Bad Creek Revised Study Plan Appendices

PART II

Appendices C-H

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Appendix C

Water Resources Study Plan

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APPENDIX C

WATER RESOURCES REVISED STUDY PLAN

Bad Creek Pumped Storage Project
FERC Project No. 2740

Oconee County, South Carolina

December 2022

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WATER RESOURCES REVISED STUDY PLAN
BAD CREEK PUMPED STORAGE PROJECT
FERC PROJECT NO. 2740
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ACRONYMS AND ABBREVIATIONS

2-D	two-dimensional
3-D	three-dimensional
Bad Creek (or Project)	Bad Creek Pumped Storage Project
Bad Creek II Complex	Bad Creek II Power Complex
CFD	computational fluid dynamics
CHEOPS	Computer Hydro-Electric Operations and Planning Software™
CWA	Clean Water Act
DO	dissolved oxygen
Duke Energy or Licensee	Duke Energy Carolinas, LLC
ft	feet/foot
ft msl	feet above mean sea level
FERC or Commission	Federal Energy Regulatory Commission
KT Project	Keowee-Toxaway Hydroelectric Project
mg/L	milligrams per liter
mi^2	square miles
MOU	Memorandum of Understanding
ORW	Outstanding Resources Waters
PAD	Pre-Application Document
PSP	Proposed Study Plan
RSP	Revised Study Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SEPA	Southeastern Power Administration
TN	Trout Natural
TPGT	Trout Put, Grow, and Take
TR	Trout Waters
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
WQMP	Water Quality Monitoring Plan

1 Study Requests and Formal Comments

The Federal Energy Regulatory Commission (FERC or the Commission) issued Scoping Document 2 on August 5, 2022, which identified the following environmental resource issues to be analyzed in the National Environmental Policy Act document for the Bad Creek Pumped Storage Project (Project) relicensing related to water resources. These resource issues address the effects of continued Project operations under the Existing License as well as potential construction and operation of a second powerhouse during the New License term for the Bad Creek II Power Complex (Bad Creek II Complex):

- Effects of construction-related erosion, sedimentation, and spoils disposal on water quality, aquatic habitat, and aquatic biota in Lake Jocassee and streams in the Project vicinity.
- Effects of Project operation on water levels in Lake Jocassee.
- Effects of Project operation on water quality in Lake Jocassee, including water temperature, dissolved oxygen (DO) concentrations, and vertical mixing of DO.
- Effects of reservoir fluctuations associated with Project operation on aquatic habitat and biota in Lake Jocassee.
- Effects of vertical mixing of DO associated with Project operation on fish populations in Lake Jocassee.

In Section 7.1.2.3 of the Pre-Application Document (PAD) (Duke Energy 2022), Duke Energy Carolinas, LLC (Duke Energy or Licensee) proposed to conduct a Water Resources Study in support of the proposed Bad Creek II Complex. More specifically, the Water Resources Study will include: 1) a summary of existing water quality data and state water quality standards, 2) an evaluation of reservoir water levels and water exchange rates, 3) vertical mixing in the Whitewater River arm (also called Whitewater River cove) of Lake Jocassee and the potential expansion of the submerged weir, and 4) an assessment of impacts related to upland spoil disposal and construction on existing surface waters.

The items listed above, in addition to comments received from stakeholders (Appendices A and B), are addressed by two separate studies in this Revised Study Plan (RSP) as follows:

(1) The Water Resources Study (Appendix C) focuses on historical water quality data of Lake Jocassee, potential impacts to surface waters due to construction of the new Bad

Creek II Power Complex (Bad Creek II Complex), and water resources affected by a second inlet/outlet structure in the Whitewater River arm of Lake Jocassee

(2) The Aquatic Resources Study (Appendix D) will evaluate impacts associated with construction and operation of the proposed Bad Creek II Complex on water quality and water resources as they relate to aquatic life and habitat.

No study requests related to water resources were received during the scoping process; however, formal comments on the PAD and SD1 regarding water resources were received from the Commission, South Carolina Department of Natural Resources (SCDNR), Foothills Trail Conservancy, Upstate Forever, and the U.S. Environmental Protection agency (USEPA). Responses to comments were included in Appendix A of the Proposed Study Plan (PSP), which was filed with the Commission on August 5, 2022. Comments on the PSP regarding water resources were received from SCDNR and Upstate Forever; requests and comments pertinent to the Water Resources Study were considered in the development of this RSP and summaries of comments and responses are included in Appendix A. Copies of all comments and correspondence are provided in Appendix B.

2 Goals and Objectives

While there are no anticipated additional adverse effects to water resources and water quality due to the continued operation of the Project, potential adverse effects resulting from the construction and operation of the Bad Creek II Complex need to be evaluated. The goal of the Water Resources Study is to evaluate the Project effects, as well as any potential effects or impacts due to the construction and operation of the proposed Bad Creek II Complex using existing and new information.

Duke Energy will conduct a Water Resources Study for the Project relicensing to include the following main objectives:

1. Evaluate water resources and water quality impacts of current Project operations using existing data.
2. Evaluate water resources and water quality impacts potentially resulting from the construction and operation of the Bad Creek II Complex.

3. Address stakeholder concerns regarding water resources in the Project Boundary with clear nexus to the Project and the proposed Bad Creek II Complex.

The main objectives will be met through the following activities:

- Perform a literature review including: (a) available historical water quality data collected in Lake Jocassee and Howard Creek and (b) current designated uses and water quality standards applicable to the Project.
- Develop a Water Quality Monitoring Plan (WQMP) in consultation with relicensing stakeholders for the proposed Bad Creek II Complex. The WQMP will encompass pre-construction, construction, and post-construction activities, including identification of applicable and appropriate threshold values for water quality parameters and monitoring means and methods. The WQMP may also address potential impacts of placement of excavated material in surface waters and wetlands in planned upland disposal areas.
- Use a two-dimensional (2-D) hydrologic model to determine the downstream extent of potential effects (i.e., vertical/horizontal mixing) from an additional powerhouse in the Whitewater River cove; results of the 2-D modeling will be used to develop physical model boundaries of Lake Jocassee for three-dimensional (3-D) computational fluid dynamics (CFD) modeling.
- Use the CFD model to evaluate water velocities in the Whitewater River arm due to the addition of a second inlet/outlet structure and associated potential effects on shoreline erosion in the Whitewater River arm.
- Use the CFD model to evaluate flows and the extent of vertical mixing in the Whitewater River arm and downstream of the submerged weir due to the addition of a second inlet/outlet structure.
- Use the existing Computer Hydro-Electric Operations and Planning Software™ (CHEOPS) model (developed for the Keowee-Toxaway [KT] Hydroelectric Project relicensing) to evaluate reservoir elevation effects associated with water exchange rates, magnitude, and duration between Bad Creek Reservoir and Lake Jocassee.
- Gather information in support of Clean Water Act (CWA) 404/401 permitting related to impacts to streams/wetlands in potential upland spoil locations and Lake Jocassee impacts from construction activities and submerged weir expansion.

3 Study Area

The study area for the Water Resources Study is shown on Figure 3-1 and includes the upper reservoir, lower reservoir (Whitewater River arm only), preliminary transmission line alignment, and main (expanded) Project site.

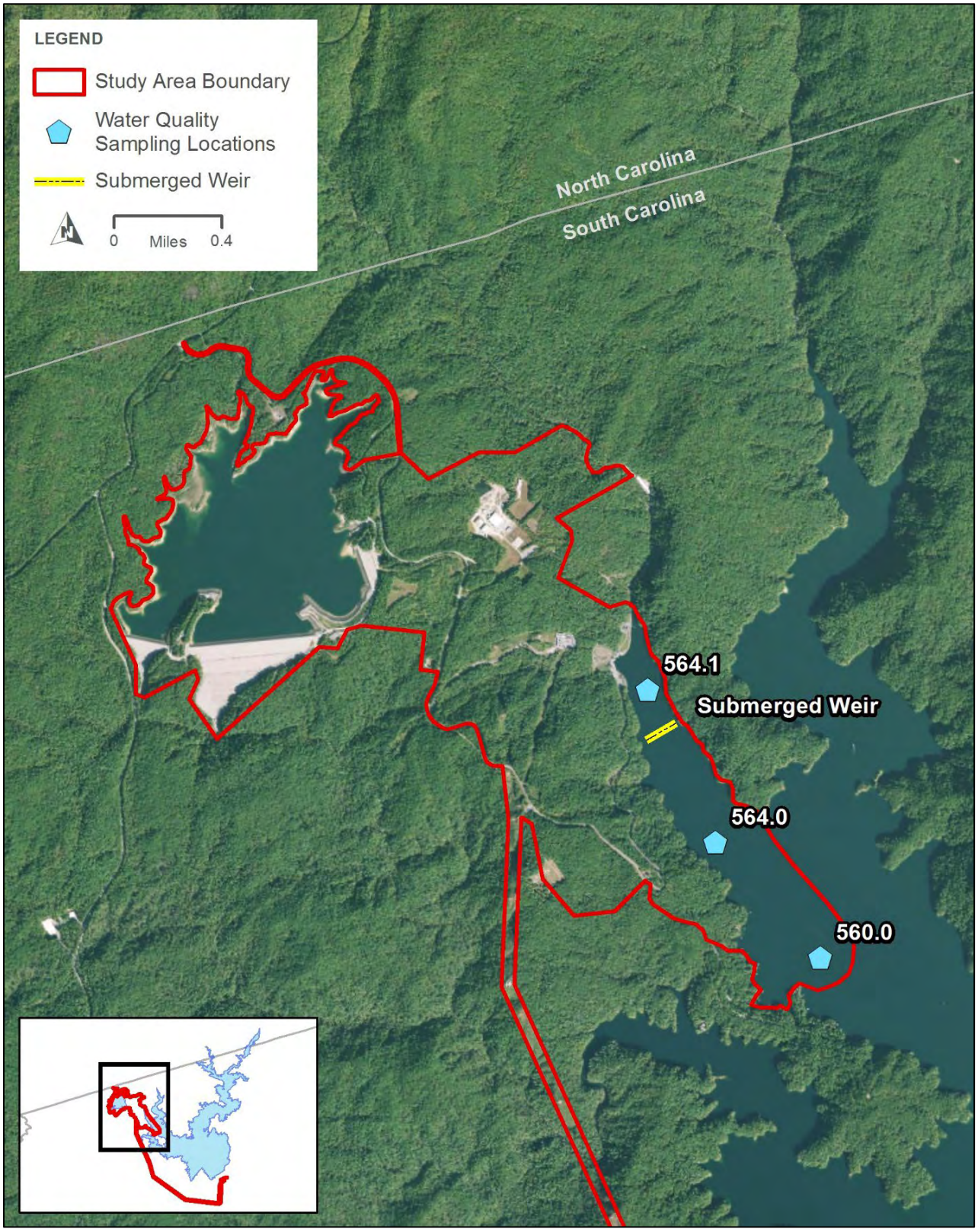

Figure 3-1. Water Resources Study Area

4 Background and Existing Information

Existing relevant and reasonably available information regarding water resources, watershed description, and water quality in the Project vicinity was presented in Sections 6.1 and 6.3 of the PAD (Duke Energy 2022). The Bad Creek upper reservoir has a drainage area of approximately 1.5 square miles (mi^2). Prior to impoundment, Bad Creek and West Bad Creek were tributaries of Howard Creek (a tributary to Lake Jocassee) near the toe of the Main Dam and West Dam, respectively. Howard Creek flows from the northwest and through the southern border of the Project Boundary with a drainage area of approximately 4.3 mi^2 at its downstream confluence with Limber Pole Creek. Seepage through the two earthen dams now flows into Howard Creek near the toe of each dam. Average seepage flows from the Main Dam and the West Dam are approximately 5.0 cubic feet (ft) per second combined. Water from Bad Creek Reservoir is exchanged directly with Lake Jocassee. Due to the small drainage area of Bad Creek Reservoir, inflows are minimal and have no effect on the operation of the Project.

Lake Jocassee, which operates as the lower reservoir for the Bad Creek Project, was formed by impounding the Keowee River at river mile 343.6, just downstream of the confluence of the Whitewater and Toxaway rivers. Lake Jocassee has a drainage area of 145 mi^2, a surface area of approximately 7,980 acres, and approximately 92 miles of shoreline at full pond (1,110 ft above mean sea level [msl]).

4.1 Water Standards and Classifications

North Carolina and South Carolina have assigned state water quality standards commensurate with a designated use of a waterbody and both states have similar categories of designated use. Some of the tributaries flowing into Lake Jocassee are wholly within North Carolina, some are wholly within South Carolina, and some flow through both states. Variations of sub-sets of general classifications between the two states exist; however, both states have recognized and distinguished between general use to maintain and support aquatic life and general contact recreation, trout habitats, and high value resource areas.

Under the authority of the South Carolina Pollution Control Act, the South Carolina Department of Health and Environmental Control (SCDHEC) Water Classification & Standards is responsible for establishing appropriate water uses and protection classifications, as well as

general rules and specific water quality criteria to protect existing water uses, establish anti-degradation rules, protect public welfare, and maintain and enhance water quality. Streams with the following Water Classifications are found within the Project Vicinity: Outstanding Resources Waters (ORW); Trout Natural (TN); and Trout Put, Grow, and Take (TPGT). The Whitewater River is classified as ORW, Howard Creek is classified as TN, and Whitewater River tributaries are classified as ORW and TPGT (SCDHEC 2021; NCDEQ 2021). Lake Jocassee is designated as TPGT. TPGT are freshwaters suitable for supporting growth of stocked trout populations and a balanced indigenous aquatic community of fauna and flora. These waters are also suitable for contact recreation and as a drinking water supply source after conventional treatment. A summary of the designated use classification for the Lake Jocassee watershed is provided in Table 4-1. These waters are subject to SCDHEC's anti-degradation rules and activities such as discharges to these waters may be prohibited to maintain their classification.

Table 4-1. Surface Water Classifications of Waterbodies within the Lake Jocassee Watershed

Name	State	Description	Surface Water Classification
Bear Camp Creek	NC	From source to state line	C; TR
Bear Creek	NC	From source to state line	C; TR
Bear Creek	SC	Portion of the creek from state line to Lake Jocassee	TN
Corbin Creek	SC	The entire creek tributary to Devils Fork	ORW (TPGT)
Devils Fork Creek	SC	Portion of the creek from confluence of Corbin Creek and Howard Creek to Lake Jocassee	TN
Horsepasture River	NC	From a point approximately 0.60 mile downstream of N.C. Hwy 281 (Bohaynee Rd) to state line	B; TR, ORW
Howard Creek	SC	Portion of the creek from its headwaters to 0.3 mile below Hwy 130 upstream of the flow augmentation system at the Bad Creek Bad Creek Main Dam.	ORW (TPGT)
Howard Creek	SC	The portion below Bad Creek Dam to Lake Jocassee	TN
Lake Jocassee	SC	The entire lake	TPGT
Laurel Fork Creek	SC	The entire creek tributary to Lake Jocassee	TN
Limber Pole Creek	SC	The entire creek tributary to Devils Fork	TN
Rock Creek	SC	Portion of the creek within South Carolina	TN
Thompson River	NC	From source to state line	C, TR
Thompson River	SC	Portion of the river from state line to Lake Jocassee	TN

Name	State	Description	Surface Water Classification
Toxaway River	NC	From dam at Lake Toxaway Estates, Inc. to state line	C
Whitewater River	NC	From Little Whitewater Creek to state line	C, TR, HWQ
Whitewater River	SC	Portion of the river from state line to Lake Jocassee	ORW (TPGT)
Write Creek	SC	The entire creek tributary to Lake Jocassee	ORW (TPGT)
Coley Creek	SC	The portion of the creek in SC	TPGT
Devils Hole Creek	SC	The entire creek tributary to Lake Jocassee	TPGT
Jackie's Branch	SC	The entire creek tributary to Lake Jocassee	TN
Mill Creek	SC	The entire creek tributary to Lake Jocassee	TPGT

B- Primary Recreation, Fresh Water; C- Aquatic Life, Secondary Recreation, Fresh Water; HQW- High Quality Waters; ORW- Outstanding Resource Waters; TN- Trout-Natural; TPGT- Trout-Put, Grow, and Take; TR- Trout Waters

Sources: SCDHEC. 2021. SC Watershed Atlas. Accessed 03/02/2021. [URL]: https://gis.dhec.sc.gov/watersheds/; NCDEQ. 2021. NC Surface Water Classifications. Accessed 03/02/2021. [URL]: https://ncdenr.maps.arcgis.com/apps/webappviewer/index.html?id=6e125ad7628f494694e259c80dd64265.

Lake Jocassee is included in the highest water quality classification (i.e., excellent rating) as designated by SCDHEC and preservation of existing conditions is recommended, with most tributaries within the watershed fully supporting their designated use. Lake Jocassee is one of only a few reservoirs in South Carolina possessing the necessary aquatic habitat (water temperatures and dissolved oxygen [DO]) to support both warmwater and coldwater (salmonid [trout]) fisheries year-round (USACE 2014). Lake Jocassee is designated TPGT waters and subject to daily average DO concentrations of 6.0 milligrams per liter (mg/L) or higher[1]. DO concentrations measured in the forebay and tailwater areas of Lake Jocassee routinely have concentrations above that threshold. As stated above, SCDHEC has consistently identified Lake Jocassee, as well as downstream Lake Keowee, among the cleanest South Carolina reservoirs based on data from 1980-1981, 1985-1986, and 1989-1990 studies (USACE 2014). Recent data continue to indicate Lake Jocassee (main lake and downstream of the weir), the Toxaway Arm, and the Whitewater Arm fully support aquatic life and recreational designated uses (USACE 2014 [Appendix C]).

[1] As part of the assessment methodology for Use Support Determination by the SCDHEC, water quality criteria and classifications are determined by sampling at a depth of 0.3 meter for a surface measurement (SCDHEC undated). For the purposes of Use Support Determination, only surface samples are used in standards comparisons and trends assessments.

A summary of water quality standards for South Carolina applicable to Project waters is included in Table 4-2.

Table 4-2. South Carolina Numeric State Water Quality Standards Applicable to Project Waters

Parameter	South Carolina Water Quality Standard
Temperature (applies to heated effluents only)	Not to exceed 2.8°C (5°F) above natural temperatures up to 32.2°C (90°F) Trout Waters: Not to vary from levels existing under natural conditions, unless determined some other temperature shall protect the classified uses
Dissolved Oxygen	Daily average not less than 5.0 mg/L Instantaneous low of 4.0 mg/L Trout Waters: Not less than 6.0 mg/L
pH	Between 6.0 and 8.5 Trout Waters: between 6.0 and 8.0
Turbidity	FW Except for lakes: Not to exceed 50 NTUs provided existing uses are maintained. FW Lakes Only: Not to exceed 25 NTUs provided existing uses are maintained. Trout Waters: Not to exceed 10 NTUs or 10% above natural conditions, provided existing uses are maintained.
Phosphorus	Blue Ridge - Shall not exceed 0.02 mg/L. Piedmont - Shall not exceed 0.06 mg/L.
Nitrogen	Blue Ridge - Shall not exceed 0.35 mg/L. Piedmont - Shall not exceed 1.5 mg/L.
Chlorophyll a	Blue Ridge - Shall not exceed 10 µg/L. Piedmont - Shall not exceed 40 µg/L.

SCDHEC 2020. R. 61 - 68 Water Classifications and Standards. Columbia, SC. URL: https://live-sc-dhec.pantheonsite.io/sites/default/files/media/document/R.61-68.pdf (Accessed March 2021)

4.2 Water Quality

Bad Creek Reservoir was created specifically to support operations for the existing Project and has not historically been monitored for water quality due to frequent and large fluctuations in water levels resulting in sampling complications and safety concerns; however, Duke Energy has monitored water quality conditions in Lake Jocassee in some capacity since the reservoir's formation in 1973. Water quality monitoring data has generally included monthly, quarterly, or annual in situ temperature, DO, conductivity and pH measurements at several locations in the lake.

As a condition of the Original License for the Bad Creek Project, and as described in Section 1.6 of the PAD, Duke Energy entered into a Memorandum of Understanding (MOU) with the SCDNR for the long-term management and maintenance of high-quality fishery resources in Lake Keowee, Lake Jocassee, and their tributary streams. The MOU and first 10-Year Work Plan were approved pursuant to Article #32(b)(1) of the Original License for the Bad Creek Project on May 1, 1997. License Article #32(b)(2) covers Lake Jocassee pelagic trout habitat and License Article #34 covers Lake Jocassee water quality. Through this MOU, SCDNR and Duke Energy personnel work cooperatively, and include third parties as necessary, to design and implement data collection and other activities to develop and enhance management strategies for fish in these areas. Activities included in the 10-Year Work Plans are focused on fisheries surveys and inventories, water quality and aquatic habitat evaluations, fish stocking, recreation, and shoreline impacts (documents supporting these environmental agreements and plans were included in the PSP).

Based on existing information, continued Project operations are not expected to adversely affect water quality in Lake Jocassee and as a task of the Water Resources Study, Duke Energy will summarize existing water quality data in Lake Jocassee. Potential water quality impacts from construction and operation of the Bad Creek II Complex will be evaluated as an objective of the Water Resources Study.

During the New License term, Duke Energy proposes to continue to implement activities established by the MOU, as may be modified in consultation with stakeholders through the relicensing process, and will continue to implement Protection, Mitigation, and Enhancement activities established under the KT Project Relicensing Agreement. Duke Energy plans to further consult with SCDHEC and relicensing stakeholders through the ILP regarding final proposed mitigation and enhancement measures directed at operation of the existing Project and the proposed Bad Creek II Complex to be included in the Final License Application.

4.3 Water Use

Because the Bad Creek and KT projects are in the headwaters of the Savannah River Basin, there are no upstream dams; however, there are numerous dams and projects downstream of the Project affected by Bad Creek and KT project operations. In 1968, the U.S. Army Corps of Engineers (USACE) and the Southeastern Power Administration (SEPA) entered into an

Operating Agreement (1968 Operating Agreement) with Duke Energy's predecessor company, Duke Power Company. The purpose of this agreement was to ensure the uppermost developments (KT Project) were operated so the USACE and SEPA would be able to meet their hydropower generating requirements at the time. Although there were many changes in both the USACE and Duke Energy systems since its inception, the 1968 Operating Agreement had never been modified. Therefore, a New Operating Agreement was signed in 2014 by the USACE, SEPA, and Duke Energy which incorporated the modified conditions of the USACE and KT Project operations and superseded the 1968 Operating Agreement. The New Operating Agreement establishes rules for determining how water is managed between the KT Project, Bad Creek Project and the USACE Projects (Hartwell, Russell and Thurmond) on the Savannah River. Operation of the Bad Creek Project during the New License term, with or without inclusion of the proposed Bad Creek II Complex, is not expected to have any impact on the New Operating Agreement.

5 Project Nexus

There are no anticipated additional potential adverse effects to existing water resources or water quality in the upper or lower reservoirs or uplands streams/wetlands due to the continued operation of the Project.

Construction and operation of the Bad Creek II Complex may impact water resources in Lake Jocassee (faster exchange of water between the upper and lower reservoirs; increased vertical mixing; water quality impacts [DO, turbidity, temperature], as well as upland water resources due to construction runoff and potential impacts of rock and spoil disposal.

6 Methods

6.1 Task 1 – Summary of Existing Water Quality Data and Standards

Duke Energy will perform a literature and desktop review of available water quality data collected in Lake Jocassee and Howard Creek. Key resources will include data collected by Duke Energy and Clemson University as well as publicly available state water quality

information from SCDHEC. Data will be summarized to represent baseline water quality conditions. Data will also be evaluated against current designated uses and water quality standards applicable to the Project.

6.2 Task 2 – Water Quality Monitoring in Whitewater River Arm

Historical water quality data were collected by Duke Energy at two locations in the Whitewater River arm and one location downstream of the Whitewater River arm (Stations 564.1, 564.0, 560.0) shown on Figure 3-1. Historic datasets represent temperature and DO profile data (i.e., non-continuous) ranging from 1973 to 2020, depending on the location. Duke Energy will gather continuous temperature data and periodic DO (bi-weekly) from the three historic locations to gather current-day representative (i.e., baseline) water quality information in 2023 and 2024. Data collection in 2023 will represent conditions under two-unit operations at the Project with a lowered upper reservoir. Duke Energy also proposes to monitor water quality (continuous temperature and bi-weekly DO) in 2024 to capture conditions with all four existing unit upgrades completed and normal upper reservoir operations. Due to the relatively high degree of mixing and short residence time of water in the Bad Creek Reservoir, warming impacts due to solar radiation in the upper reservoir are limited. However, data collected in 2023 and 2024 will cover June 1 through September 30 of each year when temperatures are expected to be warmest, therefore representing conservative (i.e., worst case) conditions.

To better understand the effectiveness of the existing submerged weir, continuous temperature data collection is proposed for sampling locations 564.1, 564.0, and 560.0. At each location, temperature loggers will be deployed vertically at strategic depths to capture changes in thermal stratification resulting from Project operations (under both generation and pumping modes). Station 564.1 is located between the Project's inlet/outlet structure and the submerged weir and is approximately 140 ft deep (based on data from historic water quality monitoring at this location). Station 564.0 is located on the downstream side of the submerged weir and just upstream of the confluence of the Whitewater River arm and the Thompson River arm of Lake Jocassee. The depth at this location is approximately 200 ft. Station 560.0 is located in Lake Jocassee downstream of the confluence of the Whitewater River arm and Thompson River arm and is approximately 260 ft deep.

Potential elevations of interest for continuous temperature monitoring include (elevations subject to change based on field conditions during data collection):

- Approximately 3 ft below the water's surface (full pond elevation is 1,110 ft msl);
- Elevation 1,080 ft msl, which is the normal maximum Lake Jocassee drawdown elevation;
- Elevation 1,060 ft msl, which is the crest of the submerged weir;
- Elevation 1,040 ft msl, which is approximately 20 ft below the crest of the submerged weir; and
- Elevation 970 ft msl, which is near the lake bottom at Station 564.1 and typically below the thermocline at Stations 564.0 and 560.0.

Water temperature and DO data collected during the discrete bi-weekly sampling events will extend from the water's surface to the lake bottom (in approximately 6 ft [2 meter] increments) at all three monitoring locations.

6.3 Task 3 – Velocity Effects and Vertical Mixing in Lake Jocassee Due to a Second Powerhouse

As described in the PAD, nearly half a million cubic yards of material from the original Project excavation was placed approximately 550 meters (1,804 ft) downstream of the Project discharge to form a submerged weir. The function of the weir is to help minimize the effects of Project operations on the natural stratification of Lake Jocassee; the weir prevents the mixing of warmer water from the pumped storage discharge with the cooler water in the lower layer of the lake, for the protection of cold-water fish habitat. The weir also serves to dissipate the energy of the discharging water. A schematic drawing showing a profile of the existing weir in Whitewater River Cove as well as the proposed expanded weir is depicted on Figure 6-1. A second powerhouse could lead to more mixing of the water column downstream of the new inlet/outlet structure. Duke Energy will use the existing 3-D CFD model to determine the spatial extent of vertical mixing in the Whitewater River arm both upstream and downstream of the submerged weir if a second inlet/outlet structure were added. In advance of CFD modeling, a 2-D hydraulic model will be developed to determine the approximate affected area (associated with Bad Creek and Bad Creek II operations) and the CFD model boundary condition will be established based on the hydraulic model results.

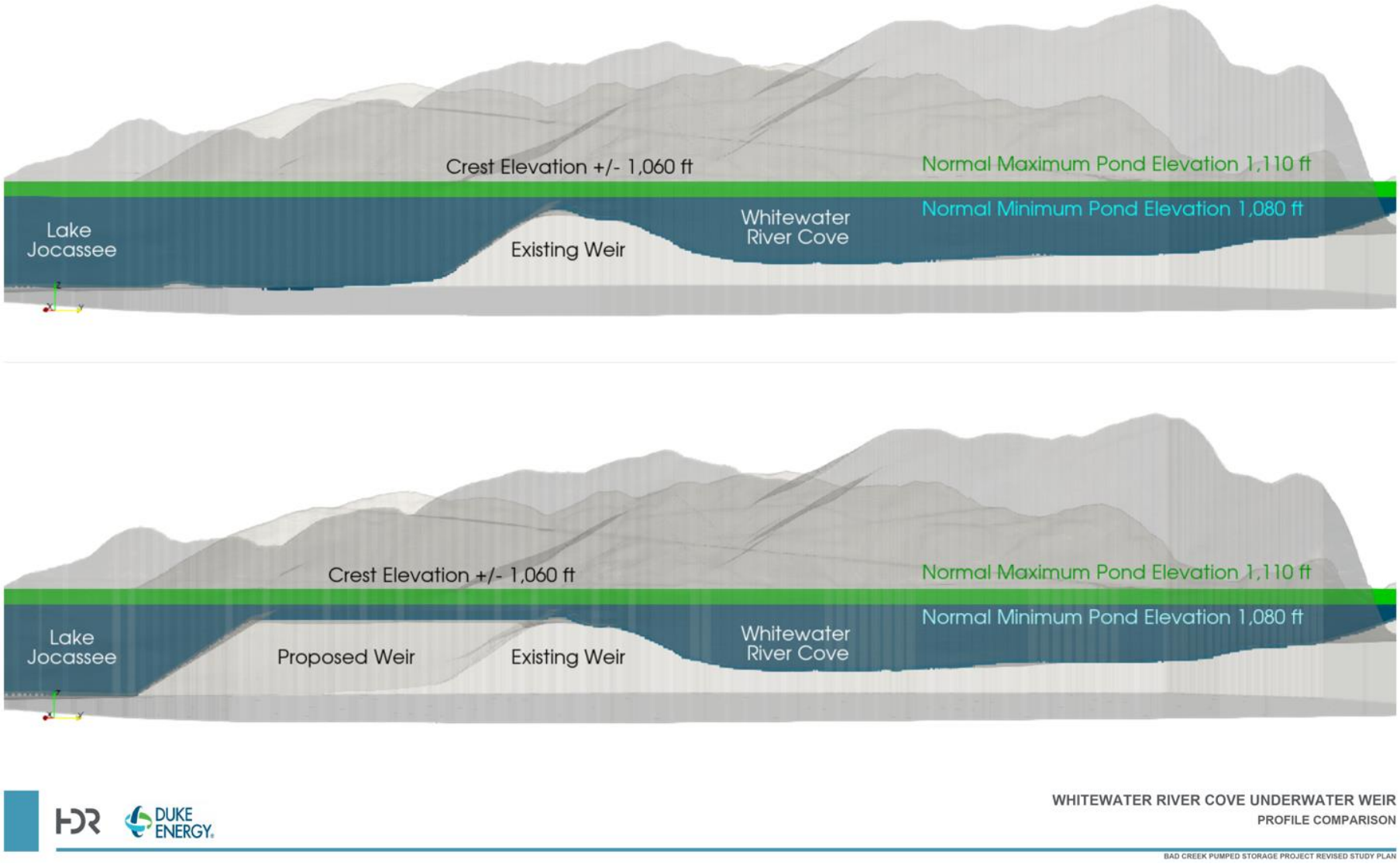

Figure 6-1. Submerged Weir in Whitewater River Cove (Existing and Proposed) – Cross Section View

The 12 scenarios listed in Table 6-1 will be evaluated to help determine the impact of Project operations on mixing in the Whitewater River arm with and without expanding the existing submerged weir (in both generating and pumping mode; and at full pond and maximum drawdown). Results from these scenarios will also help evaluate the need for additional water quality modeling to evaluate potential impacts to thermal and DO stratification in the main body of Lake Jocassee.

Additionally, shoreline impacts on the opposite bank of the Whitewater River arm due to additional discharge (i.e., increased velocities) were assessed during the Feasibility Study for the Bad Creek II Complex using the existing CFD model. These findings are reported in the RSP (Appendix I – Geology and Project Feasibility).

Table 6-1. Proposed CFD Model Scenarios

Station	Operating Mode	Submerged Weir Configuration	Reservoir Elevation (ft msl)
Bad Creek Only	Generating	Existing	1,110
			1,080
	Pumping		1,110
			1,080
Bad Creek and Bad Creek II	Generating	Existing	1,110
			1,080
	Pumping		1,110
			1,080
	Generating	Expanded	1,110
			1,080
	Pumping		1,110
			1,080

6.4 Task 4 – Water Exchange Rates and Lake Jocassee Reservoir Levels

Operation of the proposed Bad Creek II Complex, which will add pumping and generating capacity to the Project, has the potential to impact water surface elevation rate of change in Lake Jocassee compared to typical conditions, but will not change the allowable fluctuation in Lake Jocassee under the KT Project License and associated agreements. Adding pumping and generating capacity to the Project through the construction of the Bad Creek II Complex would reduce the time for maximum drawdown and refill of the upper reservoir; however, it would not result in additional water level rise in Lake Jocassee (above the Normal Maximum Elevation of

1110 ft msl), as the overall volume of water contained in the upper reservoir will not change. Additionally, the originally licensed operating band of the upper reservoir (i.e., 160 ft) is not proposed to be modified under the New License. Duke Energy proposes to use the existing CHEOPS model to evaluate the difference in water exchange rate, frequency, and magnitude between Bad Creek Reservoir and Lake Jocassee due to the addition of a second powerhouse.

An additional component of Task 4 will be to identify and evaluate impacts, if any, to Lake Keowee as a result of operating an additional powerhouse at the Project. This will be carried out using the existing CHEOPS model.

6.5 Task 5 – Future Water Quality Monitoring Plan Development

Pursuant to the existing MOU between Duke Energy and the SCDNR and subsequent 10-Year Work Plans, Duke Energy continues to collect water quality data in Lake Jocassee to support annual aquatic habitat evaluations. As part of the New License, Duke Energy plans to continue this long-term water quality monitoring program and will develop a Water Quality Monitoring Plan in consultation with agencies focused on the proposed Bad Creek II Complex. The WQMP will include three phases: pre-construction, construction, and post-construction of Bad Creek II, including identification of applicable and appropriate threshold values for water quality parameters and monitoring means and methods. Key components to be addressed in the plan are outlined in the sub-sections that follow.

6.5.1 Construction of Inlet/Outlet Structure and Submerged Weir Expansion

Similar to the construction-related impacts of the existing Project, temporarily elevated turbidity levels are anticipated in the Whitewater River arm of Lake Jocassee during construction of the Bad Creek II inlet/outlet structure and expansion of the existing submerged weir by placement of rock materials excavated during tunneling activities. Turbidity data summarized under Task 1 will be reviewed to better understand the potential for elevated turbidity levels associated with in-water construction activities. Duke Energy will also implement best management practices, as required by water quality permit(s) issued by SCDHEC, to reduce the potential for elevated turbidity in Lake Jocassee.

6.5.2 Construction in Upland Areas

Increased sediment loading during rainfall runoff events could impact existing streams and waterbodies (including wetlands) during construction of access roads, equipment laydown areas, tunneling activities, and the new electric transmission facilities. While no long-term degradation of water quality and aquatic habitat is expected to result from construction of the Bad Creek II Complex, these activities could lead to temporarily elevated turbidity levels which could impact aquatic habitat in the Whitewater River arm of Lake Jocassee.

6.5.3 Potential Upland Spoil Disposal

Overburden (i.e., soil and rock) material from the construction activities could potentially be deposited in several spoil locations throughout the site. Approximately 4 million cubic yards of rock and spoil material are expected as a result of underground excavations for Project infrastructure. This material will need to be deposited into on-site spoil locations and/or adjacent to the existing submerged weir in Lake Jocassee. Siting for spoil location alternatives is ongoing by Duke Energy; however, due to the amount of material to be managed, existing topography, and prevalence of headwater streams and seeps located throughout the site, it is unlikely there would be a practicable alternative identified that will result in zero impacts to steams, wetlands, and tributaries to Lake Jocassee. Potential spoil locations and estimated impacts to water resources (reported in length of stream or size of area) are documented in the Natural Resources Assessment included in the PAD. As described in Section 5.6.3.3 of the PAD, placement of excavated rock removed from the underground excavations on the downstream slope of the existing submerged weir in Lake Jocassee, as was done for the construction of the existing Project, would significantly reduce the amount of material placed at upland disposal sites, reducing impacts to existing streams and wetlands.

Duke Energy will perform a desktop study to further analyze and summarize the amount of spoil placement that could potentially be placed at each preliminary location and potential impacts. Upland disposal resulting in impacts to streams or wetlands, as well as placement of rock spoils at the submerged weir will require an individual permit from the USACE as well as a water quality certification from SCDHEC under the authorities of Sections 404 and 401 of the CWA. Duke Energy expects to initiate this parallel regulatory process in conjunction with the

relicensing process. This task will also include preliminary actions for gathering data to help inform the 401/404 permitting process.

6.6 Analysis and Reporting

Results of this study will be summarized in the Initial and Updated Study Reports. Duke Energy anticipates the Water Resources Study report will include Project information and background, a depiction and description of the study area, methodology, results, and analysis and discussion. The report will also include relevant stakeholder correspondence and/or consultation, as well as literature cited.

7 Schedule and Level of Effort

The preliminary schedule for this study is outlined in Table 71. The estimated level of effort for this study is approximately 2,000 hours. Duke Energy estimates the Water Resources Study will cost approximately $375,000 to complete.

Table 7-1. Proposed Water Resources Study Schedule

Task	Proposed Timeframe for Completion
Study Planning and Existing Data Review	August – December 2022
Task 1 – Summary of Existing Water Quality Data and Standards	January 2023 – April 2023
Task 2 – Water Quality Monitoring in Whitewater River Arm	June 2023 – September 2023 June 2024 – September 2024
Task 3 – Velocity Effects and Vertical Mixing in Lake Jocassee Due to a Second Powerhouse	April 2023 – October 2023
Task 4 – Water Exchange Rates and Lake Jocassee Reservoir Levels	April 2023 – October 2023
Task 5 – Future Water Quality Monitoring Plan Development	January 2024 – December 2024
Distribute Draft Study Report with the Initial Study Report	January 2024
Distribute Revised Study Report with the Updated Study Report	January 2025

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Appendix D

Aquatic Resources Study Plan

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APPENDIX D

AQUATIC RESOURCES REVISED STUDY PLAN

Bad Creek Pumped Storage Project
FERC Project No. 2740

December 2022

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AQUATIC RESOURCES REVISED STUDY PLAN
BAD CREEK PUMPED STORAGE PROJECT
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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
Bad Creek or Project	Bad Creek Pumped Storage Project
Bad Creek II Complex	Bad Creek II Power Complex
CFD	Computational Fluid Dynamics
CHEOPS	Computer Hydro-Electric Operations and Planning Software™
CPUE	catch per unit effort
CWA	Clean Water Act
DO	dissolved oxygen
Duke Energy or Licensee	Duke Energy Carolinas, LLC
FERC or Commission	Federal Energy Regulatory Commission
ft	feet/foot
ft msl	ft below mean sea level
KT Project	Keowee-Toxaway Hydroelectric Project
m	meter
mg/L	milligram per liter
MOU	Memorandum of Understanding
PAD	Pre-Application Document
PM&E	Protection, Mitigation, and Enhancement
PSP	Proposed Study Plan
RBP	Rapid Bioassessment Protocol
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency

1 Study Requests and Formal Comments

The Federal Energy Regulatory Commission (FERC or the Commission) issued Scoping Document 2 on August 5, 2022, which identified the following environmental resource issues to be analyzed in the National Environmental Policy Act document for the Bad Creek Pumped Storage Project (Project) relicensing related to aquatic resources. These resource issues address the effects of continued Project operations under the Existing License as well as potential construction and operation of a second powerhouse during the New License term for the Bad Creek II Power Complex (Bad Creek II Complex):

- Effects of construction-related erosion, sedimentation, and spoils disposal on water quality, aquatic habitat, and aquatic biota in Lake Jocassee and streams in the Project vicinity.
- Effects of Project operation on water levels in Lake Jocassee.
- Effects of Project operation on water quality in Lake Jocassee, including water temperature, dissolved oxygen (DO) concentrations, and vertical mixing of DO.
- Effects of reservoir fluctuations associated with Project operation on aquatic habitat and biota in Lake Jocassee.
- Effects of vertical mixing of DO associated with Project operation on fish populations in Lake Jocassee.
- Effects of Project operation on aquatic habitat and biota in Howard Creek.
- Effects of Project-induced impingement, entrainment, and turbine mortality on fish populations in Lake Jocassee.
- Effects of Project recreation on aquatic resources.
- Effects of construction-related erosion, sedimentation, and spoils disposal in the Bad Creek reservoir on Lake Jocassee.

In Section 7.1.3.3 of the Pre-Application Document (PAD) (Duke Energy 2022), Duke Energy Carolinas, LLC (Duke Energy or Licensee) proposed to conduct an Aquatic Resources Study in support of the proposed Bad Creek II Complex, which included a proposal to consult with agencies and other Project stakeholders regarding results of a recent desktop entrainment assessment (Kleinschmidt 2021), study updates, or modifications to address impacts of the Bad Creek II Complex; and if the Bad Creek II Complex is pursued, a presence/absence mussel

survey and other protected aquatic species (if applicable) of potentially impacted streams in upland spoil locations.

The items above are addressed by two separate studies in this Revised Study Plan (RSP) as follows:

(1) The Water Resources Study (Appendix C) focuses on historical water quality data of Lake Jocassee, potential impacts to surface waters due to construction of the new Bad Creek II Power Complex (Bad Creek II Complex), and water resources affected by a second inlet/outlet structure in the Whitewater River arm (also called Whitewater River cove) of Lake Jocassee.

(2) The Aquatic Resources Study (Appendix D) will evaluate impacts associated with construction and operation of the proposed Bad Creek II Complex on water quality and water resources as they relate to aquatic life and habitat.

No study requests related to aquatic resources were received during the scoping process; however, formal comments on the PAD and Scoping Document 1 regarding aquatic resources were received from the U.S. Environmental Protection Agency (USEPA), South Carolina Department of Natural Resources (SCDNR), and Upstate Forever. Responses to comments were included in Appendix A of the Proposed Study Plan (PSP), which was filed with the Commission on August 5, 2022. Comments on the PSP regarding aquatic resources were received from SCDNR and Upstate Forever; requests and comments pertinent to the Aquatic Resources Study were considered in the development of this RSP and summaries of comments and responses are included in Appendix A. Copies of all comments and correspondence are provided in Appendix B.

2 Goals and Objectives

While there are no anticipated additional adverse effects to aquatic resources due to the continued operation of the Project, potential adverse effects resulting from the addition of Bad Creek II Complex need to be evaluated. Therefore, the goal of the Aquatic Resources study is to evaluate potential impacts to fish and aquatic life populations, communities, and habitats, due to the construction and operation of the proposed Bad Creek II Complex.

Duke Energy will conduct an Aquatic Resources Study for this relicensing to include and address the following objectives:

- Evaluate the potential for increased fish entrainment due to the addition of Bad Creek II Complex and consult with agencies and other Project stakeholders regarding results of the recent desktop Entrainment Study (Kleinschmidt 2021).
- Assess changes to pelagic and littoral aquatic habitat in Lake Jocassee resulting from the expanded underwater weir and additional discharge, using models developed for the Water Resources Study and Keowee-Toxaway Hydroelectric Project (KT Project) relicensing.
- Evaluate potential direct impacts to aquatic habitat (including wetlands) related to Bad Creek II Complex construction activities and weir expansion by quantifying and characterizing surface waters, including resource quality. Presence/absence mussel surveys of streams located in upland areas where spoil deposition may occur will also be conducted. Note no aquatic biota sampling of the submerged weir will take place.

These objectives will be met through the following activities:

- Holding meetings with the Aquatic Resources Committee to discuss results of the Entrainment Study (Kleinschmidt 2021) and mitigation measures to minimize entrainment risk at the Project and Bad Creek II Complex.
- Using the Computational Fluid Dynamics (CFD) model (and potentially others, as necessary) developed for the Water Resources Study to evaluate potential effects on pelagic trout habitat due to water column mixing in Lake Jocassee.
- Using the existing operations Computer Hydro-Electric Operations and Planning Software™ (CHEOPS) model developed for the KT Project relicensing to inform evaluation of reservoir surface water elevation effects on littoral habitat in Lake Jocassee associated with water exchange rates, magnitude, and duration of operations between the Project and Bad Creek II Complex, and the Jocassee Pumped Storage Station.
- Describing potential direct impacts to surface waters related to Bad Creek II Complex construction and underwater weir expansion as indicated from the Water Resources

Study, prior Natural Resource Assessment, presence/absence mussel surveys, and habitat quality surveys of streams in the potential spoil deposition areas.

3 Study Area

The study area for the Aquatic Resources Study is shown on Figure 3-1 and includes the upper reservoir, lower reservoir (Whitewater River arm only), preliminary transmission line alignment, and main (expanded) project site.

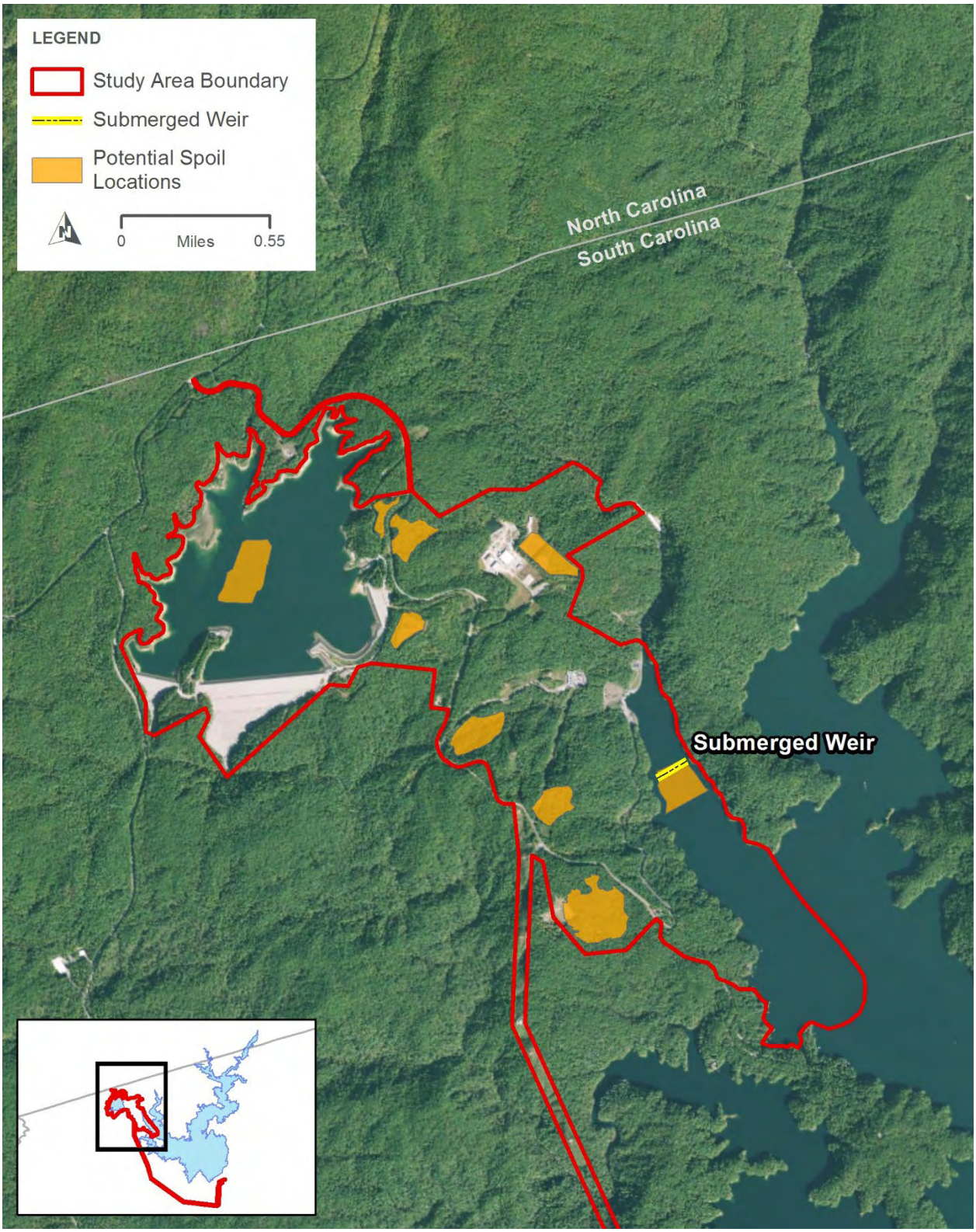

Figure 3-1. Aquatic Resources Study Area

4 Background and Existing Information

Existing and historic major protection, mitigation, and enhancement (PM&E) measures in place at the Project are primarily focused on fisheries, water quality, and recreation, and are established by the following:

- Bad Creek Pumped Storage Project Plans for Environmental Mitigation and Monitoring (License Articles 32, 34, 38, and 39)
- Duke Energy and SCDNR Memorandum of Understanding (MOU) and 10-Year Work Plans
- KT Project Relicensing Agreement

Due to the infeasibility of sampling and safety concerns under normal Project operations (frequent large fluctuations and influx from Lake Jocassee), water quality sampling is not performed in the upper reservoir. Since Bad Creek Reservoir was a newly created reservoir for the original Project and has no known designated uses, no additional impacts to fish and aquatic resources in the upper reservoir are expected from continued operation of the Project.

The combined operation of the existing Project and/or construction and operation of the Bad Creek II Complex has the potential to impact aquatic habitat in Lake Jocassee. Existing relevant and reasonably available information regarding fish and aquatic resources and environmental studies and agreements under the Existing License is included in Section 6.4 of the PAD (Duke Energy 2022). Within one year of the Original FERC License, Duke Energy filed Plans for Environmental Mitigation and Monitoring including License Articles 32, 34, 38, and 39, which address fish and wildlife PM&E measures. Plans outlined for mitigation and monitoring include information on wildlife and fisheries mitigation (Article 32), a water quality study plan (Article 34), pre-construction survey of endangered and threatened plan and animal species (Article 38), and a stream flow augmentation analysis (Article 39). Duke Energy and the SCDNR developed the MOU in 1996 to establish a framework to help maintain the high-quality fisheries of lakes Jocassee and Keowee (Duke Power and SCDNR 1996).

The Bad Creek Fishery Resources Work Plan consists of three successive 10-Year Work Plans (i.e., 1996 – 2005; 2006 – 2016[1]; and 2017 – 2027). The activities and agreements in the 10-Year Work Plans include:

1) agreement on minimizing fish entrainment via the Project;
2) electrofishing of littoral fish populations;
3) water quality monitoring for trout habitat;
4) hydroacoustic monitoring of small pelagic fish;
5) cost-sharing for trout stocking; and
6) cost-sharing for fisheries research and enhancements.

The current 10-Year Work Plan (2017-2027; SCDNR and Duke Energy 2016) continues many of the management activities implemented in prior work plans. Duke Energy and SCDNR continue to cooperatively monitor the fishery in lakes Jocassee and Keowee while annually reviewing the results of the monitoring studies. Many of the studies and activities conducted at Lake Jocassee under the MOU are relevant to assessing potential environmental impacts associated with existing and continued operation of the Project. The current 10-Year Work Plan is composed of the same main components as the six listed above, with the exception of water quality monitoring for trout habitat (no. 3), which was completed under the 2006-2015 work plan; however, trout habitat monitoring in Lake Jocassee was adopted as a requirement of the KT Project Relicensing Agreement.

Duke Energy has monitored spring littoral fish populations in Lake Jocassee via boat-mounted electrofishing since 1996 (SCDNR and Duke Energy 1996) and continues every three years (i.e., 2017, 2020, 2023, and 2026) under the current 10-Year Work Plan (SCDNR and Duke Energy 2016). As part of the 1996-2005 Work Plan, gill netting was performed at five locations annually by SCDNR and funded by Duke Energy (SCDNR and Duke Energy 1996). The purpose of these studies was to contribute data to the longest-running database on the Jocassee fishery. Vertical profile surveys of temperature and DO have been conducted in Lake Jocassee since 1973 to

[1] Several activities conducted under the first two 10-year work plans were identified as PM&E measures under the KT Project (FERC No. 2503) and are now included in the KT Project Relicensing Agreement and the KT Project New License issued by FERC in 2016. As a result, the original 2006 – 2015 Work Plan was extended by one year to cover 2016.

monitor trout habitat. Continued monitoring of trout habitat thickness is performed under the KT Project Relicensing Agreement, which requires an annual model prediction and verification by a temperature and DO survey at the deepest location in Lake Jocassee (station 558.0) in February and September, respectively. Hydroacoustic monitoring of fish populations by Duke Energy to assess pelagic prey fish (i.e., Threadfin Shad and Blueback Herring) abundance and distribution began in 1997 (SCDNR and Duke Energy 1996). Complementary to hydroacoustic monitoring, purse seine sampling was also conducted in conjunction with the fall hydroacoustic monitoring from 1997 to 2012 to characterize species composition of the pelagic forage fish community. The Bad Creek MOU lists activities eligible for cost-sharing, including fisheries research, water quality studies, trout habitat studies, stream surveys, creel surveys, fish and habitat management, development of bank and stream-side access, and stream protection and enhancement.

Duke Energy completed a 3-year fish entrainment study developed in cooperation with the SCDNR and the U.S. Fish and Wildlife Service at Bad Creek during the first three years of Project operations (1991-1993) (Barwick et al. 1994). The rate of entrainment at Bad Creek was generally low (five fish/hour) during most of the study (October 1991-August 1993) (Barwick et al. 1994). Overall, an estimated 391,327 fish were entrained at the Bad Creek during 14,244 hours of pumping from 1991 to 1993. A total of 300,406 of these fish were Threadfin Shad and most were entrained in late 1993 in response to low water levels in Lake Jocassee (14 feet [ft] below full pond elevation). Blueback Herring, White Catfish, Redbreast Sunfish, and Bluegill were the only other taxa entrained in significant numbers. In addition to entrainment estimates, the Barwick et al. (1994) study identified operational periods associated with entrainment rates at the Bad Creek Project during pump-back operations. Results from this evaluation were used to establish operational guidelines and a communications protocol between Duke Energy and SCDNR to minimize entrainment impacts. As part of those operational guidelines, Duke Energy agreed to operate its facilities to minimize, to the extent practicable, the length of time during which the Lake Jocassee pool elevation is less than 1,099 ft below msl (msl) (SCDNR and Duke Energy 2016).[2] Lake Jocassee normal full pond elevation is 1,110 ft msl, therefore, 1,099 ft msl

[2] Site-specific studies have indicated fish entrainment can increase when Lake Jocassee pool elevations drop below 1,096 ft msl. Setting the threshold at 1,099 ft msl provides a 3-ft buffer to allow time for Duke Energy to notify and consult with SCDNR.

is equivalent to an 11-ft drawdown[3]. In accordance with the current 10-Year Work Plan, if Lake Jocassee pool elevation falls below 1,099 ft msl, Duke Energy will implement operational changes at the Bad Creek Project based on hydro unit availability and other operational considerations to minimize fish entrainment (FERC 2017). These protocols include turning lights off near the inlet/outlet structure so as not to attract fish to the area and implementing a unit startup and shutdown sequence to minimize fish entrainment.[4]

More recently, a desktop entrainment study was performed by Kleinschmidt Associates (Kleinschmidt 2021) for Duke Energy in support of this relicensing and to evaluate potential impacts of the proposed Project expansion (i.e., Bad Creek II Complex). Specifically, this study considered the potential for entrainment of Lake Jocassee fishes through the Project under the proposed action (i.e., operation of two powerhouses at the Project). Like the existing Project, entrainment of fish at the Bad Creek II Complex during pumping has the potential to cause injury or mortality to fish as they pass through the water conveyance system and turbines. It is currently understood fish transferred to Bad Creek Reservoir via pumping entrainment are lost to the Lake Jocassee fishery since complete mortality has been assumed[5]. Previous studies demonstrate the overall numbers of fish entrained at the Project are primarily a function of fish density in the water column and the amount (volume) of water transferred. Although the proposed action will increase the rate at which water is pumped, the total volume of water passed during a pump back cycle is expected to remain about the same. Therefore, it is unlikely the proposed increase in pumping capacity will significantly increase the numbers of entrained fish during pumping at the Project. The full report is included in Appendix F of the PAD.

Lake Jocassee is recognized as a regional trout fishery, and maintaining this fishery is an important shared interest of SCDNR and Duke Energy. Under the current 10-Year Work Plan (2017-2027), Duke Energy will provide $80,000 (in 2017 dollars) per year to the SCDNR toward the growing and stocking of trout in Lake Jocassee and its tributaries. This funding will continue

[3] The Lake Jocassee Maximum Drawdown Elevation as specified in the KT Project Relicensing Agreement and the KT Project New License issued by FERC in 2016 is 1,080 ft msl, allowing a maximum 30-ft drawdown.

[4] The pumping protocol includes starting up Unit 4 first, followed by Units 2, 3, and 1 sequentially. Unit order is reversed during the shutdown sequence.

[5] Recent models suggest entrainment mortality may be less than 100%; therefore, Duke Energy may explore mortality rates in greater detail with stakeholders during entrainment discussions.

through 2027 and is adjusted annually based on the Consumer Price Index. This will assist in ensuring trout are available for maintaining the quality sport fishery in Lake Jocassee. Duke Energy will consult with agencies and stakeholders through the relicensing process to determine appropriate PM&E measures for fishery impacts for the New License term.

No unanticipated effects to the population, abundance, or distribution of forage fish are expected from the proposed Bad Creek II Complex operations. Annual sampling and monitoring conducted as part of the current 10-Year Work Plan and MOU, as may be modified with stakeholders through the relicensing process, will likely continue during the New License term, and any changes in forage fish populations or diversity would be identified under those activities. The data collected as part of these studies would allow effective on-going monitoring of forage populations which are the primary food of trout and other predatory sportfish in Lake Jocassee and Lake Keowee.

Similarly, no effects on the littoral fish populations or changes in suitable habitat are anticipated as a result of the proposed Bad Creek II Complex operations. Annual electrofishing conducted as part of the current 10-Year Work Plan and MOU, as may be modified with stakeholders through the relicensing process, will likely continue during the New License term, to provide data (1) to determine species composition and to detect changes, (2) to obtain catch-per-unit effort data to detect increasing or decreasing population trends, and (3) to evaluate the relative condition of largemouth and spotted bass.

No impacts to the cost-sharing program for trout stocking are anticipated from the proposed Bad Creek II Complex; however, it is likely the addition of a second powerhouse would provide rationale for continuation of some level of cost-sharing for trout stocking in future years, to be considered in consultation with stakeholders through the relicensing process.

4.1 Proposed Protection, Mitigation and Enhancement Measures

During the New License term, Duke Energy proposes to continue to implement activities established by the 10-Year Work Plan and MOU, as may be modified in consultation with stakeholders through the relicensing process, and will continue to implement PM&E activities established under the KT Project Relicensing Agreement. Major measures include:

- Project operational measures and protocol to minimize risk of entrainment during certain environmental conditions (i.e., when Lake Jocassee is at or below 1,099 ft msl).
- Hydroacoustic monitoring of pelagic prey fish populations (e.g., Threadfin Shad and Blueback Herring) to monitor for effects to these species from the addition of Bad Creek II Complex operations.
- Pelagic trout habitat thickness monitoring is performed under the KT Project Relicensing Agreement, which requires an annual model prediction and verification by temperature and DO survey at the deepest location in Lake Jocassee (Station 558.0) in February and September, respectively.
- Duke Energy provided a one-time payment of $120,000 in 2017 to support Bad Creek MOU research and monitoring activities by SCDNR. Duke Energy also provided further funding of $90,000 in 2019 and will provide another $90,000 in 2025. Under the KT Project Relicensing Agreement, Duke Energy provided $100,000 to SCDNR to support tributary stream restoration efforts. Duke Energy expects to consult with agencies and other stakeholders regarding any need for additional PM&E measures focused on fisheries research and enhancements in the New License term through the relicensing process.
- Under the current 10-Year Work Plan (2017-2027), Duke Energy provides $80,000 (in 2017 dollars) per year to the SCDNR toward the growing and stocking of trout in Lake Jocassee and its tributaries. This funding will continue through 2027 and is adjusted annually based on the Consumer Price Index. Duke Energy will consult with agencies and stakeholders through the relicensing process to determine any appropriate PM&E measures for trout for the term of the New License.

5 Project Nexus

The construction and operation of the Bad Creek II Complex has the potential to impact aquatic habitat and fish populations in Lake Jocassee. The construction of the Bad Creek II Complex and expansion of the underwater weir may cause direct, permanent and temporary impacts to aquatic resources in Lake Jocassee and in upland areas.

6 Methods

6.1 Task 1 – Consultation on Entrainment

Duke Energy will consult with agencies and other Project stakeholders regarding results of this desktop entrainment assessment and study updates or modifications required to address entrainment impacts of the Bad Creek II Complex. Duke Energy commits to one meeting with agencies and stakeholders, with additional meetings (and timing of such) to be dictated by the Aquatic Resource Committee, if necessary. Conclusions of the study and existing mitigation measures to minimize entrainment will be discussed. Meeting notes will be taken and distributed to meeting participants for comment.

6.2 Task 2 – Effects of Bad Creek II Complex and Expanded Weir on Aquatic Habitat

The addition of operation activities by Bad Creek II Complex and proposed changes to the underwater weir have the potential to influence the temperature and DO dynamics in Lake Jocassee, which could affect trout lake habitat. The operations of Bad Creek II Complex will also influence water surface elevations in Lake Jocassee; specifically, the frequency, rate, and magnitude of water surface elevation changes, which may affect littoral zone habitat in the lake.

6.2.1 Evaluation of Potential Effects to Trout Lake Habitat

Lake Jocassee is one of only a few reservoirs in South Carolina containing a combination of water temperatures and DO levels supporting both a warmwater and a coldwater (trout) fishery year-round (USACE 2014). The success of the trout fishery in Lake Jocassee is dependent on adequate availability of suitable pelagic habitat, as defined by thermal and DO criteria. Vertical profile surveys of temperature and DO have been conducted in Lake Jocassee since 1973. Profile data allow evaluation of the vertical and horizontal distribution of trout habitat conditions, as measured by thickness/depth (meters, m) and volume (m3), throughout the year and prediction of late-summer (i.e., September, when trout habitat would be expected to be at minimum) trout habitat thickness in the main body of the reservoir using an empirical model developed by Duke Energy (Foris 1991). Pelagic trout habitat is defined as water with temperatures ≤ 20.0 degrees Celsius (°C) and DO concentrations ≥ 5.0 milligrams per liter (mg/L) (Oliver et. al. 1978). The

temporal and spatial distribution of trout habitat over the 1973-2015 period were consistent with typical temperature and DO regimes observed in Lake Jocassee (Duke Energy 2014; Duke Energy 2016) and provide sufficient habitat availability in Lake Jocassee to support a robust trout population.

The addition of the Bad Creek II Complex would influence hydrodynamics downstream of the inlet/outlet structure. While the expanded weir may minimize these affects (as the present weir has done for current Project operations), the increase in discharge and velocities has the potential to extend beyond the weir and result in water column mixing, disrupting trout habitat conditions and, potentially, sufficient trout habitat availability. Duke Energy proposes to use the results from the CFD model developed for the Water Resources Study to evaluate the degree and extent of water column mixing downstream of the weir, as indicated by velocity vectors, and how this may influence trout lake habitat. Effects of operations on trout lake habitat will be evaluated seasonally regarding habitat thickness and potential influence from velocities.

6.2.2 Evaluation of Potential Effects to Littoral Zone Habitat

The littoral fish habitat in Lake Jocassee resembles many undeveloped mountain lakes in North Carolina, comprising primarily rocky outcrops with small amounts of sand, emergent vegetation or stream confluences, residentially developed piers and riprap, clay, and cobble (Duke Energy 2014). Much of the littoral zone exhibits steep slopes, with areas of significant woody structure (large stumps).

The addition of the Bad Creek II Complex operations would result in changes to water surface elevations with respect to elevation change rates, magnitude, and duration, which could result in effects to littoral zone habitat in Lake Jocassee. Duke Energy proposes to use the CHEOPS™ model developed for the KT Project relicensing and used in the Water Resources Study to evaluate the changes in water surface elevations, with a qualitative analysis of how these changes could affect fish habitat in the littoral zone such as from dewatering/fluctuations, habitat availability, and species using these areas daily or seasonally (i.e., spawning).

6.3 Task 3 – Impacts to Surface Waters and Associated Aquatic Fauna

Construction of the Bad Creek II Complex would impact existing streams and waterbodies, including wetlands. Overburden (i.e., soil and rock) material from the construction activities are proposed to be deposited in several spoil locations throughout the site. Siting for spoil location alternatives is ongoing by Duke Energy; however, due to the amount of soil material required, existing topography, and prevalence of headwater streams and seeps located throughout the site, it is unlikely there would be a practicable alternative identified that will result in zero impacts to steams, wetlands, and tributaries to Lake Jocassee. Potential spoil locations and estimated impacts to water resources (reported in length of stream or size of area) are provided in Table 5-3 in Section 5 of the PSP. As described in Section 5.6.3.3 of the PAD (Duke Energy 2022), placement of excavated rock removed from the underground excavations to the downstream slope of the existing submerged weir in Lake Jocassee, as was done for the construction of the existing Project, would significantly reduce the amount of material placed at upland disposal sites, reducing impacts to existing streams and wetlands. However, while reducing the amount of spoil material necessary for deposit in upland locations, placement of rock for weir expansion will potentially result in temporary impacts to aquatic habitat in the Whitewater River arm of Lake Jocassee.

Duke Energy proposes to evaluate the aquatic resources (streams, wetlands, and Lake Jocassee) that may experience direct impacts from spoil placement or other construction activities. This will include a characterization of aquatic resources with respect to stream types as indicated from the Natural Resources Assessment, habitat quality, and potential fauna (mussels) presence. Field activities in support of this study are outlined below.

6.3.1 Stream Habitat Quality Surveys

As stated in the Water Resources Proposed Study Plan, upland disposal resulting in impacts to streams or wetlands, as well as placement of rock spoils at the submerged weir will require an individual permit from the U.S. Army Corps of Engineers (USACE) as well as a water quality certification from South Carolina Department of Health and Environmental Control (SCDHEC) under the authorities of Sections 404 and 401 of the Clean Water Act (CWA). In preparation for these expected regulatory processes, if Bad Creek II Complex is pursued, stream habitat quality

surveys will be completed to provide a physical assessment of the potentially impacted streams. The stream surveyors will conduct habitat assessments using the Rapid Bioassessment Protocols (RBP) for Use in Streams and Wadeable Rivers (Barbour et al. 1999). The purpose of the RBP is to provide a technical methodology for conducting cost-effective biological assessments in lotic systems; the matrix used to assess habitat quality is based on key physical characteristics of the waterbody and surrounding land contributing of stream habitat quality.

6.3.2 Mussel Surveys

As part of this study, presence/absence mussel surveys will be completed for waters proposed to be impacted by spoil placement or other construction activities (i.e., excavation of the shoreline and construction of the inlet/outlet structure). These areas include the shoreline of Lake Jocassee which would be impacted due to the construction of the inlet/outlet structure, and streams within all upland spoil locations. The freshwater mussel surveys will consist of timed searches; for Lake Jocassee, the amount of effort will be a minimum of 1 person-hour. Upland stream habitats will be assessed to determine whether conditions exist to support freshwater mussel assemblages; freshwater mussels do not commonly occur in high gradient systems with large substrate and low productivity. For upland streams capable of supporting mussels, the amount of effort will be a minimum of 0.5 person-hours.

Mussels will be collected visually and tactilely (grubbing) and placed in mesh bags. Mussels will be identified to species and enumerated. The total number of mussels, relative abundance of each species, and catch per unit effort (CPUE) will be determined. Habitat conditions at each sampling location will be recorded including substrate conditions, shoreline composition, and basic water quality parameters (water temperature, dissolved oxygen).

6.4 Analysis and Reporting

Results of this study will be summarized in the Initial Study Report and Updated Study Report. Duke Energy anticipates the Aquatic Resources Study report will include Project information and background, a depiction and description of the study area, methodology, results, and analysis and discussion. The report will also include relevant stakeholder correspondence and/or consultation, as well as literature cited.

7 Schedule and Level of Effort

The preliminary schedule for this study is outlined in Table 7-1. The estimated level of effort for this study is approximately 1,300 hours. Duke Energy estimates the Aquatic Resources Study will cost approximately $200,000 to complete.

Table 7-1. Proposed Aquatic Resources Study Schedule

Task	Proposed Timeframe for Completion
Study Planning	August – December 2022
Task 1 - Consultation on Entrainment Meeting	January – June 2023
Task 2 - Desktop Studies on Pelagic and Littoral Habitat Effects	Spring-Fall 2023
Task 3 - Mussel Surveys and Stream Habitat Quality Surveys	Summer 2023
Distribute Draft Study Report with the Initial Study Report	January 2024

8 References

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Appendix E

Visual Resources Study Plan

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APPENDIX E

VISUAL RESOURCES REVISED STUDY PLAN

Bad Creek Pumped Storage Project
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FERC or Commission	Federal Energy Regulatory Commission
GPS	Global Positioning System
KT Project	Keowee-Toxaway Hydroelectric Project
PM&E	protection, mitigation, and enhancement
SMS	Scenery Management System
USFS	U.S. Forest Service

1 Study Requests and Formal Comments

The Federal Energy Regulatory Commission (FERC or the Commission) issued Scoping Document 2 on August 5, 2022, which identified the following environmental resource issues to be analyzed in the National Environmental Policy Act document for the Bad Creek Pumped Storage Project (Project) relicensing related to scenery and visual resources. The resource issue addresses the effects of continued Project operations under the Existing License as well as potential construction and operation of a second powerhouse during the New License term (Bad Creek II Power Complex [Bad Creek II Complex]):

- Effects of Project construction, operation (including the presence of Project facilities), and maintenance activities on scenery and visual resources.

In Section 7.1.7.3 of the Pre-Application Document (Duke Energy 2022), Duke Energy Carolinas, LLC (Duke Energy or Licensee) proposed to conduct a Visual Resources Study in support of the proposed Bad Creek II Complex. More specifically, the study will include an assessment of baseline conditions and an evaluation of potential visual impacts from construction and operation of the Bad Creek II Complex. No formal study requests were received related to visual resources during the scoping process; the Proposed Study Plan was filed with the Commission on August 5, 2022. Formal comments on the Proposed Study Plan related to visual resources were received from FERC and Upstate Forever and were considered in the development of this Revised Study Plan. Comment summaries and responses are included in Appendix A and copies of all correspondence are included in Appendix B.

2 Goals and Objectives

Due to the topographic location of the dams and upper reservoir, the underground location of the powerhouse, the surrounding terrain, and heavily forested nature of the Project area, there are limited public and [non-Duke Energy] private access areas providing views of Project facilities. No adverse additional effects to scenery and visual resources are expected to result from the continued operation of the Project over the New License term, and no practical or necessary

protection, mitigation, and enhancement (PM&E) measures have been previously identified or proposed for existing Project structures.

Therefore, this study is focused on visual impacts from the potential construction and operation of the Bad Creek II Complex. These impacts may include land clearing and grading activities; creation of new upland spoil areas; temporary, localized turbidity impacts in the Whitewater River cove (also called Whitewater River arm); construction traffic; temporary construction facilities; and the presence of heavy construction equipment. The scenery will be permanently altered through the addition of new Project structures, though these will be similar in appearance and adjacent to existing Project structures.

Duke Energy will conduct a Visual Resources Study for this relicensing to include and address the following:

- Describe the key scenic characteristics of the existing landscape within the Project area and surrounding lands expected to potentially be within visual range of Project facilities.
- Identify areas within the existing landscape from which the existing and proposed Bad Creek facilities are or would potentially be visible.
- Identify existing project operations and maintenance activities that affect visual characteristics.
- Evaluate expected impacts of construction and operation of the Bad Creek II Complex on visual resources and any proposed PM&E measures.

This Visual Resources Study will be carried out to provide additional information to support the pursuit of the New License for the Project; data collected will be used to support Project feasibility and design processes and to assess potential effects of the proposed Project on scenery and visual resources. This study plan briefly describes planned study activities that will be performed to address these issues.

3 Study Area

The study area for the Visual Resources study area is shown on Figure 3-1 and includes the upper reservoir, lower reservoir (Whitewater River arm only), preliminary transmission line alignment, and main (expanded) Project site. (Note that some Key Observation Points may occur outside of the Study Area boundary).

The Project is situated within the Blue Ridge Mountains in the Upstate of South Carolina. The existing landscape and scenic attributes in the vicinity are dominated by rolling hills, forests, stream corridors, steep slopes, waterfalls, rock outcrops, and mountain ridges. The areas surrounding the Project reservoir are primarily undeveloped forested land (managed by the U.S. Forest Service [USFS]). Although there is some development around Lake Jocassee, the shoreline is also mostly forested with a mixture of pines and hardwoods and there are numerous waterfalls where tributaries flow into the reservoir. Surrounding protected lands include the Sumter National Forest and the Jocassee Gorges and the area overall is aesthetically appealing.

The Project site is located entirely on Duke Energy-owned property, except for a portion of the transmission line corridor that is currently maintained under a property easement. The Project is not generally visible from any state highway nor is it visible from Lake Jocassee (via boat) - it is only visible from the Bad Creek access road. The existing inlet/outlet structure in the Whitewater River cove is the only facility structure visible to the public (via boat).

Figure 3-1. Visual Resources Study Area

4 Background and Existing Information

The FERC regulations for license applications require that Exhibit E include a report on aesthetic resources (18 CFR 4.41(f) (8)). The report must describe the scenic and visual resources of the proposed Project area, expected impacts on these resources, and the mitigation, enhancement and protection measures proposed. The report must be prepared following consultation with federal, state, and local agencies having managerial responsibility for any part of the proposed Project lands and abutting lands.

There are numerous opportunities to enjoy nature and scenery in the immediate vicinity of the Project such as hiking, camping, fishing, hunting, scenic and wildlife viewing, and boating (flatwater and whitewater). The scenic conditions within the vicinity of the Project have been a priority for Duke Energy since the 1970's and this commitment continues today. Duke Energy has played a large role in contributing to the protection of large amounts of nearby public recreational and conservation lands to enhance the scenery of the area.

Visual elements associated with the Project include the upper reservoir, the main dam, the west dam, the east dike, the equipment building, access roads, lower reservoir inlet/outlet structure and powerhouse portal area (Whitewater River arm of Lake Jocassee), transformer yard and switchyard (adjacent to equipment building), and transmission line extending from the Bad Creek transformer yard to a grid intertie station at the Jocassee Station.

During a 2013 Recreation Use and Needs Study at the Keowee-Toxaway (KT) Project (Duke Energy 2014), one third of the people surveyed stated nothing detracts from the scenic quality of Lake Jocassee. Almost half of Lake Jocassee respondents listed low-water levels as the main detraction to visual resources, while in a 2007 Recreation Use and Needs Study only 36 percent of respondents listed low-water levels as a detraction. No respondents listed "development" as detracting from scenic and visual qualities of the area (Duke Energy 2014).

As a result of the Original License for the KT Project, the Jocassee Shoreline Management Plan has provisions limiting the ability of adjoining property owners to eliminate shoreline vegetation along Lake Jocassee with the intention to provide a more natural looking shoreline buffer. Additionally, following the relicensing of the KT Project, new normal minimum lake elevations were set higher, a new drought protocol (Low Inflow Protocol) was put in place and a New

Operating Agreement with the U. S. Army Corps of Engineers was put in place; each of which contribute to reducing the frequency and magnitude of exposed Jocassee shorelines, improving the visual appearance for visitors.

As previously stated, visual impacts would result from the construction and operation of the Bad Creek II Complex. Common mitigation techniques can be applied to reduce impacts to visual resources during and after construction including minimization of disturbance (e.g., limit clearing trees and vegetation to the extent possible), lighting control, strategic placement of facility appurtenances, and reduction of visual contrast caused by new rights-of-way, access roads, laydown areas, and staging areas. Duke Energy expects the best management practices and PM&E measures required to address the requirements of the FERC license and Section 404/401 permit will also benefit visual resources. In association with this study and the larger relicensing process, Duke Energy expects to further consult with relicensing stakeholders to determine whether additional PM&E measures are needed for the protection of visual resources.

5 Project Nexus

The natural and aesthetic character of Lake Jocassee, the Foothills Trail, Whitewater Falls, and non-developed, forested areas surrounding the Bad Creek Project contribute to the recreational and cultural value of the Project vicinity, within the Blue Ridge Mountains in the Upstate of South Carolina. The existing Project facilities have been in place since construction of Bad Creek was completed in the early 1990s, and the Project has actively operated since that time.

The construction of the Bad Creek II Complex will include a new underground powerhouse and associated structures as well as the new inlet/outlet structure to Lake Jocassee. Similar to the existing inlet/outlet structure, following completion of construction, the new inlet/outlet structure will be viewable by the public via boat (primarily from the Whitewater River cove). With the construction of the proposed Project expansion, the visual landscape will be altered during and after construction.

6 Methods

Study objectives are to provide information needed to determine the potential direct, indirect, and/or cumulative effects of the proposed Project on scenic and visual resources. The results of this study, in conjunction with existing information, will be used to inform analysis in and recommendations for the New License application regarding potential Project effects on visual scenic and potential PM&E measures to be included in the New License. This study will be carried out through implementation of the tasks outlined below.

6.1 Task 1 – Existing Landscape Description

Duke Energy will review existing available information in the study area to characterize the existing landscape within the proposed expanded Project area and the scenic quality of the landscape. This task will primarily involve review of available baseline information to describe the key scenic characteristics of the existing landscape within the Project area and surrounding lands expected to potentially be within visual range of Project facilities. The objective will be to identify and describe the key elements of the existing landscape, including landforms and terrain (i.e., slope); water features; vegetative cover type, pattern, height, and distribution; soils; geology; and cultural features (i.e., developed uses and structural modifications of the natural landscape). This task will also characterize relevant management and/or regulation of the scenic resources within the Visual Resources Study area, including vegetation management and project operations. The landscape description will include the fundamental visual elements of form, line, color, texture, and pattern. Key information sources are expected to be U.S. Geological Survey (USGS) topographic maps and the National Land Cover Database; federal, commonwealth/state and local government planning documents that include information on scenic and visual resource conditions; and photographs and aerial/satellite imagery.

6.2 Task 2 – Seen Area Analysis

A preliminary seen area (viewshed) analysis will be conducted to identify areas within the existing landscape from which the existing and proposed Bad Creek project facilities are or would potentially be visible. The seen area analysis will be run in ArcGIS using the preliminary expanded Project layout and a U.S. Geological Survey 10-meter digital elevation model dataset.

The analysis results will identify locations on the terrain surface with a direct line of sight to the tip elevation of one or more project features (visible/not visible).

The initial seen area analysis will be done on a bare-earth basis, which represents line-of-sight conditions based only on topography; it does not account for factors that might obscure or block visibility from a specific location or at certain times, such as weather conditions, existing structures or vegetation. Because the primary Project area is predominantly forested, the bare-earth seen area analysis results will be a conservative representation of potential visibility.

The initial seen area analysis will address the Project reservoirs and directly associated facilities, as well as the existing transmission corridor. A subsequent viewshed analysis covering the new transmission corridor would be conducted if a new corridor is defined for the Bad Creek II Complex. The seen area analysis will be used to identify potential Key Views for the field investigation (Section 6.3) and selection of Key Views for analysis (Section 6.4).

6.3 Task 3 – Field Investigation

This task will be a field investigation of the "visible" areas identified through the seen area analysis task. Specific field instructions and data forms will be prepared in advance of the field effort. Photographs and field records will be carefully logged and organized immediately following the field investigation.

The field work to collect facilities inventory data will entail qualified personnel (two-person crew) operating Global Positioning System (GPS) equipment to take photographs at each potential Key View location. GPS location points will be recorded for each simulation viewpoint, preferably using a GPS unit with sub-meter accuracy, but at least 3-meter accuracy, to ensure repeatability. Multiple site photographs will be collected at each location using a tripod.

Site photographs to be used in assessment will be correlated with x, y, z coordinates and heading angle. For each inventory point, the following information will be collected:

- GPS – accuracy for photo-simulations should be within 3 feet (+or- 1 meter horizontal)
    - GPS model
    - PDOP (position dilution of precision) and post-processing information
- Camera
    - Make, model (suitable for producing photo-simulations)

    - Camera lens information
- Ground truth
    - Confirm Key View based on logical on-site conditions
    - Field notes – time of day, atmospheric condition, heading of camera view

This field investigation will be conducted during leaf-off conditions (i.e., between November and April).

6.4 Task 4 – Key Views Selection

This task will result in selection of a representative subset of the potential Key Views investigated during the field investigation that will be used as Key Views for the visual impact analysis. The objective will be to identify a set of Key Views (up to four) that adequately covers the range of visibility and potential scenic and visual impacts for the Project. Considerations that will be used in selecting specific Key Views include viewing distance, to ensure adequate representation of potential foreground, middleground, and background views of the Project features; viewing direction; and the types of viewer groups (typically including residents, recreational users and motorists) that might experience views of the Project facilities. This task will involve desktop analysis of data developed through the first three study tasks, and supplemental data involving travel routes and potential viewer characteristics. Additionally, Duke Energy will consult with stakeholders (the Recreation Resources Committee) to identify representative and critical Key Views.

6.5 Task 5 – Existing Visual Quality Assessment

This task will involve assessing the existing scenic and visual quality at each Key View identified in the Key Views Selection task. The assessment will be based on consideration of the standard visual elements (form, line, color, texture, and pattern), the apparent naturalness of the landscape as seen from the specific Key View, and the degree of human modification of the landscape.

Scenic and visual quality will be evaluated using concepts from the USFS Scenery Management System (SMS), includes landscape character descriptions and scenic integrity objectives for USFS landscapes that can be used to help assess the compatibility of a proposed project with the

surrounding landscape. The evaluation will take into account a wide variety of landscaped characteristics, such as:

- Slope
- Vegetative cover type, pattern, height, and distribution
- Water
- Color, texture, line
- Effects of adjacent scenery
- Cultural modifications

Distance zones are used to describe how viewers see the landscape. The SMS identifies four distance zones:

- immediate foreground (0 to 300 feet);
- foreground (300 feet to 0.5 mile);
- middleground (0.5 mile to 4 miles); and
- background (4 miles to the horizon).

Immediate foreground and foreground views tend to highlight details ranging from individual leaves to individual trees. The middleground "is usually the predominant distance zone at which National Forest landscapes are seen, except for regions of…tall, dense vegetation." In the background, "texture has disappeared and color has flattened, but large patterns of vegetation or rock are still distinguishable" (USDA, 1995).

Scenic classes recognize the idea that all National Forests have "value" as scenery. The classes, which range from 1 (most valuable scenery) to 7 (least valuable scenery) can be used to consistently evaluate the scenic value and relative scenic importance of a particular area. They are used in forest planning to compare values of scenery with other types of resources. The higher the scenic value (i.e., Scenic Classes 1 and 2), the more important it is to maintain.

Scenic Integrity Objectives range from very high to very low and express the desired future aesthetic condition of a forest. Scenic Integrity Objectives descriptions, as defined below, generally express a comparison to existing or preferred conditions (USDA 1995):

- Very High: "landscapes where the valued landscape character 'is' intact with only minute if any deviations."

- High: “landscapes where the valued landscape character ‘appears’ intact. Deviations may be present but must repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident.”
- Moderate: “landscapes where the valued landscape character ‘appears slightly altered.’ Noticeable deviations must remain visually subordinate to the landscape character being viewed.”
- Low: “landscapes where the valued landscape character ‘appears moderately altered’ Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles outside the landscape being viewed.”
- Very Low: “landscapes where the valued landscape character ‘appears heavily altered.’ Deviations may strongly dominate the valued landscape character.”

6.6 Task 6 – Visual Analysis

This task will involve specific assessment of the expected scenic and visual impact at each Key View, based on changes in landform, change or addition to structures, to determine the potential extent of visual contrast introduced by the proposed Bad Creek II Complex, and the expected viewer response to those changes. Visual simulations of the expected appearance of the expanded Project from a specified set of Key Views will be used to provide the basis for the visual analysis, which includes assessing the effect the expansion of the Project to the landscape would have on the area's landscape character and the landscape's scenic integrity. Contrast will be assessed by considering the differences in form, line, color, texture, scale, and landscape juxtaposition between the existing conditions and conditions after implementation of the Bad Creek II Complex.

These Project elements are then assessed in terms of their level of impact based on setting and viewer characteristics. Considered in terms of the setting, the assessment of impacts is made based on proximity to views—that is, whether the project element is within the foreground, middleground, or background in relation to the viewpoint. The visual impact assessment consists of an overlay of Contrast, Landscape Characteristic, and Views to determine whether the alternative is dominant to the characteristic landscape, subordinate to the characteristic

landscape, or somewhere in between. Impact results derived for the individual Key Views will be aggregated and evaluated to provide an overall assessment of the visual impacts of the proposed Project.

6.7 Task 7 – Visual Management Consistency Review

This task will involve review of the consistency of the expanded Project with visual resource protection guidance established in applicable land use plans and regulations, to the extent that such guidance exists. Based on current information regarding land ownership and management, this task will involve review of comprehensive plan direction and zoning requirements adopted by Oconee County and USFS for surrounding areas.

6.8 Task 8 – Mitigation Assessment

This task will involve identification and assessment of potential mitigation measures that would address the scenic and visual impacts of the Bad Creek II Complex identified during the visual impact assessment. Measures that could reduce the contrast created by the Project facilities, and thereby reduce the level of scenic and visual impact, will be identified. Potential measures will be evaluated in terms of their physical feasibility, approximate cost, and effectiveness in reducing contrast and visual impact.

6.9 Task 9 – Conceptual Design of Bad Creek II Complex

This task will assess, to the extent possible, visual resource conditions relative to site layouts, conceptual designs, proposed construction processes, and lighting. Three-dimensional renderings will be produced.

As part of this task, Duke Energy will evaluate relevant existing management plans or guidance documents related to lighting.

6.10 Analysis and Reporting

Results of this study will be included in the Initial and Updated Study Reports. Duke Energy anticipates that the Visual Resources Study report will include Project information and background, a depiction and description of the study area, methodology, results, and analysis and

discussion. The report will also include relevant stakeholder correspondence and/or consultation, as well as literature cited.

7 Schedule and Level of Effort

The preliminary schedule for this study is outlined in Table 7-1. The estimated level of effort for this study is approximately 850 hours. Duke Energy estimates that the Visual Resources Study will cost approximately $150,000 to complete.

Table 7-1. Proposed Visual Resources Study Schedule

Task	Proposed Timeframe for Completion
Study Planning and Existing Data Review	August – December 2022
Tasks 1-2 (Existing Landscape Description and Seen Area Analysis)	January 2023 – March 2023
Tasks 3-7 (Field Investigation, Key Views Selection, Existing Visual Quality Assessment, Visual Analysis, and Visual Consistency Review)	April 2023 – November 2023
Task 8-9 (Mitigation Assessment and Conceptual Design of Bad Creek II Complex)	Spring – Summer 2024
Distribute Draft Study Report with the Initial Study Report	January 2024
Distribute Revised Study Report with the Updated Study Report	January 2025

8 References

Duke Energy Carolinas, LLC (Duke Energy). 2014. License Application Keowee-Toxaway Project FERC No. 2503. Environmental Report (Exhibit E).

_____. 2022. Pre-Application Document, Bad Creek Pumped Storage Project FERC Project No. 2740, Oconee County, South Carolina. February 23, 2022.

U.S. Department of Agriculture (USDA). 1995. Agriculture Handbook 701, Landscape Aesthetics-A Handbook for Scenery Management.

Appendix F

Recreational Resources Study Plan

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APPENDIX F

RECREATIONAL RESOURCES REVISED STUDY PLAN

Bad Creek Pumped Storage Project
FERC Project No. 2740

December 2022

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RECREATIONAL RESOURCES REVISED STUDY PLAN
BAD CREEK PUMPED STORAGE PROJECT
FERC PROJECT NO. 2740
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ACRONYMS AND ABBREVIATIONS

ADA	American with Disabilities Act
Bad Creek or Project	Bad Creek Pumped Storage Project
Bad Creek II Complex	Bad Creek II Power Complex
CFD	computational fluid dynamics
Duke Energy or Licensee	Duke Energy Carolinas, LLC
FERC or Commission	Federal Energy Regulatory Commission
Conditions Assessment	Foothills Trail Corridor Conditions Assessment
KT Project	Keowee-Toxaway Hydroelectric Project
MOA	Memorandum of Agreement
PAD	Pre-Application Document
RMP	Recreation Management Plan
RUN Study	Recreation Use and Needs Study
SCDNR	S.C. Department of Natural Resources
WMA	Wildlife Management Area

1 Study Requests and Formal Comments

The Federal Energy Regulatory Commission (FERC or the Commission) issued Scoping Document 2 on August 5, 2022, which identified the following environmental resource issues to be analyzed in the National Environmental Policy Act document for the Bad Creek Pumped Storage Project (Project) relicensing related to recreational, land use, and aesthetic resources. The resource issues address the effects of continued Project operations under the Existing License as well as potential construction and operation of a second powerhouse during the New License term for the Bad Creek II Power Complex (Bad Creek II Complex):

- Effects of proposed project construction, operation, and maintenance on recreational use in the Project boundary, including access to the existing Foothills Trail.
- Use of Project lands for recreation activities, including fly fishing and birdwatching.
- Effects of project construction, operation, and maintenance existing land uses in project-affected area.
- Effects of land management activities within the project boundary on environmental resources.
- Effects of project construction, operation (including the presence of project facilities), and maintenance activities on visual resources.

In Section 7.1.6.3 of the Pre-application Document (PAD) (Duke Energy 2022), Duke Energy Carolinas, LLC (Duke Energy or Licensee) proposed to conduct a Recreational Resources Study in support of the proposed the Bad Creek II Complex. No study requests related to recreational resources were received during the scoping process; however, formal comments on the PAD and Scoping Document 1 regarding recreational resources were received from Upstate Forever and the Foothills Trail Conservancy. Comment responses were included in Appendix A of the Proposed Study Plan, which was filed with the Commission on August 5, 2022. Stakeholder comments on the Proposed Study Plan were submitted by the Commission, South Carolina Department of Natural Resources (SCDNR), Upstate Forever, and the Foothills Trail Conservancy. Resource issues identified by FERC (listed above) will be addressed through a combination of the Recreational Resources Study, Visual Resources Study, and Exhibit E of the license application; resource issues and stakeholder comments pertinent to the Recreational

Resources Study were considered in the development of this Revised Study Plan and summaries of comments and responses are included in Appendix A. Copies of all comments and correspondence are provided in Appendix B.

2 Goals and Objectives

The Recreational Resources Study will have four main components: (1) a Recreation Use and Needs (RUN) Study for the 43-mile-long portion of the Foothills Trail (or trail) managed by Duke Energy; (2) a Foothills Trail Corridor Conditions Assessment (Conditions Assessment) of the 43-mile-long portion of the Foothills Trail managed by Duke Energy; (3) an Existing Recreational Use Characterization of Whitewater River cove; and (4) a Recreational Public Safety Evaluation of Whitewater River cove.

The goals of the RUN Study are to assess current recreation use and identify any future recreation needs along the 43-mile-long segment of the Foothills Trail and associated access areas that are maintained by Duke Energy and referenced in the existing Recreation Plan for the Project.[1] The data collected during the RUN Study and Conditions Assessment will be used to estimate the Foothills Trail's hiking and backpacking carrying capacity. Information collected during the RUN Study will be used to develop an updated Recreation Management Plan (RMP), as needed, for the New License term and will support characterization of existing recreational use levels for areas that could be temporarily impacted by the Bad Creek II Complex construction. An updated RMP for the Project will be developed with or following the Final License Application, as needed, to address existing and proposed facilities and arrangements. Duke Energy will consult with interested stakeholders throughout the relicensing process regarding necessary recreational facility maintenance or potential new enhancement measures. The goal of the Conditions Assessment will be to evaluate the current condition of trail surface and corridor included in the 43-mile segment of the Foothills Trail maintained by Duke Energy and identify key areas of future maintenance needs or improvements.

[1] Duke Energy filed a copy of the 1980 document, "A Plan for Development and Management of the Foothills Trail and a Supplement to the Bad Creek Pumped Storage Project #2740 Exhibit R," with the Commission on July 25, 2022, in response to additional information requested by FERC staff.

The goal of the Whitewater River cove Existing Recreational Use Characterization is to characterize recreation use in Whitewater River cove and inform Duke Energy of the level of boating use disruption that could occur associated with Bad Creek II Complex construction. The goal of the Recreational Public Safety Evaluation is to evaluate potential public safety risks, specifically those associated with recreation activities at or near Whitewater River cove, that may be created or exacerbated by the Bad Creek II Complex during the construction and operation phases.

3 Study Area

The study area will include the 43-mile-long segment of the Foothills Trail (Figure 3-1) and associated access areas (Figure 3-2) on non-Project lands maintained by Duke Energy under the Original License as Project-related facilities. The study area will also include the entrance road to Musterground Road which is accessed via the Bad Creek Hydro Project Trail Access, and the Upper Whitewater Falls Trail Access, which is managed by the U.S. Forest Service. The 43-mile Duke Energy-maintained trail segment begins on the western end of the Foothills Trail at the Duke Energy / U.S. Forest Service property line on the Whitewater River near the Bad Creek Project and extends east to the Duke Energy / Table Rock State Park property line approximately 1,000 feet southwest of the top of Pinnacle Mountain. There are five spur trails that connect with the Duke Energy section of the Foothills Trail that are managed and maintained by Duke Energy including Laurel Fork Falls, Hilliard Falls, Lower Whitewater Falls Overlook, Bad Creek, and Coon Branch. The 43-mile segment includes four trailheads providing vehicular access including Sassafras Mountain Trail Access, Chimney Top Gap Trail Access, Laurel Valley Trail Access, and Bad Creek Hydro Project Trail Access, and four trailheads providing boat-in only trail access, including Laurel Fork Falls Spur Trail Access, Toxaway River Trail Access, Canebrake Trail Access, and Horsepasture River Trail Access[2].

[2] The PAD references 10 trailhead access points on the Foothills Trail. For clarity this document categorizes trailheads as areas managed by Duke Energy where users may access the trail from a parking facility or Lake Jocassee and a spur trail as providing access to a specific point off of the main Foothills Trail. This classification is consistent with the 1996 Duke Power Company Lake Management Foothills Trail Maintenance Program Policy and Procedures. Note the trail section from the Bad Creek Trail Access to the Foothills Trail is referenced as the Bad Creek Spur Trail in this document.

The study will also include an evaluation of recreation use in Whitewater Cove that may be temporarily affected if the Bad Creek II Complex is constructed. Whitewater Cove is identified in Figure 3-3.

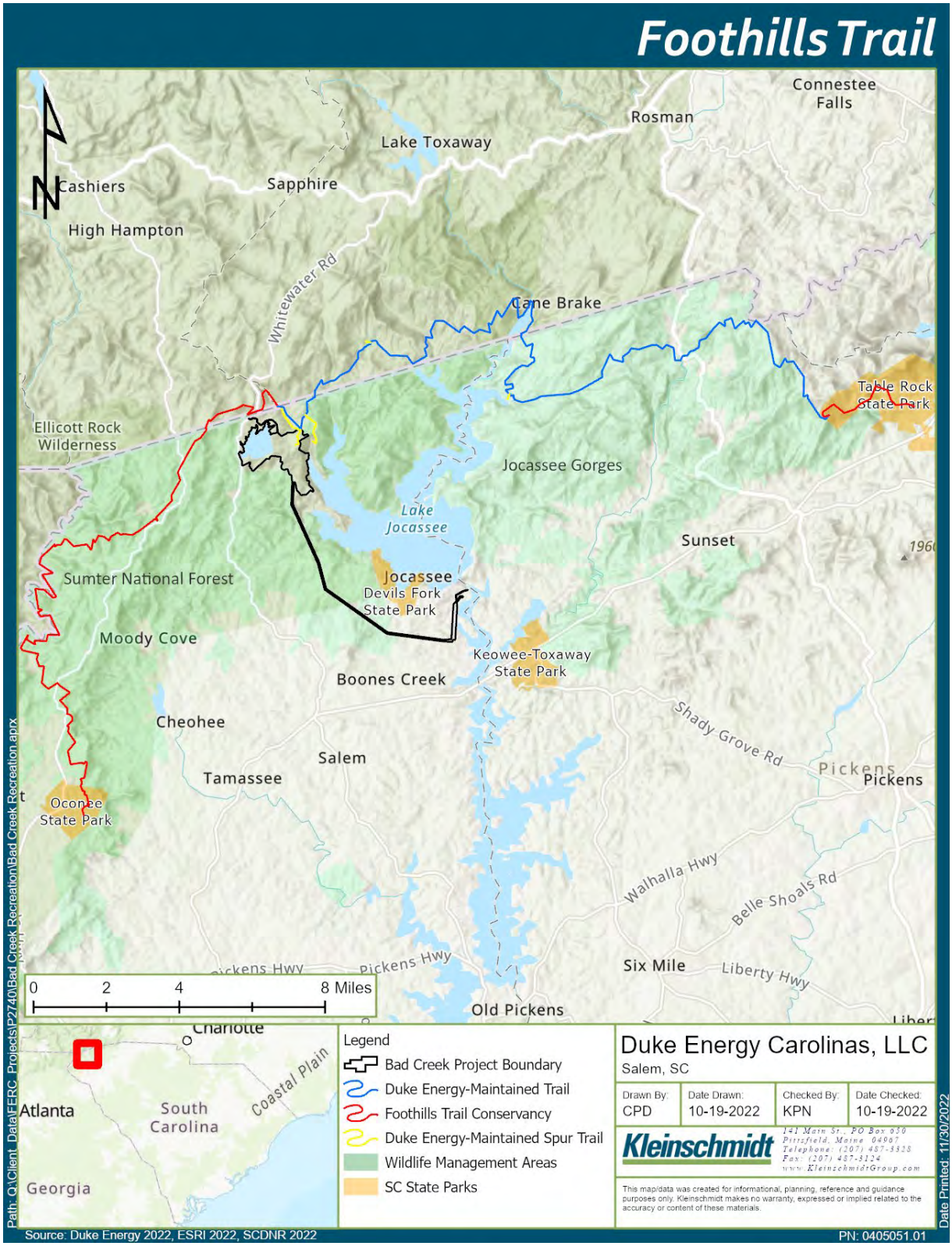

Figure 3-1. Expanded Project Boundary and Foothills Trail

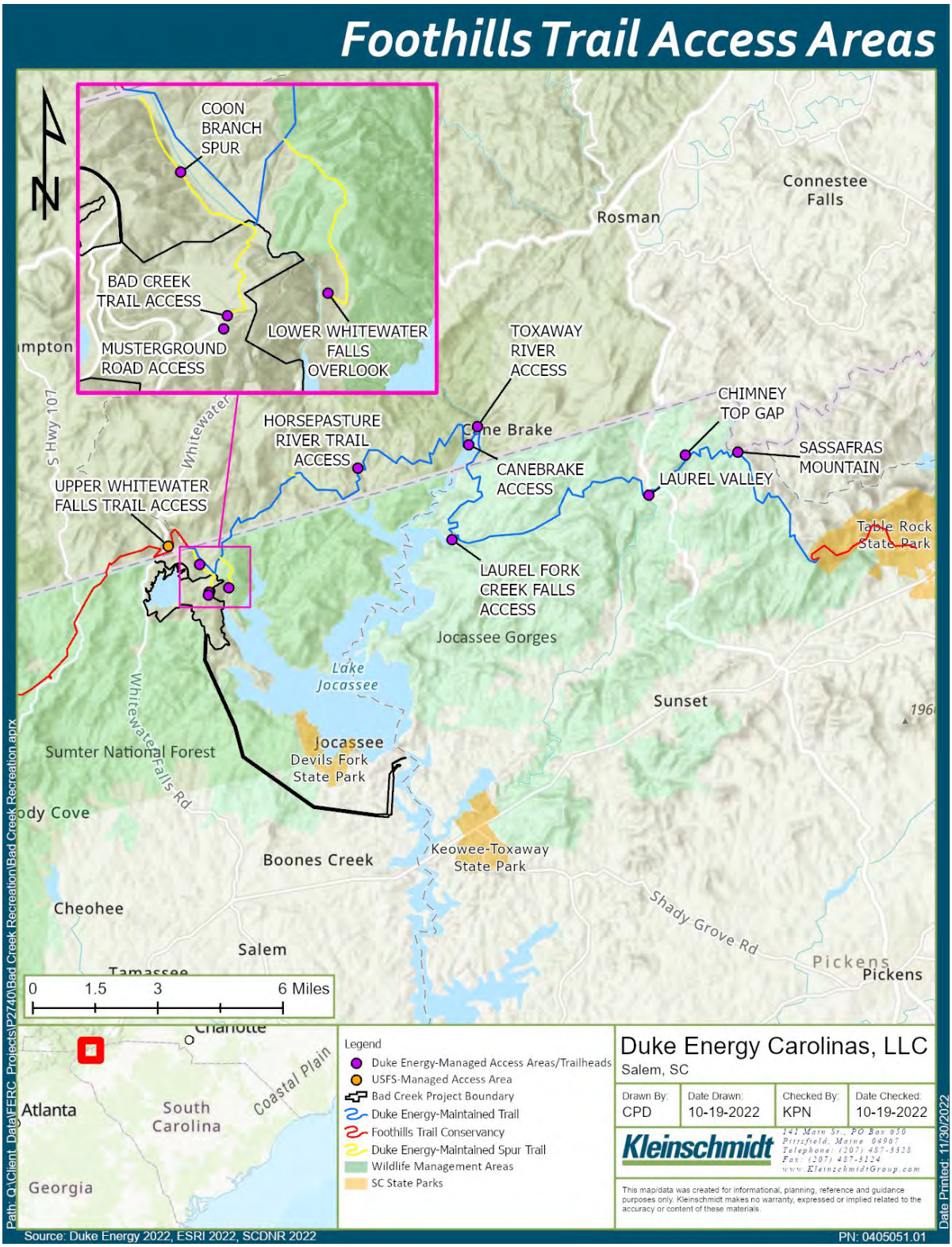

Figure 3-2. Foothills Trail Access Areas within the Study Area

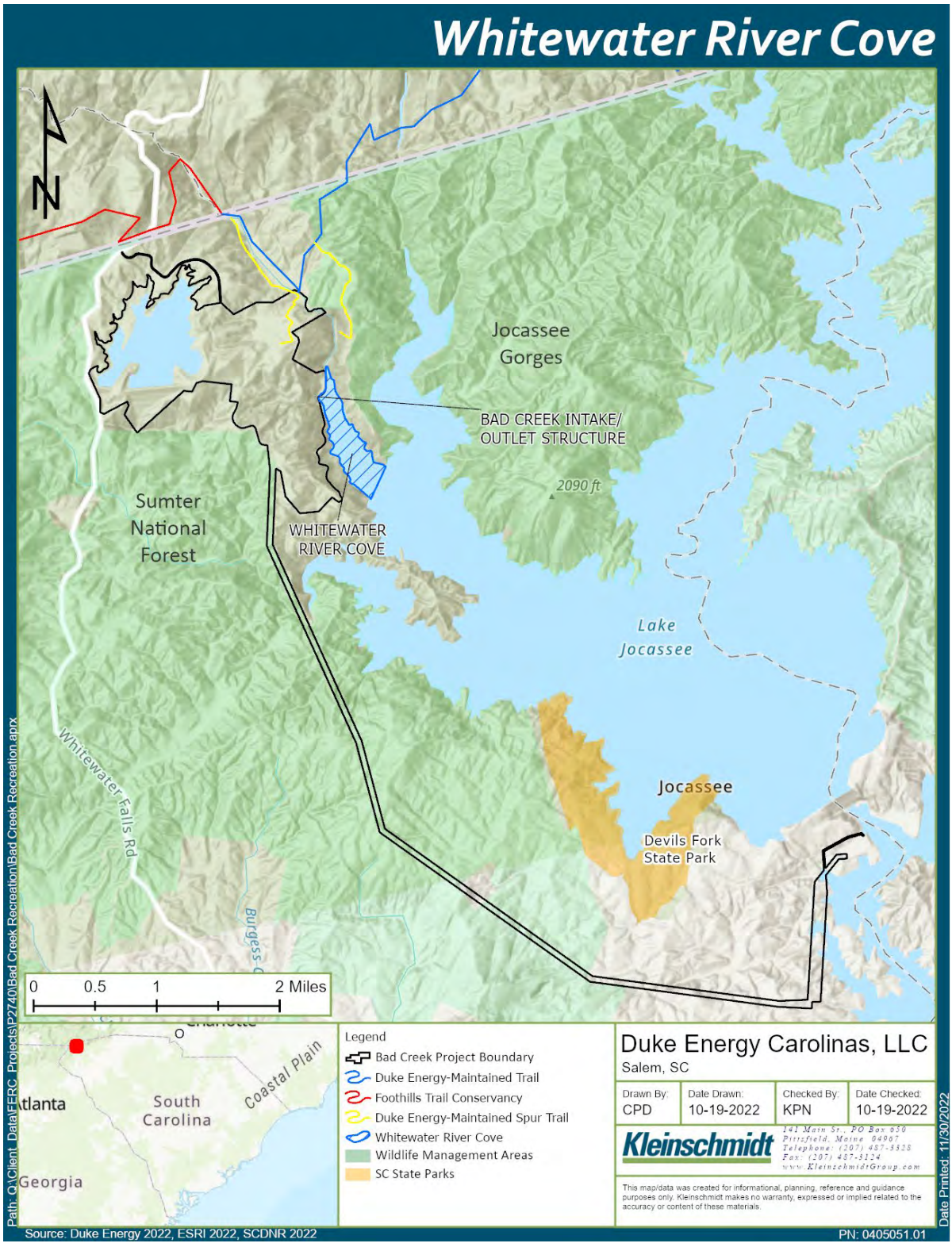

Figure 3-3. Study Area and Whitewater River Cove in Lake Jocassee

4 Background and Existing Information

Existing relevant and reasonably available information regarding recreational opportunities in the Project vicinity is presented in Section 6.8 of the PAD (Duke Energy 2022). The Project is located in a remote area in the Blue Ridge Mountains in South Carolina, just south of the North Carolina state border. Lake Jocassee, which serves as the Project's lower reservoir but is not included within the Project Boundary, provides nearby recreational opportunities for visitors. Lake Jocassee is surrounded by a series of steep-sided gorges with minimal residential development along the shoreline; the only developed public access is via Devils Fork State Park. Lake Jocassee provides opportunities for boating (i.e., motor, sailing, canoeing, kayaking, paddle boarding, etc.), fishing, swimming, and scuba diving. The surrounding area also offers visitors opportunities for hiking, camping, hunting, whitewater rafting, and viewing wildlife and waterfalls. The Project is surrounded by public non-Project recreation facilities and opportunities including the Whitewater River, Lake Jocassee, Jocassee Gorges, Devils Fork State Park, Keowee-Toxaway State Park, Toxaway Game Land, and Sumter National Forest, which all provide a wide range of recreational activities.

The Foothills Trail is a 77-mile trail linking Oconee and Table Rock State Parks that was completed in 1981. Portions of the Foothills Trail not managed by Duke Energy are managed by the Foothills Trail Conservancy, a non-profit 501(c)(3) membership organization composed of government agencies, recreational outfitters, and non-governmental organizations. As shown on Figure 3-2 and Figure 3-3 , the Bad Creek Spur Trail, Bad Creek Trail Access, and the Musterground Road Access are located within the expanded Project Boundary for the proposed Bad Creek II Complex. All other trail sections, access points, and support facilities are located outside of the existing and proposed expanded Project Boundary.

During the original licensing of the Project, Duke Energy agreed to build and maintain the central section of the Foothills Trail as mitigation for the loss of recreation opportunities associated with Project construction and in response to stakeholder request for a recreation trail

in the area. Duke Energy constructed the approximately 43-mile trail[3] and associated spur trails from Pinnacle Mountain (Table Rock State Park) west to the Whitewater River (Nantahala National Forest), following the northern shoreline of Lake Jocassee (Duke Energy 1981). While the 43-mile trail segment is located on non-Project lands[4], it is maintained by Duke Energy and private contractors with coordination and assistance from the Foothills Trails Conservancy. The Foothills Trail Conservancy is responsible for major and minor maintenance for the remaining 34 miles of the Foothills Trail on non-Duke Energy owned property.

The 43-mile trail segment includes four trailheads providing vehicular access, four trailheads providing boat-in and hike-in only trail access and five spur trails. Horsepasture Trail Access, Toxaway River Trail Access, Canebrake Trail Access, and the Laurel Fork Creek Falls Spur Trail Access provide access to/from Lake Jocassee via trail or boat. These access points do not have developed parking or recreation facilities and there is no vehicular access. Sassafras Mountain Trail Access, Chimney Top Gap Trail Access, Laurel Valley Trail Access, and Bad Creek Hydro Project Trail Access are all trailheads that provide vehicular access to the Foothills Trail.

The shoreline of Lake Jocassee is managed and protected through the Keowee-Toxaway Hydroelectric (KT) Project Shoreline Management Plan (Duke Energy 2014). For the benefit of natural, cultural, and recreation resources, Duke Energy plans to continue operating the KT Project with the existing restrictions on land and shoreline development in the vicinity of the Bad Creek Project Boundary as defined in the KT Project Shoreline Management Plan.

Current construction planning for the potential Bad Creek II Complex anticipates access to the Bad Creek Hydro Project Trail Access to remain open to provide continued access to the western portion of the Foothills Trail as well as the Wildlife Management Area (WMA) lands accessed by Musterground Road. Impacts to recreation due to construction of the Bad Creek II Complex

[3] While the original Exhibit R states 31 miles of trail were to be constructed, and the updated Exhibit R identifies approximately 38 miles, modern documents and the easement for the trail corridor identify 43 miles of main trail and 3 miles of spur trail. The spur trails are managed by Duke Energy.

[4] Duke Energy holds a 200-foot wide (100 feet from center line) lease for the main portion of the trail, five spur trails, and Sassafras Mountain, Chimney Top Gap, and Laurel Valley Trail Access areas. This easement is not located within the Bad Creek Project Boundary.

are believed to be limited to water-based recreation in the Whitewater River arm of Lake Jocassee where restrictions will be necessary during the construction. If closures of the Bad Creek Hydro Project Trail Access parking area are necessary during construction, there would be short-term impacts to recreational opportunities for the public on the western portion of the Foothills Trail and Musterground Road WMA lands. Other parking areas do, however, provide Foothills Trail access, including the nearby Upper Whitewater Falls Trail Access parking area. The Upper Whitewater Falls Trail Access parking area may have temporary, short-term impacts during construction if the Bad Creek Hydro Project Trail Access parking area is closed.

5 Project Nexus

Most recreation opportunities in the Project vicinity consist of water-based activities on Lake Jocassee and use of the Foothills Trail. Although considered non-Project recreation facilities, the 43-mile segment of the Foothills Trail was developed as a requirement of the Original License for the Project. Currently, Duke Energy also maintains eight access areas and five spur trails along that 43-mile trail segment. Duke Energy anticipates these will continue to be maintained as non-Project facilities for the New License term and therefore, proposes to assess recreation use and needs associated with the 43-mile trail segment, spur trails and access areas. Duke Energy also maintains a Memorandum of Agreement (MOA) for the maintenance and management of the Musterground Road within the SCDNR-managed WMA near the Project. This MOA is included as Attachment 1. Duke Energy plans to continue activities established by the MOA with SCDNR, which may be modified in consultation with stakeholders through the relicensing process, in the New License term. In addition, Duke Energy proposes to assess recreation use at the U.S. Forest Service-managed Upper Whitewater Falls Trail Access parking area to evaluate possible impacts to the site associated with the potential Bad Creek II Complex construction.

In addition, Duke Energy anticipates development of an updated RMP to address management of existing and proposed recreation facilities associated with the Project. The RUN Study will be used to inform development of the updated RMP. The RUN Study will provide information on existing recreational use around the Project that may be temporarily impacted during construction if the Bad Creek II Complex is pursued.

6 Methods

6.1 Task 1 – Foothills Trail Corridor Recreation Use and Needs Methodology

A variety of data collection methods will be employed to characterize current recreational use and determine future needs at the access areas on the Foothills Trail. A detailed description of each data collection method is included below and summarized in Table 6-1.

Table 6-1. Summary of Data Collection Methods

	Data Collection Methods				
Access Area	**Recreation Site Inventory**	**Traffic Counter**	**Trail Counter**	**In-Person User Surveys**	**User Surveys Accessed Via QR Code**
Table Rock State Park[a]			*		
Sassafras Mountain Trail Access	*	*	*		*
Chimney Top Gap Trail Access	*		*		*
Laurel Valley Trail Access	*	*	*	*	*
Laurel Fork Creek Falls Spur Trail Access	*		*		*
Toxaway River Trail Access[b]	*		*	*	*
Canebrake Trail Access	*		*		*
Horsepasture River Trail Access	*		*	*	*
Lower Whitewater Falls Overlook	*		*		*
Bad Creek Hydro Project Trail Access[c]	*	*	*	*	*
Coon Branch Spur Trail			*		*
Musterground Road[d]		*			
Upper Whitewater Falls Trail Access[e]		*			

[a] This site is not maintained by Duke Energy.
[b] If water levels on Lake Jocassee do not allow for boat-in access to the Toxaway River Trail Access, surveys will be conducted at an alternative boat-in access point as identified in consultation with the Recreational Resource Committee.
[c] Two traffic counters will be installed near Bad Creek Hydro Project Trail Access, including one south of the parking area and one north of the parking area.
[d] This access road is managed via the Jocassee Gorges Road Management MOA between SCDNR and Duke Energy.

[e] This access area is managed by the U.S. Forest Service. A traffic counter will be placed at this site pending approval from the U.S. Forest Service.

6.1.1 Recreation Site Inventory

A Recreation Site Inventory Form (Attachment 2) will be completed for each Duke Energy-managed access area along the Foothills Trail. The inventory will document the type, number, and size of facilities and amenities (restrooms, parking areas, boat ramps, picnic shelters and tables, etc.) located at each access area. The general condition of all facilities will be noted and recorded via photograph during the inventory and any facilities that qualify as American with Disabilities Act (ADA) or barrier-free will be identified as such.

In addition, detailed maps of the Duke Energy-maintained portion of the Foothills Trail will be developed that identify parcel boundaries, current property owner(s), access locations, spur trails, structures, and facilities/amenities. A preliminary map of these features is included as Attachment 3.

6.1.2 Traffic and Trail Counts

Traffic and trail counters will be installed at the access areas as noted in Table 6-1. For all areas except Musterground Road, data will be collected from installation in March through November 2023. A traffic counter will be installed at the gate to Musterground Road only when public access is allowed, or from September 15, 2022 - January 15, 2023, and again March 20 – May 10, 2023. Data will be downloaded approximately every two weeks to ensure the counters are working properly and no vandalism has occurred.

Traffic and trail counter data will be used to determine recreation use at each access area. At access areas where traffic counters are installed, traffic counter data will be used to provide total daily and average vehicles that entered the access area by month and by day type. Traffic counter data collected at the Upper Whitewater Falls Trail Access will be used to determine potential impacts associated with the potential Bad Creek II Complex construction. To supplement the traffic counter data collected at the Laurel Fork Creek Falls Spur Trail Access, spot counts will be collected when staff are on-site to download counter data and conduct surveys. Spot counts will identify the number of parking spaces utilized at a given time, including vehicles with trailers that may fill multiple parking spaces at once.

At access areas where trail counters are installed, trail counter data will be used to provide total daily and average visitors that used the access area by month and by day category type.

Approximate locations for traffic and trail counters at the access areas included in the study are listed in Table 6-2.

Table 6-2. Approximate Locations for Traffic and Trail Counters by Access Area

Access Area	Traffic Counter Locations	Trail Counter Locations
Table Rock State Park		35° 1'56.00"N, 82°42'2.19"W
Sassafras Mountain Trail Access	35° 3'52.12"N, 82°46'32.93"W	35° 3'51.62"N, 82°46'36.79"W
Chimneytop Gap Trail Access		35° 3'42.25"N, 82°47'52.87"W
Laurel Valley Trail Access	35° 2'56.97"N, 82°48'50.11"W	35° 3'2.85"N, 82°48'44.00"W
Laurel Fork Creek Falls Spur Trail Access		35° 1'56.00"N, 82°53'38.30"W
Toxaway River Trail Access		35° 4'18.26"N, 82°53'14.12"W
Canebrake Trail Access		35° 3'56.79"N, 82°53'25.45"W
Horsepasture River Trail Access		35° 3'23.2"N, 82°56'13.60"W
Lower Whitewater Falls Overlook		35° 0'48.11"N, 82°59'22.12"W
Bad Creek Hydro Project Trail Access	35° 0'43.73"N, 83° 0'0.59"W 35° 0'40.31"N, 83° 0'0.58"W	
Coon Branch Spur Trail		35° 1'6.96"N, 82°59'51.36"W
Musterground Road	35° 0' 41.9832" N, 82° 59' 58.2" W	
Upper Whitewater Falls Trail Access	35° 1'41.28"N, 83° 1'0.92"W	

6.1.3 User Surveys

User surveys will be collected in-person at four access areas— Laurel Valley Trail Access, Toxaway River Trail Access, Horsepasture River Trail Access, and Bad Creek Hydro Project Trail Access. Surveys will be collected on a statistically determined mix of weekdays, weekends, and holiday weekends. Survey clerks will collect surveys on 30 days between March and November at each access area during 4-hour shifts (Table 6-3). Surveys will include questions regarding user demographics, group size, length of stay, type of recreation activities participated in, and perceptions of crowding and condition of recreation facilities. A sample Recreation Use Survey Form is included in Attachment 4. The data collected will be used to identify recreation

use patterns and use estimates at the access areas. The data on user perceptions of crowding will also be used to determine future expansion needs at the access areas.

Table 6-3. In-Person Survey Schedule by Month

Month	Weekday	Weekend Day	Holiday
March	1	1	0
April	1	1	0
May	1	1	1
June	2	2	0
July	2	2	1
August	2	2	0
September	1	2	1
October	2	2	0
November	1	1	0
Total	**13**	**14**	**3**

In addition to the in-person surveys, signage will be posted at the access areas identified in Table 6-3 that will include a Quick Response (QR) code linking to an online version of the survey. Recreators will have access to the survey 24 hours a day, 7 days a week during the study window of March-November 2023. Surveys accessed via QR code will be analyzed separately from those collected in-person.

6.1.4 Parking Demand Analysis

Traffic counters will also be used to conduct a parking demand analysis at access areas with parking lots. To determine parking demand using traffic counter data, the average number of vehicles that utilize the access area on a specific day type will be divided by the estimated turnover. Since traffic counter data only accounts for vehicles entering an access area, length of stay must be considered. Length of stay is the average amount of time (hours) a visitor spends at an access area per recreation trip. Length of stay will be estimated using information collected during surveys. Length of stay is ultimately used to determine turnover at an access area. Turnover is how often a vehicle leaves an access area and is replaced over a 24-hour period. Turnover is applied to the average total vehicles, which is then compared to the total parking spaces available at the access area.

The formula for determining average percent capacity is shown below.

$$\left(\frac{\frac{Total\ Average\ Vehicles}{Turnover}}{Available\ Parking\ Spaces} \right) * 100$$

6.1.5 Trail Carrying Capacity

Duke Energy is proposing to partner with Applied Trails Research to apply the recreation user data collected during the RUN Study to the information collected during the Conditions Assessment (as described in Section 6.2), and pertinent cultural, environmental and RTE information to estimate current hiking and backpacking carrying capacity of the Trail. Carrying capacity of the trail will be determined by identifying major issues or concerns along the corridor, including condition issues (i.e., issues that may not be addressed with routine maintenance), safety issues, impacts to cultural or natural resources, and busy visitation areas and times. Maps of the corridor that display the location of these issues, along with GPS locations and trail mile, will be developed.

6.1.6 Future Recreation Use Analysis

Future annual visitation to the 43-mile Foothills Trail segment will be estimated based on review of existing population forecasts for Oconee and Pickens counties, SC and Jackson and Transylvania counties, NC. The analysis will also include population forecasts for any counties in South Carolina, North Carolina, and Georgia reported on the recreation user surveys. The population forecasts will be applied to the annual use estimates for the Project to determine a future recreation use estimate. Duke Energy will also review South Carolina and North Carolina State Comprehensive Outdoor Recreation Plans, Oconee and Pickens County Master Plans, and the South Carolina and North Carolina State Park Master Plans during the future recreation use analysis. This information will be considered when determining future recreation needs at the Project.

6.1.7 Recreation Needs Assessment

The need for recreation and site development or modifications of existing recreation resources will be assessed based on the inventory, condition assessment results, parking demand

assessment, user survey results and future recreation use estimates. The needs assessment will focus on the existing condition and user opinions of access areas, the presence of barrier free or ADA facilities at access areas, and the ability of access areas to meet current and anticipated future recreation demand. The need for new access areas, facilities, and/or amenities, and improvements to existing access areas will be determined through assessment of the information collected and consultation with stakeholders.

6.2 Task 2 – Foothills Trail Corridor Conditions Assessment

An assessment of the Foothills Trail corridor will be conducted during the 2023 study season by a professional trail builder not currently providing maintenance on any portion of the Foothills Trail maintained by Duke Energy. All 43 miles of the main trail corridor as well as spur trails will be assessed for trail tread, out slope, backslope, drainage, constructed structures (not including engineered bridges) and corridor condition. Trail standards from the Trail Solutions guide (Felton 2004) on building singletrack will be used as a base for trail condition analysis. Constructed structures (such as stairs, hand railings, bridges, etc.) will be identified and recorded and location will be tracked geospatially. Structures in need of significant maintenance or replacement will be recorded in detail with photo documentation. Similarly, trail condition and corridor features requiring maintenance or repair as well as areas of significant erosion, areas with significant drainage issues (i.e., standing water), or obstructed areas along the trail (i.e., downed trees), and notable occurrences of litter and vandalism will be recorded and tracked geospatially. At the end of each mile, the inspector will develop a qualitative assessment of that trail segment. A final report will summarize all assessment findings and identify and prioritize immediate as well as deferred maintenance needs. Immediate needs include those related to risk management or safety or acute impacts to cultural or natural resources.

An inspection of engineered bridges on the Foothills Trail is performed every five years by a licensed Professional Engineer in accordance with the Duke Energy Foothills Trail Maintenance Program[5].

5 The latest engineering inspection was conducted in 2021 and a detailed report including bridge locations and engineer's findings will be included in the 2024 Recreational Resources Study Report.

6.3 Task 3 – Whitewater River Cove Existing Recreational Use Evaluation

The Project's existing lower reservoir inlet/outlet structure is located on the western shore of the Whitewater River arm of Lake Jocassee. If Duke Energy constructs the Bad Creek II Complex, construction of the new inlet/outlet structure will occur in this general area, requiring the Whitewater River cove to be substantively closed to public boating use for an approximately five-year period. Duke Energy will develop more specific schedules and plans for closures as construction plans for the Bad Creek II Complex advance and in consultation with stakeholders. To establish a baseline of recreational use in Whitewater River cove, Duke Energy proposes to conduct a recreational use evaluation within the cove. This evaluation will inform Duke Energy of the level of boating use disruption that could occur associated with the construction of the Bad Creek II Complex.

Duke Energy will deploy a drone over the Whitewater River cove to capture images of recreation use within the cove. This imagery will be used to create a comprehensive overview of boating use in the Whitewater River cove. Drone flights will occur on 20 individual days scheduled between Memorial Day weekend and Labor Day weekend to evaluate use. Drone flights will be conducted on a mix of weekdays, weekends, and holidays and imagery will be collected multiple times per day (such as morning, afternoon, and early evening). Boats within the Whitewater River cove will be categorized as either a motorboat, non-motorized boat (such as canoe or kayak), personal watercraft (such as Jet-Ski), or paddleboard. Each category of boat will be tallied, and totals will be reported by day type.

6.4 Task 4 – Whitewater River Cove Recreational Public Safety Evaluation

The proposed Bad Creek II Complex would have an inlet/outlet structure on the western shore of the Whitewater River cove of Lake Jocassee upstream from the existing Project inlet/outlet structure. For the protection of the public, recreational activities would be prohibited in the Whitewater River cove through much of the expanded Project construction. Operation of the Bad Creek II Complex, alone or in combination with operation of the existing Project powerhouse, has the potential to impact surface water velocities in the Whitewater River cove of Lake

Jocassee, particularly during periods of generation. A three-dimensional computational fluid dynamics (CFD) model has been developed as a part of the Water Resources Study for Duke Energy to support the evaluation of the second inlet/outlet structure's effects within the Whitewater River cove. This study is applicable for the potential for increased bank erosion on the eastern shoreline of the cove as well as effects on recreation (i.e., boaters) near the discharge area. Discussions of increased water velocities in the Whitewater River arm are included in Appendix C (Water Resources Study).

A Recreational Public Safety Evaluation will be carried out in consultation with agencies and other Project stakeholders to evaluate potential public safety risks that may be created or exacerbated by the Bad Creek II Complex during both the construction and operation phases. This evaluation will include but not be limited to identification of areas where access will be temporarily or permanently restricted to the public as well as a boater safety for the Whitewater River arm of Lake Jocassee. Duke Energy proposes a desktop study to evaluate impacts of operation of the expanded Project (i.e., two powerhouses) on water velocities released to the Whitewater River arm of Lake Jocassee through development and use of the CFD model. The updated CFD model will be available to analyze a range of potential operating scenarios to evaluate impacts to water-based recreation in the Whitewater River arm of Lake Jocassee. Information gained from this study will be used to update the Bad Creek FERC Public Safety Plan as necessary.

6.5 Analysis and Reporting

Results of this study will be summarized in the Initial and Updated Study Reports. Duke Energy anticipates that the Recreational Resources Study report will include Project information and background, a depiction and description of the study area, methodology, results, and analysis and discussion. The report will also include relevant stakeholder correspondence and/or consultation, as well as literature cited.

7 Schedule and Level of Effort

The preliminary schedule for this study is outlined in Table 7-1. Cost estimates for the Recreational Resources Study are shown in Table 7-2.

Table 7-1. Proposed Recreational Resources Study Schedule

Task	Proposed Timeframe for Completion
Study Planning and Existing Data Review	August – December 2022
Study Tasks[1]	January 2023 – November 2023
Distribute Draft Study Report with the ISR	January 2024

[1] **Data collection at the Musterground Road access began on September 15, 2022.**

Table 7-2. Recreational Resources Study Cost Estimates

Study Component	Estimated Cost
Foothills Trail Corridor Recreation Use and Needs Study	$500,000
Foothills Trail Corridor Conditions Assessment	$125,000
Whitewater River Cove Existing Recreational Use Evaluation	$30,000
Whitewater River Cove Recreational Public Safety Evaluation	$50,000

8 References

Duke Energy Carolinas, LLC. 2014. Shoreline Management Plan. Keowee-Toxaway Project FERC Project No. 2503. September 1, 2014.

_____. 2022. Pre-Application Document, Bad Creek Pumped Storage Project FERC Project No. 2740, Oconee County, South Carolina. February 23, 2022.

Felton, V. 2004. Trail Solutions. IMBA's Guide to Building Sweet Singletrack. International Mountain Bicycling Association. 272 pp.

Attachment 1

Attachment 1 –
Memorandum of Agreement

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Jocassee Gorges Road Management

Memorandum of Agreement
between the
South Carolina Department of Natural Resources,
and
Duke Energy Carolinas, LLC

I. AUTHORITY

This Memorandum of Agreement (MOA) is made and entered into by and between the South Carolina Department of Natural Resources (including its successors in function and assigns), an agency of the State of South Carolina hereafter referred to as SCDNR, and Duke Energy Carolinas, LLC (including its successors and assigns), a utility owning or controlling lands in the Jocassee Gorges for the purposes of energy production and transmission, hereafter referred to as Duke Energy. SCDNR and Duke Energy may be singularly referred to herein as "Party" and collectively as the "Parties".

II. PURPOSE

SCDNR and Duke Energy have various interests in managing resources including timber lands, wildlife management areas, recreation facilities, and transmission lines in the Jocassee Gorges. These activities utilize a network of roads. Without appropriate management of this road system, erosion from the roads adversely affects the resources of the Jocassee Gorges and makes access to portions of the Jocassee Gorges very difficult.

Duke Energy has entered into a separate Wildlife Management Area (WMA) agreement to lease its transmission line Rights-of-Way (ROWs) of 1,483 acres within the Jocassee Gorges to SCDNR for inclusion in the WMA Program for a 10-year term effective July 25, 2013. This agreement is addressed in a separate lease agreement between SCDNR and Duke Energy. Roads within the WMA Agreement are maintained under this MOA.

Therefore, the purpose of this MOA is to provide a framework for the cooperative management of the road system in the Jocassee Gorges.

III. SCOPE OF WORK

A. Work Area

The work area includes certain roads, where Duke Energy retains privileges of ingress and egress, located within the Jocassee Gorges (Attachment 1).

B. Planning, Implementation and Schedule

This MOA will cover the period of January 1, 2021, or the date of the last signature on this MOA, whichever is later, through December 31, 2025. Within three months prior to expiration of this MOA, the Parties will convene to evaluate the MOA for potential renewal.

IV. FUNCTIONS

- Both Parties: Both Parties agree they will convene annually to review and contribute to the road management plan for each upcoming year.

- SCDNR: SCDNR agrees to assume the responsibility for implementation of the road management plan. SCDNR will maintain the roads in accordance with South Carolina's Best Management Practices for Forestry (BMP), as published by the South Carolina Forestry Commission.

- Duke Energy: Duke Energy will provide $25,000 per year for Jocassee Gorges road maintenance for the term of this MOA. Payments will be made during the first quarter of each calendar year, or as requested by SCDNR during each calendar year.

V. MUTUAL AGREEMENTS

It is mutually agreed by the Parties that:

- This MOA supersedes the previous MOA terms and conditions, executed on January 5, 2015, and such prior MOA is of no further force or effect.

- This MOA may be revised as necessary only by mutual consent of both Parties, by the issuance of a written amendment, signed and dated by both Parties. This MOA may be terminated by either Party upon two months written notice to the other.

- Each Party shall not be responsible for the acts of the other Party and the results thereof. Duke Energy will assume all risk and liability to itself, its agents or employees, for any injury to persons or property resulting in any manner from the conduct of its own operations, and the operation of its agents or employees under this MOA, for any loss, cost, damage, or expense resulting at any time from any and all causes due to any act or acts, negligence, or the failure to exercise proper precautions, of or by itself or its agents or its own employees, while occupying or visiting the premises under and pursuant to the MOA. The liability of the SCDNR is subject to the S.C. Tort Claims Act and other applicable law.

- SCDNR shall not be obligated to expend any of its funds for construction, maintenance, or other matters set forth hereinabove except to the extent that funds have been appropriated and budgeted for these purposes.

VI. EFFECTIVE DATE

IN WITNESS WHEREOF, the Parties hereto have executed this MOA as of the last written date below.

SOUTH CAROLINA DEPARTMENT OF NATURAL RESOURCES

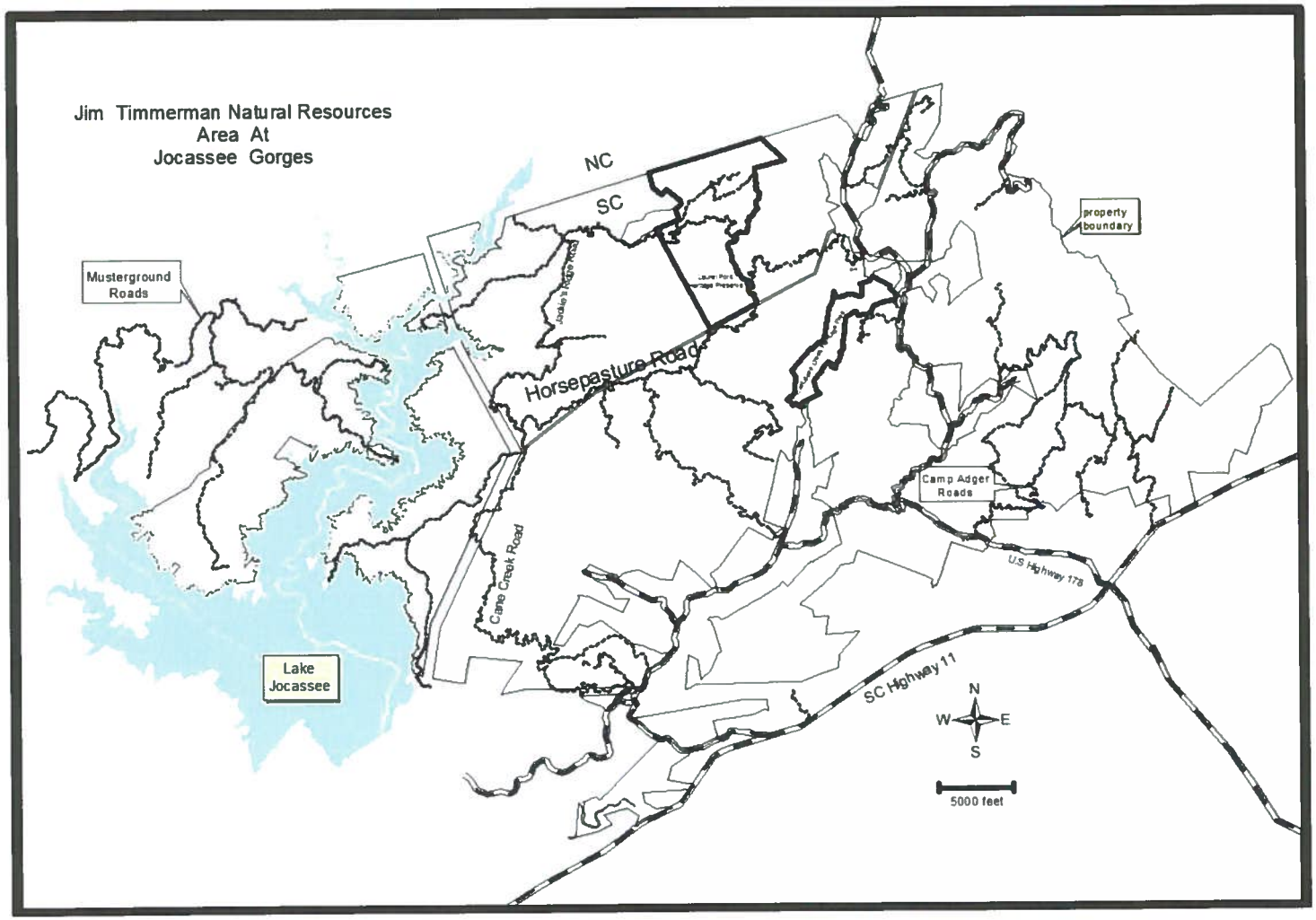
By: _____ Date: 1-12-2021

Robert H. Boyles Jr., Director

DUKE ENERGY CAROLINAS, LLC

By: _____ Date: 1/14/2021

Steven D. Jester, Vice President
Water Strategy, Hydro Licensing and Lake Services



Attachment 1. Jocassee Gorges primary road system covered under the Jocassee Gorges Road Management Memorandum of Agreement (MOA) (Note the map does not show secondary roads which are also maintained under this Agreement).

Attachment 2

Attachment 2 – Recreation Site Inventory Form

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DUKE ENERGY CAROLINAS, LLC

RECREATION STUDY

BAD CREEK PUMPED STORAGE PROJECT

(FERC NO. 2740)

Recreation Site Inventory Form

Inspector: _____

Date: _____ **Trail Mile:** _____

Site Name: _____

Site Coordinates: _____

Road Access:

	Paved	Unpaved/Gravel
Road Access		

Name of Nearest Road: _____

Distance to that road from site: _____

Closest boat access: _____

Parking (# of spaces) if completing Access Area/ Parking lot:

	Paved	Unpaved/Gravel
Vehicle Spaces		
Vehicle with Trailer Spaces		
ADA/Barrier Free Spaces		

Restrooms:

	Flush Toilets	Vault Toilets	Portable Toilets	ADA/Barrier Free
Women				
Men				
Unisex				

Shoreline Access (if applicable):

General shoreline description (document with photos):

_____

_____

Approximate slope: _____

Substrate description: _____

Camping:

	# of Sites	ADA/Barrier Free	Fire Rings
Primitive Sites			

Amenities:

	Yes	No	Additional Information/ADA/Barrier Free
Portage			
Reservoir Fishing			
Swim Area			
Trails (other than the Foothills Trail)			
Active Recreation Area			
Picnic Area			
Overlook/Vista			
Interpretive Display (Signage/Kiosk/Billboard)			
Hunting Area			
Trash Cans			
Other			

Maintenance:

	Responsible Party	Frequency	Notes
Vegetation			
Waste Mgt.			

Attachment 3

Attachment 3 – Foothills Trail and Land Parcel Maps

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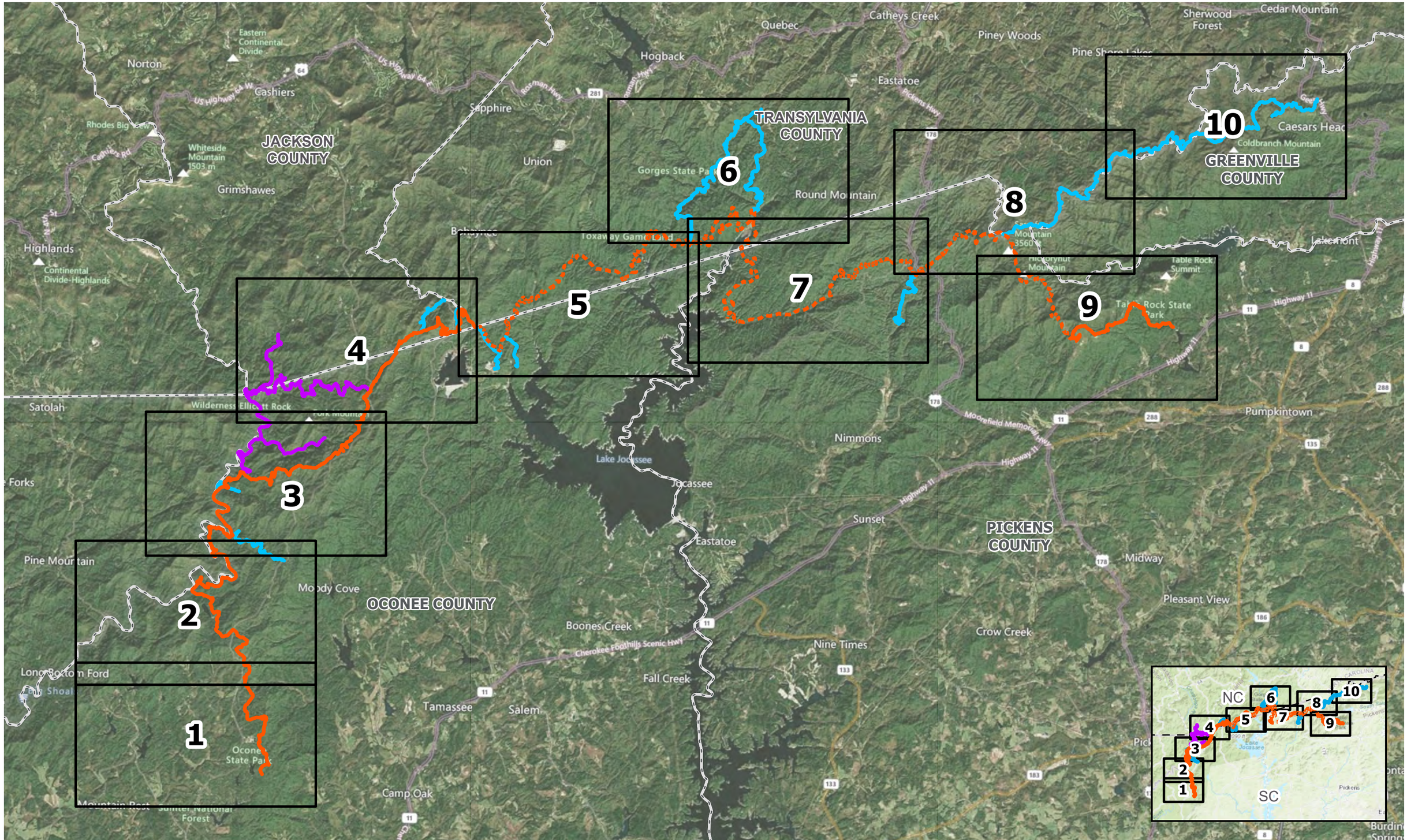
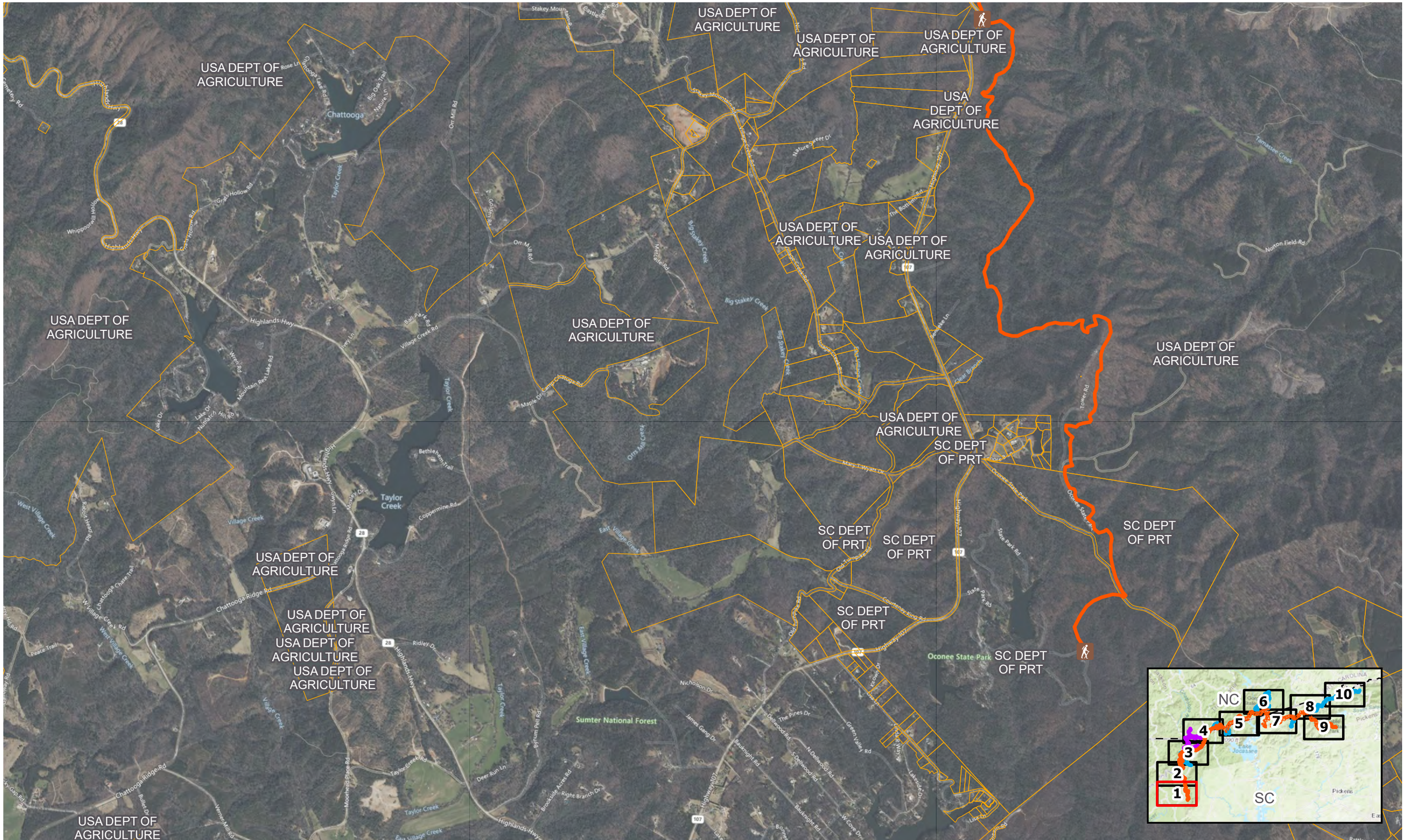


Foothills Trail
Duke Maintained Portion of Foothills Trail
Foothills Trail Spurs
Fork Mountain Trail
County Lines

0 10,000 Feet

N

FOOTHILLS TRAIL
OVERVIEW MAP



Access Area
Campground
Observation Point
Trail Access
Boat Ramps
Parking
Bridge
Foothills Trail
Duke Maintained Portion of Foothills Trail
Foothills Trail Spurs
Fork Mountain Trail
Parcel Boundary
County Line

0 Feet 2,000

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FOOTHILLS TRAIL
PARCEL OWNERSHIP

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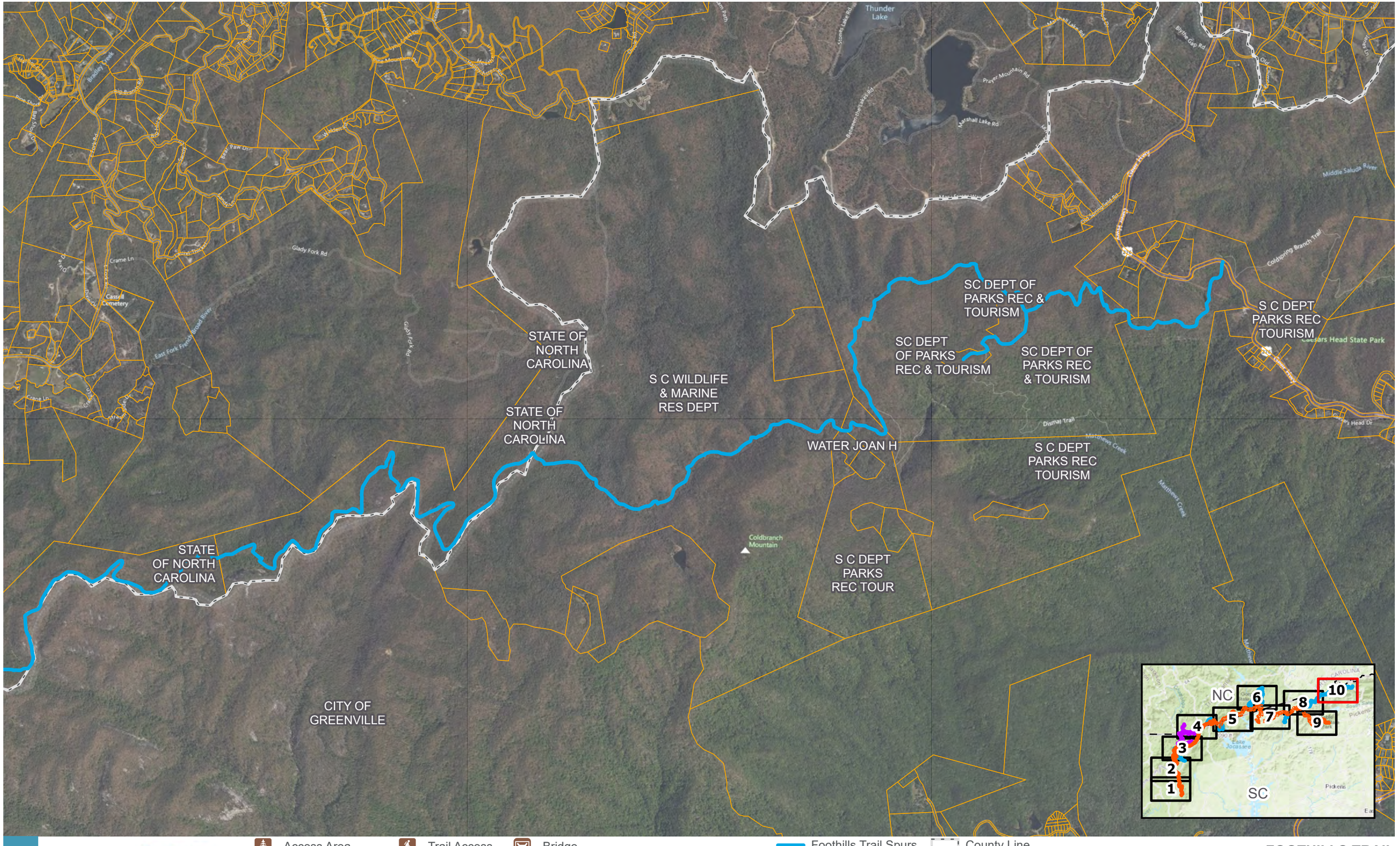

Access Area
Campground
Observation Point
Trail Access
Boat Ramps
Parking
Bridge
Foothills Trail
Duke Maintained Portion of Foothills Trail
Foothills Trail Spurs
Fork Mountain Trail
Parcel Boundary
County Line

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FOOTHILLS TRAIL
PARCEL OWNERSHIP

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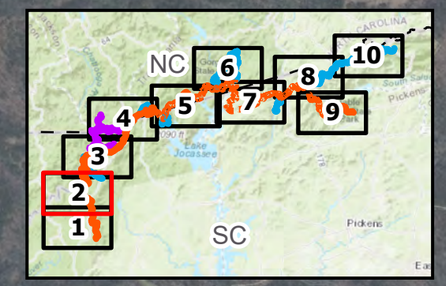


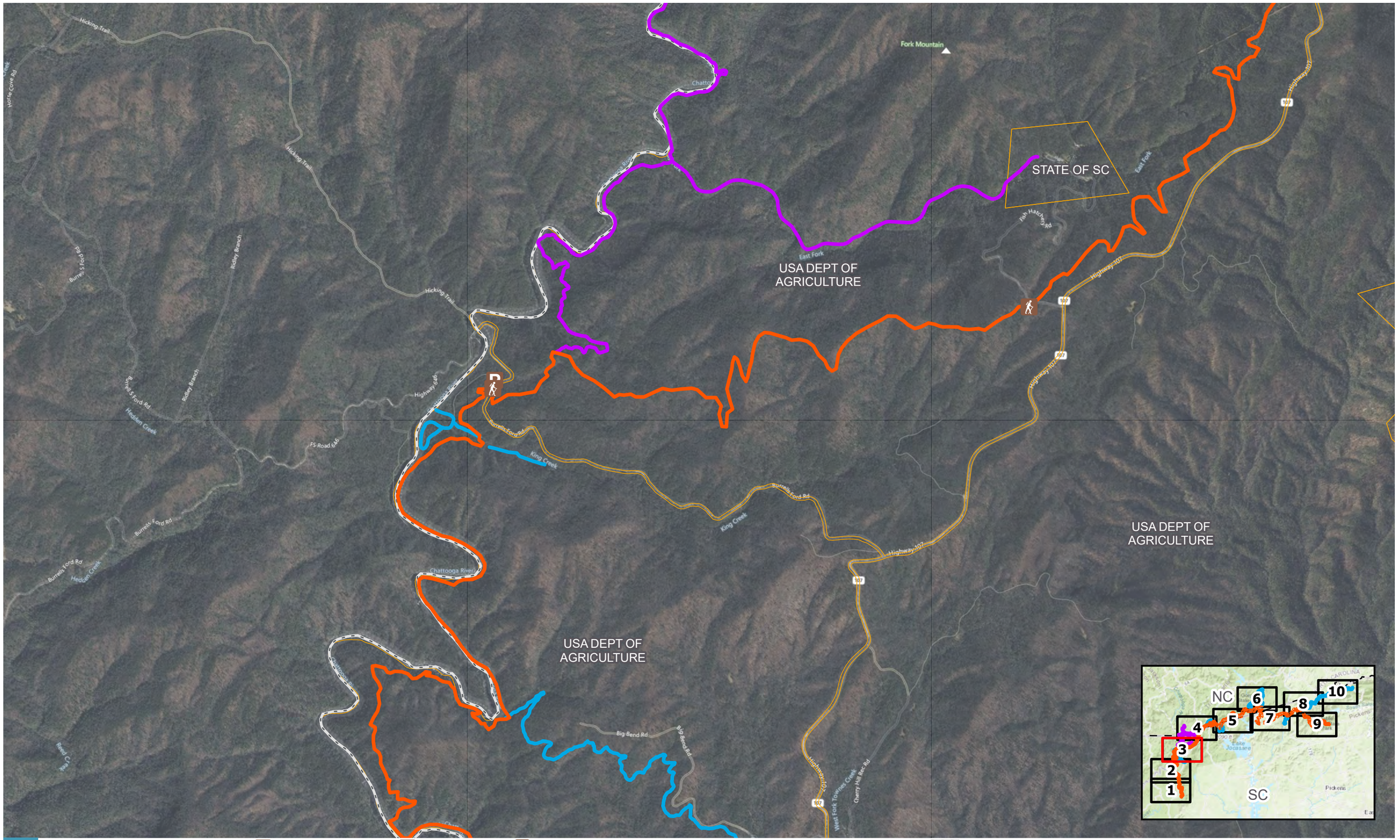
Access Area
Campground
Observation Point
Trail Access
Boat Ramps
Parking
Bridge
Foothills Trail
Duke Maintained Portion of Foothills Trail
Foothills Trail Spurs
Fork Mountain Trail
Parcel Boundary
County Line

0 Feet 2,000

N

FOOTHILLS TRAIL
PARCEL OWNERSHIP

PATH: \\CLT-SRV02\GIS\PROJECTS\DUKE_ENERGY\10261671_BADCREEK_RELICENSING\7.2_WIP\MAP_DOCS\APRX\BADCREEK_GHM.APRX -USER: GMARCHICA - DATE: 12/1/2022



Access Area
Campground
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Duke Maintained Portion of Foothills Trail
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Parcel Boundary
County Line

0 Feet 2,000

N

FOOTHILLS TRAIL
PARCEL OWNERSHIP

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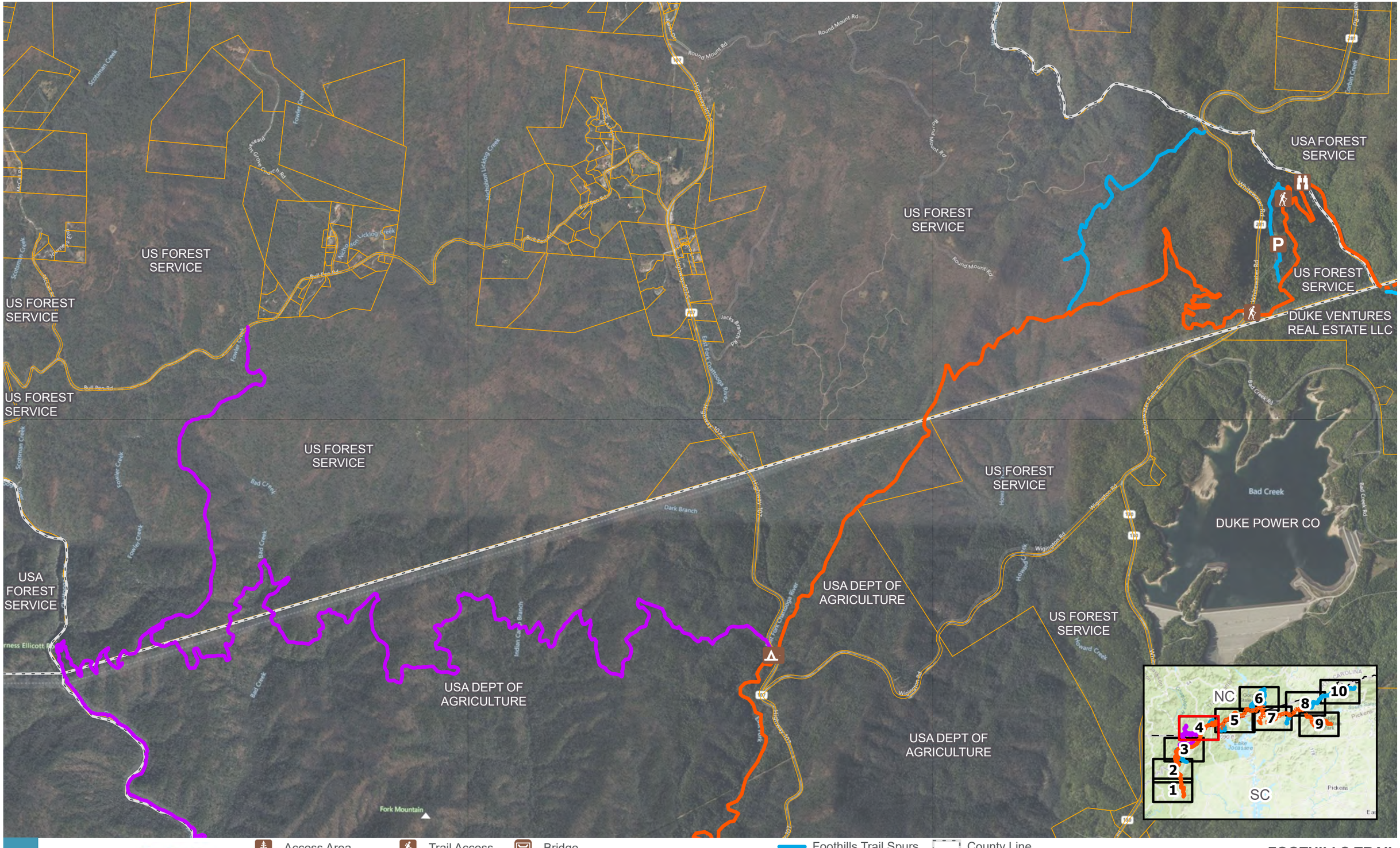

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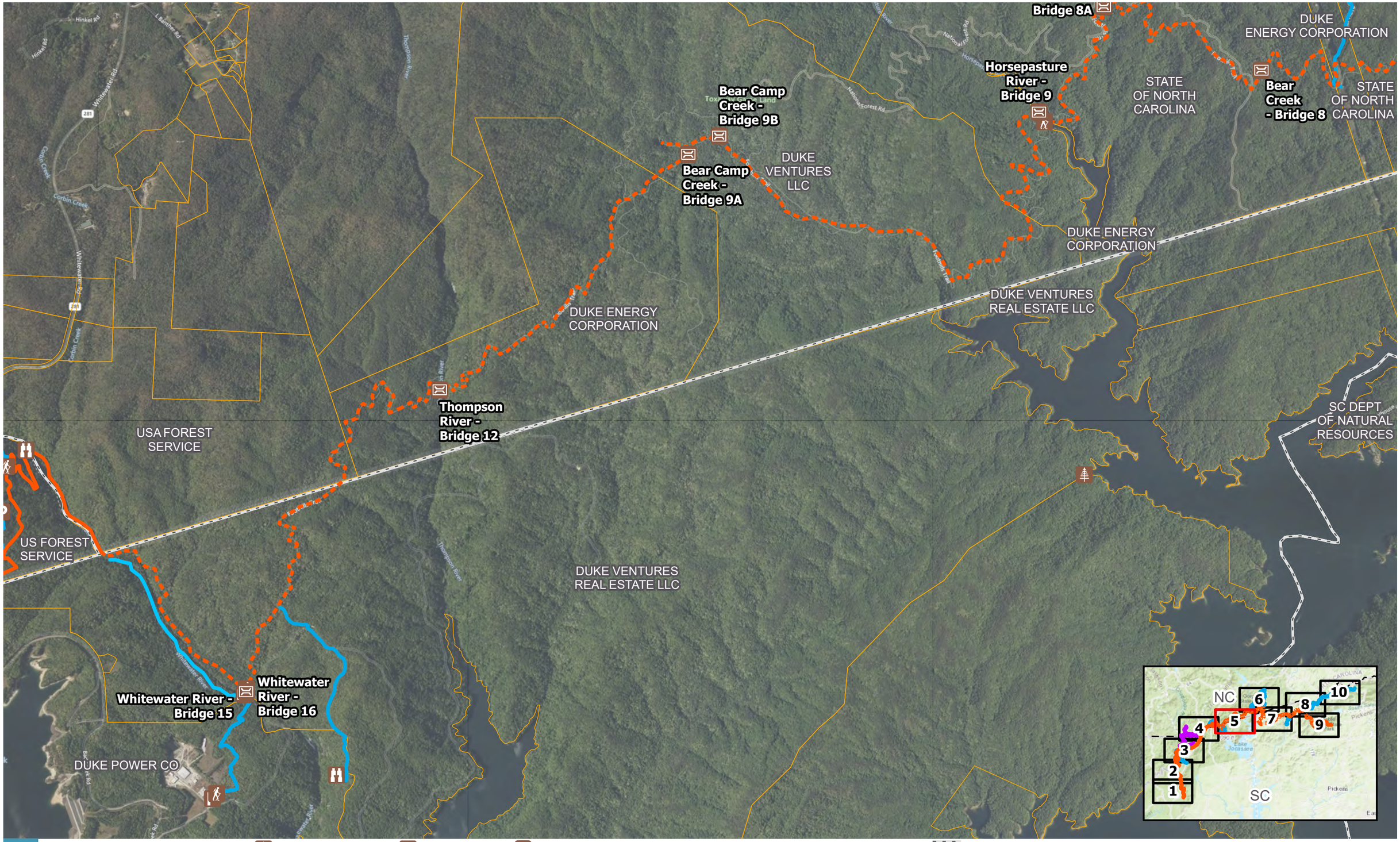

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DUKE ENERGY CORPORATION

STATE OF NORTH CAROLINA

STATE OF NORTH CAROLINA

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STATE OF NORTH CAROLINA

DUKE ENERGY CORPORATION

Gorges State Park

STATE OF NORTH CAROLINA

STATE OF NORTH CAROLINA

STATE OF NORTH CAROLINA

Toxaway River - Bridge 7

Toxaway Creek - Bridge 6

Bridge 8A

Bear Creek - Bridge 8

DUKE ENERGY CORPORATION

DUKE ENERGY CORPORATION

DUKE ENERGY CORPORATION

Rock Creek - Bridge 5

SC DEPT OF NATURAL RESOURCES

Round Mountain

NC

SC

1 2 3 4 5 6 7 8 9 10

Access Area
Campground
Observation Point

Trail Access
Boat Ramps
Parking

Bridge
Foothills Trail
Duke Maintained Portion of Foothills Trail

Foothills Trail Spurs
Fork Mountain Trail
Parcel Boundary

County Line

0 2,000 Feet

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FOOTHILLS TRAIL
PARCEL OWNERSHIP

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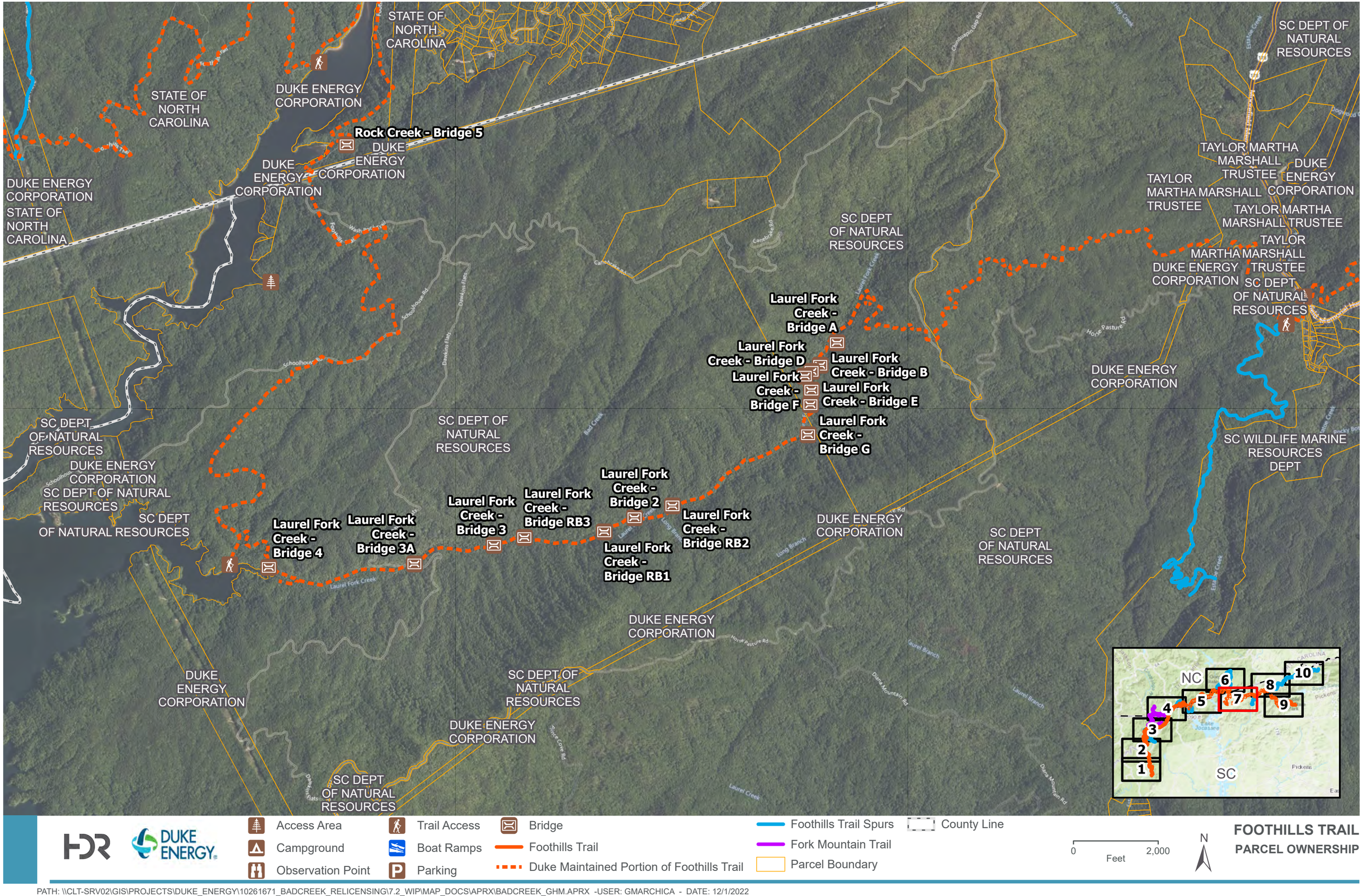

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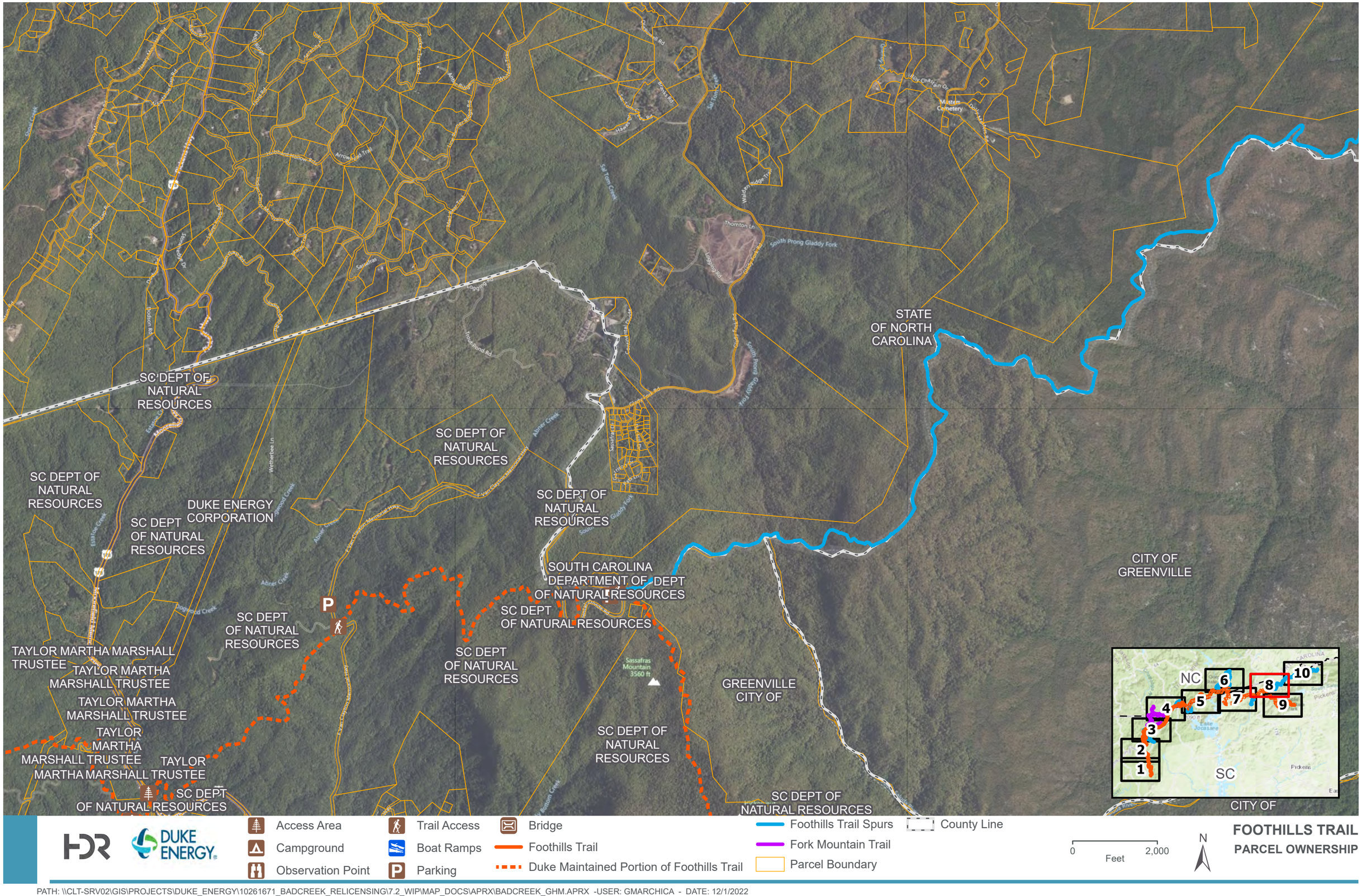

Access Area
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Observation Point
Trail Access
Boat Ramps
Parking
Bridge
Foothills Trail
Duke Maintained Portion of Foothills Trail
Foothills Trail Spurs
Fork Mountain Trail
Parcel Boundary
County Line

0 Feet 2,000

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FOOTHILLS TRAIL
PARCEL OWNERSHIP

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SC DEPT OF NATURAL RESOURCES

CITY OF GREENVILLE

GREENVILLE CITY OF

DEPT OF PARKS RECREATION TOURISM SC

SC DEPT OF NATURAL RESOURCES

DEPT OF PARKS RECREATION TOURISM SC

DEPT OF PARKS RECREATION TOURISM SC

DEPT OF PARKS RECREATION TOURISM SC

THORNWELL ORPHANAGE

OWENS RUTH AIKEN

OWENS RUTH AIKEN

CHURCH SC BOARD ADM OF WES

ANDERS PROPERTIES LLC

ANDERS PROPERTIES LLC

CHURCH SC BOARD ADM OF WES

DEPT OF PARKS RECREATION TOURISM SC

SC DEPT OF NATURAL RESOURCES

Hickorynut Mountain

Table Rock Summit

Table Rock Trail

Table Rock Mountain Trail

Table Rock State Park

Carrick Creek

Green Creek

Rocky Bottom Creek

Emory Creek

Cove Creek

Horse Mountain Rd

Willis Creek

Rachael Creek

Highway 11

Lake Jocassee

Pickens

SC

NC

1 2 3 4 5 6 7 8 9 10

Access Area
Campground
Observation Point
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Parking
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Foothills Trail
Duke Maintained Portion of Foothills Trail
Foothills Trail Spurs
Fork Mountain Trail
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County Line

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FOOTHILLS TRAIL
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Attachment 4

Attachment 4 – Sample Recreation Use Survey Form

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Duke Energy Bad Creek Pumped Storage Project Recreation Use Survey	Duke Energy is conducting this survey to learn about recreational use of the Foothills Trail, user satisfaction with existing recreation facilities, and whether facility improvements may be needed. Please take a few minutes to answer some questions about your visit today. Thank you for your participation.

Location:			Date:		Time:
Interviewer:					
1. What is your country, state, and county of residence?	Country:		State:		County:
2. How many people are in your group today? _____ people					
3. What is your age?	18-24	25-34	35-44	45-54	55+
4. If you came with others, what are their age groups? (circle all that apply)					
Children (Infants-12)	Youth (13-17)		Adults (18-55)		Senior Adults (over 55)
5. How did you hear about the area? (circle one)					
Friend/Relative	Social Media		_____Other		
6. How many times (including today), have you visited the Foothills Trail in the last 30 days? _____					
7. Do you have a vehicle parked at one of the access areas listed below? If so, indicate which one.					
No Vehicle	Sassafras Mtn.	Chimney Top Gap	Laurel Valley	Bad Creek Hydro	Upper WW Falls
8. If you have a vehicle parked at one of the access areas listed in Question 7, how long will it be parked there? _____ days, _____hours					
9. What is the primary reason for your visit today? (circle all that apply)					
Fishing/Flyfishing	Picnicking	Hiking	Canoeing/kayaking		
Camping	Swimming	Biking	Wildlife viewing		
Backpacking	Birdwatching	Hunting	Wildflower viewing		
Shoreline relaxation	Other:				
10. If you came to hike today, how would you rate your hiking experience? (circle one)					
Very Good (5)	Good (4)	Fair (3)	Poor (2)	Very Poor (1)	
11. Please rate the quality of the following facilities as they relate to the Foothills Trail. (circle one for each)					
Trails:	Very Good (5)	Good (4)	Fair (3)	Poor (2)	Very Poor (1)	Unavailable	N/A
Bridges:	Very Good (5)	Good (4)	Fair (3)	Poor (2)	Very Poor (1)	Unavailable	N/A
Restrooms:	Very Good (5)	Good (4)	Fair (3)	Poor (2)	Very Poor (1)	Unavailable	N/A
Parking:	Very Good (5)	Good (4)	Fair (3)	Poor (2)	Very Poor (1)	Unavailable	N/A
Picnic Areas:	Very Good (5)	Good (4)	Fair (3)	Poor (2)	Very Poor (1)	Unavailable	N/A
Campsites:	Very Good (5)	Good (4)	Fair (3)	Poor (2)	Very Poor (1)	Unavailable	N/A
Fishing Areas:	Very Good (5)	Good (4)	Fair (3)	Poor (2)	Very Poor (1)	Unavailable	N/A
Cleanliness:	Very Good (5)	Good (4)	Fair (3)	Poor (2)	Very Poor (1)	N/A	
Crowding:	Very Low (5)	Low (4)	Moderate (3)	High (2)	Very High (1)	N/A	
12. Overall, how would you rate your experience on the Foothills Trail during this trip? (circle one)					
Very Good (5)	Good (4)	Fair (3)	Poor (2)	Very Poor (1)	
13. If you rated your experience as "Poor" or "Very Poor", please explain why.					

14. List any specific improvements you would like to see for the Foothills Trail and/or associated access areas, and any other comments or suggestions.

Appendix G

Cultural Resources Study Plan

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APPENDIX G

CULTURAL RESOURCES REVISED STUDY PLAN

Bad Creek Pumped Storage Project
FERC Project No. 2740

December 2022

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CULTURAL RESOURCES REVISED STUDY PLAN
BAD CREEK PUMPED STORAGE PROJECT
FERC PROJECT NO. 2740
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ATTACHMENTS

Section **Title** **Page No.**

LIST OF TABLES

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ACRONYMS AND ABBREVIATIONS

APE	Area of Potential Effects
Bad Creek or Project	Bad Creek Pumped Storage Project
Bad Creek II Complex	Bad Creek II Power Complex
Duke Energy or Licensee	Duke Energy Carolinas, LLC
FERC or Commission	Federal Energy Regulatory Commission
KT Project	Keowee-Toxaway Hydroelectric Project
NRHP	National Register of Historic Places
PAD	Pre-Application Document
SHPO	State Historic Preservation Office

1 Study Requests and Formal Comments

The Federal Energy Regulatory Commission (FERC or the Commission) issued Scoping Document 2 on August 5, 2022, which identified the following environmental resource issues to be analyzed in the National Environmental Policy Act document for the Bad Creek Pumped Storage Project (Project) relicensing related to cultural resources. This resource issue addresses the effects of continued Project operations under the Existing License as well as potential construction and operation of a second powerhouse during the New License term (Bad Creek II Power Complex [Bad Creek II Complex]):

- Effects of Project construction, operation, and maintenance activities on historic and archaeological resources, traditional cultural properties, and access to exercise traditional practices and treaty rights.

In Section 7.1.8.3 of the Pre-Application Document (PAD), Duke Energy proposed to conduct a Cultural Resources Study in support of the proposed Bad Creek II Complex, including an archaeological study and an architectural survey of structures more than 40 years old. No formal study requests were received related to cultural resources during the scoping process; the Proposed Study Plan was filed with the Commission on August 5, 2022. Comments on the Proposed Study Plan were received from the Commission and were considered in the development of this Revised Study Plan. Comment summaries and responses are included in Appendix A of this Revised Study Plan and copies of all correspondence are included in Appendix B. Duke Energy Carolinas, LLC (Duke Energy) will continue consultation with Indian Tribes and other stakeholders regarding cultural resources near the Project during the relicensing.

2 Goals and Objectives

While there are no anticipated additional adverse effects to cultural resources due to the continued operation of the Project, potential adverse effects resulting from the potential addition of the Bad Creek II Complex should be evaluated. These effects include the possibility of construction activities in previously undisturbed lands, and in areas to be used for rock and soil spoil disposal, access roads, and staging areas. Duke Energy will conduct a Cultural Resources Study for this relicensing to include and address the following:

- Duke Energy plans to coordinate with the South Carolina State Historic Preservation Office (SHPO), Indian Tribes, and other stakeholders regarding potential issues with respect to cultural resources that may be located within the area of influence of the Bad Creek II Complex construction.

3 Study Area

The study area for the Cultural Resources Study is the Area of Potential Effects (APE) for Project relicensing (Figure 3-1). Duke Energy intends to define the APE in consultation with the SHPO and Indian Tribes as a component of this Cultural Resources Study.

Duke Energy tentatively proposes the following APE which may be refined through consultation:

> "The APE includes all lands within the Project boundary. The APE also includes any lands outside the Project boundary where cultural resources may be affected by Project-related activities that are conducted in accordance with the FERC license."

The Commission has not yet defined an APE for the Bad Creek II Complex. The Project Boundary encompasses all lands necessary for Project purposes. All Project-related operations, potential enhancement measures, and routine maintenance activities associated with the implementing a New License issued by the FERC are expected to take place within the proposed expanded Project Boundary shown on Figure 3-1.

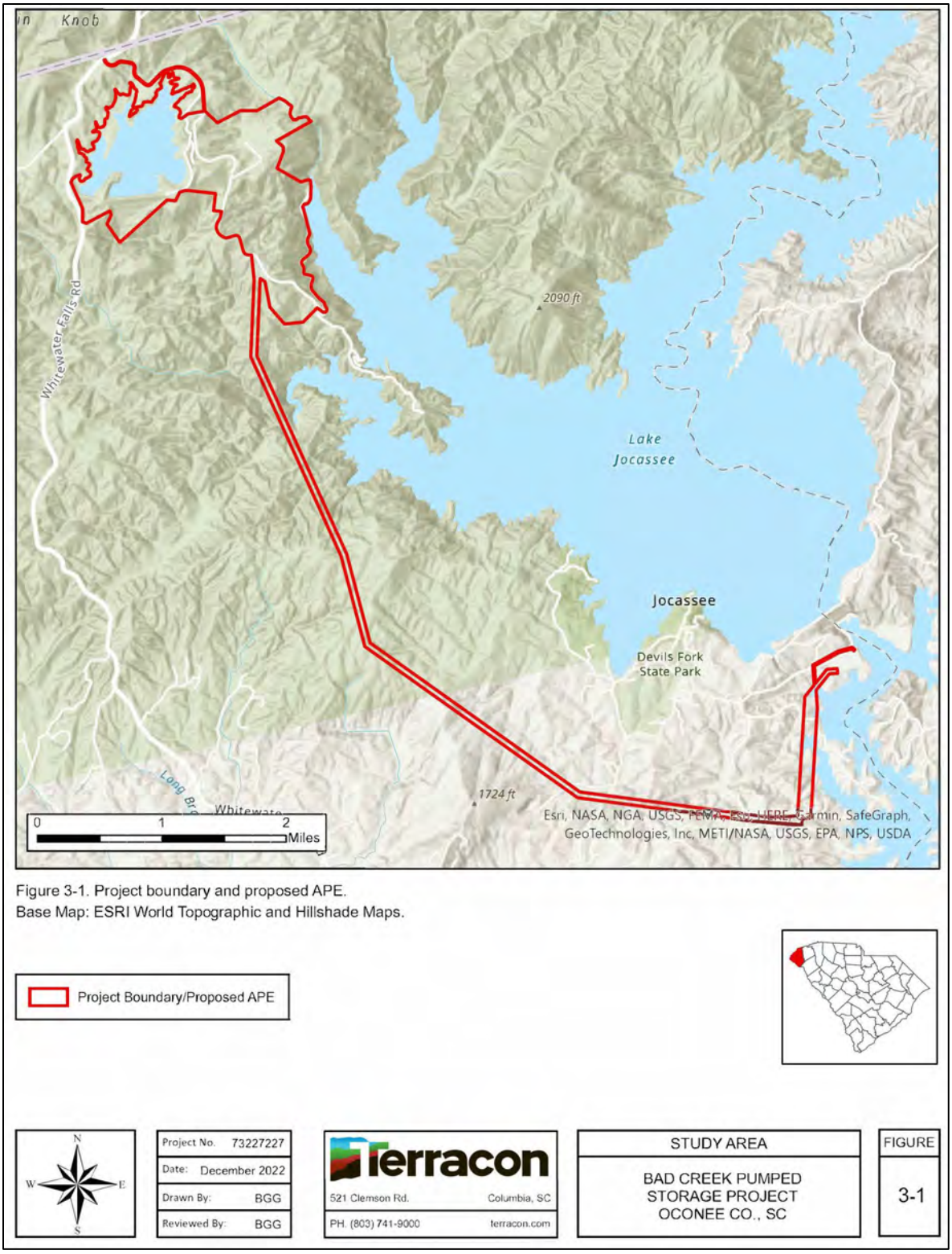

Figure 3-1. Project boundary and proposed APE.
Base Map: ESRI World Topographic and Hillshade Maps.

Figure 3-1. Cultural Resources Study Area

4 Background and Existing Information

Existing relevant and reasonably available information regarding cultural resources is provided in Section 6.10.2 of the PAD. The cultural resources information related to the Project was obtained from the ArchSite, an online cultural resources database maintained by the South Carolina Department of Archives and History and the South Carolina Institute of Archaeology and Anthropology.

The portions of the existing Project's footprint that underwent extensive land modification (i.e., removal of trees/stumps, soil, and/or bedrock to a depth of 1+ feet) in the past, or those that are currently under Lake Jocassee (lower reservoir), are unlikely to contain any significant archaeological resources or historical architectural resources other than the elements of the Project greater than 50 years of age. Portions of the Project were subject to previous cultural resource surveys (Benson 2018; Brockington 1978; Gardner et al. 1988; Grunden 2007; Stallings 2012). Figure 6.10-1 in the PAD displays the locations of previous cultural resources surveys near the Project.

The Cultural Resources Study area contains 12 known archaeological sites that are within or immediately adjacent to the Project (i.e., within 50 meters). These resources are depicted in Figure 4-1 and are summarized in Table 4-1. Three of the sites, 38OC249, 38OC250, and 38OC251, are potentially eligible for inclusion in the National Register of Historic Places (NRHP) and require additional evaluation to determine their National Register status. Sites 38OC249 and 38OC250 are within the northern portion of the Project, and 38OC251 lies just outside of the Project Boundary (Figure 4-1). There are also three historic resources, Lake Keowee (SHPO Site No. 0155), Lake Jocassee (SHPO Site No. 0156), and the Jocassee Hydroelectric Station (SHPO Site No. 0198) within the Project APE. Jocassee Hydroelectric Station was determined to be eligible for the NRHP (Dorn et al. 2022), whereas the Lake Keowee and Lake Jocassee are ineligible for inclusion in the NRHP.

Table 4-1. Previously Recorded Cultural Resources within and adjacent to the Project

Resource ID	Description	NRHP Eligibility	Source
38OC101	Pre-contact isolated find	Not Eligible	Brockington 1978
38OC102	Pre-contact lithic scatter	Not Eligible	Brockington 1978; Gardner et al. 1988
38OC103	Pre-contact lithic scatter	Not Eligible	Brockington 1978
38OC242	Middle Archaic lithic scatter	Not Eligible	Gardner et al. 1988
38OC243	Pre-contact lithic scatter	Not Eligible	Gardner et al. 1988
38OC244	Pre-contact lithic scatter	Not Eligible	Gardner et al. 1988
38OC246	Pre-contact lithic scatter	Not Eligible	Gardner et al. 1988
38OC247	Pre-contact lithic scatter	Not Eligible	Gardner et al. 1988
38OC248	Pre-contact lithic scatter	Not Eligible	Gardner et al. 1988
38OC249	Late Archaic through Mississippian rockshelters	Potentially Eligible	Gardner et al. 1988
38OC250	Mississippian short-term encampment	Potentially Eligible	Gardner et al. 1988
38OC251	Middle Archaic through Woodland/ Mississippian lithic and ceramic scatter; 19th/20th century artifact scatter	Potentially Eligible[1]	Gardner et al. 1988
0155	Lake Keowee	Not Eligible	Stallings 2012; Johnson 2022, personal communication[2]
0156	Lake Jocassee	Not Eligible	Stallings 2012; Johnson 2022, personal communication
0198	Jocassee Hydroelectric Station	Eligible	Dorn et al. 2022

1. The historic component of site 38OC251 was recommended as being ineligible for the NRHP.

2. Johnson, E. 2022. Personal communication to C. Churchill via email. Received August 10, 2022.

CUI // PRIVILEGED INFORMATION

Figure 4-1. Cultural Resources within and Adjacent to the Study Area [*CUI // Privileged Information Filed Separately]*

Construction of the proposed powerhouse complex adjacent to the existing powerhouse will result in ground-disturbing activities. As currently planned, archeological sites 38OC249 and 38OC250 are within the Project Boundary and require additional evaluation. Currently, there are no anticipated impacts to site 38OC251. Should redesign of the construction of the proposed powerhouse or other Project-related activities include 38OC251, Phase II evaluative testing will be conducted prior to any land disturbance within 50 feet of this site. If any of these sites is determined to be ineligible for the NRHP, they will require no further management consideration and land disturbing activities may occur within the site. Should any of these sites be determined eligible for the NRHP, planned land disturbing activities should be redesigned to avoid the site. If the site cannot be avoided through redesign, it will result in an adverse effect and appropriate mitigation measures should be implemented to resolve the adverse effects following the procedures outlined in 36 CFR § 800.6.

Construction of the proposed powerhouse and the facilities necessary for its operation will include peripheral connections with Jocassee Hydroelectric Station (SHPO Site No. 0198). The addition of the Bad Creek II Complex will not result in operational changes and is not expected to alter any aspects of the Jocassee Hydroelectric Station that could compromise its NRHP eligibility.

Identification of Project impacts and determinations of appropriate mitigation measures to be applied will be developed with input from the SHPO, FERC, federally recognized Indian Tribes, and additional interested parties.

5 Project Nexus

Presently, there is no evidence that archaeological or historic resources are currently being affected by the Project's operations. However, the proposed Bad Creek II Complex has the potential to affect historic properties that may be eligible for inclusion in the NRHP.

6 Methods

6.1 Task 1 - APE Determination

Duke Energy has tentatively proposed an APE as defined in Section 6.10.3 of the PAD. Pursuant to implementing regulations of Section 106 at 36 CFR § 800.4(a), Duke Energy will consult with the SHPO and Indian Tribes, and other parties, as appropriate, to determine and document the APE for the Project as defined in 36 CFR § 800.16(d).

6.2 Task 2 - Cultural Resources Survey of the APE

Duke Energy expects the SHPO will request a cultural resources survey of portions of the APE potentially impacted by the Project. A cultural resources survey would likely include shovel testing of all non-steep (less than 15 percent slopes) landforms, a pedestrian survey and/or drone survey of steeply sloped and rocky areas to look for rockshelters and/or petroglyphs, as well as an architectural survey of any structures on or near the Project that are 40+ years old. Traditional Cultural Properties will also be identified in consultation with Indian Tribes. A desktop geomorphological assessment indicates there are six areas within the anticipated APE having the potential to contain archaeological resources in buried contexts (Attachment 1). One of these areas contains site 38OC250. If any of these six areas are to be impacted, then an archaeological survey, including potential deep testing, may be necessary.

7 Analysis and Reporting

Results of this study will be included in the Initial and Updated study reports. Duke Energy anticipates the Cultural Resources Study report will include Project information and background, a depiction and description of the study area, methodology, results, analysis, and discussion. The report will also include relevant stakeholder correspondence and/or consultation, as well as literature cited.

8 Schedule and Level of Effort

The preliminary schedule for this study is outlined in Table 8-1. The estimated level of effort for this study is approximately 1,836 hours. Duke Energy estimates the Cultural Resources Study

will cost approximately $225,000 to complete, which includes Phase II evaluative testing of archaeological sites 38OC249 and 38OC250.

Table 8-1. Proposed Cultural Resources Study Schedule

Task	Proposed Timeframe for Completion
Task 1 - APE Determination	December 2022
Task 2 – Cultural Resources Survey of the APE	Spring 2023 – Fall 2023
Distribute Draft Study Report with the ISR	January 2024

9 References

Benson, R. 2018. Cultural Resources Survey of the FY2018 Andrew Pickens District Southern Pine Beetle Timber Salvage Project Andrew Pickens Ranger District Sumter National Forest. Report prepared for the Francis Marion and Sumter National Forests, U.S. Forest Service, by Southeastern Archaeological Services, Athens, Georgia.

Brockington, P. 1978. An Archaeological Survey of Duke Power's Oconee – Bad Creek 500 kV and Jocassee 100 kV Transmission Lines, Oconee County, South Carolina. Report prepared for Duke Power, Charlotte, North Carolina, by the South Carolina Institute of Archaeology and Anthropology, Columbia, South Carolina.

Dorn, M., B. Harvey, and W. Green. 2022. Architectural Survey and National Register Evaluation of the Jocassee Pumped Storage Hydro Station and Keowee-Toxaway Hydroelectric Project, Oconee and Pickens Counties, South Carolina. Report prepared for Duke Energy, Charlotte, North Carolina, by Terracon Consultants, Inc., Columbia, South Carolina.

Gardner, J., B. Southerlin, and R. Mitchell. 1988. Archaeological Survey of the Jocassee to Bad Creek to Coley Creek Transmission Corridors, Oconee County, South Carolina. Report prepared for Duke Power Company, Charlotte, North Carolina, by Brockington and Associates, Atlanta, Georgia.

Grunden, R. 2007. A Cultural Resources Survey of the Lake Jocassee Shoreline, Oconee and Pickens Counties, South Carolina. Report prepared for Duke Energy, Charlotte, North Carolina, by TRC, Inc., Columbia, South Carolina.

Stallings, P. 2007. NRHP Evaluation of the Keowee-Toxaway Hydroelectric Development, Oconee and Pickens Counties, South Carolina. Report prepared for Duke Energy, Charlotte, North Carolina, by Brockington and Associates, Inc., Atlanta, Georgia.

Attachment 1

Attachment 1 – Desktop Geomorphological Assessment

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Seramur & Associates, PC
165 knoll Drive
Boone, NC 28607

July 13, 2022

Bill Green, M.A., RPA
Principal
Terracon
521 Clemson Road
Columbia, SC 29229

Re: Geomorphology Investigation of the Bad Creek Pumped Storage Project, Oconee County, SC

Dear Mr. Green:

Seramur & Associates, PC has completed a desktop geomorphology investigation of the Bad Creek Pumped Storage Project in Oconee County, SC (Figure 1). The goal of this investigation is to determine if soils and alluvium that could contain buried cultural deposits are present within the study area. The project area is located in the Blue Ridge physiographic province of northwestern South Carolina. Bedrock is mapped as schist of the Tallulah Falls Formation and Toxaway Gneiss (Schaeffer 2016). The desktop survey included reviewing soil survey maps, digital elevation models, and topographic maps.

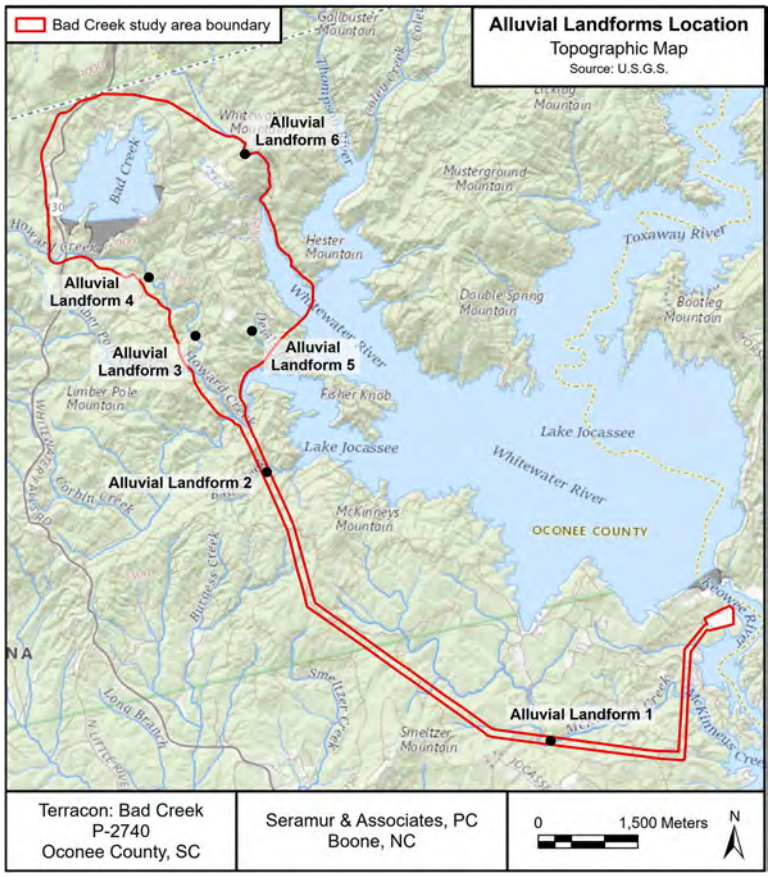

Figure 1. Topographic map of the study area showing the location of the six areas containing alluvial landforms.

Archaeology sites in the study area could be buried by either alluvial sedimentation or deposition of colluvium. Burial by colluvial processes or landslides would destroy the cultural integrity of the sites and therefore areas with colluvial deposits were not considered. Elevated landforms with well-drained soils

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would be favorable for occupation. Topographic maps and LiDAR digital elevation models were used to identify alluvial landforms. The USDA Soil Survey maps indicated the type of soils present in each area of interest (Table 1).

Six areas were identified that had the potential to contain alluvial landforms (Figure 1). Five soil units are mapped in these six areas (Table 1). The geomorphic setting, lithology, parent material and depth to groundwater for each soil unit is listed in Table 1.

Map Unit	AsF – Ashe sandy loam	HaE – Halewood fine sandy loam
Landform	Convex mountain slopes	Convex mountain slopes
Lithology	Sandy loam over gravelly sandy loam and unweathered bedrock	Fine sandy loam and sandy clay loam over sandy loam and loamy sand
Depth to Groundwater	More than 80 inches	More than 80 inches
Parent Material	Loamy residuum weathered from metamorphic rock	Loamy residuum weathered from metamorphic rock
Alluvial Landform Area	AL-6	AL-3
Map Unit	HaF – Halewood fine sandy loam	HcE – Hayesville and Cecil fine sandy loams
Landform	Convex mountain slopes	Convex interfluves
Lithology	Fine sandy loam and sandy clay loam over sandy loam and loamy sand	Fine sandy loam over clay loam and loam
Depth to Groundwater	More than 80 inches	More than 80 inches
Parent Material	Loamy residuum weathered from metamorphic rock	Clayey residuum weathered from granite and gneiss
Alluvial Landform Area	AL-1 through AL-6	AL-6
Map Unit	Mv – Riverview-Chewacla complex	
Landform	Floodplains	
Lithology	Loam over sandy clay loam and sandy loam	
Depth to Groundwater	About 39 to 60 inches	
Parent Material	Loamy alluvium derived from igneous and metamorphic rock	
Alluvial Landform Area	AL-4 and AL-6	

Table 1. Characteristics of the five soil units mapped in the alluvial landform areas.

Alluvial Landform Area 1

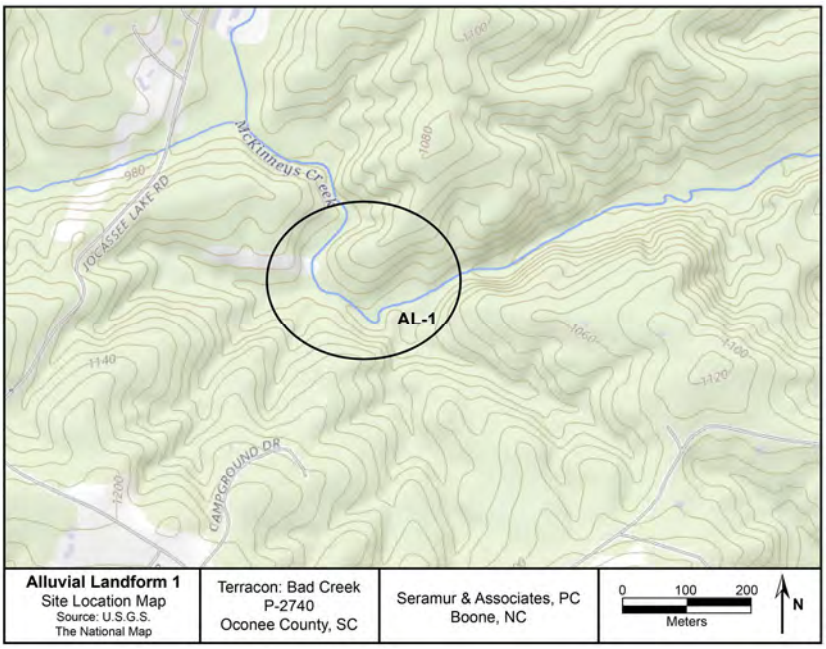

Figure 2. Topographic map of transmission line crossing of McKinney's Creek.

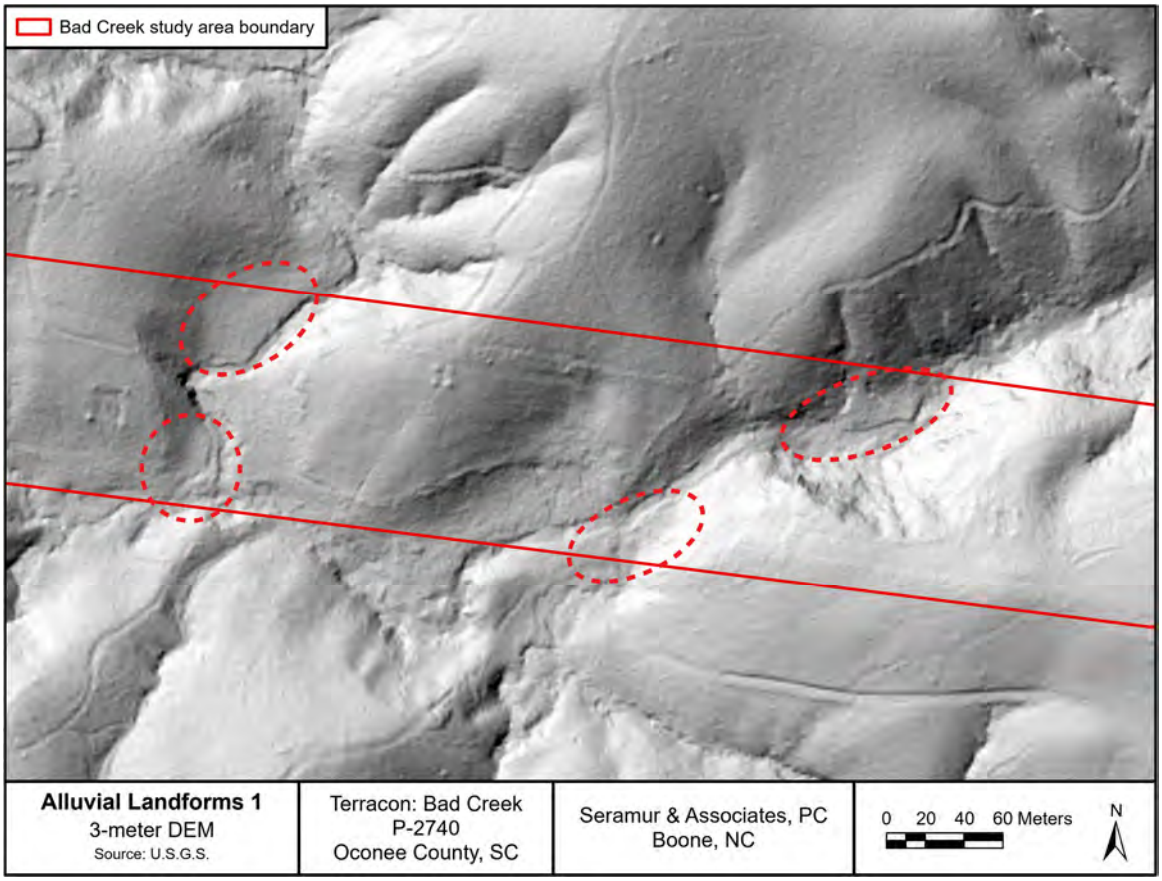

Figure 3. LiDAR DEM of transmission line crossing of McKinney's Creek. Alluvial landforms are circled in a red dashed line.

Alluvial Landform Area 1 is located where the transmission line crosses McKinney's Creek (Figures 1 and 2). The DEM shows four areas where it appears alluvial terraces are present along McKinney's Creek (red ovals on Figure 3). The soil survey map indicates that this area is underlain by the Halewood fine sandy loam (Figure 4). The parent material for this soil unit is described as residuum, as it appears that the soil survey did not map soil on the alluvial landforms along these narrow mountain streams.

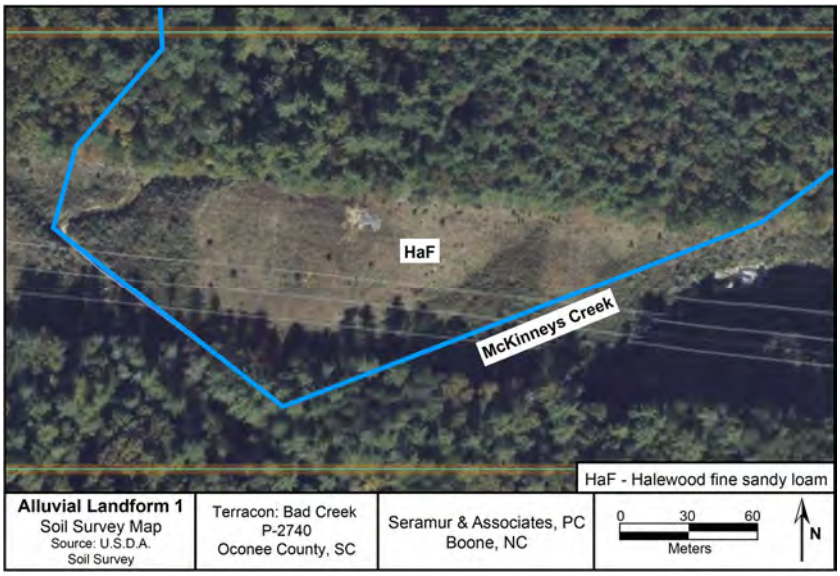

Figure 4. Soil survey map of transmission line crossing of McKinney's Creek.

Alluvial Landform Area 2

Alluvial Landform Area 2 is located where the transmission line crosses Bad Creek (Figures 1 and 5). The DEM shows alluvial terraces on each side of Bad Creek (Figure 6). The soil survey map indicates that this area is underlain by the Halewood fine sandy loam (Figure 7). The parent material for this soil unit is described as residuum, although there are clearly alluvial landforms present.

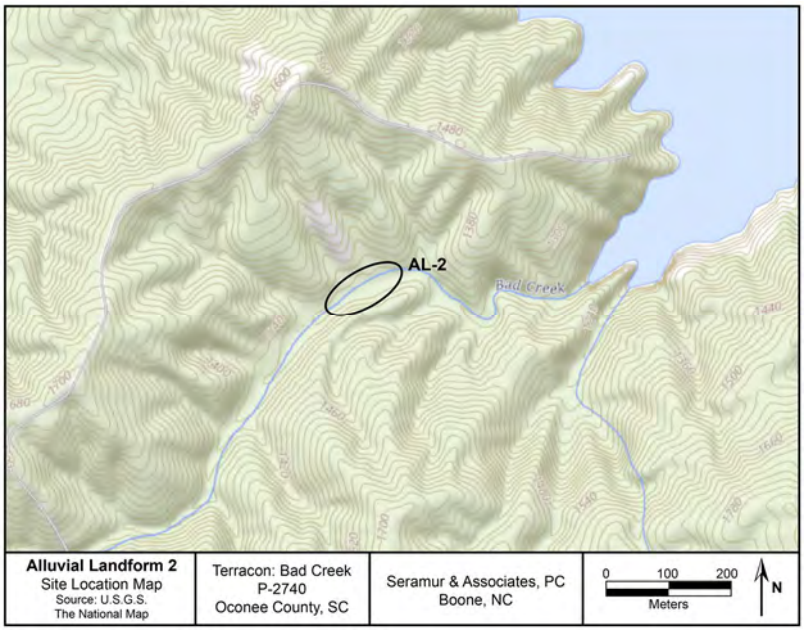

Figure 5. Topographic map of transmission line crossing of Bad Creek.

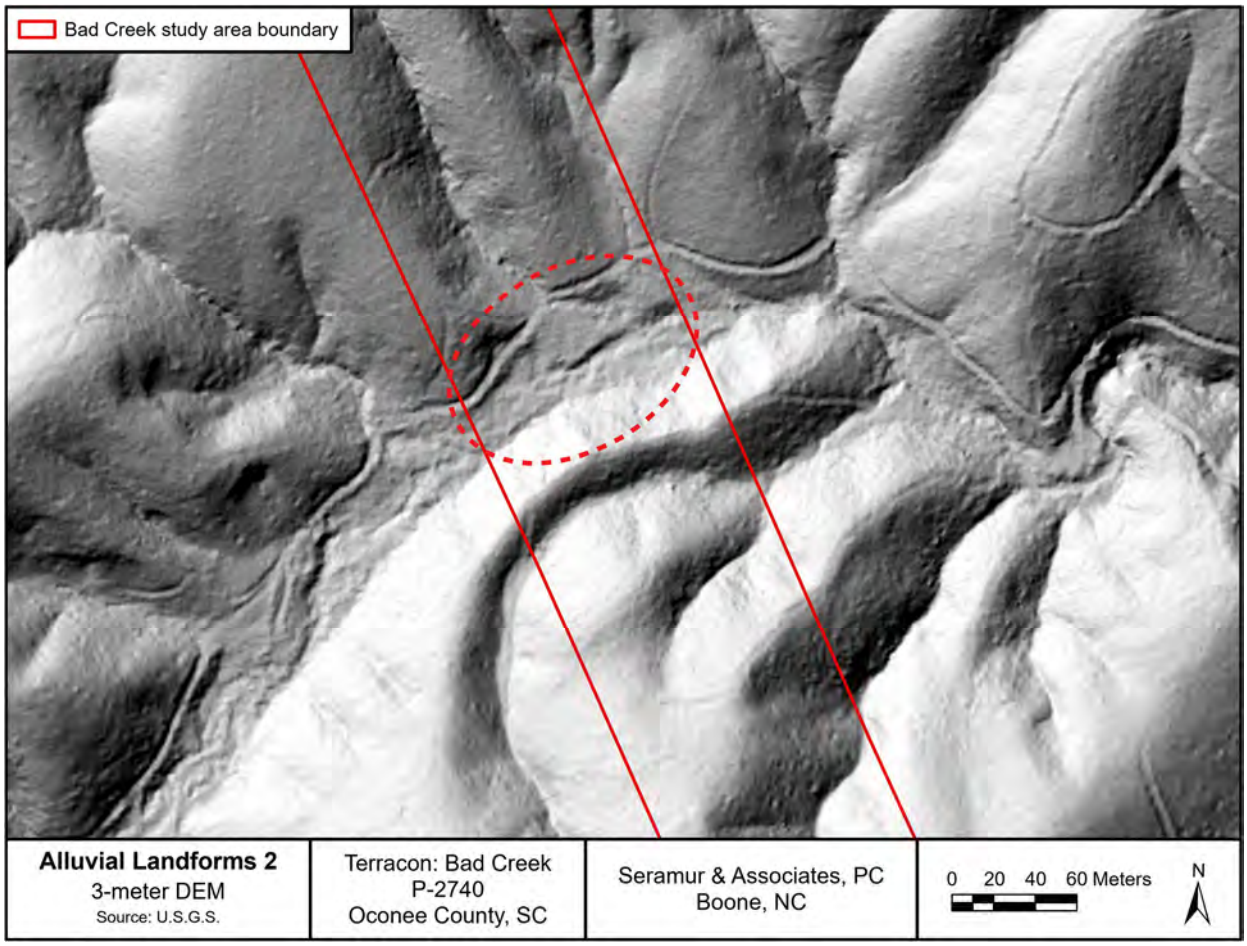

Figure 6. LiDAR DEM of transmission line crossing of Bad Creek. Alluvial landforms are circled in a red dashed line.

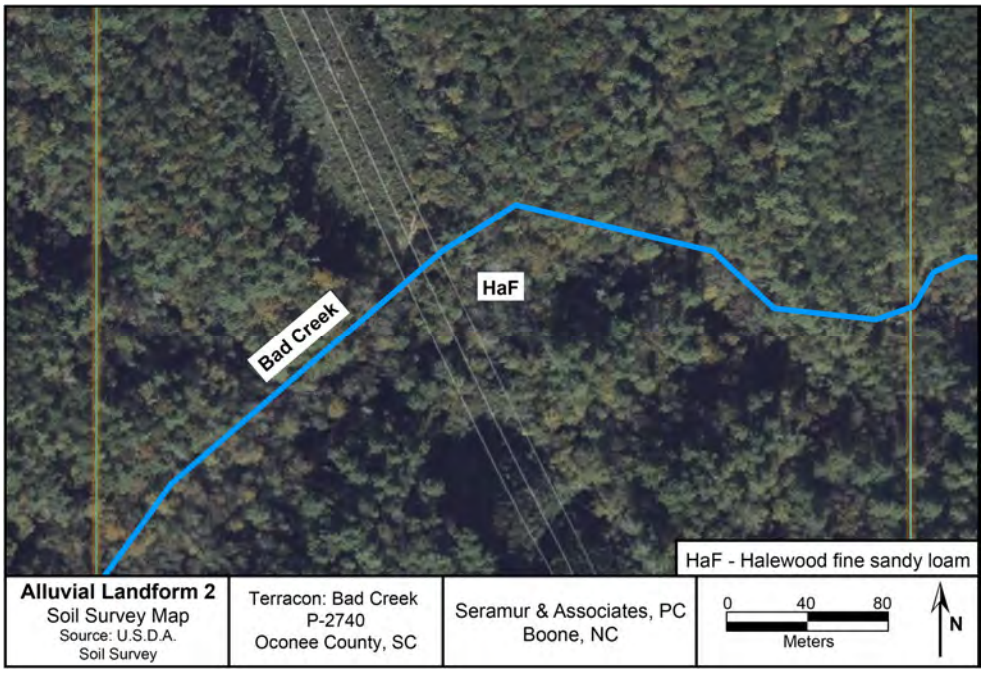

Figure 7. Soil survey map of transmission line crossing of Bad Creek.

Alluvial Landform Area 3

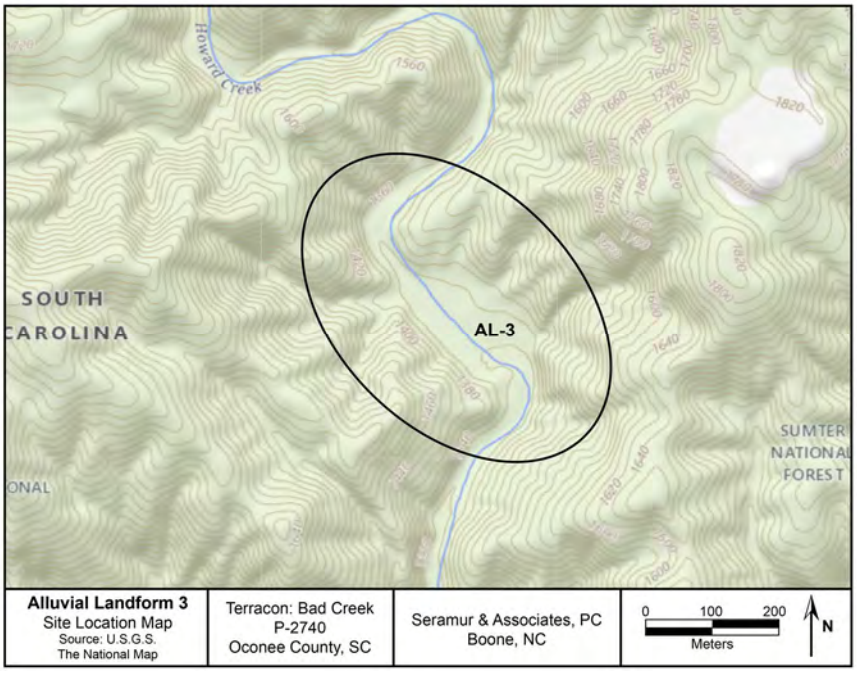

Figure 8. Topographic map of wide terrace along a southern reach of Howard Creek.

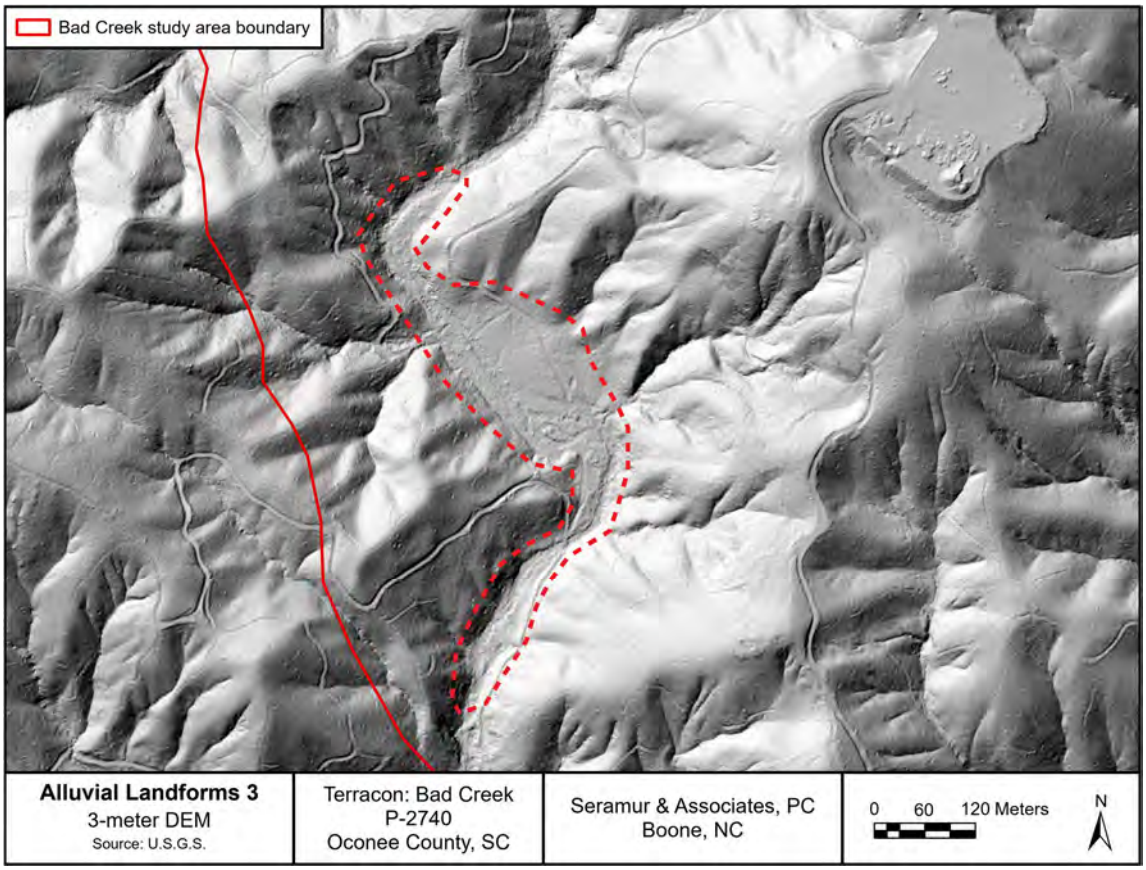

Figure 9. LiDAR DEM of wide terrace along a southern reach of Howard Creek.. Alluvial landforms are outlined in a red dashed line.

Alluvial Landform Area 3 is located in a wide section of the Howard Creek stream valley in the southern portion of the study area (Figures 1 and 8). The DEM shows a broad alluvial terrace in the central portion of AL-3 and narrow terraces to the north and south (Figure 9). The soil survey map indicates that this area is underlain by the Halewood fine sandy loam (Figure 10). The parent material for this soil unit is described as residuum, although there are clearly alluvial landforms present.

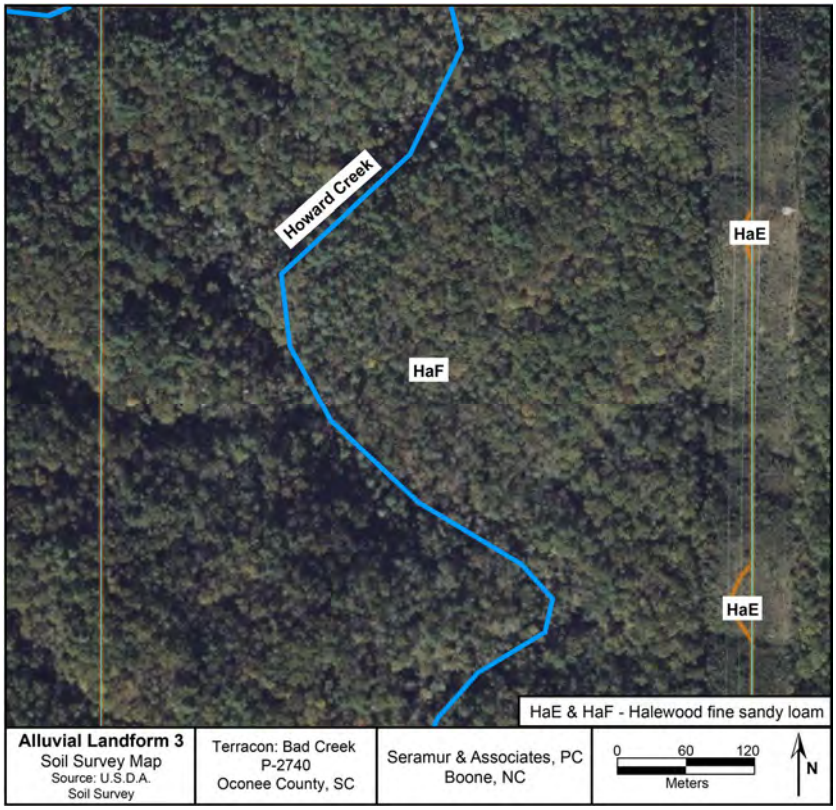

Figure 10. Soil survey map of wide terrace along a southern reach of Howard Creek.

Alluvial Landform 4

Alluvial Landform Area 4 is located in a wide section of the Howard Creek stream valley in the northern portion of the study area (Figures 1 and 11). The DEM shows a stream meandering across a broad alluvial terrace in AL-4 (Figure 12). The soil survey map indicates that this area is underlain by the Halewood fine sandy loam (Figure 13). The parent material for this soil unit is described as residuum, although there are clearly alluvial landforms present. A unit of the Riverview-Chewacla Complex soil is mapped on the western slope of the stream valley and is described as an alluvial soil. The USDA Web Soil Survey program appears to have a projection issue in this part of the study area as this alluvial soil unit should be mapped along Howard Creek.

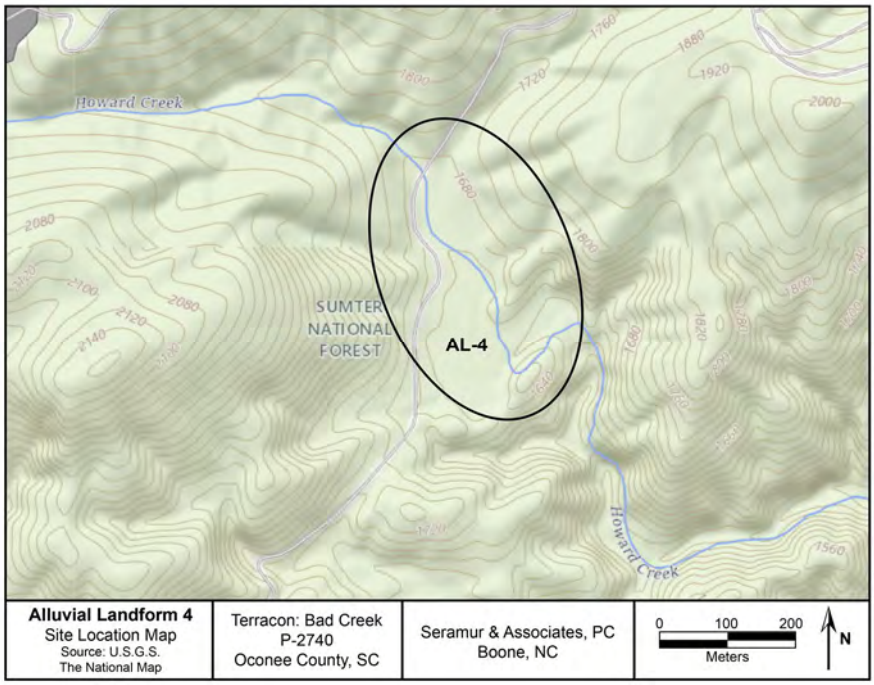

Figure 11. Topographic map of wide terrace along a northern reach of Howard Creek.

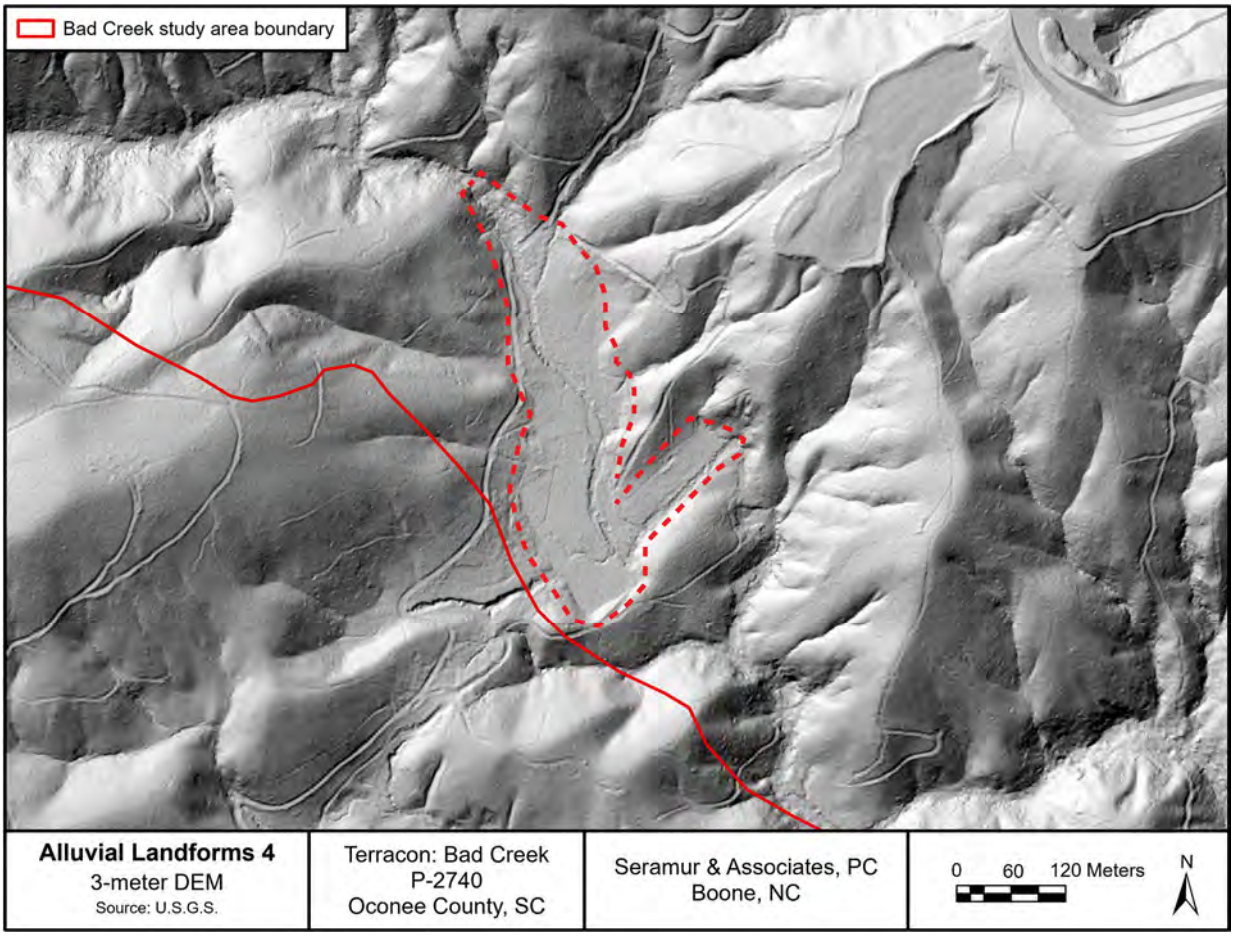

Figure 12. LiDAR DEM of wide terrace along a northern reach of Howard Creek.. Alluvial landforms are outlined in a red dashed line.

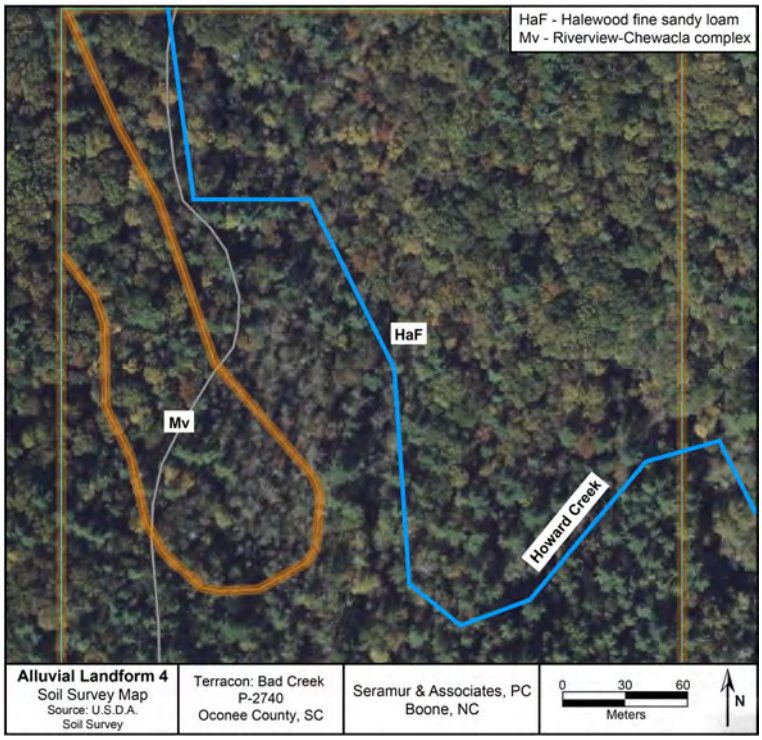

Figure 13. Soil survey map of wide terrace along a northern reach of Howard Creek.

Alluvial Landform Area 5

Alluvial Landform Area 5 is located in the headwaters of Devils Fork which is a small tributary to Lake Jocassee (Figures 1 and 14). The DEM shows a terrace on a wide section of the stream valley at the confluence of four small drainages (Figure 15). The soil survey map indicates that this area is underlain by the Halewood fine sandy loam (Figure 16). The parent material for this soil unit is described as residuum, although there is an alluvial landform present.

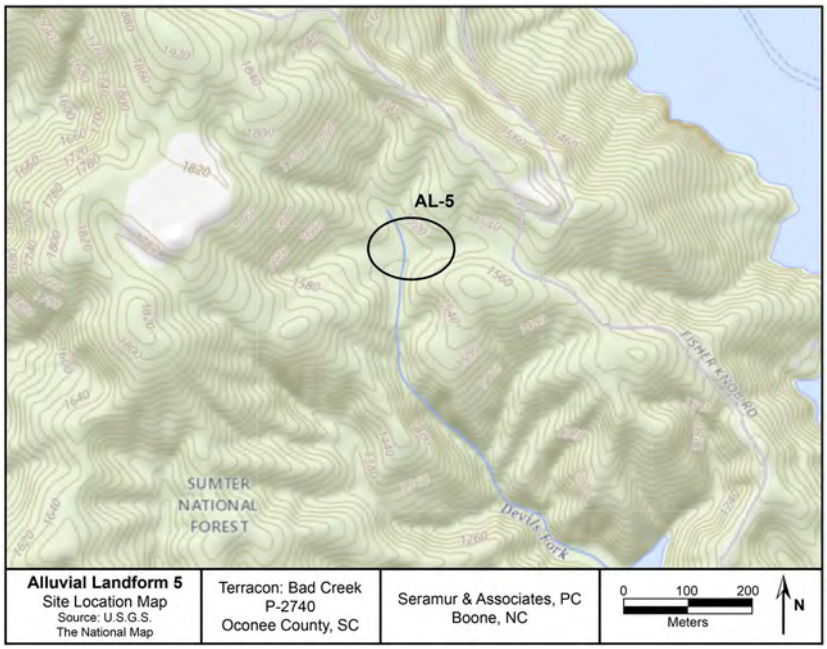

Figure 14. Topographic map of the headwaters of Devils Fork.

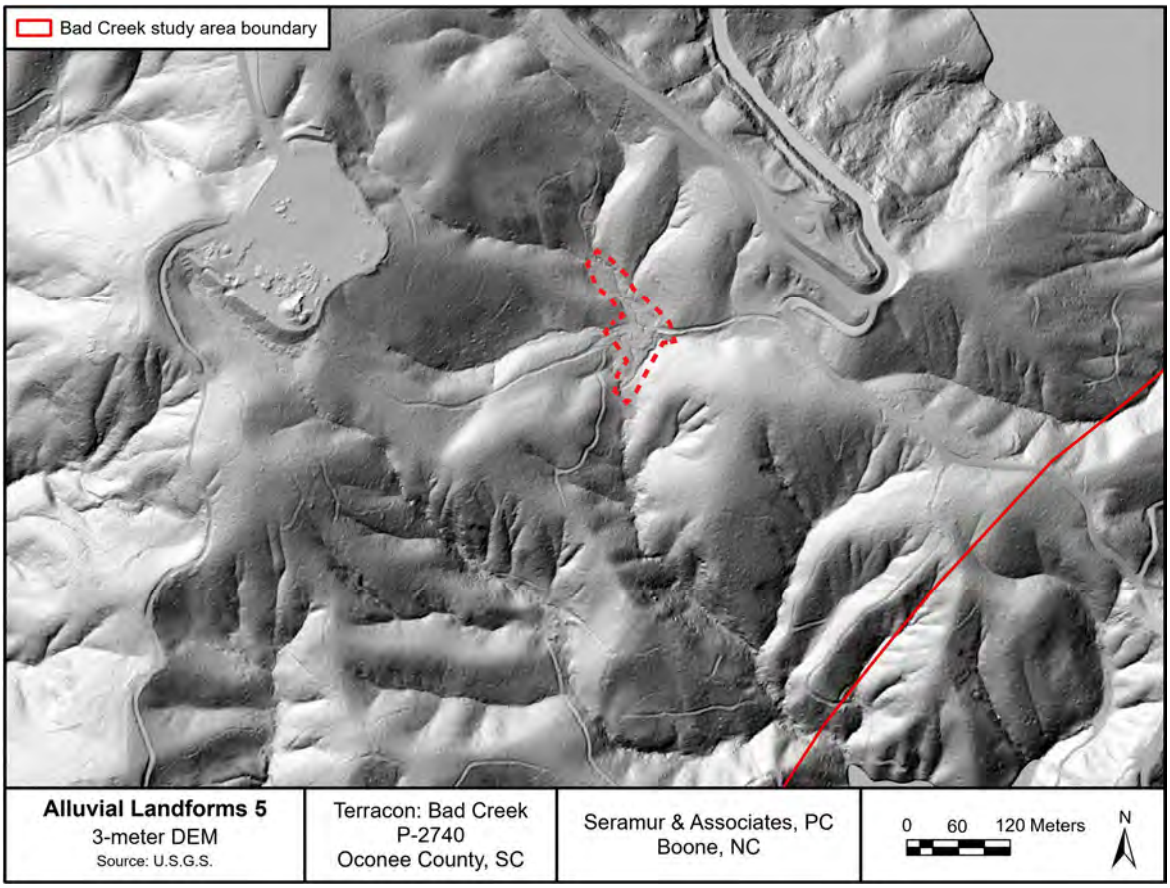

Figure 15. LiDAR DEM of the upper reaches of Devils Fork. Alluvial landforms are outlined in a red dashed line.

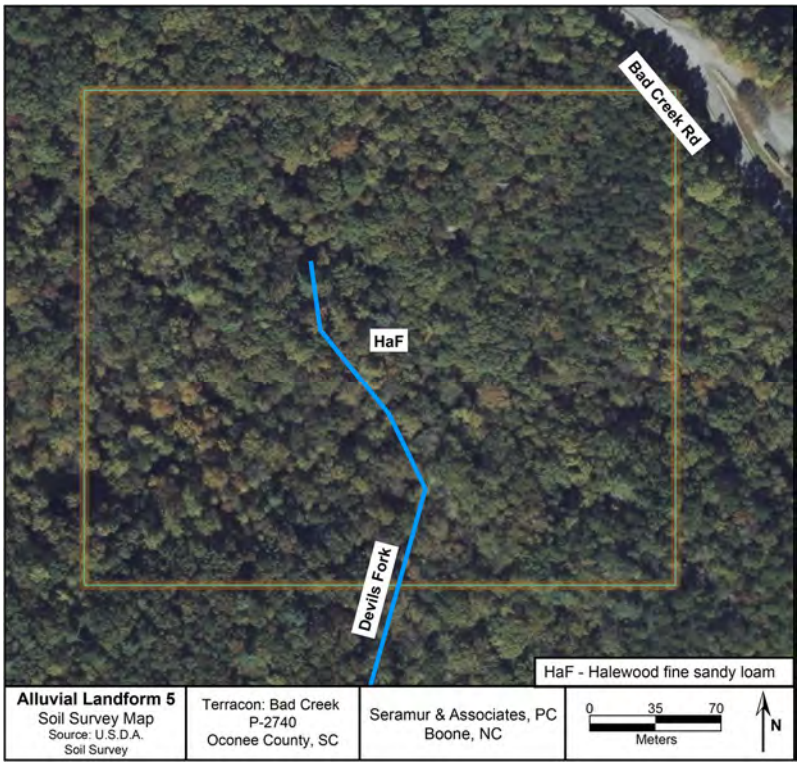

Figure 16. Soil survey map of the upper reaches of Devils Fork.

Alluvial Landform Area 6

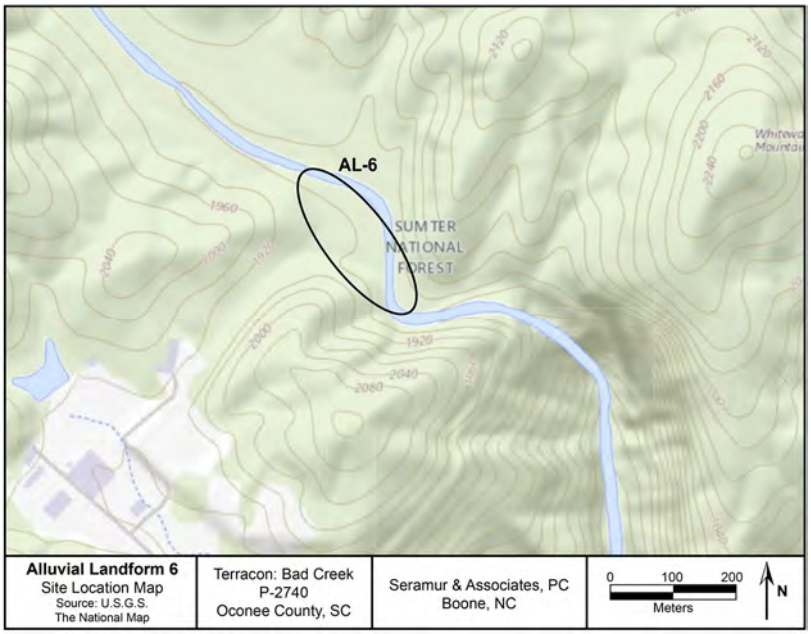

Figure 17. Topographic map of a section of the Whitewater River along the northeast edge of the study area.

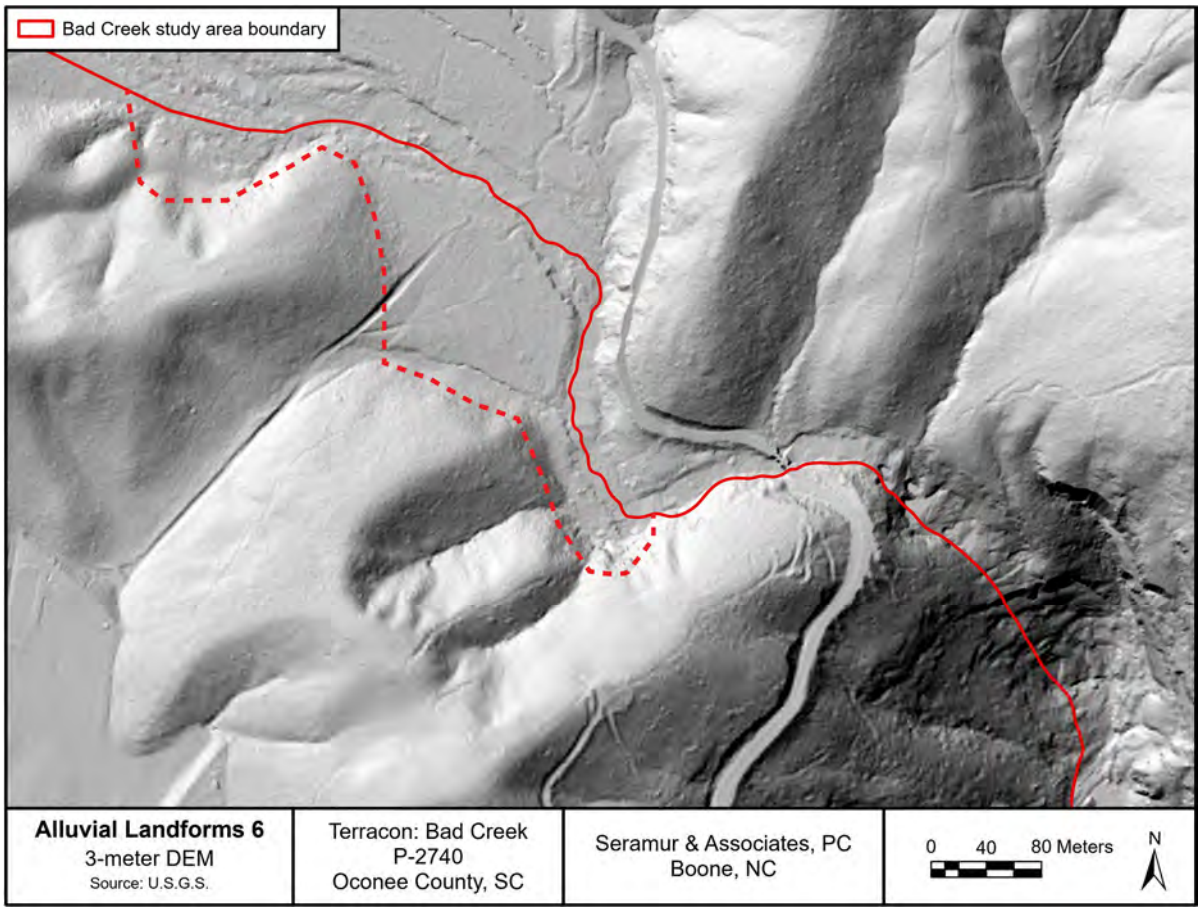

Figure 18. LiDAR DEM of a section of the Whitewater River along the northeast edge of the study area. Alluvial landforms are outlined in a red dashed line.

Alluvial Landform Area 6 is located along the Whitewater River on the northeastern edge of the study area (Figures 1 and 17). The study area is limited to the southwestern side of the stream valley (Figures 17 and 18). The DEM shows a broad terrace along the southwest side of the stream valley (Figure 18). The soil survey map indicates that this area is underlain by the Riverview-Chewacla Complex and the Halewood fine sandy loam (Figure 19). The Riverview-Chewacla Complex is described as an alluvial soil and the Halewood fine sandy loam is a residual soil.

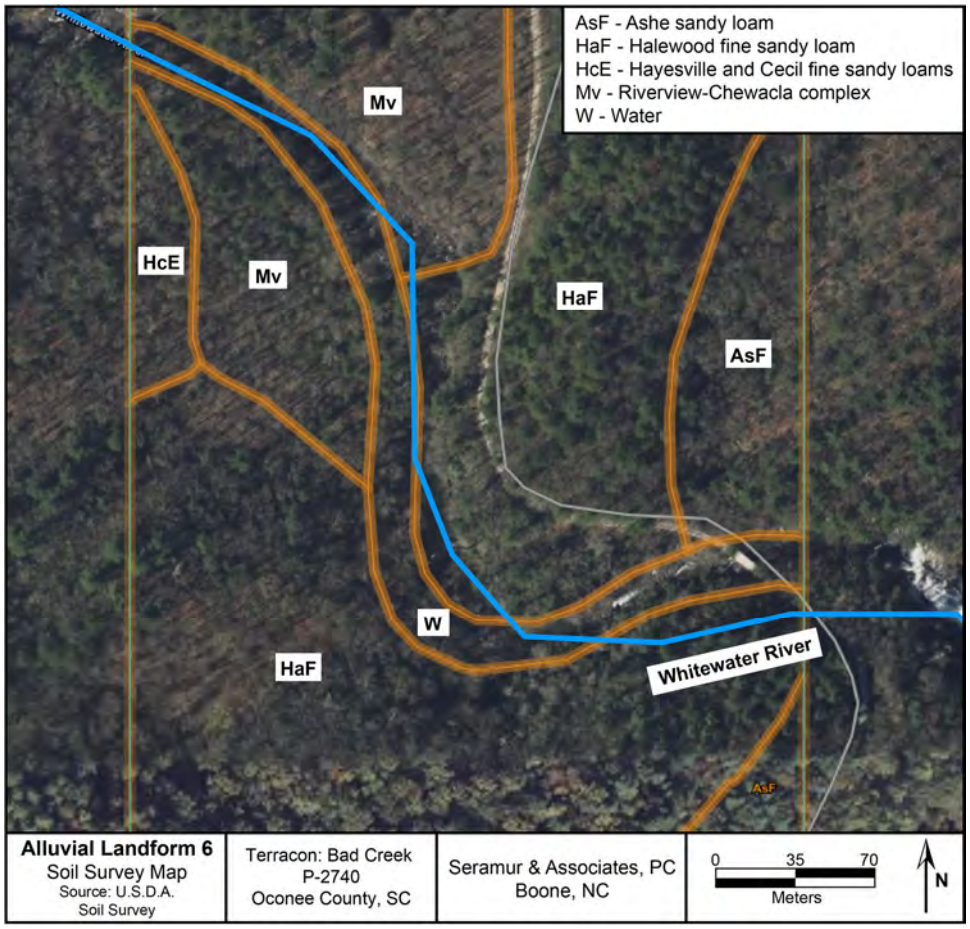

Figure 19. Soil survey map of a section of the Whitewater River along the northeast edge of the study area.

Alluvial landforms mapped in the six areas across the study area should be evaluated further for their potential to contain buried soils and cultural deposits. Seramur & Associates appreciates the opportunity to provide a desktop geomorphology investigation for this project. Please let us know if you have any questions or if we can be of further assistance.

Sincerely,

Keith C. Seramur, P.G.
Consulting Geomorphologist

References

Schaeffer, M. F. 2016. Engineering Geology of the Bad Creek Pumped Storage project, northwestern South Carolina. In: 24th Annual David S. Snipes/Clemson Hydrogeology Symposium Guidebook, March 30, April 1, and April 28, 2016.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. http://websoilsurvey.sc.egov.usda.gov/. Accessed [07/12/2022].

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Appendix H

Environmental Justice Study Plan

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APPENDIX H

ENVIRONMENTAL JUSTICE REVISED STUDY PLAN

Bad Creek Pumped Storage Project
FERC Project No. 2740

December 2022

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ENVIRONMENTAL JUSTICE REVISED STUDY PLAN
BAD CREEK PUMPED STORAGE PROJECT
FERC PROJECT NO. 2740
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ACRONYMS AND ABBREVIATIONS

Bad Creek or Project	Bad Creek Pumped Storage Project
Bad Creek II Complex	Bad Creek II Power Complex
CT	Census Tract
Duke Energy or Licensee	Duke Energy Carolinas, LLC
FERC or Commission	Federal Energy Regulatory Committee
NEPA	National Environmental Policy Act
PAD	Pre-Application Document
PSP	Proposed Study Plan
USEPA	U.S. Environmental Protection Agency

1 Study Requests and Formal Comments

On June 16, 2022, the Federal Energy Regulatory Commission (FERC or the Commission) staff issued comments on the Bad Creek Pumped Storage Project (Project) Pre-Application Document (PAD) and requested that Duke Energy Carolinas, LLC (Duke Energy) conduct an Environmental Justice Study for the Project relicensing pursuant to Section 5.9 of the Commission's regulations. The request for an Environmental Justice Study aligns with the socioeconomic resource issues identified by the Commission in Scoping Document 1 issued for the Project relicensing on April 22, 2022 and Scoping Document 2, issued on August 5, 2022; resource issues address the effects of continued Project operations under the Existing License as well as potential construction and operation of a second powerhouse during the New License term for the Bad Creek II Power Complex (Bad Creek II Complex).

- Effects of Project construction and operation activities on local roads (including traffic), housing, businesses, employment opportunities, and government services.
- Effects of Project construction and operation activities on human health or the environment in identified environmental justice communities.

In addition to the Commission's study request, Upstate Forever submitted a formal comment in support of an environmental justice study. Requests and comments on the PAD and SD1 pertinent to the Environmental Justice Study were considered in the development of the Proposed Study Plan (PSP), submitted to the FERC on August 5, 2022. Following submittal of the PSP and the PSP meeting, the Environmental Justice study area was modified to include the proposed expanded Project Boundary and based on stakeholder comments, the buffer area for the study was increased to include a five-mile radius from the Project and transmission line corridor. Summaries of comments on the PSP and responses are included in Appendix A and copies of all correspondence, including meeting summaries, are provided in Appendix B.

2 Goals and Objectives

The goal of the Environmental Justice Study is to define the potential effects of continued Project operations during the term of a New License issued by FERC, including construction and operation of a second powerhouse (i.e., Bad Creek II Complex), on disadvantaged environmental justice communities that may be present in the study area.

The Environmental Justice Study goal will be accomplished by completing the following six (6) objectives:

1. Identify the presence of environmental justice communities that may be present within the study area.
2. Identify the presence of non-English speaking populations that may be present within the study area.
3. Identify sensitive receptor locations in the study area.
4. Identify outreach strategies to engage environmental justice communities and non-English speaking populations in the relicensing if present within the study area.
5. Discuss (a) the effects of the relicensing and Bad Creek Complex II construction on any identified environmental justice communities, (b) effects that are disproportionately high and adverse, and (c) potential effects on non-English speaking communities and sensitive receptor locations, if present within the study area.
6. Identify mitigation measures to avoid or minimize project effects on environmental justice communities, non-English speaking communities, and sensitive receptor locations, if present within the study area.

3 Study Area

The geographic scope (i.e., study area) of the Environmental Justice Study will include all areas within one mile of the proposed expanded Project Boundary, and within five miles around the proposed construction of the Bad Creek II Complex and transmission corridor (Figure 3-1). Each state, county, and applicable census blocks within the Project Boundary and proposed Bad Creek II Complex study area will be analyzed, as identified in Tables 1 and 2 provided in Attachment 1.

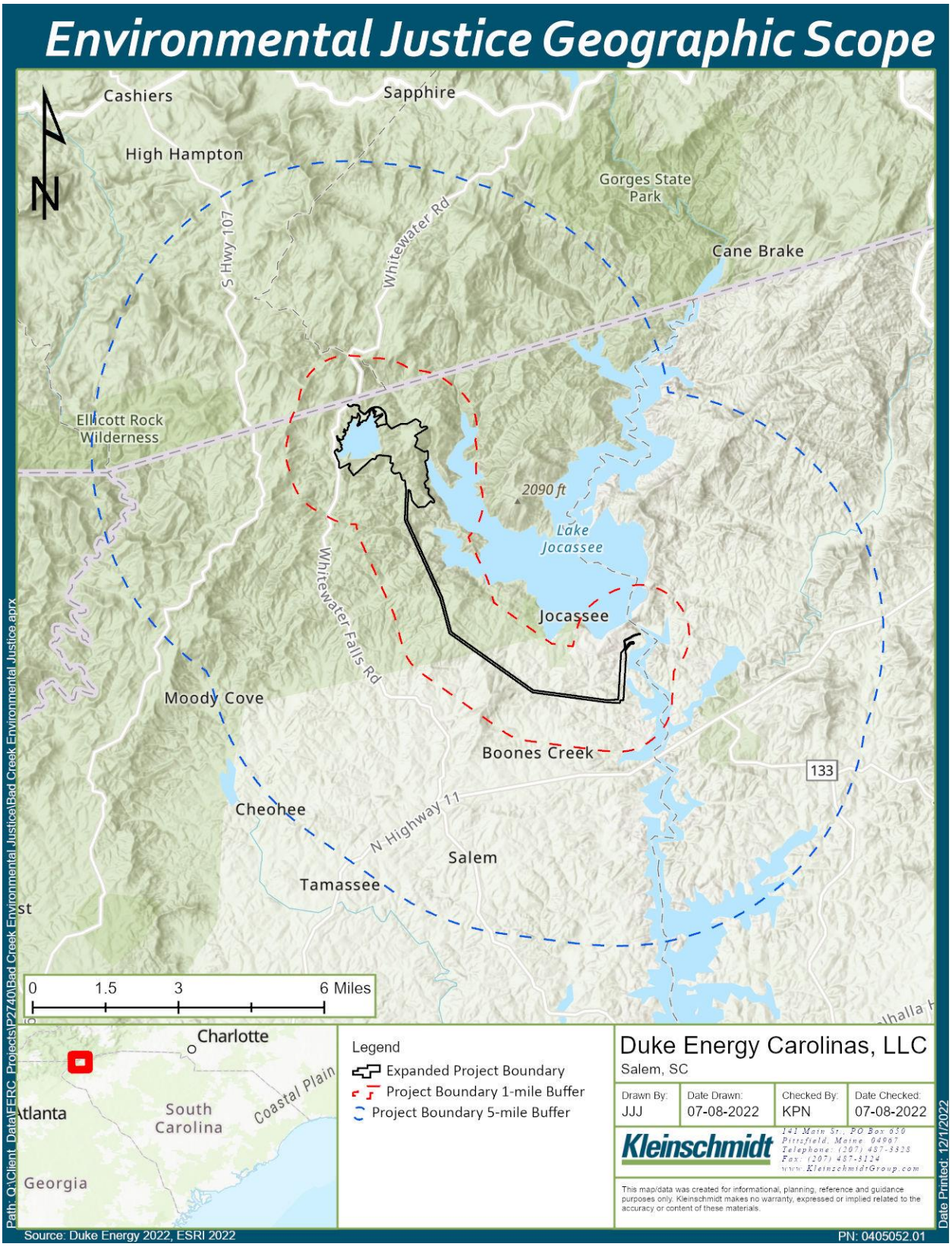

Figure 3-1. Environmental Justice Study Area

4 Background and Existing Information

The U.S. Environmental Protection Agency (USEPA) (2016) defines Environmental Justice as the "fair treatment and meaningful involvement of all people regardless of race, color, culture, national origin, income, and educational levels with respect to the development, implementation, and enforcement of protective environmental laws, regulations, and policies." The goals, objectives and study methodology outlined below is consistent with the June 16, 2022 study request, as well as the USEPA's Promising Practices for EJ Methodologies in National Environmental Policy Act (NEPA) Reviews (USEPA 2016). Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad*, most recently requires federal agencies to achieve environmental justice as "part of their missions by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts" (Executive Order 14008 2021). Additionally, Sections 4(e) and 10(a) of the Federal Power Act include provisions for the equal consideration of environmental, recreational, fish and wildlife and non-developmental values of the project in addition to the power and developmental values.

Existing relevant and reasonably available information concerning the presence of environmental justice communities near the Bad Creek Project in Oconee County, SC was presented in Section 6.11.4 of the PAD developed for the Project relicensing. The PAD identifies environmental justice populations within Census Tract (CT) 302, Oconee County, SC. The total minority population within CT 302 constitutes 12.2 percent of the total minority population in Oconee County and 2.4 percent of the total population of CT 302 (USCB 2021). No individual minority percentages within CT 302 exceed those of the county. There was no measurable population of Native Americans (American Indian or Alaskan Native; 0.0 percent), and no tribal communities are known in the Project vicinity (USCB 2022). The poverty rate of all people in Oconee County was 17.5 percent. CT 302 had a poverty rate for all people of 9.0 percent, lower than the county, state, and nation. Similarly, the per capita income of all people in CT 302 ($53,898) is higher than the county ($29,844), state ($29,426), and nation ($34,103). No identifiable low-income population is present in the Project vicinity within Oconee County. While a small minority

population exists, overall, the percentages are well below the county percentages (Duke Energy 2022).

5 Project Nexus

Project construction, operation, and maintenance has the potential to affect human health or the environment within environmental justice communities, disadvantaged communities, and sensitive receptor locations that may be present within the geographic scope of analysis. If present, appropriate protection, mitigation and enhancement measures may be developed for the New License term to minimize identified affects to these communities and/or sensitive receptor locations.

6 Methods

The methodology for the Environmental Justice Study will be consistent with the Environmental Protection Agency's Promising Practices for Environmental Justice Methodologies in NEPA Reviews (2016). The study will be conducted in eight (8) steps, as outlined below. For the purposes of this study, minority population percentages that are considered significant for environmental justice purposes will either exceed 50 percent of the general population or be meaningfully greater than the minority population percentage in the general population. Minority populations are defined herein as people who identify themselves as Asian or Pacific Islander, American Indian or Alaskan Native, Black (not of Hispanic origin), or Hispanic, either alone or in combination with other ethnicities. Low-income populations are identified using the annual statistical poverty threshold from the U.S. Census Bureau Current Population Reports Series P-60 on Income and Poverty (Duke Energy 2022).

6.1 Step 1 – Statistics Table

A table will be prepared that includes the racial, ethnic, and poverty statistics for each state, county, and census block group within the study area. The table will include the following information from the U.S. Census Bureau's most recently available American Community Surveys 5-Year Estimates for each state, county, and block group:

- Total population;
- Total population of each racial and ethnic group (i.e., White Alone Not Hispanic, Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, some other race, two or more races, Hispanic or Latino origin [of any race]) (count for each group);
- Minority population including individuals of Hispanic or Latino origin as a percentage of total population[1]; and
- Total population below poverty level as a percentage.[2]

6.2 Step 2 – Identification of Environmental Justice Communities Based on Minority Populations

Utilizing data gathered in Step 1, environmental justice communities will be identified by block group based on the presence of minority populations by applying the "50-percent" and the "meaningfully greater" analysis methods. As described above, the "50-percent" analysis method will be used to determine whether the total percent minority population of any block group in the affected area exceeds 50 percent. The "meaningfully greater" analysis will be used to determine whether any affected block group is 10 percent greater than the minority population percent in the county.

6.3 Step 3 – Identification of Environmental Justice Communities Based on Low-Income Populations

The "low-income threshold criteria method" will be used to determine environmental justice communities based on the presence of low-income populations. To qualify, the percent of the population below the poverty level in the identified block group must be equal to or greater than that of the county.

[1] To calculate the percent total minority population, subtract the percentage of "White Alone Not Hispanic" from 100 percent for any given area.

[2] To calculate percentage of total population below poverty level, divide the total households below the poverty level by the total number of households and multiply by 100.

6.4 Step 4 – Identification of Non-English-Speaking Groups

Non-English-speaking groups within the study area will be identified using U.S. Census Bureau data, regardless of whether the group is part of an identified environmental justice community. Previous or planned efforts to identify and communicate with these non-English speaking groups will be reported as well as any proposed measures to avoid and minimize any Project-related effects to these communities.

6.5 Step 5 – Outreach Efforts (if Environmental Justice Communities are Present)

If environmental justice communities are present, Duke Energy will conduct public outreach efforts regarding the Project relicensing and proposed Bad Creek Complex II development. Information regarding outreach efforts will be provided, including a summary of any outreach efforts and consultation to the communities, a description of the information provided to environmental justice communities, and any planned future outreach activities with the communities.

6.6 Step 6 – Identification of Sensitive Receptor Locations

Sensitive receptor locations (e.g., schools, day care centers, hospitals, elderly care facilities) will be identified if they occur within the geographic scope of the analysis. A table will be provided that includes their distances from Project facilities. These facilities will also be identified on the map described under Step 7, below.

6.7 Step 7 – Mapping Efforts

Maps will be developed to include the FERC Project Boundary, Project construction areas, identified environmental justice communities, and sensitive receptor locations. If environmental justice communities are present, the map will denote whether this community is based on the presence of minority populations, low-income populations, or both.

6.8 Step 8 – Project Effects on Environmental Justice Communities and Sensitive Receptor Locations and Proposed Mitigation Measures

The Environmental Justice Report will summarize the information gathered through steps 1 through 7 and include a discussion on the anticipated Project-related effects on any environmental justice communities for all the resources where there is a potential nexus between the effect and the environmental justice community. For identified effects, the report will describe whether the effects would be disproportionately high and adverse. Additionally, the report will include a description of mitigation measures proposed to avoid and/or minimize Project effects on environmental justice communities and non-English speaking groups.

7 Analysis and Reporting

Results of this study will be summarized in the Initial and Updated Study Reports. Duke Energy anticipates that the Environmental Justice Study report will include Project information and background, a depiction and description of the study area, methodology, results, and analysis and discussion. The report will also include relevant stakeholder correspondence and/or consultation, as well as literature cited.

8 Schedule and Level of Effort

The preliminary schedule for this study is outlined in Table 8-1. The estimated level of effort for this study is approximately 330 hours. Duke Energy estimates that the Environmental Justice Study will cost approximately $50,000 to complete.

Table 8-1. Proposed Environmental Justice Study Schedule

Task	Proposed Timeframe for Completion
Study Planning and Existing Data Review	August – December 2022
Study Tasks	Spring 2023-Fall 2023
Distribute Draft Study Report with the ISR	January 2024

9 References

Duke Energy Carolinas, LLC (Duke Energy). 2022. Bad Creek Pumped Storage Project (FERC 2740). Pre-Application Document. February 23, 2022.

Executive Order 14008. Tackling the Climate Crisis at Home and Abroad. 86 Fed. Reg. 7,619-7,633 January 27, 2021.

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_____. 2022. My Tribal Area. [Online] URL: https://www.census.gov/tribal. Accessed February 2022.

U.S. Environmental Protection Agency (USEPA). 2016. Promising Practices for EJ Methodologies in NEPA Reviews. [Online] URL: https://19january2021snapshot.epa.gov/sites/static/files/2016-08/documents/nepa_promising_practicies_document_2016.pdf.

Attachment 1

Attachment 1 – Environmental Justice Analysis Areas

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Table 1. Analysis Areas within the Project Boundary 1-Mile Buffer Zone

State	County	Block Group	Block Name	
South Carolina	Oconee County	1	Block 1000	Block 1074
			Block 1004	Block 1075
			Block 1005	Block 1076
			Block 1006	Block 1077
			Block 1007	Block 1078
			Block 1009	Block 1079
			Block 1011	Block 1080
			Block 1012	Block 1081
			Block 1014	Block 1082
			Block 1022	Block 1083
			Block 1023	Block 1084
			Block 1024	Block 1085
			Block 1025	Block 1086
			Block 1026	Block 1087
			Block 1027	Block 1088
			Block 1028	Block 1089
			Block 1063	Block 1090
			Block 1067	Block 1091
			Block 1068	Block 1093
			Block 1069	Block 1094
			Block 1070	Block 1095
			Block 1071	Block 1116
			Block 1072	Block 1117
			Block 1073	Block 1121
	Pickens County	1	Block 1060	Block 1088
			Block 1085	Block 1051
			Block 1062	Block 1084
			Block 1120	Block 1123
			Block 1052	Block 1089
			Block 1061	Block 1122
			Block 1048	Block 1063
			Block 1087	Block 1086
			Block 1091	Block 1090
North Carolina	Jackson County	2	Block 2109	
			Block 2080	
			Block 2110	
	Transylvania County	1	Block 1050	
			Block 1053	
			Block 1052	

Table 2. Analysis Areas within the Proposed Bad Creek II Complex 5-Mile Buffer Zone

State	County	Block Group	Block Name		
Georgia	Rabun County	1	1000		
North Carolina	Jackson County	2	2007	2055	2079
			2010	2058	2080
			2011	2059	2081
			2014	2060	2082
			2047	2062	2083
			2048	2063	2105
			2052	2077	2109
			2053	2078	2110
			2054		
	Macon County	1	1078	1094	
	Transylvania County	1	1026	1046	
			1028	1047	
			1029	1048	
			1034	1049	
			1038	1050	
			1039	1051	
			1044	1052	
			1045	1053	
South Carolina	Oconee County	1	1000	1037	1075
			1001	1038	1076
			1002	1039	1077
			1003	1040	1078
			1004	1041	1079
			1005	1042	1080
			1006	1043	1081
			1007	1044	1082
			1008	1045	1083
			1009	1046	1084
			1010	1047	1085
			1011	1048	1086
			1012	1049	1087
			1013	1050	1088
			1014	1051	1089
			1015	1052	1090
			1016	1053	1091
			1017	1055	1092
			1018	1056	1093
			1019	1057	1094
			1020	1058	1095
			1021	1059	1096
			1022	1060	1097
			1023	1061	1098
			1024	1062	1102
			1025	1063	1103
			1026	1064	1104
			1027	1065	1105
			1028	1066	1106
			1029	1067	1107
			1031	1069	1115
			1032	1070	1116
			1033	1071	1117

State	County	Block Group	Block Name		
			1034	1072	1119
			1035	1073	1120
			1036	1074	1121
			2007	2055	2079
			2010	2058	2080
			2011	2059	2081
			2014	2060	2082
		2	2047	2062	2083
			2048	2063	2105
			2052	2077	2109
			2053	2078	2110
			2054		
		3	3000		
	Pickens County		1000	1062	1092
			1001	1063	1093
			1003	1064	1094
			1005	1065	1095
			1006	1066	1096
			1013	1067	1097
			1014	1077	1098
			1015	1078	1099
			1031	1079	1100
			1047	1080	1106
		1	1048	1081	1107
			1049	1082	1108
			1050	1083	1110
			1051	1084	1118
			1052	1085	1119
			1053	1086	1120
			1054	1087	1121
			1055	1088	1122
			1056	1089	1123
			1060	1090	1124
			1061	1091	
			2000	2018	2045
			2001	2019	2046
			2002	2020	2047
			2003	2028	2048
			2004	2029	2049
			2005	2030	2050
			2006	2035	2051
			2007	2036	2052
		2	2008	2037	2053
			2009	2038	2054
			2010	2039	2055
			2011	2040	2056
			2012	2041	2057
			2013	2042	2058
			2015	2043	2059
			2016	2044	2060
			2017		