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WRITER'S DIRECT DIAL NO:
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March 14, 2025

Delivered Electronically

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

Dear Mr. Woods,

Re: Indiana-Kentucky Electric Corporation
Notification of CCR Rule Information Posting
Assessment of Corrective Measures Addendum No. 1
West Boiler Slag Pond

As required by 40 CFR 257.106(h)(7), the Indiana-Kentucky Electric Corporation (IKEC) is providing notification to the Commissioner of the Indiana Department of Environmental Management that Addendum No. 1 to the West Boiler Slag Pond (WBSP) Assessment of Corrective Measures (ACM) has been added to the company's publicly accessible internet site. Addendum No. 1 will be used to support the ongoing evaluation of potential corrective measures for the WBSP.

As required by 40 CFR 257.96(d), the addendum provides an update and details of the effectiveness of the potential corrective measures. The addendum was prepared by AGES, Inc., the site's hydrogeologist, using 40 CFR 257.24 as a basis for the selection of potential remedies. Per 40 CFR 257.106(h)(8), this letter provides notification that the report has been placed in the facility's operating record, as well as on the company's publicly accessible internet site and can be viewed at https://www.ovec.com/CCRCompliance.php . As required by 40 CFR 257.96(e), IKEC will discuss the results of the corrective measures at least 30 days prior to the selection of remedy in a public meeting with interested and affected parties.

If you have any questions, or require any additional information, please call me at (740) 289-7259.

Sincerely,

Jeremy Galloway
Environmental Specialist
JDG:zsh

AGES
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COAL COMBUSTION RESIDUALS REGULATION
ASSESSMENT OF CORRECTIVE MEASURES REPORT
ADDENDUM NO. 1
WEST BOILER SLAG POND
INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA

MARCH 2025

Prepared for:

INDIANA-KENTUCKY ELECTRIC CORPORATION (IKEC)

Prepared by:

APPLIED GEOLOGY AND ENVIRONMENTAL SCIENCE, INC.

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Prepared by:

APPLIED GEOLOGY AND ENVIRONMENTAL SCIENCE, INC.

Travis Sitko
Scientist I

Robert W. King, P.G.
Chief Hydrogeologist

COAL COMBUSTION RESIDUALS REGULATION
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MADISON, INDIANA

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

COAL COMBUSTION RESIDUALS REGULATION
ASSESSMENT OF CORRECTIVE MEASURES REPORT
ADDENDUM NO. 1
WEST BOILER SLAG POND
INDIANA-KENTUCKY ELECTRIC CORPORATION
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MADISON, INDIANA

LIST OF ACRONYMS

ºC	Degrees Celsius
ACM	Assessment of Corrective Measures
AGES	Applied Geology and Environmental Science, Inc.
bgs	Below Ground Surface
CCR	Coal Combustion Residuals
cm/sec	Centimeters per Second
ft/day	Feet per Day
GMPP	Groundwater Monitoring Program Plan
gpm	Gallons per Minute
GWPS	Groundwater Protection Standard
IKEC	Indiana-Kentucky Electric Corporation
K	Hydraulic Conductivity
mm	Millimeter
msl	Mean Sea Level
mV	Millivolts
MW	Megawatt
RCRA	Resource Conservation and Recovery Act
PVC	Polyvinyl Chloride
SSI	Statistically Significant Increase
Stantec	Stantec Consulting Services Inc.
StAP	Statistical Analysis Plan
SU	Standard Unit
U.S. EPA	United States Environmental Protection Agency
U.S. FWS	United States Fish and Wildlife Service
ug/L	Micrograms per Liter
WBSP	West Boiler Slag Pond

COAL COMBUSTION RESIDUALS REGULATION
ASSESSMENT OF CORRECTIVE MEASURES REPORT
ADDENDUM NO. 1
WEST BOILER SLAG POND
INDIANA-KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA

1.0 INTRODUCTION

The Clifty Creek Station, located in Madison, Indiana, is a 1,304-megawatt (MW) coal-fired generating plant operated by the Indiana-Kentucky Electric Corporation (IKEC), a subsidiary of the Ohio Valley Electric Corporation. The Clifty Creek Station has six (6) 217.26-MW generating units and has operated since 1955 (Figure 1-1). Beginning in 1955, coal combustion residual (CCR) products were sluiced to disposal ponds in the plant site.

On December 19, 2014, the United States Environmental Protection Agency (U.S. EPA) issued their final CCR regulation, which regulates CCR as a non-hazardous waste under Subtitle D of the Resource Conservation and Recovery Act (RCRA) and became effective six (6) months from the date of its publication (April 17, 2015) in the Federal Register, referred to as the "CCR Rule." The CCR Rule applies to new and existing landfills, as well as surface impoundments used to dispose of or otherwise manage CCR generated by electric utilities and independent power producers. Because the CCR Rule was promulgated under Subtitle D of RCRA, it does not require regulated facilities to obtain permits, does not require state adoption, and cannot be enforced by the U.S. EPA.

The CCR Rule in 40 CFR § 257.96(a) requires that an owner or operator initiate an Assessment of Corrective Measures (ACM) to prevent further release, to remediate any releases, and to restore the affected area(s) to original conditions in the event that any Appendix IV constituent has been detected at a Statistically Significant Level greater than a Groundwater Protection Standard (GWPS). An ACM must be completed within 90 days after initiation. However, the CCR Rule allows up to an additional 60 days to complete the ACM if a demonstration shows that more time is needed because of site-specific conditions or circumstances, which requires a certification from a qualified professional engineer attesting that the demonstration is accurate. The owner or operator must also include the certified demonstration in the annual groundwater monitoring and corrective action report required in 40 CFR § 257.90(e).

In October 2023, IKEC prepared an ACM Report for the West Boiler Slag Pond (WBSP) at the Clifty Creek Station in compliance with 40 CFR § 257.90(c) (AGES 2023). The report included a summary of groundwater monitoring conducted at the unit, the results of site characterization activities, and a review of potential remedial technologies to address groundwater issues at the WBSP. Due to regulatory access issues, the property boundary wells (as required by the CCR

Rule) could not be installed at the WBSP during the site characterization. Therefore, during the first quarter of 2024, property boundary wells were installed at the unit and sampled.

This report, Addendum No.1 to the ACM Report, includes the property boundary well installation details, testing and sampling, and an update on the site characterization. Based on a review of recent trends in groundwater remediation, IKEC has opted to evaluate whether phytoremediation is feasible as a supplemental remedial technology to augment other primary remedial technologies used to address groundwater at the site. Further information regarding the applicability of phytoremediation is presented in Section 5.0 of this addendum.

2.0 BACKGROUND

2.1 Detection and Assessment Monitoring Programs – January 2016-March 2023

During the course of plant operations, CCRs have been managed and disposed of in the WBSP at the site (Figure 1-1). To comply with the CCR regulation, IKEC installed a groundwater monitoring network at the WBSP. As detailed in the Monitoring Well Installation Report (AGES 2018) and the 2023 Annual Groundwater Monitoring and Corrective Action Report (AGES 2024a), the CCR groundwater monitoring network for the WBSP includes the following 13 wells:

- CF-15-04 (Background);
- CF-15-05 (Background);
- CF-15-06 (Background);
- WBSP-15-01 (Upgradient);
- WBSP-15-02 (Upgradient);
- WBSP-15-03 (Upgradient);
- WBSP-15-04a (Downgradient);
- WBSP-15-05a (Downgradient);
- WBSP-15-06a (Downgradient);
- WBSP-15-07 (Downgradient);
- WBSP-15-08 (Downgradient);
- WBSP-15-09 (Downgradient); and
- WBSP-15-10 (Downgradient).

The locations of the wells in the groundwater monitoring network are shown on Figure 2-1. As listed above and shown in Table 2-1, the CCR groundwater monitoring network for the WBSP includes six (6) background and upgradient wells and seven (7) downgradient wells, which satisfies the requirements of the CCR Rule. Generalized groundwater flow maps (including the Ohio River) for March 2022, September 2022, March 2023, and September 2023 are included in Appendix A. Note that wells CF-15-04, CF-15-05, and CF-15-06 are not shown on the groundwater flow maps as they are background wells and are not screened in the uppermost aquifer beneath the WBSP.

From January 2016 through August 2017, nine (9) rounds of background groundwater monitoring were conducted; the first round of Detection Monitoring was performed in March 2018. From 2018 through 2021, no Statistically Significant Increases (SSIs) were identified for Appendix III constituents at the WBSP; therefore, this unit remained in Detection Monitoring under the CCR program.

In March 2022, a potential SSI for Fluoride (Appendix III constituent) in well WBSP-15-09 was confirmed during the resampling event in June 2022. Based on the results and in accordance with 40 CFR § 257.94(e), IKEC established an Assessment Monitoring Program meeting the requirements of 40 CFR § 257.95 and prepared a notification stating that an Assessment Monitoring Program had been established.

Upon receipt, the September 2022 Assessment Monitoring data were statistically evaluated in accordance with 40 CFR § 257.93(f) of the CCR Rule and the Statistical Analysis Plan (StAP) (Stantec Consulting Services Inc. [Stantec] 2021). No SSIs for Appendix III constituents were identified. However, Arsenic (Appendix IV constituent) was detected in downgradient wells; therefore, in accordance with 40 CFR § 257.95(d), IKEC established GWPS for all Appendix IV constituents detected at the WBSP.

The statistical evaluation of the Appendix IV constituents from the September 2022 Assessment Monitoring event identified potential SSIs for Arsenic in wells WBSP-15-07, WBSP-15-08, and WBSP-15-09. In accordance with the StAP, IKEC resampled the wells on December 21, 2022. Based on the results of the resampling event, the potential SSI in well WBSP-15-07 was not confirmed. However, Arsenic was detected above the GWPS of 10 micrograms per liter (ug/L) in wells WBSP-15-08 (66 ug/L and 58 ug/L [resampling]), and WBSP-15-09 (23 ug/L and 16 ug/L [resampling]). Therefore, the Arsenic SSIs for wells WBSP-15-08 and WBSP-15-09 were confirmed.

In the next round of sampling in March 2023, the Assessment Monitoring results were statistically evaluated in accordance with 40 CFR § 257.93(f) of the CCR Rule and the StAP. No SSIs for Appendix III constituents were identified; however, the statistical evaluation of the Appendix IV constituents identified potential SSIs in wells WBSP-15-07 (Arsenic), WBSP-15-08 (Arsenic), WBSP-15-09 (Arsenic), and WBSP-15-10 (Arsenic and Cobalt). In accordance with the StAP, IKEC resampled the wells on June 13, 2023; the potential SSIs in well WBSP-15-10 for Arsenic and Cobalt were not confirmed. However, Arsenic was detected above the GWPS of 10 ug/L in wells WBSP-15-07 (87 ug/L and 25 ug/L [resampling]), WBSP-15-08 (100 ug/L and 70 ug/L [resampling]), and WBSP-15-09 (25 ug/L and 26 ug/L [resampling]). Therefore, the Arsenic SSIs for wells WBSP-15-07, WBSP-15-08, and WBSP-15-09 were confirmed.

2.2 Site Characterization

Based on the above results, IKEC implemented a site characterization, conducted ACM, and prepared an ACM Report for the WBSP in compliance with 40 CFR § 257.90(c) (AGES 2023). As presented in the ACM Report, to meet the requirement of 40 CFR § 257.95 (g)(1), IKEC attempted to locate four (4) wells at the facility boundary in the direction of contaminant migration. However, the property boundary in this area of the facility is densely wooded and could not be safely accessed by a drilling rig without cutting down several trees. As the facility is located within the habitat of the Indiana Bat, the Programmatic Biological Opinion (BO) for Transportation Projects in the Range of the Indiana Bat and Northern Long-Eared Bat prepared by U.S. Fish and Wildlife Service (U.S. FWS) is applicable (U.S. FWS 2018). Per this regulation, tree clearing in Indiana can only occur during inactive bat season, from October 1 to March 31; as a result, IKEC could not clear trees and safely access the area along the Ohio River with a drilling rig until at least October 1, 2023. Therefore, monitoring wells could not be installed along the property boundary within the timeframe required for the ACM Report; this was noted in the ACM Report as a data gap.

To better evaluate the extent of Arsenic impacts during the site characterization, four (4) interim wells (WBSP-23-01 through WBSP-23-04) were installed in the uppermost aquifer downgradient of the WBSP but not at the property boundary and not within the bat habitat (Figure 2-2). After installation, the wells were properly developed and sampled in August 2023 for Arsenic in accordance with the Groundwater Monitoring Program Plan (GMPP) for the Clifty Creek Station (AGES 2024b). As presented in Figure 2-3, Arsenic was detected in the following wells at concentrations that exceed the GWPS of 10 ug/L:

- WBSP-23-01: 69 ug/L;
- WBSP-23-02: 41 ug/L;
- WBSP-23-03: 16 ug/L; and
- WBSP-23-04: 42 ug/L.

2.3 Assessment Monitoring Program – September 2023

Assessment Monitoring results for September 2023 were statistically evaluated in accordance with 40 CFR § 257.93(f) of the CCR Rule and StAP. No SSIs were identified for Appendix III constituents; however, the statistical evaluation of the Appendix IV constituents identified potential SSIs in wells WBSP-15-07 (Arsenic), WBSP-15-08 (Arsenic), WBSP-15-09 (Arsenic), and WBSP-15-10 (Radium 226 & 228 [combined]). In accordance with StAP, IKEC resampled the wells on November 29, 2023; the potential SSI in well WBSP-15-10 for Radium 226 & 228 (combined) was not confirmed. However, Arsenic was detected above the GWPS of 10 ug/L in wells WBSP-15-07 (42 ug/L and 51 ug/L [resampling]), WBSP-15-08 (70 ug/L and 68 ug/L [resampling]), and WBSP-15-09 (23 ug/L and 20 ug/L [resampling]). Therefore, the Arsenic SSIs for wells WBSP-15-07, WBSP-15-08, and WBSP-15-09 were confirmed.

3.0 INSTALLATION OF PROPERTY BOUNDARY WELLS

As specified in 40 CFR § 257.95(g)(1), at least one (1) additional monitoring well must be installed at the facility boundary in the direction of contaminant migration and sampled. Because this could not be completed in 2023 due to regulatory restrictions, property boundary wells were installed at the WBSP in the first quarter of 2024. On January 29, 2024, AGES and HAD Drilling, Inc. (HAD), a drilling contractor from Rittman, Ohio, mobilized to the site with an all-terrain drilling rig to complete the work. However, upon arrival at the site, it was determined that the Ohio River had flooded, and the proposed well locations were under three (3) to four (4) feet of flood water. After the flood water receded, AGES and HAD returned to the site on February 27, 2024, and completed well installation on February 29, 2024.

Details regarding this work are presented in the following sections of this report.

3.1 Monitoring Well Installation, Development, Sampling, and Aquifer Testing

To evaluate the extent of Arsenic impacts, three (3) property boundary wells (WBSP-24-02 through WBSP-24-04) were installed in the uppermost aquifer, downgradient of the WBSP (Figure 3-1). A fourth well (WBSP-24-01) was planned for installation, but the intended location could not be safely accessed due to the topography, even with an all-terrain drilling rig. Well drilling activities were completed via hollow-stem auger drilling, during which, the drill bit was simultaneously pushed down and rotated, and continuous split-spoon samples were collected and logged by AGES. The augers were used to advance each boring to the desired depth and were kept in place to keep the borehole open during well installation. The augers were then removed as the well installation progressed.

Two (2)-inch-diameter, 0.01” slotted Schedule 40 polyvinyl chloride (PVC) pre-packed screens, designed specifically for sampling metals in groundwater, were selected for use in the wells at the WBSP to reduce turbidity. These pre-packed well screens were constructed using an inner filter pack consisting of 0.40 millimeter (mm) clean quartz filter sand between two (2) layers of food-grade plastic mesh to reduce sample turbidity by filtering out smaller particles than is possible with standard filter-packed wells and pre-pack screens. No metal components were used in the construction of the pre-packed well screens, thus eliminating potential interference with metals analysis.

Once each borehole was advanced to the desired depth, the pre-packed well screen was set into the borehole. The sand was placed as the augers were pulled back in one (1)- to two (2)-foot increments to reduce caving effects and ensure proper placement of the filter pack. The filter packs extended two (2)-feet above the top of the screens.

A two (2)-foot to three (3)-foot thick annular bentonite seal was installed above the filter pack in each well. Once in place, the bentonite seal was allowed to hydrate before the remainder of the annular space around each monitoring well was backfilled using a grout consisting of Portland cement and bentonite. Each monitoring well was completed with an above-ground protective steel casing and a locking well cap. Following installation, each monitoring well was surveyed for elevation and location by IKEC personnel.

Well construction details for the three (3) boundary wells are presented in Table 3-1. All boring and well logs are included in Appendix B.

3.1.1 Monitoring Well Development

Well development was initiated at least 48 hours after installing each of the monitoring wells and consisted of alternating surging and pumping with a submersible pump. During development of the monitoring wells, field parameters including temperature, specific conductance, pH, and turbidity were recorded at regular intervals. Development continued until field parameters stabilized. Well development data for each well is summarized in Table 3-2.

3.1.2 Groundwater Sampling

In March and September 2024, the three (3) wells were sampled for Arsenic in accordance with the GMPP for the Clifty Creek Station (AGES 2024b). The monitoring wells were purged using a pump to remove stagnant water in the casings and to ensure that representative groundwater samples were collected. Samples were collected in pre-preserved bottles provided by the laboratory. All bottles were labeled with a unique sample identification number, time and date of sample collection, and the identity of the sampling fraction. Field parameters were measured and recorded on purging forms during sample collection.

Following sample collection, the samples were packed in ice-filled coolers, insulated to four (4) degrees centigrade (ºC), and shipped to the Eurofins Environment Testing analytical laboratory in Buffalo, New York.

3.1.3 Aquifer Testing

In May 2024, slug tests were conducted on wells WBSP-24-02 and WBSP-24-03 to obtain data to calculate the saturated hydraulic conductivity (K) for the shallow and deep aquifers beneath the WBSP. Both rising and falling head slug tests were performed on each well. The falling head tests were conducted by lowering a pre-fabricated solid slug with a known volume into the water column of the well and recording the drop in head over time. The rising head tests were performed by removing the solid slug and recording the rise in head over time. The head change over time was recorded using a data logger and pressure transducer. Dedicated rope was used for each well and the slug was decontaminated between wells using the procedures specified in the GMPP for the Clifty Creek Station (AGES 2024b).

The slug test data were evaluated using AQTESOLV, a commercially available software package. Data from each monitoring well were analyzed using both the Bouwer-Rice and Hvorslev slug test solutions (with automatic curve matching), which are straight-line analytical techniques commonly used to analyze rising and falling head slug test data. The AQTESOLV data for each well are presented in Appendix C.

4.0 UNIT DESCRIPTION AND RESULTS

4.1 Regional Geologic Setting

The site lies in the Central Lowland Physiographic Province along the western flanks of the Cincinnati Arch and within the Central Stable Region. The stratigraphic sequence in the regional area consists of widespread discontinuous layers of Quaternary deposits of alluvial and glacial origin overlying sedimentary rocks generally consisting of limestones, dolomites, and interbedded shale. The exposed sedimentary rocks range in age from Mississippian to Ordovician. The Quaternary deposits are mainly of glacial origin and consist of loess, till, and outwash. Glacial outwash is present in nearly all stream valleys north of and including the Ohio River Valley. The outwash is covered, in some cases, by a veneer of recent alluvial deposits from active streams.

Unconsolidated alluvial sediments deposited along, near, or adjacent to the Ohio River Valley constitute the major aquifer of the region. These deposits are normally found only within the Ohio River Valley and the tributary streams north and northeast of the river. Wells installed in this aquifer typically yield 100 to 1,000 gallons per minute (gpm), depending upon their location and construction. The Ohio River Valley is incised into Ordovician bedrock. The low permeability bedrock forms the lateral and underlying confinement to the aquifer.

4.2 Unit-Specific Geologic Setting

The WBSP is formed by natural grade to the north, east, and west and a southern dike that runs along the bank of the Ohio River (Figure 4-1). The Devil's Backbone, an elongated bedrock ridge, borders the northern side of the WBSP. A generalized geologic cross-section of this unit is presented in Figure 4-2; the location of the cross-section is shown on Figure 3-1. Based on boring logs generated during well installation at the unit, the WBSP is underlain by alluvial deposits consisting of layers of silty clay, sandy silt, and silty sand ranging from approximately 15 feet below ground surface (bgs) on the northwest side of the WBSP (closest to the Devil's Backbone) to approximately 90 feet bgs on the southeast side of the WBSP (closest to the Ohio River). Well borings indicated that the uppermost aquifer beneath the WBSP is a layer of gray silt with fine sand, becoming more coarse-grained further to the north and northeast. The uppermost aquifer is located at an elevation of approximately 420 feet mean sea level (msl) beneath the WBSP.

Based on the results of the site characterization, a comprehensive update to the understanding of the geology at the WBSP is not necessary. However, as shown on Figure 4-2, south of the WBSP (in the area of interim well [WBSP-23-03] and property boundary well [WBSP-24-03]), the uppermost aquifer becomes finer-grained towards the Ohio River, transitioning from a silt with fine sand to a silty clay with fine/medium sand to a silty clay.

4.3 Unit-Specific Hydrogeology

4.3.1 Groundwater Flow

A complete round of groundwater level data was collected in March and September 2024 from the existing, interim, and boundary wells at the WBSP (Tables 4-1 and 4-2). Generalized groundwater flow maps were generated using this data and indicate that groundwater in the uppermost aquifer beneath the WBSP flows to the south toward the Ohio River (Figures 4-3 and 4-4). Note that during the March 2024 event, the Ohio River elevation was higher than typical resulting in a temporary reversal in the groundwater flow direction.

4.3.2 Slug Testing

Slug test results from testing completed in May 2024 are summarized in Table 4-2. The revised mean K for the uppermost aquifer downgradient of the WBSP near the Ohio River is 4.13×10^{-5} centimeters per second (cm/sec) or 0.11 feet per day (ft/day). This K value is consistent with previous site results and published literature (Fetter 1980).

4.3.3 Groundwater Flow Velocity

Using water level data collected in September 2024 and hydraulic conductivity data from the recent slug tests (Table 4-4), the average groundwater velocity for the uppermost aquifer beneath the WBSP was calculated as 0.009 ft/day (Table 4-3). With this flow velocity and a 15-foot distance between well WBSP-24-03 and the Ohio River (the property boundary), the travel time for groundwater to flow between WBSP-24-03 and the Ohio River is approximately 4.5 years. This travel time may likely be greater due to the flow reversal periods caused by the Ohio River flooding.

4.3.4 Groundwater Sampling Results

Analytical results for samples collected in March 2024 for the downgradient, interim, and property boundary wells are presented in Table 4-5, Figure 4-5, and Appendix D. In the downgradient wells, Arsenic concentrations ranged from 3.1 ug/L at well WBSP-15-10 to 58 ug/L at well WBSP-15-08. In the interim wells, Arsenic concentrations ranged from 32 ug/L at well WBSP-23-02 to 79 ug/L at well WBSP-23-01. Arsenic results for the property boundary wells were:

- WBSP-24-02: 12 ug/L;
- WBSP-24-03: 57 ug/L; and

- WBSP-24-04: 72 ug/L.

Analytical results for samples collected in September 2024 for the downgradient and property boundary wells are presented in Table 4-6, Figure 4-6, and Appendix D. The interim wells were not sampled during this event. In the downgradient wells, Arsenic concentrations ranged from 7.7 ug/L at well WBSP-15-10 to 82 ug/L in well WBSP-15-08. Arsenic concentrations for the property boundary wells were:

- WBSP-24-02: 92 ug/L:
- WBSP-24-03: 53 ug/L; and
- WBSP-24-04: 110 ug/L

All of the Arsenic results for the boundary wells exceed the GWPS of 10 ug/L. As all groundwater at the WBSP discharges to the Ohio River, the Arsenic results were compared to the unfiltered Surface Water Screening Value for a Hazardous Waste Site for Chronic Exposure (Arsenic) in freshwater of 148 ug/L (U.S. EPA 2018). All the property boundary well results are well below this screening level.

4.3.5 Calculation of Discharge Volumes to Ohio River

To further evaluate the potential impact of groundwater from the WBSP on the Ohio River, the volume of groundwater discharging from the WBSP was calculated using the following equation (Fetter 1980) and data from September 2024:

$$Q = K \times i \times A \times 7.48$$

where: Q = volume of groundwater discharge (gpm);
K = hydraulic conductivity (feet per minute);
i = groundwater flow gradient across the site (dimensionless);
A = cross sectional area of site (square feet); and
7.48 = conversion factor from cubic feet to gallons.

For the WBSP, the following values were used (Table 4-3):

K = 0.11 ft/day or 7.6×10^{-5} ft/minute; and
i = 0.016.

The cross-sectional area (A) was calculated by multiplying the distance from well WBSP-23-01 to WBSP-23-04 (~3,000 linear feet) by the average saturated thickness of the unit near the Ohio River (18 feet); the result is 54,000 square feet. With these values, the total volume of groundwater discharging from the uppermost aquifer downgradient of the WBSP was calculated at **0.49 gpm**.

Per the Ohio River Valley Sanitation Commission (ORSANCO 2024), steam-water flow in the Ohio River ranged from 24,753 cubic feet per second (cfs) (~11,000,000 gpm) to 181,684 cfs (~82,000,000 gpm) in 2023, with an average flow of approximately **39,000,000 gpm**.

With the discharge from the uppermost aquifer downgradient of the WBSP estimated at **0.49 gpm**, groundwater discharged to the Ohio River (with an average flow of **39,000,000 gpm**) would be diluted by a factor of approximately **80,000,000**. At this dilution rate, constituents in groundwater in the uppermost aquifer that is discharged to the Ohio River would be undetectable with standard analytical methods.

4.4 Summary of Results

In 2024, three (3) property boundary monitoring wells were installed downgradient of the WBSP at the Clifty Creek Station, which fulfills the requirement of the CCR Rule in 40 CFR § 257.95 (g)(1). Based on the characterization work, the shallow geology and hydrogeology of the area downgradient of the WBSP are consistent with previous results, except the uppermost aquifer being slightly finer-grained nearer to the Ohio River. Groundwater levels, hydraulic conductivity values, and flow velocity calculations are consistent with previous results.

The results for the property boundary wells exceeded the GWPS for Arsenic of 10 ug/L; however, all the results were well below the Surface Water Screening Value for a Hazardous Waste Site for Arsenic as published by U.S. EPA (2018). Finally, given the minimal groundwater discharge from the area and the stream flow in the Ohio River, constituents in groundwater, once discharged to the Ohio River, would be undetectable with standard analytical methods.

The results presented in this addendum to the ACM Report will be used to support the ongoing evaluation of potential corrective measures for the WBSP.

5.0 UPDATED ASSESSMENT OF CORRECTIVE MEASURES

Groundwater monitoring of the uppermost aquifer at the WBSP has identified Arsenic (Appendix IV constituent) at concentrations that exceed the GWPS defined under 40 CFR § 257.95(h); therefore, an ACM was necessary. An ACM requires identification and evaluation of technologies and methods that may be used as elements of remedial actions to meet the requirements of the CCR Rule. These elements include potential source control methods and various groundwater remedial technologies that may be applicable to the WBSP. The results of the ACM are presented in the initial ACM Report (AGES 2023).

As noted, given recent trends in groundwater remediation, IKEC has opted to evaluate whether phytoremediation is feasible as a supplemental remedial technology to augment other primary remedial technologies used to address groundwater at the site. To support this evaluation, presented below is a discussion of the objectives of the ACM and a summary of the assessment process for phytoremediation.

5.1 Objectives of Remedial Technology Evaluation

Per 40 CFR § 257.96(a), the objectives of the corrective measures evaluated in this ACM Report are "to prevent further releases, to remediate any releases, and to restore the affected area to original conditions." As required in 40 CFR § 257.97(b), corrective measures, at minimum, must:

(1) Be protective of human health and the environment;

(2) Attain the groundwater protection standard as specified pursuant to § 257.95(h);

(3) Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in Appendix IV to this part into the environment;

(4) Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems;

(5) Comply with standards for management of wastes as specified in § 257.98(d).

5.2 Update Potential Remedial Technologies

The focus of corrective measures for the WBSP is to address Arsenic in groundwater that exceeded the GWPS. To accomplish this, phytoremediation technology will be presented in Section 5.2.1. The detailed ACM evaluation is provided in Table 5-1. Additional remedial technologies may also be evaluated if determined to be applicable and appropriate.

5.2.1 Phytoremediation

Phytoremediation involves the planting of grasses, ferns, and/or trees that are capable of extracting metals and other pollutants from subsurface soils and groundwater. Contaminants are removed by plants without impacting the topsoil and may even improve the fertility and stability of the soils by providing organic matter. There are various mechanisms of phytoremediation such as phytoextraction, phytofiltration, phytostabilization, phytovolatilization, phytodegradation, rhizodegradation, and phytodesalination. All the mechanisms of phytoremediation handle the removal of contaminants in different ways, with phytoextraction likely being the most effective mechanism for the site. Phytoextraction occurs when plant roots take contaminants from soil or water and are converted into waste or energy. For this evaluation, phytoremediation is being considered as a supplemental remedial technology to augment either Monitored Natural Attenuation (MNA) or In-Situ Chemical Stabilization at the WBSP.

Phytoremediation is typically more expensive and requires maintenance during the initial planting and growth stages, but long-term is cost-effective and low maintenance. Long-term groundwater monitoring would be required to evaluate the effectiveness of this technology.

5.3 Evaluation to Meet Requirements in 40 CFR § 257.96(c)

For this evaluation, each of the potential remedial technologies identified above will be screened against evaluation criteria requirements in 40 CFR § 257.96(c) listed below:

The assessment under paragraph (a) of this section must include an analysis of the effectiveness of potential corrective measures in meeting all of the requirements and objectives of the remedy as described under § 257.97 addressing at least the following:

(1) The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination;

(2) The time required to begin and complete the remedy;

(3) The institutional requirements, such as state or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the remedy(s).

The ACM evaluation is provided in Table 5-1 and detailed below.

5.3.1 Grasses and Ferns

Plants such as grasses and ferns are typically utilized in phytoremediation due to their cost-effectiveness and short implementation time. However, due to their shallow root systems, plants are typically utilized whenever contaminants are located primarily in subsurface soil. Additionally, due to the shallow root depths, these plants are vulnerable to flooding, and many of the plants generate hazardous waste, such as biomass, at the surface that would need to be disposed of properly. Given the vulnerability to flooding and excess hazardous waste that would be generated from these plants, this type of phytoremediation is not likely to be a viable alternative for the site.

5.3.2 Trees

Trees are the most common form of phytoremediation for contaminants in groundwater due to their deep average root depth and minimal long-term maintenance needs. The trees utilize their roots to extract contaminants from the subsurface soil and groundwater and do not generate any hazardous waste in the process. The initial planting and growing stages are typically expensive and time-consuming as they would need to be regularly checked and treated with fertilizers and pesticides as needed. Additionally, trees typically take years to grow to their full height and may not be as effective during the early stage of remediation. There are three (3) tree species that are typically utilized for phytoremediation: Poplar, Eastern Cottonwood, and Buttonwood trees. These tree species have deep root systems ranging from 10 to 75 ft bgs and range in vulnerability to flooding during growing seasons (Poplar) to very resilient (Buttonwood). Given the resilience to flooding and root depth, phytoremediation with trees could be a viable alternative for the site.

Additional remedial technologies may also be evaluated at a later date if determined to be applicable and appropriate.

6.0 SELECTION OF REMEDY PROCESS

The remedy selection begins following the completion of the ACM Report. Per 40 CFR § 257.97(a):

Based on the results of the corrective measures assessment conducted under § 257.96, the owner or operator must, as soon as feasible, select a remedy that, at a minimum, meets the standards listed in paragraph (b) of this section. This requirement applies to, not in place of, any applicable standards under the Occupational Safety and Health Act. The owner or operator must prepare a semiannual report describing the progress in selecting and designing the remedy. Upon selection of a remedy, the owner or operator must prepare a final report describing the selected remedy and how it meets the standards specified in paragraph (b) of this section. The owner or operator must obtain a certification from a qualified professional engineer that the remedy selected meets the requirements of this section. The report has been completed when it is placed in the operating record as required by § 257.105(h)(12).

This ACM Report provides a high-level assessment of groundwater remedial technologies that could potentially address Arsenic concentrations in groundwater that exceed the GWPS at the WBSP. With the submittal of this report, IKEC will begin the remedy selection process and ultimately select a remedy. The remedy selection process and selected remedy will satisfy standards listed in 40 CFR § 257.97(b) with consideration to evaluation factors listed in 40 CFR § 257.97(c).

6.1 Data Gaps

Based on a review of data to date, the following recommendations for additional data collection/evaluation have been identified:

- Ongoing sampling of monitoring wells at the WBSP should continue to evaluate whether Arsenic concentrations in groundwater trends are increasing, decreasing, or are asymptotic and to evaluate redox conditions in groundwater. This data will be useful in developing time-series evaluations and in supporting an evaluation of MNA, In-Situ Chemical Stabilization, and/or Phytoremediation;

- Given the dynamic nature of groundwater flow at the WBSP, additional depth-to-groundwater data from wells in the area would be useful to support ongoing evaluation of remedial technologies; and

- Additional sampling may be necessary to determine general soil chemistry in the areas where the trees may be planted to ensure that the correct species is chosen.

6.2 Selection of Remedy

As noted above, IKEC has already begun the process of selecting a remedy for this site. Per 40 CFR § 257.97, the remedy will be selected and implemented as soon as feasible, and progress toward selecting the remedy will be documented in future annual reports. As part of the process, one (1) or more preferred remedial approaches will be developed based upon technology effectiveness under site conditions, implementability, cost-effectiveness, and other considerations.

6.3 Public Meeting Requirement in 40 CFR § 257.96(e)

Per 40 CFR § 257.96(e), IKEC will hold a public meeting to discuss ACM results, the remedy selection process, and the selection of one (1) or more preferred remedial approaches. The public meeting will be conducted at least 30 days prior to the selection of a final remedy, in accordance with the above-referenced rule. Prior to the meeting, citizen and governmental stakeholders will be formally notified as to the schedule for the public meeting.

6.4 Final Remedy Selection

After the selection of a remedy, a report documenting the remedy selection process will be prepared. The report will demonstrate how the remedy selection process was performed and how the selected remedial approach satisfies 40 CFR § 257.97 requirements.

7.0 REFERENCES

Applied Geology and Environmental Science, Inc. (AGES) 2024a. Coal Combustion Residuals Regulation 2023 Groundwater Monitoring and Corrective Action Report. Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Jefferson County, Indiana. January 2024.

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Fetter, Charles W. 1980. Applied Hydrogeology. Merrill, 1980.

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Stantec Consulting Services Inc. (Stantec) 2021. Coal Combustion Residuals Regulation Statistical Analysis Plan, Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Jefferson County, Indiana. July 2021.

United States Environmental Protection Agency (U.S. EPA) 2018. Region 4 Ecological Risk Assessment Supplemental Guidance. Scientific Support Section, Superfund Division. March 2018.

United States Fish and Wildlife Service (U.S. FWS) 2018. Programmatic Biological Opinion for Transportation Projects in the Range of the Indiana Bat and Northern Long-Eared Bat. Consultation Code: 09E00000-2016-F-0001. February 2018.

TABLES

TABLE 2-1
GROUNDWATER MONITORING NETWORK
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Monitoring Well ID	Designation	Date of Installation	Coordinates		Ground Elevation (ft)	Top of Casing Elevation (ft)	Top of Screen Elevation (ft)	Base of Screen Elevation (ft)	Total Depth From Top of Casing (ft)
			Northing	Easting					
CF-15-04	Background	12/3/2015	451482.81	569307.19	465.55	468.03	439.55	429.55	38.48
CF-15-05	Background	12/1/2015	447491.91	565533.64	439.85	442.58	422.85	412.85	29.73
CF-15-06	Background	11/30/2015	447026.92	565190.31	437.49	440.40	431.49	421.49	18.91
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-15-04a	Downgradient	7/28/2021	450669.20	568855.3	472.03	474.47	418.47	408.47	68.44
WBSP-15-05a	Downgradient	8/4/2021	450072.00	568895.20	473.66	476.20	413.20	402.20	76.54
WBSP-15-06a	Downgradient	8/6/2021	449478.8	568659.8	471.96	475.12	399.12	389.12	89.16
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:
The well locations are referenced to the North American Datum (NAD83), east zone coordinate system.
Elevations are referenced to the North American Vertical Datum (NAVD) 1988.

TABLE 3-1
PROPERTY BOUNDARY MONITORING WELL CONSTRUCTION DETAILS
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Monitoring Well ID	Designation	Date of Installation	Coordinates		Ground Elevation (ft)	Top of Casing Elevation (ft)	Top of Screen Elevation (ft)	Base of Screen Elevation (ft)	Total Depth From Top of Casing (ft)
			Northing	Easting					
WBSP-24-02	Property Boundary	2/27/2024	448397.38	567242.77	438.33	440.46	413.33	403.33	37.13
WBSP-24-03	Property Boundary	2/28/2024	448164.66	566796.42	434.10	436.29	410.10	400.10	36.19
WBSP-24-04	Property Boundary	2/28/2024	447933.77	566314.71	435.70	437.60	419.70	409.70	27.90

Note:
The well locations are referenced to the North American Datum (NAD83), east zone coordinate system.
Elevations are referenced to the North American Vertical Datum (NAVD) 1988.

TABLE 3-2
SUMMARY OF PROPERTY BOUNDARY
MONITORING WELL DEVELOPMENT DATA
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Monitoring Well ID	Date	Development Method	~Volume Purged (gallons)	Final Turbidity (NTU)
WBSP-24-02	2/29/2024	Pump	17	15.3
WBSP-24-03	3/4/2024	Pump	26	9.76
WBSP-24-04	3/4/2024	Pump	53	4.23

Note:
NTU: Nephelometric Turbidity Unit

TABLE 4-1
SUMMARY OF GROUNDWATER ELEVATION DATA – MARCH 2024
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Monitoring Well ID	Top of Casing Elevation (ft)	Depth to Groundwater (ft)	Groundwater Elevation (ft)
WBSP-15-01	469.36	16.61	452.75
WBSP-15-02	476.76	11.03	465.73
WBSP-15-03	488.03	11.71	476.32
WBSP-15-04a	474.47	46.30	428.17
WBSP-15-05a	476.20	48.11	428.09
WBSP-15-06a	475.12	46.64	428.48
WBSP-15-07	471.31	43.99	427.32
WBSP-15-08	471.06	40.60	430.46
WBSP-15-09	470.09	42.75	427.34
WBSP-15-10	470.69	42.37	428.32
WBSP-23-01	445.35	16.75	428.60
WBSP-23-02	446.24	16.45	429.79
WBSP-23-03	445.27	17.44	427.83
WBSP-23-04	445.35	18.01	427.34
WBSP-24-02	440.46	11.45*	429.01
WBSP-24-03	436.29	10.01	426.28
WBSP-24-04	437.6	10.30	427.30

Note:

*The depth to groundwater measured in May 2024 is presented due to an extremely low recovery rate.

TABLE 4-2
SUMMARY OF GROUNDWATER ELEVATION DATA – SEPTEMBER 2024
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Monitoring Well ID	Top of Casing Elevation (ft)	Depth to Groundwater (ft)	Groundwater Elevation (ft)
WBSP-15-01	469.36	Dry	Dry
WBSP-15-02	476.76	14.61	462.15
WBSP-15-03	488.03	11.43	476.60
WBSP-15-04a	474.47	54.68	417.35
WBSP-15-05a	476.20	56.45	419.75
WBSP-15-06a	475.12	55.04	420.08
WBSP-15-07	471.31	43.55	427.76
WBSP-15-08	471.06	41.37	429.69
WBSP-15-09	470.09	44.00	426.69
WBSP-15-10	470.69	43.75	426.94
WBSP-23-01	445.35	16.67	428.68
WBSP-23-02	446.24	15.77	430.47
WBSP-23-03	445.27	17.45	427.82
WBSP-23-04	445.35	18.51	426.84
WBSP-24-02	440.46	14.26	426.20
WBSP-24-03	436.29	13.41	422.88
WBSP-24-04	437.6	14.62	422.98

TABLE 4-3
SUMMARY OF SLUG TEST RESULTS
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Monitoring Well ID	Test	Solution Method	K	Mean K (cm/sec)
Completed in May 2016				
WBSP-15-07	Rising Head	Bouwer-Rice	9.24E-06	1.02E-05
		Hvorslev	1.06E-05	
	Falling Head	Bouwer-Rice	9.66E-06	
		Hvorslev	1.11E-05	
Completed in August 2023				
WBSP-23-01	Falling Head	Bouwer-Rice	8.39E-05	8.39E-05
		Hvorslev	8.39E-05	
WBSP-23-02	Falling Head	Bouwer-Rice	5.29E-06	5.80E-06
		Hvorslev	6.31E-06	
WBSP-23-03	Falling Head	Bouwer-Rice	2.87E-05	3.14E-05
		Hvorslev	3.42E-05	
WBSP-23-04	Falling Head	Bouwer-Rice	9.35E-05	1.04E-04
		Hvorslev	1.10E-04	
Completed in May 2024				
WBSP-24-02	Rising Head	Bouwer-Rice	2.02E-06	3.08E-06
		Hvorslev	2.45E-06	
	Falling Head	Bouwer-Rice	4.29E-06	
		Hvorslev	3.54E-06	
WBSP-24-03	Rising Head	Bouwer-Rice	4.00E-05	5.10E-05
		Hvorslev	4.86E-05	
	Falling Head	Bouwer-Rice	5.21E-05	
		Hvorslev	6.33E-05	
			Mean K (cm/sec)	**4.13E-05**
			Mean K (ft/day)	**0.11**

Notes:
cm/sec: Centimeters per Second
ft/day: Feet per Day
K: Hydraulic Conductivity

TABLE 4-4
SUMMARY OF GROUNDWATER VELOCITY CALCULATIONS – SEPTEMBER 2024
WEST BOLER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Monitoring Well Pair		h_1 (ft)	h_2 (ft)	d (ft)	K (ft/day)	n	i	V (ft/day)
Uppermost Aquifer								
WBSP-15-09 (h_1)	WBSP-24-03 (h_2)	426.69	422.88	235	0.11	0.2	0.016	0.009

h_1 = Head elevation in well #1
h_2 = Head elevation in well #2
d = distance between wells
K = Hydraulic conductivity
n = effective porosity
i = Horizontal Hydraulic Gradient
V = Groundwater Velocity

Horizontal Hydraulic Gradient:

$$i = \frac{h_1 - h_2}{d}$$

Groundwater Velocity:

$$V = K\left(\frac{i}{n}\right)$$

TABLE 4-5
SUMMARY OF FIELD PARAMETERS AND GROUNDWATER ANALYTICAL RESULTS - MARCH 2024
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Monitoring Well ID	Arsenic (ug/L)	ORP (mV)	Turbidity (NTU)	pH (SU)
Downgradient Monitoring Wells – Sampled March 2024				
WBSP-15-07	14	39	33.6	7.67
WBSP-15-08	58	31	>100	7.47
WBSP-15-09	16	-69	44.2	7.40
WBSP-15-10	3.1	56	4.89	7.23
Interim Monitoring Wells – Sampled January/February 2024				
WBSP-23-01	79	-156	14.7	6.95
WBSP-23-02	32	-79	30.4	7.11
WBSP-23-03	39	-278	10.8	7.38
WBSP-23-04	69	-171	7.27	7.33
Property Boundary Monitoring Wells – Sampled March 2024				
WBSP-24-02	12	296	15.3	6.80
WBSP-24-03	57	-8	9.76	7.08
WBSP-24-04	72	-101	8.76	6.77

Notes:
mV: Millivolts
NTU: Nephelometric Turbidity Unit
NA: No Reading Obtained
ORP: Oxidation Reduction Potential
SU: Standard Unit
ug/L: Micrograms per Liter

TABLE 4-6
SUMMARY OF FIELD PARAMETERS AND GROUNDWATER ANALYTICAL RESULTS - SEPTEMBER 2024
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

Monitoring Well ID	Arsenic (ug/L)	ORP (mV)	Turbidity (NTU)	pH (SU)
Downgradient Monitoring Wells				
WBSP-15-07	42	-69	19.8	6.45
WBSP-15-08	82	-51	73.6	6.22
WBSP-15-09	19	-115	32.2	6.45
WBSP-15-10	7.7	4	65	6.14
Interim Monitoring Wells				
WBSP-23-01	NS	NS	NS	NS
WBSP-23-02	NS	NS	NS	NS
WBSP-23-03	NS	NS	NS	NS
WBSP-23-04	NS	NS	NS	NS
Property Boundary Monitoring Wells				
WBSP-24-02	92	-255	4.36	6.59
WBSP-24-03	53	-162	4.19	7.29
WBSP-24-04	110	-161	4.08	6.95

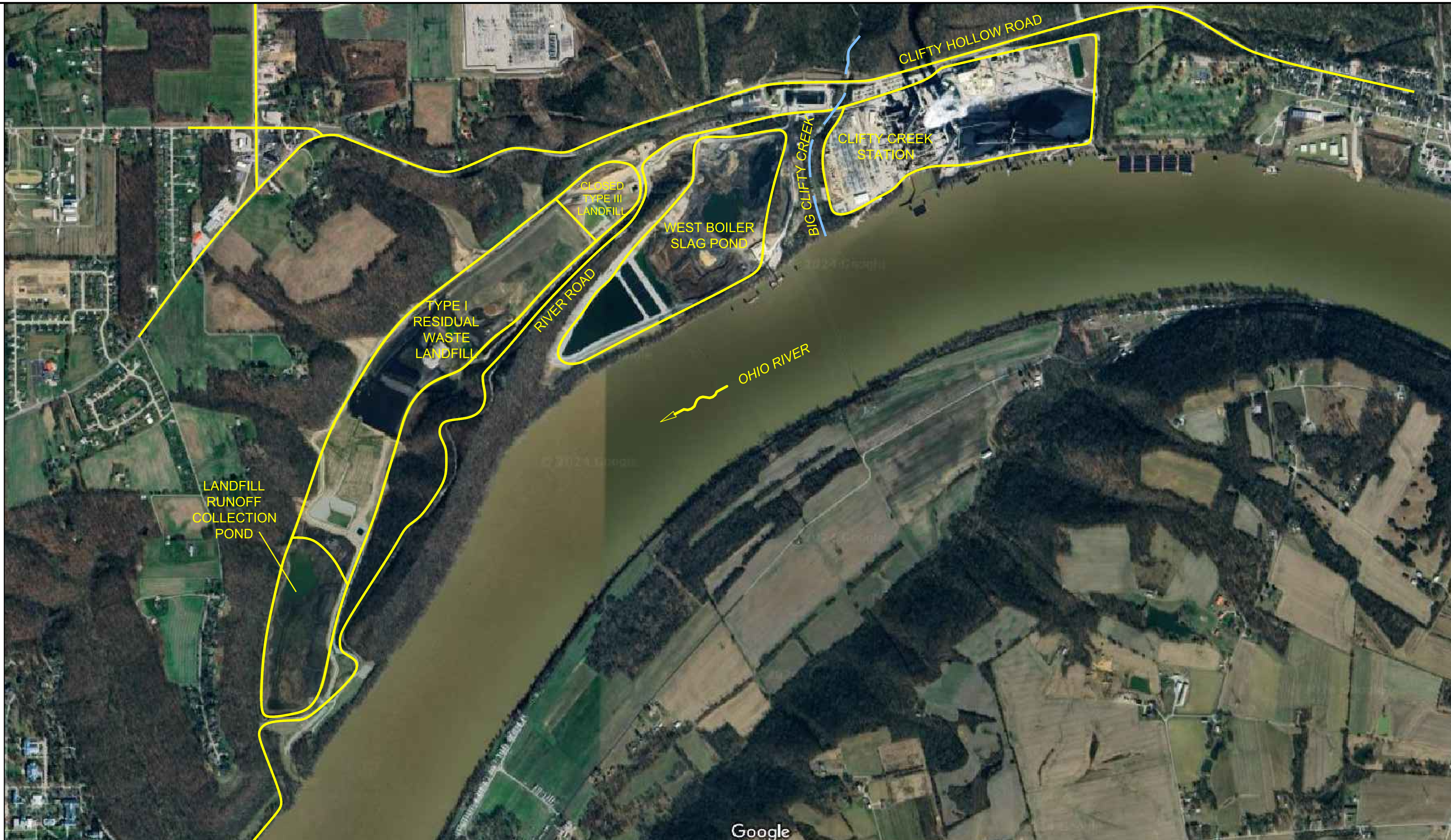
Notes:
mV: Millivolts
NTU: Nephelometric Turbidity Unit
NA: No Reading Obtained
ORP: Oxidation Reduction Potential
SU: Standard Unit
ug/L: Micrograms per Liter
NS: Not Sampled

TABLE 6-1
IN-SITU AND EX-SITU GROUNDWATER REMEDIAL TECHNOLOGIES SCREENING MATRIX - 40 CFR § 257.96(c) REQUIREMENTS
WEST BOILER SLAG POND
CLIFTY CREEK STATION
MADISON, INDIANA

	Phytoremediation	
	Grasses and Ferns	**Trees**
257.96(c)(1)		
Performance	Low	Medium
Reliability	Medium	Medium
Ease of Implementation	Medium	Medium
Potential Safety Impacts	Low	Medium Initial Removal of Current Trees Required
Potential Cross-Media Impacts	High	Low
Potential Impacts from Control of Exposure to Residual Constituents	Low	Low
257.96(c)(2)		
Time To Begin Remedy	3 months	6 months
Time To Complete Remedy	Highly Variable Further Evaluation Required	Highly Variable Further Evaluation Required
257.96(c)(3)		
State, Local or other Environmental Permit Requirements that May Impact Implementation	No	No
Additional Information	Additional Soil Sampling required to Determine Plant Species	Additional Soil Sampling required to Determine Tree Species

Notes:
Relative assessments (low, medium, high) are based on experience and professional judgement

FIGURES



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INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
SITE LOCATION MAP

DRAWING NAME: FIGURE 1–1

REV. 0

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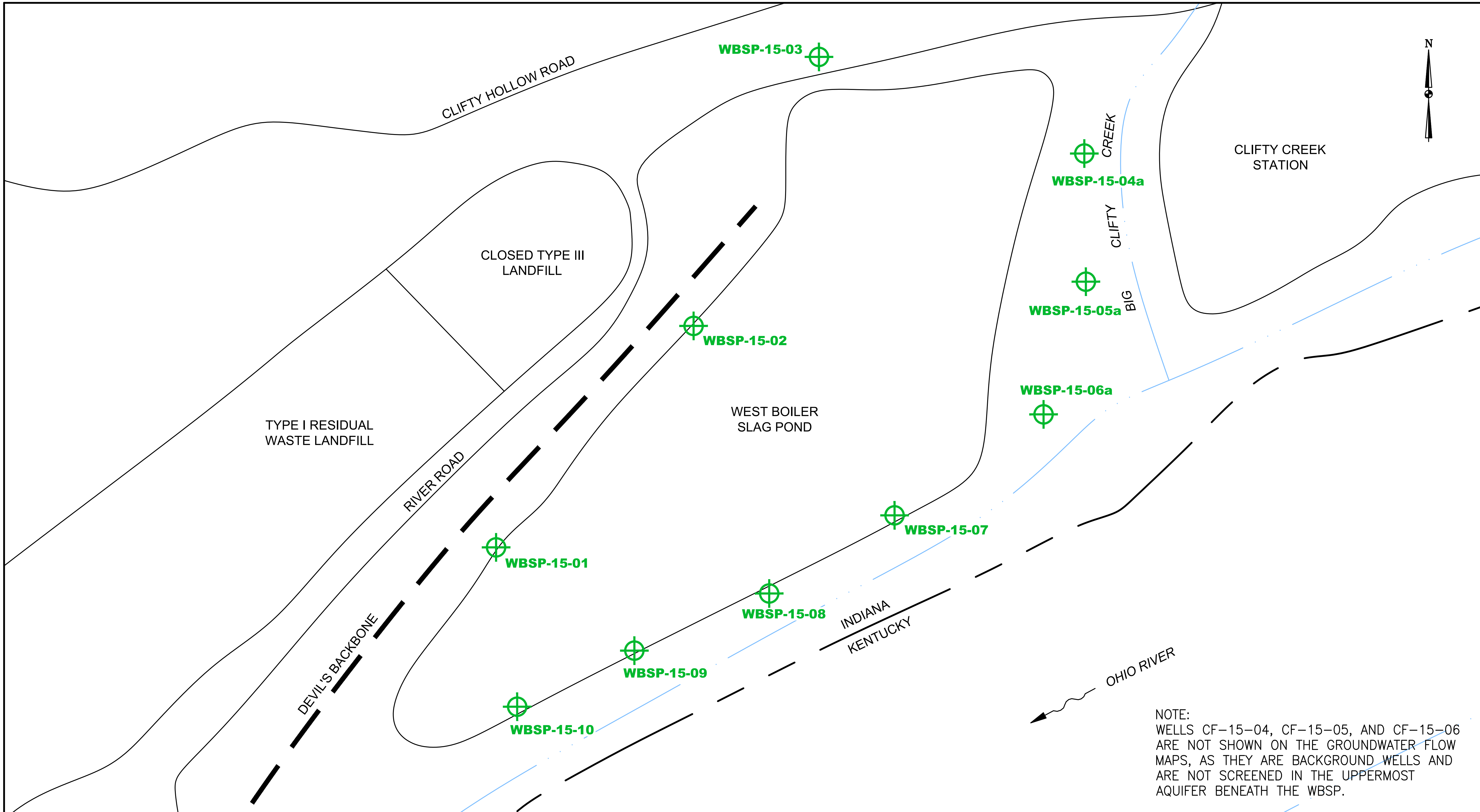

NOTE:
WELLS CF–15–04, CF–15–05, AND CF–15–06 ARE NOT SHOWN ON THE GROUNDWATER FLOW MAPS, AS THEY ARE BACKGROUND WELLS AND ARE NOT SCREENED IN THE UPPERMOST AQUIFER BENEATH THE WBSP.

LEGEND:

CCR PROGRAM MONITORING WELL

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SCALE: 1"= 400'

DATE

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JOB NO. 2024040–CLI

DWG FILE IKEC–Clifty_WBSP_Existing CCR Well Locations.dwg

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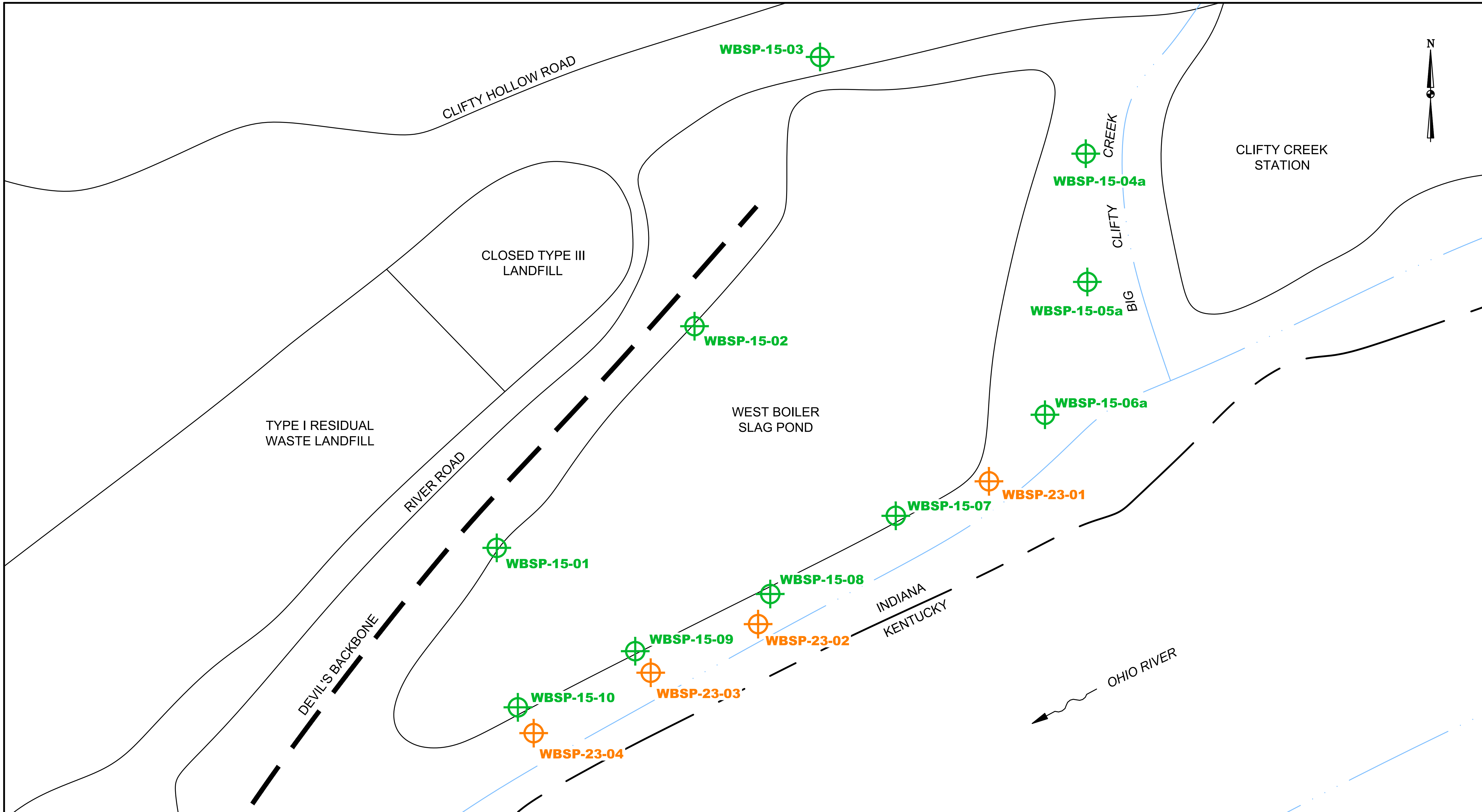
CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
EXISTING MONITORING WELL LOCATION MAP

DRAWING NAME FIGURE 2–1

REV. 0



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CCR EXISTING PROGRAM MONITORING WELL

CCR INTERIM PROGRAM MONITORING WELL

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INDIANA–KENTUCKY ELECTRIC CORPORATION

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

DRAWING NAME: FIGURE 2–2

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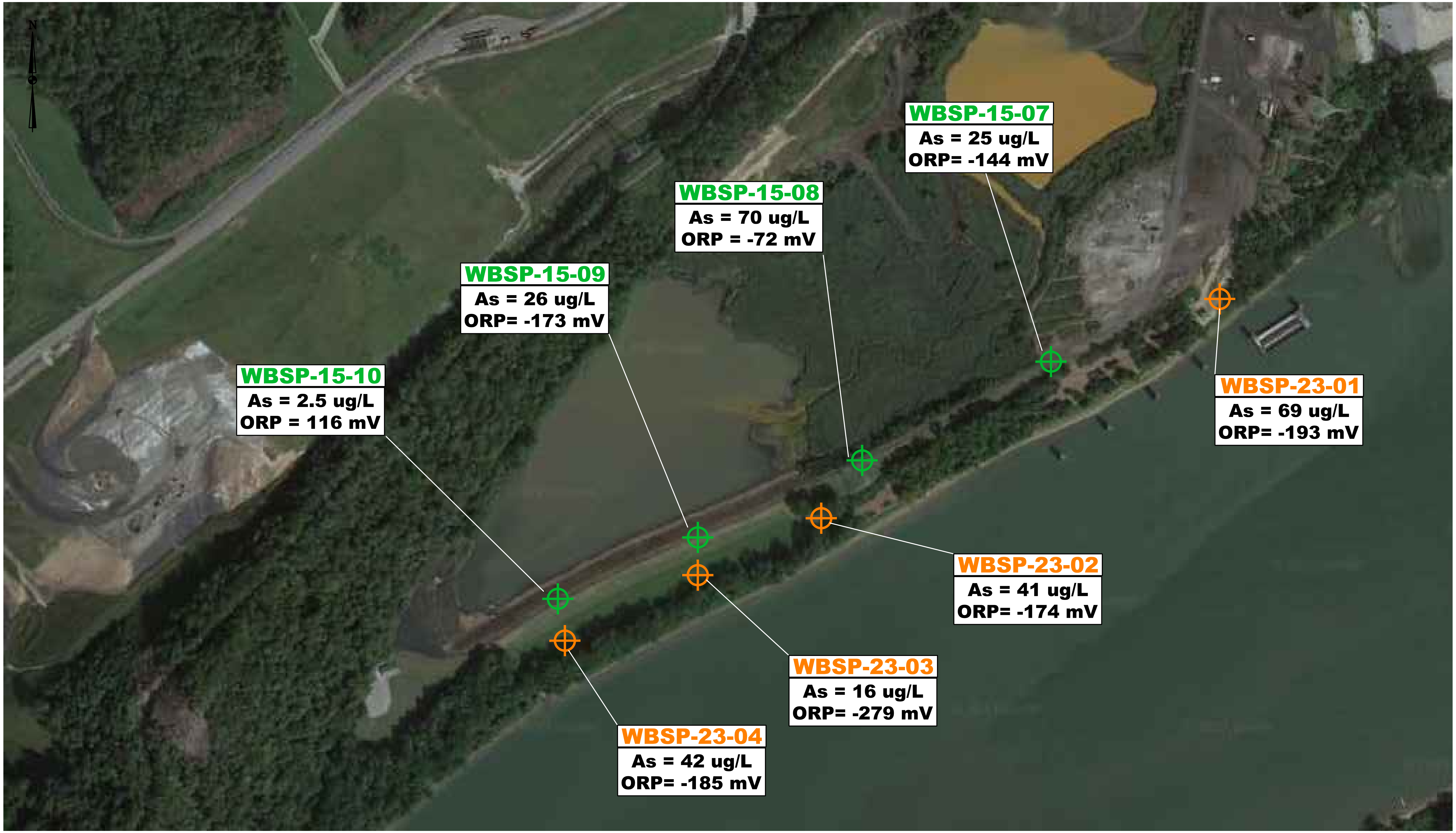

LEGEND:

- CCR EXISTING PROGRAM MONITORING WELL
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NOTES:

ARSENIC RESULTS PROVIDED IN MICROGRAMS PER LITER (UG/L).

GWPS FOR ARSENIC IS 10 UG/L.

OXIDATION REDUCTION POTENTIAL (ORP) RESULTS PROVIDED IN MILLIVOLTS (MV).

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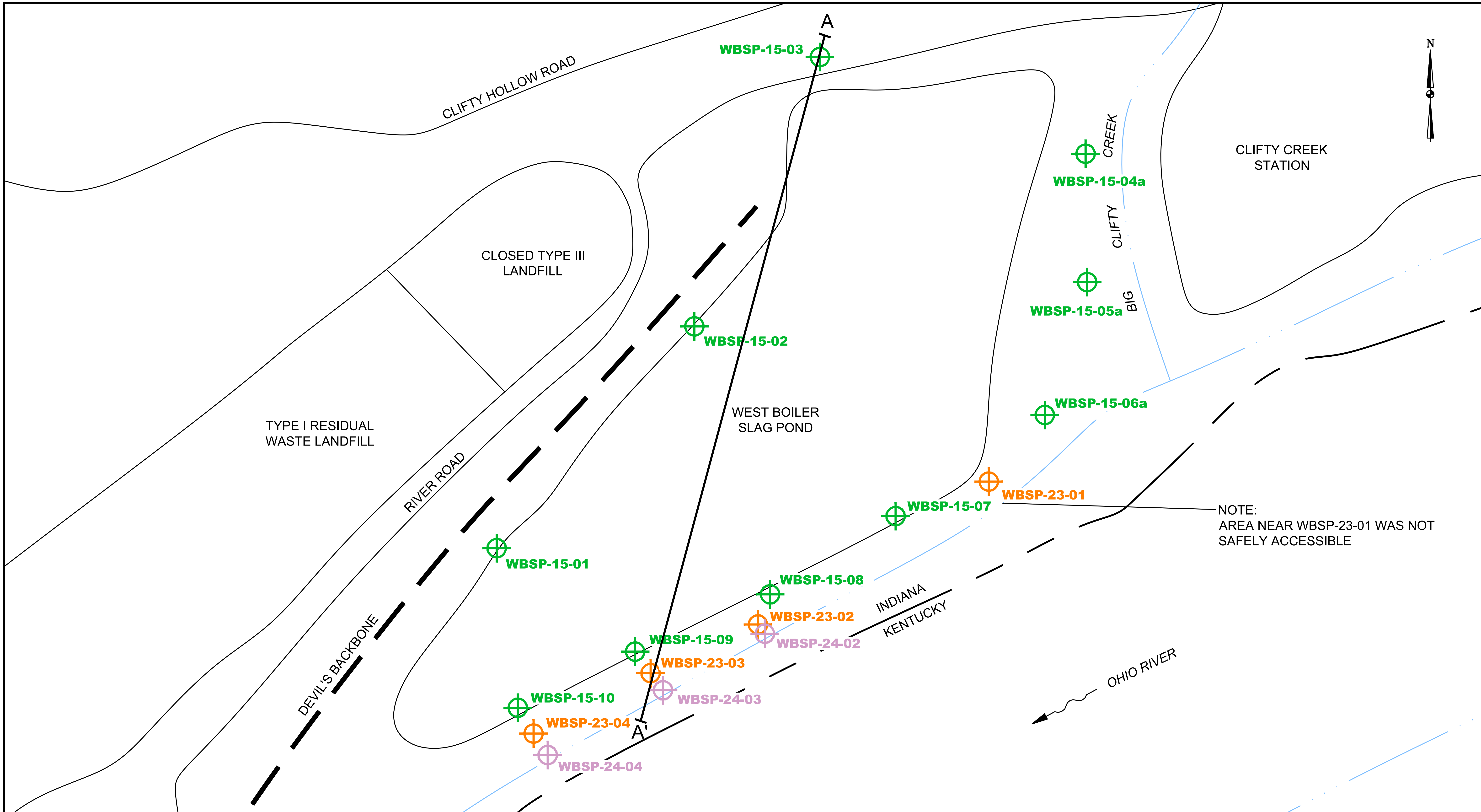
CLIFTY CREEK STATION
MADISON, INDIANA
ARSENIC CONCENTRATIONS IN GROUNDWATER – JUNE & AUGUST 2023

DRAWING NAME: FIGURE 2–3

REV. 0



LEGEND:

- CCR EXISTING PROGRAM MONITORING WELL
- CCR INTERIM PROGRAM MONITORING WELL
- CCR PROPERTY BOUNDARY PROGRAM MONITORING WELL

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SCALE: 1"= 400'

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DRAWING SCALE	AS SHOWN

AGES
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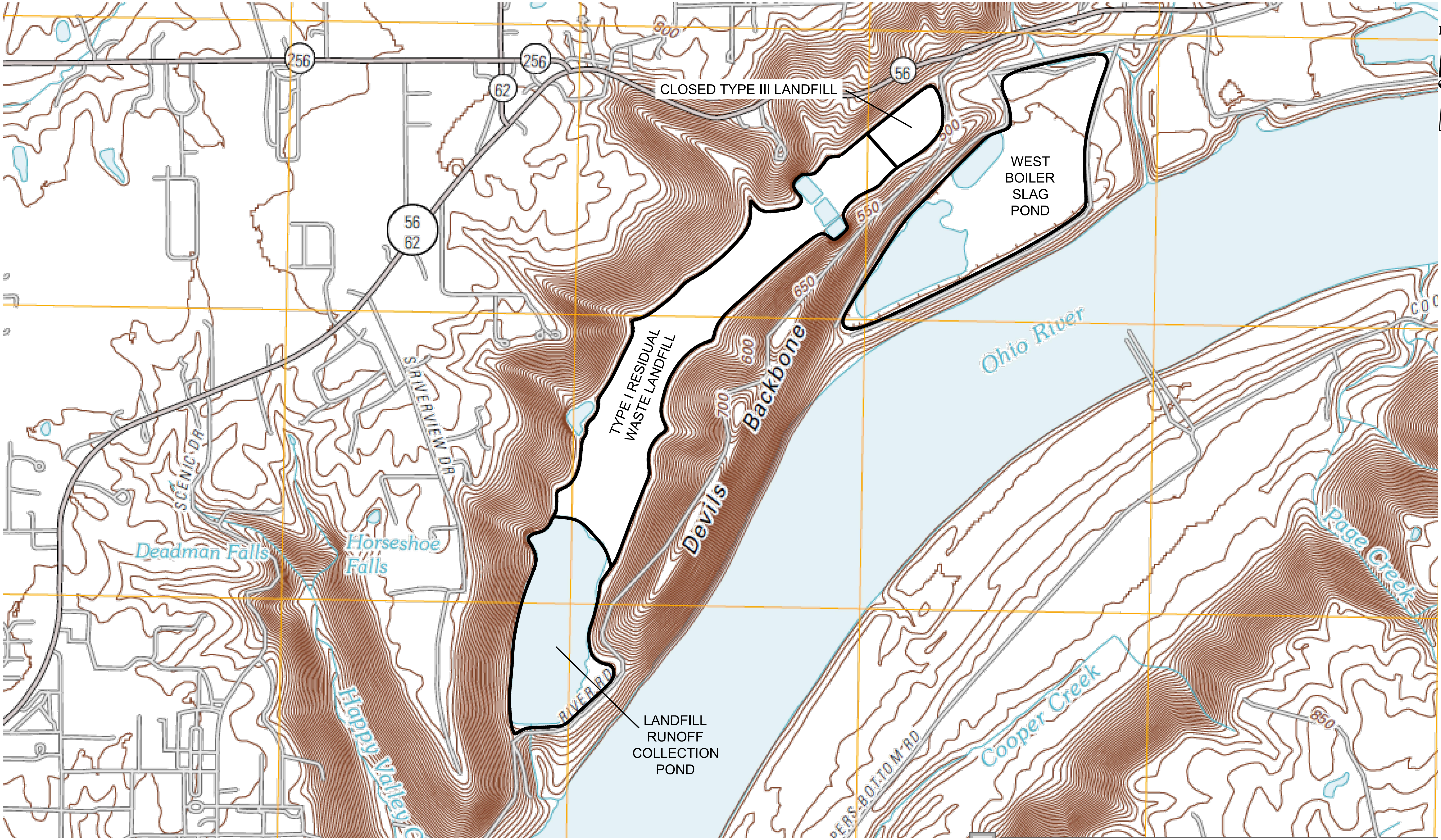
INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
EXISTING, INTERIM AND PROPERTY BOUNDARY
MONITORING WELL LOCATION MAP

DRAWING NAME: FIGURE 3-1

REV. 0

Plot: 05/29/2024 13:10 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\ACM-WBSP-Addendum No 1\IKEC-Clifty_WBSP_All Well Locations.dwg



SOURCE: USGS MADISON WEST 7.5 MINUTE TOPOGRAHIC QUADRANGLE, 2010.

DRAWN BY	MST
DATE	
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JOB NO.	2024040–CLI
DWG FILE	IKEC_Clifty_USGS TOPO b05.dwg
DRAWING SCALE	NOT TO SCALE

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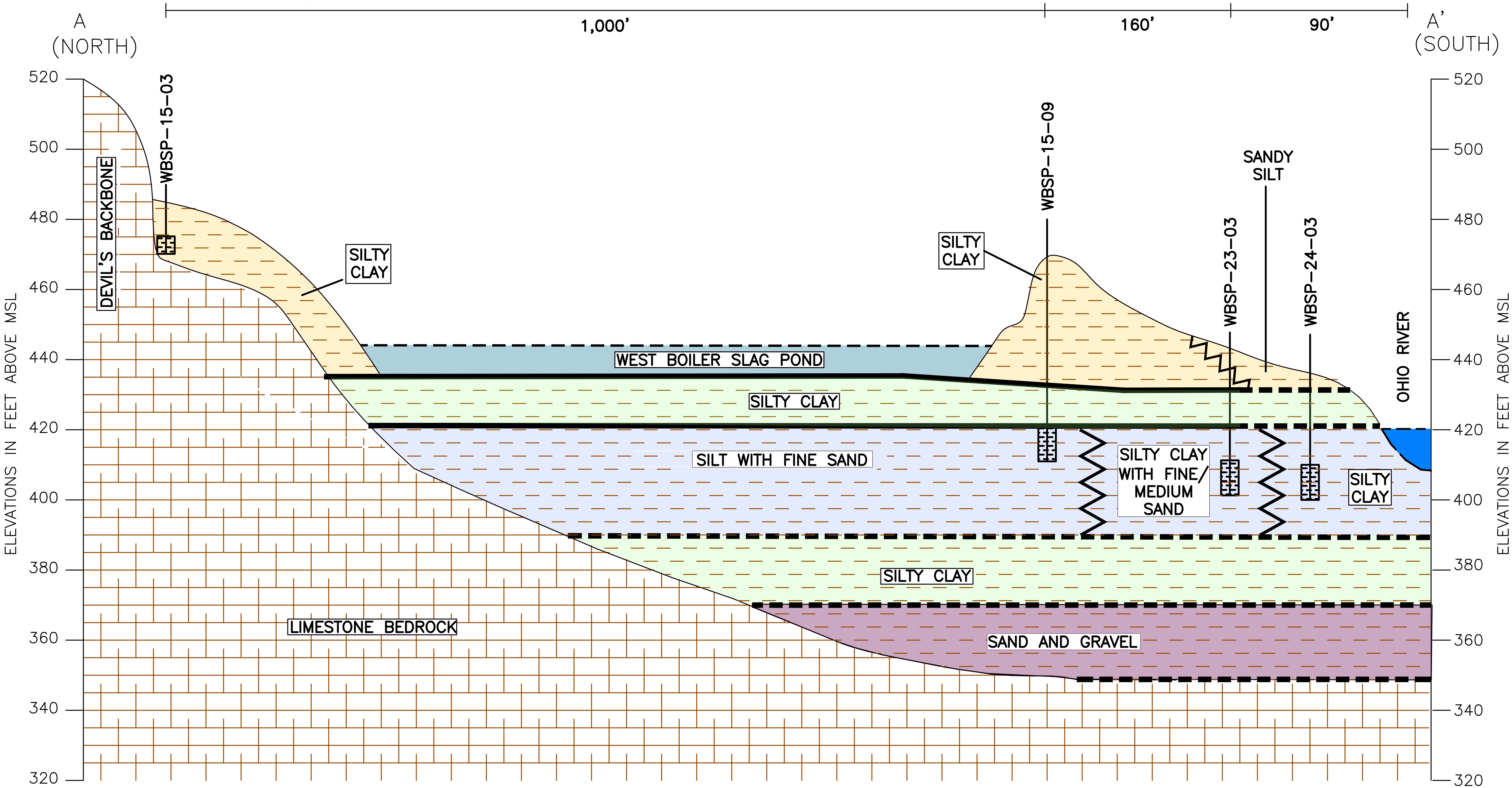
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TOPOGRAPHIC MAP

DRAWING NAME: FIGURE 4–1

REV. 0

Plot: 05/22/2024 11:24 _PROGRAMS-IKEC\Clifty Creek – CCR Program\CAD\ACM-WBSP-Addendum No 1\IKEC_Clifty_USGS TOPO b05.dwg



NOTE:
HORIZONTAL AXIS IS NOT TO SCALE

DRAWN BY	MST
DATE	
CHECKED BY	
JOB NO.	2024040 – CLI
DWG FILE	IKEC_Clifty_WBSP_Cross Sec.dwg
DRAWING SCALE	NOT TO SCALE

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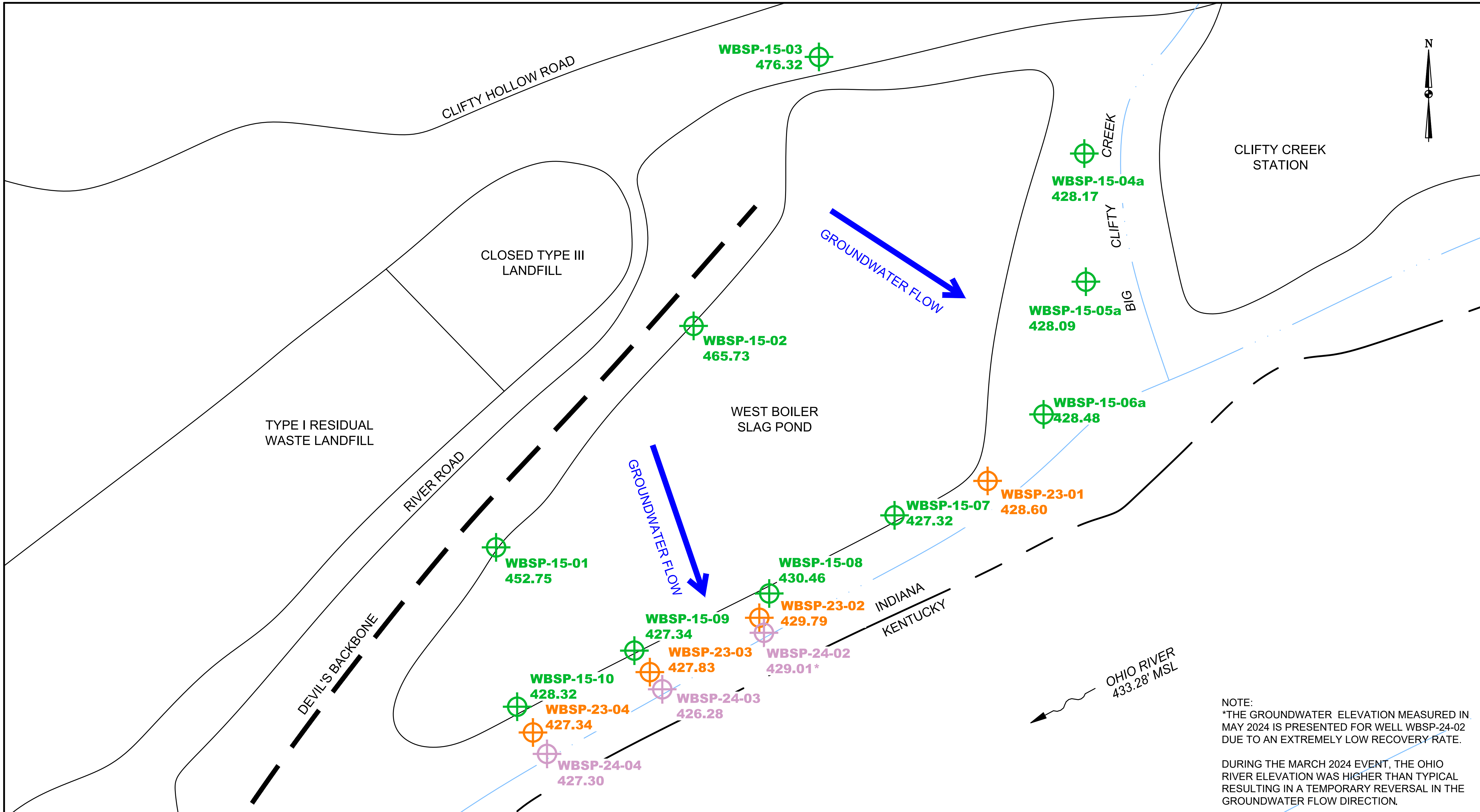
INDIANA–KENTUCKY ELECTRIC CORPORATION

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

DRAWING NAME: FIGURE 4–2
REV. 0

Plot: 05/29/2024 13:05 _PROGRAMS–IKEC\Clifty Creek – CCR Program\CAD\ACM–WBSP–Addendum No 1\IKEC_Clifty_WBSP_Cross Sec.dwg



NOTE:
*THE GROUNDWATER ELEVATION MEASURED IN MAY 2024 IS PRESENTED FOR WELL WBSP-24-02 DUE TO AN EXTREMELY LOW RECOVERY RATE.

DURING THE MARCH 2024 EVENT, THE OHIO RIVER ELEVATION WAS HIGHER THAN TYPICAL RESULTING IN A TEMPORARY REVERSAL IN THE GROUNDWATER FLOW DIRECTION.

LEGEND:

- CCR EXISTING PROGRAM MONITORING WELL
- CCR INTERIM PROGRAM MONITORING WELL
- CCR PROPERTY BOUNDARY PROGRAM MONITORING WELL

400' 0' 400' 800'

SCALE: 1"= 400'

	GRM
DATE	1–16–2025
CHECKED BY	
JOB NO.	2024146–CLI
DWG FILE	X:\SHARED\CLIENT_SHARE\GARYMALARKEY\2024 CLIFTY CREEK\CAD 1–16–2025\FIGURE 4–3_IKEC_CLIFTY_WBSP GW FLOW–GRM.DWG
DRAWING SCALE	AS SHOWN

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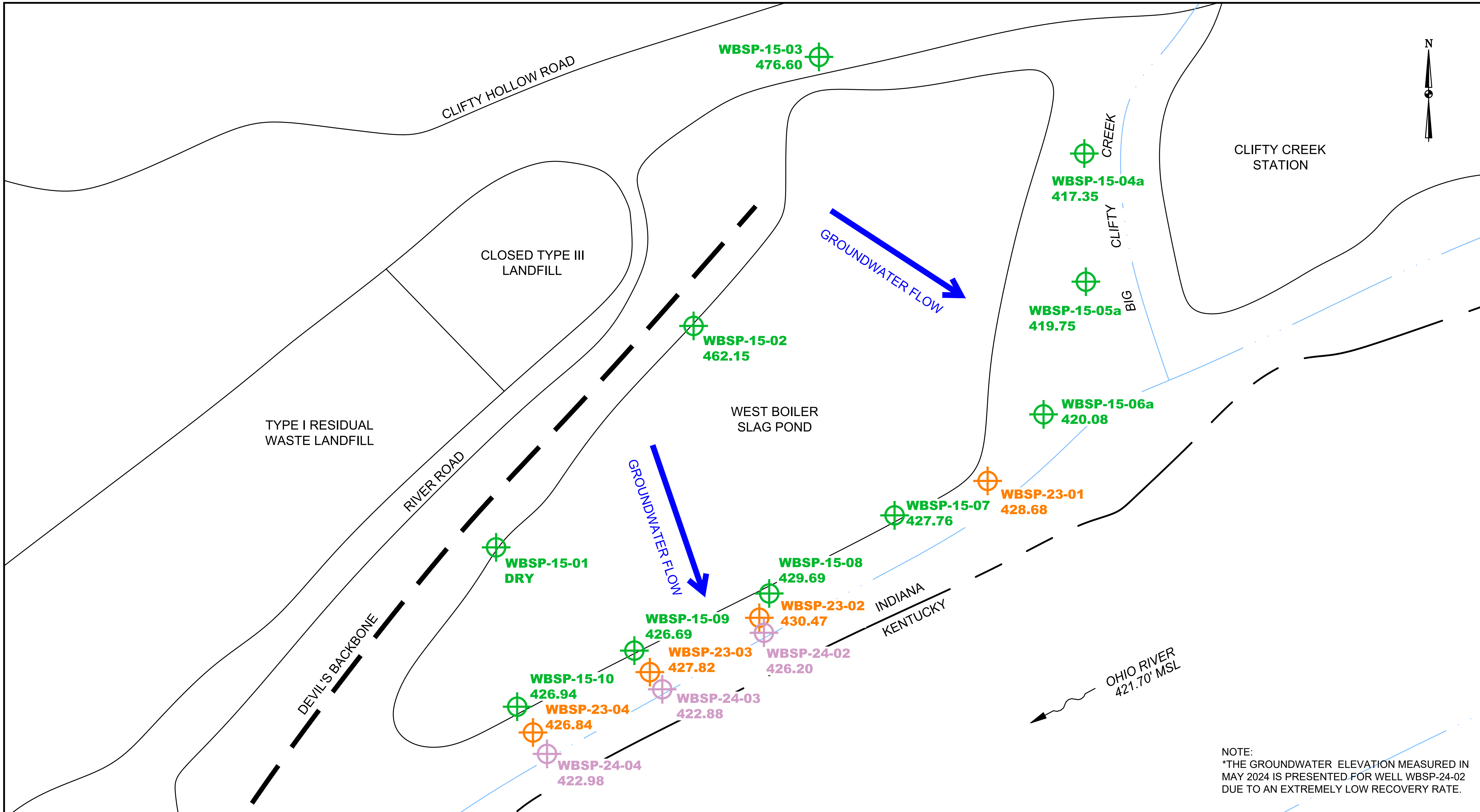
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GENERALIZED GROUNDWATER FLOW – MARCH 2024

DRAWING NAME: FIGURE 4–3

REV. 0

PLOTTED: 1/30/2025 X:\SHARED\CLIENT_SHARE\GARYMALARKEY\2024 CLIFTY CREEK\CAD 1-16-2025\FIGURE 4-3_IKEC_CLIFTY_WBSP GW FLOW-GRM.DWG



LEGEND:

- CCR EXISTING PROGRAM MONITORING WELL
- CCR INTERIM PROGRAM MONITORING WELL
- CCR PROPERTY BOUNDARY PROGRAM MONITORING WELL

400' 0' 400' 800'

SCALE: 1"= 400'

	GRM
DATE	1–16–2025
CHECKED BY	
JOB NO.	2024146–CLI
DWG FILE	X:\SHARED\CLIENT_SHARE\GARYMALARKEY\2024 CLIFTY CREEK\CAD 1–16–2025\FIGURE 4–4_IKEC_CLIFTY_WBSP GW FLOW–GRM.DWG
DRAWING SCALE	AS SHOWN

AGES

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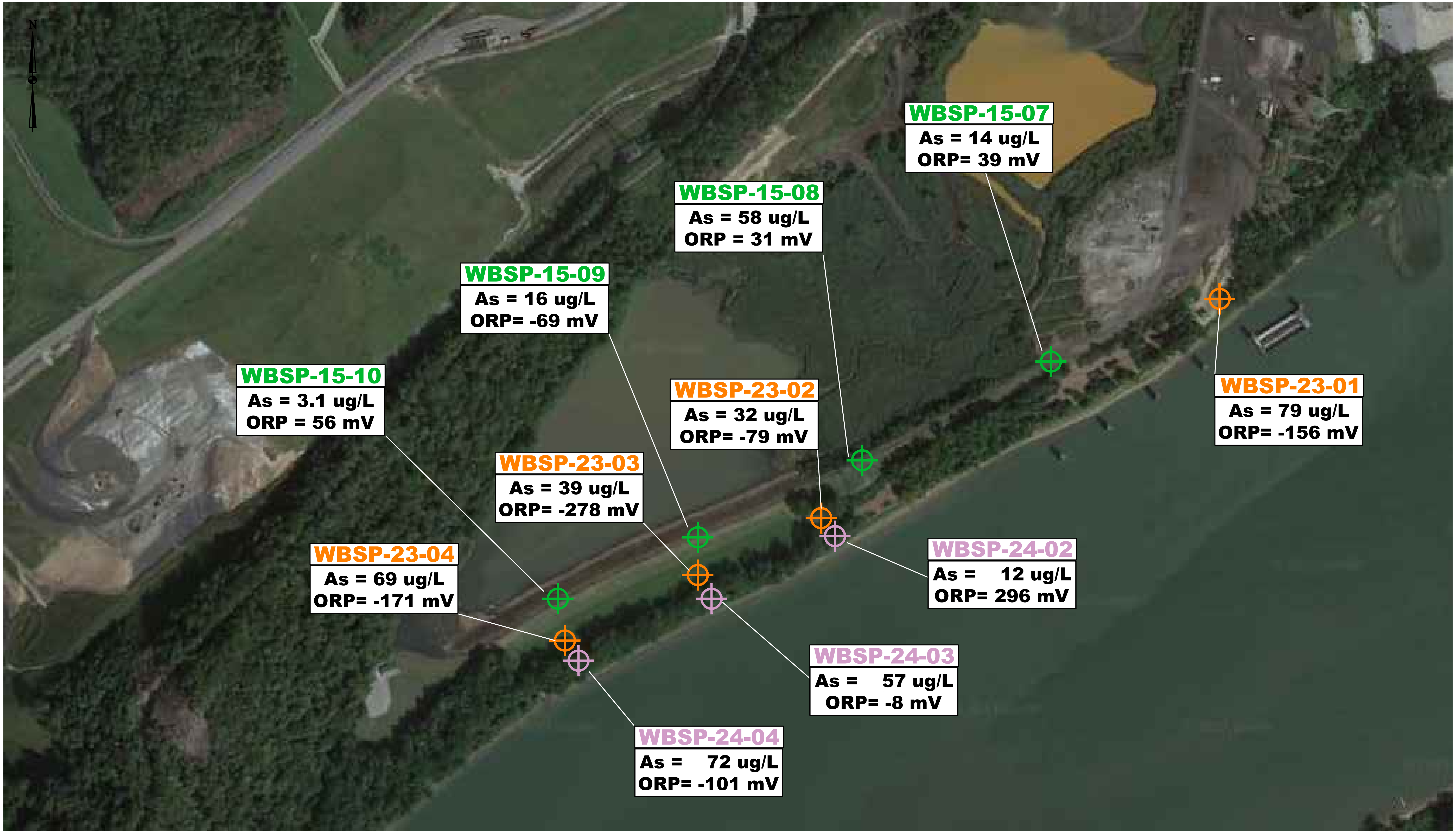
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GENERALIZED GROUNDWATER FLOW – SEPTEMBER 2024

DRAWING NAME: FIGURE 4–4

REV. 0

PLOTTED: 1/16/2025 X:\SHARED\CLIENT_SHARE\GARYMALARKEY\2024 CLIFTY CREEK\CAD 1-16-2025\FIGURE 4-4_IKEC_CLIFTY_WBSP GW FLOW-GRM.DWG



LEGEND:

- CCR EXISTING PROGRAM MONITORING WELL
- CCR INTERIM PROGRAM MONITORING WELL
- CCR PROPERTY BOUNDARY PROGRAM MONITORING WELL

NOTES:

ARSENIC RESULTS PROVIDED IN MICROGRAMS PER LITER (UG/L).

GWPS FOR ARSENIC IS 10 UG/L.

OXIDATION REDUCTION POTENTIAL (ORP) RESULTS PROVIDED IN MILLIVOLTS (MV).

DRAWN BY	GRM
DATE	1–16–2025
CHECKED BY	
JOB NO.	2024146–CLI
DWG FILE	X:\SHARED\CLIENT_SHARE\GARYMALARKEY\2024 CLIFTY CREEK\CAD 1–16–2025\FIGURE 4–5_IKEC_CLIFTY_WBSP ARSENIC IN GW 2024–GRM.DWG
DRAWING SCALE	NOT TO SCALE

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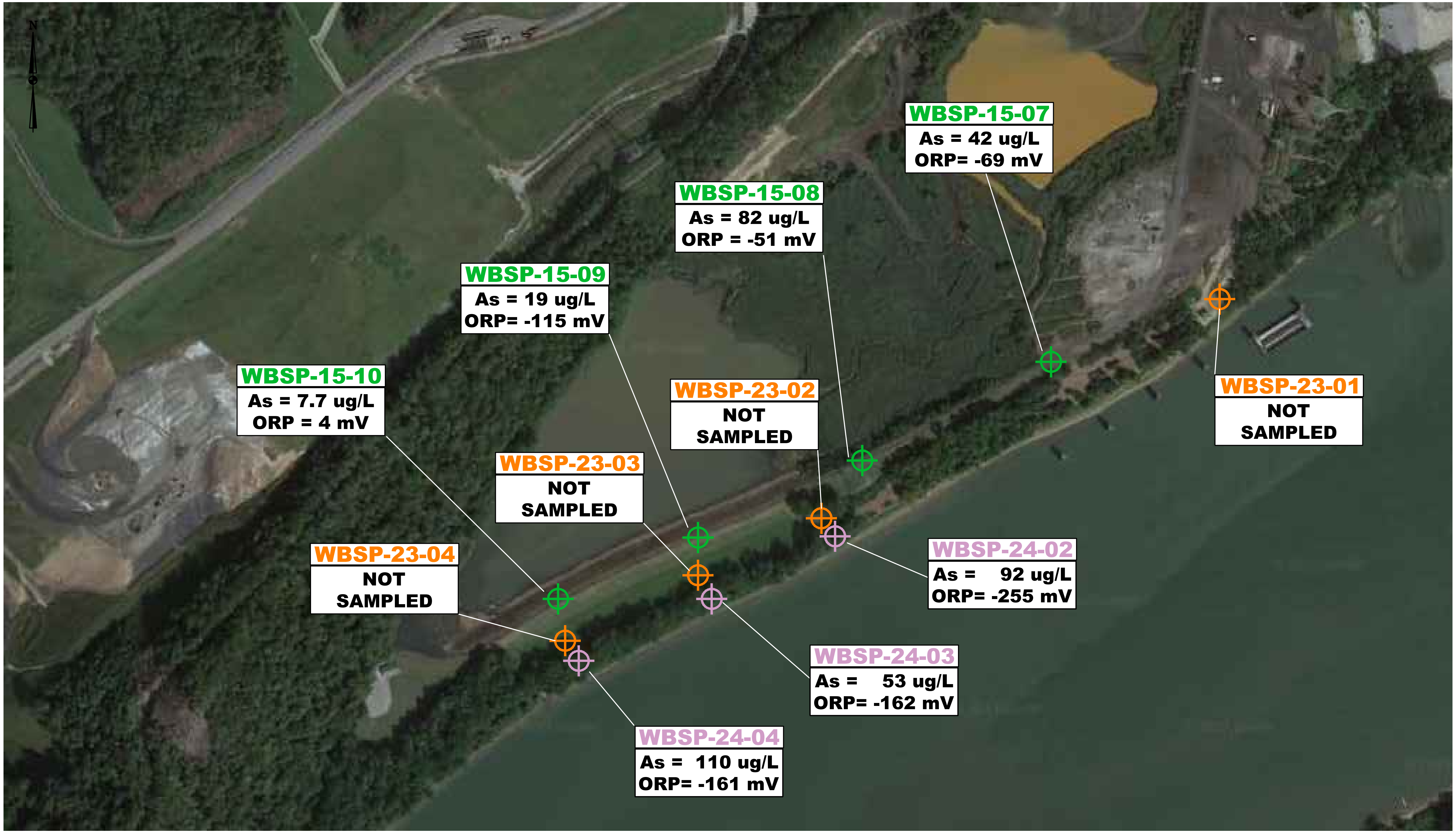
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
ARSENIC CONCENTRATIONS IN GROUNDWATER – MARCH 2024

DRAWING NAME: FIGURE 4–5

REV. 0



LEGEND:

- CCR EXISTING PROGRAM MONITORING WELL
- CCR INTERIM PROGRAM MONITORING WELL
- CCR PROPERTY BOUNDARY PROGRAM MONITORING WELL

NOTES:
ARSENIC RESULTS PROVIDED IN MICROGRAMS PER LITER (UG/L).

GWPS FOR ARSENIC IS 10 UG/L.

OXIDATION REDUCTION POTENTIAL (ORP) RESULTS PROVIDED IN MILLIVOLTS (MV).

DRAWN BY	GRM
DATE	1–16–2025
CHECKED BY	
JOB NO.	2024146–CLI
DWG FILE	X:\SHARED\CLIENT_SHARE\GARYMALARKEY\2024 CLIFTY CREEK\CAD 1-16-2025\FIGURE 4-6_IKEC_CLIFTY_WBSP ARSENIC IN GW 2024-GRM.DWG
DRAWING SCALE	NOT TO SCALE

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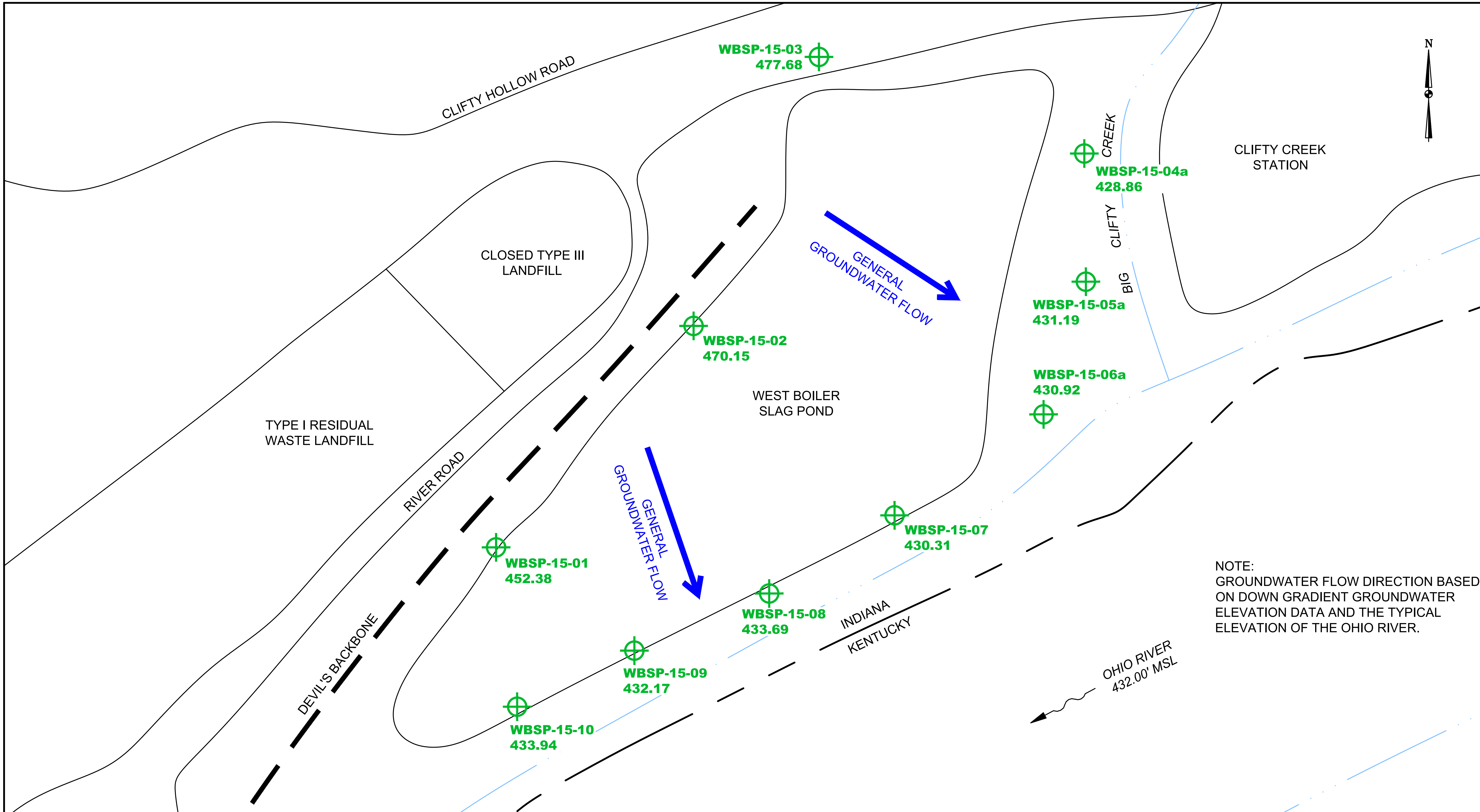
INDIANA–KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA
ARSENIC CONCENTRATIONS IN GROUNDWATER – SEPTEMBER 2024

DRAWING NAME: FIGURE 4–6
REV. 0

APPENDIX A

GENERALIZED GROUNDWATER FLOW MAPS FOR MARCH 2022, SEPTEMBER 2022, MARCH 2023 & SEPTEMBER 2023



	AB
DATE	
CHECKED BY	
JOB NO.	2023004–CLI
DWG FILE	A-1_IKEC-Clifty_GW Flow_MAR22_WBSP.dwg
DRAWING SCALE	AS SHOWN

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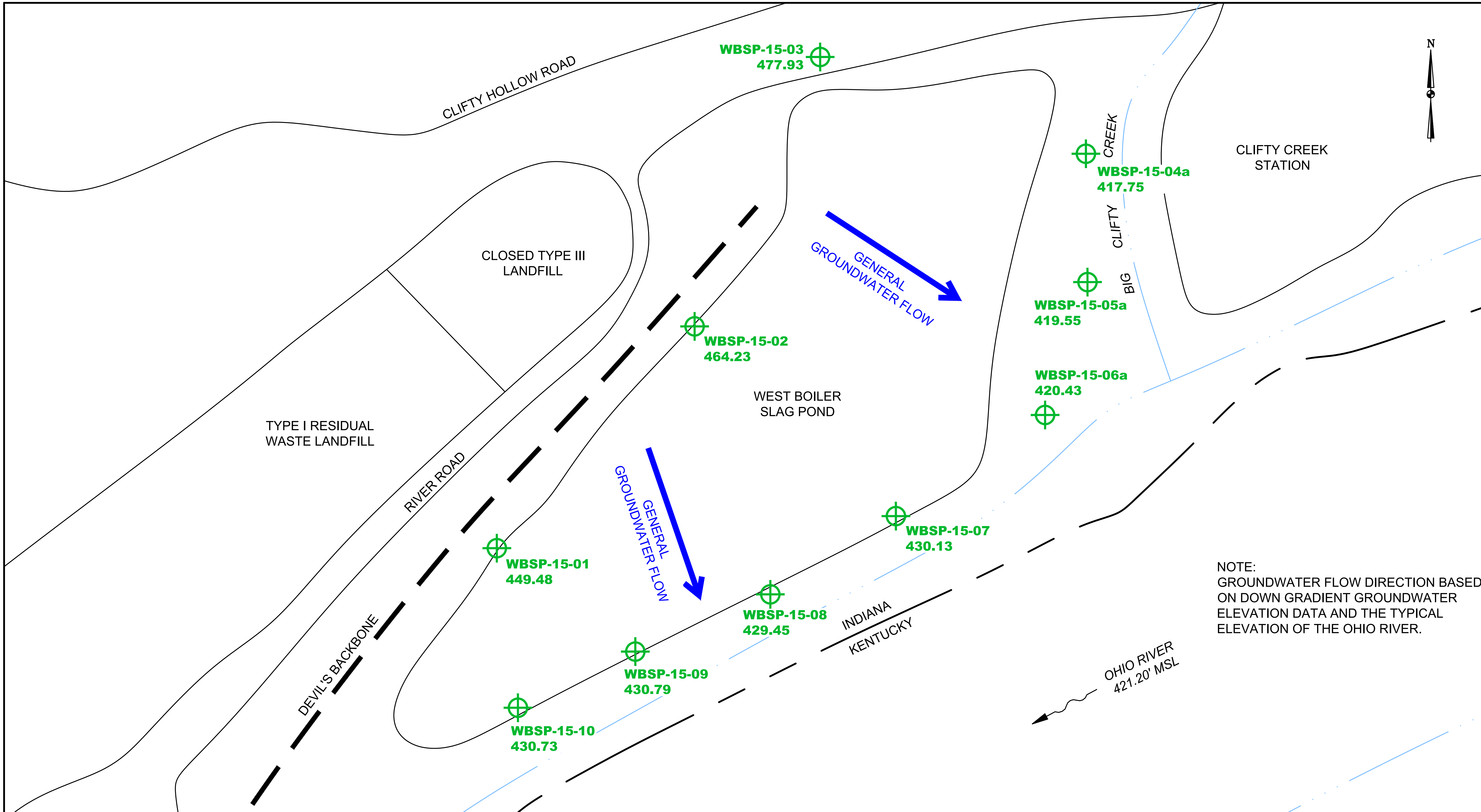
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GROUNDWATER LEVELS AND FLOW DIRECTION
MARCH 2022

DRAWING NAME: FIGURE A–1

REV. 0

Plot: 12/21/2022 14:41 _PROGRAMS–IKEC\IKEC–CCR Program\CAD\2022 GW Monitoring–Corrective Action Rpt\B–4_IKEC–Clifty_GW Flow_Appx B_Annual GW Rpt_MAR22_WBSP\well loc



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

LEGEND:
- CCR PROGRAM MONITORING WELL
- GROUNDWATER FLOW DIRECTION

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

	AB
DATE	
CHECKED BY	
JOB NO.	2023004–CLI
DWG FILE	A-2_IKEC-Clifty_GW Flow_SEPT22_WBSP.dwg
DRAWING SCALE	AS SHOWN

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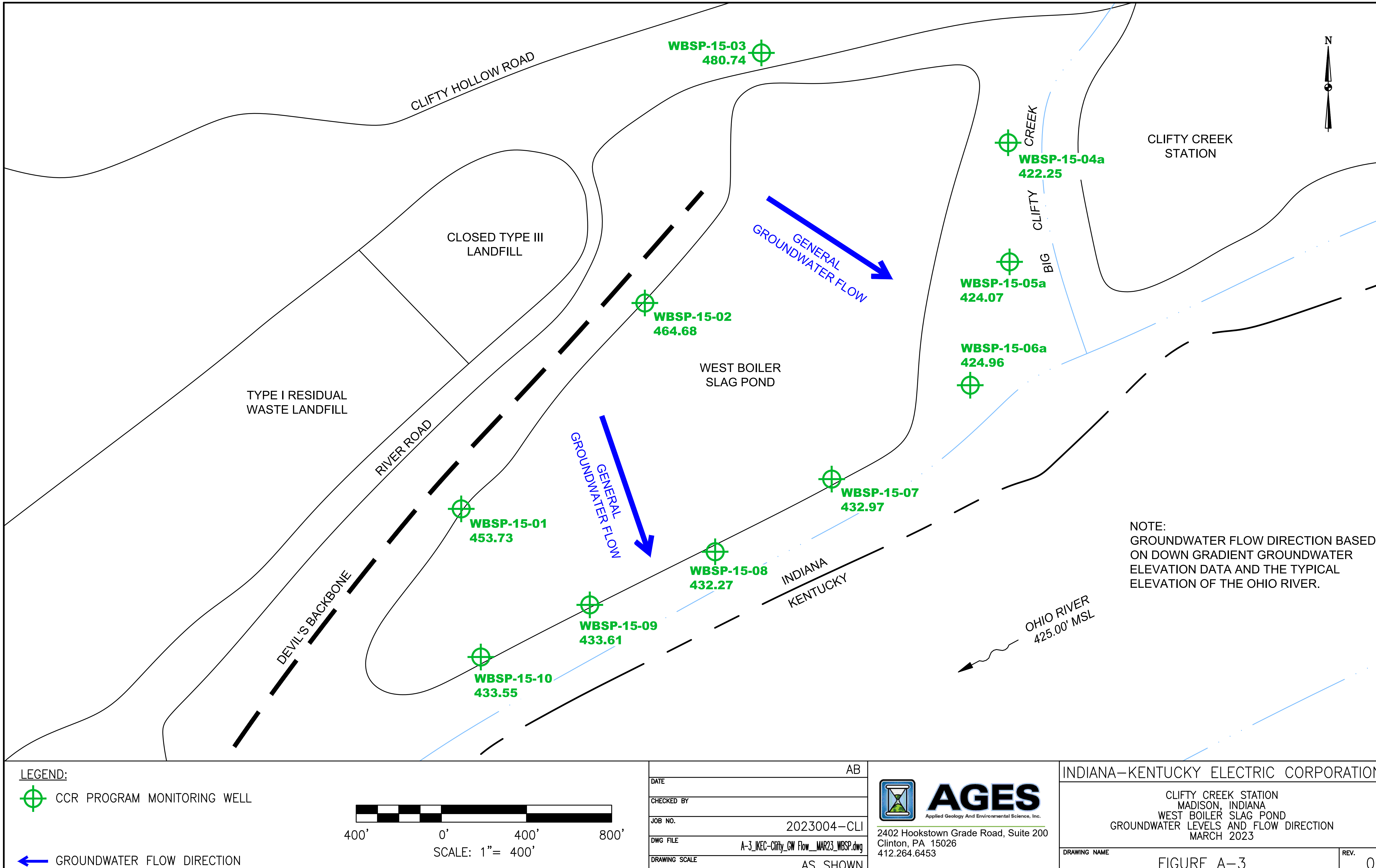
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GROUNDWATER LEVELS AND FLOW DIRECTION
SEPTEMBER 2022

DRAWING NAME	REV.
FIGURE A–2	0

Plot: 12/21/2022 14:52 _PROGRAMS–IKEC\IKEC–CCR Program\CAD\2022 GW Monitoring–Corrective Action Rpt\B–5_IKEC–Clifty_GW Flow_Appx B_Annual GW Rpt_SEPT22_WBSP\well loc



	AB
DATE	
CHECKED BY	
JOB NO.	2023004–CLI
DWG FILE	A-3_IKEC-Clifty_GW Flow__MAR23_WBSP.dwg
DRAWING SCALE	AS SHOWN

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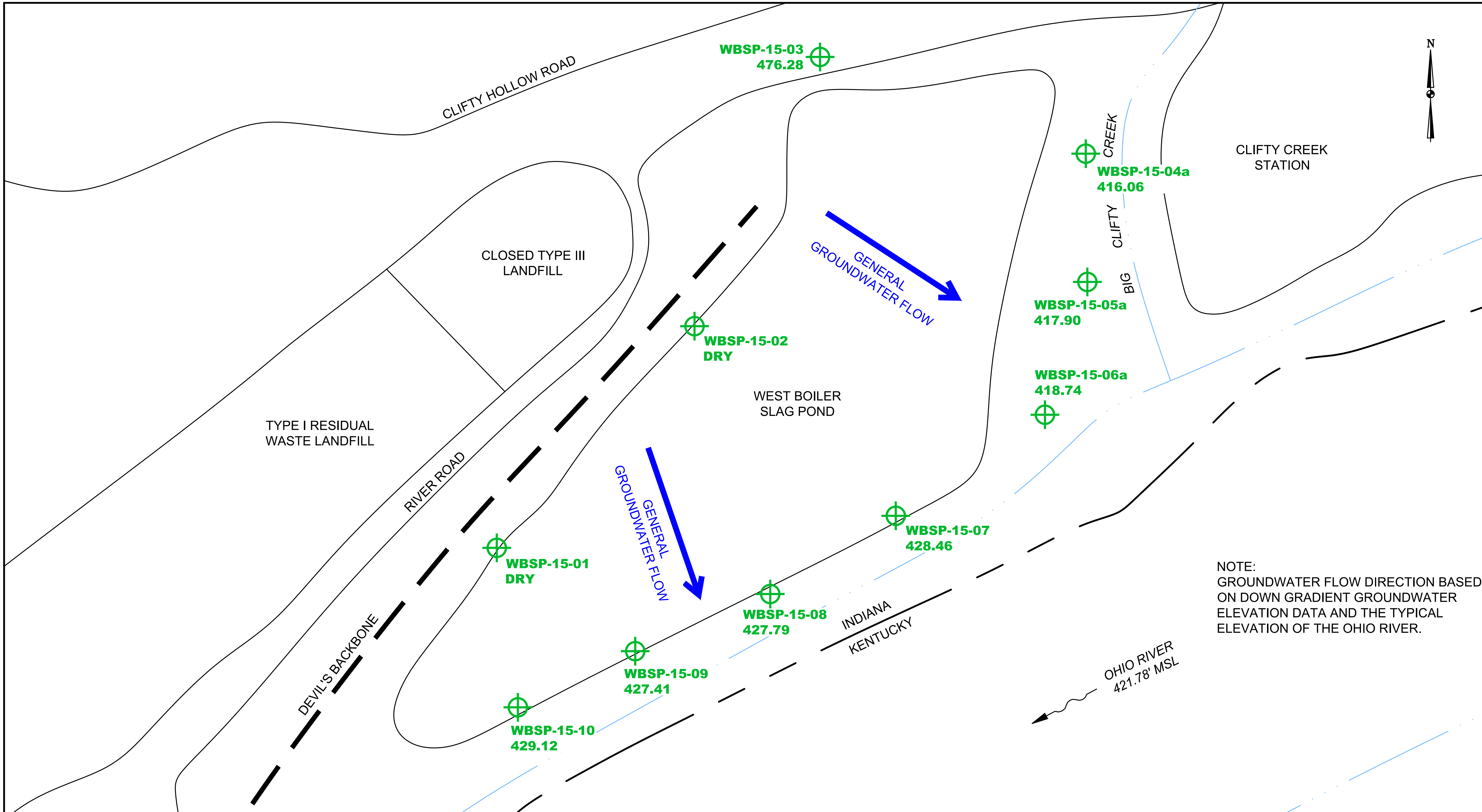
INDIANA–KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
WEST BOILER SLAG POND
GROUNDWATER LEVELS AND FLOW DIRECTION
MARCH 2023

DRAWING NAME: FIGURE A–3

REV. 0

Plot: 10/04/2023 09:31 _PROGRAMS–IKEC\IKEC–CCR Program\CAD\A–3_IKEC–Clifty_GW Flow_MAR23_WBSP\well loc



LEGEND:

CCR PROGRAM MONITORING WELL

GROUNDWATER FLOW DIRECTION

400' 0' 400' 800'

SCALE: 1"= 400'

DATE	
CHECKED BY	
JOB NO.	2024040–CLI
DWG FILE	IKEC–Clifty_WBSP App A_GW Flow SEPT23.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
SEPTEMBER 2023

DRAWING NAME	REV.
FIGURE A–4	0

Plot: 05/230/2024 14:25 _PROGRAMS–IKEC\Clifty Creek–CCR Program\CAD\ACM–WBSP–Addendum No 1\IKEC–Clifty_WBSP App A_GW Flow SEPT23.dwg

APPENDIX B

BORING AND WELL LOGS

BORING NO. WBSP-24-02
SAMPLE/CORE LOG

Project Number:	2024040	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	HAD Inc
Drilling Date(s):	2/27/24	AGES Geologist:	Chris Crown

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	160lb. and Drop 2ft
Sampling Method:	Split Spoon	Borehole Diameter:	4.25”	Drilling Fluid Used:	Water
Sampling Interval:	2ft	Borehole Depth:	40’	Surface Elevation:	

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-2	1	1-1-1-1	Brown sandy silt & clay, dry	N/A
2-4	0.4	1-2-3-4	Brown sandy silt & clay, dry	N/A
4-6	1	2-3-5-5	Brown sandy silt & clay, dry	N/A
6-8	2	3-3-3-5	Brown sandy silt & clay, dry	N/A
8-10	2	3-3-5-6	Brown sandy silt & clay, dry	N/A
10-12	2	3-3-4-6	Brown silty clay, dry	N/A
12-14	2	2-3-2-4	Brown silty clay, dry	N/A
14-16	2	3-4-4-6	Brown silty clay, dry	N/A
16-18	2	3-4-5-7	Brown clay, dry	N/A
18-20	2	4-4-6-8	Brown clay, dry	N/A
20-22	2	3-4-7-7	Brown silty clay, dry	N/A
22-24	2	1-2-2-3	Gray silty clay, dry	N/A
24-26	2	3-3-3-5	Gray silty clay, dry	N/A
26-28	2	2-2-3-4	Gray silty clay, dry	N/A
28-30	2	Wt/2-2-3	Gray silty clay, moist	N/A
30-32	2	Wt/2-3-4	Gray silty clay, wet	N/A
32-34	2	2-3-3-4	Gray silty clay, moist	N/A

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
34-36	2	3-4-4-5	Gray silty clay, moist	N/A
36-38	1.75	2-2-3-4	Gray silty clay, moist	N/A
38-40	2	3-4-4-5	Gray silty clay, dry	N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-24-02

Project Number: 2024040

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 2/27/24

Drilling Method: HSA

Drilling Contractor: HAD Inc

Development Date(s): 3/4/24-3/6/24

Development Method: Submersible Pump and Bladder Pump

Volume Purged: 17 gal.

Static Water-Level*: 17.40 ft.

Top of Well Casing Elevation:

Well Purpose:
Groundwter Monitoring

Northing (Y): 448397.38

Easting (X): 567242.77

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: Chris Crown

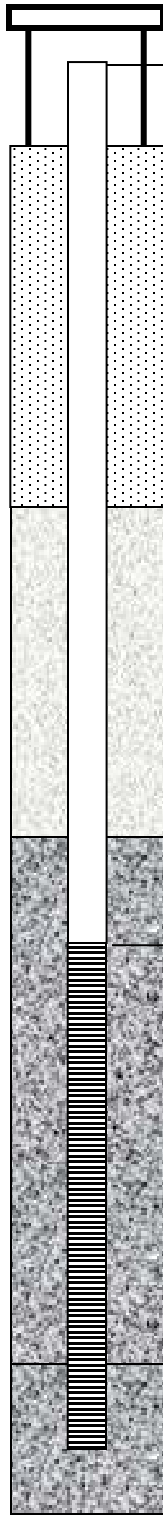
CONSTRUCTION MATERIALS USED:

6.5 Bags of Sand

1 Bags/Buckets Bentonite Pellets

5 Bags Portland for Grout

Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 440.46 ft.

Stick-up: NA ft.

Land Surface Elevation: 438.33 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch

Casing Material: PVC

Top of Seal: 21 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 23 ft*

Top of Well Screen 25 ft*

Sand/Gravel Pack; Type: Global #5

Screen Diameter: 2 Inch

Screen Slot-Size: 0.010 Inch

Screen Material: PVC

Bottom of Well Screen 35 ft.*

Base of Borehole: 35 ft.*

Total Depth of Well Below Top of Casing: 37.35 ft.

*Indicates Depth Below Land Surface

BORING NO. WBSP-24-03
SAMPLE/CORE LOG

Project Number:	2024040	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	HAD Inc
Drilling Date(s):	2/27/24-2/28/24	AGES Geologist:	Chris Crown

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	160lb. and Drop 2ft
Sampling Method:	Split Spoon	Borehole Diameter:	4.25”	Drilling Fluid Used:	Water
Sampling Interval:	2ft	Borehole Depth:	34’	Surface Elevation:	

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-2	2	1-2-3-3	Brown sandy silt, dry	N/A
2-4	1.8	1-1-2-3	Brown sandy silt, dry	N/A
4-6	0.8	1-1-2-3	Brown sandy silt, dry	N/A
6-8	1	3-4-6-6	Brown sandy silt, dry	N/A
8-10	2	4-6-8-10	Brown silty clay, dry	N/A
10-12	2	4-7-7-9	Brown silty clay, dry	N/A
12-14	2	4-6-8-9	Brown silty clay, dry	N/A
14-16	2	3-4-6-8	Gray silty clay, dry	N/A
16-18	2	3-4-4-5	Gray silty clay, dry	N/A
18-20	2	2-3-3-3	Gray silty clay, moist	N/A
20-22	2	3-3-3-3	Gray silty clay, moist	N/A
22-24	2	2-2-2-3	Gray silty clay, moist	N/A
24-26	2	2-2-2-3	Gray silty clay, moist	N/A
26-28	2	1-1-2-3	Gray silty clay, moist	N/A
28-30	2	2-3-5-4	Gray silty clay, moist	N/A
30-32	2	2-2-2-3	Gray silty clay, wet	N/A
32-34	2	2-3-3-4	Gray silty clay, wet	N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-24-03

Project Number: 2024040

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 2/28/24

Drilling Method: HSA

Drilling Contractor: HAD Inc

Development Date(s): 2/29/24-3/6/24

Development Method: Submersible Pump and Bladder Pump

Volume Purged: 25.5 gal.

Static Water-Level*: 11.04 ft.

Top of Well Casing Elevation:

Well Purpose:
Groundwter Monitoring

Northing (Y): 448164.66

Easting (X): 566796.42

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: Chris Crown

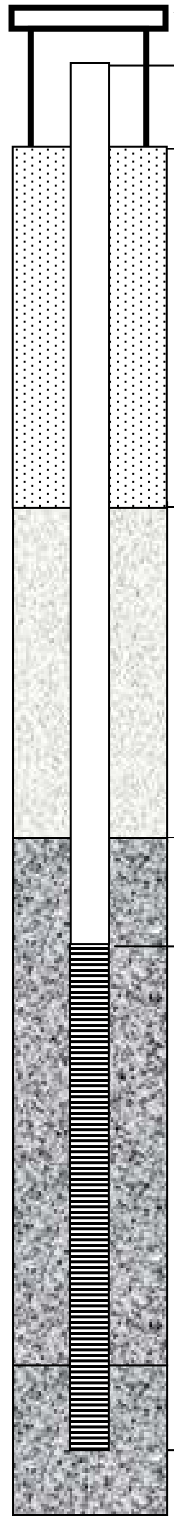
CONSTRUCTION MATERIALS USED:

7 Bags of Sand

1 Bags/Buckets Bentonite Pellets

6 Bags Portland for Grout

Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 436.29 ft.
Stick-up: NA ft.

Land Surface Elevation: 434.10 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch
Casing Material: PVC
Top of Seal: 19 ft*

Seal Type: Bentonite Pellets/Chips

Top of Sand/Gravel Pack: 22 ft*

Top of Well Screen 24 ft*

Sand/Gravel Pack; Type: Global #5

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

Bottom of Well Screen 34 ft.*

Base of Borehole: 34 ft.*

Total Depth of Well Below Top of Casing: 36.40 ft.

*Indicates Depth Below Land Surface

BORING NO. WBSP-24-04
SAMPLE/CORE LOG

Project Number:	2024040	Log Page	1 of 1
Project Location:	Clifty Creek Plant West Boiler Slag Pond	Drilling Contractor:	HAD Inc
Drilling Date(s):	2/28/24	AGES Geologist:	Chris Crown

Drilling Method:	HSA	Coring Device Size:	NA	Hammer Wt.	160lb. and Drop 2ft
Sampling Method:	Split Spoon	Borehole Diameter:	4.25”	Drilling Fluid Used:	Water
Sampling Interval:	2ft	Borehole Depth:	26’	Surface Elevation:	

NOTES/COMMENTS:

Depth Interval (feet)	Sample Recovery (feet)	Penetration (Hyd. Pres. or Blow Counts)	Sample/Core Description	PID (PPM)
0-2	2	1-2-3-4	Brown silt, dry	N/A
2-4	0.6	3-2-3-4	Brown silt, dry	N/A
4-6	0.6	1-2-4-4	Brown silt, dry	N/A
6-8	1	2-2-2-3	Brown silt, dry	N/A
8-10	1	2-2-2-2	Brown silt, dry	N/A
10-12	1	1-2-3-6	Brown silty clay, dry	N/A
12-14	1	3-3-3-5	Brown silty clay, dry	N/A
14-16	1.4	2-2-2-2	Gray silty clay, moist	N/A
16-18	1.6	1-1-1-1	Gray silty clay, wet	N/A
18-20	1.8	1-1-2-2	Gray silty clay, wet	N/A
20-22	2	Wt/4	Gray silty clay, wet	N/A
22-24	2	2-2-2-2	Gray silt, wet	N/A
24-26	2	2-2-2-3	Gray silty clay, moist	N/A

WELL CONSTRUCTION LOG
WELL NO. WBSP-24-04

Project Number: 2024040

Project Location: Clifty Creek Plant – West Boiler Slag Pond

Installation Date(s): 2/28/24

Drilling Method: HSA

Drilling Contractor: HAD Inc

Development Date(s): 3/1/24-3/6/24

Development Method: Submersible Pump and Bladder Pump

Volume Purged: 70 gal.

Static Water-Level*: 11.90 ft.

Top of Well Casing Elevation:

Well Purpose:
Groundwter Monitoring

Northing (Y): 447933.77

Easting (X): 566314.71

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: Chris Crown

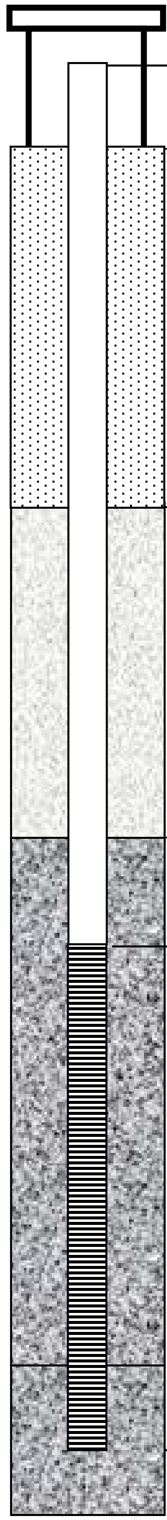
CONSTRUCTION MATERIALS USED:

7 Bags of Sand

1 Bags/Buckets Bentonite Pellets

4 Bags Portland for Grout

___ Bags Concrete/Sakrete



Protective Casing with Locking Cap

Top of Casing Elevation: 437.6 ft.

Stick-up: NA ft.

Land Surface Elevation: 435.7 ft.

Grout; Type: Portland cement/ Grout

Borehole Diameter: 6 inch

Casing Diameter: 2 Inch

Casing Material: PVC

Top of Seal: 11 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 26 ft.*

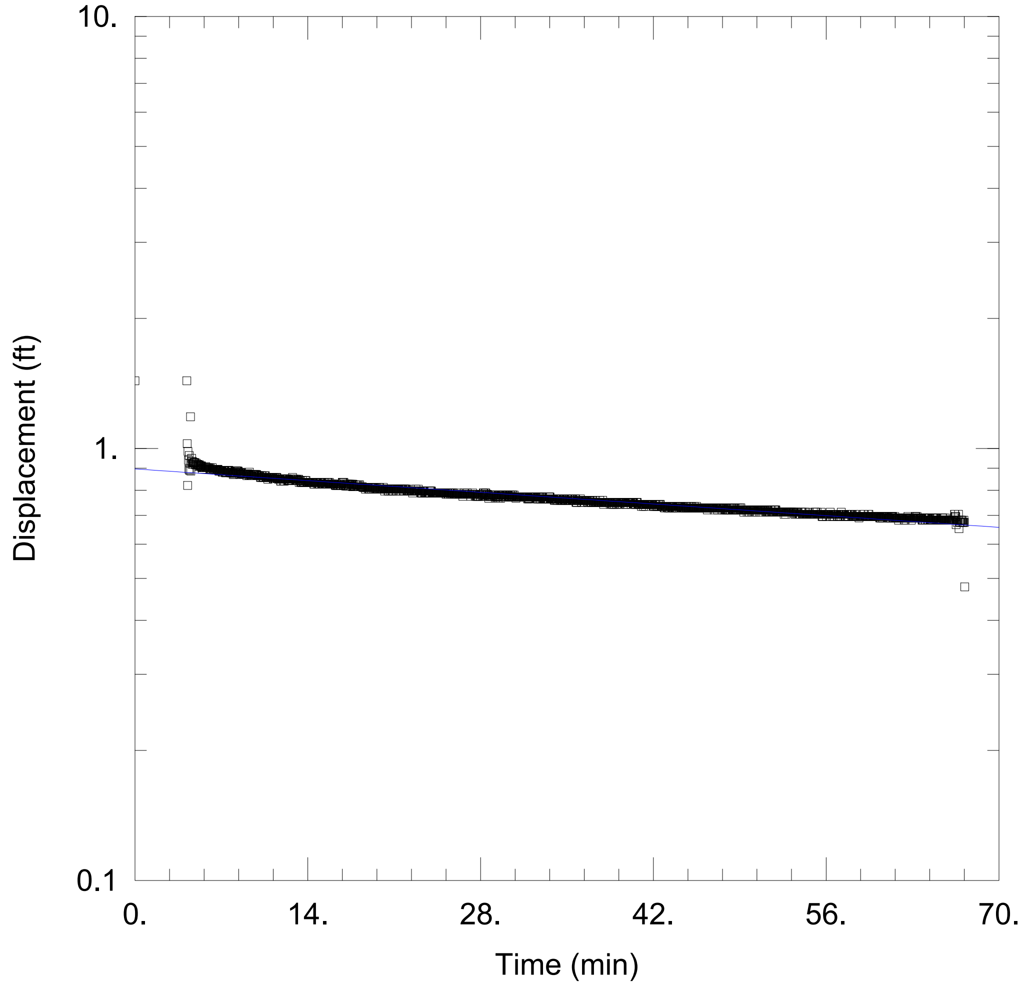
Base of Borehole: 26 ft.*

Total Depth of Well Below Top of Casing: 29.65 ft.

*Indicates Depth Below Land Surface

APPENDIX C

SLUG TEST RESULTS



WELL TEST ANALYSIS-SLUG IN

Data Set: Y:\...\wbsp-24-02.aqt
Date: 05/14/24 Time: 15:41:33

PROJECT INFORMATION

Company: AGES
Client: IKEC
Location: WBSP
Test Well: WBSP-23-02
Test Date: 8-1-23

AQUIFER DATA

Saturated Thickness: 26. ft
Anisotropy Ratio (Kz/Kr): 1.

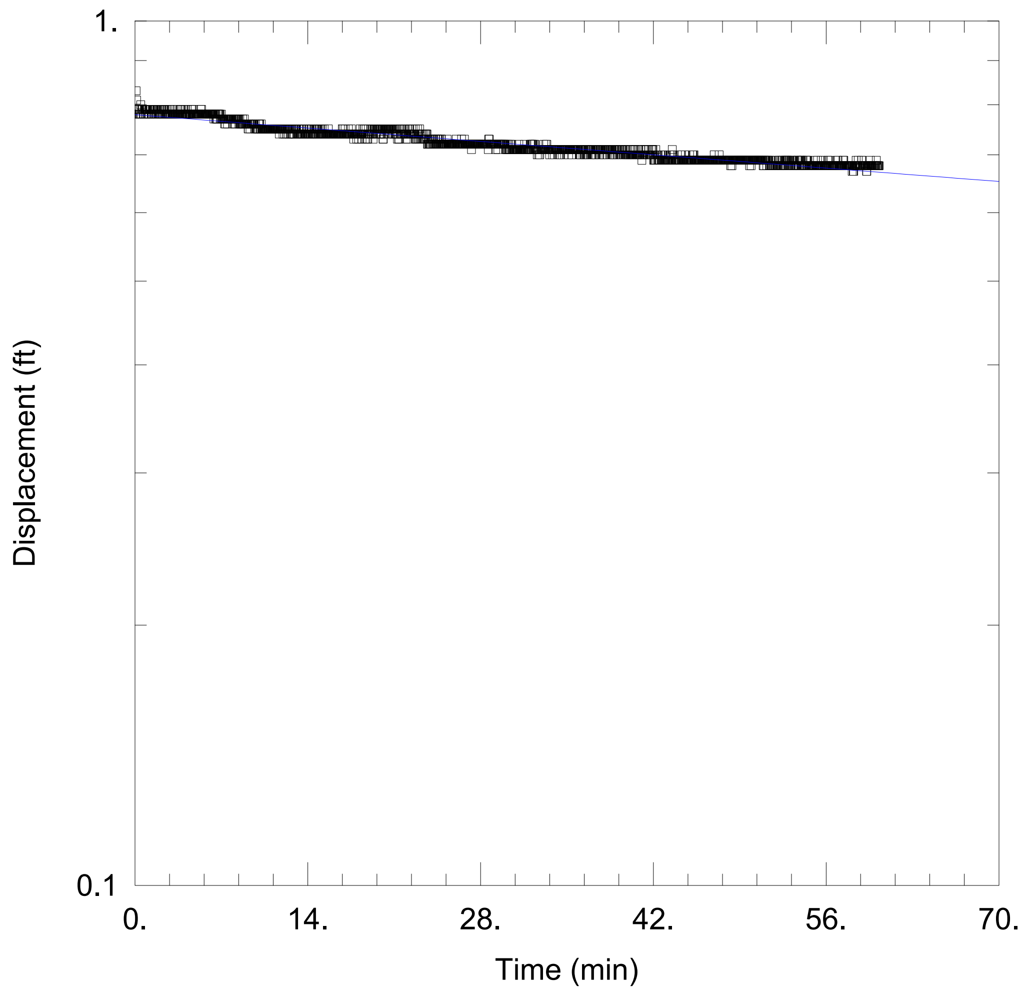
WELL DATA (WBSP-24-02)

Initial Displacement: 1.434 ft
Total Well Penetration Depth: 37. ft
Casing Radius: 0.0833 ft
Static Water Column Height: 24. ft
Screen Length: 10. ft
Well Radius: 0.0833 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 3.538E-6 cm/sec
y0 = 0.8964 ft



WELL TEST ANALYSIS-SLUG OUT

Data Set: Y:\...\OUT_wbsp-24-02.aqt
Date: 05/14/24
Time: 16:20:55

PROJECT INFORMATION

Company: AGES
Client: IKEC
Location: WBSP
Test Well: WBSP-23-02
Test Date: 8-1-23

AQUIFER DATA

Saturated Thickness: 26. ft
Anisotropy Ratio (Kz/Kr): 1.

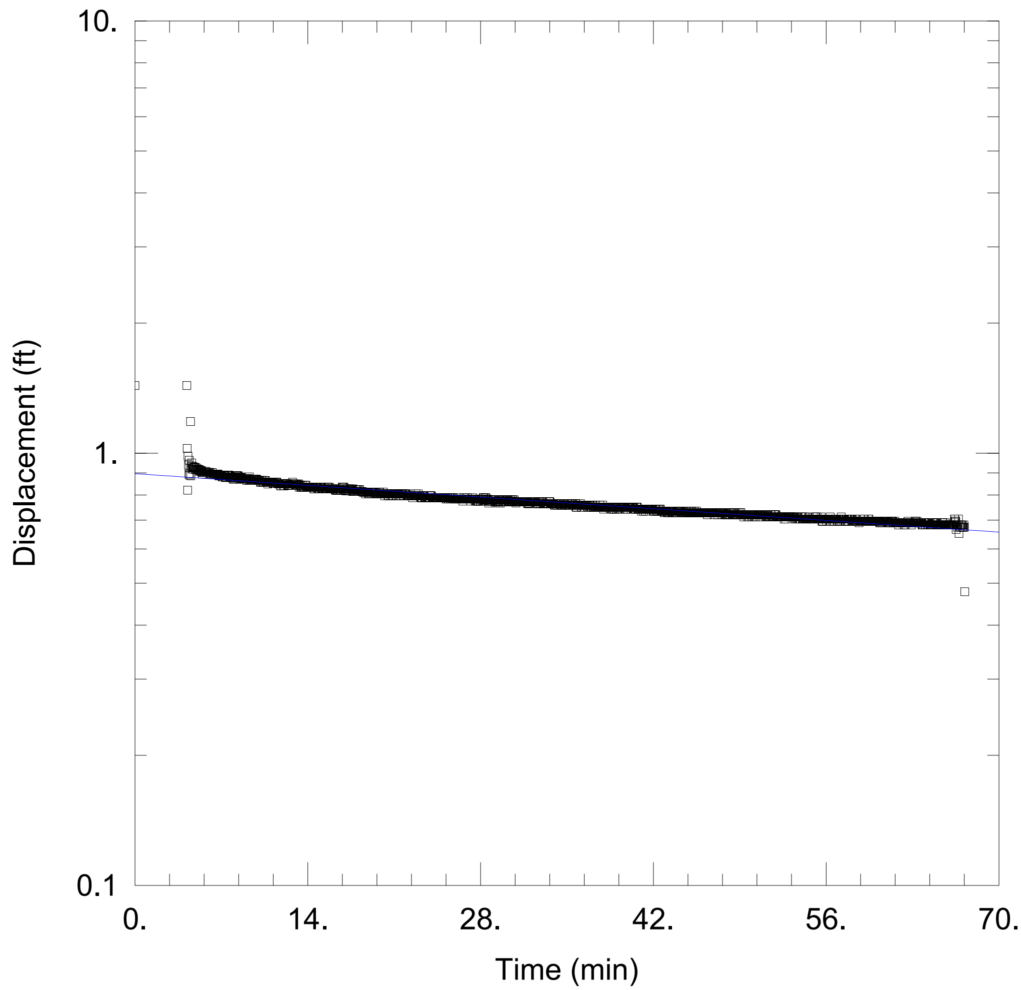
WELL DATA (WBSP-24-02)

Initial Displacement: 1.434 ft
Total Well Penetration Depth: 37. ft
Casing Radius: 0.0833 ft
Static Water Column Height: 24. ft
Screen Length: 10. ft
Well Radius: 0.0833 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 2.022E-6 cm/sec
y0 = 0.779 ft



WELL TEST ANALYSIS-SLUG IN

Data Set: Y:\...\wbsp-24-02.aqt
Date: 05/14/24 Time: 15:42:22

PROJECT INFORMATION

Company: AGES
Client: IKEC
Location: WBSP
Test Well: WBSP-23-02
Test Date: 8-1-23

AQUIFER DATA

Saturated Thickness: 26. ft Anisotropy Ratio (Kz/Kr): 1.

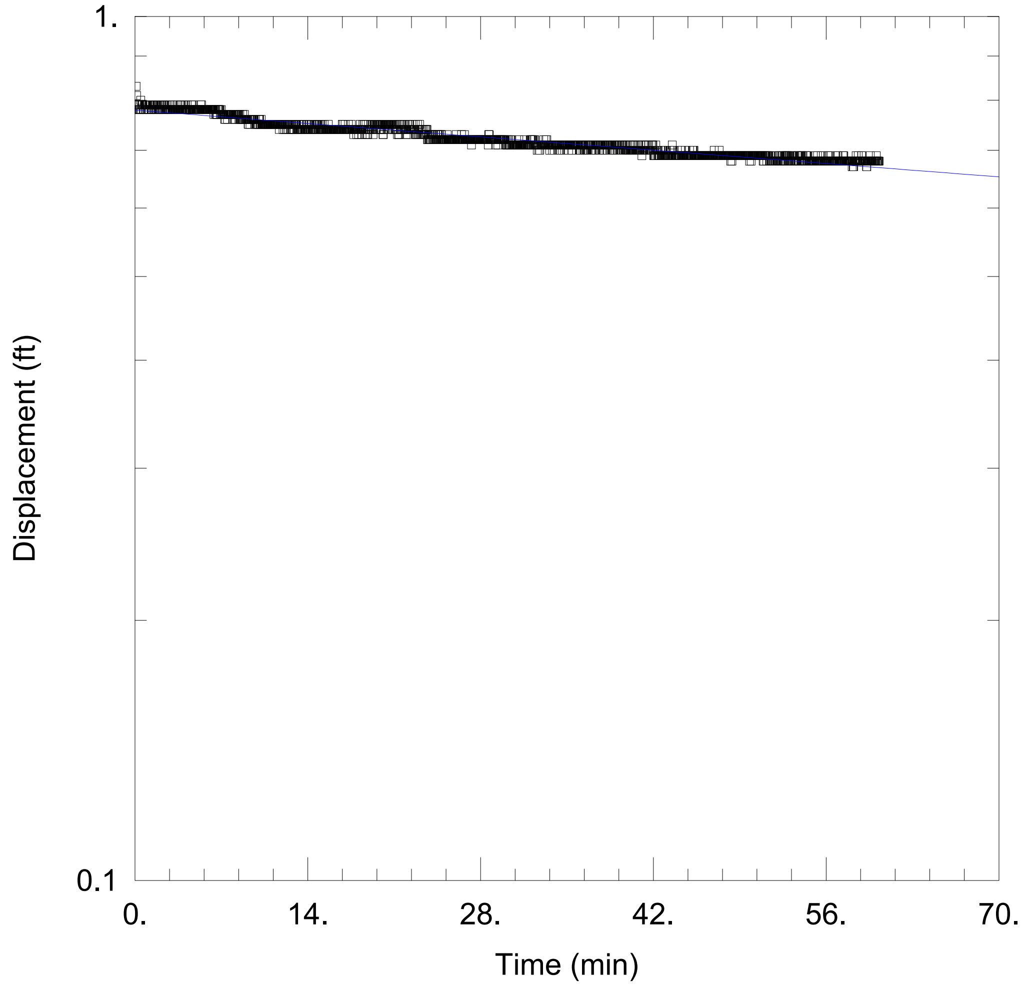
WELL DATA (WBSP-24-02)

Initial Displacement: 1.434 ft
Total Well Penetration Depth: 37. ft
Casing Radius: 0.0833 ft
Static Water Column Height: 24. ft
Screen Length: 10. ft
Well Radius: 0.0833 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 4.296E-6 cm/sec y0 = 0.8964 ft



WELL TEST ANALYSIS

Data Set: Y:\...\OUT_wbsp-24-02.aqt
Date: 05/14/24 Time: 16:20:21

PROJECT INFORMATION-SLUG OUT

Company: AGES
Client: IKEC
Location: WBSP
Test Well: WBSP-23-02
Test Date: 8-1-23

AQUIFER DATA

Saturated Thickness: 26. ft Anisotropy Ratio (Kz/Kr): 1.

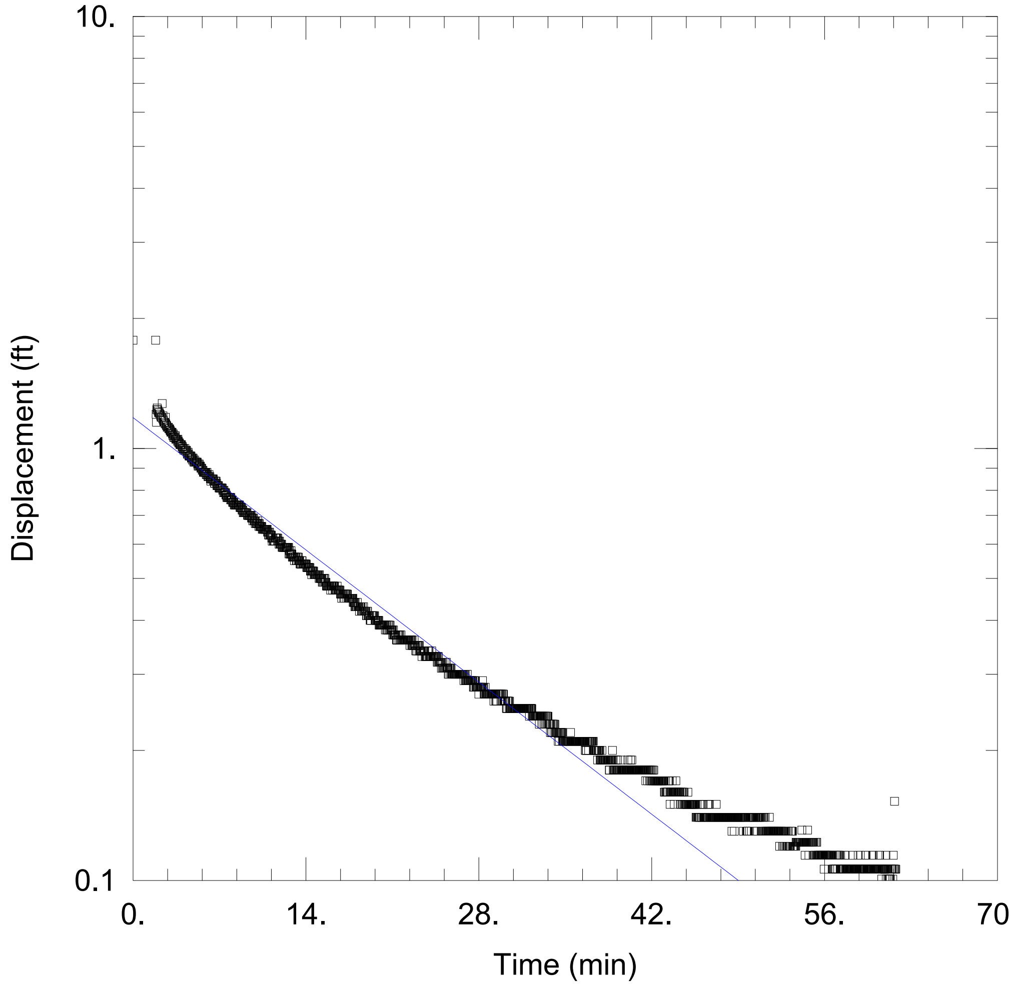
WELL DATA (WBSP-24-02)

Initial Displacement: 1.434 ft
Total Well Penetration Depth: 37. ft
Casing Radius: 0.0833 ft
Static Water Column Height: 24. ft
Screen Length: 10. ft
Well Radius: 0.0833 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 2.456E-6 cm/sec y0 = 0.779 ft



WELL TEST ANALYSIS-SLUG IN

Data Set: Y:\...\In_wbsp-24-03.aqt
Date: 05/14/24
Time: 16:39:38

PROJECT INFORMATION

Company: AGES
Client: IKEC
Location: WBSP
Test Well: WBSP-23-02
Test Date: 8-1-23

AQUIFER DATA

Saturated Thickness: 28. ft
Anisotropy Ratio (Kz/Kr): 1.

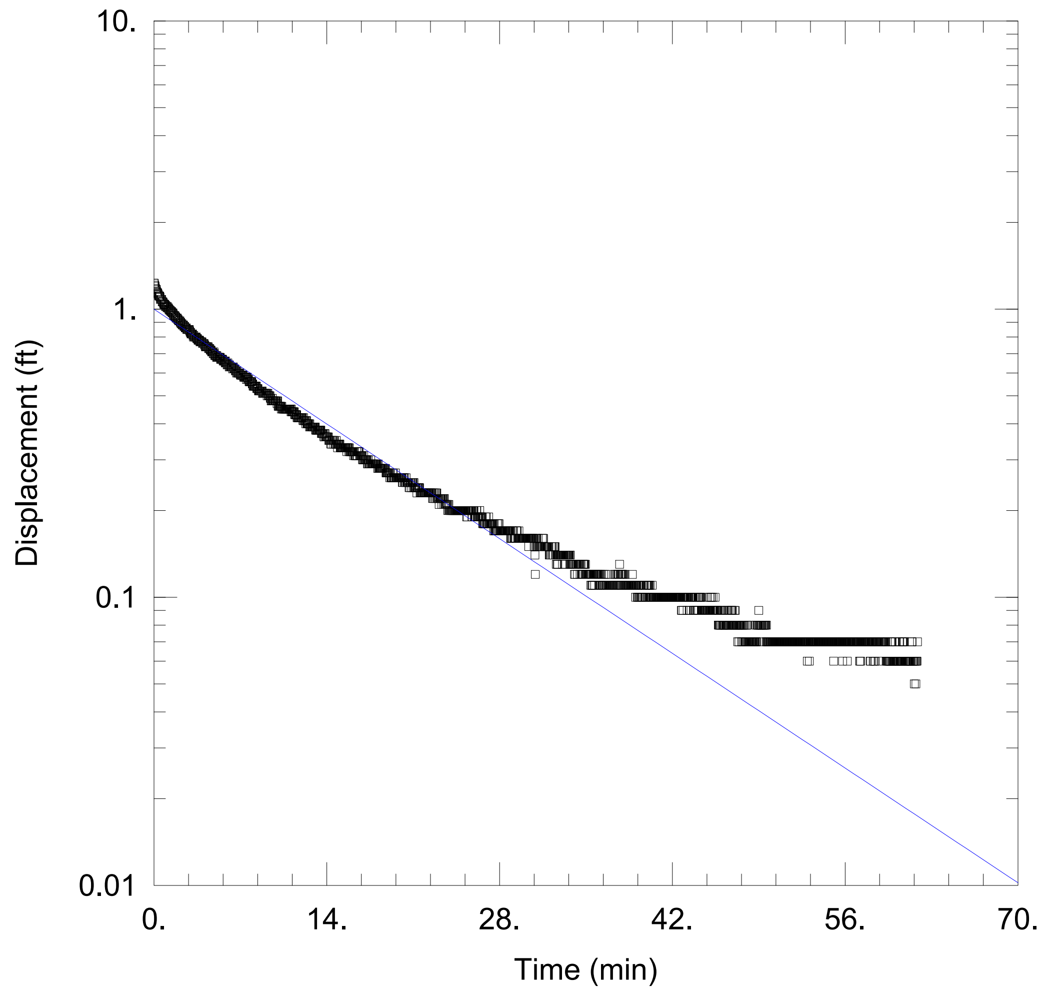
WELL DATA (WBSP-24-03)

Initial Displacement: 1.78 ft
Total Well Penetration Depth: 37. ft
Casing Radius: 0.0833 ft
Static Water Column Height: 24. ft
Screen Length: 10. ft
Well Radius: 0.0833 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 4.003E-5 cm/sec
y0 = 1.178 ft



WELL TEST ANALYSIS-SLUG OUT

Data Set: Y:\...\wbsp-24-03.aqt
Date: 05/14/24
Time: 16:48:50

PROJECT INFORMATION

Company: AGES
Client: IKEC
Location: WBSP
Test Well: WBSP-23-02
Test Date: 8-1-23

AQUIFER DATA

Saturated Thickness: 28. ft
Anisotropy Ratio (Kz/Kr): 1.

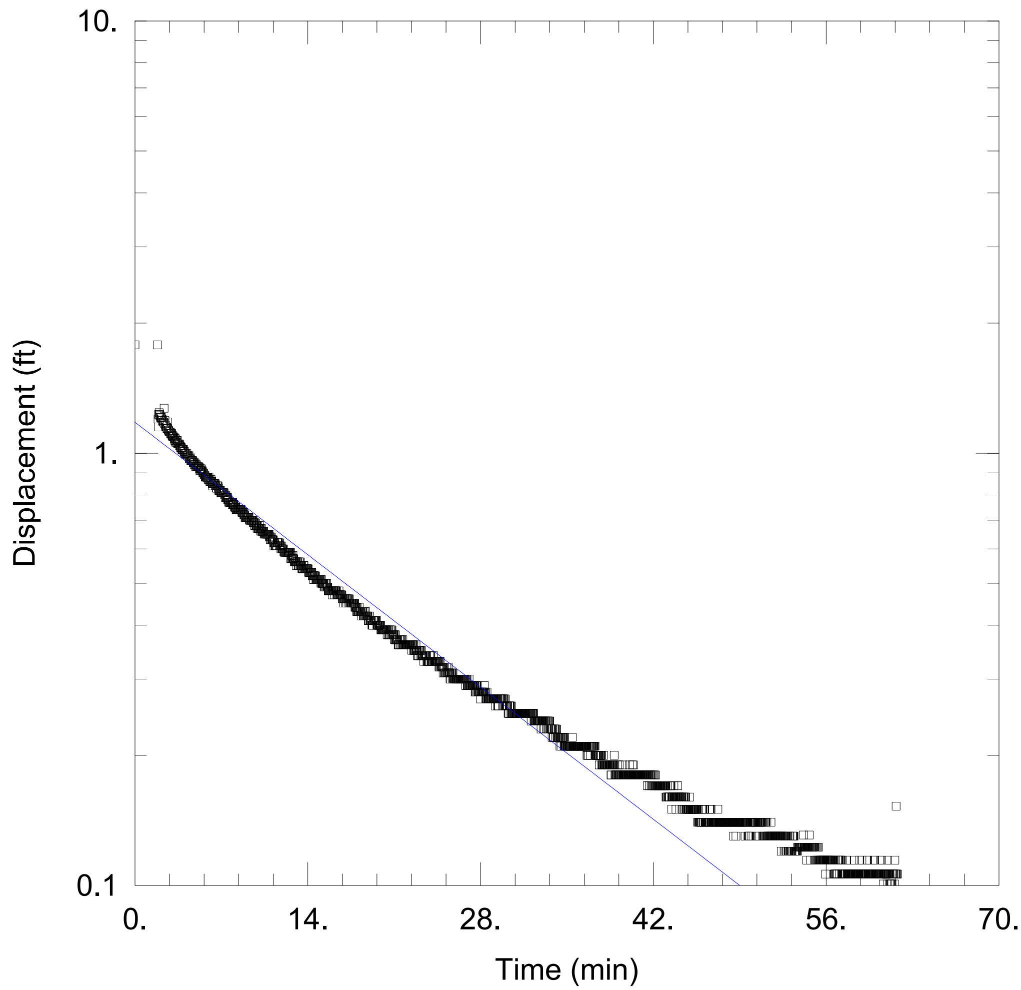
WELL DATA (WBSP-24-03)

Initial Displacement: 1.23 ft
Total Well Penetration Depth: 37. ft
Casing Radius: 0.0833 ft
Static Water Column Height: 24. ft
Screen Length: 10. ft
Well Radius: 0.0833 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 5.21E-5 cm/sec
y0 = 0.9994 ft



WELL TEST ANALYSIS-SLUG IN

Data Set: Y:\...\In_wbsp-24-03.aqt
Date: 05/14/24 Time: 16:40:19

PROJECT INFORMATION

Company: AGES
Client: IKEC
Location: WBSP
Test Well: WBSP-23-02
Test Date: 8-1-23

AQUIFER DATA

Saturated Thickness: 28. ft Anisotropy Ratio (Kz/Kr): 1.

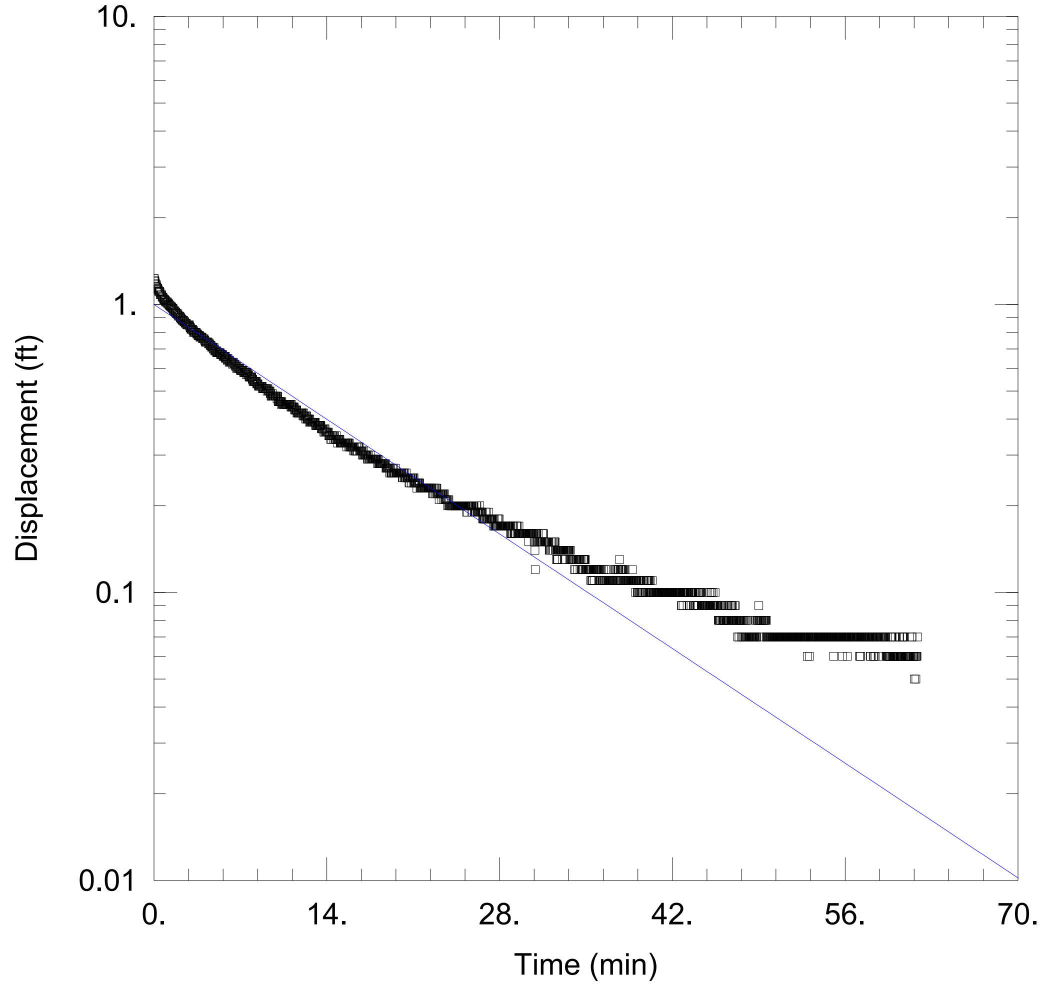
WELL DATA (WBSP-24-03)

Initial Displacement: 1.78 ft
Total Well Penetration Depth: 37. ft
Casing Radius: 0.0833 ft
Static Water Column Height: 24. ft
Screen Length: 10. ft
Well Radius: 0.0833 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 4.865E-5 cm/sec y0 = 1.179 ft



WELL TEST ANALYSIS-SLUG OUT

Data Set: Y:\...\In_wbsp-24-03.aqt
Date: 05/14/24 Time: 16:49:19

PROJECT INFORMATION

Company: AGES
Client: IKEC
Location: WBSP
Test Well: WBSP-23-02
Test Date: 8-1-23

AQUIFER DATA

Saturated Thickness: 28. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (WBSP-24-03)

Initial Displacement: 1.23 ft
Total Well Penetration Depth: 37. ft
Casing Radius: 0.0833 ft

Static Water Column Height: 24. ft
Screen Length: 10. ft
Well Radius: 0.0833 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 6.327E-5 cm/sec y0 = 0.9995 ft

APPENDIX D

SUMMARY OF 2024 ANALYTICAL DATA

SUMMARY OF MARCH 2024 ANALYTICAL RESULTS
Indiana-Kentucky Electric Corporation
Clifty Creek Station
Madison, Indiana

Parameter	Units	DOWNGRADIENT WELLS				INTERIM WELLS				PROPERTY BOUNDARY WELLS		
		WBSP-15-07	WBSP-15-08	WBSP-15-09	WBSP-15-10	WBSP-23-01	WBSP-23-02	WBSP-23-03	WBSP-23-04	WBSP-24-02	WBSP-24-03	WBSP-24-04
		SAMPLED MARCH 2024				SAMPLED JANUARY/FEBRUARY 2024				SAMPLED MARCH 2024		
Appendix III Constituents												
Boron, B	mg/L	0.025	0.029	0.016	0.021	NA	NA	NA	NA	NA	NA	NA
Calcium, Ca	mg/L	190	83	69	90	NA	NA	NA	NA	NA	NA	NA
Chloride, Cl	mg/L	12	17	4.3	23	NA	NA	NA	NA	NA	NA	NA
Fluoride, F	mg/L	0.4	0.24	0.61	0.28	NA	NA	NA	NA	NA	NA	NA
pH	s.u.	7.67	7.47	7.40	7.23	6.95	7.11	7.38	7.33	6.80	7.08	6.77
Sulfate, SO_4	mg/L	7.6 J	0.75 J	4 U	67	NA	NA	NA	NA	NA	NA	NA
Total Dissolved Solids (TDS)	mg/L	710	320	270	380	NA	NA	NA	NA	NA	NA	NA
Appendix IV Constituents												
Antimony, Sb	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	NA	NA	NA	NA	NA	NA	NA
Arsenic, As	ug/L	14	58	16	3.1	79	32	39	69	12	57	72
Barium, Ba	ug/L	330	290	160	200	NA	NA	NA	NA	NA	NA	NA
Beryllium, Be	ug/L	0.087 J	0.078 J	0.7 U	0.067 J	NA	NA	NA	NA	NA	NA	NA
Cadmium, Cd	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA	NA
Chromium, Cr	ug/L	1.1 J	1.5	1.5 U	1.6	NA	NA	NA	NA	NA	NA	NA
Cobalt, Co	ug/L	2.8	1.7	0.29 J	3.4	NA	NA	NA	NA	NA	NA	NA
Fluoride, F	mg/L	0.4	0.24	0.61	0.28	NA	NA	NA	NA	NA	NA	NA
Lead, Pb	ug/L	0.68 J	0.84 J	0.25 J	0.42 J	NA	NA	NA	NA	NA	NA	NA
Lithium, Li	mg/L	0.0023 J	0.002 J	0.004 U	0.0024 J	NA	NA	NA	NA	NA	NA	NA
Mercury, Hg	ug/L	0.2 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA	NA
Molybdenum, Mo	ug/L	17	1.1	9.6	1.5	NA	NA	NA	NA	NA	NA	NA
Radium 226 & 228 (combined)	pCi/L	1.89	5.0 U	5.0 U	5.0 U	NA	NA	NA	NA	NA	NA	NA
Selenium, Se	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	NA	NA	NA	NA	NA	NA	NA
Thallium, Tl	ug/L	0.2 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA	NA

Notes:
J: Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value
mg/L: Milligrams per Liter
NA: Sampling not required for this parameter
pCi/L: Picocuries per Liter
s.u.: Standard Units
U: Indicates the analyte was analyzed for but not detected
ug/L: Micrograms per Liter

SUMMARY OF SEPTEMBER 2024 ANALYTICAL RESULTS
Indiana-Kentucky Electric Corporation
Clifty Creek Station
Madison, Indiana

Parameter	Units	DOWNGRADIENT WELLS				INTERIM WELLS				PROPERTY BOUNDARY WELLS		
		WBSP-15-07	WBSP-15-08	WBSP-15-09	WBSP-15-10	WBSP-23-01	WBSP-23-02	WBSP-23-03	WBSP-23-04	WBSP-24-02	WBSP-24-03	WBSP-24-04
Appendix III Constituents												
Boron, B	mg/L	0.02	0.027	0.02 U	0.021	NS	NS	NS	NS	NA	NA	NA
Calcium, Ca	mg/L	180	83	76	95	NS	NS	NS	NS	NA	NA	NA
Chloride, Cl	mg/L	12	17	5.4	22	NS	NS	NS	NS	NA	NA	NA
Fluoride, F	mg/L	0.35	0.19	0.64	0.23	NS	NS	NS	NS	NA	NA	NA
pH	s.u.	6.45	6.22	6.45	6.14	NS	NS	NS	NS	6.59	7.29	6.95
Sulfate, SO_4	mg/L	15	4.0 U	4.0 U	71	NS	NS	NS	NS	NA	NA	NA
Total Dissolved Solids (TDS)	mg/L	750	320	320	400	NS	NS	NS	NS	NA	NA	NA
Appendix IV Constituents												
Antimony, Sb	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	NS	NS	NS	NS	NA	NA	NA
Arsenic, As	ug/L	42	82	19	7.7	NS	NS	NS	NS	92	53	110
Barium, Ba	ug/L	360	350	170	280	NS	NS	NS	NS	NA	NA	NA
Beryllium, Be	ug/L	0.7 U	0.7 U	0.7 U	0.24 J	NS	NS	NS	NS	NA	NA	NA
Cadmium, Cd	ug/L	0.5 U	0.5 U	0.5 U	0.092 J	NS	NS	NS	NS	NA	NA	NA
Chromium, Cr	ug/L	1.5 U	2.1	1.3 J	5.2	NS	NS	NS	NS	NA	NA	NA
Cobalt, Co	ug/L	2.6	1.6	0.35	4.9	NS	NS	NS	NS	NA	NA	NA
Fluoride, F	mg/L	0.35	0.19	0.64	0.23	NS	NS	NS	NS	NA	NA	NA
Lead, Pb	ug/L	1.0 U	0.60 J	1.0 U	2	NS	NS	NS	NS	NA	NA	NA
Lithium, Li	mg/L	0.0029 J	0.0017 J	0.004 U	0.0048	NS	NS	NS	NS	NA	NA	NA
Mercury, Hg	ug/L	0.2 U	0.2 U	0.2 U	0.2 U	NS	NS	NS	NS	NA	NA	NA
Molybdenum, Mo	ug/L	5.4	1.9	8.9	1.8	NS	NS	NS	NS	NA	NA	NA
Radium 226 & 228 (combined)	pCi/L	1.52	5.0 U	0.585	1.67	NS	NS	NS	NS	NA	NA	NA
Selenium, Se	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	NS	NS	NS	NS	NA	NA	NA
Thallium, Tl	ug/L	0.2 U	0.15 J	0.2 U	0.2 U	NS	NS	NS	NS	NA	NA	NA

Notes:
J: Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value
mg/L: Milligrams per Liter
NA: Sampling not required for this parameter
pCi/L: Picocuries per Liter
s.u.: Standard Units
U: Indicates the analyte was analyzed for but not detected
ug/L: Micrograms per Liter