

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

Belews Creek Steam Station

April 1, 2019



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Executive Summary

The Coal Ash Management Act (CAMA) establishes criteria for the closure of coal combustion residuals (CCR) surface impoundments. The CCR surface impoundment located at Duke Energy Carolinas, LLC's (Duke Energy) Belews Creek Steam Station (Belews Creek) in Stokes County, NC has 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). 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 10, 2019 in Walnut Cove, NC where the community near Belews Creek had the opportunity to learn about options for closing coal ash 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 impoundment at the Belews Creek 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 Belews Creek 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 impoundment at Belews Creek 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 CCR surface impoundment at the Belews Creek Steam Station. This document describes the CAMA requirements for closure of coal ash impoundments, the DEQ evaluation process to make an election under CAMA for the subject impoundment at the Belews Creek site, and the election by DEQ for the final closure option.

II. Site History

Duke Energy owns and operates the Belews Creek Steam Station which is located on Belews Lake Reservoir in Belews Creek, Stokes County, North Carolina. Belews Creek is a two-unit 2,240-megawatts coal-fired generating facility that began commercial operation in 1974. Prior to 1984, Belews Creek wet sluiced coal combustion residuals into one surface impoundment located on the property. The surface impoundment is known as the Active Ash Basin (AAB) and is impounded by dam STOKE-116.

In 1984, Belews Creek replaced its fly ash wet sluicing operation with a dry ash handling system and began placing dry fly ash into one of three permitted landfills located on the property: Pine Hall Road Landfill (8503-INDUS-1984, closed), Craig Road Landfill (8504-INDUS, active), and FGD Landfill (8505-INDUS, active). However, the ability to wet sluice to the AAB was still available but limited to certain situations: unit startup/shutdown, equipment maintenance, and service. Currently, a 100% dry ash handling system is being used onsite and no CCR is being sluiced to the AAB. A Flue Gas Desulfurization (FGD) scrubber system is active at Belews Creek where the FGD residuals are beneficially reused for the production wallboard.

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 Belews Creek 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 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 1×10^{-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* 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 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 10, 2019 – DEQ public meeting near Belews Creek
- 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 Belews Creek site that are either CCR impoundments or hydrologically connected to CCR 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.

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 Belews Creek 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 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 Walnut Cove, NC near Belews Creek on January 10, 2019. Approximately 98 people attended the meeting. Approximately 1052 comments were received during the comment period, which closed on February 15, 2019. Additionally, 275 people signed an attachment to written comments and an additional 340 people signed an on-line petition. A sizeable minority of commenters specifically recommend excavating coal ash and moving it to a lined onsite landfill. A small minority of commenters want the coal ash moved out of state. No commenters support the hybrid closure or closure-in-place option. Several commenters support recycling coal ash for various commercial product uses. 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 impoundment at the Belews Creek 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 at Belews Creek 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 impoundment at Belews Creek 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 impoundment at Belews Creek. 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] sub-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 Belews Creek.

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 future modeled extent of the plume, DEQ does not believe these two closure options can meet the requirements of CAMA Option B for the CCR surface impoundment at Belews Creek.

DEQ does not elect CAMA Option C (i.e., closure under the federal CCR Rules found in 40 CFR Part 257) for the CCR impoundments at Belews Creek. 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 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 impoundments across the country, CAMA was written specifically to address the CCR impoundments in North Carolina.
- e. While the federal CCR Rule allows CCR 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 at Belews Creek 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**

I. The Contaminated Plume is Beyond the Compliance Boundary

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. Significantly, the contaminated groundwater plume has already extended beyond the compliance boundary in a portion of the impoundment. The inferred general extent of groundwater impacts above applicable Background Threshold Values or 2L Standards are shown on Figure ES-1. Additional monitoring and hydrogeological data is available in the Belews Creek Steam Station October 2017 CSA Update Report (available on the DEQ website).

Based on review of data submitted to date in various reports, both soil and groundwater have been impacted by CCR handling activities at the site. Groundwater within the area of the impoundment generally flows north to northwest toward Dan River and south of a topographic ridge that serves as a groundwater divide along Pine Hall Road toward Belews Lake Reservoir. Boron concentrations above 2L Standards approximates the leading edge of the CCR plume at the site. Almost all constituents of interest (COIs) are present in the shallow flow layer. The horizontal extent of those COIs are generally within the footprint of the boron plume.

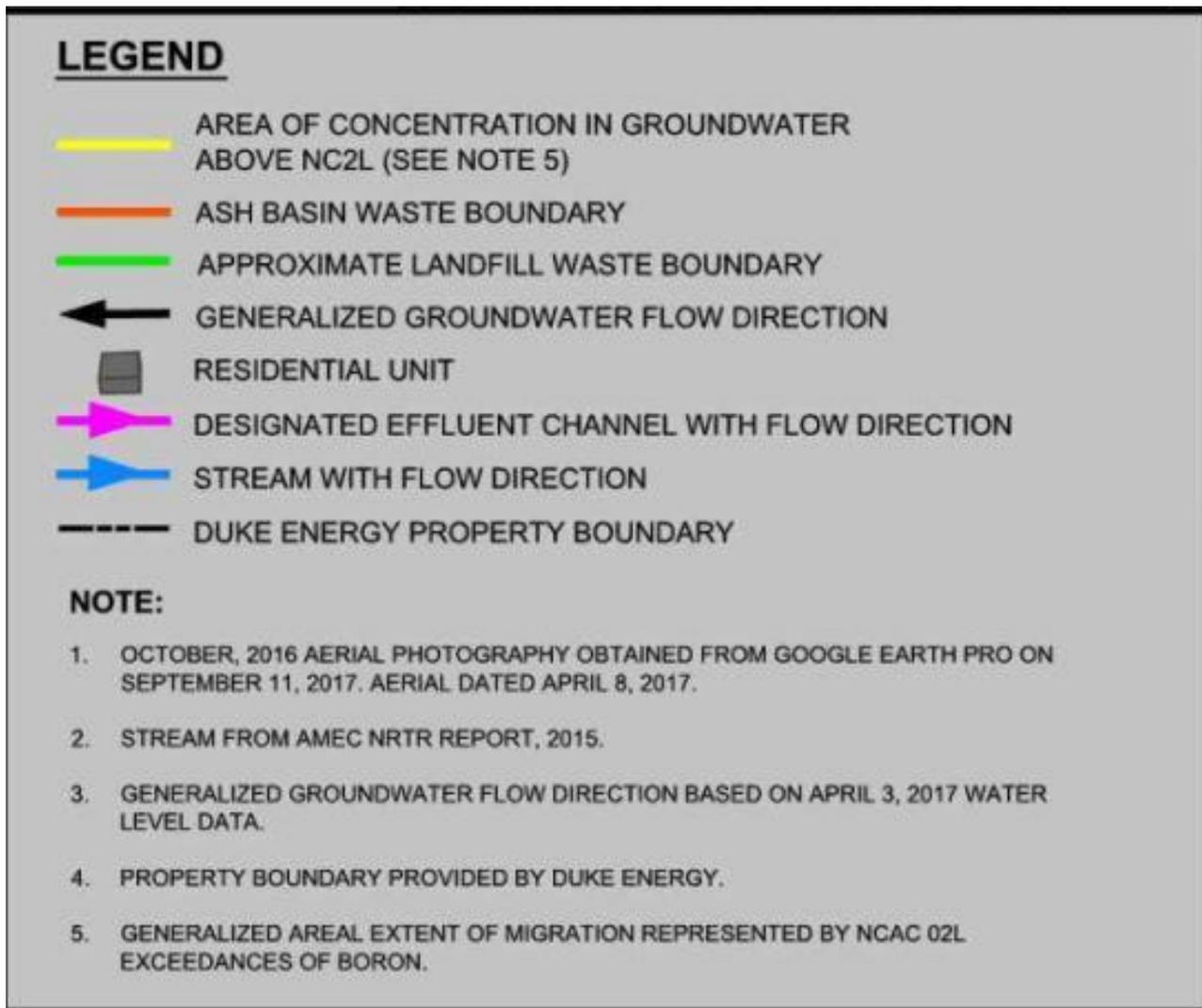
The vertical extent of most COIs is within the shallow and transition flow layers. However, data suggests the bedrock flow layer has been impacted by CCR handling activities at the site. Manganese is the only COI with a significant exceedance of the 2L standard in the bedrock flow layer.

DEQ concludes that the contaminated groundwater plume above 2L standards has extended beyond the compliance boundary along the northern edge of the property. Based on Figure ES-1, this plume extends along the entire length active ash basin.

Figure ES-1: Belews Creek Steam Station October 2017 CSA Update Report



Figure ES-1 Legend: Belews Creek Steam Station October 2017 CSA Update Report



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 6: Hybrid* would meet the criteria of CAMA Option B. DEQ considered whether the proposed closure option would prevent any post closure exceedances of the 2L groundwater quality standard at the compliance boundary upon full closure implementation. Cross-sections B-B' and C-C' were evaluated and can be seen in the figures below. These cross-sections represent 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=125 years
- upon completion of the hybrid option at t=0 years and
- hybrid option at t=118 years

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

Belews Creek Modeling Results for Cross-Section B-B'			
Model Simulation	Maximum Concentration of Boron Above 2L Beyond Compliance Boundary (ug/L)	Depth of GW Contamination Above 2L Beyond Compliance Boundary (feet bgs)	Width of Contamination Plume Beyond Compliance Boundary (feet)
Current Conditions	4,000-10,000	140	1200
Completion of Final Cover (t=0 yrs)	4,000-10,000	150	1200
Final Cover (t=125 yrs)	700-4,000	260	700
Completion of Hybrid (t=0 yrs)	4,000-10,000	145	1200
Hybrid (t=118 yrs)	700-4,000	235	900

bgs – below ground surface

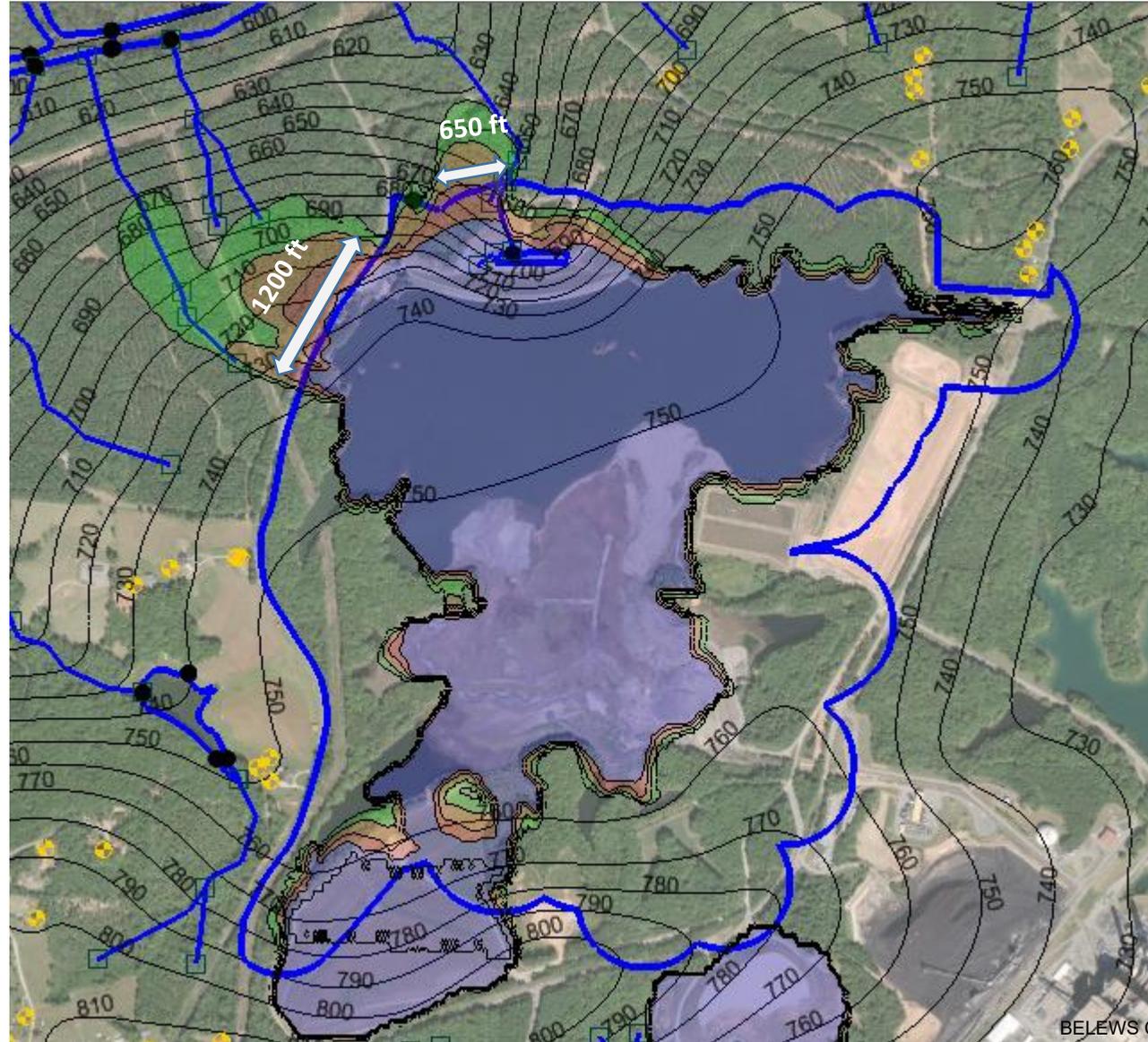
Belews Creek Modeling Results for Cross-Section C-C'			
Model Simulation	Maximum Concentration of Boron Above 2L Beyond Compliance Boundary (ug/L)	Depth of GW Contamination Above 2L Beyond Compliance Boundary (feet bgs)	Width of Contamination Plume Beyond Compliance Boundary (feet)
Current Conditions	4,000-10,000	325	650
Completion of Final Cover (t=0 yrs)	4,000-10,000	330	650
Final Cover (t=125 yrs)	700-4,000	550	700
Completion of Hybrid (t=0 yrs)	4,000-10,000	310	700
Hybrid (t=118 yrs)	700-4,000	440	750

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 118 to 125 years beyond completion of closure, the area of the plume requiring remediation remains extensive.

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.

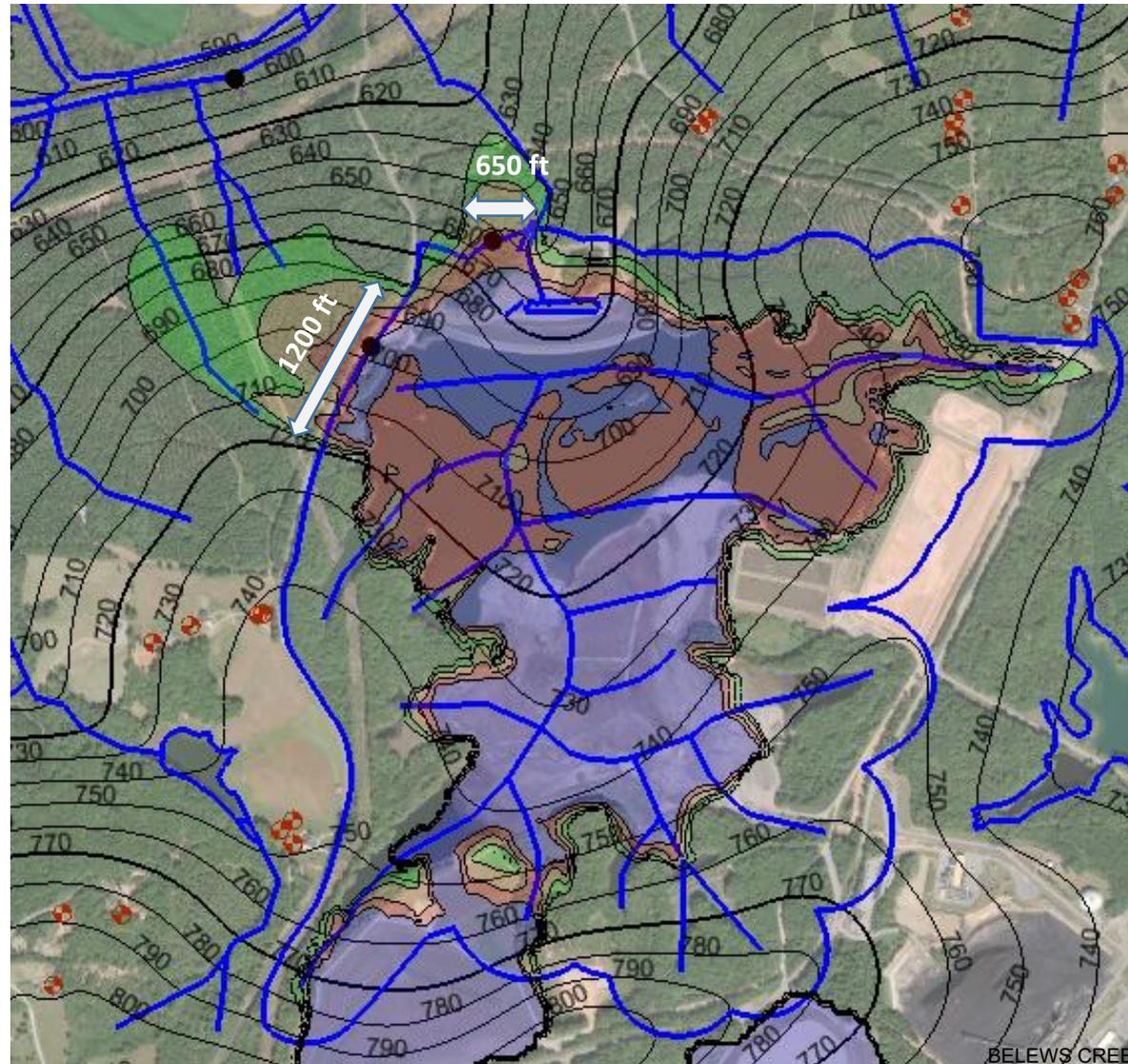
BELEWS CREEK **CURRENT CONDITIONS IN 2017**

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



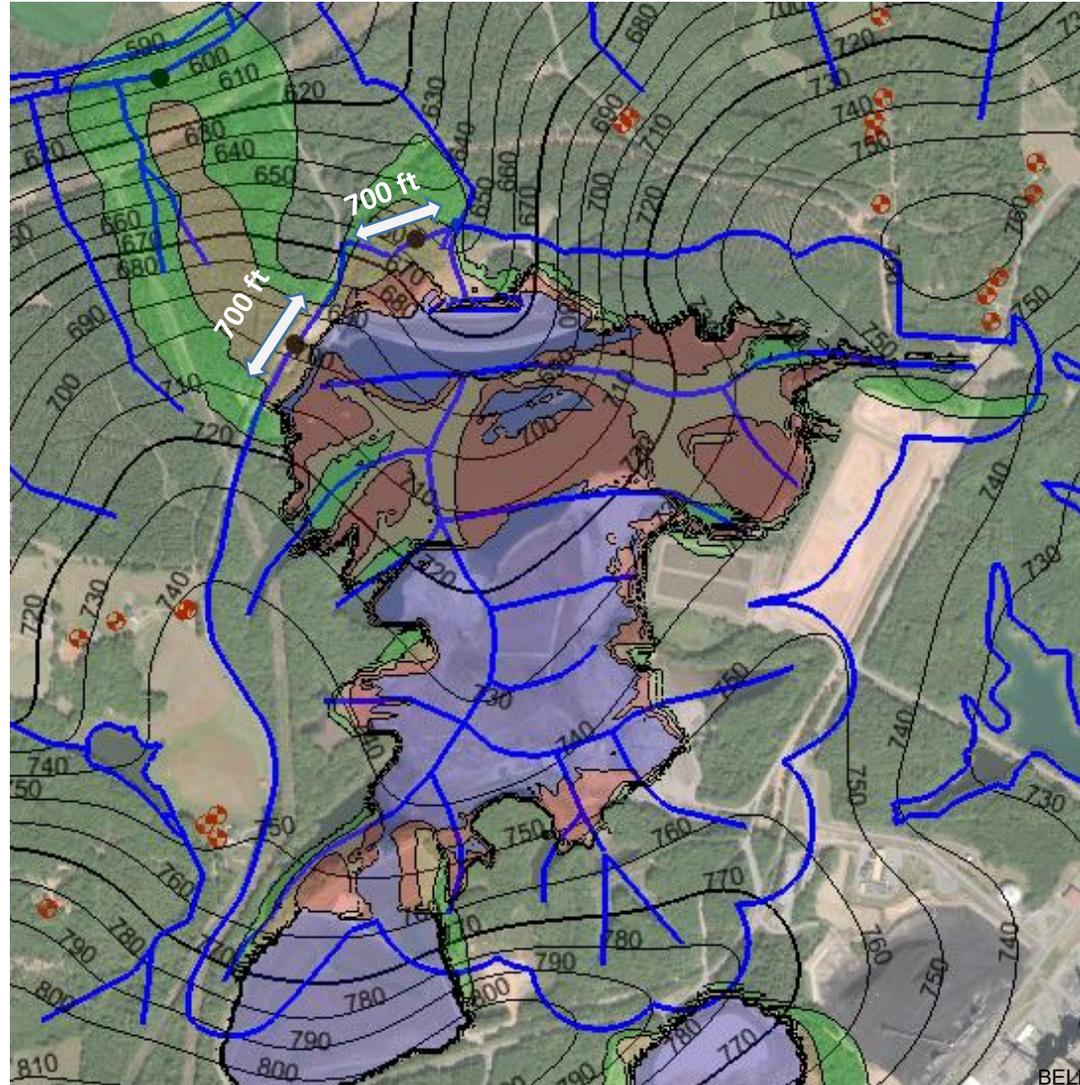
BELEWS CREEK **UPON COMPLETION OF FINAL COVER, 2025 t = 0**

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



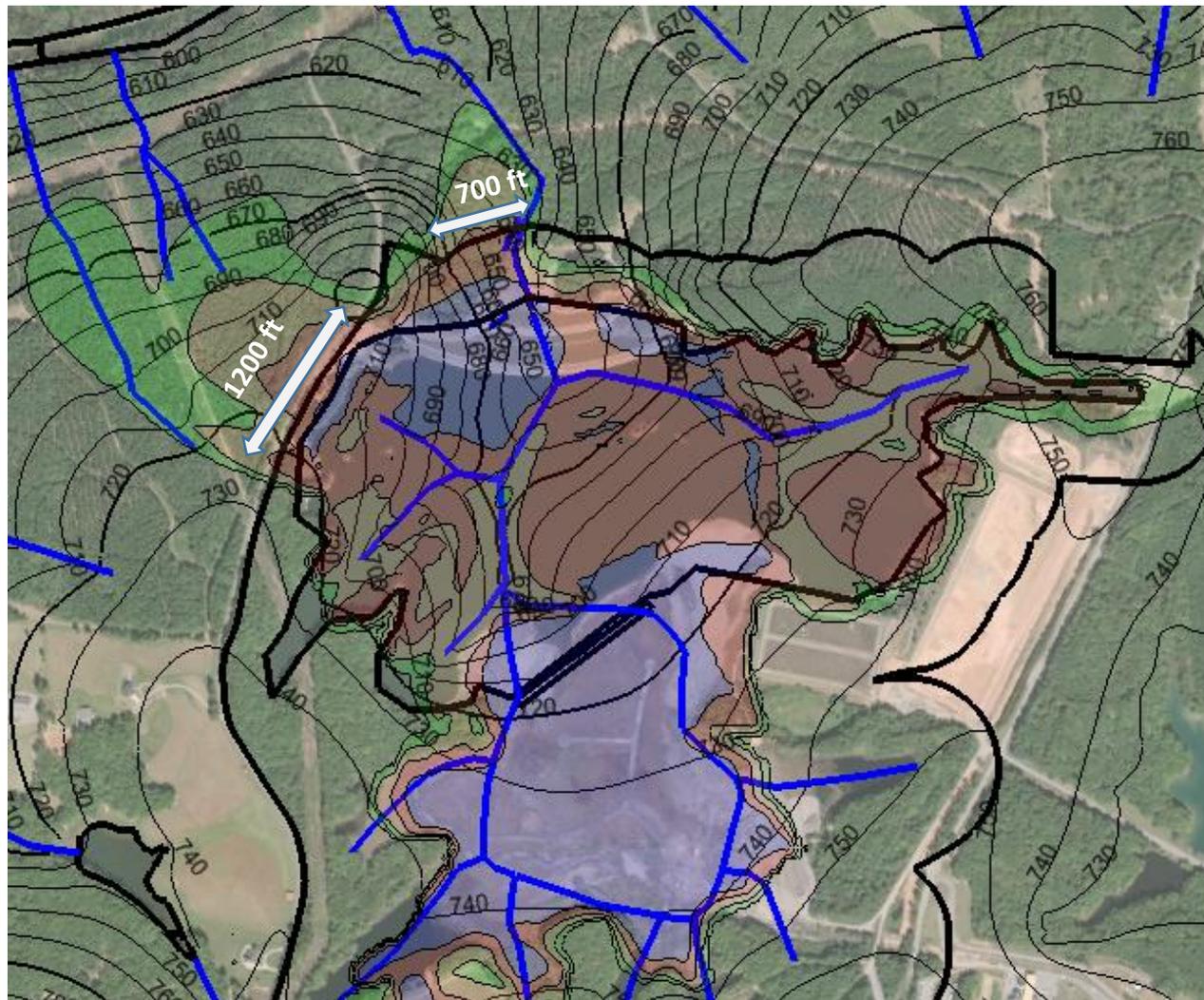
BELEWS CREEK **FINAL COVER, 2150, t = 125 years**

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



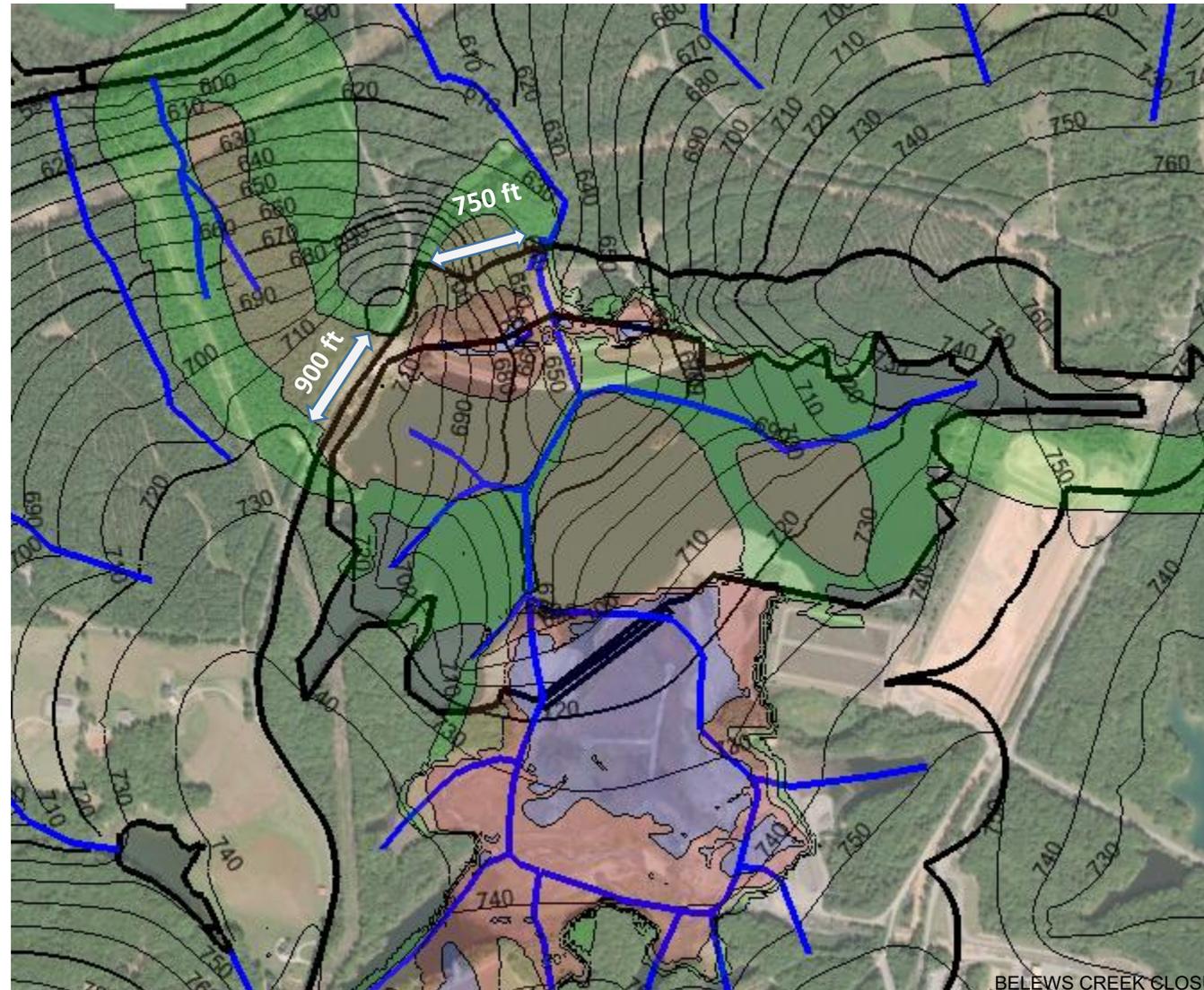
BELEWS CREEK **UPON COMPLETION OF HYBRID IN 2032, t = 0**

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



BELEWS CREEK **HYBRID, 2150, t = 118 years**

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



BELEWS CREEK **CURRENT CONDITIONS IN 2017**

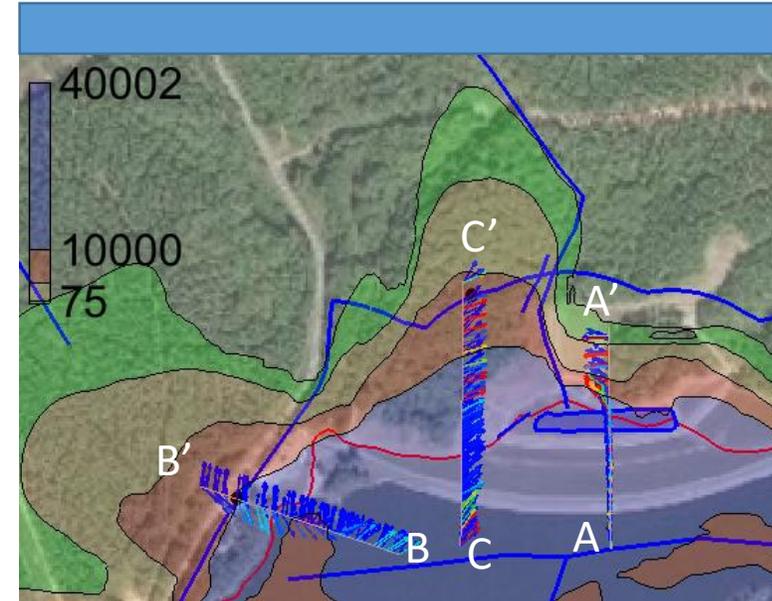
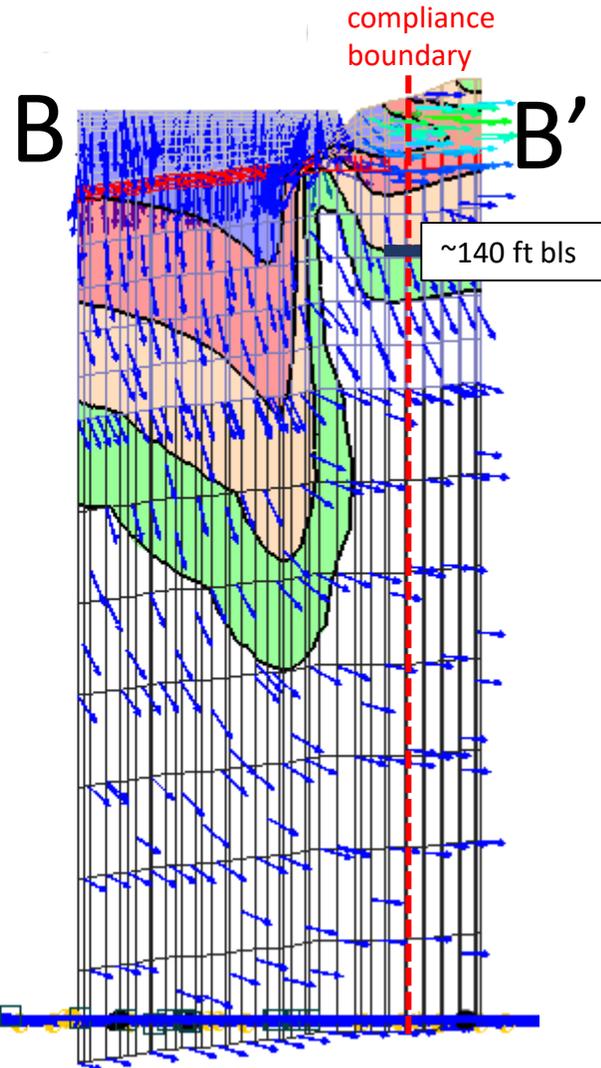
CROSS SECTION B-B' (VIEWED FROM DAM LOOKING SW)

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

Belews Creek model layers:

- Ash 1-9
- Saprolite 10-14
- TZ 15
- Bedrock 16-27

Vertical
exaggeration X 3



- A-A' 850 ft
- B-B' 850 ft
- C-C' 1000 ft

BELEWS CREEK **UPON COMPLETION OF FINAL COVER, t = 0**

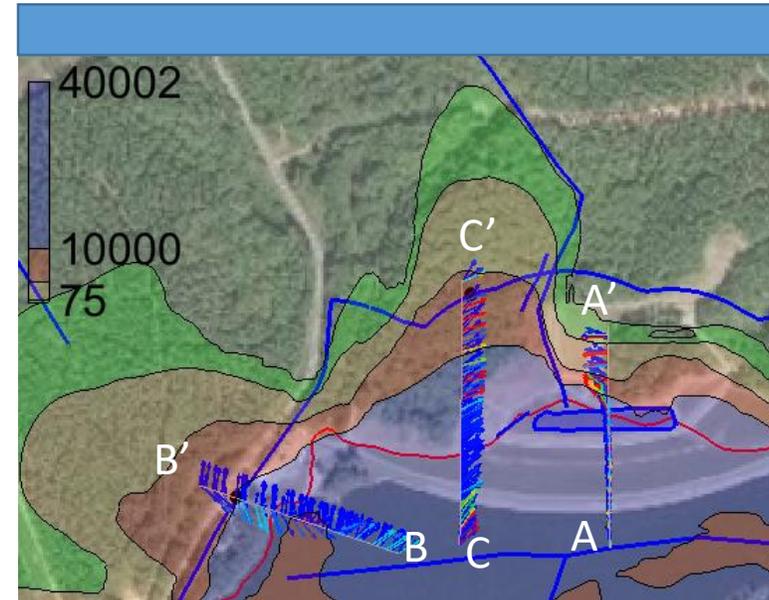
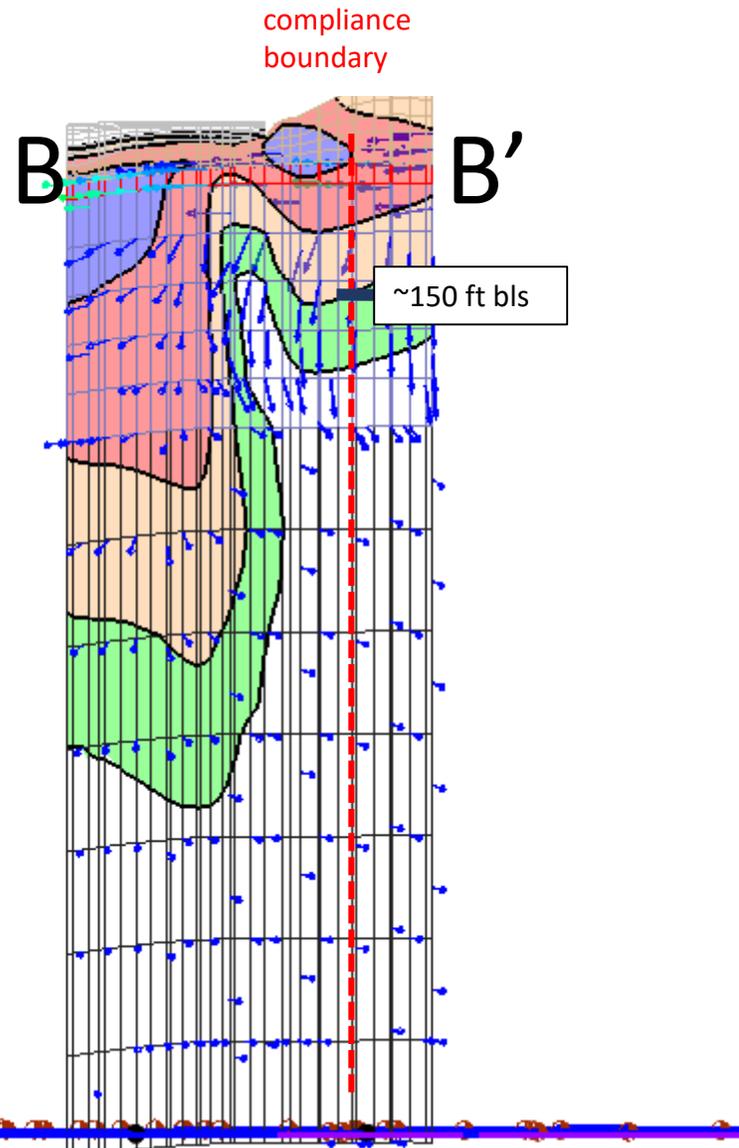
CROSS SECTION B-B' (VIEWED FROM DAM LOOKING SW)

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

Belews Creek model layers:

- Ash 1-9
- Saprolite 10-14
- TZ 15
- Bedrock 16-27

Vertical
exaggeration X 3



- A-A' 850 ft
- B-B' 850 ft
- C-C' 1000 ft

BELEWS CREEK **FINAL COVER, t = 125 years**

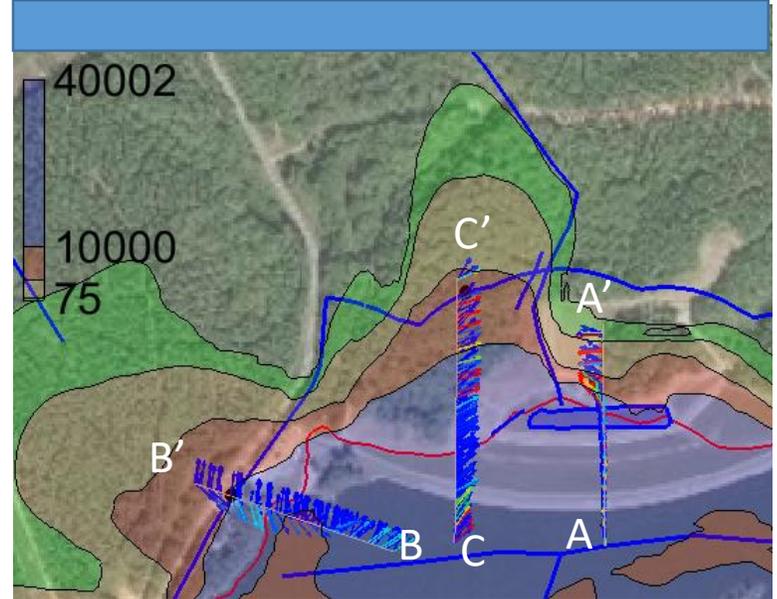
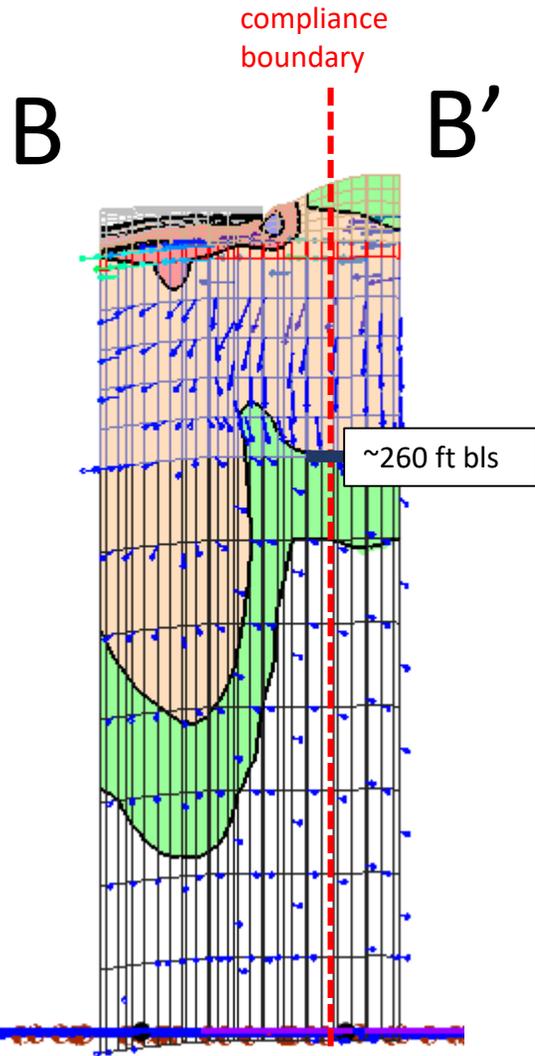
CROSS SECTION B-B' (VIEWED FROM DAM LOOKING SW)

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

Belews Creek model layers:

- Ash 1-9
- Saprolite 10-14
- TZ 15
- Bedrock 16-27

Vertical
exaggeration X 3



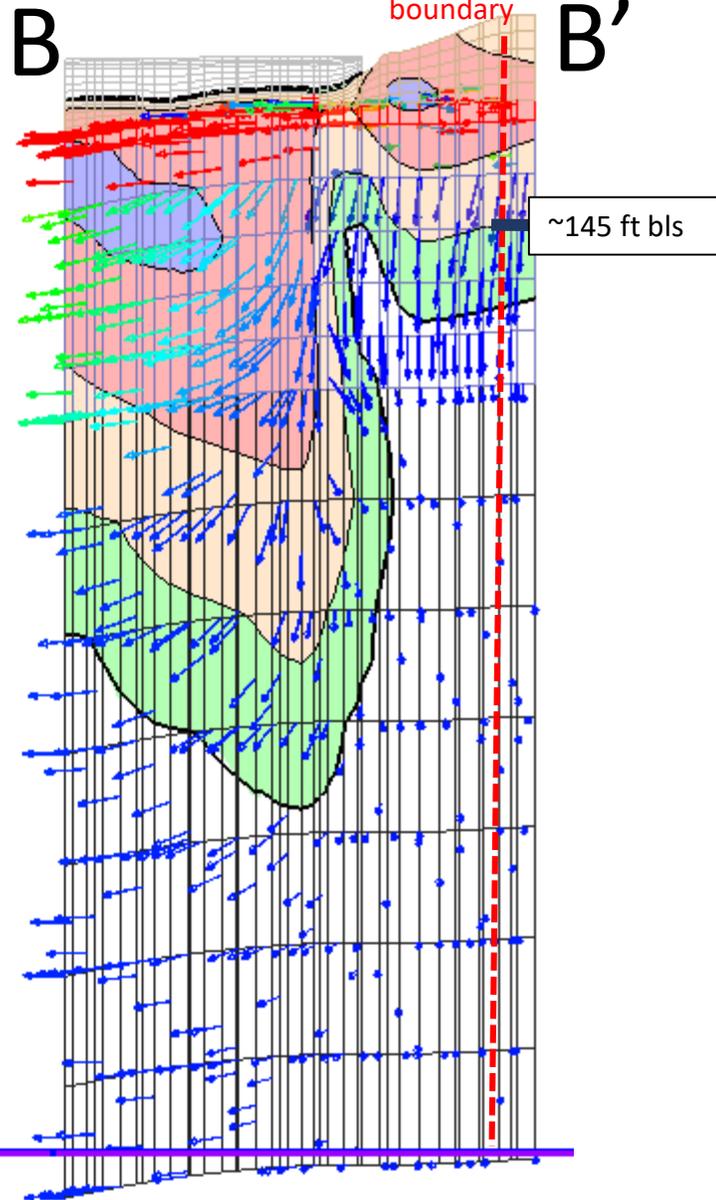
- A-A' 850 ft
- B-B' 850 ft
- C-C' 1000 ft

BELEWS CREEK **UPON COMPLETION OF HYBRID, t = 0**

CROSS SECTION B-B' (VIEWED FROM DAM LOOKING SW)

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

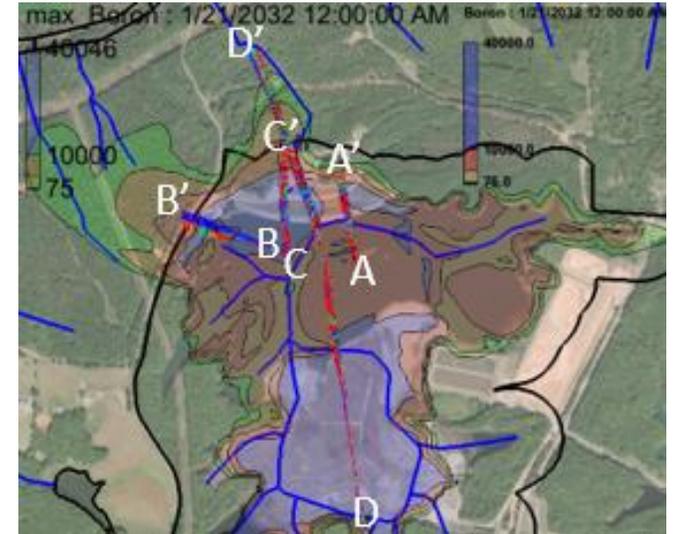
compliance boundary



Belews Creek model layers:

- Ash 1-9
- Saprolite 10-14
- TZ 15
- Bedrock 16-27

Vertical
exaggeration X 3



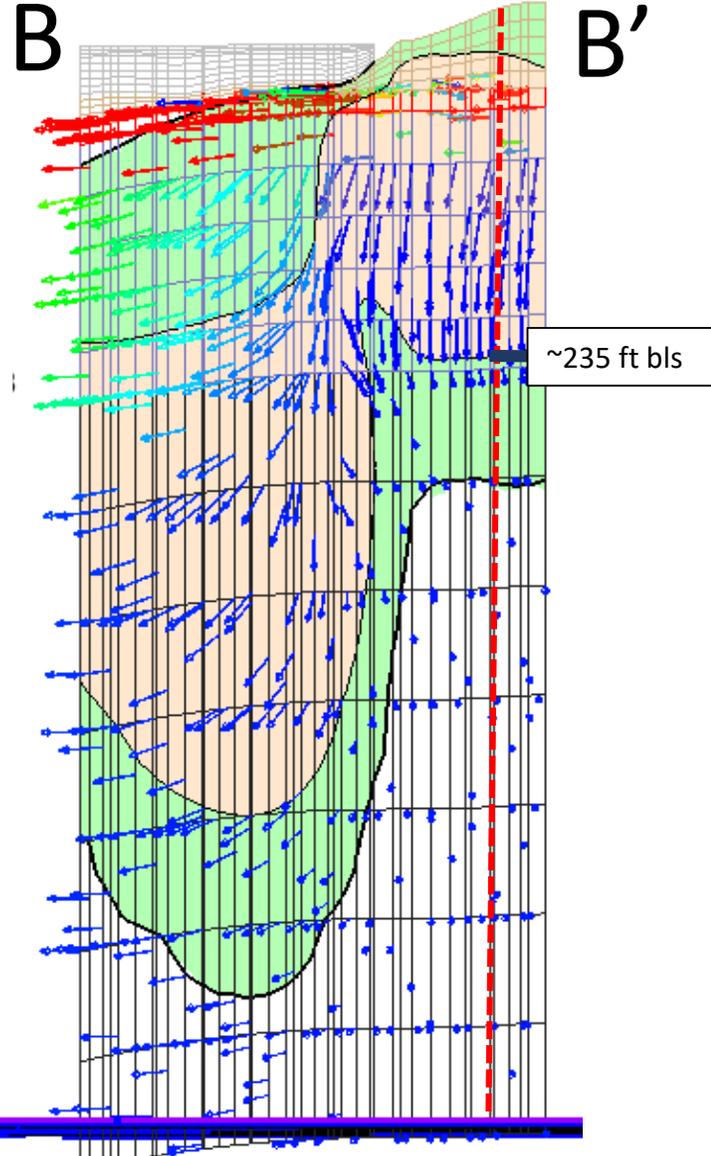
- A-A' 850 ft
- B-B' 850 ft
- C-C' 1000 ft
- D-D' 6000 ft

BELEWS CREEK **HYBRID, t = 118 years**

CROSS SECTION B-B' (VIEWED FROM DAM LOOKING SW)

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

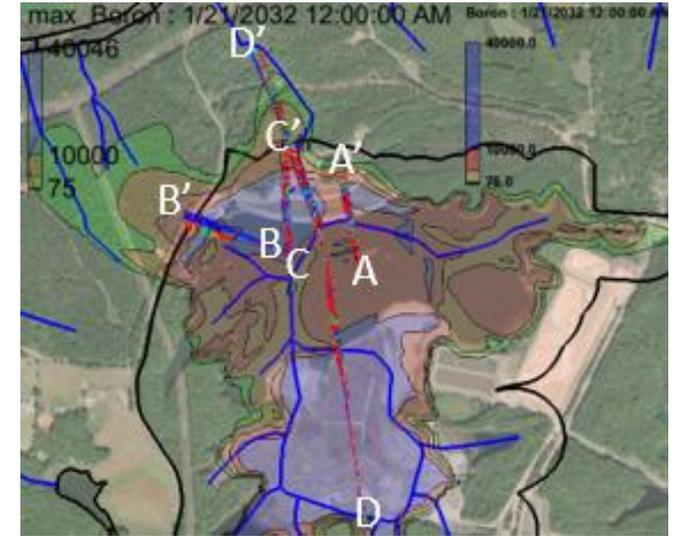
compliance
boundary



Belews Creek model layers:

- Ash 1-9
- Saprolite 10-14
- TZ 15
- Bedrock 16-27

Vertical
exaggeration X 3



- A-A' 850 ft
- B-B' 850 ft
- C-C' 1000 ft
- D-D' 6000 ft

BELEWS CREEK **CURRENT CONDITIONS IN 2017**

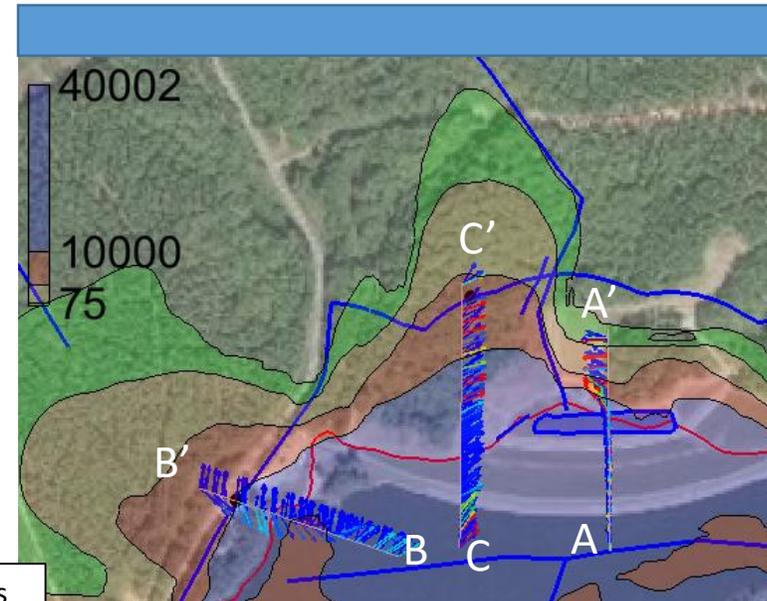
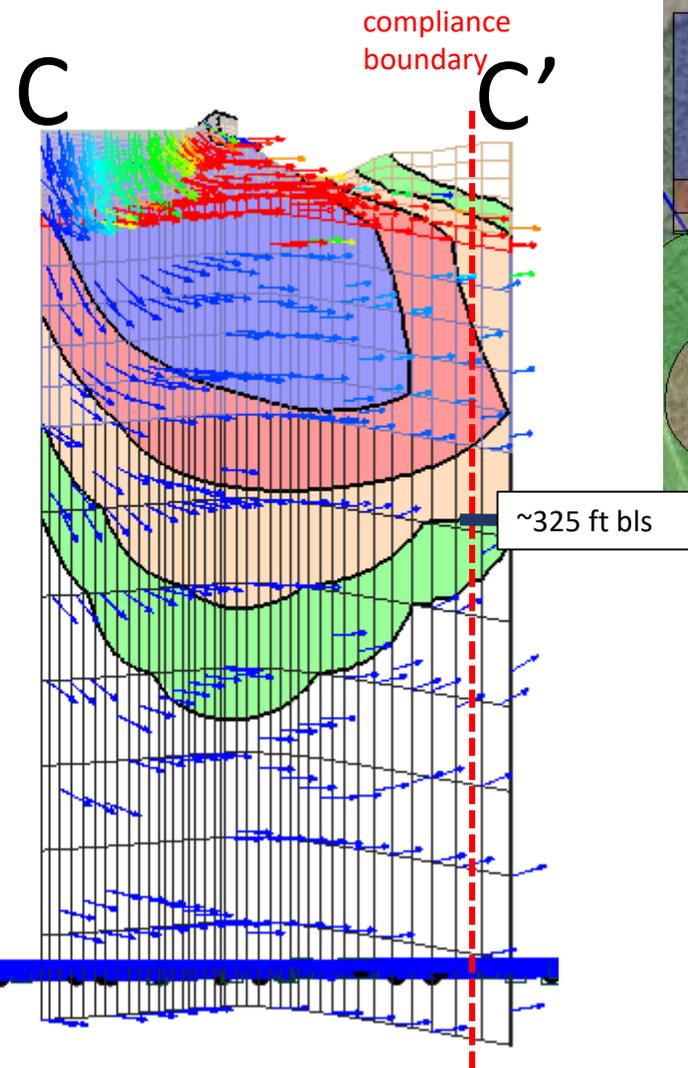
CROSS SECTION C-C' (VIEWED FROM E SIDE OF BLANKET DRAIN LOOKING WEST)

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

Belews Creek model layers:

- Ash 1-9
- Saprolite 10-14
- TZ 15
- Bedrock 16-27

Vertical
exaggeration X 3



- A-A' 850 ft
- B-B' 850 ft
- C-C' 1000 ft

BELEWS CREEK **UPON COMPLETION OF FINAL COVER, t = 0**

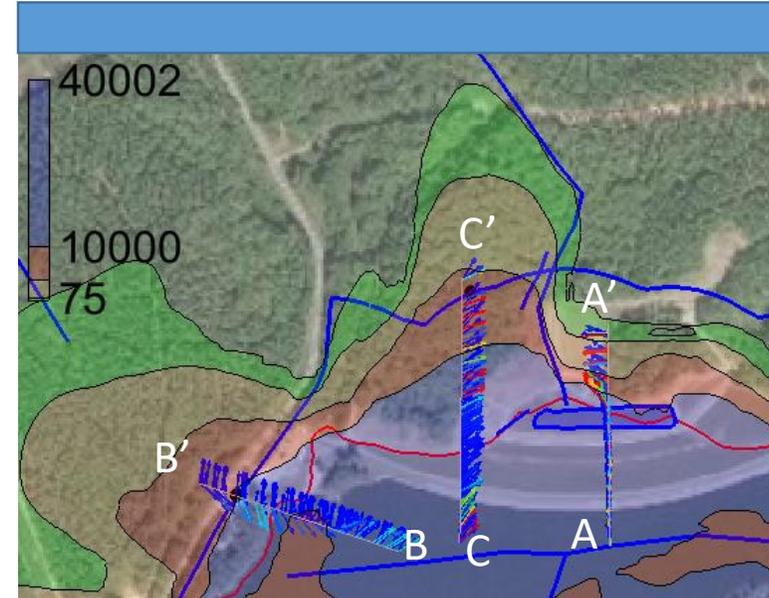
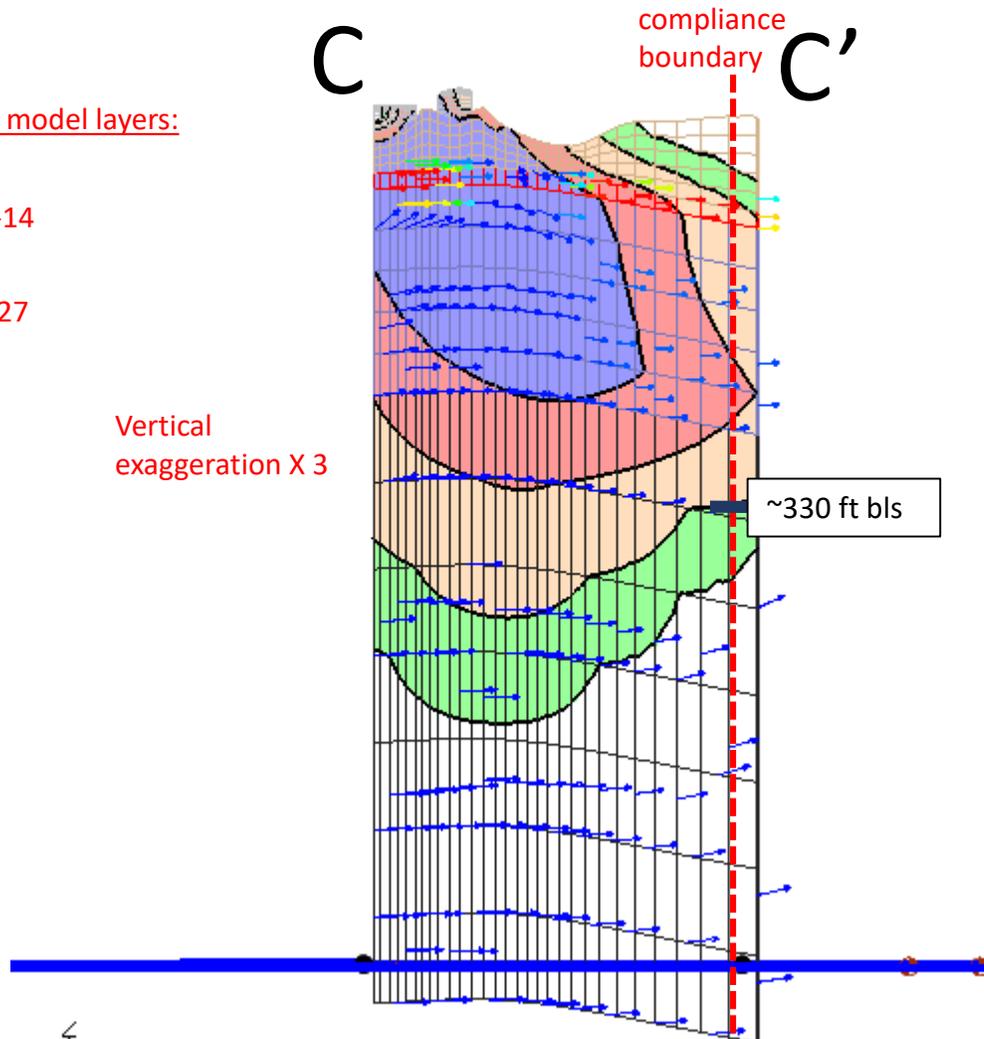
CROSS SECTION C-C' (VIEWED FROM E SIDE OF BLANKET DRAIN LOOKING WEST)

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

Belews Creek model layers:

- Ash 1-9
- Saprolite 10-14
- TZ 15
- Bedrock 16-27

Vertical
exaggeration X 3



- A-A' 850 ft
- B-B' 850 ft
- C-C' 1000 ft

BELEWS CREEK **FINAL COVER, t = 125 years**

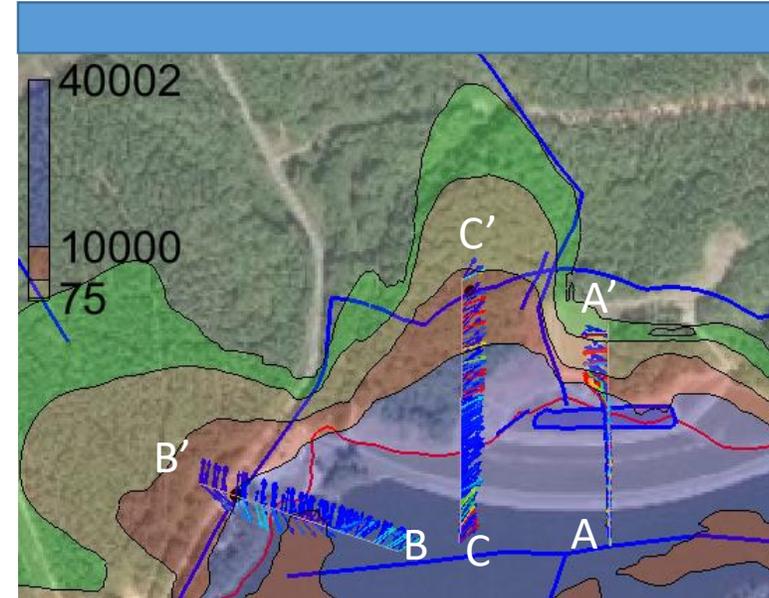
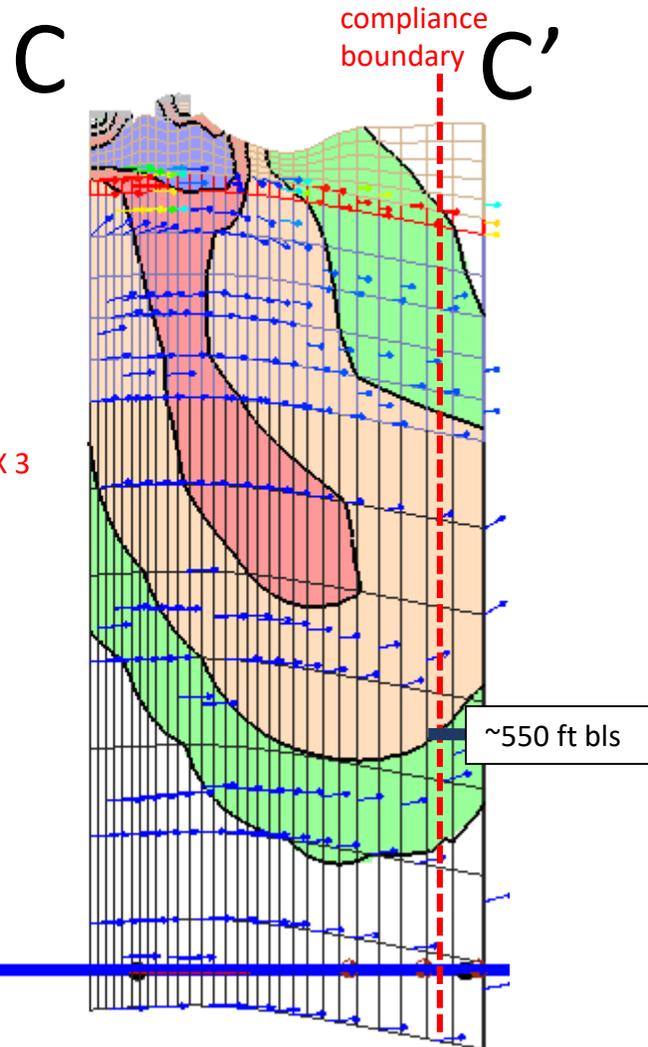
CROSS SECTION C-C' (VIEWED FROM E SIDE OF BLANKET DRAIN LOOKING WEST)

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

Belews Creek model layers:

- Ash 1-9
- Saprolite 10-14
- TZ 15
- Bedrock 16-27

Vertical
exaggeration X 3



- A-A' 850 ft
- B-B' 850 ft
- C-C' 1000 ft

BELEWS CREEK **UPON COMPLETION OF HYBRID, t = 0**

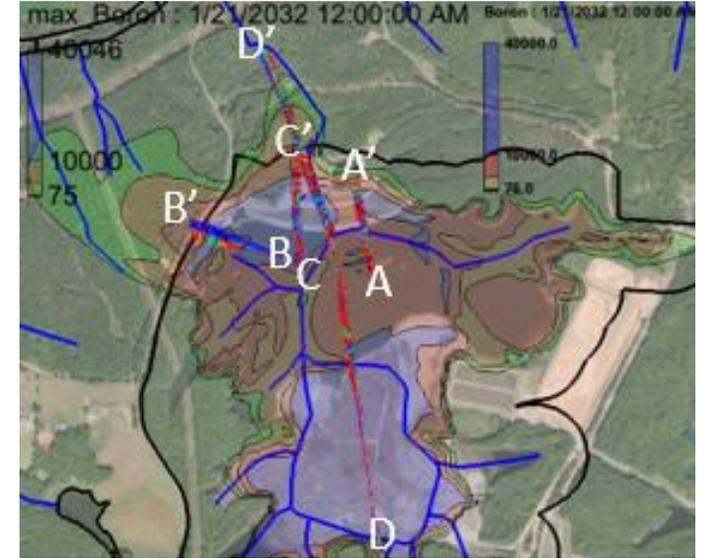
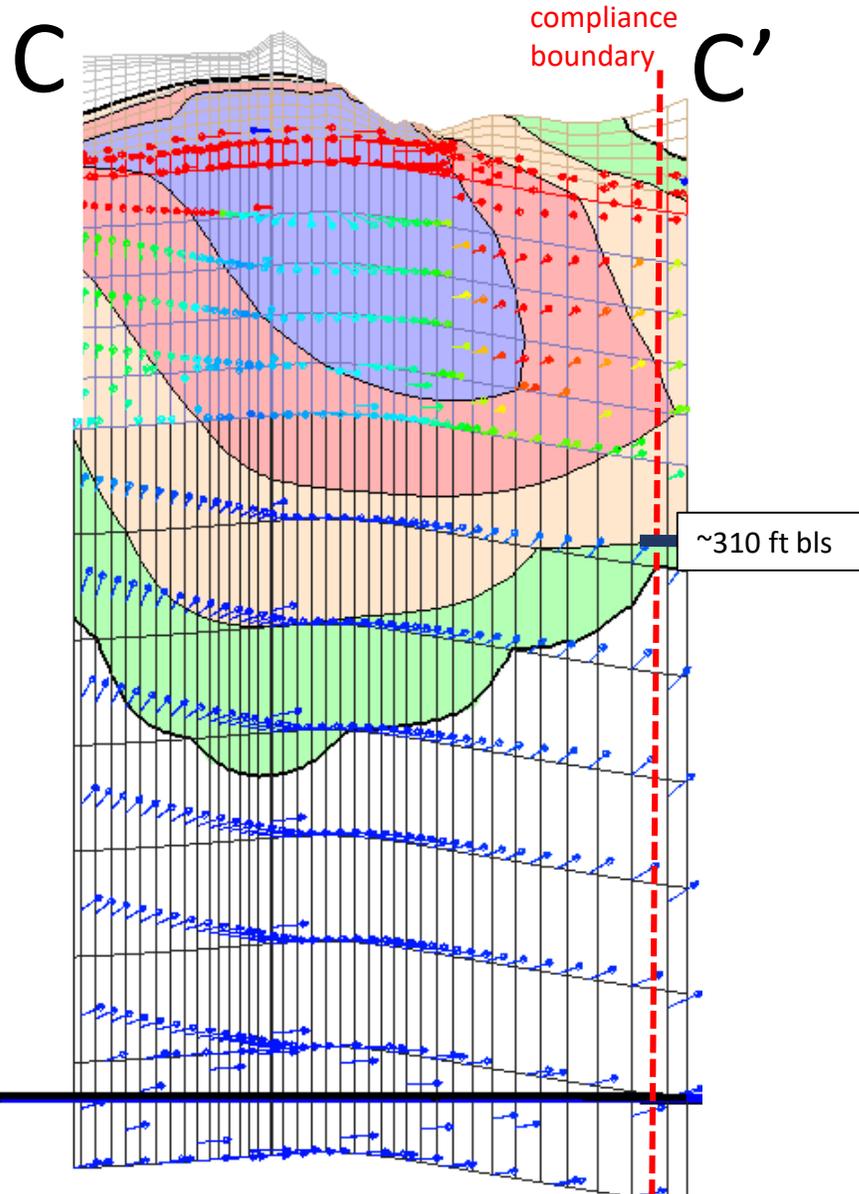
CROSS SECTION C-C' (VIEWED FROM E SIDE OF BLANKET DRAIN LOOKING WEST)

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

Belews Creek model layers:

- Ash 1-9
- Saprolite 10-14
- TZ 15
- Bedrock 16-27

Vertical
exaggeration X 3



- A-A' 850 ft
- B-B' 850 ft
- C-C' 1000 ft
- D-D' 6000 ft



BELEWS CREEK HYBRID, t = 118 years

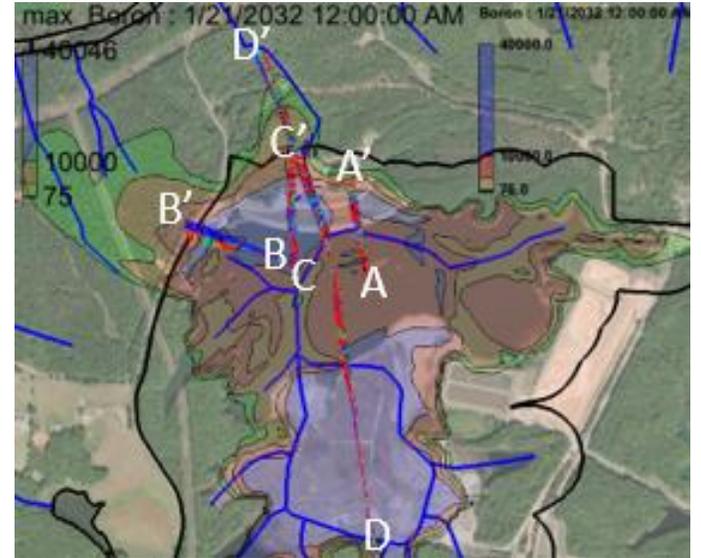
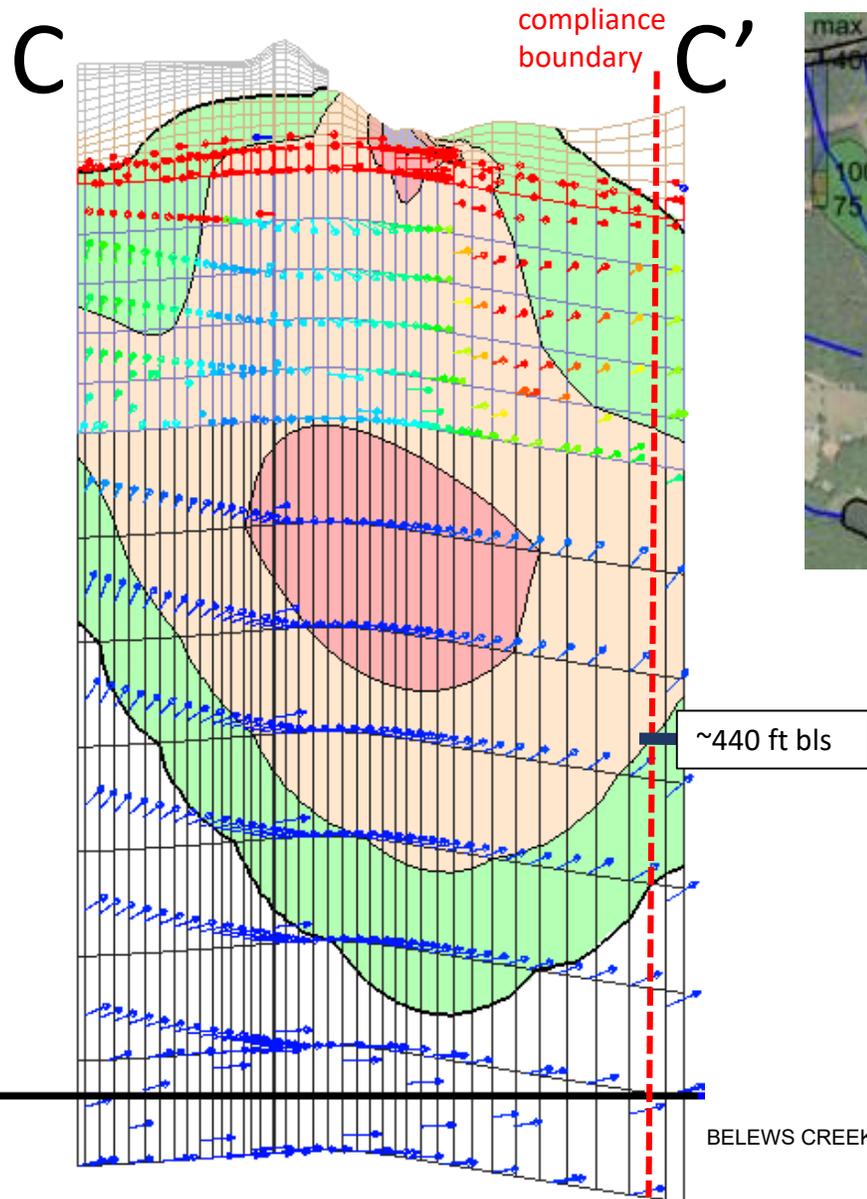
CROSS SECTION C-C' (VIEWED FROM E SIDE OF BLANKET DRAIN LOOKING WEST)

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

Belews Creek model layers:

- Ash 1-9
- Saprolite 10-14
- TZ 15
- Bedrock 16-27

Vertical
exaggeration X 3



- A-A' 850 ft
- B-B' 850 ft
- C-C' 1000 ft
- D-D' 6000 ft



ATTACHMENT B
RESPONSE TO COMMENTS

RESPONSE TO COMMENTS

I. Summary of Responses to Comments

The North Carolina Department of Environmental Quality (NCDEQ) received approximately 1052 public comments regarding the Belews Creek Steam Station Ash Basin Closure Options. Closure options considered at Belews Creek generally include closure-in-place, closure-by-removal and hybrid closure. Comments received by NCDEQ include emails, letters, two petitions (containing 275 and 340 signatures respectively) and video submissions. All but one of the comments support full excavation of all ash materials from the ash basin.

The majority of the comments support closure by removal to a lined landfill without specifying the location of the landfill. A sizeable minority specifically recommend excavating coal ash and moving it to a lined onsite landfill, although one commenter expressed concern about the onsite clear cutting of trees that may be required at Belews Creek to build the landfill. A small minority of commenters want the coal ash moved out of state. No commenter supports the hybrid closure option. No commenter unequivocally supports closure-in-place. However, one commenter registered qualified support for this option. Several commenters support recycling coal ash for various commercial product uses. A discussion of these and other related comments follow.

II. Detailed Responses to Comments

A. Closure-In-Place

No comments were received which unequivocally favored closure-in-place. Of the approximately 1,052 comments received, all but one expressly opposed closure-in-place. Many commenters stated specific reasons for their opposition. The reasons cited in opposition to closure-in-place include: water quality concerns, including concern that portions of the coal ash basin are located in the groundwater below the water table and that the ash basin was built on top of existing streams; concerns about increased risk of adverse health impacts, including cancer, respiratory and other illnesses; concerns regarding Duke Energy's motives for proposing closure-in-place; concerns regarding Duke Energy's credibility (citing Duke Energy's recent history of criminal violations); concerns about climate-related impacts on coal ash closed in place, including hurricanes and tropical storms; concerns for natural resources impacts, including both plant and animal life; concerns about recreational activities involving natural resources such as boating, swimming and fishing; concerns about fair and equal safety protections from the effects of coal ash for the Belews Creek area, citing coal ash removal and storage in lined landfills in South Carolina, Virginia and at eight other coal ash sites in North Carolina; concerns that closure-in-place both violates state and federal statutes and regulations and also grants Duke Energy arbitrary and capricious preferential treatment in a manner that is not granted to anyone else; concerns over the effectiveness and costs of oversight of long-term monitoring; concerns that closure-in-place sends the wrong message to businesses and persons considering relocation to North Carolina by adversely impacting the reputation of North Carolina nationally, including the negative impact on both property values and the desirability of North Carolina as a place for business relocation; concerns about general impacts to future generations, including "kicking the

problem down the road”; concerns about environmental justice issues and adverse impacts on minorities and the poor; concerns that Duke Energy is avoiding a real financial cost of coal generated electricity such that the market cannot make accurate cost comparisons to other energy sources; concerns about adverse effects on tourism; concerns about the adverse impacts on the fisheries industry; concerns about the health and safety risks associated with dam failure; concerns that the overwhelming majority of public comments opposing closure-in-place must be heard and followed.

Response: DEQ elects CAMA Option A (excavation and disposal to a lined landfill). DEQ does not elect closure-in-place under CAMA Option B or C.

One commenter equivocally supported closure-in-place under certain conditions. That comment is summarized below.

Comment: One commenter indicated that closure-in-place could potentially be a viable option, but did not support the specific proposal for closure-in-place presented by Duke Energy. He commented that the Duke Energy closure-in-place option allows for saturated pond ash deposits to remain, thus creating a “wet cap” closure-in-place. He stated his opinion that additional study, monitoring and safeguards would be needed to see if a different closure-in-place option could comply with applicable regulations and be safely utilized. He recommended a potential closure-in-place that steadily dewateres the coal ash impoundment, monitors the results from the dewatering over several months and uses the collected data to verify or update groundwater modeling at the site. The collected data and modeling would determine if closure-in-place is viable and if not, then closure-by-removal could be employed.

Response: NCDEQ rejects the closure-in-place option and elects excavation under CAMA Option A for Belews Creek. The excavated coal ash will be placed in a lined landfill.

B. Hybrid Option

No comments were received supporting the hybrid option. Several comments expressly opposed the hybrid option for many of the reasons cited in opposition to closure-in-place, including but not limited to health and safety concerns, water quality concerns, concerns about the natural environment and concerns that the problem was being left for future generations.

Response: DEQ elects CAMA Option A (excavation and disposal to a lined landfill). DEQ does not elect closure-in-place under CAMA Option B or C.

C. Closure-By-Removal

1. Closure-by-Removal With No Location Specified

Comment: Approximately 956 commenters stated in a form email that they were supportive of closure-by-removal to a dry lined landfill. The comment in that form email states the following:

“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: NCDEQ rejects the closure-in-place option and elects excavation under CAMA Option A for Belews Creek.

2. Closure-By-Removal to Lined Onsite Landfill

Comment: Approximately 51 comments were submitted using a second form email. These commenters supported the closure-by-removal of coal ash from unlined pits and placing it in dry, lined storage located on Duke Energy property away from Little Belews Creek and the Dan River:

- 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 Little Belews Creek and the Dan River.
- Duke Energy plans to leave its coal ash sitting in the groundwater at Belews Creek, where it will keep polluting our groundwater, lakes, streams and rivers. Recent monitoring shows Duke Energy is polluting the groundwater surrounding Belews Creek with toxic 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 a safe, lined landfill. Ash need not travel through the community or to other communities.
- Duke Energy cannot exaggerate traffic concerns while downplaying the community's real concern: Duke Energy's water pollution. Excavation will not significantly increase offsite trucking if Duke Energy uses an onsite landfill, 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 would be minimal. Duke Energy's consultant estimates that 110 trucks currently travel near Belews Creek on community roads every day. Excavation to onsite storage would add only two more trucks on community roads each day, compared to six 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: NCDEQ has determined that closure-by-removal is the best closure option for Belews Creek. The excavated coal ash will be placed in a lined landfill. The location of the lined landfill will be determined at a later date; landfill location should be addressed in the proposed closure plan which must be submitted by August 1, 2019.

D. Other Comments

1. Comment Addressing Fairness and Consistency

Comment: Many commenters, in form emails, individualized emails, submitted petitions and video submissions, voiced their concern that persons in the Belews Creek area be treated fairly and consistently with other persons both in the state and in the region regarding the risks of coal ash. They noted that coal ash is being removed at eight other sites in North Carolina, all Duke Energy sites in South Carolina and that coal ash is being removed in Virginia. The commenters assert that their community deserves the same protections with respect to the treatment of coal ash.

Response: NCDEQ has determined that closure-by-removal is the best closure option for Belews Creek. The excavated coal ash will be placed in a lined landfill.

2. Comment Addressing Cost and Accountability

Comment: Several commenters stated that Duke Energy should have to pay for all costs associated with the removal and storage of coal ash in dry lined landfill. Commenters pointed to Duke Energy's recent criminal record and Duke Energy's decision to create the situation in the first place. Several commenters stated that Duke Energy created the mess and Duke Energy should clean up the mess. Some commenters supported sharing the costs with taxpayers. Other

commenters emphasized that the coal ash must be removed and that the responsibility for costs was a secondary issue.

Response: NCDEQ has not been granted statutory authority to determine who will pay the costs associated with closure-by-removal at Belews Creek, including costs associated with storage of excavated coal ash in a lined landfill.

3. Comment Addressing the Recycling of Coal Ash

Comment: Several commenters proposed the recycling of coal ash. They proposed various means by which recycling could occur, including encasing in cement bricks, concrete, placing in wall board and other proposed uses. One commenter stated that Duke Energy could extract the usable portion of coal ash, fly ash, and put it to productive use instead of disposing of it. Another commenter stated that Duke Energy's failure to process ash such that it could be recycled has resulted in ash being imported from other countries for use in products in the United States. Another commenter emphasized the importance of researching and developing new uses for recycled ash. One commenter proposed the ash be stored in a lined basin in a manner such that the ash could be accessed for recycling in the future.

Response: The proposed closure plan, which must be submitted not later than August 1, 2019, may provide additional information on several issues involved with closure-by-removal, including whether Duke Energy plans to recycle coal ash excavated at Belews Creek. Pursuant to the requirements of the Coal Ash Management Act, the public will receive notice of the proposed closure plan and given the opportunity to comment.

4. Comments Addressing Landfill Design, Groundwater Monitoring and Safety of Workers Engaged In Removal of Ash and Construction of Lined Landfill

Comment: Several commenters expressed the need for the protection of worker safety during the removal of the coal ash, the construction of a dry lined landfill and during the placement of ash into the new landfill. Commenters proposed that appropriate particulate masks should be worn, removal precautions should be taken, OSHA inspections should be performed and protective suits should be worn as necessary.

Response: Duke Energy will be required to meet all applicable legal statutes and regulations addressing worker safety at Belews Creek. Generally, the statutory authority to regulate worker safety laws is vested in state and federal agencies other than NCDEQ.

Comment: Several commenters emphasized the importance of careful, independent research and analysis of the best options for long term storage, including emphasis on the use of best technologies and not focusing on short term savings. The landfills should be built above minimum standards with long-term safeguards, use of best liner technologies, the inclusion of redundant liners and the placement of the landfill should be based on best science after investigation and ongoing monitoring of groundwater, away from rivers, lakes and aquifers. One commenter proposed double lining to include two feet of clay on the exterior with durable lining impervious to water.

Response: The proposed closure plan, which must be submitted not later than August 1, 2019, may provide additional information on several issues involved with closure-by-removal,

including whether Duke Energy plans to recycle coal ash excavated at Belews Creek. Pursuant to the requirements of the Coal Ash Management Act, the public will receive notice of the proposed closure plan and given the opportunity to comment.

Comment: Several commenters emphasized the importance of ongoing monitoring of groundwater and voiced skepticism regarding the reliability of monitoring by Duke Energy. One commenter proposed that monitoring results should be full, public and transparent, with results accessible by internet and in other ways easy for the public to access. Another commenter proposed independent third-party verification in some instances of data produced by Duke Energy. One commenter proposed that Duke Energy be required to monitor all necessary data without “cherry picking” what to monitor in order to avoid liability.

Response: The proposed closure plan, which must be submitted not later than August 1, 2019, may provide additional information on several issues involved with closure-by-removal, including whether Duke Energy plans to recycle coal ash excavated at Belews Creek. Pursuant to the requirements of the Coal Ash Management Act, the public will receive notice of the proposed closure plan and given the opportunity to comment.

5. Comments Addressing Environmental Justice

Comment: Several commenters raised concerns regarding environmental justice issues. They were concerned that minorities and poor communities bear a disproportionate amount of the negative health and economic consequences resulting from coal ash. They expressed concern that these negative impacts affect a portion of the population that has the least voice to respond.

Response: NCDEQ has determined that closure-by-removal is the best closure option for Belews Creek. The excavated coal ash will be placed in a lined landfill.

6. Comments Addressing Health, Safety And Natural Resources Damage Associated With Potential Dam Failure At The Belews Creek Ash Basin

Comment: Several commenters expressed concern about the potentially catastrophic health and safety risks associated with dam failure at the Belews Creek ash basin. Commenters expressed concern about the potential loss of human life, destruction of property and the destruction of water quality and natural resources (including both plant and animal life).

Response: The excavated coal ash will be placed in a lined landfill. The proposed closure plan for Belews Creek, which must be submitted not later than August 1, 2019, should provide specific information relevant to this comment, including Duke Energy’s plans to address the Belews Creek ash basin dam. Pursuant to the requirements of the Coal Ash Management Act, the public will receive notice of the proposed closure plan and given the opportunity to comment.