



Harry K. Sideris
Senior Vice President
Environmental, Health & Safety
526 S. Church Street
Mail Code: EC3XP
Charlotte, NC 28202
(704) 382-4303

April 28, 2016

Jeffrey O. Poupart
Water Quality Permitting Section Chief
Division of Water Resources
Department of Environmental Quality
State of North Carolina
1617 Mail Service Center
Raleigh, NC 27699-1617

Subject: March 2, 2016 Insufficiency of Discharge Assessment Plans – Duke Energy Carolinas, LLC and Duke Energy Progress, LLC

Dear Mr. Poupart:

This responds to your letter of March 2, 2016 to Duke Energy Carolinas, LLC and Duke Energy Progress, LLC on March 2, 2016 regarding Duke Energy's proposed Discharge Assessment Plans.

With regard to your letter describing changes in *Section 3.2.2 Observation and Sampling*:

- *The discussion must include a statement noting that jurisdictional determinations regarding the extent of waters of the United States and their relationship with identified seeps at the subject facilities will be obtained from the United States Army Corps of Engineers (USA COE).*

Duke Energy does not yet have jurisdictional determinations from the US Army Corps of Engineers for the relevant areas at all of the twelve sites mentioned in your letter. We submitted applications for jurisdictional determinations in September, October, and November 2015 and have since worked with the Corps of Engineers to schedule site visits and provide draft plats for approval. Nonetheless, the timing of the approved jurisdictional determinations is up to the Corps and outside of Duke's control. To date, out of these twelve sites, only Buck has an approved jurisdictional determination, but we do not yet have the signed plats.

We will submit the maps you have requested for each site on a rolling basis, within a reasonable period after the jurisdictional determinations are complete. In order to address the changes described in your March 2, 2016 letter, we have added the following text at the start of Section 3.2.2.

Jurisdictional determinations regarding the extent of waters of the United States and their relationship with identified seeps at the subject facilities will be obtained from the United States Army Corps of Engineers (USA COE). Until jurisdictional determinations are finalized by USA COE, preliminary information will be used to evaluate the seeps as described in the section below.

The second change in Section 3.2.2 described in your letter is as follows.

- *The schedule for water quality sampling of the seeps and related jurisdictional waters must be more frequent than the semi-annual basis stated in the proposed DAPs. DWR recommends a monthly monitoring schedule, consistent with the conditions described in the DAPs' general assessment requirements, for all identified seeps that will continue for twelve (12) months. After that time, monitoring may be reduced to a semi-annual basis until such monitoring becomes a requirement of the NPDES permit.*

We do not believe sampling monthly as part of a revised Discharge Assessment Plan is warranted. For the larger receiving waters, data is available from sampling associated with NPDES permits that demonstrates the lack of impact on the larger surface waters of the state. In addition, we are conducting weekly observations of all AOWs on a dam or dike slope, sampling any new seeps, and providing the analytical results to DEQ. We recommend the sampling frequency under the DAPs remain at twice/year with the weekly inspections of dam slopes for any new seeps with data provided to DEQ. We recommend that we collectively focus our resources on the completion of all of the NPDES Wastewater Permits for the Duke Energy sites and implement appropriate sampling frequency for each of the permitted seeps in that document .

However, in order to address the changes described in your March 2, 2016 letter, we have added the following text in Section 3.2.2.

In addition to sampling conducted with the semi-annual assessments, additional seep sampling will be conducted at locations and at a frequency as determined through discussions with NC DEQ personnel.

We would like to work with DEQ to achieve alignment of the various (present and future) documents involving required seep activities including:

- Discharge Assessment Plans
- Discharge Identification Plans
- NPDES Wastewater Permits
- EPA requirements
- Any future legal agreements with either DEQ or EPA

Duke Energy is committed to providing the Department with additional information to facilitate the issuance of new NPDES Wastewater permits. The issues are complex and require special consideration, as illustrated by the time elapsed since the permit applications were submitted. We look forward to working with you further to resolve the issues identified here on a mutually acceptable schedule.

Sincerely,



Harry Sideris
Senior Vice President
Environmental, Health and Safety

Belews Creek Steam Station Ash Basin

Topographic Map and Discharge Assessment Plan

NPDES Permit NC0024406

April 29, 2016





Contents

	<u>Page</u>
Contents	i
Figures and Tables	ii
Section 1 - Introduction	1
Section 2 - Site Background	3
2.1 Plant Description	3
2.2 Ash Basin Description	3
2.3 Site Geologic/Soil Framework	3
2.4 Topographic Map and Identification of Discharges	4
2.4.1 Engineered Drainage System for Earthen Dam	4
2.4.2 Non-Engineered Seep Identification	5
Section 3 - Discharge Assessment Plan	6
3.1 Purpose of Assessment	6
3.2 Assessment Procedure	6
3.2.1 General Assessment Requirements	6
3.2.2 Observation and Sampling	7
3.2.3 Evaluation	9
3.2.4 Assessment Reporting	9
Section 4 - References	10



Figures and Tables

Figure 1 – Site Location Map

Figure 2 – Topographic Map

Table 1 – Seep and Associated Discharge Locations and Descriptions

Table 2 – Laboratory Analytical Methods

Table 3 – Belews Creek Steam Station – Example of Surface Water/Seep Monitoring Flow and Analysis Results Table



Section 1 - Introduction

The purpose of this document is to address the requirements of North Carolina General Statute (GS)130A-309.210(a) *topographic map* and (b) *Assessment of Discharges from Coal Combustion Residuals Surface Impoundments to the Surface Waters of the State*, as modified by North Carolina Senate Bill 729, for the Belews Creek Steam Station (BCSS) ash basin operated under National Pollutant Discharge Elimination System (NPDES) Permit NC0024406.

The following requirements are contained in General Statute (GS) 130A-309.210(a):

- (1) *The owner of a coal combustion residuals surface impoundment shall identify all discharges from the impoundment as provided in this subsection. The requirements for identifying all discharges from an impoundment set out in this subsection are in addition to any other requirements for identifying discharges applicable to the owners of coal combustion residuals surface impoundments.*
- (2) *No later than December 31, 2014, the owner of a coal combustion residuals surface impoundment shall submit a topographic map that identifies the location of all (i) outfalls from engineered channels designed or improved for the purpose of collecting water from the toe of the impoundment and (ii) seeps and weeps discharging from the impoundment that are not captured by engineered channels designed or improved for the purpose of collecting water from the toe of the impoundment to the Department. The topographic map shall comply with all of the following:*
 - a. *Be at a scale as required by the Department.*
 - b. *Specify the latitude and longitude of each toe drain outfall, seep, and weep.*
 - c. *Specify whether the discharge from each toe drain outfall, seep, and weep is continuous or intermittent.*
 - d. *Provide an average flow measurement of the discharge from each toe drain outfall, seep, and weep including a description of the method used to measure average flow.*
 - e. *Specify whether the discharge from each toe drain outfall, seep, and weep identified reaches the surface waters of the State. If the discharge from a toe drain outfall, seep, or weep reaches the surface waters of the State, the map shall specify the latitude and longitude of where the discharge reaches the surface waters of the State.*
 - f. *Include any other information related to the topographic map required by the Department.*

The following requirements are contained in General Statute (GS) 130A-309.210(b):

- b) *Assessment of Discharges from Coal Combustion Residuals Surface Impoundments to the Surface Waters of the State. The owner of a coal combustion residuals surface impoundment shall conduct an assessment of discharges from the coal combustion*



residuals surface impoundment to the surface waters of the State as provided in this subsection. The requirements for assessment of discharges from the coal combustion residuals surface impoundment to the surface waters of the State set out in this subsection are in addition to any other requirements for the assessment of discharges from coal combustion residuals surface impoundments to surface waters of the State applicable to the owners of coal combustion residuals surface impoundments.

- (1) No later than December 31, 2014, the owner of a coal combustion residuals surface impoundment shall submit a proposed Discharge Assessment Plan to the Department. The Discharge Assessment Plan shall include information sufficient to allow the Department to determine whether any discharge, including a discharge from a toe drain outfall, seep, or weep, has reached the surface waters of the State and has caused a violation of surface water quality standards. The Discharge Assessment Plan shall include, at a minimum, all of the following:
 - a. Upstream and downstream sampling locations within all channels that could potentially carry a discharge.*
 - b. A description of the surface water quality analyses that will be performed.*
 - c. A sampling schedule, including frequency and duration of sampling activities.*
 - d. Reporting requirements.*
 - e. Any other information related to the identification of new discharges required by the Department.**
- (2) The Department shall approve the Discharge Assessment Plan if it determines that the Plan complies with the requirements of this subsection and will be sufficient to protect public health, safety, and welfare; the environment; and natural resources.*
- (3) No later than 30 days from the approval of the Discharge Assessment Plan, the owner shall begin implementation of the Plan in accordance with the Plan's schedule.*

The North Carolina Senate Bill 729 establishes the submittal date of this topographic map and Discharge Assessment Plan no later than December 31, 2014.

The topographic map, developed to satisfy the requirements of GS130A-309.210(a), was utilized as the basis for developing the assessment procedures presented in this plan, required by GS130A-309.210(b).

Section 2 - Site Background

2.1 Plant Description

BCSS is a coal-fired electricity-generating facility with a capacity of 2,240 megawatts located on Belews Lake in Stokes County, North Carolina. BCSS is a two-unit station which began commercial operation in 1974 (Figure 1). Belews Creek, a tributary of the Dan River, was impounded by Duke Energy (formerly Duke Power at the time of initial impoundment) to form Belews Lake. Belews Lake is approximately 3,800 acres in area and provides cooling water for the station.

2.2 Ash Basin Description

The ash basin system consists of a single cell impounded by an earthen dike located on the north end of the ash basin. The ash basin system was constructed from 1970–1972 and it is located approximately 3,200 feet northwest of the power plant. The waste boundary for the ash basin encompasses approximately 342 acres.

The full pond elevation for the BCSS ash basin is approximately 750 feet. The normal pond elevation of Belews Lake is approximately 725 feet.

Due to the nature of BCSS operations, inflows to the ash basin are highly variable. The inflows from the station to the ash basin are discharged to the southeast portion of the ash basin. The ash basin pond elevation is controlled by the use of concrete stoplogs. The discharge from the ash basin is through a concrete discharge tower located in the northwest portion of the ash basin. The concrete discharge tower drains through a 24-inch-diameter SDR 17 HDPE conduit for approximately 1,600 feet and then discharges into a concrete flume box. The discharge is to an un-named tributary that flows northward to the Dan River.

2.3 Site Geologic/Soil Framework

BCSS and its associated ash basin system are located in the Milton Belt of the Piedmont physiographic province (Piedmont), one of several northeast-trending geologic belts of the southern crystalline Appalachians. The rocks of the Milton belt were formed during the Precambrian era and metamorphosed during the early to late Paleozoic era (Butler and Secor 1991). The Milton belt bedrock is characterized by strongly foliated gneiss and schist, commonly with distinct compositional layering and having felsic composition—quartzite, calc-silicate gneiss, and marble are minor units (Carpenter 1982).

The soils that overlie the bedrock in the area have generally formed from the in-place weathering of the parent bedrock. The fractured bedrock is overlain by a mantle of unconsolidated material known as regolith. The regolith, where present, includes the soil zone; a zone of weathered, decomposed bedrock known as saprolite; and alluvium. Saprolite, the product of chemical and mechanical weathering of the underlying bedrock, is typically composed of silt and coarser granular material up to boulder size and may reflect the texture of the rock from which it was formed. The weathering products of felsic rocks may be sandy-textured and rich in quartz content while mafic rocks form a more clayey saprolite (LeGrand 2004).

The BCSS ash basin is generally bounded to the north by the earthen dike and a natural ridge. Pine Hall Road runs along the east and south sides of the ash basin and appears to generally be located along a surface water divide. Belews Lake is located to the east and south of Pine Hall Road. Middleton Loop road is located on the west side of the ash basin and appears to generally be located along a surface water divide. The geology/groundwater conditions at the site are expected to be generally consistent with the characteristics of the conceptual groundwater model developed by LeGrand (LeGrand, 2004) for the Piedmont region.

2.4 Topographic Map and Identification of Discharges

A topographic map is presented in Figure 2 to meet the requirements of GS 130A-309.210(a) in the identification of outfalls from engineered channels as well as seeps and weeps.

Seepage is the movement of wastewater from the ash basin through the ash basin embankment, the embankment foundation, the embankment abutments, basin rim, through residual material in areas adjacent to the ash basin. A seep is defined in this document as an expression of seepage at the ground surface. A weep is understood to have the same meaning as a seep.

Indicators of seepage include areas where water is observed on the ground surface and/or where vegetation suggests the presence of seepage. Seepage can emerge anywhere on the downstream face, beyond the toe, or on the downstream abutments at elevations below normal pool. Seepage may vary in appearance from a "soft," wet area to a flowing "spring." Seepage may show up first as only an area where the vegetation is lush and darker green than surrounding vegetation. Cattails, reeds, mosses, and other marsh vegetation often become established in a seepage area (NCDENR, 2007). However, in many instances, indicators of seeps do not necessarily indicate the presence of seeps. Areas of apparent iron staining and/or excess iron bacteria may also indicate the presence of a seep.

Locations of seepage at the ground surface adjacent to the ash basin have been identified and are shown in Figure 2. These areas include the earthen embankment which impound the ash basin as well as adjacent areas where water from the ash basin may have infiltrated into the underlying residual materials and expressed as seepage.

2.4.1 Engineered Drainage System for Earthen Dam

Earth dams are subject to seepage through the embankment, foundation, and abutments. Seepage control is necessary to prevent excessive uplift pressures, instability of the downstream slope, piping through the embankment and/or foundation, and erosion of material by migration into open joints in the foundation and abutments. The control of seepage is performed by the use of engineered drains such as blanket drains, trench drains, and/or toe drains. In certain cases, horizontal pipes may be installed into the embankment to collect and control seepage. It is standard engineering practice to collect the seepage and convey seepage away from the dam.

The Belews Creek ash basin dam (Stoke-116) was constructed with a drainage blanket, a transverse filter drain, relief wells, and trench drains. Horizontal drains were installed after



construction was completed. The drainage features, or outfalls, associated with the ash basin dam are shown as required by GS 130A-309.210(a)(2)(i) on Figure 2.

2.4.2 Non-Engineered Seep Identification

Topographic maps of the site were reviewed to identify regions of the site where there was a potential for ash-basin-related seepage to be present. These regions were determined by comparing ash basin full pond elevations to adjacent topography with ground surface elevations lower than the ash basin full pond elevation. HDR staff performed site observations within these identified areas as part of NPDES inspections during the reapplication process during July and August 2014 and documented locations where seepage was apparent at the time of the site visit. These seeps are identified as required by GS 130A-309.210(a)(2)(ii) on Figure 2.

Section 3 - Discharge Assessment Plan

3.1 Purpose of Assessment

The purpose of the assessment is to determine whether existing, known discharges from toe drain outfalls, seeps, and weeps associated with the coal combustion residuals surface impoundment (ash basin) have reached the surface waters of the State and have caused a violation of surface water quality standards as required by North Carolina General Statute 130A-309.210(b).

Figure 2 and Table 1 present the background and downstream sampling locations to be considered as part of this Discharge Assessment Plan (DAP). These locations may be assessed by comparing surface water sampling analytical results of the associated background location with the corresponding downstream location. For discharges located at the toe of a dam, an upstream location within the channel may not have been possible to isolate for comparison given the proximity to the ash basin, which would have the same chemical composition as the discharge itself. As such, the upstream location was established upstream of the ash basin and is considered “background.” For discharges located a distance from the ash basin, an identified upstream or “background” location for sampling may be compared to the downstream portion of the discharge channel. The background and downstream sampling locations are shown on Figure 2 with “B” and “D” identifiers, respectively, and the corresponding seep locations associated with the sampling locations are indicated on Table 1.

3.2 Assessment Procedure

The assessment procedure associated with the Belews Creek ash basin is provided within this section. In addition to the specific requirements for the assessment, Section 3.2 also provides the general requirements, the frequency of assessment, documentation requirements, and a description of the surface water quality analyses that will be performed.

3.2.1 General Assessment Requirements

Assessments are to be performed in three phases as follows:

- Observation and Sampling (assessment site visit)
- Evaluation
- Assessment Reporting

The assessment site visit shall be performed when the background and downstream locations are accessible and not influenced by weather events. Locations on or adjacent to the ash basin embankments should be performed within two months after mowing, if possible. In addition, the assessment site visit should not be performed if the following precipitation amounts have occurred in the respective time period preceding the planned assessment site visit:

- Precipitation of 0.1 inches or greater within 72 hours or
- Precipitation of 0.5 inches or greater within 96 hours

The assessments shall be performed under the direction of a qualified Professional Engineer or Professional Geologist on a semi-annual basis during the following months: April to May and



October to November. The date of the initial assessment site visit shall be selected no later than 30 days from the approval of the Discharge Assessment Plan and should fall within one of the semi-annual timeframes. Additional seep locations that may have been identified and documented in an Identification of New Discharge report(s) shall be reviewed prior to performing an assessment site visit, if available.

3.2.2 Observation and Sampling

Jurisdictional determinations regarding the extent of waters of the United States and their relationship with identified seeps at the subject facilities will be obtained from the United States Army Corps of Engineers (USACE). Until jurisdictional determinations are finalized by USACE, preliminary information will be used to evaluate the seeps as described in the section below.

The initial assessment site visit should be performed to document baseline conditions of the discharge channel, including location, extent (i.e., dimensions of affected area), and flow of each discharge. Discharge channel background and downstream locations should be verified using a Global Positioning System (GPS) device. Photographs should be taken from vantage points that can be replicated during subsequent semi-annual assessments.

Initial and subsequent assessment site visits shall document a minimum of the following to respond to the requirements in 130A-309.210.1(b):

- Record the most recent ash basin water surface elevation and compare to the seep and outfall and associated discharge location surface water elevations.
- For each discharge channel, the observer shall note the following as applicable on the day of the assessment site visit:
 - Is the discharge channel flowing at the time of the assessment site visit?
 - Does the discharge channel visibly flow into a Water of the U.S. at the time of the assessment site visit?
 - How far away is the nearest Water of the U.S.?
 - Document evidence that flow has or could reach a Water of the U.S. (e.g., description of flow, including extent and/or direction) and describe the observed condition. Evidence that flow could or has reached a Water of the U.S. may be indicated by an inspection of the adjacent and downstream topographic drainage features.
 - Observe and document the condition of the discharge channel and outfall of the engineered channel or seep location with photographs. Photographs are to be taken from similar direction and scale as photographs taken during the initial assessment site visit.
- Record flow rate within the discharge channel, if measureable, using the following methods:

- Timed-volumetric method: Collect a volume of water from the discharge of the PVC pipe directly into an appropriately sized container. Measure volumes (in mL) in the field utilizing a graduated container. Record the amount of time (in seconds) needed to collect the volume of water and calculate the flows (in MGD) for the timed volume.
- A V-notch weir apparatus will be installed, if necessary, during the initial assessment site visit to impound seepage at locations with a defined channel. Once the impounded seep reaches equilibrium discharge, flows will be measured using the timed-volumetric method described above.
- Area-velocity method: Measure point velocities and water depth at a minimum of 20 stations along a transect setup perpendicular to the direction of flow using a Swoffer® 3000 flow meter mounted to a standard United States Geologic Survey (USGS) top-set wading rod. Utilize the average velocity and cross-sectional area of the wetted channel to calculate flows in MGD.
- Collect water quality samples using the following methods:
 - Collect background and downstream samples during a period with minimal preceding rainfall to minimize potential effects of stormwater runoff. Sampling procedures should prevent the entrainment of soils and sediment in water samples that can result in analytical results not being representative of the flow. Because Areas of Wetness (AOWs)/seeps often have poorly defined flow channels and minimal channel depth, conventional grab samples collected directly into laboratory containers or intermediate vessels is not possible without disturbance and entrainment of soils and sediments. Further, many AOWs are contiguous with low-lying areas subject to surface water runoff and resulting heavy sediment loading during storm events or are near surface waters subject to flooding such that representative samples of the AOW cannot be obtained. If the facility is unable to obtain an AOW sample due to the dry, low flow or high flow conditions preventing the facility from obtaining a representative sample, a “no flow” result or “excessive flow” will be recorded.
 - After collection, samples will be preserved and stored according to parameter-specific methods and delivered to the laboratory under proper Chain-of-Custody (COC) procedures.
 - Analytical parameters for analysis include: F, As, Cd, Cu, Cr, Ni, Pb, Se, and Hg. This list includes all parameters previously identified for seep sampling at Duke Energy power plants for which relevant stream water quality standards are in place. (This list is responsive to the statutory requirement for the discharge assessment to allow determination whether discharges from toe drain outfalls, seeps, or weeps have reached surface waters and caused a violation of surface water quality standards.) Analyses shall be conducted by Duke Energy’s Huntersville analytical laboratory (NC Wastewater Certification #248) and Pace Analytical Laboratories

(NC Wastewater Certification # 12). Laboratory analytical methods used for each constituent are provided in Table 2.

- Seep In-situ measurements: In-situ field parameters (temperature and pH) shall be measured utilizing calibrated field meters either at the discharge of the seep directly, at the discharge of the flow measurement devices, or in the water pool created behind the device, if sufficient water depth did not exist at the device discharge.
- Dan River and Ash Basin Sample Collection Method: Water quality samples and in-situ measurements from the Dan River shall be collected at a location upstream (Dan River-Upstream) and downstream (Dan River-Downstream) of the ash basin (Figure 2). Additionally, water samples and in-situ measurements shall be collected from an in-process ash basin location (Figure 2). The grab samples shall be collected from the river and basin's surface (0.3 m) directly into appropriate sample bottles.
- In addition to sampling conducted with the semi-annual assessments, additional seep sampling will be conducted at locations and at a frequency as determined through discussions with NC DEQ personnel.

3.2.3 Evaluation


Evaluation of the data from the initial assessment site visit will establish baseline conditions and will serve as the basis for comparison for subsequent assessment site visit results. Evaluation of observations and sampling results shall include location, extent (i.e., dimensions of affected area), and flow of each discharge. The analytical results of the upstream and downstream locations shall be compared to the 15A NCAC 2B standards for surface water quality upon receipt to identify potential exceedances.

3.2.4 Assessment Reporting

Each assessment site visit shall be documented by the individual performing the assessment, as described in Section 3.2.2 to meet the requirements in 130A-309.210.1(b). The report should contain site background, observation and sampling methodology, and a summary of the observations and descriptions of the discharge channels observed, changes in observations compared to previous assessment events, estimates of flows quantities, and photographs of discharges and outfalls of engineered channels designed or improved for collecting water from the impoundment. Photographs are to be numbered and captioned. The flow and analytical results shall be recorded and presented in tables similar to the examples provided as Tables 1 and 3. The analytical results shall be compared to the 15A NCAC 2B standards for surface water quality and exceedances highlighted. This information shall be compiled, reviewed, and submitted to NC DEQ within 90 days from the Observation and Sampling event.

Section 4 - References

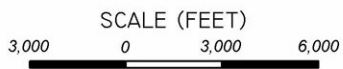
- Butler, J. R. and Secor, D. T. 1991. The Central Piedmont, p. 59-78, in Horton, J. W., Jr., and Zullo, V. A., eds., *The Geology of the Carolinas*: The University of Tennessee Press, Knoxville, Tennessee, 406p.
- Carpenter, P. A., III. 1982. Geologic map of Region G, North Carolina: North Carolina Department of Natural Resources and Community Development, Geological Survey Section, Regional Geology Series 2, Scale 1:125,000.
- LeGrand, Harry, Sr. 2004. A Master Conceptual Model for Hydrogeological Site Characterization in the Piedmont and Mountain Region of North Carolina, North Carolina Department of Environment and Natural Resources.
- North Carolina Department of Environment and Natural Resources. 2007. Dam Operation, Maintenance, and Inspection Manual, North Carolina Department of Environment and Natural Resources, Division of Land Resources, Land Quality Division, 1985 (Revised 2007).

A decorative graphic consisting of a central vertical bar divided into three colored sections: a top blue section, a middle grey section, and a bottom dark grey section. To the right of the bar, the text 'FIGURES AND TABLES' is displayed in a bold, black, sans-serif font, centered vertically relative to the middle grey section. The entire graphic is set against a white background.

**FIGURES
AND
TABLES**



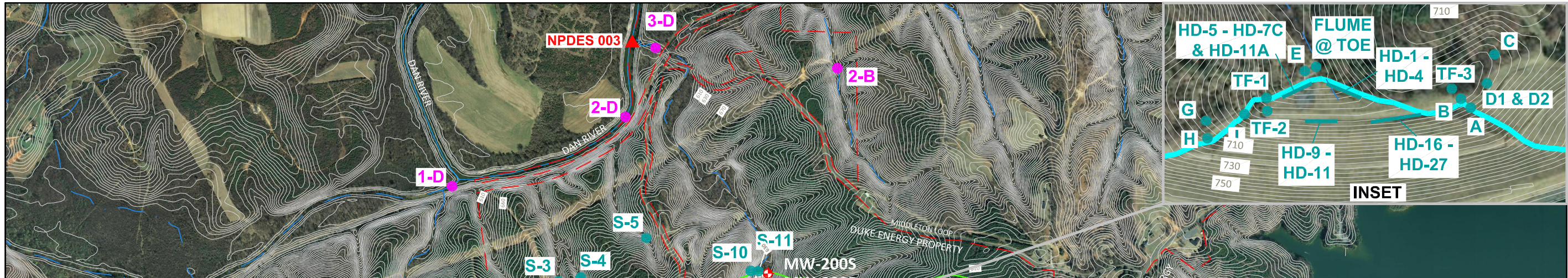
NOTES:
 1. SOURCE: USGS TOPOGRAPHIC MAP - BELEWS LAKE, NC
 CREATED 2010.



License Number: F-0116
 440 South Church Street Charlotte, NC 28202

**SITE LOCATION MAP
 BELEWS CREEK STEAM STATION
 DUKE ENERGY CAROLINAS, LLC
 STOKES COUNTY, NORTH CAROLINA**

DATE
 JULY 31, 2014
 FIGURE
1



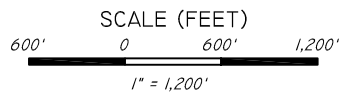
Seep / Discharge ID	Location Coordinates (NAD 83)		Flow Description	Flow Measurement (MGD) and Method	Background Sampling Location	Discharge Location and Discharge Sampling Location		Discharge Location Coordinates (NAD 83)	
	Latitude	Longitude				Latitude	Longitude		
S-1	36.293	-80.085	Continuous	0.0053 Timed-Volumetric	2-B	Tributary to the Dan River 1-D	36.302	-80.088	
S-2	36.297	-80.085	Continuous	0.0063 Timed-Volumetric					
S-3	36.298	-80.083	Continuous	0.0015 Timed-Volumetric	2-B	Tributary to the Dan River 2-D	36.304	-80.081	
S-4	36.298	-80.082	Continuous	0.0048 Timed-Volumetric					
S-5	36.300	-80.081	Continuous	0.0059 Timed-Volumetric					
S-6	36.296	-80.061	Continuous	0.0034 Timed-Volumetric	2-B	Belews Lake 4-D	36.296	-80.060	
S-7	36.287	-80.064	Continuous	0.0011 Timed-Volumetric		Belews Lake 5-D	36.287	-80.063	
S-8	36.280	-80.078	Continuous	0.0057 Timed-Volumetric	1-B	Unknown Discharge Location			
S-9	36.280	-80.072	Continuous	0.0017 Timed-Volumetric		Unknown Discharge Location			
S-10	36.299	-80.076	Continuous	0.0129 Area-Velocity					
S-11	36.299	-80.076	Continuous	0.181 Area-Velocity	2-B				
HD-1 through HD-4	36.297	-80.0752	Continuous	Unknown					
HD-5 through HD-7, & HD-11A	36.297	-80.075	No Flow	Unknown					
HD-9 through HD-11	36.297	-80.075	Continuous/No Flow	Unknown					
HD-16 Through HD-27	36.297	-80.074	Continuous	Unknown		Tributary to the Dan River 3-D	36.306	-80.080	
TF-1	36.297	-80.076	Continuous	0.03168					
TF-2	36.297	-80.076	Continuous	0.0144					
TF-3	36.297	-80.074	Continuous	0.020736					
Parshall Flume	36.297	-80.075	Continuous	0.235152					
A	36.297	-80.074	No Flow	Unknown					
B	36.297	-80.074	Continuous	Unknown					
C	36.297	-80.074	No Flow	Unknown					
D1	36.297	-80.074	Continuous	Unknown					
D2	36.297	-80.074	Continuous	Unknown					
E	36.297	-80.075	No Flow	Unknown					
G	36.297	-80.076	Continuous	Unknown					
H	36.297	-80.076	No Flow	Unknown					
I	36.297	-80.076	Continuous	Unknown					



LEGEND:

- DUKE ENERGY PROPERTY BOUNDARY
- ASH BASIN WASTE BOUNDARY
- ASH BASIN COMPLIANCE BOUNDARY
- ASH BASIN COMPLIANCE BOUNDARY COINCIDENT WITH DUKE PROPERTY BOUNDARY
- STRUCTURAL FILL, ASH LANDFILL - EDGE OF WASTE
- STREAM
- TOPOGRAPHIC CONTOUR (4 FOOT)
- ⊕ ASH BASIN COMPLIANCE GROUNDWATER MONITORING WELL
- SEEP SAMPLE LOCATION (APPROXIMATE)
- ▲ NPDES 001 NPDES OUTFALL LOCATION
- ASH BASIN WATER QUALITY SAMPLE LOCATION
- 1-B BACKGROUND SAMPLING LOCATIONS
- 1-D DISCHARGE SAMPLING LOCATIONS

- NOTES:**
1. PARCEL DATA FOR THE SITE WAS OBTAINED FROM DUKE ENERGY REAL ESTATE AND IS APPROXIMATE.
 2. ASH BASIN, ASH LANDFILL, AND STRUCTURAL FILL WASTE BOUNDARIES ARE APPROXIMATE.
 3. AS-BUILT MONITORING WELL LOCATIONS PROVIDED BY DUKE ENERGY.
 4. ORTHOPHOTOGRAPHY WAS OBTAINED FROM NC ONEMAP GIS WEB SITE (DATED 2010).
 5. TOPOGRAPHIC CONTOURS WERE OBTAINED FROM NCDOT WEB SITE (DATED 2010) AND ARE APPROXIMATE.
 6. THE ASH BASIN COMPLIANCE BOUNDARY IS ESTABLISHED ACCORDING TO THE DEFINITION FOUND IN 15A NCAC 02L .0107 (a).
 7. HYDROGRAPHY WAS OBTAINED FROM THE USGS NATIONAL MAP VIEWER AND DOWNLOAD PLATFORM ON MARCH 28, 2014 (<http://nationalmap.gov/viewer.html>)
 8. SEEP SAMPLING LOCATIONS ARE APPROXIMATE. SEEP AND HORIZONTAL DRAIN (HD) LOCATIONS IN INSET PROVIDED BY DUKE ENERGY.
 9. NPDES OUTFALL AND WATER QUALITY SAMPLE LOCATIONS PROVIDED BY DUKE ENERGY.
 10. SEE REPORT "BELEWS CREEK STEAM STATION ASH BASIN SURFACE WATER AND SEEP MONITORING - OCTOBER 2014, APPENDIX C" FOR DESCRIPTION OF DAM DRAINAGE SYSTEM



TOPOGRAPHIC MAP WITH IDENTIFIED SEEPS AND OUTFALLS
 DUKE ENERGY CAROLINAS, LLC
 BELEWS CREEK STEAM STATION ASH BASIN
 NPDES PERMIT #NC0024406
 STOKES COUNTY, NORTH CAROLINA

DATE
 DECEMBER 2014
 FIGURE
 2

Table 1 – Belews Creek Steam Station Ash Basin – Seep and Associated Discharge Locations and Descriptions

Seep / Discharge ID	Location Coordinates (NAD 83)		Flow Description	Flow Measurement (MGD) and Method	Discharge Location	Discharge Location Coordinates (NAD 83)	
	Latitude	Longitude				Latitude	Longitude
S-1	36.293	-80.085	Continuous	0.0053 Timed-Volumetric	Tributary to the Dan River 1-D	36.302	-80.088
S-2	36.297	-80.085	Continuous	0.0063 Timed-Volumetric	Tributary to the Dan River 2-D	36.304	-80.081
S-3	36.298	-80.083	Continuous	0.0015 Timed-Volumetric			
S-4	36.298	-80.082	Continuous	0.0048 Timed-Volumetric			
S-5	36.300	-80.081	Continuous	0.0059 Timed-Volumetric			
S-6	36.296	-80.061	Continuous	0.0034 Timed-Volumetric	Belews Lake 4-D	36.296	-80.060
S-7	36.287	-80.064	Continuous	0.0011 Timed-Volumetric	Belews Lake 5-D	36.287	-80.063
S-8	36.280	-80.078	Continuous	0.0057 Timed-Volumetric	Unknown Discharge Location		
S-9	36.280	-80.072	Continuous	0.0017 Timed-Volumetric	Unknown Discharge Location		

Seep / Discharge ID	Location Coordinates (NAD 83)		Flow Description	Flow Measurement (MGD) and Method	Discharge Location	Discharge Location Coordinates (NAD 83)	
	Latitude	Longitude				Latitude	Longitude
S-10	36.299	-80.076	Continuous	0.0129 Area-Velocity	Tributary to the Dan River 3-D	36.306	-80.080
S-11	36.299	-80.076	Continuous	0.181 Area-Velocity			
HD-1 through HD-4	36.297	-80.0752	Continuous	Unknown			
HD-5 through HD-7, & HD-11A	36.297	-80.075	No Flow	Unknown			
HD-9 through HD-11	36.297	-80.075	Continuous/ No Flow	Unknown			
HD-16 through HD-27	36.297	-80.074	Continuous	Unknown			
TF-1	36.297	-80.076	Continuous	0.03168			
TF-2	36.297	-80.076	Continuous	0.0144			
TF-3	36.297	-80.074	Continuous	0.020736			
Parshall Flume	36.297	-80.075	Continuous	0.235152			
A	36.297	-80.074	No Flow	Unknown			
B	36.297	-80.074	Continuous	Unknown			
C	36.297	-80.074	No Flow	Unknown			

Seep / Discharge ID	Location Coordinates (NAD 83)		Flow Description	Flow Measurement (MGD) and Method	Discharge Location	Discharge Location Coordinates (NAD 83)	
	Latitude	Longitude				Latitude	Longitude
D1	36.297	-80.074	Continuous	Unknown			
D2	36.297	-80.074	Continuous	Unknown			
E	36.297	-80.075	No Flow	Unknown			
G	36.297	-80.076	Continuous	Unknown			
H	36.297	-80.076	No Flow	Unknown			
I	36.297	-80.076	Continuous	Unknown			

Notes:

1. Flow description for each seep sample location is based on observation during site visits performed by HDR in June and July 2014
2. Flow measurements and analytical samples were collected on July 8, 15, and 16, 2014
3. Location coordinates for seep sampling locations are approximate

Table 2 – Laboratory Analytical Methods

Parameter	Method	Reporting Limit	Units	Laboratory
Fluoride (F)	EPA 300.0	1	mg/l	Duke Energy
Mercury (Hg)	EPA 245.1	0.05	µg/l	Duke Energy
Arsenic (As)	EPA 200.8	1	µg/l	Duke Energy
Cadmium (Cd)	EPA 200.8	1	µg/l	Duke Energy
Chromium (Cr)	EPA 200.8	1	µg/l	Duke Energy
Copper (Cu)	EPA 200.8	1	µg/l	Duke Energy
Lead (Pb)	EPA 200.8	1	µg/l	Duke Energy
Nickel (Ni)	EPA 200.8	1	µg/l	Duke Energy
Selenium (Se)	EPA 200.8	1	µg/l	Duke Energy

Table 3 – Belews Creek Steam Station – Example of Surface Water/Seep Monitoring Flow and Analysis Results Table

Parameter	Units	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10	S-11	Dan River-U/S	Dan River-D/S
Fluoride	mg/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Hg - Mercury (71900)	µg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.09	0.05	< 0.05	< 0.05
As - Arsenic (01002)	µg/l	< 1	< 1	1.39	< 1	< 1	1.57	10.6	< 1	< 1	1.81	2.14	< 1	< 1
Cd - Cadmium (01027)	µg/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1	< 1	< 1	< 1
Cr - Chromium (01034)	µg/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cu - Copper (01042)	µg/l	2.63	< 1	1.42	< 1	< 1	< 1	13.9	2.62	3.58	< 1	< 1	< 1	< 1
Pb - Lead (01051)	µg/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ni - Nickel (01067)	µg/l	< 1	1.03	< 1	1.04	< 1	1.17	< 1	< 1	9.79	11.4	11.1	< 1	< 1
Se - Selenium (01147)	µg/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1	3.58	7	< 1	< 1	< 1	< 1
pH	s.u.	5.5	5.9	6.77	5.7	6.32	6.55	6.09	5.5	6.41	5.73	5.92	7.12	6.47
Temperature	°C	20.4	22.1	20.2	20.3	22.2	22.7	24.4	20.8	25.4	20.2	22.3	31.6	29.7
Flow	MGD	0.0053	0.0063	0.0015	0.0048	0.0059	0.0034	0.0011	0.0057	0.0017	0.0129	0.181	158.3	158.3

Notes:

1. Flow measurements and analytical samples were collected on July 8, 15, and 16, 2014
2. S-7 sample temperature upon receipt in the analytical lab was slightly above 6 degrees Celsius (7.9 degrees C)
3. Flow at locations upstream and downstream of BCSS in the Dan River is from the USGS Dan River-Pine Hall daily average flows for the date of river sampling