



George T. Hamrick  
Senior Vice President  
Coal Combustion Products

400 South Tryon Street, ST06A  
Charlotte, NC 28202

Phone: 980-373-8113  
Email: [george.hamrick@duke-energy.com](mailto:george.hamrick@duke-energy.com)

December 30, 2019

**HAND DELIVERY AND ELECTRONIC MAIL**

Ms. Shelia Holman  
Assistant Secretary  
North Carolina Department of Environmental Quality  
1611 Mail Service Center  
Raleigh, NC 27699-1611

**RE: Buck Steam Station Ash Basin Closure Plan**

Dear Ms. Holman:

In accordance with the requirements of North Carolina General Statute § 130A-309. 214(a)(4), Closure of Coal Combustion Residuals Surface Impoundments, Duke Energy provides the attached plan for ash basin closure by excavation.

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.

Respectfully submitted,

A handwritten signature in blue ink that reads 'George T. Hamrick'.

George T. Hamrick  
Senior Vice President

NCDEQ cc: [damsafety@ncdenr.gov](mailto:damsafety@ncdenr.gov), [deq.coalash@ncdenr.gov](mailto:deq.coalash@ncdenr.gov), Ed Mussler, Steven Lanter, Toby Vinson

Duke Energy cc: Jessica Bednarcik, Dave Renner, Dan Mc Rainey, Jim Wells, Ed Sullivan, Michael Kafka, Randy Hart

**DUKE ENERGY  
BUCK STATION  
COAL COMBUSTION RESIDUALS SURFACE  
IMPOUNDMENT CLOSURE PLAN**



**CLOSURE BY EXCAVATION**

**Primary, Secondary, and Additional Primary Ash Basins  
Closure Plan Report  
Final Submittal**

Prepared for



550 South Tryon Street  
Charlotte, North Carolina 28202

Revision 0  
Issue Date: 11 December 2019

Prepared by

Wood Environment & Infrastructure Solutions, Inc.  
2801 Yorkmont Drive, Suite 100  
Charlotte, North Carolina 28208

Project No. 7812180092



## TABLE OF CONTENTS

### EXECUTIVE SUMMARY

<b>1.0 INTRODUCTION .....</b>	<b>1</b>
1.1 <i>Background .....</i>	1
1.2 <i>Closure Plan Objectives .....</i>	1
1.3 <i>Report Organization .....</i>	2
<b>2.0 GOVERNING LAWS .....</b>	<b>2</b>
<b>3.0 FACILITY DESCRIPTION AND EXISTING SITE FEATURES.....</b>	<b>3</b>
3.1 <i>Surface Impoundment Description.....</i>	3
3.1.1 <i>Site History and Operations .....</i>	3
3.1.2 <i>Estimated Volume of CCR in Impoundments .....</i>	3
3.1.3 <i>Description of Surface Impoundment Structural Integrity .....</i>	4
3.1.4 <i>Sources of Discharges into Surface Impoundments.....</i>	5
3.1.5 <i>Existing Liner System.....</i>	5
3.1.6 <i>Inspection and Monitoring Summary.....</i>	5
3.2 <i>Site Maps .....</i>	6
3.2.1 <i>Existing CCR Impoundment Related Structures.....</i>	6
3.2.2 <i>Receptor Survey.....</i>	6
3.2.3 <i>Existing On-Site Landfills .....</i>	6
3.3 <i>Monitoring and Sampling Location Plan .....</i>	6
<b>4.0 RESULTS OF HYDROGEOLOGIC, GEOLOGIC, AND GEOTECHNICAL INVESTIGATIONS.....</b>	<b>7</b>
4.1 <i>Background.....</i>	7
4.2 <i>Hydrogeology and Geologic Descriptions.....</i>	7
4.3 <i>Stratigraphy of the Geologic Units Underlying Surface Impoundments.....</i>	7
4.4 <i>Geotechnical Properties.....</i>	7
4.4.1 <i>CCR within the Basins .....</i>	7
4.4.2 <i>Liner Material Properties .....</i>	8
4.4.3 <i>Subsurface Soil Properties.....</i>	8
4.5 <i>Chemical Analysis of Impoundment Water, CCR and CCR Affected Soil.....</i>	8
4.6 <i>Historical Groundwater Sampling Results .....</i>	8
4.7 <i>Groundwater Potentiometric Contour Maps.....</i>	9
4.8 <i>Estimated Vertical and Horizontal Extent of CCR within the Impoundments .....</i>	9
<b>5.0 GROUNDWATER MODELING ANALYSIS .....</b>	<b>9</b>
5.1 <i>Site Conceptual Model Predictions .....</i>	9
5.2 <i>Groundwater Chemistry Effects .....</i>	9
5.3 <i>Groundwater Trend Analysis Methods.....</i>	9
<b>6.0 BENEFICIAL USE AND FUTURE USE.....</b>	<b>9</b>
6.1 <i>CCR Use.....</i>	9
6.2 <i>Site Future Use .....</i>	10

<b>7.0</b>	<b>CLOSURE DESIGN DOCUMENTS .....</b>	<b>10</b>
7.1	<i>Engineering Evaluations and Analyses .....</i>	10
7.2	<i>Closure Plan Activities .....</i>	10
7.3	<i>Design Drawings .....</i>	11
7.4	<i>Description of Construction Quality Assurance and Plan .....</i>	12
<b>8.0</b>	<b>MANAGEMENT OF WASTEWATER AND STORMWATER .....</b>	<b>12</b>
8.1	<i>Anticipated Changes in Wastewater and Stormwater Management .....</i>	14
8.2	<i>Wastewater and Stormwater Permitting Requirements .....</i>	15
<b>9.0</b>	<b>DESCRIPTION OF FINAL DISPOSITION OF CCR .....</b>	<b>15</b>
<b>10.0</b>	<b>APPLICABLE PERMITS FOR CLOSURE .....</b>	<b>15</b>
<b>11.0</b>	<b>DESCRIPTION OF POST-CLOSURE MONITORING AND CARE .....</b>	<b>15</b>
11.1	<i>Groundwater Monitoring Program .....</i>	16
<b>12.0</b>	<b>PROJECT MILESTONES AND COST ESTIMATES .....</b>	<b>16</b>
12.1	<i>Project Schedule .....</i>	16
12.2	<i>Closure and Post-Closure Cost Estimate .....</i>	16
<b>13.0</b>	<b>REFERENCES .....</b>	<b>18</b>

**Tables**

Table 2-1	CAMA Closure Plan Requirements Summary and Cross Reference Table
Table 4-1	Summary of Typical Material Properties
Table 10-1	Buck Station Regulatory Permits, Approvals, or Requirements for Basin Closure by Excavation

**Figures**

Figure 1-1	Vicinity Map and Site Plan
Figure 1-2	Overall Existing Conditions Plan

**Appendices**

Appendix A	Estimated Volume of CCR in Impoundment
Appendix B	Geotechnical Data and Properties
Appendix C	Engineering Evaluations and Analyses
Appendix D	Closure Plan Drawings
Appendix E	Excavation Soil Sampling Plan

## EXECUTIVE SUMMARY

In accordance with N.C.G.S. § 130A-309.214(a)(4), Duke Energy has prepared this Closure Plan to describe the closure of the coal combustion residuals (CCR) surface impoundments (Basins) at the Buck Station (Buck). The Buck Basins closure will consist of closure by excavation, whereby CCR in the Basins will be excavated, processed, and transported off-site for beneficial re-use as a concrete amendment. The removal of CCR and closure of the Basins will be in accordance with all applicable provisions of the North Carolina Coal Ash Management Act of 2014, Sess. L. 2014-122, as amended (codified at N.C.G.S. § 130A-309.200, *et seq.*) (CAMA). CCR processing will be done using on-site STAR<sup>®</sup> (Staged Turbulent Air Reactor) Technology, a patented thermal beneficiation process to transform CCR from the Basins into a high-quality, sustainable product for the concrete industry.

Duke Energy will periodically review the progress of the excavation and STAR<sup>®</sup> processing as it relates to achieving full CCR removal by the required end date of December 31, 2029. Duke Energy will implement a concurrent excavation plan in which the remaining excavated CCR will be transported to an approved landfill facility in order to meet the end date of December 31, 2029 for complete removal.

Buck is owned and operated by Duke Energy Progress, LLC (Duke Energy). The approximately 640-acre Buck site is located at 1555 Dukeville Road in Rowan County near Spencer, North Carolina on the southern bank of the Yadkin River.

Commercial operations of the station began in 1926 with two coal-fired units and later expanded to six units. Units 1 and 2 were retired in 1979, Units 3 and 4 were retired in 2011, and Units 5 and 6 were retired in 2013. There are no coal-fired units currently in operation at Buck.

This Closure Plan covers the three Basins located at Buck, impounded by 5 dam/dike structures identified in the North Carolina Department of Environmental Quality (NCDEQ) Dam Safety Inventory as follows:

- Primary Basin and Secondary Basin Main Dam (NC Dam Safety ID: ROWAN-047)
- Additional Primary Dam (NC Dam Safety ID: ROWAN-068)
- Additional Primary Basin to Primary Basin Dike (NC Dam Safety ID: ROWAN-069)
- Primary Basin to Secondary Basin Dike (NC Dam Safety ID: ROWAN-070)
- Divider Dike between the Primary Basin and Secondary Basin (NC Dam Safety ID: ROWAN-071)

During operation, CCR was transported from the plant to the Basins by hydraulic (wet) sluicing. In addition to the Basins, there is also an unlined dry CCR storage area located on the eastern side of the Additional Primary Basin. The original CCR basin (Primary Basin) began operation in 1957. The Primary Basin was later divided into two basins (Primary Basin and the Secondary Basin) and, in 1982, the Additional Primary Basin was constructed. The Additional Primary Basin served as the primary CCR retention facility until the last coal-fired operating unit was retired in March of 2013. With the permanent retirement of the coal-fired generating units, there are no longer any CCR disposal operations within the Basins.

The existing three Basins are unlined and contain up to 70 feet depth of CCR. Information provided by Duke Energy (with updated inventory data through July 31, 2019) indicates that the current estimated volume of CCR in the three Basins is approximately 6.67 million tons (5.56 million cubic yards assuming a conversion factor of 1.2 tons/cy). It should be noted that the CCR volume/tonnage estimates are approximations since they are based on assumed pre-basin grades.

Upon approval of the Closure Plan by NCDEQ, additional activities to complete closure of the Basins will commence, including beginning excavation of the CCR from the Basins, establishing final grades using soil fill where required to properly drain the Basin areas, breaching the Basin dikes following removal of CCR (soil material removed from the Basin dikes will remain on-site and will be incorporated into the final site grading plan), and development of stormwater features and vegetative covers.

This document also includes a description of the future Post-Closure Care Plan, which provides a description of the inspection, monitoring and maintenance activities required to be performed for the Buck site for a minimum of 30 years.

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 the Closure Plan, meets regulatory requirements for the stability of the site, management of stormwater runoff, and access for effective maintenance over the post-closure care period.

In a letter dated April 5, 2019, NCDEQ established submittal dates for an updated Comprehensive Site Assessment (CSA) and updated Corrective Action Plan (CAP) for CCR surface impoundments and other primary and secondary sources. Consistent with this direction, Duke Energy will submit to NCDEQ the updated CSA for Buck by October 1, 2020, and the updated CAP by July 1, 2021. The CAP sets out corrective action measures for the restoration of groundwater quality as required under CAMA and the state's groundwater quality regulations. Although this Closure Plan contains references to the CAP, all specific relevant details to groundwater and related actions will be contained in the CAP and not in this Closure Plan.

## 1.0 INTRODUCTION

### 1.1 Background

The approximately 640-acre Buck site is located at 1555 Dukeville Road in Rowan County near Spencer, North Carolina on the southern bank of the Yadkin River. Commercial operations of the station began in 1926 with two coal-fired units and later expanded to six units. Units 1 and 2 were retired in 1979, Units 3 and 4 were retired in 2011, and Units 5 and 6 were retired in 2013. All waste flows to the Basins ceased in 2019 and there are no longer any CCR disposal operations at Buck.

This Closure Plan is being submitted for approval by NCDEQ and reflects closure by excavation of the CCR from the Buck site. Processing of the excavated CCR will be done using STAR<sup>®</sup> Technology, a patented thermal beneficiation process to transform CCR from the Basins into a high-quality, sustainable product for the concrete industry. **Figure 1-1** presents a Vicinity Map and Site Plan of Buck. **Figure 1-2** presents the overall existing conditions at the site.

The Buck site has five regulated CCR impoundment structures (**Figures 1-1** and **1-2**). This Closure Plan covers the three CCR basins located at the Buck Station, impounded by the five dam/dike structures that are identified (and regulated by) the North Carolina Department of Environmental Quality (NCDEQ) and Dam Safety as follows:

- Primary Basin and Secondary Basin Main Dam (NC Dam Safety ID: ROWAN-047)
- Additional Primary Dam (NC Dam Safety ID: ROWAN-068)
- Additional Primary Basin to Primary Basin Dike (NC Dam Safety ID: ROWAN-069)
- Primary Basin to Secondary Basin Dike (NC Dam Safety ID: ROWAN-070)
- Divider Dike between the Primary Basin and Secondary Basin (NC Dam Safety ID: ROWAN-071)

This Closure Plan has been prepared for the review and approval of NCDEQ.

### 1.2 Closure Plan Objectives

The primary objective of this Closure Plan is to address the closure by excavation of CCR from the Basins at Buck pursuant to North Carolina Coal Ash Management Act of 2014, Session L. 2014-122, as amended (CAMA). A further objective is to obtain approval from the NCDEQ to proceed and develop the additional details (as described further within this Closure Plan) and working documents necessary to complete the closure actions. Duke Energy is requesting approval of this Closure Plan with the knowledge that other details will follow. 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 in N.C.G.S. § 130A-309.214(a)(4). Planned closure activities include:

- Removal of free water/bulk water volume via permitted outfall (i.e., decanting);
- Construction and operation of a temporary water management system (WMS) to manage discharges in compliance with the NPDES permit during closure;
- Construction of the STAR<sup>®</sup> Unit for processing of CCR for beneficial re-use;

- Development of sump areas in the Basins to collect and convey waters to the water management system;
- Dewatering the CCR to allow for safe access. CCR excavation and conditioning will be required prior to transport to the on-site STAR<sup>®</sup> system;
- Excavate CCR from the Basins, with sequencing determined for optimal progression. 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;
- Complete closure by excavation verification.
- Breaching of the Basin dikes and dams; and
- Grading the perimeter dikes into each of the three basins with a grading plan that will establish drainage to promote flow of stormwater away from the former Basins in a manner protective of area soils and water.

### 1.3 Report Organization

This document is structured to follow the requirements of N.C.G.S. § 130A-309.214(a)(4).

## 2.0 GOVERNING LAWS

In August 2014, the North Carolina General Assembly enacted CAMA, which contains specific statutory requirements applicable to CCR surface impoundments. Relative to the Buck Station, “coal combustion residuals surface impoundment,” as defined in N.C.G.S. § 130A-309.201(6), is interpreted to include the plant’s Basins.

In July 2016, the North Carolina General Assembly enacted House Bill 630, which added N.C.G.S. § 130A-309.216 requiring Duke Energy to identify three sites in North Carolina at which to install and operate Ash Beneficiation projects capable of processing CCR to specifications appropriate for cementitious products. The statute requires Duke Energy to use commercially reasonable efforts to produce 300,000 tons of usable CCR at each site annually. On October 5, 2016, Duke Energy selected Buck as one of the three Ash Beneficiation sites. Pursuant to subsection (c) of N.C.G.S. § 130A-309.216, CCR surface impoundments located at a site at which an Ash Beneficiation project is installed, and operating shall be closed no later than December 31, 2029.

The Excavation Soil Sampling Plan for Buck (presented in **Appendix E**), represents activities to satisfy the requirements set forth in the NCDEQ’s November 4, 2016 letter and attachment titled “CCR Surface Impoundment Closure Guidelines for Protection of Groundwater.”

In a letter dated April 5, 2019, NCDEQ established submittal dates for an updated CSA and updated CAP for CCR surface impoundments and other primary and secondary sources. Consistent with this direction, Duke Energy will submit to NCDEQ the updated CSA for Buck by October 1, 2020, and the updated CAP by July 1, 2021.

In addition to the above requirements, National Pollutant Discharge Elimination System (NPDES) permit program compliance, Special Order by Consent (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 dikes, and environmental permitting requirements must be considered as part of closure.

### 3.0 FACILITY DESCRIPTION AND EXISTING SITE FEATURES

#### 3.1 Surface Impoundment Description

This section provides details on the CCR-related features at Buck.

##### 3.1.1 Site History and Operations

**Figure 1-1** shows locations of the three CCR basins (Primary, Secondary, and Additional Primary) and five dikes (ROWAN-047, ROWAN-068, ROWAN-069, ROWAN-070, and ROWAN-071) at the Buck site. **Figure 1-2** shows the overall existing conditions at the Buck Station.

The Buck Station is located on the south bank of the Yadkin River in Rowan County, North Carolina near the town of Spencer. Review of available information indicates that the property, totaling approximately 640 acres, is owned by Duke Energy, and is reported to have begun commercial operation in 1926 and, at its peak, had six coal fired units in operation with a combined capacity of 512 megawatts. Units 1 and 2 began operation in 1926 with a combined capacity of 256 megawatts and were retired in 1979. Units 3 and 4, with a combined capacity of 113 megawatts, were retired in mid-2011, and Units 5 and 6, with a combined capacity of 143 megawatts, were retired in April 2013. The site now hosts a 620-megawatt natural gas Combined Cycle Plant which began construction in 2008 and came on line in 2011. The CCR Basins were constructed at the site between 1957 and 1982 as operational needs required additional CCR disposal area. Sluicing of CCR to the Basins ceased in 2013. Process and wastewaters continued to be treated through the Basins until 2019.

The interconnected system of CCR basins, dikes, dams, discharge structures and canals make up the CCR basin system at Buck and this system discharges at a NPDES permitted outfall point into the Yadkin River (currently Outfall 007). There are no longer any CCR disposal operations within the Basins with the permanent retirement of the coal-fired units. The Basins at the Buck Station are located in historical valley features within larger watersheds and, therefore, receive surface water run-on flows.

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

Based on CCR inventory data provided by Duke Energy as of July 31, 2019, the approximate volume of CCR in the Basins is listed in the table 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 Material in the Impoundment data sheet.

Impoundment	Estimated CCR Material Volume (cy)	Estimated CCR Material Weight (tons)*
Additional Primary Basin	2,959,167	3,551,000*
Additional Primary Basin Dry Stack	219,074	262,889*
Primary Basin	1,665,000	1,998,000*
Secondary Basin	720,000	864,000*
TOTAL	5,563,241	6,675,889*

\* Estimated CCR Material is based on updated CCR inventory data provided by Duke Energy as of July 31, 2019. To compute the estimated mass of CCR in place an assumed density of 1.2 tons per cubic yard was used, which is the Duke Energy fleet wide assumption.

### 3.1.3 Description of Surface Impoundment Structural Integrity

The purpose of this section is to summarize the Basins' structural integrity evaluations based on current existing information. This section includes brief summaries of the Geotechnical and Hydrology and Hydraulics (H&H) capacity analyses results. Duke Energy provided Wood with pertinent information regarding the integrity of the embankments, which had already been compiled and analyzed. In summary, the structural integrity of the Basins and subsequent dike inspection reports meet the regulatory requirements of EPA's CCR Rule (40 C.F.R. § 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 Dikes ROWAN-047, 068, 069, 070, 071:**

Slope stability analyses completed for the identified critical cross sections for each of the dikes indicate that the minimum factors of safety meet programmatic criteria under static, pseudo-static, and post-seismic conditions.

- **Liquefaction Conditions (where susceptible) and Liquefaction Potential for dikes ROWAN-047, 068, 069, 070:**

Embankment and foundation soils associated with these dikes have low susceptibility to liquefaction, and risk of excessive deformation or settlement of the embankment is considered negligible during the Maximum Design Earthquake (MDE).

- **Liquefaction Conditions (where susceptible) and Liquefaction Potential for Divider Dike ROWAN-071:**

Advanced liquefaction analysis for the CCR comprising the foundation of the Divider Dam indicates that the CCR is not susceptible to liquefaction during the Maximum Design Earthquake (MDE). Deformations of the embankment are predicted by fully coupled dynamic analysis to be negligible for the MDE.

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

In April 2019, the NCDEQ promulgated new dam safety rules and, per the dam safety High Hazard Classification, each CCR Basin is required to pass a full Probable Maximum Precipitation (PMP). Each basin is classified as high hazard by NCDEQ due to the potential for environmental impacts greater than \$200,000, if the Basin failed. The most recent study prepared by AECOM for the Full-PMP storm event indicates that the spillway systems for the Basins are capable safely conveying the Full-PMP storm event while also removing 80 percent of the detained storm volume within 15 days following the design storm peak, per requirements of the North Carolina dam safety rules. The most recent analysis performed by AECOM is included in **Appendix C**.

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

Duke Energy has decommissioned the coal-fired power plant at this site. Since it is now permanently retired from service, CCR is no longer sluiced into the Basins. All wastewater flow into the Additional Primary Basin ceased in April 2019. Since the Basins were constructed by placing a dike at the downstream end of a natural drainage area, the contributing drainage area to each of the basins is larger than the basins themselves. Thus, in addition to direct rainfall, there is watershed run-on drainage entering the Basins during rainfall events.

### **3.1.5 Existing Liner System**

The Basins located at the Buck Station do not include geomembrane or clay liner systems and are considered to be unlined.

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

Duke Energy conducts routine weekly, monthly, and annual inspections of the Basins, consistent with North Carolina's dam safety requirements and the federal CCR rule.

Weekly Basin inspections 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 dikes and 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 repair activities on the dike or dam 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 impoundment 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 for the annual inspections are used to identify needed repairs, repair schedules, to assess the safety and operational adequacy of the dike or dam, and to assess compliance activities regarding applicable permits and environmental and dam regulations. Annual inspections are also performed to evaluate previous repairs.

The 2015 through 2019 annual inspections did not identify features or conditions in Basin dams/dikes 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 inspections of the Basins may be performed during episodes of high-flow, earthquake, emergency, or other extraordinary events. Visual inspections are performed after a heavy precipitation event when accumulation of 4 inches of rainfall or greater occurs within a 24-hour period. An internal inspection will be performed if a seismic event is detected by the U.S. Geological Survey measuring greater than a Magnitude 3 and with an epicenter within 50 miles of the dikes. A special inspection would also be performed during an emergency, such as when a potential dike breach condition might be identified or when construction activities (e.g., basin cleanout) are planned on or near the dikes. They are also determined 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 Buck Station Basins with their boundaries, and topographic and bathymetric contours are shown on **Figure 1-2**.

### **3.2.2 Receptor Survey**

This information is included as part of the updated CAP being prepared separately by SynTerra for Duke Energy and will be submitted to NCDEQ by July 1, 2021. 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 no known on-site landfills at the Buck Station.

## **3.3 Monitoring and Sampling Location Plan**

This information is included as part of the updated CAP being prepared separately by SynTerra for Duke Energy and will be submitted to NCDEQ by July 1, 2021. 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 **Figure 4** of the Closure Plan Drawings included in **Appendix D**, but the CAP should be consulted for details of well locations, names, and status.

## **4.0 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 drawings included in **Appendix D (Figure 4)**.

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; geotechnical properties of the CCR and the uppermost stratigraphic unit under the surface impoundment; and the CCR and CCR-affected soils. Duke Energy provided Wood with pertinent documentation regarding the site geology and hydrologic information, which had already been compiled.

### **4.2 Hydrogeology and Geologic Descriptions**

This information is included as part of the updated CSA being prepared separately by SynTerra for Duke Energy and will be submitted to NCDEQ by October 1, 2020. The CSA 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 updated CSA being prepared separately by SynTerra for Duke Energy and will be submitted to NCDEQ by October 1, 2020. The CSA 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 Basins and Basin dikes 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 Basins generally consist of CCR (primarily interbedded layers of fly ash and bottom ash, along with coal slag, unburned coal, and plant stormwater) placed in the Basins primarily by hydraulic sluicing underlain by residual soil, saprolite, partially weather rock (PWR), and bedrock.

For purposes of discussion of the geotechnical properties of the materials, the saprolite material is described as residual material. General properties of the various materials encountered within and surrounding the Basins are described below. A range of measured material properties of laboratory tests performed by AECOM, HDR, and Mactec for the subsurface explorations completed within the Basins is presented in **Appendix B**. A summary of typical measured properties for different material types are presented in **Table 4-1**. A summary of laboratory tests data performed at the Buck Station in support of the closure design is presented in **Appendix B**.

#### **4.4.1 CCR within the Basins**

The CCR within the Basins consists primarily of layers and mixtures of bottom ash and fly ash. Other CCR materials such as slag are also typically encountered. The bottom ash generally

consists of very loose to loose, moist to wet, dark gray to gray, silty sand (SM) or silt and sandy silt (ML). At some drilling locations, a surficial layer of CCR fill material (SP or SW or SW-SM) was encountered that was used for boring access road construction.

The fly ash generally consists of very soft to soft, moist to wet, light to medium gray sandy silt and silt (ML).

Further information is included as part of the updated CSA being prepared separately by SynTerra for Duke Energy and will be submitted to NCDEQ by October 1, 2020. The CSA is herein incorporated by this reference, but its content is not the work product of Wood.

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

The Basins at the Buck Station are unlined, so there are no associated material properties.

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

**Alluvium:** Based on information supplied by Duke Energy, alluvial soil was encountered beneath the sluiced CCR in multiple borings in various locations within the Basins. The alluvial soil was reported to consist of the following throughout the site:

- Loose to dense, gray, pink, white, black, orange, red, dark brown, silty fine to very coarse sands (SP, SM, and SW) with interlayered fat clay and elastic silt. Typical thicknesses ranged from 0.5 to 10.0 feet.
- Soft to very stiff, gray, brown, red, orange, fine to coarse sandy clays to fat clays with interbedded layers of fine to medium sand (CL and CH) with thicknesses ranging from 5.0 to 10.0 feet.
- Very soft to very stiff, gray, brown, tan, red, fine to medium sandy clayey silts (MH and ML) and ranged in thickness from 0.5 to 5.0 feet.
- Alluvial soils were reported in some of the monitoring well boring locations and consisted of silty sand (SM), fat clay (CH) with elastic silt, and varied in thicknesses from 5.0 to 15.0 feet.

**Residuum:** The residuum (including saprolite) is the next layer encountered and generally consists of soft to hard sandy lean clay (CL), fine sandy to clayey silt (ML/MH), and silty sand (SM)

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

This information is included as part of the updated CSA being prepared separately by SynTerra for Duke Energy and will be submitted to NCDEQ by October 1, 2020. The CSA 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 updated CSA being prepared separately by SynTerra for Duke Energy and will be submitted to NCDEQ by October 1, 2020. The CSA 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 updated CSA being prepared separately by SynTerra for Duke Energy and will be submitted to NCDEQ by October 1, 2020. The CSA 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 updated CSA being prepared separately by SynTerra for Duke Energy and will be submitted to NCDEQ by October 1, 2020. The CSA is herein incorporated by this reference, but its content is not the work product of Wood.

### **5.0 GROUNDWATER MODELING ANALYSIS**

This information is included as part of the updated CAP being prepared separately by SynTerra for Duke Energy and will be submitted to NCDEQ by July 1, 2021. The CAP is herein incorporated by this reference, but its content is not the work product of Wood.

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

This information is included as part of the updated CAP being prepared separately by SynTerra for Duke Energy and will be submitted to NCDEQ by July 1, 2021. 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 updated CAP being prepared separately by SynTerra for Duke Energy and will be submitted to NCDEQ by July 1, 2021. 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 updated CAP being prepared separately by SynTerra for Duke Energy and will be submitted to NCDEQ by July 1, 2021. The CAP is herein incorporated by this reference, but its content is not the work product of Wood.

### **6.0 BENEFICIAL USE AND FUTURE USE**

#### **6.1 CCR Use**

Duke Energy has developed plans for on-site recovery and reclamation/recycling of a significant portion of the CCR at the Buck Station, in accordance with rate established by NCGS § 130A-309.216. Duke Energy will implement a concurrent excavation plan in which the remaining excavated CCR will be transported to an approved landfill facility in order to meet the end date of December 31, 2029 for complete removal of the CCR.

The beneficial use activities consist of removing and transporting CCR from the Basins for processing at a STAR<sup>®</sup> facility to be constructed on-site. The STAR<sup>®</sup> facility will process the reclaimed CCR to a level of quality and condition suitable for future reuse in the concrete industry.

## 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 Basins.

Since this Closure Plan details a closure by excavation method, no recording of a notation on the deed to the property is required.

## 7.0 CLOSURE DESIGN DOCUMENTS

Closure of the Basins at the Buck Station will be completed in two phases. Phase 1 is excavation and Phase 2 will be the final decommissioning of the basin dikes and final grading.

### 7.1 Engineering Evaluations and Analyses

Engineering evaluations and analyses to support closure of the Basins at the Buck Station, as detailed in this Closure Plan, are provided in **Appendix C**. Based on the final post-closure configuration of the Basins and absence of engineered fill features, no geotechnical calculations accompany the Closure Plan presented herein. Calculations related to dike removal will be included in the dam modification permit applications.

Safe and effective access to the Basins is critical to CCR excavation and the completion of closure. Access road locations into or across the Basins 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 (drying) of CCR are 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 Basins. 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(drying) 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 NPDES discharge outlet.
- Install stormwater run-on diversion or retention controls, to minimize stormwater flow into the Basins to the extent practical.
- Operation of a temporary water management system to manage all discharges in compliance with the NPDES permit during closure.
- Construct a STAR<sup>®</sup> unit for processing CCR for beneficial re-use.
- Dewater the CCR to allow for safe access. CCR excavation and conditioning prior to transport to the STAR<sup>®</sup> unit.
- Start CCR excavation from the Basins, with sequencing determined for optimal progression. 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 safe and stable work areas and slopes.
- Maintain required hydraulic storage capacity throughout the excavation process.
- Manage dusting from closure activities through the use of appropriate controls.
- Complete closure by excavation verification. Grade the area to promote positive drainage and seed for vegetative growth.
- Sequence final dam/dike breach with 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

Two sets of Closure Plan drawings can be found in **Appendix D**. One set is for the combined Primary and Secondary basins, and the other set is for the Additional Primary Basin. Each set includes the following sheets:

- Sheet 1 - Cover sheet
- Sheet 2 - General notes
- Sheet 3 - Existing overview aerial
- Sheet 4 - Existing conditions
- Sheet 5 - Estimated bottom of ash grades
- Sheet 6 – Proposed final conditions
- Sheet 7 - 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 dike modification and/or decommissioning permits, erosion, and sediment control permits, NPDES permit modifications, and any 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 CCR Basins located at the Buck Station site. This CQA Plan description has been prepared to address N.C.G.S. § 130A-309.214(a)(4)(g) of CAMA, and its purpose is to provide a description of the CQA program to be adhered to in execution of the final closure activities at the Buck Station, being the construction of the dike breach and stormwater channels. The CQA Plan will be a component of the dam decommissioning package and will include a description of the roles and responsibilities for monitoring and testing activities and will provide 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 will present specific material properties and specifications.

The CQA Plan addresses the following materials and CQA activities and deliverables:

- Earthwork
- Stormwater Channels
- HDPE Piping
- As-Built Conditions
- Record Documentation Report

## 8.0 MANAGEMENT OF WASTEWATER AND STORMWATER

### • Existing Wastewater and Stormwater Conditions

The Basins at the Buck Station are located in historical valley features within larger watersheds and, therefore, receive surface water run-on flows. The surrounding topography around the Additional Primary Basin may permit some limited redirection of run-on stormwater during excavation. However, due to the surrounding topography around the Primary/Secondary Basin, it may not be feasible to divert, or re-direct run-on stormwater flows around the Primary/Secondary Basins during construction. Temporary diversions and retention features can be provided in certain areas and within the Basins during CCR excavation. Additional measures may be needed to maintain treatment requirements.

In April 2019, NCDEQ promulgated new dam safety requirements and, per the dam safety High Hazard Classification, each CCR basin is now required to pass a full PMP storm event. The Buck Basins are classified as High Hazard by NCDEQ due to the potential for environmental impacts greater than \$200,000, if the Basins failed. The PMP event will produce 29.49 inches of rainfall (HMR-51 6-hour, 10 mi<sup>2</sup>, All-Season PMP Isoplethial Map).

AECOM evaluated the site for the full PMP rainfall event and preliminary results indicated that the Additional Primary Basin (ROWAN-069) as well as the Secondary Basin (ROWAN-047) would safely pass the Full PMP storm event. The initial analysis indicated that the Primary Basin

(contained by the upper portion of ROWAN-047, ROWAN-070, and ROWAN-071) would overtop in the Full PMP storm event. AECOM subsequently developed a modification to the Primary to Secondary Basin outfall structure. This modification, which involved lowering the stop logs in the Primary Basin discharge structure to elevation 677 along with dredging of CCR in the vicinity of the structure, was completed in August 2019 and the Primary Basin (contained by the upper portion of ROWAN-047, ROWAN-070, and ROWAN-071) safely passes the Full PMP storm event. Additional internal storage capacity will be obtained as excavation of the CCR progresses. This analysis is in **Appendix C**.

The Secondary Basin has the capacity to contain the PMP storm event by maintaining the water surface level elevation at or below El. 677.78 ft, which provides a minimum freeboard of 1.82 ft. As part of the closure, the Basin dike will be removed by excavating an engineered breach in the east portion. Under this post closure condition, there will be increased flow downstream of the Basin dike compared to the existing conditions, however, this flow is not expected to have an adverse impact on the receiving waters.

The Primary Basin has the capacity to contain the PMP storm event by maintaining the water surface level elevation at or below El. 687.48 ft, which provides a minimum freeboard of 0.63 ft. As part of the CCR excavation, the Divider Dike between the Primary and Secondary Basins will be removed.

The Additional Primary Basin has the capacity to contain the PMP storm event by maintaining the water surface level elevation at or below El. 708.81 ft, which provides a minimum freeboard of 0.59 ft. As part of the closure, the Basin dike will be removed by excavating an engineered breach in the in the west portion. Under this post closure condition, there will be increased flow downstream of the Basin dike compared to the existing conditions. This discharge will have to cross Dukeville Road, located downstream of the dike, via a new culvert and will empty into a wetland area that drains to the Yadkin River.

The Buck Station operates under a NPDES permit issued by the NCDEQ. Permit number NC0004774, effective November 1, 2018 through October 31, 2023, authorizes a total of five outfalls, four of which discharge into the Yadkin River. Outfall 007 is the associated outfall for the Basin discharges.

- **Wastewater and Stormwater Management During CCR Excavation**

Wastewater from the Basins will be pumped, treated (if required) and discharged, meeting the NPDES permit discharge requirements, 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. The water management system (WMS) during this phase consists of a temporary Level 1 physical-chemical treatment system designed to meet the requirements of the discharge permit including continuous monitoring for pH and Total Suspended Solids. The Buck WMS has a designed flow rate of 750 gpm. Following the Decanting phase and as the Closure schedule dictates, the Buck site will advance into the Dewatering phase to remove interstitial water from the Basins. 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 the Dewatering phase, the Buck WMS will have a designed flow rate of 250 to 500 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 have to be conditioned (screened) prior to transport to the STAR<sup>®</sup> unit. Consideration of required conditioning and management of contact water during excavation will be included in the development of closure phasing.

- **Post-Closure Stormwater Management**

The post-closure grades restore much of the historical natural valley channels that will route flow toward the dikes. Up to and including the last phase of closure before Basin dikes are breached, the Basins will maintain the capacity to contain the full PMP storm event.

The concept plans for post-closure grading are based conservatively on 100-year storm events. Appendix C presents the results of the post-closure stormwater management calculations.

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

Following completion of CCR excavation operations in Additional Primary Basin, all stormwater runoff will collect in the low point near the Additional Primary Basin Main dam (ROWAN-068) at the north end of the basin. A pump and discharge line will be installed which will discharge at the NPDES outfall location as clean stormwater. This pump and discharge line will remain in place until dam decommissioning.

Closure of the Basins has necessitated changes in the management of a number of wastewater and process streams. Wastewater and process streams previously discharging to the Basins have been rerouted to new station outfalls.

A temporary WMS has been installed for the closure of the Basins. A floating intake suction pump and screen has been placed at the location of the lowest elevation within the Basins. The system design, including pump capacity and filter size, will be such that the existing NPDES Outfall 007 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 excavation will be developed as part of the excavation packages for field implementation and formal Erosion and Sediment Control Plan permit submittal. The Basins are a NPDES permitted wastewater treatment unit. Therefore, only activities that can impact the areas outside the Basins will need to be addressed as part of the Erosion and Sediment Control Plan. However, water quality of discharges from the Basins during excavation may be impacted due to activities within the Basins, and appropriate planning and control measures will need to be implemented. This will be addressed during subsequent stages of the design, and calculations to support the Erosion and Sediment Control Plans will be developed during future stages of the design, 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**

Information on required permits is described in **Section 10**.

## **9.0 DESCRIPTION OF FINAL DISPOSITION OF CCR**

CCR materials in the Basins at the Buck Station will be excavated, processed, and beneficially reused for Buck to achieve project goals in accordance with applicable state and federal requirements and beneficial reuse contracts. CCR processing will be done using STAR<sup>®</sup> Technology, a patented thermal beneficiation process to transform CCR into a high-quality, sustainable product for the concrete industry.

An estimate of 6.68 million tons (5.56 million cubic yards) of CCR are currently stored in the Basins at the Buck Station (refer to section 3.1.2 for a detailed discussion and to **Appendix A** for quantities). At full production, the STAR<sup>®</sup> facility is designed to process 400,000 tons of CCR material per year (based on information provided by Duke Energy). Assuming 10-years of processing (2020-2029), this would allow approximately 4 million tons of CCR material to be processed for beneficial re-use, leaving 2.68 million tons which would potentially require handling by another process.

In order to meet the CCR removal deadline, Duke Energy will periodically review the progress of the excavation and STAR<sup>®</sup> processing as it relates to achieving full CCR removal by the required end date of December 31, 2029. Duke Energy will implement a concurrent excavation plan in which excavated ash will be transported to a permitted facility in order to meet the end date of December 31, 2029 for complete removal.

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

## **10.0 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 will follow NCDEQ approval of the Closure Plan.

## **11.0 DESCRIPTION OF POST-CLOSURE MONITORING AND CARE**

A Post-Closure Care Plan will be developed following NCDEQ approval of the Closure Plan for closure of the CCR Basins located at the Buck Station site. The purpose of the Post-Closure Care 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 CCR Basins at the Buck Station site. The Basins at the Buck Station site are detailed in this Closure Plan as being closed by excavation.

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 included in the Post-Closure Care Plan for the Buck Station 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;
- 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 was developed by HDR in the CSA and CSA Supplement 1 Reports (2015, 2016), which are herein incorporated by this reference. This information is included as part of the updated CSA being prepared separately by SynTerra for Duke Energy and will be submitted to NCDEQ by October 1, 2020. The CSA is herein incorporated by this reference, but its content is not the work product of Wood.

## **12.0 PROJECT MILESTONES AND COST ESTIMATES**

### **12.1 Project Schedule**

On June 30, 2017, Duke Energy selected the Buck Station as an ash beneficiation site as required by N.C.G.S. § 130A-309.216. Excavation of CCR from the Buck site for beneficial use will occur over multiple project phases. Activities started in April 2017 and will continue until all CCR is removed in 2029, then continuing until approximately 2030, when final site restoration is completed.

A Closure project high-level milestone schedule has been prepared by Duke Energy and the major activities and milestones are provided below:

Engineering, Dewatering	Ongoing
Complete CCR Excavation	Q4-2029
Site Restoration	Q4-2030

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

Cost estimates for closure and post-closure care of the CCR Basins at Buck 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 has not been 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 \$532 million.

The cost to perform the 30-year post-closure activities and monitoring is estimated as \$45 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 updated CAP being prepared separately by SynTerra for Duke Energy and will be submitted to NCDEQ by July 1, 2021. The CAP is herein incorporated by this reference, but its content is not the work product of Wood.

### **13.0 REFERENCES**

- North Carolina Department of Environmental Quality report, "Coal Combustion Residual Impoundment Risk Classification" (2016)
- North Carolina Department of Environmental Quality, 15A N.C.A.C 02K – North Carolina dam safety rules
- North Carolina Department of Environmental Quality, 15A N.C.A.C. 02L - North Carolina groundwater rules
- North Carolina General Assembly, Session Law 2014-122, Coal Ash Management Act, as amended
- United States Environmental Protection Agency, Coal Combustion Residuals (CCR) Rule 40 C.F.R. Part 257, subpart D

## Tables

**Table 2-1: CAMA Closure Plan Requirements  
 Summary and Cross Reference Table  
 Duke Energy, Buck Station**

No.	Description	Corresponding Closure Plan Section
Part II. Provisions for Comprehensive Management of Coal Combustion Residuals § 130A-309.212(a)(4) Closure Plans for all impoundments shall include all of the following:		
a. Facility and coal combustion residuals surface impoundment. – 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.	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. 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	3.3

	generating station and disposed of through transfer to structural fills.	
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
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.	4.1
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,	4.4

	effective friction angle, maximum dry density, optimum moisture content, and permeability.	
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  (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,	5.2

	<p>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.</p>	
3	<p>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.</p>	5.3
e.	<p>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).</p>	6.1
f.	<p>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.</p>	7.1, 7.2
g.	<p>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.</p>	7.3
h.	<p>A description of the provisions for disposal of wastewater and management of stormwater and the plan for obtaining all required permits.</p>	8
i.	<p>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</p>	9

	<p>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.</p>	
j.	<p>A list of all permits that will need to be acquired or modified to complete closure activities.</p>	10
k.	<p>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:</p>	11
1	<p>A demonstration of the long-term control of all leachate, affected groundwater, and stormwater.</p>	11.1
2	<p>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.</p>	11.2
l.	<p>An estimate of the milestone dates for all activities related to closure and post-closure.</p>	12.1

<p>m. Projected costs of assessment, corrective action, closure, and post-closure care for each coal combustion residuals surface impoundment.</p>	<p>12.2</p>
<p>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.</p>	<p>6.2</p>
<p>§ 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.</p>	
<p>§ 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.</p>	



**Table 4-1: Summary of Typical Material Properties**  
**Duke Energy, Buck Station**

Properties	Soil Cover/Fill above or below the CCR Basins		CCR within the Basins		Alluvial Soil below the CCR Basins		Foundation Soil (Saprolite/Residual) below the Basins	Saprolite/Weathered Rock (WR) below the Basins	Fill Soil within the Embankment Dikes	Foundation Soil (Saprolite/Residual) below the Embankment Dikes	Saprolite/Weathered Rock (WR) below the Embankment Dikes
Soil Type	ML, MH, SM, CL, CH, and SC		Silty Sand (SM) - Predominantly Bottom Ash, Silt/Sandy Silt (ML) - Predominantly Fly Ash		SP, SM, SW, CL, CH, ML, and MH		SM, SC, MH, ML, and CL	Breaks down to Sandy Silt and silty sand with rock fragments	ML, MH, SM, CL, CH, and SC	SM, SC, MH, ML, and CL	Breaks down to Sandy Silt and silty sand with rock fragments
Color	Red, brown, tan, light brown, and dark gray		Black, gray, dark gray, and greenish black		Gray, white, black, orange, brown, and dark brown		Gray, orange, white, brown, tan, and black	Gray, light green, brown, and orange	Red, brown, tan, light brown, and dark gray	Gray, orange, white, brown, tan, and black	Gray, light green, brown, and orange
Plasticity	NP to 24 - 30		Predominantly Non Plastic		**		NP to 25 - 33	**	NP - 30	NP - 33	**
Liquid Limit	NP to 30 - 65		Predominantly Non Plastic		**		NP to 26 - 68	**	NP - 65	NP - 68	**
Plasticity Index	NP to 6 - 35		Predominantly Non Plastic		**		NP to 1 - 25	**	NP - 35	NP - 25	**
	<b>Representative Range</b>	<b>Geometric Mean</b>	<b>Representative Range</b>	<b>Geometric Mean</b>	<b>Representative Range</b>	<b>Geometric Mean</b>	<b>Representative Range</b>				
Natural Moisture Content (%)	18% - 34%	27%	11% - 75%	49%	17% - 33%	**	15% - 54%	11% - 36%	18% - 34%	15% - 54%	11% - 36%
Fines Content	42% - 85%	62%	9% - 98%	58%	26% - 72%	**	6% - 88%	**	42% - 85%	6% - 88%	**
Clay Content	12% - 51%	30%	1% - 21%	5%	2% - 37%	**	1% - 56%	**	12% - 51%	1% - 56%	**
Blow Count - Uncorrected N Value (bpf)	3 - 39	12	WOR - 19	**	3 - 26	12	2 - 73	50/0" - 50/5"	3 - 24	3 - 62	50/0" - 50/5"
Moist Unit Weight	**	**	**	**	**	**	**	**	**	**	**
Dry Unit Weight	**	**	49 - 76 pcf	64 pcf	**	**	76 - 120 pcf	**	**	76 - 120 pcf	**
Specific Gravity	2.6 - 2.8	2.7	2.1 - 2.3	2.2	2.8	*	2.6 - 3.0	**	2.6 - 2.8	2.6 - 3.0	**
Horizontal Hydraulic Conductivity (cm/sec)	**	**	**	**	**	**	**	**	**	**	**
Vertical Hydraulic Conductivity (cm/sec)	1.3E-07 - 5.6E-05	9.60E-06	1.8E-05 - 1.6E-03	3.30E-04	1.10E-04	*	9.9E-07 - 2.9E-04	4.2E-06 - 4.8E-05	1.3E-07 - 5.6E-05	9.9E-07 - 2.9E-04	4.2E-06 - 4.8E-05

Notes:

Outlier values are not included in the table above. Please refer to lab data summary sheets presented with laboratory data for all available values.

NP: Non Plastic

pcf: Pounds per cubic foot (lb/ft<sup>3</sup>)

WOR: Weight of Rod

WOH: Weight of Hammer

bpf: Blows per foot

\*Only one lab test available

\*\*No lab data available

**Table 10-1: Regulatory Permits, Approvals, or Requirements for Ash Basin Closure by Excavation**

**Duke Energy, Buck Station**

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	Rowan 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	US ACoE		New Permit	Breaching of Primary/Secondary Main Dam (ROWAN-047) will likely impact the Yadkin River and will require a new permit.
Clean Water Act 404	US ACoE		New Permit	Breaching of Primary/Secondary Main Dam (ROWAN-047) will likely impact the Yadkin River and will require a new permit.
Cutting Trees	USFWS			
Dam Safety	NCDEQ		Certificate of Approval to Modify	Ash Basin Dam - Permitting is required to modify the dam in accordance with the Dam Safety Law of 1967, 15A

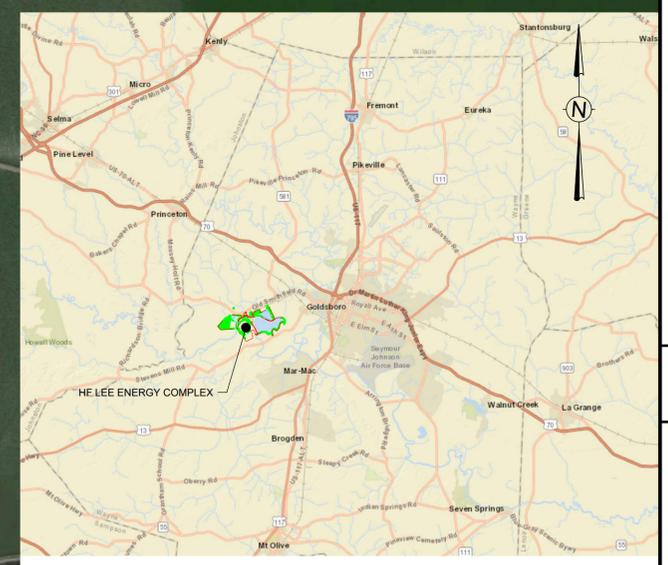
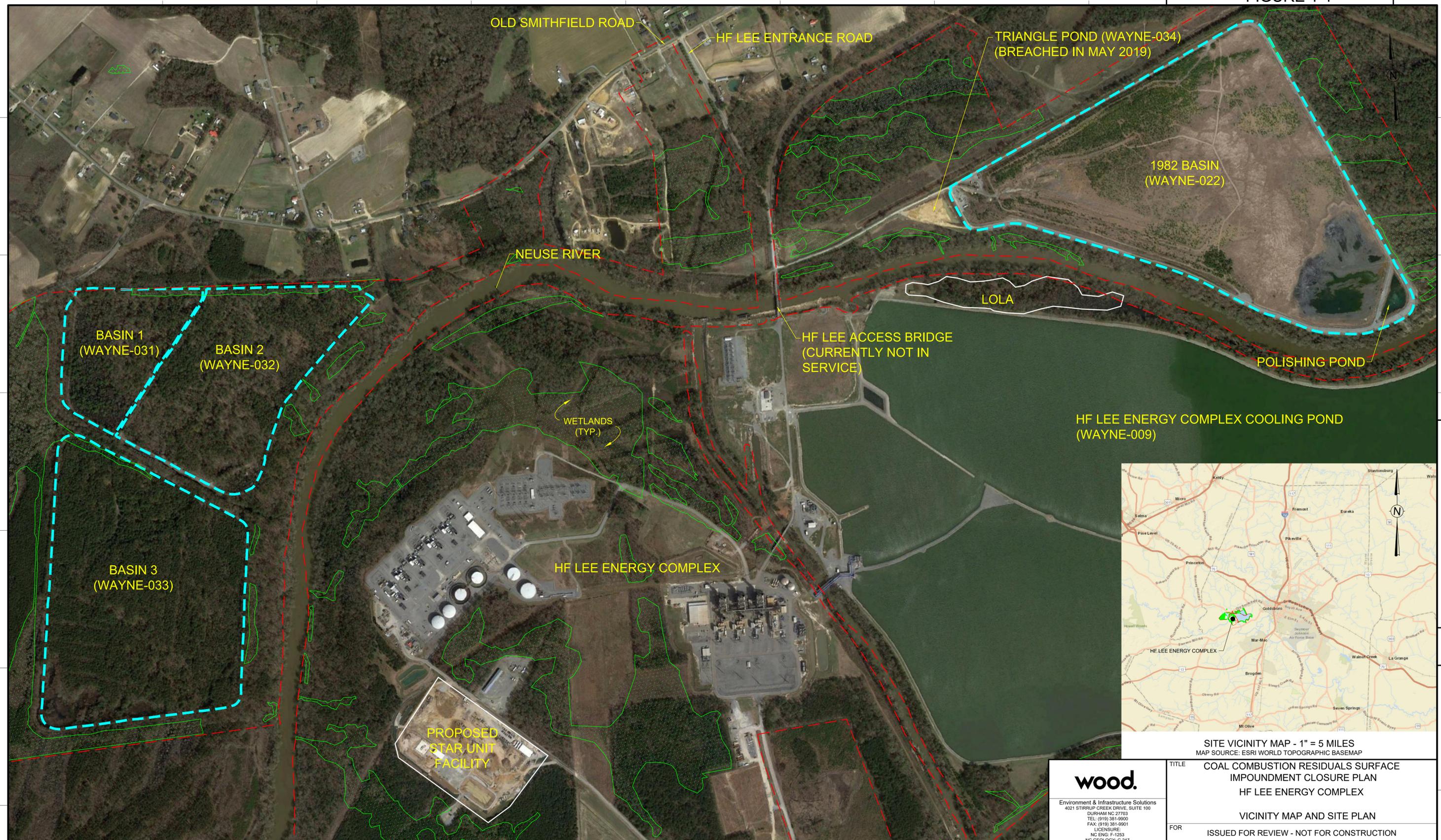
				NCAS 02K.0201 (b)(2); an application must be filed with the Division of Energy, Mineral, and Land Resources (DEMLR)
Dam Safety	NCDEQ	ROWAN-047	Certificate of Approval to Modify	Main Dam - Permitting is required to modify the dam in accordance with the Dam Safety Law of 1967, 15A NCAS 02K.0201 (b)(2); an application must be filed with the Division of Energy, Mineral, and Land Resources (DEMLR)
Dam Safety	NCDEQ	ROWAN-068	Certificate of Approval to Modify	Additional Primary Dam - Permitting is required to modify 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	ROWAN-069	Certificate of Approval to Modify	Basin 1 to Basin 2 Dam - Permitting is required to modify 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	ROWAN-070	Certificate of Approval to Modify	Basin 2 to Basin 3 Dam - Permitting is required to modify 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	ROWAN-071	Certificate of Approval to Modify	Divider Dike - Permitting is required to modify 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	NCDOT			Utilization of or modification to state or federal highways to transport CCR will require consultation or notification to relevant DOT agency
Driveway Permit	NCDOT		Not Anticipated	
Erosion and Sediment Control (E&SC)	NCDEQ		Permit not required	Land disturbance activities outside of the ash basin will not exceed one acre, therefore in conformance with 15A NCAC 04, an E&SC Permit is not 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	Rowan County		New Permit	Flood Damage Prevention Ordinance of Rowan County (05-04-2009), 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 ash basin
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	NC0004774	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			Not Anticipated	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: Candidate Conservation Agreement Avian Protection Plan(s) Bird and Bat Conservation Strategies Eagle Conservation Plan Eagle Take Permit	NCDEQ/EPA		Existing Eagle Take Permit is in place.	Existing Eagle Take Permit allows one take. 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 Site Suitability	NCDEQ		Not Anticipated	No new CCR Landfill planned
Solid Waste Permit to Construct	NCDEQ		Not Anticipated	No new CCR Landfill planned
Solid Waste Permit to Operate	NCDEQ		Not Anticipated	No new CCR Landfill planned
Solid Waste Zoning - County Approval	Rowan County		Not Anticipated	No new CCR Landfill planned

## FIGURES

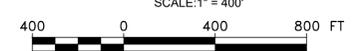


SITE VICINITY MAP - 1" = 5 MILES  
MAP SOURCE: ESRI WORLD TOPOGRAPHIC BASEMAP

**LEGEND**

	WETLANDS
	APPROXIMATE LIMIT OF WASTE
	APPROXIMATE PROPERTY LINE

**VICINITY MAP AND SITE PLAN**  
SCALE: 1" = 400'

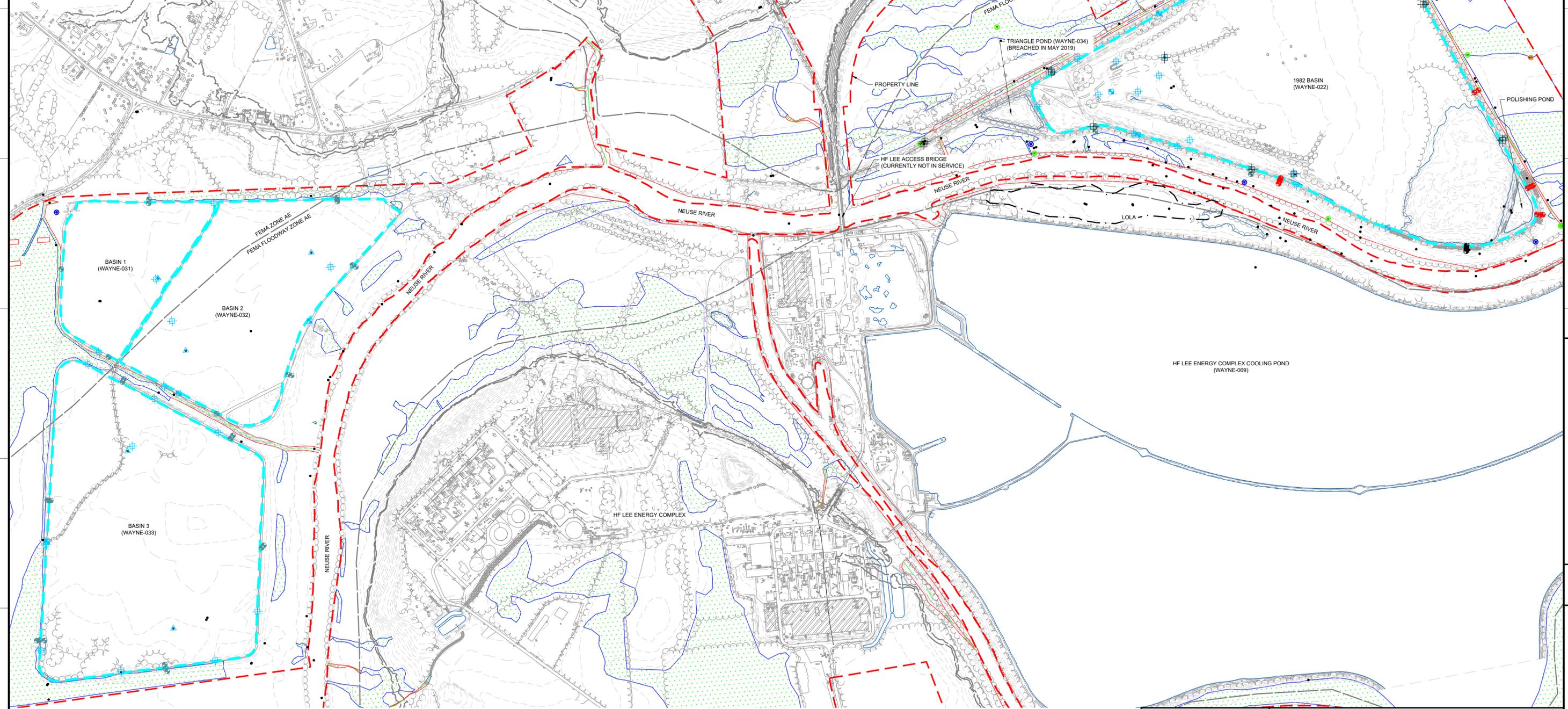


 Environment & Infrastructure Solutions 4021 STIRRUP CREEK DRIVE, SUITE 100 DURHAM NC 27703 TEL: (919) 381-9900 FAX: (919) 381-9901 LICENSE: NC ENG: F-1263 NC GEOLOGY: C-247	<b>TITLE</b> COAL COMBUSTION RESIDUALS SURFACE IMPOUNDMENT CLOSURE PLAN HF LEE ENERGY COMPLEX VICINITY MAP AND SITE PLAN	
	<b>FOR</b> ISSUED FOR REVIEW - NOT FOR CONSTRUCTION	
SEAL  <b>ISSUED FOR REVIEW NOT FOR CONSTRUCTION</b>	SCALE: AS SHOWN DWG TYPE: DWG JOB NO: 7812180091 DATE: 12/10/2019	DES: WMN DFTR: WMN CHKD: BBC ENGR: WAW APPD: CRK
	FILENAME: HFL_EXISTING OVERALL AERIAL.dwg DWG SIZE: 22"x34"	DRAWING NO. <b>FIGURE 1-1</b>
	REVISION	

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

OVERALL EXISTING CONDITIONS PLAN

SCALE: 1" = 400'



**LEGEND**

--- 100 ---	EXISTING MAJOR CONTOURS	◇	EXISTING ELECTRIC UTILITY POLE	□	GEOSYNTEC BORINGS
---	EXISTING MINOR CONTOURS	⊠	EXISTING ELECTRIC UTILITY TOWER	⊕	GEOSYNTEC CPTS & SCPTS
==	EXISTING GRAVEL ROAD	MW ⊕	EXISTING MONITORING WELL	△	GEOSYNTEC PIEZOMETERS
---	EXISTING ROAD	WV ⊕	EXISTING WATER UTILITY	○	SYNTERRA MONITORING WELLS
---	EXISTING TREE LINE	⊠	EXISTING UTILITY TELEPHONE	⊕	S&ME MONITORING WELLS
---	EXISTING SITE FENCE	---	FLOOD HAZARD LINE	○	CATLIN MONITORING WELLS
---	EXISTING OVERHEAD ELECTRIC LINES	---	APPROXIMATE PROPERTY LINE	○	EXISTING PIEZOMETERS
---	EXISTING WATER	---	APPROXIMATE LIMIT OF WASTE	●	WELL LOCATIONS AS PROVIDED BY SYNTERRA TO DUKE ENERGYWOOD
---	EXISTING WETLANDS	---	EXISTING LIMITS	MW ⊕	EXISTING MONITORING WELL
---	EXISTING RIP RAP	---	EXISTING STRUCTURES (VARIOUS)	⊕	AMEC BORINGS
---	EXISTING UTILITY LIGHT	---	EXISTING UTILITY LIGHT	⊕	MACTEC BORINGS
---	EXISTING FIRE HYDRANT	---	EXISTING FIRE HYDRANT	⊕	LAW BORINGS
---	EXISTING SEWER MANHOLE	---	EXISTING SEWER MANHOLE	⊕	

- REFERENCES:**
- EXISTING TOPOGRAPHY AND SURVEY PROVIDED BY WSP DATED JULY 2015.
  - EDGE OF WATER PROVIDED IN SURVEY BY WSP FOR DUKE ENERGY PROGRESS, LLC. TITLED "AERIAL TOPOGRAPHIC SURVEY HF LEE ENERGY COMPLEX," REVISION 1, DATED 24 JULY 2015, FILE NAME: "HF LEE FINAL - REV 07-27-2015.DWG".
  - LOCATION OF ANY AND ALL UTILITIES SHOWN IS BASED ON PHOTOGRAMMETRIC MAPPING AND IS APPROXIMATE. CONTRACTOR SHALL VERIFY LOCATION OF UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION.
  - EXISTING STREAMS AND WETLANDS PROVIDED BY MCKIM & CREED DATED OCTOBER 9, 2017.

<p>Environment &amp; 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</p>	<p>TITLE: COAL COMBUSTION RESIDUALS SURFACE IMPOUNDMENT CLOSURE PLAN HF LEE ENERGY COMPLEX</p>	
	<p>OVERALL EXISTING CONDITIONS PLAN</p>	
<p>ISSUED FOR REVIEW NOT FOR CONSTRUCTION</p>	<p>FOR: ISSUED FOR REVIEW - NOT FOR CONSTRUCTION</p>	
	<p>SCALE: AS SHOWN</p>	<p>DES: WMN</p>
<p>DWG TYPE: DWG</p>	<p>DFTR: WMN</p>	<p>CHKD: BBC</p>
<p>DATE: 12/10/2019</p>	<p>ENGR: WAW</p>	<p>APPD: CRK</p>
<p>FILENAME: HFL_EXISTING OVERALL TOPOGRAPHY.dwg</p>	<p>DWG SIZE: ANSI D 22"x34"</p>	<p>DRAWING NO. FIGURE 1-2</p>
<p>REVISION</p>	<p>REVISION</p>	<p>REVISION</p>

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

FIGURE 1-2