



*Paul Draovitch
Senior Vice President
Environmental, Health & Safety
526 S. Church Street
Mail Code: EC3XP
Charlotte, NC 28202
(980) 373-0408*

December 30, 2019

Ms. Sheila Holman
Assistant Secretary for Environment
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
Roxboro Steam Electric Plant

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 Roxboro 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 Roxboro coal ash basins. After regulatory approval, excavating the basin ash would require 15 years to move the ash to a new lined landfill within plant property. The landfill would be located in the prior footprint of the East Ash Basin adjacent to Dunnaway Road, rising about 180 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 Roxboro 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 CAP approach. The West Ash Basin is currently in compliance with state groundwater standards at the compliance boundary. The CAP designed for Roxboro will achieve groundwater standards at the East Ash Basin through a combination of strategically placed groundwater extraction wells coupled with clean water infiltration wells.

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
Roxboro Steam Electric Plant
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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
ROXBORO STEAM ELECTRIC PLANT
COAL COMBUSTION RESIDUALS SURFACE
IMPOUNDMENT CLOSURE PLAN**

CLOSURE BY EXCAVATION

**WEST ASH BASIN (WAB) AND FGD BASINS
CLOSURE PLAN REPORT
Final Submittal**

Prepared for



550 South Tryon Street
Charlotte, North Carolina 28202

Final Revision 0
Issue Date: December 18, 2019

Prepared by

Wood Environment & Infrastructure Solutions, Inc.
4021 Stirrup Creek Drive, Suite 100
Durham, North Carolina 27703

Project No. 7812190186



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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 West Ash Basin (WAB) and Flue Gas Desulfurization (FGD) Basins at the Roxboro Steam Electric Plant. This plan details closure-by-excavation of the WAB and FGD Basins (collectively, Basins), and placement of the excavated coal combustion residuals (CCR) in a proposed expansion to the existing permitted on-site lined landfill. Closure of the WAB includes the Southern Extension Impoundment (SEI) area of the WAB. The excavation of CCR and the closure of the WAB 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.).

The Roxboro Plant is owned and operated by Duke Energy Progress (Duke Energy) and is located in Person County, approximately 5 miles southeast of Semora, North Carolina. The Roxboro Plant consists of four coal-fired electric generating units with a combined generating capacity of 2,422 megawatts. The first generating unit (Unit 1) at the Roxboro Plant site went into service in 1966.

Duke Energy has historically operated impoundments at the Roxboro Plant site for storing CCR, including the WAB, FGD Basins and the East Ash Basin (EAB). It should be noted that a separate Closure Plan has been prepared for closure of the EAB. The WAB was formed by construction of the EAB Main Dam (regulated by NCDEQ as PERSO-038) around 1973. In 1986, The WAB Main Dam was raised by 13 feet to the current maximum height of 70 feet. Raising of the WAB Main Dam also included construction of WAB Dike No. 1 (regulated by NCDEQ as PERSO-039), saddle dikes and extension of the existing discharge outlet channel (also referred to as the “western discharge canal”). The WAB closure area includes the Southern Extension Impoundment (SEI) area of the WAB.

The FGD Basins (also referred to as FGD Ponds) are located within the WAB for storage of wet sluiced FGD process residuals (also CCR). Construction for the current configuration of the FGD Basins (regulated by NCDEQ as PERSO-040, 041, and 042) was completed in 2009, and the FGD Basins have a total surface area of approximately 26.6 acres. The FGD Basins are constructed on CCR deposits and are located on the northwest side of the WAB near the WAB Main Dam.

The area enclosed by the CCR boundary of the WAB is estimated to be approximately 225 acres, which includes approximately 42 acres for the SEI area of the WAB. Based on a topographic survey performed in April 2014 and other data, bathymetric survey performed in January 2015, and production data thru July 2019, the WAB closure area is estimated to contain approximately 10.81 million cubic yards of CCR or approximately 12.97 million tons. This estimate includes CCR contained within the FGD Basins and the SEI area of the WAB.

Closure activities for the Basin have already begun with the initiation of decanting under the Special Order by Consent (SOC). Upon approval of a Closure Plan by NCDEQ, additional actions will commence, including finalization of the detailed designs, dewatering and removal of interstitial

water, contracting and detailed planning for the closure work, removal and disposal of CCR from the SEI area of the WAB, excavation of CCR from the Basin, excavation and removal of CCR from the FGD Ponds, removal of the FGD Pond dikes and related facilities, construction of additional industrial landfill capacity to permanently store the excavated CCR, breaching and partial removal of the WAB Main Dam, complete removal of WAB Dike No. 1, and restoration of disturbed areas.

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



Figure ES-1 Current View



Figure ES-2 Post Closure View

The Basin CCR will be removed to a new lined landfill expansion within the Station property, located partially within the prior footprint of the EAB, adjacent to Dunnaway Road. The landfill would rise approximately 180 feet above Dunnaway Road. Post-excavation, the Basin 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 Basin Dam will be removed, allowing Hyco Lake to reach back into the footprint.

This document also includes a description of the Post-Closure Care Plan, which provides a description of the inspection, monitoring, and maintenance activities required to be performed throughout the 30-year post-closure care period for the closed Basins at the Roxboro Plant.

This document provides a summary of 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 this Closure Plan, meets regulatory requirements for the stability of the site, management of surface water run-off, and access for effective maintenance over the post-closure care period.

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 has begun to implement, and will continue implementing, source control measures at the site, including (i) complete decanting of the East

Ash Basin and West Ash Basin to lower the hydraulic head within the basins and decrease hydraulic gradients, reducing groundwater seepage velocities and COI transport potential; and (ii) complete closure of the East Ash Basin and West Ash Basin. In addition, Duke Energy intends to implement a robust active groundwater remediation program that includes extraction and treatment at the East Ash Basin, and a combination of groundwater extraction and clean water infiltration at the gypsum storage area and dry fly ash handling area. The CAP provides that these corrective action measures will most effectively achieve remediation of the groundwater through the installation of (i) extraction wells in the area of the unnamed pond north of the East Ash Basin; (ii) extraction wells on the northeast side of the East Ash Basin; (iii) extraction wells in the comingling zone near the dry fly ash handling area; and (iv) extraction wells and clean water infiltration wells in the area between the gypsum storage area/dry fly ash handling area and Intake Canal. Significantly, groundwater modeling simulations indicate (i) these measures will address COI at or beyond the East Ash Basin 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 at or beyond the East Ash Basin compliance boundary will meet the remedial objectives in nine years. Critically, as discussed above, the model indicates that COI concentrations currently meet the 02L Standards at and beyond the West Ash Basin compliance boundary.

1. INTRODUCTION

1.1 Background

The Roxboro Plant is located in Person County, approximately 5 miles southeast of Semora, North Carolina and consists of four coal-fired electric generating units with a combined generating capacity of 2,422 megawatts. The first generating unit (Unit 1) at the Roxboro Plant site went into service in 1966. CCR has historically been managed in the Roxboro Plant's on-site West Ash Basin (WAB), East Ash Basin (WAB) and the Flue Gas Desulfurization (FGD) Basins (also referred to as FGD Ponds). The Roxboro Plant ceased all waste flows to the WAB in 2019 with exception of FGD Basins (pending NPDES permit approval). The CCR boundary for WAB includes the Southern Extension Impoundment (SEI) area.

Figure 1-1 presents a Vicinity Map and Site Plan of the Roxboro Plant.

For this Closure Plan, Duke Energy uses three facilities to manage CCR at the Roxboro Plant that include dams and dikes regulated by the NCDEQ:

1. The West Ash Basin Main Dam (NCDEQ ID: PERSO-038);
2. The West Ash Basin Dike No. 1 (NCDEQ ID: PERSO-039); and
3. The FGD Basins including the FGD West Settling Pond Dikes (NCDEQ ID: PERSO-040), FGD East Settling Pond Dikes (NCDEQ ID: PERSO-041), and FGD Forward Flush Pond Dikes (PERSO-042).

As further discussed in Section 2 below, the closure method mandated by order of the NCDEQ for the Basins 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 Basin and FGD Ponds as directed by order of NCDEQ. Wood understands Duke Energy does so without prejudice of its position that closure by excavation is not necessary for either the Basin or FGD Ponds. 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 Basins 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::

- Removal and disposal of CCR from the SEI area of the WAB;
- Decanting the WAB;
- Excavation and removal of CCR from the FGD Ponds;
- Demolition, excavation and removal of the FGD Pond dikes and related facilities;
- Construction and operation of a temporary water management system to manage discharges in compliance with NPDES permit during closure;

- Dewatering to support safe excavation of CCR from the Basins;
- Excavation and removal of CCR from the WAB and establishing post-excavation final grades using soil fill where required;
- Construction of CCR landfill expansion capacity to permanently store the excavated CCR;
- Breaching and removal of the WAB Main Dam;
- Complete removal of WAB Dike No. 1 including discharge outlet features; and
- Restoration of disturbed areas.

1.3 Report Organization

This document is structured to follow the requirements provided in 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 CCR Basins. Subsequently, in July 2016, the North Carolina General Assembly enacted House Bill 630, 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 WAB as “low-risk.”

On April 1, 2019, NCDEQ issued its Closure Determination mandating that the WAB be closed by excavation of the CCR pursuant to N.C.G.S. § 130A-309.214(a)(3)a. A closure plan is required for each CCR surface impoundment regardless of the risk classification. The CAMA 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 report was submitted to NCDEQ in September 2015, with supplemental reports submitted August 2016 and October 2017. The Corrective Action Plan (CAP) Part 1 was submitted December 2015 and the CAP Part 2 was submitted February 2016. Duke Energy intends that an updated CAP will be submitted in parallel with this Closure Plan.

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 CCR basin dams, and environmental permitting requirements must be considered as part of closure.

3. FACILITY DESCRIPTION AND EXISTING FEATURES DESCRIPTION

3.1 Surface Impoundment Description

This section provides details on the CCR-related features for the WAB Closure Plan at the Roxboro Plant.

3.1.1 Site History and Operations

Figure 1-1 presents a Vicinity Map and Site Plan for the Roxboro Plant and **Figure 3-1** presents an Existing Conditions Plan for the WAB, FGD Basins and other site features.

For this Closure Plan, CCR facilities located on-site include the WAB and FGD Basins as described in more detail below:

West Ash Basin (WAB Main Dam NCDEQ ID: PERSO-038 and Dike No. 1 ID: PERSO-039)

The WAB is situated southwest of the Roxboro Plant generating units. The surface area enclosed within the CCR boundary for WAB is estimated to be approximately 225 acres, which includes the SEI area of the WAB. The WAB is unlined and is located in a former valley area of Sargents Creek drainage basin. The WAB was operated at a normal pond level of Elevation 463 feet.

The WAB Main Dam was constructed in 1973 with an earth-fill embankment and a central low permeability earth core. The original structural height of the dam was about 70 feet with a crest at Elevation 457 feet. In 1986, the dam was raised by 13 feet to the current crest level at Elevation 470 feet. The WAB Main Dam has a “Large Size” and “High Hazard” classification under the regulations of NCDEQ, Division of Energy, Mineral and Land Resources, Land Quality Section, Dam Safety Program. The North Carolina Dam Identification Number for the WAB Main Dam is PERSO-038. Additionally, the 1986 modifications included construction of four new containment dikes (Nos. 1, 2, 3, and 4) and an excavated outlet channel. The modifications provided additional storage capacity and changed the internal circulation to increase ash retention/settling time.

The WAB Dike No. 1 (also referred to as the “Filter Dike”) is constructed of rock fill, primarily excavated from the nearby outlet channel (western discharge canal). The embankment design includes provisions for a sand filter blanket on the upstream slope below a layer of rock fill; however, the sand filter blanket has not been observed during field investigations. The original crest of the embankment is at Elevation 473 feet, and the maximum structural height is approximately 50 feet. Two discharge outlet structures were originally installed for the basin, both located within WAB Dike No. 1. These discharge outlet structures have been abandoned and grouted closed and replaced with a new spillway system. The WAB Dike No. 1 has a “Large Size” and “High Hazard” classification under the regulations of NCDEQ, Division of Energy, Mineral and Land Resources, Land Quality Section, Dam Safety Program. The North Carolina Dam Identification Number for WAB Dike No. 1 is PERSO-039.

The SEI area of the WAB constitutes a ponded area within the CCR boundary of the WAB, which is located south and upstream of WAB Dike No. 1. The estimated surface area for the SEI area of the WAB is around 42 acres.

Stormwater and other discharges from within the WAB currently flow through the western discharge canal into the Heated Water Discharge Pond and are finally released to the Hyco Reservoir through NPDES Outfall 003.

The WAB historically accepted bottom ash and fly ash generated from operation of the Roxboro Plant conveyed via wet sluicing methods, along with various other waste water streams. The WAB has received fly ash, bottom ash, CCR transport water, coal pile runoff, stormwater runoff, cooling tower blowdown, and low volume wastewater.

The Plant converted from wet to dry CCR handling system. During 2019, modifications were completed to re-direct plant stormwater, wastewater and process flows; therefore, those flows to the WAB have ceased.

The stormwater outflow from part of the EAB currently discharges into the WAB through existing culvert pipes located under Dunnaway Road.

Flue Gas Desulfurization (FGD) Basins (West Settling Pond NCDEQ ID: PERSO-040, East Settling Pond ID: PERSO-041 and Forward Flush Pond ID: PERSO-042

Wastewater from Roxboro Plant Flue Gas Desulfurization (FGD) equipment operations is currently conveyed to the FGD Ponds, then is released to the Bioreactor facility for treatment before being discharged to western discharge canal. The Roxboro Plant is currently planning to cease discharge of FGD wastewater flow into the FGD Basins following receipt of NPDES permit approval.

The FGD Ponds are constructed on top of CCR deposits located entirely within the CCR boundary of the WAB. Construction of the FGD West Settling Pond and FGD Forward Flush Pond was completed in 2008. The FGD Ponds were temporarily shut down for improvements, which was completed in 2011. The FGD Pond containment dikes have “Medium Size” and “High Hazard” classification under the regulations of NCDEQ, Land Quality Section, Dam Safety Program.

The FGD West Settling Pond and portions of the FGD Forward Flush Pond containment dikes are constructed of compacted fly ash material, with portions of the FGD Flush Pond dikes constructed of compacted soil. The FGD East Settling Pond containment dike was constructed on the east side of the FGD West Settling Pond and the north side of the FGD Flush Pond dikes. The north and east containment dikes of the FGD East Settling Pond were constructed of compacted soil. The outer perimeter of the FGD Pond dikes have topsoil and grass vegetation for erosion protection on the exterior slopes. A liner system on the interior slopes and bottom of each pond area consists of a geosynthetic clay liner (GCL) and a surface liner of 60-mil-thick, linear low-density polyethylene (LLDPE). The design crest level for the dikes for the West Settling Pond and Forward Flush Ponds is at Elevation 506 feet. The design crest level for the East Settling Pond dike is at Elevation 500 feet.

3.1.2 Estimated Volume of CCR in Impoundment

Based on CCR inventory data provided by Duke Energy as of July 31, 2019 and upon surface comparison calculations, comparing the approximate pre-development topography to recent topographic and bathymetric surveys, the approximate volume of CCR in the Basins, including the FGD Pond areas is listed in the table below.

During 2016, field investigations were performed for the purpose of estimating the extent of CCR material present within the SEI area of the WAB. The estimated volume of CCR for the SEI area of the WAB is included in the estimate provided below.

To compute the estimated volume of CCR in place an assumed density of 1.2 tons per cubic yard was used, which is the Duke Energy fleet-wide assumption. See **Appendix A** for the Estimated Volume of CCR in Impoundment calculation.

Impoundment Description	Estimated CCR Volume (CY)	Estimated CCR Weight (Tons)
West Ash Basin (WAB) (Notes 1 & 2)	10,811,667	12,974,000
SEI Area of the WAB	Included in estimate above.	Included in estimate above
Totals	10,811,667	12,974,000

Table Notes:

1. The WAB Estimated CCR includes the CCR contained within the FGD Basins.
2. The WAB Estimated CCR is based on updated CCR Inventory Data provided by Duke Energy as of July 31, 2019.

3.1.3 Description of Surface Impoundment Structural Integrity

The purpose of this section is to summarize the structural integrity evaluations for the WAB based on current existing information. This section includes the geotechnical, and hydrology and hydraulics 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 257.3). 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 WAB Main Dam embankment, Dike No. 1, and FGD Basin enclosure dikes, the 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 criteria. Slope stability results under the loading conditions mentioned above met regulatory requirements.

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

A liquefaction screening analysis was performed for the site including the WAB Main Dam, Dike No. 1, and the FGD Pond areas. Based on the evaluation of the available borings, the Seismic Site Classification for subsurface conditions to 100 feet below the foundation level of the dikes was determined to be C for the WAB Main Dam and Dike No. 1. The FGD Basins are constructed on sedimented CCR with a depth of up to approximately 85 feet; therefore, Site Class E was selected for analysis of this area.

Based on the conditions encountered in the borings performed for this project, ground motions for the design seismic event (2,500-year return period) are calculated not to trigger liquefaction or cyclic softening within granular soils below the embankments for the WAB Main Dam and Dike No. 1 (i.e., factors of safety above 1.1). For the FGD Pond dikes, the conclusion of liquefaction potential analyses is that global failure of the FGD Pond dikes is unlikely during the design seismic event. Shallow surficial sloughing may occur on the downstream slopes and near/outside the toe of the FGD Pond dikes, which could be considered as maintenance issues.

- **Hydrology and Hydraulics (H&H) Capacity Analyses**

WAB Main Dam and Dike No. 1: H&H analyses were performed to evaluate whether the existing Ash Basin and discharge outlet could safely pass a design storm for the full Probable Maximum Precipitation (PMP) storm event without overtopping the dam. This analysis was based on a design flood for a site specific PMP storm event as developed by Applied Weather Associates (AWA). It is assumed that the existing 10-foot diameter culvert under Dunnaway Road will be placed into service prior to closure of the WAB. Thus, for this analysis, inflow was assumed from the EAB to be through the 10-foot culvert and the two existing 30-inch diameter culverts under Dunnaway Road. The results for the additional H&H analyses indicate that the WAB can contain and safely pass the full site specific PMP with 0.9 feet of freeboard (peak elevation 469.1).

FGD Basins: H&H analyses were performed to evaluate whether the existing FGD Basins could safely pass a design storm for the full PMP storm event without overtopping the dam. This analysis was based on a design flood for a site specific PMP storm event as developed by Applied Weather Associates (AWA). Based on the results for the analyses, the existing conditions for the FGD Ponds will safely contain the design storm event (back-to-back PMP storm events) without an uncontrolled discharge and are compliant with North Carolina Dam Safety Regulations.

3.1.4 Sources of Discharges into Surface Impoundments

Process flows are no longer discharged into the WAB. The Roxboro Plant currently employs a dry ash handling system transporting CCR to the on-site landfill.

Stormwater flows from the EAB into the WAB through existing culvert pipes located under Dunnaway Road.

The FGD Basins currently receive process water from plant scrubber equipment operations, which is released to the Bioreactor facility for treatment before being discharged to the western discharge canal. The FGD Basins are perched and have no watershed other than direct rainfall. The Roxboro Plant is currently planning to cease discharge of FGD wastewater flow into the FGD Basins following receipt of NPDES permit approval.

3.1.5 Existing Liner System

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

The interior slopes and bottom of the FGD Basins are lined with a geosynthetic clay liner (GCL) and a 60-mil-thick LLDPE liner.

3.1.6 Inspection and Monitoring Summary

Weekly inspections of the Basins 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 Basins include the weekly monitoring elements with the addition of piezometer and observation well readings, 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 Basins are 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. Historically, independent inspections of the WAB Main Dam have performed by an independent third-party consultant on a 5-year and annual basis between 1998 and 2013.

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.

Review of current annual inspection reports did not identify features or conditions in the CCR Basin 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 CCR Impoundment Related Structures

A site map showing property boundary, location of the Roxboro Plant, WAB and FGD Basins with their boundaries and topographic 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 are currently three existing permitted landfills on site, which are identified in the table below, along with the status (active/closed). The existing landfills are shown on the attached **Figure 3-1**, and described in more detail in Section 3.1.1 of the separate EAB Closure Plan. The CCR contained within the landfill is not subject to this Closure Plan.

Landfill	Permit Number	Comment
On-site Industrial Landfill	7302-INDUS-1988	Active
LCID Landfill	73D-LCID-2002	Non-CCR, Active
1979 C&D Landfill	73-A	Non-CCR, Inactive

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.

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, piezometers and Cone Penetration Test (CPT) sounding locations is shown on the drawings included in **Appendix D**. In addition, the available boring logs

and records for subsurface exploration are provided in the Wood, Geotechnical Data Report – Final Rev. 0, Roxboro Steam Station – West Ash Basin, July 1, 2019 (Wood, 2019d), which is included in **Appendix B**.

This section 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; and geotechnical properties of the CCRs and the uppermost stratigraphic unit under the surface impoundment.

4.2 Hydrologic 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 the CAP 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 provides a summary of geotechnical conditions and properties found from investigations performed within the WAB for the WAB Main Dam, WAB Dike No. 1, and FGD Pond 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 WAB 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. Explorations in the FGD Basins area encountered embankment fill underlain by CCR, residual soils, and PWR.

General properties of the various materials encountered within and surrounding the WAB are described below. The results of available laboratory tests performed on samples from the subsurface explorations completed within the WAB area were reviewed, and the range of measured material properties was evaluated to select representative material properties. The results of available laboratory tests performed on samples from the subsurface explorations completed within and surrounding the WAB were reviewed, and the range of representative material properties is summarized in **Table 4-1**.

4.4.1 CCR within Basins

The CCR within the WAB consists primarily of bottom ash and fly ash. Other CCR such as slag are also typically encountered. The bottom ash is generally described as very loose to loose, moist to wet, dark gray to gray material, and typically classified as silty sand (SM). The fly ash is generally described as very soft to soft, moist to wet, light to medium gray material, and typically classified as sandy silt and silt (ML).

The CCR within the FGD Basins consists primarily of residue from FGD blowdown. When excavated, this material will be placed in the on-site landfill.

4.4.2 Liner Material Properties

The WAB is unlined so there are no associated material properties. The FGD Basins are lined with a geosynthetic clay liner (GCL) and a 60-mil-thick LLDPE geomembrane.

4.4.3 Subsurface Soil Properties

Alluvium: Alluvial soil is typically encountered beneath the sluiced CCR. The alluvium generally consists of very loose to loose, wet, silty fine sand (SM) or soft to firm, wet, fine sandy silt (ML). The soil colors encountered ranged from gray to dark gray, green, brown and black. Alluvium may not be encountered in excavated areas.

Residuum: The residuum (including saprolite) is the next layer encountered and generally was found to consist of soft to hard sandy lean clays (CL) and sandy silts (ML), or loose to dense silty sands (SM) and clayey sands (SC). The soil colors encountered ranged from gray to dark gray, green, brown and black. The saprolite layers typically were sampled as sandy silt (ML) or silty sand (SM).

PWR: Partially Weathered Rock (PWR) is typically encountered below the residuum for the Basin. PWR primarily consists of wet, light gray to reddish brown to light brown mottled sand (SP), silty sand (SM), sandy non-plastic silt (ML), sand with clay (SP-SC), lean clay (CL), and weathered meta-quartz diorite, meta-granodiorite, and meta-diorite bedrock.

Bedrock: Bedrock is typically encountered below the PWR for the Basin. The bedrock primarily consists of dark greenish gray, very strong, coarse grained, massive Meta-Quartz diorite, and black and white, strong, fine to coarse grained Meta-Diorite bedrock.

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.

The updated CAP evaluates the extent of, and remedies for, constituents of interest (COI) in groundwater associated with the East Ash Basin and gypsum storage area, focusing on constituent concentrations detected above the applicable O2L Standards, Interim Maximum Allowable Concentrations, or approved background threshold values beyond the basin's compliance boundary. Importantly, constituent concentrations in groundwater associated with the West Ash Basin are less than applicable regulatory standards at and beyond the compliance boundary. Accordingly, groundwater corrective action under North Carolina's O2L standards is not required for this basin. In addition to the state's corrective action requirements, 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 has begun to implement, and will continue implementing, source control measures at the site, including (i) complete decanting of the East Ash Basin and West Ash Basin to lower the hydraulic head within the basins and decrease hydraulic gradients, reducing groundwater seepage velocities and COI transport potential; and (ii) complete closure of the East Ash Basin and West Ash Basin. In addition, Duke Energy intends to implement a robust active groundwater remediation program that includes extraction and treatment at the East Ash Basin, and a combination of groundwater extraction and clean water infiltration at the gypsum storage area and dry fly ash handling area. The CAP provides that these corrective action measures will most effectively achieve remediation of the groundwater through the installation of (i) extraction wells in the area of the unnamed pond north of the East Ash Basin; (ii) extraction wells on the northeast side of the East Ash Basin; (iii) extraction wells in the comingling zone near the dry fly ash handling area; and (iv) extraction wells and clean water infiltration wells in the area between the gypsum storage area/dry fly ash handling area and Intake Canal. Significantly, groundwater modeling simulations indicate (i) these measures will address COI at or beyond the East Ash Basin 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 at or beyond the East Ash Basin compliance boundary will meet the remedial objectives in nine years. Critically, as discussed above, the model indicates that COI concentrations currently meet the O2L Standards at and beyond the West Ash Basin 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 Basins at Roxboro Plant.

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 WAB.

7. CLOSURE DESIGN DOCUMENTS

7.1 Engineering Evaluations and Analyses

Engineering evaluations and analyses to support closure of the Basins at the Roxboro Plant, as detailed in this Closure Plan, are provided in **Appendix C**.

The FGD Basins will be fully removed and the waste material will be placed in a permitted solid waste facility approved to receive the waste stream. Decommissioning of the FGD Basins will be completed before proceeding with WAB closure.

Geotechnical calculations for the proposed landfill expansion design will be performed separately as part of its permit application, which will follow NCDEQ approval of this Closure Plan. Dam removal-related calculations will be included in the dam modification permit applications, which will follow NCDEQ approval of this Closure Plan.

Safe and effective access to the Basin is critical to CCR excavation and the completion of closure. Access road locations into or across the Basin 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 surface 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 will be established within the closure limits of the Basin and require placement or stacking of CCR excavated from other areas of the WAB. 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 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. However, the proposed excavation and sampling plan for closure by excavation areas is included in **Appendix E**.

7.2 Closure Plan Activities

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

- Remove and dispose of CCR from within the SEI area of the WAB.
- Reduce free/surface water volume via discharge to the existing NPDES-permitted Outfall 003.
- Decant by using floating pumps, screened intakes, and pumping.
- Construction and operation as necessary of a temporary water management system (WMS) to manage all discharges in compliance with the NPDES permit during closure.
- Dewater the CCR to allow access for CCR excavation and conditioning (drying) prior to placement in the proposed on-site landfill.
- Start CCR excavation from the basin, 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 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 hydraulic storage capacity though the excavation process and progressively breach the WAB Main Dam and Dike No.1 as excavation progresses.

- Complete closure by excavation verification. Grade the area to promote positive drainage.
- Sequence final dam breach for the WAB Main Dam and complete removal for the WAB Dike No. 1 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 can be found in **Appendix D**.

7.3 Design Drawings

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

- Cover sheet
- General notes
- Existing conditions plan with aerial photograph
- Existing conditions plan with topography
- Subsurface exploration location plan
- Estimated bottom of CCR plan
- Demolition plan
- Final grading plan
- Final surface water management plan
- Site cross sections

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 have been achieved, the procedures described in the Duke Energy Excavation Soil Sampling Plan (**Appendix E**) will be followed to confirm that closure by excavation has been achieved.

7.4 Description of Construction Quality Assurance and Plan

A Construction Quality Assurance (CQA) Plan will be developed following NCDEQ approval of the Closure Plan for closure of the Basins at the Roxboro Plant. The CQA Plan will be prepared to address N.C.G.S. §130A-309.214(a)(4)(g), and its purpose is to provide a description of the CQA program to be adhered to in execution of closure activities. The CQA Plan will present a description of the roles and responsibilities for monitoring and testing activities and provides 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
 - Soil Fill
- HDPE Piping
- Vegetation
- As-Built Conditions
- Record Documentation Report

8. MANAGEMENT OF WASTEWATER AND STORMWATER

The Roxboro Plant manages wastewater under NPDES Permit NC0003425. The permit authorizes two discharge points into the Hyco Reservoir.

The Roxboro Plant manages stormwater under NPDES Permit NCS000581. The facility is permitted to discharge stormwater to the Hyco Reservoir.

Process flows no longer discharge into the WAB at the Roxboro Plant. Process flows are directed toward newly-constructed lined retention basins. The WAB will continue to operate during closure to meet the NPDES permit discharge requirements as it goes through decanting and dewatering. The WAB must also continue to safely pass the PMP to meet dam safety requirements.

Decanting of the WAB will be performed to drawdown the existing free/standing water using floating pumps, screened intakes, and pumping. The pumping system is expected to draw down the stored water after storm events, route it through the WMS, if necessary, and discharge the water via the permitted outfall. When dewatering of the CCR begins, all discharge flows are anticipated to be routed through the WMS and meet the permitted discharge limits.

The WAB currently has the capacity to contain the PMP storm event by maintaining the water surface level at or below the crest level for the WAB Main Dam at Elevation 470.0 feet, which provides a minimum freeboard of 0.9 feet. As part of the closure, the WAB Main Dam will be partially removed by excavating an engineered breach in the embankment along with lowering the crest level along the entire length of the dam. In addition, WAB Dike No. 1 will be completely removed for closure resulting in run-on flow being redirected toward the WAB Main Dam engineered breach. Under this post-closure condition, there will not be a net increase in flow downstream of the WAB Main Dam within the receiving body of water compared to the existing conditions. No additional stormwater retention capacity will be needed following the planned dam breaching and removal.

Dewatering will be performed to remove the interstitial water from the CCR to facilitate excavation and access to in-place CCR. Along with other factors, dewatering will be used to facilitate 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.

Wastewater from the WAB will be pumped, treated as needed and discharged in two phases: the decanting phase and dewatering phase. In the decanting phase, free water above the settled CCR layer will be removed from the basins without the mechanical disturbance of the CCR. For the decanting phase, the Roxboro water management process has a designed flow rate of 1250 gpm. Following the decanting phase and as the Closure Plan schedule dictates, the WAB site will advance into the dewatering phase to remove interstitial water from the Basin. During this phase, additional physical-chemical treatment processes may be added to the WMS as necessary to maintain compliance with the requirements of the discharge permit. During dewatering phase, the designed flow rate may drop to 250-400 gpm.

The post-closure grades restore the historical flows from the surrounding landscape and route that flow toward the breached WAB Main Dam. Up to and including the last phase of closure before the WAB dam is breached, the WAB will maintain the capacity to contain the run-on from the required storm size/flows.

Detention basin requirements and 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, which will follow NCDEQ approval of this Closure Plan. **Appendix C1** presents the results of the post-closure stormwater management calculations. Detailed stormwater design for the proposed landfill expansion will be developed as part of its permit process and is not covered herein.

8.1 Anticipated Changes in Wastewater and Stormwater Management

Wastewater and process streams from the Roxboro Plant previously discharging to the WAB have been rerouted to a new lined retention basin. The FGD Basins still receive process streams, which will be rerouted when NPDES permit approval is received.

A temporary WMS will be utilized as necessary such that the permitted NPDES effluent discharge limits, or other limits as directed by the NCDEQ, will be met throughout the duration of dewatering and closure.

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. 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 expansion. Duke Energy intends to laterally expand the existing on-site industrial landfill (NCDEQ Permit 7302-INDUS-1988) to accommodate CCR in completion of the NCDEQ-mandated closure by excavation. A permit application for construction of the on-site landfill will be prepared and submitted to NCDEQ Division of Waste Management following approval of this Closure Plan.

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/approval needed to implement this Closure Plan. 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 closure of the WAB. 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 WAB.

The post-closure care plan will be developed to meet the requirements of N.C.G.S. §130A-309.214(a)(4)(k). The items that will be in the Post-Closure Care plan for the Roxboro site 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 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	Q4-2020
Start new landfill expansion construction	Q4-2021
Start CCR excavation	Q1-2023
Complete CCR excavation	Q4-2035
Complete final closure and cover system of landfill	Q4-2036
Site final grading and vegetative cover	Q4-2037

It should be noted that NCDEQ approval of this Closure Plan by March 31, 2020 will allow completion of the CCR excavation actions 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 Basin at Roxboro Plant was 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 is estimated to be \$507 Million.

The cost to perform the 30-year post-closure activities and monitoring is estimated as \$67 Million

The cost estimates include the following major activities:

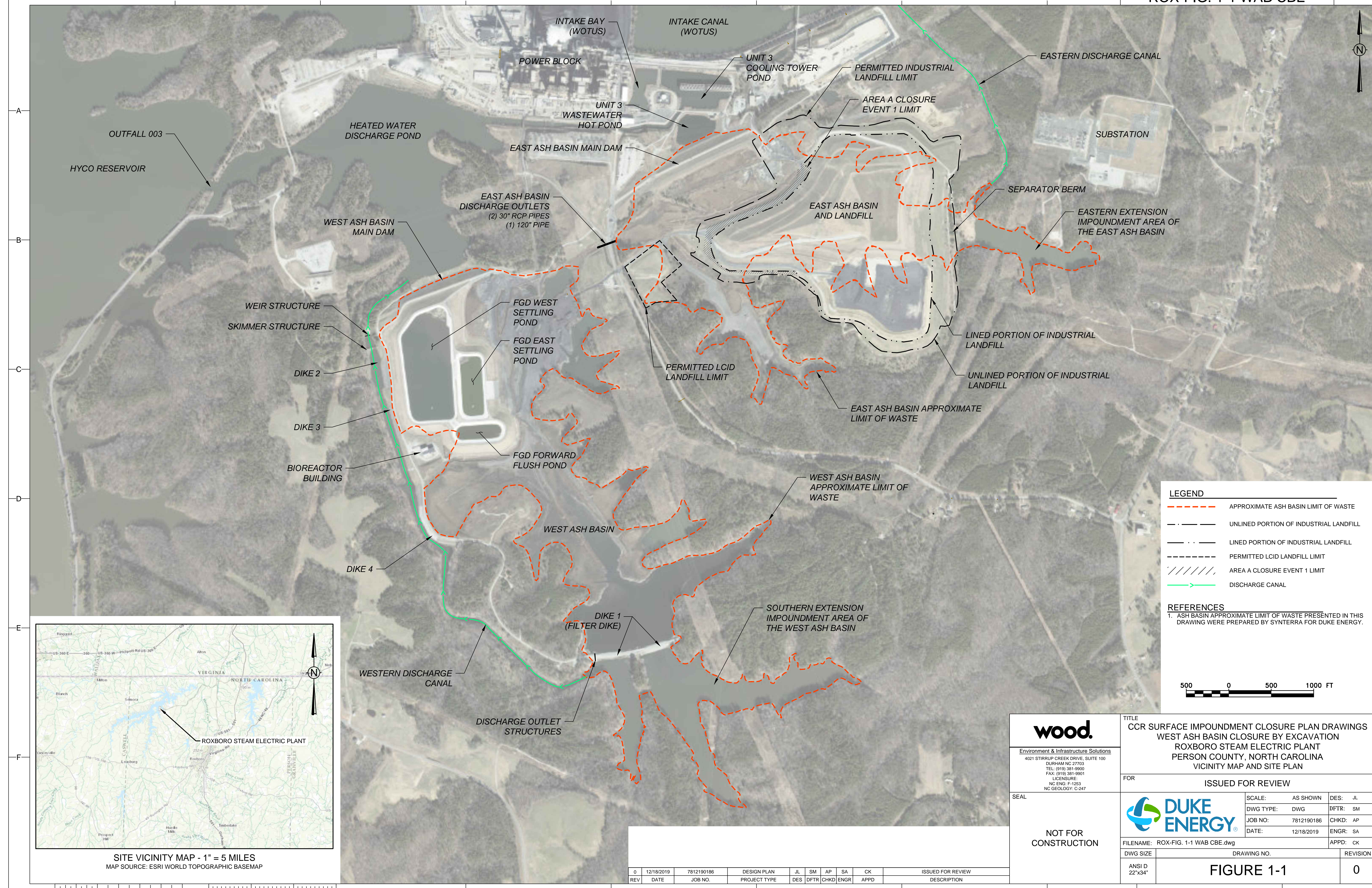
- Mobilization and Site Preparation
- Dewatering, earthwork, and subgrade preparation
- CCR excavation
- Stormwater management, erosion and sediment control, and site restoration
- Engineering support (design and CQA)
- Post closure – groundwater monitoring
- Post closure – operations and maintenance
- 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

- (Amec, 2013). Amec, 2013 Five-year Independent Consultant Dam Inspection, Duke Energy Progress – Roxboro Electric Plant, Person County, North Carolina, October 23, 2013.
- (Amec, 2015). Amec Foster Wheeler, Report of Tail Risk Liquefaction Study (ROX-601), West Ash Pond FGD Pond Area, Roxboro Steam Station, Person County, North Carolina, December 1, 2015.
- (Amec, 2015a). Amec Foster Wheeler, Summary of FGD Pond Slope Stability Factors of Safety, Roxboro Steam Station, Person County, North Carolina, December 30, 2015.
- (Amec, 2016). Amec Foster Wheeler, Re-evaluation of Liquefaction Potential, Roxboro FGD Ponds, Roxboro Steam Station, Person County, North Carolina, February 5, 2016.
- (Amec 2016a). Amec Foster Wheeler, Report of Ash Extent Exploration (Issue ROX-134), Former Part of the West WAB, November 14, 2016.
- (Wood, 2019). Wood E&IS, Roxboro East and West Ash ponds H&H Update, Summary of Supporting H&H Analyses, Duke Energy – Roxboro Steam Station, November 5, 2019.
- (Wood, 2019a). Wood E&IS, Roxboro East FGD Settling Pond H&H Update, Summary of Supporting H&H Analyses, Duke Energy – Roxboro Steam Station, Person County, North Carolina, April 26, 2019.
- (Wood, 2019b). Wood E&IS, Roxboro West FGD Settling Pond H&H Update, Summary of Supporting H&H Analyses, Duke Energy – Roxboro Steam Station, Person County, North Carolina, April 26, 2019.
- (Wood, 2019c). Wood E&IS, Roxboro FGD Forward Flush Pond H&H Update, Summary of Supporting H&H Analyses, Duke Energy – Roxboro Steam Station, Person County, North Carolina, April 26, 2019.

FIGURES

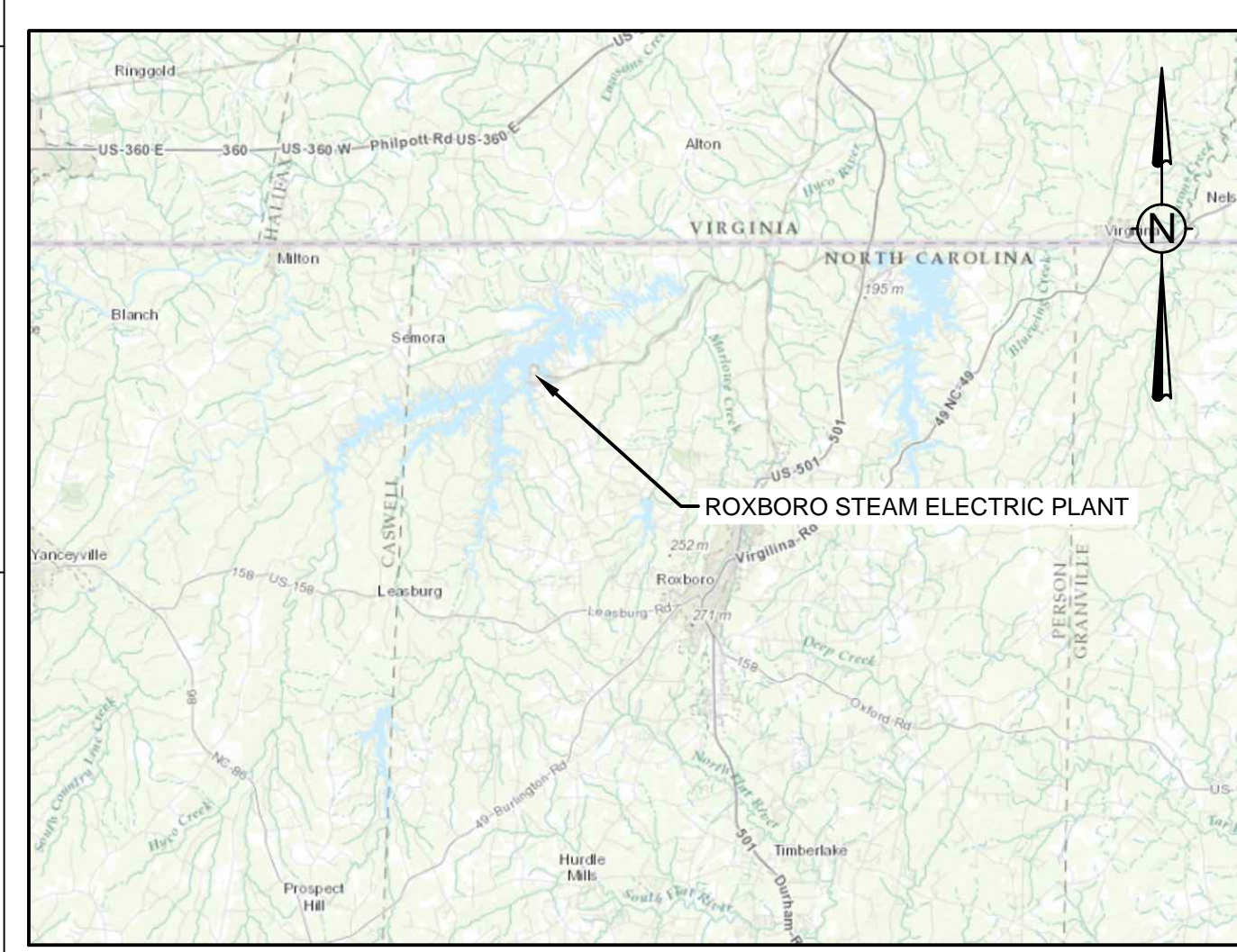
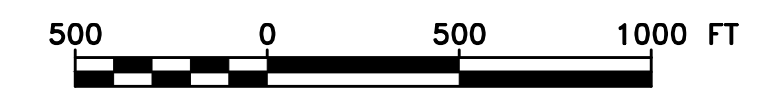


ROX-FIG. 1-1 WAB CBE

REV. 0

- LEGEND**
- APPROXIMATE ASH BASIN LIMIT OF WASTE
 - UNLINED PORTION OF INDUSTRIAL LANDFILL
 - LINED PORTION OF INDUSTRIAL LANDFILL
 - PERMITTED LCID LANDFILL LIMIT
 - AREA A CLOSURE EVENT 1 LIMIT
 - DISCHARGE CANAL

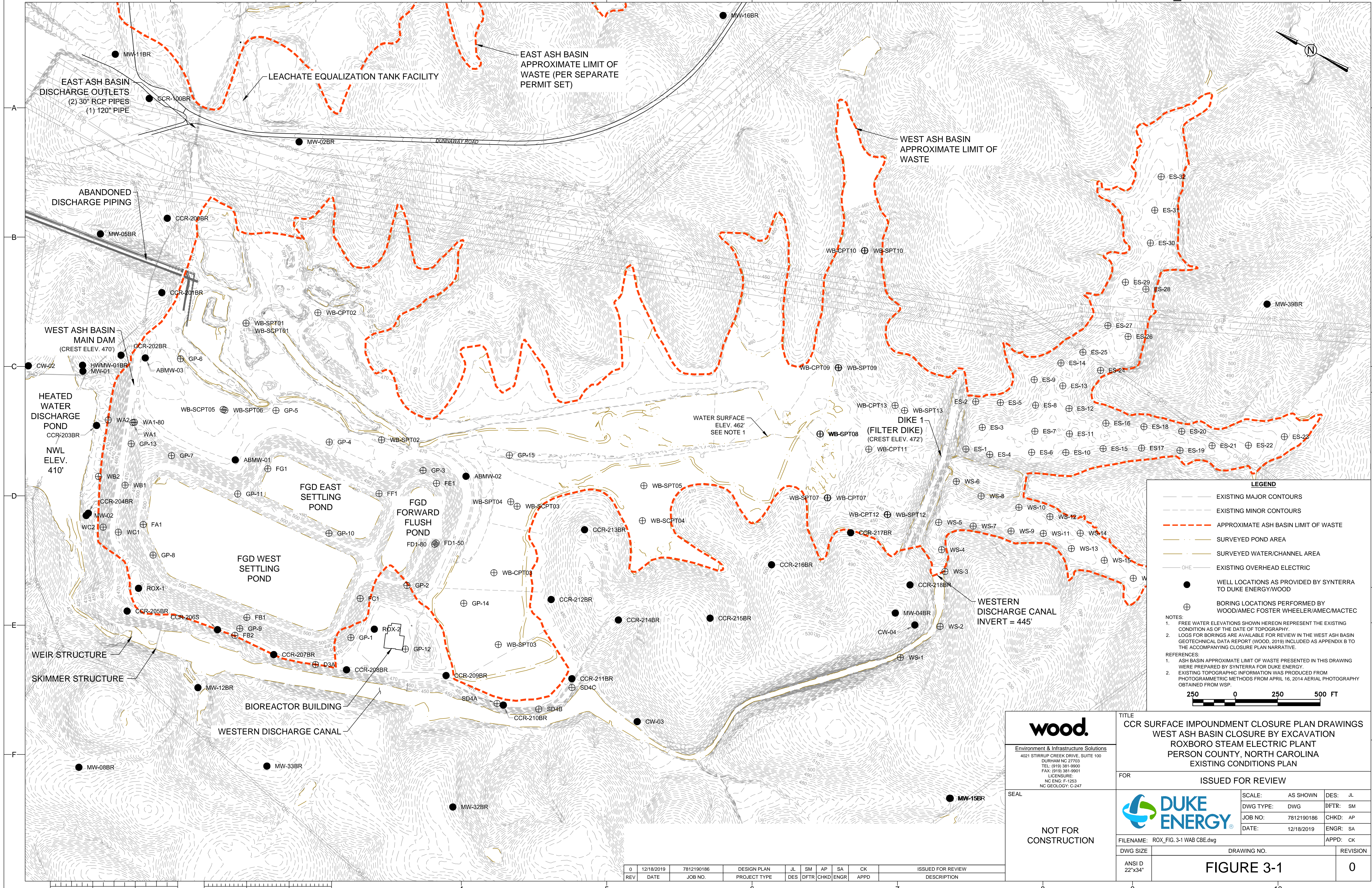
- REFERENCES**
1. ASH BASIN APPROXIMATE LIMIT OF WASTE PRESENTED IN THIS DRAWING WERE PREPARED BY SYNTERRA FOR DUKE ENERGY.



SITE VICINITY MAP - 1" = 5 MILES
MAP SOURCE: ESRI WORLD TOPOGRAPHIC BASEMAP

wood. <small>Environment & Infrastructure Solutions 4021 STIRRUP CREEK DRIVE, SUITE 100 DURHAM NC 27703 TEL: (919) 381-9900 FAX: (919) 381-9901 LICENSEURE: NC ENG: F-1253 NC GEOLOGY: C-247</small>	TITLE CCR SURFACE IMPOUNDMENT CLOSURE PLAN DRAWINGS WEST ASH BASIN CLOSURE BY EXCAVATION ROXBORO STEAM ELECTRIC PLANT PERSON COUNTY, NORTH CAROLINA VICINITY MAP AND SITE PLAN		
	FOR ISSUED FOR REVIEW		
NOT FOR CONSTRUCTION		SCALE: AS SHOWN DWG TYPE: DWG JOB NO: 7812190186 DATE: 12/18/2019	DES: JL DFTR: SM CHKD: AP ENGR: SA
	FILENAME: ROX-FIG. 1-1 WAB CBE.dwg		APPD: CK
DWG SIZE: ANSI D 22"x34"		DRAWING NO. FIGURE 1-1	REVISION 0

REV	DATE	JOB NO.	PROJECT TYPE	DES	DFTR	CHKD	ENGR	APPD	DESCRIPTION
0	12/18/2019	7812190186	DESIGN PLAN	JL	SM	AP	SA	CK	ISSUED FOR REVIEW



LEGEND

- EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- APPROXIMATE ASH BASIN LIMIT OF WASTE
- SURVEYED POND AREA
- SURVEYED WATER/CHANNEL AREA
- EXISTING OVERHEAD ELECTRIC
- WELL LOCATIONS AS PROVIDED BY SYNTERRA TO DUKE ENERGY/WOOD
- BORING LOCATIONS PERFORMED BY WOOD/AMEC FOSTER WHEELER/AMEC/MACTEC

NOTES:

- FREE WATER ELEVATIONS SHOWN HEREON REPRESENT THE EXISTING CONDITION AS OF THE DATE OF TOPOGRAPHY.
- LOGS FOR BORINGS ARE AVAILABLE FOR REVIEW IN THE WEST ASH BASIN GEOTECHNICAL DATA REPORT (WOOD, 2019) INCLUDED AS APPENDIX B TO THE ACCOMPANYING CLOSURE PLAN NARRATIVE.

REFERENCES:

- ASH BASIN APPROXIMATE LIMIT OF WASTE PRESENTED IN THIS DRAWING WERE PREPARED BY SYNTERRA FOR DUKE ENERGY.
- EXISTING TOPOGRAPHIC INFORMATION WAS PRODUCED FROM PHOTOGRAMMETRIC METHODS FROM APRIL 16, 2014 AERIAL PHOTOGRAPHY OBTAINED FROM WSP.

250 0 250 500 FT

wood.
Environment & Infrastructure Solutions
4021 STIRRUP CREEK DRIVE, SUITE 100
DURHAM, NC 27703
TEL: (919) 381-9900
FAX: (919) 381-9901
LICENSEURE
NC ENG. F-1253
NC GEOLOGY: C-247

TITLE
CCR SURFACE IMPOUNDMENT CLOSURE PLAN DRAWINGS
WEST ASH BASIN CLOSURE BY EXCAVATION
ROXBORO STEAM ELECTRIC PLANT
PERSON COUNTY, NORTH CAROLINA
EXISTING CONDITIONS PLAN

FOR
ISSUED FOR REVIEW

SCALE: AS SHOWN **DES:** JL
DWG TYPE: DWG **DFTR:** SM
JOB NO: 7812190186 **CHKD:** AP
DATE: 12/18/2019 **ENGR:** SA

FILENAME: ROX_FIG_3-1 WAB CBE.dwg **APPD:** CK

DWG SIZE: ANS I D 22"x34" **DRAWING NO.:** **REVISION:**

FIGURE 3-1

0

NOT FOR CONSTRUCTION

REV	DATE	JOB NO.	PROJECT TYPE	DES	SM	AP	SA	CK	APPD	DESCRIPTION
0	12/18/2019	7812190186	DESIGN PLAN	JL	SM	AP	SA	CK		ISSUED FOR REVIEW

TABLES

**Table 2-1: NC CAMA Closure Plan Requirements
 Summary and Cross Reference Table
 Duke Energy, Roxboro Steam Electric Plant**

No.	Description	Corresponding Closure Plan Section
Part II. Provisions for Comprehensive Management of Coal Combustion Residuals § 130A-309.214 Closure Plans for all impoundments shall include all of the following:		
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:		
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.	3.1.5
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. Site maps, which, at a minimum, illustrate all of the following:		
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.	3.1.1
3	The property boundary for the applicable site, including established compliance boundaries within the site.	3.1.1
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.	3.2.1
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	3.2.3

	compliance boundaries and components of associated groundwater and surface water monitoring systems.	
7	All existing and proposed groundwater monitoring wells associated with any coal combustion residuals surface impoundment on the site.	3.2.1
8	All existing and proposed surface water sample collection locations associated with any coal combustion residuals surface impoundment on the site.	3.2.1
c. The results of a hydrogeologic, geologic, and geotechnical investigation of the site, including, at a minimum, all of the following:		
1	A description of the hydrogeology and geology of the site.	4.2
2	A description of the stratigraphy of the geologic units underlying each coal combustion residuals surface impoundment located on the site.	4.3
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.	4.4
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
d. The results of groundwater modeling of the site that shall include, at a minimum, all of the following:		
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	5.1

	(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.	
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.	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).	6.1
f.	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.	7.1, 7.2, 7.3
g.	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.	7.3
h.	A description of the provisions for disposal of wastewater and management of stormwater and the plan for obtaining all required permits.	8
i.	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.	9
j.	A list of all permits that will need to be acquired or modified to complete closure activities.	10
k.	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	11

	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:	
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.	11.1
i.	An estimate of the milestone dates for all activities related to closure and post-closure.	12.1
m.	Projected costs of assessment, corrective action, closure, and post-closure care for each coal combustion residuals surface impoundment.	12.2
n.	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.	6.2
§ 130A-309.212(b)(3) 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.		
§ 130A-309.212(d) Within 30 days of its approval of a Coal Combustion Residuals Surface Impoundment Closure Plan, the Department shall submit the Closure Plan to the Coal Ash Management Commission.		

**Table 4-1: Summary of Typical Materials Properties
Duke Energy, Roxboro Steam Electric Plant**

Table 4.1: Summary of Typical Material Properties

Properties	Fill Soil covering CCR within the CCR Basins		Compacted CCR within the CCR Basins ¹		Sedimented CCR within the CCR Basins ¹		Foundation Soil (Residual) below the CCR Basins		Weathered Rock (WR) below the Embankment Dikes and the CCR Basins	Fill Soil within the Embankment Dikes	Foundation Soil (Residual) below the Embankment Dikes
	Representative Range	Geometric Mean	Representative Range	Geometric Mean	Representative Range	Geometric Mean	Representative Range	Geometric Mean	Representative Range		
Soil Type	CL, SM, ML, and SC		Silt/Sandy Silt (ML) - Predominantly Fly Ash		Silty Sand (SM) - Predominantly Bottom Ash, Silt, Sandy Silt (ML) - Predominantly Fly Ash		SC, SM, ML, CL, CH		Breaks down to Sandy Silt and silty sand with rock fragments - Weathered Gneiss	SM, SC, GW	SC, SM, CL, ML
Color	Dark gray, tan, and brown		Gray to dark gray, black		Gray to dark gray, black		Gray to dark gray, green, brown, and black		Gray, light green, brown, and orange	Gray, black, and brown	Tan, green, brown, gray to dark gray
Plasticity	NP to 20 - 30		Predominantly Non Plastic		Predominantly Non Plastic		NP to 14 - 35		**	NP - 22	NP - 36*
Liquid Limit	NP to 36 - 59		Predominantly Non Plastic		Predominantly Non Plastic		NP to 24 - 46		**	NP - 40	NP - 113*
Plasticity Index	NP to 16 - 28		Predominantly Non Plastic		Predominantly Non Plastic		NP to 7 - 22		**	NP - 18	NP - 77*
Natural Moisture Content (%)	8% - 63%	25%	5% - 52%	26%	12% - 98%	49%	8% - 72%	20%	**	18% - 41%	7% - 44%
Fines Content	6% - 68%	27%	12% - 69%	42%	27% - 90%	55%	6% - 68%	27%	**	**	**
Clay Content	2% - 54%	20%	1% - 20%	6%	3% - 29%	10%	2% - 54%	20%	**	**	**
Blow Count - Uncorrected N Value (bpf)	4 - 72	17	2 - 58	17	WOR - 27	4	0 - 80	23	50/0" - 50/5"	4 - 48	4 - 26
Moist Unit Weight	**	**	92 - 93 pcf	92 pcf	52 - 100 pcf	83 pcf	**	**	**	97 - 140 pcf	113 - 139 pcf
Dry Unit Weight	**	**	68 - 70 pcf	69 pcf	30 - 74 pcf	55 pcf	**	**	**	69 - 116 pcf	86 - 121 pcf
Specific Gravity	**	**	2.1	*	1.9 - 2.3	2.1	**	**	**	**	**
Horizontal Hydraulic Conductivity (cm/sec)	**	**	**	**	**	**	**	**	**	**	**
Vertical Hydraulic Conductivity (cm/sec)	**	**	**	**	**	**	**	**	**	**	6.0E-08 - 1.6E-06

Notes:

Outlier values were not included in the table above. For additional laboratory testing information, see attached Appendix

NP: Non-Plastic

pcf: Pounds per Cubic Foot (lb/ft³)

bpf: blows per foot

WOH: Weight of hammer

WOR: Weight of Rods

*Only one lab test available

**No lab data available

¹Data used to differentiate between compacted ash and sedimented ash was obtained from lab tests and boring logs from the 2015 and 2016 Amec Foster Wheeler, Geotechnical Investigation of West Ash Bain

**Table 10-1: Regulatory Permits, Approvals, or Requirements for WAB Closure by Excavation
 Duke Energy, Roxboro Steam Electric Plant**

General Permit Name or Subject	Regulating Agency	Existing Permit No. (if applicable)	<u>Permit/Approval</u> Type of Regulatory Approval Mechanism or Not Required	Comments
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	Person County		New Permit	A local building permit is required for installation of construction trailers
CAMA Monitoring Plan	NCDEQ		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				
Clean Water Act 404				
Cutting Trees				
Dam Safety	NCDEQ		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	PERSO-035	Certificate of Approval to Modify	WAB Dam - Permitting is required to modify the dam in accordance with the Dam Safety Law of 1967, 15A NCAS 02K.0201 (b)(2); an

**Table 10-1: Regulatory Permits, Approvals, or Requirements for WAB Closure by Excavation
 Duke Energy, Roxboro Steam Electric Plant**

General Permit Name or Subject	Regulating Agency	Existing Permit No. (if applicable)	<u>Permit/Approval</u> Type of Regulatory Approval Mechanism or Not Required	Comments
				application must be filed with the Division of Energy, Mineral, and Land Resources (DEMLR)
Dam Safety	NCDEQ	PERSO-36	Certificate of Approval to Modify	FGD Settling Pond 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)
Dam Safety	NCDEQ	PERSO-37	Certificate of Approval to Modify	FGD Flush Pond 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

**Table 10-1: Regulatory Permits, Approvals, or Requirements for WAB Closure by Excavation
 Duke Energy, Roxboro Steam Electric Plant**

General Permit Name or Subject	Regulating Agency	Existing Permit No. (if applicable)	<u>Permit/Approval</u> Type of Regulatory Approval Mechanism or Not Required	Comments
Erosion and Sediment Control (E&SC)	NCDEQ and Person County		New Permit	Land disturbance activities outside of the WAB 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 dependent on the potential for fire ants and geographic regions involved
Floodplain Development	Person 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 WAB

**Table 10-1: Regulatory Permits, Approvals, or Requirements for WAB Closure by Excavation
 Duke Energy, Roxboro Steam Electric Plant**

General Permit Name or Subject	Regulating Agency	Existing Permit No. (if applicable)	Permit/Approval Type of Regulatory Approval Mechanism or Not Required	Comments
Multi-State Agreement			Not required	If movement of CCR will cross state lines, multi-state regulations might apply
NPDES (National Pollution Discharge Elimination System)	NCDEQ	NC0038377	Permit modification likely	Modification of NPDES may be necessary if new source or outfall is created.
NPDES (National Pollution Discharge Elimination System) Industrial Stormwater	NCDEQ		Permit revision likely	Revision to existing sitewide permit or new permit may be required for access roads, staging areas, etc.
NPDES (National Pollution Discharge Elimination System) Stormwater	NCDEQ		New Permit possible	Permit required for temporary and permanent stormwater rerouting.
Noxious Weeds				Removal from or import of vegetated material could be restricted dependent 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.



**Table 10-1: Regulatory Permits, Approvals, or Requirements for WAB Closure by Excavation
 Duke Energy, Roxboro Steam Electric Plant**

General Permit Name or Subject	Regulating Agency	Existing Permit No. (if applicable)	<u>Permit/Approval</u> Type of Regulatory Approval Mechanism or Not Required	Comments
Threatened or Endangered Species: Candidate Conservation Agreement Avian Protection Plan(s) Bird and Bat Conservation Strategies Eagle Conservation Plan Eagle Take Permit	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		Permit	Landfill expansion
Solid Waste Permit to Operate	NCDEQ		Permit	Landfill expansion