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December 30, 2019

Ms. Sheila Holman  
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North Carolina Department of Environmental Quality  
1611 Mail Service Center  
Raleigh, North Carolina 27699-1611

Subject: Submittal of Ash Basin Closure Plan and Corrective Action Plan Update  
Rogers Energy Complex (Cliffside)

Dear Ms. Holman:

In accordance with the requirements of N.C.G.S. §§ 130A-309.211(b) and .214(a)(4), Duke Energy provides the following documents: (1) a plan for basin closure by excavation, and (2) a corrective action plan (CAP) for the Cliffside site, which will address groundwater impacts within 9 years of full-scale operation, regardless of the specific closure method.

#### **Closure by Excavation**

The enclosed excavation plan is in response to NCDEQ's April 1 order requiring excavation of the Cliffside coal ash basins. After regulatory approval, excavating the basin ash would require 8 years to move the ash to a new lined landfill within plant property. The landfill would be located next to the existing lined landfill south of McCraw Road and rise about 170 feet above the road.

#### **Continuing to Protect Water Resources**

Robust scientific study, conducted under the direction of NCDEQ, demonstrates that drinking and recreational water supplies around the Cliffside facility are well-protected from coal ash impacts and will only continue to improve during and after closure. Ongoing research and monitoring also provide a detailed understanding of groundwater conditions at the site, indicating that the impact is highly localized and will be addressed through the planned corrective action approach. The CAP designed for Cliffside will achieve groundwater remediation through a combination of strategically placed groundwater extraction wells coupled with clean water infiltration wells, the installation of Tree Well™ technology, and installation of a groundwater collection.

Prior to submission, the closure plan was reviewed by the National Ash Management Advisory Board (NAMAB), which consists of nationally and internationally recognized and published experts with practical experience working with and for the private sector, federal government, and academia. NAMAB helped develop the guiding principles for safe basin closure and their feedback is incorporated herein.

Duke Energy remains committed to safely and permanently closing basins in ways that continue to protect people and the environment and welcomes the opportunity to work constructively with NCDEQ to move forward.

Ms. Sheila Holman  
December 30, 2019  
Submittal of Ash Basin Closure Plan and Corrective Action Plan Update  
Rogers Energy Complex (Cliffside)  
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Sincerely,



Paul Draovitch  
Senior Vice President  
Environmental, Health & Safety

Enclosure:

- Corrective Action Plan Update
- Closure by Excavation Closure Plan

**Duke Energy Cliffside Steam Station  
Inactive Unit 5 Ash Basin  
COAL COMBUSTION RESIDUALS SURFACE IMPOUNDMENT  
CLOSURE PLAN (Closure by Excavation)  
Revision 0**

Prepared for



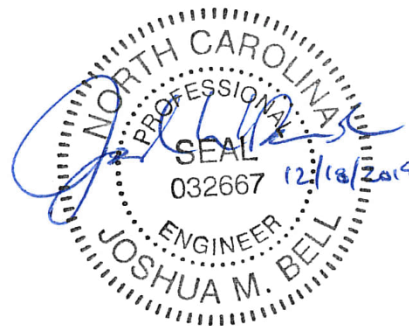
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## EXECUTIVE SUMMARY

As required by the North Carolina Department of Environmental Quality's (NCDEQ) April 1, 2019 "Coal Combustion Residuals Surface Impoundment Closure Determination," (Closure Determination) Duke Energy has prepared this Closure Plan to describe the closure of the Inactive Unit 5 Ash Basin at Rogers Energy Complex (Cliffside Station). This plan details closure by excavation of the Inactive Unit 5 Ash Basin (U5B) and placement of the excavated coal combustion residuals (CCR) in the permitted, on-site CCR landfill. The excavation of CCR and the closure of the U5B will be in accordance with applicable provisions of the North Carolina Coal Ash Management Act of 2014, as amended (CAMA), (codified at N.C.G.S. § 130A-309.200 et seq.), and the federal Disposal of Coal Combustion Residuals from Electric Utilities rule (CCR Rule) (codified at 40 C.F.R. § 257.50 et seq.).

Cliffside Station is located at 573 Duke Power Road, Mooresboro, North Carolina. The Station is approximately 55 miles west of Charlotte and about 1 ½ miles south of the town of Cliffside, North Carolina. The Station is situated along the southern bank of the Broad River in Rutherford and Cleveland Counties and is approximately 1,000 acres in area. Cliffside Station consists of two coal and natural gas fired electric generating units with a combined generating capacity of 1,387 megawatts.

CCR was previously collected from the generating units and conveyed by hydraulic methods for disposal within permitted basins located on the station site. CCR is currently collected from the generating units and conveyed by pneumatic (dry) handling methods into storage silos, loaded into trucks and then transported for disposal within the on-site CCR landfill.

Cliffside Station historically operated three unlined impoundments, the Active Ash Basin (AAB), Unit 5 Inactive Ash Basin (U5B), and Units 1-4 Inactive Ash Basin. The approximately 86-acre AAB was constructed in 1980. The approximately 46-acre U5B was constructed in 1970. Units 1-4 Inactive Ash Basin was closed in March 2018 by removal of CCR and is not covered in this closure plan.

The U5B includes two dams known as the Inactive Ash Basin Unit 5 Main Dam (RUTHE-070) and Inactive Ash Basin Unit 5 Saddle Dam (RUTHE-072). The Inactive Unit 5 Ash Basin was constructed in 1969 and 1970 and retired in 1980. Storm water drainage is currently released through a primary discharge outlet located at the Main Dam to the Broad River.

The U5B is unlined and contains up to 92 feet of ash. Based on CCR Inventory Data provided by Duke as of July 31, 2019, the U5B is estimated to contain 1.96 million cubic yards of CCR, or approximately 2.36 million. The estimates are approximate because they are based on assumed pre-basin grades.

Closure activities for the Basins have already begun with the initiation of decanting under the Special Order by Consent (SOC). Upon approval of the Closure Plan by NCDEQ additional actions will commence, including finalization of detailed designs, dewatering and removal of interstitial water, contracting and detailed planning for the closure work, expansion of the existing

CCR landfill, excavation of the CCR, final grading of the site and landfill, and development of storm water features and vegetative covers.

**Figures ES-1** and **ES-2** illustrate the current state, and post-closure state of the U5B as detailed by this Closure Plan.



**Figure ES-1 Current View**



**Figure ES-2 Post Closure View**

The U5B CCR will be removed to a new lined landfill on the Station property, located adjacent to the current landfill south of McCraw Road. The landfill would rise approximately 170 feet above McCraw Road. Post-excavation, the U5B site will resemble the land's valley shape before the basin was created. Soil will be graded to restore contours for stormwater flows, then planted with native grasses for erosion control. The existing U5B dam will be partially removed, and stormwater flows will then make their way to the Broad River.

This document also includes a description of the Post-Closure Plan, which will describe the inspection, monitoring, and maintenance activities required to be performed throughout the 30-year post-closure care period for the closed basins at the Cliffside Station.

This document summarizes properties of the site, as well as geotechnical properties of CCR and natural soils to support engineering analyses of the closure design. These analyses indicate that closure by excavation, as detailed in the Closure Plan, meets regulatory requirements for the stability of the site, management of storm water run-off, and access for effective maintenance over the post-closure care period. The U5B dam is proposed to be removed or breached as part of closure and removed from the state's regulatory jurisdiction inventory.

In accordance with the requirements of N.C.G.S. § 130A-309.211(b)(1), Duke Energy separately submitted an updated Corrective Action Plan (CAP) in parallel with this Closure Plan; the updated CAP is herein incorporated in its entirety by this reference. Neither the updated CAP nor its content is the work product of Wood. Although the Closure Plan contains references to the updated CAP, all specific relevant details to groundwater and related actions are found in the updated CAP itself and not in this Closure Plan.



As detailed in the updated CAP, Duke Energy (i) will complete ash basin closure; and (ii) intends to implement a groundwater extraction system. The CAP provides that these corrective action measures will most effectively achieve remediation of the groundwater through the installation of groundwater extraction wells northeast of the U5 Inactive Ash Basin saddle dam. Significantly, groundwater modeling simulations indicate (i) these measures will control COI at or beyond the compliance boundary, and (ii) at such time the site-specific considerations detailed within the CAP have been satisfied, including, but not limited to, securing all required state approvals, installing the necessary equipment, and commencing full-scale system operation, COI migration will be contained within the compliance boundary.

## 1. INTRODUCTION

### 1.1 Background

The primary objective of this Closure Plan is to address the closure of the U5B at the Cliffside Station which is a coal and natural gas fired electricity-generating facility owned and operated by Duke Energy. The Station is located on the Broad River approximately 55 miles west of Charlotte and about 1 ½ miles south of the town of Cliffside, North Carolina. The power plant is situated on the south side of the Broad River and straddles the Cleveland/Rutherford County line. Cliffside Station is a two-unit, 1,387 megawatt, coal and natural gas fired power generation facility that began commercial operation in 1940 with Units 1-4. Units 1-4 were retired on October 1, 2011. In 1972, Unit 5 began commercial operation and is still in operation. Duke completed the modernization project with the addition of Unit 6, which began commercial operation in December 2012. CCR have historically been managed in the Station's on-site basins. Cliffside Station ceased all waste flows to the basins in 2019.

**Figure 1-1** presents a Vicinity Map and Site Plan of the Cliffside Station.

Duke Energy uses three facilities to manage CCR at the Cliffside Station that include the following earthen embankment dams regulated by NCDEQ:

1. Active Ash Basin Downstream Dam (State ID CLEVE-049);
2. Active Ash Basin Upstream Dam (State ID CLEVE-050);
3. Unit 5 Inactive Ash Basin Main Dam (State ID RUTHE-070); and
4. Unit 5 Inactive Ash Basin Saddle Dam (State ID RUTHE-072).

As further discussed in Section 2 below, the closure method mandated by order of the NCDEQ for the U5B is closure by excavation.

### 1.2 Closure Plan Objectives

The objective of this Closure Plan is to address the closure by excavation of CCR from the U5B as directed by order of NCDEQ. Duke Energy does so without prejudice of its position that closure by excavation is neither necessary nor appropriate for the U5B. Duke Energy also notes that approval from NCDEQ is required to proceed and develop the additional details as described further within this Closure Plan to complete the necessary working documents to complete the closure actions. Duke Energy submits this Closure Plan with the knowledge that other details will follow, as necessary. This Closure Plan describes and communicates the key actions and activities necessary to close the AAB in accordance with the requirements for written Closure Plans for CCR surface impoundments presented in N.C.G.S. §130A-309.214(a)(4). Planned closure activities include:

- Decanting the Basin;
- Construction and operation of a water management system to manage discharges in compliance with the NPDES permit during closure;
- Dewatering to support safe excavation of CCR from the basin;

- Excavation of the CCR and establishing post-excavation final grades using soil fill where required;
- Lowering and removal of the U5B Main dam;
- Expansion of the on-site CCR landfill to permanently store the excavated CCR,
- Modification of the discharge channel downstream of the Main Dam; and
- Restoration of disturbed areas.

### 1.3 Report Organization

This Closure Plan is structured to follow the requirements provided in CAMA (N.C.G.S. § 130A-309.214(a)(4)).

## 2. GOVERNING LAWS

In August 2014, the North Carolina General Assembly enacted CAMA, which contains specific statutory requirements applicable to the Basins. Subsequently, in July 2016, the North Carolina General Assembly enacted H.B. 630, Session Law 2016-95, which provides that impoundments be classified as “low-risk” if, by certain deadlines, the owner has established permanent alternative water supplies, as required, and has rectified any deficiencies identified by, and has otherwise complied with requirements of, any dam safety order. NCDEQ determined that Duke Energy met these criteria on November 14, 2018, and officially classified the U5B at Cliffside Station as “low-risk.”

On April 1, 2019, NCDEQ issued its Closure Determination mandating that the U5B be closed by excavation of the CCR. A closure plan is required for each CCR surface impoundment regardless of the risk classification. CAMA’s closure plan requirements and cross-referenced sections of this Closure Plan are summarized in **Table 2-1**. On April 26, 2019, Duke Energy filed a Petition for Contested Case Hearing before the North Carolina Office of Administrative Hearings appealing this determination and on May 24, 2019 Duke Energy filed amended petitions in the case. The petitions allege that in issuing its Closure Determination, NCDEQ failed to (i) follow the mandatory process and procedure outlined in CAMA and (ii) consider or apply the scientific and engineering evidence submitted and available to it in reaching its decision to require the most expensive closure method available despite scientific and engineering evidence demonstrating the availability of less expensive and more rapid closure options that would continue to fully protect human health and the environment. Certain decisions by the administrative law judge in that case are currently under appeal to the North Carolina Superior Court.

In addition to the closure plan requirements, CAMA sets out groundwater assessment and corrective action requirements. A Comprehensive Site Assessment (CSA) report update was submitted to NCDEQ in January 2018. Duke Energy intends that an updated CAP will be submitted in parallel with this Closure Plan to NCDEQ in December 2019.

In addition to the above requirements, National Pollutant Discharge Elimination System (NPDES) permit program compliance, SOC (which commits Duke Energy to initiate and complete decanting of the Basins by dates certain) compliance, dam safety approvals for modifications to regulated Basin dams, and environmental permitting requirements must be considered as part of closure.

### 3. FACILITY DESCRIPTION AND EXISTING SITE FEATURES

#### 3.1 Surface Impoundments Description

This section provides details on the Inactive Unit 5 Ash Basin at the Cliffside Station.

##### 3.1.1 Site History and Operations

**Figure 1-1** shows locations of the plant and the CCR facilities. **Figure 3-1** presents overall existing conditions including topography and bathymetry of the U5B. The U5B addressed within this closure plan is described below:

*Inactive Unit 5 Ash Basin (Dam ID: RUTHE-070 and RUTHE-072):*

The U5B is located on the western portion of the site, west and southwest of coal-fired Unit 5 and Unit 6. The Main Dam (Dam ID - RUTHE-070) and Saddle Dam (Dam ID - RUTHE-072) are the principal embankments which form the Basin. The Main Dam is approximately 1,460 feet long at the crest and the Saddle Dam is about 590 feet long at the crest. A smaller, non-regulated containment dike exists along the eastern border of the basin adjacent to the plant access road and is referred to as the Roadway Embankment. The dams and dike were constructed in 1969 and 1970 in advance of Unit 5 operations. The U5B received sluiced CCR from Unit 5 starting in 1972 until it was retired in 1980 when it reached capacity. The U5B currently receives stormwater from a localized drainage area. A majority of the eastern side of the U5B is currently used as a lay down yard for equipment and materials.

##### 3.1.2 Estimated Volume of CCR in Surface Impoundments

Based on CCR inventory data provided by Duke as of July 31, 2019, the approximate volume of CCR in the U5B is listed in the table below. To compute the estimated mass of CCR in place an assumed density of 1.2 tons per CY was used, which is the Duke Energy fleet wide assumption. See **Appendix A** for the Estimated Volume of CCR in Impoundment calculation.

Impoundment	Estimated CCR Volume (CY)	Estimated CCR Weight (Tons)
Inactive Unit 5 Ash Basin	1,960,000	2,352,000

##### 3.1.3 Description of Surface Impoundment Structural Integrity

The purpose of this section is to summarize the Basin's structural integrity evaluations based on current existing information. This section includes the geotechnical, and hydrology and hydraulics (H&H) capacity analyses results. In summary, the structural integrity of the Basin and subsequent dam inspection reports meets the regulatory requirements of EPA's CCR Rule (40 § CFR 257.73). Duke Energy's certifications of these requirements are available on Duke Energy's publicly-accessible CCR Rule Compliance Data and Information website.

- **Slope stability**

For the U5B Main and Saddle Dams, slope stability analysis results for the existing conditions global factors of safety for static long-term maximum storage pool, static maximum surcharge pool, sudden drawdown conditions, and pseudo-static seismic conditions meet regulatory and programmatic criteria.

- **Liquefaction conditions (where susceptible) and Liquefaction potential**

In 2016, Wood performed a screening level liquefaction analysis for the U5B dams. Based on the screening analyses, the U5B dams and their foundation soils are not liquefaction-susceptible.

Based on the conditions encountered in the borings performed for this project, ground motions of the design seismic event (2,500-year return period) were calculated and analyzed for evaluation of liquefaction potential. The analysis was performed using the methodology from Idriss and Boulanger (2014). The results of this analysis do not indicate the potential to trigger liquefaction or cyclic softening within granular soils in the embankments, or below the embankments for the U5B dams.

- **Hydrology and hydraulics (H&H) capacity analyses**

Hydrologic analysis performed by Wood following the 2016 construction of alternate spillway for the U5B show that the U5B is capable of conveying the inflow design flood event while maintaining adequate freeboard. This study also indicates that the spillway system for the U5B is capable of removing 80 percent of the detained storm volume within 15 days following the design storm peak [6 hour 3/4 probable maximum precipitation (PMP)], as required by the North Carolina Dam Safety Rules.

Per direction from NCDEQ, additional hydrologic modeling was conducted to evaluate whether the existing U5B and spillway system could convey the spillway design flood (SDF) generated during the full PMP event without overtopping the dam. The evaluation involved incorporation of updated drainage area characteristics. The evaluation showed that the U5B and existing spillway system was capable of conveying the SDF generated during the full PMP without overtopping the dam. This analysis is in Appendix C.

### **3.1.4 Sources of Discharges into Surface Impoundments**

Process flows no longer discharge into the U5B. Process flows are directed toward newly-constructed holding and auxiliary basins. The Cliffside Station currently employs a dry ash handling system transporting CCR by truck to the on-site industrial landfill.

Currently, the U5B receives only stormwater runoff.

### **3.1.5 Existing Surface Impoundment Liner System**

The U5B located at the Cliffside Station does not include a geomembrane or clay liner system and is considered to be unlined. The U5B was constructed directly on top of the historical ground surface.

### **3.1.6 Inspection and Monitoring Summary**

Weekly Basin inspections have been on-going since 2014, and include observation of upstream slopes and shorelines, crest, downstream slopes, toes, abutment contacts and adjacent drainage way(s), spillway(s) and associated structure(s), and other structures and features of the dams.

Monthly inspections of the U5B include the weekly monitoring elements with the addition of piezometer and observation well readings and water level gauges/sensors.

Daily inspections of the basins are not routinely required, however, on a case-by-case basis, the basins may be inspected daily beginning at such times and continued for the duration as specified by plant management. Such daily inspections might be initiated during a repair activity on the dam or in response to a specific imposed regulatory agency requirement.

The U5B is inspected annually by an independent third-party consultant. In a letter dated August 13, 2014, NCDEQ requires these inspections to be conducted annually at all of Duke Energy's CCR impoundments in North Carolina. These inspections are intended to confirm adequacy of the design, operation, and maintenance of the surface impoundments in accordance with accepted engineering standards. Reports are to be submitted to the NCDEQ within 30 days of the completion of the inspection.

The results of the annual inspections are used to identify needed repairs, repair schedules, to assess the safety and operational adequacy of the dam, and to assess compliance activities regarding applicable permits, environmental and dam regulations. Annual inspections are also performed to evaluate previous repairs. The annual inspections of the dikes have been ongoing since 2009, with 5-year inspections conducted between 1979 and 2009.

The 2015 through 2019 annual inspections did not identify features or conditions in the U5B dams, or their outlet structures or spillways that indicate an imminent threat of impending failure hazard. Review of critical analyses indicated the design conforms to current engineering state of practice to a degree that no immediate actions are required other than the recent and ongoing surveillance and monitoring activities already underway.

Special, episodic inspections of the Basins may be performed during episodes of earthquake, emergency, or other extraordinary events. Visual inspections are performed after a heavy precipitation event when accumulation of four inches of rainfall or greater occurs within a 24-hour period. An internal inspection will be performed if an earthquake is felt locally or detected by the US Geological Survey measuring greater than a Magnitude 3 and with an epicenter within 50 miles of the dams. A special inspection would also be performed during an emergency, such as when a potential dam breach condition might be identified or when construction activities (e.g., basin cleanout) are planned on or near the dams. Special inspections are also conducted when the ongoing surveillance program identifies a condition or a trend that warrants special evaluation.

## **3.2 Site Maps**

### **3.2.1 Existing Surface Impoundment Related Structures**

A site map showing property boundary, location of the Cliffside Station and Basins with their boundaries, topographic contours, and bathymetric contours are shown on **Figure 3-1**.

### 3.2.2 Receptor Survey

This information is included as part of the CAP being prepared separately by SynTerra for Duke Energy and is being submitted in parallel to this Closure Plan. The CAP is herein incorporated by this reference, but its content is not the work product of Wood.

### 3.2.3 Existing On-Site Landfills

There is an on-site industrial landfill at the Cliffside Station, as identified in the table below. **Figure 1-1** shows locations of this landfill.

Landfill	Permit Number	Comment
Rogers CCP Landfill	8106-INDUS-2009	Active

### 3.3 Monitoring and Sampling Location Plan

This information is included as part of the CAP being prepared separately by SynTerra for Duke Energy and is being submitted in parallel to this Closure Plan. The CAP is herein incorporated by this reference, but its content is not the work product of Wood.

Locations of the existing groundwater monitoring wells are shown in the Closure Plan Drawings, **Appendix D**, but the CAP should be consulted for details of well locations, names, and status.

## 4. RESULTS OF HYDROGEOLOGIC, GEOLOGIC, AND GEOTECHNICAL INVESTIGATIONS

### 4.1 Background

An overall boring and existing monitoring well location plan indicating the locations of recent and historical borings, monitoring wells, and piezometers is shown on in the drawings included in **Appendix D**.

This chapter summarizes the site geology and hydrogeology; site stratigraphy of the geologic units underlying the surface impoundments, hydraulic conductivity of CCR and the soils underlying the surface impoundment, geotechnical properties of the CCRs and the uppermost stratigraphic unit under the surface impoundment, and CCR and CCR affected soils.

### 4.2 Hydrogeology and Geologic Descriptions

This information is included as part of the CAP being prepared separately by SynTerra for Duke Energy and is being submitted in parallel to this Closure Plan. The CAP is herein incorporated by this reference, but its content is not the work product of Wood.

### **4.3 Stratigraphy of the Geologic Units Underlying Surface Impoundments**

This information is included as part of the CAP being prepared separately by SynTerra for Duke Energy and is being submitted in parallel to this Closure Plan. The CAP is herein incorporated by this reference, but its content is not the work product of Wood.

### **4.4 Geotechnical Properties**

This section summarizes the geotechnical conditions and properties found from investigations performed within the U5B and U5B Main and Saddle Dam areas. The presented information was obtained from previous geotechnical investigations at the site and recent investigation activities conducted to support the Closure Plan development. The geotechnical conditions within the U5B generally consist of CCR (interbedded layers of fly ash and bottom ash) placed in the basin primarily by hydraulic sluicing underlain by residual soil, saprolite, partially weather rock (PWR), and bedrock.

For the purposes of discussion of the geotechnical properties of the materials, the saprolite material is described as partially weathered rock. General properties of the various materials encountered within and surrounding the U5B are described below. A range of measured material properties of laboratory tests performed by Wood, AECOM, HDR, and SynTerra for the subsurface explorations completed within the U5B is presented in **Table 4-1. Appendix B** of this Closure Plan presents boring and laboratory information collected at the site used for the analyses and development of this document.

#### **4.4.1 CCR Within Basin**

The CCR within the U5B consists primarily of alternating layers and mixtures of bottom ash and fly ash. Bottom ash consists of moist, gray to dark gray, fine to coarse silty sand (SM). Fly ash obtained consists of very loose, wet, and gray to dark gray silt (ML) material.

#### **4.4.2 Liner Material Properties**

The U5B is unlined so there are no associated material properties.

#### **4.4.3 Subsurface Soil Properties**

Subsurface residual soil (including saprolite) consists of very loose to very dense and soft to hard; moist to wet; fine to coarse; brown, orange, gray, tan, yellow and red silty sand or clayey sand with some plastic soil.

#### **4.4.4 CCR Basin Dam Soil Properties**

The embankment fills are predominately classified as silty sand (SM) with some layers of sandy silt (ML) also encountered. The consistency of the silty sand fill materials ranged from loose to medium dense.



#### **4.5 Chemical Analysis of Impoundment Water, CCR and CCR-Affected Soil**

This information is included as part of the CAP being prepared separately by SynTerra for Duke Energy and is being submitted in parallel to this Closure Plan. The CAP is herein incorporated by this reference, but its content is not the work product of Wood.

#### **4.6 Historical Groundwater Sampling Results**

This information is included as part of the CAP being prepared separately by SynTerra for Duke Energy and is being submitted in parallel to this Closure Plan. The CAP is herein incorporated by this reference, but its content is not the work product of Wood.

#### **4.7 Groundwater Potentiometric Contour Maps**

This information is included as part of the CAP being prepared separately by SynTerra for Duke Energy and is being submitted in parallel to this Closure Plan. The CAP is herein incorporated by this reference, but its content is not the work product of Wood.

#### **4.8 Estimated Vertical and Horizontal Extent of CCR within the Impoundments**

This information is included as part of the CAP being prepared separately by SynTerra for Duke Energy and is being submitted in parallel to this Closure Plan. The CAP is herein incorporated by this reference, but its content is not the work product of Wood.

### **5. GROUNDWATER MODELING ANALYSIS**

In accordance with the requirements of N.C.G.S. § 130A-309.211(b)(1), Duke Energy separately submitted an updated Corrective Action Plan (CAP) in parallel with this Closure Plan; the updated CAP is herein incorporated in its entirety by this reference. Neither the updated CAP nor its content is the work product of Wood. Although the Closure Plan contains references to the updated CAP, all specific relevant details to groundwater and related actions are found in the updated CAP itself and not in this Closure Plan.

Among other areas, the updated CAP evaluates the extent of, and remedies for, constituents of interest (COI) in groundwater associated with the Unit 5 Inactive Ash Basin, focusing on constituent concentrations detected above the applicable 02L Standards, Interim Maximum Allowable Concentrations, or approved background threshold values north and northeast of the Unit 5 Inactive Ash Basin. In addition, the updated CAP considers the federal groundwater corrective action requirements at 40 C.F.R. §§ 257.96-.98.

As detailed in the updated CAP, Duke Energy (i) will complete ash basin closure; and (ii) intends to implement a groundwater extraction system. The CAP provides that these corrective action measures will most effectively achieve remediation of the groundwater through the installation of groundwater extraction wells northeast of the U5 Inactive Ash Basin saddle dam. Significantly, groundwater modeling simulations indicate (i) these measures will control COI at or beyond the compliance boundary, and (ii) at such time the site-specific considerations detailed within the CAP have been satisfied, including, but not limited to, securing all required state approvals, installing

the necessary equipment, and commencing full-scale system operation, COI migration will be contained within the compliance boundary.

### **5.1 Site Conceptual Model Predictions**

This information is included as part of the CAP being prepared separately by SynTerra for Duke Energy and is being submitted in parallel to this Closure Plan. The CAP is herein incorporated by this reference, but its content is not the work product of Wood.

### **5.2 Groundwater Chemistry Effects**

This information is included as part of the CAP being prepared separately by SynTerra for Duke Energy and is being submitted in parallel to this Closure Plan. The CAP is herein incorporated by this reference, but its content is not the work product of Wood.

### **5.3 Groundwater Trend Analysis Methods**

This information is included as part of the CAP being prepared separately by SynTerra for Duke Energy and is being submitted in parallel to this Closure Plan. The CAP is herein incorporated by this reference, but its content is not the work product of Wood.

## **6. BENEFICIAL USE AND FUTURE USE**

### **6.1 CCR Use**

At this time, Duke Energy has not identified a beneficial use of CCR from the U5B at Cliffside Station.

### **6.2 Site Future Use**

At this time Duke Energy has not identified any future use of the land reclaimed by the dewatering and excavation of the U5B.

## **7. CLOSURE DESIGN DOCUMENTS**

### **7.1 Engineering Evaluations and Analyses**

Engineering evaluations and analyses to support closure of the U5B at the Cliffside Station, as detailed in this Closure Plan, are provided in **Appendix C**.

The U5B will be fully removed down to grade. Based on the final post closure configuration and absence of engineered fill features, no geotechnical calculations have been included for the Closure Plan (approval stage) design. A permit to construct application with associated geotechnical and hydrogeologic analyses has been prepared and submitted to NCDEQ Solid Waste Section for expansion of the CCR landfill into Phases III and IV. Dam removal related calculations will be included in the dam modification permit applications.

Safe and effective access to the U5B is critical to CCR excavation and the completion of closure. Access road locations into or across the U5B for excavation cannot be reliably established until

detailed phasing of closure is developed, and a contractor is selected to complete the work. A variety of mitigation techniques can be applied, such as installation of a geogrid and crushed stone aggregate, placement and spreading of dry CCR over the basin surfaces to establish access, and use of low ground pressure or light weight construction equipment.

Areas for stockpiling or conditioning of CCR are generally needed. These areas must be established within the limits of the CCR unit and require placement or stacking of CCR excavated from other areas of the U5B. They can be established in areas where all or most of the CCR has been removed, or on areas where a significant depth of CCR remains in place. Sluiced CCR forming the foundation of stockpiles or conditioning areas may be subject to bearing capacity or slope failures from the additional vertical compressive stress imparted by the stacked CCR and hauling equipment.

During excavation of CCR, interim or temporary excavated CCR slopes are commonly created. These slopes vary in height and the duration they will have to stand. Some slopes are subject to potential loading from hauling or stockpiling operations. The location and geometry of such slopes cannot be established during design. These elements depend on the means and methods employed by the construction contractor, site conditions, schedule and other site conditions. Excavation in a deep valley fill creates significant safety risks that need further evaluation and will require the means and methods inputs from a contractor to fully address before closure excavation work commences. A detailed phasing and excavation plan will be developed after this Closure Plan is approved by NCDEQ.

## **7.2 Closure Plan Activities**

The primary activities associated with closure by excavation are as follows:

- Decant by using floating pumps, screened intakes, and pumping through the discharge pipe outlets.
- Construction and operation of a temporary water management system (WMS) to manage all discharges in compliance with the NPDES permit during closure.
- Dewater the CCR to the extent necessary to allow for access, CCR excavation, and conditioning (drying) prior to placement in the on-site landfill.
- Start CCR excavation from the U5B, with sequencing determined for optimal progression. Manage and control of dust-generating activities through specific site planning and mitigation. Construct landfill cells in coordination with CCR excavation. Place the excavated CCR in the on-site landfill after conditioning, and compact. Instrumentation and monitoring requirements to be developed prior to construction will be followed to verify construction phase stability. Construction dewatering to be used as needed to provide stable work areas and slopes.
- Maintain required hydrologic/hydraulic storage capacity throughout the excavation process and progressively breach the U5B Main Dam as excavation advances.
- Complete closure by excavation verification. Grade the area to promote positive drainage and seed for vegetative growth.

- Sequence final dam breach with construction of proposed stormwater detention basins and inflow design flood management.

Additional information and details pertaining to the closure design are provided in the Closure Plan drawings, which are presented in **Appendix D**.

### 7.3 Design Drawings

The Closure Plan drawings presented in **Appendix D** include the following:

- Cover sheet
- General notes
- Existing conditions plan with aerial photograph
- Existing conditions plan with topography
- Exploration location plan
- Demolition plan
- Estimated bottom of CCR contour plans
- Final grading plan
- Final grading profiles, cross-sections and details
- Excavation plan
- Excavation profiles and details
- Closure details
- Stormwater management – ditch details
- Erosion and Sediment Control Details

These Closure Plan drawings will be further developed and refined to develop construction level drawings during subsequent stages following NCDEQ approval of the Closure Plan. In addition, supplemental drawing sets will be prepared on an as needed basis to support dam modification and/or decommissioning permits, erosion and sediment control permits, NPDES permit modifications, and other related permits.

Once the excavation grades shown on the Closure Plan drawings or the actual ash soil interface with residual soil material (where it differs from the drawings) have been achieved the procedures described in the Duke Energy Excavation Soil Sampling Plan (**Appendix E**) will be followed to confirm that the closure by excavation has been achieved.

### 7.4 Description of the Construction Quality Assurance Plan

A Construction Quality Assurance (CQA) Plan will be developed following NCDEQ approval of the Closure Plan for the U5B. The CQA Plan will be prepared to address G.S. §130A-309.214(a)(4)(g). Its purpose is to describe the CQA program to be adhered to in execution of

closure activities at the Cliffside Station. The CQA Plan will present the roles and responsibilities for monitoring and testing activities and presents guidance on the methodology to be used for evaluating whether the construction has been performed in accordance with the approved Closure Plan. The CQA Plan will also detail the material testing frequencies; methods for transportation, handling, and storage of materials; test methods and verifications; manufacturer, field, and laboratory testing; field activities for construction monitoring and oversight; and reporting and documentation requirements. Technical specifications to be developed as part of the construction level design packages for contractor bidding and will present specific material properties and specifications.

The CQA Plan will address materials and CQA activities associated with the following components:

- Earthwork
  - CCR Excavation
  - Structural Soil Fill
- HDPE Piping
- Vegetation
- As-Built Conditions
- Record Documentation Report

## **8. MANAGEMENT OF WASTEWATER AND STORM WATER**

The Cliffside Station manages wastewater and stormwater under the NPDES permit issued by the NCDEQ. Permit number NC0005088, effective September 1, 2018 through August 31, 2023, authorizes six discharge points into the Broad River. Outfalls 002B, 002C are for emergency overflows that are unlikely to happen. Outfalls 104 and 106 are constructed seep discharges. Outfall 002 is the associated outfall for the AAB discharges. Outfall 005 is associated with the water management system treated discharge effluent. The treated wastewater from the U5B will be discharged through NPDES Outfall 005. All discharges are to be conducted in accordance with NPDES permit NC0005088. The stormwater from the power station area is sent to the new water management system where it also is treated and then discharged through NPDES outfall 005. Other stormwater outfalls associated with industrial activities are discharged in accordance with Industrial Storm Water permit NCS000571.

The U5B has historically collected the wastewater from plant operations and stormwater runoff before discharging it through the basins' outlet structures. All power station stormwater (contact water) is now routed to the new WMS and no longer discharges into the U5B. Stormwater that falls directly onto or in the surrounding area of the U5B, runs through a vegetated area and then discharges out storm water outfall SW009, which is regulated by permit NCS000571. Stormwater that accumulates elsewhere on the Cliffside Station property that does not enter the Basins is regulated per NCS000571.

The U5B currently has the capacity to contain the PMP storm event by maintaining the water surface level elevation at or below El. 764.87 ft, which provides a minimum freeboard of 0.13 ft. As part of the closure, the U5B Main Dam will be removed by excavating an engineered breach. Under this post closure condition, there will be increased flow downstream of the U5B Main Dam compared to the existing conditions. Additional stormwater retention capacity will need to be developed following dam removal or the existing downstream culverts will need to be retrofitted to increase their conveyance capacities. The closure design proposed herein provides additional storage capacity following breach of the U5B Main Dam using detention basins as described further below. The concept designs for these proposed basins were based on limiting post-closure downstream stormwater flows to less than or equal to existing stormwater flows.

Wastewater from the U5B will be pumped, treated and discharged in two phases; the (very limited) Decanting phase and Dewatering phase. U5B does not currently have a significant amount of ponded water. The U5B will advance into the Dewatering phase to remove interstitial water. During this phase, additional physical-chemical treatment processes will be added to the WMS as necessary to maintain compliance with the requirements of the discharge permit. During Dewatering phase, the Cliffside Station WMS will have a designed flow rate of 250 to 400 gpm.

Dewatering is performed to remove the interstitial or pore water from the CCR to facilitate excavation, to access in-place CCR or to establish safe slopes prior to and after CCR excavation. It is anticipated that performance criteria will be established in the construction-level documentation to identify required vertical and horizontal limits of interstitial water removal at critical locations and for critical conditions during closure.

Excavated CCR will likely have to be conditioned (dried) prior to placement into the landfill as part of closure. Consideration of required conditioning and management of contact water during excavation will be included in the development of closure phasing and landfill fill placement.

The proposed post-closure grades restore the historical flows from the surrounding landscape and route flow toward the Downstream Dam and the Broad River. Up to and including the last phase of closure before the U5B dams are breached, the U5B will maintain the capacity to contain the required storm size/flows functioning as a detention basin.

The detention basin design criteria will be further refined for the construction-level documents based on actual field elevations reached in the excavated areas and discussions with NCDEQ with regards to the embankment heights, which will follow NCDEQ approval of this Closure Plan. The designs for the detention basins are conceptual level at this time. These concept designs for the detention basin are based conservatively on 100-year storms. Appendix C presents the results of the closure stormwater management calculations.

## **8.1 Anticipated Changes in Wastewater and Stormwater Management**

Closure of the AAB has necessitated changes in the management of a number of wastewater and process streams. Wastewater and process streams previously discharging to the AAB have been rerouted to the new holding and auxiliary basins as separate treatment systems.

The company will obtain necessary permit coverage for any flows associated with post closure conditions as plans are finalized. A WMS will be utilized such that the permit terms can be met throughout the duration of dewatering, closure and post-closure timeframes

Erosion and Sediment Control Plans for different phases of the construction will be developed as part of the construction level packages and formal Erosion and Sediment Control Plan permit submittal. The details for the erosion and sediment control measures depicted on the drawings in this Closure Plan submittal will be re-evaluated after the specific construction phasing is established, which will follow NCDEQ approval of this Closure Plan. In addition, erosion and sediment control measures may be installed and removed in phases as stabilization is achieved.

## **8.2 Wastewater and Stormwater Permitting Requirements**

Additional information on required permits is described in **Section 10**

## **9. DESCRIPTION OF FINAL DISPOSITION OF CCR**

CCR will be dispositioned by placement into an approved and permitted lined on-site CCR landfill.

Vegetation encountered or removed during the progression of the work will be managed in accordance with state regulations for handling and disposal.

## **10. APPLICABLE PERMITS FOR CLOSURE**

Refer to **Table 10-1** for detailed information on the potential and applicable permitting needed to perform closure by excavation. Development of permitting package submittals and/or regulatory approval requests would follow NCDEQ approval of the Closure Plan.

## **11. DESCRIPTION OF POST-CLOSURE MONITORING AND CARE**

A post-closure Plan will be developed following NCDEQ approval of the Closure Plan for the Closure by Excavation Plan for the U5B closures at the Cliffside Station. The purpose of the post-closure Plan will be to provide a description of the inspection, monitoring, and maintenance activities required to be performed throughout the 30-year post-closure care period for the closed U5B.

The post-closure Plan will be developed to meet the requirements of CAMA (G.S. §130A-309.214(a)(4)(k)). The items that will be included in the post-closure Plan for the U5B include:

- Name, address, phone number, and email address of the responsible office or person;
- Means and methods of managing affected groundwater and stormwater;
- Maintenance of the groundwater monitoring systems;
- Regular inspection and maintenance of the final cover system;
- Groundwater and surface water monitoring and assessment program (included as part of the CAP);
- Post-closure inspection checklist to guide post-closure inspections;

- Description of planned post-closure uses; and
- Financial assurance estimates for post-closure operations and maintenance and remedial action.

### **11.1 Groundwater Monitoring Program**

This information is included as part of the CAP being prepared separately by SynTerra for Duke Energy and is being submitted in parallel to this Closure Plan. The CAP is herein incorporated by this reference, but its content is not the work product of Wood.

## **12. PROJECT MILESTONES AND COST ESTIMATES**

### **12.1 Project Schedule**

A Closure project high level milestone schedule has been prepared by Duke Energy and is provided below. The schedule defines the following anticipated activities and milestones:

Engineering, decanting, dewatering	Ongoing
Submit plan and design for landfill expansion construction permit	Ongoing
Start landfill expansion construction	Q4-2021
Start CCR excavation	Q4-2021
Complete CCR excavation	Q4-2028
Complete final closure and cover system of new landfill	Q4-2029
Site final grading and vegetative cover	Q4-2030

It should be noted that CCR excavation will not be completed by the CAMA 2029 deadline at N.C.G.S. § 130A-309.214(a)(3). A detailed construction schedule will be developed following NCDEQ approval of this Closure Plan.

### **12.2 Closure and Post-Closure Cost Estimate**

Cost estimates for closure and post-closure of the Basins at Cliffside Station were developed by Duke Energy and provided to Wood. These cost estimates are not a work product of Wood. These are Class 5 estimates as the detailed and final design is not developed at this stage of the closure project. Following approval of this Closure Plan by NCDEQ and further development of the project plans and engineering designs the cost estimate will be refined and updated.

The cost to complete the closure by excavation, including the landfill expansion, is estimated to be \$87 million.

The cost to perform the 30-year post-closure activities and monitoring is estimated to be \$43 million.

The cost estimates prepared by Duke Energy includes the following major activities:

- Mobilization and Site Preparation
- Dewatering, earthwork, and subgrade preparation



- CCR excavation
- Stormwater management, erosion and sediment control, and site restoration
- Engineering support (design and CQA)
- Post closure – groundwater monitoring
- Post closure – operations and maintenance
- Contingency

Corrective action costs are included as part of the CAP being prepared separately by SynTerra for Duke Energy and is being submitted in parallel to this Closure Plan. The CAP is herein incorporated by this reference, but its content is not the work product of Wood.

### **13. REFERENCED DOCUMENTS**

Idriss and Boulanger, CPT and SPT Based Liquefaction Triggering Procedures, Report UCD/CGM- 14/01, Department of Civil and Environmental Engineering, University of California, Davis, CA, April 2014.

NCDEQ, 2009. Industrial Solid Waste Landfill Facility Permit No. 8106, Issued June 24, 2009.

NCDEQ, 2015. Permit No. NCS000571 to Discharge Stormwater under the National Pollutant Discharge Elimination System. September 30, 2015.

NCDEQ, 2018. Permit No. NC0005088 to Discharge Wastewater under the National Pollutant Discharge Elimination System. July 13, 2018.

## TABLES

**Table 2-1: NC CAMA Closure Plan Requirements  
Summary and Cross Reference Table  
Duke Energy, Rogers Energy Complex - Cliffside Steam Station**

No.	Description	Corresponding Closure Plan Section
<b>Part II. Provisions for Comprehensive Management of Coal Combustion Residuals</b>		
<b>§ 130A-309.214(a)(4) Closure Plans for all impoundments shall include all of the following:</b>		
<b>a. Facility and coal combustion residuals surface impoundment description. – A description of the operation of the site that shall include, at a minimum, all of the following:</b>		
1	Site history and history of site operations, including details on the manner in which coal combustion residuals have been stored and disposed of historically.	3.1.1
2	Estimated volume of material contained in the impoundment.	3.1.2
3	Analysis of the structural integrity of dikes or dams associated with impoundment.	3.1.3
4	All sources of discharge into the impoundment, including volume and characteristics of each discharge.	3.1.4
5	Whether the impoundment is lined, and, if so, the composition thereof.	7.1
6	A summary of all information available concerning the impoundment as a result of inspections and monitoring conducted pursuant to this Part and otherwise available.	3.1.6
<b>b. Site maps, which, at a minimum, illustrate all of the following:</b>		
1	All structures associated with the operation of any coal combustion residuals surface impoundment located on the site. For purposes of this sub-subdivision, the term "site" means the land or waters within the property boundary of the applicable electric generating station.	3.2.1
2	All current and former coal combustion residuals disposal and storage areas on the site, including details concerning coal combustion residuals produced historically by the electric generating station and disposed of through transfer to structural fills.	3.3
3	The property boundary for the applicable site, including established compliance boundaries within the site.	3.3
4	All potential receptors within 2,640 feet from established compliance boundaries.	3.2.2
5	Topographic contour intervals of the site shall be selected to enable an accurate representation of site features and terrain and in most cases should be less than 20-foot intervals.	3.3
6	Locations of all sanitary landfills permitted pursuant to this Article on the site that are actively receiving waste or are closed, as well as the established compliance boundaries and components of associated groundwater and surface water monitoring systems.	3.2.3
7	All existing and proposed groundwater monitoring wells associated with any coal combustion residuals surface impoundment on the site.	3.3
8	All existing and proposed surface water sample collection locations associated with any coal combustion residuals surface impoundment on the site.	3.3
<b>c. The results of a hydrogeologic, geologic, and geotechnical investigation of the site, including, at a minimum, all of the following:</b>		
1	A description of the hydrogeology and geology of the site.	4.1
2	A description of the stratigraphy of the geologic units underlying each coal combustion residuals surface impoundment located on the site.	4.2
3	The saturated hydraulic conductivity for (i) the coal combustion residuals within any coal combustion residuals surface impoundment located on the site and (ii) the saturated hydraulic conductivity of any existing liner installed at an impoundment, if any.	4.3
4	The geotechnical properties for (i) the coal combustion residuals within any coal combustion residuals surface impoundment located on the site, (ii) the geotechnical properties of any existing liner installed at an impoundment, if any, and (iii) the uppermost identified stratigraphic unit underlying the impoundment, including the soil classification based upon the Unified Soil Classification System, in-place moisture content, particle size distribution, Atterberg limits, specific gravity, effective friction angle, maximum dry density, optimum moisture content, and permeability.	4.4
5	A chemical analysis of the coal combustion residuals surface impoundment, including water, coal combustion residuals, and coal combustion residuals-affected soil.	4.5
6	Identification of all substances with concentrations determined to be in excess of the groundwater quality standards for the substance established by Subchapter L of Chapter 2 of Title 15A of the North Carolina Administrative Code, including all laboratory results for these analyses.	4.6
7	Summary tables of historical records of groundwater sampling results.	4.6
8	A map that illustrates the potentiometric contours and flow directions for all identified aquifers underlying impoundments (shallow, intermediate, and deep) and the horizontal extent of areas where groundwater quality standards established by Subchapter L of Chapter 2 of Title 15A of the North Carolina Administrative Code for a substance are exceeded.	4.7
9	Cross-sections that illustrate the following: the vertical and horizontal extent of the coal combustion residuals within an impoundment; stratigraphy of the geologic units underlying an impoundment; and the vertical extent of areas where groundwater quality standards established by Subchapter L of Chapter 2 of Title 15A of the North Carolina Administrative Code for a substance are exceeded.	4.8

**Table 2-1: NC CAMA Closure Plan Requirements (continued)  
Summary and Cross Reference Table  
Duke Energy, Rogers Energy Complex – Cliffside Steam Station**

No.	Description	Corresponding Closure Plan Section
<b>d.</b>	<b>The results of groundwater modeling of the site that shall include, at a minimum, all of the following:</b>	
1	An account of the design of the proposed Closure Plan that is based on the site hydrogeologic conceptual model developed and includes (i) predictions on post-closure groundwater elevations and groundwater flow directions and velocities, including the effects on and from the potential receptors and (ii) predictions at the compliance boundary for substances with concentrations determined to be in excess of the groundwater quality standards for the substance established by Subchapter L of Chapter 2 of Title 15A of the North Carolina Administrative Code.	5.1
2	Predictions that include the effects on the groundwater chemistry and should describe migration, concentration, mobilization, and fate for substances with concentrations determined to be in excess of the groundwater quality standards for the substance established by Subchapter L of Chapter 2 of Title 15A of the North Carolina Administrative Code pre- and post-closure, including the effects on and from potential receptors.	5.2
3	A description of the groundwater trend analysis methods used to demonstrate compliance with groundwater quality standards for the substance established by Subchapter L of Chapter 2 of Title 15A of the North Carolina Administrative Code and requirements for corrective action of groundwater contamination established by Subchapter L of Chapter 2 of Title 15A of the North Carolina Administrative Code.	5.3
e.	<b>A description of any plans for beneficial use of the coal combustion residuals in compliance with the requirements of Section .1700 of Subchapter B of Chapter 13 of Title 15A of the North Carolina Administrative Code (Requirements for Beneficial Use of Coal Combustion By-Products) and Section .1205 of Subchapter T of Chapter 2 of Title 15A of the North Carolina Administrative Code (Coal Combustion Products Management).</b>	6.1
f.	<b>All engineering drawings, schematics, and specifications for the proposed Closure Plan. If required by Chapter 89C of the General Statutes, engineering design documents should be prepared, signed, and sealed by a professional engineer.</b>	7.1, 7.2
g.	<b>A description of the construction quality assurance and quality control program to be implemented in conjunction with the Closure Plan, including the responsibilities and authorities for monitoring and testing activities, sampling strategies, and reporting requirements.</b>	7.3
h.	<b>A description of the provisions for disposal of wastewater and management of stormwater and the plan for obtaining all required permits.</b>	8
i.	<b>A description of the provisions for the final disposition of the coal combustion residuals. If the coal combustion residuals are to be removed, the owner must identify (i) the location and permit number for the coal combustion residuals landfills, industrial landfills, or municipal solid waste landfills in which the coal combustion residuals will be disposed and (ii) in the case where the coal combustion residuals are planned for beneficial use, the location and manner in which the residuals will be temporarily stored. If the coal combustion residuals are to be left in the impoundment, the owner must (i) in the case of closure pursuant to sub-subdivision (a)(1)a. of this section, provide a description of how the ash will be stabilized prior to completion of closure in accordance with closure and post-closure requirements established by Section .1627 of Subchapter B of Chapter 13 of Title 15A of the North Carolina Administrative Code and (ii) in the case of closure pursuant to sub-subdivision (a)(1)b. of this section, provide a description of how the ash will be stabilized pre- and post-closure. If the coal combustion residuals are to be left in the impoundment, the owner must provide an estimate of the volume of coal combustion residuals remaining.</b>	9
j.	<b>A list of all permits that will need to be acquired or modified to complete closure activities.</b>	10
k.	<b>A description of the plan for post-closure monitoring and care for an impoundment for a minimum of 30 years. The length of the post-closure care period may be (i) proposed to be decreased or the frequency and parameter list modified if the owner demonstrates that the reduced period or modifications are sufficient to protect public health, safety, and welfare; the environment; and natural resources and (ii) increased by the Department at the end of the post-closure monitoring and care period if there are statistically significant increasing groundwater quality trends or if contaminant concentrations have not decreased to a level protective of public health, safety, and welfare; the environment; and natural resources. If the owner determines that the post-closure care monitoring and care period is no longer needed and the Department agrees, the owner shall provide a certification, signed and sealed by a professional engineer, verifying that post-closure monitoring and care has been completed in accordance with the post-closure plan. If required by Chapter 89C of the General Statutes, the proposed plan for post-closure monitoring and care should be signed and sealed by a professional engineer. The plan shall include, at a minimum, all of the following:</b>	11
1	A demonstration of the long-term control of all leachate, affected groundwater, and stormwater.	11.1
2	A description of a groundwater monitoring program that includes (i) post-closure groundwater monitoring, including parameters to be sampled and sampling schedules; (ii) any additional monitoring well installations, including a map with the proposed locations and well construction details; and (iii) the actions proposed to mitigate statistically significant increasing groundwater quality trends.	11.2
l.	<b>An estimate of the milestone dates for all activities related to closure and post-closure.</b>	12.1
m.	<b>Projected costs of assessment, corrective action, closure, and post-closure care for each coal combustion residuals surface impoundment.</b>	12.2
n.	<b>A description of the anticipated future use of the site and the necessity for the implementation of institutional controls following closure, including property use restrictions, and requirements for recordation of notices documenting the presence of contamination, if applicable, or historical site use.</b>	6.2
§ 130A-309.214(b)(3)	<b>No later than 60 days after receipt of a proposed Closure Plan, the Department shall conduct a public meeting in the county or counties proposed Closure Plan and alternatives to the public.</b>	

**Table 4-1. Summary of Typical Geotechnical Measured Properties**

<i>Properties</i>	<i>CCR/Ash within Ash Basin</i>		<i>Foundation Soil (Residual) below Ash Basin</i>		<i>Embankment Soil</i>	<i>Foundation Soil (Alluvial) below Embankment Dams</i>	<i>Foundation Soil (Residual) below Embankment Dams</i>	<i>Partially Weathered Rock (PWR)</i>
<i>Soil Type</i>	Silt (ML) - Fly Ash, Silty Sand (SM) - Bottom Ash		Silty Sand (SM), Clayey Sand (SC)		Predominantly Silty Sand (SM or SP), or Sandy Silt (ML), Lean Clay (CL), and Fat Clay (CH)	Silty Sand (SM and SP-SM), Silt (ML and MH)	Silty Sand (SM) and Clayey Sand (SC)	Breaks down to Silty Sand (SM) with rock fragments
<i>Color</i>	Gray to Dark Gray		Brown, Tan, White, Olive, Red, Gray, Yellow		Brown, Orange, Red, Gray, Tan	Brown, Tan, Red, Gray	Brown, Gray, Tan, Orange, Red, Yellow	White, Brown, Gray, Multicolor
<i>Plasticity</i>	Non Plastic		Non Plastic to Very Plastic		Non Plastic to Very Plastic	Non plastic to Very Plastic	Non plastic to Medium Plastic	Non Plastic
<i>Liquid Limit</i>	Non Plastic		NP - 47%		NP - 60%	NP - 64	NP - 42	Non Plastic
<i>Plasticity Index</i>	Non Plastic		NP - 21%		NP - 30%	NP - 28	NP - 16	Non Plastic
	<b><i>Representative Range</i></b>	<b><i>Geometric Mean</i></b>	<b><i>Representative Range</i></b>	<b><i>Geometric Mean</i></b>	<b><i>Representative Range</i></b>			
<i>Natural Moisture Content (%)</i>	15% - 81%	54%	15% - 26%	19%	5% - 54%	20% - 26%	14% - 38%	12% - 17%
<i>Fines Content</i>	14% - 99%	65%	16% - 44%	25%	2% - 83%	7% - 91%	17% - 43%	14% - 22%
<i>Clay Content</i>	1% - 28%	11%	4% - 37%	9%	3% - 44%	-	8% - 25%	-
<i>Moist Unit Weight - <math>\gamma_m</math> (pcf)</i>	-	-	-	-	-	-	98 - 104 pcf	-
<i>Dry Unit Weight - <math>\gamma_d</math> (pcf)</i>	-	-	-	-	81 - 114 pcf	104 pcf	2.63 - 2.73 pcf	-
<i>Specific Gravity</i>	2.05 - 2.61	2.3	2.55 - 2.70	2.65	2.65 - 2.76	2.68	---	2.63 - 2.71
<i>Horizontal Hydraulic Conductivity (cm/sec)</i>	-	-	-	-	-	-	---	-
<i>Vertical Hydraulic Conductivity (cm/sec)</i>	1.5E-07 - 3.82E-04	1.03E-04	3.0E-06 - 1.3E-04	4.8E-05	1.0E-07 - 8.6E-05	-	5.5E-06 - 5.2E-05	-

Notes:

<sup>1</sup> Data obtained from laboratory tests conducted by AECOM, Wood/Amec Foster Wheeler, and HDR performed on materials obtained from within the Ash Basins and associated dams.

**Table 10-1. Inactive Unit 5 Ash Basin - Regulatory Permits, Approvals, or Requirements for Basin Closure by Excavation**

General Permit Name or Subject	Regulating Agency	Existing Permit No. (if applicable)	Permit/Approval	Comments
			Type of Regulatory Approval Mechanism or Not Required	
Air Quality	NCDEQ		Permit modification likely	Permit modification likely due to the increased heavy equipment vehicle traffic and potential dust generated during closure activities
Building Permit	Rutherford or Cleveland County		New Permit	A local building permit is required for installation of construction trailers
CAMA Monitoring Plan	NCDEQ	N/A	Written NCDEQ DWR approval	Modification or abandonment of CAMA program monitoring wells require the approval of the Division of Water Resources (DWR)
CCR Impoundment Closure	US EPA CCR Rule		Self-Regulating	Required postings to Public Record
CCR Impoundment Monitoring Network	US EPA CCR Rule		Self-Regulating	Maintain CCR GW monitoring network and requirements as stated in 257.90 - 257.98
Clean Water Act 401	NCDEQ		Potential	If work is needed that physically impacts WOTUS
Clean Water Act 404	USACE		Potential	If work is needed that physically impacts WOTUS
Cutting Trees				
Dam Safety	NCDEQ	RUTHE-070 RUTHE-072	Certificate of Approval to Modify	Permitting is required to modify or abandon wells and instrumentation on regulatory dams through the Division of Energy, Mineral, and Land Resources (DEMLR)
Dam Safety	NCDEQ	RUTHE-070	Certificate of Approval to Modify	Inactive Unit 5 Ash Basin Main Dam - Permitting is required to modify the dam in accordance with the Dam Safety Law of 1967, 15A NCAS

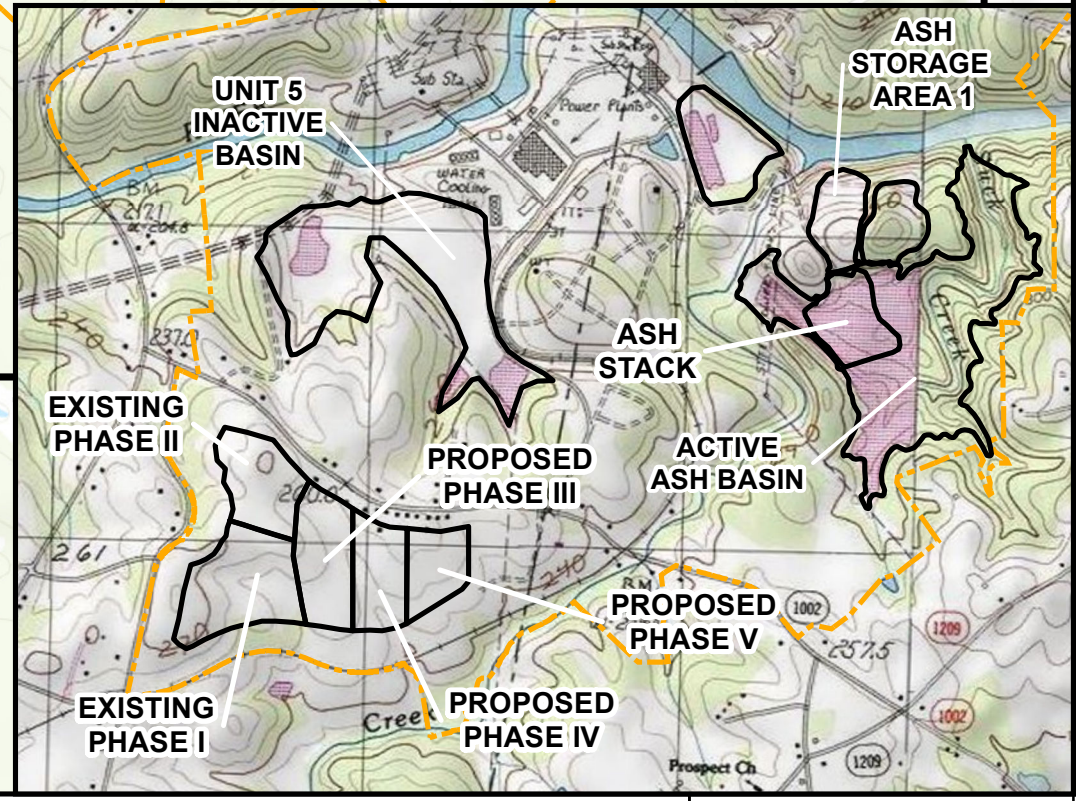
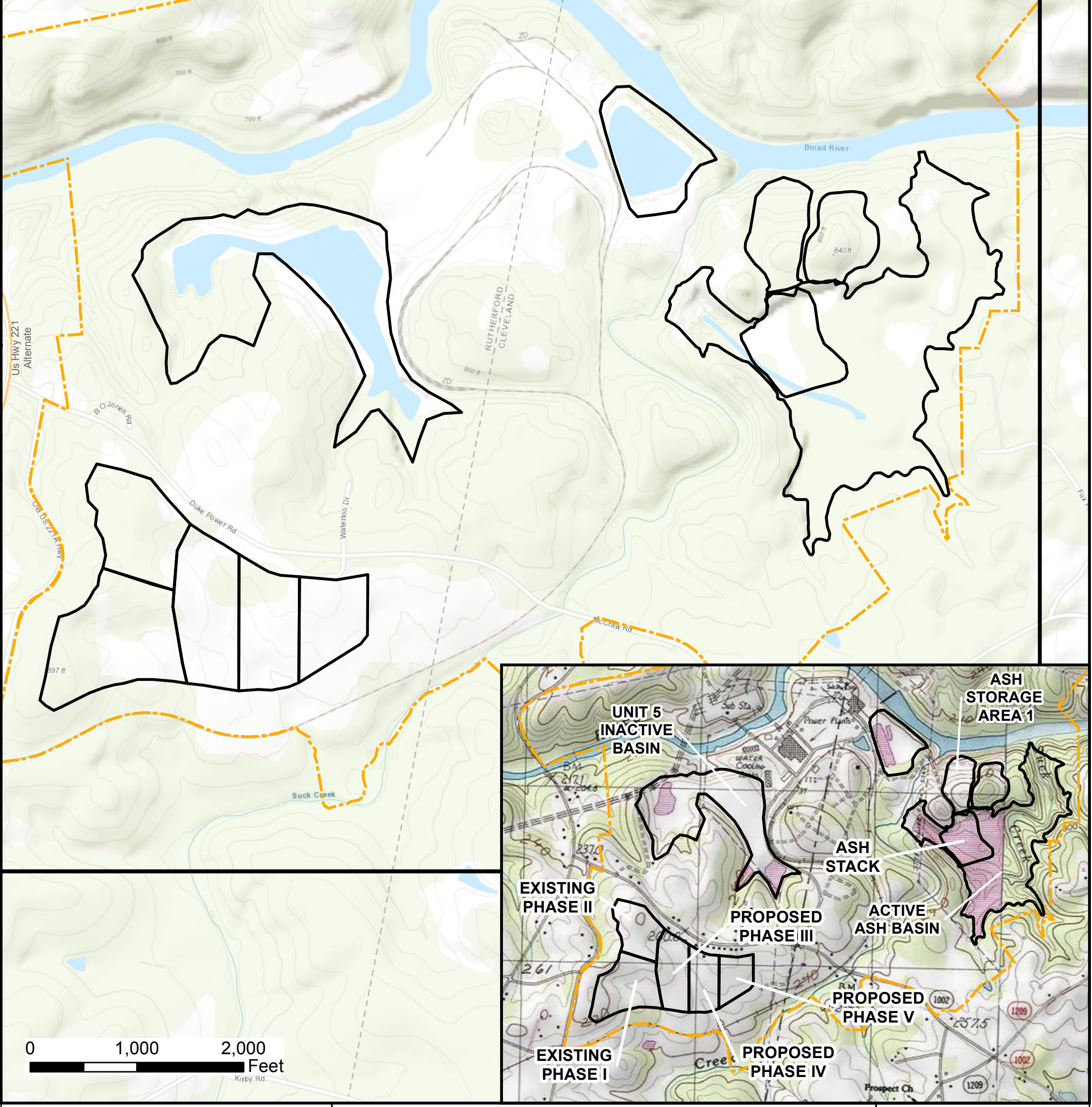
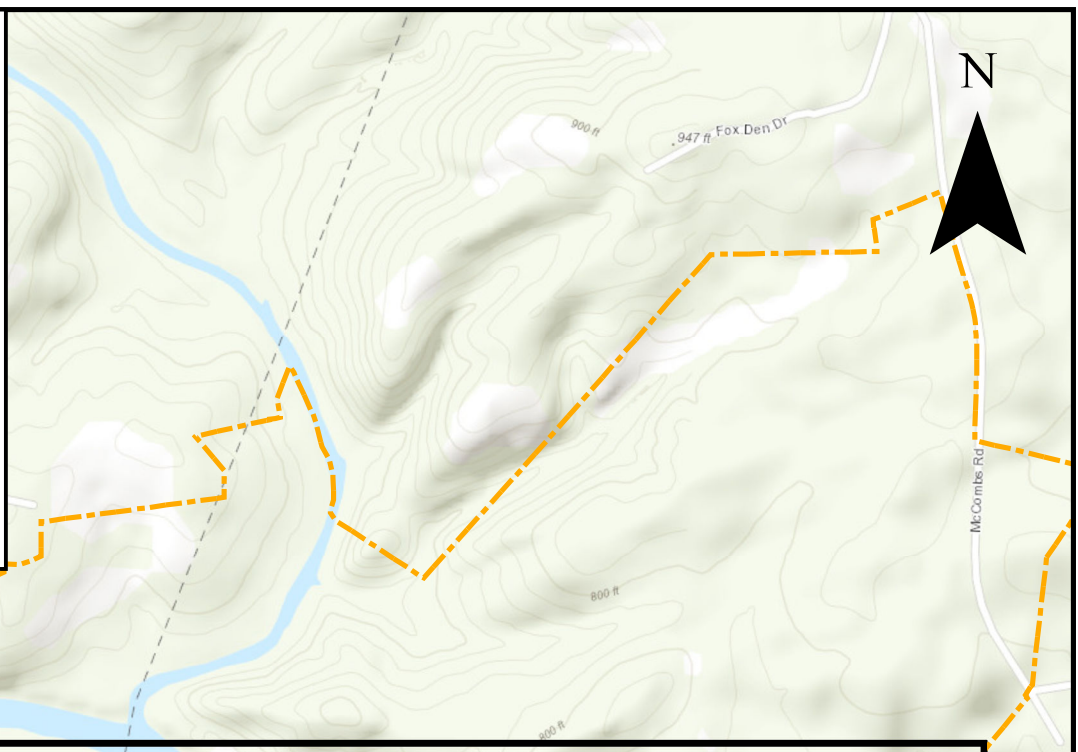
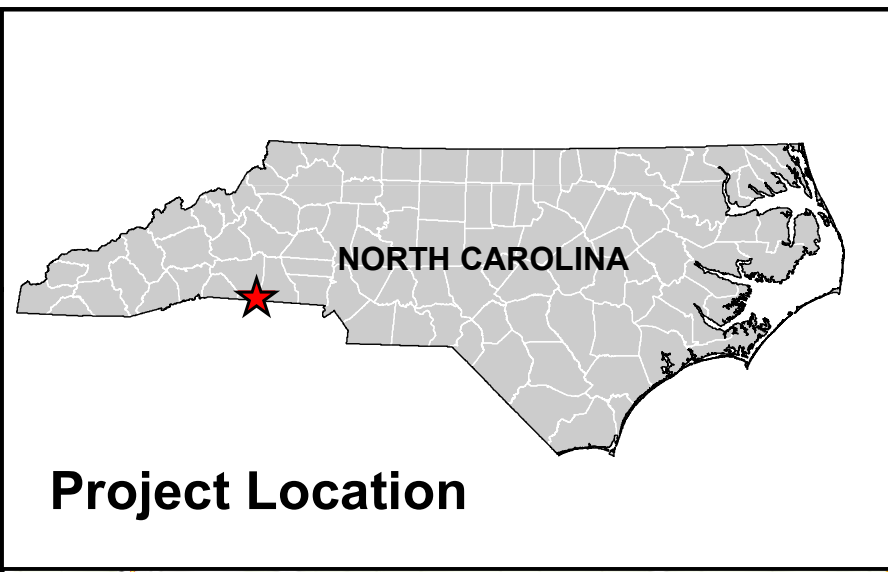
General Permit Name or Subject	Regulating Agency	Existing Permit No. (if applicable)	Permit/Approval	Comments
			Type of Regulatory Approval Mechanism or Not Required	
				02K.0201 (b)(2); an application must be filed with the Division of Energy, Mineral, and Land Resources (DEMLR)
Dam Safety	NCDEQ	RUTHE-072	Certificate of Approval to Modify	Inactive Unit 5 Ash Basin Saddle Dam - Permitting is required to remove the dam in accordance with the Dam Safety Law of 1967, 15A NCAS 02K.0201 (b)(2); an application must be filed with the Division of Energy, Mineral, and Land Resources (DEMLR)
DOT - General				Utilization of or modification to state or federal highways to transport CCR will require consultation or notification to relevant DOT agency
Driveway Permit	NCDOT			Temporary access or driveway permits as needed
Erosion and Sediment Control (E&SC)	NCDEQ Mooreville Regional Office		New Permit	Land disturbance activities outside of the Basin will exceed one acre, therefore in conformance with 15A NCAC 04, an E&SC Permit is required from Land Quality prior to commencement of construction in those areas. Note that land disturbance includes tree clearing and grubbing and vehicular wheel or tracking as disturbance.
Fire Ants			Restriction not likely	Removal from or import of material could be restricted depending on the potential for fire ants and geographic regions involved



General Permit Name or Subject	Regulating Agency	Existing Permit No. (if applicable)	Permit/Approval	Comments
			Type of Regulatory Approval Mechanism or Not Required	
Floodplain Development	Rutherford County		New Permit	Flood Damage Prevention Ordinance of Person County, Article 3 General Provisions, Section C, requires a Floodplain Development Permit prior to any development activities within FEMA mapped Special Flood Hazard Areas for the Flood Insurance Rate Maps
Large Capacity Water Supply Well	NCDEQ		New Permit possible	Permits are required to construct any water supply well or water well system with a design capacity equal to or greater than 100,00 gallons per day - for dewatering outside of the Basin
Multi-State Agreement			Not required	If movement of CCR will cross state lines, multi-state regulations might apply
NPDES (National Pollutant Discharge Elimination System)	NCDEQ	NC0005088	Permit modification likely	Modification of NPDES may be necessary if new source or outfall is created.
NPDES (National Pollutant Discharge Elimination System) Industrial Stormwater	NCDEQ	NCS000571	Permit revision likely	Revision to existing sitewide permit or new permit may be required for access roads, staging areas, etc.
NPDES (National Pollutant Discharge Elimination System) Stormwater	NCDEQ	NC0005088	New Permit possible	Permit required for temporary and permanent stormwater rerouting.

General Permit Name or Subject	Regulating Agency	Existing Permit No. (if applicable)	Permit/Approval	Comments
			Type of Regulatory Approval Mechanism or Not Required	
Noxious Weeds				Removal from or import of vegetated material could be restricted depending on the vegetation and geographic regions involved
Railroad Easement, Access, or Crossing Permit				Construction activities adjacent to tracks/ballast or a new railroad crossing require an agreement or permit
SPCC (Spill Prevention Control and Countermeasure ) Plan	NCDEQ		Modification of existing plan	In accordance with the Federal Water Pollution Control Act (Clean Water Act) of 1974, Title 40, Code of Federal Regulations, Part 112.
Threatened or Endangered Species	NCDEQ And EPA			Federal and/or state regulations may apply including agency consultation and performing site-specific surveys within the proper survey period (e.g., flowering period for listed plant) to determine if Threatened or Endangered Species or their habitat exist within the limits of disturbance
Solid Waste Permit to Construct	NCDEQ	8106-INDUS-2009	Permit	Existing CCR Landfill Expansion
Solid Waste Permit to Operate	NCDEQ	8106-INDUS-2009	Permit	Existing CCR Landfill Expansion

## FIGURES



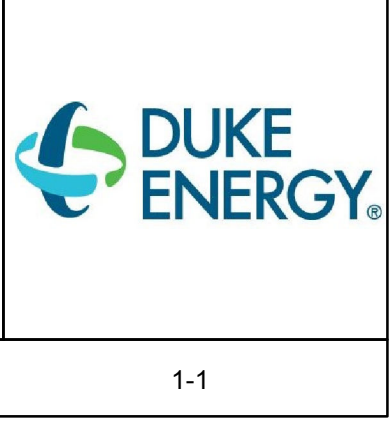
**LEGEND**

- WASTE BOUNDARY & CCR LANDFILL
- DUKE PROPERTY BOUNDARY

**VICINITY MAP AND SITE PLAN  
DUKE ENERGY ROGERS ENERGY COMPLEX  
CLEVELAND AND RUTHERFORD COUNTIES,  
NORTH CAROLINA**

JOB NUMBER 7812-19-0194

FIGURE 1-1



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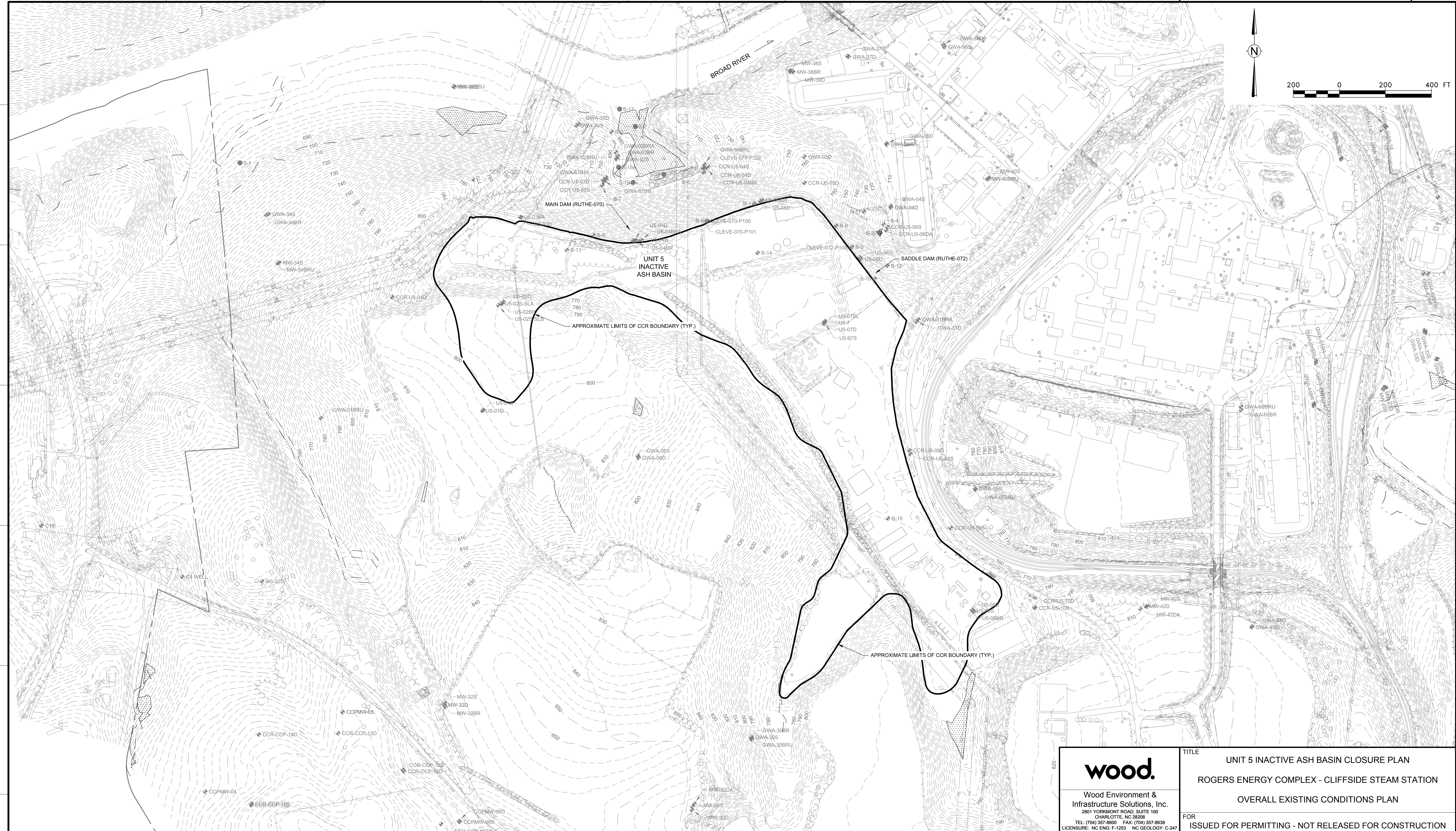


FIGURE 3-1

**NOTE:**  
 1. THE "APPROXIMATE LIMITS OF ASH BASIN FACILITY BOUNDARY" AND THE "APPROXIMATE LIMITS OF CCR BOUNDARY" ARE BASED ON AERIAL PHOTOGRAPHY, TOPOGRAPHIC MAPPING, AND OTHER HISTORICAL DRAWINGS AND INFORMATION AND SHOULD BE CONSIDERED APPROXIMATE. THE "APPROXIMATE LIMITS OF ASH BASIN FACILITY BOUNDARY" INCLUDES THE CONTAINMENT DAMS AND DIKES WHILE THE "APPROXIMATE LIMITS OF CCR BOUNDARY" EXCLUDES THOSE STRUCTURES AND IS BASED ON UPDATED TOPOGRAPHIC MAPPING, REPORTED OPERATIONAL LEVELS, AND SUBSURFACE DATA COLLECTED WITHIN THE BASIN. IT SHOULD BE NOTED THAT THE DETERMINATION OF THE ACTUAL LATERAL EXTENT OF THE CCR MATERIALS WILL TAKE PLACE PRIOR TO, AND/OR DURING, IMPLEMENTATION.

**REFERENCES:**  
 1. ASH BASIN FACILITY BOUNDARIES, BORING LOCATIONS, PIEZOMETER LOCATIONS, AND SEEP LOCATIONS PROVIDED BY DUKE ENERGY.  
 2. EXISTING TOPOGRAPHIC INFORMATION WAS PRODUCED FROM PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY OBTAINED ON JULY 31, 2015 BY WSP.

REV	DATE	JOB NO.	PROJECT TYPE	DES	DFTR	CHKD	ENGR	DESCRIPTION

**wood.**  
 Wood Environment & Infrastructure Solutions, Inc.  
 2801 YORKMONT ROAD, SUITE 100  
 CHARLOTTE, NC 28208  
 TEL: (704) 357-8800 FAX: (704) 357-8838  
 LICENSE: NC ENG. F-1253 NC GEOLOGY. C-247

**NOT FOR CONSTRUCTION**

**wood.**  
 Wood Environment & Infrastructure Solutions, Inc.  
 2801 YORKMONT ROAD, SUITE 100  
 CHARLOTTE, NC 28208  
 TEL: (704) 357-8800 FAX: (704) 357-8838  
 LICENSE: NC ENG. F-1253 NC GEOLOGY. C-247

**DUKE ENERGY**

**NOT FOR CONSTRUCTION**

**UNIT 5 INACTIVE ASH BASIN CLOSURE PLAN**  
 ROGERS ENERGY COMPLEX - CLIFFSIDE STEAM STATION  
 OVERALL EXISTING CONDITIONS PLAN

FOR ISSUED FOR PERMITTING - NOT RELEASED FOR CONSTRUCTION

SCALE: AS SHOWN DES: VMO  
 DWG TYPE: DWG DFTR: VMO/ANE  
 JOB NO: 7812-19-0194 CHKD: KRJ  
 DATE: OCTOBER 15, 2019 ENGR: JB  
 APPD: JB

FILENAME: FIGURE 3-1 U5.dwg  
 DWG SIZE: ANSI D 22"x34" DRAWING NO. REVISION

**FIGURE 3-1**

## APPENDICES