarter
N. Seeding and Mulching			
Submittals	QC Manager	-review fertilizer/lime application rates and laboratory test results	1/year (or) 1 per borrow source
O. Concrete Drainage Structures			
Submittals	QC Manager	-review material submittals and shop drawings	Each delivery
	QC Team	-observe each delivery for signs of damage or nonconformance, observe and document subgrade conditions and backfill methods	Each structure

Notes:

1) The task summary is a itemized list of the general responsibilities to be administrated by the Construction Manager and the QC Manager/QC Team per the current Quality Control Plan and the associated testing schedule

2) All materials testing and site observations are to be conducted in accordance with the current Quality Control Plan and the associated testing schedule to assure that minimum project specifications are maintained on the site during the construction of the special waste disposal facility. Frequency stated when applicable. Many manager or team tasks, such as subgrade inspection, have no quantifiable testing frequency but are required during work progress.

3) IN DOT - "Standard Specifications" current edition.

4) Responsible Personnel Definitions:

Clifty Creek West Boiler Slag Pond Quality Control Task Summary[1] - DRAFT			
Task	**Responsible Personnel[4]**	**Task Description/Itemization**	**Minimum Frequency/ Notes[2]**
	Construction Manager - An IKEC employee or representative designated to be the Owner representative on the construction site. Responsibilities involve overall management of site operations including construction administration tasks, waste disposal, contracting and retaining the services of all necessary personnel (including a qualified engineer) for the life of the facility. The Construction Manager also is a liaison for the Owner to the QC Manager and Contractors. QC Manager - Licensed Professional Engineer in the State of Indiana. Responsibilities generally include the management of the construction monitoring and/or testing; networking with contractors, engineering consultants, regulatory authorities and owner representatives; and preparation of construction QA documents. QC Team - Personnel qualified in construction quality assurance/quality control (QA/QC) testing procedures pertinent to the Clifty Creek Power Plant facility working under the direct supervision of the QC Manager. IDEM Contact - IDEM Solid Waste Branch Manager or other designated IDEM personnel.		

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Appendix B

Clifty Creek West Boiler Slag Pond Quality Control Plan - Material Testing and Product Certification Schedule - DRAFT				
MATERIAL	**PROPERTY**	**TEST METHOD**	**Value**	**Frequency (1)**
Structural Fill				
	Soil Classification	ASTM		1/ material type or change in material
	Proctor	ASTM		1/ material type or change in material
	Nuclear Density and Moisture	ASTM	Min. 95% standard Proctor	1/ 5,000 CYD
	Thickness	Project Requirements	Project Requirements	Project Requirements
Flexible Membrane Liner (FML)				
40 mil PVC Geomembrane				
	Thickness	*ASTM*	40 $\pm$2 mil	1/ MQC Plan (2)
	Tensile Properties	*ASTM*		1/ MQC Plan
	Minimum Strength at Break	*ASTM*	97 lbs/in	
	Minimum Elongation	*ASTM*	430%	1/ 10 rolls
	Minimum Modulus at 100%	*ASTM*	40 lbs/in	1/ 20,000 lb
	Minimum Tear Strength	*ASTM*	10 lbs	1/ 200,000 lb
	Dimensional Stability (max chg)	*ASTM*	3%	1/ 20,000 lb
	Low Temperature Impact	*ASTM*	-20^{o} F	1/ MQC Plan
	Typical Specific Gravity	*ASTM*	1.2 g/cc	1/ 40,000 lb
	Water Extraction Percent Loss (max)	*ASTM*	0.20%	1/ 40,000 lb
	Average Plasticizer Molecular Weight	*ASTM*	400	1/ MQC Plan
	Volatile Loss Percent (max)	*ASTM*	1.50%	1/ 40,000 lb
	Soil Burial (max chg)	*ASTM*		1/ 40,000 lb
	Break Strength	*ASTM*	92%	1/ MQC Plan
	Elongation	*ASTM*	344%	1/ MQC Plan
	Modulus at 100%	*ASTM*	20%	1/ MQC Plan
	Minimum Hydrostatic Resistance	*ASTM*	120 psi	
	Minimum Shear Strength	*ASTM*	77.6 lbs/in	1/ 500 ft
	Minimum Peel Strength	*ASTM*	15 lbs/in	1/ 500 ft

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Clifty Creek West Boiler Slag Pond Quality Control Plan - Material Testing and Product Certification Schedule - DRAFT				
MATERIAL	**PROPERTY**	**TEST METHOD**	**Value**	**Frequency (1)**
Flexible Membrane Liner (FML)				
LLDPE Geomembrane Raw Materials	Geomembrane Resin Density	*ASTM*	0.915 - 0.926	1/ MQC Plan (2)
	Geomembrane Resin Melt Index	*ASTM*	<1.0	1/ MQC Plan
40 mil LLDPE Geomembrane	Thickness	*ASTM*	Project Requirements	1/ 10 rolls
	Density	*ASTM*	0.939 g/ml	1/ 200,000 lb
	Tensile Properties	*ASTM*	Project Requirements	1/ 20,000 lb
	2% Modulus	*ASTM*	2400 lb/in	1/ MQC Plan
	Tear Resistance	*ASTM*	22 lb	1/ 40,000 lb
	Puncture Resistance	*ASTM*	56 lb	1/ 40,000 lb
	Axi-Symmetric Break Resistance Strain	*ASTM*	30%	1/ MQC Plan
	Carbon Black Content	*ASTM*	2.0 - 3.0 %	1/ 40,000 lb
	Carbon Black Dispersion	*ASTM*	Project Requirements	1/ 40,000 lb
	Oxidative Induction Time (OIT)(4)	*ASTM*	100 or 400 minutes	1/ MQC Plan
	Oven Aging at 85 degrees C(4)	*ASTM*	35% or 60 %	1/ MQC Plan
	UV Resistance	*ASTM*	35%	1/ MQC Plan
	Seam Properties - Shear Strength	*ASTM*	60 ppi (5)+max one coupon Non-Film Tear Bond (FTB)	1/ 500 ft
	Seam Properties - Peel Strength	*ASTM*	FTB	1/ 500 ft
	Non-Destructive Seam Integrity	*GRI*	Per GRI	Continuous
CCR Materials	Classification and Proctor	ASTM	varies	1/ year
	Compaction and moisture control	ASTM	Three passes of compactor (minimum). Adjusted based on annual test pads.	Daily

Clifty Creek West Boiler Slag Pond
Quality Control Plan - Material Testing and Product Certification Schedule - DRAFT

MATERIAL	PROPERTY	TEST METHOD	Value	Frequency (1)
Final Cover				
Upper 6 inches	Soil Classification	ASTM	CH, MH, CL, ML, SC and associated dual symbols	1/ year/source/soil class
	Lime, Fertilizer and other Soil Amendments	Natural Resources Conservation Service (NRCS)	Application Rates per NRCS recommendations based on testing	1/ year/source/soil class
Lower 24 to 36 inches	Soil Classification	ASTM	CH, MH, CL, ML, SC and associated dual symbols	1/ year/source/soil class
Geocomposite				
Geocomposite Natural Resin	Resin Density	*ASTM*	>0.94 g/cm^3	1/ MQC Plan
	Resin Melt Index	*ASTM*	±1.0 g/10 min	1/ MQC Plan
250 mil Geocomposite	Transmissivity	*ASTM*	1x10^{-3} m^2/sec	1/ MQC Plan
	Thickness	*ASTM*	0.270 in	1/ MQC Plan
	Tensile Strength (MD)[8]	*ASTM*	44 lb/in	1/ MQC Plan
	Carbon Black Content	*ASTM*	2.0%	1/ MQC Plan
	Mass per Unit Area	*ASTM*	0.330 psf	1/ MQC Plan
	Specific Gravity	*ASTM*	Project Requirements	1/ MQC Plan
	Melt Flow Index	*ASTM*	Project Requirements	1/ MQC Plan
	Carbon Black Content	*ASTM*	Project Requirements	1/ MQC Plan
	Abrasion or Tumble Test	*ASTM*	Project Requirements	1/ MQC Plan
	Creep	*ASTM*	Project Requirements	1/ MQC Plan
	Thickness	*ASTM*	Project Requirements	1/ MQC Plan
	Chemical Compatibility	*ASTM*	Project Requirements	1/ MQC Plan
	Resistance to Extreme Temperature	*ASTM*	Project Requirements	1/ MQC Plan
	Resistance to Bacteria	*ASTM*	Project Requirements	1/ MQC Plan
	Resistance to Burial Deterioration	*ASTM*	Project Requirements	1/ MQC Plan

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Appendix B

Clifty Creek West Boiler Slag Pond Quality Control Plan - Material Testing and Product Certification Schedule - DRAFT				
MATERIAL	**PROPERTY**	**TEST METHOD**	**Value**	**Frequency [(1)]**
Coarse Aggregates				
No. 2	Gradation	*IN DOT*	IN DOT	1/ supplier/year
No. 53	Gradation	*IN DOT*	IN DOT	1/ supplier/year
No. 9	Gradation	*IN DOT*	IN DOT	1/ supplier/year
Class 1 Riprap	Gradation	*IN DOT*	IN DOT	1/ supplier/year
Grouted Class 1 Riprap	Gradation	*IN DOT*	IN DOT	1/ supplier/year
Geotextile Filter Fabrics **Application:** **Separator/Filtration**	Type	-	Non-woven	
	Burst Strength	*ASTM*	300 psi	1/ manufacturer/year
	Tensile Strength	*ASTM*	160 psi	1/ manufacturer/year
	Puncture Strength	*ASTM*	45 pounds	1/ manufacturer/year
	Permeability	*ASTM*	$3x10^{-1}$ cm/sec	1/ manufacturer/year
	AOS	ASTM	Based on gradation of materials placed against geotextile determined prior to construction	1/ manufacturer/year
	Gradient Ratio or Hydraulic Conductivity Ratio Test	ASTM	Based on gradation of materials placed against geotextile determined prior to construction	1/ manufacturer/year
Cushion	Type	-	Non-woven	
	Elongation	ASTM		1/ manufacturer/year
	Trapezoidal Tear	ASTM		1/ manufacturer/year
	Ultraviolet Resistance Test	ASTM		1/ manufacturer/year
	Abrasion or Tumble Test	ASTM		1/ manufacturer/year
	Burst Strength	ASTM	300 psi	1/ manufacturer/year
	Tensile Strength	ASTM	160 psi	1/ manufacturer/year
	Puncture Strength	ASTM	45 pounds	1/ manufacturer/year

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Appendix B

Clifty Creek West Boiler Slag Pond Quality Control Plan - Material Testing and Product Certification Schedule - DRAFT				
MATERIAL	**PROPERTY**	**TEST METHOD**	**Value**	**Frequency [1]**
Drainage Ditch	Type	-	Non-woven	
	Burst Strength	ASTM	300 psi	1/ manufacturer/year
	Tensile Strength	ASTM	160 psi	1/ manufacturer/year
	Puncture Strength	ASTM	45 pounds	1/ manufacturer/year
	Permeability	ASTM	$3x10^{-1}$ cm/sec	1/ manufacturer/year
	AOS	ASTM	Based on gradation of materials placed against geotextile determined prior to construction	1/ manufacturer/year
Road Reinforcement	Type	-	Woven	
	Burst Strength	ASTM	540 psi	1/ manufacturer/year
	Tensile Strength	ASTM	250 psi	1/ manufacturer/year
	Puncture Strength	ASTM	45 pounds	1/ manufacturer/year
	Permeability	ASTM	NA	
	AOS	ASTM	NA	
Class A Concrete	Compressive Strength	ASTM	4,000 psi	1/ pour or 1/ 20 CYDS
	IN DOT Standard Specifications	*IN DOT*		1/ supplier/year

Notes:

[1] or one (1) test per noted change in material or waste production/processing change (whichever is applicable)
[2] MQC - Manufacturer Quality Control Plan: Manufacturer shall provide written certification materials meet all specified values and related MQC data.
[3] GRI - Geosynthetic Research Institute Testing Method
[4] Results for Standard OIT or High Pressure OIT respectively
[5] ppi - pounds per inch. FTB pass/fail criteria shall be based on current GRI standards
[6] ASTM F1417-92
[7] IN DOT - Italics Indicate Contractor Submittals Certified by Manufacturer/Supplier. Remaining tests to be conducted by project QC Team.
[8] MD - Machine Direction

APPENDIX K

WBSP Post-Closure Plan
(IKEC, 2016)

Stantec
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;

**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).

SIGNATURE ______ DATE 10/11/16

ADDRESS: 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

STAN A. HAR... REGISTERED No. PE-19700150 STATE OF INDIANA PROFESSIONAL ENGINEER

10/11/16

Post-closure Plan

CFR 257.104(d)

West Boiler Slag Pond

Clifty Creek Station

Madison, Indiana

October 2016

Prepared by: Indiana-Kentucky Electric Corporation

3932 U.S. Route 23

Piketon, OH 45661

Table of Contents

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 Bottom 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 Bottom Slag Pond for purposes of storage.

The West Bottom 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 CCR unit, and the frequency at which these activities will be performed]

3.1 Section 257.104(b)(1)

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

Inspections are performed for the items noted below. The inspection frequencies are scheduled to properly detect any issues so that repairs can be performed before significant harm occurs.

- Embankment: The waste embankment will be inspected for slides, settlement, subsidence, displacement, and cover condition (see below).

- Final Cover Surface: 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).

- Stormwater Management System: 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.

- Erosion Damage Repair: 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.

- Settlement, Subsidence, Displacement: Any areas at the closed site exhibiting evidence of settlement, subsidence, or displacement will be examined to determine the cause of the movement. If backfilling or placing additional fill material is needed to maintain the integrity of the closed structure, it will be performed in accordance with the site/closure specifications, including seeding. If the condition reoccurs or persists, or if the severity of the condition 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.

- Closure Cap Surface: 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, re-seeded to support vegetative growth, and maintained to minimize the ponding of water.

- Stormwater Drainage System: 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.

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. The only activities occurring on the closed CCR unit will be related to the Post-Closure care activities. All other activities will be prohibited.

APPENDIX J

Closure and Post-Closure Cost Estimate

Opinion of Closure Costs
West Boiler Slag Pond
Clifty Creek Plant
Indiana-Kentucky Electric Corporation
Madison, Jefferson County, Indiana

Facility Name:	**Clifty Creek West Boiler Slag Pond**	
Facility Location:	**Madison, Indiana**	
Facility County:	**Jefferson**	
Total Waste Fill Acreage:	**89.6**	**Acres**
Total Grading Acreage:	**93.9**	**Acres**
Closure Year:	**2020-2023**	
Phase 1 Acreage for Closure	**9.2**	**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 close the facility. For items that will vary depending upon the number of acres to be closed, the quantities should be indicated on a per-acre basis.

A. Item	B. Quantity	C. Units (per acre)
Geosynthetic materials (geomembrane, geotextile, geocomposite drainage layer)	89.6	$ 88,761.60
Uncompacted 30-inch soil layer	89.6	$ 35,717.53
6-inch vegetative soil layer	89.6	$ 12,524.64
Vegetative cover	89.6	$ 3,288.19
Surveying	89.6	$ 850.00
Engineering certification	89.6	$ 1,392.86
Additional items	lump sump	$ 306,100.00
Deed notation	lump sump	$ 10,000.00

V. COST PER ACRE FOR FINAL COVER & VEGETATION

A. What Percent of Final Cover and Topsoil is Available from Areas that are Controlled, and will be Controlled through Post-Closure, by the Permittee?

1. % of final cover:	0%
2. Describe location of sources:	Offsite borrow sources are being assessed.
3. % of topsoil:	0%
4. Describe the location of sources:	Offsite borrow sources are being assessed.

B. Cost per Acre for Acquisition and Placement of 30-inch Soil Layer

1. Acquisition		
a. Quantity of soil needed per acre (cubic yard (yd^3)/acre)	4,033	
b. Excavation unit cost ($/$yd^3$) (if obtained onsite)	N/A	
c. Purchase unit cost ($/$yd^3$) (if obtained offsite)	$ 0.50	
d. Delivery unit cost ($/$yd^3$) (if obtained offsite)	$ 5.50	
e. Acquisition cost ($/acre)	$ 24,198.00	[1a * (1c+1d)]
2. Placement and Compaction		
a. Placement/spreading unit cost	$ 2.41	
b. Compaction unit cost ($/$yd^3$)	$ -	
c. Placement and compaction cost ($/acre)	$ 9,719.53	[1a * (2a+2b)]
3. Testing		
a. Soil classification (if soil source is of variable quality) ($/acre)	$ 500.00	
b. Survey control for cover thickness and proper slopes ($/acre)	$ 1,300.00	
c. Density testing (if planned) ($/acre)	N/A	
d. Testing cost ($/acre)	$ 1,800.00	
4. TOTAL COST, SOIL COVER ($/acre)	**$ 35,717.53**	[1e + 2c + 3d]

C. Cost per Acre for Acquisition and Placement of Geosynthetic Materials			
1. Acquisition			
a. Quantity of material needed per acre (square yards, yd^2)		4,840	
b. Purchase and install geomembrane ($/$yd^2$)	$	5.67	
c. Purchase and install nonwoven geotextile ($/$yd^2$)	$	2.19	
d. Purchase and install composite drainage layer ($/$yd^2$)	$	7.38	
e. Delivery unit cost ($/$yd^2$) (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]
4. TOTAL COST, GEOSYNTHETIC LAYERS ($/acre)	**$**	**88,761.60**	[1f + 2 +3c]

D. Cost per Acre for Acquisition & Placement of Topsoil			
1. Acquisition			
a. Quantity of topsoil needed per acre (yd^3/acre)		807	
b. Excavation unit cost ($/$yd^3$) (if obtained onsite)		N/A	
c. Purchase unit cost ($/$yd^3$) (if obtained offsite)	$	7.61	
d. Delivery unit cost ($/$yd^3$) (if obtained offsite)	$	5.50	
e. Acquisition cost ($/$yd^3$)	$	10,579.77	[1a * (1c+1d)]
2. Placement			
a. Spreading unit cost ($/$yd^3$)	$	2.41	
b. Placement cost ($/acre)	$	1,944.87	[1a * 2a]
3. Topsoil Cost ($/acre)	$	12,524.64	[1e + 2b]

F. 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 ($)	$	124,800.00	[1f * 1g]
i. Area of site permitted for filling (acres)		89.6	
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 (89.6 acres)	$	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**	
Additional soil cover under channels (6,000 feet at $43/foot)	$	250,000.00	
6,000 ft of stormwater diversion channels at $9.35/foot	$	56,100.00	
C. Total	$	316,100.00	[A + B]
VII. CLOSURE COST ESTIMATE	**$**	**12,886,259.62**	[(Acreage * VI) + VI.C]
VIII. ADDITIONAL INFORMATION REQUIRED FOR FACILITIES PROVIDING FINANCIAL ASSURANCE ON AN INCREMENTAL BASIS			
A. Will Closure Financial Assurance be Provided on an Incremental Basis?		No	

Opinion of Post-Closure Costs
West Boiler Slag Pond
Clifty Creek Plant
Indiana-Kentucky Electric Corporation
Madison, Jefferson County, Indiana

Facility Name:	**Clifty Creek West Boiler Slag Pond**	
Facility Location:	**Madison, Indiana**	
Facility County:	**Jefferson**	
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Total Grading Acreage:	**93.9**	**Acres**
Closure Year:	**2020-2023**	
Phase 1 Acreage for Closure	**9.2**	**Acres**

(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		60	
b. Inspector time required (hours/insp)		30	
c. Inspector time labor cost ($/hour)	$	90.00	
d. Inspection cost ($)	$	162,000.00	[1a * 1b * 1c]
2. Report Preparation			
a. Number of reports during post-closure period		60	
b. Cost per report ($)	$	5,000.00	
c. Report cost	$	300,000.00	[2a * 2b]
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 * 1b]
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 ($)	$	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 + 2f]
C. Cost for Leachate Treatment and Disposal		N/A	
D. Cost for Leachate Collection System Monitoring and Maintenance		N/A	

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	
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			
a. Number of wells needing replacement during post-closure period		0	
b. Existing monitoring well abandonment unit cost ($)	$	-	
c. New monitoring well construction unit cost ($)	$	-	(drilling charged by foot)
d. Monitoring well replacement cost ($)	$	-	
e. Number of pumps/bailers needing replacement during post-closure period		5	
f. Pump/bailer unit cost ($/pump)	$	2,000.00	
g. Pump/bailer replacement cost ($)	$	10,000.00	[2e * 2f]
h. Monitoring Maintenance and Pump/bailer Replacement Cost ($)	$	48,880.00	[1e + 2d + 2g]
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			
1. Drainage and erosion control maintenance frequency (visits/30 years)		60	
2. Cost for materials to repair per visit	$	500.00	
3. Total material cost ($)	$	30,000.00	[1 * 2]
4. Maintenance time required per visit (hours)		10	
5. Unit labor cost	$	140.00	
6. Total labor costs ($)	$	84,000.00	[1 * 4 * 5]
7. TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST	**$**	**114,000.00**	[3 + 6]
H. Cost for Access Control and Benchmark Maintenance			
4. Fencing material cost ($)	$	-	Facility is fenced.
7. Total labor costs ($)	$	-	
8. Benchmark maintenance cost (if applicable ($)	$	5,000.00	
9. Other ($)	$	-	
10. TOTAL, ACCESS CONTROL/BENCHMARK MAINTENANCE COST	**$**	**5,000.00**	[4 + 7 + 8 + 9]
I. Optional - Maintenance of dike(s) required for facilities constructed in floodplain/floodway			
J. Other costs - Costs not included in the above items should be listed here. They may include such items as access road maintenance, lift station power costs, etc. Please enter "N/A" if you do not have additional costs to place here.	**N/A**		
K. TOTAL POST-CLOSURE COST	**$**	**3,701,122.49**	[A3 + B3 + C4 + D3 + E4 + F3 + G7 + H10 + I7 + J]

ATTACHMENT 2

- Request for Additional Information No. 1. Closure Plan (Addendum 1). Clifty Creek Station. West Boiler Slag Pond. Phase 1 Closure. *Stantec Consulting Services Inc. (2020).*
- West Boiler Slag Closure Plan – Revision to RAI #1 Response. SW Program ID 39-005. *Indiana-Kentucky Electric Corporation (2020).*
- Adjacent Landowner/Occupant Affidavit. State Form 51872 (8-04) Indiana Department of Environmental Management. Phase 1 Closure – Clifty Creek Station West Boiler Slag Closure Plan. *Indiana-Kentucky Electric Corporation (2020).*

OVEC/IKEC
Ohio Valley Electric Corporation / Indiana-Kentucky 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

July 1, 2020

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Ms. Kate Garvey
Office of Land Quality
Indiana Department of Environmental Management
Solid Waste Permits Section
IGCN 1101
100 North Senate Avenue
Indianapolis, Indiana 46204-2251

RECEIVED
JUL 06 2020
DEPARTMENT OF
ENVIRONMENTAL MANAGEMENT
OFFICE OF LAND QUALITY

Dear Ms. Garvey:

Re: Indiana-Kentucky Electric Corporation
West Boiler Slag Pond Closure Plan- Response to RAI
SW Program ID 39-005

This letter and accompanying attachments are in response to a Request for Additional Information (RAI) received from IDEM on May 15, 2020, regarding the proposed plan for partial closure of Clifty Creek Station's West Boiler Slag Pond, Solid Waste Program ID Number FP 39-005.

The Indiana-Kentucky Electric Corporation (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 address your concerns. The accompanying response package, included as Attachment I, has been prepared by Stantec, functioning as the site's Qualified Professional Engineer (QPE), and provides detailed responses to each point of inquiry. Additionally, included as Attachment II is the appropriate executed certification statement for the RAI submission.

If you have any further questions or concerns, please direct them to Mr. Tim Fulk, who can be reached at (740) 897-7768.

Sincerely,

J. Michael Brown
Environmental, Safety, and Health Director

JMB:tlf

Attachments

OVEC/IKEC
Ohio Valley Electric Corporation / Indiana-Kentucky Electric Corporation

INDIANA-KENTUCKY ELECTRIC CORPORATION
3932 U. S. Route 23
P. O. Box 468
Piketon, Ohio 45661
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RETURN RECEIPT REQUESTED

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Office of Land Quality
Indiana Department of Environmental Management
Solid Waste Permits Section
IGCN 1101
100 North Senate Avenue
Indianapolis, Indiana 46204-2251

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West Boiler Slag Pond Closure Plan- Response to RAI
SW Program ID 39-005

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Sincerely,

J. Michael Brown

J. Michael Brown
Environmental, Safety, and Health Director

JMB:tlf

Attachments

bcc: (w/o Attachments)

J. M. Brown – System
G. S. Coriell
C. Carnes – Clifty
B. S. Canter
D. L. Hunt

Solid Waste Land Disposal Facilities
Signatures and Certification Statements for Requested Additional Information

329 IAC 10-11-3(d) requires that the signatory of a solid waste land disposal facility permit application and of other information requested by or on behalf of the Commissioner (including the supplemental information requested by our office for your solid waste land disposal facility permit application) sign the following certification statement:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I further certify that I am authorized to submit this information."

J. Michael Brown

APPLICANT'S SIGNATURE

07/01/2020

DATE

J. Michael Brown

APPLICANT'S NAME TYPED

Note: It is not necessary to submit this form if an equivalent signed certification statement is incorporated into your submittal.

Request for Additional Information No. 1

Closure Plan (Addendum 1)

Clifty Creek Station

West Boiler Slag Pond

Phase 1 Closure

Madison, Jefferson County, Indiana

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

June 30, 2020

Design with community in mind

Closure Plan
(Addendum 1)

West Boiler Slag Pond
Phase 1 Closure
Clifty Creek Station
Madison, Jefferson County, Indiana

List of Attachments

ENGINEERING ENCLOSURE
Request for Additional Information
West Boiler Slag Pond
Closure Plan
SW Program ID 39-005
Jefferson County

Reviewer: Jeff Teague
Telephone: (317) 233-1053
Email: JTeague@idem.IN.gov

Please address the following comments developed from an engineering review of the Indiana-Kentucky Electric Company (IKEC)'s Phase 1 Partial Closure Plan dated February 12, 2020 (VFC #82914220) for the West Boiler Slag Pond (WBSP) at the Clifty Creek Generating Station:

1. The descriptions for pond dewatering and soil stabilization methods in the closure plan are not clear. Please provide additional information on these activities, considering the remaining portions of the WBSP will be ponding water.

   IKEC Response:
   Flow in the WBSP currently moves from the sluice pipes (northeast corner) to NPDES-regulated Outfall 002 (southwest corner) with sedimentation occurring along the southwesterly path. The historic structural fill within the Phase 1 closure footprint is predominantly comprised of boiler slag and has an anticipated permeability of 10^{-3} to 10^{-5} centimeters per second (cm/s). The placement of final cover and addition of stormwater channels allow the station to minimize surface water run-on and infiltration into the area, enabling the station to begin the overall phased closure of the WBSP. The proposed phased closure is necessary to cease the discharge from the WBSP prior to April 1, 2022, as required by NPDES Permit No. IN0001759, and requires the station to divert non-contact stormwater, reduce run-on and infiltration, and modify the operational flow management. The operational pool within the WBSP has been lowered to elevation 444.5 feet to support field explorations for detailed design of Phases 2, 3, and 4. Following Phase 1 construction, water levels within the area will be minimized using well points and sumps for subsequent phases. Piezometers will be installed along the western edge of Phase 1 to monitor water levels within the closed footprint.

2. The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1×10^{-5} cm/sec, whichever is less (40 CFR 257.102(d)(3)(i)(A)). Please demonstrate the permeability of the natural subsoils present is equal to or higher than 1×10^{-5} cm/sec. Include soil testing locations and permeability data. If the permeability of the natural soils is less than 1×10^{-5} cm/sec, please revise the maximum permeability of the soil cover to that of the natural subsoil.

   IKEC Response:
   Three permeability tests have been performed near the as-built elevation (433 feet) of the bottom of the WBSP. The boring logs and plan view location maps are included in Appendix E of the closure plan.

Boring	Permeability		
WBSP-15-07	1.02×10^{-5} (mean K, cm/s)	(screened at 426.82 to 416.82 ft)	AGES (2018), averages rising and falling head test, Bouwer-Rice and Hvorslev methods
B-4	1.58×10^{-6} (vertical hydraulic conductivity, cm/s)	436.4 to 435.9 (7.6-8.1 ft)	Stantec (2016), ASTM D 5084, method C
B-6	2.01×10^{-7} (vertical hydraulic conductivity, cm/s)	427.9 to 427.4 (17.6-18.1 ft)	Stantec (2016), ASTM D 5084, method C

The closure plan was written to meet the requirements of 40§257.102(d)(3). Due to the natural variability of the permeability results around the WBSP, it is anticipated that a demonstration will need to be performed prior to phase construction, should a soil-only final cover be selected. A field exploration program is being planned as part of the detailed design for the remaining phases and can incorporate the Phase 1 area should the demonstration be needed.

3. Please demonstrate the proposed concrete and conveyor system will not cause differential settlement of the proposed cap or the waste contained within the WBSP. Please provide the following:

   a. Settlement and structural stability calculations for the cap and the waste materials underneath.
   b. Testing procedures and testing frequency for the wastes and structural fill (above the waste) to verify differential settlement will not occur upon construction of the cover system and the construction and operation of the concrete and conveyor system.

   IKEC Response:

   a. Estimated settlements imposed by the concrete pad and conveyor loads, have been computed to be 1.6 inch at the center of the slab and 0.8 inch at the edge of the slab, indicating differential settlement of 0.8 inch, or conservatively 1 inch. The technical specifications for the liner indicate an allowable elongation of 400% until yield. The actual computed elongation based upon 1 inch of differential settlement is .000043%. Geotechnical settlement computations are included in Attachment A.

   b. Testing procedures for the subgrade installation of the concrete slab are as specified in Kozera (2019) as 98% compaction in accordance with ASTM 698 for each lift. The testing procedure for differential settlement will be the survey of installed control points in the slab. The baseline elevations will be established by the as-built survey performed at completion of construction. Testing for differential settlement will be performed weekly for the initial month after completion of construction and annually thereafter.

4. Please provide the final version of the Construction Quality Assurance (CQA) Plan for the construction of the cap for the West Boiler Slag Pond.

IKEC Response:
The CQA Plan for the WBSP is included as Attachment B.

5. Please provide the following for the portion of the cover system using concrete cap:

   a. The closure plan states, "Concrete may be used in lieu of a portion of the earthen material." The closure plan also states a cushion fabric and a minimum 12-inch cover material is anticipated beneath the concrete to protect the geomembrane. Please verify the liner system under the concrete. Please note the 12-inch cover material above geomembrane must be natural soils.
   b. Specify the design details for the concrete (e.g., dimensions, thickness, strength, rebars, and drainage)
   c. Provide drawings showing the following:
      i. Detailed drawings of pads, roads, etc.
      ii. Transition between concrete and earthen or geomembrane cover system

   IKEC Response:
   a. The typical cross section of the concrete, cover, liner, and subgrade is shown in Attachment C, Sheet C102. The 12-inch cover material is specified as 12 inches of sand or natural soils having a permeability less than 1 x 10^{-5} cm/sec. The geomembrane and cushion fabric submittals will be provided to the CQA team prior to construction. Section 5.2 of the Closure Plan has been updated with the new text underlined. The Closure Plan (text-only) is included in Attachment I.
   b. Concrete design details including dimensions, thickness, strength, rebar, and drainage are indicated in Attachment C.
   c. Drawings are provided in Attachment C.

6. Please provide the calculations for the drainage ditches to show they are adequately designed for a 25-year, 24-hour rainfall.

   IKEC Response:
   The ditch sizing calculations are included in Attachment D.

7. The current design has ditches in Phase 1 draining into the West Boiler Slag Pond as shown in the drawings titled "Phase 1 Subgrade Plan" and "Phase 1 Final Grade Plan." Since the entire WBSP is proposed to be closed, indicate how the drainage of the Phase 1 area will not be modified with future closure of the pond.

   IKEC Response:
   A general overall cap design has been proposed. However, refinements are anticipated with the boiler slag settling basin design area in Phase 2 and the balanced closure by removal and closure in place area in Phase 4. Stormwater and operational flows will be managed within the existing WBSP to utilize the existing outfall. Construction of Phase 1 allows the station to begin reducing flows to the WBSP in preparation of the next phases of construction.

8. Please revise the closure plan to have consistent language in the narrative and the CQA plan for the design of the cover system (for example, the design of the

cap system is different in Section 3.6, 5.2, and the CQA Plan).

<u>IKEC Response</u>:
The WBSP CQA Plan was revised to reflect the closure plan narrative. It is included in Attachment B. Sections 3.6 and 5.2 of the Closure Plan have been updated with the new text underlined. The Closure Plan (text-only) is included in Attachment I.

9. Please note if a geomembrane (or a flexible membrane liner (FML)) is used in the cover system, IDEM requires a minimum of 30 inches of soil protective cover and 6” of vegetative layer (36” total).

<u>IKEC Response</u>:
As discussed in Question 2, it is IDEM’s intent to require this surface impoundment engineered cap system to meet the standards of 40§257.102(d)(3). The federal requirement specifies (in order of construction from bottom to top):

- 18 inches of compacted soil with a maximum permeability of 1 x 10^{-7} cm/s
- 6 inches of soil capable of sustaining vegetation and reasonably free from deleterious matter that would prevent the formation of a suitable seedbed.

If the selected borrow materials are not sufficiently impermeable, or if there is not a sufficient quantity, then a synthetic geomembrane will be included in the final cap design. This alternative cap system will consist of the following materials (listed in order of construction from bottom to top):

- 40-mil geomembrane
- Geocomposite drainage layer
- 24 inches of cover soil, of which the top 6 inches are capable of supporting vegetation.

IDEM also noted during the December 2019 WBSP closure plan proposal meeting that the agency intends to treat this surface impoundment as a restricted waste site Type I or nonmunicipal solid waste landfill upon closure. Therefore, the final cover was designed in accordance with the more stringent 329 IAC 10-30-2(c), similar to the final cover system permitted within Clifty Creek Station’s RWS Type I landfill permit. This requires that the final compacted cover have (from top to bottom) 6 inches of topsoil and a minimum depth of compacted clay of:

- two (2) feet for slopes less than or equal to fifteen percent (15%)
- three (3) feet for slopes less than fifteen percent (15%) but less than twenty-five percent (25%); and
- four (4) feet for slopes greater than twenty-five percent.

The existing cap system maintains slopes less than 15% with additional compacted clay under the stormwater diversion channels due to their sideslopes.

Final cover soils will be challenging to acquire within a reasonable distance of Madison, Indiana. The additional six inches across the cap surface, if the closure is also held to the existing municipal solid waste landfill standards (329 IAC 10-22-6(b)(6)), will have a deleterious effect to the project soil balance and aggressive schedule required to meet federal regulations.

10. Many of the construction drawings still indicate they are only 30% submittal and not for Construction. Please clarify if these are final construction drawings for Phase 1 closure. If not, provide final drawings for Phase 1 closure construction.

    IKEC Response:
    The revised Phase 1 permit drawings are provided in Attachment E. They will be used for construction.

11. Drawings titled "Waste Limit", "Closure Phases" and "Existing Conditions and Project Baseline Layout" (pages 137 – 139) show railroad tracks on Phase 1 area. Please clarify if it is still there (Google map does not show this). If yes, please describe how the final cover will be constructed in this area.

    IKEC Response:
    The historical railroad tracks are no longer present on site and have been removed from the drawings.

12. Item 7 of the draft CQA plan indicates CCR material will be placed in lifts of 12-inches. Please indicate how full compaction of the lift can occur and how it can be integrated with the underlying material in the previous lift.

    IKEC Response:
    The CCR material placed in the WBSP is predominantly boiler slag, which is cohesionless and behaves like a sand. A 12-inch loose lift compacts to closer to an 8- or 9- compacted layer. This is a structural fill for this project and provides the foundation for the final cover system. Boiler slag has been used for structural fill and other construction components at the station's RWS Type I landfill. During construction, a smooth drum roller or pneumatic tire roller method specification has been sufficient to achieve 95% standard Proctor.

13. Please verify if a geocomposite drainage layer will be installed over the geomembrane as indicated in Section 5.2 Cap System.

    IKEC Response:
    A geocomposite drainage layer would be necessary to meet 40§257.102(d)(3) if a flexible membrane liner is used.

14. Please verify the testing requirements in the CQA Plan are adequate. IDEM recommends following the testing specified in 329 IAC 10-17. The testing should address both the options of the final cover, the compacted clay soil cover, the geomembrane and the 30 inches of protective soil cover over the geomembrane.

    IKEC Response:
    The revised CQA Plan is included in Attachment B.

15. Please provide the following regarding the slope stability modeling:

a. Indicate why there are different acceptable Factor of Safety (FS) based on the 2016 and 2020 models.
b. Indicate why a FS of 1.0 was considered acceptable for the undrained scenarios for the 2016 model.
c. Indicate why the 2020 models were not based upon the same groundwater conditions as in the 2016 model.
d. Indicate why no models were performed based upon the Ohio River at the flood stage of 464 feet.
e. Indicate why stability modeling was not performed for Sections A-A' and B-B' in the 2020 model for the final slopes of the unit. Only Section C-C' was provided since it was the location for the proposed conveyor and off-loading system.
f. The stability analysis only address slope failure with respect to the outer dike. Please demonstrate there will not be any slope failures for the closed portions of the WBSP and the remaining portions of WBSP (e.g., the stability of the Phase 1 area and the remaining pond after Phase 1 is closed and the facility is operating the conveyor system).

IKEC Response:

a. Cross sections A, B, and C were performed as part of the EPA Final CCR Rule's design criteria demonstration (Stantec, 2016). The factors of safety reflect the requirements of 40§257.73(e)(1). The stability sections reflect the existing WBSP surface impoundment dike under operational conditions. Only Section D, the barge loading station cross section, and the new Section E, the interior slope, lie within the Phase 1 footprint with final cover modeled. A plan view showing the locations of cross sections A, B, C, D (the barge loading station cross section), and E (the Phase 1 interior slope) are included in Attachment F.
b. The undrained analyses referenced from Stantec (2016) are the seismic loading case and meet the intent of 40§257.73(e)(1)(iii).
c. Stantec (2016) was required to model the 50% probable maximum flood conditions within the WBSP under 40§257.73(e)(1) for Section A, B, and C. The normal WBSP pool in for Stantec (2016) and Stantec (2020) analyses is 448 feet. Additional runs were performed for Section D using an Ohio River normal pool of elevation 426 feet instead of 420 feet since this is the critical cross section in the Phase 1 footprint. These model results are included in Attachment F.
d. Cross sections A, B, and C are in future phases of the WBSP closure. Revised stability sections will be provided once final cover grading is finalized.

   Section D (the barge loading station cross section) was revised to change the Ohio River normal pool level to elevation 426 feet and to include an interior slope stability model using a flood stage of 464 feet for the Ohio River. The model results are included in Attachment F.
e. Cross sections A, B, and C are in future phases of the WBSP closure. Revised stability sections will be provided once final cover grading is finalized. Section D, the barge loading station cross section, is east of Section C as shown on the plan view in Attachment F.
f. A slope stability analysis was performed for an internal Phase 1 slope towards the operational WBSP. The summary table and plan view for Section E are included in Attachment F.

16. The closure approaches you have proposed leave waste in place either in contact or in potential contact with ground water. Based upon the piezometric map, Figure E-9, the groundwater elevation is 430 feet to 470 feet within WBSP. Please provide the following information regarding your plans to control, minimize, or eliminate infiltration of ground water into the waste and potential releases to the maximum extent feasible under 40 CFR 257.102(d), *Closure performance standard when leaving CCR in place*:

    a. An evaluation of feasibility of closure measures to control, minimize, or eliminate ground water infiltration and potential for releases to the maximum extent feasible.
    b. Describe how the closures are designed so that the measures to control, minimize, or eliminate ground water infiltration and potential releases from waste in contact with ground water will be conducted as part of closure.

    IKEC Response:
    The hydrogeology discussion in Attachment G provides three cross sections through the WBSP. This depicts the steep bedrock elevation change between the Devil's Backbone northwest of the WBSP and the Ohio River. The three wells referenced (WBSP-15-01, WBSP-15-02, and WBSP-15-03) are located at a higher elevation than the WBSP to reflect water quality upgradient of the surface impoundment. The water levels shown in the piezometers mirror the higher elevation of the bedrock as it flows along this interface. The uppermost aquifer for the WBSP has been identified as the gray/brown fine sand located downhill from these wells and is isolated from the base elevation of the WBSP by at least five feet as indicated in the facility's CCR rule siting criteria demonstration.

    As outlined in Question 1, a phased approach is the plan to reduce flows into the WBSP. The intent is to divert non-contact stormwater, reduce run-on from the adjacent hillsides, reduce infiltration of direct rainfall into the cap system, modify the operational flow management from the station, and restrict recharge in this area.

17. Please adjust the closure and post-closure cost estimates for the following:

    a. The cost for dike maintenance in the post-closure cost estimates.
    b. The post-closure cost estimates must include at 10% of final cover closure for the maintenance of the cover.
    c. The cost for cover was estimated to be $140,289.96/acre; hence $14,028.9/acre (for 89.6 acres = $1,256,998) should be included in the post-closure cost estimates for cover maintenance.
       Closure plan/post-closure plan for Phase 1 only. Size up based on acreage. This is conservative based on the current closure concepts.
    d. The estimated cover maintenance cost of $3,571.75/acre is very low. Also, costs for maintaining the alternative covers like concrete is not included.
    e. Include post-closure cost estimates for maintaining measures initially taken during closure to control, minimize, or eliminate ground water infiltration and potential releases from waste potentially in contact with ground water. Please see Engineering Comment #13.
    f. Please include a minimum 10% contingency cost for both the closure and post-closure cost estimates on the total estimated costs.

IKEC Response:

a. Post-closure dike maintenance has been added to B of the post-closure estimate. The typical cross section for the dike is approximately 265 feet from southern toe to inside crest. Approximately 5,500 linear feet of permanent dike is anticipated along the Ohio River. The maintenance was assumed to be 10% of the placement cost of final cover and vegetation (excluding geosynthetics) per acre.

b., c. The post-closure estimate for final cover maintenance was updated as requested. Please see B. of the post-closure cost estimate.

d. The cost to place the reinforced concrete is $650/cubic yard for 1,233 cubic yards (approximately one acre) for an installation cost of $801,450. Due to the longevity of reinforced concrete, two percent (2%) of the placement cost is proposed to maintain the pad. The additional cost is added to B. of the post-closure cost estimate.

e. Please see the response to Comment #13.

f. A 10% contingency was added to both closure and post-closure cost estimates.

The revised closure and post-closure cost estimate are included in Attachment H.

18. For Section 5.5. Closure Documentation, please include the following:

a. Testing results from the CQA plan
b. Subgrade drawings of Phase 1
c. Final survey drawings for the completed cover for Phase 1.

IKEC Response:

The revised Closure Plan (text only) is included in Attachment I. Section 5.5 of the Closure Plan has been updated with the new text underlined.

19. Please revise the language for the post-closure use of the property in the post-closure plan and Section 6. The post-closure plan currently states, “The post-closure use of the property will be undisturbed vacant land space. The only activities occurring on the closed CCR unit will be related to the post-closure care activities. All other activities will be prohibited.” Revise this section to indicate the post-closure use of the WBSP will include the conveyor system for the synthetic gypsum loading operations.

IKEC Response:

The revised Closure Plan (text only) is included in Attachment I. The revised Post-Closure Plan is included in Attachment J.

20. Upon final closure, a legal description of the WBSP boundary and an Environmental Restrictive Covenant (ERC) will be required. The provided legal boundaries seems to be for the facility.

IKEC Response:

Upon completion of the final closure for the WBSP, a legal description of the WBSP boundary will be provided with the construction certification report. IKEC will work with OLQ to apply an environmental restrictive covenant to the WBSP site, limiting future use of the site for only commercial or industrial purposes.

21. Please note 30-year post-closure monitoring and maintenance will be required upon completion of the closure of the entire WBSP.

IKEC Response:
The 30-year post-closure monitoring and maintenance required per 329 IAC 10-31-2 will begin upon completion of the final closure certification for the WBSP per 329 IAC 10-31-2(b).

ATTACHMENT A

Geotechnical Engineering Study

(Kocera, 2020)

Geotechnical Engineering Study, Clifty Creek Plant, Material Handling Pad, IKEC Power Plant, Madison, Indiana (DWK Contract Number 19049.D) (Revised May 20, 2020)

D.W. KOZERA, INC.
PROFESSIONAL ENGINEERS & GEOLOGISTS

July 9, 2019
(Revised May 20, 2020)

Whitney, Bailey, Cox and Magnani, LLC
300 East Joppa Road
Baltimore, Maryland 21286

Attn: Mr. Gus Fotinos, P.E.
(gfotinos@wbcm.com)

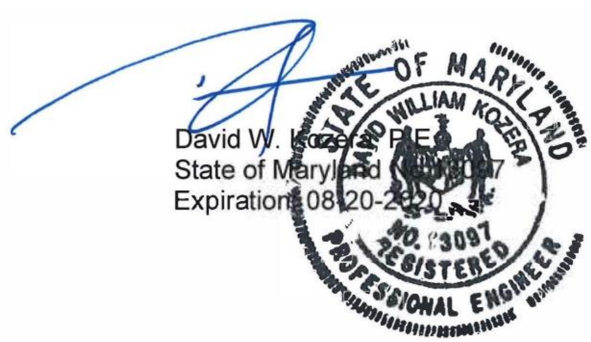
Subject: Geotechnical Engineering Study, Clifty Creek Plant, Material Handling Pad, IKEC Power Plant, Madison, Indiana (DWK Contract Number 19049.D)

Dear Mr. Fotinos:

D.W. Kozera, Inc. is pleased to submit this report containing the results of the subsurface investigation and geotechnical engineering study of the Material Handling Pad at the IKEC Power Plant in Madison, Indiana. The scope of services referenced in this report was performed in accordance with our contract dated May 24, 2019. Note this revision includes settlement estimates of the loaded concrete pad, as well as revised concrete pavement design using a CAT 980 loader.

We appreciate the opportunity to be of service to you. Please contact us if you have any questions related to this subsurface investigation report.

Very truly yours,
D.W. KOZERA, INC.



1408 Bare Hills Avenue, Suite 200
Baltimore, MD 21209 Phone: 410.823.1060 Fax: 410.823.1062

<u>Geotechnical Engineering Study</u>
Clifty Creek Plant, Material Handling Pad
IKEC Power Plant
Madison, Indiana
(DWK Contract Number 19049.D)

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APPENDICES

EXECUTIVE SUMMARY

A Material Handling Pad is to be constructed for the handling and loading from the Clifty Creek Power Plant onto barges. This Material Handling Pad is to be constructed on top of a reclaimed area which has been filled with a combination of Boiler Slag and Lean Clay. This pad will support a rubber tired loader (CAT 980M) and a tracked excavator which will load a conveyor system to barges.

The recommended concrete pad (pavement) thickness is 9.5 inches using concrete having a minimum unconfined compressive strength of 4,000 psi. This design is for the CAT 980M, rubber tired loader. The design requirements of the concrete pad based on the excavator will be performed by Whitney, Bailey, Cox and Magnani, LLC using the soil properties provided herein.

In order to achieve the design subgrade value of CBR=5 (min.), the pad area should be recompacted to a minimum of 98% of maximum dry density for ASTM D698.

The total long-term settlements under the center of the pad are estimated to be 1.65 inches with edge settlements of 0.8 inches. This yields a distortional settlement of 0.0007 in/in.

1.0 INTRODUCTION

1.1 Purpose and Scope

This report contains the results of our geotechnical investigation and analysis for Clifty Creek Plant, Material Handling Pad located at the IKEC Power Plant in Madison, Indiana. The report is based on the evaluation of 6 test borings performed on the project site, available geologic data, and our experience on neighboring sites. This study was conducted to characterize the subsurface conditions, and to establish engineering properties of the underlying materials in order to prepare recommendations for the concrete pad and issues related to the construction of foundation and site work.
The geotechnical investigation was performed in accordance with our contract dated May 23, 2019. This report includes:

a) Presentation of our test procedures, results of all testing conducted and available geotechnical and geological data from our previous studies.

b) Description of site geologic and groundwater conditions.

c) Presentation of subsurface soil stratigraphy with pertinent available physical properties.

d) Recommended geotechnical design parameters including soil strength, density, and compressibility as applicable.

e) Design recommendations for concrete pavements.

f) Determination as to whether on-site material will be suitable for use in control fills, and the extent to which acceptable on-site materials will be available and if off-site borrows will be required.

g) Recommendations on monitoring construction procedures including construction control measures, as well as recommended installation, monitoring of validation tests or instrumentation.

1.2 Limitations

This geotechnical study has been prepared in accordance with generally accepted geotechnical engineering practices. It is intended for the exclusive use of Whitney, Bailey, Cox and Magnani, LLC for the design and construction of the Material Handling Pad and site work as described herein. This report includes both factual and interpreted information. Factual information is defined as objective data based on direct observations, such as soil samples and laboratory testing results. Interpreted information or geotechnical engineering interpretation is based on the engineering judgment, correlation, or extrapolation from factual information.

This report is based on information for the proposed structure that was made available to us at the time of the writing of this report. No warranties, express or implied, are intended or should be assumed. D.W. Kozera, Inc. should be allowed to review the project drawings and specifications as a continuation of our design recommendations and as a precursor to our providing geotechnical engineering services during construction. In the event that any changes in the grades, loads, or location as described in this report are planned, the conclusions and recommendations contained herein shall not be considered valid unless D.W. Kozera, Inc. reviews the changes, and either verifies or modifies the conclusions of this report in writing.

Information contained in this report is based on data obtained from limited subsurface exploration that represents the soil conditions only at the specific location and time investigated, and only to the depth penetrated. Subsurface conditions and groundwater levels at other locations or depths may differ from conditions occurring at the investigated locations. An attempt has been made to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during construction.

D.W. Kozera, Inc. considers construction observations and testing of the foundations and earthwork an integral part of the geotechnical design, and therefore, these services should be provided by the geotechnical engineer of record. This is necessary so that we may modify our assumptions and recommendations based on actual conditions that are exposed during construction and observed by us. We cannot assume responsibility or liability for the adequacy of our foundation recommendations if we do not observe the construction.

1.3 Site Description

The IKEC Clifty Creek Power Plant is located west of Madison, Indiana. The proposed materials handling pad is located west of the main plant along the Ohio River. The pad is to be placed atop of a reclaimed area adjacent to the north side of the Ohio River.

1.4 Proposed Construction

This Material Handling Pad is to measure 180 x 235 feet and be used for the loading of Flue Gas Desulfurization (FGD) into a conveyor system which will service barge loading at the river. The conveyor and hopper system located at the southwest corner of the pad will be pile supported. The concrete pad will support stockpiles of FGD and two support vehicles: A Caterpillar rubber tired wheel loader, CAT 980M and a Liebhehr tracked excavator which we understand will be placed on timber mats. The maximum FGD stockpile is expected to be 11,000 tons.

2.0 SUBSURFACE INVESTIGATION

2.1 Field Investigation

The subsurface investigation was performed on June 19, 2019. It included drilling a total of 6 test borings to depths of 30 feet below existing grade. The locations of the soil test borings are shown on the Boring Location Plan, Appendix A. The borings were drilled using a drill rig which has automatic hammer to obtain SPT samples. The test borings were backfilled upon completion.

2.2 Soil Test Borings

Test borings were advanced using hollow-stem augers (3-1/4 inch I.D. HSA) and soil samples were recovered from the borings at selected intervals by driving a 1-3/8 inch ID (2-inch OD) split-spoon sampler in accordance with ASTM D-1586 specifications. SPT were conducted at changes in strata or at intervals not exceeding five feet. The sampler was first seated about 6 inches to penetrate through the loose cuttings and then driven an additional 1 foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated as the Standard Penetration Resistance (N) value. Soils obtained from the sampling device were sealed in glass sample jars and transported to soils testing laboratory. The recovered soil samples were inspected and classified by a Geotechnical Engineer using the ASTM Soil Classification System (ASTM D 2487). A description of the soils and conditions encountered at each test boring location are presented on the Boring Logs and are included in Appendix A.

2.3 Groundwater Conditions

Groundwater levels were noted in each of the borings during drilling operations, immediately after completion of drilling. Groundwater was observed on the drill rods and samples during drilling operations in five of the test borings. Groundwater readings at the end of drilling and after the HSA auger is pulled out were noted. The groundwater depth and the corresponding groundwater reading time were recorded. These are included in the boring logs which are attached in Appendix A. The groundwater elevations vary from EL 446± to EL 447± (i.e. 23 feet to 24 feet below the existing ground surface). It should be noted that groundwater level will fluctuate due to seasonal changes, precipitation, construction activities, etc. Also note that, the highest groundwater observations are normally encountered in late winter and early spring.

2.4 Soil Laboratory Testing

Two bulk samples and two jar samples were tested for soil laboratory testing. These tests included water moisture content (ASTM D2216), Atterberg Limits (ASTM D4318) and Gradation Analysis (ASTM D422). In addition, Compression Tests (ASTM D698) and California Bearing Ratio Tests were performed on both the Lean Clay (CL) sampled and the Granular Boiler Slag to assess these materials for support of the concrete pad.

3.0 SUBSURFACE CONDITONS

3.1 Stratification

The Boring Logs included in Appendix A contain details related to the subsurface conditions encountered at the test boring locations. Stratification lines shown on the Boring Logs in the Appendix represent approximate transitions between material types. Strata changes can occur gradually or at different levels than those shown on the Boring Logs that depict conditions at the specific indicated locations and depths at the time of our subsurface exploration program.

3.1.1 Stratum A and A1: Man-Placed Fill

The site is underlain by at least 30 feet of fill material. This fill material consisted either of Boiler Slag (Stratum A) fill or a lean clay fill (Stratum A-1). Man-placed fill was encountered in all of the test borings. The fill material was observed to consist either of boiler slag, which is a silty sand with gravel or lean clay. The penetration resistance in the fill indicated a low to medium density with standard penetration resistance (SPT) N-values ranging from 4 blows per foot (BPF) to 56 BPF. The Boiler Slag Fill had typically higher blowcounts than the lean clay fill.

4.0 EARTHWORK

In order to prepare the materials handling pad, the following sections discuss the requirements for cut/fill and recompaction of the existing fills.

4.1 Discussion

Careful subgrade preparation, including stripping of organic layers, and/or soft surface soils is required to prepare a suitable fill subgrade. Less than 2 feet of cut and fill is expected for the material slab on grade.

4.2 Excavation Characteristics

Excavation of this site is expected to be performed using conventional earthmoving equipment. Careful preparation of fill subgrades, proper placement and compaction of structural fill and backfill are both necessary to prepare a suitable site for the support of the proposed structures.

4.3 Subgrade Preparation

Compacted structural fill may be placed to support the materials slab. All vegetation and topsoil located below proposed slab should be removed from the fill subgrades prior to filling. The fill subgrades should be proofrolled to assure that all unsuitable, soft, and loose soils have been removed from below the building and pavement areas. During proofrolling, the subgrades should be observed by the geotechnical engineer of record. Any unsuitable soils that are observed to be excessively settling or to be pumping during proofrolling, should be removed down to firm soils, and then replaced with satisfactory soil materials compacted in accordance with the project specifications.

The on-site soils may become unstable in wet weather and under construction traffic. Undercutting of floor and fill subgrades should be expected if the subgrades are exposed to the above events. The Project Specifications should require the contractor be responsible for protecting the subgrades from weather and equipment damage.

4.4 Compacted Structural Fill

Fill Materials:

Compacted structural fill and backfill for use below structures should consist of satisfactory soils classified as SM or better in accordance with the Unified Soil Classification System, ASTM D-2487. Soils meeting this requirement are classified as SM, SP, SW, GM, GP, and GW. GC and SC materials may be utilized as compacted structural fill if they contain less than 35% passing the No. 200 sieve and Plasticity Index (PI) of less than 15. Unsatisfactory soils are those classified as OL, OH, CH, CL, MH and ML.

The on-site Boiler Slag is expected to consist primarily of Silty Sand with Gravel. These materials are expected to be suitable for reuse as compacted structural fill. Some segregation of the on-site material may be required in order to dispose of unsuitable material.

Soils used for compacted fill should be free of unsuitable materials such as topsoil and other organics, rubble, and rocks larger than 4 inches in diameter. The in-place moisture content of the satisfactory soils material shall be adjusted by the contractor thoroughly wetting or drying, to within 3 percent of the optimum moisture content. Moisture conditioning of these soils may be required depending on the time of the year the fill is placed.

Fill Compaction:

Compacted structural fill should be placed in approximately horizontal layers, each layer having a loose thickness of not more than 8 inches. All structural fill should be compacted to 95 percent of the maximum dry density in accordance with ASTM D698, Standard Proctor. The contractor should select appropriate compaction equipment to achieve the required compaction.

Field moisture contents of the fill may have to be adjusted in order to obtain suitable degrees of compaction. It is anticipated that field moisture contents of fill materials will need to be controlled to the range of optimum moisture content plus or minus 3 percentage points if stable fills with adequate degrees of compaction are to be obtained.

Compacted structural fill shall be placed to at least five feet beyond the edge of mat. The supporting slopes of the fill shall be compacted to the same compaction requirements as the fills below the structure.

All fill placement and compaction operations should be monitored by an experienced Soils Inspector on a full-time basis to ensure that fill materials are being placed and compacted in compliance with the project specifications. Should compaction problems develop during grading operations, the Geotechnical Engineer should be consulted for an evaluation of the problems.

5.0 RECOMMEDATIONS FOR CONCRETE PAD

5.1 Concrete Design

The design of the Materials Handling Pad was performed using a rigid pavement analysis for the CAT 980M wheel loader. CBR testing indicated that the CBR value for the granular boiler slag and clay fill at this site were 11.8 to 4.9, respectively.

The recommended pavement thickness for the CAT 980M loader is

CBR Value	Calculated Pavement Thickness
5	9.5 inches

Concrete having minimum compression strength of 4,000 psi was used in the analysis. A maximum joint spacing of 15 feet is required. The steel dowel design, as well as any wire mesh shrinkage reinforcement, is being performed by WBCM. The design of the Lieder Tracked Excavator, reportedly to be placed on wooden mats is also being performed by WBCM.

For the design of the concrete pad to support the tracked loader (on timber mats) the software program 'SPMATS' will be utilized by WBCM. This program requires both a soil subgrade modulus and an allowable soil pressure. Based on the soil laboratory tests performed, a soil subgrade modulus of k_s =175 pci may be used which represents the clay fill soils. The selection of the allowable soil pressure is either settlement controlled or strength (bearing capacity) for the loaded area. For the tracked excavator, placed directly on the concrete mat, an allowable soil pressure of 2,000 psf should be used. When this excavator is placed on timber mats which measures at least 25 ft. x 20 ft., an allowable soil pressure of 6,000 psf can be used.

5.2 Settlement Estimates

An elastic settlement analysis was performed using the data from the 2019 borings which extend to 30 feet, and the 1953 borings which extend to approximately 100 feet below the Pad Elevation.

The soil profile analyzed, as well as the applicable 1953 borings, are included in Appendix D. The analysis assumed that the 11,000 ton product load would be distributed over 75% of the pad yielding a distributed pressure of 695 psf. The weight of the pad, 105 psf, was also added to the load yielding a total pressure of 800 psf. The predicted settlement at the center of the pad is 1.18 inches of immediate settlement and 1.65 inches of total settlement after 10 years. The settlement at the pad edge can be considered as 0.6 inches of immediate settlement and a total of 0.8 inches of settlement after 10 years. The distortional settlement across the pad is therefore estimated to be 0.0007 in/in.

6.0 CONSTRUCTION CONSIDERATIONS

Specific recommendations for pad construction are given below:

6.1 Earthwork

The work areas should be stripped of existing topsoil and soft surface soils, and the resulting subgrades proofrolled under the observation of our representative. Any soft or unsuitable soils encountered should be removed and replaced with compacted fill.

6.2 Compacted Structural Fill

Compacted fill should meet the requirements outlined in this report. All compacted structural fill and backfill should be compacted to 95 percent of the maximum dry density per ASTM D698, Standard Proctor. Moisture conditioning, such as wetting or drying, should be expected to be required depending on the time of year construction occurs. However, it is recommended that earthwork be performed in the warmer, drier months between April and November. Soil additives such as lime, cement or kiln dust may be used to expedite compaction in soils above the optimum moisture for compaction.

6.3 Review of Construction Documents

Any deviation to the project design subsequent to the date of this report, such as changes in floor grades, building loads and building location, should be brought to our attention to determine if our recommendations contained herein remain valid. We should be allowed to review the project drawings and specifications, as a follow-up to our design recommendations and as a precursor to our providing the geotechnical engineering services during construction.

6.4 Construction Observation and Testing

Regardless of the thoroughness of a geotechnical engineering exploration, there is always a possibility that conditions will vary from those encountered in the test borings, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. D.W. Kozera, Inc. considers construction observation and testing of the foundations and earthwork an integral part of the geotechnical design, and therefore these services should be provided by the geotechnical engineer of record. As the actual subsurface conditions are exposed and observed by us during construction, modifications to our report recommendations can be made promptly and efficiently as needed. Note that we cannot assume liability or responsibility for the adequacy of our foundation recommendations if we do not observe the foundation construction.

Observations and testing should at minimum include full-time observations of the excavation of footing, fill, and floor subgrades, and field density testing of compacted structural fill. Other services, including materials testing (concrete, reinforcing steel, etc.) can be provided upon request.

APPENDIX A

Subsurface Investigation Report

APPENDIX A

GENERAL NOTES FOR TEST BORINGS AND TEST PITS
Geotechnical Engineering Study
Clifty Creek Plant, Madison, Indiana
(DWK Contract Number 19049.D)

1. Test Borings

Test borings are advanced by turning an auger with a center opening of 2-1/2 or 3-1/4 inches. Cuttings are brought to the surface by the auger flights. Sampling is performed through the center opening in the hollow stem auger by standard methods. No water was introduced into the borings using this procedure.

1.1. Standard Penetration Tests

Testing is performed by driving a two-inch O.D., 1-3/8 inch I.D. sampling spoon through three, six-inch intervals or as indicated, using a 140 pound hammer falling 30 inches according to ASTM D1586. The number given as the 'N' value is the sum of the blows required to drive the samples for the second and third intervals.

2. Test Pits

Test pits are logged to provide a record for geotechnical evaluation, construction inspection, or other specialized purpose such as building damage investigations, subgrade inspections, etc.

2.1. Test Procedures

PP, when indicated, denotes the results of tests performed with a Pocket Penetrometer. The numbers indicate the unconfined compressive strength of the undisturbed soils in tsf. DCP, when indicated, denotes the results of tests performed with a Dynamic Cone Penetrometer at an initial seating increment of two-inches, and 1-3/4-inch increments thereafter. The penetrometer is driven by a 15-pound hammer falling 20-inches, and the number of hammer blows per increment is recorded.

3. General

The test pits and test boring logs represent subsurface conditions only at the specified location and at the particular time excavated. The passage of time may result in changes in these conditions. Conditions at other locations on the site may differ from conditions occurring at the test pit or test boring location.

The stratification lines represent the approximate boundary line between soil and rock types as observed in the test pit and test boring. The soil profile, foundation dimensions, water level observations, and test results presented on the log have been made with reasonable care and accuracy but must be considered only an approximate representation of the subsurface conditions to be encountered at that particular location.

The observed water levels are considered a reliable indication of the groundwater table levels at the time indicated. The groundwater table may be completely dependent on the amount of precipitation at the site during a particular period of time. Fluctuations in the water table should be expected with variations in precipitation, surface run-off, evaporation, construction activity, etc.

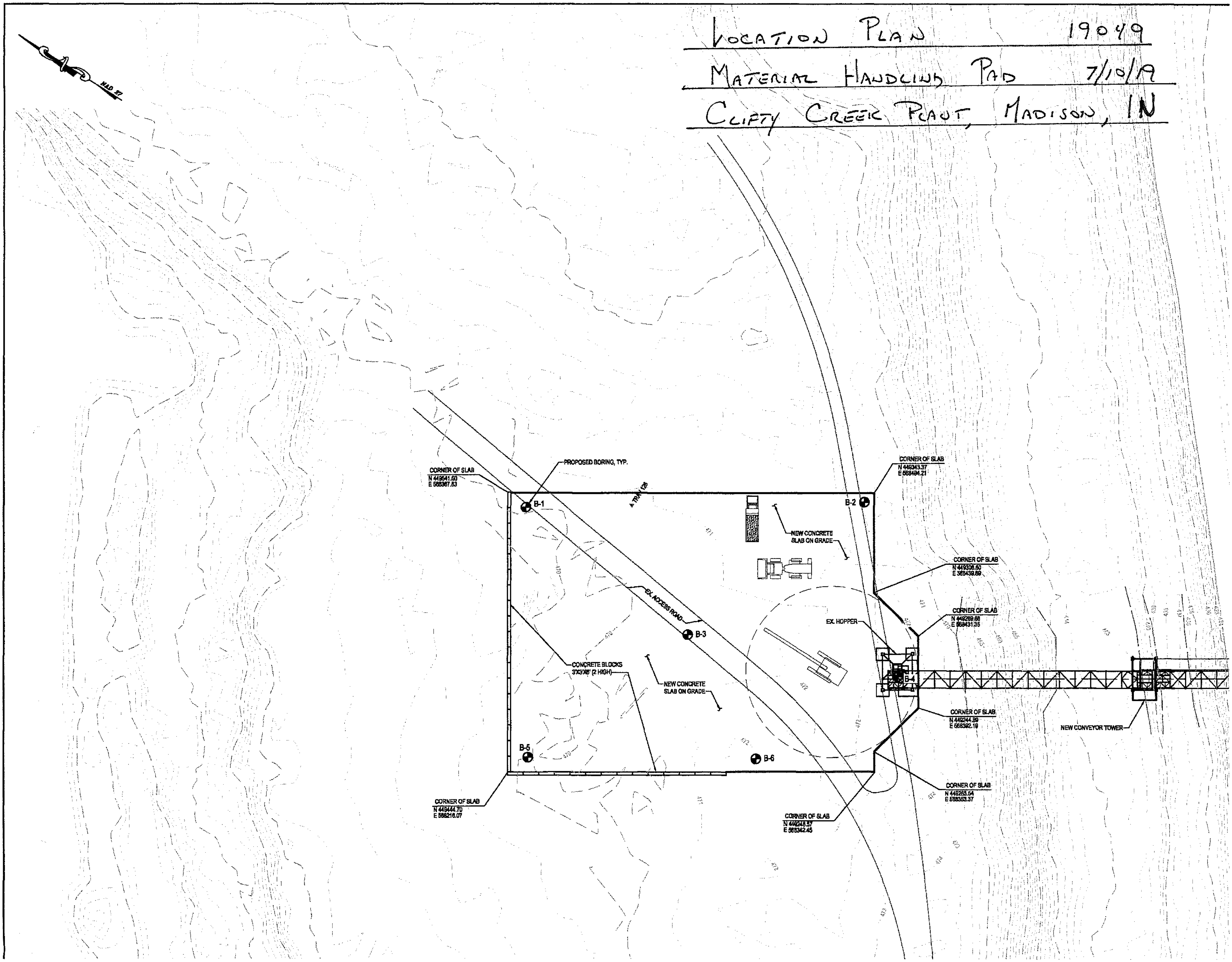
4. Locations and Grades

The test borings were located in the field by D.W. Kozera, Inc. based on drawings provided to us. The ground surface elevations were estimated from the drawings.

Location Plan 19049

Material Handling Pad 7/10/19

Clifty Creek Plant, Madison, IN



D. W. KOZERA, INC.
Baltimore, Maryland

PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B1
Contract No.: 19049
Page: 1 of 1

Project: Clifty Creek Plant
Location: 1335 Clifty Hollow Road
Madison, IN

Ground Surf. El. (±) : 470.0
Date Started : 6-19-19
Date Completed : 6-19-19
Contractor : CinDrill, Inc.
Driller : D. Ciprioni
Rig : cme 55
Drill Method : 3-1/4" HSA
Inspector : D. Kozera

	GROUNDWATER OBSERVATIONS				
	Date	Time	Depth	Casing	Caved
Encountered	6-19	08:00	24.0	23.5	---
Completion	6-19	08:05	---	---	---
Casing Pulled	6-19	08:10	---	---	---
	6-19	08:30	Backfilled	Upon	Completion

Depth (ft)	Surf. Elev. 470.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0	470							Boiler slag, silty sand, FILL, trace gravel, moist, dark brown	Fill	A	
		1	39-29-20	49							
		2	4-4-4	8							
5	465										
		3	3-2-2	4							
		4	2-3-12	15							
10	460										
		5	13-23-32	55							
15	455										
		6	21-22-22	44							
20	450										
		7	6-3-3	6	∇						
25	445										
								wet @ 28.0'			
		8	2-1-3	4							
30	440							Bottom of Test Boring @ 30.0'			

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B2
Contract No.: 19049

Project: Clifty Creek Plant
Location: 1335 Clifty Hollow Road
Madison, IN

Ground Surf. El. (±) : 471.0
Date Started : 6-19-19
Date Completed : 6-19-19
Contractor : CinDrill, Inc.
Driller : D. Ciprioni
Rig : cme 55
Drill Method : 3-1/4" HSA
Inspector : D. Kozera

GROUNDWATER OBSERVATIONS

	Date	Time	Depth	Casing	Caved
Encountered	6-19	09:05	Dry	---	---
Completion	6-19	09:06	Dry	---	---
Casing Pulled	6-19	09:10	---	---	---
	6-19	10:00	Backfilled	Upon	Completion

Depth (ft)	Surf. Elev. 471.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0								Boiler slag, silty sand, FILL, trace gravel, moist, dark brown	Fill	A	
	470	1	13-21-25	46							
		2	9-7-3	10							
5								Lean clay, FILL, moist, tan, gray		A-1	
	465	3	3-3-3	6							
		4	6-7-4	11							
10	460										
		5	6-7-7	14				Lean clay, FILL, with trace boiler slag	Fill		
15	455										
								cobbles @ 18.0'			
		6	28-23-12	35							
20	450										
		7	6-7-8	15							
25	445										
		8	3-5-7	12							
30								Bottom of Test Boring @30.0'			

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B3
Contract No.: 19049
Page: 1 of 1

Project: Clifty Creek Plant
Location: 1335 Clifty Hollow Road
Madison, IN

Ground Surf. El. (±) : 470.5
Date Started : 6-19-19
Date Completed : 6-19-19
Contractor : CinDrill, Inc.
Driller : D. Ciprioni
Rig : cme 55
Drill Method : 3-1/4" HSA
Inspector : D. Kozera

GROUNDWATER OBSERVATIONS

	Date	Time	Depth	Casing	Caved
Encountered	6-19	10:20	23.5	23.0	---
Completion	6-19	10:25	---	---	---
Casing Pulled	6-19	10:30	---	---	---
	6-19	10:35	Backfilled	Upon	Completion

Depth (ft)	Surf. Elev. 470.5	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0	470							Boiler slag FILL, silty sand, trace gravel, moist, dark brown	Fill	A	
		1	12-14-12	26							
		2	18-25-25	50							
5	465	3	15-16-18	34							
		4	19-18-20	38							
10	460										
		5	15-17-18	35							
15	455										
		6	15-28-28	56							
20	450										
					∇						
		7	11-11-9	20							
25	445										
								wet @ 28.0'			
		8	9-12-12	24							
30								Bottom of Test Boring @30.0'			

D. W. KOZERA, INC.
Baltimore, Maryland

PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B4
Contract No.: 19049

Project: Clifty Creek Plant
Location: 1335 Clifty Hollow Road
Madison, IN

Ground Surf. El. (±) : 472.0
Date Started : 6-19-19
Date Completed : 6-19-19
Contractor : CinDrill, Inc.
Driller : D. Ciprioni
Rig : cme 55
Drill Method : 3-1/4" HSA
Inspector : D. Kozera

	GROUNDWATER OBSERVATIONS				
	Date	Time	Depth	Casing	Caved
Encountered	6-19	11:30	Moist	---	---
Completion	6-19	11:35	---	---	---
Casing Pulled	6-19	11:40	---	---	---
	6-19	11:45	Backfilled	Upon	Completion

Depth (ft)	Surf. Elev. 472.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0								Lean clay, FILL, with gravel, moist, brown	Fill	A-1	
	470	1	12-14-16	30							
		2	6-6-4	10							
5	465	3	5-6-7	13							
		4	5-6-8	14							
10								trace boiler slag below 10.0'			
	460										
15		5	5-8-8	16							
	455										
20		6	6-7-7	14							
	450										
25		7	5-7-8	15							
	445										
30		8	5-5-8	13				Bottom of Test Boring @ 30.0'			

D. W. KOZERA, INC.
Baltimore, Maryland

PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B5
Contract No.: 19049
Page: 1 of 1

Project: Clifty Creek Plant
Location: 1335 Clifty Hollow Road
Madison, IN

Ground Surf. El. (±)	: 470.0				
Date Started	: 6-19-19				
Date Completed	: 6-19-19				
Contractor	: CinDrill, Inc.				
Driller	: D. Ciprioni				
Rig	: cme 55				
Drill Method	: 3-1/4" HSA				
Inspector	: D. Kozera				

GROUNDWATER OBSERVATIONS

	Date	Time	Depth	Casing	Caved
Encountered	6-19	13:30	23.5	23.5	---
Completion	6-19	13:35	---	---	---
Casing Pulled	6-19	13:40	---	---	---
	6-19	13:45	Backfilled	Upon	Completion

Depth (ft)	Surf. Elev. 470.0	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0	470							Lean clay, FILL, with silty sand, moist, dark brown	Fill	A-1	
		1	6-4-6	10							
		2	3-4-6	10							
5	465										
		3	3-4-3	7							
		4	2-1-3	4							
10	460										
		5	2-1-3	4							
15	455										
								Silty sand, boiler slag FILL, with gravel, dark brown			
		6	11-13-16	29							
20	450										
					∇						
		7	19-14-9	23							
25	445										
		8	5-4-4	8							
30	440							Bottom of Test Boring @ 30.0'			

D. W. KOZERA, INC.
Baltimore, Maryland
PROFESSIONAL ENGINEERS & GEOLOGISTS

TEST BORING LOG

Boring No.: B6
Contract No.: 19049

Project: Clifty Creek Plant
Location: 1335 Clifty Hollow Road
Madison, IN

Ground Surf. El. (±) : 471.5
Date Started : 6-19-19
Date Completed : 6-19-19
Contractor : CinDrill, Inc.
Driller : D. Ciprioni
Rig : cme 55
Drill Method : 3-1/4" HSA
Inspector : D. Kozera

GROUNDWATER OBSERVATIONS	Date	Time	Depth	Casing	Caved
Encountered	6-19	14:30	24.8	23.0	---
Completion	6-19	14:35	---	---	---
Casing Pulled	6-19	14:40	---	---	---
	6-19	14:45	Backfilled	Upon	Completion

Depth (ft)	Surf. Elev. 471.5	Samples	Blow Counts	"N" Value	Water Level	Graphic	USCS	Description	Formation	Stratum	Remarks
0								Silty sand, boiler slag FILL, with gravel, moist, dark brown	Fill	A	
	470	1	24-28-32	60							
		2	6-7-6	13							
5	465	3	6-4-8	14							
		4	16-15-12	27							
10	460										
		5	2-2-2	4							
15	455										
		6	2-2-2	4							
20	450										
		7	3-4-5	9	∇						
25	445										
		8	2-3-4	7							
30								Bottom of Test Boring @ 30.0'			

APPENDIX B

Soil Laboratory Test Results

SUMMARY OF LABORATORY TESTING

CLIFTY CREEK

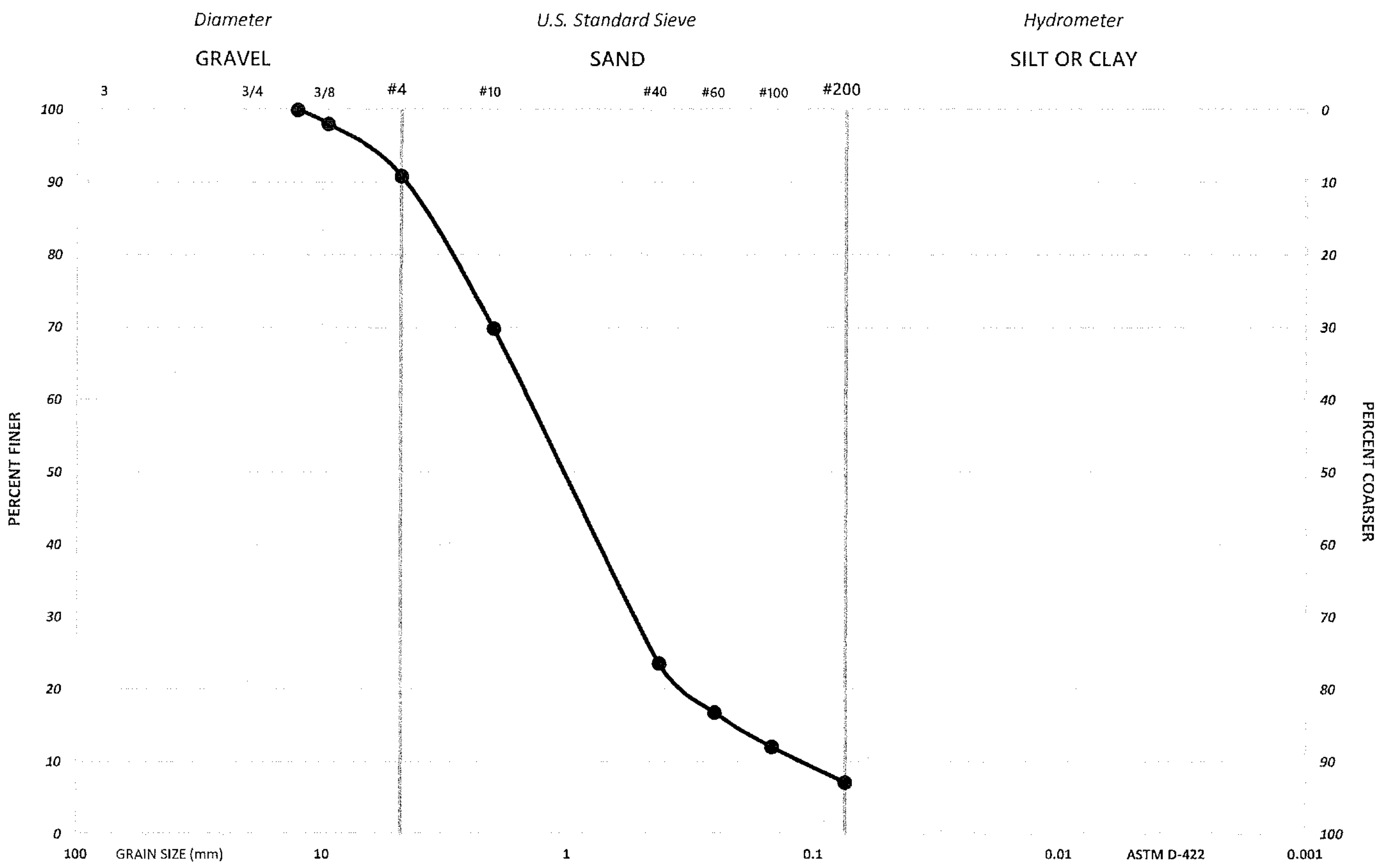
PROJECT NO.	19049	SAMPLE DATE	-	**JAY KAY TESTING, INC.**
SAMPLES:	4	LOCATION:	*Indiana*	5233 Lehman Road, Suite 110
REPORT:	07/04/19	REMARKS:	-	Spring Grove, PA 17362 Phone: (814) 404-9283

BORING	SAMPLE	DEPTH	MC %	OM %	LL	PL	PI	% FINES	USCS
B-1	-	3.5-5	5.0	-	NP	NP	NP	7.1	SW-SM
B-3	-	1-2.5	5.7	-	NP	NP	NP	10.1	SW-SM
B-4	Bulk	1-13	13.8	-	32	17	15	68.3	CL
B-5	Bulk	1-8	16.1	-	31	18	13	48.4	SC

Jay Kay Testing, Inc. (AASHTO-Accredited)

CLIFTY CREEK

Boring:	**B-1**	Project No.:	19049		**JAY KAY TESTING, INC.**
Sample:		Sample Date:	-		5233 Lehman Road, Suite 110
Depth:	**3.5-5'**	Location:	*Indiana*		Spring Grove, PA 17362 Phone: (814) 404-9283



GRAIN SIZE ANALYSIS

Diameter	75.0	50.8	37.5	25.4	19.0	12.7	9.51	4.75	2.0	0.42	0.25	0.147	0.074
Sieve Size	3"	2"	1.5"	1"	3/4"	1/2"	3/8"	#4	#10	#40	#60	#100	**# 200**
% Passing	-	-	-	-	-	100.0	98.1	90.9	69.9	23.6	16.8	12.1	**7.1**

% GRAVEL	% SAND	*Coarse Gravel*	*Fine Gravel*	*Coarse Sand*	*Medium Sand*	*Fine Sand*	CC	CU
9.1	**83.8**	-	9.1	21.0	46.3	16.5	1.75	12.57

Moisture Content	5.0	Organic Content	-
pH	-	Other	-

ATTERBERG LIMITS

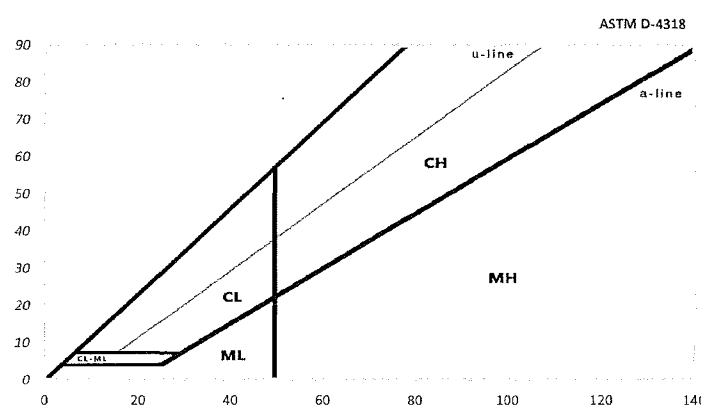
Liquid Limit	NP
Plastic Limit	NP
Plasticity Index	NP

CLASSIFICATION

AASHTO	A-1-b
USCS	SW-SM

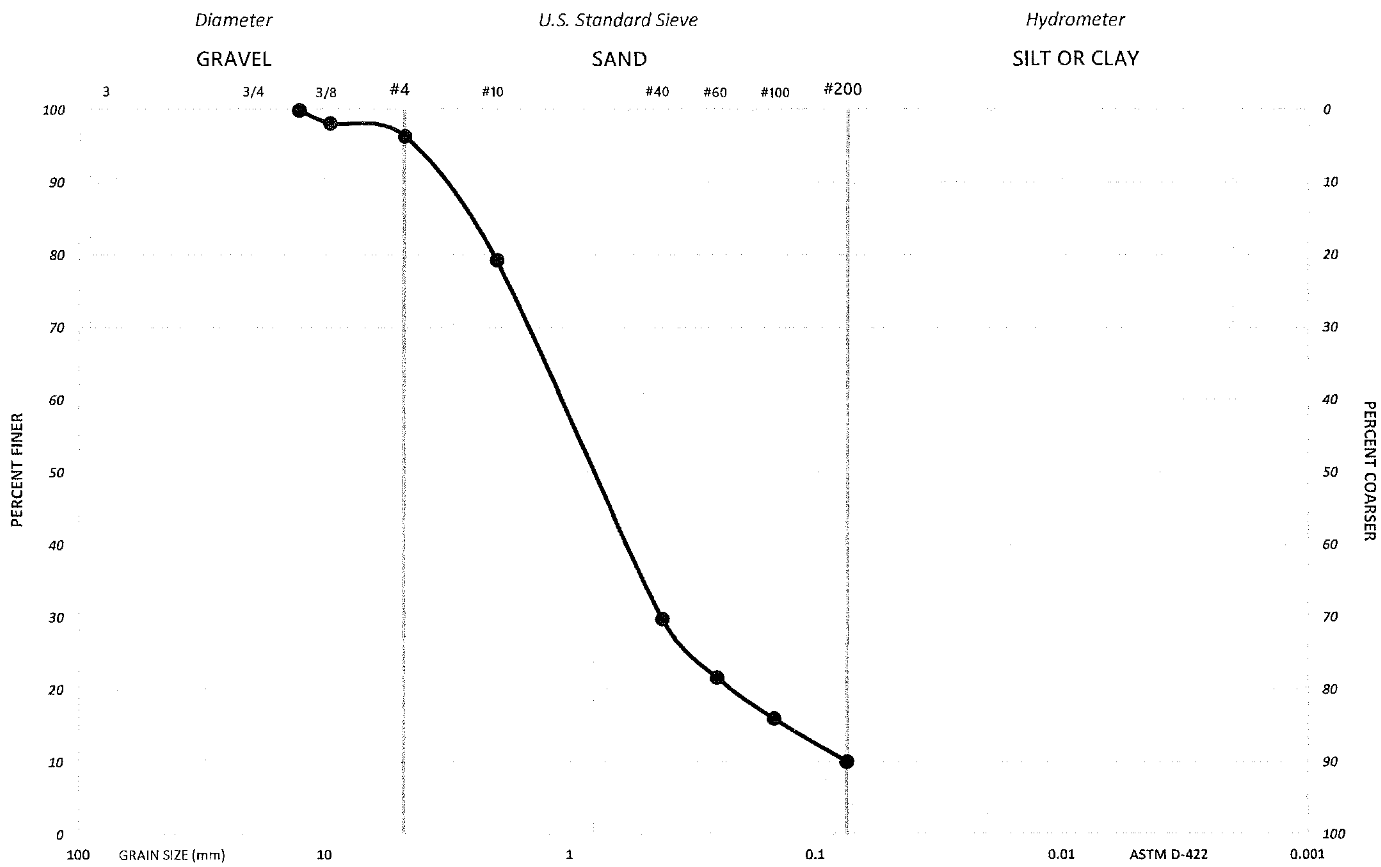
SOIL DESCRIPTION

Black well graded SAND with silt



CLIFTY CREEK

Boring:	B-3	Project No.:	19049	**JAY KAY TESTING, INC.**
Sample:		Sample Date:	-	5233 Lehman Road, Suite 110
Depth:	1-2.5'	Location:	*Indiana*	Spring Grove, PA 17362
				Phone: (814) 404-9283



GRAIN SIZE ANALYSIS

Diameter	75.0	50.8	37.5	25.4	19.0	12.7	9.51	4.75	2.0	0.42	0.25	0.147	0.074
Sieve Size	3"	2"	1.5"	1"	3/4"	1/2"	3/8"	#4	#10	#40	#60	#100	**# 200**
% Passing	-	-	-	-	-	100.0	98.2	96.4	79.4	29.8	21.7	16.0	**10.1**

% GRAVEL	**% SAND**	*Coarse Gravel*	*Fine Gravel*	*Coarse Sand*	*Medium Sand*	*Fine Sand*	CC	CU
3.6	**86.3**	-	3.6	17.0	49.6	19.7	2.42	15.18

Moisture Content	5.7	Organic Content	-
pH	-	Other	-

ATTERBERG LIMITS

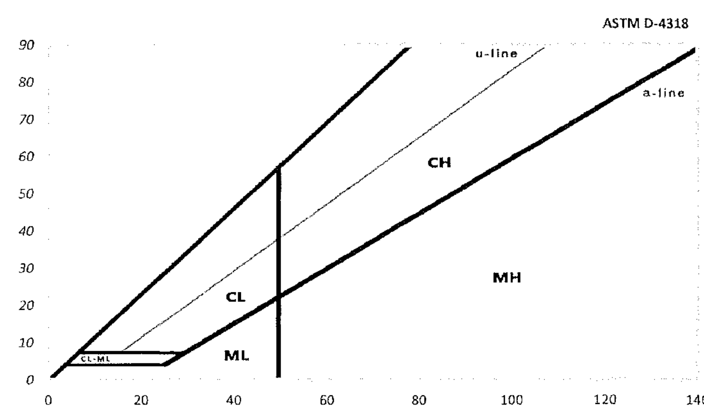
Liquid Limit	NP
Plastic Limit	NP
Plasticity Index	NP

CLASSIFICATION

AASHTO	A-1-b
USCS	SW-SM

SOIL DESCRIPTION

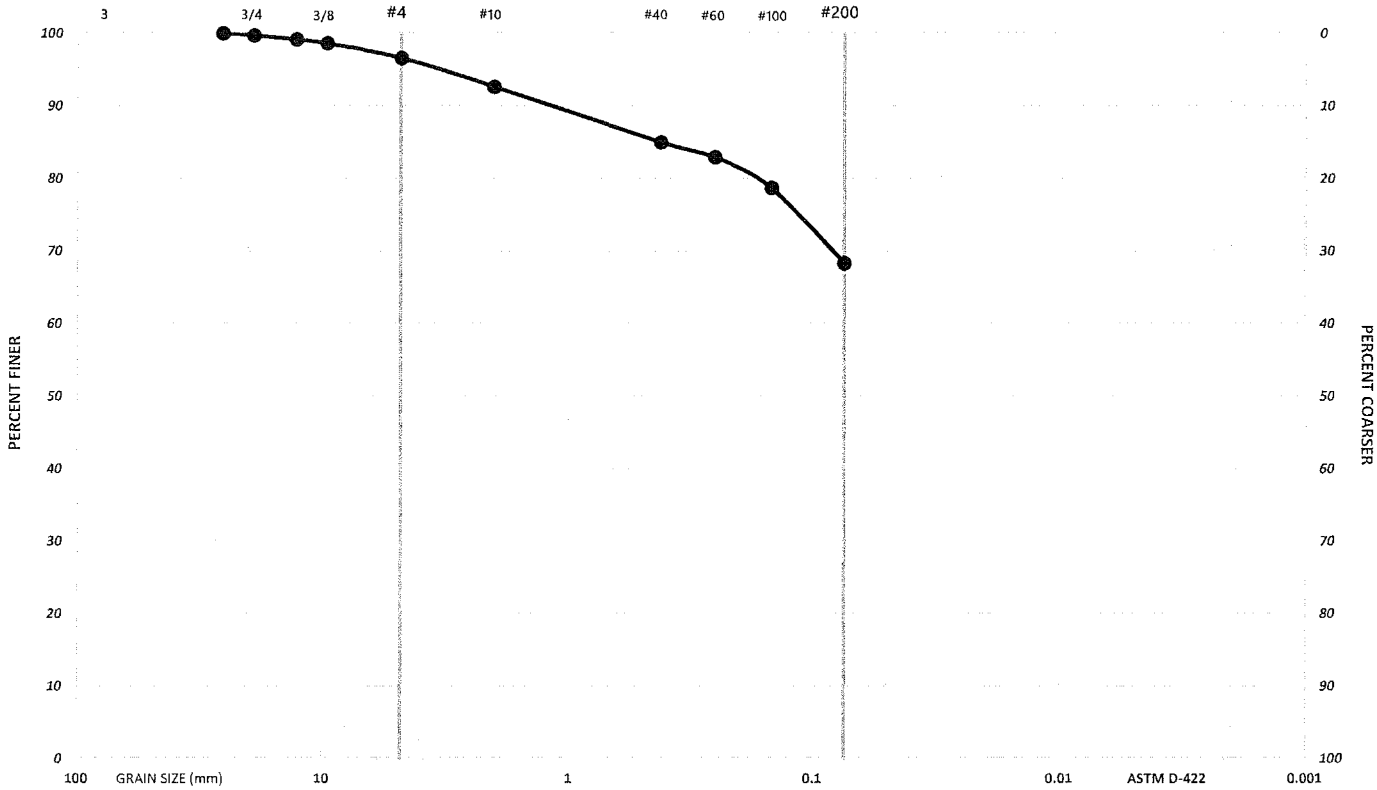
Black well graded SAND with silt



CLIFTY CREEK

Boring:	**B-4**	Project No.:	19049	
Sample:	**Bulk**	Sample Date:	-	
Depth:	**1-13'**	Location:	*Indiana*	

JAY KAY TESTING, INC.
5233 Lehman Road, Suite 110
Spring Grove, PA 17362
Phone: (814) 404-9283



GRAIN SIZE ANALYSIS

Diameter	75.0	50.8	37.5	25.4	19.0	12.7	9.51	4.75	2.0	0.42	0.25	0.147	0.074
Sieve Size	3"	2"	1.5"	1"	3/4"	1/2"	3/8"	#4	#10	#40	#60	#100	**# 200**
% Passing	-	-	-	100.0	99.7	99.1	98.6	96.6	92.6	85.0	82.9	78.7	**68.3**

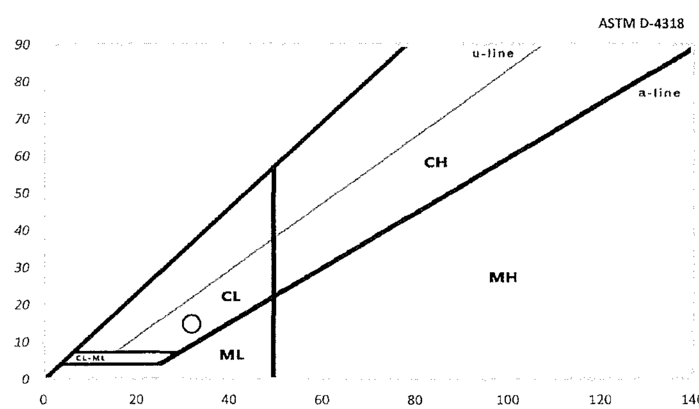
% GRAVEL	**% SAND**	*Coarse Gravel*	*Fine Gravel*	*Coarse Sand*	*Medium Sand*	*Fine Sand*	CC	CU
3.4	**28.3**	0.3	3.1	4.0	7.6	16.7	-	-

Moisture Content	13.8	Organic Content	-
pH	-	Other	-

ATTERBERG LIMITS		CLASSIFICATION	
Liquid Limit	32	AASHTO	A-6
Plastic Limit	17	USCS	CL
Plasticity Index	15		

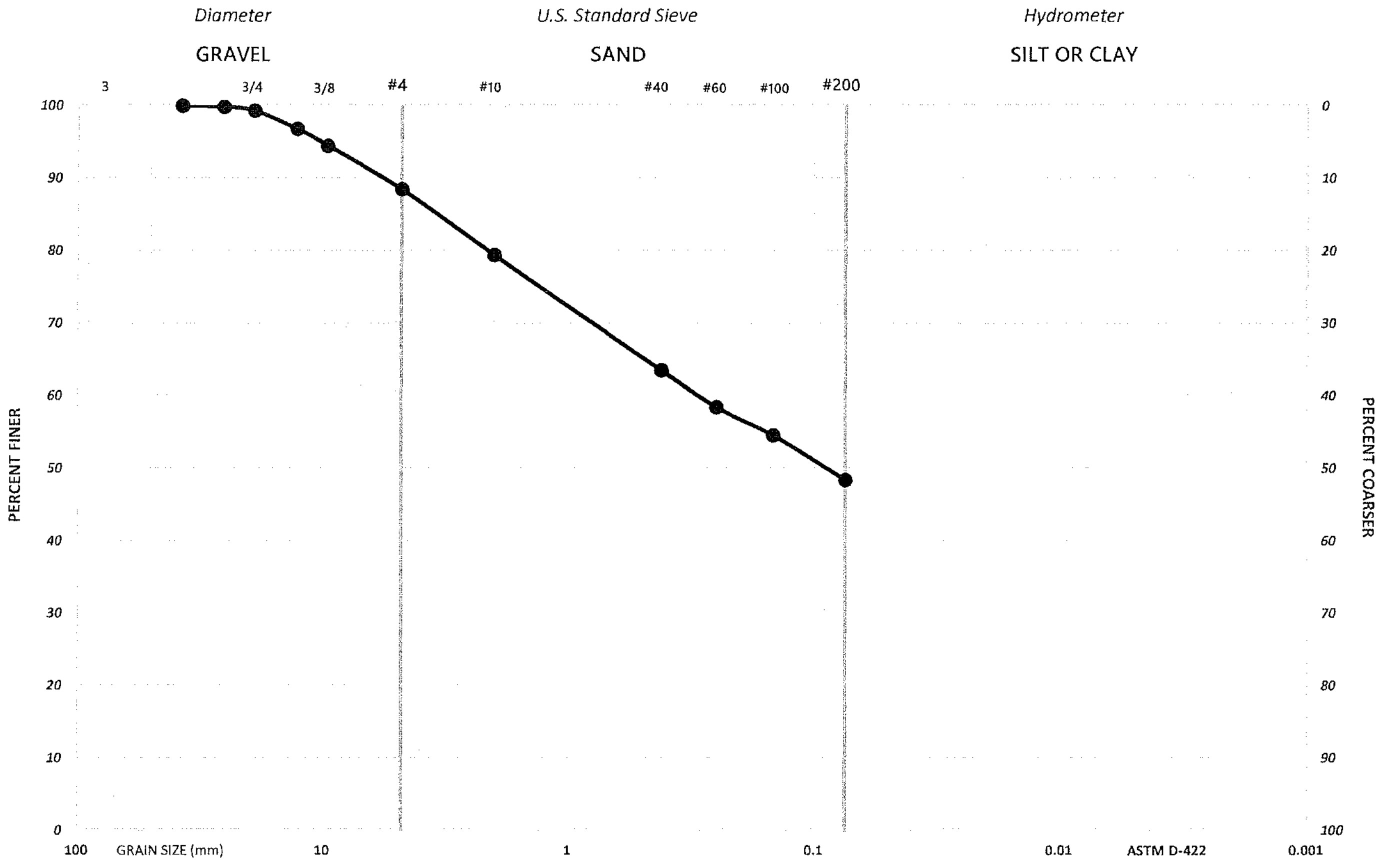
SOIL DESCRIPTION

Light brown sandy lean CLAY



CLIFTY CREEK

Boring:	**B-5**	Project No.:	19049	**JAY KAY TESTING, INC.**
Sample:	**Bulk**	Sample Date:	-	5233 Lehman Road, Suite 110
Depth:	**1-8'**	Location:	*Indiana*	Spring Grove, PA 17362
				Phone: (814) 404-9283



GRAIN SIZE ANALYSIS

Diameter	75.0	50.8	37.5	25.4	19.0	12.7	9.51	4.75	2.0	0.42	0.25	0.147	0.074
Sieve Size	3"	2"	1.5"	1"	3/4"	1/2"	3/8"	#4	#10	#40	#60	#100	**# 200**
% Passing	-	-	100.0	99.8	99.3	96.8	94.5	88.5	79.5	63.5	58.4	54.5	**48.4**

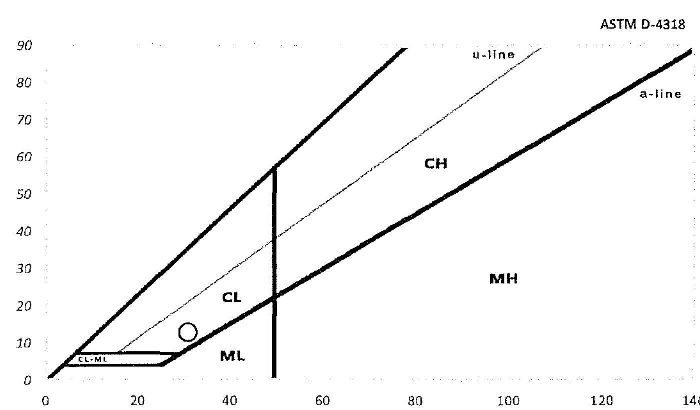
% GRAVEL	% SAND	*Coarse Gravel*	*Fine Gravel*	*Coarse Sand*	*Medium Sand*	*Fine Sand*	CC	CU
11.5	**40.1**	0.7	10.8	9.0	16.0	15.1	-	-

Moisture Content	16.1	Organic Content	-
pH	-	Other	-

ATTERBERG LIMITS		CLASSIFICATION	
Liquid Limit	31	AASHTO	A-6
Plastic Limit	18	USCS	SC
Plasticity Index	13		

SOIL DESCRIPTION

Black clayey SAND



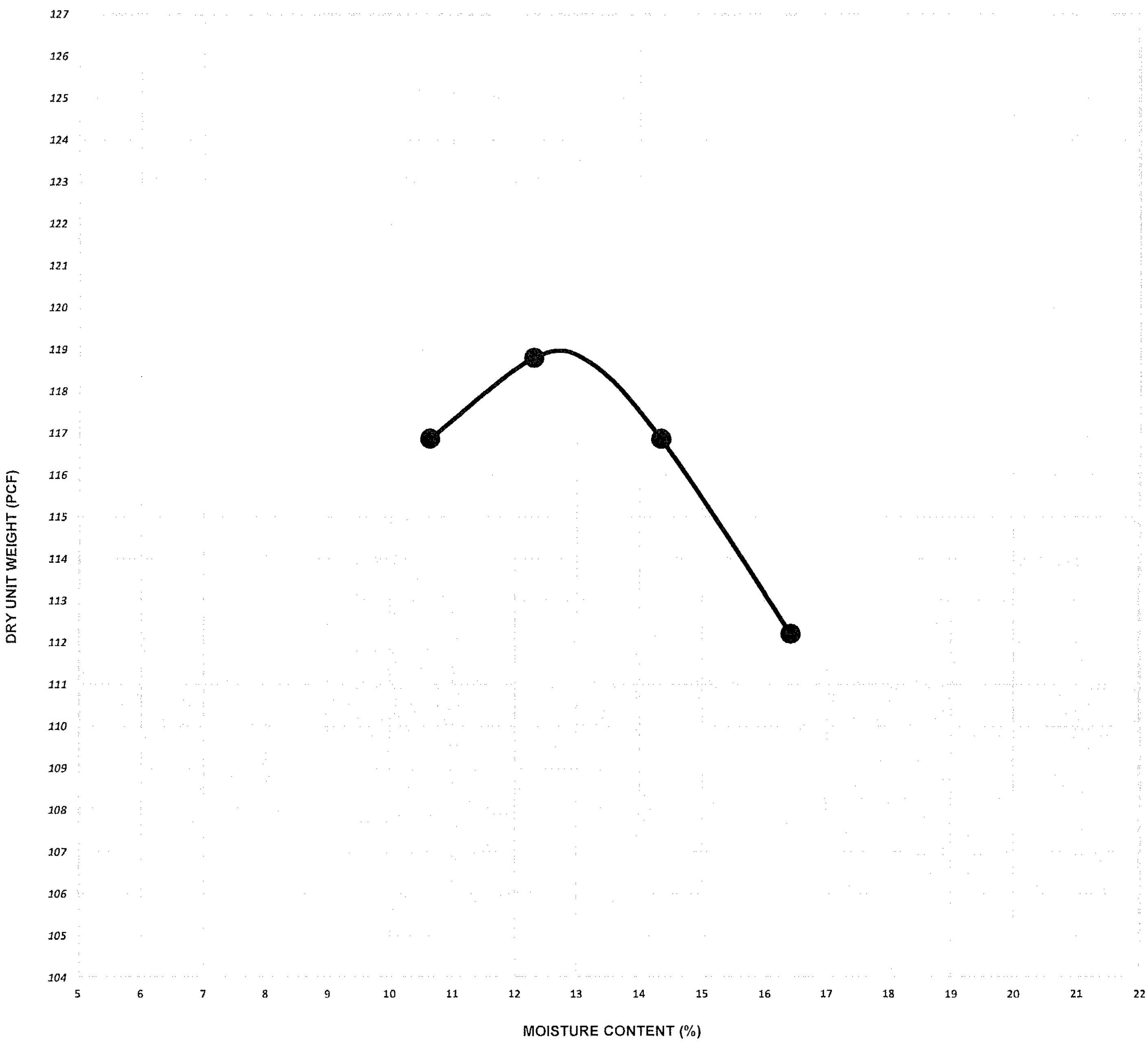
CLIFTY CREEK

Boring:	**B-4**	Project No.:	19049	**JAY KAY TESTING, INC.**
Sample:	**Bulk**	Sample Date:	-	5233 Lehman Road, Suite 110
Depth:	**1-13'**	Location:	*Indiana*	Spring Grove, PA 17362 Phone: (814) 404-9283

STANDARD PROCTOR TEST RESULTS

TEST METHOD: ASTM D-698 (A)

MAXIMUM DRY UNIT WEIGHT	OPTIMUM MOISTURE CONTENT
118.9	12.7
PCF	%



MC	LL	PL	PI	USCS	AASHTO	FINES	SOIL DESCRIPTION
13.8	32	17	15	CL	A-6	68.3	Light brown sandy lean CLAY

CLIFTY CREEK

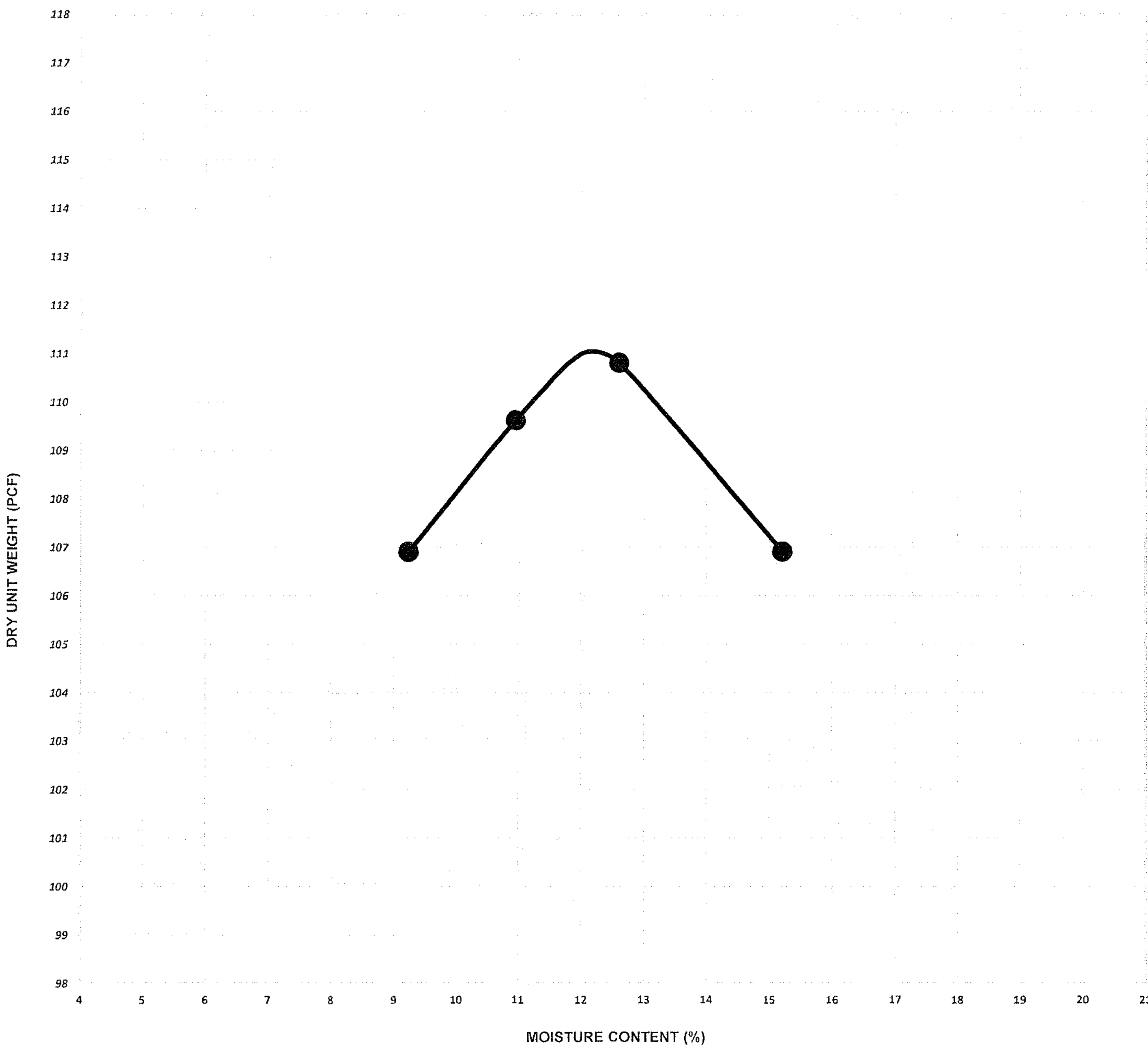
Boring:	**B-5**	Project No.:	19049	**JAY KAY TESTING, INC.**
Sample:	**Bulk**	Sample Date:	-	5233 Lehman Road, Suite 110
Depth:	**1-8'**	Location:	*Indiana*	Spring Grove, PA 17362 Phone: (814) 404-9283

STANDARD PROCTOR TEST RESULTS

TEST METHOD: ASTM D-698 (B)

*Corrected for 5.5% retained on 3/8" sieve

	UNCORRECTED		CORRECTED *
Maximum Dry Unit Weight	111.0	PCF	113.0
Optimum Moisture Content	12.1	MC	11.5



MC	LL	PL	PI	USCS	AASHTO	FINES	SOIL DESCRIPTION
16.1	31	18	13	SC	A-6	48.4	Black clayey SAND

CLIFTY CREEK

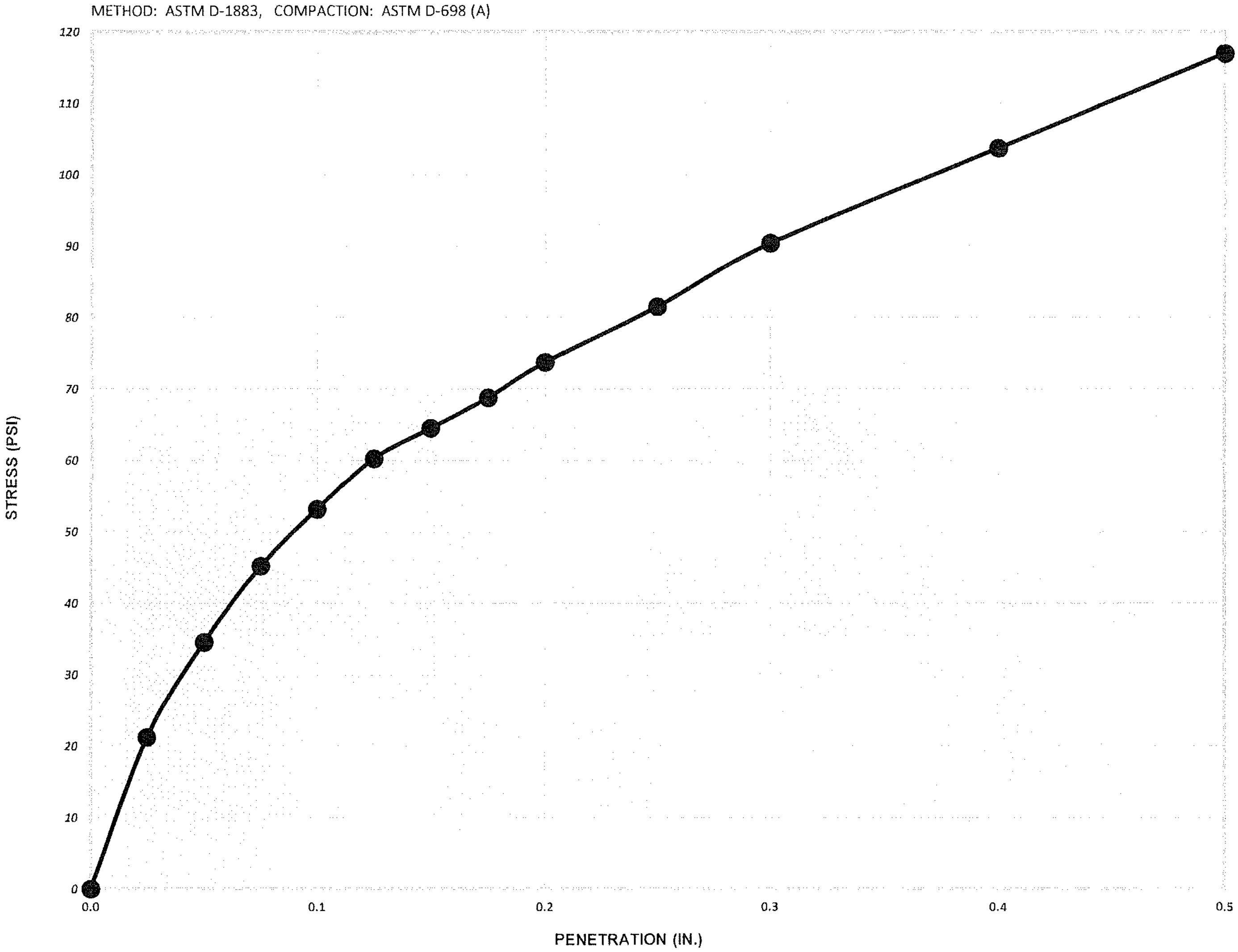
Boring:	**B-4**	Project No.:	19049	**JAY KAY TESTING, INC.**
Sample:	**Bulk**	Sample Date:	-	5233 Lehman Road, Suite 110
Depth:	**1-13'**	Location:	*Indiana*	Spring Grove, PA 17362
				Phone: (814) 404-9283

CALIFORNIA BEARING RATIO TEST RESULTS

CBR AT 0.1"	CBR AT 0.2"
5.3	4.9

	Dry Unit Weight	Moisture Content	Compaction	Swell	Surcharge
As Molded	113.4	12.6	95.3	-	100
After Soak	-	-	-	1.12	100
	PCF	%	%	%	PSF

METHOD: ASTM D-1883, COMPACTION: ASTM D-698 (A)



MC	LL	PL	PI	USCS	AASHTO	FINES	SOIL DESCRIPTION
13.8	32	17	15	CL	A-6	68.3	Light brown sandy lean CLAY

CLIFTY CREEK

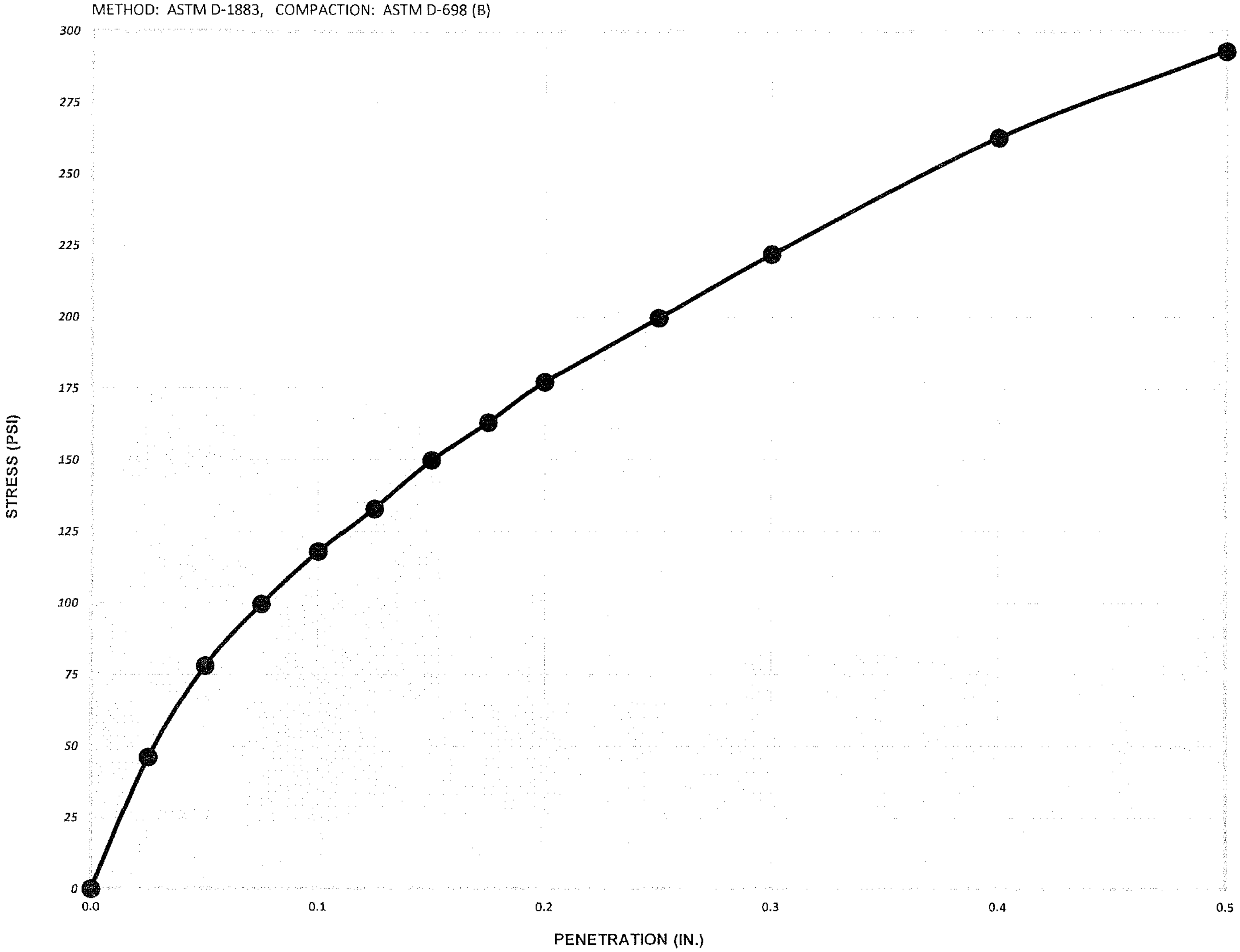
Boring:	**B-5**	Project No.:	19049	**JAY KAY TESTING, INC.**
Sample:	**Bulk**	Sample Date:	-	5233 Lehman Road, Suite 110
Depth:	**1-8'**	Location:	*Indiana*	Spring Grove, PA 17362
				Phone: (814) 404-9283

CALIFORNIA BEARING RATIO TEST RESULTS

CBR AT 0.1"	CBR AT 0.2"
11.8	11.8

	Dry Unit Weight	Moisture Content	Compaction	Swell	Surcharge
As Molded	108.7	11.9	96.2	-	100
After Soak	-	-	-	0.26	100
	PCF	%	%	%	PSF

METHOD: ASTM D-1883, COMPACTION: ASTM D-698 (B)



MC	LL	PL	PI	USCS	AASHTO	FINES	SOIL DESCRIPTION
16.1	31	18	13	SC	A-6	48.4	Black clayey SAND

APPENDIX C

Pavement Design Output

19046

PavementDesigner.org

DESIGN SUMMARY REPORT FOR

INTERMODAL CONCRETE PAVEMENT

DATE CREATED:

Fri Dec 13 2019 12:52:30 GMT-0500 (Eastern Standard Time)

Project Description

Project Name:	CAT 980	Owner:	WBCM	Zip Code:
Designer's Name:	DWK	Route:	CLIFTY CREEK	

Project Description:

Design Summary

	Undoweled		
Recommended Design Thickness:	9.75 in.	Maximum Joint Spacing:	15 ft.
Calculated Minimum Thickness:	9.60 in.	Stress Ratio:	0.5 %

*Control vehicle with greatest fatigue impact

Vehicle Name	Maximum Angle	Maximum Stress	Allowable Total Repetitions	Thickness
CAT 980M	0	333.18 psi	607,009	9.6 in

Pavement Structure

SUBBASE Calculated Composite K-Value of Substructure: 138 psi/in

Layer Type	Resilient Modulus	Layer Thickness
CONCRETE SURFACE		
SUBGRADE		

CONCRETE

Compressive Strength: 5000 psi

Modulus of Elasticity: 4000000 psi

Calculated Flexural Strength: 673 psi

Edge Support: Yes

SUBGRADE

CBR: 5 %

Calculated MRSG Value 5,842 psi

Design Method

The ACPA AirPave design methodology was used to produce these results.

PavementDesigner.org

DESIGN SUMMARY REPORT FOR

INTERMODAL CONCRETE PAVEMENT

DATE CREATED:

Fri Dec 13 2019 12:49:40 GMT-0500 (Eastern Standard Time)

Project Description

Project Name:	CAT 980	Owner:	WBCM	Zip Code:	
Designer's Name:	DWK	Route:	CLIFTY CREEK		

Project Description:

Design Summary

	Undoweled		
Recommended Design Thickness:	9.50 in.	Maximum Joint Spacing:	15 ft.
Calculated Minimum Thickness:	9.40 in.	Stress Ratio:	0.5 %

*Control vehicle with greatest fatigue impact

Vehicle Name	Maximum Angle	Maximum Stress	Allowable Total Repetitions	Thickness
CAT 980M	0	332.6 psi	621,847	9.4 in

Pavement Structure

SUBBASE Calculated Composite K-Value of Substructure: 200 psi/in

Layer Type	Resilient Modulus	Layer Thickness
CONCRETE SURFACE		
SUBGRADE		

CONCRETE				SUBGRADE	
Compressive Strength:	5000 psi	Edge Support:	Yes	CBR:	10 %
Modulus of Elasticity:	4000000 psi			Calculated MRSG Value	9,389 psi
Calculated Flexural Strength:	673 psi				

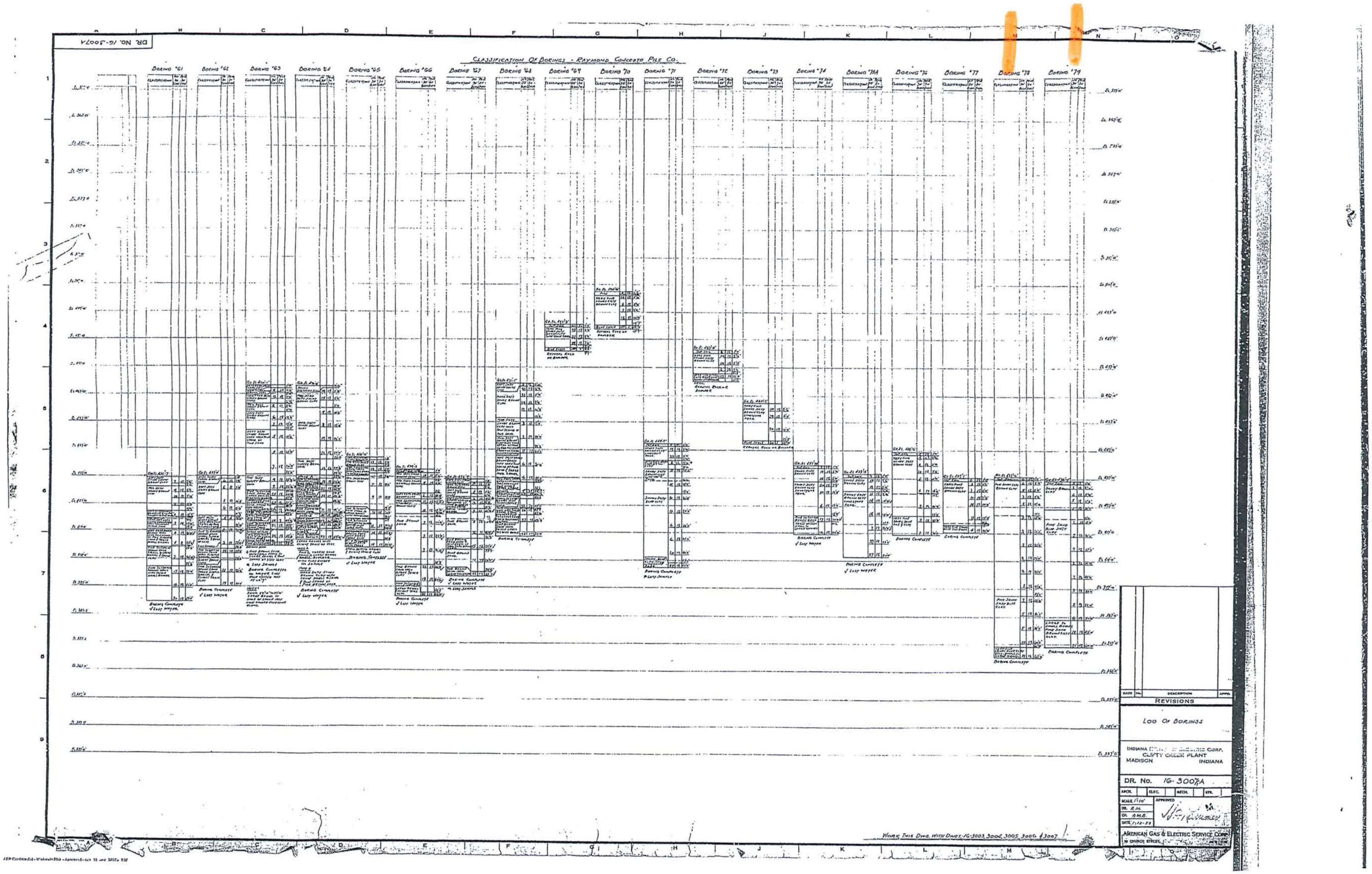
Design Method

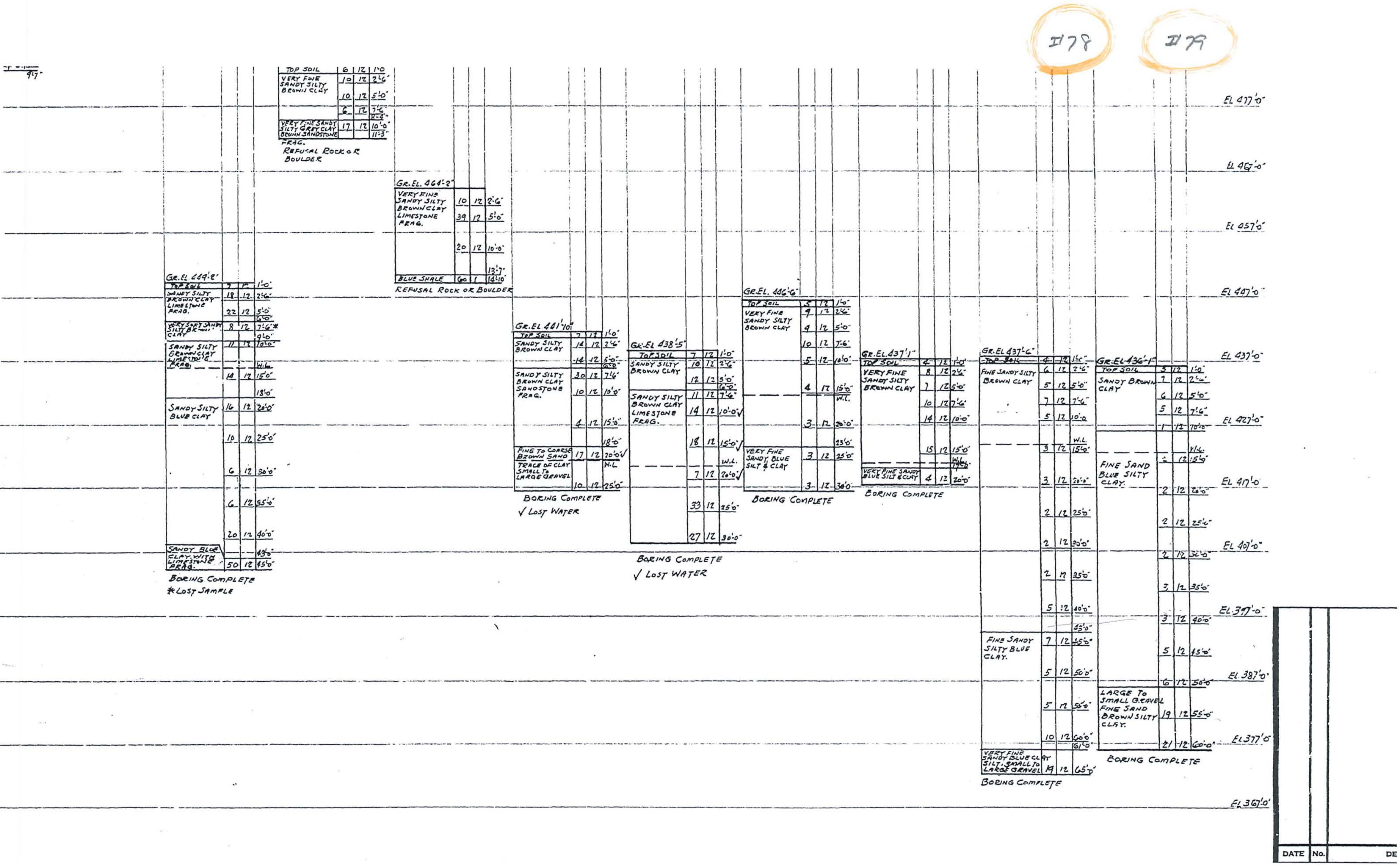
The ACPA AirPave design methodology was used to produce these results.

APPENDIX D

Settlement Analysis


BOTTOM EL 445
Note
Excavate to EL 445
No Fill in Bottom of this area
Note:
DIKE REVISED
SEE DWG 16-3002 & 16-3002 A
Borings
90°
79
78
77
Slope 2:1
Slope 2.2:1
525'
600'
575'
EL 465
EL 475'
420 - NP
150
50'


DR. No. 16-3007A
CLASSIFICATION OF BORINGS - RAYMOND CONCRETE PILE CO.
BORING '67
BORING '68
BORING '69
BORING '70
BORING '71
REVISIONS
DATE
DESCRIPTION
LOG OF BORINGS
CLIFTY CREEK PLANT
MADISON
INDIANA
DR. No. 16-3007A
SCALE 1"=10'
DR. R.M.
CH. AMB.
APPROVED
AMERICAN GAS & ELECTRIC SERVICE CORP.



I78
I79
EL 477'0"
EL 467'0"
EL 457'0"
EL 447'0"
EL 437'0"
EL 427'0"
EL 417'0"
EL 407'0"
EL 397'0"
EL 387'0"
EL 377'0"
EL 367'0"
TOP SOIL
VERY FINE SANDY SILTY BROWN CLAY
VERY FINE SANDY SILTY GREY CLAY BROWN SANDSTONE FRAG.
REFUSAL ROCK OR BOULDER
GR. EL. 464'-2"
VERY FINE SANDY SILTY BROWN CLAY LIMESTONE FRAG.
BLUE SHALE
REFUSAL ROCK OR BOULDER
GR. EL 449'-8"
SANDY SILTY BROWN CLAY LIMESTONE FRAG.
SANDY SILTY BROWN CLAY LIMESTONE FRAG.
SANDY SILTY BLUE CLAY
SANDY BLUE CLAY WITH LIMESTONE FRAG.
BORING COMPLETE
* LOST SAMPLE
GR. EL 441'-10"
SANDY SILTY BROWN CLAY
SANDY SILTY BROWN CLAY SANDSTONE FRAG.
FINE TO COARSE BROWN SAND TRACE OF CLAY SMALL TO LARGE GRAVEL
BORING COMPLETE
✓ LOST WATER
GR. EL 438'-5"
SANDY SILTY BROWN CLAY
SANDY SILTY BROWN CLAY LIMESTONE FRAG.
BORING COMPLETE
✓ LOST WATER
GR. EL. 446'-6"
VERY FINE SANDY SILTY BROWN CLAY
VERY FINE SANDY BLUE SILT & CLAY
BORING COMPLETE
GR. EL 437'-1"
VERY FINE SANDY SILTY BROWN CLAY
VERY FINE SANDY BLUE SILT & CLAY
BORING COMPLETE
GR. EL 437'-6"
FINE SANDY SILTY BROWN CLAY
FINE SANDY SILTY BLUE CLAY
VERY FINE SANDY BLUE CLAY SILT, SMALL TO LARGE GRAVEL
BORING COMPLETE
GR. EL 436'-1"
SANDY BROWN CLAY
FINE SAND BLUE SILTY CLAY
LARGE TO SMALL GRAVEL FINE SAND BROWN SILTY CLAY
BORING COMPLETE
W.L.
DATE
No.
1953

D.W. KOZERA, INC.
Professional Engineers & Geologists

CLIENT: WBCM		JOB NO.: 19049.D
PROJECT: Cliffy Creek Power Plant		SHEET 1 OF 2
SUBJECT: FGD Pad	DESIGN BY: AE	DATE: 5.19.20
Settlement	CHECKED BY: DJC	DATE: 5.19.20

Soil Profile

2019 Borings B-1/B-6 & 1953 Borings #79/#78

470

SLAG $N_{AV} = 23$ BPF

460

$E_S = 400$ TSF

450

440

430 SyC $N_{AV} = 6$ BPF $E_S = 150$ TSF

420

PS w/ SyC N = 2/3 BPF

410

$E_S = 40$ TSF

400

390 Sy&yC $N_{AV} = 6$ BPF

E_S 150 TSF

380

370 SyG N = 20+

$E_S = 1000$ TSF

360

Table 5-16
Elastic constants of various soils (after AASHTO 2004 with 2006 Interims)

Soil Type	Typical Range of Young's Modulus Values, E_s (tsf)	Poisson's Ratio, ν
Clay:		
Soft sensitive	25-150	0.4-0.5 (undrained)
Medium stiff to stiff	150-500	
Very stiff	500-1,000	
Loess	150-600	0.1-0.3
Silt	20-200	0.3-0.35
Fine Sand:		
Loose	80-120	0.25
Medium dense	120-200	
Dense	200-300	
Sand:		
Loose	100-300	0.20-0.36
Medium dense	300-500	
Dense	500-800	0.30-0.40
Gravel:		
Loose	300-800	0.20-0.35
Medium dense	800-1,000	
Dense	1,000-2,000	0.30-0.40

Estimating E_s from SPT N-value

Soil Type	E_s (tsf)
Silts, sandy silts, slightly cohesive mixtures	4 $N1_{60}$
Clean fine to medium sands and slightly silty sands	7 $N1_{60}$
Coarse sands and sands with little gravel	10 $N1_{60}$
Sandy gravel and gravels	12 $N1_{60}$

Estimating E_s (tsf) from q_c static cone resistance

Sandy soils	$2q_c$ where (q_c is in tsf)

Note: 1 tsf = 95.76 kPa

Table 5-17
Rate of increase of soil modulus with depth n_h (tsf/ft) for sand (AASHTO 2004 with 2006 Interims)

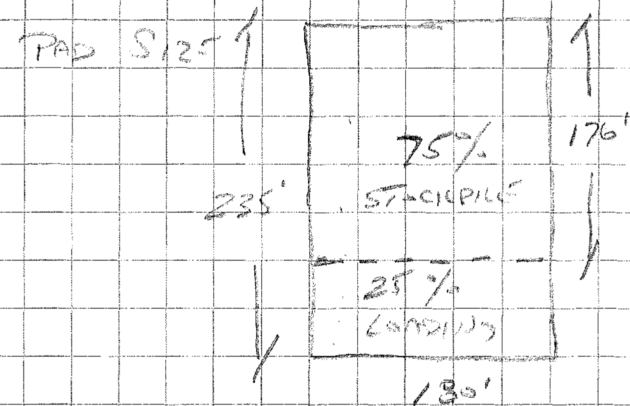
Consistency	Dry or Moist	Submerged
Loose	30	15
Medium	80	40
Dense	200	100
Note: 1 tsf/ft = 314.7 kPa/m		

D.W. KOZERA, INC. Professional Engineers & Geologists	CLIENT: WBCM		JOB NO.: 19049.D
	PROJECT: CLIFTY CREEK POWER PLANT		SHEET 2 OF 2
	SUBJECT: FGD PAD	DESIGN BY: AE	DATE: 5.19.2
	SETTLEMENT	CHECKED BY: DK	DATE: 5.19.20

MAXIMUM FGD LOAD = 11,003 T

PAD SIZE 180' x 235'

ASSUME FGD STOCKPILE OVER 75% OF PAD
25% OF PAD FOR LOADING AREA



AVERAGE SOIL PRESSURE = $(11,003^{T})(2000^{\#/T}) / 180' \times 176'$

= 695 psf

ADD PAD WT = 105 psf

<u>TOTAL WEIGHT</u> = <u>800 psf</u>

USE ELASTIC ANALYSIS TO COMPUTE SETTLEMENT

$\delta_i = 1.18$ in

$\underline{\delta_T = 1.65 \text{ in}}$

SETTLEMENT CALCULATION

for Shallow Foundations

USING SCHMERTMANN APPROXIMATION INFLUENCE FACTOR

Version 09.04 (beta) 4/21/09

(INPUT VALUES ARE IN BLUE-BOLD-ITALIC COURIER FONT)

Project Data

Name:	*Clifty Creek Pad Loaded 3/4 Area*	Contract #	*19049.0*
Location:	*Baltimor Madison Indiana*	Structure:	*Pad*
Calculated by:	*az* Checked: *dk*	Date:	*may 18 2020*

Foundation Data:

Footing Width (ft)	*176*	Foundn. Design Pressure(psf)	*800.0*
Footing Length (ft)	*180*	Ground EL (ft)	*470.0*
Test Boring No.	*B-1/B-3/B-5*	Footing Subgrade EL (ft)	*468.0*
Number of Layers :	*5* (Max 10)	Ground Water EL (ft)	*450.0*
Increment Size(ft):	*3.00*	*Increment should be greater than*	2.60 ft

Additional Input Data:

		Soil Unit Wt for subgrade (pcf)	*125.00*
Creep time -Long term settlmnt (yr)	*10.0*	Water Unit Wt (pcf)	*62.40*

Calculations: Selected Dimensions B (ft) 176.000 L(ft) 180.000

Calc L/B= 1.02	Used L/B= 1.02	Depth of Influence (ft)	352.89
Surcharge Pressure (psf)	250.0	Net Foundation Pressure (psf)	550.0

Influence Factor: X_0 = 0.100 Y_{max} = 2.005 $Y_{0.5x}$ = 0.501

EL for Max Izp (ft): 379.7777778 σ_izp (pcf) 6895.9 Izp 0.5282

Soil Layer No.	Bottom Elevation	E (tsf)	Layer Thickness	Top Depth	Bottom Depth	z*Iz	Settlement (inch)
1	*435*	*400.00*	33.0	0.0	33.0	5.9498	0.0379
2	*425*	*150.00*	10.0	33.0	43.0	3.4734	0.0590
3	*395*	*40.00*	30.0	43.0	73.0	11.4488	0.7299
4	*375*	*150.00*	20.0	73.0	93.0	10.4956	0.1784
5		*1000.00*	375.0	93.0	468.0	67.4050	0.1719

Check: 1. Increment value is greater than minimum value - OK

2. Total depth of defined layers is higher than Influence Depth - OK

Results: 0.280 1.18

Correction Factors		
	Immediate Settlement adjusted for Surcharge (inch)	1.18
SurchargeC1 0.773	**Long Term Settlement adjusted for Surcharge & Creep (inch)**	
Creep -C2 1.400	(for Creep period of 10.0 years)	**1.65**

Notes: 1. Spreadsheet for educational purpose only. Use at your own risk.

2. Final settlement may be factored by 0.6 for residual soils if E values are assumed from N values or pressuremeter test results

ATTACHMENT B

WBSP CQC/CQA Plan

Construction Quality Control/Quality Assurance Plan
West Boiler Slag Pond
(Type I Restricted Waste Landfill)
Clifty Creek Power Plant
Madison, Jefferson County, Indiana

1. Purpose and Scope

This document is a site-specific construction quality control/quality assurance (CQC/CQA) plan that addresses the construction of the structural fill, flexible membrane liner, drainage geocomposite, soil cover, geotextiles, drainage control structures, erosion and sediment control, and instrumentation for the proposed facility.

This plan defines acceptable construction materials, authority of the Owner as well as the responsibilities of designated quality control/quality assurance (QC/QA) personnel. The plan should be considered to represent the minimum CQC/CQA requirements.

2. Responsibility and Authority

A tabulation summarizing personnel responsibilities and related QC/QA activities is presented as Appendix A of this attachment.

2.1. Permitting Agency

The West Boiler Slag Pond (WBSP) will be closed as a Type I Restricted Waste Landfill under a permit issued by the Indiana Department of Environmental Management (IDEM).

2.2. Quality Control Manager and Testing Laboratory

A qualified, licensed professional engineer in Indiana designated as the quality control manager (QC Manager) will be responsible for management of construction monitoring, testing, and preparation of related documentation as outlined herein. The quality control team (QC Team) shall include qualified personnel working under the direct supervision of the QC Manager. QC Team personnel should be familiar with the CCR stream process, the proper CCR placement protocols as well as the functional intent of the respective design components. The QC Manager shall designate appropriate test standards and methods for the QC testing designated herein or as outlined in project requirements. The QC Manager shall be responsible for review of all QC data for conformance with project requirements, collection of documentation, generation of QC related reports, and communications with contractors, engineering consultants, regulatory authorities, and Owner representatives.

2.3. Owner

The Owner is Indiana-Kentucky Electric Corporation (IKEC). The Owner shall be responsible for overall management of operations, including construction administration, contracting, waste disposal, and retaining the services of qualified engineering consultants as required during the life of the facility. The Owner will approve all design revisions and administer related permit modifications. The Owner shall designate one representative to serve as the

Construction Manager. The Construction Manager may be an employee of the Owner or an independent contractor.

3. Quality Control Activities

3.1. Project Meetings

During liner and geosynthetics construction, project meetings shall be arranged by the Construction Manager. The primary purpose of these project meetings will be to verify that all parties involved with construction operations are familiar with the design, construction procedures, associated QC and QA requirements, as well as safety issues. Project safety issues will be the responsibility of designated safety professionals.

A CQA/CQC preconstruction meeting will be held prior to construction operations. The Owner, Construction Manager, QC Manager, IDEM, and the primary contractor will be in attendance. The IDEM permit manager will be notified 10 working days prior to the preconstruction meeting.

3.2. Modifications

General construction and QA modifications may be executed following approval of the Owner and the QC Manager. Proposed modifications shall be developed by the QC Manager and submitted to the Owner for review and comment, and to IDEM for approval of proposed modifications prior to incorporation into the closure design. Documentation of project modifications shall be submitted to IDEM following each phase of construction for inclusion within their project records.

3.3. Contractor Submittals

Contractor submittals will be reviewed and approved by the QC Team prior to delivery and/or use of the respective construction materials. Submittals include manufacturer data and certifications that supplied materials meet or exceed project specifications, material samples, pre-qualification test results, and construction work plans. Minimum required submittals are outlined within this plan.

3.4. Conformance Testing

Conformance testing consists of periodic testing of materials or construction products to verify conformance with project requirements. Conformance testing will be conducted by the QC Team as required by this plan and/or at the direction of the QC Manager. A tabulation of the project conformance testing schedule, including minimum test frequencies is presented as Appendix B to this attachment.

3.5. Field Observations and Testing

Construction related field observations, testing and related documentation will be performed by the QC Team in accordance with the requirements provided in this plan.

CCR processing management and oversight of related CQA/CQC protocols will be the responsibility of the Construction Manager. In addition, the Construction Manager 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.

3.6. IDEM Record Keeping and Reporting Requirements

3.6.1. Documentation

Complete CQA/CQC documentation shall be maintained and organized by the QC Manager and Construction Manager during each phase of liner and final cover construction. The documentation should include the items outlined within this plan in addition to the following items:

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

IDEM will be notified of variances or changes from the sampling program and tests analyses presented in this attachment.

3.6.2. Construction Reports

At the completion of each phase and/or cell units of construction, the QC Manager and Construction Manager shall prepare and submit to IDEM a construction progress report which documents construction procedures, observations, and tests performed.

4. Structural Fill

4.1. General

Structural fill refers to all CCRs placed to achieve liner system subgrade elevations as shown on the approved permit drawings or as directed by the Construction Manager.

Structural fill shall meet the following requirements:

1. Be constructed with CCRs (fly ash, boiler slag or gypsum), soil, or rock that are free of organic or other deleterious materials.

- CCRs may be obtained from plant operations or excavated from on-site ponds or landfills.

- Rock used as structural fill shall contain no particles greater than 12-inches in any dimension.

- Soil and rock may be obtained from on-site excavations or off-site borrow sources.

2. Be placed in approximate horizontal lifts and compacted as follows:

   - The initial lift of CCRs or soil shall be of a sufficient thickness to create a stable working platform over the existing ash pond surface. The thickness of the bridging lift shall be kept to a minimum and shall not exceed three feet unless otherwise approved by the QC Manager. Remaining lifts of CCRs or soil shall be placed in eight-inch loose lifts.

   - Material shall be compacted to at least 95 percent of standard Proctor density as determined by ASTM D 698. Moisture control shall be as necessary to facilitate compaction and dust control. Compaction equipment shall consist of tamping foot, sheepsfoot, steel drum or pneumatic tire rollers as appropriate for the material being placed or as specified by the QC Manager.

   - Rock shall be placed in placed in maximum 12-inch loose lifts and compacted with at least three passes of a vibratory tamping foot roller.

4.2. Structural Fill CQA/CQC

The QC Manager or QC Team personnel shall:

1. Verify the surface on which structural fill is to be placed has been stripped and is free of organic, vegetative and deleterious materials; soft areas have been stabilized; and proof rolling has been performed.

2. Coordinate sampling and testing of borrow soils and CCRs proposed for use as structural fill. Minimum testing requirements are presented in Appendix B.

3. Monitor fill placements and compaction operations to:

   - Document that fill is placed in uniform lifts as required by this plan;

   - Document compaction and moisture content are as required by this plan. Frequency of testing is presented in Appendix B of this attachment.

5. Flexible Membrane Liner

5.1. General

The flexible membrane liner (FML) system will consist of a 40-mil thick PVC or a 40-mil thick LLDPE membrane with material properties defined in Appendix B of this attachment.

5.2. Storage and Deployment

Liner materials shall be unloaded and stored in accordance with manufacturer recommendations. The contractor shall generate a material inventory log during unloading of material shipments to the project site.

A conceptual panel layout shall be developed by the QC Manager. Panels should be deployed with the longer side panel seams oriented generally parallel to the principal slope direction. Panel layout and deployed conditions should minimize the number of end seams located along perimeter slopes. End panel seams shall be positioned a minimum of twenty (20) feet beyond the perimeter berm slope intersection with interior pond floor grades.

Deployed membrane shall be provided with sufficient slack in material not to generate pre-stress conditions. Excessive pre-stress is typically indicated by tension on the liner during cooler ambient periods.

Deployed panels shall be temporarily anchored in accordance with manufacturer recommendations and the anchoring methodology shall account for prevailing as well as inclement weather conditions.

5.3. Placement

Prior to the placement of FML over the graded CCR/structural layer, the finished surface of the structural fill shall be rolled with a smooth drum roller and the surface approved by the QC Manager. Installation and placement of FML panels shall be in accordance with Manufacturer recommendations and the liner specifications.

5.4. Seaming

Roll goods deployed in the field are referred to as panels. Panels will be seamed to form continuous lined areas. Production seaming methodology and equipment shall be conducive to the following:

- Digital welding temperature monitoring,
- Forming uniform bonds by applying constant heat and pressure to the seam area,
- Controlling liner surface tension,
- Providing uniform dry, and clean seaming surfaces, and
- Providing adequate and consistent overlap between adjacent panels.

Production seaming shall be accomplished through dual wedge fusion seaming methods or adhesive bonding. Dual wedge welding or seaming shall provide a continuous air channel between two (dual) seams. All production seaming, repairs, patches, and capped areas shall be tested through non-destructive methods for 100% of seam length.

When applicable, fillet extrusion welding shall be performed on repairs, pipe boots connections, and in general, any area where dual wedge fusion welding is not practical. All extrusion welds shall be continuously tested using a vacuum box or other approved non-destructive test method.

All patched areas shall have a minimum dimension of 6-inches and provide minimum 1-inch radius at corners. When applicable, all extrusion weld zones shall be cleaned and ground in accordance with manufacturer recommendations prior to initiating welding.

Panel corner intersections and “T-Joints” shall be capped and non-destructively tested.

5.4.1. Trial Seams

Trial seams shall be performed on maximum four work hour intervals. Trial seams consist of seaming runs performed under the same conditions and by the same personnel that will be executing the production seaming. All trial seams shall be tested in the field following manufacturer recommendations prior to approval of the respective seaming device and seamer for that work shift. Test seams failing to meet prior requirements shall result in the subject apparatus being tagged appropriately and not used for production seaming until satisfactory test seams are demonstrated.

5.4.2. Destructive Seam Testing

Destructive samples of production seaming shall be obtained on maximum intervals of one sample per 500 linear feet of seam. Destructive samples are cut directly from the seamed panels. Destructive samples shall be tested to verify seam conformance to project requirements. All destructive sampling points shall be repaired in accordance with project requirements and repairs shall be non-destructively tested.

5.5. FML CQA/CQC Requirements

The QC Manager shall record daily observations relative to the condition of FML rolls delivered to the site, FML panel sampling locations, FML seam and repair operations, and general FML placement operations. These observations shall be compiled with the project records.

Laboratory quality control testing of the FML will include destructive and non-destructive tests of samples in accordance with the bottom liner specifications and manufacturer recommendations. The frequency of FML sampling/testing shall be as shown in the testing schedule or stated in the bottom liner specifications.

5.6. Protection

The deployed FML shall be protected from damage during landfill construction and general operations. Under no condition shall vehicles or heavy equipment traverse lined areas without the appropriate minimum thickness of soil cover.

6. Geocomposite Drainage System

6.1. General

Overlying the flexible membrane liner (FML) will be the geocomposite drainage layer.

6.2. Geocomposite Installation

1. Geocomposite shall be deployed as the drainage layer over the FML as shown on the plans or as directed by the QC Manager.

2. Geocomposite shall consist of a geonet meeting the requirements of Appendix B with a non-woven geotextile on both sides. The geotextile shall meet the requirements of Section 9 of this plan.

3. Storage and handling shall conform to the manufacturer's recommendations.

4. Panels shall be oriented parallel to the slope. Successive panels shall be overlapped a minimum of four inches in the direction of flow and shall be secured by using self locking ties. Geotextile coverings shall be "shingled" in the direction of flow at all joints.

5. In the corners of sided slopes, where overlaps between rolls are staggered, an additional layer of geocomposite shall be installed from the top to the bottom of the slope.

6. Geocomposite shall be covered with a minimum of two feet of final cover soil within 15 days of deployment.

6.3. Geocomposite Drainage System CQA/CQC Requirements

1. Prior to delivery, manufacturer and supplier certifications shall be submitted to the QC Manager indicating that all materials meet, or exceed, the minimum properties established in this section. Certifications shall be accompanied by supporting quality assurance and quality control testing.

2. Conformance testing of geocomposite shall be performed in accordance with the schedule and procedures identified in Appendix B and every time a change in source(s) occurs.

3. Pipe suppliers, geotextile manufacturers, and geocomposite manufacturers shall submit certified material specification, delivery tickets and QC documentation to show that the supplied material meets the project requirements.

4. Construction monitoring and field acceptance of geocomposite deployment shall be documented by the QC Manager or QC Team representative.

7. Soil Cover

7.1. General

1. The final cover as shown on the drawings shall consist of soils that classify as CH, CL, MH, ML, CL-ML, SC or SM-SC according to the Unified Soil Classification System. The material shall not contain rock fragments with the largest dimension exceeding three inches. Soil may be obtained from on-site excavations or off-site borrow sources.

2. Final cover shall be placed in approximately eight-inch loose lifts and compacted to at least 92% of standard Proctor as determined by ASTM D 698.

3. Moisture shall be as necessary to facilitate compaction and control dusting.

4. The upper six-inch zone of the cover system shall consist of topsoil or soil capable of sustaining vegetation. Topsoil should be tracked in place with dozer equipment. Dozer tracks should be perpendicular to the final slope.

5. Under no condition shall bulldozers or other equipment that are not low ground pressure (6 psi or less contact pressure) traverse areas with deployed geosynthetics without a minimum of 18 inches of cover soil and 6 inches of vegetative cover in place.

7.2. Soil Cover CQA/CQC Requirements

1. Conformance testing schedule and procedures for soil cover are provided in Appendix B.

2. No soil may be placed as final cover until approved by the QC Manager.

3. A QC Team representative shall observe and document placement of soil cover.

8. Compacted Soil Liner

8.1. General

1. In lieu of geocomposites and soil cover, the final cover as shown on the drawings may also consist of a compacted soil liner that classify as CH, CL, MH, ML, CL-ML, SC or SM-SC according to the Unified Soil Classification System. The permeability of the compacted soil liner must be less than or equal to the permeability of natural subsoils present, or a permeability no greater than 1×10^{-5} cm/s. Soil may be obtained from on-site excavations or off-site borrow sources.

2. Compacted soil liner shall be placed in approximately eight-inch loose lifts and compacted to at least 92% of standard Proctor as determined by ASTM D 698.

3. Moisture shall be as necessary to facilitate compaction and control dusting.

4. The upper six-inch zone of the cover system shall consist of topsoil or soil capable of sustaining vegetation. Topsoil should be tracked in place with dozer equipment. Dozer tracks should be perpendicular to the final slope.

8.2. Compacted Soil Liner CQA/CQC Requirements

1. Conformance testing schedule and procedures for compacted soil lineer are provided in Appendix B.

2. No soil may be placed as compacted soil liner until approved by the QC Manager.

3. A QC Team representative shall observe and document placement of compacted soil liner.

9. Geotextile

9.1. General

1. Geotextile fabric applications for the project include filtration between the final cover soil and the FML, separation of the coarse aggregates from the soil subgrade along perimeter access roadways, filtration applications beneath designated riprap lined drainage ditches, FML cushion as part of the final cover system.

2. Geotextile shall be polyester or polypropylene fabric meeting the minimum requirements in Appendix B.

3. Geotextile shall be protected from direct sunlight, ultraviolet rays, temperature greater that 140 degrees Fahrenheit, mud, dirt, dust and debris. During storage, geotextile shall be wrapped in a heavy-duty protective covering.

4. Installation shall be in accordance with manufacturer's recommendations.

5. Surfaces to receive geotextile shall be prepared to a relatively smooth condition, free of obstructions, depressions, and debris.

6. Geotextile shall be placed with the long dimension parallel with the centerline of ditch and road, and/or parallel to embankment slopes, as applicable. Geotextile shall be laid smooth, and free of tension, stress, folds, wrinkles, or creases.

7. On slopes 4H:1V and greater, adjacent strips of geotextile or reinforcing fabric shall be joined by stitching together continuously. All stitched seam strengths shall be greater than 90 percent of the grab tensile strength of the geotextile as determined by ASTM D 1682.

8. On slopes less than 4H:1V overlapping in the slope direction may be used. Overlaps shall be a minimum of two feet.

9. Geotextile shall be covered with soil or other materials within 15 days of deployment.

9.2. Geotextile CQA/CQC Requirements

1. Prior to delivery, manufacturer certifications shall be submitted to the QC Manager indicating that all materials meet, or exceed, the minimum properties established in the section. Certifications shall be accompanied by supporting quality assurance and quality control testing.

2. Conformance testing schedule and procedures are provided in Appendix B.

3. The QC Team shall monitor geotextile deployment and covering operations to document that these activities were conducted in accordance with project

requirements and manufacturer recommendations for the subject application as well as industry practice.

10. Concrete Structures

10.1. General

1. Pre-cast concrete structures and related components shall meet the requirements of applicable sections of "Standard Specifications", Indiana Department of Transportation, current edition. Modifications to these standards as required on the project shall be included within shop drawings submitted to the QC Manager for review and approval.

10.2. Concrete Structure CQA/CQC Requirements

1. Material submittals and shop drawings shall be reviewed and approved by the QC Manager prior to delivery.

2. A QC Team representative shall observe all precast structures upon delivery. Any structures showing signs of shipment damage or non-conformance to design or project specifications shall be replaced.

3. The QC Team shall observe and document the subgrade and backfill methods for drainage structures.

11. Erosion and Sediment Control

Basic sediment and erosion control structures are presented on the permit drawings for the project. The Construction Manager shall periodically observe these structures as well as overall site drainage conditions. Appropriate adjustments to site drainage and related sediment control structures shall be made as necessary based on current site conditions during facility construction and operations.

Observations relative to sedimentation control, maintenance, and modifications shall be documented within project records by the QC Manager.

12. Instrumentation

12.1. General

The proposed field instrumentation consists of a system of piezometers installed post construction. This section of the CQA/CQC plan provides the minimum system testing requirements.

1. The Owner shall develop a quality control system that documents each test, calibration, and installation activity. Each instrument shall have a QC document, consisting of a single form or booklet, which documents any and all activities performed on the instrument. The form shall, at a minimum, contain:

    a. instrument type, model number, and project instrument number;

b. manufacturer's name and serial number;

c. date tested and calibrated by the manufacturer (with the manufacturer's test form and certifications of test equipment attached);

d. date received at the project site and person who received the instrument;

e. verification of no apparent damage in shipping;

f. verification of the proper lead wire type and length (if applicable);

g. date of pre-installation testing;

h. measurements made during the pre-installation testing;

i. signatures of the person that performed the pre-installation testing and the QC Team representative monitoring pre-installation testing; and

j. description of any deficiencies and any action taken to address the deficiencies.

2. When the instrument is installed, this form, shall follow the instrument into the field and be updated to show:

   a. date and time of installation;

   b. conditions encountered during the installation;

   c. results of testing conducted during installation;

   d. signature of person in charge of the installation and testing; and

   e. as-built instrument location.

3. When lead wires for vibrating wire instruments are connected to the terminal box, the form shall be updated to reflect the date and time of the connection, the manual read value prior to the connection, and the signature of the person recording the values. Following each activity, a copy of the form shall be submitted to the Owner.

4. After installations are completed, an operation and maintenance report shall be prepared. This report will document operation and maintenance activities, including malfunctions, damages, replacements, etc. Manufacturer instructions and schedules will be provided for the testing, maintenance and monitoring of each sensor and data logger. The report shall be cumulative to include all records to date.

12.2. Instrumentation CQA/CQC Requirements

Prior to and during instrumentation installation, the QC Manager or a QC Team representative shall:

1. Review complete and up to date Quality Control Documents for each instrument installed and operating.

2. Review instrument readings as landfill construction progresses.

13. Seeding and Mulching

13.1. General

Seeding and mulching activities include preparing the seedbed, fertilizing, seeding, and mulching vegetative cover soils of the landfill, as well as other areas disturbed due to construction and operation of the landfill facility.

Seeding and mulching activities will be performed on surfaces that have achieved final grade per approved permit plans. Vegetation will begin as soon as practicable. The upper six inches of the final cover will consist of topsoil or soil capable of sustaining vegetation. Topsoil will be spread over the area to be seeded prior to the application of seed and soil amendments. Seed, mulch, and mulch anchoring methods will be in accordance the Indiana Department of Transportation "Standard Specifications", current edition. Fertilizer and lime application rates will be in accordance with local Natural Resources Conservation Service (NRCS) recommendations. Throughout the construction, operation, and post-closure care period of the landfill facility, seeded and vegetated areas will be maintained, and damage will be repaired.

13.2. Seeding and Mulching CQA/CQC Requirements

Prior to seeding and mulching operations, the QC Manager shall:

1. Review fertilizer/lime application rate testing in accordance with the local NRCS recommendations. Testing laboratories will be approved by the QC Manager. Testing will be performed once per year for each borrow source or visual change in material.

2. Observe seedbed preparation, fertilizer and lime application, seeding and mulching activities to confirm appropriate vegetation procedures per the project requirements. Appropriate personnel will perform necessary maintenance.

WBSP Closure Plan
CQA Plan
Appendix A

Clifty Creek West Boiler Slag Pond Quality Control Task Summary[1]			
Task	**Responsible Personnel[4]**	**Task Description/Itemization**	**Minimum Frequency/ Notes[2]**
A. General Site and Construction Tasks			
QC Testing	QC Manager	-Designate appropriate test standards and methods to maintain quality standards outlined in the Technical Specifications.	As needed
		-Review all QC data for conformance with project standards and specifications.	As needed
		-Collection and maintenance of all QC documentation.	As needed
		-Generation of all QC-related reports.	As needed
		-Notify the IDEM Contact of designated construction events.	As needed
Project Meetings	Construction Manager	-Organize meetings as necessary to ensure construction related personnel are familiar with design, construction procedures, and QA/QC requirements.	As needed
Contractor Submittals	QC Manager (QC Team)	-Approval of contractor submittals a minimum of 10 days before materials arrive on site.	As needed
Site Inspections	Construction Manager	-Site observations of outslopes for indications of slope failure and/or instability.	monthly
B. Structural Fill/Subgrade			
Subgrade Inspection	QC Manager	-Verify exposed subgrade inspections per current QC Plan occur.	As needed
Subgrade Elevations	QC Manager	-Confirm proper subgrade elevations prior to placement of liner.	As needed
Subgrade / Structural Fill density & moisture content testing	QC Manager	-Confirm that minimum number of subgrade and structural fill density and moisture content tests are performed per testing schedule. Confirm proofroll in applicable areas.	As needed
Borrow Materials	QC Manager	-Confirm minimum number of conformance tests performed on borrow material.	As needed
		-Coordinate borrow conformance sampling with contractor.	

Clifty Creek West Boiler Slag Pond
Quality Control Task Summary[1]

Task	Responsible Personnel[4]	Task Description/Itemization	Minimum Frequency/ Notes[2]
C. Flexible Membrane Liner (FML)			
Submittals	QC Manager	-Approval of material samples and certified material specifications a minimum of 10 days prior to product arrival on site	1/manufacturer/ year
		-Approval of installation layout proposed by Contractor per current QC Plan	1/installation plan
		-Approval of qualified field installation supervisor and/or master seamer per current QC Plan	1/field installation supervisor and/or master seamer
Conformance Testing	QC Manager	-Collection, organization and maintenance of delivery tickets and all available documentation that each roll delivered to the site meet or exceed project specifications	Each delivery
		-Verification of conformance testing/results per current QC Plan	Each delivery
Installation	QC Team	-Verify storage of geomembranes prior to deployment performed per project specifications and manufacturer/industry standards	Prior to Installation
		-Observation and documentation of subgrade preparation performed per project specifications and manufacturer/industry standards prior to geomembrane layout	Prior to Installation
		-Monitor and document all geomembrane deployment, field seaming and repair operations performed per project requirements, manufacturer recommendations and industry standard practice	Prior to Installation
		-Observation and documentation of anchor trench earthwork performed per project specifications	Prior to Installation

Clifty Creek West Boiler Slag Pond
Quality Control Task Summary(1)

Task	Responsible Personnel(4)	Task Description/Itemization	Minimum Frequency/ Notes(2)
D. Soil Cover			
Submittals	QC Manager	-Approve pre-qualification testing of materials	Prior to placement
		-Approve soil classification, proctor, and permeability testing	Prior to placement
Conformance Testing	QC Manager	-Verify minimum conformance testing per current QC Plan	Varies, see testing schedule
E. Geotextiles			
Submittals	QC Manager	-Approval of material samples and certified material specifications	Each delivery
Conformance Testing	QC Manager	-Collection, organization and maintenance of delivery tickets and all available documentation that supplied materials meet or exceed project specifications	
		-Verification of minimum conformance tests	1/manufacturer/ year
Installation	QC Team	-Monitor geotextile deployment and covering operations	During placement
		-Documentation that operations performed per project requirements, manufacturer recommendations, and industry practice	During placement

Clifty Creek West Boiler Slag Pond Quality Control Task Summary[1]			
Task	**Responsible Personnel[4]**	**Task Description/Itemization**	**Minimum Frequency/ Notes[2]**
F. Geocomposite			
Submittals	QC Manager	-Approval of material samples and certified material specifications	Prior to delivery
Conformance Testing	QC Manager	-Collection, organization and maintenance of delivery tickets and all available documentation that supplied materials meet or exceed project specifications	Each delivery
		-Verification of minimum conformance tests	1/manufacturer/ year
Installation	QC Team	-Monitor geocomposite deployment and covering operations	Daily
		-Documentation that operations performed per project requirements, manufacturer recommendations, and industry practice	Daily
G. Compacted Soil Liner			
Borrow Materials	QC Manager	-Confirm minimum number of conformance tests performed on borrow material -Coordinate borrow conformance sampling with contractor	As needed
Submittals	QC Manager	-Approve pre-qualification testing of materials	Prior to placement
		-Approve soil classification, proctor and permeability testing	Prior to placement
Conformance Testing	QC Manager	-Verify minimum conformance testing per current QC Plan	Varies, see testing schedule
H. Durable Coarse Aggregate Materials			
Submittals	QC Manager	-Approval of documentation regarding conformance and IN DOT[3] acceptance of proposed aggregate supplier and aggregate materials for IN DOT projects.	1/supplier/year
Conformance Testing	QC Manager	-Verify minimum conformance testing per current QC Plan	1/supplier/year

Clifty Creek West Boiler Slag Pond
Quality Control Task Summary[(1)]

Task	Responsible Personnel[(4)]	Task Description/Itemization	Minimum Frequency/ Notes[(2)]
I. Piping			
Submittals	QC Manager	-Approval of shop drawings, material samples, and certified material specifications	Prior to delivery
Conformance Testing	QC Manager	-Collection, organization and maintenance of delivery tickets and all available documentation confirming that supplied materials meet or exceed project specifications -Verification of minimum conformance testing/results per current QC Plan	Each delivery 1/product/ manufacturer
Installation	QC Team	-Inspection, acceptance, and documentation of pipe trench/backfill and pipe to structure penetration seals, pipe joints and lines/grades of pipe network	Each installation
J. Erosion and Sediment Control			
Site Inspections and Evaluations	Construction Manager	-Periodic erosion and sediment control structure inspections and overall site drainage evaluations -Adjustments to site drainage and structures as necessary, based upon prevalent site conditions -Documentation of sediment control observations and modifications	1/month As needed 1/month
K. CQA/CQC Documentation			
Documentation	QC Manager AND Construction Manager	-Overall organization and maintenance of CQA/CQC documentation of items outlined above as well as those designated in the CQA/CQC Plan	1/quarter
L. Instrumentation			
Quality Control Documents	QC Manager AND Construction Manager	-review Quality Control Document for each instrument -review instrument readings	1/quarter 1/quarter

Clifty Creek West Boiler Slag Pond
Quality Control Task Summary[1]

Task	Responsible Personnel[4]	Task Description/Itemization	Minimum Frequency/ Notes[2]
M. Seeding and Mulching			
Submittals	QC Manager	-review fertilizer/lime application rates and laboratory test results	1/year (or) 1 per borrow source
N. Concrete Drainage Structures			
Submittals	QC Manager QC Team	-review material submittals and shop drawings -observe each delivery for signs of damage or nonconformance, observe and document subgrade conditions and backfill methods	Each delivery Each structure

Notes:

1) The task summary is a itemized list of the general responsibilities to be administrated by the Construction Manager and the QC Manager/QC Team per the current Quality Control Plan and the associated testing schedule

2) All materials testing and site observations are to be conducted in accordance with the current Quality Control Plan and the associated testing schedule to assure that minimum project specifications are maintained on the site during the construction of the special waste disposal facility. Frequency stated when applicable. Many manager or team tasks, such as subgrade inspection, have no quantifiable testing frequency but are required during work progress.

3) IN DOT - "Standard Specifications" current edition.

4) Responsible Personnel Definitions:

Construction Manager - An IKEC employee or representative designated to be the Owner representative on the construction site. Responsibilities involve overall management of site operations including construction administration tasks, waste disposal, contracting and retaining the services of all necessary personnel (including a qualified engineer) for the life of the facility. The Construction Manager also is a liaison for the Owner to the QC Manager and Contractors.

QC Manager - Licensed Professional Engineer in the State of Indiana. Responsibilities generally include the management of the construction monitoring and/or testing; networking with contractors, engineering consultants, regulatory authorities and owner representatives; and preparation of construction QA documents.

QC Team - Personnel qualified in construction quality assurance/quality control (QA/QC) testing procedures pertinent to the Clifty Creek Power Plant facility working under the direct supervision of the QC Manager.

IDEM Contact - IDEM Solid Waste Branch Manager or other designated IDEM personnel.

WBSP Closure Plan
CQA Plan
Appendix B

Clifty Creek West Boiler Slag Pond
Quality Control Plan - Material Testing and Product Certification Schedule

MATERIAL	PROPERTY	TEST METHOD	Value	Minimum Conformance Test
Structural Fill				
	Soil Classification	ASTM		1/ material type or change in material
	Proctor	ASTM		1/ material type or change in material
	Nuclear Density and Moisture	ASTM	Min. 95% standard Proctor	1/ 5,000 CYD
	Thickness	Project Requirements	Project Requirements	Project Requirements
Flexible Membrane Liner (FML)				
40 mil PVC Geomembrane				
	Thickness	*ASTM*	40 $\pm$2 mil	1/ MQC Plan (2)
	Tensile Properties	*ASTM*		1/ MQC Plan
	Minimum Strength at Break	*ASTM*	97 lbs/in	
	Minimum Elongation	*ASTM*	430%	1/ 10 rolls
	Minimum Modulus at 100%	*ASTM*	40 lbs/in	1/ 20,000 lb
	Minimum Tear Strength	*ASTM*	10 lbs	1/ 200,000 lb
	Dimensional Stability (max chg)	*ASTM*	3%	1/ 20,000 lb
	Low Temperature Impact	*ASTM*	-20^{o} F	1/ MQC Plan
	Typical Specific Gravity	*ASTM*	1.2 g/cc	1/ 40,000 lb
	Water Extraction Percent Loss (max)	*ASTM*	0.20%	1/ 40,000 lb
	Average Plasticizer Molecular Weight	*ASTM*	400	1/ MQC Plan
	Volatile Loss Percent (max)	*ASTM*	1.50%	1/ 40,000 lb
	Soil Burial (max chg)	*ASTM*		1/ 40,000 lb
	Break Strength	*ASTM*	92%	1/ MQC Plan
	Elongation	*ASTM*	344%	1/ MQC Plan
	Modulus at 100%	*ASTM*	20%	1/ MQC Plan
	Minimum Hydrostatic Resistance	*ASTM*	120 psi	
	Minimum Shear Strength	*ASTM*	77.6 lbs/in	1/ 500 ft
	Minimum Peel Strength	*ASTM*	15 lbs/in	1/ 500 ft

Clifty Creek West Boiler Slag Pond
Quality Control Plan - Material Testing and Product Certification Schedule

MATERIAL	PROPERTY	TEST METHOD	Value	Minimum Conformance Test
Flexible Membrane Liner (FML)				
LLDPE Geomembrane Raw Materials	Geomembrane Resin Density	*ASTM*	0.915 - 0.926	1/ MQC Plan (2)
	Geomembrane Resin Melt Index	*ASTM*	<1.0	1/ MQC Plan
40 mil LLDPE Geomembrane	Thickness	*ASTM*	Project Requirements	1/ 10 rolls
	Density	*ASTM*	0.939 g/ml	1/ 200,000 lb
	Tensile Properties	*ASTM*	Project Requirements	1/ 20,000 lb
	2% Modulus	*ASTM*	2400 lb/in	1/ MQC Plan
	Tear Resistance	*ASTM*	22 lb	1/ 40,000 lb
	Puncture Resistance	*ASTM*	56 lb	1/ 40,000 lb
	Axi-Symmetric Break Resistance Strain	*ASTM*	30%	1/ MQC Plan
	Carbon Black Content	*ASTM*	2.0 - 3.0 %	1/ 40,000 lb
	Carbon Black Dispersion	*ASTM*	Project Requirements	1/ 40,000 lb
	Oxidative Induction Time (OIT)(4)	*ASTM*	100 or 400 minutes	1/ MQC Plan
	Oven Aging at 85 degrees C(4)	*ASTM*	35% or 60 %	1/ MQC Plan
	UV Resistance	*ASTM*	35%	1/ MQC Plan
	Seam Properties - Shear Strength	*ASTM*	60 ppi (5)+max one coupon Non-Film Tear Bond (FTB)	1/ 500 ft
	Seam Properties - Peel Strength	*ASTM*	FTB	1/ 500 ft
	Non-Destructive Seam Integrity	*GRI*	Per GRI	Continuous

Clifty Creek West Boiler Slag Pond
Quality Control Plan - Material Testing and Product Certification Schedule

MATERIAL	PROPERTY	TEST METHOD	Value	Minimum Conformance Test
Final Cover Upper 6 inches	Soil Classification	ASTM	CH, MH, CL, ML, and associated dual symbols	1/ year/source/soil class
	Lime, Fertilizer and other Soil Amendments	Natural Resources Conservation Service (NRCS)	Application Rates per NRCS recommendations based on testing	1/ year/source/soil class
Lower 24 to 36 inches	Soil Classification	ASTM	CH, MH, CL, ML, SC and associated dual symbols	1/ year/source/soil class
(If used as Compacted Soil Liner) Lower 24 to 36 inches	Soil Classification	ASTM	Preconstruction During Construction	1 test/5,000 CYD or change in material 1 tests/acre/lift
	Nuclear Density and Moisture	ASTM	Moisture-Density Curve Min. 95% standard Proctor During Construction	1 test/5,000 CYD or change in material 5 tests/acre/lift, evenly distribute
	Lab Hydraulic Conductivity (Remolded)	ASTM	During Construction Moisture-Density Curve Less than or equal to natural subsoils or no greater than 1x10-5 cm/sec	1 test/5,000 CYD or change in material 1 test/10,000 CYD
	Undisturbed Hydraulic Conductivity	ASTM	Less than or equal to natural subsoils or no greater than 1x10-5 cm/sec	1 test/acre/lift
	Dry Density and Moisture Content (Undisturbed)	ASTM	During Construction	1 test/acre/lift

WBSP Closure Plan
CQA Plan
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Clifty Creek West Boiler Slag Pond
Quality Control Plan - Material Testing and Product Certification Schedule

MATERIAL	PROPERTY	TEST METHOD	Value	Minimum Conformance Test
Geocomposite				
Geocomposite Natural Resin	Resin Density	*ASTM*	>0.94 g/cm^3	1/ MQC Plan
	Resin Melt Index	*ASTM*	±1.0 g/10 min	1/ MQC Plan
250 mil Geocomposite	Transmissivity	*ASTM*	1x10^{-3} m^2/sec	1/ MQC Plan
	Thickness	*ASTM*	0.270 in	1/ MQC Plan
	Tensile Strength (MD)[8]	*ASTM*	44 lb/in	1/ MQC Plan
	Carbon Black Content	*ASTM*	2.0%	1/ MQC Plan
	Mass per Unit Area	*ASTM*	0.330 psf	1/ MQC Plan
	Specific Gravity	*ASTM*	Project Requirements	1/ MQC Plan
	Melt Flow Index	*ASTM*	Project Requirements	1/ MQC Plan
	Carbon Black Content	*ASTM*	Project Requirements	1/ MQC Plan
	Abrasion or Tumble Test	*ASTM*	Project Requirements	1/ MQC Plan
	Creep	*ASTM*	Project Requirements	1/ MQC Plan
	Thickness	*ASTM*	Project Requirements	1/ MQC Plan
	Chemical Compatibility	*ASTM*	Project Requirements	1/ MQC Plan
	Resistance to Extreme Temperature	*ASTM*	Project Requirements	1/ MQC Plan
	Resistance to Bacteria	*ASTM*	Project Requirements	1/ MQC Plan
	Resistance to Burial Deterioration	*ASTM*	Project Requirements	1/ MQC Plan
Coarse Aggregates				
No. 2	Gradation	*IN DOT*	IN DOT	1/ supplier/year
No. 53	Gradation	*IN DOT*	IN DOT	1/ supplier/year
No. 9	Gradation	*IN DOT*	IN DOT	1/ supplier/year
Class 1 Riprap	Gradation	*IN DOT*	IN DOT	1/ supplier/year
Grouted Class 1 Riprap	Gradation	*IN DOT*	IN DOT	1/ supplier/year

Clifty Creek West Boiler Slag Pond
Quality Control Plan - Material Testing and Product Certification Schedule

MATERIAL	PROPERTY	TEST METHOD	Value	Minimum Conformance Test
Geotextile Filter Fabrics Application: Separator/Filtration	Type	-	Non-woven	
	Burst Strength	*ASTM*	300 psi	1/ manufacturer/year
	Tensile Strength	*ASTM*	160 psi	1/ manufacturer/year
	Puncture Strength	*ASTM*	45 pounds	1/ manufacturer/year
	Permeability	*ASTM*	$3x10^{-1}$ cm/sec	1/ manufacturer/year
	AOS	ASTM	Based on gradation of materials placed against geotextile determined prior to construction	1/ manufacturer/year
	Gradient Ratio or Hydraulic Conductivity Ratio Test	ASTM	Based on gradation of materials placed against geotextile determined prior to construction	1/ manufacturer/year
Cushion	Type	-	Non-woven	
	Elongation	ASTM		1/ manufacturer/year
	Trapezoidal Tear	ASTM		1/ manufacturer/year
	Ultraviolet Resistance Test	ASTM		1/ manufacturer/year
	Abrasion or Tumble Test	ASTM		1/ manufacturer/year
	Burst Strength	ASTM	300 psi	1/ manufacturer/year
	Tensile Strength	ASTM	160 psi	1/ manufacturer/year
	Puncture Strength	ASTM	45 pounds	1/ manufacturer/year
Drainage Ditch	Type	-	Non-woven	
	Burst Strength	ASTM	300 psi	1/ manufacturer/year
	Tensile Strength	ASTM	160 psi	1/ manufacturer/year
	Puncture Strength	ASTM	45 pounds	1/ manufacturer/year
	Permeability	ASTM	$3x10^{-1}$ cm/sec	1/ manufacturer/year
	AOS	ASTM	Based on gradation of materials placed against geotextile determined prior to construction	1/ manufacturer/year

WBSP Closure Plan
CQA Plan
Appendix B

Clifty Creek West Boiler Slag Pond Quality Control Plan - Material Testing and Product Certification Schedule				
MATERIAL	**PROPERTY**	**TEST METHOD**	**Value**	**Minimum Conformance Test**
Road Reinforcement	Type	-	Woven	
	Burst Strength	ASTM	540 psi	1/ manufacturer/year
	Tensile Strength	ASTM	250 psi	1/ manufacturer/year
	Puncture Strength	ASTM	45 pounds	1/ manufacturer/year
	Permeability	ASTM	NA	
	AOS	ASTM	NA	
Class A Concrete				
	Compressive Strength	ASTM	4,000 psi	1/ pour or 1/ 20 CYDS
	IN DOT Standard Specifications	*IN DOT*		1/ supplier/year

Notes:

(1) or one (1) test per noted change in material or waste production/processing change (whichever is applicable)

(2) MQC - Manufacturer Quality Control Plan: Manufacturer shall provide written certification materials meet all specified values and related MQC data.

(3) GRI - Geosynthetic Research Institute Testing Method

(4) Results for Standard OIT or High Pressure OIT respectively

(5) ppi - pounds per inch. FTB pass/fail criteria shall be based on current GRI standards

(6) ASTM F1417-92

(7) IN DOT - Italics Indicate Contractor Submittals Certified by Manufacturer/Supplier. Remaining tests to be conducted by project QC Team.

(8) MD - Machine Direction

ATTACHMENT C

Barge Loading Station Plans

(WBCM, 2020)

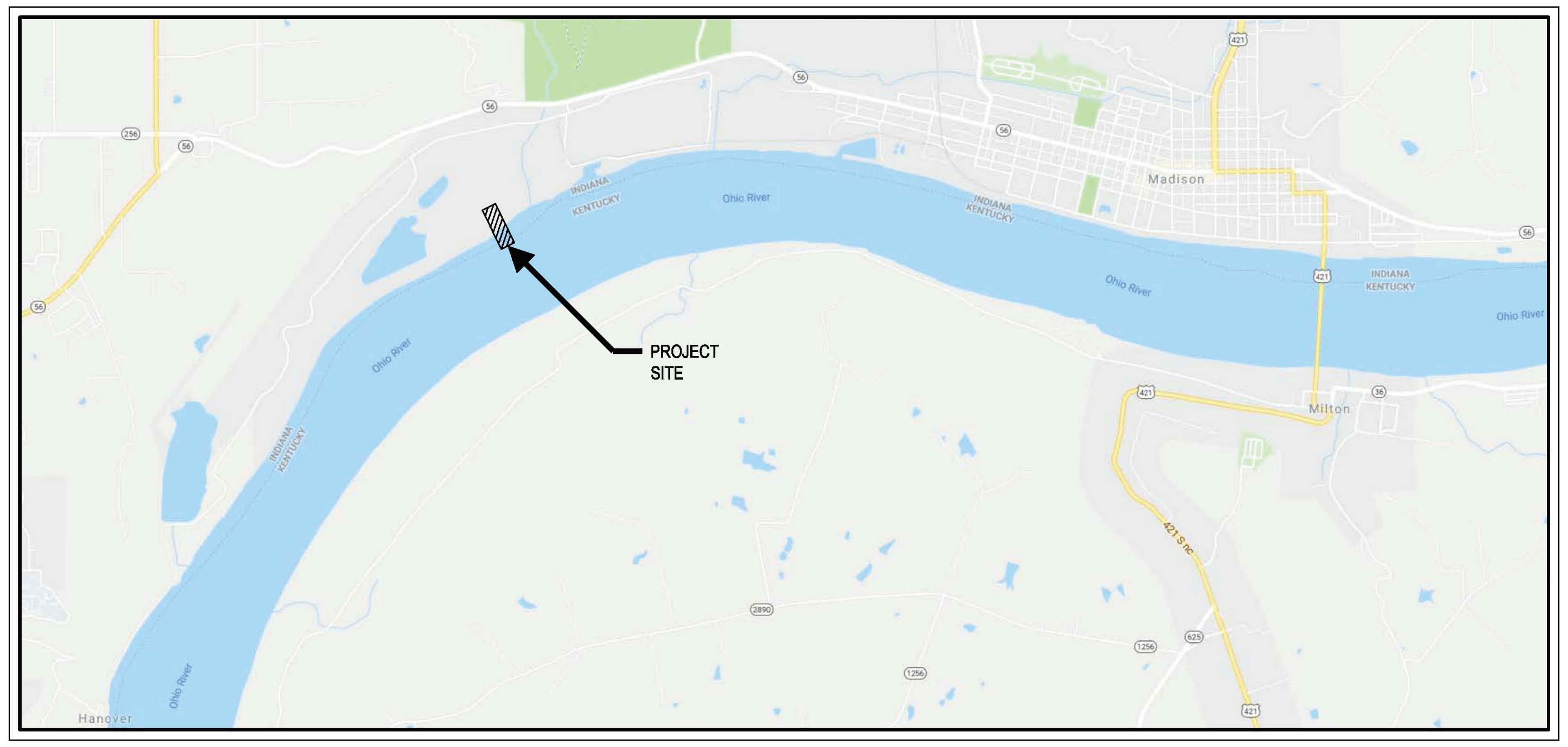
CONTINENTAL BUILDING PRODUCTS

MADISON, INDIANA

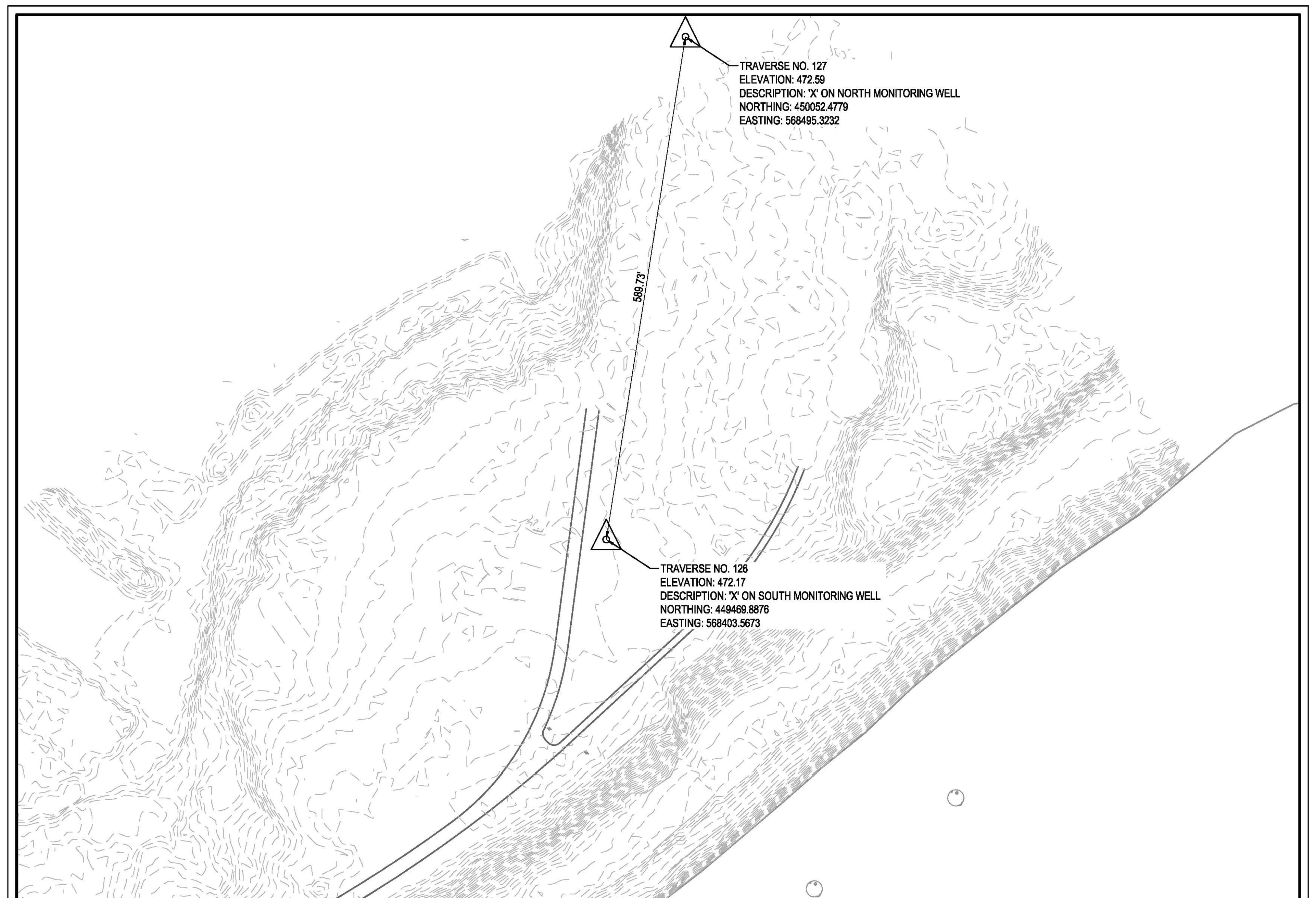
BARGE LOADING STATION AT
INDIANA-KENTUCKY ELECTRIC CORPORATION (IKEC)

GENERAL NOTES:

1. THE TOPOGRAPHY SHOWN IS BASED UPON A PARTIAL FIELD RUN SURVEY PERFORMED BY RIVERSIDE CONTRACTING AND PROVIDED TO WBCM IN APRIL, 2019. SUPPLEMENTAL INFORMATION HAS BEEN ADDED FROM RECORD DRAWINGS AND AERIAL MAPS.
2. HORIZONTAL COORDINATES SHOWN HEREON ARE BASED UPON NAD27 INDIANA STATE PLANE.
3. ELEVATIONS SHOWN HEREON ARE BASED UPON NORTH AMERICAN VERTICAL DATUM NAVD 88.
4. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD-VERIFY ACTUAL SITE CONDITIONS PRIOR TO THE START OF ANY WORK. THERE IS NO WARRANTY OR GUARANTEE ON THE COMPLETENESS OR CORRECTNESS OF THE EXISTING CONDITION INFORMATION. ANY DISCREPANCY FOUND SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE ENGINEER PRIOR TO THE START OF ANY WORK.
5. THE LOCATION OF EXISTING UNDERGROUND UTILITIES IS SHOWN IN AN APPROXIMATE WAY, ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFICATION OF THE EXACT LOCATION OF ALL EXISTING UNDERGROUND UTILITIES BEFORE COMMENCING ANY WORK. CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR THE COST OF REPAIR OF ANY AND ALL DAMAGES WHICH OCCUR AS A RESULT OF A FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL EXISTING UTILITIES TO REMAIN.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING "MISS UTILITY" AT 1-800-257-7777 THREE DAYS PRIOR TO THE START OF ANY EXCAVATION WORK.
7. THE CONTRACTOR SHALL STAKE-OUT ALL BASELINES OF CONSTRUCTION AND THE LOCATION OF ALL NEW CONSTRUCTION, AND VERIFY ALL SETBACKS, OFFSETS, AND CLEARANCES PRIOR TO START OF ANY WORK.
8. THE CONTRACTOR SHALL VERIFY ALL EXISTING UTILITY INVERTS AND CLEARANCES FROM NEW WORK PRIOR TO START OF ANY WORK.
9. ALL DISTURBED AREAS NOT STABILIZED WITH STRUCTURES, PAVING, AND PLANTINGS SHALL BE STABILIZED WITH FOUR INCHES OF TOPSOIL, SEED, MULCH, AND WATER TO ESTABLISH AN ADEQUATE GROWTH OF GRASS.
10. ALL WORK SHALL BE ACCOMPLISHED IN ACCORDANCE WITH THE REQUIREMENTS OF THE PROJECT SPECIFICATIONS.
11. THE TOPS OF ALL FRAMES, GRATES, AND COVERS OF ALL EXISTING UTILITIES WITHIN THE LIMITS OF CONTRACT AND/OR DISTURBANCE SHALL BE ADJUSTED TO THE NEW GRADES.
12. CONTRACTOR SHALL MAINTAIN POSITIVE DRAINAGE AT ALL TIMES AND SHALL PROVIDE ALL NEEDED LABOR, EQUIPMENT, AND MATERIALS TO PROTECT THE PROJECT SITE FROM PONDING WATER AND FLOODING.
13. NUMERICAL DIMENSIONS AND ELEVATIONS SHOWN SHALL SUPERSEDE ANY DISCREPANCY IN THE SCALING ON THE DRAWINGS.



N
VICINITY MAP
SCALE: 1" = 2000'



N
TRAVERSE MAP
SCALE: 1" = 100'

DRAWING INDEX

DWG. NO.	DRAWING NAME
G101	TITLE SHEET
	PROCESS
GA101	GENERAL ARRANGEMENT PLAN
GA102	GENERAL ARRANGEMENT ELEVATIONS
GA103	GENERAL ARRANGEMENT ELEVATIONS EXTREMES
GA104	CONVEYOR PIVOT DETAILS
D100	PARTIAL CONVEYOR #1 & #2 REMOVAL
D101	PARTIAL CONVEYOR #1 REMOVAL
D102	PARTIAL CONVEYOR #2 REMOVAL
F100	PULLEY SUPPORT FRAMES FABRICATION & RELOCATION
F101	HOPPER FABRICATION DRAWING
F102	HOPPER FABRICATION DRAWING DEFLECTION PLATE
F103	CHUTE FABRICATION DRAWING
PR300	UTILITY SHED EQUIPMENT & PIPING PLAN
PR301	UTILITY SHED EQUIPMENT & PIPING SECTION
PR302	UTILITY SHED EQUIPMENT & PIPING SECTION
PR303	UTILITY SHED EQUIPMENT & PIPING SECTION
PFD101	PROCESS FLOW DIAGRAM
P&ID101A	PIPING AND INSTRUMENTATION DIAGRAM LEGEND
P&ID101B	PIPING AND INSTRUMENTATION DIAGRAM LEGEND
P&ID102	PIPING AND INSTRUMENTATION DIAGRAM
	CIVIL
C001	EXISTING CONDITIONS AND DEMOLITION PLAN
C101	CONCRETE SLAB LAYOUT AND GEOMETRY PLAN
C102	SITE DETAILS
C201	CONCRETE SLAB GRADING AND UTILITY PLAN
C301	SEDIMENT AND EROSION CONTROL PLAN
	STRUCTURAL
S001	GENERAL NOTES
S101	OVERALL STRUCTURAL PLAN
S102	HOPPER FOUNDATION AND FRAMING
S103	HOPPER TOWER SECTIONS AND DETAILS
S104	CONVEYOR #1 TAIL END MOUNTING DETAILS
S201	CONVEYOR TOWER DETAILS
S202	CONVEYOR TOWER DETAILS
S203	CONVEYOR DETAILS
S204	CONVEYOR TOWER DETAILS
S205	GANGWAY ELEVATION AND DETAILS
S206	CHUTE PIVOT DETAIL
S301	CONVEYOR TRUSS #2 MODIFICATION PLANS & SECTIONS
S302	BARGE PART PLAN AND SECTION
S303	CONVEYOR TRUSS #2 NEW SUPPORT ELEVATIONS AND DETAILS
S304	CONVEYOR TRUSS #2 NEW SUPPORT DETAILS
S401	CAPTIVE BARGE MODIFICATION DETAILS
S402	CAPTIVE BARGE DETAILS
	ARCHITECTURAL
A101	UTILITY SHED FLOOR PLAN AND ELEVATION
	MECHANICAL
M001	MECHANICAL NOTES, LEGENDS, AND ABBREVIATIONS
M002	MECHANICAL SPECIFICATIONS
M201	UTILITY SHED - NEW WORK - HVAC
M601	MECHANICAL DETAILS, SCHEDULES, AND CONTROL SEQUENCES

1

2

ISSUED FOR CONSTRUCTION

NO.	DATE	REVISION	BY
1	4/21/20	ADDED PR300, PR301, PR302, PR303	
2	5/6/2020	ADDED M001, M002, M201, M601	

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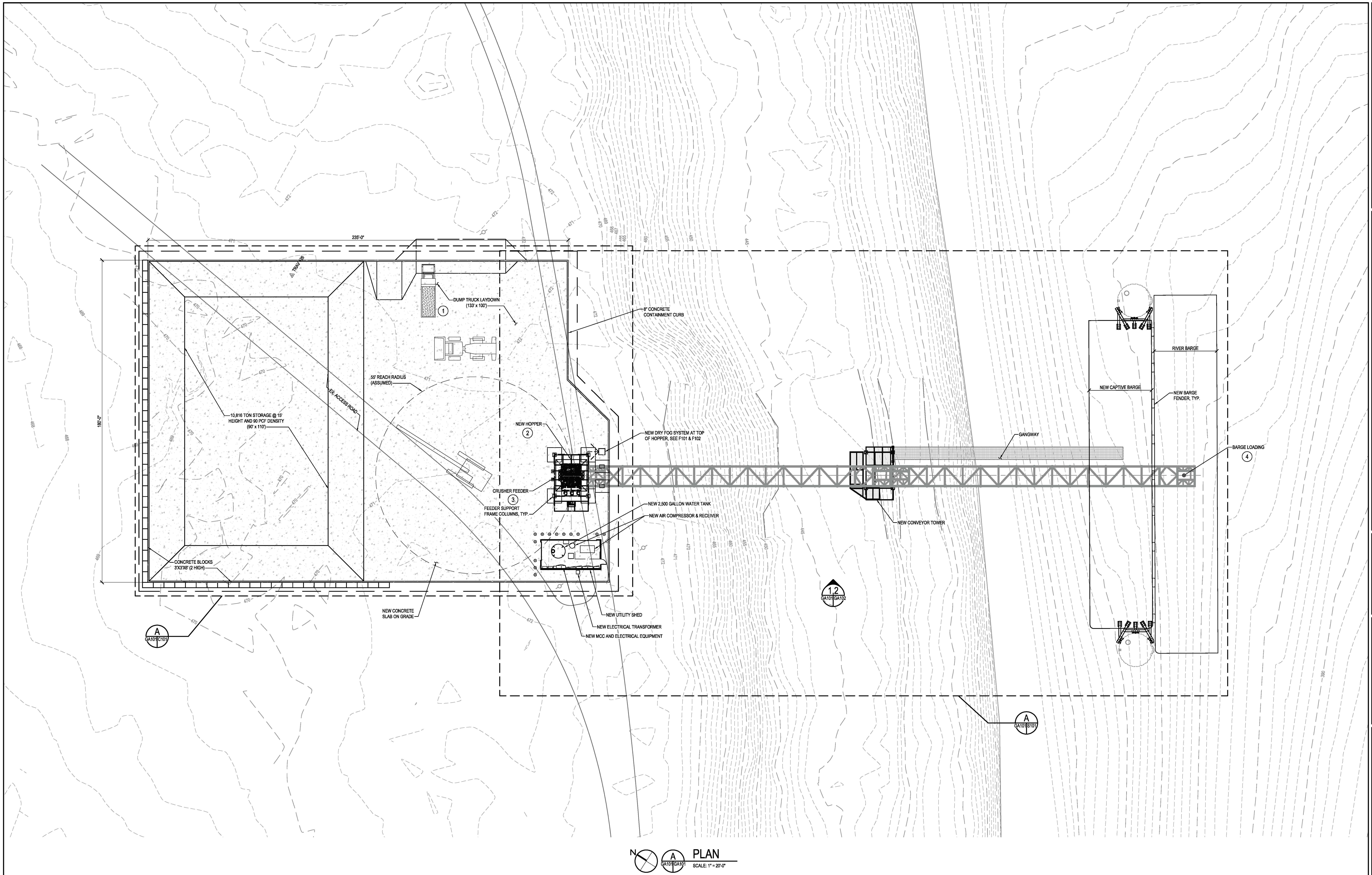
CONTINENTAL
BUILDING PRODUCTS

TITLE SHEET

BARGE LOADING STATION AT
IKEC CLIFTY CREEK STATION
CONTINENTAL BUILDING PRODUCTS
1335 CLIFTY HOLLOW ROAD
MADISON, INDIANA 47250

DESIGNED:	G.F. / J.R.C.
DRAWN:	E.C.F.
CHECKED:	M.W.S.
SCALE:	AS NOTED
DATE:	MAY 2020
PROJECT:	2018063600
DRAWING:	G101



AIR PERMIT TRANSFER POINT SUMMARY:

1. TRUCK UNLOADING ONTO STOCKPILE
2. EXCAVATOR LOADING INTO HOPPER
3. HOPPER DROPPING ONTO BELT
4. CONVEYOR UNLOADING ONTO BARGE

(X) = EMISSION TRANSFER POINT

CAUTION:
IF THIS DRAWING IS A REDUCTION,
USE THE GRAPHIC SCALES.

1"=20'-0"

ISSUED FOR CONSTRUCTION

NO.	DATE	REVISION	BY

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300 East Joppa Road Suite 200
Baltimore, MD 21286
410.512.4500 www.wbcm.com

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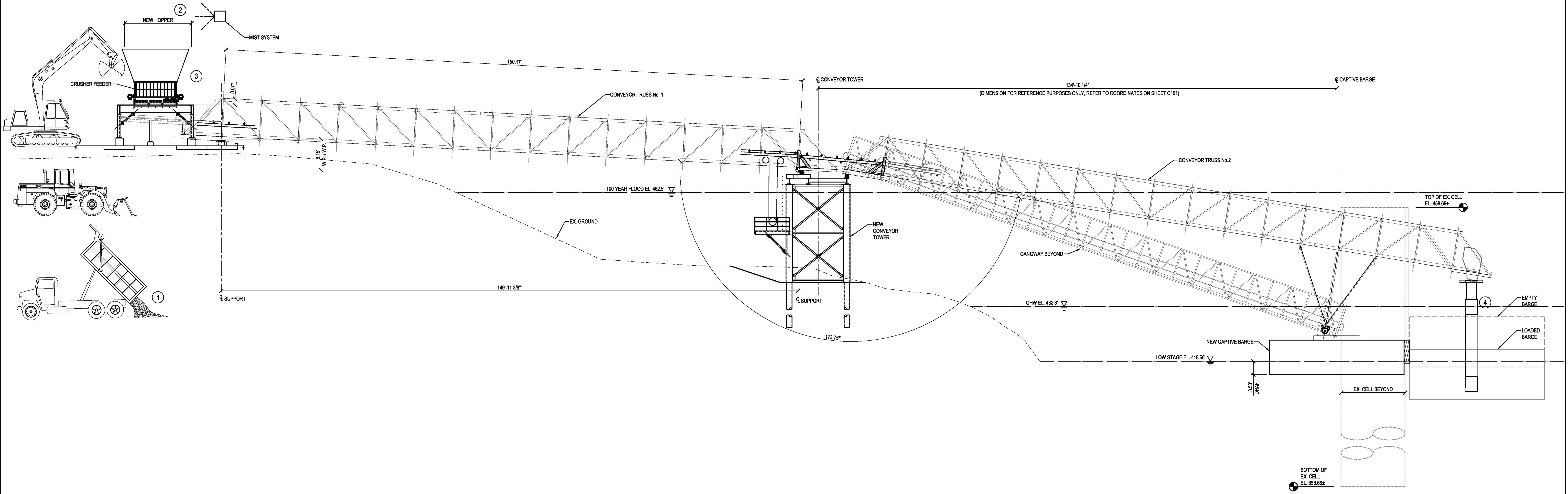
Designing Infrastructure for Tomorrow®

CONTINENTAL™
BUILDING PRODUCTS

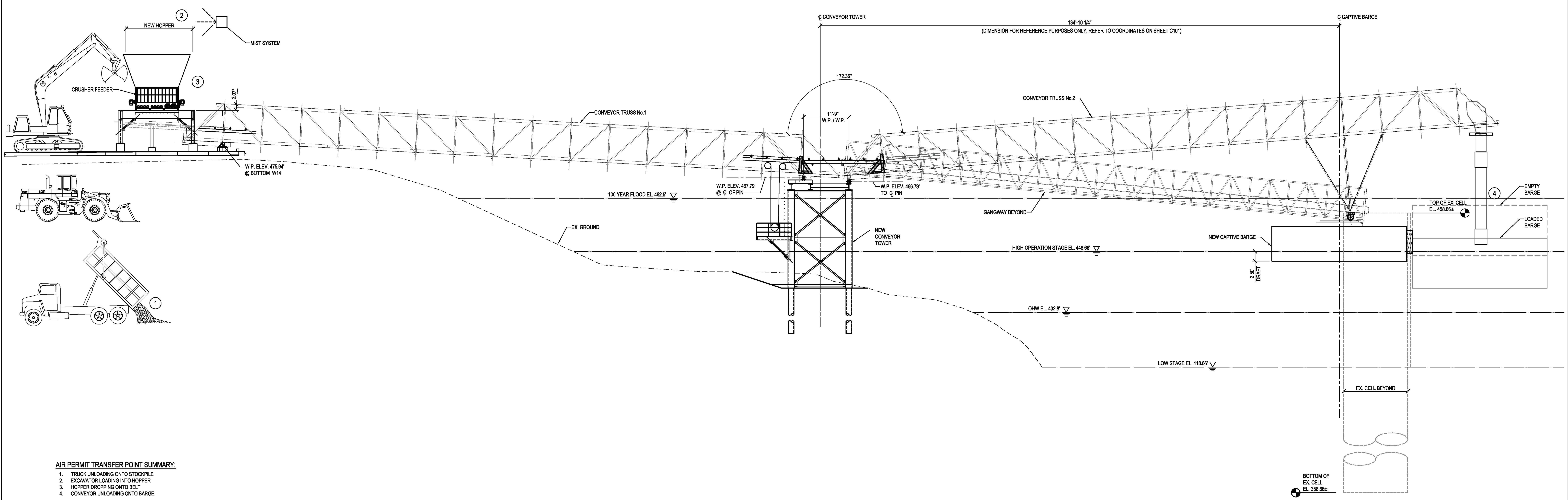
GENERAL ARRANGEMENT PLAN

BARGE LOADING STATION AT
IKEC CLIFTY CREEK STATION
CONTINENTAL BUILDING PRODUCTS
1335 CLIFTY HOLLOW ROAD
MADISON, INDIANA 47250

DESIGNED:	G.F.
DRAWN:	E.C.F.
CHECKED:	M.W.S.
SCALE:	AS NOTED
DATE:	FEBRUARY 2020
PROJECT:	2018063600
DRAWING:	GA101



ELEVATION
GA101 GA102
SCALE: 3/32" = 1'-0"



ELEVATION
GA101 GA102
SCALE: 3/32" = 1'-0"

AIR PERMIT TRANSFER POINT SUMMARY:

1. TRUCK UNLOADING ONTO STOCKPILE
2. EXCAVATOR LOADING INTO HOPPER
3. HOPPER DROPPING ONTO BELT
4. CONVEYOR UNLOADING ONTO BARGE

(X) = EMISSION TRANSFER POINT

CAUTION:
IF THIS DRAWING IS A REDUCTION, USE THE GRAPHIC SCALES.

3/32"=1'-0" 0 2 4 8 16 32

ISSUED FOR CONSTRUCTION

NO.	DATE	REVISION	BY

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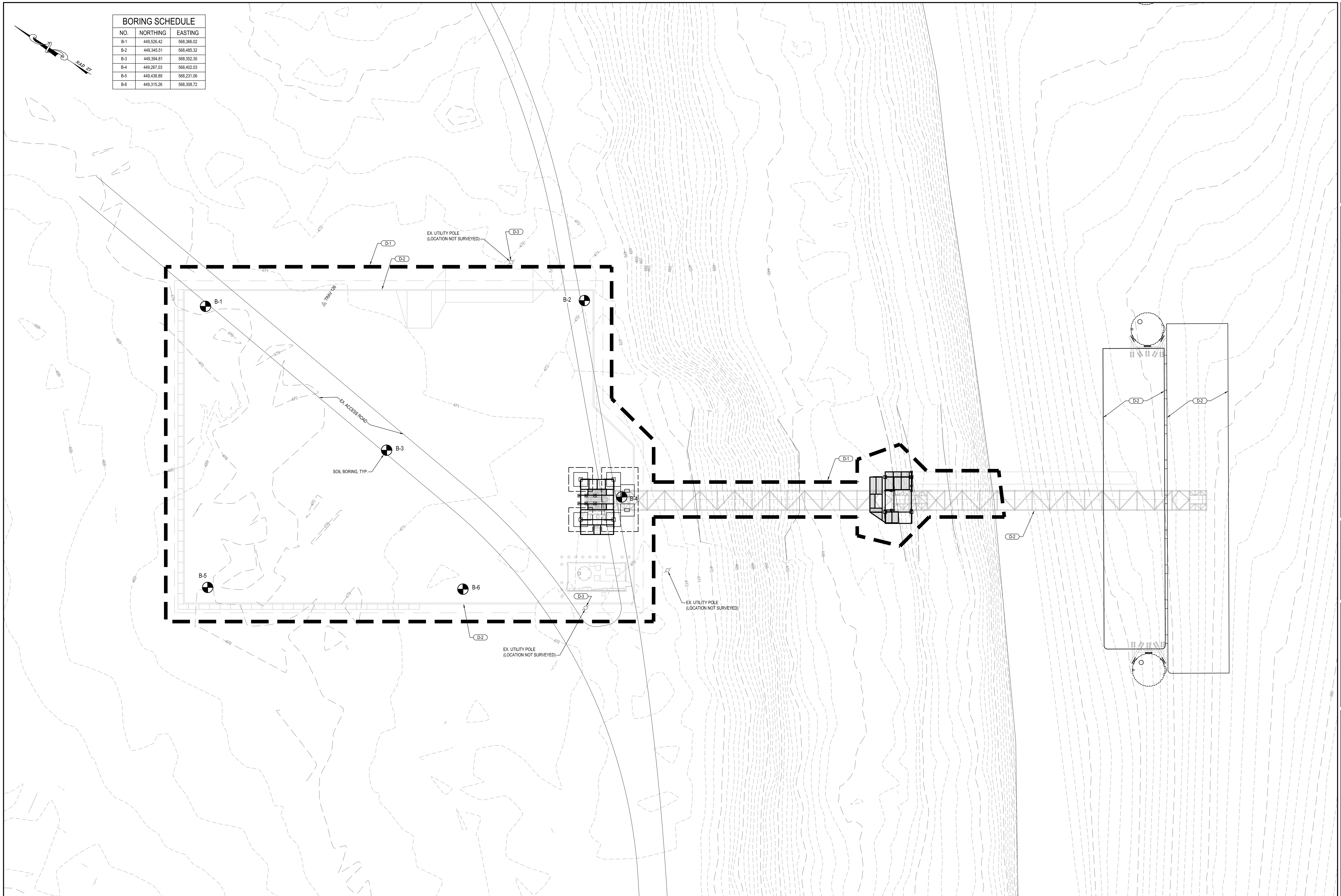
Baltimore, MD 21286
410.512.4500 www.wbcm.com

CONTINENTAL BUILDING PRODUCTS

GENERAL ARRANGEMENT ELEVATIONS

BARGE LOADING STATION AT
IKEC CLIFTY CREEK STATION
CONTINENTAL BUILDING PRODUCTS
1335 CLIFTY HOLLOW ROAD
MADISON, INDIANA 47250

DESIGNED:	G.F.
DRAWN:	E.C.F.
CHECKED:	M.W.S.
SCALE:	AS NOTED
DATE:	FEBRUARY 2020
PROJECT:	2018063600
DRAWING:	GA102



BORING SCHEDULE		
NO.	NORTHING	EASTING
B-1	449,526.42	568,366.02
B-2	449,345.51	568,485.32
B-3	449,394.81	568,352.30
B-4	449,267.03	568,402.03
B-5	449,438.89	568,231.06
B-6	449,315.26	568,308.72

DEMOLITION NOTES:

D-1 LIMIT OF CLEARING AND GRUBBING. WITHIN LIMIT: REMOVE ALL VEGETATION, BRUSH, GRAVEL, CONCRETE AND MISCELLANEOUS STRUCTURES AND DEBRIS, ETC. COORDINATE WITH PLANT MANAGER FOR STOCKPILE OR DISPOSAL OF ITEMS.

D-2 PROPOSED WORK SHOWN FOR REFERENCE.

D-3 REMOVE EXISTING UTILITY POLE AS NECESSARY. CONTRACTOR TO COORDINATE REMOVAL AND RELOCATION WITH PLANT ENGINEER.

A C001 C001 PLAN
SCALE: 1" = 10'

CAUTION:
IF THIS DRAWING IS A REDUCTION,
USE THE GRAPHIC SCALES.

1"=20'-0" 20 0 10 20 40

ISSUED FOR CONSTRUCTION

NO.	DATE	REVISION	BY

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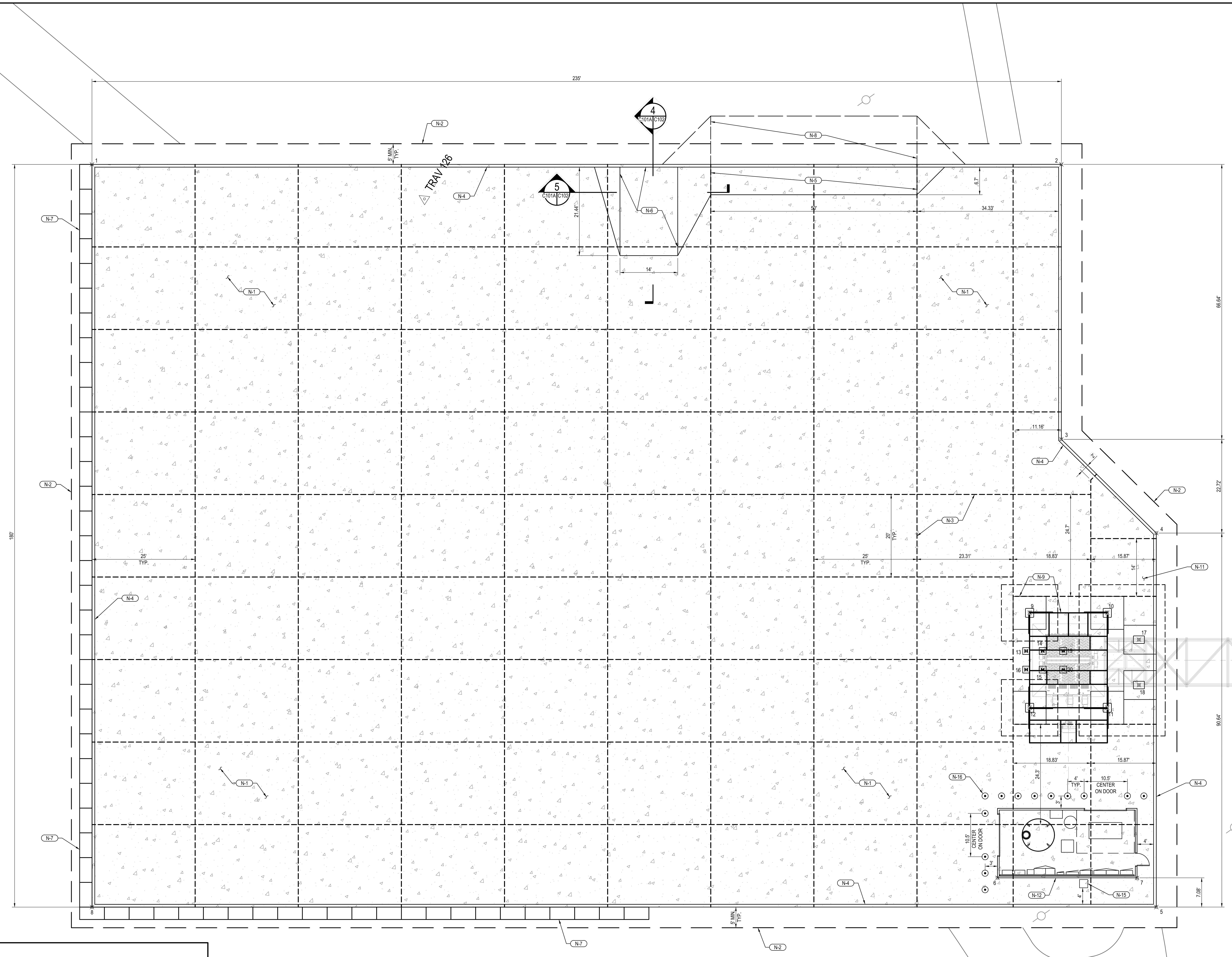
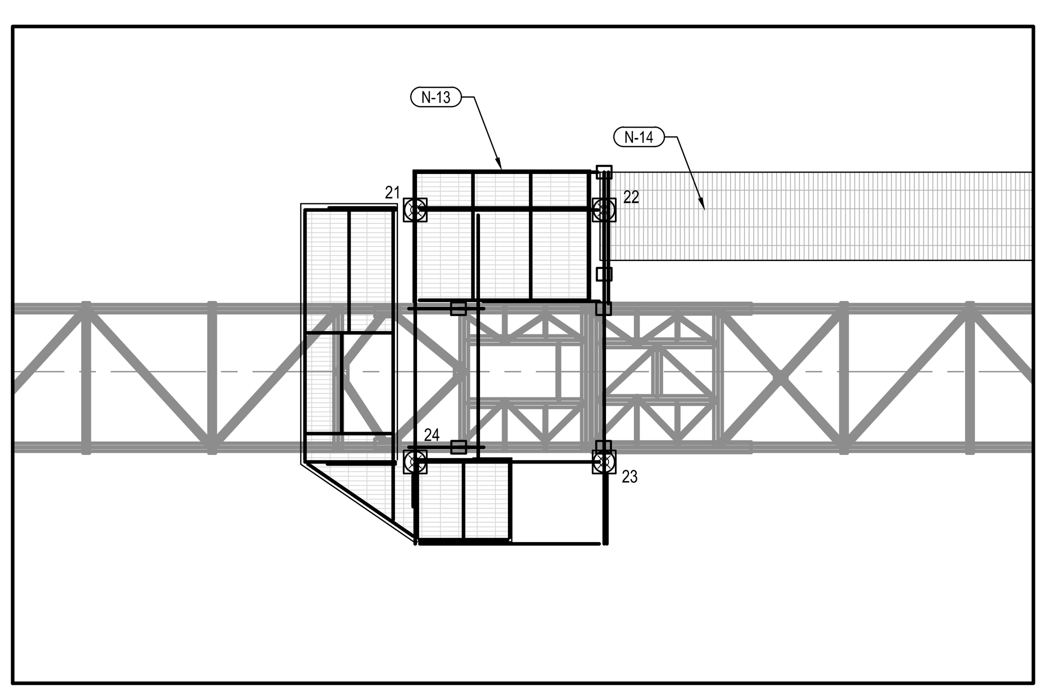
EXISTING CONDITIONS AND DEMOLITION PLAN

BARGE LOADING STATION AT
IKEC CLIFTY CREEK STATION
CONTINENTAL BUILDING PRODUCTS
1335 CLIFTY HOLLOW ROAD
MADISON, INDIANA 47250

DESIGNED:	T.M.P.
DRAWN:	E.C.F.
CHECKED:	M.W.S.
SCALE:	AS NOTED
DATE:	FEBRUARY 2020
PROJECT:	2018063600
DRAWING:	C001



A PLAN
SCALE: 1" = 10'



B CONVEYOR TOWER PART PLAN
SCALE: 1" = 10'

GEOMETRY POINT TABLE

PT #	DESCRIPTION	NORTHING	EASTING
1	CORNER OF SLAB	449542.35	568367.29
2	CORNER OF SLAB	449344.22	568493.66
3	CORNER OF SLAB	449308.39	568437.48
4	CORNER OF SLAB	449276.76	568430.70
5	CORNER OF SLAB	449228.02	568354.29
6	CORNER OF SHED	449264.29	568339.55
7	CORNER OF SHED	449235.76	568357.75
8	CORNER OF SLAB	449445.55	568215.53
9	CENTER OF HOPPER SUPPORT PEDESTAL	449292.25	568397.89
10	CENTER OF HOPPER SUPPORT PEDESTAL	449276.37	568408.01
11	CENTER OF HOPPER SUPPORT PEDESTAL	449264.00	568388.62
12	CENTER OF HOPPER SUPPORT PEDESTAL	449279.88	568378.49
13	CENTER OF CONVEYOR SUPPORT PEDESTAL	449287.98	568389.64
14	CENTER OF CONVEYOR SUPPORT PEDESTAL	449284.61	568391.79
15	CENTER OF CONVEYOR SUPPORT PEDESTAL	449282.19	568388.00
16	CENTER OF CONVEYOR SUPPORT PEDESTAL	449285.56	568385.85
17	CENTER OF CONVEYOR SUPPORT PEDESTAL	449266.41	568406.66
18	CENTER OF CONVEYOR SUPPORT PEDESTAL	449260.50	568397.38
19	CENTER OF CONVEYOR SUPPORT PEDESTAL	449280.39	568394.48
20	CENTER OF CONVEYOR SUPPORT PEDESTAL	449277.97	568390.69
21	CENTER OF CONVEYOR TOWER PILE	449146.13	568492.67
22	CENTER OF CONVEYOR TOWER PILE	449133.49	568500.73
23	CENTER OF CONVEYOR TOWER PILE	449122.73	568483.87
24	CENTER OF CONVEYOR TOWER PILE	449135.38	568475.81

CONSTRUCTION NOTES:

N-1 NEW CONCRETE SLAB ON GRADE. CONCRETE SLAB POURS SHALL BE AS CLOSE TO SQUARE AS POSSIBLE. THE POUR ASPECT RATIO SHALL NOT EXCEED 1.5:1. SEE DETAIL 2, DRAWING C102.

N-2 MINIMUM LIMIT OF STRUCTURAL FILL. SEE DETAIL 2, DRAWING C102.

N-3 NEW CONTROL JOINTS, SEE PLAN FOR SPACING, TYP. SEE DETAIL 3, DRAWING C102.

N-4 NEW CONCRETE CURB. SEE DETAIL 1, DRAWING C102.

N-5 NEW CONCRETE ACCESS RAMP. SEE DRAWING C201 FOR GRADING.

N-6 NEW SUMP / LOADER ACCESSIBLE MUCKOUT AREA AND PUSH WALL. SEE DETAIL 4 AND 5, DRAWING C102 AND STRUCTURAL DRAWING S106.

N-7 NEW 3' x 3' x 6' (2 LEVELS HIGH) CONCRETE BLOCKS, TYP.

N-8 NEW ACCESS RAMP BY OTHERS.

N-9 NEW HOPPER AND FEEDER SUPPORT FRAMING AND FOUNDATIONS. SEE STRUCTURAL DRAWINGS.

N-10 NEW CONVEYOR. SEE STRUCTURAL DRAWINGS.

N-11 NEW MISTING SYSTEM (NOT SHOWN).

N-12 NEW UTILITY SHED WITH DUST SUPPRESSION SYSTEM EQUIPMENT AND MCC AND ASSOCIATED ELECTRICAL EQUIPMENT. SEE ARCHITECTURAL DRAWING A101.

N-13 NEW CONVEYOR TOWER. SEE STRUCTURAL DRAWINGS.

N-14 NEW GANGWAY. SEE STRUCTURAL DRAWINGS.

N-15 NEW ELECTRICAL TRANSFORMER. SEE ELECTRICAL DRAWINGS.

N-16 NEW CONCRETE FILLED BOLLARD, TYP. OF 13. SEE DETAIL 6, DRAWING C102.

CAUTION:
IF THIS DRAWING IS A REDUCTION, USE THE GRAPHIC SCALES.

1"=10'-0" 10 0 5 10 20

ISSUED FOR CONSTRUCTION

NO.	DATE	REVISION	BY

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300 East Joppa Road Suite 200
Baltimore, MD 21286
410.512.4500 www.wbcm.com
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CONTINENTAL™ BUILDING PRODUCTS

CONCRETE SLAB LAYOUT AND GEOMETRY PLAN

BARGE LOADING STATION AT
IKEC CLIFTY CREEK STATION
CONTINENTAL BUILDING PRODUCTS
1335 CLIFTY HOLLOW ROAD
MADISON, INDIANA 47250

DESIGNED:	T.M.P.
DRAWN:	E.C.F.
CHECKED:	M.W.S.
SCALE:	AS NOTED
DATE:	FEBRUARY 2020
PROJECT:	2018063600
DRAWING:	C101

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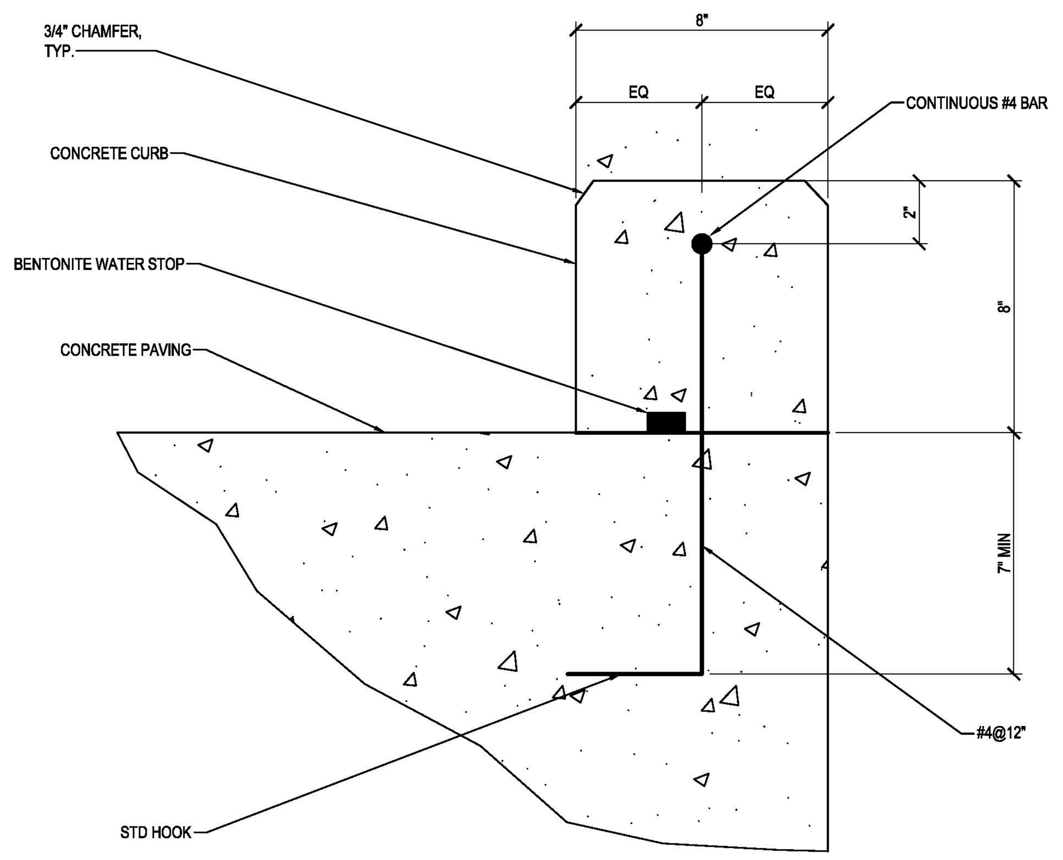
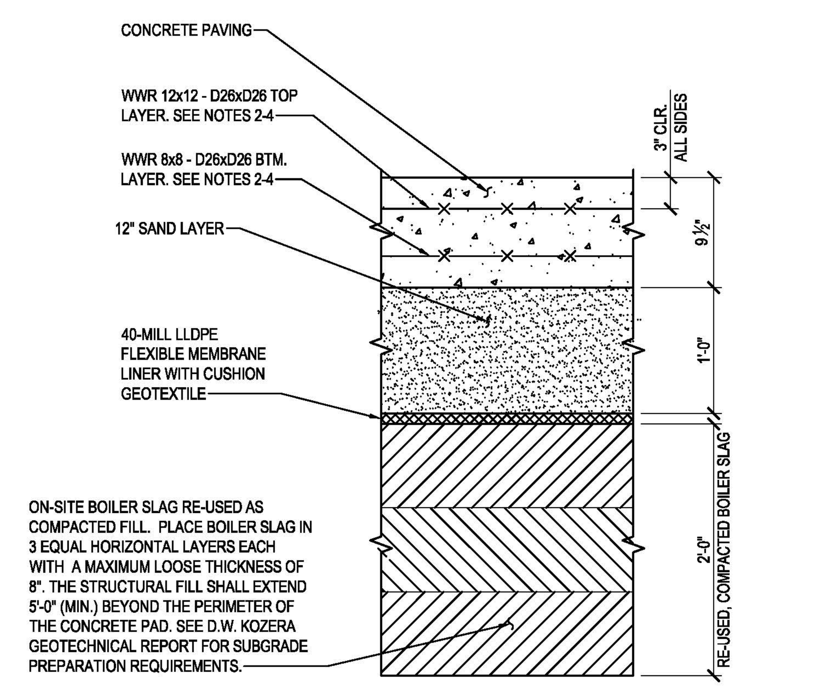


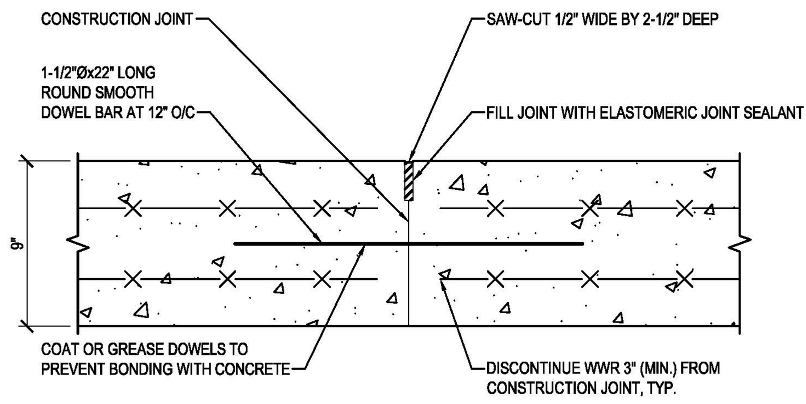
CONCRETE CURB

1 DETAIL
C101 C102
SCALE: 3" = 1'-0"

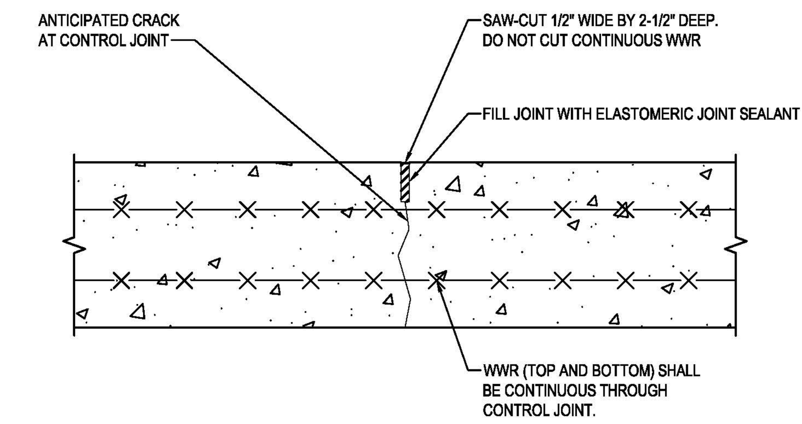


2 DETAIL
C101 C102
SCALE: 1" = 1'-0"

NOTES:
1. SEE STRUCTURAL DRAWINGS FOR CONCRETE SPECIFICATIONS
2. DIFFERENT WWR SHEET PATTERNS ARE PERMITTED TO BE USED WHEN APPROVED BY THE ENGINEER. THE SUBSTITUTED SHEETS SHALL HAVE AN EQUIVALENT OR LARGER REINFORCEMENT AREA THAN SHOWN.
3. WWR D26 LAP SPLICES SHALL BE 14". LAP SPLICE LENGTHS SHALL BE LENGTHS REQUIRED BY ACI318 IF DIFFERENT SHEET PATTERNS ARE SUBSTITUTED.
4. WWR SHALL BE INSPECTED AND APPROVED BY ENGINEER PRIOR TO CONCRETE PLACEMENT.



CONTROL JOINTS AT ADJACENT POURS

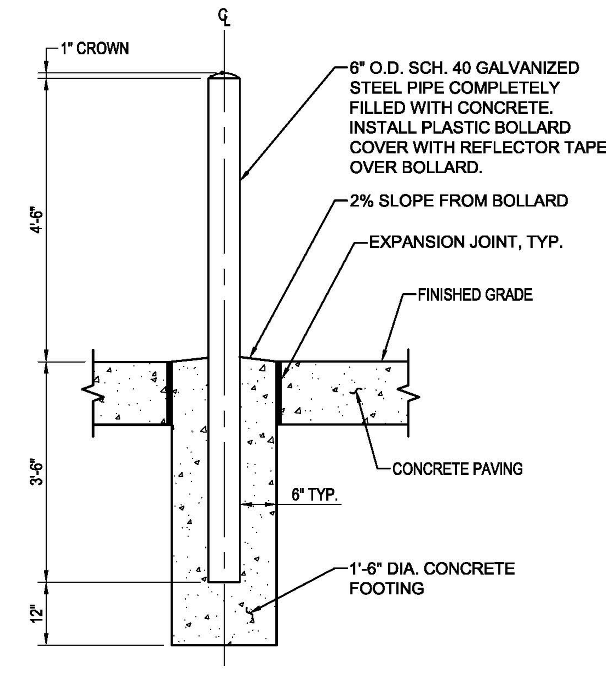


SAWCUT CONTROL JOINTS

1

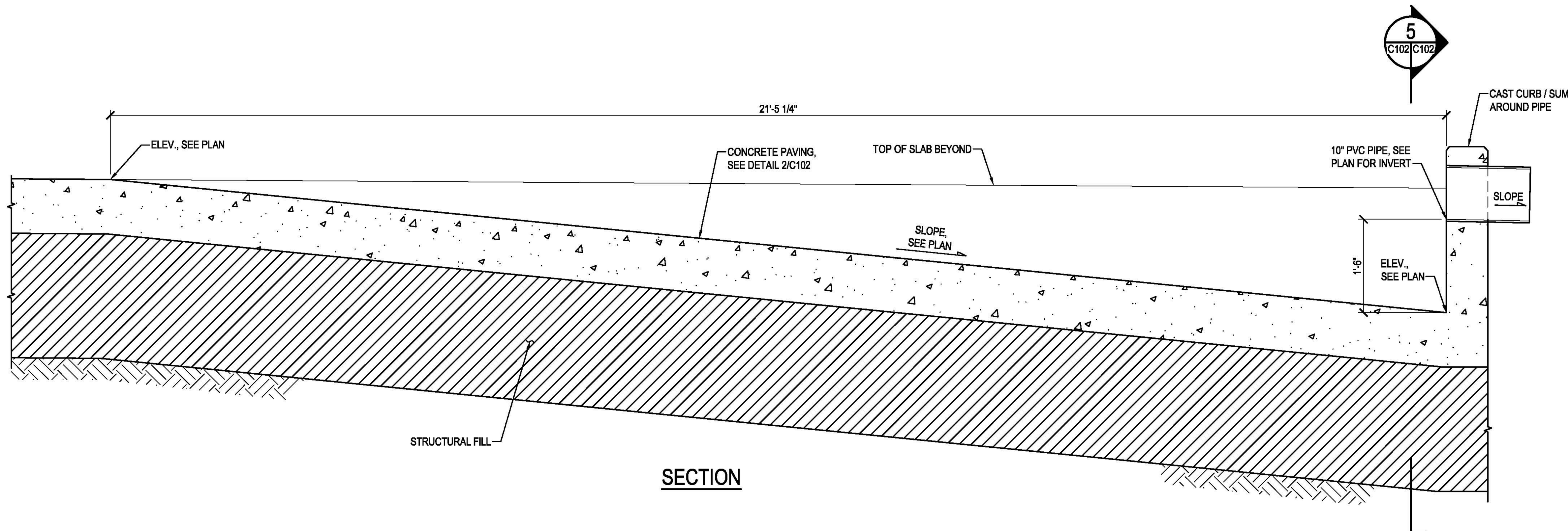
3 DETAIL - CONTROL JOINTS
C101 C102
SCALE: 1-1/2" = 1'-0"

NOTES:
1. SEE PLAN FOR LOCATIONS OF CONTROL JOINTS.
2. RECOMMENDED MAXIMUM POUR SIZE IS 75'x50'



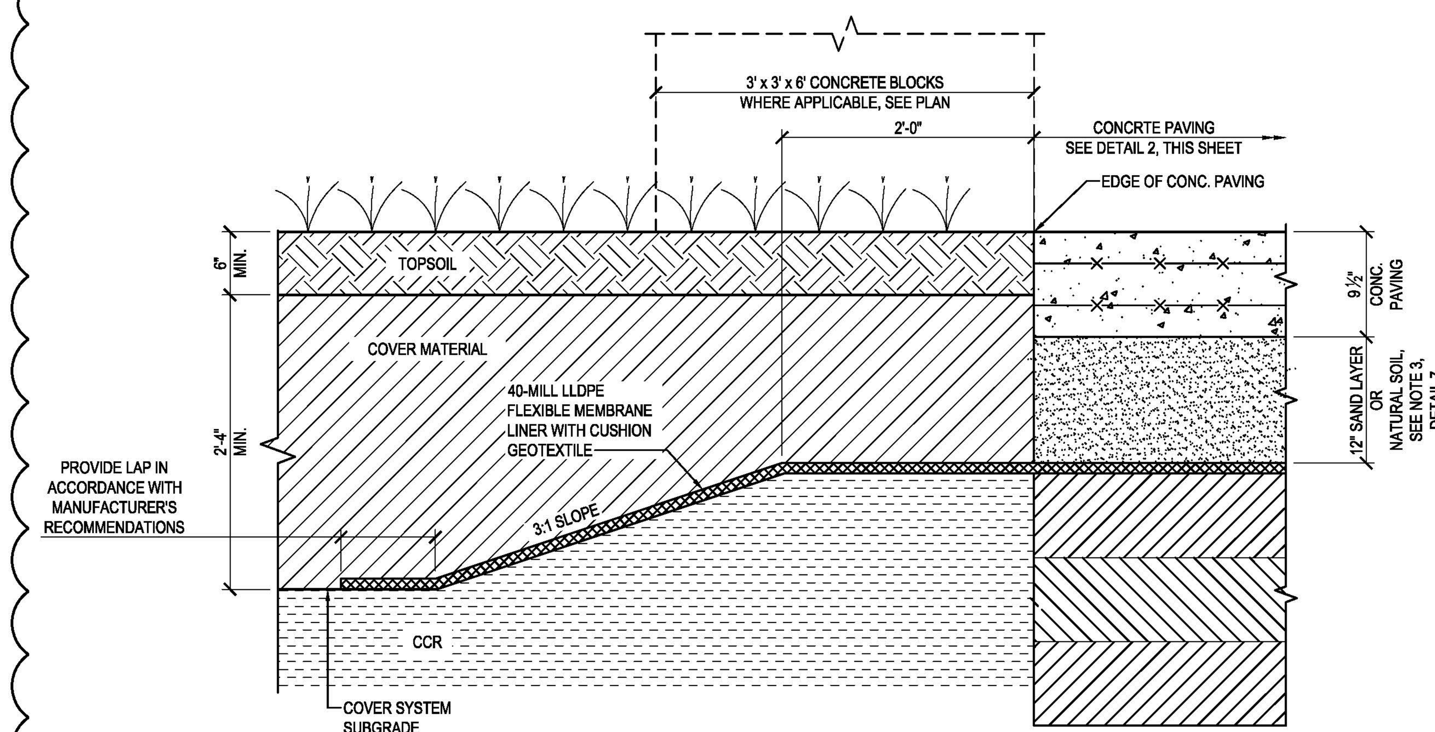
SECTION

6 DETAIL - CONCRETE FILLED BOLLARD
C101 C102
NOT TO SCALE



SECTION

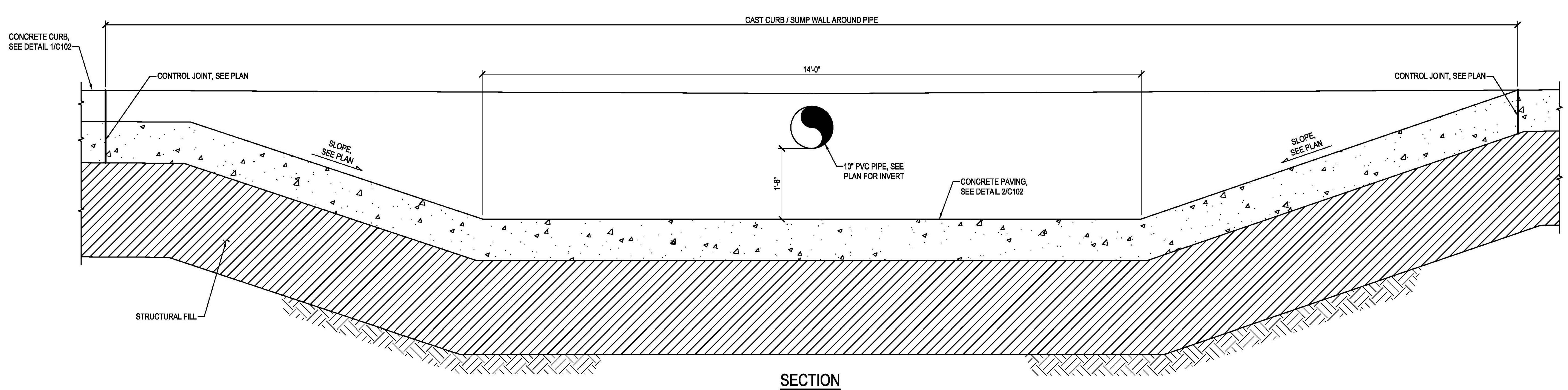
4 DETAIL - CONCRETE SUMP
C101 C102
SCALE: 3/4" = 1'-0"



7 DETAIL - TRANSITION COVER SYSTEM TO CONCRETE PAD
C102 C102
SCALE: 1" = 1'-0"

NOTES:
1. MINIMUM CROSS SLOPE = 3%.
2. MAXIMUM SLOPE = 3H:1V.
3. COVER MATERIAL THICKNESS SHALL BE 2' (MIN.) FOR SLOPES LESS THAN OR EQUAL TO 15% AND 4' (MIN.) FOR SLOPES GREATER THAN 25%.
4. THE COMPACTED COVER MATERIAL SHALL HAVE A PERMEABILITY LESS THAN OR EQUAL TO THE PERMEABILITY OF THE NATURAL SUBSOILS, OR NO GREATER THAN 1X10^{-5} CM/SEC, WHICHEVER IS LESS. IF MATERIAL OF SUFFICIENT QUALITY/QUANTITY CANNOT BE FOUND, THEN A 40-MIL LLDPE FLEXIBLE MEMBRANE LINER (AND CUSHION GEOTEXTILE) SHALL BE INSTALLED BETWEEN THE SUBGRADE AND COVER MATERIAL.

2



SECTION

5 DETAIL - CONCRETE SUMP
C101 C102 C102
SCALE: 3/4" = 1'-0"

ISSUED FOR CONSTRUCTION

NO.	DATE	REVISION	BY
1	02/18/20	REVISION 1	J.R.C.
2	05/22/20	REVISION 2	F.R.

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300 East Joppa Road, Suite 200
Baltimore, MD 21286
410.512.4500 www.wbcm.com

CONTINENTAL BUILDING PRODUCTS

SITE DETAILS

BARGE LOADING STATION AT IKEC CLIFTY CREEK STATION
CONTINENTAL BUILDING PRODUCTS
1335 CLIFTY HOLLOW ROAD
MADISON, INDIANA 47250

DESIGNED:	T.M.P.
DRAWN:	E.C.F.
CHECKED:	M.W.S.
SCALE:	AS NOTED
DATE:	MAY 2020
PROJECT:	2018063600
DRAWING:	C102

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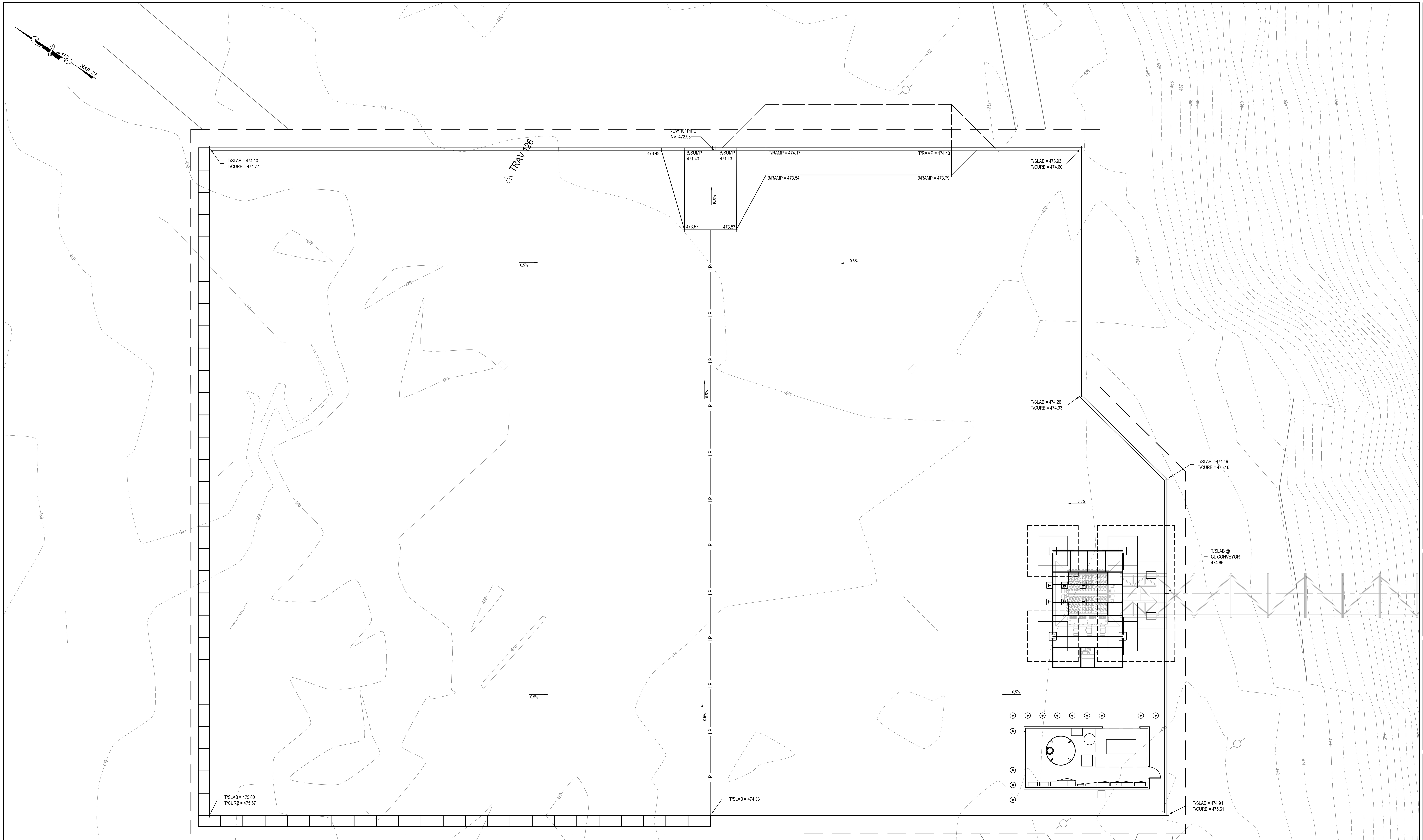
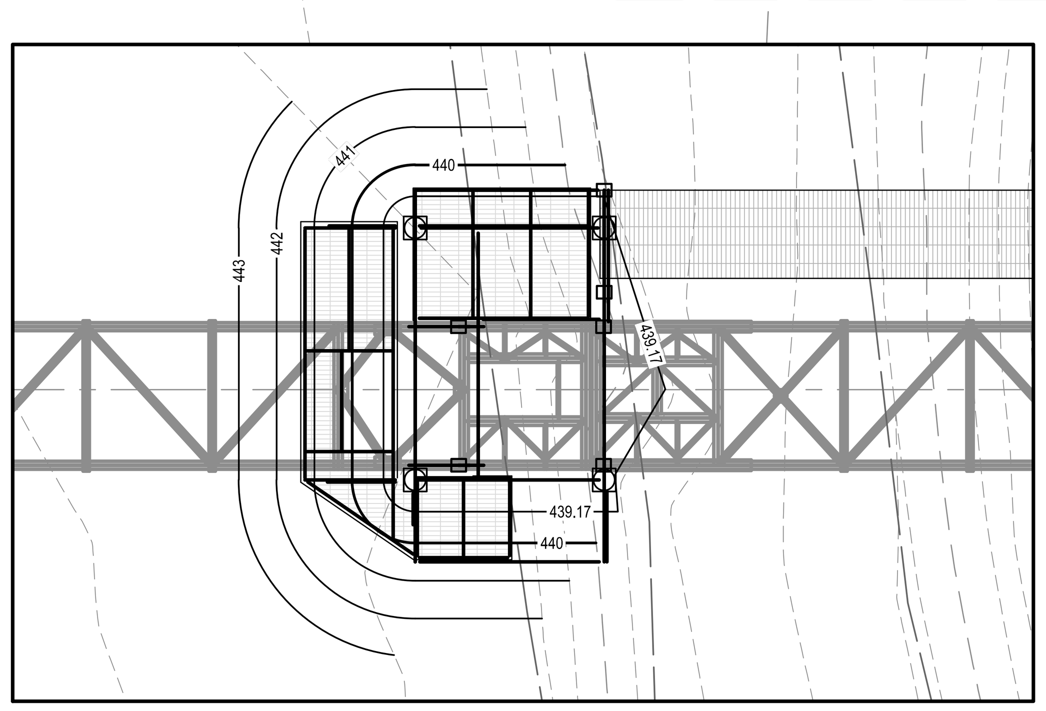
May 22, 2020 - 1:29pm User: efloss





B CONVEYOR TOWER PART PLAN
C201 C201
SCALE: 1" = 10'

A PLAN
C201 C201
SCALE: 1" = 10'

CAUTION:
IF THIS DRAWING IS A REDUCTION,
USE THE GRAPHIC SCALES.

1"=10'-0"   10   0   5   10   20

ISSUED FOR CONSTRUCTION

NO.	DATE	REVISION	BY

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Baltimore, MD 21286
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CONTINENTAL™
BUILDING PRODUCTS

CONCRETE SLAB GRADING AND UTILITY PLAN

BARGE LOADING STATION AT
IKEC CLIFTY CREEK STATION
CONTINENTAL BUILDING PRODUCTS
1335 CLIFTY HOLLOW ROAD
MADISON, INDIANA 47250

DESIGNED:	T.M.P.
DRAWN:	E.C.F.
CHECKED:	M.W.S.
SCALE:	AS NOTED
DATE:	FEBRUARY 2020
PROJECT:	2018063600
DRAWING:	C201

GENERAL NOTES

1. DESIGN CODES

A. 2015 INTERNATIONAL BUILDING CODE (IBC), ITS SUPPLEMENTS, AND LOCAL AMENDMENTS.

a. ACI 318-14, "BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE"

b. AISC 341-10, "SEISMIC PROVISIONS FOR STRUCTURAL STEEL BUILDINGS"

c. AISC 360-10, "SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS"

d. ASCE 7-10, "MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES"

e. AWS D1.1, "STRUCTURAL WELDING CODE - STEEL"

2. DESIGN CRITERIA

2A. GENERAL

A. ALL STRUCTURAL COMPONENTS HAVE BEEN DESIGNED FOR THE LOADS AND CRITERIA SHOWN BELOW AND ON THE CONTRACT DOCUMENTS. ANY INCREASE OF LOADS DUE TO CHANGE IN USAGE OR CONSTRUCTION MATERIALS, ETC. SHALL HAVE THE WRITTEN APPROVAL OF THE ENGINEER.

B. CONTROLS
HORIZONTAL: NORTH AMERICAN DATUM OF 1927 (NAD27)
VERTICAL: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

C. WATER LEVELS
WATER LEVELS WERE OBTAINED FROM FEMA AND THE "CLIFTY CREET PLANT" RECORD DRAWING "16-34701-0" DATED JUNE 23, 1993.
DATUM: NORTH AMERICAN VERTICAL DATUM (NAVD88)

FEMA 100-YEAR FLOOD	= 462.50 FEET
FLOOD STAGE (PEAK)	= 448.66 FEET
(OHW)	= 418.66 FEET

D. CLIMATE

FROST DEPTH	= 42 INCHES
AMBIENT TEMPERATURE	= 110 DEGREES F MAX
	= -20 DEGREES F MIN

E. SNOW LOAD

GROUND SNOW LOAD (P_g)	= 20 PSF

F. WIND LOAD

ULTIMATE DESIGN WIND SPEED (V_{ult})	= 105 MPH (ULT 3-SECOND GUST)
NOMINAL DESIGN WIND SPEED (V_{asd})	= 90 MPH (ASD 3-SECOND GUST)
FASTEST MILE WIND SPEED (V_{FM})	= 75 MPH
WIND EXPOSURE	= C

G. EARTHQUAKE DESIGN DATA
S_S = 0.179
S_1 = 0.088
SITE CLASS = D
S_{DS} = 0.191
S_{D1} = 0.141

H. DESIGN VESSEL(S)

a. 200-FOOT HOPPER BARGE

PARTICULARS:

LENGTH OVERALL (LOA)	= 200 FEET
LENGTH BTWN PERP (LBP)	= 200 FEET
BEAM (B)	= 35 FEET
HEIGHT (H)	= 13 FEET
LADEN DRAFT (D_L)	= 12 FEET
LADEN FREEBOARD (F_L)	= 1 FEET
DISPLACEMENT (D)	= 2,295 TONNES
BLOCK COEFFICIENT (C_B)	= 0.94

2B. HOPPER TOWER

A. DEAD LOAD

a. HOPPER	= 12.1 KIPS
b. FEEDER	= 9.2 KIPS
c. FGD MATERIAL	= 88.2 KIPS
d. FRAMING	= 14.6 KIPS
e. TOTAL DEAD LOAD	= 124 KIPS

B. EARTHQUAKE DESIGN DATA
RISK CATEGORY = I
SEISMIC IMPORTANCE FACTOR (I_e) = 1.00
SEISMIC DESIGN CATEGORY = C
BASIC SEISMIC FORCE-RESISTING SYSTEM = ORDINARY CONCENTRICALLY BRACED FRAMES
RESPONSE MODIFICATION COEFFICIENT (R) = 3.25
OVERSTRENGTH FACTOR (W_o) = 2
DEFLECTION AMPLIFICATION FACTOR (C_d) = 3.25
ANALYSIS PROCEDURE USED = EQUIVALENT LATERAL FORCE PROCEDURE
SEISMIC RESPONSE COEFFICIENT (C_S) = 0.059
DESIGN BASE SHEAR (V) = 7.32 KIPS

2C. CONSTRUCTION LOADS

A. ALL STRUCTURAL COMPONENTS HAVE BEEN DESIGNED FOR THE DEAD LOADS SHOWN ON THE PLANS AND THE LIVE LOADS SHOWN ABOVE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE ALLOWABLE CONSTRUCTION LOADS AND TO PROVIDE PROPER DESIGN AND CONSTRUCTION OF THOSE ITEMS NECESSARY TO FACILITATE CONSTRUCTION INCLUDING BUT NOT LIMITED TO FALSEWORK, FORMWORK, STAGING, BRACING, SHEETING AND SHORING, ETC.

B. THE STRUCTURE HAS BEEN DESIGNED FOR THE DEAD AND LIVE LOADS INDICATED ABOVE. ANY INCREASE OF LOADS DUE TO CHANGE IN USAGE OR CONSTRUCTION MATERIALS, ETC. SHALL HAVE THE WRITTEN APPROVAL OF THE ENGINEER.

3. GENERAL

A. THE CONTRACTOR SHALL FIELD CHECK AND VERIFY ALL DIMENSIONS AND ELEVATIONS OF EXISTING WORK PRIOR TO FABRICATION OF ANY NEW MATERIALS AND BEFORE PROCEEDING WITH CONSTRUCTION. ALL DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER.

B. THE CONTRACTOR IS ADVISED THAT ALL PLANS, DIMENSIONS, AND DETAILS DEPICT FIELD CONDITION AS KNOWN. MINOR VARIATIONS ARE TO BE EXPECTED AND ANY DEVIATIONS FROM THE CONTRACT DOCUMENTS SHALL BE APPROVED BY THE ENGINEER IN WRITING PRIOR TO WORK EXECUTION.

C. NUMERICAL DIMENSIONS AND ELEVATIONS SHOWN SHALL SUPERSEDE ANY DISCREPANCY IN THE SCALING ON THE DRAWINGS.

D. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FAMILIARIZE HIMSELF WITH THE LOCATION OF ANY UTILITIES IN THE IMMEDIATE VICINITY OF THE CONSTRUCTION SITE TO PREVENT DAMAGE TO THEM. SHOULD ANY DAMAGE TO SUCH UTILITIES OCCUR, THE CONTRACTOR SHALL BE REQUIRED TO REPAIR SUCH DAMAGE AT HIS OWN EXPENSE AND TO THE SATISFACTION OF THE OWNER.

E. THE CONTRACTOR SHALL PROVIDE ALL SHORING AND BRACING AS REQUIRED TO SUPPORT THE EXISTING STRUCTURES DURING CONSTRUCTION. THE CONTRACTOR SHALL EXAMINE THE EXISTING STRUCTURE TO DETERMINE THE EXTENT OF NECESSARY SHORING. THE CAPACITY AND METHOD USED FOR SHORING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

F. SHOP DRAWINGS FOR ALL STRUCTURAL ELEMENTS SHOWN ON THE CONTRACT DOCUMENTS MUST BE SUBMITTED BY THE GENERAL CONTRACTOR. IF A CONTRACTOR OR OWNER FAILS TO SUBMIT THE SHOP DRAWINGS, THE ENGINEER WILL NOT BE RESPONSIBLE FOR THE STRUCTURAL CERTIFICATION OR FOR THE DESIGN OF THE PROJECT.

AT THE TIME OF SHOP DRAWING SUBMISSION, THE GENERAL CONTRACTOR SHALL STATE IN WRITING ANY DEVIATION OR OMISSIONS FROM THE CONTRACT DOCUMENTS.

THE GENERAL CONTRACTOR SHALL REVIEW ALL SHOP DRAWINGS BEFORE SUBMISSION TO THE ENGINEER AND MAKE ALL CORRECTIONS AS DEEMED NECESSARY.

G. ANY REVIEW OF STRUCTURAL ITEM SHOP DRAWINGS BY THE ENGINEER IS FOR GENERAL CONFORMANCE WITH THE DESIGN CONCEPT AS PRESENTED BY THE CONTRACT DOCUMENTS. NO DETAILED CHECK OF QUANTITIES OR DIMENSIONS WILL BE MADE.

H. SUBMIT SHOP DRAWINGS FOR SPECIFIC AREAS IN THEIR ENTIRETY.

I. ALL CHANGES AND ADDITIONS MADE ON RE-SUBMITTALS MUST BE CLEARLY FLAGGED AND NOTED. THE REVIEW OF THE RE-SUBMITTALS WILL BE LIMITED TO THOSE ITEMS CAUSING THE RE-SUBMISSION.

J. THE STRUCTURAL CONTRACT DOCUMENTS ARE NOT TO BE REPRODUCED FOR USE AS SHOP DRAWINGS.

K. ALL SAFETY REGULATIONS SHALL BE STRICTLY FOLLOWED.

L. METHODS OF CONSTRUCTION AND ERECTION OF STRUCTURAL MATERIAL SHALL BE THE CONTRACTOR'S RESPONSIBILITY.

M. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO THE EXISTING FACILITY THAT IS A RESULT OF THE WORK.

N. THE CONTRACTOR SHALL IMMEDIATELY RETRIEVE ANY DEBRIS THAT FALLS INTO THE WATER.

O. THE CONTRACTOR SHALL REMOVE DEBRIS FROM THE SITE ON A DAILY BASIS, UNLESS SPECIFICALLY NOTED OTHERWISE. ALL MATERIALS NOTED FOR REMOVAL SHALL REMAIN THE PROPERTY OF THE CONTRACTOR AND SHALL BE DISPOSED OF OFFSITE.

4. FOUNDATIONS

4A. SPREAD FOOTING FOUNDATIONS

A. THE BOTTOM OF ALL EXTERIOR FOOTINGS SHALL BE A MINIMUM OF 2'-0" BELOW FINISH GRADE UNLESS NOTED OTHERWISE.

B. ALL FILL UNDER FOOTINGS AND SLABS SHALL BE COMPACTED TO A DRY DENSITY OF AT LEAST 95 PERCENT OF MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D1557.

a. THE COMPACTED FILL MATERIAL SHOULD CLASSIFY AS SC OR BETTER WITH A MAXIMUM PLASTICITY INDEX OF 15 AND MAXIMUM FINE CONTENT OF 30%.

b. THE ON-SITE SLAG MAY BE CONSIDERED FOR REUSE AND COMPACTED FILL IF IT MEETS THIS CRITERIA.

C. ALL EXCAVATION, BACKFILLING, AND FILLING OPERATIONS BENEATH THE BUILDING SLAB AND FOUNDATIONS, AND ALL COMPACTION TESTS AND INSPECTION, SHALL BE DONE UNDER THE DIRECTION AND SUPERVISION OF A REGISTERED PROFESSIONAL SOILS ENGINEER RETAINED BY THE OWNER. ALL SOIL, EQUIPMENT AND PROCEDURES SHALL BE APPROVED BY THE SOILS ENGINEER PRIOR TO ALL EARTHWORK OPERATIONS.

D. FOOTINGS ARE DESIGNED ACCORDING TO THE GEOTECHNICAL REPORT SUBMITTED BY D.W. KOZERA, INC. DATED MAY 8, 2019 FOR A NET ALLOWABLE SOIL BEARING CAPACITY OF 1,500 PSF.

4B. STEEL PILES

A. MINIMUM STEEL PILE CAPACITIES SHALL BE AS FOLLOWS:

18" DIA. x 0.375" WALL = 50 TONS COMPRESSION

B. ALL PILES SHALL BE IN CONFORMANCE WITH ASTM A252 GR. 3 Fy = 45,000 psi.

C. PILES SHALL BE INSTALLED OPEN-ENDED.

D. A PROJECT GEOTECHNICAL RECOMMENDATION REPORT HAS BEEN PREPARED BY D.W. KOZERA INC. AND IS INCLUDED AS PART OF THE CONTACT DOCUMENTS.

E. CONTRACTOR SHALL HIRE GEOTECHNICAL ENGINEER TO CONDUCT PILE DYNAMIC ANALYSIS TO ESTABLISH DRIVING CRITERIA TO MEET THE PILE DESIGN CAPACITIES.

F. STEEL PILES SHALL HAVE A MINIMUM FACTOR OF SAFETY OF 2.0 IN COMPRESSION AND 3.0 IN TENSION.

G. 1 OF THE STEEL PILES SHOWN ON THE DRAWINGS SHALL BE TESTED WITH THE PILE DYNAMIC ANALYZER (PDA). THE PILE SHALL BE TESTED DURING INITIAL DRIVING AND A SUBSEQUENT RESTRIKE TEST SHALL BE PERFORMED.

H. CONTRACTOR AND TESTING AGENCY SHALL KEEP PILE INSTALLATION LOGS AND MONITOR THE PILE INSTALLATION AS DIRECTED BY GEOTECHNICAL ENGINEER.

4C. CONTROLLED STRUCTURAL FILL

A. STRUCTURAL FILL MATERIALS SHALL BE FREE FROM ORGANIC MATERIALS, TRASH, MUCK, ROOTS, LOGS, STUMPS AND OTHER DELETERIOUS SUBSTANCES.

B. BEFORE DEPOSITING FILLS, THE SURFACE OF THE GROUND SHALL BE CLEARED OF ALL REFUSE, BRUSH, LARGE STONES, GRASS AND ROOTS. ALL ORGANIC MATTER, MUD, MUCK AND OTHERWISE UNSUITABLE SOILS, SHALL BE REMOVED FROM THE SURFACES UPON WHICH FILLS ARE TO BE PLACED. THE SURFACE SHALL BE PLOWED OR SCARIFIED TO A DEPTH OF SIX INCHES. SURFACE SOILS SO SCARIFIED, OR WHICH HAVE BEEN DISTURBED BY GRUBBING AND STRIPPING OPERATIONS, SHALL BE COMPACTED TO UNDISTURBED SOIL BELOW BY DISCING, LEVELING, ROLLING AND COMPACTING AT THE MOISTURE CONTENT AND TO DENSITY SPECIFIED BELOW FOR COMPACTED EMBANKMENTS.

C. PLACING, SPREADING AND COMPACTING MATERIALS OF FILLS:

a. THE FILL MATERIAL SHALL BE PLACED IN LAYERS WHICH, BEFORE COMPACTION, SHALL NOT EXCEED 8 INCHES. EACH LAYER SHALL BE SPREAD UNIFORMLY AND EVENLY AND SHALL BE THOROUGHLY BLADE MIXED DURING THE SPREADING TO ENSURE UNIFORMITY OF MATERIAL IN EACH LAYER.

b. AFTER EACH LAYER HAS BEEN PLACED, MIXED AND SPREAD EVENLY, IT SHALL BE THOROUGHLY COMPACTED TO NOT LESS THAN 95% OF THE DRY MAXIMUM DENSITY AS DETERMINED BY ASTM D1557.

c. THE MOISTURE CONTENT OF THE FILL SHALL BE AS REQUIRED TO ATTAIN THE DEGREE OF COMPACTION SPECIFIED.

d. COMPACTION SHALL BE BY APPROVED MULTIPLE-WHEEL PNEUMATIC TIRED ROLLERS, VIBRATORY ROLLER OR OTHER TYPES OF ACCEPTABLE ROLLERS.

e. THE FILLING OPERATION SHALL BE CONTINUED IN 8-INCH (AS DEPOSITED LOOSE) LAYERS, AS SPECIFIED ABOVE, UNTIL THE FILL HAS BEEN BROUGHT TO THE SLOPES AND GRADES AS SHOWN ON THE CONTRACT DRAWING, MAKING PROPER ALLOWANCES FOR THICKNESS OF TOPSOIL, PAVEMENT, FLOOR SLABS, ETC.

f. WHEN THE WORK IS INTERRUPTED BY RAIN, FILL OPERATIONS SHALL NOT BE RESUMED UNTIL FIELD TESTS INDICATE THAT THE MOISTURE CONTENT AND DENSITY OF THE TOP 6 INCHES OF FILL IS WITHIN THE LIMITS HEREINBEFORE SPECIFIED.

5. CAST-IN-PLACE CONCRETE

5A. GENERAL

A. ALL CONCRETE WORK SHALL CONFORM TO THE LATEST APPROVED (BY LOCAL GOVERNMENT) EDITIONS OF THE FOLLOWING ACI AND ASTM DOCUMENTS:

ACI 117	SPECIFICATIONS FOR TOLERANCES FOR CONCRETE CONSTRUCTION AND MATERIALS
ACI 211	PROPORTIONS OF CONCRETE
ACI 214	COMPRESSION TESTS
ACI 301	SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS
ACI 302,1R	FLOOR AND SLAB CONSTRUCTION
ACI 304	PLACING CONCRETE
ACI 305	HOT WEATHER
ACI 306	COLD WEATHER
ACI 308	CURING CONCRETE
ACI 315	DETAILING
ACI 318	BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE
ACI 347	FORMWORK
ASTM C94	READY-MIX CONCRETE

B. ALL FIELD AND LAB TESTING OF CONCRETE SHALL CONFORM TO THE LATEST APPROVED (BY LOCAL GOVERNMENT) EDITIONS OF ASTM:

ASTM C172	SAMPLING FRESH CONCRETE
ASTM C31	FIELD CYLINDER SPECIMENS
ASTM C143	SLUMP TEST
ASTM C231	AIR CONTENT (WHEN REQUIRED)
ASTM C39	LAB TESTING CYLINDERS
ASTM C42	HARDENED CORES (WHEN REQUIRED)

C. ADMIXTURES:

a. NO ADMIXTURES CONTAINING CALCIUM CHLORIDE SHALL BE PERMITTED.

b. ADMIXTURES FOR CONCRETE SHALL BE IN ACCORDANCE WITH THE MAUFACTURER'S RECOMMENDATIONS AND SHALL CONFORM TO THE REQUIREMENTS OF ASTM C494.

D. ALL CONCRETE MIX DESIGNS AND ADMIXTURES SHALL BE APPROVED BY THE ENGINEER 30 DAYS PRIOR TO INITIATION OF FIRST POUR.

E. ALL CONCRETE SHALL BE SAMPLED AND TESTED BY AN AGENCY RETAINED BY THE CONTRACTOR. THE CONTRACTOR SHALL NOTIFY THE TESTING AGENCY 48 HOURS PRIOR TO THE POURING OF ANY CONCRETE.

F. PROVIDE WATER STOPS IN ALL CONSTRUCTION AND CONTROL JOINTS IN CONCRETE BELOW GRADE AND WHERE NOTED. WATERSTOPS SHALL BE SELF-EXPANDING BUTYL RUBBER UNLESS NOTED OTHERWISE.

G. ALL EXPOSED EDGES OF CONCRETE BEAMS AND COLUMNS SHALL BE CHAMFERED 3/4", UNLESS SHOWN OR NOTED OTHERWISE.

H. ALL FORMWORK SHALL BE IN ACCORDANCE WITH THE AMERICAN CONCRETE INSTITUTE "FORMWORK FOR CONCRETE", SPECIAL PUBLICATION NO. 4 AND ACI'S "STANDARD RECOMMENDED PRACTICE FOR CONCRETE FORMWORK" (ACI-347, LATEST LOCAL APPROVED EDITION).

5B. CONCRETE MIXES

A. ALL CONCRETE, UNLESS NOTED OTHERWISE, SHALL BE STONE AGGREGATE CONCRETE.

a. MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS = 5,000 PSI

b. MAXIMUM W/C RATIO (BY WEIGHT) = 0.45

c. CEMENT:

1) PORTLAND CEMENT = ASTM C150, TYPE IIA

2) BLENDED HYDRAULIC CEMENT = ASTM C595, TYPE IS(MS)A

d. AGGREGATE:

1) NORMAL-WEIGHT = ASTM C33

2) LIGHTWEIGHT = ASTM C330

e. MAXIMUM AGGREGATE SIZE = 3/4"

f. SLUMP = 4" ± 1"

g. MAXIMUM SLUMP WITH HRWR ADMIXTURE = 8"

h. AIR ENTRAINMENT = 6%±1.5% (CONCRETE EXPOSED TO WEATHER)

i. ADMIXTURES:

1) WATER REDUCING ADMIXTURE: NOT REQUIRED

5C. REINFORCING STEEL

A. ALL REINFORCING SHALL BE DETAILED, FABRICATED, AND PLACED IN ACCORDANCE WITH THE ACI'S MANUAL OF STANDARD PRACTICE FOR DETAILING CONCRETE STRUCTURES (ACI 315).

B. ALL REINFORCING BARS SHALL CONFORM TO ASTM A615 GRADE 60. REINFORCEMENT TO BE WELDED SHALL CONFORM TO ASTM A706. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185.

C. ALL SPLICES IN REINFORCING SHALL BE CLASS "B" SPLICES (1'-0" MIN.) EXCEPT AS NOTED ON THE PLANS.

D. PROVIDE CONCRETE PROTECTION FOR REINFORCING BARS AS FOLLOWS UNLESS NOTED OTHERWISE:

a. DIRECTLY ABOVE OR SUBMERGED IN A PERMENANT BODY OF WATER = 3" ALL FACES

b. CAST AGAINST AND PERMANENTLY IN CONTACT WITH EARTH = 3"

c. EXPOSED TO WEATHER OR IN CONTACT WITH EARTH = 2" (#6 AND LARGER)
= 1 1/2" (#5 AND SMALLER)

d. NOT EXPOSED TO WEATHER OR IN CONTACT WITH EARTH:

1) SLABS, JOISTS, WALLS = 3/4" (#11 AND SMALLER)
= 1 1/2" (#14 AND LARGER)

2) BEAMS, COLUMNS, PEDESTALS, TENSION TIES = 1 1/2" TO TIES

E. REINFORCEMENT SHALL BE CONTINUOUS THROUGH ALL CONSTRUCTION JOINTS UNLESS OTHERWISE INDICATED ON THE DRAWINGS.

F. COLUMN DOWELS SHALL BE SET WITH A TEMPLATE.

6. STRUCTURAL AND MISCELLANEOUS STEEL

A. ALL STRUCTURAL STEEL SHALL BE AS FOLLOWS:

W-SHAPES	ASTM A992, FY = 50 KSI
HP-SHAPES	ASTM A572, FY = 50 KSI
CHANNELS	ASTM A36, FY = 36 KSI
ANGLES	ASTM A36, FY = 36 KSI
MISCELLANEOUS STEEL	ASTM A36, FY = 36 KSI

B. CONNECTIONS DETAILED BY THE FABRICATOR SHALL MEET THE FOLLOWING REQUIREMENTS:

a. UNLESS OTHERWISE NOTED ALL CONNECTIONS DESIGNED BY THE FABRICATOR SHALL BE DESIGNED IN ACCORDANCE WITH THE "AISC STEEL CONSTRUCTION MANUAL", 14TH EDITION. THE USE OF "SNUG TIGHT" BOLTED CONNECTIONS IS NOT PERMITTED. BOLTS SHALL BE SLIP CRITICAL OR BEARING.

b. WHERE BEARING TYPE CONNECTIONS ARE SPECIFIED, SHEAR VALUES FOR THREADS INCLUDED IN THE SHEAR PLANE SHALL BE USED, EXCEPT AS FOLLOWS: SPECIAL CONNECTIONS FOR REACTIONS EXCEEDING 45 KIPS MAY BE DESIGNED AND DETAILED USING LARGE DIAMETER BOLTS AND/OR HIGH STRENGTH BOLTS AND/OR BOLT STRENGTHS FOR THREADS EXCLUDED FROM THE SHEAR PLANE.

c. CONNECTIONS OTHER THAN THOSE SPECIFIED ABOVE MAY BE USED PROVIDED THAT COMPLETE STRUCTURAL COMPUTATIONS SIGNED AND SEALED BY A STRUCTURAL ENGINEER LICENSED IN INDIANA ARE SUBMITTED TO THE ENGINEER.

C. ALL BOLTED CONNECTIONS SHALL USE 3/4" Ø ASTM A325 HIGH STRENGTH BOLTS UNLESS NOTED OTHERWISE. NO CONNECTION SHALL BE MADE USING LESS THAN TWO BOLTS.

D. ALL HOOKED, HEADED, AND THREADED & NUTTED ANCHOR RODS SHALL CONFORM TO ASTM F1554 GRADE 36.

E. ALL WELDED CONNECTIONS SHALL BE PERFORMED WITH E70XX ELECTRODES. SHOP AND FIELD WELDS SHALL BE PERFORMED BY APPROVED CERTIFIED WELDERS AND SHALL CONFORM TO THE AMERICAN WELDING SOCIETY CODE FOR BUILDINGS AWS D1.1. WELDS SHALL DEVELOP THE FULL STRENGTH OF MATERIALS BEING WELDED UNLESS OTHERWISE NOTED.

F. ALL BEAM CONNECTIONS SHALL DEVELOP THE FULL UNIFORM LOAD CAPACITY THE MEMBER CAN CARRY WITH DUE CONSIDERATION TO CONCENTRATED LOADS AT THE ENDS OF THE MEMBER. ALL BRACING CONNECTIONS SHALL DEVELOP THE FULL AXIAL CAPACITY OF THE MEMBER IN COMPRESSION AND TENSION.

G. PROVIDE 2-3/8" THICK STIFFENER PLATES WHERE STEEL BEAMS CANTILEVER OVER TOPS OF COLUMNS. ALL COLUMN CAP PLATES SHALL BE 5/8" THICK WITH 4-3/4" Ø A325 BOLTS AT CANTILEVER BEAMS.

H. ALL BUTT WELDS SHALL BE FULL PENETRATION BUTT WELDS IN ACCORDANCE WITH THE STRUCTURAL WELDING CODE (ANSI/AWS D1.1). THESE WELDS SHALL BE MADE ONLY BY OPERATORS QUALIFIED BY PRESCRIBED TESTS IN THE STRUCTURAL WELDING CODE IN BUILDING CONSTRUCTION OF THE AMERICAN WELDING SOCIETY. ACCEPTANCE TO BE SUBJECT TO THE INSPECTION AND REVIEW OF AN INDEPENDENT INSPECTION AGENCY.

I. WELDING SEQUENCE AND TECHNIQUE SHALL BE SUCH THAT DISTORTION OF STEEL MEMBERS IS MINIMIZED AND UNDUE DISTORTION IS AVOIDED.

J. ALL STEEL BOLTS, NUTS, AND WASHERS SHALL BE HOT-DIPPED GALVANIZED IN ACCORDANCE WITH ASTM A153.

K. AN INDEPENDENT INSPECTION AGENCY SHALL BE EMPLOYED BY THE CONTRACTOR AND APPROVED BY THE ENGINEER TO INSPECT THE STRUCTURAL STEEL IN THE FIELD AND VERIFY THAT IT CONFORMS TO THE REQUIREMENTS OF THE CONTRACT DOCUMENTS.

L. EXISTING FRAMING MEMBERS REMOVED OR SHORTENED MAY BE CUT WITH A BURNING TORCH IF CAREFULLY AND NEATLY DONE.

M. ALL CONNECTIONS TO EXISTING STEEL FRAMING SHALL BE FIELD BOLTED UNLESS SHOWN OR NOTED OTHERWISE. AS AN ALTERNATE, WELDED CONNECTIONS TO THE EXISTING STEEL FRAMING WILL BE PERMITTED PROVIDED THE CONTRACTOR SECURES SAMPLES AND TESTS THE STEEL WITH RESPECT TO STRENGTH AND CHEMICAL PROPERTIES BY A CERTIFIED TESTING LABORATORY. TESTING METHODS AND RESULTS WILL BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO ANY FIELD WELDING TO EXISTING STEEL.

N. PLATFORM GRATING

a. PROVIDE GRATING WITH HOT DIPPED GALVANIZED COATING AFTER FABRICATION ASTM A123, THICKNES GRADE 100.

b. PROVIDE GRATING WITH SERRATED WALKING SURFACE.

c. EDGE-BAND GRATING WITH THE SAME SIZE AND MATERIAL AS BEARING BARS AT THE FOLLOWING SECTIONS:

1) OPEN ENDS OF GRATING AT HEAD OF LADDER APPROACHES TO PLATFORM

2) OPENINGS WHERE MORE THAN FOUR BARS ARE CUT IN GRATINGS INCLUDING FIELD CUT OPENINGS WITHOUT TOE-PLATE PROTECTION

3) GRATING PANELS WITH FOUR OR LESS CROSS BARS

d. GRATINGS SHALL BE PROVIDED IN ACCORDANCE WITH MANUFACTURER'S STANDARD LOAD TABLES TO WITHSTAND ALL DEAD LOADS PLUS A MINIMUM LIVE LOADING AS FOLLOWS:

1) MINIMUM UNIFORM LOAD: 100 PSF

2) MINIMUM CONCENTRATED LOAD: 1000 LBS PER SF WIDTH

3) MAXIMUM DEFLECTION: SPAN/360

7. PROTECTIVE COATINGS

A. COAL TAR EPOXY COATING:

a. STEEL PIPE PILES SHALL RECEIVE A COAL TAR EPOXY COATING WITH A MINIMUM DRY FILM THICKNESS OF 18 MILS FROM PILE CUT-OFF ELEVATION TO 15 FEET BELOW THE MUD LINE.

b. THE COATING SHALL BE APPLIED IN A MINIMUM OF (2) COATS. EACH COAT SHALL HAVE A MINIMUM DRY FILM THICKNESS OF 9 MILS.

c. COAL TAR EPOXY SHALL BE SHERWIN WILLIAMS TARGUARD, CARBOLINE BITUMINOUS NO. 300M, OR APPROVED EQUAL.

d. STEEL SHALL BE CLEANED TO WHITE METAL IN CONFORMANCE WITH SSPC-SP10.

e. COATING SHALL BE SHOP-APPLIED BY AN APPROVED APPLICATOR.

f. ALL SCRATCHES OR NICKS IN THE COATING AS A RESULT OF HANDLING, WELDING OR CUTTING SHALL BE FIELD REPAIRED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

B. ALL STRUCTURAL STEEL ABOVE MEAN LOW WATER SHALL BE SHOP OR FIELD PAINTED WITH TWO COATS OF SHERWIN-WILLIAMS MACROPOXY 646-100 FAST CURE EPOXY OR AN APPROVED EQUIVALENT. COATING SHALL BE APPLIED TO A MINIMUM FILM THICKNESS OF 10 MILS WHEN DRY. APPLY COATING IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. FIELD TOUCH-UP ANY AREA WHERE COATING HAS BEEN REMOVED DURING HANDLING OR CONSTRUCTION. COLOR SHALL BE MILL WHITE.

ISSUED FOR CONSTRUCTION

NO.	DATE	REVISION	BY

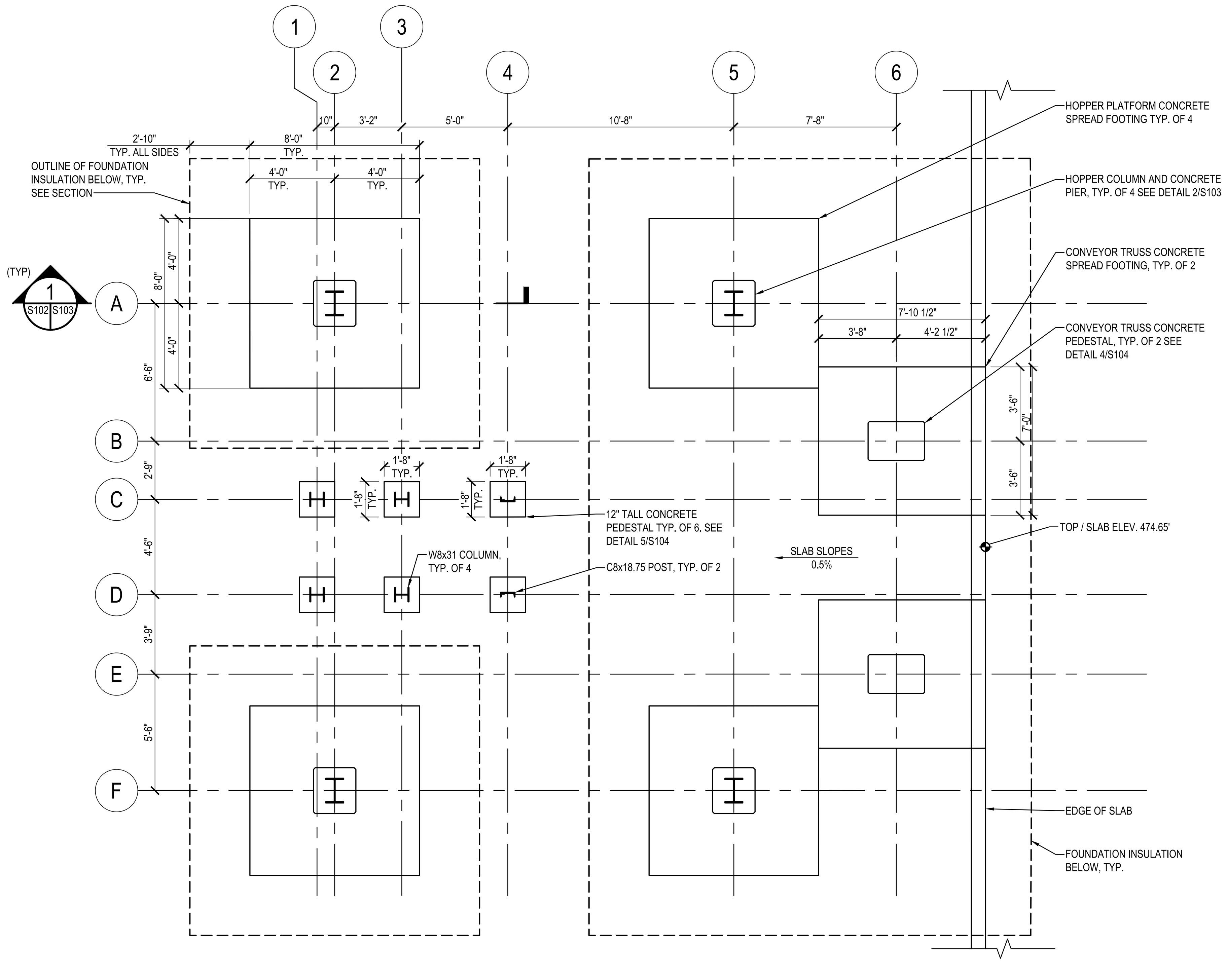
WHITNEY BAILEY COX & MAGNANI, LLC
300 East Joppa Road Suite 200
Baltimore, MD 21286
410.512.4500 www.wbcm.com
WBCM
Designing Infrastructure for Tomorrow®

CONTINENTAL™ BUILDING PRODUCTS

GENERAL NOTES

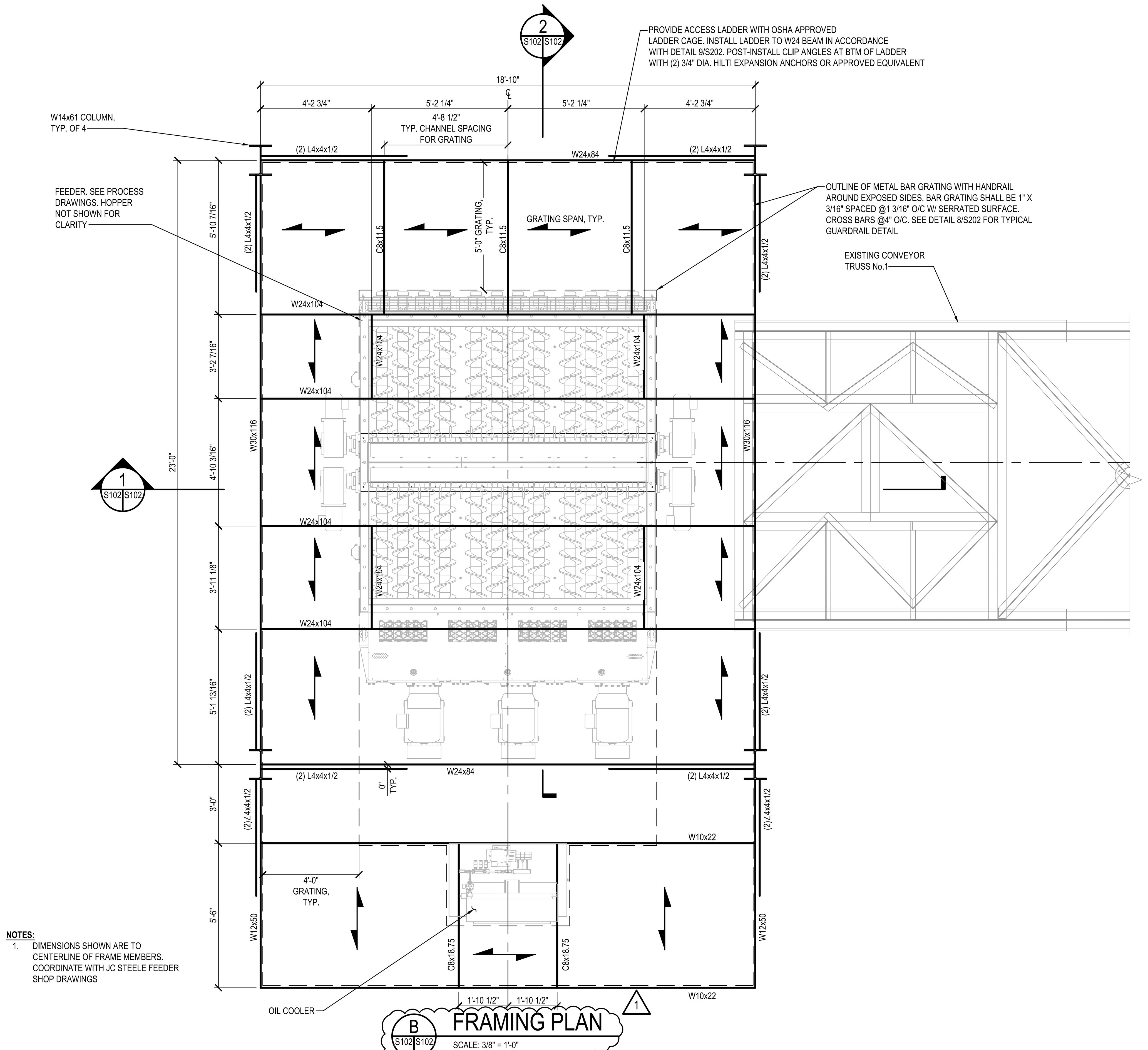
BARGE LOADING STATION AT IKEC CLIFTY CREEK STATION
CONTINENTAL BUILDING PRODUCTS
1335 CLIFTY HOLLOW ROAD
MADISON, INDIANA 47250

DESIGNED:	G.F. / J.R.C.
DRAWN:	E.C.F.
CHECKED:	M.W.S.
SCALE:	AS NOTED
DATE:	FEBRUARY 2020
PROJECT:	2018063600
DRAWING:	S001



FOUNDATION PLAN

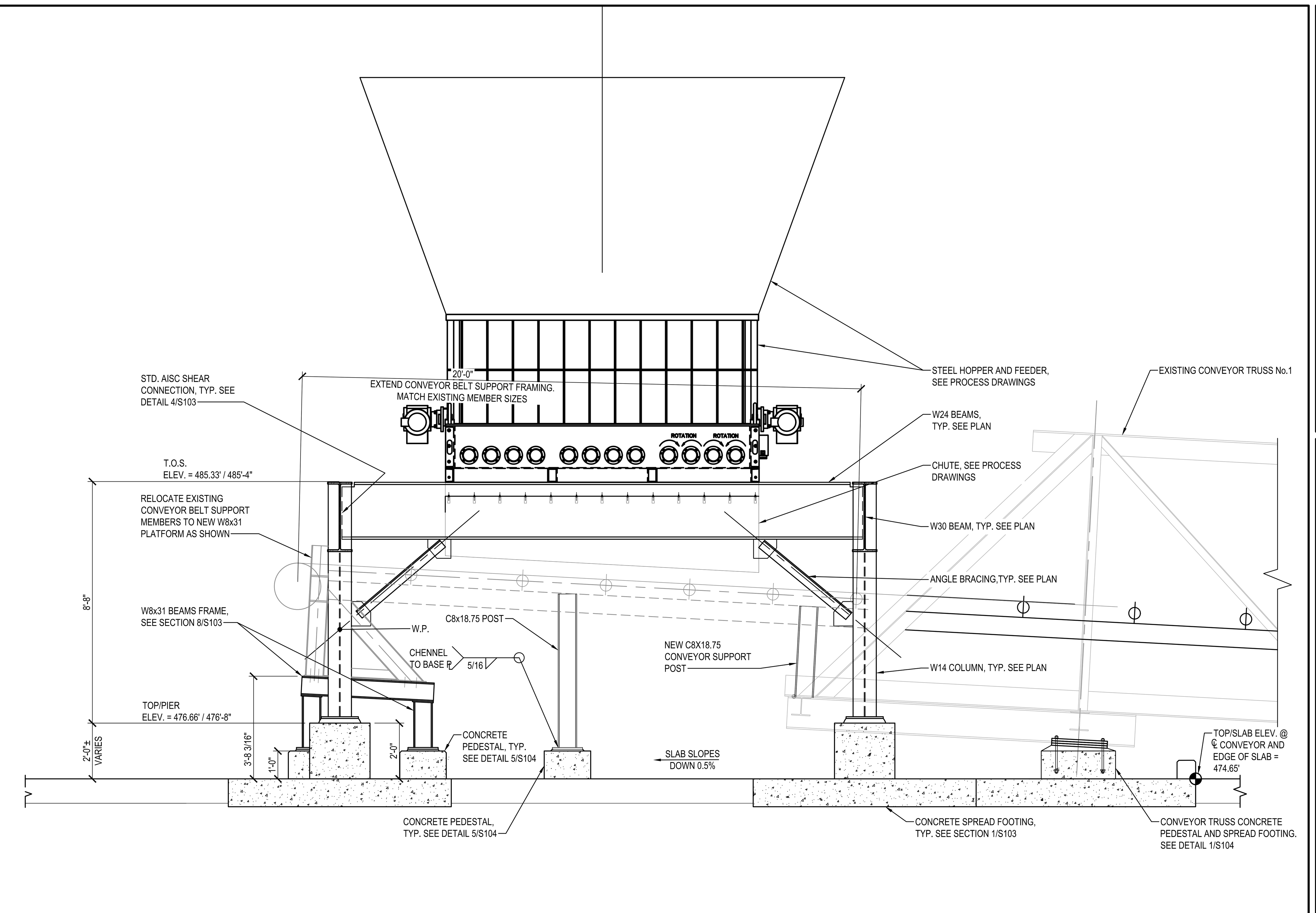
SCALE: 3/8" = 1'-0"



FRAMING PLAN

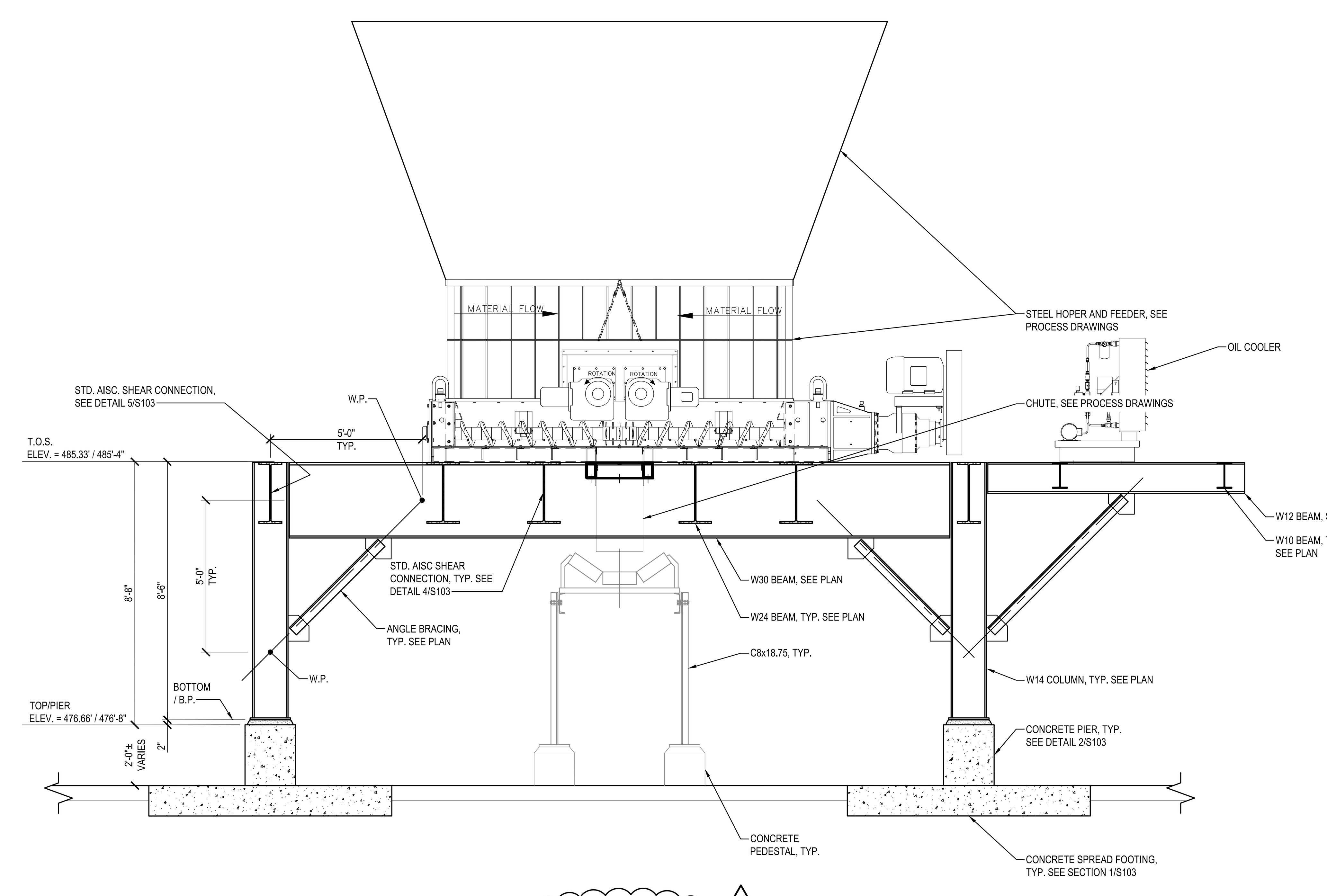
SCALE: 3/8" = 1'-0"

NOTES:
1. DIMENSIONS SHOWN ARE TO CENTERLINE OF FRAME MEMBERS. COORDINATE WITH JC STEELE FEEDER SHOP DRAWINGS



SECTION

SCALE: 3/8" = 1'-0"



SECTION

SCALE: 3/8" = 1'-0"

NOTES:
1. GRATING AND GUARDRAIL NOT SHOWN FOR CLARITY. SEE PLAN B/S102 FOR LOCATION OF GRATING AND DETAIL 8/S202 FOR TYPICAL GUARDRAIL DETAIL.

ISSUED FOR CONSTRUCTION

NO.	DATE	REVISION	BY
1	02/19/2020	REVISION 1	J.R.C.

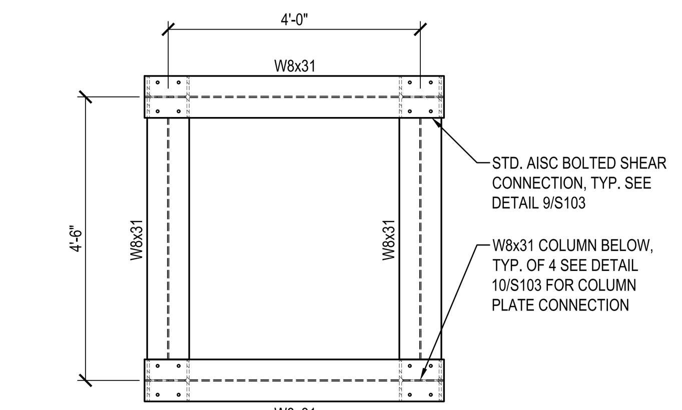
WBCM
Designing Infrastructure for Tomorrow®
WHITNEY BAILEY COX & MAGNANI, LLC
300 East Joppa Road, Suite 200
Baltimore, MD 21286
410.512.4500 www.wbcm.com

CONTINENTAL™ BUILDING PRODUCTS

HOPPER FOUNDATION AND FRAMING

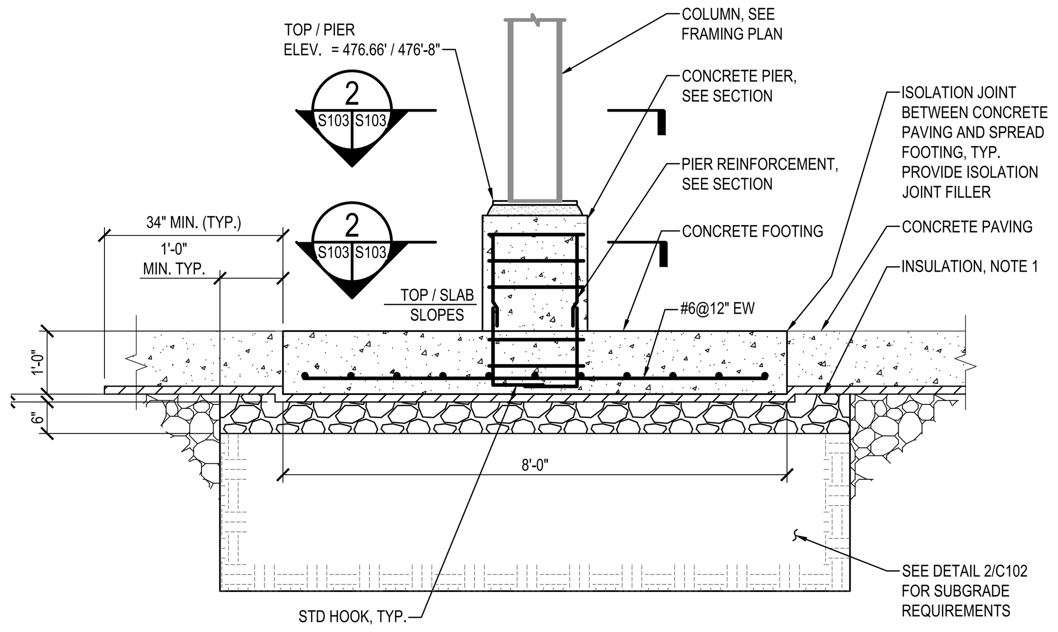
BARGE LOADING STATION AT IKEC CLIFTY CREEK STATION
CONTINENTAL BUILDING PRODUCTS
1335 CLIFTY HOLLOW ROAD
MADISON, INDIANA 47250

DESIGNED:	J.R.C.
DRAWN:	A.R.W.
CHECKED:	G.F.
SCALE:	AS NOTED
DATE:	FEBRUARY 2020
PROJECT:	2018063600
DRAWING:	S102



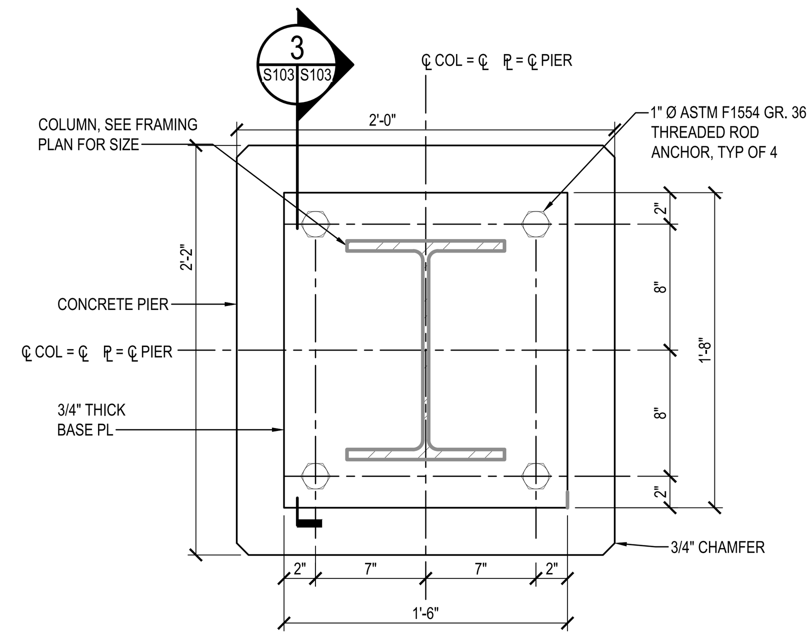
CONVEYOR TAIL SUPPORT FRAME PLATFORM

A PLAN S103 S103
SCALE: 1/2" = 1'-0"

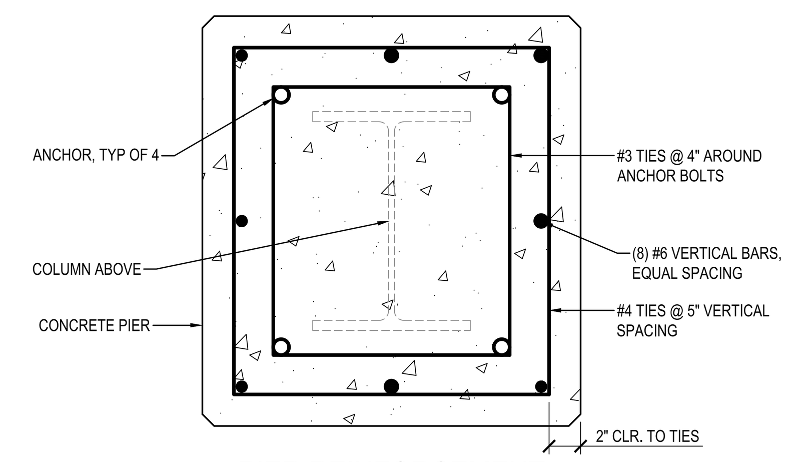


1 SECTION S102 S103
SCALE: 1/2" =1'- 0"

NOTES:
1. INSULATION SHALL BE EXTRUDED POLYSTYRENE CONFORMING TO ASTM C578, TYPE VI (R =4.0/in.) WITH A MINIMUM ALLOWABLE BEARING PRESSURE OF 1,500 PSF.
2. PROVIDE SAME STEEL REINFORCEMENT AND SUBGRADE FOR CONVEYOR TRUSS SPREADFOOTING

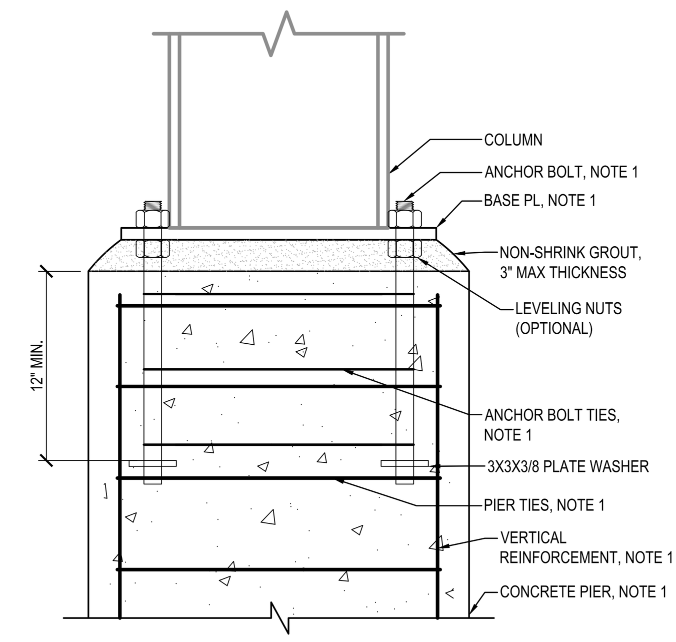


COLUMN BASE



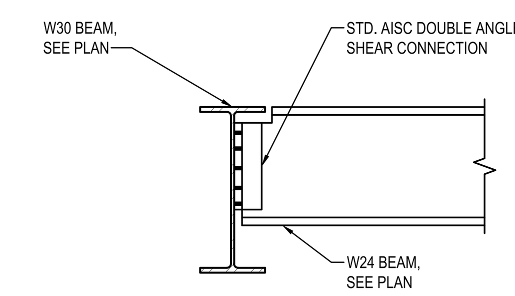
PIER REINFORCEMENT

2 DETAIL - HOPPER COLUMN PEDESTAL S102 S103
SCALE: 1 1/2" =1'- 0"



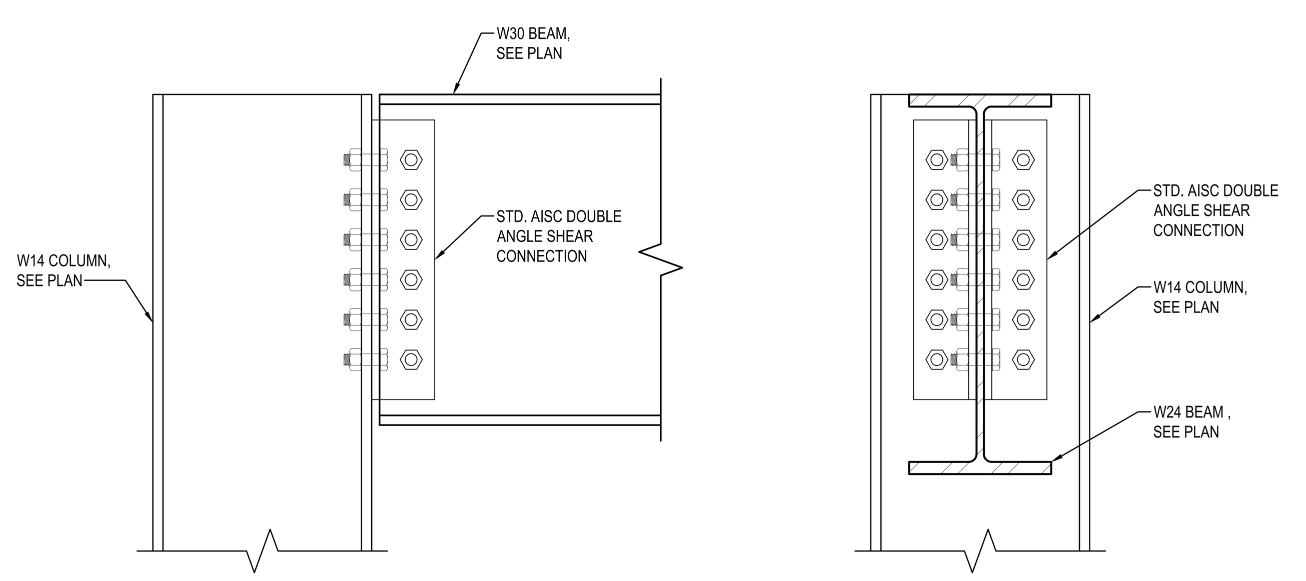
3 SECTION S103 S103
SCALE: 1 1/2" =1'- 0"

NOTES:
1. SEE 2/S103 FOR DETAIL



BEAM TO BEAM

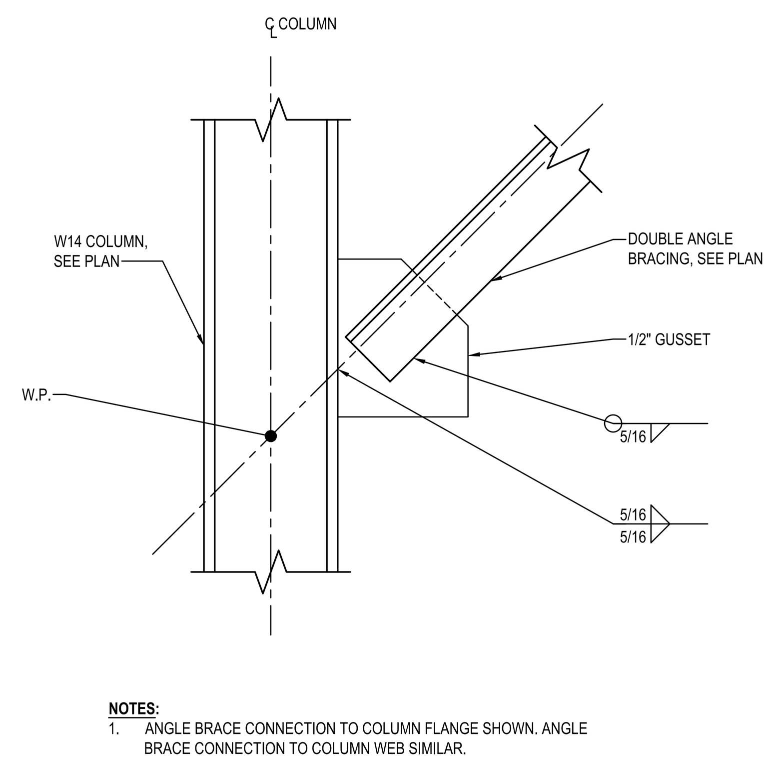
4 DETAIL S103 S103
NOT TO SCALE



COLUMN FLANGE

COLUMN WEB

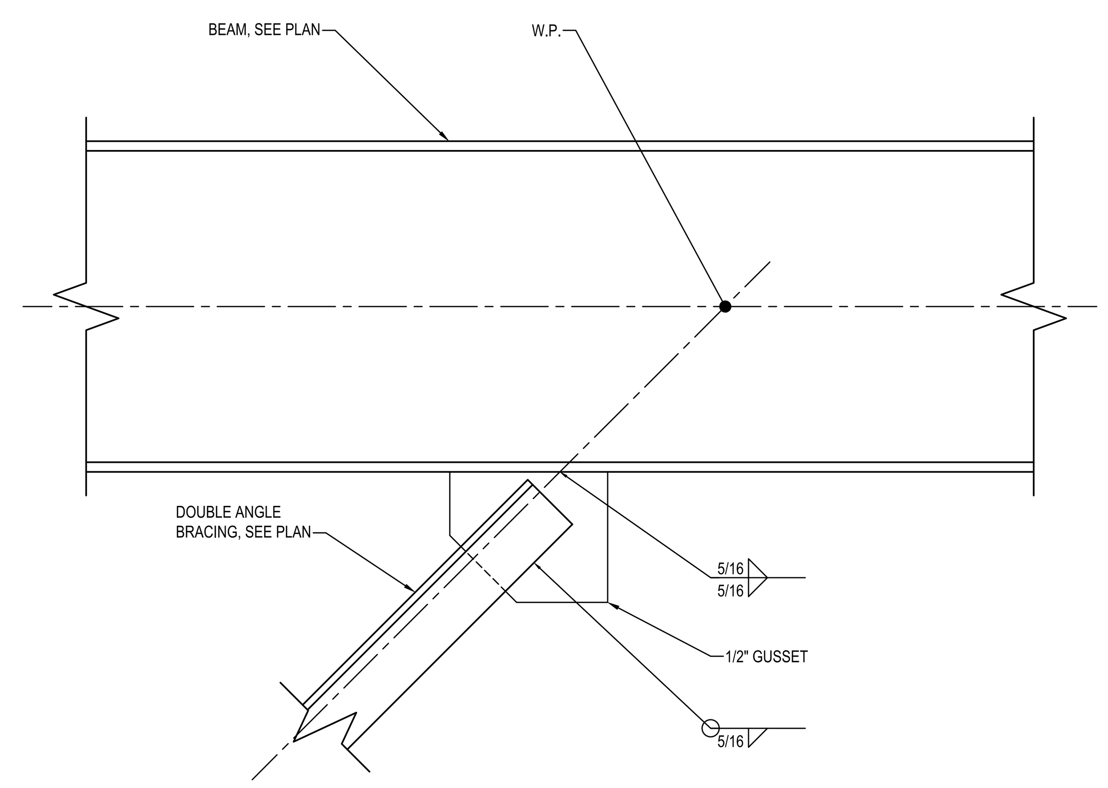
5 DOUBLE ANGLE SHEAR CONNECTION S103 S103
SCALE: 1 1/2" = 1'-0"



NOTES:
1. ANGLE BRACE CONNECTION TO COLUMN FLANGE SHOWN, ANGLE BRACE CONNECTION TO COLUMN WEB SIMILAR.

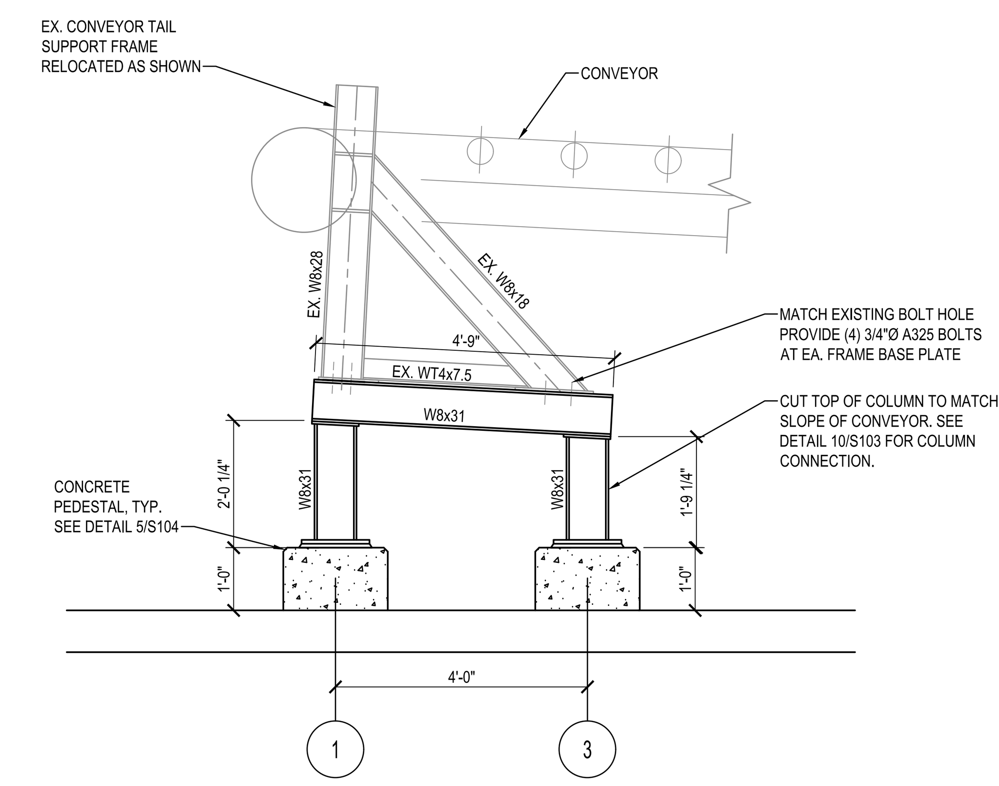
ANGLE TO COLUMN FLANGE

6 DETAIL S102 S103
SCALE: 1 1/2" = 1'-0"



ANGLE TO BEAM FLANGE

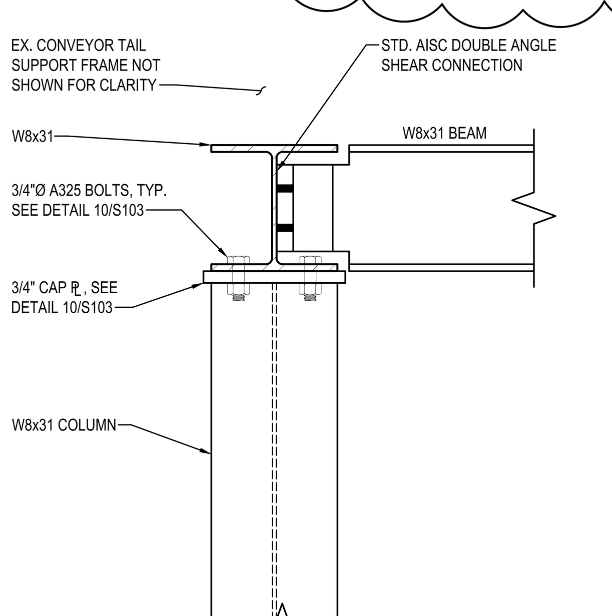
7 DETAIL S102 S103
SCALE: 1 1/2" = 1'-0"



CONVEYOR TAIL SUPPORT FRAME PLATFORM

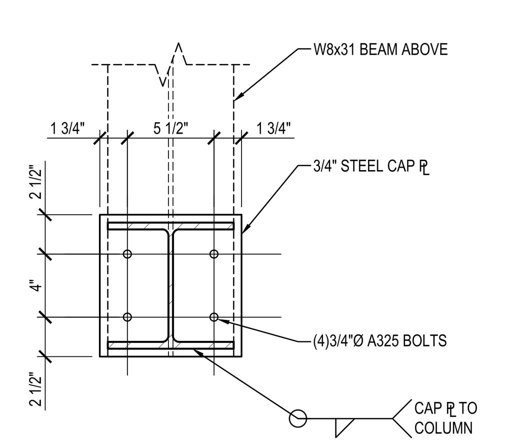
8 SECTION S102 S103
SCALE: 1/2" = 1'-0"

NOTES:
1. SEE PLAN A/S103



BEAM CONNECTION

9 DETAIL S103 S103
SCALE: 1 1/2" = 1'-0"



COLUMN CAP PLATE

10 DETAIL S103 S103
SCALE: 1 1/2" = 1'-0"

ISSUED FOR CONSTRUCTION

NO.	DATE	REVISION	BY
1	02/18/20	REVISION 1	J.R.C.

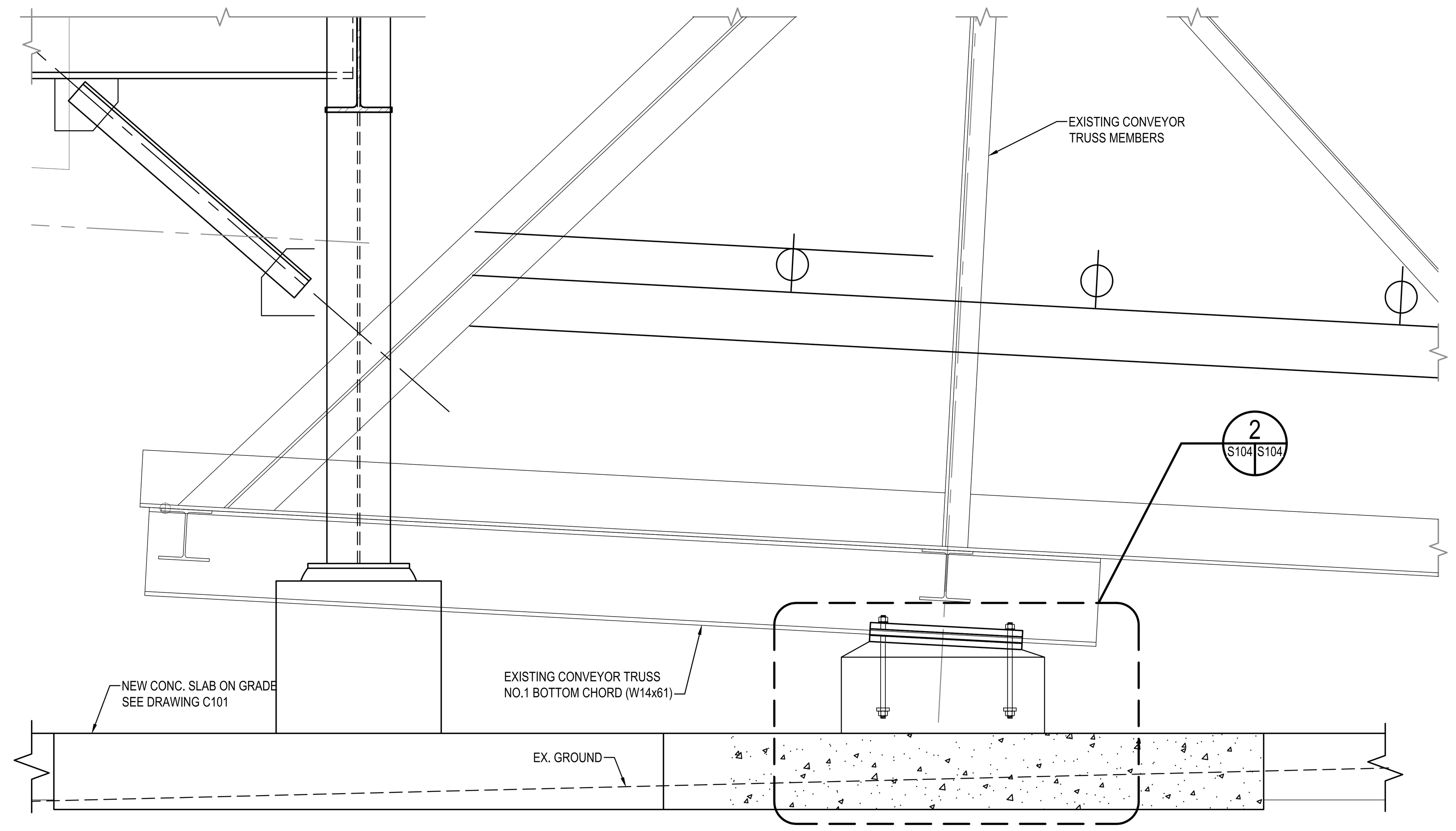
WBCM
Designing Infrastructure for Tomorrow®
WHITNEY BAILEY COX & MAGNANI, LLC
300 East Joppa Road Suite 200
Baltimore, MD 21286
410.512.4500 www.wbcm.com

CONTINENTAL™ BUILDING PRODUCTS

HOPPER TOWER SECTIONS AND DETAILS

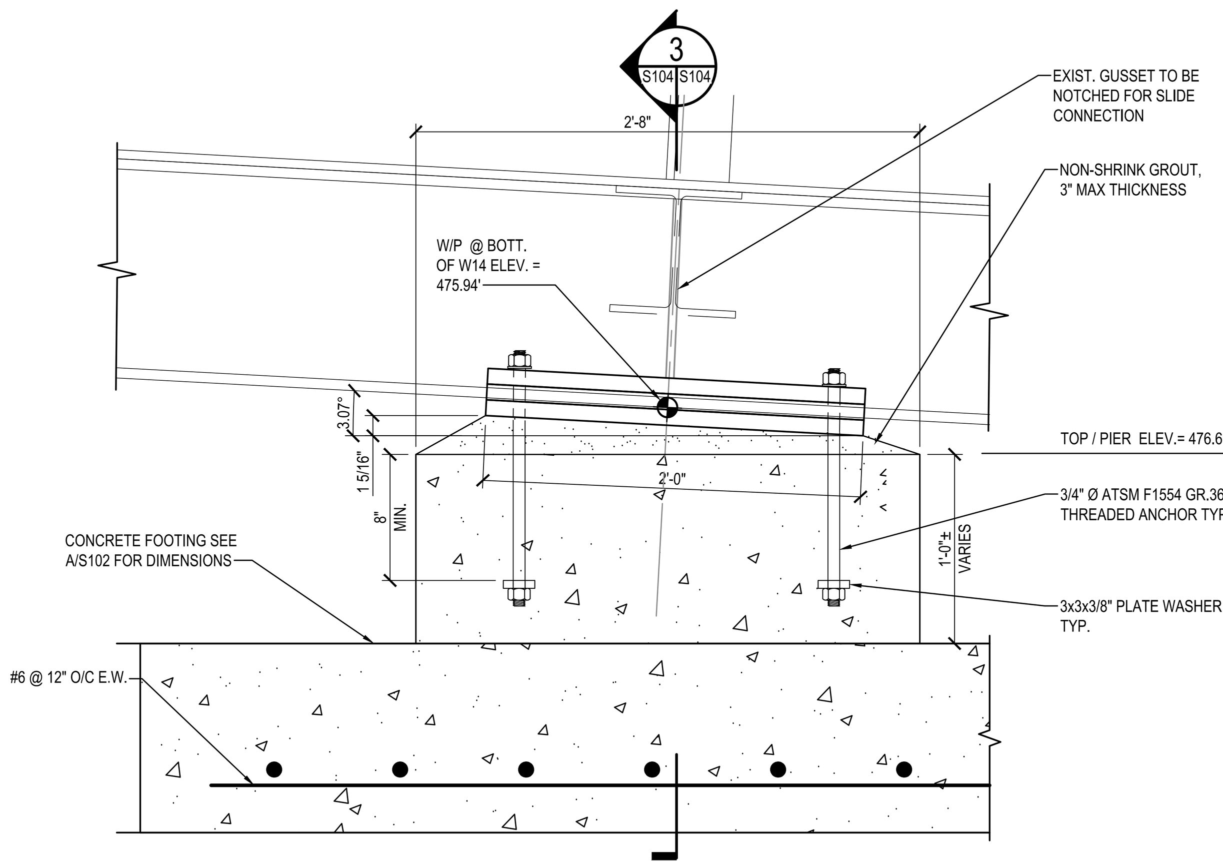
BARGE LOADING STATION AT IKEC CLIFTY CREEK STATION
CONTINENTAL BUILDING PRODUCTS
1335 CLIFTY HOLLOW ROAD
MADISON, INDIANA 47250

DESIGNED:	J.R.C.
DRAWN:	E.C.F.
CHECKED:	G.F.
SCALE:	AS NOTED
DATE:	FEBRUARY 2020
PROJECT:	2018063600
DRAWING:	S103



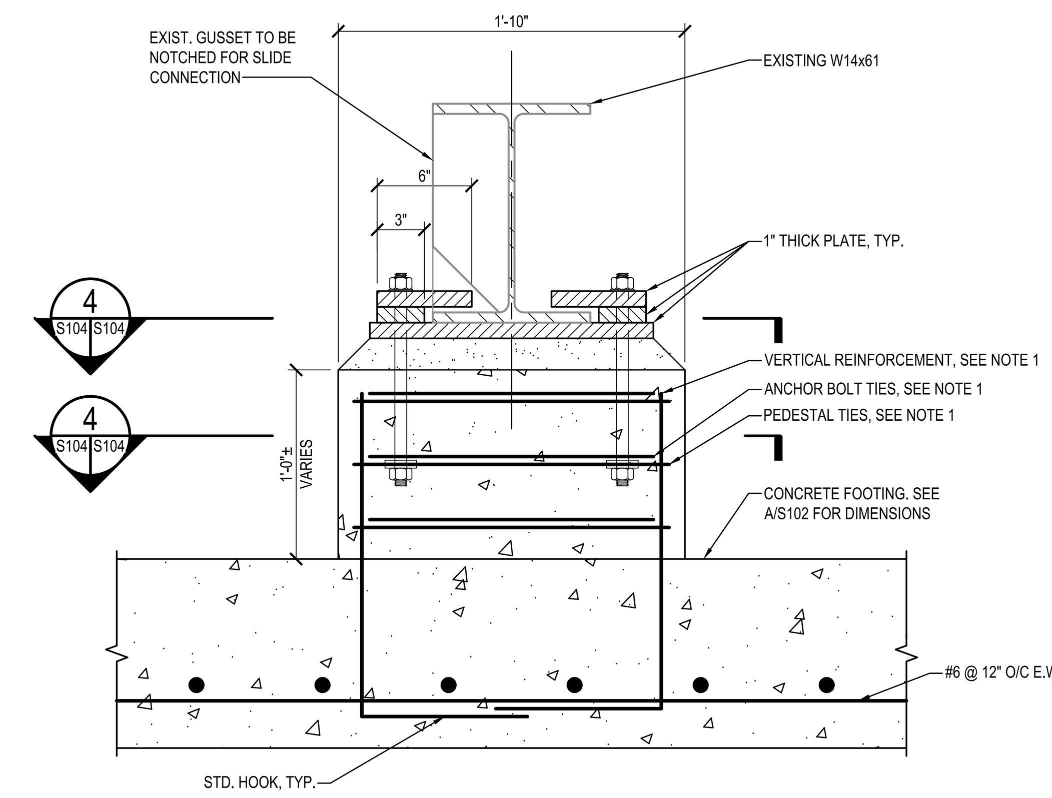
ELEVATION

1 S104 S104 CONVEYOR TRUSS MOUNT DETAIL
SCALE: 3/4" = 1'-0"



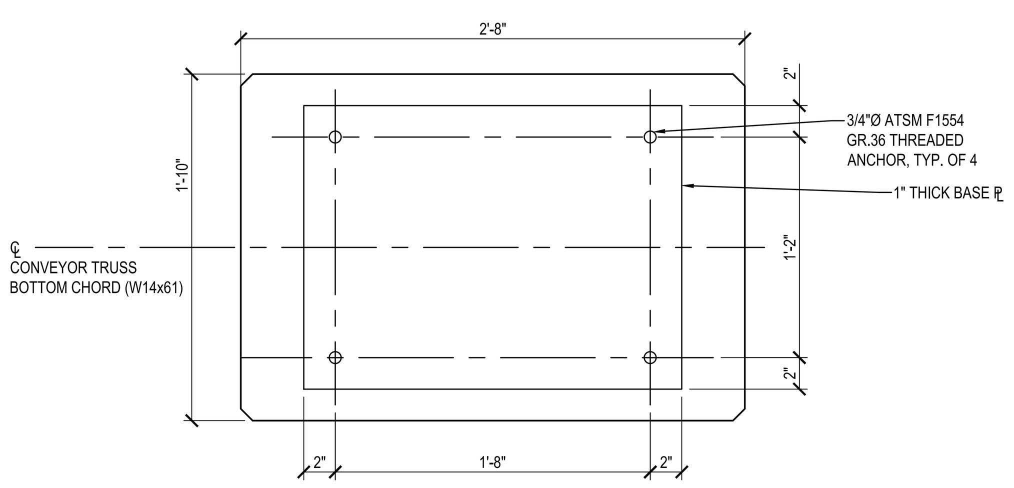
2 S104 S104 SLIDING PLATE AND PEDESTAL DETAIL
SCALE: 1 1/2" = 1'-0"

NOTE:
1. PEDESTAL REINFORCEMENT NOT SHOWN FOR CLARITY, SEE 4/S104 FOR PEDESTAL REINFORCEMENT
2. SEE 1/S103 FOR SUB GRADE REQUIREMENTS

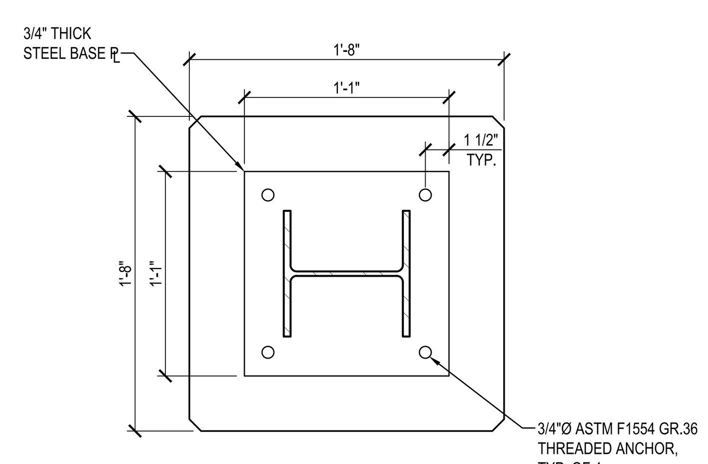


3 S104 S104 SLIDING PLATE AND PEDESTAL DETAIL
SCALE: 1-1/2" = 1'-0"

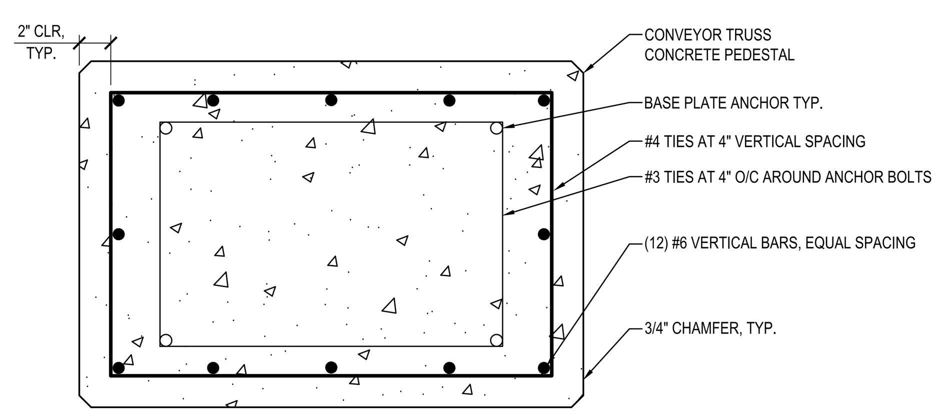
NOTE:
1. SEE 4/S104 FOR PEDESTAL REINFORCEMENT
2. SEE 1/S103 FOR SUB GRADE REQUIREMENTS



BASE PLATE

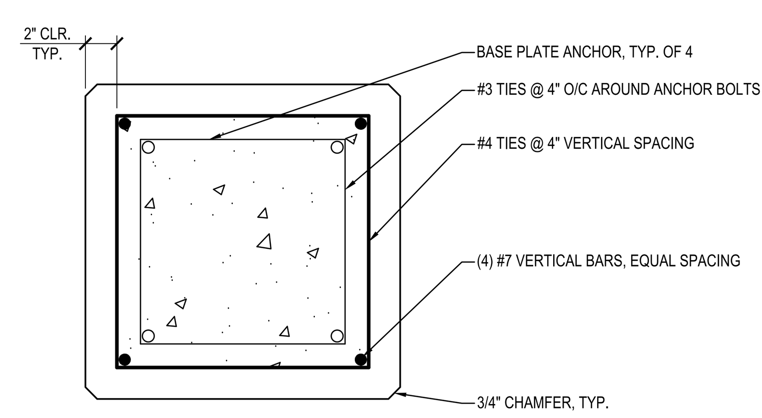


BASE PLATE



PEDESTAL REINFORCEMENT

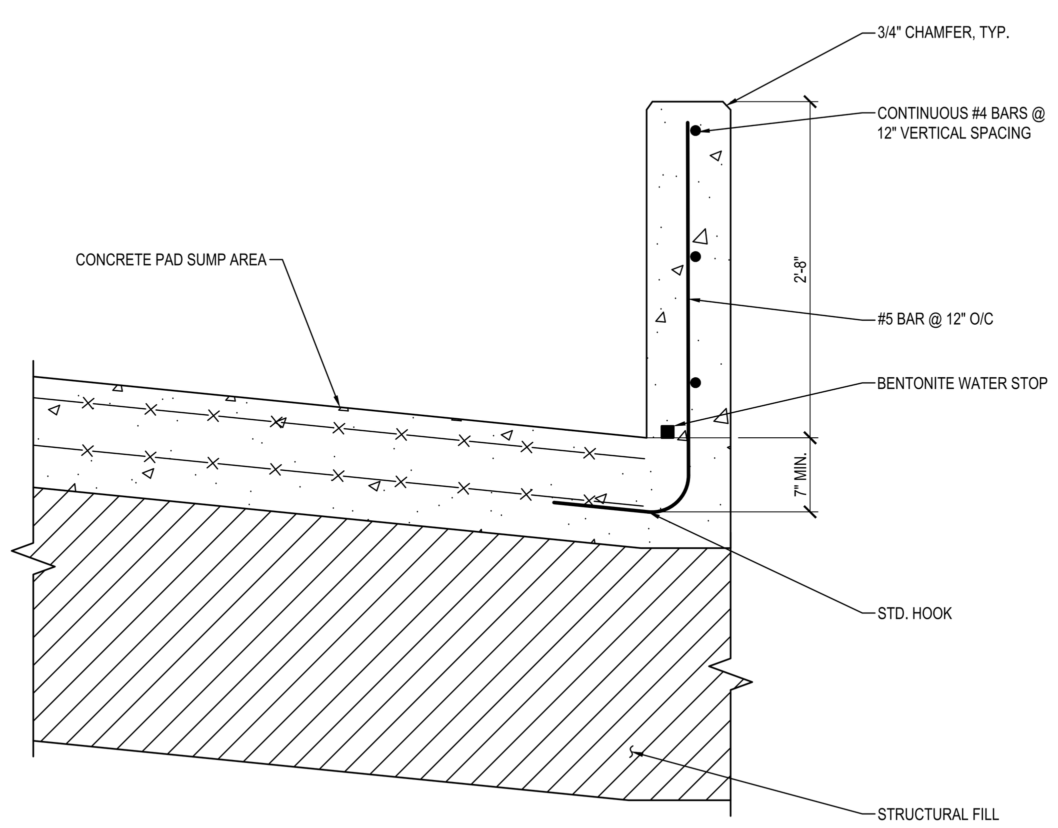
4 S104 S104 DETAIL - CONVEYOR TRUSS PEDESTAL
SCALE: 1-1/2" = 1'-0"



PEDESTAL REINFORCEMENT

5 S102 S104 DETAIL - CONCRETE PEDESTAL
SCALE: 1 1/2" = 1'-0"

NOTES:
1. PROVIDE STD. HOOKS ON #7 VERTICAL BARS TO ANCHOR PEDESTAL TO SLAB ON GRADE.



CONCRETE SUMP

6 S104 S104 DETAIL
SCALE: 1" = 1'-0"

CAUTION:
IF THIS DRAWING IS A REDUCTION, USE THE GRAPHIC SCALES.

1 1/2"=1'-0" 0 0.5 1 2
3/4"=1'-0" 0 1 2 3 4

ISSUED FOR CONSTRUCTION

NO.	DATE	REVISION	BY

WHITNEY BAILEY COX & MAGNANI, LLC
300 East Joppa Road, Suite 200
Baltimore, MD 21286
410.512.4500 www.wbcm.com
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CONTINENTAL™ BUILDING PRODUCTS

CONVEYOR #1 TAIL END MOUNTING DETAILS

BARGE LOADING STATION AT IKEC CLIFTY CREEK STATION
CONTINENTAL BUILDING PRODUCTS
1335 CLIFTY HOLLOW ROAD
MADISON, INDIANA 47250

DESIGNED:	J.R.C.
DRAWN:	A.R.W.
CHECKED:	G.F.
SCALE:	AS NOTED
DATE:	FEBRUARY 2020
PROJECT:	2018063600
DRAWING:	

S104

ATTACHMENT D

Ditch Sizing Calculations

Ohio Valley Electric Corporation / Indiana-Kentucky Electric Corporation Madison Township, Indiana	**Clifty Creek Station Phase 1 Closure – West Boiler Slag Pond**

Stantec

Hydrologic and Hydraulic Analysis Ditch Sizing Calculations

Purpose:

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

Methods:

Peak discharges were estimated using USACE Hydrologic Engineering Center - Hydrologic Modeling System (HEC-HMS) version 4.3. HEC-HMS required inputs are storm intensity and duration, subbasin drainage areas, time of concentration defined as lag time, and land use characteristics. The NRCS TR-55 methodology was used to determine these inputs; specifically the unit hydrograph, time of concentration and curve number.

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
Time of Concentration / Lag Time	TR-55, SCS Unit Hydrograph
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 30% Phase 1 Closure Drawings (Stantec, 2020.01.13)

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

Watershed Delineation:

Watershed (subbasin) boundaries were delineated manually within ArcGIS. The 30% final grade and existing grade topographic LiDAR surfaces were used to form the basis for the subbasin extents. Drainage areas were calculated using the geometry tools in ArcGIS. See Attachment A for subbasin boundaries.

Table 2 – Subbasin Drainage Areas

Subbasin	Area* (acres)
A_1	0.69
A_2	1.49
A_3	1.97
A_4	1.80
A_5	2.65
A_6	1.15
B_1	0.13
B_2a	0.15
B_2b	0.16
B_3a	0.16
B_3b	0.16
B_4a	0.14
B_4b	0.16
B_5a	0.19
B_5b	0.05
B_6	0.04

*Note: Subbasin 'A' drainage area includes area draining from subbasin 'B'

Time of Concentration:

Time of Concentration values were calculated as a combination of Sheet Flow/ Overland Flow and Shallow Concentrated Flow as described in the NRCS Technical Report 55 (TR-55) methodology. The maximum allowable fllow path for Overland flow used was 100-feet. Channel flow was not used as the proposed ditches do not appear to meet the criteria according to IN Hydrology Guidance section 202-2.05(03).

The minimum allowed time of concentration according to the TR-55 guidance is 6-miuntes. Because the sub basin boundaries are relatively small, the calculated time of concentration was less than 6 minutes in some cases. 6 minutes was used as the minimum time of concentration value. An example time of concentration calculation can be found in Appendix B.

HEC-HMS uses lag time instead of time of concentration. Lag Time is defined as (0.6 x ToC). Toc and Lag Time values can be found on Table 3 on the following page.

Table 3 – Time of Concentration Results

Subbasin	Time of Concentration (mins)	Lag Time (mins)
A_1	9.3	5.6
A_2	9.4	5.7
A_3	9.3	5.6
A_4	9.8	5.9
A_5	13.0	7.8
A_6	9.7	5.8
B_1	6.0*	3.6
B_2a	6.0*	3.6
B_2b	6.0*	3.6
B_3a	6.0*	3.6
B_3b	6.0*	3.6
B_4a	6.0*	3.6
B_4b	6.0*	3.6
B_5a	6.0*	3.6
B_5b	6.0*	3.6
B_6	6.0*	3.6

**Calculated ToC < 6-mins. Default to 6-min per TR-55 Guidance*

Curve Numbers

The NRCS curve number method was used to estimate runoff during the design storm event. A composite curve number was generated for the watershed using the proposed final grade, subgrade, and access road details in the 30% permit drawings. 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). A summary of curve numbers used in this analysis is provided in Table 4.

Table 4 – Curve Number Results

Subbasin	Total Area (acres)	Final Cap Area (A1) (acres)	CN A1 (Final Cap)	Gravel Access Road Area (A2) (acres)	CN A2 (Gravel)	Composite Curve Number
A_1	0.69	0.56	78	0.13	91	**80**
A_2	1.49	1.19	78	0.31	91	**81**
A_3	1.97	1.65	78	0.32	91	**80**
A_4	1.80	1.51	78	0.30	91	**80**
A_5	2.65	2.47	78	0.19	91	**79**
A_6	1.15	1.15	78	-	-	**78**
B_1	0.13	-	-	0.13	91	**91**
B_2a	0.15	-	-	0.15	91	**91**
B_2b	0.16	-	-	0.16	91	**91**
B_3a	0.16	-	-	0.16	91	**91**

Table 4 – Curve Number Results, cont'd						
Subbasin	**Total Area (acres)**	**Final Cap Area (A1) (acres)**	**CN A1 (Final Cap)**	**Gravel Access Road Area (A2) (acres)**	**CN A2 (Gravel)**	**Composite Curve Number**
B_3b	0.16	-	-	0.16	91	**91**
B_4a	0.14	-	-	0.14	91	**91**
B_4b	0.16	-	-	0.16	91	**91**
B_5a	0.19	-	-	0.19	91	**91**
B_5b	0.05	0.05	78	-	-	**78**
B_6	0.04	0.04	78	-	-	**78**

Calculations/Results:

Peak Discharge Calculations were performed using HEC-HMS. Model results for the individual subbasins analyzed can be found below. The peak discharges were used in order to perform hydraulic calculations for the purpose of sizing the drainage ditches.

Table 5 – Peak Discharge Calculations

Subbasin	Peak Q (cfs)
A_1	3.3
A_2	7.1
A_3	9.3
A_4	8.3
A_5	11.0
A_6	5.1
B_1	0.8
B_2a	0.8
B_2b	0.8
B_3a	1.2
B_3b	1.2
B_4a	0.8
B_4b	1.2
B_5a	1.2
B_5b	0.3
B_6	0.3

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 the Type A and Type B ditches. The peak flow calculated was used to size all Type A or Type B ditches.

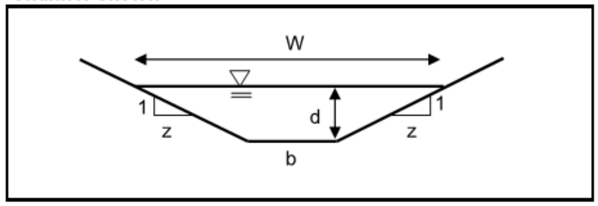
Type A Ditch Calculations

Drainage Ditch - Channel Capacity & Depth Calculations

Channel Section 1

1. Uniform (Symmetrical) Trapezoidal Section

Channel Sketch



Input Data:

Manning's "n" value	0.035	
Longitudinal Slope - S_o	0.020	ft/ft
Design Discharge - Q	11.0	ft^3/s - cfs

Channel Geometry Data:

Bottom Width(s)		
b_1 or b	4	feet
Side Slope(s)		
z_1 or z	3.0	z H:1V

Governing Geometry Equations

$$W = b + 2dz$$

$$A = bd + zd^2$$

$$W_P = b + 2d\sqrt{z^2 + 1}$$

Output Data:

Calculated Depth - d	**0.57**	feet
Calculated Top Width - W	**7.40**	feet
Calculated Area - A	3.23	ft^2
Calc. Wetted Perimeter - Wp	7.59	feet
Calc. Hydr. Radius - R	0.43	feet
Calculated Discharge - Q'	11.02	ft^3/s - cfs
Convergence	0.02	ft^3/s - cfs
Calculated Velocity	**3.41**	ft / s
Calculated Shear Stress - τ_d	**0.71**	lb / ft^2

$$Q = \frac{1.49}{n} A R^{\frac{2}{3}} S_o^{\frac{1}{2}} \qquad R = \frac{A}{W_p}$$

$$\tau_d = \gamma d S \qquad V = \frac{Q}{A}$$

The maximum estimated depth in the channel is 0.57-feet. Less than the Type A design depth of 2.0-feet as shown on the 30% drawings.

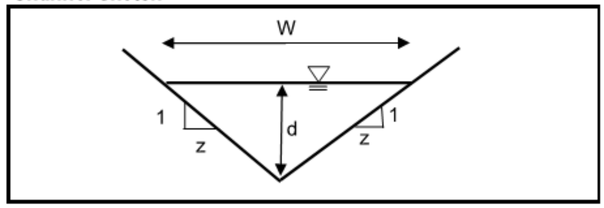
Type B Ditch Calculations

Drainage Ditch - Channel Capacity & Depth Calculations

Channel Section 1

3. Uniform (Symmetrical) Triangular Section

Channel Sketch



Input Data:

Manning's "n" value	0.035	
Longitudinal Slope - S_o	0.010	ft/ft
Design Discharge - Q	1.2	ft^3/s - cfs

Channel Geometry Data:

Bottom Width(s)		
b_1 or b	0	feet
Side Slope(s)		
z_1 or z	3.0	z H:1V

Governing Geometry Equations

$$W = b + 2dz$$

$$A = bd + zd^2$$

$$W_P = b + 2d\sqrt{z^2 + 1}$$

Output Data:

Calculated Depth - d	**0.50**	feet
Calculated Top Width - W	**2.98**	feet
Calculated Area - A	0.74	ft^2
Calc. Wetted Perimeter - Wp	3.14	feet
Calc. Hydr. Radius - R	0.24	feet
Calculated Discharge - Q'	1.20	ft^3/s - cfs
Convergence	0.00	ft^3/s - cfs
Calculated Velocity	**1.62**	ft / s
Calculated Shear Stress - τ_d	**0.31**	lb / ft^2

$$Q = \frac{1.49}{n} A R^{\frac{2}{3}} S_o^{\frac{1}{2}} \qquad R = \frac{A}{W_p}$$

$$\tau_d = \gamma d S \qquad V = \frac{Q}{A}$$

The maximum estimated depth in the channel is 0.5-feet. Less than the Type B design depth of 1.0-feet as shown on the 30% drawings.

References:

NOAA. (2013). *NOAA Atlas 14 Point Precipitation Frequency Estimates*. Retrieved July, 2015, from http://dipper.nws.noaa.gov/hdsc/pfds/

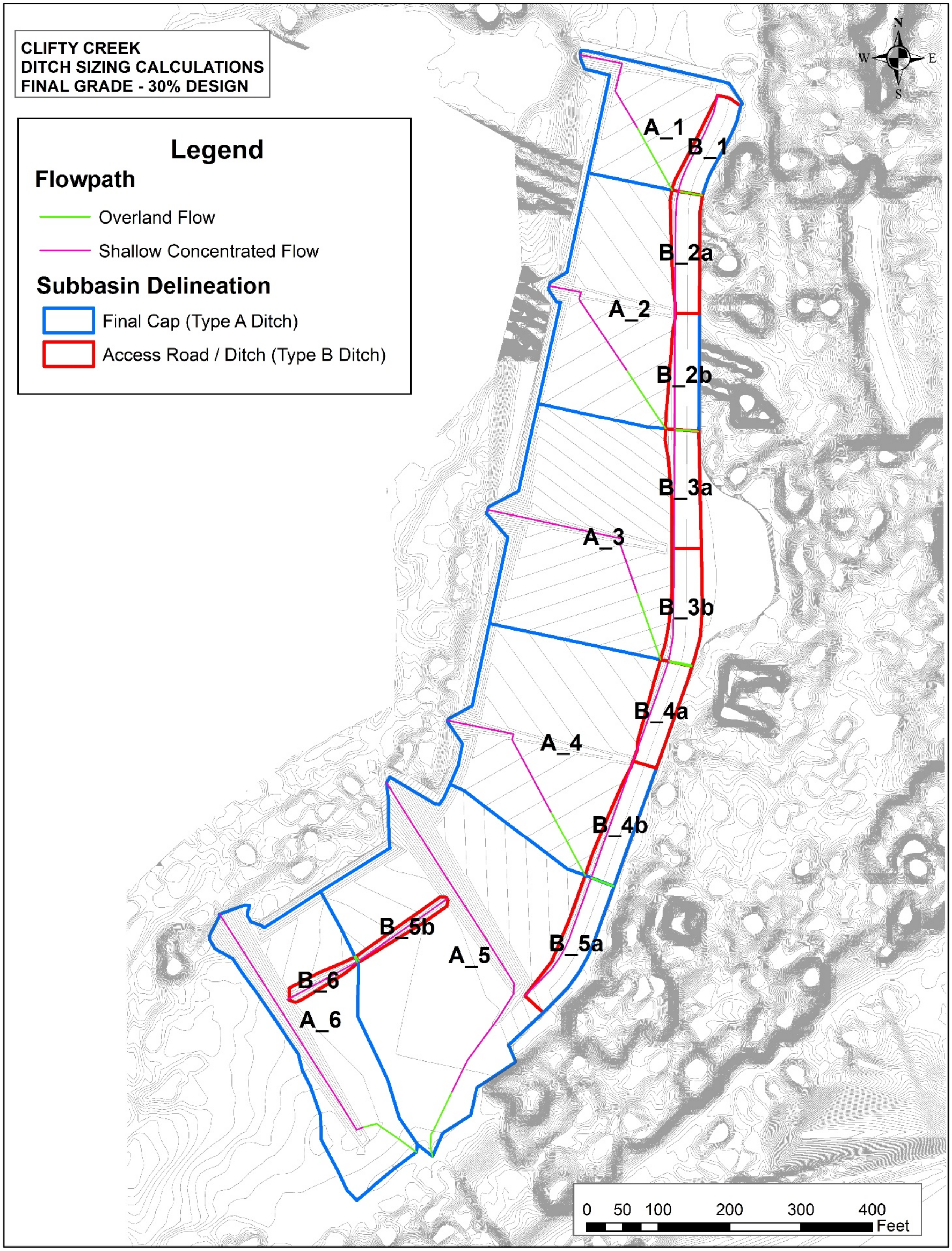
USDA. (1986). Urban Hydrology for Small Watersheds, TR-55. United States Department of Agriculture.

Indiana Department of Transportation – 2013 Design Manual, Chapter 202 Hydrology, Revision Date Feb. 2014

Attachments:	
Attachment A: Final Grade Subbasin Boundaries Attachment B: Time of Concentration Calculations	
Calculation Performed by: Stantec Consulting Services, Inc.	
Prepared by: Nick Mueller	*Reviewed by: Daniel Hoffman*
Revisions:R0	

June, 2020

Attachment A – Subbasin Boundaries



Attachment B – Time of Concentration Calculation Example (Subbasin A5)

		WORKSHEET: Time of Concentration (Tc)		
Project:	Clifty Creek West Boiler Slag Pond Closu	By:	NM	Date: 6/22/2020
Watershed ID:	Subbasin A5	Checked:	DH	Date: 6/22/2020
Sheet Flow		Segment ID	1	
1. Surface description			Grass, short prairie	
2. Manning's roughness coef., n			0.15	
3. Flow length, L (Total L less than 300/100 ft)		ft	97.52	
4. Two-year, 24-hour Rainfall, P2		in	3.2	
5a. Upstream elevation		ft	474.5	
5b. Downstream elevation		ft	472.2	
5. Land slope, S		ft / ft	0.024	
6. Tt = $[0.007(nL)^{0.8}]/[\text{sqrt}(P2)\ S^{0.4}]$		hr	0.15	
		mins	9.0	
Shallow Concentrated Flow (a)		Segment ID	2	
7. Surface description (paved or unpaved)			Unpaved	
8. Flow length, L		ft	162.18	
9a. Upstream elevation		ft	472.2	
9b. Downstream elevation		ft	470	
9. Watercourse slope, S		ft / ft	0.0136	
10. Average velocity, V		ft / s	1.9	
11. Tt = L / 3600V		hr	0.024	
		mins	1.4	
Shallow Concentrated Flow (b)		Segment ID	3	
7. Surface description (paved or unpaved)			Unpaved	
8. Flow length, L		ft	14.58	
9a. Upstream elevation		ft	470	
9b. Downstream elevation		ft	467.5	
9. Watercourse slope, S		ft / ft	0.171	
10. Average velocity, V		ft / s	6.7	
11. Tt = L / 3600V		hr	0.00061	
		mins	0.04	
Shallow Concentrated Flow (c)		Segment ID	4	
7. Surface description (paved or unpaved)			Unpaved	
8. Flow length, L		ft	333.58	
9a. Upstream elevation		ft	467.5	
9b. Downstream elevation		ft	460.8	
9. Watercourse slope, S		ft / ft	0.0201	
10. Average velocity, V		ft / s	2.3	
11. Tt = L / 3600V		hr	0.041	
		mins	2.4	
25. Watershed Tc (sum Tt from 6, 11(a)(b)(c))			13.0	minutes
26. Watershed lag time, TL (=0.6 x Tc)			7.8	minutes

ATTACHMENT E

Permit Drawings, WBSP Phase 1 Closure

(Stantec, 2020)

PERMIT DRAWINGS

PHASE 1 CLOSURE
WEST BOILER SLAG POND
CLIFTY CREEK STATION
JEFFERSON COUNTY, MADISON TOWNSHIP, INDIANA

PREPARED FOR

OVEC
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION
IKEC

PIKETON, OHIO

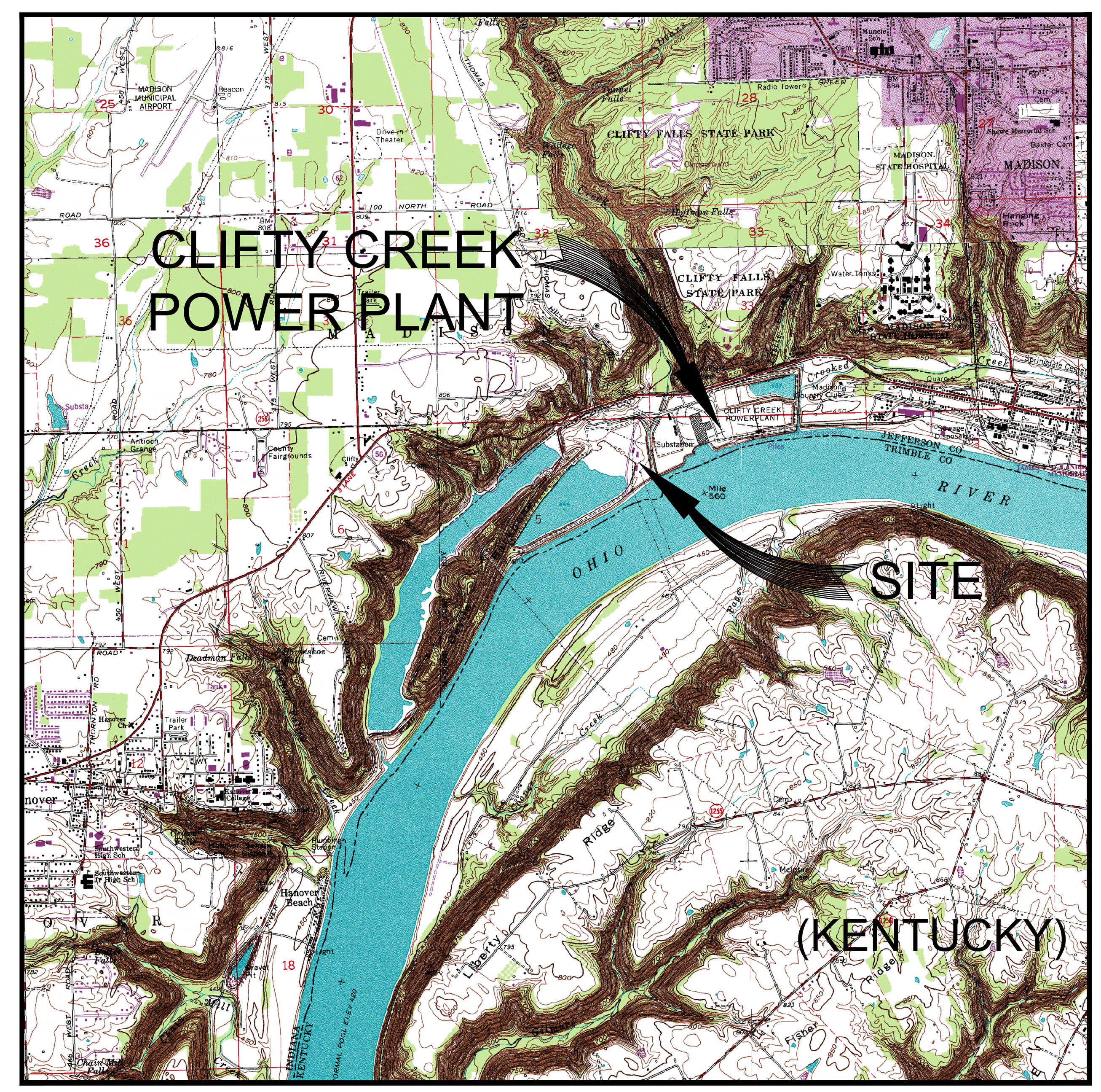
INDEX OF SHEETS

DRAWING NO.	DESCRIPTION	REVISION
01	COVER SHEET	A
02	WASTE LIMIT	A
03	CLOSURE PHASES	A
04	EXISTING CONDITIONS AND BASELINE LAYOUT	A
05	PHASE 1 SUBGRADE PLAN	A
06	PHASE 1 FINAL GRADE PLAN	A
07	PHASE 1 EROSION CONTROL PLAN	A
08	PROFILE - PROJECT BASELINE	A
09	CROSS SECTIONS - PROJECT BASELINE	A
10	DETAILS	A

PREPARED BY

Stantec

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 1 MILE
GRAPHIC SCALE

Stantec
11687 Lebanon Road
Cincinnati, Ohio 45241-2012
Tel: (513) 842-8200
www.stantec.com

Consultant

Notes

Revision	By	Appd	YYYY.MM.DD
0			

Issued	By	Appd	YYYY.MM.DD
A			

File Name: 01_39026C-001-CVR	TJ	KDL	JSH	2020.06.29
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Permit/Seal

JACQUELINE S. HARMON
REGISTERED
No. 10911138
STATE OF
INDIANA
PROFESSIONAL ENGINEER
6/30/2020

Client/Project Logo

OVEC IKEC

Client/Project
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION
PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
COVER SHEET

Project No.	Scale
175539026	AS SHOWN

Revision	Sheet	Drawing No.
A	1 of 10	

WASTE LIMIT NOTE:
WASTE BOUNDARY LOCATION WILL BE VERIFIED IN THE FIELD DURING CLOSURE ACTIVITIES AND UPDATED IN THE AS-BUILT DOCUMENTATION.

0 200' 400'

Stantec

Stantec
11687 Lebanon Road
Cincinnati, Ohio 45241-2012
Tel: (513) 842-8200
www.stantec.com

Consultant

Notes

MAPPING SOURCE NOTE:
MAPPING WAS PROVIDED BY AMERICAN ELECTRIC POWER. IT WAS DRONE SURVEYED ON SEPTEMBER 23, 2019. BATHYMETRIC DATA WAS CREATED USING DEPTH SHOTS PROVIDED BY CLIFTY CREEK STATION PERSONNEL ON SEPTEMBER 30, 2019. HORIZONTAL DATUM IS NAD83, EAST ZONE. VERTICAL DATUM IS NAVD 1988.

LEGEND

- ELECTRIC TOWER
- PB ELECTRIC PULLBOX
- TREE/SHRUB
- ELECTRIC POLE
- POWER POLE
- CB STORM CATCH BASIN
- OHE OVERHEAD ELECTRIC
- UGE UNDERGROUND ELECTRIC
- X FENCE
- PROPERTY LINE
- RAILROAD TRACKS
- ST STORM SEWER
- EDGE OF WATER
- TREELINE
- 450 EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR

	By	Appd	YYYY.MM.DD
0			
Revision	By	Appd	YYYY.MM.DD
A			
Issued	By	Appd	YYYY.MM.DD

File Name: 02_39026C-101-WL1	TJ	KDL	JSH	2020.06.29
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Permit/Seal

JACQUELINE S. HARMON REGISTERED No. 10911138 STATE OF INDIANA PROFESSIONAL ENGINEER
6/30/2020

Client/Project Logo

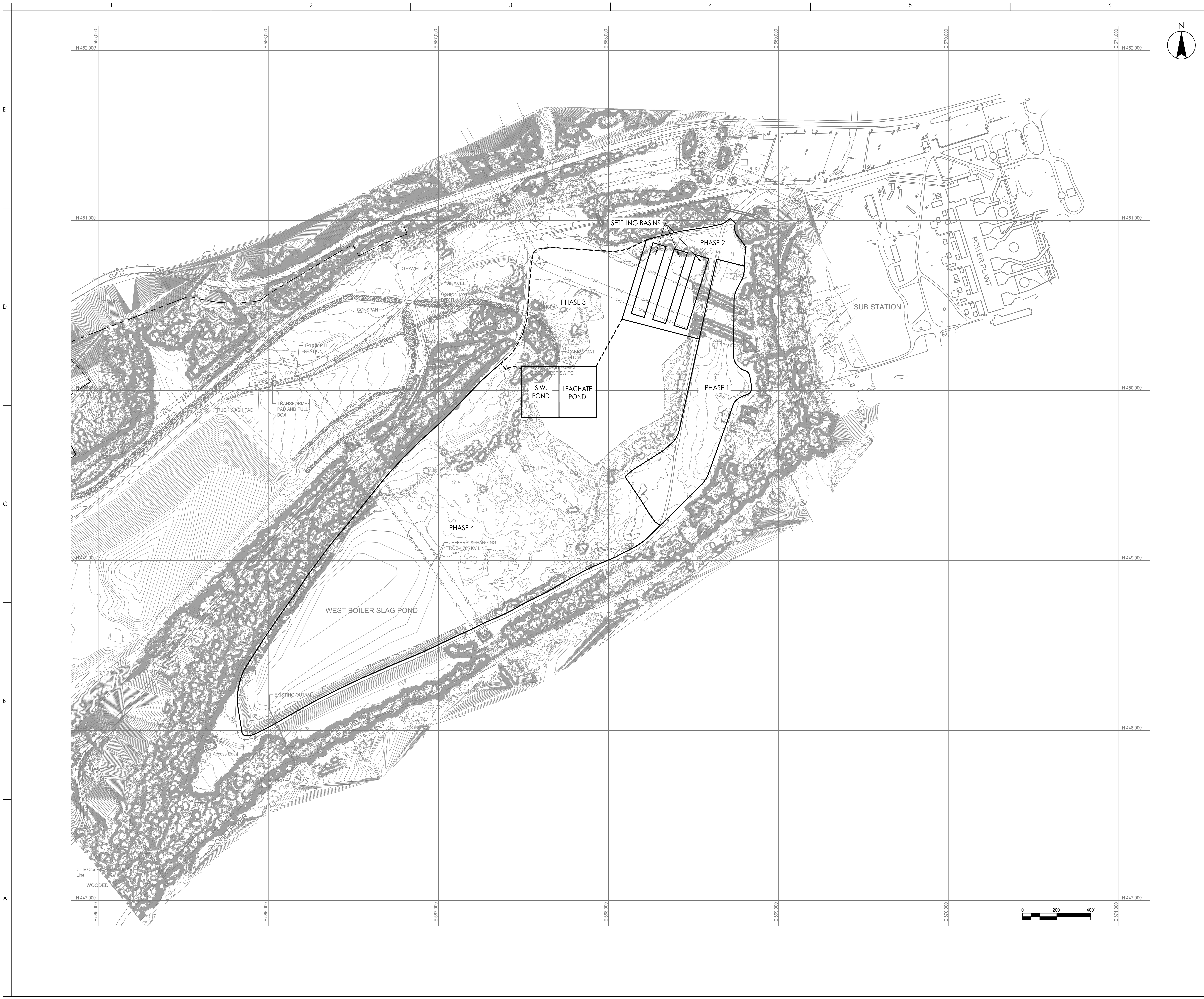
OVEC IKEC

Client/Project
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION
PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
WASTE LIMIT

Project No.	Scale
175539026	1"=200'

Revision	Sheet	Drawing No.
A	2 of 10	



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LEGEND

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- PB ELECTRIC PULLBOX
- TREE/SHRUB
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- OHE OVERHEAD ELECTRIC
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- PROPERTY LINE
- RAILROAD TRACKS
- ST STORM SEWER
- EDGE OF WATER
- TREELINE
- 450 EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR

Revision	By	Appd	YYYY.MM.DD
0			

Issued	By	Appd	YYYY.MM.DD
A			

File Name: 03_39026C-101-CP1	TJ	KDL	JSH	2020.06.29
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

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JACQUELINE S. HARMON
REGISTERED
No. 10911138
STATE OF
INDIANA
PROFESSIONAL ENGINEER

6/30/2020

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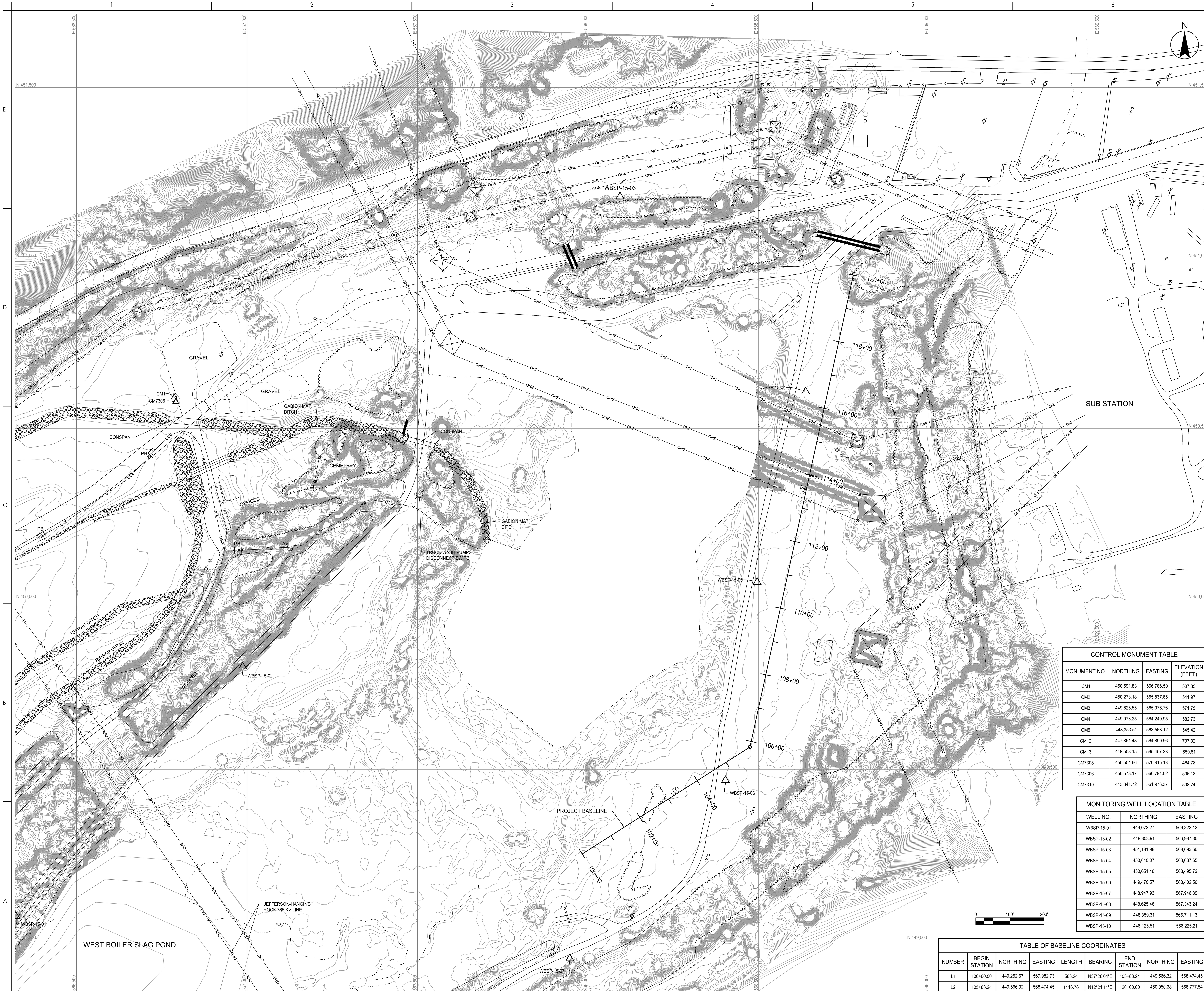
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION
PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
CLOSURE PHASES

Project No.	Scale
175539026	1"=200'

Revision	Sheet	Drawing No.
A	3 of 10	



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Cincinnati, Ohio 45241-2012
Tel: (513) 842-8200
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LEGEND

- ELECTRIC TOWER
- PB ELECTRIC PULLBOX
- TREE/SHRUB
- ELECTRIC POLE
- POWER POLE
- CB STORM CATCH BASIN
- OHE OVERHEAD ELECTRIC
- UGE UNDERGROUND ELECTRIC
- X FENCE
- PROPERTY LINE
- RAILROAD TRACKS
- ST STORM SEWER
- EDGE OF WATER
- TREELINE
- 450 EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- GROUNDWATER MONITORING WELL
- CONTROL MONUMENT

CONTROL MONUMENT TABLE			
MONUMENT NO.	NORTHING	EASTING	ELEVATION (FEET)
CM1	450,591.83	566,786.50	507.35
CM2	450,273.18	565,837.85	541.97
CM3	449,625.55	565,076.76	571.75
CM4	449,073.25	564,240.95	582.73
CM5	448,353.51	563,563.12	545.42
CM12	447,851.43	564,890.96	707.02
CM13	448,508.15	565,457.33	659.81
CM7305	450,554.66	570,915.13	464.78
CM7306	450,578.17	566,791.02	506.18
CM7310	443,341.72	561,976.37	508.74

MONITORING WELL LOCATION TABLE		
WELL NO.	NORTHING	EASTING
WBSP-15-01	449,072.27	566,322.12
WBSP-15-02	449,803.91	566,987.30
WBSP-15-03	451,181.98	568,093.60
WBSP-15-04	450,610.07	568,637.65
WBSP-15-05	450,051.40	568,495.72
WBSP-15-06	449,470.57	568,402.50
WBSP-15-07	448,947.93	567,946.39
WBSP-15-08	448,625.46	567,343.24
WBSP-15-09	448,359.31	566,711.13
WBSP-15-10	448,125.51	566,225.21

TABLE OF BASELINE COORDINATES								
NUMBER	BEGIN STATION	NORTHING	EASTING	LENGTH	BEARING	END STATION	NORTHING	EASTING
L1	100+00.00	449,252.67	567,982.73	583.24'	N57°28'04"E	105+83.24	449,566.32	568,474.45
L2	105+83.24	449,566.32	568,474.45	1416.76'	N12°21'11"E	120+00.00	450,950.28	568,777.54

0			
Revision	By	Appd	YYYY.MM.DD
A			
Issued	By	Appd	YYYY.MM.DD

File Name: 04_39026C-101-EC1	TJ	KDL	JSH	2020.06.29
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Permit/Seal

JACQUELINE S. HARMON
REGISTERED
No. 10911138
STATE OF
INDIANA
PROFESSIONAL ENGINEER
6/30/2020

Client/Project Logo

OVEC
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION
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OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION

PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION

MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title

EXISTING CONDITIONS AND PROJECT BASELINE LAYOUT

Project No. 175539026

Scale 1"=100'

Revision A

Sheet 4 of 10

Drawing No.

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Notes

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NOTE:
EXISTING RAILROAD TRACKS, DRAINAGE PIPES, AND OTHER FEATURES SHALL BE DEMOLISHED FROM WITHIN THE PROJECT LIMITS.

LEGEND

- ELECTRIC TOWER
- PB ELECTRIC PULLBOX
- TREE/SHRUB
- ELECTRIC POLE
- POWER POLE
- CB STORM CATCH BASIN
- OHE OVERHEAD ELECTRIC
- UGE UNDERGROUND ELECTRIC
- X FENCE
- PROPERTY LINE
- RAILROAD TRACKS
- ST STORM SEWER
- EDGE OF WATER
- TREELINE
- 450 EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- 450 PROPOSED SUBGRADE INDEX CONTOUR
- PROPOSED SUBGRADE INTERMEDIATE CONTOUR
- GROUNDWATER MONITORING WELL
- CONTROL MONUMENT

0			
Revision	By	Appd	YYYY.MM.DD
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Issued	By	Appd	YYYY.MM.DD

File Name: 05_39026C-101-SG1	TJ	KDL	JSH	2020.06.29
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

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REGISTERED
No. 10911138
STATE OF
INDIANA
PROFESSIONAL ENGINEER
6/30/2020

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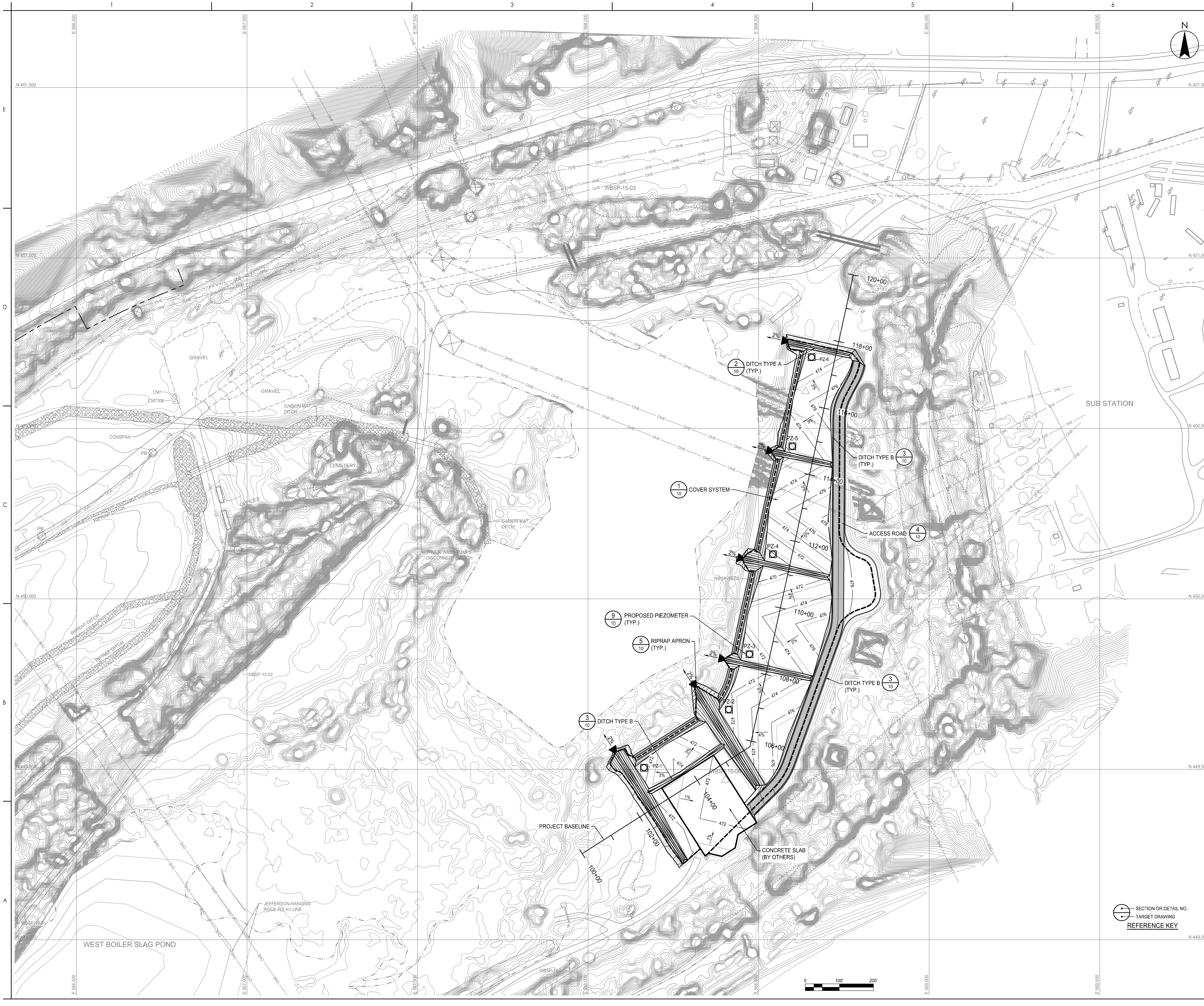
PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION

MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
PHASE 1 SUBGRADE PLAN

Project No.	Scale
175539026	1" = 100'
Revision A	Sheet 5 of 10	Drawing No.



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NOTE:
BASEMAP HAS BEEN MODIFIED TO REFLECT A MERGE OF EXISTING CONDITIONS AND SUBGRADE DESIGN CONTOURS.

LEGEND

- ELECTRIC TOWER
- PB ELECTRIC PULLBOX
- TREE/SHRUB
- ELECTRIC POLE
- POWER POLE
- CB STORM CATCH BASIN
- OHE OVERHEAD ELECTRIC
- UGE UNDERGROUND ELECTRIC
- X FENCE
- PROPERTY LINE
- RAILROAD TRACKS
- ST STORM SEWER
- EDGE OF WATER
- TREELINE
- 450 EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- 450 PROPOSED FINAL GRADE INDEX CONTOUR
- PROPOSED FINAL GRADE INTERMEDIATE CONTOUR
- GROUNDWATER MONITORING WELL
- PROPOSED PIEZOMETER
- CONTROL MONUMENT
- LIMITS OF COVER SYSTEM

0			
Revision	By	Appd	YYYY.MM.DD
A			
Issued	By	Appd	YYYY.MM.DD

File Name: 06_39026C-101-FG1	TJ	KDL	JSH	2020.06.29
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

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REGISTERED
No. 10911138
STATE OF
INDIANA
PROFESSIONAL ENGINEER
6/30/2020

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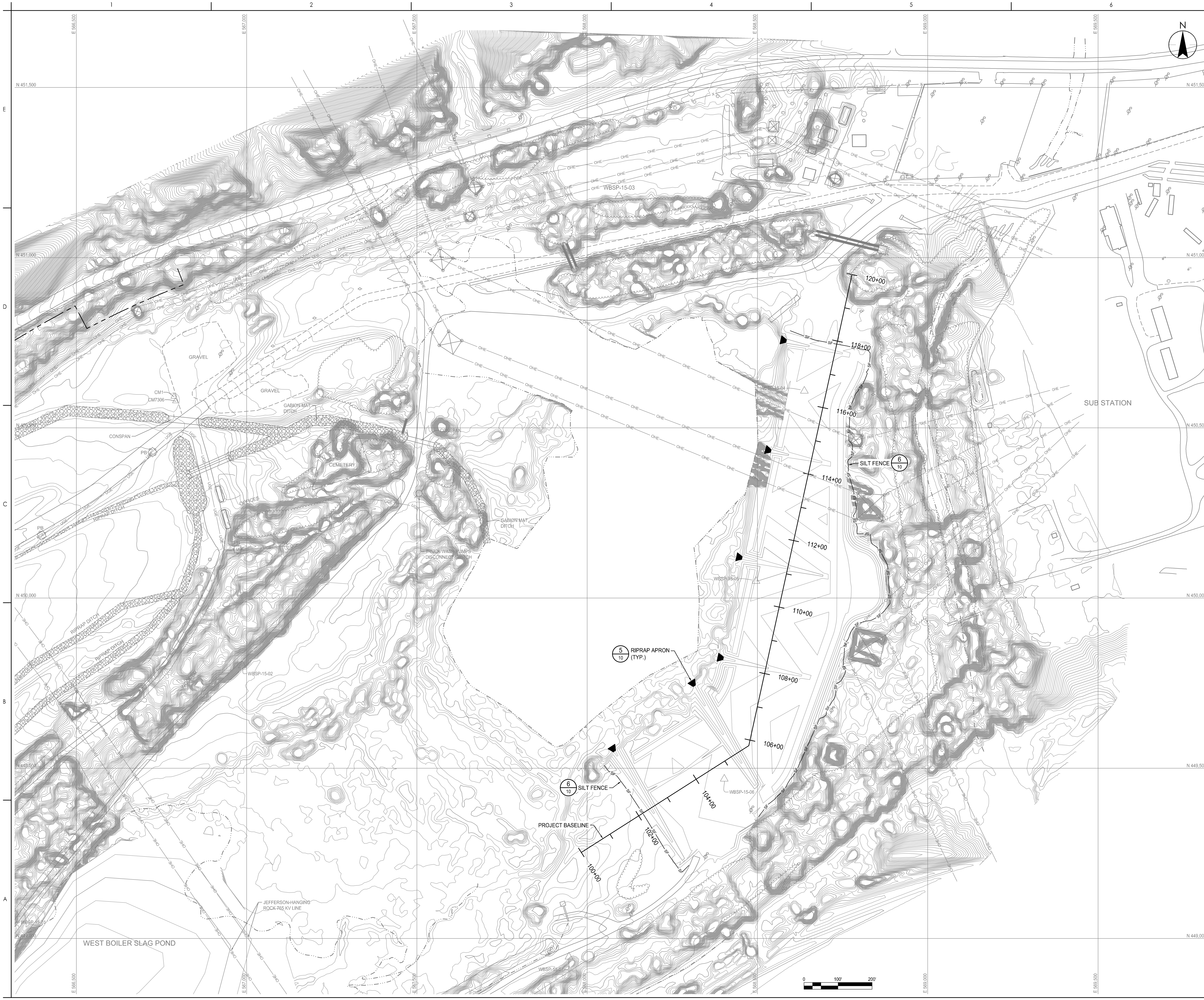
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION
PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
PHASE 1 FINAL GRADE PLAN

Project No.	Scale
175539026	1" = 100'

Revision	Sheet	Drawing No.
A	6 of 10	



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11687 Lebanon Road
Cincinnati, Ohio 45241-2012
Tel: (513) 842-8200
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NOTES:
1. BASEMAP HAS BEEN MODIFIED TO REFLECT A MERGE OF EXISTING CONDITIONS AND SUBGRADE / FINAL GRADE DESIGN CONTOURS.
2. THE EROSION CONTROL PLAN MEASURES SHOWN SHALL BE CONSIDERED THE MINIMUM; SUPPLEMENTAL MEASURES SHALL BE PROVIDED BY THE CONTRACTOR AS FIELD CONDITIONS DICTATE OR AS DIRECTED BY THE ENGINEER, OWNER, OR ANY REGULATORY AUTHORITY.

LEGEND
ELECTRIC TOWER
PB ELECTRIC PULLBOX
TREE/SHRUB
ELECTRIC POLE
POWER POLE
CB STORM CATCH BASIN
OHE OVERHEAD ELECTRIC
UGE UNDERGROUND ELECTRIC
X FENCE
PROPERTY LINE
RAILROAD TRACKS
ST STORM SEWER
EDGE OF WATER
TREELINE
450 EXISTING INDEX CONTOUR
EXISTING INTERMEDIATE CONTOUR
GROUNDWATER MONITORING WELL
CONTROL MONUMENT

Revision	By	Appd	YYYY.MM.DD
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Issued	By	Appd	YYYY.MM.DD
A			

File Name: 07_39026C-101-ER1	TJ	KDL	JSH	2020.06.29
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JACQUELINE S. HARMON
REGISTERED
No. 10911138
STATE OF INDIANA
PROFESSIONAL ENGINEER
6/30/2020
Jacqueline S Harmon

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INDIANA-KENTUCKY ELECTRIC CORPORATION
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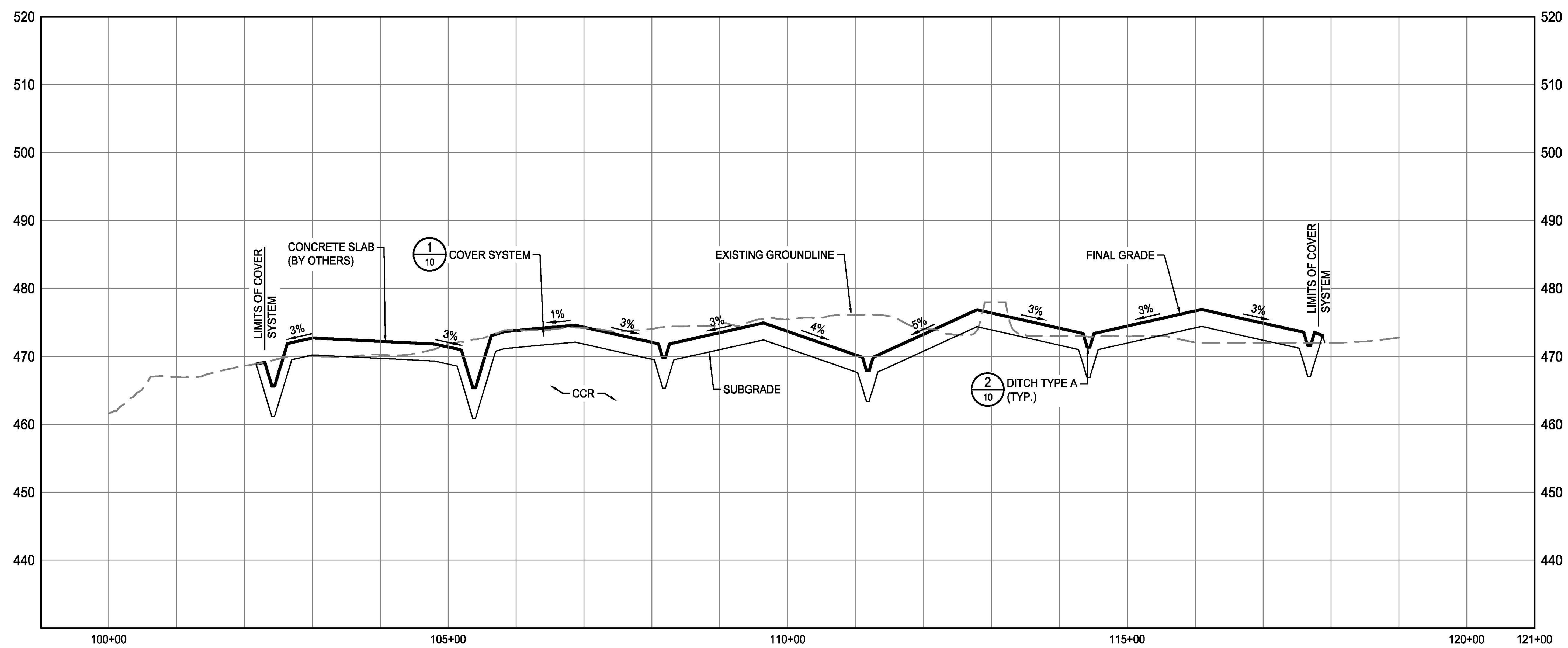
INDIANA-KENTUCKY ELECTRIC CORPORATION
PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
PHASE 1 EROSION CONTROL PLAN

Project No. 175539026
Scale 1" = 100'
Revision A
Sheet 7 of 10
Drawing No.



1/8 PROFILE - PROJECT BASELINE
SCALE: 1"=100' (HORIZONTAL)
1"=10' (VERTICAL)

SECTION OR DETAIL NO.
TARGET DRAWING
REFERENCE KEY

Stantec

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11687 Lebanon Road
Cincinnati, Ohio 45241-2012
Tel: (513) 842-8200
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Notes

Revision	By	Appd	YYYY.MM.DD
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A			

File Name: 08_39026C-301-PF1	TJ	KDL	JSH	2020.06.29
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

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6/30/2020

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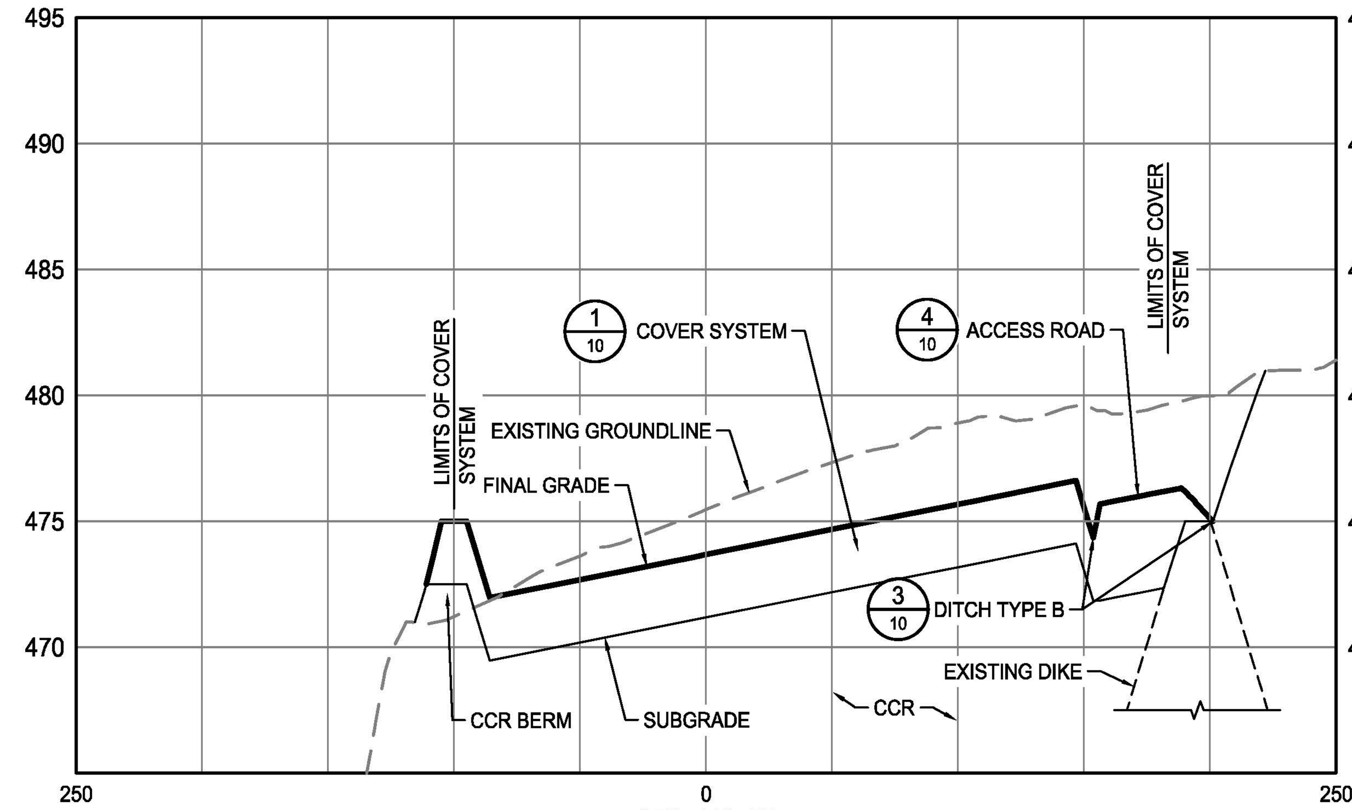
INDIANA-KENTUCKY ELECTRIC CORPORATION

PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION

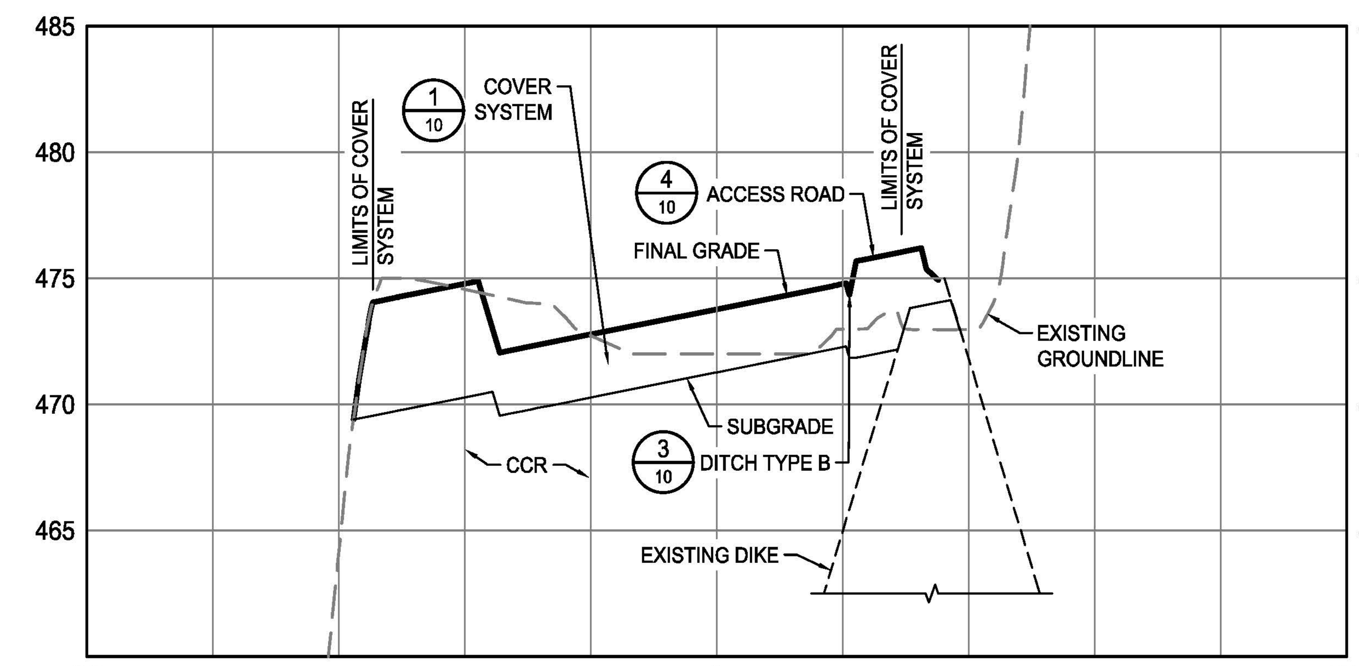
MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
PROFILE - PROJECT BASELINE

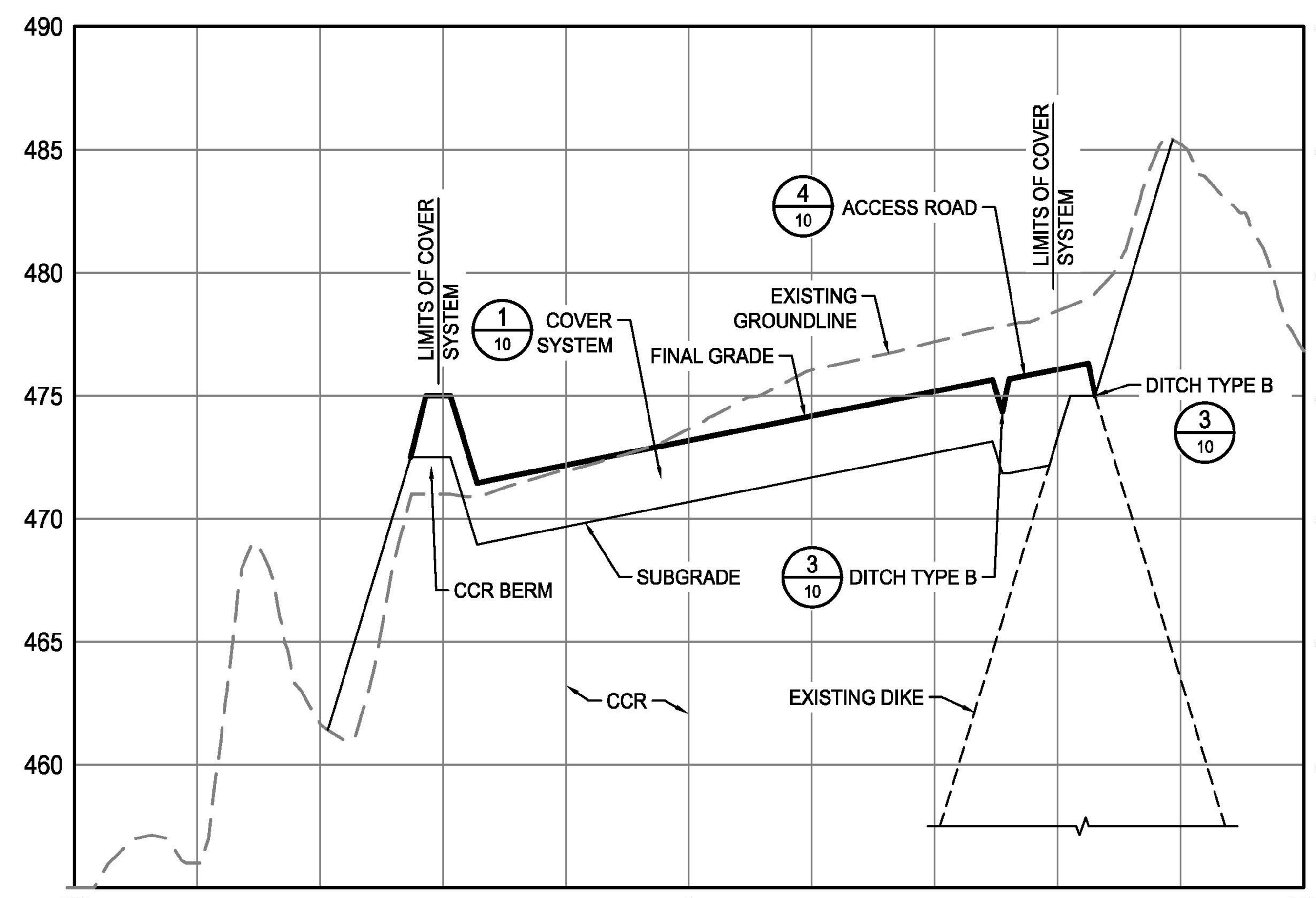
Project No. 175539026
Scale AS SHOWN
Revision A
Sheet 8 of 10
Drawing No.



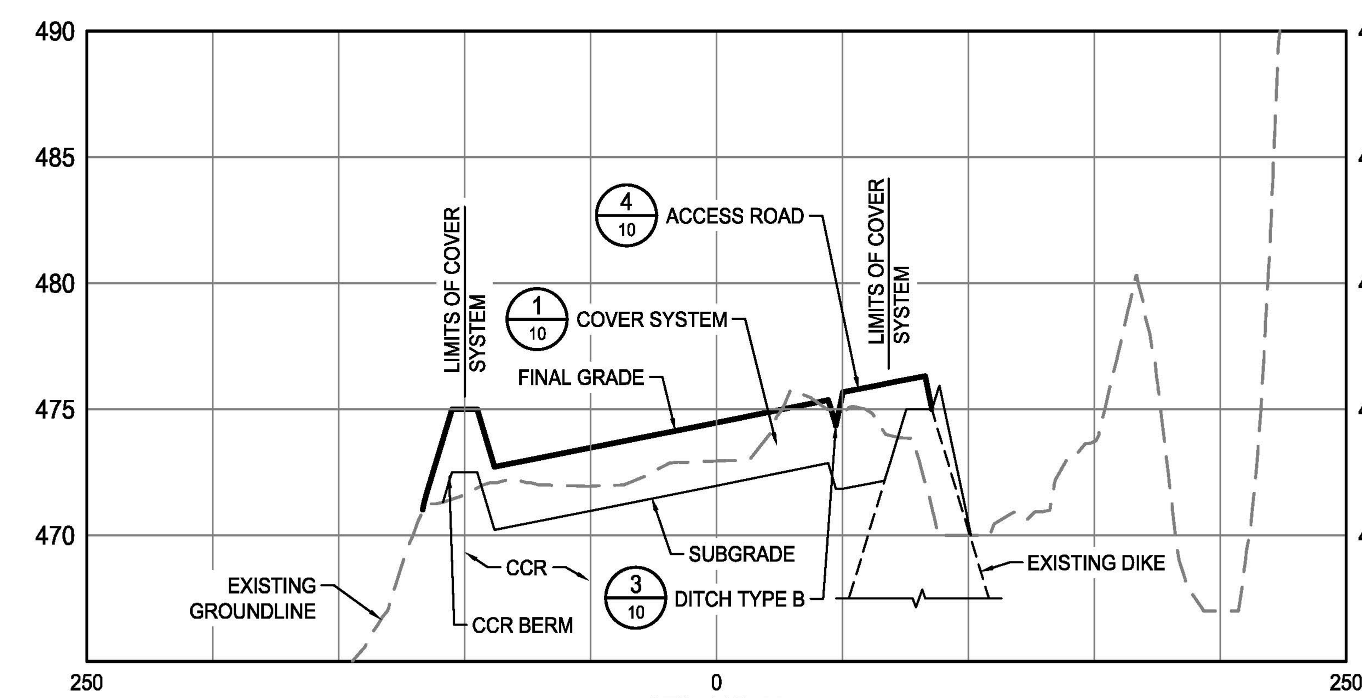
STA. 110+00



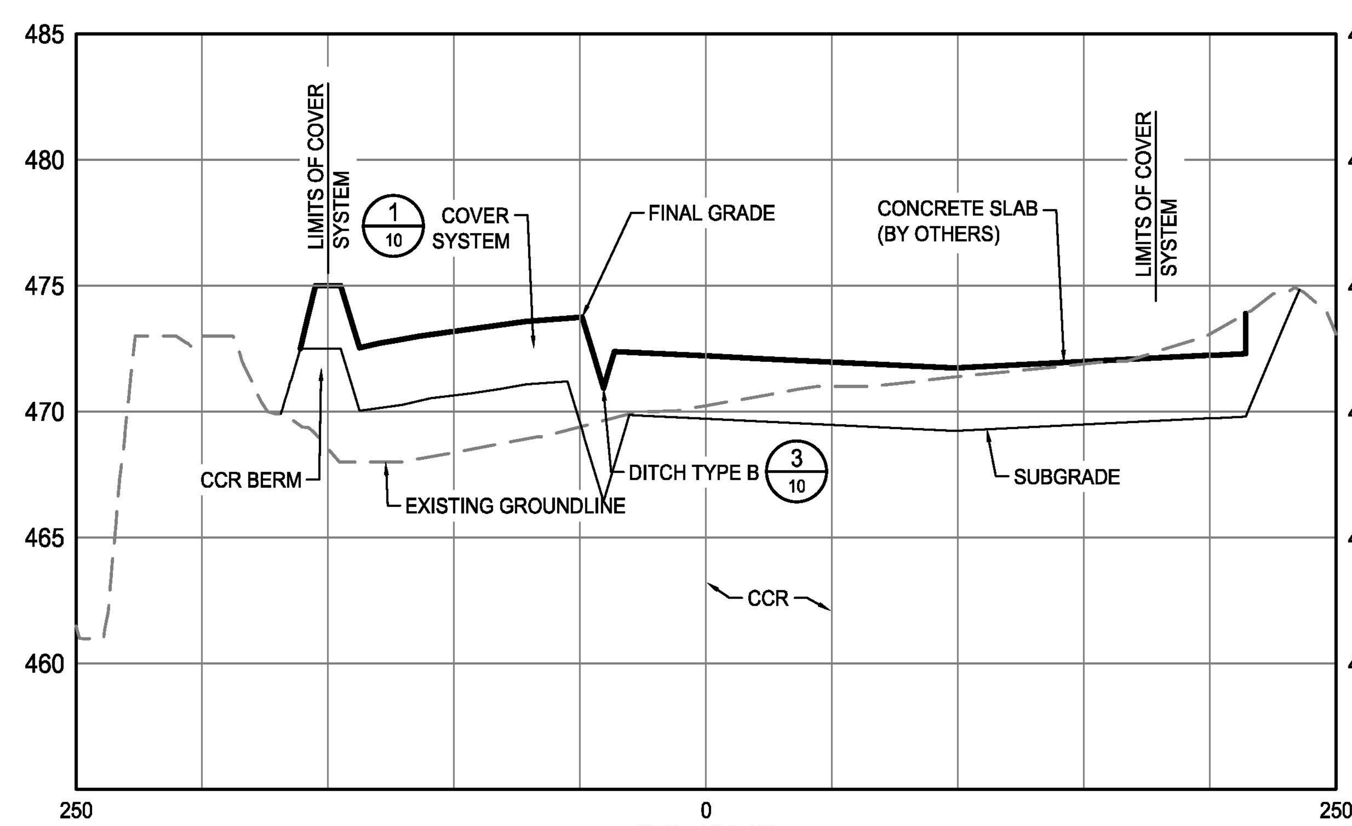
STA. 117+50



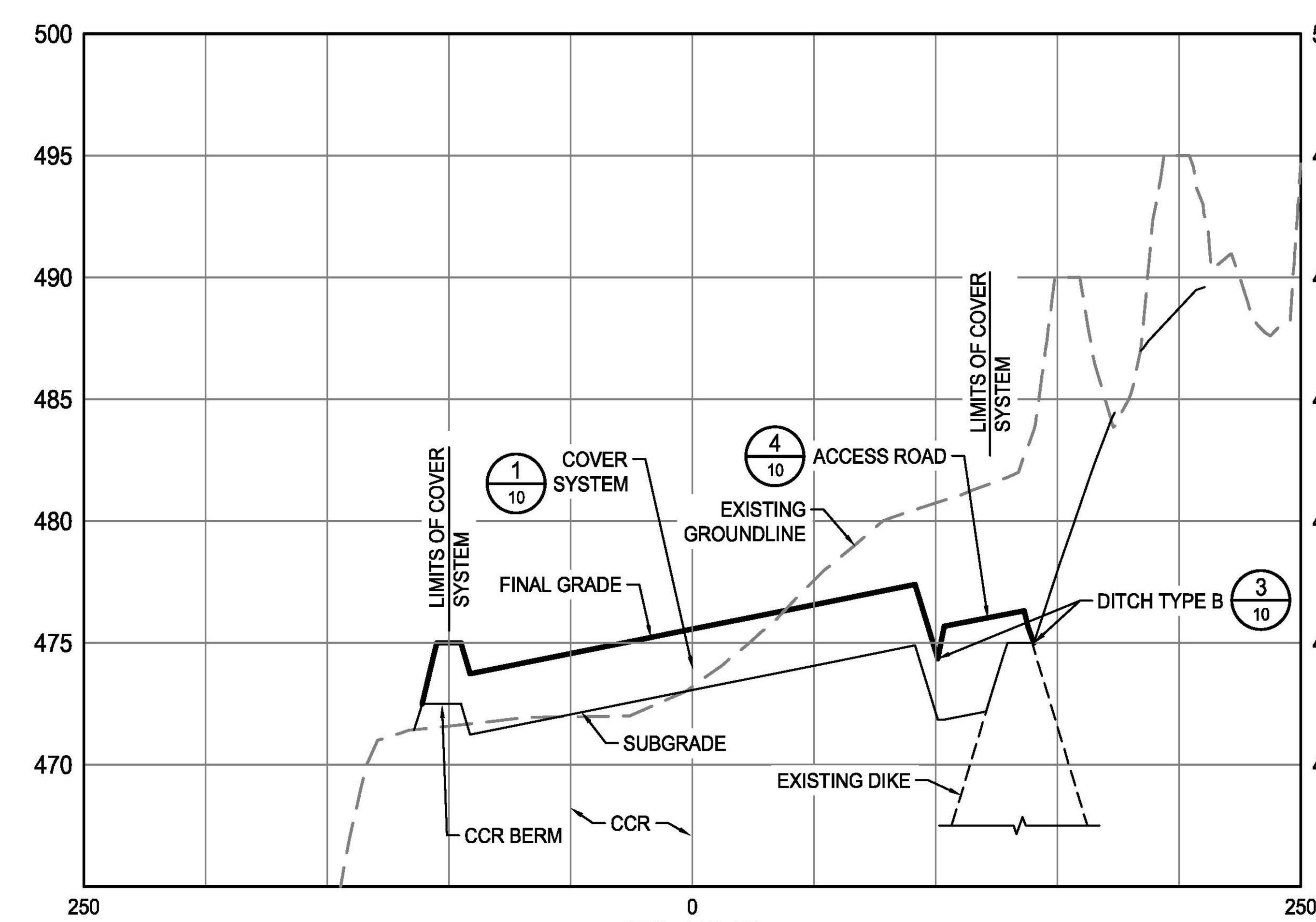
STA. 107+50



STA. 115+00



STA. 104+00



STA. 112+50

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11687 Lebanon Road
Cincinnati, Ohio 45241-2012
Tel: (513) 842-8200
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Notes

0			
Revision	By	Appd	YYYY.MM.DD
A			
Issued	By	Appd	YYYY.MM.DD

File Name: 09_39026C-301-XS1	TJ	KDL	JSH	2020.06.29
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

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JACQUELINE S. HARMON
REGISTERED
No. 10911138
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PROFESSIONAL ENGINEER
6/30/2020

Client/Project Logo

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OHIO VALLEY ELECTRIC CORPORATION
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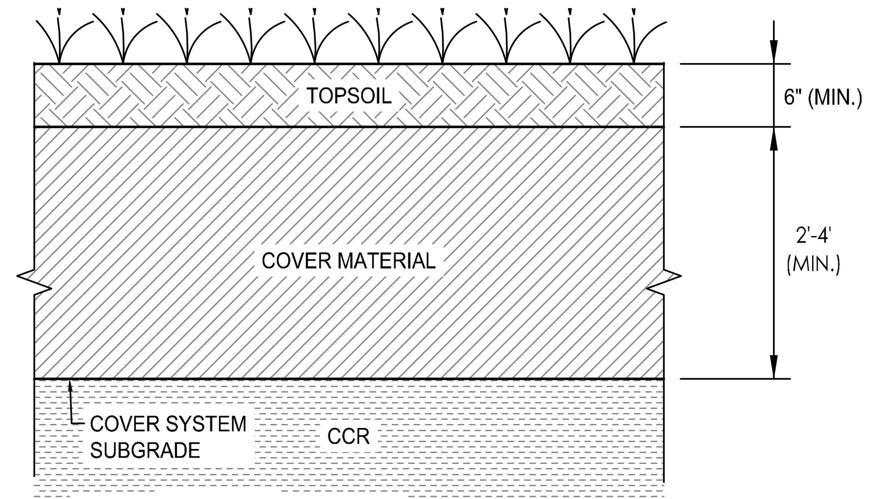
INDIANA-KENTUCKY ELECTRIC CORPORATION
PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

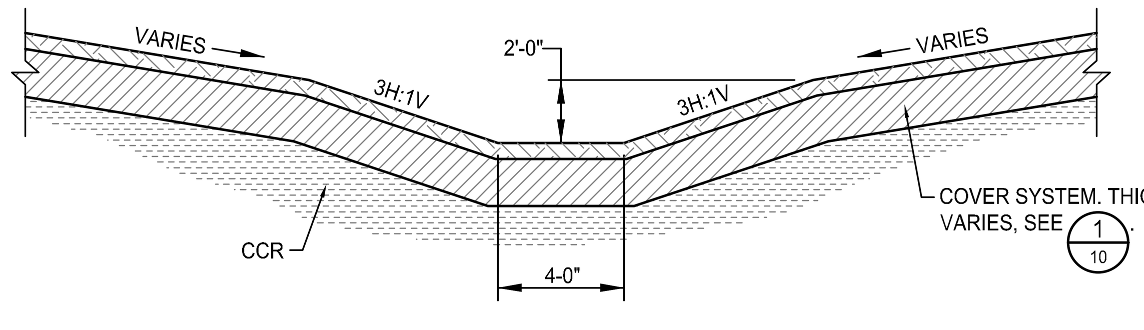
Title
CROSS SECTIONS - PROJECT BASELINE

Project No. 175539026	Scale AS SHOWN
Revision A Sheet 9 of 10	Drawing No.

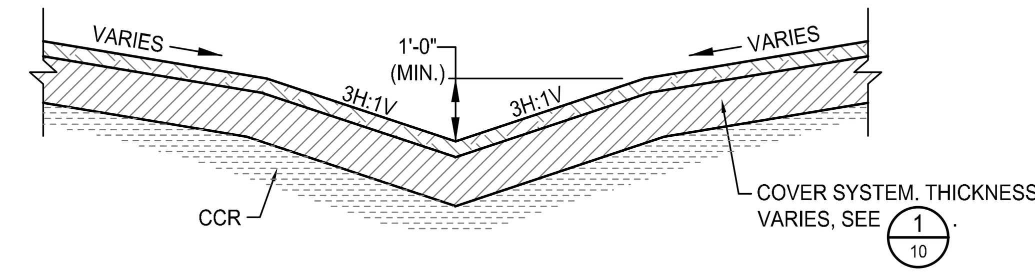


NOTES:
1. MINIMUM CROSS SLOPE = 3%.
2. MAXIMUM SLOPE = 3H:1V.
3. COVER MATERIAL THICKNESS SHALL BE 2' (MIN.) FOR SLOPES LESS THAN OR EQUAL TO 15% AND 4' (MIN.) FOR SLOPES GREATER THAN 25%.
4. THE COMPACTED COVER MATERIAL SHALL HAVE A PERMEABILITY LESS THAN OR EQUAL TO THE PERMEABILITY OF THE NATURAL SUBSOILS, OR NO GREATER THAN $1X10^{-5}$ CM/SEC, WHICHEVER IS LESS. IF MATERIAL OF SUFFICIENT QUALITY/QUANTITY CANNOT BE FOUND, THEN A 40-MIL LLDPE FLEXIBLE MEMBRANE LINER AND GEOCOMPOSITE DRAINAGE LAYER SHALL BE INSTALLED BETWEEN THE SUBGRADE AND COVER MATERIAL.

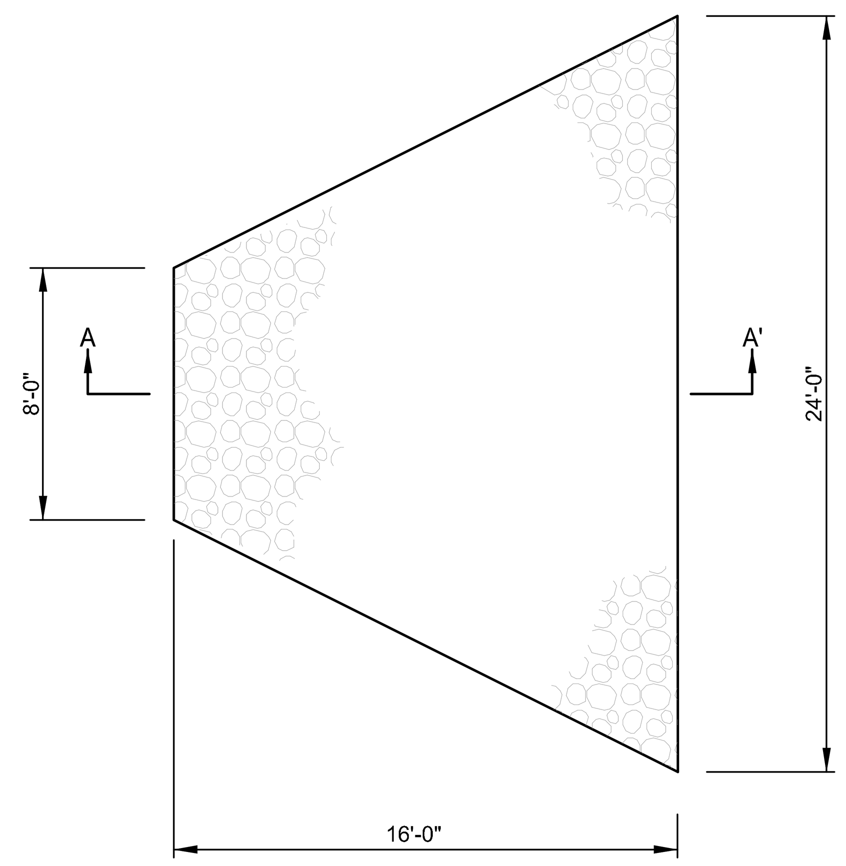
1 / 10 DETAIL - COVER SYSTEM
SCALE: 1"=1'-0"



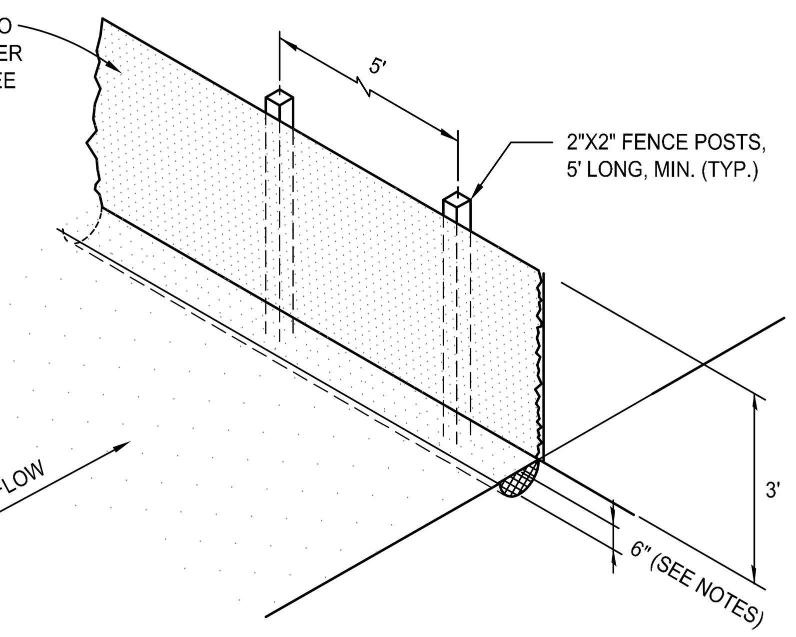
2 / 10 DETAIL - DITCH TYPE A
NOT TO SCALE



3 / 10 DETAIL - DITCH TYPE B
NOT TO SCALE



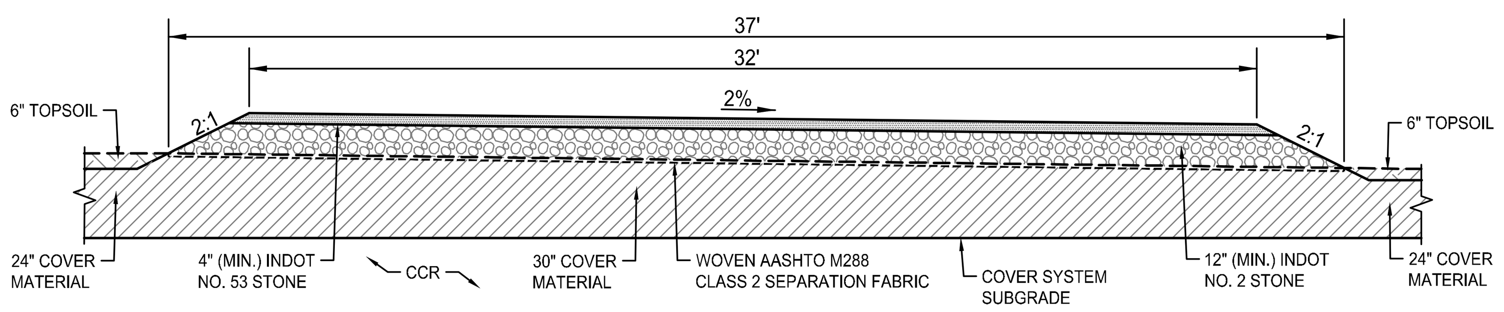
PLAN



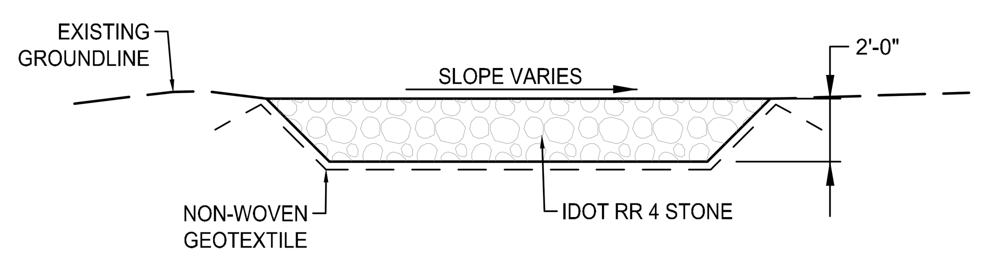
GEOTEXTILE FABRIC SHALL BE ATTACHED TO FENCE USING STAPLES, HOGRINGS OR OTHER METHODS APPROVED BY THE ENGINEER (SEE NOTES).

NOTES:
1. THE BOTTOM 12 INCHES OF THE FABRIC SHALL BE BURIED IN A 6-INCH TRENCH CUT INTO THE GROUND OR COVERED BY 6 INCHES OF FILL MATERIAL TO PREVENT SEDIMENT FROM ESCAPING UNDER THE FENCE. ALL EARTH-WORK SHALL BE ON THE UPSTREAM SIDE OF THE FENCE.
2. GEOTEXTILE FABRIC SHALL MEET THE FOLLOW-ING SPECIFICATIONS: GRAB STRENGTH (ASTM D 1682) - 100 LBS. MIN., WIDTH - 4' MIN., BURSTING STRENGTH (ASTM D751) - 150 P.S.I. MIN., FLOW RATE (KM64-106) - 0.3 GAL./SQ. FT., RETENTION EFFICIENCY (KM64-106) - 75%

6 / 10 DETAIL - SILT FENCE
NOT TO SCALE

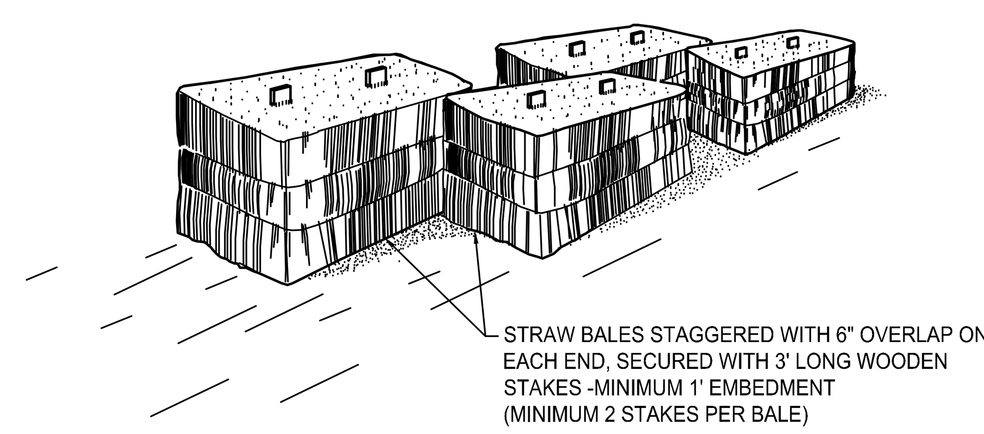


4 / 10 DETAIL - ACCESS ROAD
SCALE: 1/4"=1'-0"

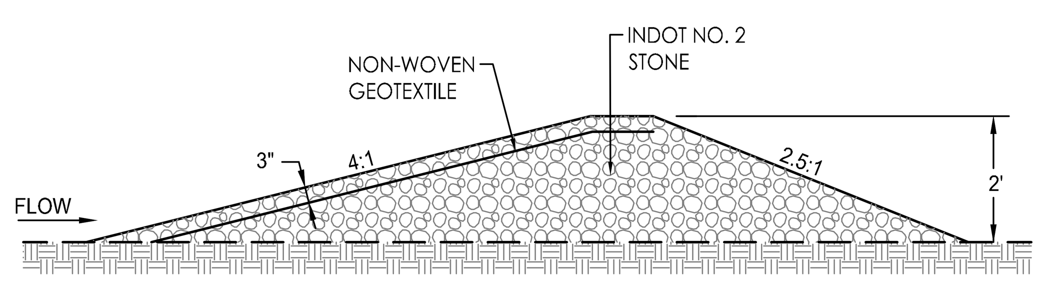


SECTION A-A'

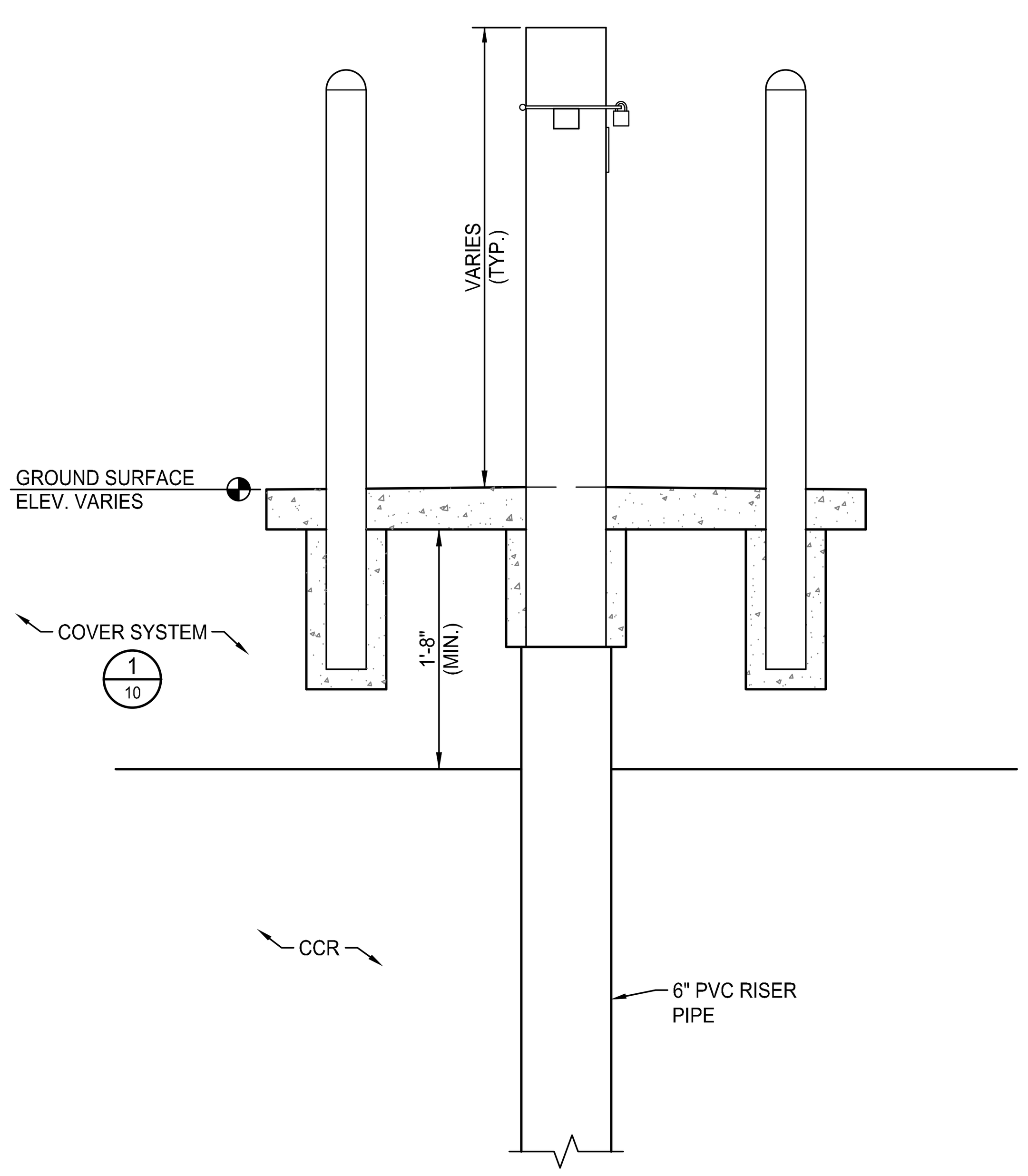
5 / 10 DETAIL - RIPRAP APRON
SCALE: 1/4"=1'-0"



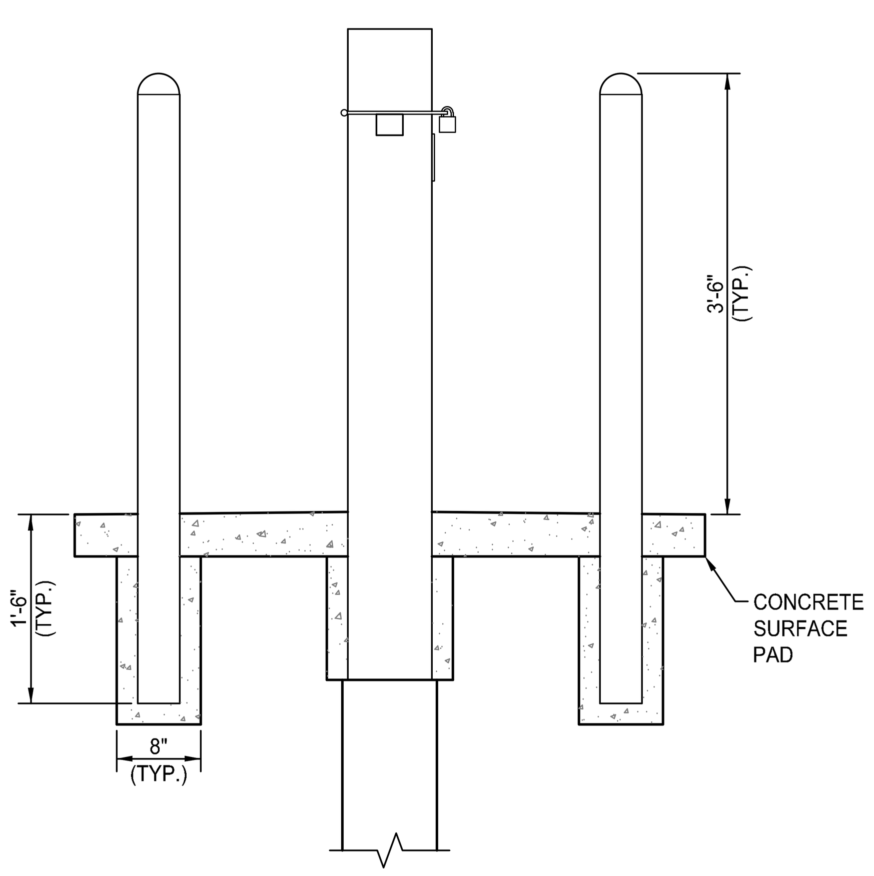
8 / 10 DETAIL - SILT CONTROL BALES
NOT TO SCALE



7 / 10 DETAIL - ROCK CHECK DAM
SCALE: 1/2"=1'-0"



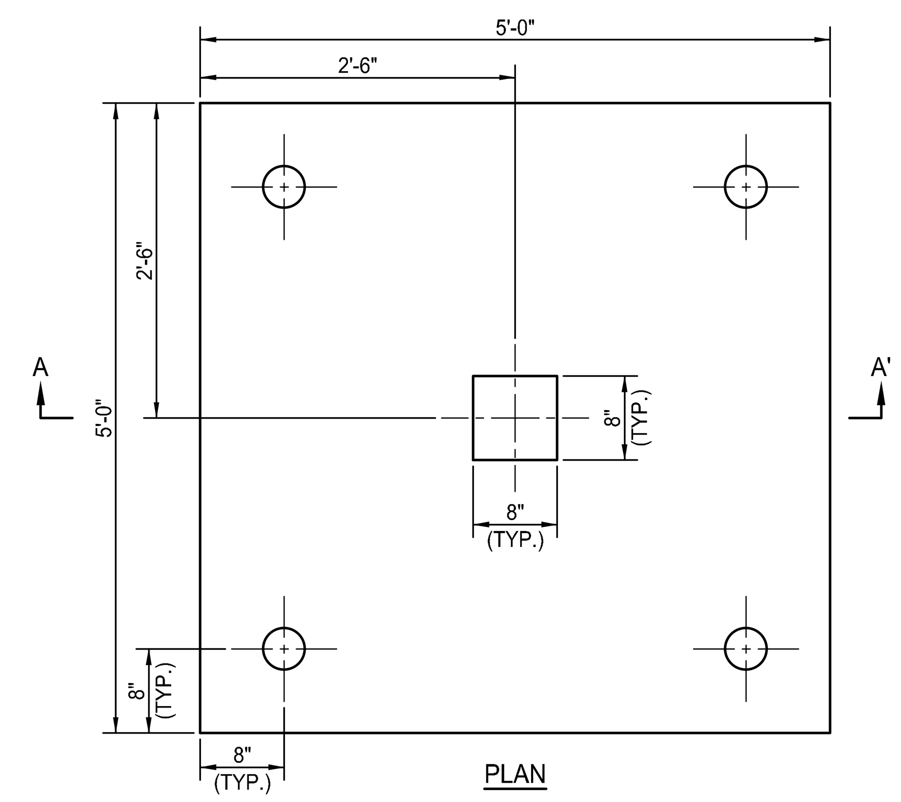
COVER PENETRATION



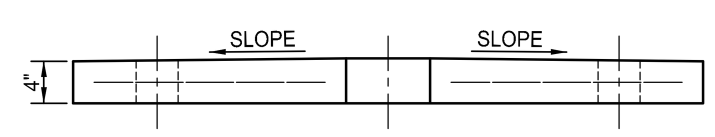
CONCRETE PAD

NOTES:
1. PROTECTIVE BOLLARDS TO BE FILLED WITH 3000 PSI CONCRETE AND CONE-TAPER THE TOP.
2. DRILL 3/16" DIAMETER VENT HOLE, 2 INCHES BELOW TOP OF PVC RISER.
3. NEW PROTECTIVE COVERS DO NOT REQUIRE PAINTING.
4. POSITION PROTECTIVE COVER WITH HINGE AT SAME ELEVATION AS TOP OF PVC RISER. FILL INSIDE OF PROTECTIVE COVER WITH CEMENT GROUT TO SAME LEVEL AS CONCRETE PAD.
5. DRILL 3/16" DIAMETER WEEP HOLE AT TOP OF GROUT INSIDE PROTECTIVE COVER.

9 / 10 DETAIL - PROPOSED PIEZOMETER
SCALE: 1"=1'-0"



PLAN



SECTION A-A'

NOTES:
1. SLOPE CONCRETE PAD SURFACE TO PREVENT PONDING WATER.
2. PLACE WIRE MESH 2 INCHES MINIMUM FROM ALL CONCRETE EDGES.

CONCRETE SURFACE PAD

SECTION OR DETAIL NO.
TARGET DRAWING
REFERENCE KEY

Stantec

Stantec
11687 Lebanon Road
Cincinnati, Ohio 45241-2012
Tel: (513) 842-8200
www.stantec.com

Consultant

Notes

Revision	By	Appd	YYYY.MM.DD
0			

Issued	By	Appd	YYYY.MM.DD
A			
File Name: 10_39026C-501-D01	TJ	KDL	JSH	2020.06.29
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Permit/Seal

JACQUELINE S. HARMON REGISTERED No. 10911136 STATE OF INDIANA PROFESSIONAL ENGINEER
6/30/2020

Client/Project Logo

OVEC IKEC

Client/Project
OHIO VALLEY ELECTRIC CORPORATION
INDIANA-KENTUCKY ELECTRIC CORPORATION
PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
DETAILS

Project No.	Scale
175539026	AS SHOWN
Revision A	Sheet 10 of 10	Drawing No.

ATTACHMENT F

Phase 1 Slope Stability Analyses

LEGEND

- ELECTRIC TOWER
- PB ELECTRIC PULLBOX
- TREE/SHRUB
- ELECTRIC POLE
- POWER POLE
- CB STORM CATCH BASIN
- OHE OVERHEAD ELECTRIC
- UGE UNDERGROUND ELECTRIC
- X FENCE
- PROPERTY LINE
- RAILROAD TRACKS
- ST STORM SEWER
- EDGE OF WATER
- TREELINE
- 450 EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- 450 PROPOSED FINAL GRADE INDEX CONTOUR
- PROPOSED FINAL GRADE INTERMEDIATE CONTOUR
- GROUNDWATER MONITORING WELL
- PROPOSED PIEZOMETER
- CONTROL MONUMENT
- LIMITS OF COVER SYSTEM

SECTION OR DETAIL NO.
TARGET DRAWING
REFERENCE KEY

Stantec
11687 Lebanon Road
Cincinnati, Ohio 45241-2012
Tel: (513) 842-8200
www.stantec.com

Consultant

Notes

MAPPING SOURCE NOTE:
MAPPING WAS PROVIDED BY AMERICAN ELECTRIC POWER. IT WAS DRONE SURVEYED ON SEPTEMBER 23, 2019. BATHYMETRIC DATA WAS CREATED USING DEPTH SHOTS PROVIDED BY CLIFTY CREEK STATION PERSONNEL ON SEPTEMBER 30, 2019. HORIZONTAL DATUM IS NAD83, EAST ZONE. VERTICAL DATUM IS NAVD 1988.

NOTE:
BASEMAP HAS BEEN MODIFIED TO REFLECT A MERGE OF EXISTING CONDITIONS AND SUBGRADE DESIGN CONTOURS.

	By	Appd	YYYY.MM.DD
0			
Revision	By	Appd	YYYY.MM.DD
A			
Issued	By	Appd	YYYY.MM.DD

File Name: 06_39026C-FG1	MJ	KDL	JSH	2020.06.29
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Permit/Seal

Client/Project Logo

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

PHASE 1 CLOSURE - WEST BOILER SLAG POND
CLIFTY CREEK STATION

MADISON TOWNSHIP, JEFFERSON COUNTY, INDIANA

Title
STABILITY SECTION PLAN VIEW

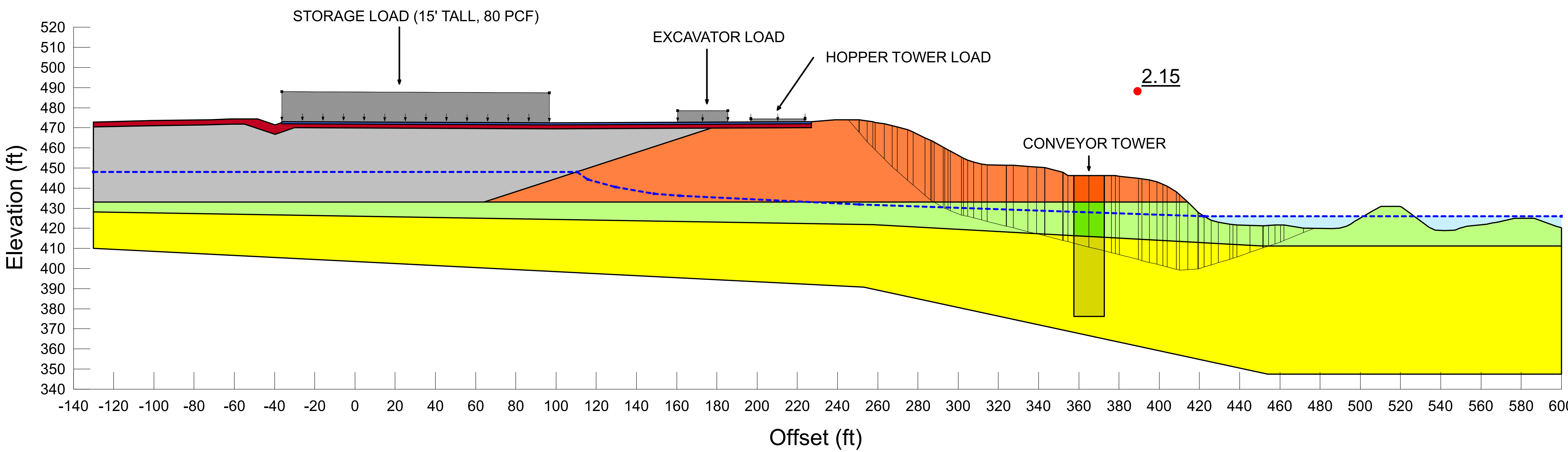
Project No.	Scale
175539026	1" = 100'
Revision: - Sheet: 1 of 1	Drawing No. F-1

Section D - Conveyor System Summary Table						
Headwater Pool	**Ohio River Level**	**Drainage**	**Incipient Motion**	**Seismic Load Case**	**Acceptance Criteria**	**Factor of Safety**
Normal Pool (448 ft)	426 ft	Drained	Outward	No	1.50	2.15
Normal Pool (448 ft)	464 ft		Inward		1.50	16.07
High Pool (462.8 ft)	426 ft		Outward		1.40	2.15
High Pool (462.8 ft)	464 ft		Inward		1.40	13.48
Normal Pool (448 ft)	426 ft	Undrained	Outward	No	1.50	1.82
Normal Pool (448 ft)	464 ft		Inward		1.50	10.36
High Pool (462.8 ft)	426 ft		Outward		1.40	1.82
High Pool (462.8 ft)	464 ft		Inward		1.40	9.20
Normal Pool (448 ft)	426 ft	Undrained	Outward	Yes	1.00	1.34
Normal Pool (448 ft)	464 ft		Inward		1.00	4.21
High Pool (462.8 ft)	426 ft		Outward		1.00	1.34
High Pool (462.8 ft)	464 ft		Inward		1.00	3.90

Clifty Creek Station	**Slope Stability Analysis – FS = 2.15**
West Boiler Slag Pond	L01_drained_normal_water Drained Static Stengths Headwater = 448.0 ft, Tailwater = 426.0 ft
Section D - Conveyor System Cross Section (Including Towers)	

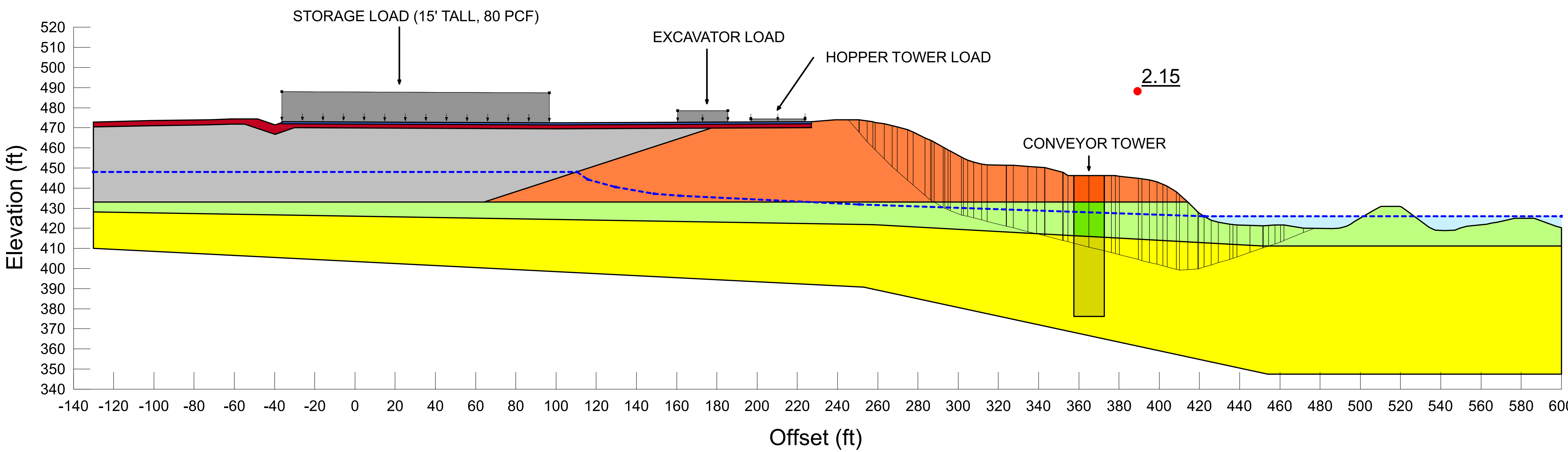
Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.

Material	Unit Weight (pcf)	***Drained Strength Parameters*** Phi (deg.)	Cohesion (psf)
Concrete (Drained)	150	33.2	165
Compacted Clay/Cover (Drained)	130	33.2	165
Boiler Slag (Drained)	105	31	0
Embankment (Drained)	130	33.2	165
Embankment Piles (Drained)	142	33.2	165
Lean Clay with Sand (Drained)	119	27.2	160
Lean Clay with Sand Piles (Drained)	131	27.2	160
Sandy Silt (Drained)	130	30	0
Sandy Silt Piles (Drained)	142	30	0



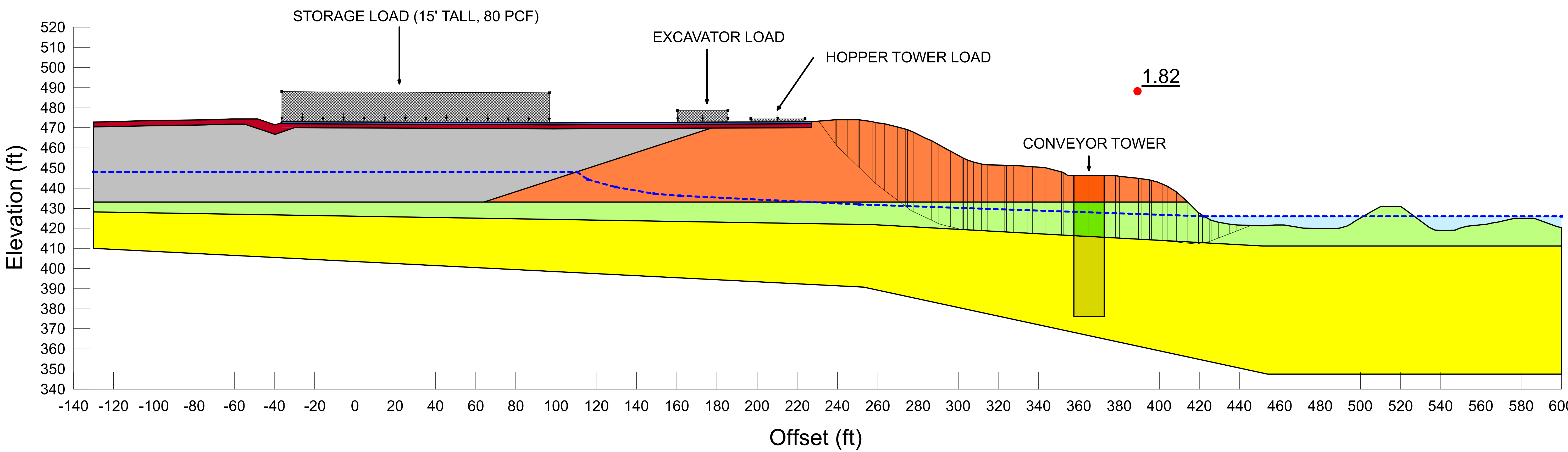
Clifty Creek Station	**Slope Stability Analysis – FS = 2.15**	Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.
West Boiler Slag Pond	L02_drained_high_water Drained Static Stengths Headwater = 462.8 ft, Tailwater = 426.0 ft	
Section D - Conveyor System Cross Section (Including Towers)		

Material	Unit Weight (pcf)	*Drained Strength Parameters* Phi (deg.)	Cohesion (psf)
Concrete (Drained)	150	33.2	165
Compacted Clay/Cover (Drained)	130	33.2	165
Boiler Slag (Drained)	105	31	0
Embankment (Drained)	130	33.2	165
Embankment Piles (Drained)	142	33.2	165
Lean Clay with Sand (Drained)	119	27.2	160
Lean Clay with Sand Piles (Drained)	131	27.2	160
Sandy Silt (Drained)	130	30	0
Sandy Silt Piles (Drained)	142	30	0



Clifty Creek Station	**Slope Stability Analysis – FS = 1.82**	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.
West Boiler Slag Pond	L03_undrained_normal_water Undrained Static Stengths Headwater = 448.0 ft, Tailwater = 426.0 ft	
Section D - Conveyor System Cross Section (Including Towers)		

Material	Unit Weight (pcf)	*Drained Strength Parameters* Phi (deg.)	Cohesion (psf)	*Undrained Strength Parameters* Phi (deg.)	Cohesion (psf)
Concrete (Undrained)	150	33.2	165	13	600
Compacted Clay/Cover (Undrained)	130	33.2	165	13	600
Boiler Slag (Undrained)	105	31	0	31	0
Embankment (Undrained)	130	33.2	165	13	600
Embankment Piles (Undrained)	142	33.2	165	13	600
Lean Clay with Sand (Undrained)	119	27.2	160	5	1200
Lean Clay with Sand Piles (Undrained)	131	27.2	160	5	1200
Sandy Silt (Undrained)	130	30	0	30	0
Sandy Silt Piles (Undrained)	142	30	0	30	0



Project No. 175539026

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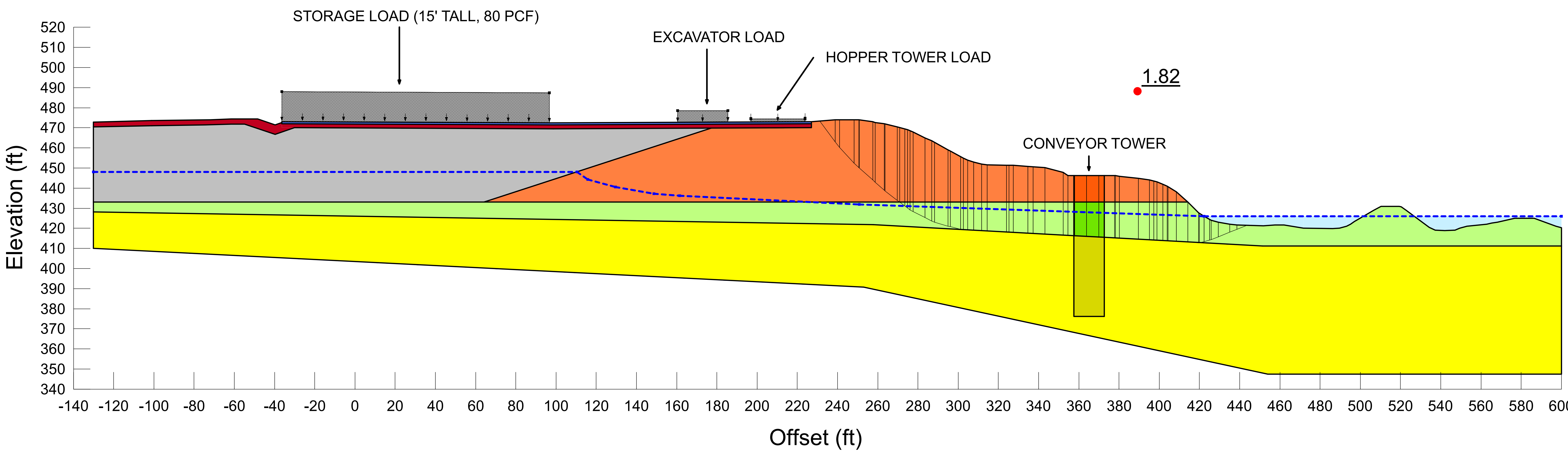
Clifty Creek Station	**Slope Stability Analysis – FS = 1.82**
West Boiler Slag Pond	L04_undrained_high_water Undrained Static Stengths Headwater = 462.8 ft, Tailwater = 426.0 ft
Section D - Conveyor System Cross Section (Including Towers)	

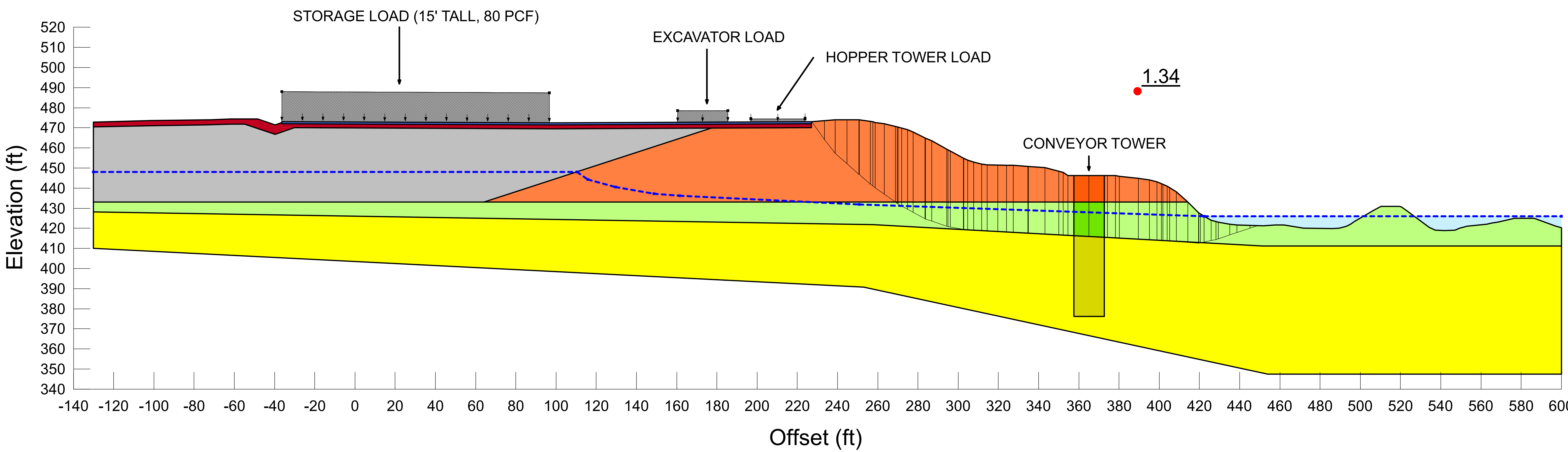
Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.

Material	Unit Weight (pcf)	Drained Strength Parameters: Phi (deg.)	Drained Strength Parameters: Cohesion (psf)	Undrained Strength Parameters: Phi (deg.)	Undrained Strength Parameters: Cohesion (psf)
Concrete (Undrained)	150	33.2	165	13	600
Compacted Clay/Cover (Undrained)	130	33.2	165	13	600
Boiler Slag (Undrained)	105	31	0	31	0
Embankment (Undrained)	130	33.2	165	13	600
Embankment Piles (Undrained)	142	33.2	165	13	600
Lean Clay with Sand (Undrained)	119	27.2	160	5	1200
Lean Clay with Sand Piles (Undrained)	131	27.2	160	5	1200
Sandy Silt (Undrained)	130	30	0	30	0
Sandy Silt Piles (Undrained)	142	30	0	30	0



Clifty Creek Station	**Slope Stability Analysis – FS = 1.34**	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.
West Boiler Slag Pond	L05_seismic_undrained_normal_water Undrained Seismic Stengths (Horizontal Acceleration = 0.0884) Headwater = 448.0 ft, Tailwater = 426.0 ft	
Section D - Conveyor System Cross Section (Including Towers)		

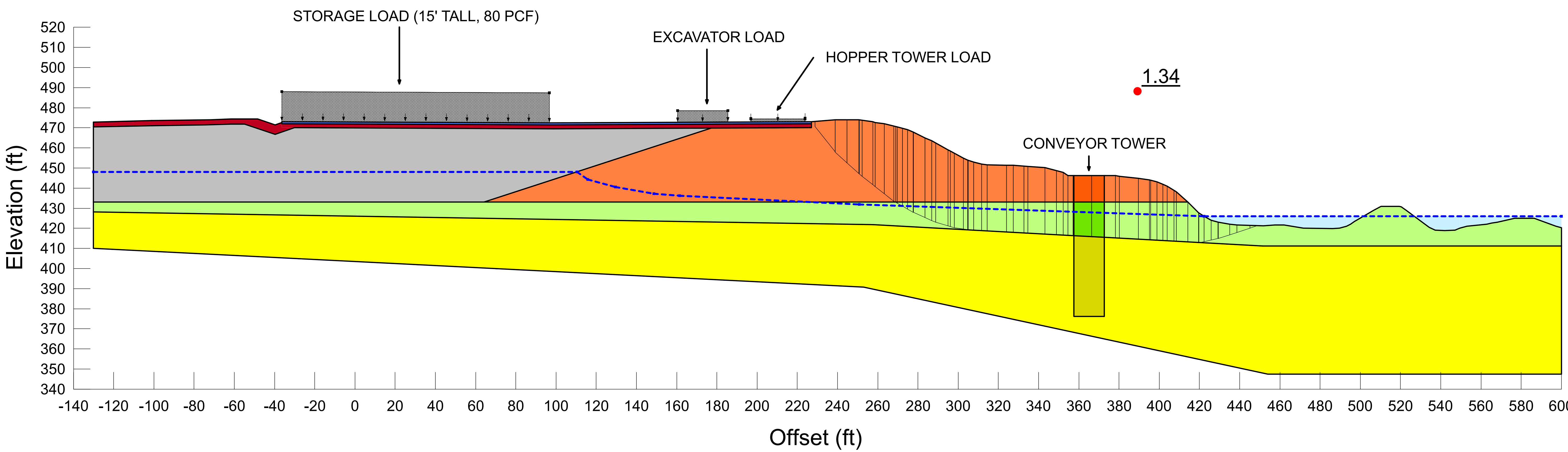
Material	Unit Weight (pcf)	*Drained Strength Parameters* Phi (deg.)	Cohesion (psf)	*Seismic Undrained Strength Parameters* Phi (deg.)	Cohesion (psf)
Concrete (Seismic Undrained)	150	33.2	165	13	600
Compacted Clay/Cover (Seismic Undrained)	130	33.2	165	13	600
Boiler Slag (Seismic Undrained)	105	31	0	31	0
Embankment (Seismic Undrained)	130	33.2	165	13	600
Embankment Piles (Seismic Undrained)	142	33.2	165	13	600
Lean Clay with Sand (Seismic Undrained)	119	27.2	160	5	1200
Lean Clay with Sand Piles (Seismic Undrained)	131	27.2	160	5	1200
Sandy Silt (Seismic Undrained)	130	30	0	30	0
Sandy Silt Piles (Seismic Undrained)	142	30	0	30	0



Clifty Creek Station	**Slope Stability Analysis – FS = 1.34**
West Boiler Slag Pond	L06_seismic_undrained_high_water Undrained Seismic Stengths (Horizontal Acceleration = 0.0884) Headwater = 462.8 ft, Tailwater = 426.0 ft
Section D - Conveyor System Cross Section (Including Towers)	

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.

Material	Unit Weight (pcf)	*Drained Strength Parameters* Phi (deg.)	Cohesion (psf)	*Seismic Undrained Strength Parameters* Phi (deg.)	Cohesion (psf)
Concrete (Seismic Undrained)	150	33.2	165	13	600
Compacted Clay/Cover (Seismic Undrained)	130	33.2	165	13	600
Boiler Slag (Seismic Undrained)	105	31	0	31	0
Embankment (Seismic Undrained)	130	33.2	165	13	600
Embankment Piles (Seismic Undrained)	142	33.2	165	13	600
Lean Clay with Sand (Seismic Undrained)	119	27.2	160	5	1200
Lean Clay with Sand Piles (Seismic Undrained)	131	27.2	160	5	1200
Sandy Silt (Seismic Undrained)	130	30	0	30	0
Sandy Silt Piles (Seismic Undrained)	142	30	0	30	0



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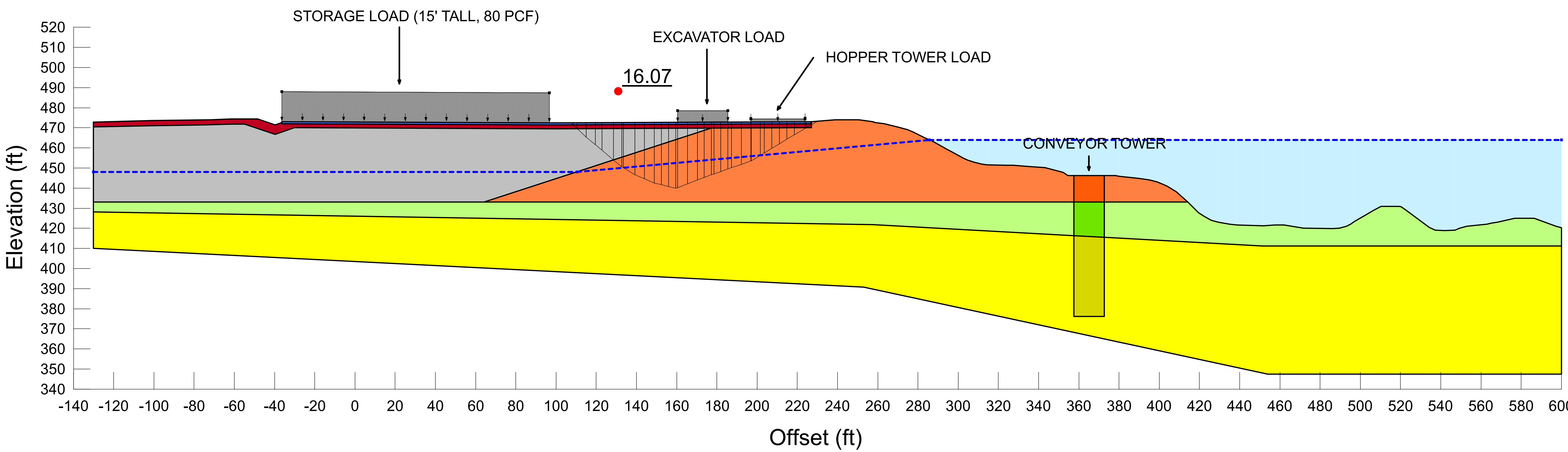
Clifty Creek Station	**Slope Stability Analysis – FS = 16.07**
West Boiler Slag Pond	L01_drained_normal_water_inward Drained Static Stengths Headwater = 448.0 ft, Tailwater = 464.0 ft
Section D - Conveyor System Cross Section (Including Towers)	

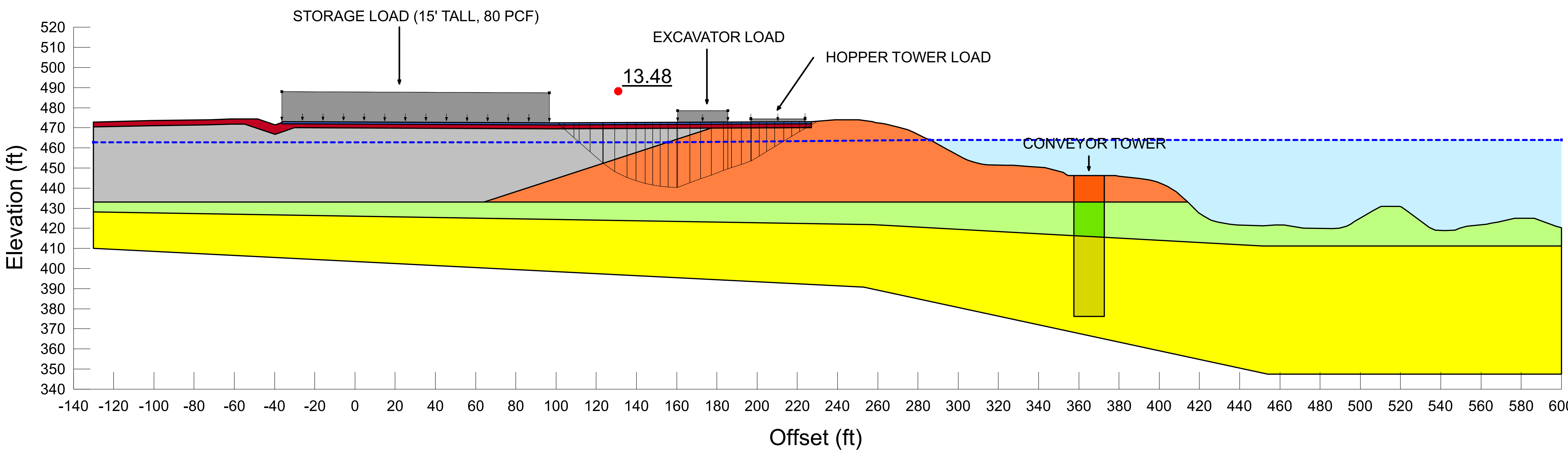
Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.

Material	Unit Weight (pcf)	*Drained Strength Parameters* Phi (deg.)	Cohesion (psf)
Concrete (Drained)	150	33.2	165
Compacted Clay/Cover (Drained)	130	33.2	165
Boiler Slag (Drained)	105	31	0
Embankment (Drained)	130	33.2	165
Embankment Piles (Drained)	142	33.2	165
Lean Clay with Sand (Drained)	119	27.2	160
Lean Clay with Sand Piles (Drained)	131	27.2	160
Sandy Silt (Drained)	130	30	0
Sandy Silt Piles (Drained)	142	30	0



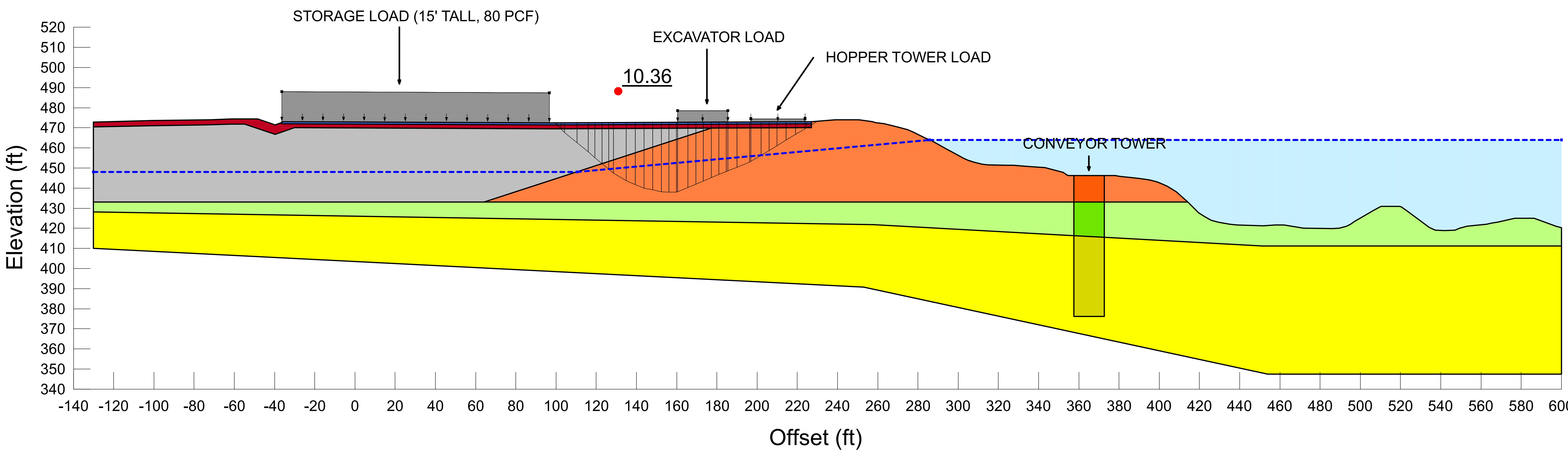
Clifty Creek Station	**Slope Stability Analysis – FS = 13.48**	Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.
West Boiler Slag Pond	L02_drained_high_water_inward Drained Static Stengths Headwater = 462.8 ft, Tailwater = 464.0 ft	
Section D - Conveyor System Cross Section (Including Towers)		

Material	Unit Weight (pcf)	*Drained Strength Parameters* Phi (deg.)	Cohesion (psf)
Concrete (Drained)	150	33.2	165
Compacted Clay/Cover (Drained)	130	33.2	165
Boiler Slag (Drained)	105	31	0
Embankment (Drained)	130	33.2	165
Embankment Piles (Drained)	142	33.2	165
Lean Clay with Sand (Drained)	119	27.2	160
Lean Clay with Sand Piles (Drained)	131	27.2	160
Sandy Silt (Drained)	130	30	0
Sandy Silt Piles (Drained)	142	30	0



Clifty Creek Station	**Slope Stability Analysis – FS = 10.36**	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.
West Boiler Slag Pond	L03_undrained_normal_water_inward Undrained Static Stengths Headwater = 448.0 ft, Tailwater = 464.0 ft	
Section D - Conveyor System Cross Section (Including Towers)		

Material	Unit Weight (pcf)	***Drained Strength Parameters*** Phi (deg.)	Cohesion (psf)	***Undrained Strength Parameters*** Phi (deg.)	Cohesion (psf)
Concrete (Undrained)	150	33.2	165	13	600
Compacted Clay/Cover (Undrained)	130	33.2	165	13	600
Boiler Slag (Undrained)	105	31	0	31	0
Embankment (Undrained)	130	33.2	165	13	600
Embankment Piles (Undrained)	142	33.2	165	13	600
Lean Clay with Sand (Undrained)	119	27.2	160	5	1200
Lean Clay with Sand Piles (Undrained)	131	27.2	160	5	1200
Sandy Silt (Undrained)	130	30	0	30	0
Sandy Silt Piles (Undrained)	142	30	0	30	0



Project No. 175539026

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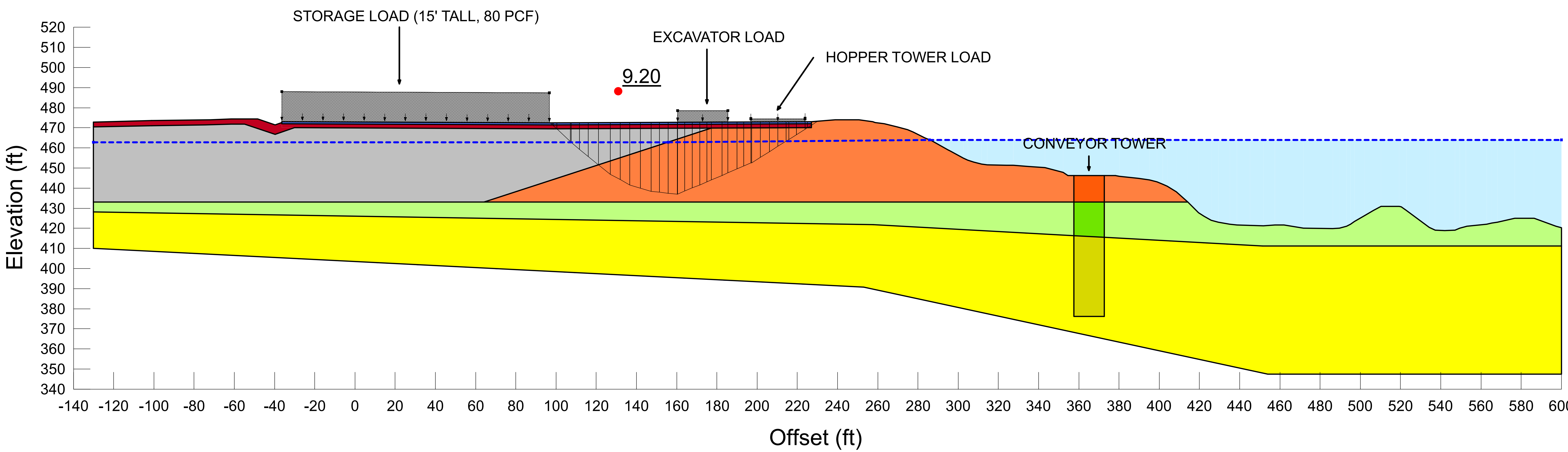
Clifty Creek Station	**Slope Stability Analysis – FS = 9.20**
West Boiler Slag Pond	L04_undrained_high_water_inward Undrained Static Stengths Headwater = 462.8 ft, Tailwater = 464.0 ft
Section D - Conveyor System Cross Section (Including Towers)	

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.

Material	Unit Weight (pcf)	*Drained Strength Parameters* Phi (deg.)	Cohesion (psf)	*Undrained Strength Parameters* Phi (deg.)	Cohesion (psf)
Concrete (Undrained)	150	33.2	165	13	600
Compacted Clay/Cover (Undrained)	130	33.2	165	13	600
Boiler Slag (Undrained)	105	31	0	31	0
Embankment (Undrained)	130	33.2	165	13	600
Embankment Piles (Undrained)	142	33.2	165	13	600
Lean Clay with Sand (Undrained)	119	27.2	160	5	1200
Lean Clay with Sand Piles (Undrained)	131	27.2	160	5	1200
Sandy Silt (Undrained)	130	30	0	30	0
Sandy Silt Piles (Undrained)	142	30	0	30	0



Project No. 175539026

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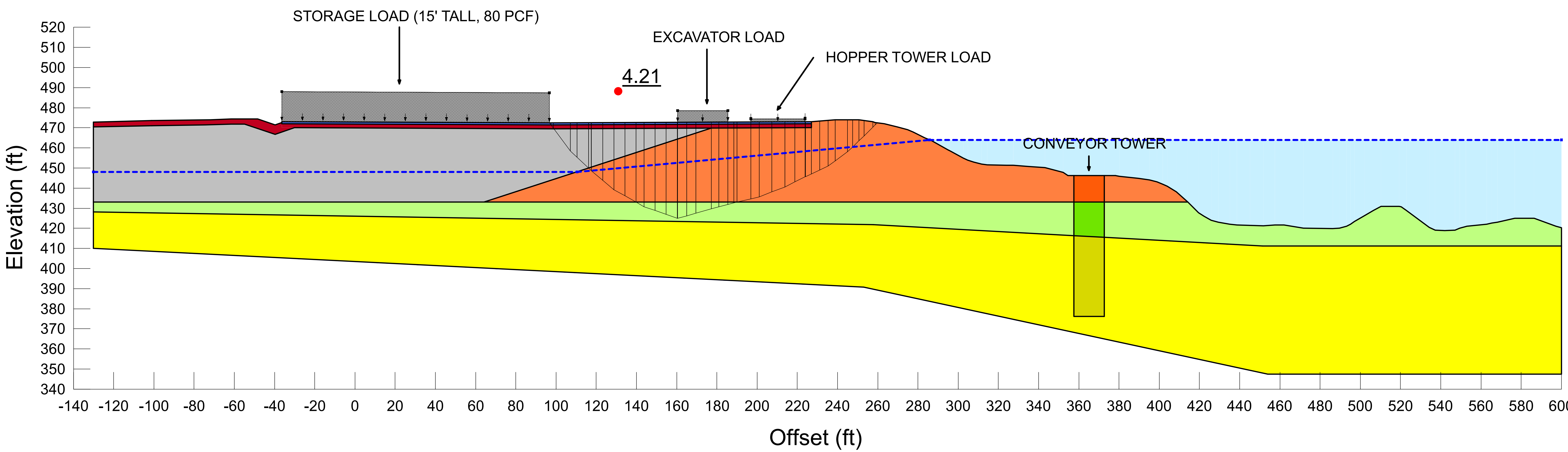
Clifty Creek Station	**Slope Stability Analysis – FS = 4.21**	Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.
West Boiler Slag Pond	L05_seismic_undrained_normal_water_inward Undrained Seismic Stengths (Horizontal Acceleration = 0.0884) Headwater = 448.0 ft, Tailwater = 464.0 ft	
Section D - Conveyor System Cross Section (Including Towers)		

Material	Unit Weight (pcf)	*Drained Strength Parameters* Phi (deg.)	Cohesion (psf)	*Seismic Undrained Strength Parameters* Phi (deg.)	Cohesion (psf)
Concrete (Seismic Undrained)	150	33.2	165	13	600
Compacted Clay/Cover (Seismic Undrained)	130	33.2	165	13	600
Boiler Slag (Seismic Undrained)	105	31	0	31	0
Embankment (Seismic Undrained)	130	33.2	165	13	600
Embankment Piles (Seismic Undrained)	142	33.2	165	13	600
Lean Clay with Sand (Seismic Undrained)	119	27.2	160	5	1200
Lean Clay with Sand Piles (Seismic Undrained)	131	27.2	160	5	1200
Sandy Silt (Seismic Undrained)	130	30	0	30	0
Sandy Silt Piles (Seismic Undrained)	142	30	0	30	0

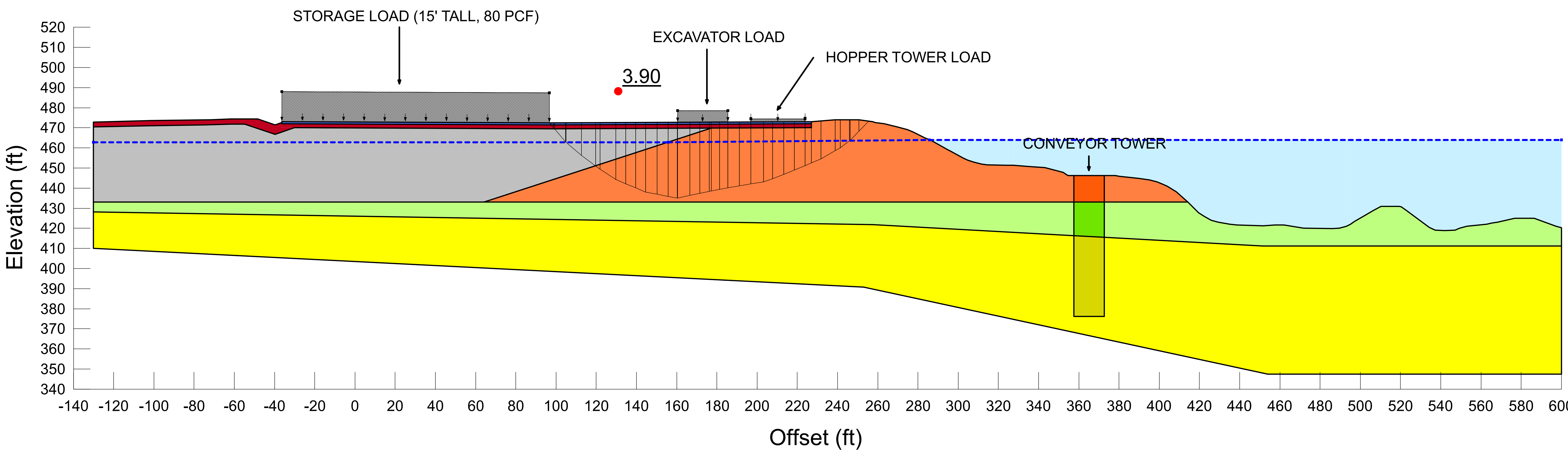


Project No. 175539026

06/30/2020: 02:13:45 PM

Clifty Creek Station	**Slope Stability Analysis – FS = 3.90**	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.
West Boiler Slag Pond	L06_seismic_undrained_high_water_inward Undrained Seismic Stengths (Horizontal Acceleration = 0.0884) Headwater = 462.8 ft, Tailwater = 464.0 ft	
Section D - Conveyor System Cross Section (Including Towers)		

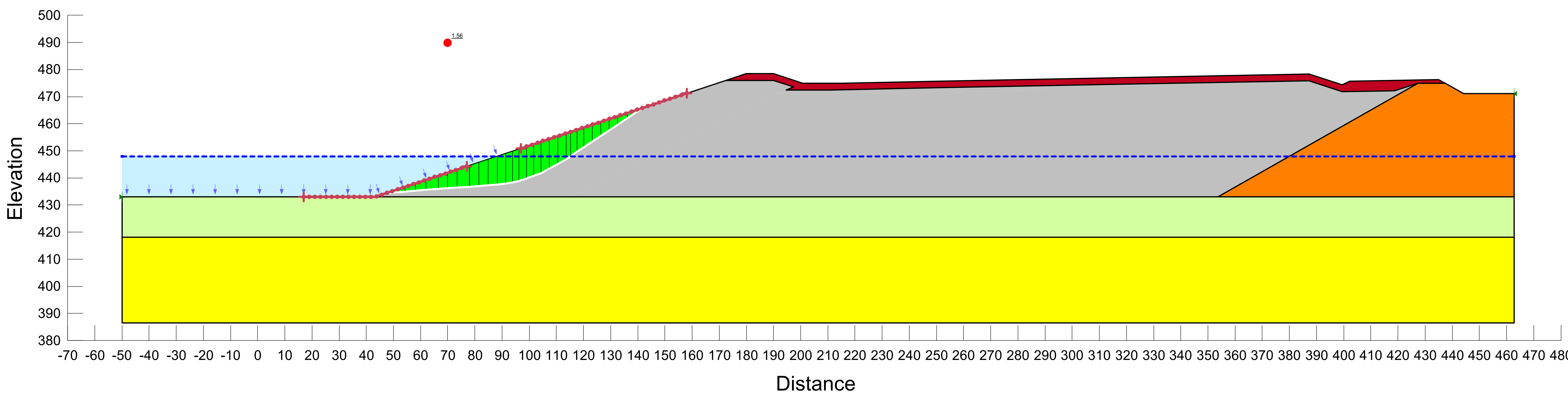
Material	Unit Weight (pcf)	*Drained Strength Parameters* Phi (deg.)	Cohesion (psf)	*Seismic Undrained Strength Parameters* Phi (deg.)	Cohesion (psf)
Concrete (Seismic Undrained)	150	33.2	165	13	600
Compacted Clay/Cover (Seismic Undrained)	130	33.2	165	13	600
Boiler Slag (Seismic Undrained)	105	31	0	31	0
Embankment (Seismic Undrained)	130	33.2	165	13	600
Embankment Piles (Seismic Undrained)	142	33.2	165	13	600
Lean Clay with Sand (Seismic Undrained)	119	27.2	160	5	1200
Lean Clay with Sand Piles (Seismic Undrained)	131	27.2	160	5	1200
Sandy Silt (Seismic Undrained)	130	30	0	30	0
Sandy Silt Piles (Seismic Undrained)	142	30	0	30	0



Section E - Phase 1 Final Cover Summary (3:1 Toe Slope)			
Case #	Case	Water level	Factor of Safety
L01	Drained	Normal	1.56
L02	Drained	High	1.56
L03	Undrained	Normal	1.56
L04	Undrained	High	1.56
L05	Seismic Undrained	Normal	1.03
L06	Seismic Undrained	High	1.02

Clifty Creek Station	**Slope Stability Analysis – FS = 1.56**	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.
West Boiler Slag Pond	L01_drained_normal_water Drained Static Strengths Water Level = 448.0 ft	
Section E - Phase 1 Final Cover		

Material	Unit Weight (pcf)	Cohesion (psf)	Phi (deg)
Boiler Slag (Drained)	105	0	31
Compacted Clay/Cover (Drained)	130	165	33.2
Embankment (Drained)	130	165	33.2
Lean Clay with Sand (Drained)	119	160	27.2
Sandy Silt (Drained)	130	0	30

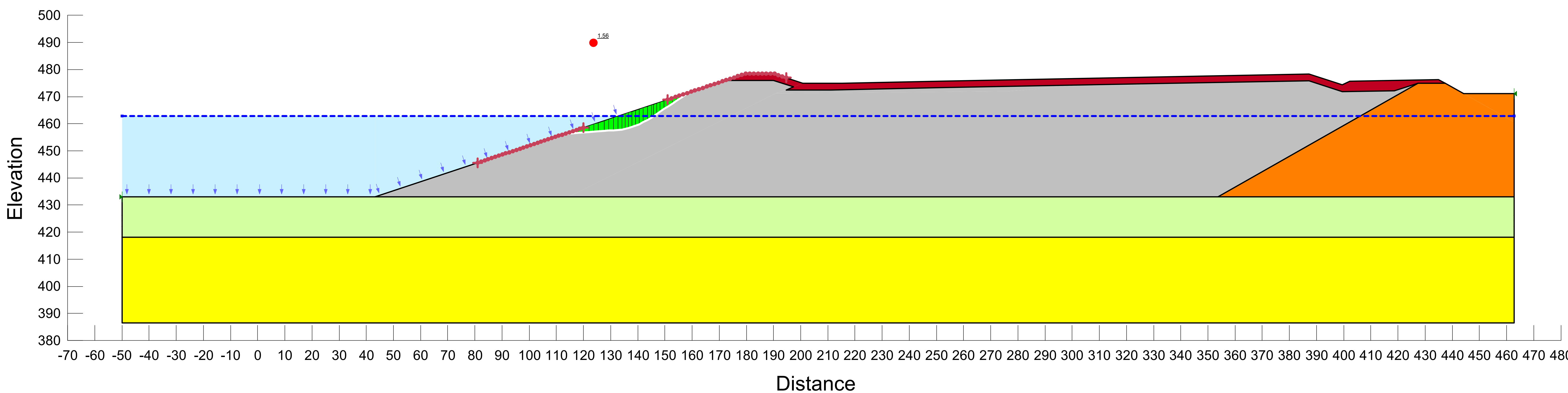


Project No. 175539026

06/30/2020: 01:54:50 PM

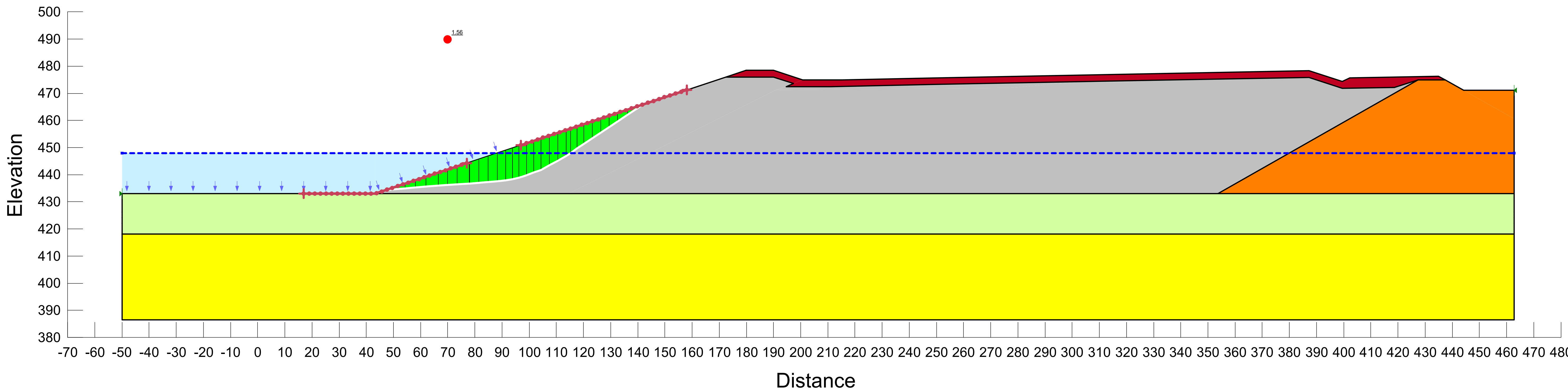
Clifty Creek Station	**Slope Stability Analysis – FS = 1.56**	Note: The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions.
West Boiler Slag Pond	L02_drained_high_water Drained Static Strengths Water Level = 462.8 ft	
Section E - Phase 1 Final Cover		

Material	Unit Weight (pcf)	Cohesion (psf)	Phi (deg)
Boiler Slag (Drained)	105	0	31
Compacted Clay/Cover (Drained)	130	165	33.2
Embankment (Drained)	130	165	33.2
Lean Clay with Sand (Drained)	119	160	27.2
Sandy Silt (Drained)	130	0	30



Clifty Creek Station	**Slope Stability Analysis – FS = 1.56**	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.
West Boiler Slag Pond	L03_undrained_normal_water Drained Static Strengths Water Level = 448.0 ft	
Section E - Phase 1 Final Cover		

Material	Unit Weight (pcf)	Cohesion (psf)	Phi 1 (deg)	Phi 2 (deg)	Normal (psf)
Boiler Slag (Undrained)	105	0	31	31	0
Compacted Clay/Cover (Undrained)	130	165	33.2	13	1,027
Embankment (Undrained)	130	165	33.2	13	1,027
Lean Clay with Sand (Undrained)	119	160	27.2	5	2,439
Sandy Silt (Undrained)	130	0	30	30	0

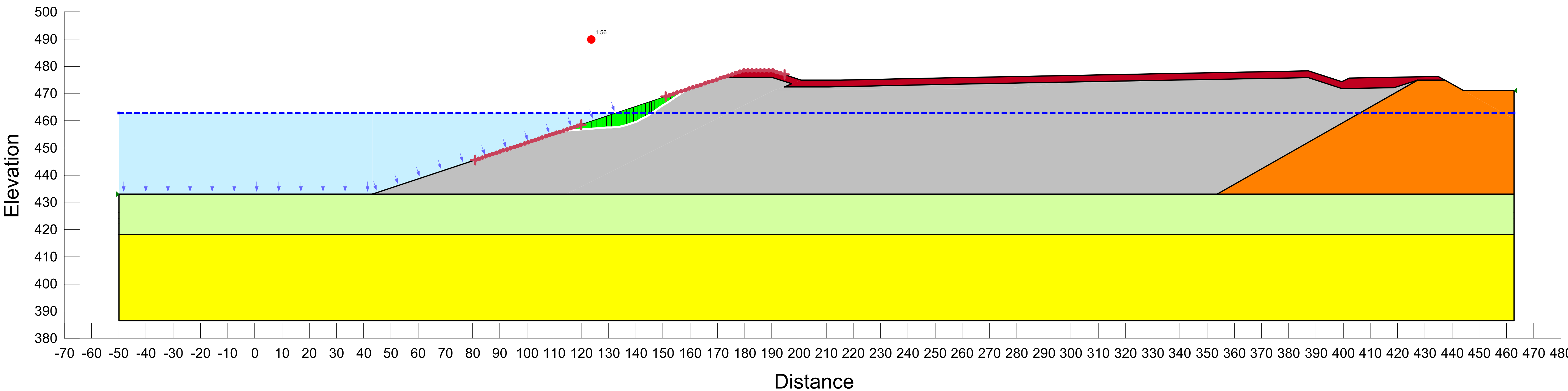


Project No. 175539026

06/30/2020: 01:54:50 PM

Clifty Creek Station	**Slope Stability Analysis – FS = 1.56**	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.
West Boiler Slag Pond	L04_undrained_high_water Drained Static Strengths Water Level = 462.8 ft	
Section E - Phase 1 Final Cover		

Material	Unit Weight (pcf)	Cohesion (psf)	Phi 1 (deg)	Phi 2 (deg)	Normal (psf)
Boiler Slag (Undrained)	105	0	31	31	0
Compacted Clay/Cover (Undrained)	130	165	33.2	13	1,027
Embankment (Undrained)	130	165	33.2	13	1,027
Lean Clay with Sand (Undrained)	119	160	27.2	5	2,439
Sandy Silt (Undrained)	130	0	30	30	0

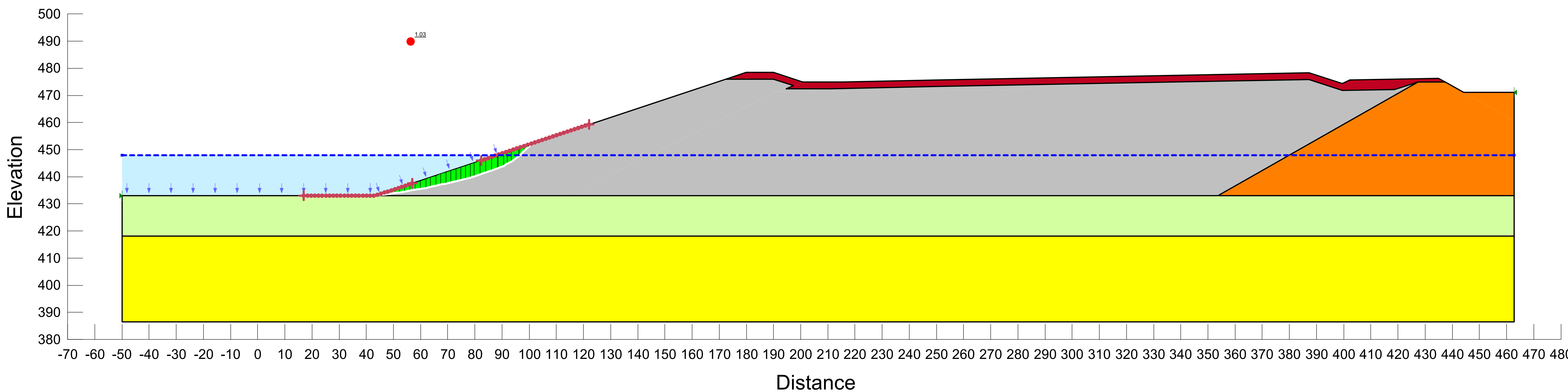


Project No. 175539026

06/30/2020: 01:54:50 PM

Clifty Creek Station	**Slope Stability Analysis – FS = 1.03**	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.
West Boiler Slag Pond	L05_seismic_undrained_normal_water Drained Static Strengths Water Level = 448.0 ft	
Section E - Phase 1 Final Cover		

	Material	Unit Weight (pcf)	Cohesion (psf)	Phi 1 (deg)	Phi 2 (deg)	Normal (psf)
	Boiler Slag (Seismic Undrained)	105	0	31	31	0
	Compacted Clay/Cover (Seismic Undrained)	130	165	33.2	13	1,027
	Embankment (Seismic Undrained)	130	165	33.2	13	1,027
	Lean Clay with Sand (Seismic Undrained)	119	160	27.2	5	2,439
	Sandy Silt (Seismic Undrained)	130	0	30	30	0

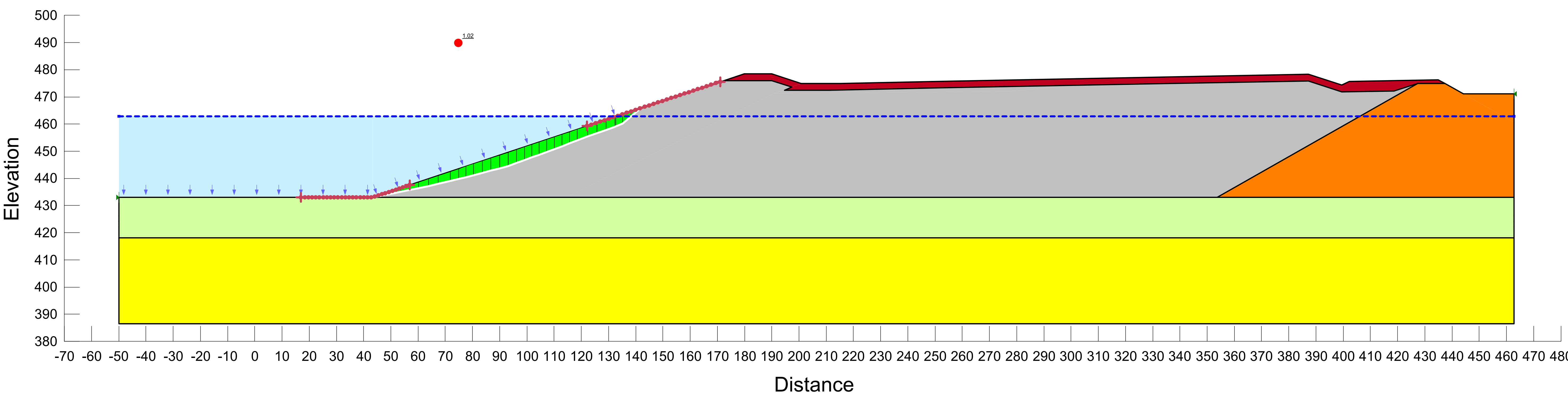


Project No. 175539026

06/30/2020: 01:54:50 PM

Clifty Creek Station	**Slope Stability Analysis – FS = 1.02**	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.
West Boiler Slag Pond	L06_seismic_undrained_high_water Drained Static Strengths Water Level = 462.8 ft	
Section E - Phase 1 Final Cover		

Material	Unit Weight (pcf)	Cohesion (psf)	Phi 1 (deg)	Phi 2 (deg)	Normal (psf)
Boiler Slag (Seismic Undrained)	105	0	31	31	0
Compacted Clay/Cover (Seismic Undrained)	130	165	33.2	13	1,027
Embankment (Seismic Undrained)	130	165	33.2	13	1,027
Lean Clay with Sand (Seismic Undrained)	119	160	27.2	5	2,439
Sandy Silt (Seismic Undrained)	130	0	30	30	0



ATTACHMENT G

WBSP Hydrogeology Evaluation

(AGES, 2020)

Evaluation of Hydrogeology at the West Boiler Slag Pond
Clifty Creek Station
February 2020

As requested by the Indiana-Kentucky Electric Corporation (IKEC), AGES has prepared this summary of hydrogeologic conditions at the West Boiler Slag Pond (WBSP) at the Clifty Creek Station in Madison, Indiana. To comply with the Coal Combustion Residual (CCR) regulation, a total of 10 monitoring wells were installed and developed at the WBSP in November/December 2015, including three (3) background wells (WBSP-15-01, WBSP-15-02 and WBSP-15-03) and seven (7) downgradient wells (WBSP-15-04 through WBSP-15-10) (Figure 1). Boring and construction logs for the wells are included in Attachment A. Since 2016, routine water level measurements have been collected from all 10 wells at the WBSP under the CCR Program.

Summary of Site Geology

Based on information acquired during the investigative work described above, it was determined the WBSP is underlain by alluvial deposits consisting of layers of silty clay, sandy silt and silty sand ranging from approximately 18 feet below ground surface (bgs) on the northwest side of the WBSP to at least 90 feet bgs on the southeast side of the WBSP (closest to the Ohio River). Three (3) cross-sections through the WBSP (Figures 2 through 4) were developed using data from the site. The locations of the cross-sections are shown on Figure 1.

As shown on Figures 2 through 4, the WBSP is surrounded by a clay dike and is underlain a continuous silty clay layer present immediately beneath the bottom of WBSP, which is encountered at an approximate elevation of 433 feet mean sea level (msl). The silty clay layer extends downward to elevations ranging from 425 feet msl (8 feet below the bottom of the WBSP) to 413 feet msl (20 feet below the bottom of the WBSP). Below the continuous silty clay layer, a layer of silt with fine sand that is gray to brown in color is encountered. The silt with fine sand overlays another layer of silty clay that extends downward to the limestone bedrock.

Based on permeability testing conducted by Stantec Consulting Services, Inc. (Stantec), the hydraulic conductivity of the continuous silty clay underlying the WBSP is extremely low, ranging on the order of 10^{-9} centimeters per second (cm/sec) to 10^{-6} cm/sec. The mean hydraulic conductivity of the silt with fine sand is 1.4×10^{-2} cm/sec based on slug testing conducted during the CCR program.

Designation of Uppermost Aquifer

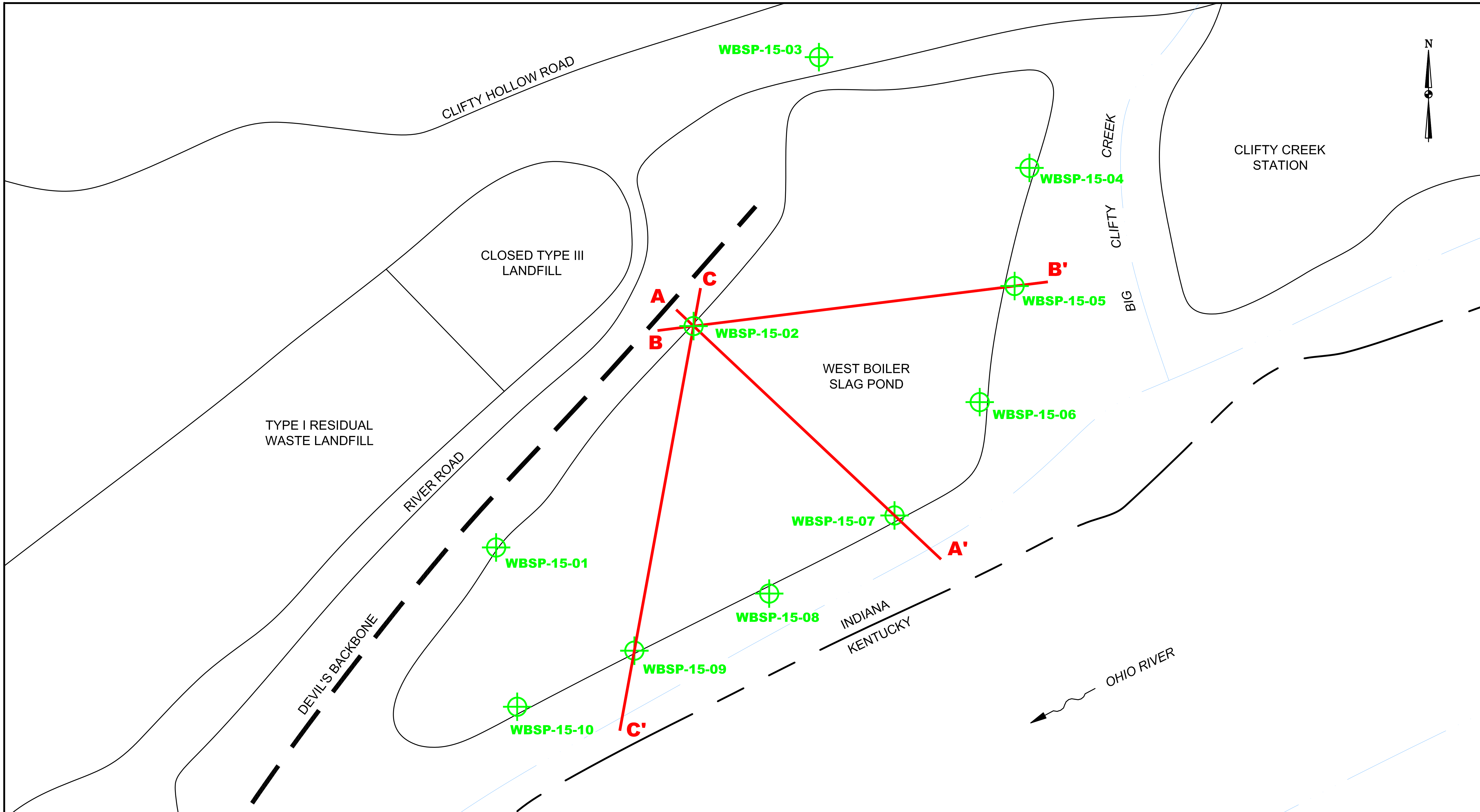
The Indiana Department of Environmental Management (IDEM) defines an aquifer as a "natural underground layer, often of sand or gravel that has the ability to receive, store, and transmit water." Based on its thickness and permeability, the silt with fine sand is the uppermost unit that meets this definition; this unit has therefore been designated as the uppermost aquifer at the WBSP. This uppermost aquifer (silt with fine sand) is separated from the bottom of the WBSP by 8 to 20 feet of a relatively impermeable silty clay, which acts as an aquitard that hydraulically separates the bottom of the WBSP from the uppermost aquifer.

Groundwater Flow at the WBSP

A summary of groundwater levels from wells at the WBSP collected from 2016 through 2019 is included in Table 1. Groundwater flow maps for March and October 2019 are presented in Figures 5 and 6. Background wells WBSP-15-01, WBSP-15-02 and WBSP-15-03 were installed to obtain background groundwater quality. Due to the presence of the large limestone ridge east of the WBSP (the Devil's Backbone), these wells are screened approximately 20 to over 40 feet above the uppermost aquifer. Groundwater elevation data from these wells was therefore not used directly in the development of groundwater flow directions for the site. The Ohio River is locked with extensive flood control measures in place. Although the river elevation can vary, the typical pool elevation for the river is 420 feet msl based on public records.

As shown in Figures 5 and 6, groundwater in the uppermost aquifer at the site typically flows toward the southeast, eventually discharging to the Ohio River. The uppermost aquifer (silt with fine sand) is under confined conditions, with the overlying silty clay acting as the confining layer. This is evidenced by the potentiometric surface of groundwater in the unit, which is above the top of the uppermost aquifer.

FIGURES



LEGEND:

MONITORING WELL LOCATION

400' 0' 400' 800'

SCALE: 1"= 400'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2019195–CLIFTY
DWG FILE	2019195_IKEC_Clifty_MW Locs_WBSP.dwg
DRAWING SCALE	AS SHOWN

AGES
Applied Geology And Environmental Science, Inc.

2402 Hookstown Grade Road, Suite 200
Clinton, PA 15026
412.264.6453

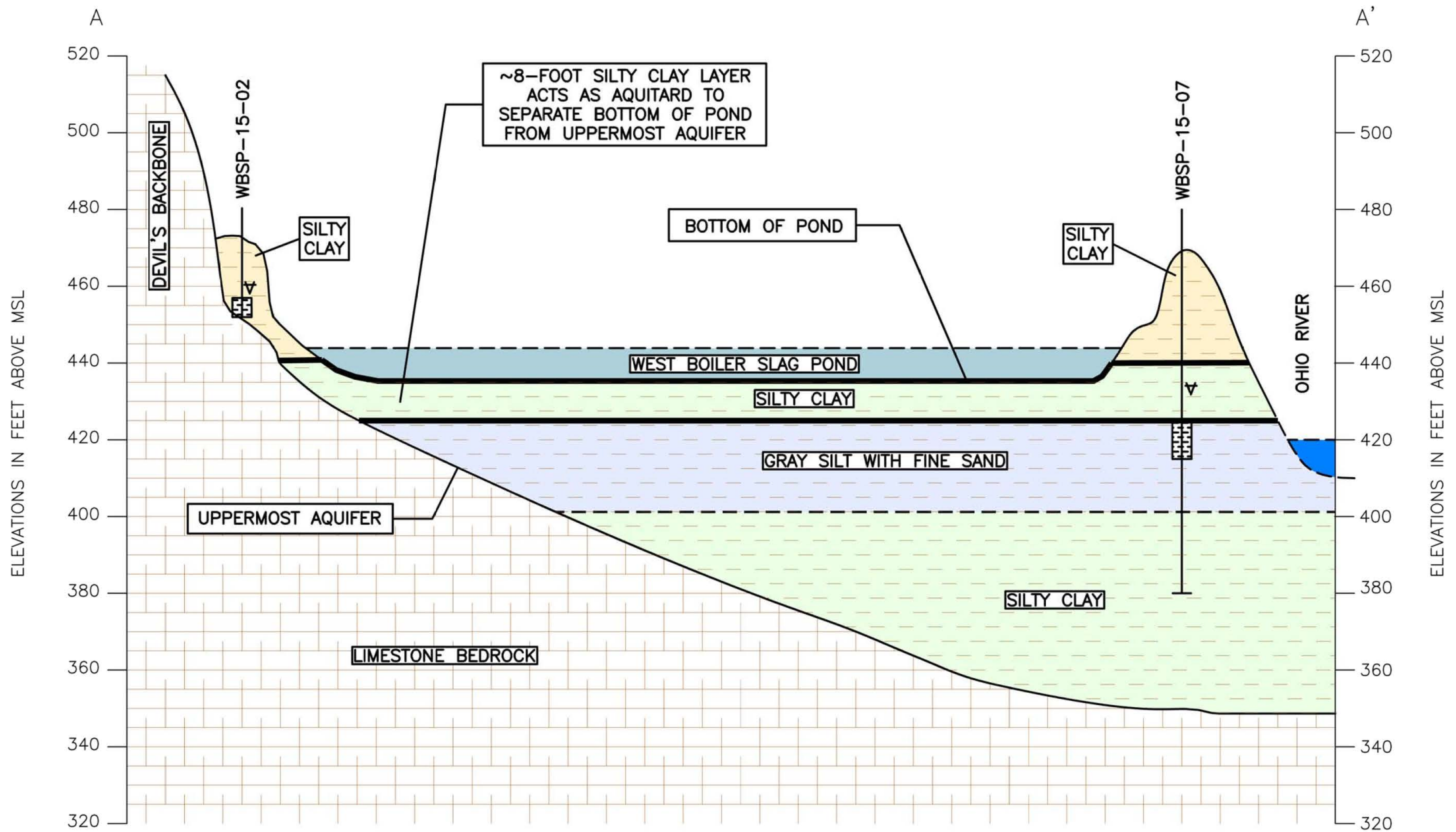
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
MONITORING WELL LOCATION MAP

DRAWING NAME: FIGURE 1

REV.: 0

Plot: 02/10/2020 11:43 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\2019195_WBSP\2019195_IKEC_Clifty_MW Locs_WBSP.dwg



NOTE:

1) CROSS-SECTION LOCATION SHOWN ON FIGURE 1.

2) HORIZONTAL DISTANCE NOT TO SCALE.

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2019195-CLIFTY
DWG FILE	2019195_IKEC_Clifty_WBSP X-Sec A-A'.dwg
DRAWING SCALE	NOT TO SCALE

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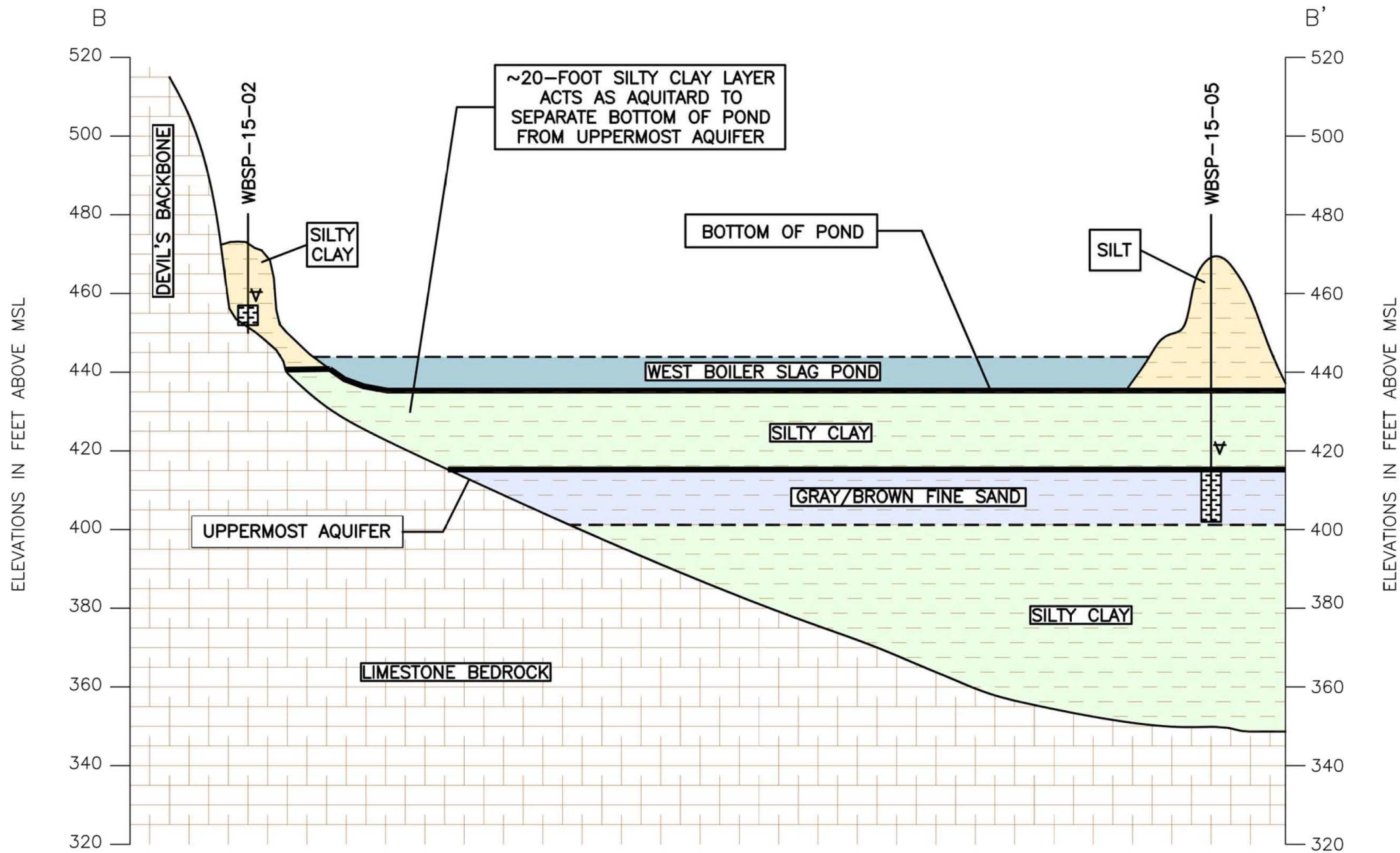
CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GENERALIZED GEOLOGIC CROSS-SECTION A-A'

DRAWING NAME: FIGURE 2 | REV. 0

Plot: 02/10/2020 11:55 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\2019195_WBSP\2019195_IKEC_Clifty_WBSP X-Sec A-A'.dwg



NOTE:
1) CROSS-SECTION LOCATION SHOWN ON FIGURE 1.

2) HORIZONTAL DISTANCE NOT TO SCALE.

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2019195-CLIFTY
DWG FILE	2019195_IKEC_Clifty_WBSP X-Sec B-B'.dwg
DRAWING SCALE	NOT TO SCALE

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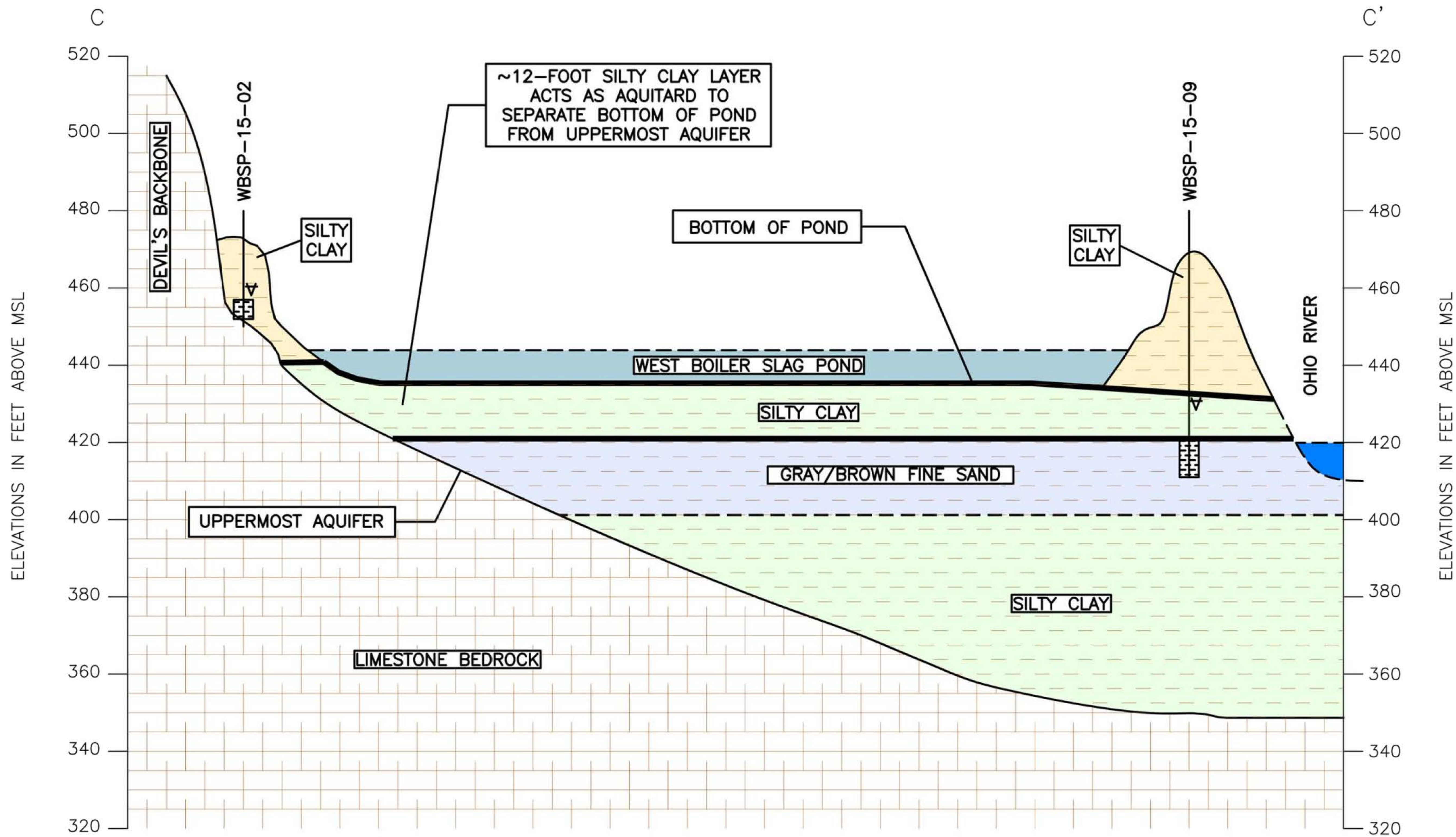
CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GENERALIZED GEOLOGIC CROSS-SECTION B-B'

DRAWING NAME: FIGURE 3

REV. 0

Plot: 02/10/2020 12:14 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\2019195_WBSP\2019195_IKEC_Clifty_WBSP X-Sec B-B'.dwg



NOTE:
1) CROSS-SECTION LOCATION SHOWN ON FIGURE 1.

2) HORIZONTAL DISTANCE NOT TO SCALE.

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2019195-CLIFTY
DWG FILE	2019195_IKEC_Clifty_WBSP X-Sec C-C'.dwg
DRAWING SCALE	NOT TO SCALE

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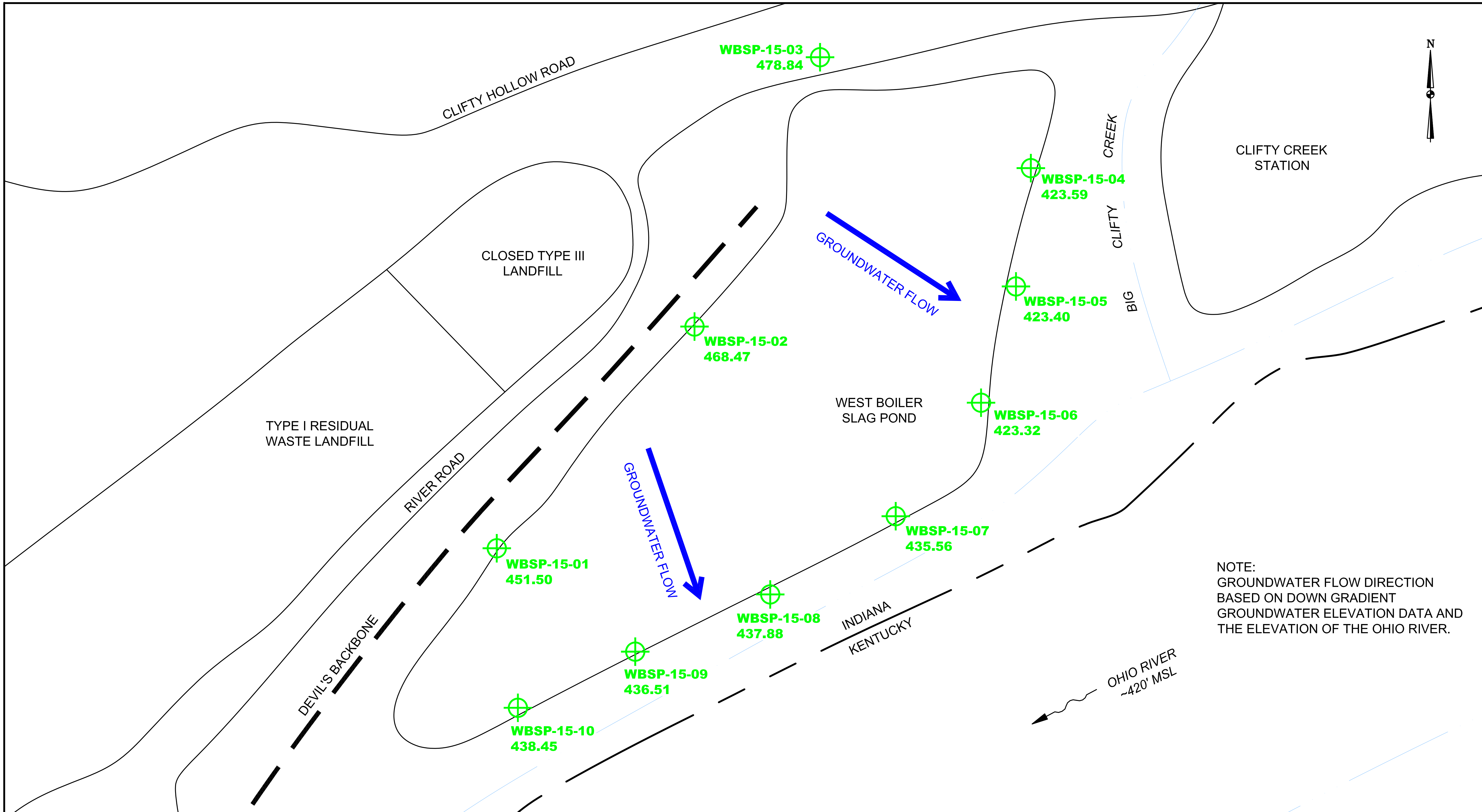
INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GENERALIZED GEOLOGIC CROSS-SECTION C-C'

DRAWING NAME: FIGURE 4
REV. 0

Plot: 02/10/2020 12:30 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\2019195_WBSP\2019195_IKEC_Clifty_WBSP X-Sec C-C'.dwg



NOTE:
GROUNDWATER FLOW DIRECTION BASED ON DOWN GRADIENT GROUNDWATER ELEVATION DATA AND THE ELEVATION OF THE OHIO RIVER.

LEGEND:
- MONITORING WELL LOCATION
- GROUNDWATER FLOW DIRECTION

400' 0' 400' 800'
SCALE: 1"= 400'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2019195–CLIFTY
DWG FILE	2019195_IKEC_Clifty_WBSP GW Flow_MAR19_WBSP.dwg
DRAWING SCALE	AS SHOWN

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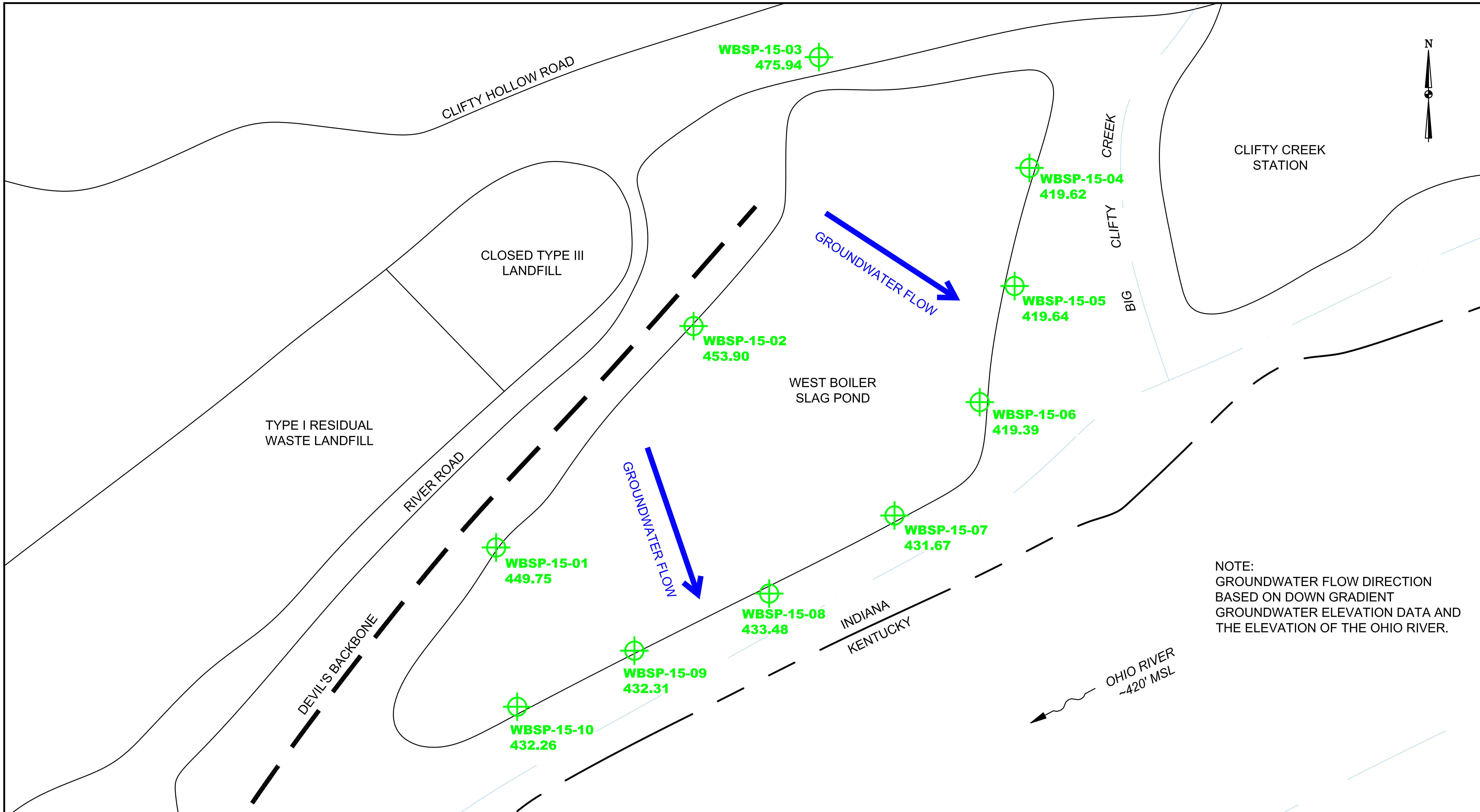
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GROUNDWATER LEVELS AND FLOW DIRECTION
MARCH 2019

DRAWING NAME: FIGURE 5
REV. 0

Plot: 01/20/2020 15:13 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\2019195_WBSP\2019195_IKEC_Clifty_WBSP GW Flow_MAR19_WBSP.dwg\MAR19



LEGEND:

MONITORING WELL LOCATION

GROUNDWATER FLOW DIRECTION

400' 0' 400' 800'

SCALE: 1"= 400'

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	2019195–CLIFTY
DWG FILE	2019195_IKEC_Clifty_WBSP GW Flow_OCT19_WBSP.dwg
DRAWING SCALE	AS SHOWN

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INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GROUNDWATER LEVELS AND FLOW DIRECTION
OCTOBER 2019

DRAWING NAME: FIGURE 6

REV. 0

Plot: 01/20/2020 15:16 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\2019195_WBSP\2019195_IKEC_Clifty_WBSP GW Flow_OCT19_WBSP.dwg\OCT19

TABLE 1

Groundwater Elevations
West Boiler Slag Pond
2016-2019

Monitoring Well Designation	Jan-16 Groundwater Elevation (ft)	Mar-16 Groundwater Elevation (ft)	May-16 Groundwater Elevation (ft)	Jul-16 Groundwater Elevation (ft)	Aug-16 Groundwater Elevation (ft)	Nov-16 Groundwater Elevation (ft)	Feb-17 Groundwater Elevation (ft)	Jun-17 Groundwater Elevation (ft)	Aug-17 Groundwater Elevation (ft)	Mar-18 Groundwater Elevation (ft)	Oct-18 Groundwater Elevation (ft)	Mar-19 Groundwater Elevation (ft)	Jun-19 Groundwater Elevation (ft)	Oct-19 Groundwater Elevation (ft)
WBSP-15-01	451.72	453.01	453.27	449.97	450.26	449.72	450.90	450.64	449.88	469.36	450.21	451.50	455.00	449.75
WBSP-15-02	468.31	472.52	471.52	457.52	462.38	454.37	462.67	462.60	455.24	476.76	459.58	468.47	470.10	453.90
WBSP-15-03	477.03	477.11	477.62	476.00	477.04	474.52	477.06	476.33	474.83	488.03	476.91	478.84	480.65	475.94
WBSP-15-04	429.22	436.25	424.96	420.14	420.57	420.19	422.41	420.57	419.90	473.71	424.69	423.59	433.47	419.62
WBSP-15-05	428.95	436.12	424.84	417.06	420.46	420.09	422.29	420.44	419.75	474.42	424.52	423.40	433.46	419.64
WBSP-15-06	428.82	436.06	424.77	419.96	420.40	420.06	422.28	420.39	419.68	473.51	424.52	423.32	433.21	419.39
WBSP-15-07	429.72	430.41	430.88	431.07	430.49	428.99	428.53	430.53	430.42	471.31	431.85	435.56	442.61	431.67
WBSP-15-08	434.03	434.62	434.81	434.53	433.99	433.55	433.57	434.48	434.47	471.06	435.37	437.88	444.42	433.48
WBSP-15-09	432.17	430.39	432.21	427.79	430.33	429.38	432.53	432.08	432.59	470.69	432.67	436.51	443.25	432.31
WBSP-15-10	431.41	433.28	432.58	431.95	432.19	431.59	432.25	432.61	431.94	470.69	432.46	438.45	443.20	432.26

ATTACHMENT A

BORING NO. _____WBSP-15-01_
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/30/15	AGES Geologist:	Mike 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:	18’	Surface Elevation:	466.93’ MSL		

NOTES/COMMENTS:

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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-01

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/30/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Submersible Pump, Peristaltic Pump, Bailer
Field parameters stabilized.
Turbidity = 3.12 NTUs

Volume Purged: 33 gallons

Static Water-Level*: 16.76’

Top of Well Casing Elevation: 469.36’

Well Purpose:
Groundwater Monitoring
Northing (Y): 449072.27
Easting (X): 566322.12

Comments/Notes:
2 inch PVC riser and screen
10 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

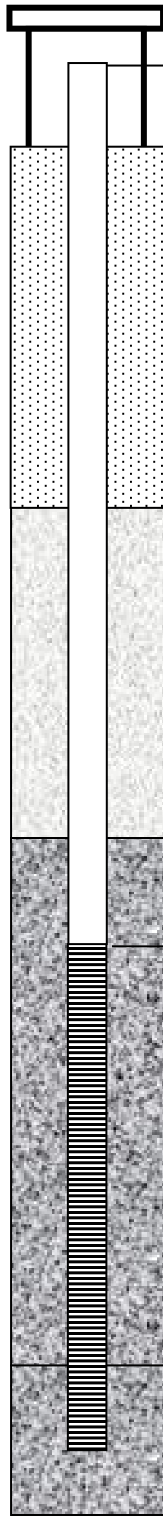
CONSTRUCTION MATERIALS USED:

4 Bags of Sand

2 Bags/Buckets Bentonite Pellets

______ Bags Portland for Grout

______ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 469.36 ft.
Stick-up: 2.43 ft.

Land Surface Elevation: 466.93 ft.

Grout; Type: Potland cement/Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 6 ft*

Top of Well Screen 8 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 18 ft.*

Base of Borehole: 18 ft.*

Total Depth of Well Below Top of Casing: 20.43 ft.

*Indicates Depth Below Land Surface

BORING NO. WBSP-15-02
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/11/15	AGES Geologist:	Mike 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:	21’	Surface Elevation:	473.83’ MSL

NOTES/COMMENTS:

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, boiler slag, loose, moist	N/A
10-20	8	NA	10’-11’ Red brown silt, fine sand, 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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-02

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/11/15

Drilling Method: Roto-Sonic

Drilling Contractor: Bowser Morner

Development Date(s): 12/7/15

Development Method: Submersible Pump, Peristaltic Pump, Bailer

Field parameters stabilized.

Turbidity = 3.69 NTUs

Volume Purged: 114.5 gallons

Static Water-Level* 15.40'

Top of Well Casing Elevation: 476.76'

Well Purpose:

Groundwater Monitoring

Northing (Y): 449803.91

Easting (X): 566987.30

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.

Inspector: Michael Gelles

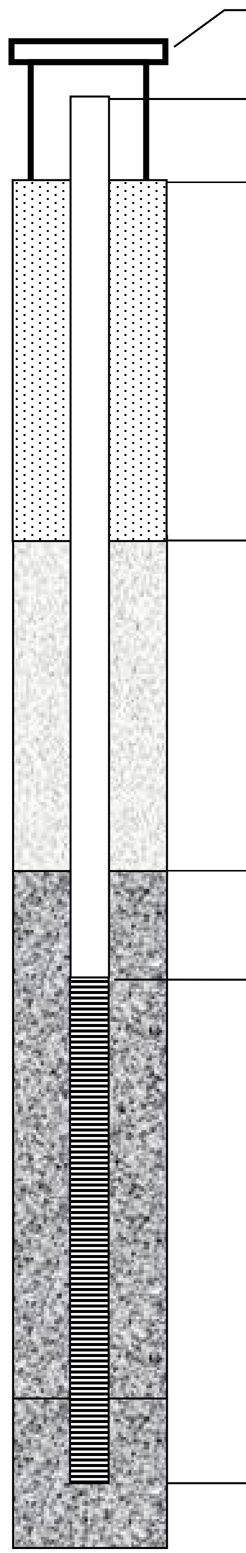
CONSTRUCTION MATERIALS USED:

3 Bags of Sand

4 Bags/Buckets Bentonite Pellets

______ Bags Portland for Grout

______ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 476.76 ft.

Stick-up: 2.93 ft.

Land Surface Elevation: 473.83 ft.

Grout; Type: Portland cement/Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch

Casing Material: PVC

Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 14 ft*

Top of Well Screen 16 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch

Screen Slot-Size: 0.010 Inch

Screen Material: PVC

Bottom of Well Screen 21 ft.*

Base of Borehole: 21 ft.*

Total Depth of Well Below Top of Casing: 23.93 ft.

*Indicates Depth Below Land Surface

BORING NO. WBSP-15-03
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	12/4/15	AGES Geologist:	Mike 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:	18’	Surface Elevation:	484.91’ MSL

NOTES/COMMENTS:

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, limestone fragments, stiff, plastic, moist; 13’-18’ Gray, limestone, weathered, dry	N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-03

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 12/4/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/15/15

Development Method: Submersible Pump, Peristaltic Pump, Bailer
Field parameters stabilized.
Turbidity = 2.42 NTUs

Volume Purged: 14.5 gallons

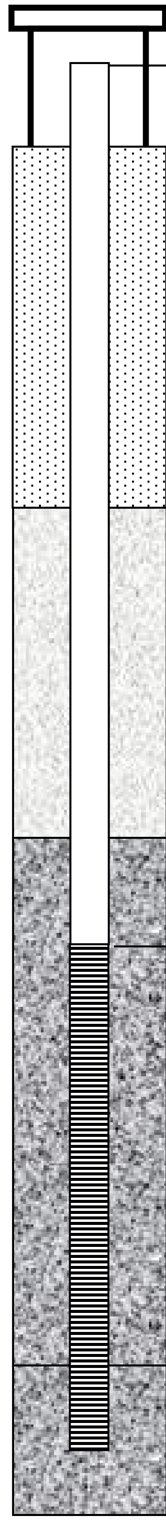
Static Water-Level*: 11.08’

Top of Well Casing Elevation: 488.03’

Well Purpose:
Groundwater Monitoring
Northing (Y): 451181.98
Easting (X): 568093.60

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.

Inspector: Michael Gelles



Protective Casing with Locking Cap

Top of Casing Elevation: 488.03 ft.
Stick-up: 3.12 ft.

Land Surface Elevation: 484.91 ft.

Grout; Type: Portland cement/Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 6 ft*

Top of Well Screen 8 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 13 ft.*

Base of Borehole: 18 ft.*

Total Depth of Well Below Top of Casing: 16.12 ft.

*Indicates Depth Below Land Surface

CONSTRUCTION MATERIALS USED:

3 Bags of Sand

4 Bags/Buckets Bentonite Pellets

______ Bags Portland for Grout

______ Bags Concrete/Sakrete

BORING NO. _ ____WBSP-15-04 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/11/15-11/12/15	AGES Geologist:	Mike 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 Elevation:	471.17’ MSL

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, 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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-04

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/11/15-11/12/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/9/15

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 0.91 NTUs

Volume Purged: 65 gallons

Static Water-Level* 50.68'

Top of Well Casing Elevation: 473.71'

Well Purpose:
Groundwater Monitoring
Northing (Y): 450610.07
Easting (X): 568637.65

Comments/Notes:
2 inch PVC riser and screen
10 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

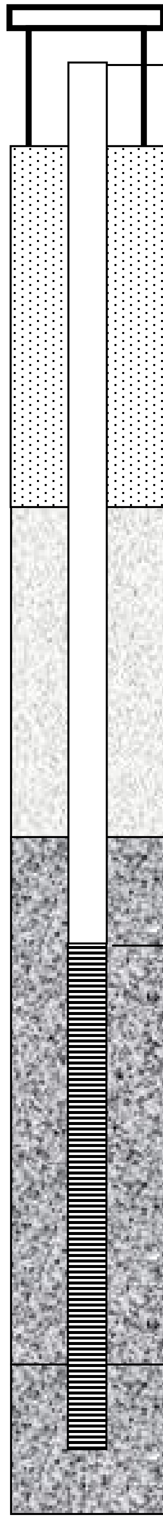
CONSTRUCTION MATERIALS USED:

5 Bags of Sand

2 Bags/Buckets Bentonite Pellets

12 Bags Portland for Grout

___ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 473.71 ft.
Stick-up: 2.54 ft.

Land Surface Elevation: 471.17 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 2 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 53 ft*

Top of Well Screen 55 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 65 ft.*

Base of Borehole: 70 ft.*

Total Depth of Well
Below Top of Casing: 67.54 ft.

*Indicates Depth Below Land Surface

BORING NO. _ ____WBSP-15-05 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/13/15-11/17/15	AGES Geologist:	John Campbell

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:	71’	Surface Elevation:	471.90’ MSL		

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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-05

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/13/15-11/17/15

Drilling Method: Roto-Sonic

Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Submersible Pump

Field parameters stabilized.

Turbidity = 4.28 NTUs

Volume Purged: 46 gallons

Static Water-Level* 52.42’

Top of Well Casing Elevation: 474.42’

Well Purpose:

Groundwater Monitoring

Northing (Y): 450051.40

Easting (X): 568495.72

Comments/Notes:

2 inch PVC riser and screen

10 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: John Campbell

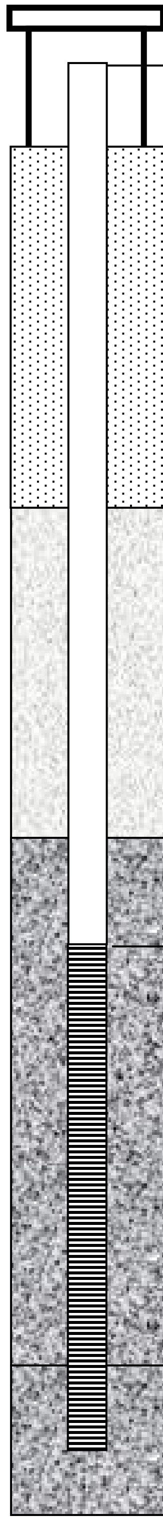
CONSTRUCTION MATERIALS USED:

6 Bags of Sand

2 Bags/Buckets Bentonite Pellets

18 Bags Portland for Grout

___ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 474.42 ft.

Stick-up: 2.52 ft.

Land Surface Elevation: 471.90 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch

Casing Material: PVC

Top of Seal: 55 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 59 ft*

Top of Well Screen 61 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch

Screen Slot-Size: 0.010 Inch

Screen Material: PVC

Bottom of Well Screen 71 ft.*

Base of Borehole: 71 ft.*

Total Depth of Well Below Top of Casing: 73.52 ft.

*Indicates Depth Below Land Surface

BORING NO. _____WBSP-15-06 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/18/15-11/19/15	AGES Geologist:	John Campbell

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/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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-06

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/18/15-11/19/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/9/15

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 3.44 NTUs

Volume Purged: 100 gallons

Static Water-Level* 51.55'

Top of Well Casing Elevation: 473.51'

Well Purpose:
Groundwater Monitoring
Northing (Y): 449470.57
Easting (X): 568402.50

Comments/Notes:
2 inch PVC riser and screen
10 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: John Campbell

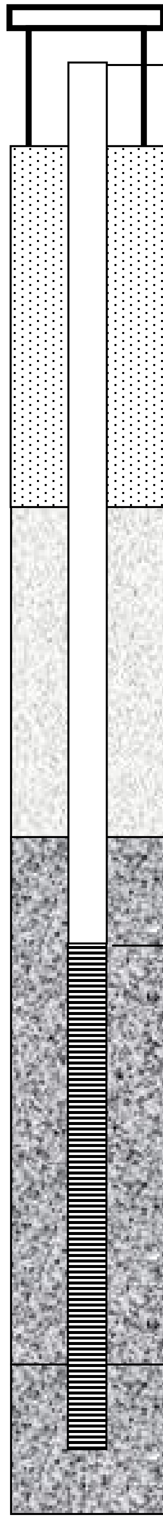
CONSTRUCTION MATERIALS USED:

6 Bags of Sand

2 Bags/Buckets Bentonite Pellets

12 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 473.51 ft.
Stick-up: 2.23 ft.

Land Surface Elevation: 471.28 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 69.5 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 73.5 ft*

Top of Well Screen 75.5 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 85.5 ft.*

Base of Borehole: 85.5 ft.*

Total Depth of Well Below Top of Casing: 87.73 ft.

*Indicates Depth Below Land Surface

BORING NO. _ ____WBSP-15-07 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/20/15-11/23/15	AGES Geologist:	John Campbell

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:	468.82’ MSL		

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
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-07

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/20/15-11/23/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 2.86 NTUs

Volume Purged: 35.5 gallons

Static Water-Level* 41.01’

Top of Well Casing Elevation: 471.31’

Well Purpose:
Groundwater Monitoring
Northing (Y): 448947.93
Easting (X): 567946.39

Comments/Notes:
2 inch PVC riser and screen
10 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: John Campbell

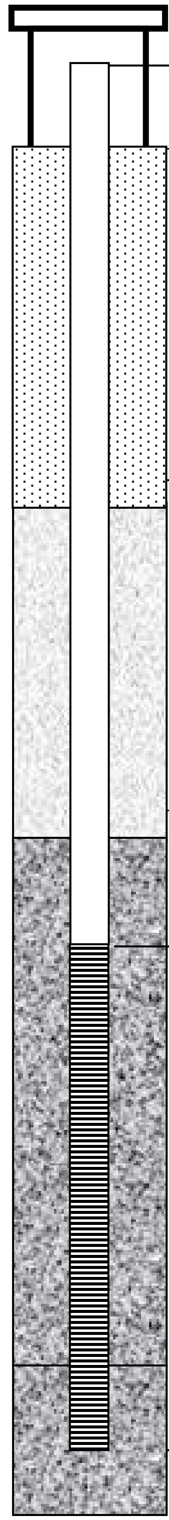
CONSTRUCTION MATERIALS USED:

6 Bags of Sand

14 Bags/Buckets Bentonite Pellets

12 Bags Portland for Grout

______ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 471.31 ft.
Stick-up: 2.49 ft.

Land Surface Elevation: 468.82 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 36 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 40 ft*

Top of Well Screen 42 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 52 ft.*

Base of Borehole: 90 ft.*

Total Depth of Well
Below Top of Casing: 54.49 ft.

*Indicates Depth Below Land Surface

BORING NO. _____WBSP-15-08 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	11/24/15-11/25/15	AGES Geologist:	John Campbell

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/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
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-08

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 11/24/15-11/25/15

Drilling Method: Roto-Sonic
Drilling Contractor: Bowser Morner

Development Date(s): 12/16/15

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 4.96 NTUs

Volume Purged: 89.5 gallons

Static Water-Level* 37.02’

Top of Well Casing Elevation: 471.06’

Well Purpose:
Groundwater Monitoring
Northing (Y): 448625.46
Easting (X): 567343.24

Comments/Notes:
2 inch PVC riser and screen
10 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: John Campbell

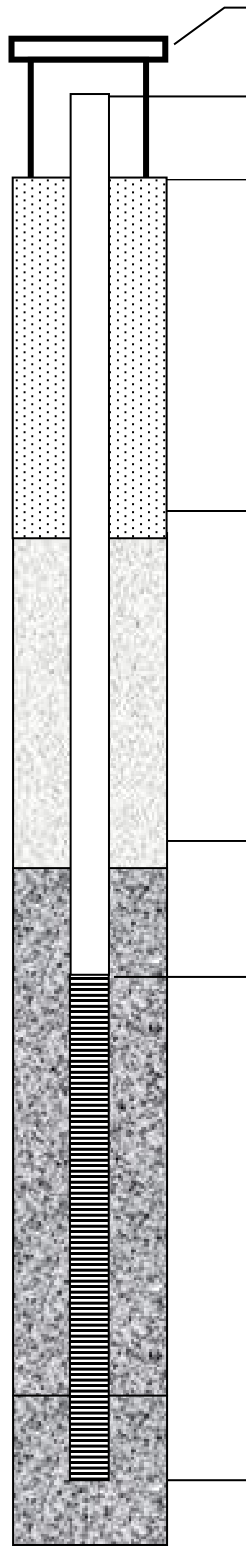
CONSTRUCTION MATERIALS USED:

8 Bags of Sand

4 Bags/Buckets Bentonite Pellets

12 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 471.06 ft.
Stick-up: 2.5 ft.

Land Surface Elevation: 468.56 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 46.5 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 50.5 ft*

Top of Well Screen 52.8 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 62.8 ft.*

Base of Borehole: 80 ft.*

Total Depth of Well
Below Top of Casing: 65.3 ft.

*Indicates Depth Below Land Surface

BORING NO. _ ____WBSP-15-09 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	1/5/16-1/6/16	AGES Geologist:	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:	60’	Surface Elevation:	471.21’ MSL

NOTES/COMMENTS:

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

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-09

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 1/5/16-1/6/16

Drilling Method: Hollow Stem Auger
Drilling Contractor: Bowser Morner

Development Date(s): 1/19/16

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 3.57 NTUs

Volume Purged: 74.5 gallons

Static Water-Level* 38.52'

Top of Well Casing Elevation: 470.69'

Well Purpose:
Groundwater Monitoring
Northing (Y): 448359.31
Easting (X): 566711.13

Comments/Notes:
2 inch PVC riser and screen
10 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

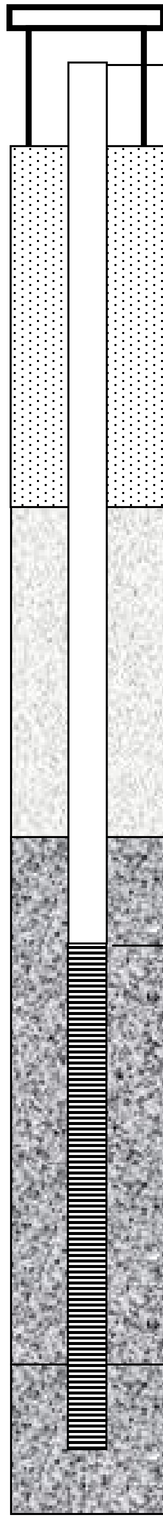
CONSTRUCTION MATERIALS USED:

7 Bags of Sand

2 Bags/Buckets Bentonite Pellets

10 Bags Portland for Grout

Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 470.69 ft.
Stick-up: -0.52 ft.

Land Surface Elevation: 471.21 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 4.25 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 44 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 48 ft*

Top of Well Screen 50 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 60 ft.*

Base of Borehole: 60 ft.*

Total Depth of Well
Below Top of Casing: 59.48 ft.

*Indicates Depth Below Land Surface

BORING NO. _ ____WBSP-15-10 _
SAMPLE/CORE LOG

Project Number:	2015067	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	Bowser Morner
Drilling Date(s):	1/4/16-1/5/16	AGES Geologist:	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/COMMENTS:

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
				N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-15-10

Project Number: 2015067

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 1/4/16-1/5/16

Drilling Method: Hollow Stem Auger
Drilling Contractor: Bowser Morner

Development Date(s): 1/20/16

Development Method: Submersible Pump
Field parameters stabilized.
Turbidity = 3.59 NTUs

Volume Purged: 58.5 gallons

Static Water-Level* 39.28'

Top of Well Casing Elevation: 470.69'

Well Purpose:
Groundwater Monitoring
Northing (Y): 448125.51
Easting (X): 566225.21

Comments/Notes:
2 inch PVC riser and screen
10 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

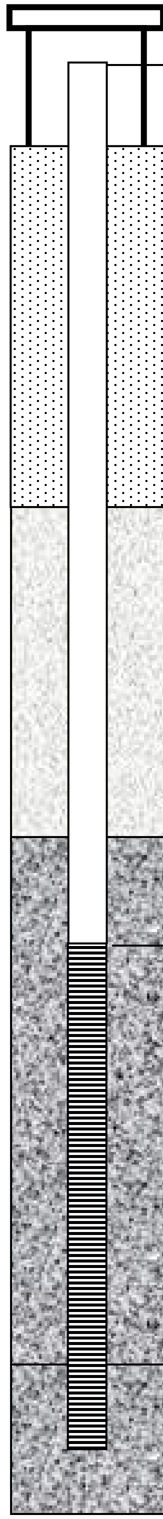
CONSTRUCTION MATERIALS USED:

8.5 Bags of Sand

2 Bags/Buckets Bentonite Pellets

10 Bags Portland for Grout

____ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 470.69 ft.
Stick-up: -0.52 ft.

Land Surface Elevation: 471.21 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 4.25 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 40 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 44 ft*

Top of Well Screen 46 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch
Screen Slot-Size: 0.010 Inch
Screen Material: PVC

Bottom of Well Screen 56 ft.*

Base of Borehole: 56 ft.*

Total Depth of Well
Below Top of Casing: 55.48 ft.

*Indicates Depth Below Land Surface

ATTACHMENT H

Closure-Post Closure Cost Estimate

(rev. 1)

Opinion of Closure Costs
West Boiler Slag Pond
Clifty Creek Plant
Indiana-Kentucky Electric Corporation
Madison, Jefferson County, Indiana

Facility Name:	**Clifty Creek West Boiler Slag Pond**	
Facility Location:	**Madison, Indiana**	
Facility County:	**Jefferson**	
Total Waste Fill Acreage:	**89.6**	**Acres**
Total Grading Acreage:	**93.9**	**Acres**
Closure Year:	**2020-2023**	
Phase 1 Acreage for Closure	**9.2**	**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 close the facility. For items that will vary depending upon the number of acres to be closed, the quantities should be indicated on a per-acre basis.

A. Item	B. Quantity	C. Units (per acre)
Geosynthetic materials (geomembrane, geotextile, geocomposite drainage layer)	89.6	$ 88,761.60
Uncompacted 30-inch soil layer	89.6	$ 35,717.53
6-inch vegetative soil layer	89.6	$ 12,524.64
Vegetative cover	89.6	$ 3,288.19
Surveying	89.6	$ 850.00
Engineering certification	89.6	$ 1,392.86
Additional items	lump sump	$ 306,100.00
Deed notation	lump sump	$ 10,000.00

V. COST PER ACRE FOR FINAL COVER & VEGETATION

A. What Percent of Final Cover and Topsoil is Available from Areas that are Controlled, and will be Controlled through Post-Closure, by the Permittee?

1. % of final cover:	0%
2. Describe location of sources:	Offsite borrow sources are being assessed.
3. % of topsoil:	0%
4. Describe the location of sources:	Offsite borrow sources are being assessed.

B. Cost per Acre for Acquisition and Placement of 30-inch Soil Layer

1. Acquisition		
a. Quantity of soil needed per acre (cubic yard (yd^3)/acre)	4,033	
b. Excavation unit cost ($/$yd^3$) (if obtained onsite)	N/A	
c. Purchase unit cost ($/$yd^3$) (if obtained offsite)	$ 0.50	
d. Delivery unit cost ($/$yd^3$) (if obtained offsite)	$ 5.50	
e. Acquisition cost ($/acre)	$ 24,198.00	[1a * (1c+1d)]
2. Placement and Compaction		
a. Placement/spreading unit cost	$ 2.41	
b. Compaction unit cost ($/$yd^3$)	$ -	
c. Placement and compaction cost ($/acre)	$ 9,719.53	[1a * (2a+2b)]
3. Testing		
a. Soil classification (if soil source is of variable quality) ($/acre)	$ 500.00	
b. Survey control for cover thickness and proper slopes ($/acre)	$ 1,300.00	
c. Density testing (if planned) ($/acre)	N/A	
d. Testing cost ($/acre)	$ 1,800.00	
4. TOTAL COST, SOIL COVER ($/acre)	**$ 35,717.53**	[1e + 2c + 3d]

C. Cost per Acre for Acquisition and Placement of Geosynthetic Materials			
1. Acquisition			
a. Quantity of material needed per acre (square yards, yd^2)		4,840	
b. Purchase and install geomembrane ($/$yd^2$)	$	5.67	
c. Purchase and install nonwoven geotextile ($/$yd^2$)	$	2.19	
d. Purchase and install composite drainage layer ($/$yd^2$)	$	7.38	
e. Delivery unit cost ($/$yd^2$) (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]
4. TOTAL COST, GEOSYNTHETIC LAYERS ($/acre)	**$**	**88,761.60**	[1f + 2 +3c]
D. Cost per Acre for Acquisition & Placement of Topsoil			
1. Acquisition			
a. Quantity of topsoil needed per acre (yd^3/acre)		807	
b. Excavation unit cost ($/$yd^3$) (if obtained onsite)		N/A	
c. Purchase unit cost ($/$yd^3$) (if obtained offsite)	$	7.61	
d. Delivery unit cost ($/$yd^3$) (if obtained offsite)	$	5.50	
e. Acquisition cost ($/$yd^3$)	$	10,579.77	[1a * (1c+1d)]
2. Placement			
a. Spreading unit cost ($/$yd^3$)	$	2.41	
b. Placement cost ($/acre)	$	1,944.87	[1a * 2a]
3. Topsoil Cost ($/acre)	$	12,524.64	[1e + 2b]
F. 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 ($)	$	124,800.00	[1f * 1g]
i. Area of site permitted for filling (acres)		89.6	
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 (89.6 acres)	$	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**	
Additional soil cover under channels (6,000 feet at $43/foot)	$	250,000.00	
6,000 ft of stormwater diversion channels at $9.35/foot	$	56,100.00	
C. Total	$	316,100.00	[A + B]
VII. CLOSURE COST ESTIMATE	**$**	**12,886,259.62**	[(Acreage * VI) + VI.C]
10% Contingency (per IDEM)	**$**	**1,288,625.96**	
Total	**$**	**14,174,885.58**	
VIII. ADDITIONAL INFORMATION REQUIRED FOR FACILITIES PROVIDING FINANCIAL ASSURANCE ON AN INCREMENTAL BASIS			
A. Will Closure Financial Assurance be Provided on an Incremental Basis?		No	

Opinion of Post-Closure Costs
West Boiler Slag Pond
Clifty Creek Plant
Indiana-Kentucky Electric Corporation
Madison, Jefferson County, Indiana

Facility Name:	**Clifty Creek West Boiler Slag Pond**	
Facility Location:	**Madison, Indiana**	
Facility County:	**Jefferson**	
Total Waste Fill Acreage:	**89.6**	**Acres**
Total Grading Acreage:	**93.9**	**Acres**
Closure Year:	**2020-2023**	
Phase 1 Acreage for Closure	**9.2**	**Acres**

(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		60	
b. Inspector time required (hours/insp)		30	
c. Inspector time labor cost ($/hour)	$	90.00	
d. Inspection cost ($)	$	162,000.00	[1a * 1b * 1c]
2. Report Preparation			
a. Number of reports during post-closure period		60	
b. Cost per report ($)	$	5,000.00	
c. Report cost	$	300,000.00	[2a * 2b]
3. TOTAL COST, INSPECTIONS AND REPORTS ($)	**$**	**462,000.00**	[1d + 2c]

B. Cost for Maintenance of Dike, Final Cover, and Vegetation/Vegetation Control			
1. Dike Maintenance - The cost for dike maintenance and vegetation control shall be 10% of the cost per acre calculated for final cover and vegetation in the closure plan (329 IAC 10-23-3(c)(5)(A)).			
a. Permanent dike along the Ohio River (feet)		5,500	
b. Estimate distance from riverside toe to inside of dike crest (feet)		265	(33.46 acres)
c. 10% of cost for placement of final cover and vegetation (0.10 * cost for soil cover, vegetative layer, and vegetative cover) per acre	$	5,153.04	
d. Total Cost, Maintenance of Dike	$	172,418.50	
2. 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 for geosynthetics, soil cover, vegetative layer, and vegetative cover)	$	14,029.20	
b. Total permitted fill acreage		89.6	
c. Difference for one acre of reinforced concrete (2% of cost)	$	16,029.00	
d. Total Cost, Maintenance of Final Cover and Vegetation Cover	$	1,273,044.96	[1a * 1b]
3. 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 ($)	$	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 DIKE, FINAL COVER, AND VEGETATION	**$**	**3,116,676.88**	[1c + 2f]

C. Cost for Leachate Treatment and Disposal		N/A	
D. Cost for Leachate Collection System Monitoring and Maintenance		N/A	
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	
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			
a. Number of wells needing replacement during post-closure period		0	
b. Existing monitoring well abandonment unit cost ($)	$	-	
c. New monitoring well construction unit cost ($)	$	-	(drilling charged by foot)
d. Monitoring well replacement cost ($)	$	-	
e. Number of pumps/bailers needing replacement during post-closure period		5	
f. Pump/bailer unit cost ($/pump)	$	2,000.00	
g. Pump/bailer replacement cost ($)	$	10,000.00	[2e * 2f]
h. Monitoring Maintenance and Pump/bailer Replacement Cost ($)	$	48,880.00	[1e + 2d + 2g]
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			
1. Drainage and erosion control maintenance frequency (visits/30 years)		60	
2. Cost for materials to repair per visit	$	500.00	
3. Total material cost ($)	$	30,000.00	[1 * 2]
4. Maintenance time required per visit (hours)		10	
5. Unit labor cost	$	140.00	
6. Total labor costs ($)	$	84,000.00	[1 * 4 * 5]
7. TOTAL, DRAINAGE AND EROSION CONTROL MAINTENANCE COST	**$**	**114,000.00**	[3 + 6]
H. Cost for Access Control and Benchmark Maintenance			
4. Fencing material cost ($)	$	-	Facility is fenced.
7. Total labor costs ($)	$	-	
8. Benchmark maintenance cost (if applicable ($)	$	5,000.00	
9. Other ($)	$	-	
10. TOTAL, ACCESS CONTROL/BENCHMARK MAINTENANCE COST	**$**	**5,000.00**	[4 + 7 + 8 + 9]

I. Optional - Maintenance of dike(s) required for facilities constructed in floodplain/floodway		
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.	**N/A**	
K. TOTAL POST-CLOSURE COST	**$ 4,826,556.88**	[A3 + B3 + C4 + D3 + E4 + F3 + G7 + H10 + I7 + J]
10% Contingency (per IDEM)	**$ 482,655.69**	
Total	**$ 5,309,212.57**	

ATTACHMENT I

Closure Plan (Addendum 1)

(rev. 1) (text only)

Closure Plan (Addendum 1)

Clifty Creek Station

West Boiler Slag Pond

Phase 1 Closure

Madison, Jefferson County, Indiana

Prepared for:

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

June 30, 2020
Revision 1

Design with community in mind

Closure Plan
(Addendum 1)

West Boiler Slag Pond
Phase 1 Closure
Clifty Creek Station
Madison, Jefferson County, Indiana

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Closure Plan
(Addendum 1)

West Boiler Slag Pond
Phase 1 Closure
Clifty Creek Station
Madison, Jefferson County, Indiana

1. Objective

Indiana-Kentucky Electric Corporation (IKEC) is submitting this Closure Plan (Addendum 1) 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 Phase 1 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 is preparing to regrade, cap, and close an inactive portion of the WBSP (Phase 1) 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). This area lies within the WBSP clay dike, is at capacity, and has previously been repurposed as a laydown area for the station.

Three subsequent closure phases for the WBSP are also outlined. Their design will be defined further as the USEPA's final rule amending 40 CFR 423, the Effluent Limitations, Guidelines, and Standards for the Steam Electric Power Generating Point Source Category (ELG Postponement Rule) is addressed to modify operations at the Clifty Creek Station. This will include design and construction of concrete CCR settling tanks and lined ponds to manage stormwater and leachate from the CCR landfill (Phases 2 and 3). 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 would then begin construction to close the remainder of the surface impoundment.

The closure design includes consolidation of CCRs and closure in place, filling and regrading the pond area and installing an engineered cap system. Water levels within each phase would be lowered and monitored using wellpoints, sumps, and piezometers. Phase 1 is an inactive 9.2 acres on the east side of the WBSP. The remaining 80.4 acres will be subdivided into three phases. Phase 2 includes construction of a series of settling basins to manage operational boiler slag and serving as part of the facility's ELG Compliance Strategy. Phase 3 will be the construction of two geomembrane-lined ponds as a stormwater sedimentation pond and a leachate collection pond for the CCR landfill. Discharge from the WBSP will cease prior to April 30, 2022. Phase 4 then consolidates and closes the last of the WBSP active surface impoundment. Addendums to this closure plan will be provided for Phases 2, 3, and 4 as they are designed.

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 constructed 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.

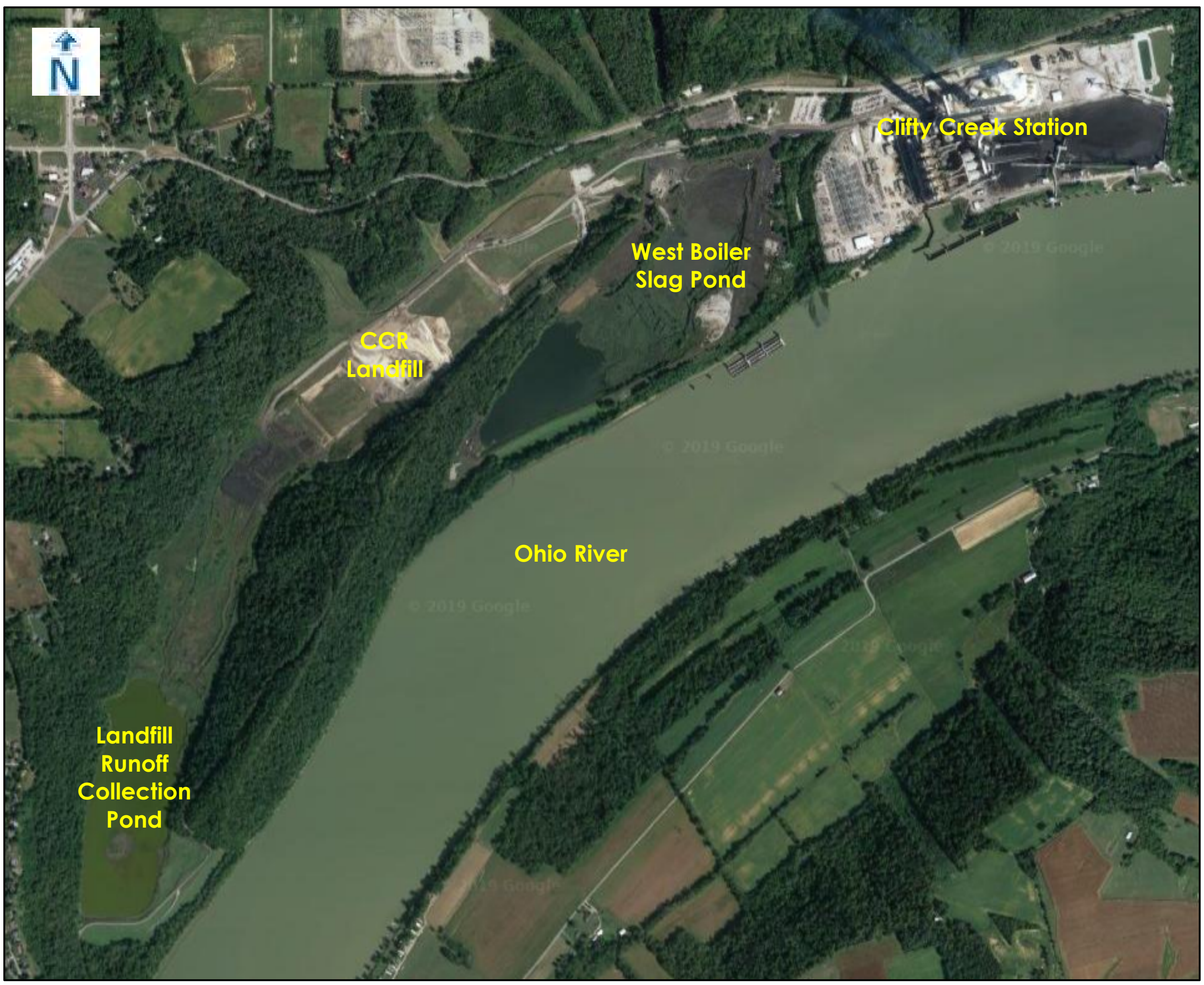

Figure 1- Aerial View of Clifty Creek Station

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 elevation 475 feet. The dike varies in height above the adjacent plant grades with a maximum height of approximately 41 feet. FEMA (2015) shows that the flood stages of the Ohio River at the WBSP are 464 feet and 469.5 feet for the 1 and 0.2 percent annual chance of flooding.

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. 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. 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.

Table 1 - Water Wells Within a Half-Mile Offset

Well Record Reference No.	Type	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

2.4. Available Geotechnical Data

Geotechnical data is available from four field explorations at the WBSP. A plan view of the borings and logs are provided in Appendix E.

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.

2.5. Hydrogeology

AGES, Inc., the station's hydrogeologist of record, has prepared a summary of the hydrogeologic conditions at the WBSP. Appendix F includes a narrative, plan view of the monitoring well network, geologic cross sections, and plan views showing groundwater levels and flow direction. As part of the CCR Rule, a monitoring network of 10 wells was installed and developed at the WBSP during late 2015. Routine water sampling began in 2016.

AGES prepared a Monitoring Well Installation Report (AGES, 2018) which indicated that:

> "Soil and well borings indicated that a layer of gray silt with fine sand, becoming more coarse-grained further to the north & northeast…is the uppermost aquifer beneath the WBSP." (AGES, 2018).

Based on information presented in the AGES report, and for the purpose of this demonstration, the uppermost aquifer (UMA) was identified as an interval of gray silt with sand and coarse-grained alluvium.

The estimated elevations representing the top of the UMA were subtracted from the estimated base of the CCR unit at each certified monitoring well location to represent the separation of the base of the CCR unit from the top of the UMA. Within the extent of the WBSP, the estimated separation between the base of the CCR unit and the UMA was greater than five (5) feet (Stantec, 2018).

3. Regulatory Overview

3.1. Regulatory Framework for Design

In Indiana, coal ash surface impoundments that are subject to an NPDES permit are not regulated under IDEM's solid waste program. 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) 10-3-1(9). Effective December 10, 2016, IDEM adopted by reference a portion of the USEPA CCR regulation governing CCR surface impoundments (329 IAC 10-9-1(b) and (c)) (IDEM, CO0518L).

The EPA Final CCR Rule defines the criteria for conducting the closure of CCR units under 40 CFR 257.102. 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 first phase of the WBSP. The plan will be amended as needed to address the three subsequent phases to meet the pending ELG regulations. Below is a general summary of how the WBSP will be closed. The permit-level Phase 1 drawings are included in Appendix G.

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 within the WBSP where possible, grade stored CCR as structural fill, and close the facility in place. The closure will consist of dewatering the unit through an NPDES-permitted outfall, grading, and construction of an engineered cap.

IDEM's OLQ has requested that the WBSP be closed in accordance with Type I restricted solid waste (RSW) 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:
    - two feet for slopes less than or equal to 15 percent
    - three feet for slopes greater than 15 but less than 25 percent, and
    - four feet for slopes greater than 25 percent
- Slopes not less than two percent nor greater than 33 percent.

Appendix H includes the final cover soil loss calculations. The final cover consists of a two-foot soil infiltration layer and six inches of earthen material capable of growing and sustaining native vegetative growth. Within the drainage channels, the soil infiltration layer is thickened to four feet. If the selected borrow materials are not sufficiently impermeable, or if there is not a sufficient quantity, then a synthetic geomembrane will be included in the final cap design. The capped surface will be graded to promote surface water runoff, and then seeded and mulched to promote growth of the vegetative cover.

An alternative to the final cover system as specified in 257.102 (d)(3)(ii) is included for Phase 1. At the southeast corner and along the proposed eastern access road, concrete may be used in lieu of a portion of the earthen material to create a working access road and material handling area to support an anticipated conveyor system. The conveyor will be used to load barges as part of CCR repurposing.

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 closure system, the CCR unit will be pumped to remove surface water, drawing down the phreatic level within the ash to facilitate construction. All water will be managed in the remaining open portion of the pond and discharged through the existing NPDES outfall. A CCR berm will be constructed to define the edge of the closure phase. 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 a flexible geomembrane liner (FML), that will have a permeability that is less than or equal to the permeability of the natural subsoils, and is no greater than $1x10^{-5}$ cm/sec. A portion of the FML will extend over the phase's CCR berm. FML will be installed directly over the graded CCR material followed by a 2.5 or 4.5-foot thick soil fill consisting of a 24- or 48-inch soil infiltration layer and 6-inches of earthen material capable of growing and sustaining native vegetative growth. The capped surface will be graded to promote surface water runoff, and then seeded and mulched to promote growth of the vegetative cover.

An alternative to the final cover system as specified in 257.102 (d)(3)(ii) is identified in certain areas of Phase 1. Concrete may be used in lieu of a portion of the earthen material to create a working access road and material handling area.

Piezometers will be installed along the western edge of Phase 1 to monitor water levels within the closed footprint. Wellpoints and sump pumps will be added as needed to draw the in-situ water levels down within Phase 1 during the phased closure process. 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.

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. Both analyses are included in Appendix I.

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

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

The impoundment will be vegetated to prevent 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. Phase 1 will begin final design and construction upon approval of this permit application. The intent is to complete construction of the Phase 1 cap in 2020.

Three subsequent closure phases for the WBSP are anticipated. The design will be defined further as the USEPA's final rule amending 40 CFR 423, the Effluent Limitations, Guidelines, and Standards for the Steam Electric Power Generating Point Source Category (ELG Postponement Rule) is addressed to modify operations at the Clifty Creek Station. This will include design and construction of concrete CCR settling tanks and lined ponds to manage stormwater and leachate from the CCR landfill (Phases 2 and 3). 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 would then begin construction to close the remainder of the surface impoundment.

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.]

<u>The final cover system will consist of the following materials, listed in order of construction (from bottom to top):</u>

- 24 or 48 inches of compacted soil with a permeability less than or equal to natural subsoils present or no greater than 1x10^{-5} cm/sec.
- 6 inches of soil capable of sustaining vegetation and reasonably free from deleterious matter that would prevent the formation of a suitable seedbed.

If the selected borrow materials are not sufficiently impermeable, or if there is not a sufficient quantity, then a synthetic geomembrane (FML) will be included in the final cap design. This alternative cap system will consist of the following materials, listed in order of construction (bottom to top):

- 40-mil geomembrane
- Geocomposite drainage layer
- 30 or 54 inches of cover soil, of which the top 6 inches are capable of supporting vegetation

The final closure system will be installed directly over the graded CCR material. The capped surface will be graded to promote surface water runoff, and then seeded and mulched to promote growth of the vegetative cover. The final cover slope will be a minimum of two percent (2%). A stormwater management system will convey surface water to a NPDES-permitted outfall.

An alternative to the final cover system as specified in 257.102 (d)(3)(ii) is outlined for Phase 1. Concrete may be used in lieu of a portion of the earthen material to create a working access road and material handling area.

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 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 largest area of the CCR unit ever requiring a final cover is approximately 89.6 acres. Following completion of Phase 1, this area will decrease to 80.4 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.]

Phase 1 will begin final design and construction upon approval of this permit application. The intent is to complete construction of the cap and the conveyor/material handling pad in 2020.

USEPA (2020) has defined a closure schedule process for existing CCR surface impoundments that are considered "unlined" under the CCR Rule. Phases 2, 3, and 4 are in design now to maintain the necessary operational pool levels needed for achieving permitted discharge thresholds through settlement. Table 2 provides an approximate closure schedule to meet the required regulation. Addendums to this closure plan will be provided to IDEM for review and approval as design is finalized.

Table 2 - Proposed Closure Schedule

Task	Date
Phases 2, 3, and 4 - Design	Ongoing
Phase 1 construction	Summer 2020
Phase 2 construction	Spring 2021
Phase 3 construction	Fall 2021
Phase 4 construction begins	Spring 2022
Boiler slag retrofit complete	April 1, 2022
NPDES permit no. IN0001759 expires	April 30, 2022
WBSP closure completion deadline (USEPA-proposed)	October 15, 2023

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.

The recommended design approach will include installing an engineered cap system over an approximately 9.2-acre area on the east side of the WBSP where the pond is at grade and inactive. The remaining 80.4 acres will be subdivided into three phases. Phase 2 includes construction of a series of concrete settling basins to manage operational boiler slag, which will serve as part of the facility's ELG compliance strategy. Phase 3 will be the construction of two geomembrane-lined ponds as a stormwater sedimentation pond and a leachate collection pond for the CCR landfill. Discharge from the WBSP will cease prior to April 30, 2022. Phase 4 then consolidates and closes the last of the WBSP active surface impoundment.

A CCR berm will be constructed on the west boundary of the proposed capped area to define Phase 1. The capped area will grade toward the active pond and tie into the existing dike forming the eastern perimeter of the WBSP. Work to be completed through the closure process includes:

1. Construct the CCR berm at the western edge of Phase 1.
2. Regrade the existing CCRs to drain westward toward the active pond.
3. Construct the engineered cap system over the Phase 1 footprint. FML will extend over the CCR berm at the western edge.
4. Construct stormwater collection conveyance channels/piping.
5. Construct piezometers within the western edge of Phase 1 to monitor water levels.
6. Establish wellpoints or sumps as needed to further draw down the water levels within the closed Phase 1 footprint.
7. Establish the access road and vegetation on the site.
8. Notification of completion of Phase 1 final closure to the IDEM OWQ and OLQ.

5. Closure Plan Scope of Work

Phase 1 closure of the WBSP will require modification of the current pond system. The following general tasks are anticipated as part of the closure process.

5.1. CCR Berm

A CCR berm will be constructed to form the western boundary of the sediment contained within Phase 1. The dike will regrade the existing CCR material to create a stable limit for the cover system. Additional CCR will be placed and compacted in lifts.

5.2. Cap System

An engineered cap system will be constructed over Phase 1 closure area. Appendix G provides the proposed Phase 1 permit drawings, including the cap area and details.

The engineered cap will consist of the following materials, listed in order of construction (from bottom to top):

- 24 or 48 inches of compacted soil with <u>a permeability less than or equal to natural subsoils present or no greater than</u> 1×10^{-5} cm/sec.
- 6 inches of soil capable of sustaining vegetation and reasonably free from deleterious matter that would prevent the formation of a suitable seedbed.

If the selected borrow materials are not sufficiently impermeable, or if there is not a sufficient quantity, then a synthetic geomembrane (FML) will be included in the final cap design. This alternative cap system will consist of the following materials, listed in order of construction (bottom to top):

- 40-mil geomembrane
- Geocomposite drainage layer
- 30 or 54 inches of cover soil, of which the top 6 inches are capable of supporting vegetation

An alternative to the final cover system as specified in 257.102 (d)(3)(ii) is anticipated for portions of Phase 1. Concrete may be used in lieu of a portion of the earthen material to create a working access road and material handling area. A cushion fabric and minimum 12-inch cover material comprised of natural soils is anticipated beneath the concrete to protect the geomembrane.

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

5.3. 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.

5.4. Construction Quality Assurance

The construction quality assurance (CQA) plan 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 CQA plan will include:

A. Purpose and Scope

B. Responsibility and Authority

C. Quality Control Activities

D. Product Submittals and Material Testing

E. Project Documentation

Appendix J includes a draft CQA plan based on the Clifty Creek Station's existing CCR Landfill permit. This is proposed as the basis for the final plan to maintain consistency on the site.

5.5. 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. <u>IDEM has requested the inclusion of:</u>

- <u>Testing results from the CQA Plan,</u>
- <u>Subgrade drawings of Phase 1, and</u>
- <u>Final survey drawings for the completed cover for Phase 1.</u>

6. Post-Closure Plan

Post-closure care will be performed in accordance with the Post-closure Plan (IKEC, <u>2020</u>). A copy of the publicly available document is included as Appendix K. The closed Phase 1 area 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.

American Electric Power Service Corporation (AEPSC) (2015). *2015 Dam and Dike Inspection Report. GERS-15-018*. Clifty Creek Plant. Madison, Indiana. October 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.

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.

Indiana Department of Environmental Management (IDEM). *Fact Sheet. Coal Combustion Residuals (Coal Ash).* Office of Land Quality – Permitting Branch. CO0518L.

Indiana Department of Environmental Management (IDEM). (2018). Letter from Jerry Dittmer, OWQ to J. Michael Brown, IKEC. Re: NPDES Permit No. IN0001759, Permit Modification. IKEC – Clifty Creek Station. Madison, IN – Jefferson County. April 10. VFC No. 82625441.

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.

Indiana-Kentucky Electric Corporation. (<u>2020</u>). *Post-Closure Plan. CFR 257.104(d). West Boiler Slag Pond. Clifty Creek Station. Madison, Indiana.* <u>June</u>.

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.

ATTACHMENT J

Post-Closure Plan

(rev. 1)

Post-closure Plan

CFR 257.104(d)

West Boiler Slag Pond

Clifty Creek Station

Madison, Indiana

June 2020

Prepared by: Indiana-Kentucky Electric Corporation

3932 U.S. Route 23

Piketon, OH 45661

OVEC IKEC

Ohio Valley Electric Corporation Indiana-Kentucky Electric Corporation

Table of Contents

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 Bottom 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 Bottom Slag Pond for purposes of storage.

The West Bottom 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 CCR unit, and the frequency at which these activities will be performed]

3.1 Section 257.104(b)(1)

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

Inspections are performed for the items noted below. The inspection frequencies are scheduled to properly detect any issues so that repairs can be performed before significant harm occurs.

- Embankment: The waste embankment will be inspected for slides, settlement, subsidence, displacement, and cover condition (see below).

- Final Cover Surface: 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).

- Stormwater Management System: 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.

- Erosion Damage Repair: 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.

- Settlement, Subsidence, Displacement: Any areas at the closed site exhibiting evidence of settlement, subsidence, or displacement will be examined to determine the cause of the movement. If backfilling or placing additional fill material is needed to maintain the integrity of the closed structure, it will be performed in accordance with the site/closure specifications, including seeding. If the condition reoccurs or persists, or if the severity of the condition 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.

- Closure Cap Surface: 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, re-seeded to support vegetative growth, and maintained to minimize the ponding of water.

- Stormwater Drainage System: 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.

<u>3.2 SECTION 257.104(b)(3)</u>

[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 <u>POST-CLOSURE CONTACT 257.104 (d)(1)(ii)</u>

[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 <u>POST-CLOSURE PLANNED USE 257.104 (d)(1)(iii)</u>

[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.

From:	TFulk@ovec.com
To:	Garvey, Kathleen R
Cc:	TEAGUE, JEFF; gcoriell@ovec.com
Subject:	Clifty Creek WBSP Closure- Revision to RAI No. 1 Item 9
Date:	Monday, October 12, 2020 11:09:45 AM
Attachments:	CC WBSP Partial Closure- RAI No. 1 Revision to Item 9.pdf

Ms. Garvey,

During a conference call with your technical staff it was discussed that an error existed in response number 9 of RAI No. 1 for Clifty Creek Station's West Boiler Slag Pond Phase I Closure. It was requested that we submit a letter correcting the issue. The requested letter is attached below, and its primary purpose it to correct the stated Federal hydraulic conductivity standard from 1 x 10^-7 to 1 x 10^-5. The remainder of the response has not been changed. Additionally, I will be submitting the required affidavit, certifying adjoining landowners have been notified of the upcoming WBSP closure, shortly. Please let me know if you have any questions. Thanks.

Tim Fulk
Engineer II
Environmental, Safety & Health
Ohio Valley Electric Corporation
Phone: (740) 897-7768
Mobile: (740) 222-4133
email: tfulk@ovec.com

OVEC IKEC
Ohio Valley Electric Corporation Indiana-Kentucky Electric Corporation

"Work SAFE today, someone will need you tomorrow!

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

October 12, 2020

Delivered Electronically

Ms. Kate Garvey
Office of Land Quality
Indiana Department of Environmental Management
Solid Waste Permits Section
IGCN 1101
100 North Senate Avenue
Indianapolis, Indiana 46204-2251

Dear Ms. Garvey:

Re: Indiana-Kentucky Electric Corporation
West Boiler Slag Pond Closure Plan- Revision to RAI #1 Response
SW Program ID 39-005

On July 1, 2020, the Indiana-Kentucky Electric Corporation (IKEC) provided response to the Indiana Department of Environmental Management's (IDEM) Request for Additional Information (RAI) #1 for Clifty Creek Station's West Boiler Slag Pond Phase 1 Closure permit application. This response package was intended to provide additional information and clarity to the overall closure plan application submitted to IDEM on February 13, 2020. During the agency's technical review of the permit package and associated RAI #1 response, a discrepancy was noted in the language provided as response to IDEM inquiry #9, which stated the following:

> *"Please note if a geomembrane (or a flexible membrane liner (FML)) is used in the cover system, IDEM requires a minimum of 30 inches of soil protective cover and 6" of vegetative layer (36" total)."*

IKEC's original response to the above inquiry incorrectly cited the Federal Standard from 40§257.102(d)(3). IDEM technical staff requested that IKEC file a letter with the agency to remedy the discrepancy in the language. The following language is IKEC's full response to IDEM inquiry No. 9 and is meant to supersede the language currently found within the July 1, 2020, response package:

> *"As discussed in Question 2, it is IDEM's intent to require this surface impoundment engineered cap system to meet the standards of 40§257.102(d)(3). The federal requirement specifies (in order of construction from bottom to top):*
>
> - *18 inches of compacted soil with a maximum permeability of 1 x 10^{-5} cm/s*
> - *6 inches of soil capable of sustaining vegetation and reasonably free from deleterious matter that would prevent the formation of a suitable seedbed.*

If the selected borrow materials are not sufficiently impermeable, or if there is not a sufficient quantity, then a synthetic geomembrane will be included in the final cap design. This alternative cap system will consist of the following materials (listed in order of construction from bottom to top):

- *40-mil geomembrane*
- *Geocomposite drainage layer*
- *24 inches of cover soil, of which the top 6 inches are capable of supporting vegetation.*

IDEM also noted during the December 2019 WBSP closure plan proposal meeting that the agency intends to treat this surface impoundment as a restricted waste site Type I or nonmunicipal solid waste landfill upon closure. Therefore, the final cover was designed in accordance with the more stringent 329 IAC 10-30-2(c), similar to the final cover system permitted within Clifty Creek Station's RWS Type I landfill permit. This requires that the final compacted cover have (from top to bottom) 6 inches of topsoil and a minimum depth of compacted clay of:

- *two (2) feet for slopes less than or equal to fifteen percent (15%)*
- *three (3) feet for slopes less than fifteen percent (15%) but less than twenty-five percent (25%); and*
- *four (4) feet for slopes greater than twenty-five percent.*

The existing cap system maintains slopes less than 15% with additional compacted clay under the stormwater diversion channels due to their side slopes.

Final cover soils will be challenging to acquire within a reasonable distance of Madison, Indiana. The additional six inches across the cap surface, if the closure is also held to the existing municipal solid waste landfill standards (329 IAC 10-22-6(b)(6)), will have a deleterious effect to the project soil balance and aggressive schedule required to meet federal regulations."

If you have any further questions or concerns, I can be reached at (740) 897-7768.

Sincerely,

Tim Fulk

Tim Fulk
Engineer II

TLF:klr

From:	TFulk@ovec.com
To:	Garvey, Kathleen R
Cc:	gcoriell@ovec.com
Subject:	IKEC WBSP Partial Closure- Adjacent Landowner Affidavit
Date:	Wednesday, October 14, 2020 12:39:20 PM
Attachments:	IDEM Adjacent Landowner Affidavit- Clifty Creek WBSP Partial Closure.pdf

Ms. Garvey,

Attached below is an executed copy of the required Adjacent Landowner/ Occupant Affidavit, as required by IC 13-15-8 and 329 IAC 10-12-1(a)-(b), for the Partial Closure of Clifty Creek Station's West Boiler Slag Pond. It is my understanding that upon receipt, IDEM will be drafting a letter deeming our application complete, at which time IKEC will have 5-days to post a copy of the permit application in the local library. Please let me know if you have any questions or concerns. Thank you.

Tim Fulk
Engineer II
Environmental, Safety & Health
Ohio Valley Electric Corporation
Phone: (740) 897-7768
Mobile: (740) 222-4133
email: tfulk@ovec.com

OVEC IKEC
Ohio Valley Electric Corporation Indiana-Kentucky Electric Corporation

"Work SAFE today, someone will need you tomorrow!

ADJACENT LANDOWNER/OCCUPANT AFFIDAVIT
State Form 51872 (8-04)
Indiana Department of Environmental Management

Clifford Carnes, being first duly sworn upon oath, deposes and says:

1. I live in Jefferson County, Indiana, and being of sound mind and over twenty-one (21) years of age, I am competent to give this affidavit.

2. I hold the position of Plant Manager for IKEC- Clifty Creek Station (permit applicant's or facility's name).

3. By virtue of my position with IKEC- Clifty Creek Station (permit applicant's or facility's name), I am authorized to make the representation contained in this affidavit on behalf of the facility.

4. I understand that the notice requirement of IC 13-15-8 and 329 IAC 10-12-1(a)-(b) applies to IKEC- Clifty Creek Station (permit applicant's or facility's name) for purposes of the accompanying permit application.

5. As required by IC 13-15-8 and 329 IAC 10-12-1(a)-(b), the permit applicant will send written notice to adjacent landowners not more than ten (10) days after submission of the accompanying application for Phase I Closure- Clifty Creek Station West Boiler Slag Pond (briefly describe type of permit application) filed on behalf of

   Indiana-Kentucky Electric Corporation- Clifty Creek Station (permit applicant's of facility's name).

Further Affiant Saith Not.

I affirm under penalty for perjury that the representations contained in this affidavit are true, to the best of my information and belief.

10.14.2020
Date

[signature]
Signature of Affiant

Clifford Carnes
Printed Name

STATE OF INDIANA)
)SS
COUNTY OF Jefferson)

Before me a Notary Public in and for said County and State, personally appeared Clifford Carnes and being first duly sworn by me upon oath, says that the facts stated in the foregoing instrument are true. Signed and sealed this 14th day of October, 2020.

Debra L Gullion

Printed: Debra L Gullion

My Commission Expires: 12-13-2020

Residence of Switzerland County

DEBRA L GULLION
Notary Public - Seal
State of Indiana
My Commission Expires Dec 13, 2020

From:	TFulk@ovec.com
To:	Garvey, Kathleen R
Cc:	gcoriell@ovec.com
Subject:	IKEC Neighbors within 1 Mile of WBSP Waste Boundary
Date:	Wednesday, October 14, 2020 2:48:31 PM
Attachments:	IKEC Neighbors within 1 Mile of WBSP Waste Boundary.docx

Ms. Garvey,

In addition to the executed affidavit from my email earlier today, it was requested that IKEC provide a list of neighboring landowners that are within 1 mile of Clifty Creek Station's West Boiler Slag Pond Waste Boundary. I have attached that list below for IDEM's use in mailing the final permit decision document upon IKEC's completion of Public Process requirements. Please let me know if you have any questions or concerns. Thank you.

Tim Fulk
Engineer II
Environmental, Safety & Health
Ohio Valley Electric Corporation
Phone: (740) 897-7768
Mobile: (740) 222-4133
email: tfulk@ovec.com

OVEC IKEC
Ohio Valley Electric Corporation Indiana-Kentucky Electric Corporation

"Work SAFE today, someone will need you tomorrow!

IKEC Neighbors within 1 Mile of WBSP Waste Boundary

- Crafton C Dean & Denise L
  887 S Riverview Dr
  Hanover ,IN 47243
- Krantz John H & Margaret
  3442 W 75 S
  Hanover,IN 47243
- Brown Stephen C & Beverly K
  3372 W 75 S
  Hanover,IN 47243
- Koehler Gregory W
  933 S Riverview Dr
  Hanover ,IN 47243
- Wehner Ronnie Jay & Linda W
  707 S Riverview Dr
  Hanover,IN 47243
- Cline Jason J
  1302 S Riverview Dr
  Hanover,IN 47243
- Oak Heritage Conservancy Inc
  PO Box 335
  Hanover,IN 47243
- Totten Mark D & Nancy D
  1100 S Riverview Dr
  Hanover,IN 47243
- Koehler Michael J & Penny J
  866 S Riverview Dr
  Hanover,IN 47243
- Jones Logan T and Miller Tori
  826 S Riverview Dr
  Hanover,IN 47243
- Hamilton Kenneth L & Margaret
  786 S Riverview Dr
  Hanover ,IN 47243
- Hay Allen
  746 S Riverview Dr
  Hanover,IN 47243
- Bell James R And Tonya L
  706 Riverview Dr
  Hanover,IN 47243
- Goodman David R Jr
  532 S Revonah Dr
  Hanover,IN 47243
- Goldsmith Gregory K
  846 S Deer Bend Dr
  Hanover,IN 47243
- Estes Billy G
  827 S Deer Bend Dr
  Hanover,IN 47243
- Ungru Doug Howard And Beynon Leah
  662 S Revonah Dr
  Hanover,IN 47243
- Goodman Ann Selby
  524 Bay Villas Ln
  NAPLES,FL 34108

- Wilkes James & Rita
  PO Box 247
  Hanover,IN 47243
- Green Gene R & Sarah Jane
  81 S 325 W
  Hanover,IN 47243
- Fas Plastic Enterprises Inc
  3408 W State Road 56
  Hanover,IN 47243
- Yoder Mervin & Ada
  3498 W State Road 56
  Hanover,IN 47243
- Snell Roger & Donna
  3632 W State Road 56
  Hanover,IN 47243
- Mix Katie L and Zack A Pearson
  255 S Amber Waves Blvd
  Hanover,IN 47243
- Hale Wanda L
  250 S Amber Waves Blvd
  Hanover ,IN 47243
- GAD Investments LLC
  4230 N State Road 62
  Madison,IN 47250
- Ferrell Wade T
  230 S Amber Waves Blvd
  Hanover,IN 47243
- Burkhardt Mary Jean
  220 S Amber Waves Blvd
  Hanover,IN 47243
- Nelson Richard Thomas
  140 N Willow Dr
  Madison,IN 47250
- Moll Christa
  190 S Amber Waves Blvd
  Hanover,IN 47243
- Owens Mary K
  180 S Amber Waves Blvd
  Hanover,IN 47243
- Proffett Properties LLC
  5877 S Hanover Saluda Rd
  Hanover,IN 47243
- Brandon Anthony & Dawn Cont: Rudd Shelia
  150 S Amber Waves Blvd
  Hanover,IN 47243
- Ball Larry S & Amy T Cont: Ball Curtis R
  2222 Bedford Fls
  Madison,IN 47250
- Green Martha F & Golden D Hyman
  235 S Amber Waves Blvd
  Hanover,IN 47243
- Friend William Jr & Kathy A
  225 S Amber Waves Blvd
  Hanover,IN 47243
- Goode Lonnie N
  215 S Amber Waves Blvd
  Hanover,IN 47243

- Chandler Carol and Chandler Ronald
  205 S Amber Waves Blvd
  Hanover,IN 47243
- Eisert Lee Ann
  235 N Willow Dr
  Madison,IN 47250
- Everhart Louise A & Roberts Jacquelyne
  185 S Amber Waves Blvd
  Hanover,IN 47243
- Fulton Chris
  175 S Amber Waves Blvd
  Hanover,IN 47243
- Robinson Cliff E
  2515 Poplar Ridge Ln
  Madison,IN 47250
- Rogers Lori L
  155 S Amber Waves Blvd
  Hanover,IN 47243
- Biswell Jason
  3565 W Vista Plains Ct
  Hanover,IN 47243
- Perry Ernest E & Carol A
  219 Grandview Ave
  Waverly,OH 45690
- RJL Properties LLC
  523 Walnut St
  Madison,IN 47250
- Lundergan Michael S & Victoria M
  2321 E State Road 62
  Madison,IN 47250
- Kreeger & Hensler Trust Cont: Miller Karen
  PO Box 885
  Hanover,IN 47243
- Lewellyn James F & Beth A
  3042 Penewit Rd
  SPRING VALLEY,OH 45370
- Knotts Dennis W & Connie S
  85 S Amber Waves Blvd
  Hanover,IN 47243
- Synergy Properties Of Hanover LLC
  9801 Fall Creek Rd
  INDIANAPOLIS,IN 46256
- Dow Mason & Deborah
  3543 Golden Prairie Ct
  Hanover,IN 47243
- Sutton Donna K
  3512 Golden Prairie Ct
  Hanover,IN 47243
- Voris William H Sr & Chasity
  3522 Golden Prairie Ct
  Hanover,IN 47243
- B & K Assets LLC
  3195 S River Bluff Dr
  Hanover,IN 47243
- Cruisin Inc
  3713 Clifty Dr
  Madison,IN 47250

- Pyles Nancy K
  3471 W State Road 256
  Madison,IN 47250
- D&H Holdings Of Madison LLC
  3647 Clifty Dr
  Madison,IN 47250
- Prannath LLC
  2707 Willow Ridge Dr
  NAPERVILLE,IL 60564
- Eckert Family Farm LLC
  2918 Brandywine Rd
  KALAMAZOO,MI 49008
- Gray Marcus W Revocable Trust
  7474 E Riverside Dr
  Madison,IN 47250
- Green Gene R & Sarah Jane
  81 S 325 W
  Hanover,IN 47243
- Gray Marc
  3713 Clifty Dr
  Madison,IN 47250
- Gray Marcus Chad
  1000 E Duggan Hollow Rd
  Madison,IN 47250
- Auxier Kristi M
  2300 Clifty Hollow Rd
  Madison,IN 47250
- Valley Station Towne Center LLC
  2606 Alia Cir
  LOUISVILLE,KY 40222
- Perkins Glenn
  754 Sprague Ln
  MILTON,KY 40045
- Lebre Greg And Cynthia
  3641 Clifty Dr
  Madison,IN 47250
- Hussong Michael J & Mary E
  3222 W State Road 256
  Madison,IN 47250
- Turner Rick R & Shelley G
  6301 Robinson Rd
  NABB,IN 47147
- Clapp Robert E & Sarah S
  3617 Clifty Dr
  Madison,IN 47250
- INDYRE LLC
  17962 Foxborough Ln
  BOCA RATON,FL 33496
- Marshall Brian & Summer
  201 Plum St
  Madison,IN 47250
- Sisabro LLC
  10105 Hedden Rd
  EVANSVILLE,IN 47725-8920
- Indiana & Michigan Electric Co
  PO Box 16428
  Columbus,OH 43216-6428

- Powell Robert D II
  601 Holcroft Rd
  Madison,IN 47250
- Minor Kenneth A & Sara J
  613 Holcroft Rd
  Madison,IN 47250
- Thorpe Leonard D Jr And McCloud Rebara K
  332 Goins Rd
  Madison,IN 47250
- Cardwell Paul & Theresa
  328 Goins Rd
  Madison ,IN 47250
- Jones Shirley A (1/2) and Burress Sheila R (1/2) Cont: Jones Brian P
  488 Ovo Dr
  Madison,IN 47250
- Lipperd Tina R and Henry Ernest William
  96 Caledonia Rd
  Madison,IN 47250
- Wilson Shari L
  560 Holcroft Rd
  Madison ,IN 47250
- Sloan Suzanne E
  554 Holcroft Rd
  Madison,IN 47250
- Johnson Delaney B Fraley
  552 Holcroft Rd
  Madison,IN 47250
- Kennedy Thomas & Tamma
  544 Holcroft Rd
  Madison,IN 47250
- Bussell Michael M & Tina Mv
  540 Holcroft Rd
  Madison,IN 47250
- O'Connor Mary Frances And O'Connor Molly
  520 Holcroft Rd
  Madison,IN 47250
- Barker Megan And Vaughan Adam G
  538 Holcroft Rd
  Madison,IN 47250
- Fitzgerald Alice J
  2320 Clifty Hollow Rd
  Madison,IN 47250
- Garrett Thomas H & Debra J
  5478 W State Road 256
  Madison,IN 47250
- Cambron Paul J & Schafer-Cambron Aline
  241 Holcroft Rd
  Madison,IN 47250
- Kowals Ruth
  419 W Jefferson Blvd
  SOUTH BEND,IN 46601
- M & M Investment Group LLC CONT Harcrow Robert D And Chatham Jill A
  PO Box 208
  CORTLAND,IN 47228
- Chatham Jill Ann
  290 Goins Rd
  Madison,IN 47250
- Chatham Doug And Sheila
  225 Goins Rd
  Madison,IN 47250

- White Barn Venue LLC
  908 W Main St
  Madison,IN 47250
- Ison Kenny & Jennifer
  175 Goins Rd
  Madison,IN 47250
- Smith Gary & Sherry
  151 E Goins Rd
  Madison,IN 47250
- Eaton Justin Lee and Andrea Nicole
  475 Thomas Hill Rd
  Madison,IN 47250
- Jester Harold K & Joyce A
  433 Thomas Hill Rd
  Madison,IN 47250
- Goley Mark A & Marjorie S
  412 Thomas Hill Rd
  Madison ,IN 47250
- Wilson Robert & Evelyn Trust
  5906 W Holly Hills Rd
  Hanover,IN 47243
- Scroggins Brandon Tyler and Heitz-Sontag Sara B
  400 Thomas Hill Rd
  Madison,IN 47250
- Clifty Falls State Park
  City of Madison
  Madison,IN 47250
- Ayers Kathryn G
  340 Thomas Hill Rd
  Madison,IN 47250
- Alexander Keith J
  328 Thomas Hill Rd
  Madison,IN 47250
- Greiner Robert G Et Al
  3291 NE Holly Creek Dr
  Jensen Beach,FL 34957
- Wallace Scott Walker
  3291 NE Holly Creek Dr
  Jensen Beach,FL 34957
- Holcroft Jeffery Lynn as Trustee
  2516 Clifty Dr
  Madison,IN 47250
- Lyon Kyle and Cheryl L Trustees of the Kyle Lyon and Cheryl L Lyon Revocable Living Trust
  3189 N Paper Mill Rd
  Madison,IN 47250
- Tandy Bruce & Cheryl
  3582 N State Road 7
  Madison,IN 47250
- Koontz Mark D & Angela R
  3037 N Greenbrier Rd
  Madison,IN 47250
- Grimes Janice M
  3521 W State Road 256
  Hanover,IN 47243
- Johnson Sarah Beth
  140 S Amber Waves Blvd
  Hanover,IN 47243

- Boggs Melissa D
  130 S Amber Waves Blvd
  Hanover,IN 47243
- Barber William Newton Jr
  120 S Amber Waves Blvd
  Hanover,IN 47243
- Brown Elizabeth
  110 S Amber Waves Blvd
  Madison,IN 47250
- Leach John W & Cheryl D
  100 S Amber Waves Blvd
  Hanover ,IN 47243
- Day Taylor D
  90 S Amber Waves Blvd
  Hanover,IN 47243
- Burton Janice L
  70 S Amber Waves Blvd
  Hanover,IN 47243
-

ATTACHMENT 3

Approval of CCR Partial Closure/Post-Closure Plan. West Boiler Slag Pond. Jefferson County. SW Program ID 39-005. *Indiana Department of Environmental Management (2021).*

VIA EMAIL
Indiana-Kentucky Electric Corporation
Attn:Justin Cooper
3932 US Route 23, P.O. Box 468
Piketon, Ohio 45661

Dear Justin Cooper:

Re: Approval of CCR Partial
Closure/Post-Closure Plan
West Boiler Slag Pond
Jefferson County
SW Program ID 39-005

Indiana-Kentucky Electric Corporation (IKEC)'s coal combustion residuals (CCR) surface impoundment closure and post-closure plan for the West Boiler Slag Pond (WBSP) at Clifty Creek Station is approved under 329 IAC 10-9-1(c), which incorporates portions of 40 CFR 257, Subpart D (the federal CCR regulations). This approval is subject to the terms of this letter, the closure and post-closure plans referenced in this document, and the enclosed requirements. The facility is located in Jefferson County at 1335 Clifty Hollow Road, Madison, 47250.

Please note, this approval is only for the Phase 1 area consisting of 9.2 acres at the east side of the WBSP. The WBSP will be closed in a phased approach, and the closure and post-closure plans for the remaining portions of the WBSP have not been submitted to IDEM for approval at this time. The total acreage for the WBSP is approximately 89.6 acres.

The Phase 1 area of WBSP will be closed in place. Upon completing closure of the entire WBSP, this surface impoundment will be subject to post-closure requirements.

Public records for your facility are available in IDEM's Virtual File Cabinet at www.in.gov/idem. Documents related to this approval include the application dated February 12, 2020 (VFC #82914220), and supplemental information dated July 1, 2020 (VFC #83003672), October 12, 2020 (VFC #83057921), and October 14, 2020 (VFC #83057922).

This approval does not: convey any property rights of any sort or any exclusive privileges; authorize any injury to any person or private property or invasion of other private rights or any infringement of federal, state, or local laws or regulations; or preempt any duty to comply with other state or local requirements.

If you wish to appeal this decision, you must file a request for administrative review with the Office of Environmental Adjudication within 18 days after the postmark of this letter. The enclosed guidance provides information on the appeal process and your rights and responsibilities for filing an adequate and timely appeal.

If you have any questions, please contact Kate Garvey, the Permit Manager assigned this facility, by dialing (317) 233-5552 or by e-mail at KRGarve@idem.IN.gov.

Sincerely,

SJThill

Stephen D. Thill, Chief
Permits Branch
Office of Land Quality

Enclosures: Approval Requirements
Guidance on How to Appeal IDEM Decision

cc with enclosures Gabe Coriell, IKEC
Tim Fulk, IKEC
Jefferson County Health Department
Jefferson County Commissioners
Southeastern Solid Waste Management District
Director, Southeast Regional Office
Mayor, City of Madison
President, Hanover Town Council

CLOSURE AND POST-CLOSURE PLAN APPROVAL REQUIREMENTS

A. General Requirements

B. Closure Requirements

C. Post-Closure Requirements

D. Groundwater Monitoring Requirements

E. Financial Responsibilities for Closure and Post-Closure

F. Compliance Schedule Requirements

A. GENERAL REQUIREMENTS

A1. The owner or operator must close and maintain the West Boiler Slag Pond – Phase 1 as described in the approved plans and specifications in the document titled "Indiana-Kentucky Electric Corporation Clifty Creek Station West Boiler Slag Pond Phase I Partial Closure Plan," dated February 12, 2020 (VFC #82914220), the requirements of this approval, and the following submittals:

a. Document dated July 1, 2020 (VFC #83003672), response to request for additional information (RAI) dated May 15, 2020 (VFC #82968974)
b. Document received on October 12, 2020 (VFC #83057921)

A2. The owner or operator must call **(888) 233-7745** (IDEM's emergency response line) as soon as possible after learning of any event related to the facility that may cause an imminent and substantial endangerment to human health or the environment, such as a reportable spill (327 IAC 2-6.1) or a fire or explosion that requires the response of the local fire department.

The owner or operator must follow up by sending a written report to the Solid Waste Permits Section at the address given in Requirement A3 within five business days after the event. The report must describe the event, and actions taken or planned to correct the event and prevent its recurrence.

A3. Unless otherwise noted, submittals must be sent to the permit manager assigned your facility at the following address:

Indiana Department of Environmental Management
Office of Land Quality
Solid Waste Permits Section
IGCN 1101
100 North Senate Avenue
Indianapolis, IN 46204-2251

An electronic copy in Acrobat PDF format on CD or DVD, in place of printed copies is appreciated, but not required.

A4. Records of all monitoring information and activities which are required to be submitted by this approval or specified in the closure or post-closure plan, must contain information listed in 329 IAC 10-1-4(a). Records must be maintained as specified in 40 CFR 257.105 and 329 IAC 10-1-4(b) and (c).

A5. Reports must be signed as specified in 329 IAC 10-11-3(b).

B. CLOSURE REQUIREMENTS

B1. The owner or operator must follow the approved closure and post-closure plans and specifications for the West Boiler Slag Pond – Phase 1 as described in the document titled "Indiana-Kentucky Electric Corporation Clifty Creek Station West Boiler Slag Pond Phase I Closure Plan," dated February 12, 2020 (VFC #82914220), and the following submittals:

a. Document dated July 1, 2020 (VFC #83003672)
b. Document dated October 12, 2020 (VFC #83057921)

B2. The method of closure approved for Indiana-Kentucky Electric Corporation Clifty Creek Station West Boiler Slag Pond - Phase 1 is closure in place.

B3. The owner or operator must notify IDEM in writing at least 15 days before the intended date to begin closure of the West Boiler Slag Pond – Phase 1.

B4. The owner or operator must follow the schedule included in the closure and post-closure plans to complete the preparation activities and final closure of the West Boiler Slag Pond – Phase 1.

B5. The owner or operator must manage surface water as described in the approved plans and meet the following requirements:

a. Maintain drainage ditches and the sedimentation basin to prevent off-site deposition of waste and sediments. Remove sediment deposits from drainage ditches as necessary to convey storm water as designed.
b. Construct temporary run-off structures as needed in areas that are unable to drain to sedimentation basin.
c. Construct erosion control silt fences, as needed, as depicted in sheet titled "Details," dated July 1, 2020 (VFC #83003672, p. 116 of 203).
d. Construct erosion and surface water control structures as follows:

(1) As specified in the document titled "Request for Additional Information No. 1, Closure Plan (Addendum 1), Clifty Creek Station West Boiler Slag Pond Phase 1 Closure," dated July 1, 2020 (VFC #83003672, pp. 111 – 116 of 203).
(2) As specified in the document titled "Indiana-Kentucky Electric Corporation Clifty Creek Station West Boiler Slag Pond Phase 1 Closure Plan," dated February 12, 2020 (VFC #82914220, pp. 146 – 152 of 233).

B6. The owner or operator must properly dispose of water that has been in contact with waste, in accordance with all applicable local, state, and federal laws (including 329 IAC 10-28-16 and IC 13-30-2-1).

B7. The owner or operator must perform inspections of the West Boiler Slag Pond until completion of the final closure as described in 40 CFR 257.83 (Inspection Requirement for CCR Surface Impoundments) and as required by this approval.

B8. The owner or operator must adopt measures that will effectively minimize CCR from becoming airborne, including waste that generates fugitive dust (40 CFR 257.80) (Air Criteria) and fugitive particulate matter, in a way that does not violate the rule for fugitive dust (326 IAC 6-4) or fugitive particulate matter (326 IAC 6-5), including 326 IAC 6-5-4(g) for solid waste handling control measures (329 IAC 10-8.2-2). The owner or operator must implement dust control measures as specified in the facility's Coal Combustion Residuals Fugitive Dust Control Plan dated included in the Title V air permit modification issued on September 15, 2020 (VFC #83043031) and take any additional steps necessary to prevent violations of fugitive dust rules and 40 CFR 257.80.

B9. The owner or operator must construct the soil and CCR material structural fill as follows:

a. Soil structural fill must be placed in loose lifts not to exceed 12 inches and be compacted to 95% of the standard proctor maximum dry density.
b. CCR materials placed as structural fill at an elevation within five feet of final cover subgrade (top of CCR before placement of final cover) must be placed in loose lifts not to exceed 12 inches and be compacted to at least 85% of the standard proctor maximum dry density.
c. Place structural fill as described in the WBSP CQC/CQA Plan included in the document dated July 1, 2020 (VFC #83003672, Appendix B, pp. 59 – 83 of 203).

B10. The owner or operator must construct the final cover as specified in the approved final grading plan drawing titled "Phase 1 Final Grade Plan," dated July 1, 2020 (VFC #83003672, Appendix B, p. 112 of 203). Grading and stabilization of the final cover must be accomplished as described in 329 IAC 10-28-14.

B11. The owner or operator must construct the final cover system for the West Boiler Slag Pond – Phase 1 in compliance with the applicable requirements of 329 IAC 10-30-2, 329 IAC 10-28-11, and 40 CFR 257.102(d) and the following specifications:

a. For the Phase 1, except for the area where the conveyor system will be located, starting from top to the bottom subgrade (top-of-existing ash) in compliance with options (1) or (2) specified below:

(1) Consisting of the following as shown in Detail 1 of the drawing titled "Details," dated July 1, 2020 (VFC #83003672, Appendix B, p. 116 of 203)
- 6 inches of vegetative soil
- A minimum two feet of compacted low permeability soil layer.

The low permeability soil layer must consist of the following:
- Compacted cohesive soil with the following properties:
  - A minimum thickness as required by 329 IAC 10-30-2(c)(2)
    - 2 feet, on slopes less than or equal to 15%
    - 3 feet, on slopes between 15% and 25%
    - 4 feet, on slopes greater than 25%

- A maximum hydraulic conductivity of the lesser of the following:
  - 1 x 10^{-5} centimeter/second
  - The hydraulic conductivity of the natural soils underneath the CCR materials in the WBSP.

Or

(2) Consisting of a geomembrane liner system as follows:

- 6 inches of vegetative soil
- 30 inches of uncompacted cover soil
- Geotextile cushion or geocomposite drainage layer
- 40-mil PVC or 40-mil LLDPE geomembrane liner or equivalent installed over 2 feet of compacted structural fill

b. For the area where the conveyor system will be located, the cover system starting from top to the bottom subgrade (top-of-existing ash) as specified below:

Consisting of a geomembrane liner system with concrete cover as shown in the detail drawings in the drawing titled “C102” dated July 1, 2020 (VFC #83003672, p. 90 of 203) and as follows:

- 9.5 inches of reinforced concrete pad
- 12 inches of sand layer
- 40-mil PVC or 40-mil LLDPE geomembrane liner or equivalent installed over 2 feet of compacted structural fill

B12. The owner or operator must test and install final cover components as specified in the WBSP CQC/CQA Plan included in the document dated July 1, 2020 (VFC #83003672, Appendix B, pp. 59 – 83 of 203), except as otherwise noted in this approval.

B13. Upon selecting the specific materials for the composite liner system, the owner or operator must test the materials to verify the interface friction values meet or exceed the values in the approved design. If the tests show the interface friction values do not achieve the minimum factor of safety assumed in the approved plans, the owner or operator must select and test alternate materials and rerun the slope stability analysis.

B14. The owner or operator must submit a final closure certification to IDEM no later than 90 days after the completion of construction of the final cover system and establishment of vegetation. The owner or operator must submit verification of environmental restrictive covenant (ERC) and deed notation to IDEM no later than 90 days after completion of all closure activities for the entire West Boiler Slag Pond. The final closure certification must comply with the following:

a. Meet the requirements of 40 CFR 257.102(f)(3), (g), (h), and (i), and 329 IAC 10, as applicable.
b. Certify the final closure is constructed according to the approved closure plan and the Quality Assurance Manual (QAM).
c. A registered professional engineer must certify the closure construction complies with the approved plans and specifications.
d. The final closure certification must include the following:

(1) The boundaries of the certified area.
(2) The results of all tests conducted during construction.
(3) The results of the interface friction tests and any new slope stability analyses, if applicable.
(4) Documentation of all storm water management features that have been constructed or installed to the extent possible as designed.
(5) Any deviation/changes from the approved closure plan must be noted and explained in the report, if any.

C. POST-CLOSURE REQUIREMENTS

C1. The owner or operator must perform a minimum of 30 years of post-closure monitoring and maintenance including the activities specified in the facility's post-closure plan dated July 1, 2020 (VFC # 83003672, Appendix J, pp. 198 – 203 of 203) and the following requirements:

a. Performance standards and post-closure duties, as specified in requirements of 40 CFR 257.104 and 329 IAC 10, as applicable.
b. The 30-year post-closure period will begin when all the CCR units/areas at the facility are certified closed and IDEM accepts the certifications.
c. Monitor and maintain the closed CCR units/areas of the facility until the 30-year post-closure period begins.

C2. To be released from post-closure monitoring, the owner or operator must submit a post-closure certification statement signed by both the owner/operator and a registered professional engineer stating the post-closure care requirements have been met and the surface impoundments are stabilized. The post-closure certification is considered adequate unless, within 90 days of receipt of the post-closure certification, IDEM either notifies the owner/operator the certification is inadequate or issues a notice of deficiency indicating post-closure care is not complete, including actions necessary to correct the deficiencies.

C3. The owner or operator must comply with the facility's ERC and/or deed restriction subsequent to the completion of post-closure care certification. The owner or operator is responsible for the following:

a. Correcting and controlling any nuisance conditions occurring at the facility (329 IAC 10-31-5);
b. Eliminating any threat to human health or the environment (329 IAC 10-31-6); and
c. Performing any remedial action at the facility, if necessary (329 IAC 10-31-7).

D. GROUNDWATER MONITORING REQUIREMENTS

D1. The owner or operator must comply with 329 IAC 10-9-1(c) and 40 CFR 257, Subpart D (Groundwater Monitoring and Corrective Action).

D2. The owner or operator must conduct groundwater monitoring throughout the closure and the 30-year post-closure care period of the unit (40 CFR 257.104(c)). IDEM will extend the post-closure care period if the facility is under assessment monitoring until the facility returns to detection monitoring (40 CFR 257.104(c)(2)).

MONITORING DEVICES

D3. The facility's groundwater monitoring system (System) includes the following groundwater monitoring wells: WBSP-15-01, WBSP-15-02, WBSP-15-03, WBSP-15-04, WBSP-15-05, WBSP-15-06, WBSP-15-07, WBSP-15-08, WBSP-15-09, and WBSP-15-10. Background groundwater monitoring wells are WBSP-15-01, WBSP-15-02, and WBSP-15-03.

At least 60 days before installing new monitoring devices, the owner or operator must submit a device-installation plan for IDEM approval. The plan must provide the following:

a. A map showing the location of each device with respect to the facility's entire System and a current potentiometric surface.
b. A demonstration that each device will yield representative groundwater samples at an appropriate location and depth within the same aquifer or aquifers as the facility's existing System, and will meet the installation requirements of 40 CFR 257.91(e).
c. Drilling methods and procedures that follow 329 IAC 10-21-4; well construction materials and details, including protocol for collecting, describing, and analyzing consolidated or unconsolidated materials (329 IAC 10-24-3(3)).
d. An example of a borehole log that includes information specified under 329 IAC 10-24-3(2).
e. Environmental qualifications of all field personnel.
f. Provisions to include the installation records in the facility operating record (40 CFR 257.91(e)(1)).

The owner or operator must submit all field documentation to IDEM within 60 days after completing all related field work.

D4. The owner or operator must label all groundwater monitoring wells with a permanent and unique identification. When reporting well information, the owner or operator must include the identification for each well.

D5. The owner or operator must secure the access ways to all groundwater monitoring wells to prevent unauthorized access and maintain the access ways so they are passable year round with the exception of flooding conditions.

D6. The owner or operator must maintain all groundwater monitoring wells as follows:

a. Complete necessary repairs, other than replacement (see Requirement D8), within 10 days after discovery or other time frame approved by IDEM.
b. Keep the wells securely capped and locked when not in use.
c. Repair all cracks in and around the casings and well pads that may affect the integrity of the wells.
d. Control vegetation height.
e. Redevelop the wells as needed.

D7. When abandoning a groundwater monitoring well that is part of the facility's approved System listed in Requirement D3, the owner or operator must:

a. Submit a written proposal for approval explaining the reasons for and detailing the method of abandonment.
b. Use methods that comply with Indiana Department of Natural Resources (IDNR) regulation 312 IAC 13-10-2.
c. Notify the IDEM Geology Section by phone, email, or letter at least 10 days before the date the abandonment work will occur.
d. Provide written notification of abandonment to IDEM and IDNR within 30 days after plugging is complete. (IDNR (312 IAC 13-10-2(f)) requires written notice.); and
e. Include the abandonment records in the facility operating record (40 CFR 257.91(e)(1)).

D8. The owner or operator must notify IDEM by phone, email, or letter within 10 days after discovering that a groundwater monitoring well has been destroyed or is not functioning properly. The owner or operator must repair the well if possible. If the well cannot be repaired, then within 30 days after discovery, the owner or operator must submit a proposal for abandonment or replacement.

PLANS

D9. The owner or operator must follow an IDEM approved Sampling and Analysis Plan (SAP) that meets the minimum requirements listed in 40 CFR 257.93(a) through (e), and (i). Requirement F4 specifies the submission of an SAP.

D10. The owner or operator must follow an IDEM approved Quality Assurance Project Plan (QAP$_j$P) that meets the requirements listed in 40 CFR 257.93(a) and (b). Requirement F5 specifies the submission of a QAPjP.

D11. The owner or operator must follow an IDEM approved Statistical Evaluation Plan (StEP) that meets the minimum requirements listed in 40 CFR 257.93(f) through (h). Requirement F6 specifies the submission of a StEP.

D12. If IDEM requests a revision to an SAP, QAPjP, or StEP, the owner or operator must submit the revised plan(s) for approval. The owner or operator must submit the plan(s) within 60 days after receiving the request. This submittal must include one original paper copy and one PDF electronic file of each plan. The owner or operator must not implement the revised plan(s) before receiving approval.

D13. If the owner or operator makes design changes to the existing System listed in Requirement D3, the owner or operator must submit a revised SAP, and if applicable, a revised QAPjP or StEP for approval. The owner or operator must submit the plans within 60 days after completing all field activities associated with the design changes. This submittal must include one original paper copy and one PDF electronic file of each plan. The owner or operator must not implement the revised plan(s) before receiving approval.

MONITORING PROGRAMS

D14. The owner or operator must sample the facility's System listed in Requirement D3 semiannually during May and November of each year. Each sample must be analyzed following the Detection Monitoring Program (40 CFR 257.94) for the following Appendix III constituents:

a. Total Boron
b. Total Calcium
c. Chloride
d. Fluoride
e. Field pH
f. Sulfate
g. Total Dissolved Solids

The owner or operator may demonstrate an alternative frequency of sampling for the Appendix III constituents following 40 CFR 257.94(d).

When applicable (see Requirement D19), each sample must be analyzed following the Assessment Monitoring Program (40 CFR 257.95) for the following Appendix IV constituents:

h. Total Antimony
i. Total Arsenic
j. Total Barium
k. Total Beryllium
l. Total Boron
m. Total Cadmium
n. Total Chromium
o. Total Cobalt
p. Fluoride
q. Total Lead
r. Total Lithium
s. Total Mercury
t. Total Molybdenum
u. Total Selenium
v. Total Thallium
w. Radium 226 and 228 combined

For specific metallic constituents, if the owner or operator demonstrates with the approval of IDEM that the results for a filtered (dissolved) metal are no greater than 20% of the relative percent difference of an unfiltered (total recoverable) metal, then the owner or operator may incorporate historic filtered results into the background data set instead of collecting a minimum of eight additional independent samples (40 CFR 257.94(c)) for the unfiltered metal results. The owner or operator may propose an alternative method for incorporating historic results of the specific dissolved metal into the background data set for IDEM review and approval.

Whenever results of total chromium occur at or above its background concentration or maximum contaminant level, whichever is the higher concentration, the owner or operator must speciate and report both trivalent and hexavalent chromium.

D15. The owner or operator must use the results of the static water level measurements from the System listed in Requirement D3 to prepare potentiometric surface maps or groundwater flow that include the following information:

a. Location and identification of each groundwater monitoring well.
b. Groundwater elevations for each well and surface water elevations for the Ohio River. The owner or operator must measure all static water levels on the same day and as close in time as possible before the purging and sampling event.
c. Date and time of static water level measurement for each well.
d. Ground-surface elevation at each well.
e. Facility property boundaries.
f. Identification of the aquifer represented, either by a name or elevation.
g. Solid waste fill boundaries.
h. Facility name and county.
i. Map scale, north arrow, groundwater flow direction arrows, and potentiometric-surface contour intervals.
j. Indications of which wells are considered background, upgradient, or downgradient.
k. Locations and elevations of all site benchmarks.

D16. If a groundwater flow map indicates that the groundwater flow direction, including flow reversals, is other than anticipated in the design of the System listed in Requirement D3, then the owner or operator must notify IDEM of the difference in the groundwater monitoring report submitted for Requirement D23. The notification must include either of the following: information demonstrating that the System complies with 40 CFR 257.91(c); or a proposal to revise the System design for IDEM approval.

The owner or operator must determine if the System currently complies with 40 CFR 257.91(c) before collecting samples for the scheduled semiannual sampling event. If a flow reversal occurs, then the owner or operator may postpone, with IDEM approval, the scheduled semiannual sampling event in 30-day extension increments if they determine that the System does not comply with 40 CFR 257.91(c).

If the owner or operator determines a groundwater flow reversal occurred during a scheduled semiannual sampling event, then data from that sampling event must not be utilized in statistical evaluations specified in the StEP or incorporated into background groundwater quality and groundwater protection standard calculations, unless the owner or operator adequately demonstrates to IDEM that the data accurately represents established groundwater quality conditions when a flow reversal did not occur. Additionally, the owner or operator must immediately schedule a replacement sampling event in order to complete the required semiannual evaluation for groundwater releases from the facility. Within seven days of scheduling the replacement sampling event, the owner or operator must notify IDEM of the schedule.

If design changes to the existing System are necessary, then the owner or operator must make the changes within 30 days after receiving IDEM approval of the revised design or other time frame approved by IDEM.

D17. Background groundwater monitoring well(s) must provide groundwater samples that represent historical conditions unaffected by a CCR unit or facility activities that may contribute Appendix III and Appendix IV constituents listed in Requirement D14 against which background comparisons occur. Additionally, for any background well added to the System listed in Requirement D3, the owner or operator must:

a. Establish background groundwater quality for the Appendix III and Appendix IV constituents listed in Requirement D14.
b. Determine the background groundwater quality by sampling each new well for eight independent sampling events within 12 months after the well's installation, unless the owner or operator can justify to IDEM an extended period of no more than 12 additional months.

If the owner, operator, or IDEM determines that the current System (see Requirement D3) does not have the required background well(s), then within 60 days the owner or operator must submit a plan per Requirement D3 proposing to establish new or additional background wells for the current System for IDEM review and approval. This plan must include well location(s) for obtaining background groundwater quality samples that satisfy the specifications of this requirement.

D18. The owner or operator must implement the StEP identified in Requirement D11 and include the outcome of each statistical determination in a statistical evaluation report (see Requirement D23.d).

D19. The owner or operator must implement a detection monitoring program consistent with 40 CFR 257.94 and the StEP. If the owner or operator determines there is a statistically significant increase (SSI) over background for one or more of the Appendix III constituents listed in Requirement D14 at any of the downgradient groundwater monitoring wells, then the owner or operator must comply with one of the following requirements:

a. Demonstrate that a source other than the CCR unit caused the SSI over background levels for a constituent, or that the SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (40 CFR 257.94(e)(2)). Within 45 days of detecting an

SSI over background levels, or other time frame approved by IDEM, the owner or operator must submit the written demonstration to IDEM.

If the demonstration is approved, the owner or operator may continue with a detection monitoring program for any unit for which the demonstration was made;

b. Within 30 days of receiving notice that the demonstration is not acceptable to IDEM, submit an assessment monitoring program plan meeting the requirements of 40 CFR 257.95, which includes the Appendix IV constituents listed in Requirement D14, to IDEM for approval. Within 90 days of determining an SSI, the owner or operator must establish and implement the assessment monitoring program following 40 CFR 257.95, which includes the Appendix IV constituents listed in Requirement D14. The owner or operator must also implement the assessment monitoring program plan after receiving approval from IDEM; or

c. If a demonstration is not pursued, the owner or operator must submit an assessment monitoring program plan specified in Requirement 19.b within 30 days of determining the SSI. Within 90 days of determining an SSI, the owner or operator must establish and implement the assessment monitoring program following 40 CFR 257.95, which includes the Appendix IV constituents listed in Requirement D14. The owner or operator must also implement the assessment monitoring program plan after receiving approval from IDEM.

D20. Within 90 days of finding that any of the Appendix IV constituents listed in Requirement D14 have been detected at a statistically significant level exceeding the groundwater protection standards defined in 40 CFR 257.95(h), or the groundwater protection standard for boron of 4 mg/L or background, whichever is greater, the owner or operator must comply with one of the following requirements (40 CFR 257.95(g)(3)):

a. Complete the assessment of corrective measures as required by 40 CFR 257.96, and submit the results of the corrective measures assessment to IDEM for approval. As part of the selection of corrective measures, the owner or operator must include an evaluation of potential groundwater flow reversals on the System. The 90-day deadline to complete the assessment of corrective measures may be extended for no longer than 60 days. After receiving IDEM approval, the owner or operator must implement Requirement D21; or

b. Demonstrate that a source other than the CCR unit caused the contamination, or that the statistically significant level exceeding the groundwater protection standard resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality consistent with 40 CFR 257.95(g)(3)(ii). Within 90 days of detecting a statistically significant level exceeding the groundwater protection standard, the owner or operator must complete and submit the written demonstration to IDEM for approval.

If the demonstration is approved, then the owner or operator may continue with an assessment monitoring program for any unit for which the demonstration was made.

D21. At least 30 days prior to initiating 40 CFR 257.97, the owner or operator must hold a public meeting to discuss the results of the corrective measures assessment with interested and affected parties. As soon as feasible, the owner or operator must select a remedy that, at a minimum, meets the standards listed in 40 CFR 257.97(b). The owner or operator must submit the first semiannual report describing the progress in selecting and designing the remedy (40 CFR 257.97(a)) to IDEM for review and approval. If additional semiannual progress reports are necessary, the owner or operator must submit the reports within six months of submitting the previous semiannual report. The final report for the selected remedy must, at a minimum, meet the standards listed in 40 CFR 257.97(b), utilizing the provisions specified in 40 CFR 257.97(c) and (d), and must be approved by IDEM.

D22. Within 90 days of receiving IDEM approval of the selected remedy, the owner or operator must initiate remedial activities based on the approved remedy and the standards listed in 40 CFR 257.98. The corrective action program is complete when IDEM approves the owner or operator’s demonstration that concentrations of Appendix IV constituents listed in Requirement D14 have not exceeded the groundwater protection standard(s) for a period of three consecutive years at all points of the plume beyond the System following 40 CFR 257.98(c).

REPORTING

D23. The owner or operator must submit a groundwater monitoring report that includes the results obtained from the implementation of Requirements D14 or D17 no later than 60 days after each groundwater monitoring event with the following exceptions:

- The owner or operator must submit radium-specific information no later than 90 days after the groundwater monitoring event.
- If the owner or operator implements a verification resampling program, then the owner or operator must submit verification resampling results no later than 30 days after the last verification event. Verification resampling is defined in the March 2009 *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities* (EPA 530/R-09-007).

The owner or operator must submit the report to the IDEM Solid Waste Permits Section in one unbound paper copy and in one electronic PDF file. The report must include the following:

a. One original unbound laboratory-certified report with analytical results, field parameters (see Requirement D24), field sheets, and chain-of-custody forms. The laboratory-certified report must include the following: detection limit for each chemical constituent, date samples collected, date the laboratory received the samples, date the laboratory analyzed the samples, date the laboratory prepared the report, method of analysis the laboratory used for each constituent, sample identification number for each sample, and results of all sample analyses.

b. All information specified in Requirement D15 and a table summarizing the static water level and groundwater elevation for each well.

c. An evaluation of the groundwater quality, recent notifications of any compliance issues related to a problematic well (see Requirement D8), special field observations and procedures, and deviations from the SAP.

d. One original unbound copy of the statistical evaluation report (see Requirement D18).

The owner or operator may mail the PDF copy and electronic data file specified in Requirement D24 on a CD-ROM or DVD. The owner or operator must clearly label the PDF copy and electronic data file with the facility name and a brief description of the file. Alternatively, the owner or operator may email the PDF copy and electronic data file to the IDEM Solid Waste Permits Section at the address listed in Requirement A3 and carbon copy olqdata@idem.IN.gov. The email must include the facility name and a brief description typed in the email's subject heading.

D24. The owner or operator must submit one electronic data file of the analytical results and field parameters from the System (see Requirement D3) formatted as an ASCII, tab-delimited text file. The electronic data file must contain the facility name, SW Program ID number, and the name of the analytical laboratory. Additionally, the file must include the fields listed below for the analytical results and as applicable, the following field parameters: pH, specific conductance, temperature, turbidity, well depth, depth to water, and static water elevation.

a. SamplingDate: Month, day, and year (mm/dd/yyyy). Value should be formatted as a date if possible.

b. SamplePointName: Names of groundwater monitoring wells, piezometers, leachate wells, surface water collection points, etc.

c. LaboratorySample ID: ID assigned to the sample by the laboratory.

d. SampleType: Regular, duplicate(s), trip blank(s), equipment blank(s), field blank(s), verification re-sample(s), and replicate(s).

e. SpeciesName: Chloride, sodium, ammonia, field pH, etc. The order of constituents is not critical. However, it is best to reflect the order that is on the laboratory-data sheets and keep all field data grouped together. Metals should indicate "dissolved" phase or "total" phase. Associated static water levels do not have their own header, but must be entered as "GW WaterLevel" under the header "SpeciesName." The actual elevations must be entered under the header "Concentration."

f. Concentration (results): The entry must be a number. Please do not enter text, such as "NA," "ND," or "<."

g. ConcentrationUnits: mg/l, µg/l, standard units for pH, degrees Celsius (^{o}C) or degrees Fahrenheit (^{o}F) for temperature, and umhos/cm for specific conductance.

h. Detected: Yes or no.

i. DetectionLimit.

j. AnalyticalMethods.

k. EstimatedValue: Indicate “Yes” if the reported concentration is an estimated value. If a value recorded was not estimated, enter “No.” If a concentration is estimated, use the “Comment” field to explain why the concentration was estimated.
l. Comment: Analytical laboratory and/or field personnel comments regarding the reported results.
m. SampleMedium: Groundwater, leachate, surface water, etc.
n. ProgramArea: Solid Waste.

Additional guidance on electronic data file submittals is available on IDEM's website at www.in.gov/idem/landquality/2369.htm or by emailing questions to olqdata@idem.IN.gov.

D25. The owner or operator must retain laboratory quality assurance/quality control (QA/QC) documentation from valid analyses of groundwater samples for at least three years.

Upon IDEM request, the owner or operator must submit the laboratory QA/QC for a specified groundwater monitoring data package, in one paper copy and one electronic copy in PDF format, within 60 days after receiving the request. The "*Solid & Hazardous Waste Programs, Analytical Data Deliverable Requirements: Supplemental Guidance*" provides additional information about laboratory QA/QC. The guidance is available on IDEM's website at www.in.gov/idem/landquality/files/sw_resource_data_deliverable_reqs.pdf.

E. FINANCIAL RESPONSIBILITY FOR CLOSURE AND POST-CLOSURE

E1. The owner or operator must update and maintain a financial assurance mechanism as specified in 329 IAC 10-39 in an amount not less than the estimated costs of closure and post-closure in the approved closure and post-closure plan for the Phase I of the West Boiler Slag Pond.

E2. The owner or operator must annually review and submit an update by June 15 addressing the following items as detailed in 329 IAC 10-39-2(c) and (d), and 329 IAC 10-39-3(c):

a. The owner or operator must adjust the closure and post-closure cost estimates for inflation.
b. The owner or operator must revise the cost estimates to account for changes which increase the cost of closure or post-closure.
c. The owner or operator may revise the cost estimates to account for changes which reduce the cost of closure or post-closure. The owner or operator must provide documentation supporting reduced cost-estimates, for example, letters and maps documenting areas certified as closed.
d. The owner or operator must submit an existing contour map of the approved solid waste land disposal facility that delineates the boundaries of all areas into which waste has been placed, and the boundaries of areas certified as closed. The map must be certified by a professional engineer or a registered land surveyor.

e. The owner or operator must submit documentation showing that the financial assurance mechanism is current to cover the estimated costs of closure and post-closure.

F. COMPLIANCE SCHEDULE REQUIREMENTS

F1. The owner or operator must establish a financial assurance mechanism as specified in 329 IAC 10-39 in an amount not less than the estimated costs of closure and post-closure in the approved closure and post-closure plan for Phase 1 of the West Boiler Slag Pond no later than 45 days after receipt of this approval and submit proof of the establishment of the financial assurance to IDEM no later than 60 days after receipt of this approval.

F2. At least 60 days prior to commencing placement of the cover system, the owner or operator must notify IDEM if either a soil cover system or a geosynthetic cover system will be applied to the West Boiler Slag Pond – Phase 1.

F3. At least 60 days prior to commencing closure activities for the West Boiler Slag Pond – Phase 1, the owner/operator must submit to IDEM the permeability test results for the subsurface soils beneath the West Boiler Slag Pond and receive approval from IDEM the maximum hydraulic conductivity allowed for the low permeability soil layer specified in Requirement B11.a.1.

F4. Within 60 days after receiving this IDEM Approval Letter, the owner or operator must submit a Sampling and Analysis Plan (SAP) that meets Requirement D9. The SAP must describe sampling protocols, equipment, and methods for collecting samples to be analyzed for constituents listed in Requirement D14. The owner or operator must implement the SAP upon IDEM's written approval. The submittal must include one original paper copy and one PDF electronic file.

F5. Within 60 days after receiving this IDEM Approval Letter, the owner or operator must submit a Quality Assurance Project Plan (QAP_jP) that meets Requirement D10 for the constituents listed in Requirement D14. The owner or operator must implement the QAP_jP upon IDEM's written approval. The submittal must include one original paper copy and one PDF electronic file.

F6. Within 60 days after receiving this IDEM Approval Letter, the owner or operator must submit a Statistical Evaluation Plan (StEP) that meets Requirement D11. The StEP is effective upon IDEM's written approval. The submittal must include one original paper copy and one PDF electronic file.

In the StEP, the owner or operator must present the data distribution assumptions. The statistical procedures must be appropriate for the data distribution and provide a balance between the probability of falsely identifying a statistically significant difference and the probability of failing to identify a statistically significant difference. To achieve the balance, the owner or operator should consider the background sample sizes, the number of individual statistical tests performed, the number of groundwater monitoring wells, and the specific verification resampling method. The statistical procedures must account for analytical results below method detection limits.