

Dan River Combined Cycle Station

Ash Basin

Plan for Identification of New Discharges

NPDES Permit NC0003468

September 30, 2014





Report Verification

**PROJECT: GROUNDWATER MONITORING PROGRAM
DAN RIVER COMBINED CYCLE STATION
ASH BASIN
NPDES PERMIT NC0003468**

TITLE: PLAN FOR IDENTIFICATION OF NEW DISCHARGES

This document has been reviewed for accuracy and quality commensurate with the intended application.

Prepared by: _____

Date: _____

Checked by: _____

Date: _____

Approved by: _____

Date: _____

Project Manager: Brooke Ahrens, PE

Professional Engineer Seal:

HDR Engineering, Inc. of the Carolinas
440 South Church St., Suite 1000
Charlotte, NC 28202
North Carolina Engineering Firm Number F-0116



Table of Contents

	<u>Page</u>
Report Verification	i
Table of Contents.....	ii
List of Figures	iii
Section 1 - Introduction	1
Section 2 - Site Description.....	3
2.1 Plant Description	3
2.2 Ash Basin Description	3
Section 3 - Site Geology and Hydrogeology	5
3.1 Site Geologic/Soil Framework	5
3.2 Site Hydrogeologic Framework	5
Section 4 - Identification of New Discharges	7
4.1 Purpose of Inspection.....	7
4.2 Seepage	7
4.3 Area To Be Inspected for New Discharges	7
4.4 Inspection Procedure	7
Section 5 - References	8

Appendices

A – Dan River Steam Station Ash Basin – Inspection for Identification of New Discharges



List of Figures

Figure 1 – Site Location Map

Figure 2 – Areas To Be Inspected For Seeps



Section 1 - Introduction

The purpose of this document is to address the requirements of North Carolina General Statute (GS)130A-309.210 (d) *Identification and assessment of discharges; correction of unpermitted discharges*, as modified by North Carolina Senate Bill 729, for the Dan River Combined Cycle Station (DRCCS). The DRCCS is part of the greater Dan River site which also includes the retired Dan River Steam Station (DRSS) and an ash basin system which operates under National Pollutant Discharge Elimination System (NPDES) Permit NC0003468.

The following requirements are contained in General statute 130A-309.210:

d) *Identification of New Discharges.* – *No later than October 1, 2014, the owner of a coal combustion residuals surface impoundment shall submit a proposed Plan for the Identification of New Discharges to the Department for its review and approval as provided in this subsection.*

(1) *The proposed Plan for the Identification of New Discharges shall include, at a minimum, all of the following:*

a. *A procedure for routine inspection of the coal combustion residuals surface impoundment to identify indicators of potential new discharges, including toe drain outfalls, seeps, and weeps.*

b. *A procedure for determining whether a new discharge is actually present.*

c. *A procedure for notifying the Department when a new discharge is confirmed.*

d. *Any other information related to the identification of new discharges required by the Department.*

(2) *The Department shall approve the Plan for the Identification of New Discharges 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 Plan for the Identification of New Discharges, the owner shall begin implementation of the Plan in accordance with the Plan.*

The North Carolina Senate Bill 729 establishes the submittal date of this Plan for Identification of New Discharges no later than October 1, 2014.

This bill also modified GS 130A to establish the following submittals that are related to this Plan. GS130A-309.210(a) was modified to require:

(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 inspection procedures presented in this plan, developed to satisfy the requirements of GS130A-309.210(d), will be used as the basis for developing the topographic map required by GS130A-309.210(a)(2).

Section 2 - Site Description

2.1 Plant Description

DRSS was a coal-fired generating facility located near the town of Eden in Rockingham County, North Carolina. The three-unit station began commercial operation in 1949. All three coal-fired units, along with three oil-fired combustion turbine units, were retired from service in 2012 and are currently being decommissioned. Simultaneously, the DRCCS, a 620-megawatt natural gas facility, began commercial operations on-site on December 10, 2012.

The Dan River site is located on the north bank of the Dan River, and the surrounding area generally consists of undeveloped and agricultural land, the Dan River, and a small number of residential properties (Figure 1).

2.2 Ash Basin Description

The ash basin system is located adjacent to the Dan River and consists of a Primary Cell, a Secondary Cell, and associated embankments and outlet works, as shown on Figure 2. The ash basin is impounded by earthen dikes and an earthen/ash divider dike separates the Primary Cell from the Secondary Cell. The Primary Cell lies at an elevation of approximately 535 feet and has a surface area of approximately 21.8 acres. The Secondary Cell lies at an elevation of approximately 527 feet and has a surface area of approximately 12.2 acres. The elevation of the Dan River adjacent to monitoring well MW-22 (S/D) is approximately 482 feet.

The original ash basin was constructed in 1956 with an approximate crest elevation of 525 feet. In 1968 and 1969, the ash storage basin was expanded to cover the area occupied today. At that time, the dikes were raised to an approximate elevation of 530 feet.

In 1976 and 1977, the intermediate dike was constructed to stage sluicing by subdividing the basin into a Primary Cell and Secondary Cell. The intermediate dike and new Primary Cell dikes were vertically expanded through inward dike construction, where the outward dike slope was maintained and extended upward to the dike crest. Through inward dike construction, portions of the main dike were constructed over ash. The intermediate dike was also constructed over ash.

In 1980, newer dikes, referenced as the dredge dikes, were constructed north of the Primary and Secondary Ponds, creating a dredge pond and two dry storage areas. Ash was dredged to the southernmost portion of the northern ash fill and free liquids were allowed to gravity drain to the topographically lower dredge pond located between the dry storage areas. Once dewatered, ash was hauled and placed dry in the two dry storage areas known as Ash Fill 1 and Ash Fill 2. The placement of ash in the ash storage areas occurred during multiple projects.

The ash basin was operated as an integral part of the site's wastewater treatment system. During operation of the DRSS coal-fired units, the ash basin received variable inflows from the ash removal system, station yard drain sump, stormwater flows, and other permitted discharges. The coal ash was sluiced to the southwest corner of the Primary Cell on a variable basis (i.e., dependent on DRSS operations) via sluice pipes.



Flow is routed from the Primary Cell to the Secondary Cell through a concrete discharge tower. Effluent from the Secondary Cell is routed to the Dan River via a concrete discharge tower located in the Secondary Cell. The water surface in both the Primary and Secondary Cells is controlled by the use of stop logs.

Section 3 - Site Geology and Hydrogeology

3.1 Site Geologic/Soil Framework

The Dan River site is located within the Dan River Triassic Basin in the Piedmont physiographic province (Piedmont) (North Carolina Geological Survey 1985). Based on the location of the site on the geologic map of the Charlotte 1° x 2° Quadrangle, North and South Carolina (Goldsmith et al. 1988), the underlying bedrock at the site mainly consists of conglomerate, sandstone, and mudstones with intrusive diabase dikes and sills.

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).

3.2 Site Hydrogeologic Framework

Piedmont topography is characterized by gently rounded sloped hills and valleys. Recharge typically occurs on upland areas and slopes while groundwater discharge is concentrated in surface water bodies and lowland areas. LeGrand's (1988, 2004) conceptual model of the groundwater setting in the Piedmont incorporates the above two medium systems into an entity that is useful for the description of groundwater conditions. That entity is the surface drainage basin that contains a perennial stream or river (LeGrand 1988). Each basin is similar to adjacent basins and the conditions are generally repetitive from basin to basin. Within a basin, movement of groundwater is generally restricted to the area extending from the drainage divides to a perennial stream or river (Slope-Aquifer System; LeGrand 1988, 2004). Rarely does groundwater move beneath a perennial stream or river to another more distant stream (LeGrand 2004).

Therefore, in most cases in the Piedmont, the groundwater system is a two-medium system (LeGrand 1988) restricted to the local drainage basin. The groundwater occurs in a system composed of two interconnected layers: residuum/saprolite and weathered rock overlying fractured crystalline rock separated by the transition zone. Typically, the residuum/saprolite is partly saturated and the water table fluctuates within it. Water movement is generally through the fractured bedrock. The near-surface fractured crystalline rocks can form extensive aquifers. The character of such aquifers results from the combined effects of the rock type, fracture system, topography, and weathering. Topography exerts an influence on both weathering and the opening of fractures while the weathering of the crystalline rock modifies both transmissive and storage characteristics.

The aquifer system in the Piedmont typically exists in an unconfined or semi-confined condition in the bedrock zone. Under natural conditions, the general direction of groundwater flow can be



approximated from the surface topography. Groundwater moves both vertically down through the regolith and parallel to the bedrock surface to areas where groundwater discharges as seepage into streams, lakes, or other surface water bodies.

The Dan River site is located adjacent to and north of the Dan River which flows from southwest to northeast along the ash basin dike (Figure 2). Two unnamed tributaries of the Dan River are located along the eastern and western sides of the site property. A surface water divide is located generally along South Edgewood Road, with surface water on the east side of South Edgewood Road draining towards the unnamed tributary located on the east side of the property and surface water on the west side of Edgewood Road draining towards the unnamed tributary located to the west of the property. Based on the slope aquifer system, groundwater on the east side of South Edgewood Road is expected to flow toward the unnamed tributary and the Dan River.

Section 4 - Identification of New Discharges

4.1 Purpose of Inspection

The purpose of the inspection is to identify indicators of potential new discharges, including toe drain outfalls, seeps, and weeps associated with the coal combustion residuals surface impoundments (ash basins).

4.2 Seepage

Seepage is considered to be the movement of wastewater from the ash basin through the ash basin embankment, the embankment foundation, the embankment abutments, or 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 lusher and darker green than surrounding vegetation. Cattails, reeds, mosses, and other marsh vegetation often become established in a seepage area.¹ However, in many instances, indicators of seeps do not necessarily indicate the presence of seeps.

4.3 Area To Be Inspected for New Discharges

The areas to be inspected are the areas of the site where water contained in the ash basins might infiltrate into the underlying residual material and be expressed as seepage. This would include the earthen embankments which impounds the ash basins and certain adjacent areas.

The extent of the area to be inspected was determined based on the generalized LeGrand conceptual model, the concept of the slope-aquifer system, and the site topography. In this generalization, flow of water from the ash basin would be expected to be located within the slope-aquifer compartment and to be below the full basin elevation of the ash basin. The area to be inspected for new discharges is shown on Figure 2.

4.4 Inspection Procedure

The inspection procedure for identification of new discharges and indicators of potential new discharges associated with the Dan River ash basin system is provided in Appendix A. In addition to the specific requirements for the inspection, Appendix A also provides the general requirements, the frequency of inspections, documentation requirements, and provides a decision flow chart for determining if the discharge is associated with the ash basin.

¹ Dam Operation, Maintenance, and Inspection Manual, North Carolina Department of Environment and Natural Resources, Division of Land Resources, Land Quality Division, 1985 (Revised 2007).

Section 5 - References

North Carolina Geological Survey, 1985, Geologic map of North Carolina: North Carolina Geological Survey, General Geologic Map, scale 1:500000.

Goldsmith, R., Milton, D.J., and Horton, J.W, Jr. 1988. Geologic map of the Charlotte 10 x 20 quadrangle, North Carolina and South Carolina: United States Geological Survey, Miscellaneous Investigations Series, Map I-1251-E, scale 1:250,000.

LeGrand, H.E. 1988. Region 21, Piedmont and Blue Ridge, p.201-208, in Black, W., Rosenhein, J.S., and Seaber, P.R., eds., Hydrogeology: Geological Society of America, The Geology of North America, v. O-2, Boulder, Colorado, 524p.

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.

Figures



License Number: F4116
 440 South Church Street Charlotte, NC 28202

**SITE LOCATION MAP
 DAN RIVER COMBINED CYCLE STATION ASH BASIN
 DUKE ENERGY CAROLINAS, LLC
 ROCKINGHAM COUNTY, NORTH CAROLINA**

DATE
 SEPTEMBER 30, 2014

FIGURE

1

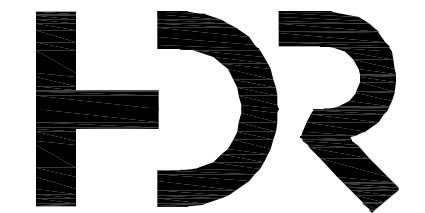


LEGEND:

	DUKE ENERGY PROPERTY BOUNDARY
	ASH BASIN WASTE BOUNDARY
	ASH STORAGE AREA BOUNDARY
	COMPLIANCE BOUNDARY
	COMPLIANCE BOUNDARY COINCIDENT WITH DUKE PROPERTY BOUNDARY
	STREAM
	LANDFILL - LAND CLEARING & INERT DEBRIS
	TOPOGRAPHIC CONTOUR (4-FT INTERVAL)
	AREA TO BE INSPECTED FOR SEEPS
	ASH BASIN COMPLIANCE GROUNDWATER MONITORING WELL LOCATION

- NOTES:**
1. PARCEL DATA FOR THE SITE WAS OBTAINED FROM DUKE ENERGY REAL ESTATE AND IS APPROXIMATE.
 2. WASTE BOUNDARY IS APPROXIMATE.
 3. AS-BUILT MONITORING WELL LOCATIONS PROVIDED BY DUKE ENERGY.
 4. AERIAL PHOTOGRAPHY WAS OBTAINED FROM WSP DATED APRIL 2014.
 5. TOPOGRAPHY DATA FOR THE SITE WAS OBTAINED FROM NC DOT GEOGRAPHIC INFORMATION SYSTEM (GIS) WEB SITE (DATED 2010).
 6. THE COMPLIANCE BOUNDARY IS ESTABLISHED ACCORDING TO THE DEFINITION FOUND IN 15A NCAC 02L .0107 (a).

SCALE (FEET)
 150' 0 150' 300'
 1" = 300'



AREAS TO BE INSPECTED FOR SEEPS
DUKE ENERGY CAROLINAS, LLC
DAN RIVER COMBINED CYCLE STATION
NPDES PERMIT NO. NC0003468
 ROCKINGHAM COUNTY, NORTH CAROLINA

DATE
 9/30/2014
 FIGURE
 2



A

DAN RIVER STEAM
STATION ASH BASIN
INSPECTION FOR
IDENTIFICATION OF
NEW DISCHARGES

1. Purpose of Inspection

The purpose of the inspection is to identify new discharges and indicators of potential new discharges, including toe drain outfalls, seeps, and weeps that arise after the initial submittal of maps required by North Carolina General Statute 130A-309.210(a)(2)(ii). Seepage is considered to be the movement of wastewater from the ash basin through the ash basin embankment, the embankment foundation, the embankment abutments, or through residual material in areas adjacent to the ash basin. Therefore, 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. If new discharges or indicators of potential new discharges are identified, the decision flow chart (see Figure A-1) will be used to determine if the potential new discharge is from the ash basin and if notification to the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Water Resources (DWR) is required.

2. General Inspection Requirements

- 2.1. Inspections are to be performed on areas that are below the ash basin full pond elevation and within the area shown on Figure A-2. The purpose of the inspection is to identify new discharges and indicators of potential new discharges, including toe drain outfalls, seeps, and weeps associated with the coal combustion residuals surface impoundment (ash basin).
- 2.2. If required, a larger scale figure showing the locations of outfalls from engineered channels will be developed. If a separate figure showing outfalls from engineered channels is not developed, Figure A-2 will be revised to show these features.
- 2.3. Inspections of areas on or adjacent to the ash basin embankments should be performed within two months after mowing, if possible.
- 2.4. Inspections should not be performed if the following precipitation amounts have occurred in the respective time period preceding the planned inspection:
 - 2.4.1. Precipitation of 0.1 inches or greater within 72 hours or
 - 2.4.2. Precipitation of 0.5 inches or greater within 96 hours
- 2.5. Record the most recent ash basin water surface elevation.
- 2.6. Review previous Inspection for Identification of New Discharge report(s) prior to performing inspection.
- 2.7. Review the most recent previous dam inspections.
- 2.8. Conduct an interview with the Site Environmental Coordinator prior to performing inspection to inquire about possible changes to site conditions, such as pond elevations, operations, additions or removal of wastewater discharges to the ash basin, changes to site surface water drainage, etc.

3. Frequency of Inspections

Inspections will be performed on a semi-annual basis during the following months: April to May and October to November.

4. Qualifications

The inspections shall be performed under the direction of a qualified Professional Engineer or Professional Geologist.

5. Documentation of Inspection

The inspection shall be documented by the individual performing the inspection. The report should contain observations and descriptions of the seeps observed, changes in observations compared to previous inspections, estimates of flows quantities, and photographs of seeps and outfalls of engineered channels designed or improved for collecting water from the impoundment. Photographs are to be numbered and captioned.

6. Initial Inspection

An initial inspection should be performed to identify features and document baseline conditions including location, extent (i.e., dimensions of affected area), and flow. Seep locations should be recorded using a Global Positioning System (GPS) device. Photographs should be taken from vantage points that can be replicated during subsequent semi-annual inspections.

7. Inspection For New Seeps at Outfalls From Engineered Channels

Inspect the outfalls from engineered channels designed and/or improved (such as through the placement of rip-rap) associated with the ash basin dikes to identify new seeps or indicators of new seeps.

- 7.1. Inspect all outfalls from engineered channels designed and/or improved (such as through the placement of rip-rap)
- 7.2. Document the condition of the outfall of the engineered channel with photographs. Photographs are to be taken from similar direction and scale as photographs taken during the initial inspection.
- 7.3. Observe outfall for seepage and for indicators of seeps.
- 7.4. Compare current seepage location, extent, and flow to seepage photographs and descriptions from previous inspections.
- 7.5. Record flow rate if measureable.

9. Inspection For New Seeps Not Captured by Engineered Channels

Inspect areas below the ash basin full pond elevation and within the slope-aquifer system shown on Figure A-2 to identify new seeps or indicators of new seeps. Inspect topographic drainage features that potentially could contain new seeps that potentially discharge from the ash basin.

9.1. Previously Identified Seeps

- a) Inspect previously identified seep locations. Document the condition of the seeps with a photograph. Photographs are to be taken from similar direction and at a similar scale as the photograph documenting original photograph of seep. Describe the approximate dimensions and flow conditions of the seep.
- b) If flow measurement device is installed at the outfall, record flow.
- c) Observe seep to determine if changes to location, extent, or flows are present. Document changes to location, extent, and/or flow amount or pattern.

9.2. New Seep or Indicators of Seep

- a) Mark the location of new seep or indicators of seep using a GPS device.
- b) Document the condition of the seeps or indicators of seeps with a photograph.
- c) Describe the approximate dimensions and flow conditions of the seep.
- d) Map the location of new seep or indicator of seep using GPS coordinate points collected during the site visit.
- e) If seep or indicator of seep was not caused by changes in surface water drainage and if the location is below the ash basin pond elevation, utilize the decision flow chart to determine if the seep represents a discharge from the ash basin and if notification to DWR is required.

10. Update Maps Identifying Seeps

If new seeps are identified during the inspection, Figure A-2 shall be updated to show the location of the new seeps. All seeps located below the ash basin full pond elevation and within the slope-aquifer system shown are to be shown on Figure A-2.

11. Decision Flow Chart

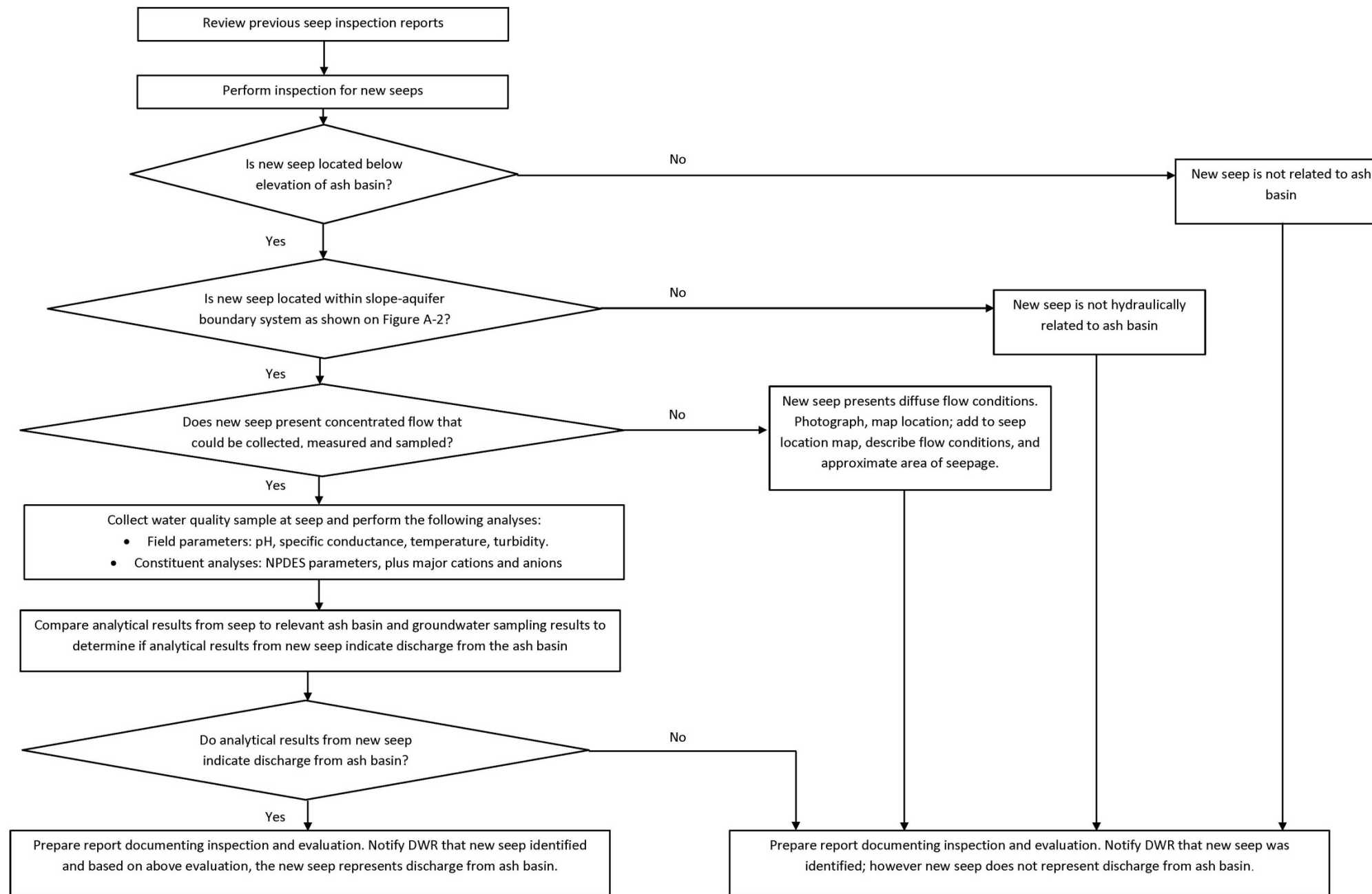
The decision flow chart developed to determine whether a new seep discharges from the ash basin is found on Figure A-1.

Dan River Combined Cycle Station Ash Basin
INSPECTION FOR IDENTIFICATION OF NEW DISCHARGES

12. Procedure for Notifying NCDENR DWR If New Discharge Is Confirmed

If it is determined that a newly identified seep is present, Duke Energy will notify the DWR Regional Office by mail within 14 days after the determination.

Figure A-1 - Decision Flow Chart for Determining If New Seep Represents Discharge From the Ash



Notes:

1. If no new seeps are identified, inspection will be documented however no notification to NCDENR DWR is required.
2. If new seeps are identified that do not represent discharge from the ash basin during the same inspection that identifies new seeps that do represent a discharge from the ash basin, a single report will be submitted to NCDENR DWR.



LEGEND:

	DUKE ENERGY PROPERTY BOUNDARY
	ASH BASIN WASTE BOUNDARY
	ASH STORAGE AREA BOUNDARY
	COMPLIANCE BOUNDARY
	COMPLIANCE BOUNDARY COINCIDENT WITH DUKE PROPERTY BOUNDARY
	STREAM
	LANDFILL - LAND CLEARING & INERT DEBRIS
	TOPOGRAPHIC CONTOUR (4-FT INTERVAL)
	AREA TO BE INSPECTED FOR SEEPS
	ASH BASIN COMPLIANCE GROUNDWATER MONITORING WELL LOCATION

- NOTES:**
1. PARCEL DATA FOR THE SITE WAS OBTAINED FROM DUKE ENERGY REAL ESTATE AND IS APPROXIMATE.
 2. WASTE BOUNDARY IS APPROXIMATE.
 3. AS-BUILT MONITORING WELL LOCATIONS PROVIDED BY DUKE ENERGY.
 4. AERIAL PHOTOGRAPHY WAS OBTAINED FROM WSP DATED APRIL 2014.
 5. TOPOGRAPHY DATA FOR THE SITE WAS OBTAINED FROM NC DOT GEOGRAPHIC INFORMATION SYSTEM (GIS) WEB SITE (DATED 2010).
 6. THE COMPLIANCE BOUNDARY IS ESTABLISHED ACCORDING TO THE DEFINITION FOUND IN 15A NCAC 02L .0107 (a).

SCALE (FEET)
 150' 0 150' 300'
 1" = 300'



AREAS TO BE INSPECTED FOR SEEPS
DUKE ENERGY CAROLINAS, LLC
DAN RIVER COMBINED CYCLE STATION
NPDES PERMIT NO. NC0003468
 ROCKINGHAM COUNTY, NORTH CAROLINA

DATE
 9/30/2014
 FIGURE
 A-2