

**DEQ Coal Combustion Residuals  
Surface Impoundment  
Closure Determination**

**Rogers Energy Complex/Cliffside Steam Station**

**April 1, 2019**



# DEQ Coal Combustion Residuals Surface Impoundment Closure Determination

## Rogers Energy Complex/Cliffside Steam Station

### Executive Summary

The Coal Ash Management Act (CAMA) establishes criteria for the closure of coal combustion residuals (CCR) surface impoundments. The CCR surface impoundments located at Duke Energy Carolinas, LLC's (Duke Energy) Rogers Energy Complex/formerly Cliffside Steam Station (Rogers Energy/Cliffside) in Stokes County, NC have received a low-risk classification. Therefore, according to N.C. Gen. Stat. § 130A-309.214(a)(3), the closure option for CCR surface impoundments is at the election of the North Carolina Department of Environmental Quality (DEQ or Department). CAMA provides three principal closure pathways: (a) closure in a manner allowed for a high-risk site, such as excavation and disposal in a lined landfill [CAMA Option A]; (b) closure with a cap-in-place system similar to the requirements for a municipal solid waste landfill [CAMA Option B]; or (c) closure in accordance with the federal CCR rule adopted by EPA [CAMA Option C].

In preparing to make its election, DEQ requested information from Duke Energy related to closure options. By November 15, 2018, Duke Energy provided the following options for consideration: closure in place, full excavation, and a hybrid option that included some excavation with an engineered cap on a smaller footprint of the existing CCR surface impoundments. DEQ held a public information session on January 22, 2019 in Forest City, NC where the community near Rogers Energy/Cliffside had the opportunity to learn about options for closing CCR surface impoundments and to express their views about proposed criteria to guide DEQ's coal ash closure decision making process. To evaluate the closure options, the Department considered environmental data gathered as part of the site investigation, permit requirements, ambient monitoring, groundwater modeling provided by Duke Energy and other data relevant to the CAMA requirements.

**DEQ elects the provisions of CAMA Option A that require movement of coal ash to an existing or new CCR, industrial or municipal solid waste landfill located on-site or off-site for closure of the CCR surface impoundments at the Rogers Energy/Cliffside facility in accord with N.C. Gen. Stat. § 130A-309-214(a)(3). In addition, DEQ is open to considering beneficiation projects where coal ash is used as an ingredient in an industrial process to make a product as an approvable closure option under CAMA Option A.**

DEQ elects CAMA Option A because removing the coal ash from unlined CCR surface impoundments at Rogers Energy/Cliffside is more protective than leaving the material in place. DEQ determines that CAMA Option A is the most appropriate closure method because removing the primary source of groundwater contamination will reduce uncertainty and allow for flexibility in the deployment of future remedial measures.

Duke Energy will be required to submit a final Closure Plan for the CCR surface impoundments at Rogers Energy/Cliffside by August 1, 2019. The Closure Plan must conform to this election by DEQ.

## I. Introduction

DEQ has evaluated the closure options submitted by Duke Energy for the two CCR surface impoundments at Rogers Energy/Cliffside. This document describes the CAMA requirements for closure of CCR surface impoundments, the DEQ evaluation process to make an election under CAMA for the subject CCR surface impoundments at the Rogers Energy/Cliffside site, and the election by DEQ for the final closure option.

## II. Site History

Duke Energy owns and operates the Rogers Energy/Cliffside station, which consists of approximately 1,000 acres in Mooresboro, Rutherford and Cleveland Counties, North Carolina. Rogers Energy/Cliffside began operation in 1940 and has a current capacity of 1,381 megawatts.

CCR coal ash residuals and other liquid discharges from coal combustion processes at the site have historically been managed in ash basins, which consist of the Active Ash basin, the Units 1-4 Inactive Ash Basin, and the Unit 5 Inactive Ash Basin. The Units 1-4 Inactive Ash Basin is located immediately east of the retired Units 1-4. It was constructed in 1957 and began operations the same year. The Units 1-4 Ash Basin was retired in 1977 once it reached capacity. However, stormwater ponds were constructed on top of the retired basin and continued to operate until the basin was excavated.

The Unit 5 Inactive Ash Basin is located on the western portion of the site, west and southwest of Units 5 and 6. The Unit 5 Inactive Ash Basin is currently used as a laydown yard for the station. This ash basin was constructed in 1970 (in advance of Unit 5 operations) and received sluiced ash from Unit 5 starting in 1972 until it was retired in 1980 when it reached full capacity. It is currently covered with a layer of topsoil and is stable with vegetation. The Active Ash Basin is located on the eastern portion of the site, east and southeast of Units 5 and 6. Construction of the Active Ash Basin occurred in 1975, and it began receiving sluiced ash from Unit 5. The Active Ash Basin expanded in 1980 to its current footprint and continues to receive sluiced bottom ash from Unit 5 in addition to other waste streams.

There are two CCR surface impoundments at the site: the Active Ash Basin and Unit 5 Inactive Ash Basin. The Units 1-4 Inactive Ash Basin was excavated and is no longer considered a CCR surface impoundment. The Active Ash Basin and the Unit 5 Inactive Ash Basin are approximately 132 acres in size and contain approximately 7,390,000 tons of CCR. The Active Ash Basin and Unit 5 Inactive Ash Basin are subject to the requirements of General Statute § 130A-309.214(a)(3).

### III. CAMA Closure Requirements

CAMA establishes closure requirements for CCR surface impoundments. The General Assembly has mandated that DEQ “shall review a proposed Coal Combustion Residuals Surface Impoundment Closure Plan for consistency with the minimum requirements set forth in subsection (a) of this section and whether the proposed Closure Plan is protective of public health, safety, and welfare; the environment; and natural resources and otherwise complies with the requirements of this Part.” N.C. Gen. Stat. § 130A-309.214(b). Similarly, the General Assembly has required that DEQ “shall disapprove a proposed Coal Combustion Residuals Surface Impoundment Closure Plan unless the Department finds that the Closure Plan is protective of public health, safety, and welfare; the environment; and natural resources and other complies with the requirements of this Part.” N.C. Gen. Stat. § 130A-309.214(c).

CAMA requires DEQ to review any proposed Closure Plan for consistency with the requirements of N.C. Gen. Stat. § 130A-309.214(a). See N.C. Gen. Stat. § 130A-309.214(b). DEQ must disapprove any proposed Closure Plan that DEQ finds does not meet these requirements. See N.C. Gen. Stat. § 130A-309.214(c). Therefore, an approvable Closure Plan must, at a minimum, meet the requirements of N.C. Gen. Stat. § 130A-309.214(a).

Pursuant to N.C. Gen. Stat. § 130A-309.213(d)(1), DEQ has classified the CCR surface impoundment at Rogers Energy/Cliffside station as low-risk. The relevant closure requirements for low-risk impoundments are in N.C. Gen. Stat. § 130A-309.214(a)(3), which states the following:

- Low-risk impoundments shall be closed as soon as practicable, but no later than December 31, 2029;
- A proposed closure plan for a low-risk impoundment must be submitted as soon as practicable, but no later than December 31, 2019; and
- At a minimum, impoundments located in whole above the seasonal high groundwater table shall be dewatered and impoundments located in whole or in part beneath the seasonal high groundwater table shall be dewatered to the maximum extent practicable.

In addition, N.C. Gen. Stat. § 130A-309.214(a)(3) requires compliance with specific closure criteria set forth verbatim below in Table 1. The statute provides three principal closure pathways: (a) closure in a manner allowed for a high-risk site, such as excavation and disposal in a lined landfill [CAMA Option A]; (b) closure with a cap-in-place system similar to the requirements for a municipal solid waste landfill [CAMA Option B]; or (c) closure in accordance with the federal CCR rule adopted by EPA [CAMA Option C]. For each low-risk impoundment, the choice of the closure pathway in CAMA is at the “election of the Department.”

Table 1: CAMA Closure Options for Low-Risk CCR Surface Impoundments  
N.C. Gen. Stat. § 130A-309.214(a)(3)

At the election of the Department, the owner of an impoundment shall either:

- a. Close in any manner allowed pursuant to subdivision (1) of this subsection; [CAMA Option A]
- b. Comply with the closure and post-closure requirements established by Section .1627 of Subchapter B of Chapter 13 of Title 15A of the North Carolina Administrative Code, except that such impoundments shall not be required to install and maintain a leachate collection system. Specifically, the owner of an impoundment shall Comply with the closure and post-closure requirements established by Section .1627 of Subchapter B of Chapter 13 of Title 15A of the North Carolina Administrative Code, except that such impoundments shall not be required to install and maintain a leachate collection system. Specifically, the owner of an impoundment shall install and maintain a cap system that is designed to minimize infiltration and erosion in conformance with the requirements of Section .1624 of Subchapter B of Chapter 13 of Title 15A of the North Carolina Administrative Code, and, at a minimum, shall be designed and constructed to (i) have a permeability no greater than  $1 \times 10^{-5}$  centimeters per second; (ii) minimize infiltration by the use of a low-permeability barrier that contains a minimum 18 inches of earthen material; and (iii) minimize erosion of the cap system and protect the low-permeability barrier from root penetration by use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth. In addition, the owner of an impoundment shall (i) install and maintain a groundwater monitoring system; (ii) establish financial assurance that will ensure that sufficient funds are available for closure pursuant to this subdivision, post-closure maintenance and monitoring, any corrective action that the Department may require, and satisfy any potential liability for sudden and nonsudden accidental occurrences arising from the impoundment and subsequent costs incurred by the Department in response to an incident, even if the owner becomes insolvent or ceases to reside, be incorporated, do business, or maintain assets in the State; and (iii) conduct post-closure care for a period of 30 years, which period may be increased by the Department upon a determination that a longer period is necessary to protect public health, safety, welfare; the environment; and natural resources, or decreased upon a determination that a shorter period is sufficient to protect public health, safety, welfare; the environment; and natural resources. The Department may require implementation of any other measure it deems necessary to protect public health, safety, and welfare; the environment; and natural resources, including imposition of institutional controls that are sufficient to protect public health, safety, and welfare; the environment; and natural resources. The Department may not approve closure for an impoundment pursuant to sub-subdivision b. of subdivision (3) of this subsection unless the Department finds that the proposed closure plan includes design measures to prevent, upon the plan's full implementation, post-closure exceedances of groundwater quality standards beyond the compliance boundary that are attributable to constituents associated with the presence of the impoundment; [CAMA Option B]  
or
- c. Comply with the closure requirements established by the United States Environmental Protection Agency as provided in 40 CFR Parts 257 and 261, "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities." [CAMA Option C]

By referencing the closure options for *high-risk* CCR surface impoundments in “subdivision (1)” or N.C. Gen. Stat. § 130A-309.214(a)(1), CAMA allows for closure of a *low-risk* CCR impoundment in N.C. Gen. Stat. § 130A-309.214(a)(3) through the same removal scenarios:

- “Convert the coal combustion residuals impoundment to an industrial landfill by removing all coal combustion residuals and contaminated soil from the impoundment temporarily, safely storing the residuals on-site, and complying with the requirements for such landfills.” N.C. Gen. Stat. § 130A-309.214(a)(1)a.; or
- “Remove all coal combustion residuals from the impoundment, return the former impoundment to a nonerosive and stable condition and (i) transfer the coal combustion residuals for disposal in a coal combustion residuals landfill, industrial landfill, or municipal solid waste landfill or (ii) use the coal combustion products in a structural fill or other beneficial use as allowed by law.” N.C. Gen. Stat. § 130A-309.214(a)(1)b.

#### IV. DEQ Election Process

Beginning with a letter to Duke Energy on October 8, 2018, DEQ began planning for a thorough evaluation of the closure options for low-risk CCR surface impoundments before making an election as outlined in Table 1 above. DEQ’s objectives were to receive input on closure options from Duke Energy and to engage with community members near low-risk sites. DEQ outlined the following schedule in the October 8, 2018 letter:

- November 15, 2018 – Duke Energy submittal of revised closure option analyses and related information
- January 22, 2019 – DEQ public meeting near Rogers Energy/Cliffside
- April 1, 2019 – DEQ evaluation of closure options
- August 1, 2019 – Duke Energy submittal of closure plan
- December 1, 2019 – Duke Energy submittal of updated corrective action plan for all sources at the Rogers Energy/Cliffside site that are either CCR surface impoundments or hydrologically connected to CCR surface impoundments

DEQ received the requested information from Duke Energy by November 15, 2018: closure options analysis, groundwater modeling and net environmental benefits assessment. These materials are posted on the DEQ website. Duke Energy provided the following options for consideration: closure in place, full excavation with an onsite landfill, and a hybrid option that included some excavation with an engineered cap on a smaller footprint of the existing impoundment for the Active Ash Basin. Duke Energy proposed closure in place and full excavation with an onsite landfill for the Unit 5 Inactive Ash Basin.

In preparing to make its election of the closure option, DEQ considered environmental data contained in the comprehensive site assessment, permit requirements, ambient monitoring, closure options analysis and groundwater modeling provided by Duke Energy and other data relevant to the CAMA requirements. The Rogers Energy/Cliffside site has extensive amounts of data that have been collected during the site assessment process, and these data were used as

part of the evaluation of closure options. DEQ's evaluation of the closure in place and hybrid option based on groundwater monitoring and modeling data is provided in Attachment A. That analysis demonstrates that the contaminated plume is already beyond the compliance boundary for the site. All of these references are part of the record supporting DEQ's determination.

DEQ conducted a public meeting in Forest City, NC near Rogers Energy/Cliffside on January 22, 2019. There were 28 people who attended the meeting. Approximately 1207 comments were received during the comment period, which closed on February 15, 2019. The majority of the comments supported closure by removal to a lined landfill. A review and response to comments are included in Attachment B.

#### V. DEQ Evaluation of Closure Options

DEQ has evaluated the closure options proposed by Duke Energy for the CCR surface impoundments at the Rogers Energy/Cliffside facility. The purpose of this evaluation was to determine which closure option or options may be incorporated into an approvable Closure Plan under CAMA.

DEQ elects the provisions of CAMA Option A that require movement of coal ash to an existing or new CCR, industrial or municipal solid waste landfill located on-site or off-site for closure of the Active Ash Basin and Unit 5 Inactive Ash Basin at Rogers Energy/Cliffside in accord with N.C. Gen. Stat. § 130A-309.214(a)(3). In addition, DEQ is open to considering beneficiation projects where coal ash is used as an ingredient in an industrial process to make a product as an approvable closure option under CAMA Option A.

DEQ elects CAMA Option A because removing the coal ash from the two unlined impoundments at Rogers Energy/Cliffside is more protective than leaving the material in place. DEQ determines that CAMA Option A is the most appropriate closure method because removing the primary source of groundwater contamination will reduce uncertainty and allow for flexibility in the deployment of future remedial measures.

DEQ does not elect CAMA Option B for the CCR surface impoundments at Rogers Energy/Cliffside. In N.C. Gen. Stat. § 130A-309.214(a)(3)b, the General Assembly mandated that "[t]he Department may not approve closure for an impoundment pursuant to [this] subdivision . . . unless the Department finds that the proposed closure plan includes design measures to prevent, upon the plan's full implementation, post-closure exceedances of groundwater quality standards beyond the compliance boundary that are attributable to constituents associated with the presence of the impoundment." N.C. Gen. Stat. § 130A-309.214(a)(3)b. In light of these requirements and based on DEQ's review of the information provided by Duke Energy as well as DEQ's independent analysis, DEQ does not believe that Duke Energy can incorporate CAMA Option B into an approvable Closure Plan for Rogers Energy/Cliffside.

As DEQ considered the closure options presented by Duke Energy, DEQ evaluated whether the closure in place or the hybrid options met the requirement for CAMA Option B.

Specifically, DEQ attempted to determine whether upon full implementation of the closure plan the design would prevent any post-closure exceedances of groundwater standards beyond the compliance boundary. To address this question, DEQ considered the current state of the groundwater contamination and reviewed the results of the groundwater modeling submitted by Duke Energy. The evaluation is provided in Attachment A. DEQ's overall conclusion is that based on the current geographic scope and vertical extent of the groundwater contamination plume, and the modeled extent of the plume in the future, DEQ does not believe these two closure options can meet the requirements of CAMA Option B for the CCR surface impoundments at Rogers Energy/Cliffside.

DEQ does not elect CAMA Option C (i.e., closure under the federal CCR Rules found in 40 CFR Part 257) for the CCR surface impoundments at Rogers Energy/Cliffside. DEQ has determined that:

- a. Under the facts and circumstances here, CAMA Option C is less stringent than CAMA Option A. Specifically, DEQ's election of Option A would also require Duke Energy to meet the requirements of the federal CCR Rule (i.e., CAMA Option C) but election of CAMA Option C would not require implementation of CAMA Option A.
- b. Because CAMA Option A adds additional requirements or performance criteria beyond Option C, it advances DEQ's duty to protect the environment (see N.C. Gen. Stat. §§ 279B-2 & 143-211) and the General Assembly's mandate under CAMA that DEQ ensure that any Closure Plan, which must incorporate an approvable closure option, is protective of public health, safety, and welfare, the environment, and natural resources (see N.C. Gen. Stat. § 130A-309.214(b) & (c)).
- c. For the CCR surface impoundments for which the closure option(s) must be determined, CAMA Option A provides a better CAMA mechanism for ensuring State regulatory oversight of the closure process than Option C, as well as greater transparency and accountability.
- d. While the federal CCR Rule was written to provide national minimum criteria for CCR surface impoundments across the country, CAMA was written specifically to address the CCR surface impoundments in North Carolina.
- e. While the federal CCR Rule allows CCR surface impoundment owners to select closure either by removal and decontamination (clean closure) or with a final cover system (cap in place), EPA anticipates that most owners will select closure through the less protective method of cap in place.
- f. There is considerable uncertainty regarding the status and proper interpretation of relevant provisions of the federal CCR Rule. For instance, EPA is reconsidering portions of the federal CCR Rule. Also, the performance standards in 40 CFR § 257.102(d) for cap in place closure are the subject of conflicting interpretations (and possible litigation) among industry and state authorities.

## VI. Conclusion

The final closure plan is due on August 1, 2019 in accordance with this determination. Based on DEQ's evaluation of the options submitted by Duke Energy, DEQ elects the provisions of CAMA Option A that require movement of coal ash to an existing or new CCR, industrial or municipal solid waste landfill located on-site or off-site for closure of the Active Ash Basin and Unit 5 Inactive Ash Basin at Rogers Energy/Cliffside in accord with N.C. Gen. Stat. § 130A-309.214(a)(3). In addition, DEQ is open to considering beneficiation projects where coal ash is used as an ingredient in an industrial process to make a product as an approvable closure option under CAMA Option A.

While beneficiation is not a requirement of the closure plan, DEQ encourages Duke Energy to consider opportunities for beneficiation of coal ash that would convert coal combustion residuals into a useful and safe product.

**ATTACHMENT A**

**DEQ EVALUATION OF CLOSURE IN PLACE AND HYBRID OPTIONS BASED ON  
GROUNDWATER MONITORING AND MODELING DATA**

## DEQ EVALUATION OF CLOSURE IN PLACE AND HYBRID OPTIONS BASED ON GROUNDWATER MONITORING AND MODELING DATA

### I. Groundwater Monitoring Summary

As DEQ considered the closure options presented by Duke Energy, DEQ evaluated whether the closure in place or the hybrid options met the requirement for CAMA Option B. Specifically, DEQ attempted to determine whether the design would prevent any post-closure exceedances of groundwater standards beyond the compliance boundary upon full implementation of the closure plan. To help address this question, DEQ considered the current state of the groundwater contamination.

Figure ES-1 shows the inferred general extent of constituent migration in groundwater based on evaluation of concentrations greater than both the calculated PBTVs, 2L Standards, and/or IMACs. The figure also shows that groundwater within the area of the CCR surface impoundments generally flows from south to north and discharges to the Broad River and to Suck Creek, a perennial stream flowing south to north and discharging to the Broad River. The horizontal extent of contaminant concentrations greater than the PBTV or 2L Standard approximates the leading edge of the CCR-derived plume (yellow shaded area) from the source areas.

The plume near the Active Ash Basin has extended beyond the compliance boundary near the northeast corner of the CCR surface impoundment where a small portion of an adjacent property extends along the Broad River. The plume has also extended beyond the compliance boundary in the area of the ash storage area.

The vertical extent of most constituents of interest is within the shallow and transition flow zones. However, the results of the assessment show that the bedrock aquifer has been impacted by CCR. Arsenic, sulfate, thallium, TDS, and total radium appear to have exceedances in the bedrock north of Unit 5 Inactive Ash Basin and/or near the plant.

DEQ concludes that the contaminated groundwater plume in the area near the Active Ash Basin has extended beyond the compliance boundary near the northeast corner of the impoundment where a small portion of an adjacent property extends along the Broad River. The plume has also extended beyond the compliance boundary in the area of the ash storage area. The horizontal extent of nearly all COIs such as arsenic, chromium, cobalt, iron, manganese, strontium, sulfate, thallium, TDS, vanadium, total uranium, and total radium occur in the shallow flow zone and are generally within the boron plume footprint. Total chromium and cobalt appear to have some exceedances in isolated pockets outside the boron plume near the plant. Strontium and sulfate plumes appear to be slightly more widespread, extending outside the boron plume near the Unit 5 Inactive Ash Basin and the plant.

The Unit 5 Inactive Ash Basin does not have a NPDES or any other agency permit and therefore does not have compliance boundaries. Any exceedance of the 2L Standards in this area, including within the waste boundary is subject to cleanup requirements.

Figure ES-1: Cliffside from 2017 CSA Update

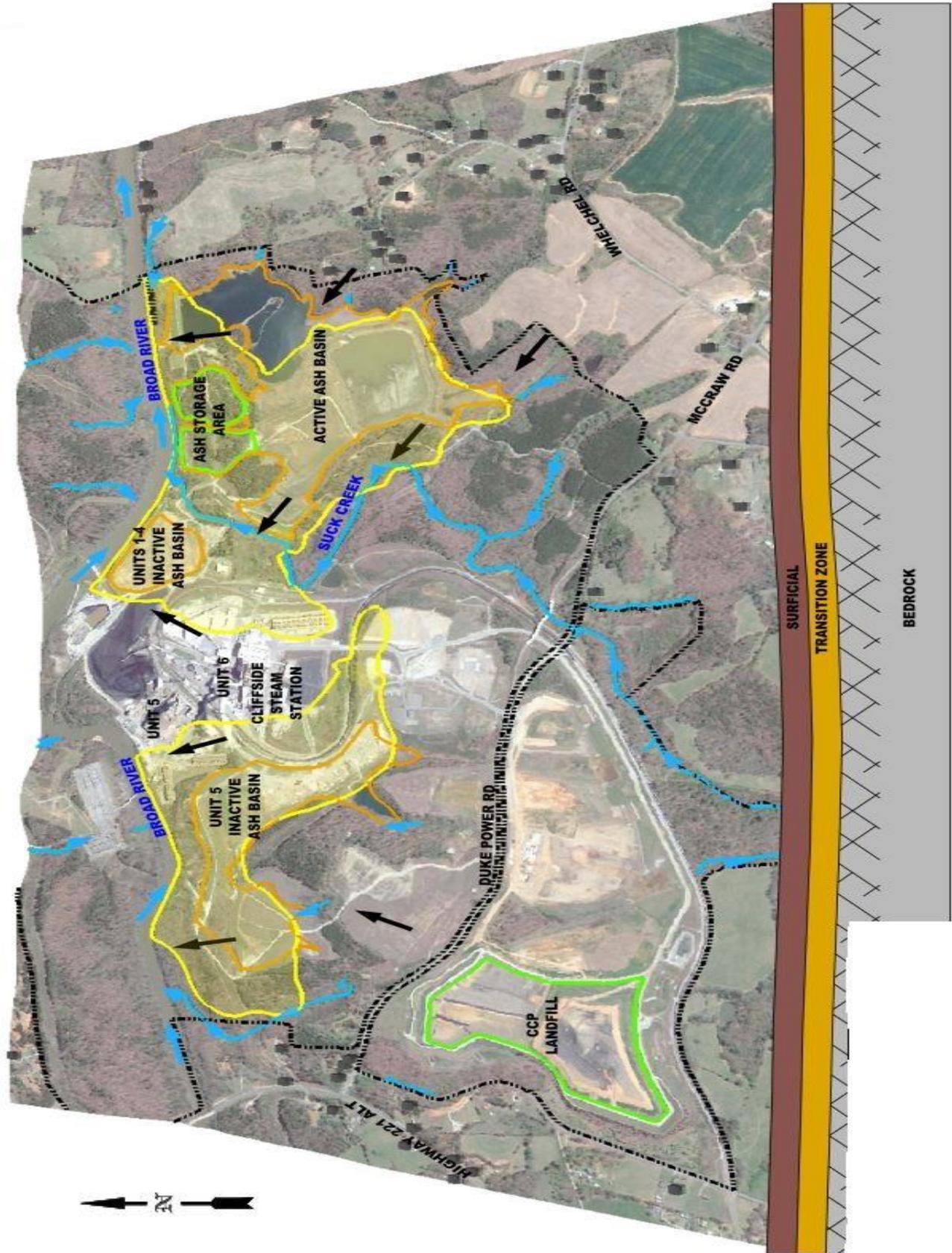
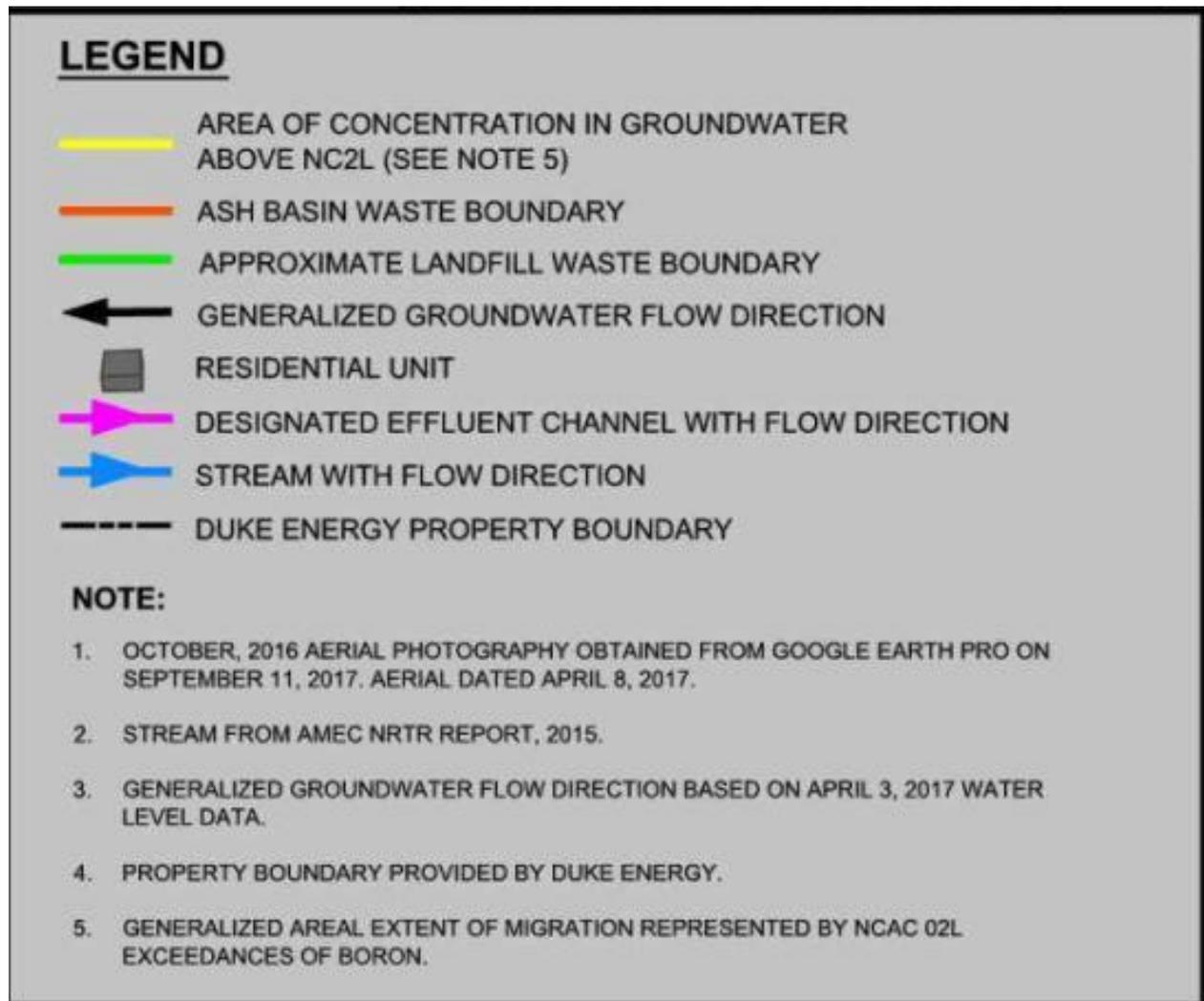


Figure ES-1 Legend: Cliffside from 2017 CSA Update



## II. Groundwater Cross-section Modeling

DEQ evaluated cross-sections of the groundwater modeling results provided by Duke Energy to determine whether Duke Energy's final closure *Option 1: Closure-in-Place* and *Option 3: Hybrid* for the Active Ash Basin would meet the criteria of CAMA Option B. DEQ considered whether the agency could conclude that the proposed closure option includes design measures to prevent any post closure exceedances of the 2L groundwater quality standards (15A NCAC 02L) at the compliance boundary upon the plan's full implementation. Cross section A-A' was evaluated and can be seen in the figures below. This cross section represents where the boron concentration above the 2L standard of 700 µg/L has crossed the compliance boundary based on groundwater monitoring and modeling.

Next, the model results were evaluated based on the following model simulations:

- current conditions in 2017 when the model was calibrated based on raw field data
- upon completion of the final closure-in-place cover system at t=0 years
- closure-in-place option at t=100 years
- upon completion of the hybrid option at t=0 years
- hybrid option at t=125 years

The table below summarizes the results from the model simulations. The boron concentrations depicted in the table represent the maximum boron concentration in any layer (ash, saprolite, transition zone, and bedrock) of the model.

Cliffside Modeling Results for Cross-Section A-A'			
Model Simulation	Maximum Concentration of Boron Above 2L Beyond Compliance Boundary (µg/L)	Depth of GW Contamination Above 2L Beyond Compliance Boundary (feet bgs)	Width of Contamination Plume Beyond Compliance Boundary (feet)
Current Conditions	700-4,000	80	600
Completion of Final Cover (t=0 yrs)	700-4,000	80	580
Final Cover (t=100 yrs)	700-4,000	120	175
Completion of Hybrid (t=0 yrs)	700-4,000	80	580
Hybrid (t=125 yrs)	700-4,000	120	100

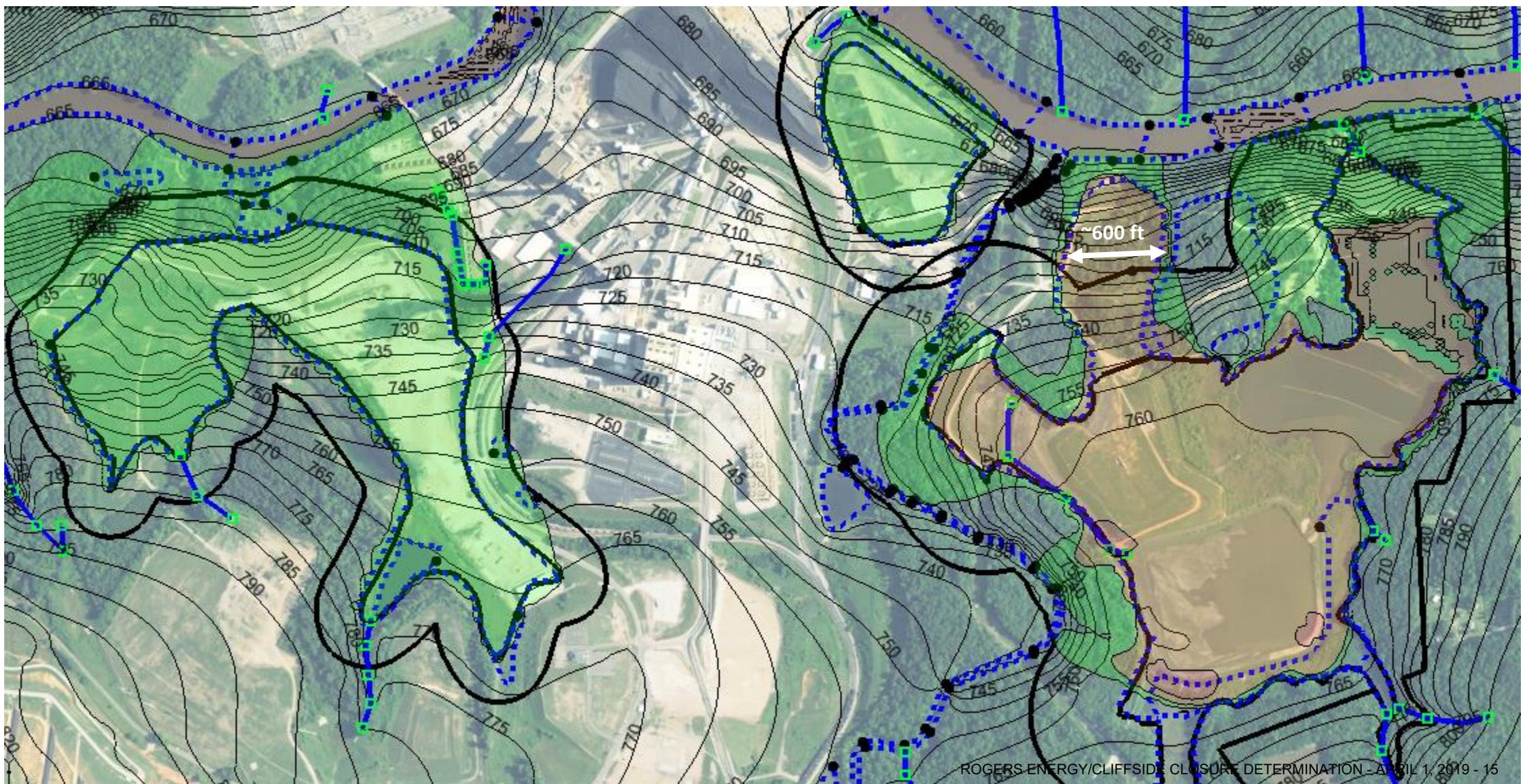
bgs – below ground surface

These data illustrate that after completion of closure with the final cover or hybrid option, the groundwater plume still extends beyond the compliance boundary above the 2L groundwater standard and the area of the plume requiring remediation is immense. Even 100 or 125 years beyond completion of closure, the area of the plume requiring remediation remains extensive under these two closure options.

DEQ recognizes that there are no groundwater remediation corrective actions included in the groundwater modeling simulations submitted to DEQ as part of Duke Energy's closure options analysis documentation. However, based on the current geographic scope, vertical extent of the groundwater contamination plume, and future modeled extent of the plume, DEQ does not believe these two closure options can meet the requirements of CAMA Option B for the Active Ash Basin. DEQ also does not believe Duke Energy's *Option 1: Closure-in-Place* for the Unit 5 Inactive Ash Basin can meet the requirements of CAMA Option B, given the extent of the groundwater plume beyond the waste boundary, extending to the Broad River as depicted in ES-1 in Attachment B, and the lack of a compliance boundary for the impoundment.

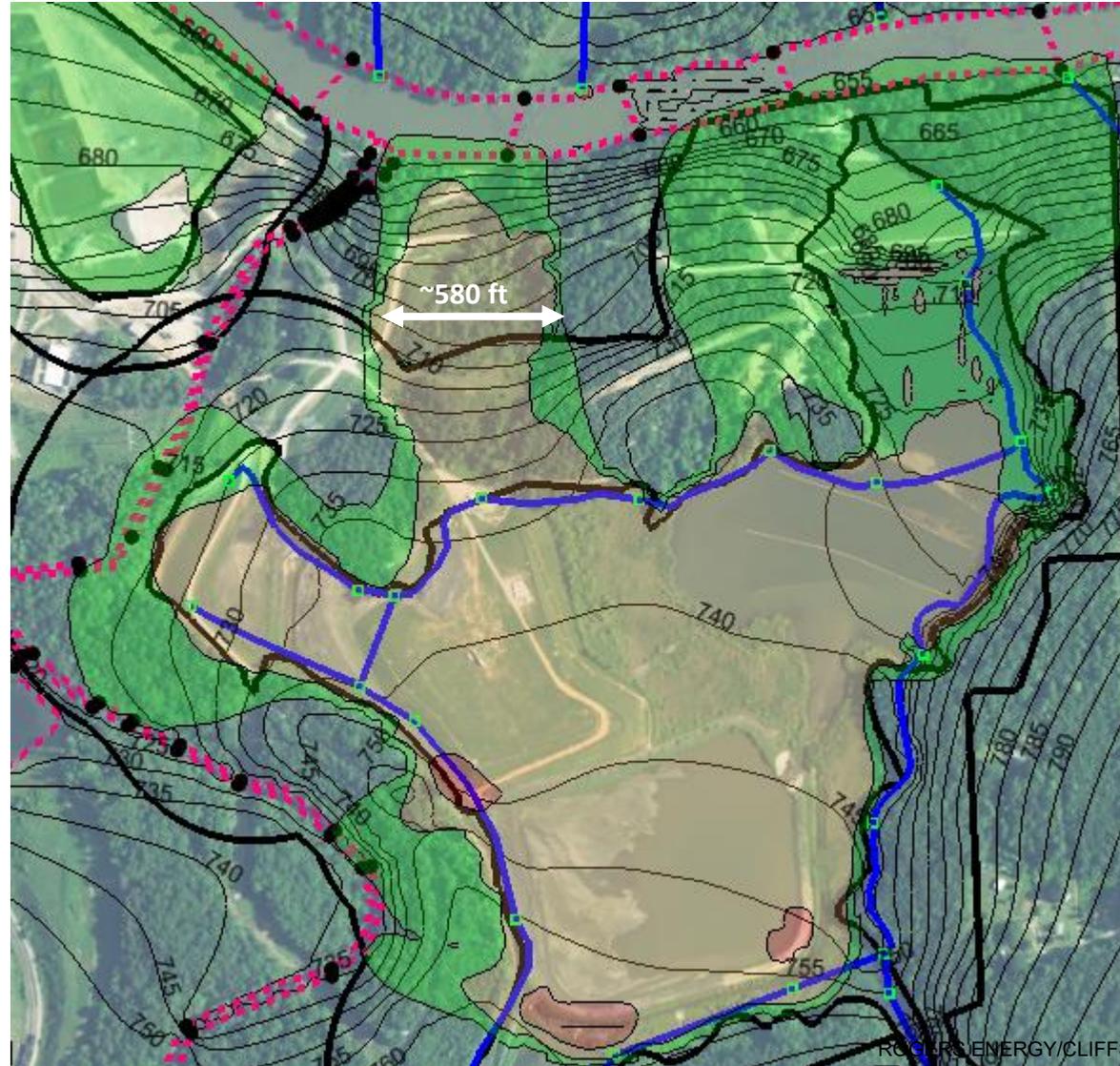
# CLIFFSIDE **CURRENT CONDITIONS IN 2018**

MAX BORON ANY LAYER (ug/L)    green = 75-700, tan = 700-4000, red = 4000-10,000, blue = 10,000-40,000



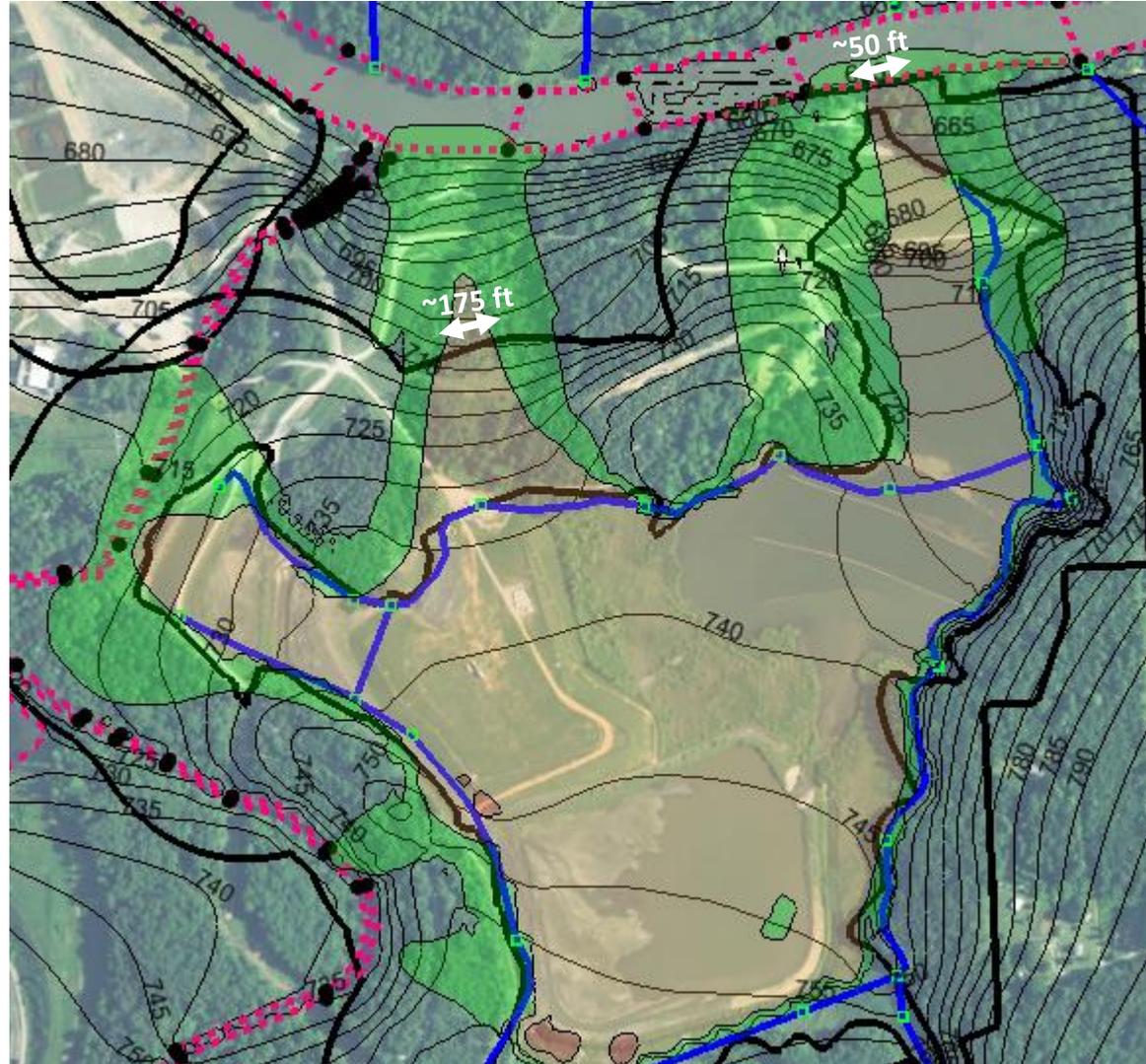
CLIFFSIDE **UPON COMPLETION OF FINAL COVER IN 2022**

MAX BORON ANY LAYER (ug/L)      green = 75-700, tan = 700-4000, red = 4000-10,000, blue = 10,000-40,000



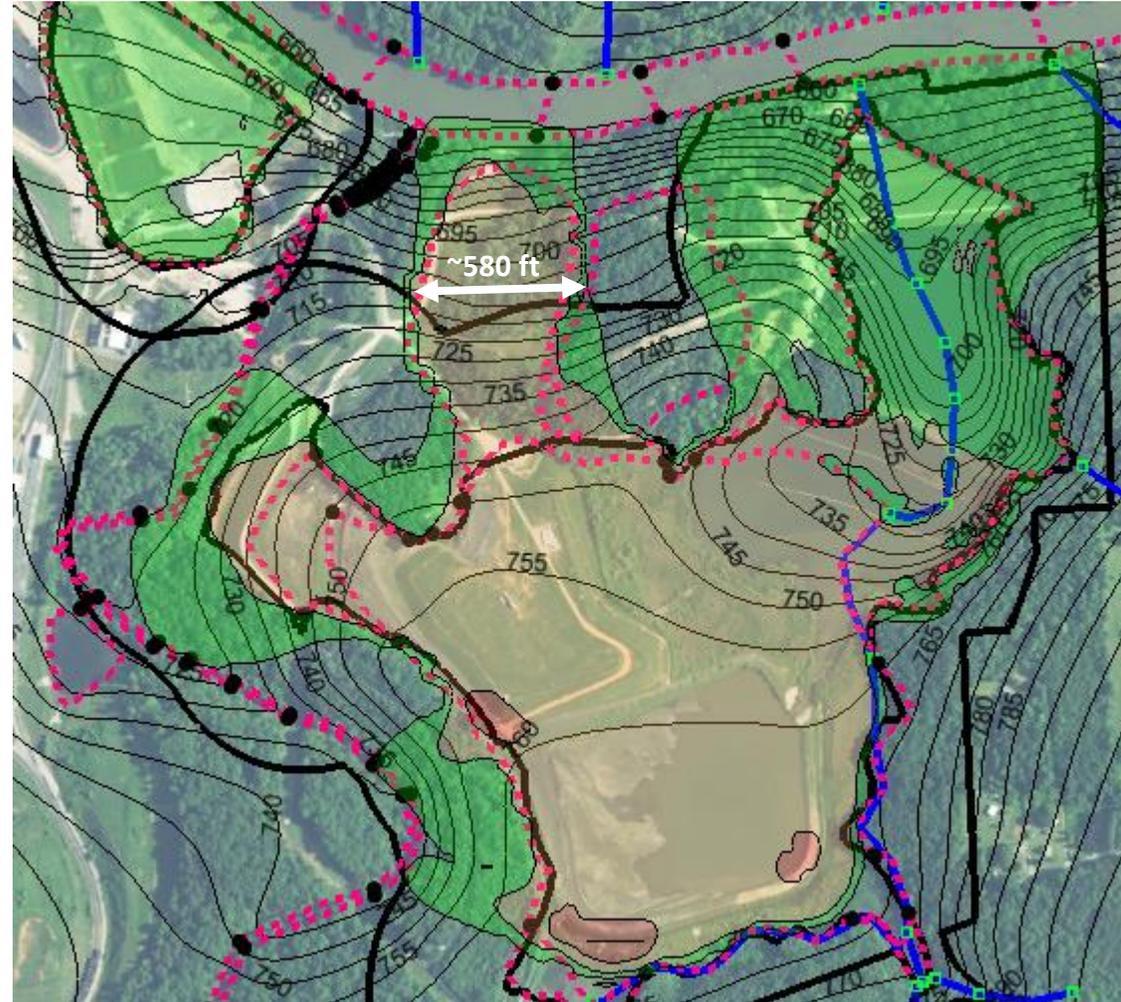
CLIFFSIDE **FINAL COVER IN 2125, t ~ 100 years**

MAX BORON ANY LAYER (ug/L)      green = 75-700, tan = 700-4000, red = 4000-10,000, blue = 10,000-40,000



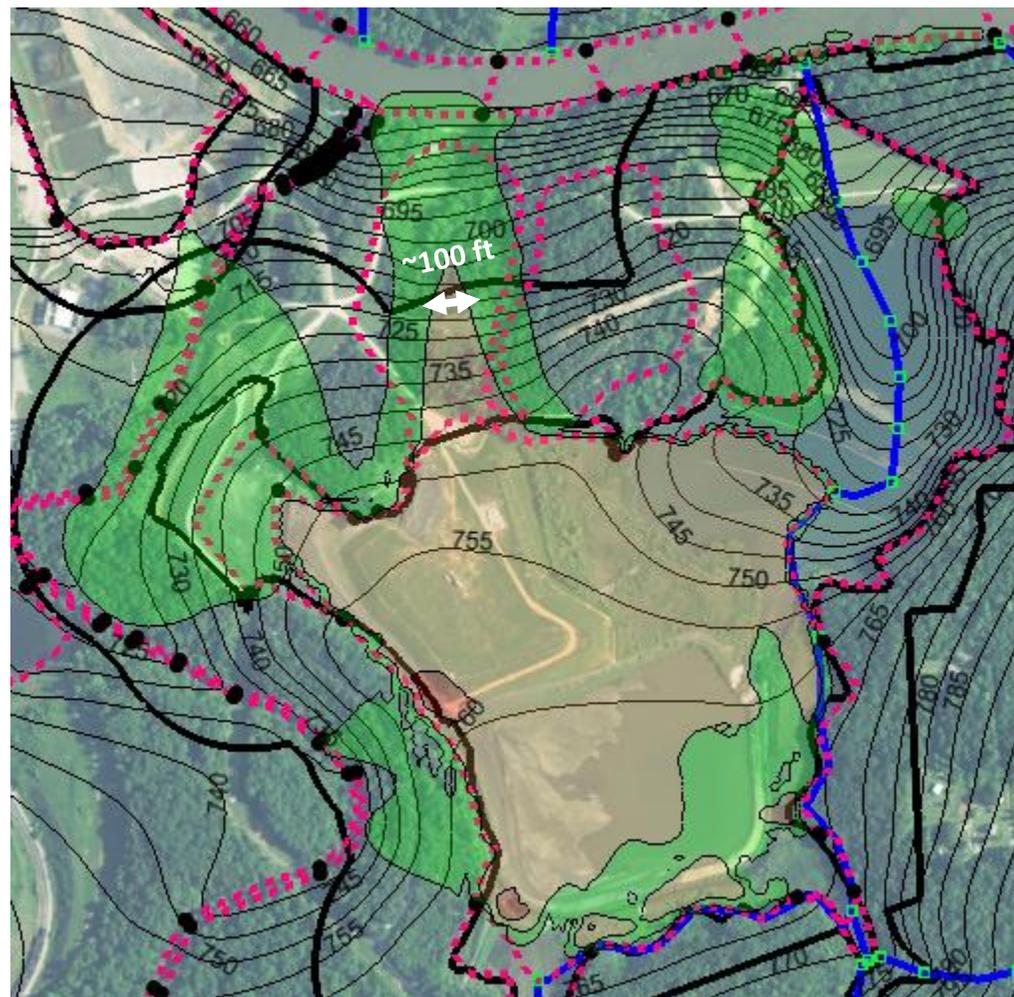
CLIFFSIDE **UPON COMPLETION OF HYBRID IN 2023**

MAX BORON ANY LAYER (ug/L)      green = 75-700, tan = 700-4000, red = 4000-10,000, blue = 10,000-40,000



CLIFFSIDE **HYBRID IN 2125, t ~ 100 years**

MAX BORON ANY LAYER (ug/L)      green = 75-700, tan = 700-4000, red = 4000-10,000, blue = 10,000-40,000



# CLIFFSIDE **CURRENT CONDITIONS IN 2018**

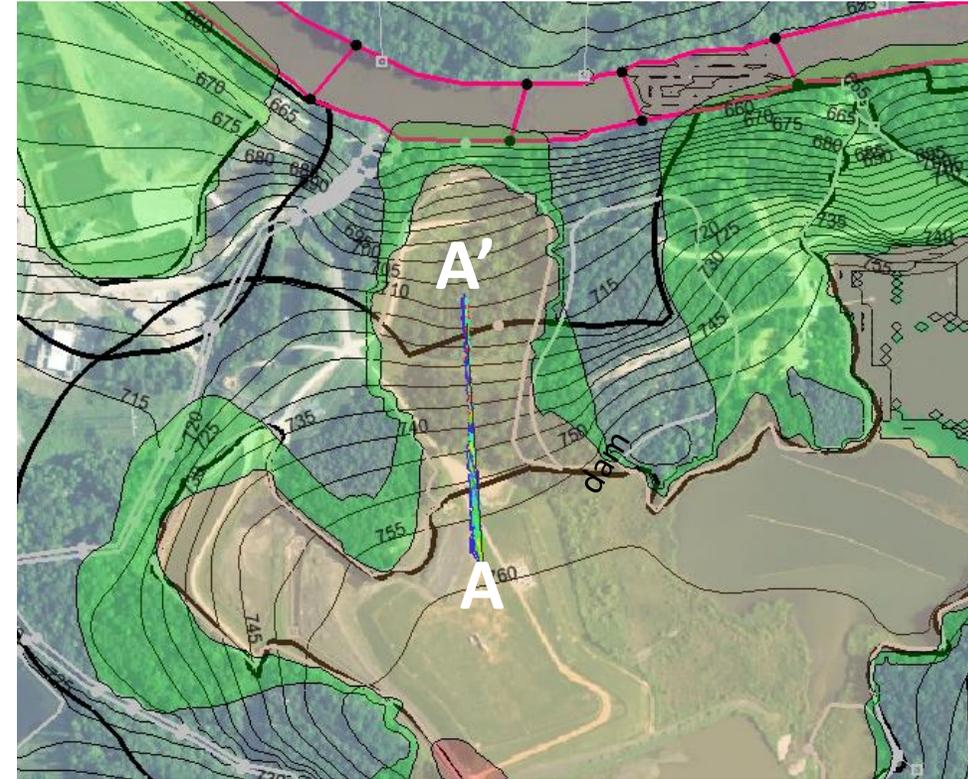
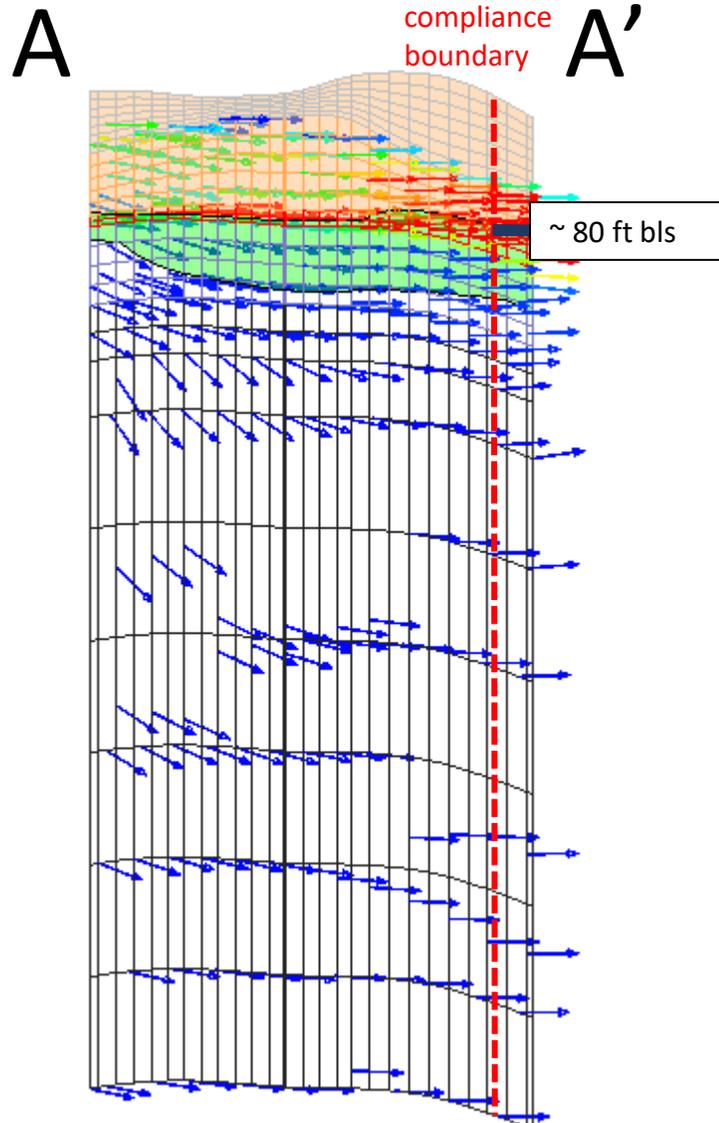
## CROSS SECTION A-A' (VIEWED FROM EAST SIDE OF CROSS SECTION LOOKING WEST)

MAX BORON ANY LAYER      green = 75-700, tan = 700-4000, red = 4000-10,000, blue = 10,000-40,000

### Cliffside model layers:

- Ash 1-8
- Saprolite 9-13
- TZ 14-16
- Bedrock 16-28

Vertical  
exaggeration X 3



A-A' ~800 ft

CLIFFSIDE **UPON COMPLETION OF FINAL COVER IN 2022, t = 0**

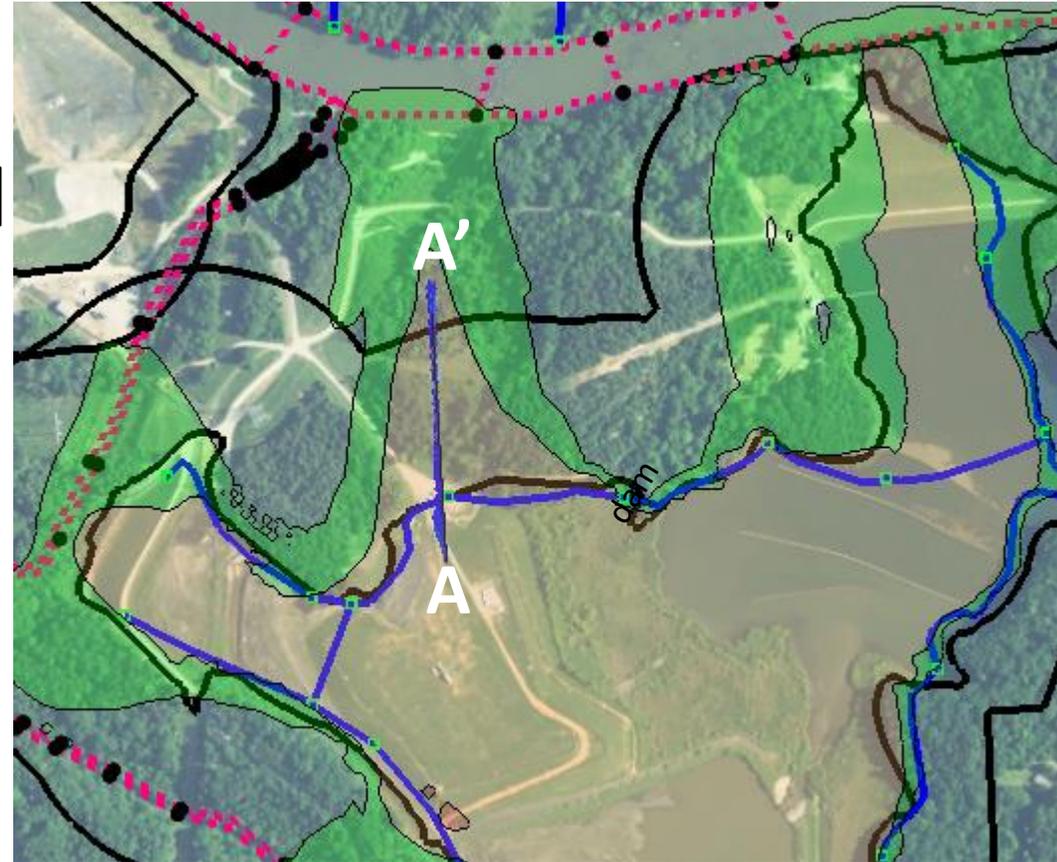
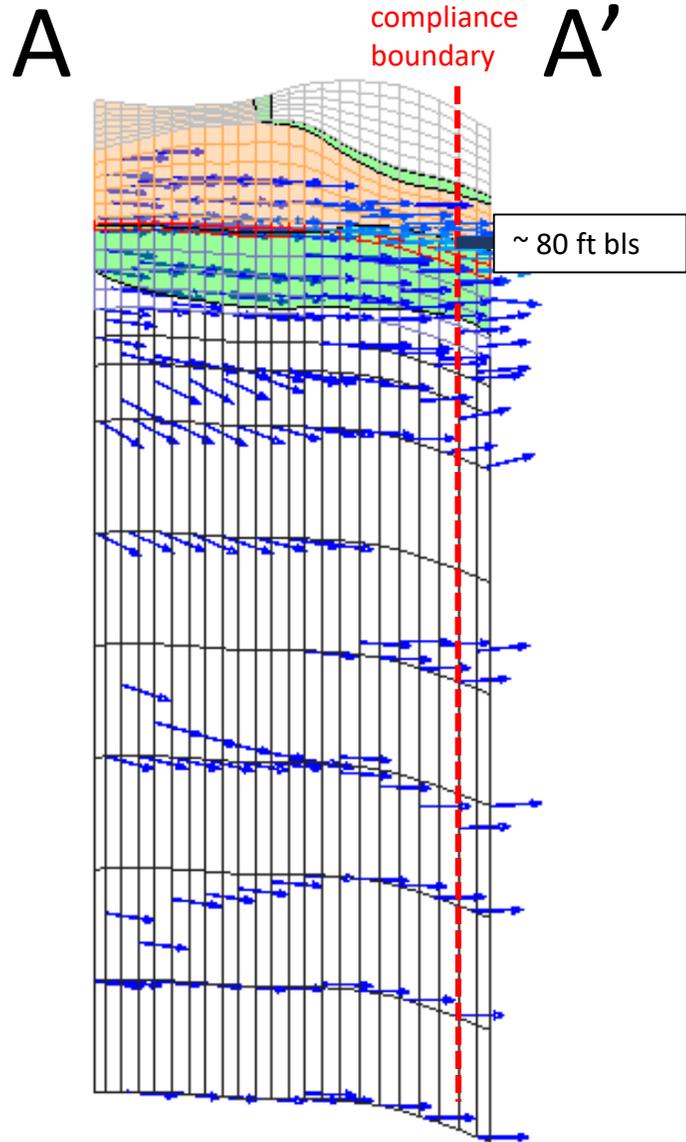
CROSS SECTION A-A' (VIEWED FROM EAST SIDE OF CROSS SECTION LOOKING WEST)

MAX BORON ANY LAYER green = 75-700, tan = 700-4000, red = 4000-10,000, blue = 10,000-40,000

Cliffside model layers:

- Ash 1-8
- Saprolite 9-13
- TZ 14-16
- Bedrock 16-28

Vertical  
exaggeration X 3



A-A' ~800 ft

CLIFFSIDE **FINAL COVER IN 2125, t ~ 100 years**

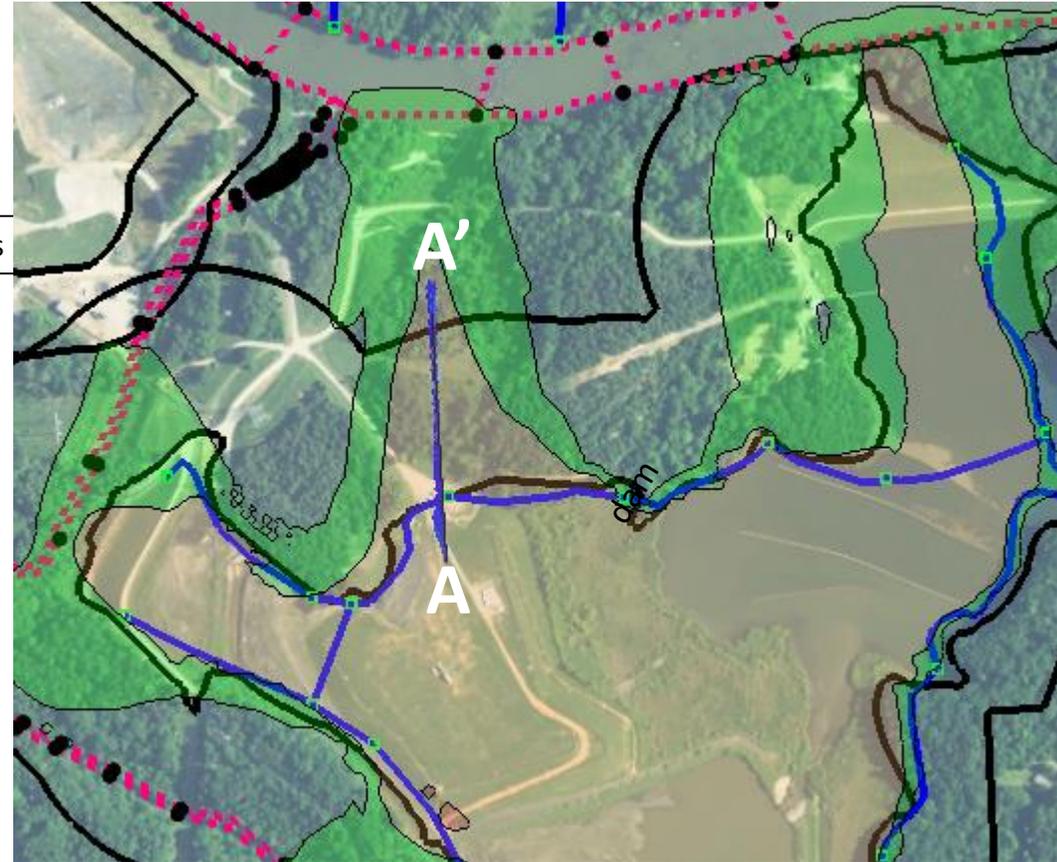
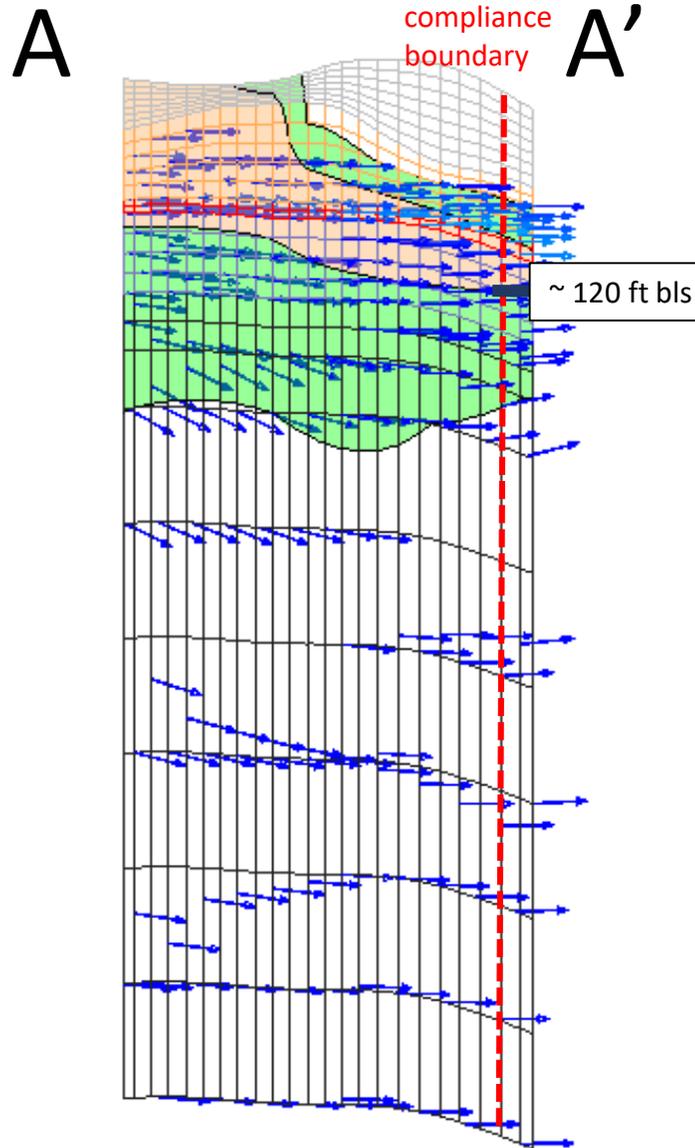
CROSS SECTION A-A' (VIEWED FROM EAST SIDE OF CROSS SECTION LOOKING WEST)

MAX BORON ANY LAYER green = 75-700, tan = 700-4000, red = 4000-10,000, blue = 10,000-40,000

Cliffside model layers:

- Ash 1-8
- Saprolite 9-13
- TZ 14-16
- Bedrock 16-28

Vertical  
exaggeration X 3



A-A' ~800 ft

CLIFFSIDE **UPON COMPLETION OF HYBRID IN 2023, t = 0**

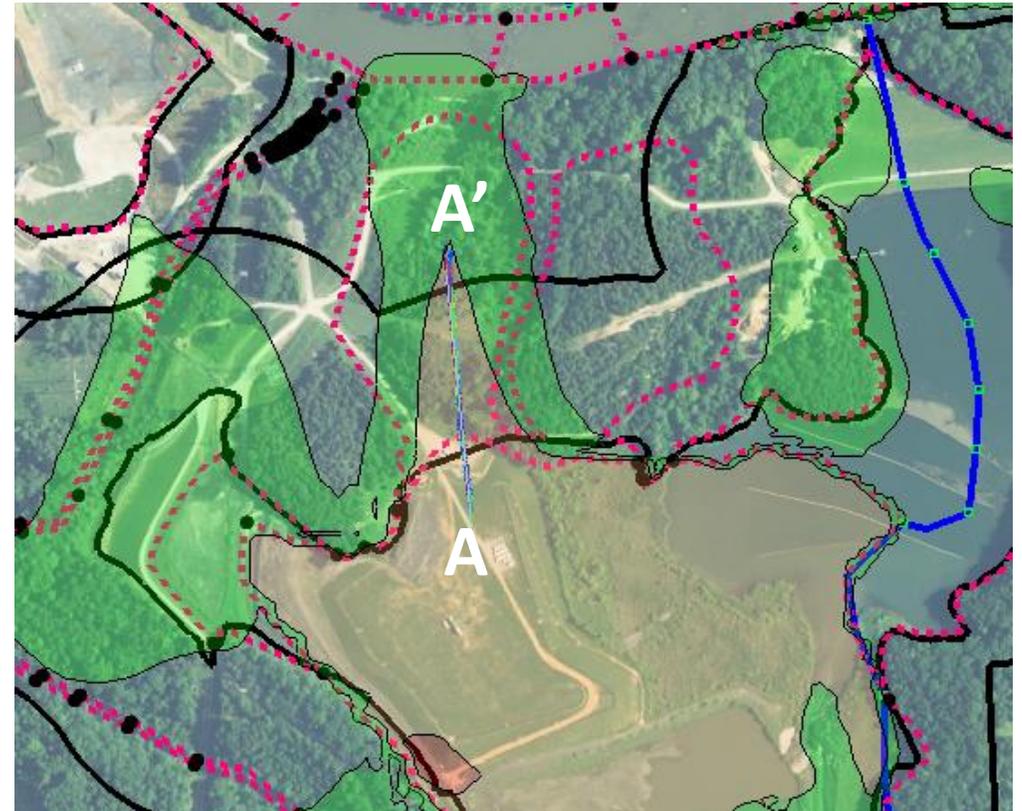
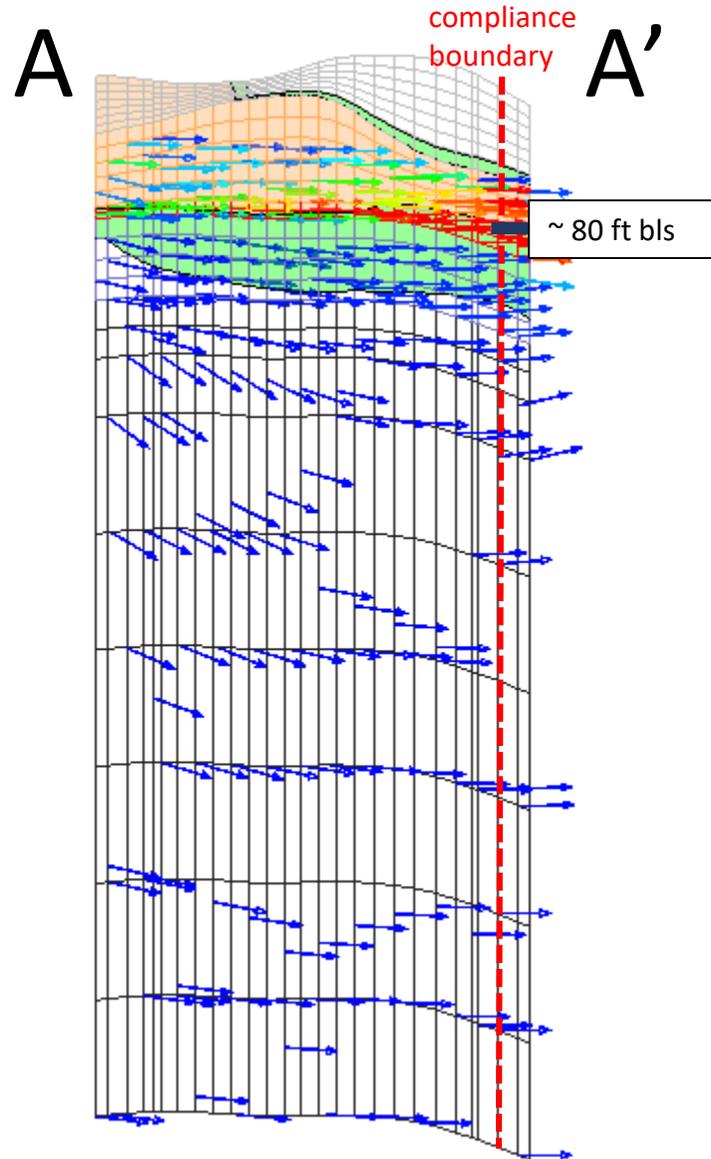
CROSS SECTION A-A' (VIEWED FROM EAST SIDE OF CROSS SECTION LOOKING WEST)

MAX BORON ANY LAYER      green = 75-700, tan = 700-4000, red = 4000-10,000, blue = 10,000-40,000

Cliffside model layers:

- Ash 1-8
- Saprolite 9-13
- TZ 14-16
- Bedrock 16-28

Vertical  
exaggeration X 3



A-A' ~800 ft

# CLIFFSIDE **UPON COMPLETION OF HYBRID IN 2150, t ~ 125 years**

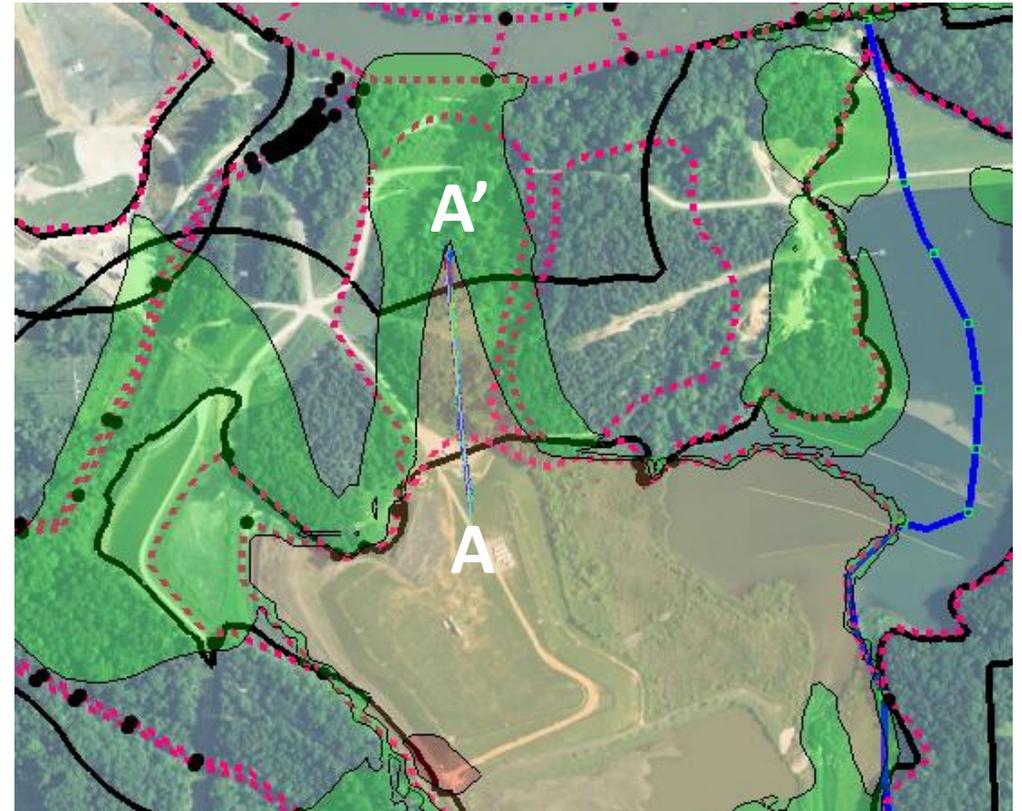
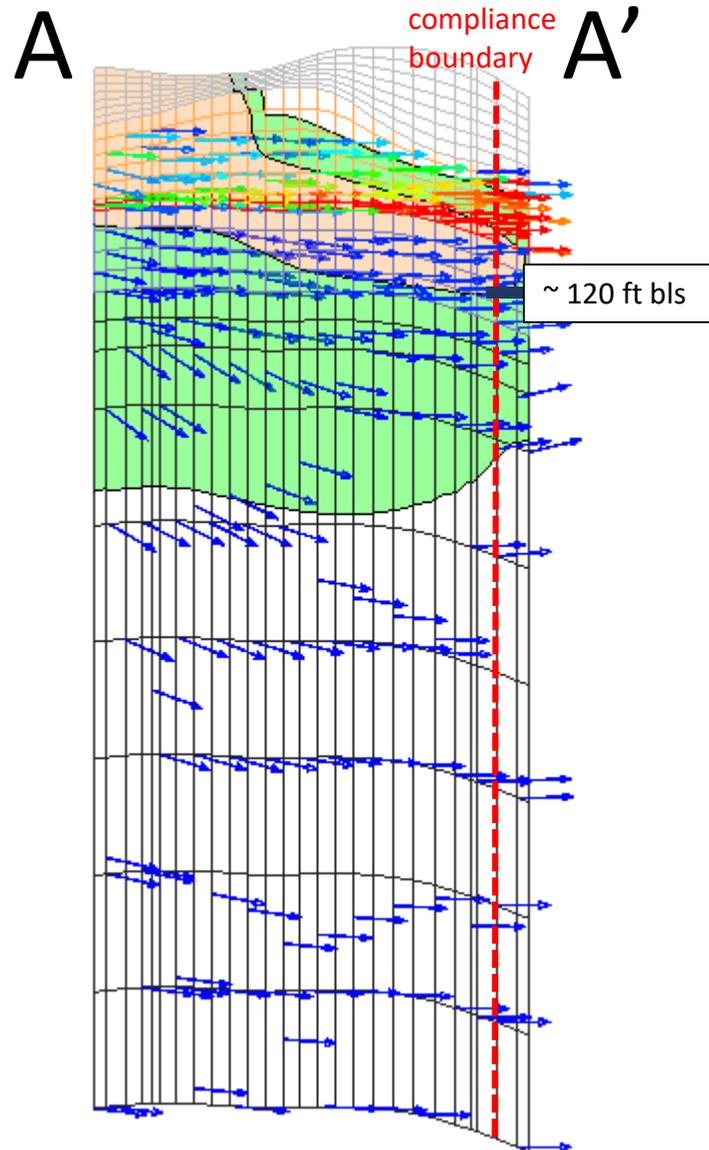
CROSS SECTION A-A' (VIEWED FROM EAST SIDE OF CROSS SECTION LOOKING WEST)

MAX BORON ANY LAYER      green = 75-700, tan = 700-4000, red = 4000-10,000, blue = 10,000-40,000

Cliffside model layers:

- Ash 1-8
- Saprolite 9-13
- TZ 14-16
- Bedrock 16-28

Vertical  
exaggeration X 3



A-A' ~800 ft

**ATTACHMENT B**

**RESPONSE TO COMMENTS**

## RESPONSE TO COMMENTS

### I. Summary of Responses to Comments

The North Carolina Department of Environmental Quality (“NCDEQ,” or “Department”) received approximately 1207 comments regarding the five closure options at the Duke Energy Rogers facility. The majority of the comments supported closure by removal to a lined landfill without specifying the location of the landfill. A sizeable minority specifically recommended excavating coal ash and moving it to an onsite landfill. A small minority of commenters either urged for excavation without registering any opinion as to how the excavated coal ash should be handled, or discussed disposal options other than relocation to a lined landfill. No commenters unequivocally supported closure-in-place, however, one commenter registered qualified support for this option. Detailed responses to the comments received by the Department regarding closure options for this site, as well as responses to those comments, are below.

### II. Detailed Responses to Comments

#### **A. Closure-in-place**

No comments were received which unequivocally favored closure-in-place. Of the more than 1200 comments received, all but two advocated for excavating coal ash from its existing location. A very small number of commenters solely urged for excavation of coal ash without any further specific comment. Similarly, a small number of commenters registered their opposition of cap-in-place, went on to cite specific reasons for their opposition of cap-in-place, but made no specific proposal regarding disposition of excavated coal ash.

Among these commenters, the reasons cited for opposing cap-in-place were: water quality and health concerns, concerns regarding Duke’s motives in proposing this solution, concerns over the effectiveness of long-term monitoring, accountability concerns, and/or general fairness concerns over leaving coal ash in place in some places when it is being excavated at others. One commenter did not specifically address any of the closure options, but, rather expressed his concern with the effects of contamination associated with coal ash. These general concerns are summarized and addressed in this section under the sub-heading “General Opposition of Closure-in-place.” Most commenters expressed some opinion regarding the ultimate disposition of excavated coal ash and are summarized in different sections below. One commenter neither expressly supported closure-in-place, nor opposed the option. A summary of that comment follows:

**Comment:** One commenter indicated that cap-in-place could potentially be a viable option, but expressed concern regarding the specific proposal for cap-in-place presented by Duke. He stated his opinion that additional study and safeguards would be needed for this option to comply with applicable regulations and be safely utilized.

**Response:** After review of the comments and other relevant data, the Department will require the removal of all coal ash, which must then be disposed of in lined landfills.

**Comment:** As noted above, some comments were submitted exclusively registering the commenters' opposition of closure-in-place. Additionally, a small number of commenters registered their opposition of cap-in-place, cited specific reasons for their opposition of cap-in-place, but made no were silent regarding disposition of excavated coal ash. Among these commenters, the chief reasons cited for opposing cap-in-place were: water quality and health concerns, concerns regarding Duke's motives in proposing this solution, concerns over the effectiveness of long-term monitoring, accountability concerns, and/or general fairness concerns over leaving coal ash in place in some places when it is being excavated at others. One commenter did not specifically address any of the closure options, but, rather expressed his general concern with the effects of contamination associated with coal ash.

**Response:** The Department will require all coal ash at the site to be excavated and disposed of in lined landfills.

## **B. Hybrid Option**

There were no comments directly addressing either hybrid option.

## **C. Closure by Removal to a Lined Landfill**

### **1. Comments Supporting Closure by Removal to a New Onsite Landfill**

Of the approximately 1200 comments North Carolina Department of Environmental Quality (NCDEQ) received regarding the five Rogers closure options, the overwhelming majority of comments were submitted via one of several form emails that supported removal to a lined landfill. The form email commenters asked for coal ash removal from leaking, unlined pits and movement to dry lined storage away from waterways and groundwater. Most of these commenters, however, did not specifically distinguish between moving the coal ash to an onsite landfill or removal to an offsite landfill.

A large number (approximately 238) of commenters supported closure by removal specifically to a new onsite dry lined landfill. The vast majority of commenters supporting this option submitted one of two form letters. Some of these commenters included individualized comments along with the form letter. A small number of commenters supporting this option did not utilize either form letter. Those comments are summarized as follows:

**Comment:** Roughly 70% of comments supporting closure by removal specifically to an onsite dry lined landfill were submitted using the following form letter:

*"I urge you to require Duke Energy to remove the coal ash from their leaking, unlined pits and to move it to dry lined storage, which is already available onsite, away from the Broad River and the groundwater of Cliffside. The Cliffside community has come out time after time over the last several years to make their concerns about this toxic coal ash clear. It is long past time for DEQ to listen.*

*The coal ash pit at Cliffside extends dozens of feet deep into the groundwater table, violating of federal and state rules. Cap in place in place won't solve these problems; it will just hide them. Duke's own models show that cap in place will continue polluting groundwater for 500 more years!*

*North Carolinians deserve better. To comply with the law and protect water quality Duke must excavate its coal ash now.*

*Thank you for your consideration."*

**Response:** The Department will require all coal ash at the site to be excavated and disposed of in a lined landfill. The Department has not yet determined whether disposal shall be at an onsite landfill, or an offsite landfill.

**Comment:** A smaller number of commenters supporting closure by removal to an onsite dry lined landfill submitted the following form email:

- DEQ should require Duke Energy to remove its coal ash from its leaking, unlined pits and move it to dry, lined storage on its own property — away from the Broad River and out of our groundwater.
- Duke Energy plans to leave its coal ash sitting in the groundwater at Cliffside, where it will keep polluting our groundwater, streams and rivers. Recent monitoring shows Duke Energy is polluting the groundwater surrounding Cliffside with toxic and radioactive materials. We need cleanup—not coverup!
- The community has come out time after time over the last several years, making clear that we're concerned about pollution from Duke Energy's coal ash and want Duke Energy to get its coal ash out of its unlined, leaking pits. It is long past time for DEQ and Duke Energy to remove the ash.
- Duke Energy is already required to remove its coal ash from eight other communities in North Carolina and all of its sites in South Carolina, and the governor of Virginia recently called for all the coal ash to be removed from Dominion's unlined sites—our families and our community deserve the same protections.
- Duke Energy can dispose all the ash from its leaking ponds onsite in an existing safe, lined landfill. Ash will not travel through the community or to other communities.
- Duke cannot exaggerate traffic concerns while downplaying the community's real concern: Duke Energy's water pollution. None of these plans will have a significant increase in offsite trucking, and only excavation will remove the source of the water pollution.

- Duke Energy’s own experts know that even cap-in-place will involve trucking construction materials to the site—just like any other construction project. But even under their estimates, the additional trucking impacts are next to nothing. Duke Energy’s consultant estimates that 97 trucks currently travel near Cliffside on community roads every day. Excavation would add only nine more trucks on community roads each day, compared to 13 more trucks on community roads for the duration of the cap-in-place scenario.
- It is past time for DEQ to listen to the community—not Duke Energy’s consultants—about what our community needs. We need Duke to clean up its coal ash and stop the water pollution.

**Response:** The Department will require all coal ash at the site to be excavated and disposed of in a lined landfill. The Department has not yet determined whether disposal shall be at an onsite landfill, or an offsite landfill.

**Comment:** A comment supported excavation of coal ash and relocation to onsite dry lined storage. They discussed the risks associated with cap-in-place, particularly to vulnerable populations, as well as stated that cap-in-place violated applicable regulations. They also expressed concern regarding the data submitted by Duke in favor of cap-in-place.

**Response:** The Department will require excavation to a lined landfill, but the location of the landfill has not yet been determined.

**Comment:** A comment urged the Department to require excavating coal ash and moving it to lined landfills on Duke’s property at all of the sites under consideration. In the letter supporting this option, the commenter discusses the risks to human and environmental health associated with cap-in-place, as well as the potential long-term costs of the option.

**Response:** The Department has determined that excavation to a lined landfill will be required, but has not yet determined the location of the landfill.

## **2. Comments Supporting Removal to a Lined Landfill, No Location Specified**

**Comment:** The overwhelming majority of commenters stated in a form email that they were supportive of closure by removal to dry lined landfill. The comment in that form email states the following:

*“Dear Coal Ash Comment Administrator North Carolina DEQ: Rogers,*

*The North Carolina Department of Environmental Quality (DEQ) should require Duke Energy to remove its coal ash from its leaking, unlined pits and move it to dry lined storage away from our waterways and out of our groundwater. Duke Energy plans to leave its coal ash sitting in the groundwater at six sites in North Carolina, where it will keep polluting our groundwater, lakes, and rivers.*

*Recent monitoring shows Duke Energy is polluting the groundwater at its coal ash ponds in North Carolina with toxic and radioactive materials. We need cleanup—not coverup! The communities around the coal ash ponds have come out time after time over the last several years, making clear that we’re concerned about pollution from Duke Energy’s coal ash and want Duke Energy to get its coal ash out of its unlined, leaking pits. It is long past time for DEQ and Duke Energy to listen to the communities.*

*Duke Energy is already required to remove its coal ash at eight other sites in North Carolina and all of its sites in South Carolina—our families and our community deserve the same protections.”*

**Response:** The Department will require that all coal ash at the site be excavated and relocated to lined landfills.

**Comment:** Several commenters submitted individual comments urging excavation and relocation of coal ash to lined landfills, citing water quality concerns, health concerns, accountability concerns, fairness concerns, and/or concerns relating to Duke’s motives in proposing cap-in-place and/or the data submitted by Duke supporting this option.

**Response:** The Department will require that all coal ash at the site be excavated and relocated to lined landfills.

**Comment:** One commenter urged for excavation and removal to a lined landfill stating that compliance with applicable regulations is not possible without excavation. He went on to state that the locations of coal ash impoundments would never have been permitted as hazardous waste disposal sites. He indicated his belief that classification of these sites as low risk is inappropriate, and cited numerous fairness and accountability concerns.

**Response:** The Department will require that all coal ash at the site be excavated and relocated to lined landfills.

**Comment:** Citing previous experience with a catastrophic coal spill insisted that NCDEQ should require Duke Energy to remove its coal ash from its leaking, unlined impoundments and move it to dry lined storage. There were also concerns for protecting the Catawba River and down stream rivers.

**Response:** The Department will require that all coal ash at the site be excavated and relocated to lined landfills.

**Comment:** Another commenter expressed serious concern regarding the closure-in-place option and provided lengthy commentary on why this option was not viable:

“Cap-in-place is unacceptable for any of the coal ash sites in North Carolina. Any ‘solutions’ proposed by Duke Energy that do not excavate and move ash to fully lined,

scientifically designed systems that fully encapsulate coal ash must be rejected. Without multiple, sealed bottom, side, and top liners, North Carolina's groundwater will always be at risk. Due to increases in extreme weather, more frequent hurricanes and massive rainstorms, groundwater models of 100 or 500-year floodplain are obsolete. Given the unpredictable fluctuations in the water tables and groundwater flows, there is no way that surface capping without properly engineered underlying bottom liners can protect groundwater in the coming decades."

The commenter continued by stating: "DEQ should require Duke Energy's new landfills to go beyond the minimal mandatory protections provided by current regulations. DEQ must carry out independent studies and obtain recommendations for the best liner technologies, redundant liners, and with multiple long-term safeguards. Scientifically based placements for baseline and ongoing groundwater monitoring wells should be established. These must be thoroughly and constantly monitored – with full, public, transparent, internet accessible, easily available data from the monitoring results. Ground water and surface monitoring should be ongoing for a minimum of 50 years . . . While transporting existing coal ash dumps away from rivers and floodplains is essential, every effort should be taken by DEQ to ensure that the distances coal ash is moved is minimized and that the coal ash destinations are always kept on Duke Energy's property."

The commenter expressed significant concern for worker safety while the above referenced work is carried out, stating that "During excavation, construction, and filling of the landfills, all worker safety measures should be taken to prevent a repeat of the serious harms to worker health from the cleanup crews that worked on the TVA spill....worker safety, proper fitting and testing of N95, or better, particulate masks should be required...wherever needed, full protective suits should be provided."

The commenter concluded: "Once constructed, these new lined landfills should represent the best technologies and materials available – not materials that create short-term financial savings. The original existing dumps were disasters for public health, for NC communities, and for our state's waters. We have this one chance to remediate some of the damages and most importantly, to safeguard future generations from heavy metal coal ash contamination. Our state-wide re-design of storage systems for millions of tons of coal ash must be done right this time."

**Response:** The Department will require that all coal ash at the site be excavated and relocated to lined landfills.

**Comment:** Another commenter who supports removal to a lined landfill urged NCDEQ to consider conducting its own independent analysis that identifies the safest closure option.

**Response:** The Department will require that all coal ash at the site be excavated and relocated to lined landfills.

**Comment:** A commenter submitted extensive written comments urging NCDEQ to require the Rogers coal ash basins to be excavated to a lined landfill to protect the environment and human health.

The commenter claimed coal ash impoundments are not eligible for closure-in-place under CAMA because cap-in-place will violate state groundwater Rules and the federal CCR Rules. The commenter sets out the following arguments it believes supports its claim that closure will violate state Groundwater Rules: 1) Duke Energy's modelling demonstrates it will not meet groundwater standards if it chooses closure-in-place; 2) Duke Energy's modelling underestimates the extent of contamination; 3) Duke Energy tested groundwater compliance at the wrong location; 4) the groundwater rule prohibits closure-in-place because the coal ash will contribute to violations of the groundwater standard for centuries; and 5) closure-in-place is unavailable because it will not restore groundwater to the legal standard.

The commenter next claimed that coal ash impoundments at Allen are not eligible for closure-in-place under the Coal Combustion Residuals (CCR) rule. The commenter supported this argument by its assertions that: 1) the CCR rules' performance standards require separating ash from the groundwater and precluding its future impoundment; and 2) the CCR rules' corrective action requirements preclude closure-in-place.

The commenter continues by arguing that NCDEQ must base its closure determination on effectiveness and not cost to the polluter. The commenter further maintains that NCDEQ should reject Duke Energy's "Community Impact Analysis." The commenter claims that Duke's Energy's report downplays well-established pollution risks and exaggerates the impact on communities of excavating and trucking material to offsite landfills. Further, they claim that diesel emissions do not meaningfully distinguish between closure methods and that the report's habitat analysis is flawed. The commenter concludes by questioning the validity of Duke Energy's closure options scoring system - and offers its own analysis to demonstrate why it believes Duke Energy manipulated scores to suit a desired outcome.

**Response:** The Department will require that all coal ash at the site be excavated and relocated to lined landfills.

**Comment:** The same commenter requested that NCDEQ ignore a Duke Energy report on estimated greenhouse gas emissions associated with various closure options for the six unresolved coals ash sites. The commenter claimed NCDEQ should disregard this submission because it was made after NCDEQ's deadline for Duke Energy to submit its materials and outside the public comment period, thereby denying the public an opportunity to respond to it. NCDEQ should also disregard this submission because it is irrelevant to the decision facing NCDEQ, which is to select a closure method that stops the ongoing pollution and continuing threat to our water resources posed by Duke Energy's leaking coal ash basins.

**Response:** The Department is requiring excavation of coal ash and removal to a lined landfill.

**Comment:** A commenter stated that the pits should be excavated as soon as possible to the maximum safe extent with at least twenty-five (25) percent recycled through encasement in cement bricks, concrete and other methods. The remainder of excavated ash should be moved into double-lined landfills away from rivers, lakes and aquifers with monitored leak detection systems. The double-lining would include 2' of clay on the exterior with a durable lining impervious to water.

**Response:** The Department has determined that all coal ash at the site must be excavated and removed to a lined landfill. The Department will consider beneficial use of excavated coal ash, as well as the location of lined landfills for disposal at a later date.

**Comment:** A small number of other commenters also suggested the material should be at least partially recycled.

**Response:** The Department has determined that all coal ash at the site must be excavated and removed to a lined landfill. The Department will consider beneficial use of excavated coal ash, as well as the location of lined landfills for disposal at a later date.

**Comment:** Several comments were received in the form of YouTube testimonials following NCDEQ's Environmental Justice Advisory Board meeting in Wilmington, NC. Links to each these testimonials follow:

Caroline Armijo - ACT Member <https://youtu.be/cJag3oPI4qU>

Johnny Hairston - resident in harm's way of basin failure <https://youtu.be/6iK1sbVOO58>

Rev. Gregory Hairston – leader/resident in close proximity <https://youtu.be/IV9crtEyTJY>

John Wagner - ACT Member <https://youtu.be/IV9crtEyTJY>

Frank Holleman - lead attorney of SELC <https://youtu.be/elwPWPYb3Uc>

**Response:** The Department will require that all coal ash at the site be excavated and relocated to lined landfills.

**Comment:** Four additional videos were submitted regarding the impact of coal ash spills:

At What Cost (2014) <https://youtu.be/rraUoadqr8o>

Danielle Bailey-Lash on CNN <https://youtu.be/OCTU-CUoQzQ>

A Time to Sing (Abridged) (August 2018) <https://youtu.be/HQFYKBaf4NQ>

A Day of Prayer (February 2019) [https://youtu.be/agRzScT\\_BEs](https://youtu.be/agRzScT_BEs)

**Response:** The Department will require that all coal ash at the site be excavated and relocated to lined landfills.