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

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

July 8, 2019

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

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

Dear Mr. Pigott:

Re: Indiana-Kentucky Electric Corporation
Notification of Successful ASD- Clifty Creek Station Landfill

As required by 40 CFR 257.106(h)(6), the Indiana-Kentucky Electric Corporation (IKEC) previously notified the Commissioner (State Director) of the Indiana Department of Environmental Management on February 14, 2019 that a statistically significant levels of Molybdenum, an Appendix IV constituent, have been detected and confirmed to be above Groundwater Protection Standards (GWPS) established for the Clifty Creek Station Landfill and the Landfill Runoff Collection Pond.

The Clifty Creek Station Landfill and Landfill Runoff Collection Pond share a monitoring network, and therefore both entered Assessment Monitoring as prescribed by 40 CFR 257.96(a) on February 14, 2019. Subsequently, on May 15, 2019 it was determined that a successful Alternative Source Demonstration (ASD) argument could be made for the Clifty Creek Station Landfill, and that the unit would remain in Detection Monitoring. A copy of the ASD report, certified by IKEC's Qualified Professional Engineer, has been posted to IKEC's publically accessible internet site at: https://www.ovec.com/CCRCompliance.php.

If you have any questions, or require any additional information, please call me at (740) 897-7768.

Sincerely,

Tim Fulk
Engineer II

TLF:klr

Stantec Consulting Services Inc.
11687 Lebanon Road, Cincinnati OH 45241-2012

July 3, 2019
File: 175534018, 200.201

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

Reference: Alternate Source Demonstration Report
March 2018 Detection Monitoring Event
CCR Landfill and Landfill Runoff Collection Pond
EPA Final Coal Combustion Residuals (CCR) Rule
Clifty Creek Station
Madison, Jefferson County, Indiana

Dear Mr. Coriell,

This letter documents Stantec Consulting Services Inc.'s (Stantec's) certification of the alternate source demonstration report for the March 2018 detection monitoring event for the Indiana-Kentucky Electric Corporation (IKEC) Clifty Creek Station's CCR Landfill and Landfill Runoff Collection Pond (LRCP) multiunit groundwater system in accordance with 40 CFR 257.94(e)(2).

The *Disposal of Coal Combustion Residuals From Electric Utilities* rule (CCR Rule) was signed by the U.S. Environmental Protection Agency (EPA) Administrator on December 19, 2014 and published in the Federal Register on April 17, 2014. IKEC contracted Applied Geology and Environmental Science, Inc. (AGES) to administer the Clifty Creek Station's CCR Rule groundwater monitoring program based on AGES's history with the site and the Indiana groundwater program. IKEC enlisted Stantec to provide engineering support for the demonstrations required under the CCR Rule. Stantec has worked with the Clifty Creek Station since 2005 and is the design engineer and engineer of record for the station's CCR Landfill. Ongoing coordination for the three companies during the CCR Rule groundwater schedule has included biweekly conference calls and in-person meetings.

Stantec personnel (the certifying professional engineer and a senior hydrogeologist) have reviewed the *Coal Combustion Residuals Regulation, Alternate Source Demonstration Report, March 2018 Detection Monitoring Event, Indiana Kentucky Electric Corporation, Clifty Creek Plant, Type I Residual Waste Landfill and Landfill Runoff Collection Pond, Madison, Jefferson County, Indiana* (AGES, June 2019).

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 report was prepared in accordance with the reasonable skill and diligence required by customarily accepted professional practices and procedures normally provided in the performance of the services at the time when and the location in which the services were performed and

Reference: **Alternate Source Demonstration Report**
March 2018 Detection Monitoring Event
CCR Landfill and Landfill Runoff Collection Pond
EPA Final Coal Combustion Residuals (CCR) Rule
Clifty Creek Station
Madison, Jefferson County, Indiana

2. that the alternate source demonstration for boron for the March 2018 detection monitoring event at the IKEC Clifty Creek Station's CCR Landfill meets the requirements specified in 40 CFR 257.94(e)(2).

SIGNATURE Jacqueline S. Harmon DATE 7/3/2019

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

TELEPHONE: (513) 842-8200

ATTACHMENTS: Applied Geology and Environmental Science, Inc. (AGES) (2019). Coal Combustion Residuals Regulation, Alternate Source Demonstration Report, March 2018 Detection Monitoring Event, Indiana Kentucky Electric Corporation, Clifty Creek Plant, Type I Residual Waste Landfill and Landfill Runoff Collection Pond, Madison, Jefferson County, Indiana. June.

c. John Griggs, John McInnes (Stantec)

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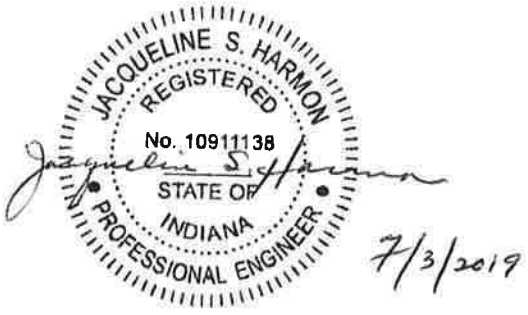

AGES
Applied Geology And Environmental Science, Inc.

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COAL COMBUSTION RESIDUALS REGULATION
ALTERNATE SOURCE DEMONSTRATION REPORT
MARCH 2018 DETECTION MONITORING EVENT

INDIANIA KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK PLANT
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
MADISON, JEFFERSON COUNTY, INDIANA

June 2019

Prepared for:

INDIANA KENTUCKY ELECTRIC CORPORATION (IKEC)

By:

APPLIED GEOLOGY AND ENVIRONMENTAL SCIENCE, INC.

ALTERNATE SOURCE DEMONSTRATION REPORT
MARCH 2018 DETECTION MONITORING EVENT
INDIANA KENTUCKY ELECTRIC CORPORATION
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MADISON, JEFFERSON COUNTY, INDIANA

June 2019

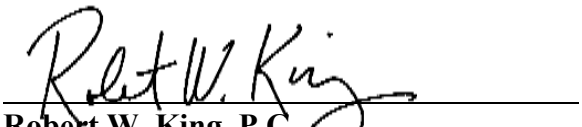
Prepared for:

INDIANA KENTUCKY ELECTRIC CORPORATION (IKEC)

Prepared By:

Applied Geology and Environmental Science, Inc.

Diane E. Miller, P.G.
Senior Geologist



Robert W. King, P.G.
President/Chief Hydrogeologist

ALTERNATE SOURCE DEMONSTRATION REPORT
MARCH 2018 DETECTION MONITORING EVENT
INDIANIA KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK PLANT
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
MADISON, JEFFERSON COUNTY, INDIANA

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ALTERNATE SOURCE DEMONSTRATION REPORT
MARCH 2018 DETECTION MONITORING EVENT
INDIANIA KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK PLANT
TYPE I RESIDUAL WASTE LANDFILL AND
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ALTERNATE SOURCE DEMONSTRATION REPORT
MARCH 2018 DETECTION MONITORING EVENT
INDIANIA KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK PLANT
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
MADISON, JEFFERSON COUNTY, INDIANA

1.0 INTRODUCTION

On December 19, 2014, the United States Environmental Protection Agency (U.S. EPA) issued their final Coal Combustion Residuals (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, 2015) in the Federal Register, referred to as the "CCR Rule."

The Indiana Kentucky Electric Corporation (IKEC) contracted with Applied Geology and Environmental Science, Inc. (AGES) to administer the CCR Rule groundwater monitoring program at the Clifty Creek Station located in Madison, Jefferson County, Indiana. There are three (3) CCR units at the Clifty Creek Station (Figure 1):

- Type I Residual Waste Landfill (Type I Landfill);
- Landfill Runoff Collection Pond (LRCP); and,
- West Boiler Slag Pond (WBSP).

Statistically Significant Increases (SSIs) were not identified at the WBSP during the March 2018 Detection Monitoring event. Therefore, the WBSP is not discussed further in this report.

During the March 2018 Detection Monitoring event, Boron SSIs were confirmed in two (2) wells located downgradient of the Type I Landfill and LRCP and these CCR units entered into Assessment Monitoring on September 11, 2018. As presented in this report, OVEC has determined that the Type I Landfill is not the source of the Boron. Therefore, the Type I Landfill will return to Detection Monitoring. As an alternate source for Boron at the LRCP could not be established, the LRCP will remain in Assessment Monitoring.

Details regarding this evaluation are presented in this report.

1.1 Background

In accordance with §257.91(d) of the CCR Rule, as detailed in the Well Installation Report (AGES 2016b), because the LRCP is directly adjacent to the southwest (downgradient) of the Type I Landfill, and because of the hydrogeologic conditions of the site, IKEC installed a

multiunit groundwater monitoring system to monitor groundwater quality directly downgradient of the Type I Landfill & LRCP. In accordance with §257.94 of the CCR Rule, IKEC completed the groundwater monitoring requirements of the Detection Monitoring Program at the Type I Landfill & LRCP as described below.

The first round of Detection Monitoring groundwater samples was collected from monitoring wells at the Type I Landfill & LRCP at the Clifty Creek Station between March 19 and 22, 2018 in accordance with §257.94(a) of the CCR Rule (Figure 1). All samples were collected in accordance with the Groundwater Monitoring Program Plan (GMPP) (AGES 2016a) and analyzed for all Appendix III constituents.

Upon receipt, the groundwater monitoring data were statistically evaluated in accordance with §257.93(f) of the CCR Rule and the Statistical Analysis Plan (SAP) (Stantec 2018) for the Clifty Creek Station CCR groundwater monitoring program. The initial statistical evaluation identified potential SSIs of one (1) or more Appendix III constituents in monitoring wells CF-15-07 through CF-15-09 at the Landfill and LRCP. The results of the statistical evaluation are summarized in Table 1.

In accordance with the SAP, IKEC resampled the wells for those constituents with potential SSIs on May 21 and May 22, 2018. Based on the results of the resampling event, SSIs for Boron were confirmed in monitoring wells CF-15-08 and CF-15-09 (Table 1).

1.2 Purpose of This Report

The purpose of this report is to present an Alternate Source Demonstration (ASD) and provide sufficient evidence that the SSIs identified for Boron in wells CF-15-08 and CF-15-09 resulted from a source other than the active Type I Landfill & LRCP.

The CCR Rule does not contain specific requirements for an ASD beyond what is stated, as follows, in §257.94(e)(2):

"The owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels to include obtaining a certification from a qualified professional engineer verifying the accuracy of the information in the report. If a successful demonstration is completed within the 90-day period, the owner or operator of the CCR unit may continue with a detection monitoring program under this section. If a successful demonstration is not completed within the 90-day period, the owner or operator of the CCR unit must initiate an assessment monitoring program as required under § 257.95. The owner or operator must also include the demonstration in the

annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer."

In addition to the above requirements of the CCR Rule, this ASD has been conducted and presented using guidance and documentation recommendations included in the U.S. EPA document *Solid Waste Disposal Facility Criteria Technical Manual EPA 530-R-93-017* (U.S. EPA 1993).

A detailed discussion of the confirmed SSIs, and a technical justification that the exceedances result from a source other than the Type I Landfill & LRCP are presented in the following sections of this report.

2.0 DESCRIPTION OF THE TYPE I LANDFILL & LRCP

2.1 Unit Description

The active Type I Landfill occupies an approximately 200-acre area situated within an eroded bedrock channel. 109 acres were approved as a Type I residual waste landfill by the Indiana Department of Environmental Management (IDEM) in 2007. The remaining 91 acres consist of the LRCP located at the southwest end of the Type I Landfill (Figures 1 and 2).

Beginning in 1955, ash products were sluiced to disposal ponds located in the bedrock channel at the plant site. To allow for more disposal capacity, an on-site fly ash pond was developed into a Type III residual landfill in 1988. All required permits for the Type III Residual Waste Landfill (Type III Landfill) were obtained from IDEM. The Type III Landfill was permitted to be constructed, and to serve as closure for the historic fly ash ponds. The Type III Landfill is located at the northeast end of the bedrock channel and went operational in 1991.

After IDEM approval, IKEC upgraded the Type III Landfill to a Type I residual waste landfill (Type I Landfill). As a result, the Type III Landfill was closed and the Type I Landfill was designed and constructed to serve as the cap for the closed Type III Landfill. The Type I Landfill, which went operational in 2011, is completely separated from the closed Type III Landfill by a geosynthetic liner and a compacted clay liner.

The LRCP is an unlined pond located at the southern edge of the station. It is bordered by the Type I Landfill to the north, natural grade to the east and west, and by a dam to the south that runs along the bank of the Ohio River. Approximately 508 acres of both landfill contact water and stormwater runoff drain to the LRCP (Stantec 2016). The base of the LRCP consists of historic hydraulically-placed fly ash. The LRCP does not receive CCR and any CCR within the LRCP is not being actively managed. Therefore, the LRCP is identified as an inactive unit under the CCR Rule.

2.2 Hydrogeology

Based on information in the Hydrogeologic Study Report (AGES 2007), bedrock beneath the Type I Landfill & LRCP and the closed Type III Landfill consists of impermeable limestone and shale of the Ordovician Dillsboro formation, which is overlain by approximately 20 to 35 feet of gray clay. The gray clay is directly overlain by fly ash that had been historically hydraulically placed in the area. A generalized cross section showing the proposed final limits of the Type I Landfill & LRCP, the location and limits of the closed Type III Landfill, and the extent of the historic hydraulically place fly ash is presented in Figure 3. A limestone ridge known as the Devil's Backbone runs northeast to southwest along the length of the Type I Landfill & LRCP and the closed Type III Landfill. The Devil's Backbone acts as an impermeable barrier that forces groundwater passing beneath both of the landfills to flow either toward the northeast or toward the southwest. A detailed hydrogeologic study determined that a groundwater flow divide is present near the northeast end of the bedrock channel and that all groundwater beneath the active Type I Landfill flows toward the southwest (AGES 2007) (Figure 4). As detailed in the Monitoring Well Installation Report (AGES 2016b), an aquifer does not exist beneath either of the landfills. Therefore, alluvial deposits located southwest of the LRCP are designated as the uppermost aquifer for the Type I Landfill & LRCP.

The Type I Landfill was constructed using a geosynthetic liner and a compacted clay liner to prevent water from the Type I Landfill from entering the underlying layers. Water in the Type I Landfill is collected by an underground leachate system and is currently discharged into the West Boiler Slag Pond (WBSP) where it mixes with surface water runoff from the surrounding 510-acre drainage area.

In November and December 2015, six (6) monitoring wells were installed at the Type I Landfill & LRCP (Figure 1). Three (3) monitoring wells (CF-15-07, CF-15-08 and CF-15-09) were installed in the alluvial deposits (uppermost aquifer) located southwest of the LRCP (Figure 1). Based on exploratory soil borings and historical data, there were no suitable upgradient locations for the Type I Landfill & LRCP. CF-15-04 was installed northeast of and outside the hydrologic influence of the Type I Landfill & LRCP and the closed Type III Landfill to serve as the required background monitoring well. CF-15-06 was installed to serve as a second background monitoring well and CF-15-05 was installed as a background/intermediate monitoring well to ensure groundwater from the West Boiler Slag Pond is not impacting groundwater at well CF-15-06. Wells WBSP-15-01 and WBSP-15-02 are located southeast of the impermeable devil's Backbone and are hydraulically separated from groundwater flowing beneath the Type I Landfill & LRCP. Because these wells are outside the hydraulic influence of the Type I Landfill & LRCP, these wells were designated as background wells. Table 2 presents construction details for the monitoring wells in the groundwater monitoring network for the Type I Landfill & LRCP.

Based on groundwater levels measured from each well from January through March 2018, groundwater beneath the Type I Landfill & LRCP flows to the southwest toward the Ohio River. Appendix A presents a groundwater contour map for March 2018.

3.0 ALTERNATE SOURCE DEMONSTRATION

As noted above, Boron was identified as a confirmed SSI in wells CF-15-08 and CF-15-09 downgradient of the Type I Landfill & LRCP. Based on a review of the current and historic data, AGES/IKEC have determined that the active Type I Landfill is not the source of the Boron SSIs reported in the CCR monitoring wells and that historic fly ash that had been sluiced into the valley beginning in 1955 is the alternate source for the Boron SSIs. As discussed in detail below, this conclusion is based on the following lines of evidence:

- Ash that was historically sluiced into the bedrock valley in the 1950s is a known source of Boron and is hydraulically connected to groundwater downgradient of the Type I Landfill and LRCP;

- Boron has been detected in groundwater downgradient from the hydraulically-placed ash (and the Type I Landfill & LRCP) in IDEM program wells CF-9405, CF-9406 and CF-9407 (located near wells CF-15-08 and CF-15-09) since 1994, which is 17 years prior to operation of the Type I Landfill; and

- Given the extremely low groundwater flow velocity at the landfill, the travel time for a release of Boron from the Type I Landfill to reach wells CF-15-08 and CF-15-09 is estimated at 120 years. As the Type I Landfill has only been in operation for seven (7) years, the landfill cannot be the source of the Boron.

Details to support these conclusions are presented below.

3.1 Alternate Source Demonstration Method

The evaluation of the alternate source for Boron in wells CF-15-08 and CF-15-09 was assessed in general accordance with guidelines presented in the *Solid Waste Disposal Facility Criteria Technical Manual* (U.S. EPA 1993) using the following methods:

- Identify a potential alternate source;
- Establish that a hydraulic connection exists between the alternate source and the wells with the confirmed SSIs;
- Establish that constituents of concern are present at the alternate source; and
- Establish that the concentrations observed in the compliance wells could not have resulted from the CCR unit given the hydrogeologic conditions at the site.

3.2 Alternate Source Identification

The initial groundwater investigation conducted for the former Type III Landfill (beginning in 1994) focused on the fly ash that had been hydraulically placed in the bedrock channel beginning in 1955. The Type III Landfill was permitted to serve as the closure for the hydraulically placed fly ash.

After IDEM approval, IKEC upgraded the Type III Landfill to a Type I Landfill and the Type I Landfill was permitted as the closure for the Type III Landfill. The active Type I Landfill was constructed with a geosynthetic liner, and an engineered clay liner on top of the Type III Landfill to serve as a cap. The two (2) liners prevent migration of groundwater from the active Type I Landfill to the closed Type III Landfill. The closed Type III Landfill is not a CCR unit and is not subject to regulation under the CCR Rule.

Both landfills were constructed on top of the historic hydraulically placed fly ash, which extends the length of the bedrock channel (Figure 3) beneath the LRCP to the embankment at the southwestern end of the LRCP (Figure 5). Although the base of the LRCP contains historic hydraulically placed fly ash, the LRCP does not receive CCR and the existing historic CCR is not actively managed. Therefore, the LRCP is considered an inactive CCR unit.

Due to the age and extent of the historic, hydraulically placed ash, this material was identified as the alternate source for the Boron detected in wells CF-15-08 and CF-15-09.

3.3 Establish a Hydraulic Connection

A review of the permit drawings, construction drawings, and a figure from the *Initial Structural Stability Assessment, Landfill Runoff Collection Pond* report (Stantec 2016) (Appendix C), indicated that material from the closed Type III Landfill and the historic hydraulically placed fly ash are located entirely beneath the active Type I Landfill & LRCP (Figure 3). The base of the layer of "hydraulically placed fly ash" is located between elevations 445 ft msl and 500 ft msl.

When the fly ash was originally emplaced in the bedrock channel, there were no impermeable liners constructed to separate the fly ash from the underlying "foundation soils." The CCR and IDEM groundwater monitoring wells are screened in these "foundation soils," which consist of alluvial deposits of silt, sand and gravel. These alluvial deposits extend from beneath the LRCP and the hydraulically placed fly ash southwest to the Ohio River and provide a direct hydraulic connection between the historic hydraulically placed fly ash and the groundwater monitoring wells (Figure 5).

3.4 Constituents Are Present at the Alternate Source

Both the closed Type III Landfill and the Type I Landfill are currently being monitored under an IDEM groundwater monitoring program. In 1994, three (3) monitoring wells (CF-9405, CF-9406 and CF-9407) were installed south of the LRCP as a condition of a pH Variance for the former Type III Landfill granted by IDEM. Since 1994, routine semi-annual and quarterly monitoring of these wells has been conducted. In 2009, three (3) additional wells (CF-07-06D, CF-07-08 and CF-07-09) were installed per IDEM to monitor groundwater quality during the year prior to the start of operations of the Type I Landfill in 2011. Wells in the IDEM groundwater monitoring network are located south of the LRCP and screened in the same "foundation soils" as the wells in the CCR monitoring network (Figure 6).

As shown on Table 3 and Figure 7, Boron was detected in wells CF-9406 (9.0 mg/L to 17.1 mg/L) and CF-9407 (1.19 mg/L to 7.7 mg/L) from 1995 through 2011 (Table 3 and Figure 7). This demonstrates that Boron was present in groundwater downgradient of the eventual location of the Type I Landfill 17 years prior to its operation. Boron concentrations in downgradient CCR wells have ranged from 7.62 mg/L to 10.9 mg/L in well CF-15-08, and from 5.78 mg/L to 7.01 mg/L in CF-15-09 (Table 3 and Figure 7). These concentrations are similar to historic Boron concentrations observed in wells CF-9506 and CF-9407 from 1994 through 2011.

Because Boron concentrations similar to those observed in CCR wells CF-15-08 and CF-15-09 were detected in IDEM wells CF-9406 and CF-9407 prior to construction of the Type I Landfill, the historic hydraulically placed ash is the source of the detected Boron.

3.5 Hydrogeologic Conditions and Groundwater Flow Velocity

As presented in the *Evaluation of Potential Risk to Supply Well Fields* report (AGES 2006), a groundwater flow velocity of 45 feet per year (ft/yr) was calculated for alluvial deposits, which are designated as the uppermost aquifer for these CCR units. Based on the most recent topographical survey conducted of the Type I Landfill (Appendix B), the current limit of waste for the active Type I Landfill is located approximately 5,400 feet (more than one (1) mile) northeast of the three (3) CCR groundwater monitoring wells (CF-15-07, CF-15-08 and CF-15-09) (Figure 8). Based on this data, it was calculated that it will take 120 years for groundwater to flow from the current limit of waste in the Type I Landfill to the CCR monitoring wells. Waste placement in the Type I Landfill began in early 2011. Given the two (2) constructed liners, the distance and the flow rate, water from the Type I Landfill is not able to enter the groundwater, and groundwater has not had enough time to reach the CCR monitoring wells.

Based on the calculations presented above, the active Type I Landfill cannot be the source of Boron detected in the CCR monitoring wells.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The ASD has been completed in general accordance with guidelines presented in the *Solid Waste Disposal Facility Criteria Technical Manual* (U.S. EPA 1993).

Based on a review of the current and historic data, AGES/IKEC have determined that the Type I Landfill is not the source of Boron detected in the CCR monitoring wells. This conclusion is supported by the following evidence:

- "Foundation soils" that extend from beneath the LRCP and the hydraulically placed fly ash southwest to the Ohio River provide a direct hydraulic connection between the historic hydraulically placed fly ash and the CCR groundwater monitoring wells CF-15-08 and CF-15-09.

- Historic data from the IDEM groundwater monitoring program indicate that Boron concentrations similar to those observed in CCR wells CF-15-08 and CF-15-09 were detected in IDEM wells CF-9406 and CF-9407 for 17 years prior to operation of the Type I Landfill, indicating that the Boron is associated with the historic hydraulically placed fly ash.

- Using the previously calculated groundwater flow velocity of 45 ft/yr, it is estimated that it would take 120 years for groundwater flowing beneath the Type I Landfill to reach the CCR monitoring wells.

Based on the demonstration presented above, the Type I Landfill is not the source of the Boron detected in CCR monitoring wells. Therefore, it is recommended that the Type I Landfill return to Detection Monitoring.

Because the LRCP is unlined and the historic hydraulically placed fly ash extends beneath the LCRP to the embankment, it is recommended that the LRCP remain in Assessment Monitoring.

5.0 REFERENCES

Applied Geology and Environmental Science, Inc. (AGES), 2006. Evaluation of Potential Risk to Supply Well Fields, Clifty Creek Coal Ash Landfill, Clifty Creek Station, Madison, Indiana. June 2006.

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Applied Geology and Environmental Science, Inc. (AGES), 2016a. Coal Combustion Residuals Regulation Groundwater Monitoring Program Plan, Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Jefferson County, Indiana. September, 2016.

Applied Geology and Environmental Science, Inc. (AGES), 2016b. Coal Combustion Residuals Regulation Monitoring Well Installation Report. Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Jefferson County, Indiana. October, 2016.

Stantec Consulting Services, Inc. (Stantec), 2016. Coal Combustion Residuals Regulation Initial Structural Stability Assessment, Landfill Runoff Collection Pond, Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Jefferson County, Indiana. October 2016.

Stantec Consulting Services, Inc. (Stantec), 2018. Coal Combustion Residuals Regulation Statistical Analysis Plan, Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Jefferson County, Indiana. January 2018.

United States Environmental Protection Agency (U.S. EPA) 1993. Solid Waste Disposal Criteria Technical Manual, EPA 530-R-93-017. November 1993.

TABLES

TABLE 1
CCR DETECTION MONITORING
SUMMARY OF POTENTIAL AND CONFIRMED STATISTICALLY SIGNIFICANT INCREASES
CLIFTY CREEK STATION
MADISON, INDIANA

Well Id	UPL (mg/L)	1st Detection Monitoring Event		Detection Monitoring Resampling	
		Potential SSI	Result (mg/L)	Confirmed SSI (Yes/No)	Result (mg/L)
Type I Residual Waste Landfill & Landfill Runoff Collection Pond					
CF-15-07	5.957 - 7.904 (s.u.)	pH	10.12	No	7.12
CF-15-08	5.02	Boron	8.5	**Yes**	8.6
	5.957 - 7.904 (s.u.)	pH	10.21	No	7.45
CF-15-09	5.02	Boron	5.86	**Yes**	6.1
	5.957 - 7.904 (s.u.)	pH	10.85	No	7.09

SSI: Statistically Significant Increase
UPL: Upper Prediction Limit
mg/L: Milligrams per liter
s.u.: Standard Units

TABLE 2
GROUNDWATER MONITORING NETWORK
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION 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					
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
CF-15-07	Downgradient	11/23/2015	443135.08	562259.25	438.61	441.11	432.61	422.61	18.50
CF-15-08	Downgradient	11/19/2015	443219.57	562537.29	460.33	462.79	430.33	420.33	42.46
CF-15-09	Downgradient	11/25/2015	443445.96	562871.69	456.73	459.45	447.73	442.73	16.72
WBSP-15-01	Background	11/30/2015	449072.27	566322.12	466.93	469.36	458.93	448.93	20.43
WBSP-15-02	Background	11/11/2015	449803.91	566987.30	473.83	476.76	457.83	452.83	23.93

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

TABLE 3
HISTORIC BORON CONCENTRATIONS
IDEM WELLS CF-9406 & CF-9407 AND
CCR WELLS CF-15-08 AND CF-15-09

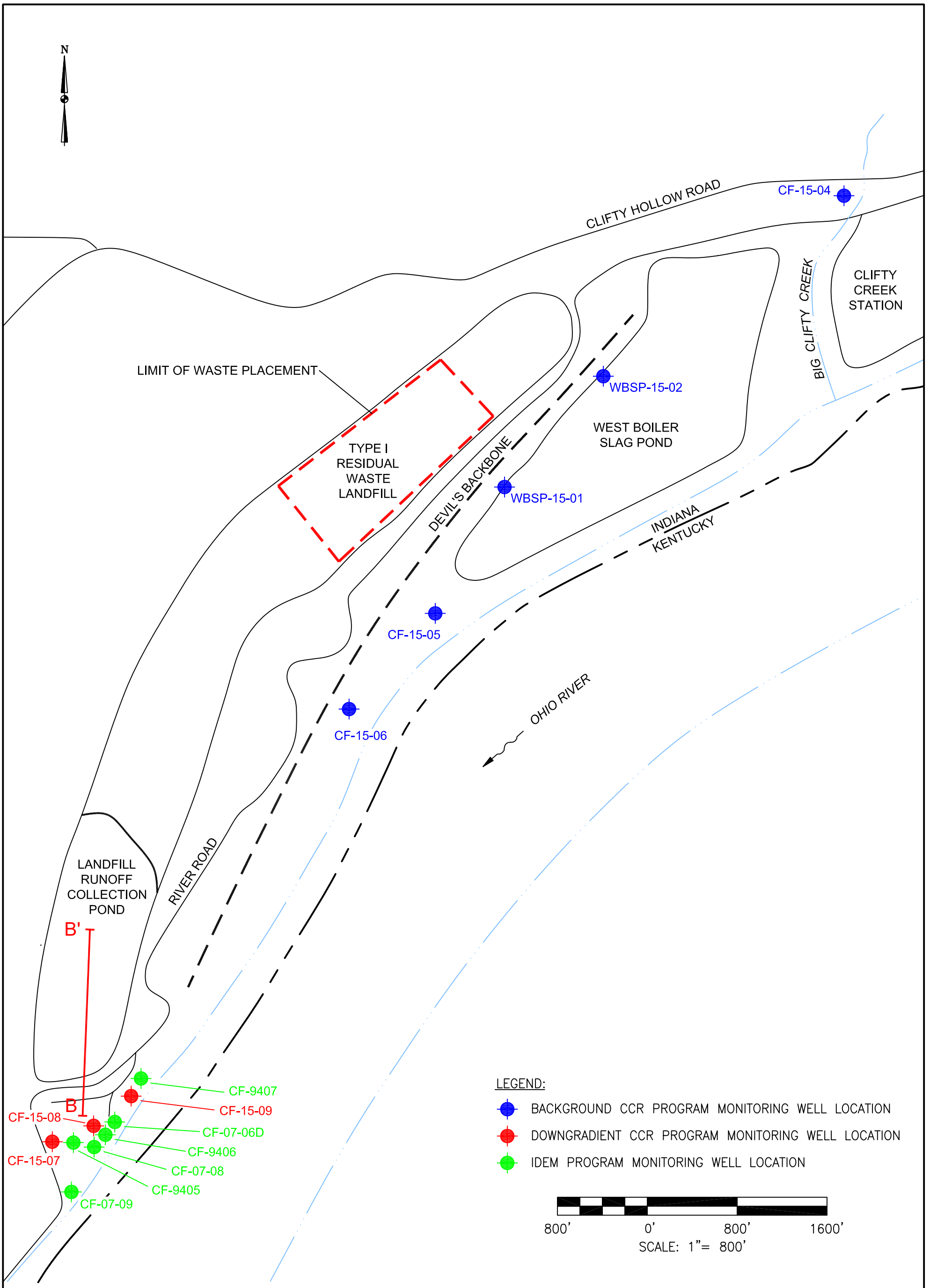
Boron Concentrations in IDEM Wells (1994 through 2015)					
Date	**CF-9406**	**CF-9407**	**Date**	**CF-9406**	**CF-9407**
6/8/1994	10	2.9	**11/19/2002**	16.2	5.92
6/22/1994	9.8	4.7	**5/14/2003**	13.7	3.83
7/6/1994	11	6.3	**11/12/2003**	14.7	5.4
7/20/1994	12	8.4	**5/11/2004**	14.2	3.86
8/3/1994	10	6.3	**11/9/2004**	**17.1**	5.28
8/17/1994	**9**	6.4	**5/9/2005**	15.2	7.16
8/31/1994	12	**7.7**	**11/8/2005**	14.3	DRY
9/14/1994	9.8	6.9	**5/17/2006**	12.8	7.4
9/28/1994	9.7	5.9	**11/15/2006**	15	5.69
10/12/1994	12	7.3	**5/9/2007**	13.7	4.71
10/26/1994	12	6.8	**11/14/2007**	14.6	DRY
11/9/1994	11	6.7	**5/13/2008**	15	3.21
11/30/1994	11	5	**11/12/2008**	15.6	DRY
12/7/1994	10	3.6	**5/19/2009**	14.7	4.75
12/21/1994	11	2.5	**11/16/2009**	14.7	7.23
1/18/1995	11	3	**12/16/2009**	NM	NM
2/22/1995	13	3.6	**01/14/2010**	NM	NM
6/14/1995	13	4.5	**02/23/2010**	NM	NM
12/21/1995	14	4.7	**03/16/2010**	NM	NM
6/26/1996	14	3.3	**04/15/2010**	NM	NM
12/23/1996	12	5.3	**5/19/2010**	14.1	6.77
4/30/1997	9.9	6.9	**06/23/2010**	NM	NM
6/30/1997	12	5.9	**07/15/2010**	NM	NM
10/7/1997	15	DRY	**08/24/2010**	NM	NM
12/16/1997	14	7.5	**09/14/2010**	NM	NM
4/16/1998	14	6.5	**10/19/2010**	NM	NM
6/24/1998	13	6.5	**11/3/2010**	16.9	DRY
9/23/1998	14	DRY	**Type I Landfill Operational**		
1/21/1999	13	5.1	**5/17/2011**	12.3	4.21
3/31/1999	12	4.3	**11/28/2011**	16.2	**1.19**
6/30/1999	13	7.5	**5/7/2012**	14.5	5.09
10/7/1999	DRY	DRY	**11/13/2012**	15.9	DRY
1/6/2000	15	4.4	**3/30/2013**	15	5.25
6/6/2000	15	7.2	**9/23/2013**	14.2	DRY
1/10/2001	16	7.4	**5/21/2014**	12.63	5.646
5/15/2001	15	6.6	**11/11/2014**	14.58	DRY
11/26/2001	18	7.3	**5/9/2015**	15.47	DRY
5/15/2002	13.5	5.1	**11/3/2015**	13.8	DRY

TABLE 3
HISTORIC BORON CONCENTRATIONS
IDEM WELLS CF-9406 & CF-9407 AND
CCR WELLS CF-15-08 AND CF-15-09

Boron Concentrations IDEM & CCR Wells (January 2016 through May 2018)				
Date	**CF-9406**	**CF-9407**	**CF-15-08**	**CF-15-09**
1/11/2016	NM	NM	8.64	6.86
3/7/2016	NM	NM	8.24	**5.78**
5/11/2016	10.6	2.48	NM	NM
5/16/2016	NM	NM	9.34	6.58
7/25/2016	NM	NM	9.65	**7.01**
8/29/2016	NM	NM	9.63	DR
11/9/2016	15.3	DRY	NM	NM
11/28/2016	NM	NM	**10.9**	DRY
2/27/2017	NM	NM	9.29	6.78
5/8/2017	7.46	5.4	NM	NM
6/12/2017	NM	NM	**7.62**	6.3
8/28/2017	NM	NM	9.04	6.81
11/14/2017	11.7	7.58	NM	NM
3/1/2018	NM	NM	8.5	5.86
5/7/2018	13.8	7.25	8.6	6.1

Notes:
All concentrations are mg/L
NM: Well was not monitored on this date
DRY: Well was dry and not able to be sampled
Maximum and minimum Boron results for each well are shown in **Bold.**

FIGURES



DRAWN BY	JM
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CHECKED BY	
JOB NO.	2017114-CLI
DWG FILE	IKEC_Clifty_ASD_MW Locs_b03.dwg
DRAWING SCALE	NOT TO SCALE

AGES
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INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL
MONITORING WELL LOCATIONS

DRAWING NAME	REV.
FIGURE 1	0

Plot: 01/10/2019 13:32 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\ASD GW Sampling\IKEC_Clifty_ASD_MW Locs_b03.dwg\FIG 1

DWG. NO.: 16-30500-01-A

TYPE I RESIDUAL WASTE LANDFILL

LRCP

WEST BOILER SLAG POND

A

A'

Proposed Grading Limit

Ohio River

LEGEND:

A-A' CROSS SECTION TRANSECT

SOURCE: CLIFTY CREEK PERMIT DRAWINGS (FMSM, NOVEMBER 2006)

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DATE	
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JOB NO.	2017116-CLI
DWG FILE	Clifty_ASD_Boring Plan b04.dwg
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INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
OVERVIEW OF TYPE I LANDFILL AND LRCP

DRAWING NAME: FIGURE 2

REV.: 0

Plot: 12/12/2018 10:47 _PROGRAM-IKEC\Clifty Creek-CCR Program\CAD\ASD GW Sampling\Clifty_ASD_Boring Plan b04.dwg

A
SOUTHWEST

A'
NORTHEAST

600

550

500

450

400

ELEVATIONS IN FEET ABVOVE MSL

TYPE I LANDFILL

APPROXIMATE AREA OF
GROUNDWATER DIVIDE

GEOSYNTHETIC
LINERS

STRUCTURAL FILL (SUBGRADE)

TYPE III LANDFILL (ASH)

STRUCTURAL FILL (BOILER SLAG)

EXISTING BOILER SLAG

HYDRAULICALLY PLACED FLY ASH

ORIGINAL GROUND LINE

FOUNDATION SOILS

BEDROCK

70+00 60+00 50+00 40+00 30+00 20+00 10+00 0+00

STATION

APPROXIMATE PHREATIC SURFACE

GROUNDWATER FLOW DIRECTION

DRAWN BY	JM
DATE	
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JOB NO.	2017116-CLI
DWG FILE	Clifty_ASD_Cross Sec b02.dwg
DRAWING SCALE	NOT TO SCALE

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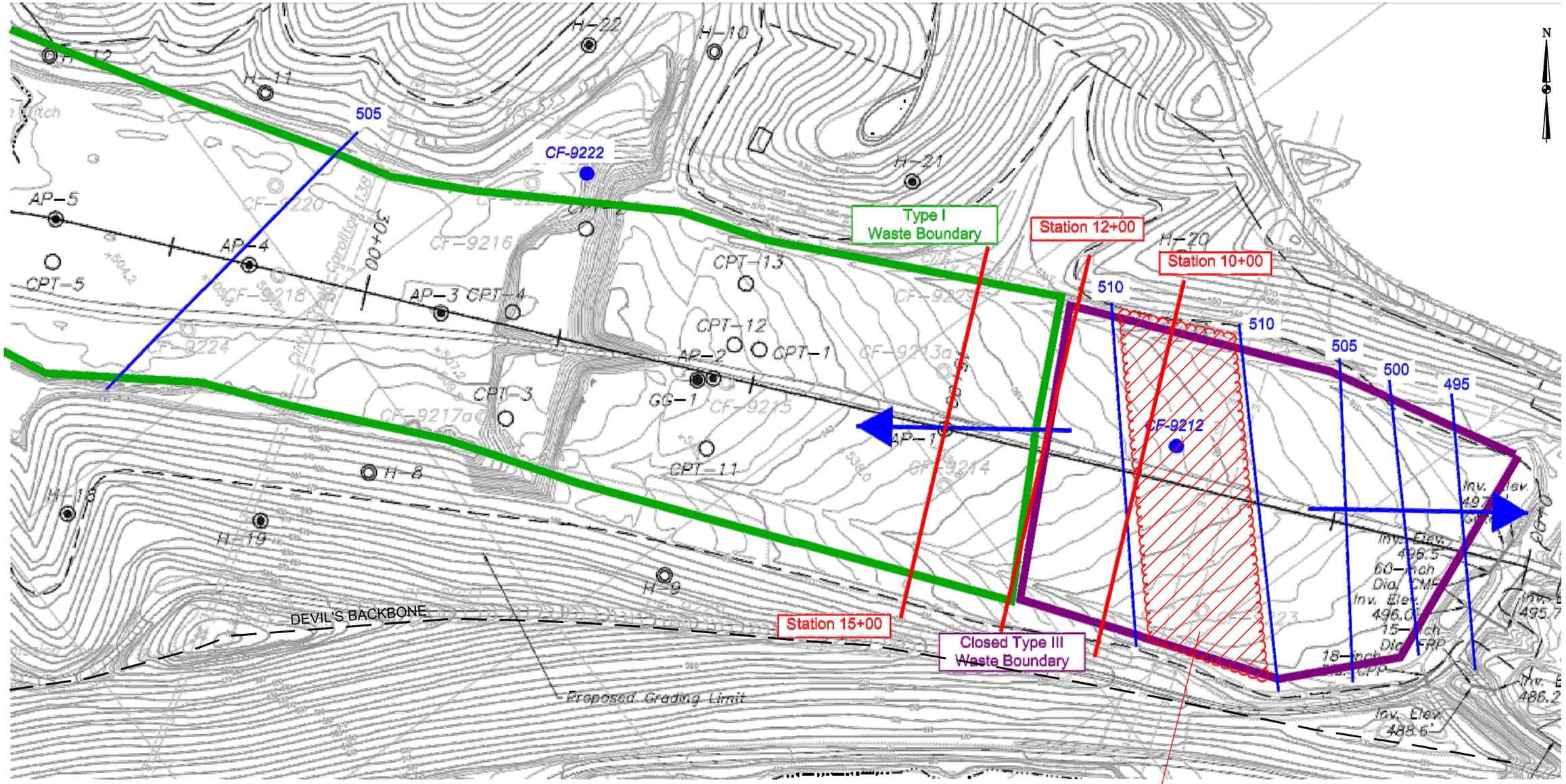
INDIANA-KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL
GENERALIZED GEOLOGIC CROSS-SECTION
A-A' (SOUTHWEST-NORTHEAST)

DRAWING NAME: FIGURE 3

REV.: 0

Plot: 07/15/2019 08:44 _PROGRAM-IKEC\Clifty Creek-CCR Program\CAD\ASD GW Sampling\Clifty_ASD_Cross Sec b02.dwg



505 — January 2006 Groundwater Contour

Groundwater Flow Direction

APPROXIMATE LOCATION OF GROUNDWATER DIVIDE.
BETWEEN STATIONS 7+00 AND 10+00.

DRAWN BY	JM
DATE	
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JOB NO.	2017116-CLI
DWG FILE	Clifty_GW Divide b01.dwg
DRAWING SCALE	NOT TO SCALE

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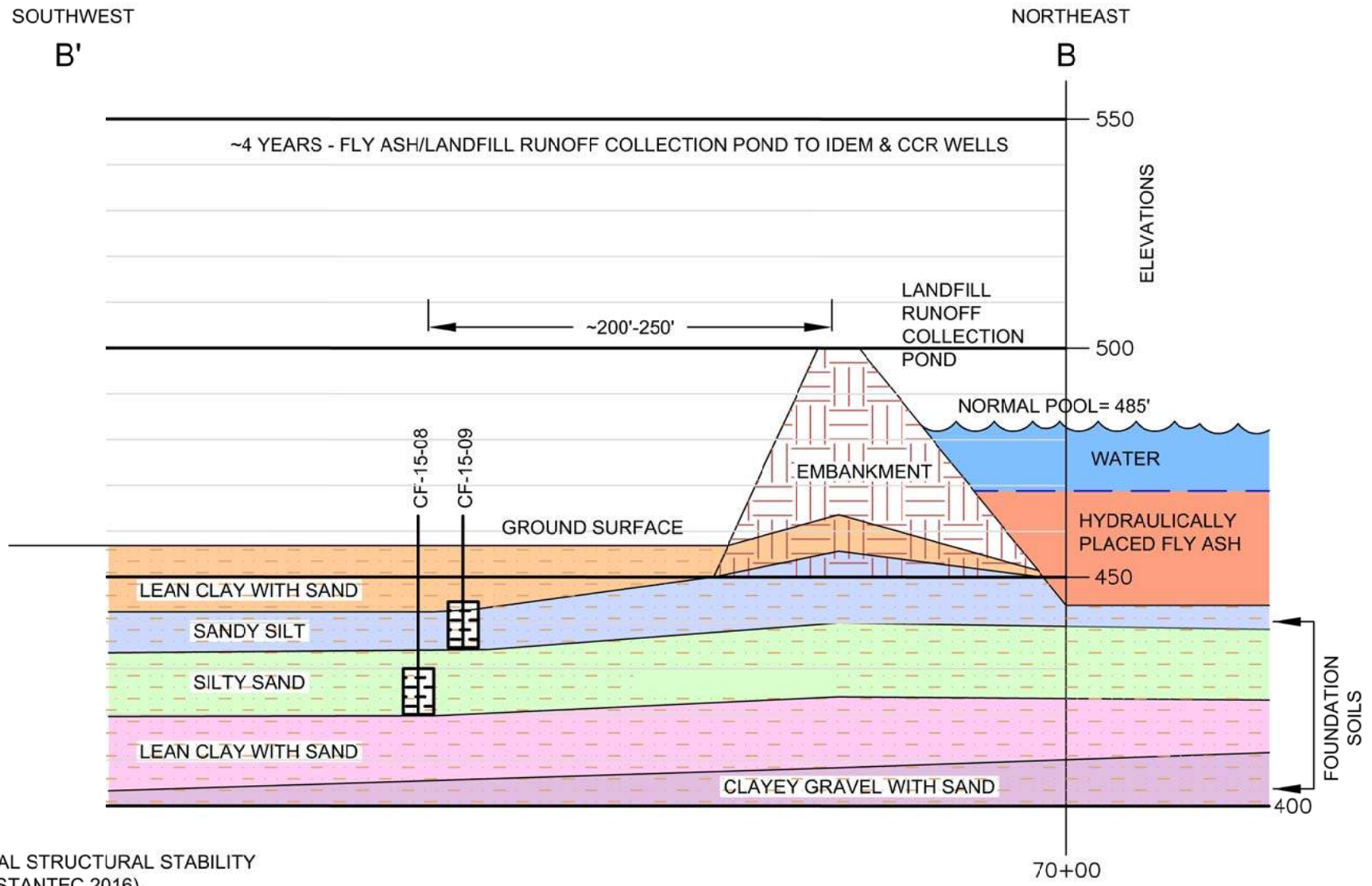
INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
GROUNDWATER FLOW AT
NORTHEAST END OF BEDROCK CHANNEL

DRAWING NAME: FIGURE 4

REV. 0



NOTES:
BASED ON INITIAL STRUCTURAL STABILITY ASSESSMENT (STANTEC 2016).

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DRAWING SCALE	NOT TO SCALE

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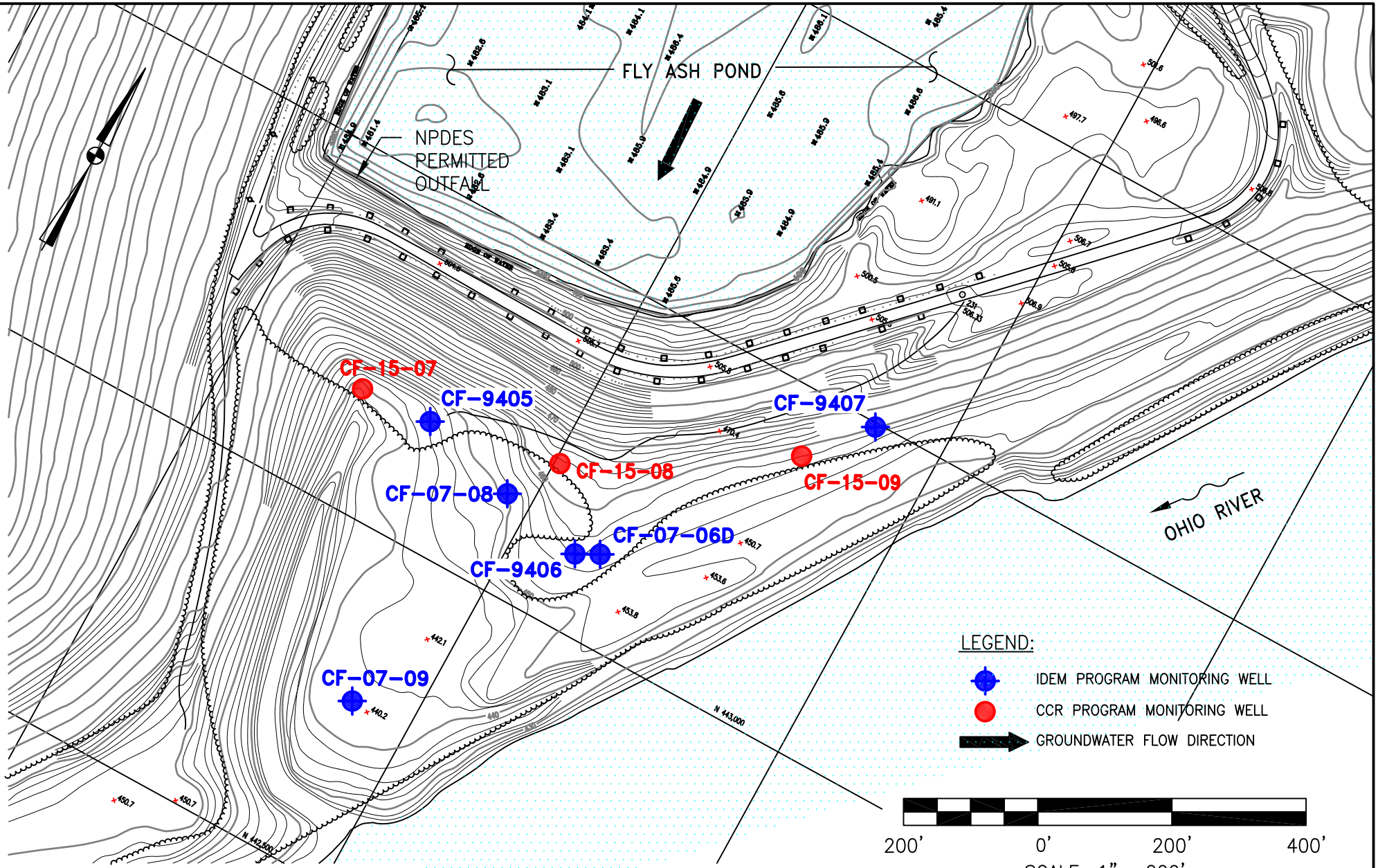
INDIANA-KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA
GENERALIZED CROSS-SECTION
LANDFILL RUNOFF COLLECTION POND TO
CCR MONITORING WELLS

DRAWING NAME	REV.
FIGURE 5	0

Plot: 01/10/2019 13:45 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\ASD GW Sampling\Clifty_ASD_X-Sec Pond-Wells a06.dwg



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DATE	
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JOB NO.	2017116-CLI
DWG FILE	CLIFTY Well Locations a03 R2.dwg
DRAWING SCALE	AS SHOWN

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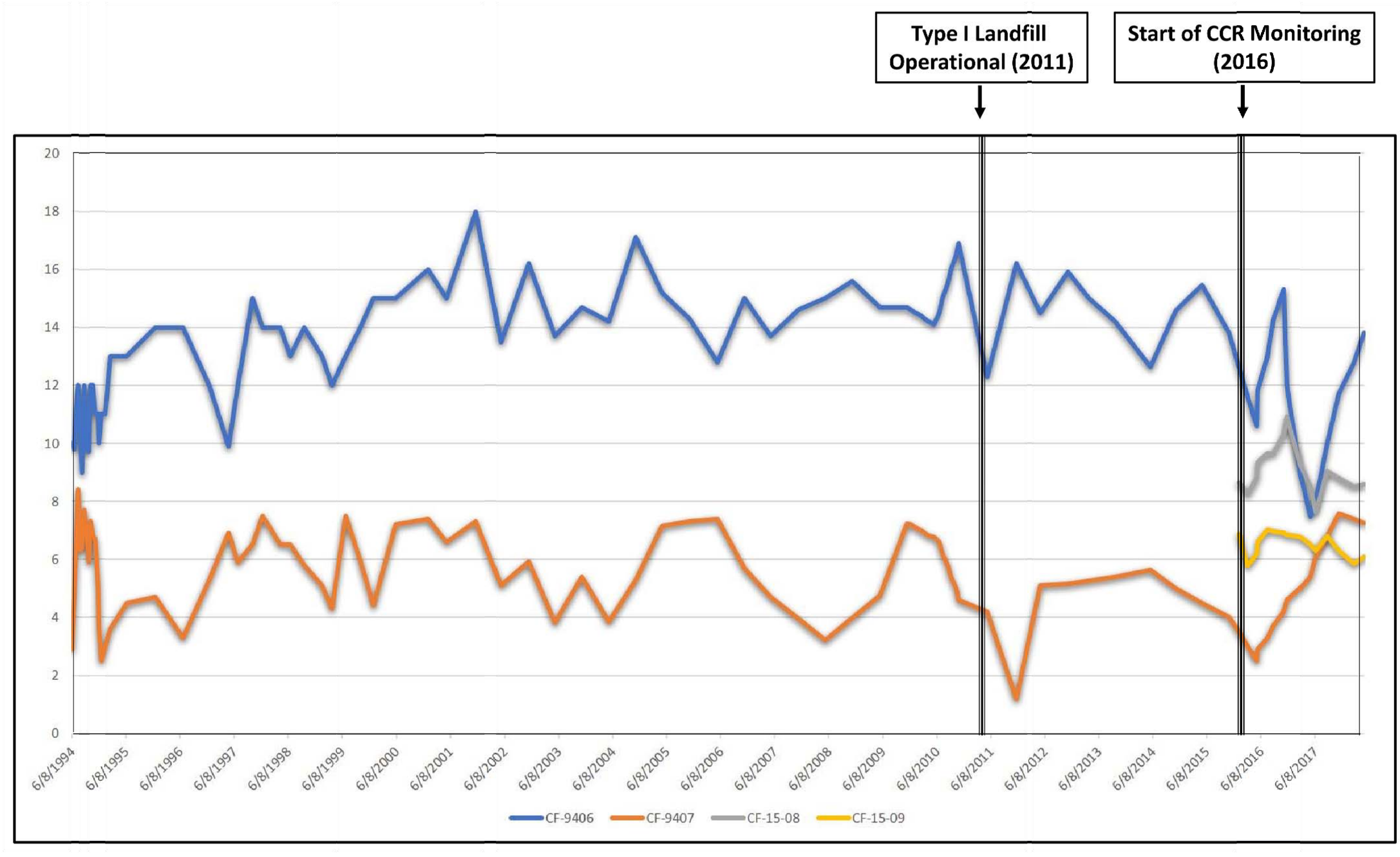
INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK PLANT
MADISON, INDIANA
CCR PROGRAM AND IDEM PROGRAM
MONITORING WELL LOCATION MAP

DRAWING NAME	REV.
FIGURE 6	0

Plot: 12/12/2018 12:18 _PROGRAM-IKEC\Clifty Creek-CCR Program\CAD\ASD GW Sampling\CLIFTY Well Locations a03 R2.dwg



DRAWN BY	JM
DATE	
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JOB NO.	2017116-CLI
DWG FILE	Clifty_ASD_Boron-Time Graph b07.dwg
DRAWING SCALE	NOT TO SCALE

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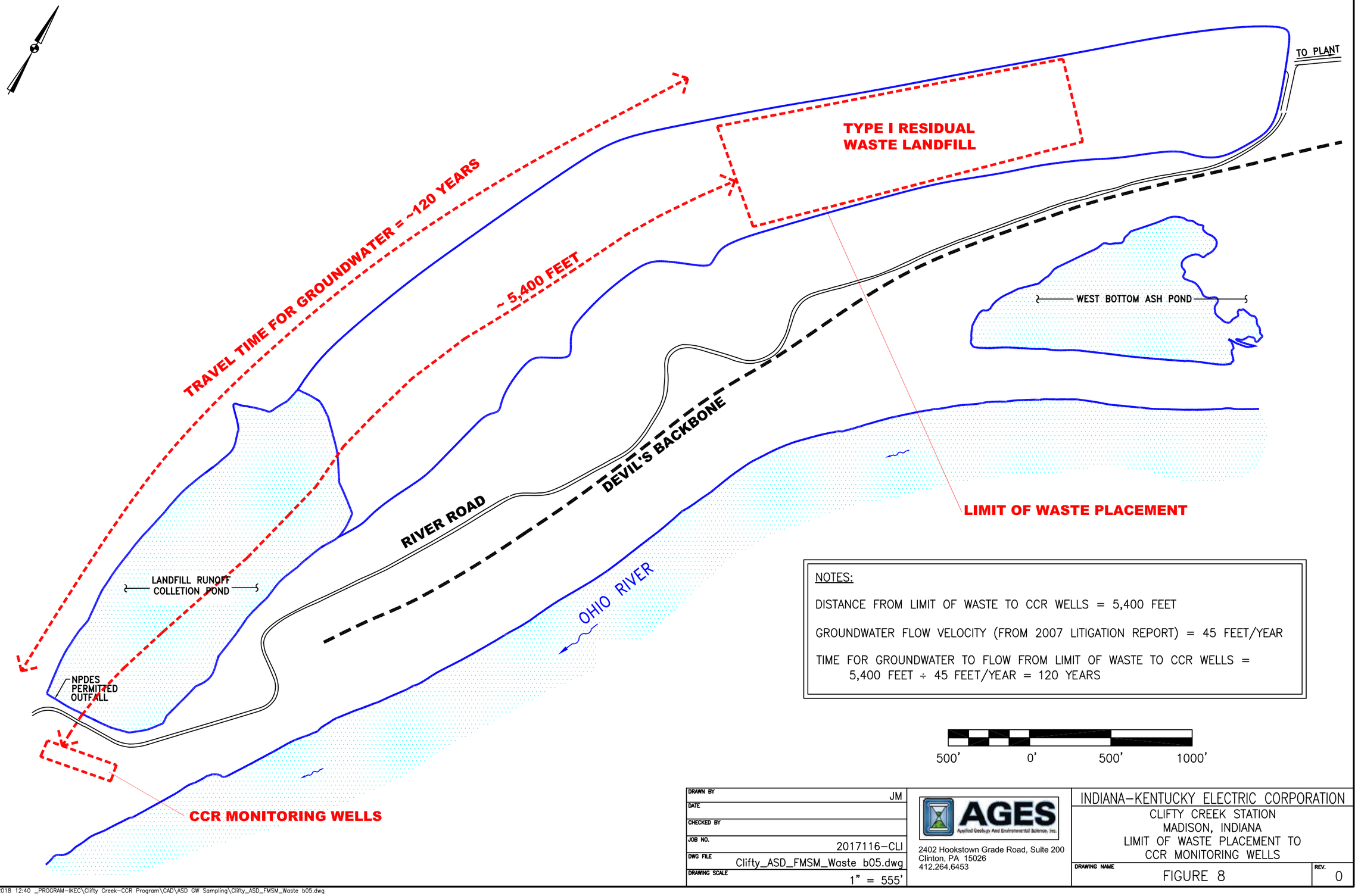
INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK STATION
MADISON, INDIANA
TIME SERIES DATA FOR BORON (mg/L)
CF-9406, CF-9407, CF-15-08 AND CF-15-09

DRAWING NAME: FIGURE 7

REV.: 0

Plot: 12/12/2018 13:25 _PROGRAM-IKEC\Clifty Creek-CCR Program\CAD\ASD GW Sampling\Clifty_ASD_Boron-Time Graph b07.dwg



NOTES:

DISTANCE FROM LIMIT OF WASTE TO CCR WELLS = 5,400 FEET

GROUNDWATER FLOW VELOCITY (FROM 2007 LITIGATION REPORT) = 45 FEET/YEAR

TIME FOR GROUNDWATER TO FLOW FROM LIMIT OF WASTE TO CCR WELLS =
5,400 FEET ÷ 45 FEET/YEAR = 120 YEARS

500' 0' 500' 1000'

DRAWN BY	JM
DATE	
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JOB NO.	2017116-CLI
DWG FILE	Clifty_ASD_FMSM_Waste b05.dwg
DRAWING SCALE	1" = 555'

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INDIANA-KENTUCKY ELECTRIC CORPORATION
CLIFTY CREEK STATION
MADISON, INDIANA
LIMIT OF WASTE PLACEMENT TO
CCR MONITORING WELLS

DRAWING NAME: FIGURE 8 REV. 0

Plot: 12/12/2018 12:40 _PROGRAM-IKEC\Clifty Creek-CCR Program\CAD\ASD GW Sampling\Clifty_ASD_FMSM_Waste b05.dwg

APPENDIX A

Groundwater Flow Map
March 2018

N

TREES

LANDFILL
RUNOFF
COLLECTION
POND

TREES

DEVIL'S BACKBONE

RIVER ROAD

INDIANA

KENTUCKY

CF-15-09
447.06

OHIO RIVER

CF-15-07
436.46

CF-15-08
441.81

TREES

LEGEND:

MONITORING WELL LOCATION

GROUNDWATER FLOW DIRECTION

200' 0' 200' 400'

SCALE: 1"= 200'

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JOB NO.	2018070-2-CLI
DWG FILE	Clifty GW Elev 3-19-18 b07.dwg
DRAWING SCALE	AS SHOWN

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INDIANA-KENTUCKY ELECTRIC CORPORATION

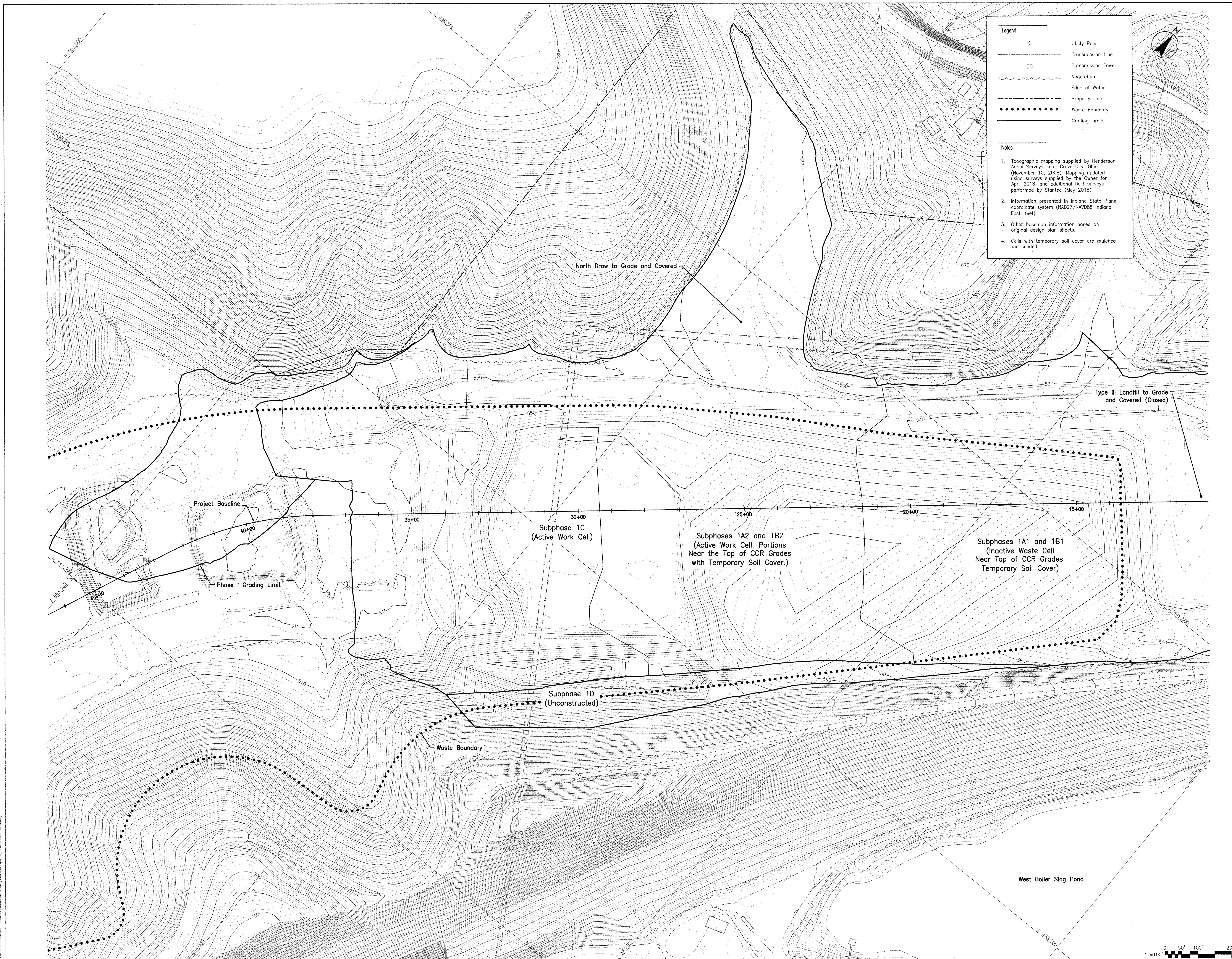
CLIFTY CREEK STATION
MADISON, INDIANA
TYPE I RESIDUAL WASTE LANDFILL AND
LANDFILL RUNOFF COLLECTION POND
GROUNDWATER ELEVATIONS
MARCH 19, 2018

DRAWING NAME	REV.
FIGURE A-1	0

Plot: 09/26/2018 11:59 _PROGRAMS-IKEC\Clifty Creek-CCR Program\CAD\ASD GW Sampling\Clifty GW Elev 3-19-18 b07.dwg\b07

APPENDIX B

PHASE I EXISTING CONDITIONS TOPOGRAPHIC MAP (Stantec 2018)



Legend

- Utility Pole
- Transmission Line
- Transmission Tower
- Vegetation
- Edge of Water
- Property Line
- Waste Boundary
- Grading Limits

Notes

1. Topographic mapping supplied by Henderson Aerial Surveys, Inc., Grove City, Ohio (November 10, 2008). Mapping updated using surveys supplied by the Owner for April 2018, and additional field surveys performed by Stantec (May 2018).
2. Information presented in Indiana State Plane coordinate system (NAD27/NAVD88 Indiana East, feet).
3. Other basemap information based on original design plan sheets.
4. Cells with temporary soil cover are mulched and seeded.

Stantec
11687 Lebanon Road
Cincinnati, Ohio 45241-2012
www.stantec.com

Client/Project
INDIANA-KENTUCKY ELECTRIC CORPORATION

CLIFTY CREEK COAL ASH LANDFILL MODIFICATION
JEEFERSON COUNTY, MADISON TOWNSHIP, INDIANA

Title
PHASE 1 EXISTING CONDITIONS
(JUNE 2018)

Permit-Seal
JACQUELINE S. HARMON REGISTERED No. 10911138 STATE OF INDIANA PROFESSIONAL ENGINEER
7/13/2018

Project Number: 175538039

File Name: 38039-18-01.dwg MJ Dwn. JSH Chkd. JSH Dsgn. 18.07.16 YY.MM.DD

Drawing No. 1
Revision - Sheet 1 of 8

APPENDIX C

FIGURE FROM STABILITY ASSESSMENT REPORT (Stantec 2016)

Indiana-Kentucky Electric Corporation
Clifty Creek Station
Landfill Runoff Collection Pond Dam
Madison, Indiana
Section D-D'

Existing Geometry
Sudden Drawdown
Undrained, Sudden Drawdown Strengths

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.

Sudden Drawdown

Material Type	Unit Weight	Effective - c'	Effective - phi	Total - c	Total - phi
Embankment (SDD)	129 pcf	198 psf	27.5 °	1400 psf	21 °
Lean Clay with Sand (SDD)	127 pcf	206 psf	28 °	1200 psf	17 °
Sandy Silt (SDD)	125 pcf	0 psf	30 °	0 psf	30 °
Silty Sand (SDD)	94 pcf	0 psf	30 °	0 psf	30 °
Clayey Gravel with Sand (SDD)	130 pcf	0 psf	35 °	0 psf	35 °
Fly Ash (SDD)	115 pcf	0 psf	25 °	0 psf	25 °