

**FINAL ENVIRONMENTAL ASSESSMENT
FOR HYDROPOWER LICENSE**

Keowee-Toxaway Hydroelectric Project—FERC Project No. 2503-154
South Carolina and North Carolina

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
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Washington, D.C. 20426

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ACRONYMS AND ABBREVIATIONS

2014 Operating Agreement	2014 Operating Agreement between the U.S. Army Corps of Engineers, Southeastern Power Administration, and Duke Energy Carolinas, LLC
AAII	Access Area Improvement Initiative
AD	Anno Domini
Advisory Council	Advisory Council on Historic Preservation
AMSL	above mean sea level
APE	area of potential effects
Bad Creek Project	Bad Creek Hydroelectric Project
BP	Before Present
Certification	water quality certification
C.F.R.	Code of Federal Regulations
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
CWRG	Cultural Resources Working Group
CZMA	Coastal Zone Management Act
dbh	diameter at breast height
DO	dissolved oxygen
Duke Energy	Duke Energy Carolinas, LLC
EA	environmental assessment
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
°F	degrees Fahrenheit
FERC	Federal Energy Regulatory Commission
FOLKS	Friends of Lake Keowee Society, Inc.
Forest Service	U.S. Department of Agriculture, Forest Service
fps	feet per second
FPA	Federal Power Act
FWS	U.S. Fish and Wildlife Service
Greenville Water	Commissioners of Public Works of the City of Greenville, South Carolina
HPMP	Historic Properties Management Plan
Interior	U.S. Department of the Interior
Jocassee Gorges	Jim Timmerman Natural Resources Area at the Jocassee Gorges
Keowee-Toxaway Project or project	Keowee-Toxaway Hydroelectric Project
kV	kilovolt
μ/L	microgram per liter

mg/L	milligram per liter
MGD	million gallons per day
LIP	Low Inflow Protocol
MEP	Maintenance and Emergency Protocol
MW	megawatt
MWh	megawatt-hours
National Register	National Register of Historic Places
NERC	North American Electric Reliability Corporation
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
North Carolina DENR	North Carolina Department of Environment and Natural Resources
North Carolina DWQ	North Carolina Division of Water Quality
NRI	Nationwide Rivers Inventory
ntu	nephelometric turbidity units
PA	Programmatic Agreement
PAD	Pre-Application Document
pCi/L	picocuries per liter
RM	river mile
RMP	Recreation Management Plan
RUN Study	Recreation Use and Needs Study
Russell Lake	Richard B. Russell Lake
SCORP	State Comprehensive Outdoor Recreation Plan
SCFW	South Carolina Wildlife Federation
SD1	Scoping Document 1
SD2	Scoping Document 2
SEPA	Southeastern Power Administration
SERC	SERC Reliability Corporation
SHPO	State Historic Preservation Officer
SMP	Shoreline Management Plan
South Carolina DHEC	South Carolina Department of Health and Environmental Control
South Carolina DNR	South Carolina Department of Natural Resources
South Carolina DPRT	South Carolina Department of Parks, Recreation and Tourism
South Carolina EPPC	South Carolina Exotic Plant Pest Council
South Carolina IAA	South Carolina Institute of Archaeology and Anthropology
Thurmond Lake	J. Strom Thurmond Lake
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
YOY	young-of-the-year

EXECUTIVE SUMMARY

Proposed Action

On August 27, 2014, Duke Energy Carolinas, LLC (Duke Energy) filed an application for a new license for its Keowee-Toxaway Hydroelectric Project (Keowee-Toxaway Project or project). The existing, 867.6-megawatt (MW) project consists of two developments: the 710.1-MW Jocassee Development and the 157.5-MW Keowee Development. The project is located on the Toxaway, Keowee, and Little Rivers in Oconee County and Pickens County, South Carolina and Transylvania County, North Carolina. The project does not occupy federal land. The project generates an average of 1,018,258 megawatt-hours annually. Duke Energy proposes no new generation facilities or other capacity additions.

As its relicensing proposal, Duke Energy proposes to implement a November 29, 2013 Relicensing Agreement, signed by Duke Energy and sixteen other entities (the stakeholders),¹ and filed with the Commission on August 27, 2014. The Relicensing Agreement incorporates the operating provisions also outlined in an Operating Agreement between the U.S. Army Corps of Engineers (Corps), the Southeastern Power Administration (SEPA), and Duke Energy (2014 Operating Agreement), which was executed on October 17, 2014. The Commission solicited comments on the Relicensing Agreement as part of its February 5, 2015 notice requesting comments on the license application.

Project Description

The Keowee-Toxaway project includes two developments. The Jocassee Development is a pumped storage facility that includes Lake Jocassee, which is the upper reservoir; two saddle dikes; two cylindrical intake structures; Jocassee Dam; two water conveyance tunnels; a powerhouse/pumping station; a gated emergency spillway; and Lake Keowee, which is the lower reservoir. The powerhouse contains four reversible

¹ These entities include: Advocates for Quality Development, Inc.; Anderson Area Chamber of Commerce; City of Seneca, South Carolina; Commissioners of Public Works of the City of Greenville, South Carolina; Friends of Lake Keowee Society, Inc. (FOLKS); Oconee County, South Carolina; Pickens County, South Carolina; Pickens County Water Authority; South Carolina Department of Archives and History; South Carolina Department of Natural Resources (South Carolina DNR); South Carolina Department of Parks, Recreation, and Tourism (South Carolina DPRT); South Carolina Wildlife Federation; The Cliffs at Keowee Vineyards Community Association, Inc.; The Reserve at Lake Keowee; Upstate Forever; and Warpath Development, Inc.

pump-turbine units, each with an authorized installed capacity of 177.525 MW. The total authorized installed capacity for the powerhouse is 710.1 MW. The development generates power during peak electricity demand periods, typically during the day, and pumps water from Lake Keowee back to Lake Jocassee during low energy demand periods, typically at night.

The Keowee Development is a conventional hydropower facility that includes Keowee Dam, Little River Dam, four saddle dikes, the Oconee Nuclear Station intake dike, Lake Keowee, a gated spillway, the Keowee powerhouse, an excavated tailrace, and an intake structure. The powerhouse contains two Francis turbine/generator units, each with an authorized installed capacity of 78.75 MW. The total authorized installed capacity for the powerhouse is 157.5 MW. Flows from the Keowee powerhouse are released directly into Hartwell Lake, a reservoir operated by the Corps on the Savannah River.

The existing license authorizes Duke Energy to operate Lake Jocassee between 1,080 feet and 1,110 feet above mean sea level (AMSL). Based on Nuclear Regulatory Commission requirements for Oconee Nuclear Station and other agreements, Duke Energy typically operates Lake Keowee between elevations 794.6 feet and 799.5 feet AMSL. Lake Keowee typically fluctuates less than 1 foot daily and almost never fluctuates more than 1.8 feet in a day, which can occur during high energy demand periods.

Duke Energy proposes to modify project operation in accordance with the 2014 Operating Agreement and the Relicensing Agreement for the Keowee-Toxaway Project. The proposed changes in project operation are based on the results of an Operations Model Study and stakeholder negotiations for basin-wide water distribution. For Lake Jocassee, Duke Energy proposes to continue to operate Lake Jocassee between 1,080 feet and 1,110 AMSL. For periods of normal inflow, Duke Energy proposes a Normal Minimum elevation of 1,096 feet AMSL for Lake Jocassee. For Lake Keowee, Duke Energy proposes the existing high elevation of 800 feet AMSL; however, the low elevation would be increased from 775 feet to 790 feet AMSL. The 790-foot elevation limit would be implemented by December 31, 2019 to allow time for Oconee Nuclear Station to be modified to operate at that level. The interim low elevation for Lake Keowee would be 794.6 feet AMSL, which Duke Energy currently maintains to meet the needs of Oconee Nuclear Station. During periods of normal inflow, Duke Energy proposes a Normal Minimum elevation of 796 feet for Lake Keowee.

Duke Energy proposes to implement a five-stage Low Inflow Protocol (LIP) which would limit weekly flow releases from the Keowee Dam during drought conditions, as described in the Relicensing Agreement. The LIP includes minimum lake elevations, which would be the same as currently licensed for Lake Jocassee, and higher than currently licensed for Lake Keowee. Duke Energy also proposes a Maintenance and

Emergency Protocol (MEP), for circumstances including hydro unit outages, dam safety emergencies, maintenance activities, and flood events, which specifies operating procedures and notification and consultation requirements during and after these events.

Proposed Environmental Measures

In addition to the measures described above, the Relicensing Agreement includes the following:

- Monitoring dissolved oxygen (DO) in the tailwaters of the Jocassee and Keowee Developments during August for the term of the new license, and submitting the monitoring results to the South Carolina Department of Health and Environmental Control (South Carolina DHEC) and the Commission annually by November 30 to ensure the project meets state water quality standards.
- Implementing a Recreation Management Plan (RMP) filed with the license application, which includes operation and maintenance provisions for the existing project recreation sites as well as proposed recreation facility enhancements at Lake Jocassee and Lake Keowee.
- Conducting a Recreation Use and Needs (RUN) Study and updating to the RMP every 12 years, if determined necessary.
- Implementing a Shoreline Management Plan (SMP) filed with the license application, which includes: (1) shoreline classification maps; (2) lake use restrictions for each shoreline classification based on existing uses, environmental criteria, and potential future uses; and (3) shoreline management guidelines that address permitting requirements for non-project use of project lands and waters including (e.g., the construction of piers and boat docks and shoreline vegetation management).
- Revising the SMP ten years following license issuance, and every ten years thereafter.
- Implementing a Historic Properties Management Plan (HPMP), in accordance with the Programmatic Agreement (PA) for the project, executed on May 8, 2015.

Alternatives Considered

This final environmental assessment (EA) considers the following alternatives: (1) Duke Energy's proposal, as described above; (2) Duke Energy's proposal with staff modifications (staff alternative); (3) the staff alternative including the mandatory

conditions provided by South Carolina DHEC; and (4) a no action alternative, meaning that Duke Energy would continue to operate the project with no changes.

Staff Alternative

Under the staff alternative, the project would include Duke Energy's proposed measures, with the following staff modifications:

- Revise the RMP to: (1) clearly indicate that Duke Energy must complete construction of recreation amenities proposed at Crow Creek Access Area; (2) remove cost caps and contingencies associated with the recreation enhancements proposed for Mile Creek County Park; (3) include provisions for monitoring the capacity and condition of Warpath Access Area and developing plans to address capacity issues or overuse, if necessary; (4) describe existing and proposed facilities at World of Energy Picnic Area; (5) require the stabilization of 6,250 feet of shoreline on certain Lake Keowee islands; (6) provide an implementation schedule that includes the anticipated year of construction for recreation enhancement measures; and (7) clarify that recreation site improvements made as part of the Access Area Improvement Initiative (AAII) must be identified in the RMP.
- Modify the project boundary to enclose the recreation facilities at World of Energy Picnic Area to identify the site as a project recreation facility.
- Modify the SMP to extend the exemption timeframe for expanded private facilities (e.g., boat docks) through December 31, 2020 in response to proposed changes in project operation.
- Require annual reporting on modifications made to the SMP to protect any newly discovered resources (e.g., rare, threatened, or endangered species or previously unidentified cultural resources) and corrections to shoreline classification maps.

The staff alternative does not include Duke Energy's proposed water quality monitoring measure because existing water quality in the reservoirs and tailwaters is meeting or exceeding state water quality standards and proposed project operations would be unlikely to affect water quality over the term of a new license.

Staff Alternative with Mandatory Conditions

On October 29, 2015, South Carolina DHEC issued a water quality certification for the project with conditions. The staff alternative with mandatory conditions includes all of the measures under the staff alternative as well as the mandatory conditions filed by South Carolina DHEC.

Public Involvement and Areas of Concern

Before filing its license application, Duke Energy conducted pre-filing consultation under the Integrated Licensing Process. The intent of the Commission's pre-filing process is to initiate public involvement early in the project planning process and encourage citizens, governmental entities, tribes, and interested parties to identify and resolve issues prior to an application being formally filed with the Commission.

Prior to the filing of the license application, we conducted scoping to determine what issues and alternatives should be addressed. On May 17, 2011, we distributed a scoping document (SD1) to interested parties, soliciting comments, recommendations, and information on the project. We held two scoping meetings on June 15, 2011, in Seneca, South Carolina. Based on discussions during the scoping meetings and written comments filed with the Commission, we issued a second scoping document (SD2) on August 25, 2011.

Duke Energy filed its final license application on August 27, 2014. The license application also contained Duke Energy's Relicensing Agreement. On February 5, 2015, we issued a notice that the application was ready for environmental analysis and requested comments, recommendations, and terms and conditions.

The Commission issued a draft EA on October 1, 2015, and requested that comments be filed by October 31, 2015. Duke Energy, FWS, South Carolina DNR, Oconee County Administration, FOLKS, Advocates for Quality Development, Inc., and Upstate Forever filed comments on the draft EA.

The primary issues associated with relicensing the project are: reservoir levels and operation of the project, particularly during drought periods; access to the reservoirs for public recreation; and land use within the project boundary.

Staff Alternative

Geology and Soil Resources

Soils around the reservoirs are highly vulnerable to erosion, which is made worse by the steep slopes in the region. Duke Energy's shoreline erosion studies indicate that shoreline erosion at both Lake Jocassee and Lake Keowee is primarily caused by wind and boat wakes. Project operation affects the elevation where erosion may occur, but does not significantly affect the overall volume of erosion because the strength of wind and boat wakes is generally independent of lake level. Duke Energy's reservoir elevation models indicate that under proposed operation, during normal conditions, modeled lake levels are similar to those under existing conditions, suggesting that the effect of project operation on soil erosion is likely to be similar that under existing conditions.

Duke Energy's proposal to implement shoreline stabilization near sensitive cultural resources, at project recreation sites, and on Lake Keowee islands would protect these sites from further erosion.

Aquatic Resources

Water Quantity

As under existing conditions, Duke Energy's proposed project operation would result in daily and long-term fluctuations in reservoir elevations. Duke Energy's modeling indicates that, under LIP conditions, drawdowns would be less severe than under the existing mode of operation.

For consumptive water withdrawals from the project, operational changes are unlikely to affect existing uses, which include municipal water supplies for the Cities of Greenville and Seneca, South Carolina and cooling water for Oconee Nuclear Station because the water levels will still be above the intake levels. Duke Energy's proposal would prohibit the construction of new large water intakes on Lake Jocassee. The proposal would also require any new or modified intakes on Lake Keowee to be constructed below Keowee Hydro Station's lowest possible operating level. These requirements would ensure that the proposed changes in project operation would not affect the function of large water intakes.

Water Quality

As designed, both the Jocassee and Keowee Developments draw water from high in the water column and pass well-oxygenated water through their generator and pump-generator units, respectively. Existing water quality in Lakes Jocassee and Keowee is considered excellent, and is meeting existing state standards and designated uses. In addition, studies conducted during relicensing indicate that ongoing project operation has little influence on water quality in the reservoirs and the releases from the Jocassee and Keowee Developments. Modeling results also indicate that proposed project operation would not affect the project's ability to meet state water quality standards.

Fisheries

Both developments currently entrain fish in the water intakes, and forage fish are particularly susceptible because they use open water habitat near the intake structures. Forage fish are important because they provide a food source that supports the sport fishery. Duke Energy's study of entrainment and turbine mortality demonstrated that a maximum of 1 percent of the forage fish population in Lakes Jocassee and Keowee is removed under existing project operation. This rate of turbine mortality is likely to continue if the project is relicensed. The entrainment mortality, however, would be unlikely to negatively affect the forage fish populations in Lake Jocassee and Lake

Keowee, because the affected species can overcome mortality rates much greater than 1 percent.

Duke Energy's proposed project operation (pumping and generation) at the Jocassee Development can cause vertical mixing of the water in Lake Jocassee, and break-up the natural temperature layering that occurs in reservoirs (warm surface water, cold deep water). Such mixing can allow warm water to penetrate to deeper water. Adult trout in Lake Jocassee require the cool, well-oxygenated water found in deep water, but the vertical mixing can reduce the amount of this cool habitat, and negatively affect the trout population. Analyses indicate that the amount of cool, well-oxygenated adult trout habitat is primarily driven by winter air temperature, and Jocassee Development operation plays a minor role. Because Duke Energy is not proposing to change pumping or generation, continued operation of the Jocassee Development would continue to have only have a minor adverse effect on the amount of adult trout habitat.

Terrestrial Resources

Duke Energy's proposed project operation, with reservoir fluctuations similar to existing operation, would continue to minimize the risk of shoreline erosion and would maintain wetland and riparian habitat and associated wildlife at the project. As specified in the proposed SMP, monitoring and managing non-native invasive plants, as needed, would benefit native plant communities and the wildlife that depend on them. Implementing the proposed SMP's shoreline classifications with associated restrictions on vegetation management and erosion control measures, would protect native botanical and wildlife species within the project boundary from disturbances related to shoreline development. Duke Energy's proposed botanical signage under the proposed RMP would help protect Oconee bells, a state-listed plant species, at Devils Fork State Park and Fall Creek Access Area.

Threatened and Endangered Species

No federally listed threatened or endangered species are currently known to occur at the project. If federally listed species are found in the future, Duke Energy's proposal to develop species protection plan(s) would be a means for addressing any potential project-related effects on these species.

Recreation Resources

The proposed changes in project operation would not affect recreational access to Lake Jocassee or Lake Keowee because, except during drought conditions, there would be no significant change in project operation. Duke Energy's proposed RMP specifies procedures for closures of recreation facilities, such as boat launches, under LIP or MEP conditions if the facilities cannot be used safely. However, such closures would be temporary and less likely to affect public access in the long term than under existing

project operation because the LIP would better balance drawdowns during drought conditions.

The facility enhancement measures in the proposed RMP would improve public access to project recreation opportunities. The staff-recommended modifications to the measures for Crow Creek Access Area and Mile Creek County Park Access Area would ensure that recreation amenities are constructed as described in the RMP. Capacity and use monitoring at Warpath Access Area would provide Duke Energy with additional flexibility to address future needs that were not identified during relicensing because of Warpath Development, Inc.'s proposal to redevelop the site. Revising the RMP to include World of Energy Picnic Area as a project recreation site would ensure continued operation and maintenance of its picnic area, boat dock, fishing pier, and hiking trail over the term of a license. Revising the RMP to contain a more detailed schedule for completing the construction of the proposed recreation facility improvements would assist in Commission administration of the license. The staff-recommended shoreline stabilization of islands in Lake Keowee would protect the islands from further erosion and ensure their continued use for day-use recreation.

Requiring implementation of Duke Energy's proposed RMP review and update procedures would provide a mechanism for updating the RMP if new recreation uses or needs are identified over the term of a license.

Land Use

Duke Energy's proposed SMP would be a means of balancing the demand for residential and commercial development with resource protection and recreation access to the project's shoreline. Proposed project operation may affect the ability of some dock owners to safely use their docks during extreme drought conditions because, under Stage 5 of the LIP, reservoir levels on Lake Keowee could be lowered to 790 AMSL, which is 4.6 feet lower than the current minimum. The proposed SMP includes a provision for a one-year period during which existing dock owners may apply for a 200-square foot dock expansion (up to a maximum dock size of 1,200 square feet). Modifying Duke Energy's proposal to allow existing dock owners to apply for dock expansions through December 31, 2020 would provide residents additional time to extend or reconfigure their boat docks in response to Duke Energy's proposed changes in project operation.

Filing an annual report with the Commission, identifying changes made to the SMP to protect resources and describe corrected mapping errors, would assist in Commission administration of the license.

Adding 150 acres within the project boundary, including lands necessary for project operation and recreation (i.e., the 25-acre Double Springs Campground expansion, Crow Creek Access Area, High Falls II Access Area, and Mosquito Point Access Area) and to correct mapping errors, as proposed by Duke Energy, and enclosing

World of Energy Picnic Area within the project boundary, as recommended by staff, would help to identify these areas as project land and facilities. Duke Energy's proposal to remove 29 acres from the project boundary would correct mapping errors and remove lands within public road rights-of-ways not necessary for project purposes.

Cultural Resources

The provisions of an HPMP, filed on November 5, 2014, in accordance with the PA, would protect cultural resources at the project which include: (1) the project structures at the Jocassee Development and the Keowee Development; (2) the Alexander-Hill House which is listed on the National Register of Historic Places (National Register); (3) three archaeological sites at Lake Keowee; and (4) five cemeteries at Lake Keowee. Once project structures reach the 50-year federal threshold, Duke Energy would evaluate their National Register-eligibility to determine if additional measures are necessary to protect the historic integrity of project features.

Socioeconomics

Under the proposed change in project operations, during normal conditions, reservoir levels would remain similar to those under existing project operations. However, during Stage 5 LIP conditions, Duke Energy could lower Lake Keowee to a minimum of 790 feet AMSL, which is 4.6 feet lower than under existing conditions. Because, for a majority of the time, proposed project operation would not differ significantly from existing project operation in terms of the daily fluctuation of modeled lake levels and because the LIP provides a managed drought response designed to reduce the severity of drawdowns, the socioeconomic effects of the modifications on recreation, shoreline properties, and businesses would be minimal.

No-Action Alternative

Under the no-action alternative, the project would continue to operate under the terms of the existing license. No new environmental protection, mitigation, or enhancement measures would be implemented.

Conclusions

Based on our analysis, we recommend relicensing the project as proposed by Duke Energy with some staff modifications and additional measures.

In section 4.2 of the final EA, we estimate the likely cost of alternative power for each of the four alternatives identified above. Our analysis shows that during the first year of operation under the no-action alternative, project power would cost \$107,071,126 or \$105.15 per megawatt-hour (MWh) less than the likely alternative cost of power. Under the proposed action alternative, project power would cost \$108,926,968 or

\$91.45/MWh less than the likely alternative cost of power. Under the staff alternative, project power would cost \$108,929,052 or \$91.45/MWh less than the likely alternative cost of power. Under the staff alternative with mandatory conditions, project power would cost \$108,907,740 or \$91.44/MWh less than the likely alternative cost of power.

We chose the staff alternative as the preferred alternative because: (1) the project would provide a dependable source of electrical energy for the region (1,191,013 MWh annually) and (2) the recommended environmental measures proposed by Duke Energy, as modified by staff, would adequately protect and enhance environmental resources affected by the project. The overall benefits of the staff alternative would be worth the cost of the proposed and recommended environmental measures.

We conclude that issuing a new license for the project, with the environmental measures we recommend, would not be a major federal action significantly affecting the quality of the human environment.

FINAL ENVIRONMENTAL ASSESSMENT

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
Washington, D.C.

Keowee-Toxaway Hydroelectric Project FERC Project No. 2503-154—South Carolina and North Carolina

1.0 INTRODUCTION

1.1 APPLICATION

On August 27, 2014, Duke Energy Carolinas, LLC (Duke Energy) filed an application for a new license to continue to operate and maintain its 867.6-megawatt (MW) Keowee-Toxaway Hydroelectric Project (Keowee-Toxaway Project). The project consists of two developments, the 710.1-MW Jocassee Development and the 157.5-MW Keowee Development. The Jocassee Development operates as a pumped storage facility. The project is located on the Toxaway, Keowee, and Little Rivers in Oconee and Pickens Counties, South Carolina and Transylvania County, North Carolina (figure 1-1). The project has an estimated annual generation of 1,018,258 megawatt-hours (MWh). Duke Energy proposes no new generation facilities or other capacity additions. The project does not occupy federal land.

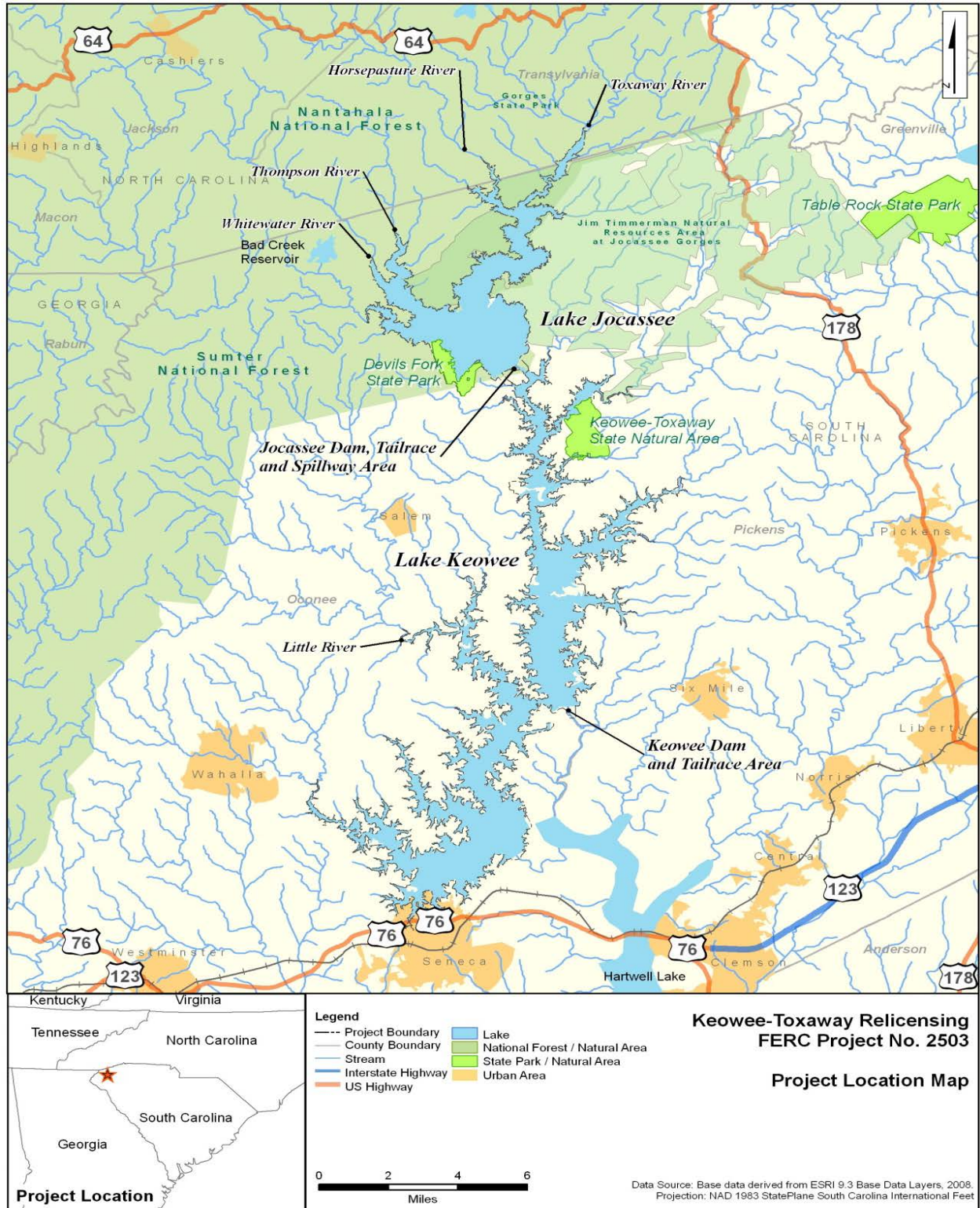


Figure 1-1. Location of Keowee-Toxaway Project (Source: Duke Energy, 2014a).

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the Keowee-Toxaway Project relicensing proposal is to continue to provide a source of hydroelectric power. The project also serves as a source of cooling water and back-up power supply for Oconee Nuclear Station. Under the provisions of the Federal Power Act (FPA), the Federal Energy Regulatory Commission (Commission or FERC) must decide whether to issue a license to Duke Energy for the Keowee-Toxaway Project and what conditions should be placed on any license issued. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (such as flood control, irrigation, or water supply), the Commission must give equal consideration to the purposes of: (1) energy conservation; (2) the protection of, mitigation of damage to, and enhancement of fish and wildlife resources; (3) the protection of recreational opportunities; and (4) the preservation of other aspects of environmental quality.

Issuing a new license for the Keowee-Toxaway Project would allow Duke Energy to generate electricity for the term of a new license, making electrical power from a renewable resource available to its customers.

This final environmental assessment (EA) assesses the effects associated with operation of the project, alternatives to the proposed action, and makes recommendations to the Commission on whether to issue a new license, and if so, makes recommendations regarding terms and conditions to become a part of any license issued.

In this final EA, we assess the environmental and economic effects of operating the project: (1) as proposed by Duke Energy; (2) as proposed by Duke Energy with our recommended measures (staff alternative); and (3) as required by the water quality certification issued by the South Carolina Department of Health and Environmental Control (South Carolina DHEC) (staff alternative with mandatory conditions). We also consider the effects of the no-action alternative. The primary issues associated with relicensing the project are changes in reservoir levels and operation of the project, particularly during drought periods; shoreline erosion; water quality in the tailwaters of each development; effects of project operation and turbine mortality on fishery resources; effects of reservoir fluctuations on terrestrial resources, including state-listed Oconee bells populations; access to the reservoirs for public recreation; management of land use within the project boundary; and the socioeconomic effects of project operation.

1.2.2 Need for Power

The Keowee-Toxaway Project is an integral component of the North Carolina and South Carolina regional power grid, supplying 867.6 MW of installed capacity for peak load demand, spinning reserve, base load energy use, and black start capability. The project's two developments generate an estimated 1,018,258 MWh of energy each year.

The North American Electric Reliability Corporation (NERC) annually forecasts electrical supply and demand nationally and regionally for a 10-year period. The Keowee-Toxaway Project is located in the SERC Reliability Corporation (SERC) region of NERC, in the VACAR sub-region, which covers portions of Virginia, North Carolina, and South Carolina. According to NERC's most recent 2014 annual report, the average annual growth rate in the SERC region for peak energy demand over the last 10-year period (2004-2013) has been 1.91 percent per year (SERC, 2014). The projected growth rate for peak energy demand for the next 10-year period (2014-2023) is 1.33 percent per year. Total energy use for the same period is projected to increase by 1.26 percent per year and SERC estimates that additional capacity will be needed to maintain reliability.

Should a new license for the project not be granted, the services that the project provides including peak generation, grid stabilization during periods of low demand, and black-start capability would need to be provided by other existing projects or in some other fashion by the system operator. We conclude that power from the Keowee-Toxaway Project would help meet a need for power in the SERC region in both the short- and long-term.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

A license for the Keowee-Toxaway Project is subject to numerous requirements under the FPA and other applicable statutes. The major regulatory and statutory requirements are described below.

1.3.1 Federal Power Act

1.3.1.1 Section 18 Fishway Prescriptions

Section 18 of the FPA states that the Commission is to require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of Commerce or the Interior. The U.S. Department of the Interior (Interior), by letter filed March 30, 2015, requests that a reservation of authority to prescribe fishways under section 18 be included in any license for the project.

1.3.1.2 Section 10(j) Recommendations

Under section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency. No agency submitted fish and wildlife recommendations pursuant to section 10(j) of the FPA.

1.3.2 Clean Water Act

Under section 401 of the Clean Water Act (CWA), a license applicant must obtain either certification that any discharges from a project would comply with applicable provisions of the CWA, or a waiver of certification by the appropriate state agency. On March 31, 2015, Duke Energy applied to the South Carolina DHEC for 401 water quality certification (certification) for the Keowee-Toxaway Project.² South Carolina DHEC received this request on April 1, 2015. The South Carolina DHEC timely issued the certification on October 29, 2015 (letter from H. Preston, Director, Division of Water Quality, South Carolina DHEC, Columbia, South Carolina to Duke Energy Carolinas LLC, Charlotte, North Carolina). The conditions of the certification are described under section 2.4, *Staff Alternative with Mandatory Conditions*.

1.3.3 Endangered Species Act

Section 7 of the Endangered Species Act requires federal agencies to ensure their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. By letter October 24, 2008, the Commission designated Duke Energy as its non-federal representative to conduct informal consultation with the U.S. Fish and Wildlife Service (FWS) regarding relicensing of the project. Duke Energy consulted with FWS in

² The majority of the project is located in South Carolina, with a small portion of Lake Jocassee located in Transylvania County, North Carolina. Because no project releases occur in North Carolina, the North Carolina Division of Water Quality (North Carolina DWQ), in a letter dated April 7, 2011 and filed with the license application, indicated that it did not intend to issue a certification. The North Carolina DWQ is now known as the North Carolina Division of Water Resources.

2010 to identify federally listed species with potential to occur in the project area. Prior to conducting its approved studies in 2012, Duke Energy refined this species list based on literature searches on existing habitat type maps, natural heritage/agency databases, and agency consultations. On August 5, 2015, FWS filed a letter with an updated list³ of federally listed threatened and endangered species known to occur in one or more of the counties encompassing the project area including Oconee and Pickens Counties, South Carolina and Transylvania County, North Carolina.

Our analyses of project effects on threatened and endangered species are presented in section 3.3.4, *Threatened and Endangered Species*, and our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

Table 1-1 summarizes the listing status and our determination of effect for listed species that may be affected by the project and are known to occur in the project area, or within one or more of the three counties encompassing the project area. FWS concurred with our determinations on October 30, 2015 (letter from J. Mizzi, Field Supervisor, FWS, Asheville, North Carolina, to K.D. Bose, Secretary, FERC, Washington, D.C.).

³ This species list was referenced in the Interior's letter filed on April 3, 2015; however, it was not enclosed with the electronic filing. In addition to federally listed threatened and endangered species, the list included federal species of concern, candidate species, species that the FWS has been petitioned to list and for which a positive 90-day finding has been issued, indicating listing may be warranted, and species that are either former candidate species or are emerging conservation priority species.

Table 1-1. Listed species and determinations of effect for the Keowee-Toxaway Project (Source: staff).

Species	Status	Determination of effect
<i>Aquatic Species</i>		
Appalachian elktoe	Endangered	No effect
<i>Terrestrial Species</i>		
Rock gnome lichen	Endangered	No effect
Smooth coneflower	Endangered	Not likely to adversely affect
Persistent trillium	Endangered	No effect
Mountain sweet pitcher plant	Endangered	No effect
Spreading avens	Endangered	No effect
Black-spored quillwort	Endangered	No effect
Small whorled pogonia	Threatened	No effect
Dwarf-flowered heartleaf	Threatened	No effect
Swamp pink	Threatened	No effect
Virginia spiraea	Threatened	No effect
Carolina northern flying squirrel	Endangered	No effect
Indiana bat	Endangered	Not likely to adversely affect
Gray bat	Endangered	Not likely to adversely affect
Northern long-eared bat	Threatened	Not likely to adversely affect
Bog turtle	Threatened (similarity of appearance) ^a	No effect

^a Bog turtles are listed as threatened in the U.S. except in Georgia, North Carolina, South Carolina, and Virginia. This southern population of bog turtles is listed as threatened due to similarity of appearance (i.e., T (S/A)) to bog turtles found in northern states (i.e., Connecticut, Delaware, Maryland, Massachusetts, New Jersey, New York, and Pennsylvania). This designation bans the collection and interstate and international commercial trade of bog turtles from the southern population but has no effect on land management activities by private landowners within the southern population range. FWS also considers the southern population of bog turtles as a federal species of concern due to habitat loss.

1.3.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 U.S.C. § 1456(3)(A), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state CZMA agency concurs with the license applicant's certification of consistency with the state's CZMA program, or the agency's concurrence is conclusively presumed by its failure to act within 6 months of its receipt of the applicant's certification.

The project is not located within the state-designated Coastal Management Zone, which extends to South Carolina's eight coastal counties (Jasper, Beaufort, Colleton, Berkeley, Dorchester, Charleston, Georgetown, and Horry), and the project would not affect South Carolina's coastal resources. Therefore, the project is not subject to South Carolina coastal zone program review and no consistency certification is needed for the action. By email filed August 27, 2014,⁴ the South Carolina DHEC concurred.

1.3.5 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA),⁵ and its implementing regulations,⁶ requires that every federal agency "take into account" how each of its undertaking could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties, and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (National Register).

To meet the requirements of section 106, the Commission executed a Programmatic Agreement (PA) with the South Carolina State Historic Preservation Officer (SHPO) on May 19, 2015, and the North Carolina SHPO on May 8, 2015, and invited Duke Energy, the Eastern Band of Cherokee Indians, the United Keetoowah Band of Cherokee Indians in Oklahoma, the Cherokee Nation, and the Catawba Indian Nation to concur with the stipulations of the PA. Duke Energy and the Catawba Indian Nation concurred. The PA requires Duke Energy to implement a Historic Properties Management Plan (HPMP), filed on November 5, 2014. Execution of the PA demonstrates the Commission's compliance with section 106 of the NHPA.

1.3.6 Wild and Scenic Rivers Act

Section 7(a) of the Wild and Scenic Rivers Act requires federal agencies to make a determination as to whether the operation of the project under a new license would invade the area or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the designated river corridor. Public Law 99-530 (October 27, 1986)

⁴ See correspondence dated November 21, 2013 from J. Cox, Coastal Zone Consistency Section Coordinator, South Carolina DHEC, Charleston, South Carolina, to A. Stuart, Senior Environmental Resource Manager, Duke Energy, Charlotte, North Carolina, filed with the license application.

⁵ 54 U.S.C. § 306108 (2014).

⁶ 36 C.F.R. Part 800 (2014).

designated 4.6 miles of the Horsepasture River as a Wild and Scenic River. The downstream extent of the Wild and Scenic River corridor is located adjacent to, but not within, the project boundary for the Keowee-Toxaway Project. The Wild and Scenic Horsepasture River is managed by the U.S. Department of Agriculture, Forest Service (Forest Service) to maintain and enhance the scenic characteristic of the river and to provide water-oriented recreation in a natural setting.

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations (18 C.F.R., sections 5.1–5.16) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, ESA, NHPA, and other federal statutes. Pre-filing consultation must be completed and documented according to the Commission's regulations.

Relicensing of the Keowee-Toxaway Project was formally initiated March 11, 2011, when Duke Energy filed with the Commission a Pre-Application Document (PAD) and a Notice of Intent to license the Keowee-Toxaway Project using the Integrated Licensing Process. The Commission issued a Notice of Commencement of Proceeding on May 17, 2011.

1.4.1 Scoping

Before preparing this EA, we conducted scoping to determine what issues and alternatives should be addressed. A scoping document (SD1) was distributed to interested agencies and others on May 17, 2011. It was noticed in the Federal Register on May 23, 2011. Two scoping meetings, both advertised in local newspapers were held on June 15, 2011, in Seneca, South Carolina, to request oral comments on the project. A court reporter recorded all comments and statements made at the scoping meetings, and these are part of the Commission's public record for the project. In addition to comments provided at the scoping meetings, the following entities provided written comments:

<u>Entity</u>	<u>Date Filed</u>
Town of Salem, South Carolina	July 8, 2011
American Whitewater	July 13, 2011
Commissioners of Public Works of the City of Greenville, South Carolina (Greenville Water)	July 14, 2011
U.S. Environmental Protection Agency (EPA)	July 14, 2011
Duke Energy	July 15, 2011
Foothills Paddling Club	July 15, 2011
North Carolina Department of Administration	July 15, 2011

North Carolina Department of Cultural Resources	July 15, 2011
North Carolina Department of Environment and Natural Resources (North Carolina DENR) ⁷	July 15, 2011
Pendleton District Commission	July 15, 2011
Pickens County Historical Society	July 15, 2011
South Carolina Department of Natural Resources (South Carolina DNR)	July 15, 2011
South Carolina Wildlife Federation (SCWF)	July 15, 2011
FWS	July 15, 2011
Upstate Forever	July 15, 2011
Friends of Lake Keowee Society, Inc. (FOLKS)	July 18, 2011
Representative David R. Hiott, South Carolina State House of Representatives	July 18, 2011
Senator Larry A. Martin, South Carolina State Senate	July 18, 2011
Pickens City Council	July 19, 2011

In addition to the entities above, written comments on various issues were also filed by 62 individuals.

A revised scoping document (SD2), addressing these comments, was issued on August 25, 2011.

1.4.2 Interventions

On February 5, 2015, the Commission issued a notice that Duke Energy had filed an application to relicense the Keowee-Toxaway Project. This notice set April 6, 2015, as the deadline for filing protests and motions to intervene. In response to the notice, the following entities filed motions to intervene (none opposed issuance of a license):

<u>Intervenor</u>	<u>Date Filed</u>
South Carolina DNR	March 3, 2015 ⁸
North Carolina DENR	March 25, 2015
Interior	March 30, 2015

⁷ North Carolina DENR's name was changed to the North Carolina Department of Environmental Quality in 2015. For the purposes of this document, we use North Carolina DENR to denote filings from this office.

⁸ South Carolina DNR filed a second notice of intervention on April 1, 2015.

National Marine Fisheries Service (NMFS)

April 3, 2015

1.4.3 Comments on the Application

The February 5, 2015, notice also stated that the application was ready for environmental analysis, and requested that comments, recommendations, terms and conditions, and prescriptions be filed. The following entities or individuals filed comments, terms and conditions, recommendations, or prescriptions:

<u>Commenting Entity</u>	<u>Date Filed</u>
South Carolina Department of Parks, Recreation and Tourism (South Carolina DPRT)	March 13, 2015
Mr. Douglas Barker	March 17, 2015
Mr. James Vaughan	March 18, 2015
Mr. Ronald E. Davis	March 18, 2015
Advocates for Quality Development, Inc.	March 20, 2015
South Carolina DNR	March 20, 2015
Oconee County Administration	March 23, 2015
Mr. Douglas Barker and 1,286 petitioners (Petitioners)	March 23, 2015
Upstate Forever	March 24, 2015
FOLKS	March 27, 2015
FWS	March 30, 2015 ⁹
Interior	April 3, 2015
Greenville Water	April 6, 2015
SCWF	April 6, 2015
Warpath Development, Inc.	April 6, 2015
Congressman Jeff Duncan	April 16, 2015

Duke Energy filed reply comments on May 21, 2015.

1.4.4 Settlement Agreement

On August 27, 2014, Duke Energy filed a Relicensing Agreement for the Keowee-Toxaway Project with its license application (Appendix C). The Relicensing Agreement incorporates the operating provisions also outlined in an Operating Agreement between the U.S. Army Corps of Engineers (Corps), the Southeastern Power Administration

⁹ A duplicate of the FWS's section 18 fishway prescription was filed with the Commission on April 6, 2015.

(SEPA), and Duke Energy (2014 Operating Agreement), which was executed on October 17, 2014 (Appendix D).

The Relicensing Agreement was signed by Duke Energy; Advocates for Quality Development, Inc.; Anderson Area Chamber of Commerce, City of Seneca, South Carolina; Greenville Water; FOLKS; Oconee County, South Carolina; Pickens County, South Carolina; Pickens County Water Authority; South Carolina Department of Archives and History; South Carolina DNR; South Carolina DPRT; SCWF; the Cliffs at Keowee Vineyards Community Association, Inc.; The Reserve at Lake Keowee, Upstate Forever, and Warpath Development, Inc. The Relicensing Agreement was crafted by the signatories in consultation with the FWS, Corps, and South Carolina DHEC.

The Commission solicited comments on the Relicensing Agreement as part of its February 5, 2015 notice requesting comments on the license application. Comments received on the Relicensing Agreement are reflected in section 1.4.3, *Comments on the Application*, above.

1.4.5 Comments on the Draft EA

On October 1, 2015, the Commission issued a draft EA. Comments on the draft EA were due October 31, 2015.¹⁰ The following entities filed comments:

<u>Commenting Entity</u>	<u>Date Filed</u>
FWS	October 30, 2015
Duke Energy	October 30, 2015
Duke Energy	November 2, 2015
South Carolina DNR	November 2, 2015
Oconee County Administration	November 2, 2015
FOLKS	November 2, 2015
Advocates for Quality Development, Inc.	November 3, 2015
Upstate Forever	November 10, 2015

¹⁰ The notice issuing the draft EA established a 30-day comment period for the draft EA. Because October 31, 2015 fell on a weekend, comments received by the close of the following business day, November 2, 2015, were considered timely.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

The no-action alternative is the baseline from which to compare the proposed action and all action alternatives that are assessed in this EA. Under the no-action alternative, the project would continue to operate under the terms and conditions of the current license. Thus, the no-action alternative would include the existing facilities and current project operation.

2.1.1 Existing Project Facilities

The Keowee-Toxaway Project consists of two developments: the Jocassee Development located on the Toxaway and Keowee Rivers in North Carolina and South Carolina, and the Keowee Development located approximately 12 miles downstream on the Keowee and Little Rivers in South Carolina.

Jocassee Development

The Jocassee Development is a pumped storage facility. It includes Lake Jocassee, which serves as the upper reservoir; two saddle dikes; two cylindrical intake structures; Jocassee Dam; two water conveyance tunnels; a powerhouse/pumping station; a gated emergency spillway; and Lake Keowee, which serves as the lower reservoir (figure 2-1). The development generates power during peak electricity demand periods, typically during the day, and pumps water from Lake Keowee back to Lake Jocassee during low energy demand periods, typically at night.

The Jocassee Dam is a 385-foot-high and 1,800-foot-long earth and rock-fill dam located at river mile (RM) 366.5 of the Keowee River. Two cylindrical concrete/steel intake structures, located in Lake Jocassee at the north section of the dam, lead to two power tunnels which bifurcate and pass flows to four turbines in the powerhouse. The cylindrical intakes have eight screened water intakes positioned between elevations 1,043 and 1,067 feet above mean sea level (AMSL).¹¹

¹¹ All elevations are AMSL unless otherwise noted.

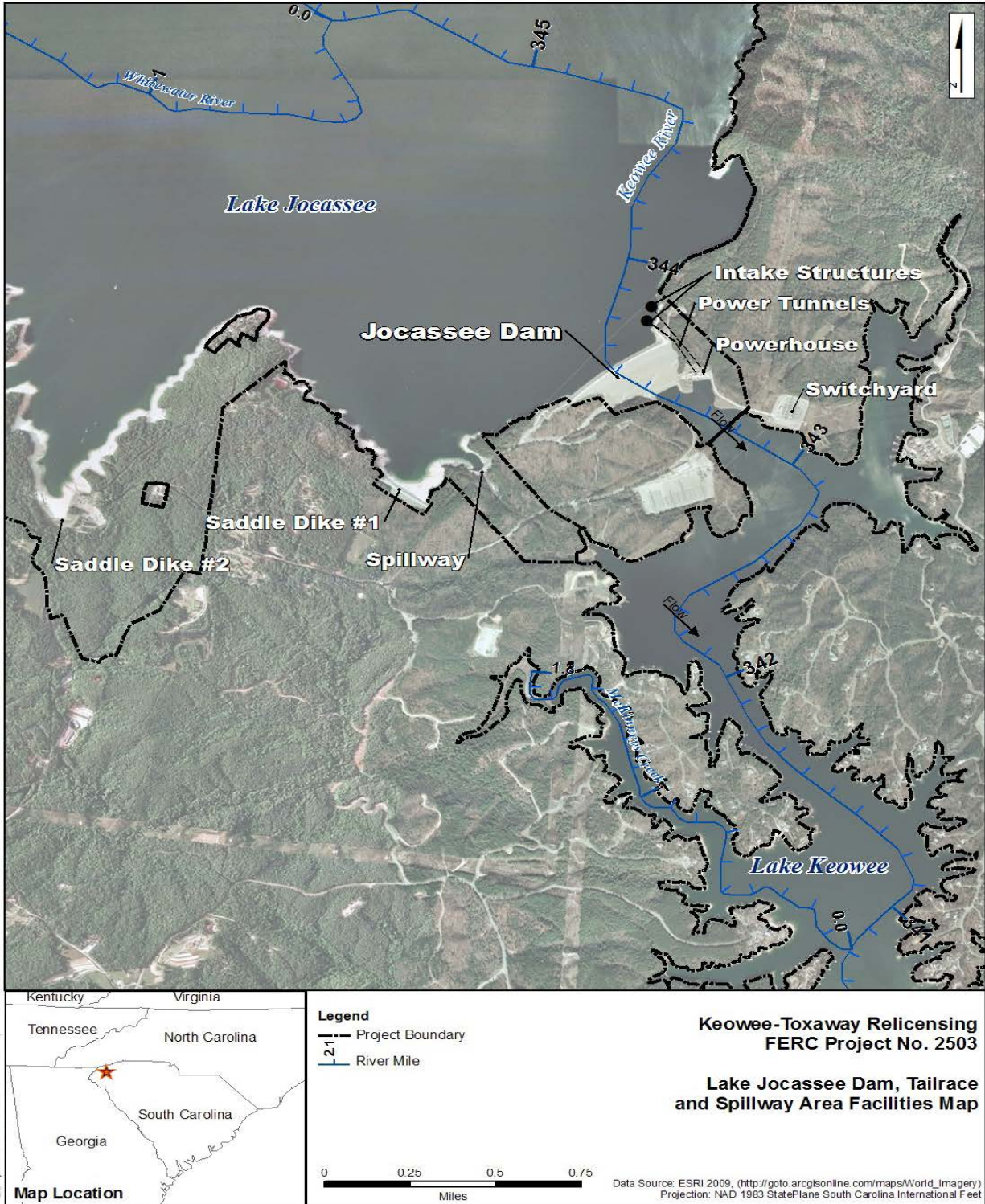


Figure 2-1. Project area for the Jocassee Development at the Keowee-Toxaway Project (Source: Duke Energy, 2014a).

Lake Jocassee has a shoreline length of 92.4 miles and a surface area of 7,980 acres at full pool elevation of 1,110 feet. The usable storage capacity is 225,387 acre-feet between elevations 1,110 feet and 1,080 feet.

Two earthfill saddle dikes, Saddle Dike 1 and Saddle Dike 2, are located on Lake Jocassee. Saddle Dike 1, 35 feet high by 825 feet long, is located 3,000 feet southwest of Jocassee Dam. Saddle Dike 2, 25 feet high by 500 feet long, is located 8,000 feet west of Jocassee Dam. The saddle dikes, which serve to contain Lake Jocassee, are grass covered with the exception of a riprap-lined zone for wave protection and a riprap-covered toe drain on each downstream face.

The Jocassee powerhouse/pumping station is located at the east toe of the dam and is situated mostly underground. The powerhouse contains four reversible pump-turbine units, each with an authorized installed capacity of 177.525 MW.¹² The total authorized installed capacity for the powerhouse is 710.1 MW. The maximum hydraulic capacity for the units is 36,200 cubic feet per second (cfs), and maximum pumping rate is 31,720 cfs. Flows pass from the powerhouse into a 200-foot-long tailrace section which empties directly to Lake Keowee. The tailrace banks consist of riprap covered slopes.

There are no primary transmission lines at the Jocassee Development. Power generated by each turbine passes through a dedicated generator step-up transformer, located at the powerhouse, which feed a 230-kilovolt (kV) transmission system. The transformers for Units 1, 3 and 4 are rated at 230/14.4 kV. The transformer for Unit 2 is rated at 230/14.4/14.4 kV.

Keowee Development

The Keowee Development includes Keowee Dam, Little River Dam, four saddle dikes, the Oconee Nuclear Station intake dike, Lake Keowee, a gated spillway, the Keowee powerhouse, an excavated tailrace, and an intake structure (figure 2-2). Keowee Dam is located about 12 miles downstream of Jocassee Dam. Flows from the Keowee powerhouse are released into Hartwell Lake, a Corps operated reservoir on the Savannah River.

¹² 133 FERC ¶ 62,192 (2010). On December 1, 2010 the Commission amended the license to replace the turbine runners for units 1 and 2 at the Jocassee Development, resulting in a total authorized capacity of 177.525 MW.

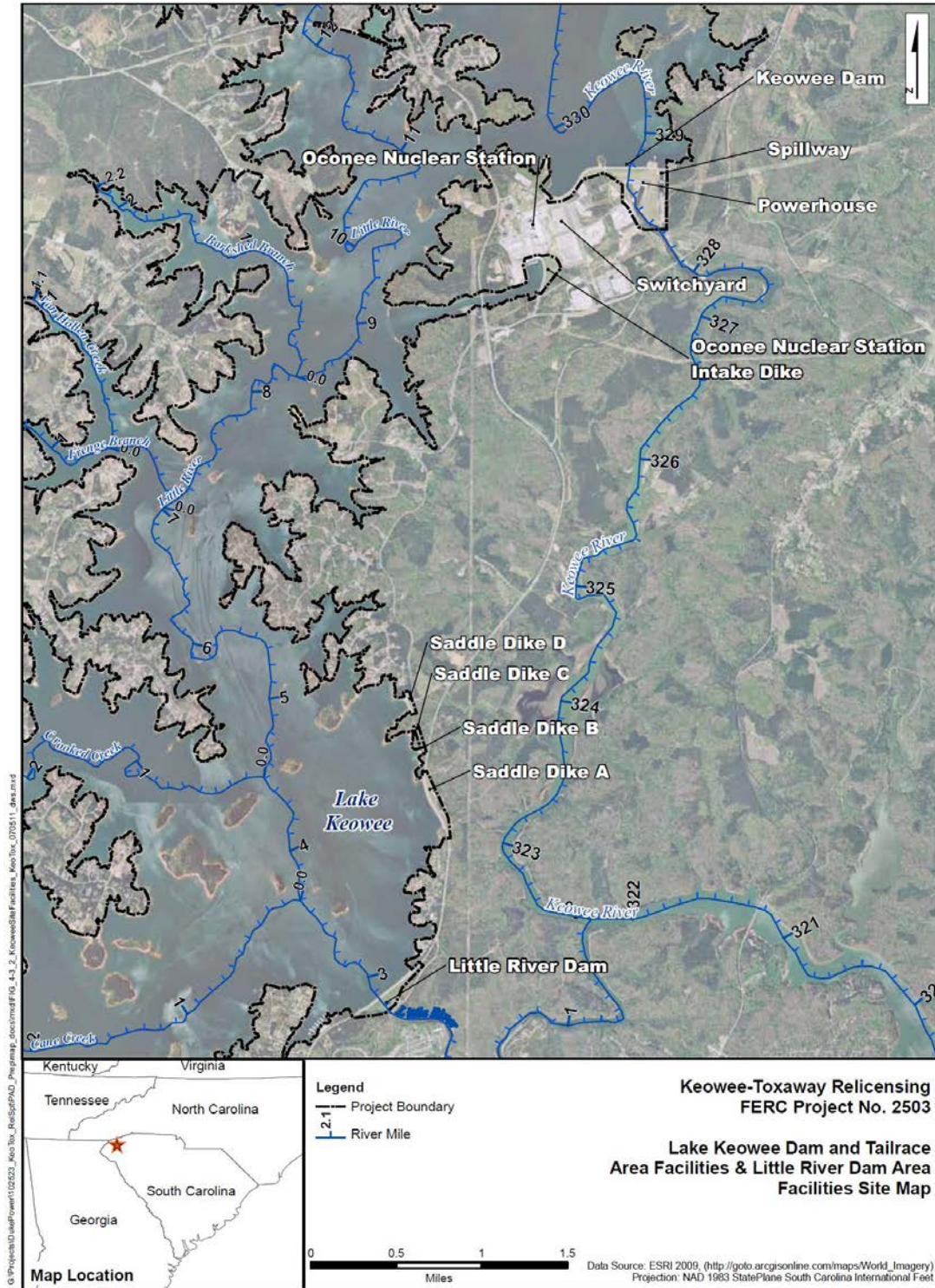


Figure 2-2. Project area for the Keowee Development at the Keowee-Toxaway Project (Source: Duke Energy, 2014a).

Keowee Dam is a 3,500-foot-long, 165-foot-high earthfill dam located at RM 328.8. The dam serves to impound the portion of the Lake Keowee in the Keowee River watershed. One cylindrical concrete/steel intake structure, located in Lake Keowee at the east section of the dam, leads to a power tunnel which bifurcates and passes flows to two turbines in the powerhouse. The cylindrical intake has eight screened water intakes positioned at different elevations in the reservoir.

The Little River Dam is a 1,800-foot-long, 165-foot-high earthfill dam located 5 miles southwest of Keowee Dam at RM 325. The dam has no gates or water release structures and serves to impound the portion of Lake Keowee in the Little River watershed.

Four earthfill saddles dikes, Saddle Dike A, B, C, and D, are located 1.5 miles north of Little River Dam on the eastern edge of Lake Keowee. The maximum design elevation for each of the dikes is 815 feet, in order to impound Lake Keowee at normal pond elevation 800 feet. Saddle Dike A is 50 feet high and 1,900 feet long; Saddle Dike B is 15 feet high and 225 feet long; Saddle Dike C is 15 feet high and 350 feet long; and Saddle Dike D is 40 feet high and 650 feet long.

Lake Keowee has a surface area of 17,660 acres, and 388 miles of shoreline at full pond elevation of 800 feet. The gross storage capacity of the lake at full pond elevation is 869,338 acre-feet. Usable storage capacity is 364,884 acre-feet between elevations 775 feet and 800 feet; however, drawdowns are limited to 794.6 feet,¹³ resulting in an operating range of 5.4 feet and storage capacity of 90,319 acre-feet.

The Oconee Nuclear Station intake dike is an earthfill dike located approximately three-fourths of a mile southwest of Keowee Dam in the intake channel for Oconee Nuclear Station. The 1,200-foot-long dike has a top elevation of 825 feet, and serves to impound Lake Keowee within the intake channel. The dike has no gates or water release structures.

A 176-foot-wide concrete gated spillway is located at the east end of the Keowee Dam. The spillway includes an entrance channel with concrete wingwalls and concrete side walls, and four 38-foot-wide by 35-foot-high Tainter gates capable of releasing up to 106,000 cfs at full pond elevation. Flows from the Tainter gates pass into a 311-foot-long concrete discharge channel which empties directly into Hartwell Lake.

¹³ The minimum reservoir elevation for Lake Keowee is currently limited by operating constraints for the Oconee Nuclear Power Station, as discussed in section 2.1.3, *Existing Project Operation*.

A concrete/steel powerhouse is located at the base of the dam. The powerhouse contains two Francis turbine/generator units, each with an authorized installed capacity of 78.75 MW. The total authorized installed capacity for the powerhouse is 157.5 MW. The maximum hydraulic capacity for the units is 24,920 cfs. Flows pass from the powerhouse into a 200-foot-long tailrace section which empties directly to Hartwell Lake.

There are no primary transmission lines at the Keowee Development. Power generated by each turbine passes through a dedicated generator step-up transformer, located at the powerhouse, which feeds a 230-kV transmission system. The transformer for Units 1 and 2 are rated at 230/13.2 kV.

2.1.2 Project Safety

The Keowee-Toxaway Project has been operating for more than 39 years under the existing license, and during this time, Commission staff has conducted annual operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operation, compliance with the terms of the license, and proper maintenance. In addition, the project has been inspected and evaluated every 5 years by an independent consultant, and a documented consultant's safety report has been submitted for Commission review. As part of relicensing, Commission staff will evaluate the continued adequacy of the proposed project facilities under a new license. Special articles would be included in any license, as appropriate. Commission staff would continue to inspect the project during the new license term to ensure continued compliance to Commission-approved plans and specifications, special license articles relating to construction (if any), operation and maintenance, and accepted engineering practices and procedures.

2.1.3 Existing Project Operation

The Keowee-Toxaway Project interacts directly with several adjacent energy and water uses. Lake Keowee serves as the cooling water source and back-up power supply for Duke's existing 2,538-MW Oconee Nuclear Station. Immediately downstream of the project are the Corps' Hartwell Lake, Richard B. Russell (Russell) Lake, and J. Strom Thurmond (Thurmond) Lake, located on the Savannah River. Upstream of the project, Duke Energy's existing 1,065-MW Bad Creek Hydroelectric Project No. P-2740 (Bad Creek Project) is a pumped storage project which uses Lake Jocassee as its lower reservoir. Duke Energy has agreements with two municipal water withdrawers on Lake Keowee, the City of Seneca, South Carolina and the Greenville, South Carolina Water System.

Jocassee Development

The Jocassee Development is operated as a pumped storage facility, with the pump-turbine units used for generating power during peak demand periods (typically during the day), and for pumping water back through the power tunnels into Lake Jocassee (typically during the night). The average annual energy production from the Jocassee Development is 953,715 MWh/year. The average annual pumping energy used at the Jocassee Development is 1,076,966 MWh/year. The Jocassee Development is operated remotely from Charlotte, North Carolina by Duke Energy. Power generation occurs on a flexible schedule, as the start and duration is determined by system demands.

Lake Jocassee is licensed to operate between 1,080 feet and 1,110 feet; however the normal operating range when not in drought conditions has been far narrower. Historically, Duke Energy has operated Lake Jocassee at or above 1,094 feet more than 80 percent of the time. Daily fluctuations in the reservoir have ranged from 1.5 feet to 2.9 feet. The reservoir can be drawn down 30 feet, to elevation 1,080 feet, under the most severe drought conditions. The reservoir level is typically maintained by passing flows through one or more of the four turbine/pump units. During extreme flood events, when the reservoir elevation cannot be maintained using generation flow, the Tainter gates on the emergency spillway can be partially or fully opened to maintain the reservoir elevation at or below 1,110 feet. The emergency spillway, which has a capacity of 20,000 cfs, has not been used during the history of the project. The pump-turbine units can pass an additional 32,720 cfs.

Keowee Development

The Keowee Development is a conventional hydropower facility, which is operated manually by staff on site. Average annual energy production from the Keowee Development is 64,543 MWh. Energy generated from the Keowee Development provides energy to the grid and standby emergency power for the 2,538-MW Oconee Nuclear Station located adjacent to Keowee Hydro Station. Lake Keowee provides cooling water to Oconee Nuclear Station, and municipal water to the City of Seneca, South Carolina and the Greenville, South Carolina Water System.

Lake Keowee is licensed to operate between elevations of 775 and 800 feet. However, based on Nuclear Regulatory Commission requirements for Oconee Nuclear Station and other agreements, Duke Energy typically operates Lake Keowee between elevations 794.6 and 799.5 feet. On a daily average basis, Lake Keowee fluctuates less than 1 foot, rarely exceeding a fluctuation of 1.8 feet during high energy demand periods. Gross storage is 869,338 acre-feet and usable storage is 90,319 acre-feet.

In the event of extended low inflows, a 1968 Operating Agreement between Duke Energy, the Corps, and SEPA outlined a drought management plan which required minimum required weekly water releases from the Keowee Development to meet storage

needs in two of the three downstream Corps reservoirs. Duke Energy has replaced the 1968 Operating Agreement with the 2014 Operating Agreement, which was signed by the Corps, SEPA, and Duke Energy on October 17, 2014 (Appendix D). Duke Energy is currently implementing a Low Inflow Plan (LIP) and a Maintenance and Emergency Protocol (MEP) which are incorporated into the 2014 Operating Agreement.¹⁴ The LIP and MEP are further discussed in section 2.2.2, *Proposed Project Operation*.

During high inflow events, Duke Energy uses the two generating units at the Keowee Development to pass inflow. The maximum hydraulic capacity of the Keowee powerhouse is 24,920 cfs. When this inflow is exceeded, Duke Energy partially or fully opens the spillway gates to maintain the reservoir elevation.

2.1.4 Existing Environmental Measures

Article 42 of the current license¹⁵ requires Duke Energy to provide recreation facilities within the project boundary. Duke Energy manages its existing project recreation facilities through a Commission-approved Recreation Management Plan (RMP).¹⁶ Duke Energy manages shoreline development at project reservoirs through the Commission-approved Shoreline Management Plan (SMP) for Lake Jocassee¹⁷ and SMP for Lake Keowee.¹⁸ Duke Energy manages historic properties in accordance with a 2007 PA for the Keowee-Toxaway Project.¹⁹

¹⁴ Duke Energy began implementing the LIP and MEP on December 1, 2013, which is the effective date of the executed Relicensing Agreement.

¹⁵ Duke Energy's current license was issued September 26, 1966, and was amended August 1, 1977, September 27, 1996, August 11, 1997, November 14, 1997, August 24, 2006, February 13, 2008, and December 1, 2010.

¹⁶ 132 ¶ FERC 62,045 (2010).

¹⁷ 142 FERC ¶ 62,086 (2013).

¹⁸ 119 FERC ¶ 62,165 (2007).

¹⁹ Executed May 9, 2007 as a requirement of the SMP for Lake Keowee.

2.2 APPLICANT'S PROPOSAL

2.2.1 Proposed Project Facilities

Duke Energy does not propose any construction or structural changes to existing project facilities. Changes in project operation are discussed in section 2.2.2, *Proposed Project Operation*, and changes to the project boundary are discussed in section 2.2.3, *Project Boundary*.

2.2.2 Proposed Project Operation

The Relicensing Agreement includes three measures for project operation which are described below.

Lake Levels/Releases

For Lake Jocassee, Duke Energy proposes the existing high elevation of 1,110 feet and low elevation of 1,080 feet (figure 2-3). For periods of normal inflow, Duke Energy proposes a Normal Minimum elevation of 1,096 feet, the lowest reservoir level expected if inflows and outflows are average, and neither the LIP nor MEP has been implemented.

For Lake Keowee, Duke Energy proposes the existing high elevation of 800 feet; however, the low elevation would be increased from 775 feet to 790 feet (figure 2-4). The 790-foot elevation limit would be implemented by December 31, 2019 to allow time for Oconee Nuclear Station to be modified to operate at that level. The interim low-level elevation for Lake Keowee would be 794.6 feet, which Duke Energy currently maintains to comply with the needs of Oconee Nuclear Station. For periods of normal inflow, Duke Energy proposes a Normal Minimum elevation of 796 feet, the lowest reservoir level expected if inflows and outflows are average and neither the LIP nor MEP has been implemented.

Duke Energy proposes to operate the project during flood periods so as not to cause peak discharges downstream of the Keowee Development greater than those which would have occurred in the absence of the project.

Duke Energy proposes to release water from the Keowee Development at such a rate or such a volume as may be prescribed by the Corps in the interest of its downstream projects.

Low Inflow Protocol

Duke Energy proposes to implement a LIP at both the Jocassee and Keowee Developments. The LIP is a protective measure intended to help meet power and water demands during low inflow conditions, while also protecting key recreational and

environmental resources. The LIP coordinates basin-wide reductions in water consumption during periods of drought. Details of the LIP are in Appendix C, which provides the Relicensing Agreement inclusive of the LIP.

The LIP allows Duke Energy to draw its lakes below the proposed Normal Minimum elevations during periods of low inflow, or drought periods. During low inflow conditions, Lake Jocassee would be kept at an elevation of 1,080 feet or higher. Lake Keowee would be kept at an elevation of 790 feet or higher.

The LIP outlines five drought stages (Stage 0 through 4, *see* figure 2-3 and figure 2-4) and accompanying minimum elevations for each reservoir. Each LIP stage is defined by the percentage of combined, remaining, usable storage in Duke Energy's three reservoirs or the Drought Plan Level for the three downstream Corps' reservoirs, along with the confirming triggers of the U.S. Drought Monitor designation and stream flows indicative of conditions in the upper Savannah River Basin. Each confirming trigger is averaged over a specified time period and compared to historical seasonal averages.

The LIP limits weekly flow releases from the Keowee Dam to amounts mandated by the applicable LIP stage in effect. Weekly flow releases include the sum of all water released downstream from the Keowee Dam, including Keowee Hydro Station generation, leakage, seepage from Keowee Dam and Keowee Hydro Station, and flood gate releases. When operating in the LIP near reservoir Stage Minimum Elevations, Duke Energy would not intentionally release water from the Keowee Dam if the release would cause the levels of Lake Jocassee or Lake Keowee to fall below their respective Stage Minimum Elevations for the given LIP stage, except for flow releases required by the Commission, operation of Oconee Nuclear Station, or situations covered by the MEP. Additionally, when in Stage 4 of the LIP, if the combined remaining usable storage in Duke Energy's three reservoirs is at 12 percent or less, Duke Energy would not make a flow release from Keowee Dam if the flow release would cause Lake Keowee to fall below 791.5 feet AMSL. However, in such situations, leakage, seepage, on-lake withdrawals, and evaporation would continue and potentially could cause Lake Keowee reservoir elevations to fall below 791.5 ft.

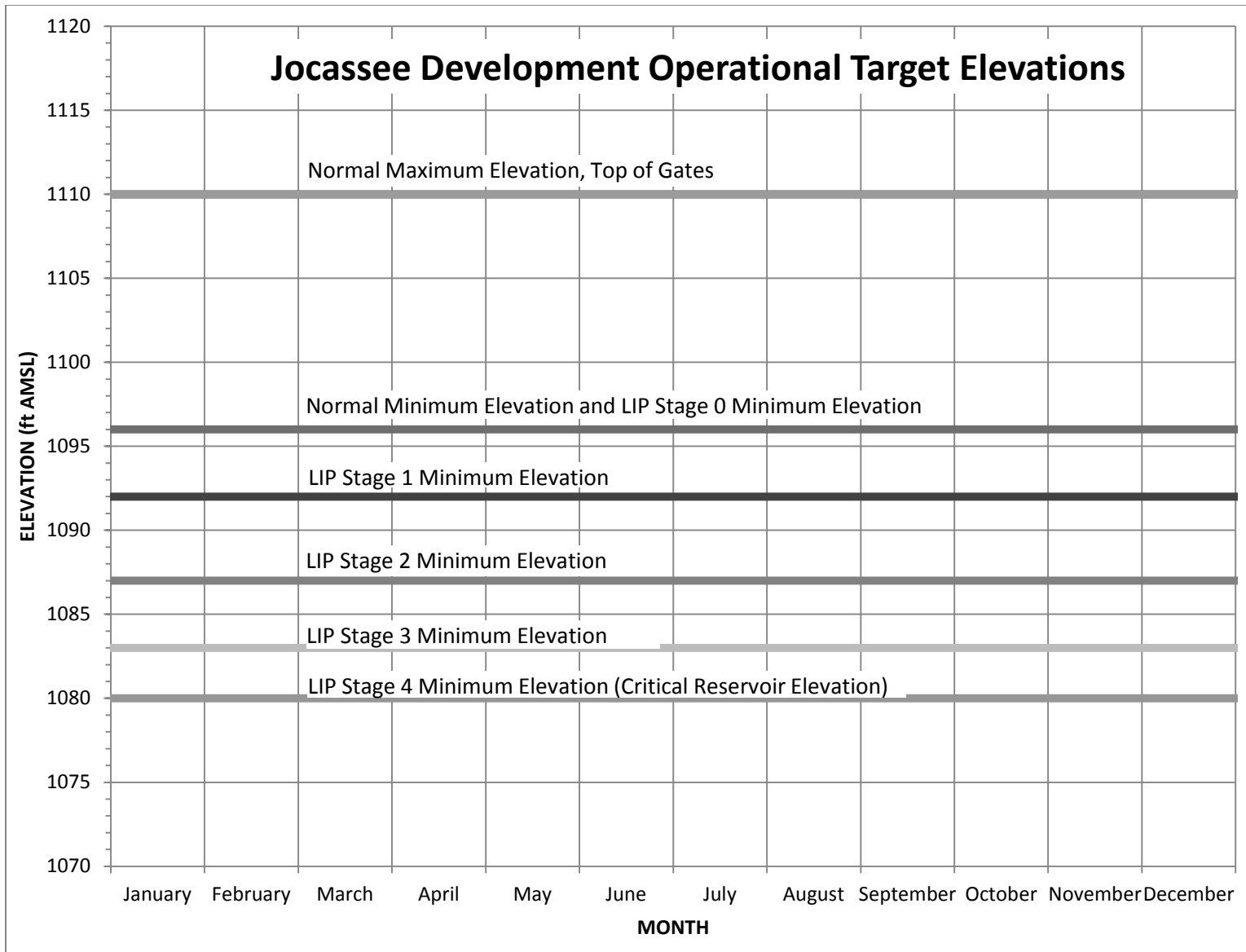


Figure 2-3. Proposed target elevations for the Jocassee Development (Source: Duke Energy, 2014a, as modified by staff).

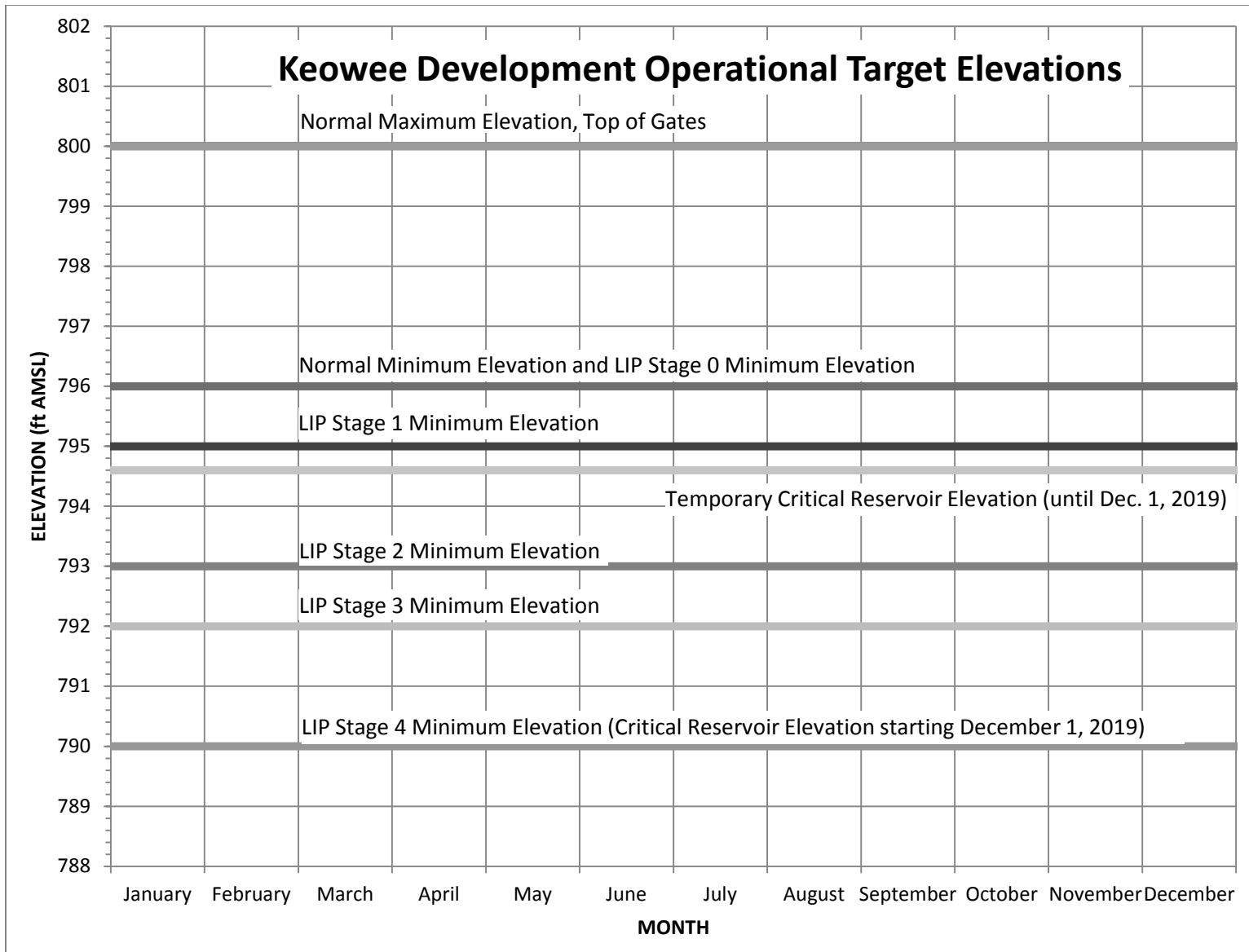


Figure 2-4. Proposed target elevations for the Keowee Development (Source: Duke Energy, 2014a, as modified by staff).

Maintenance and Emergency Protocol

Duke Energy proposes to implement a MEP. Details of the MEP are in Appendix C, which provides the Relicensing Agreement inclusive of the MEP. Circumstances under which the MEP may be in effect include hydro unit outages, dam safety emergencies, maintenance activities, and flood events.

Lake Jocassee would typically be maintained between 1,106 and 1,110 feet using the four development turbines. The MEP provides that during flood conditions, if turbine flow fails to manage reservoir elevations, Duke Energy would either partially or fully open one or both Tainter gates at Jocassee Dam to balance inflow. Similarly, if the reservoir elevation of Lake Keowee could not be maintained with turbine flow alone, Duke Energy would open the spillway gates at Keowee Dam to match inflow. The MEP lists the affected parties that would be notified and/or consulted under such conditions, and provides guidelines on how to do so.

2.2.3 Proposed Environmental Measures

The Relicensing Agreement includes nine proposed articles for inclusion in a new license for the project. Three articles relate to project operation, which are described above in section 2.2.2, *Proposed Project Operation*. The remaining six articles are measures for the protection and enhancement of environmental resources of the project area and are described below. The Relicensing Agreement also includes off-license measures between Duke Energy and the signatories, which are described in Appendix C.

The Relicensing Agreement includes the following on-license environmental measures:

- Continually monitor dissolved oxygen (DO) in the tailwaters of the Jocassee and Keowee Developments during August for the term of the new license and submit monitoring results to South Carolina DHEC and the Commission annually by November 30 (proposed Water Quality Monitoring article).
- Implement a Recreation Management Plan (RMP), filed with the license application, which includes operations and maintenance provisions for project recreation sites as well as proposed recreation facility enhancements at Lake Jocassee and Lake Keowee (proposed Recreation Management Plan article).
- Consult with the South Carolina DPRT and South Carolina DNR every 12 years to develop a plan to conduct a Recreation Use and Needs (RUN) Study and update to the RMP (proposed Recreation Planning article).
- Implement a SMP, filed with the license application, which includes:
 - (1) shoreline classification maps; (2) lake use restrictions for each shoreline

classification based on existing uses, environmental criteria, and potential future uses; and (3) shoreline management guidelines that address permitting requirements for non-project use of project lands and waters (proposed Shoreline Management Plan article).

- Revise the SMP in consultation with the U.S. Fish and Wildlife Service (FWS), South Carolina DPRT, South Carolina DNR ten years following license issuance, and every ten years thereafter (proposed Shoreline Management Plan and Review Procedures article).
- Implement a HPMP to protect archaeological and historic resources (proposed Historic Properties article).²⁰

2.2.4 Proposed Project Boundary

The Keowee-Toxaway project boundary generally follows the 1,110-foot to 1,120-foot contour elevation around Lake Jocassee, and the 800-foot to 810-foot contour elevation around Lake Keowee. The project boundary also extends to encompass project recreation sites, islands, and lands needed for project operation, with the exception of the existing Crow Creek Access Area. Duke Energy owns all lands within the project boundary.

Duke Energy proposes to modify the project boundary to include lands now needed for project purposes and exclude lands no longer needed. Duke Energy also proposes to update and correct project boundary maps. Duke Energy would add 150 acres to the project boundary and remove 29 acres for a net total increase of 121 acres of land and a cumulative total of 28,165 acres. Duke Energy owns all lands proposed for inclusion in the project boundary. Table 2-1 depicts the acreages associated with Duke Energy's proposed modifications to the project boundary.

²⁰ In the Explanatory Statement at Section 12.0, the Relicensing Agreement assumed that the HPMP filed with the license application would be approved by the Commission and, therefore, the draft cultural resources article (A-11.0) would be included in any license issued. However, staff found the HPMP needed revisions, which Duke Energy subsequently completed. The executed PA, which Duke Energy signed, incorporates an HPMP filed on November 5, 2014. This HPMP supersedes the one filed with the license application and mentioned in the Relicensing Agreement. Consequently, the draft cultural resources article (A-11.0) is not relevant.

Table 2-1. Proposed project boundary revisions (Source: Duke Energy, 2014a, as modified by staff).

Location	Proposed Addition (Deletion) (acres)	Reason for Revision
<i>Jocassee Development</i>		
Double Springs Campground	25	Access area expansion to support development of additional campsites
Devils Fork State Park	(3)	Mapping correction to reflect location of private, non-Project inholding
Project Structures (Saddle Dike #1)	1	Additional land to support maintenance of the dike
Reservoir Shoreline Lands	2	Mapping errors discovered during shoreline permitting and updating of the SMP shoreline classification maps
<i>Keowee Development</i>		
Cane Creek Access Area	3	More accurate estimate based on computer-generated GIS polygon ^a
Crow Creek Access Area	55	Incorporation of existing Project Access Area into Project Boundary
Fall Creek Access Area	(13)	Removal of public road rights-of-way from Project Boundary; more accurate estimate based on computer-generated GIS polygon ^a
High Falls County Park Access Area	(1)	More accurate estimate based on computer-generated GIS polygon ^a
Mile Creek Access Area	(3)	More accurate estimate based on computer-generated GIS polygon ^a
South Cove County Park Access Area	(1)	More accurate estimate based on computer-generated GIS polygon ^a
Stamp Creek Access Area	(1)	More accurate estimate based on computer-generated GIS polygon ^a
Warpath Access Area	(7)	More accurate estimate based on computer-generated GIS polygon ^a
High Falls II Access Area	37	Future Project Access Area
Mosquito Point Access Area	10	Future Project Access Area
Project Structures (Keowee Dam)	5	Additional land added on eastern end of dam and downstream portion of spillway channel
Reservoir Shoreline Lands	12	Mapping errors discovered during shoreline permitting and updating of the SMP shoreline classification maps

^a Changes are associated solely with improvements in mapping accuracy, not changes in the configuration of project recreation site boundaries.

2.3 STAFF ALTERNATIVE

Under the staff alternative, the project would include Duke Energy's proposals for the following:

- Project operation and reservoir levels for Lake Jocassee and Lake Keowee, the LIP, and the MEP;
- A RMP and provisions for future recreation planning (as modified below);
- A SMP and provisions for future SMP review and update (as modified below); and
- An HPMP, in accordance with the PA for the Keowee-Toxaway Project.

Under the staff alternative, the project would include the following additions or modifications to Duke Energy's proposed recreation and shoreline management measures:

- Revise the RMP to: (1) clearly indicate that Duke Energy must complete construction of recreation amenities proposed at Crow Creek Access Area if the amenities are not constructed by The Reserve at Lake Keowee; (2) remove cost caps and contingencies associated with the recreation enhancements proposed for Mile Creek County Park; (3) include provisions for monitoring the capacity and condition of Warpath Access Area annually during summer recreation seasons and develop plans to address capacity issues or overuse, if necessary; (4) include a description of the existing facilities, drawings, and schedule of any recreation facility enhancements proposed over the term of a license at World of Energy Picnic Area; (5) require the stabilization of 6,250 feet of shoreline on certain islands in Lake Keowee to preserve the use of the islands for day-use recreation; (6) provide an implementation schedule with the anticipated year of construction for all recreation enhancement measures specified in the plan; and (7) clarify that all improvements made to project recreation sites as part of the Access Area Improvement Initiative (AAII) must be identified in the Commission-approved RMP.
- Modify the project boundary to enclose the recreation facilities at World of Energy Picnic Area.
- Modify the SMP to extend the provision for exemptions to the maximum size limit for private facilities (e.g., boat docks) from the time of license issuance through December 31, 2020.

- Require an annual report describing modifications made to the SMP to protect any newly discovered resources and corrections made to shoreline classification maps.

2.4 STAFF ALTERNATIVE WITH MANDATORY CONDITIONS

We recognize that the Commission is required to include conditions required by the certification in any license issued for the project. The staff alternative with mandatory conditions includes staff-recommended measures along with South Carolina DHEC's certification requirements of section 401 of the CWA, which state in condition number one that Duke Energy shall operate the project in accordance with Section A-2.0 Low Inflow Protocol Article and Section A-7.0 Water Quality Monitoring Article in the Relicensing Agreement.²¹ The purpose of these conditions is to ensure that South Carolina water quality standards are met at all times, including during low flow periods and droughts.

2.5 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

We considered several alternatives to Duke Energy's proposal, but eliminated them from further analysis because they are not reasonable in the circumstances of this case. They are: (1) issuing a non-power license, (2) federal government takeover of the project, and (3) retiring the project.

2.5.1 Issuing a Non-power License

A non-power license is a temporary license that the Commission will terminate when it determines that another governmental agency will assume regulatory authority and supervision over the lands and facilities covered by the non-power license. At this point, no agency has suggested a willingness or ability to do so. No party has sought a non-power license, and we have no basis for concluding that the project should no longer be used to produce power. Thus, we do not consider issuing a non-power license a realistic alternative to relicensing in this circumstance.

²¹ South Carolina DHEC's certification requirements of section 401 also included two additional conditions: (1) Duke Energy must prevent fuel, oil, tar, trash, debris, and other pollutants from entering adjacent waters or wetlands; and (2) any "large water intake" owner or "major water withdrawer" applicant to Duke Energy for a large water intake or major withdrawal from the project must comply with the Surface Water Withdrawal, Permitting, Use and Reporting Act.

2.5.2 Federal Government Takeover of the Project

We do not consider federal takeover to be a reasonable alternative. Federal takeover and operation of the project would require Congressional approval. While that fact alone would not preclude further consideration of this alternative, there is no evidence to indicate that federal takeover should be recommended to Congress. No party has suggested federal takeover would be appropriate, and no federal agency has expressed an interest in operating the project.

2.5.3 Retiring the Project

Project retirement could be accomplished with or without dam removal. Either alternative would involve denial of the relicense application and surrender or termination of the existing license with appropriate conditions. No participant has suggested that dam removal would be appropriate in this case, and we have no basis for recommending it. Lake Jocassee and Lake Keowee are popular, regional recreation destinations. Lake Keowee serves as a municipal water supply and as cooling water for Oconee Nuclear Station. Removing project facilities would adversely affect these resources and have significant costs. Thus, dam removal is not a reasonable alternative to relicensing the project with appropriate protection, mitigation, and enhancement measures.

The second project retirement alternative would involve retaining the dams and disabling or removing equipment used to generate power. Project works would remain in place and could be used for historic or other purposes. This would require us to identify another government agency with authority to assume regulatory control and supervision of the remaining facilities. No agency has stepped forward, and no participant has advocated this alternative. Nor have we any basis for recommending it. Because the services supplied by the project are needed, a source of replacement service would have to be identified. In these circumstances, we do not consider removal of the electric generating equipment to be a reasonable alternative.

3.0 ENVIRONMENTAL ANALYSIS

In this section, we present: (1) a general description of the project vicinity; (2) an explanation of the scope of our cumulative effects analysis; and (3) our analysis of the proposed action and other recommended environmental measures. Sections are organized by resource area. Under each resource area, historic and current conditions are first described. The existing condition is the baseline against which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of proposed mitigation, protection, and enhancement measures, and any potential cumulative effects of the proposed action and alternatives. Staff conclusions and recommended measures are discussed in section 5.1, *Comprehensive Development and Recommended Alternative*.²²

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The Keowee-Toxaway Project is located in the upper Savannah River Basin on the Keowee and Little Rivers in Transylvania County, North Carolina and Pickens and Oconee Counties, South Carolina. The Savannah River Basin has a total drainage area of 10,577 square miles, the majority of which is in South Carolina and Georgia (figure 3-1). Lake Jocassee has a drainage area of 145 square miles, and Lake Keowee has a drainage area of 435 square miles, which represents approximately 4 percent of the Savannah River Basin's drainage area.

Lake Jocassee was formed by impounding the Keowee River at RM 343.6, just downstream of the confluence of the Whitewater and Toxaway Rivers. The Horsepasture and Thompson Rivers also flow into Lake Jocassee. Lake Jocassee has a drainage area of 145 square miles, a surface area of approximately 7,980 acres, and approximately 92 miles of shoreline at full pond elevation 1,110 feet. Releases from the Jocassee Development flow directly into Lake Keowee. Lake Jocassee also serves as the lower reservoir for the 1,065-MW Bad Creek Project operated by Duke Energy under a separate FERC license.²³

²² Unless noted otherwise, the sources of our information are the license application (Duke Energy, 2014a) and additional information filed by Duke Energy (Duke Energy, 2014d).

²³ *Duke Power Co.*, 59 F.P.C. 1266 (1977).

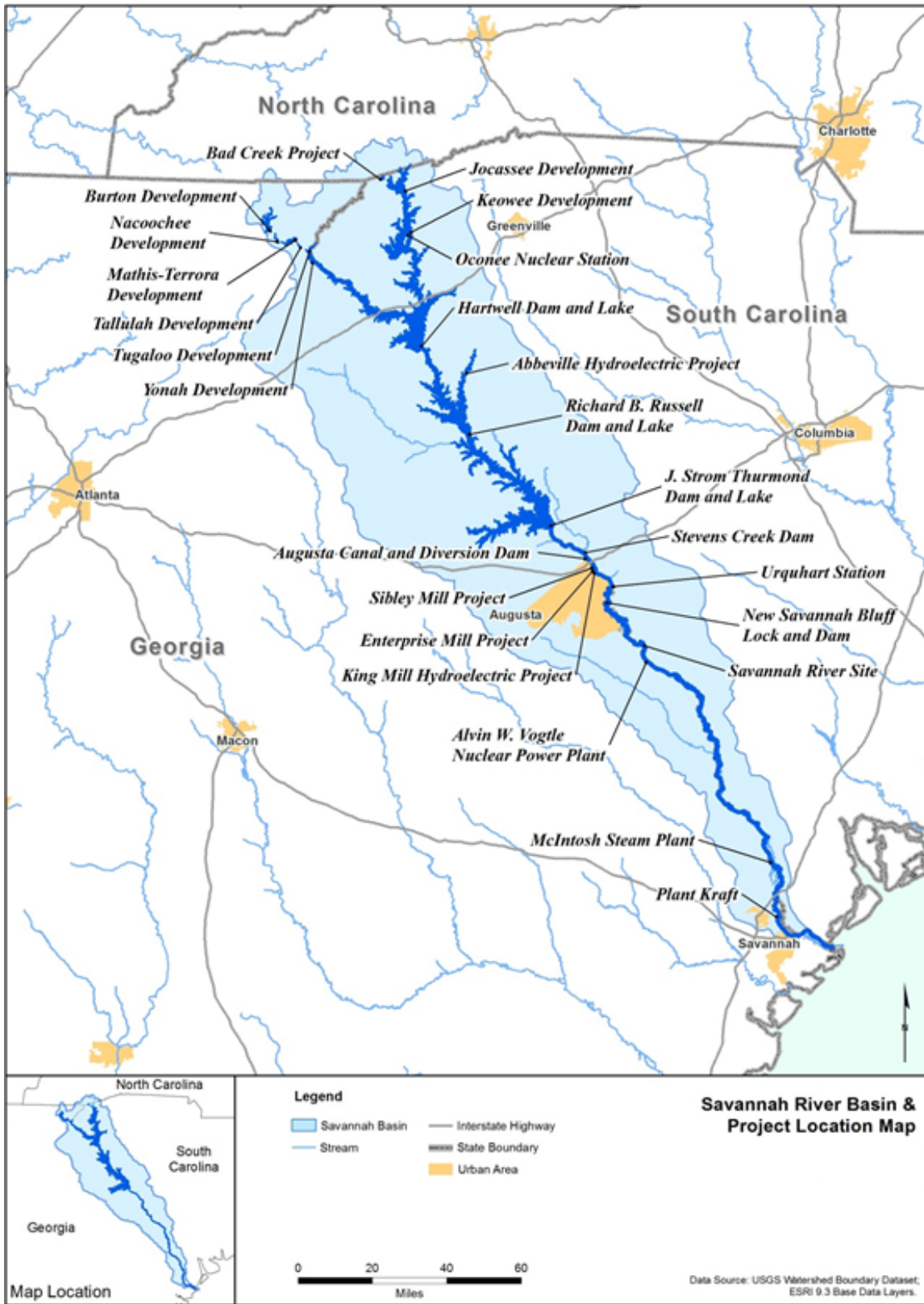


Figure 3-1. Savannah River Basin and project location map (Source: Corps, 2014 as modified by staff).

Lake Keowee was formed by impounding the Keowee and Little Rivers. The two impoundments are connected through an excavated canal that creates one large impoundment. Keowee Dam is located on the Keowee River at RM 328.8 and has a drainage area of 435 square miles. Little River Dam is located on the Little River at approximately RM 325. Lake Keowee has approximately 388 miles of shoreline with a surface area of approximately 17,660 acres at a full pond elevation of 800 feet. Duke Energy's Oconee Nuclear Station is located on the shores of Lake Keowee immediately west of Keowee Dam. Little River Dam creates a 0.3-mi-long bypassed reach of the Little River from the toe of the dam to the Courtenay Dam in Newry, South Carolina. Courtenay Dam is located in the headwaters of the Corps' Hartwell Lake and historically diverted water to Courtenay Mill, which is no longer in operation.

Downstream of Lake Keowee, the Corps operates three lakes with hydropower facilities: Hartwell Lake, Russell Lake, and Thurmond Lake. Hartwell Lake is located immediately downstream of Lake Keowee. Hartwell Dam is located on the Savannah River at RM 289. Russell Lake is located on the Savannah River at RM 259. Thurmond Lake, located downstream of Richard B. Russell Dam at RM 222, is the last major dam on the Savannah River as it flows to the Atlantic Ocean. Along the lower Savannah River, there are small dams and diversion dams including: Stevens Creek, North Augusta, Augusta Canal Diversion, Augusta Canal Diversion Return, Augusta, and New Savannah Bluff Lock and Dam.

The climate in the Savannah River Basin varies widely because of the differences in the topography between the headwaters, where the project is located, and the eastern portion of the watershed near the Atlantic Ocean. The climate in the project area is characterized by warm and humid summers and cool winters. In Clemson, South Carolina, about 3 miles southeast of Lake Keowee, average July high temperatures are about 91 degrees Fahrenheit (°F) and average lows are about 70 °F. Average annual precipitation is about 53 inches with the average monthly values relatively evenly distributed. At higher elevations in the headwaters above Lake Jocassee, average annual precipitation is much higher, near 100 inches, and the average temperatures are lower.

Public lands dominate the area around Lake Jocassee, which is located in the Blue Ridge Province of North Carolina and South Carolina. Mature deciduous forests cover most valleys and hill slopes, with pines common on open dry ridges and steep south-facing slopes at lower elevations. Lake Keowee is located in the more intensively-developed Piedmont Province of South Carolina. Lands immediately surrounding Lake Keowee are generally developed for residential use, although the primary landscape features in the province are patches of pine and deciduous forest mixed with cultivated fields. Various industries including healthcare, retail trade, and manufacturing drive the regional economy. Oconee Nuclear Station is a major employer in the region, with over 3,800 employees on-site.

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (40 C.F.R., section 1508.7), a cumulative effect is the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over time, including hydropower and other land and water development activities.

Based on our review of the license application and agency and public comments, we identified geology and soils, aquatic resources (including water quantity, water quality, and fisheries resources), terrestrial resources, recreation resources, and land use as having the potential to be cumulatively affected by the proposed action in combination with other past, present, and future activities. These resources were selected for analysis because the presence and operation of the Keowee-Toxaway Project, in combination with other developments, dams, and diversions in the basin, has affected shoreline erosion, water quantity and quality, fishery resources, terrestrial resources, recreation access, and land use in the region.

The effects of other actions occurring in the river basin relative to existing project resources can be derived from the following environmental document which is incorporated by reference per 40 C.F.R., section 1508.7:

- The Final Environmental Assessment, New Operating Agreement between the U.S. Army Corps of Engineers, Southeastern Power Administration, and Duke Energy Carolinas, LLC, October 2014 (Corps' 2014 EA).

3.2.1 Geographic Scope

The geographic scope of analysis defines the physical limits or boundaries of the proposed action's effects on the resources. Because the proposed action would affect the resources differently, the geographic scope for each resource may vary.

We identify the Jocassee/Keowee watershed upstream of the Keowee Dam as our geographic scope of analysis for geology and soil resources. Regulation of flows by the project and upstream dams causes daily and seasonal changes in surface water fluctuations that interact with natural factors in the process of shoreline erosion.

We identify the Jocassee/Keowee watershed, including the basins of the tributaries to Lake Jocassee (Whitewater Thompson, Horsepasture, and Toxaway Rivers, Bad Creek, and other streams) and the tributaries to Lake Keowee (Keowee and Little Rivers and smaller streams) as our upstream geographic scope of analysis for aquatic resources.

The land use in the contributing watershed influences the lake levels, water quality, and aquatic habitat of Lake Jocassee and Lake Keowee. In addition, we identify the downstream geographic scope of analysis as extending to the mouth of the Savannah River. The operation of the project influences lake levels, water quality, flow releases, and aquatic habitat in Hartwell Lake, Russell Lake, and Thurmond Lake, and all the impoundments influence the flow and chemistry of the Savannah River. In addition, the dams in the basin have restricted the movement of fish and other aquatic organisms in the river.

We identify the Jocassee/Keowee watershed as our geographic scope of analysis for terrestrial resources. Regulation of flows by the project and upstream dams causes daily and seasonal changes in surface water fluctuations that may lead to shoreline erosion, spread of invasive species, and alteration of riparian and wetland habitats. Project facilities and operation, transmission line right-of-way maintenance, agricultural activities, roads, and residential and commercial development have collectively contributed to the loss and alteration of wildlife habitat. Many of these non-project developments may have occurred outside of the project boundary, but are close enough to have an effect on resources within the project area. Upstream and upslope development and land clearing in combination with project operation may contribute to establishment and spread of invasive species throughout the Jocassee/Keowee watershed. Land development, road construction, vehicular traffic, and foot traffic associated with recreational pursuits may also contribute to the degradation and loss of sensitive habitats and displacement of wildlife.

We identify the upper Savannah River Basin as the geographic scope of analysis for recreation resources. Fluctuations in reservoir pool levels associated with project operation and natural seasonal flow fluctuations may affect the ability of the public to access project reservoirs and the downstream Corps' lakes at times. Increased recreational use near the reservoirs because of project operation and recreation enhancement measures may affect the public's use and enjoyment of recreation resources at the project.

We identify the Jocassee/Keowee watershed as the geographic scope of analysis for land use. Residential and commercial development has the potential to cumulatively affect land use in the Jocassee/Keowee watershed. Consequently, non-project use of projects lands and other non-project developments outside of the project boundary may affect the adequacy of lands available to protect environmental and recreational resources at the project.

In section 3.3.1, *Geology and Soil Resources*, we discuss the site-specific as well as cumulative effects of relicensing the project on soil erosion. In section 3.3.2, *Aquatic Resources*, we discuss the site-specific as well as cumulative effects of relicensing the project on water quantity, water quality, and fishery resources. In section 3.3.3,

Terrestrial Resources, we discuss the site-specific as well as cumulative effects of relicensing the project on terrestrial resources including wildlife habitat and terrestrial species. In section 3.3.5, *Recreation Resources*, we discuss the site-specific as well as cumulative effects of relicensing the project on recreation access. In section 3.3.6, *Land Use*, we discuss the site-specific as well as cumulative effects of relicensing the project on land use in the project vicinity.

3.2.2 Temporal Scope

The temporal scope of analysis includes a discussion of the past, present, and reasonably foreseeable future actions and their effects on water quantity, water quality, and fisheries resources. Based on the term of the proposed license, we will look 30 to 50 years into the future, concentrating on the effects on geology and soils, water quantity, water quality, fisheries resources, terrestrial resources, recreation resources, and land use from reasonably foreseeable future actions. The historical discussion is limited, by necessity, to the amount of available information. We identified the present resource conditions based on the license application, agency comments, and comprehensive plans.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

In this section, we discuss the effect of the project alternatives on environmental resources. For each resource, we first describe the affected environment, which is the existing condition and baseline against which we measure effects. We then discuss and analyze the specific cumulative and site-specific environmental issues.

Only the resources that would be affected, or about which comments have been received, are addressed in detail in this EA. Based on this, we have determined that geology and soils, aquatic, terrestrial, threatened and endangered species, recreation, land use, cultural, and socioeconomic resources may be affected by the proposed action and action alternatives. Aesthetic resources are discussed as part of the recreation and land use analysis. We present our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

3.3.1 Geology and Soil Resources

3.3.1.1 Affected Environment

Geology

Located within the upper Savannah River Basin, the Keowee-Toxaway Project lies at the intersection of the Blue Ridge and Piedmont provinces. The Blue Ridge province is characterized by rugged plateaus, cross ridges, and broad intermountain valley floors surrounded to the east and west by large mountain chains. The Piedmont province is composed of rolling, well rounded hills, low ridges, and river-cut valleys.

Bedrock in both provinces is significantly fractured from age and the natural evolution of the Appalachian Mountains. In some locations, heavy exposure to chemical and physical weathering has reduced surface layers of rock to saprolite, a form of compacted soil easily eroded by wave action.

Soils

Soils around the reservoirs are mostly upland soils. They are typically sandy loam or a combination of sandy and clay loam, with certain locations defined as intermittently rocky. All soils surrounding the project's shorelines are residuals of weathered bedrock and significantly vulnerable to erosion. That vulnerability is made worse by the steep slopes in the region.

Jocassee Soils

The primary soil types at Lake Jocassee are dominated by fine sandy loam with a sandy loam surface layer, which is about five inches thick. The subsoil at Lake Jocassee is highly susceptible to erosion if exposed. Weathered and unweathered bedrock underlie surface layers at depths of ten inches to two feet.

Keowee Soils

The dominant soil types at Lake Keowee consist of clay, clay loam, or sandy clay. Weathered rock, including saprolite, lies below the subsoil at depths of 24 inches to 60 inches.

3.3.1.2 Environmental Effects

Erosion

Based on the studies presented in its license application, and as required by the 2014 Operating Agreement, Duke Energy proposes to maintain the existing maximum pond elevations of 1,110 feet and 800 feet for Lake Jocassee and Lake Keowee, respectively. For Lake Jocassee, Duke Energy proposes the existing minimum elevation of 1,080 feet, but will add a Normal Minimum elevation of 1,096 feet. For Lake Keowee the minimum elevation would be increased from 775 to 790 feet, and Duke Energy proposes to add a Normal Minimum elevation of 796 feet. Duke Energy states that the proposed elevation changes would reduce the frequency of deep drawdowns, which in turn would expose less of the lower bank slopes to erosive forces.

Also, Duke Energy proposes to implement shoreline stabilization measures outlined in the proposed HPMP, RMP, and off-license, through the Relicensing Agreement. The Relicensing Agreement provides for measures to stabilize 12,500 feet of actively eroding shoreline within 3 years following license issuance, as described in table

3-1. Enhanced riprap and staking of native plants would be introduced at strategic locations to increase the presence of natural buffers.

Table 3-1. Shoreline stabilization locations and lengths (Source: Duke Energy, 2014d, as modified by staff).

Location	Approximate Length (feet)
<i>Stabilization Activities in the HPMP</i>	
Island (Site 38OC461)	1,000
Island (Site 38OC462)	1,000
Island (Site 38OC466)	800
Shoreline (Site 38PN175)	300
<i>Stabilization Activities in the RMP</i>	
Fall Creek Access Area	1,050
High Falls II Access Area	1,050
Mosquito Point Access Area	1,050
<i>Off-license Shoreline Stabilization</i>	
Island 1C	900
Island 1E	750
Island 3B	800
Island 3C	500
Island 3C''	1,000
Island 5	750
Island 6	750
Island 8	500
Island 16	300

Our Analysis

Early in the relicensing process, the FWS, South Carolina DNR, FOLKS, Upstate Forever, and SCWF raised concern with Duke Energy's conclusion, based on a 2010 study presented in its PAD, that shoreline erosion at both Lake Jocassee and Lake Keowee is an ongoing, natural phenomenon that does not appear to be directly related to project operation and maintenance. Duke Energy's conclusion was based on its 2010 assessment of: (1) shoreline erosion conditions and contributing factors at Lake Jocassee; (2) meteorological wind data for wave induced erosion at Lake Keowee; and (3) changes in land cover along vegetated shorelines of both reservoirs from 1976 to 2009.

As a result of the study determination²⁴ process and stakeholder and staff concerns documented in that process, W.F. Baird and Associates (2013) conducted an additional shoreline erosion study. The study: (1) identified, mapped, and photographed erosion hot spots on Lake Jocassee and Lake Keowee and (2) assessed the source of erosion at each site. The analysis of the erosion source at each site was based on wind and wave data, field observation, and historic aerial, orthophotographic comparison. W.F. Baird and Associates (2013) again concluded that shoreline erosion is a benign, naturally occurring process at both Lake Jocassee and Lake Keowee and reported that the primary catalyst of erosion at the two reservoirs is wind and boat-induced wave forces.

No stakeholders commented on the results of the erosion study or Duke Energy's proposed erosion measures in response to the Commission's notice that the application was ready for environmental analysis.

Staff concurs with W.F. Baird and Associates' (2013) findings included in Duke Energy's application. As documented in the study, project operation, mainly fluctuations in reservoir levels, do not have a significant impact on erosion. Changes in reservoir level appear to influence the elevation at which erosion may occur in these impoundments, but have little impact on the frequency and magnitude of shoreline loss. When LIP or MEP conditions are encountered, Duke Energy proposes to limit drawdowns of Lake Jocassee to 1,080 feet, and limit drawdowns of Lake Keowee to 790 ft. The implementation of Normal Minimum reservoir elevations at Lake Jocassee and Lake Keowee would reduce the frequency of deeper drawdowns, expose less of the lower bank slopes to wind-generated waves and boat wakes, and in turn may preserve the integrity of shorelines at lower elevations.

Because the majority of erosion at the reservoirs is the result of natural factors, Duke Energy can do little to mitigate erosion on a large scale. Duke Energy's proposal to implement the shoreline stabilization measures indicated in the Relicensing Agreement, RMP, and HPMP would minimize soil erosion and sedimentation and provide localized relief from the erosion issue. These shoreline stabilization measures are discussed further in section 3.3.5, *Recreation Resources* and section 3.3.7, *Cultural Resources*, respectively.

²⁴ Results of the study determination process are addressed in the Revised Study Plan filed by Duke Energy Carolinas, LLC on December 22, 2011.

3.3.1.3 Cumulative Effects

Erosion and Sedimentation in the Reservoirs

Though project operation does not appear to directly cause shoreline erosion, shoreline erosion and reservoir sedimentation are cumulative effects of activities in and around the impoundments and in the watersheds. The dominant sources of shoreline erosion are identified as physical weathering, wave action, concentrated runoff, and upland non-project development. The natural, steep topography surrounding the project further exacerbates the impact of natural erosive forces. Boat wake and wind-driven wave action induces the most erosion across both developments. Across the 10 monitoring sites identified by Duke Energy, the degree of erosion was observed to be dependent on the magnitude of the waves and the capacity of local substrate to withstand the force of the waves.

The Shoreline Erosion Study indicated that recreational use of the reservoirs has the potential to affect soil erosion. Boat wakes account for 25-45 percent of wave-based erosion at Lake Jocassee, 20 percent of the erosion at the northern portion of Lake Keowee, and 80 percent at the southern portion of Lake Keowee (W.F. Baird Associates, 2013). Recreational use of project access areas and islands may also contribute to soil erosion when recreationists moor boats, enter or exit the reservoirs, or use areas of the project shoreline and islands for day-use recreation. Over the term of a license, general recreation use at the project is anticipated to grow by 53 percent. Water-based recreation is expected to grow by 65-70 percent (Kleinschmidt, 2013). By directing recreation use to designated areas and implementing shoreline stabilization techniques, Duke Energy may reduce the cumulative effects of recreation use on shoreline erosion.

Upland Erosion and Sedimentation

Upland development, particularly residences constructed near the Lake Keowee shoreline outside of the project boundary, has the potential to cumulatively affect soil erosion at the project over the term of a license. Residential development increases the amount of impervious surface in the upland and decreases the availability of natural shoreline buffers to reduce stormwater runoff. These factors contribute to erosion of project shorelines. Currently, there are approximately 4,500 shoreline residences at Lake Keowee (comprising approximately 37.2 percent of the Lake Keowee shoreline), and the proposed SMP designates 40.3 miles (10.7 percent) of Lake Keowee's shoreline for future residential development. Duke Energy's proposed SMP contains provisions for adjacent landowners to manage natural shoreline vegetation and minimize the potential impacts of residential development (e.g., boat docks) on shoreline erosion. The proposed SMP also provides guidance for shoreline stabilization techniques on non-project lands.

All but the finest of the sediment particles will stay and settle in the reservoir, much of it near the erosion site. This relatively coarse sediment could modestly change

local habitat or influence navigation access and will have a small effect on impoundment storage volume. Particles fine enough to stay suspended in the slow moving waters of the impoundments could pass over the dam. Particles of that size, however, would be carried away quickly in the energetic, velocity-driven environment of the receiving river. The various sources of shoreline erosion would have a small, cumulative effect on sedimentation in the impoundments and almost no effect below the dams in the downstream environment. In the impoundments, sedimentation could affect local navigation, wetlands, and aesthetic conditions. The shoreline management measures discussed above will reduce the effects of shoreline erosion to the degree feasible in the impoundments. For further discussion, see section 3.3.5, *Land Use*.

3.3.2 Aquatic Resources

3.3.2.1 Affected Environment

Water Quantity

As part of its Commission-approved study plan, between 2012 and 2013, Duke Energy completed several studies which provide detailed information on water quantity and project operation. These studies include: (1) Reservoir Level and Project Flow Releases Study, (2) Operations Model Study, and (3) Water Supply Study. The Reservoir Level and Project Flow Releases Study provided existing reservoir level and flow release data. The Operations Model Study provided a hydrologic/hydraulic water quantity simulation model (CHEOPS) which was used to evaluate alternative operating scenarios and the potential effects of project operation. The Water Supply Study identified existing and future water withdrawals within the river basin. Final study reports were filed with the license application.

Historical Flow Data

Historical flow data has not been collected for the Keowee-Toxaway Project. Instead, Duke Energy calculated mean and maximum daily inflows for each development for the period 1939 through 2011 using stream gage data and daily reservoir operation data. The mean daily inflow at Lake Jocassee is 450 cfs, and the maximum daily inflow is 20,050 cfs. The mean daily inflow at Lake Keowee is 1,110 cfs, while the daily maximum inflow is 28,840 cfs.

Years 2007 through 2009 include extreme drought years and this period is considered to be the historical period of critical streamflow. The calculated mean inflow during this period at the Keowee Development was 540 cfs, compared to a non-drought period mean inflow of 1,110 cfs. The calculated mean inflow at the Jocassee Development was 130 cfs, compared to a normal mean inflow of 450 cfs.

Annual and monthly flow duration curves for the Jocassee and Keowee Developments were developed by Duke Energy for the period 1939 through 2011. The curves are provided in exhibit B, section B2.2 of Duke Energy's license application.

Water Withdrawals

There are no consumptive water withdrawals from Lake Jocassee, although Lake Jocassee serves as the lower reservoir for the Bad Creek Project. Water withdrawals from Lake Keowee include public water supply, irrigation, and thermal cooling needs for Oconee Nuclear Station which cumulatively have a withdrawal of 65.6 million gallons per day (MGD), or about 101.5 cfs. Details of the withdrawals are provided in Table 3-2.

Table 3-2. Major water withdrawals from Lake Keowee (Source: Duke Energy 2014a, as modified by staff).

Withdrawal	Amount	Use
Oconee Nuclear Station	24 MGD	Cooling Needs
Greenville Water	30 MGD	Public Water Supply
City of Seneca, South Carolina	6.24 MGD	Public Water Supply
Reserve at Lake Keowee	0.39 MGD	Irrigation
Cliffs Club at Keowee Vineyards	0.39 MGD	Irrigation

Lake Jocassee Water Levels

Historic water surface elevations for Lake Jocassee are shown in figure 3-2. As discussed in section 2.1.3., *Existing Project Operation*, Duke Energy is licensed to operate Lake Jocassee between 1,080 and 1,110 feet. With the exception of drought periods, Duke Energy has operated Lake Jocassee at or above 1,094 feet approximately 80 percent of the time. Under severe drought conditions the reservoir can be drawn down to 1,080 feet. Documented daily reservoir elevations for Lake Jocassee from 1975 to 2011 indicate that the median daily fluctuation is approximately 0.8 foot, while about 88 percent of daily fluctuations are less than 1.5 feet, and nearly all fluctuations are less than 2.9 feet.

Lake Keowee Water Levels

Historic water surface elevations for Lake Keowee are shown in figure 3-3. As discussed in section 2.1.3., *Existing Project Operation*, Duke Energy is licensed to operate Lake Keowee within a range of 775 to 800 feet. However, during normal inflow conditions Duke Energy maintains the lake elevation between 794.6 and 799.5 feet due to requirements for Oconee Nuclear Station. Daily reservoir elevations recorded from April 17, 1971 through December 31, 2011 indicate that median daily fluctuations are approximately 0.55 foot. Nearly 86 percent of daily fluctuations in elevation remain less than 1 foot, and almost all variations in water level are less than 1.80 feet.

Lake Keowee Flow Releases

For the Keowee Development, Duke Energy provided data on weekly release rates from 1971 through 2011, and during a period of drought from 2006 to 2009, as well as quarterly release rates and volumes for the period of record. The release rates are indicative of the rate of inflow into the development, rather than the rate of flow through the powerhouse. Weekly water releases range from 50 cfs to more than 8,000 cfs over the course of the 40-year period of record. During the drought period, weekly water releases range from 50 cfs to over 4,000 cfs. The average weekly water release rate is approximately 900 cfs.

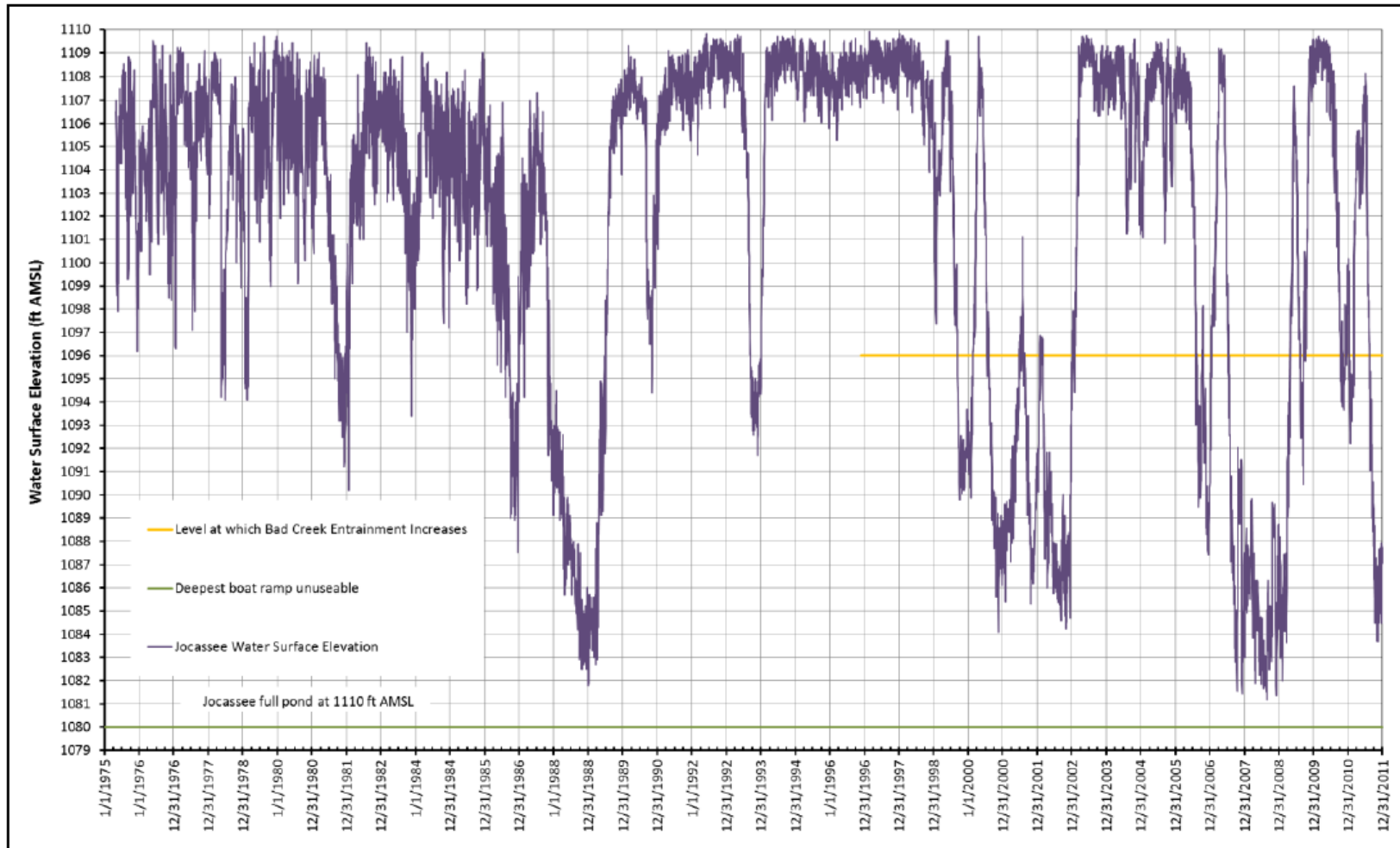


Figure 3-2. Lake Jocassee surface elevations for May 1, 1975 through December 31, 2011 (Source: Duke Energy, 2014a).

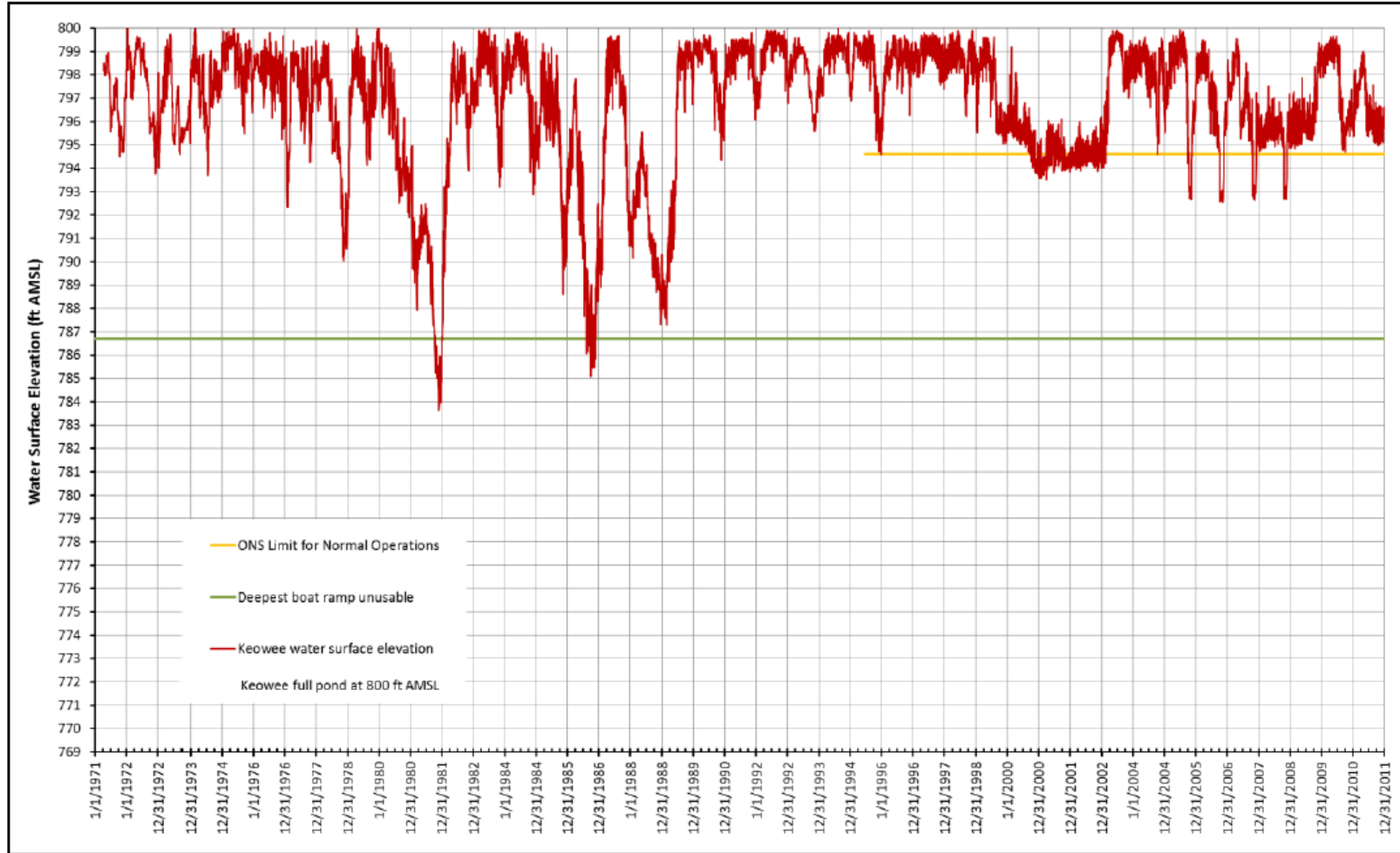


Figure 3-3 Lake Keowee surface elevations for April 17, 1971 through December 31, 2011 (Source: Duke Energy, 2014a).

Water Quality

As part of its Commission-approved study plan, between 2012 and 2013, Duke Energy completed a water quality study which provided existing water quality data and evaluated the potential for the project to maintain water quality standards under Duke Energy's proposed operation. A final study report, The Keowee Reservoir Water Quality Modeling Study Report, was filed with the license application.

Designated Water Uses and Water Quality Standards

South Carolina and North Carolina assign water quality standards that correspond to a designated use of a waterbody. Although the specific designated use classifications vary slightly, both states recognize and distinguish between general use to maintain and support aquatic life and general contact recreation, trout habitats, and high value resource areas (South Carolina DHEC, 2012a; North Carolina DWQ, 2007b). Table 3-3 lists the states' numerical standards applicable to project waters.

Table 3-3. South Carolina and North Carolina state numeric water quality standards relevant to the Keowee-Toxaway Project (Sources: South Carolina DHEC, 2012b; North Carolina DWQ, 2007b).

Parameter	South Carolina Water Quality Standard	North 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 that some other temperature shall protect the classified uses	Not to exceed 2.8 °C (5.04 °F) above the natural water temperature Not to exceed 29 °C (84.2 °F) for mountain and upper piedmont waters Not to exceed 32 °C (89.6 °F) for lower piedmont and coastal plain waters Trout waters: not to be increased by more than 0.5 °C (0.9 °F) and in no case exceed 20 °C (68 °F)
Dissolved Oxygen	Daily average not less than 5.0 mg/L Low of 4.0 mg/L Trout Waters: Not less than 6.0 mg/L	Not less than 5.0 mg/L daily average Instantaneous value not less than 4.0 mg/L Trout Waters: Not less than 6.0 mg/L daily
pH	Between 6.0 and 8.5 Trout Waters: Between 6.0 and 8.0	6.0 – 9.0

Parameter	South Carolina Water Quality Standard	North Carolina Water Quality Standard
Turbidity	Freshwaters, except for lakes: Not to exceed 50 NTUs provided existing uses are maintained Freshwaters, 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.	Not to exceed 50 NTUs
Phosphorus	Blue Ridge: Shall not exceed 0.02 mg/L Piedmont: Shall not exceed 0.06 mg/L	N/A
Nitrogen	Blue Ridge: Shall not exceed 0.35 mg/L Piedmont : Shall not exceed 1.5 mg/L	N/A
Chlorophyll- <i>a</i>	Blue Ridge: Shall not exceed 10 µg/L Piedmont: Shall not exceed 40 µg/L	Not greater than 40 µg/L

Note: N/A – not applicable; µg/L – micrograms per liter; mg/L – milligrams per liter; NTU – nephelometric turbidity units.

South Carolina DHEC (1991), using data from 1980-81, 1985-86, and 1989-90, places Lake Jocassee and Lake Keowee in its highest water quality classification (excellent) and recommends preservation of existing conditions. South Carolina DHEC (1993) classified the waters of the state by designated use and assigned water quality standards to each use classification. Based on several assessments over the years (South Carolina DHEC, 2003, 2006a, 2006b; North Carolina DWQ, 2007a), all designated uses are supported in Lakes Jocassee and Keowee. South Carolina DHEC (2010) shows a decreasing trend in turbidity and total phosphorus in some watersheds and in Lakes Jocassee and Keowee. At the same time, South Carolina DHEC has issued a fish consumption advisory for mercury in Lake Jocassee which recommends no more than one meal per week for spotted bass and largemouth bass (South Carolina DHEC, 2013).

Dissolved Oxygen and Water Temperature

Seasonal and Yearly Trends

Lake Jocassee—Duke Energy started monitoring water quality conditions in Lake Jocassee after its formation in 1973, primarily as an assessment of the effect on Lake Keowee. With the introduction of a put-grow-take trout fishery,²⁵ Duke Energy continued to monitor water quality to evaluate DO and temperature regimes in the reservoir for the purposes of characterizing adult trout habitat.²⁶

Most southeastern lakes are monomictic, meaning the lakes thermally stratify²⁷ during the summer and, as cooling occurs during the fall-winter period, complete mixing of the water column occurs (Hutchinson, 1957). Lake Jocassee is monomictic; however, it does not achieve complete mixing in all years. Because it is a deep lake, in years with mild winters, Lake Jocassee may not exchange enough heat with the atmosphere to cool the deeper portion of the lake, resulting in incomplete winter mixing.²⁸

The amount of winter mixing has a pronounced effect on DO concentrations in deeper parts of the reservoir in subsequent seasons, as exemplified by temperature and DO vertical profiles collected in Lake Jocassee in the contrasting years 1990–91 (a year without complete mixing) and 1992–93 (a year with complete mixing) (see Figures E3.4-13 through E3.4-16 in Exhibit E, pages E3-71 through E3-74, of license application; Duke Energy, 2014a). Temperature profiles collected in these years indicate that

²⁵ A put-grow-and-take fishery is one in which juvenile fish are stocked, they grow to a fishable size, and are caught, and usually removed by anglers. Juveniles are then stocked again at regular intervals

²⁶ Adult trout habitat is defined as the band (or thickness) of water less than or equal to 68 °F and containing greater than or equal to 5 mg/L DO.

²⁷ Thermal stratification occurs when surface waters heat-up, and the warmer, lower density water separates from the higher density cold water near the bottom, creating a density barrier. The density barrier prevents higher DO in the surface waters from replenishing the DO in the bottom water, which is declining due to respiration of microorganisms.

²⁸ The depth of winter mixing can be estimated using indices such as the maximum depth at which 5.0 mg/L DO concentration occurs and the maximum depth at which 68°F occurs. These estimates can also be used to determine the availability of adult trout habitat (see discussion below).

sufficient heat loss occurred during the fall and winter of 1992–1993 to break down the thermal gradient (thermocline) and cause complete mixing throughout the water column, while in the milder 1990–1991 winter there was insufficient cooling to achieve complete mixing, and thus the thermocline was maintained. The consequence of incomplete mixing was that the oxygen concentrations remained very low in deep areas in March 1991, whereas the DO profile in March of 1993 showed complete mixing during the winter, resulting in high DO levels throughout the water column.

Lake Keowee—Unlike Lake Jocassee, Lake Keowee is a typical southeastern monomictic reservoir with one stratified period and a long fall-winter mixing period. Rather than having a single basin like Lake Jocassee, Lake Keowee has two basins, the Little River Basin and Keowee River Basin, connected by a man-made canal. Although connected, each basin exhibits slightly different patterns of temperature and oxygen stratification. Unlike Lake Jocassee, both basins of Lake Keowee mix completely every year due to the lake’s comparatively lower relative depth, and consequently, the entire lake is re-aerated every winter (see Figures E3.4-19 through E3.4-22 in Exhibit E, pages E3-83 through E3-86, of license application; Duke Energy, 2014a). Because of this, DO and water temperature patterns in years with mild winters (1990-1991) and severe winters (1992-1993) show similar trends (see Figures E3.4-23 and E3.4-24 in Exhibit E, pages E3-87 and E3-88, of license application; Duke Energy, 2014a). Typical of monomictic lakes, the colder winters produces higher DO and colder water temperatures throughout the water column in both basins at the end of the mixing period (March).

Water Temperatures

Duke Energy has monitored water temperatures in the Keowee Development’s forebay and tailrace daily since 2000. In addition, Duke Energy recently expanded its monitoring program to assess the potential effects of the installation of upgraded runners at the Jocassee Development’s Units 3 and 4 in 2007–2008 and Units 1 and 2 runners in 2010-2011.²⁹

Daily temperatures recorded in the Keowee Development’s forebay and tailrace show a constant pattern among years with very little difference (figure 3-4). Water temperatures exceeded South Carolina’s 90 °F temperature standard on only 4 days during the 10-year period within the Keowee Development forebay and never in the development’s tailrace.

²⁹ In 2008, Duke Energy installed water quality monitors immediately downstream from the Jocassee Development and the Keowee Development. In 2012, Duke Energy installed additional monitors in each of the Jocassee Development’s two intake structures (Reservoir Environmental Management, 2013).

More recent data collected with the DO and water temperature monitors installed in 2008 show a similar yearly cycle of temperatures in the Keowee Development's tailrace and the Jocassee Development's tailwater (figure 3-5). The difference between the temperature data from the Jocassee Development's tailwater and the Keowee Development's tailwater is largely reflective of the difference in the withdrawal depths. The Jocassee Development releases cooler water from deeper in the lake than the surface water withdrawal at the Keowee Development.

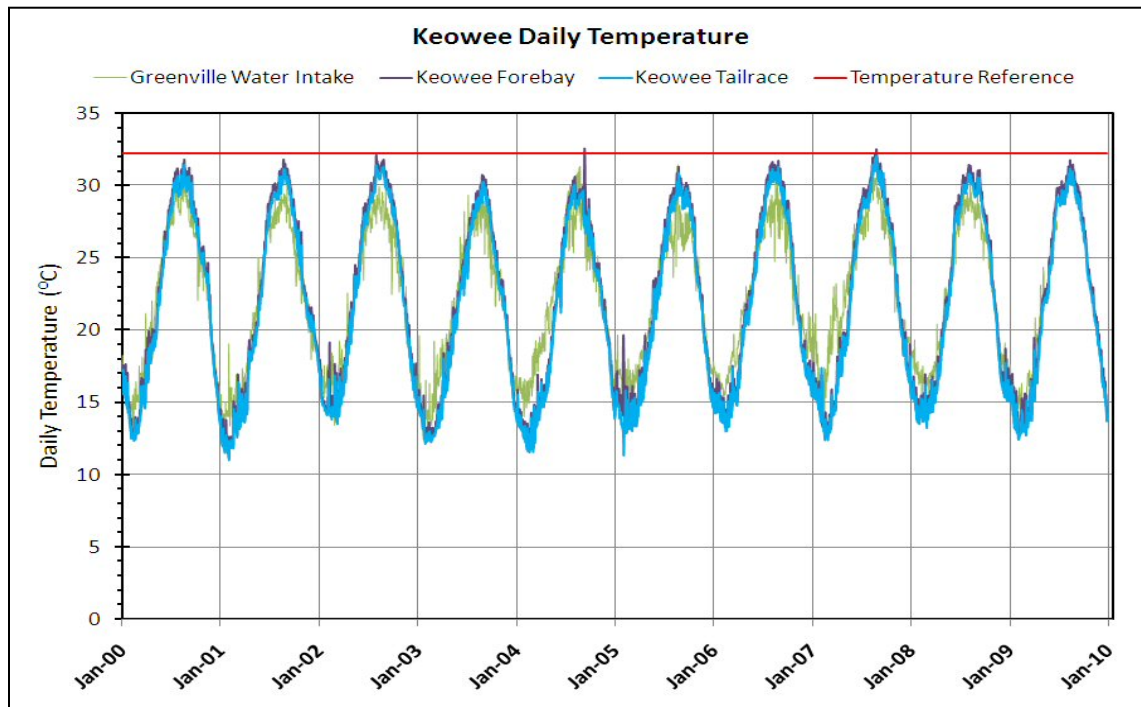


Figure 3-4. Daily temperature in Keowee Development forebay and tailrace, 2000 through 2009 (Source: Duke Energy, 2011).

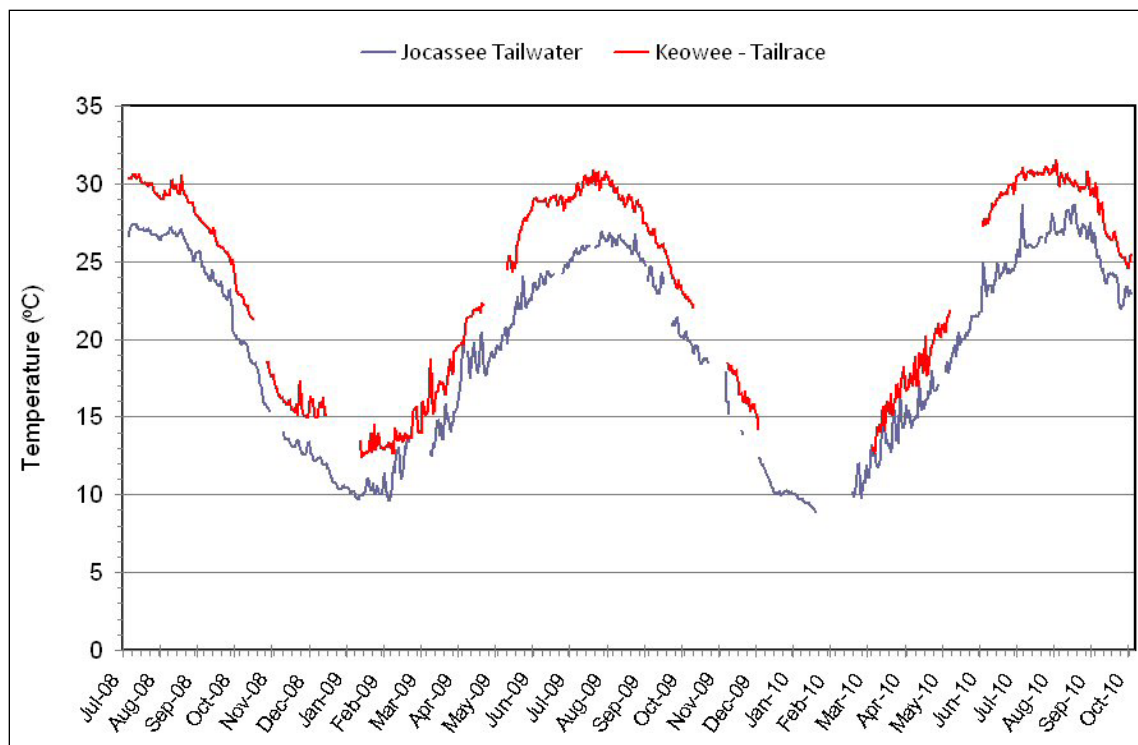


Figure 3-5. Daily average temperatures recorded downstream of Jocassee Development and Keowee Development, 2008 through 2010 (Source: Duke Energy, 2011).

Dissolved Oxygen

DO levels measured in the Jocassee Development's tailwater and Keowee Development's tailwater from 2008 through 2010 reflect the DO levels at the withdrawal depths, with the Jocassee Development's releases exhibiting less variability than the Keowee Development's releases (figure 3-6). DO levels in the water released from both the Jocassee and Keowee Developments were well above state water quality standards at all times.

Results of continuous monitoring in the Jocassee tailwater show that DO levels exceeded the state standard in 2011 (see Figure E3.4-28 in Exhibit E, page E3-92, of license application; Reservoir Environmental Management, 2013). In addition, monitoring results from 2012 show DO levels in the intake and tailwater Jocassee were well above state standards throughout 2012 (see Figure E3.4-29 and Tables E3.4-12 through E3.4-14 in Exhibit E, pages E3-93 through E3-96, of license application; Reservoir Environmental Management, 2013).

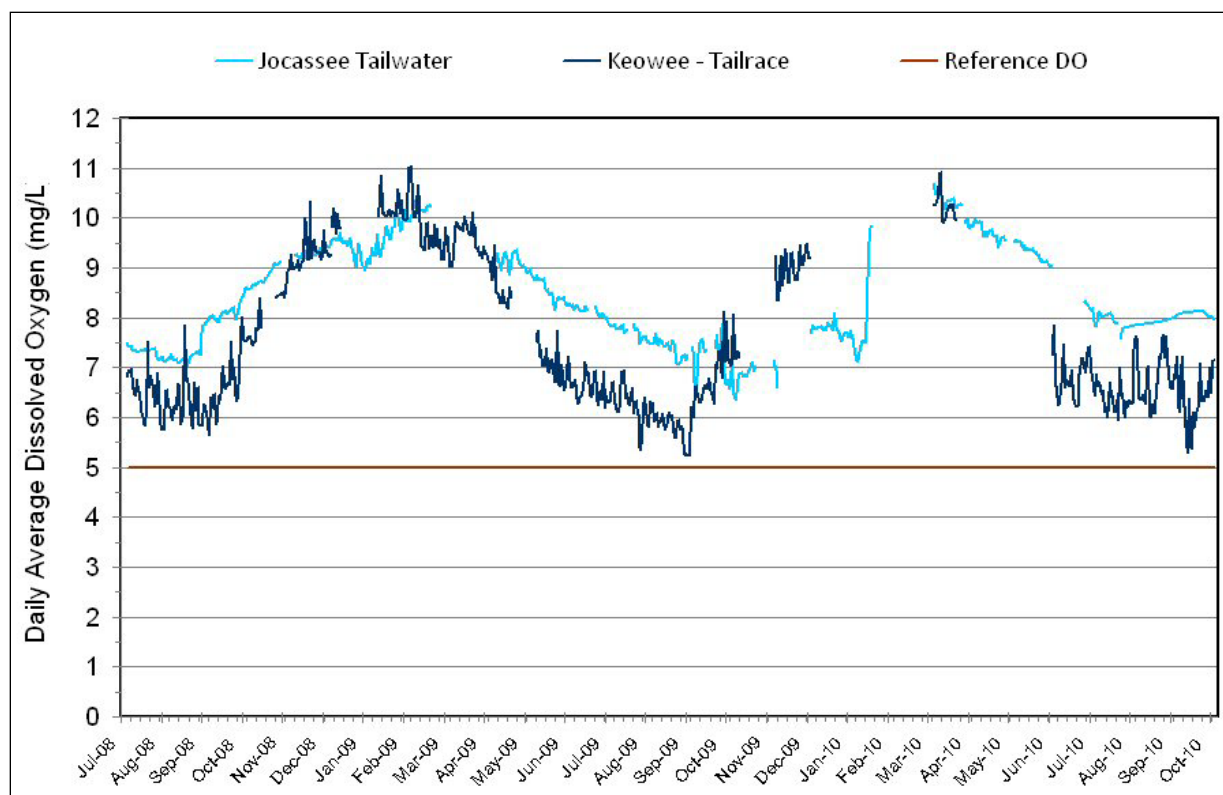


Figure 3-6. Daily average dissolved oxygen recorded downstream of Jocassee Development and Keowee Development, 2008 through 2010 (Source: Duke Energy, 2011).

Other Water Quality Parameters

pH

Based on chemical analysis of project waters, the pH in both lakes is a function of the ratio of bicarbonate³⁰ to carbon dioxide. The bicarbonate concentration in Lake Jocassee is extremely low, with Lake Keowee bicarbonate only slightly higher, yielding little buffer capacity in either reservoir.³¹ As carbon dioxide increases, usually from biological respiration and decomposition processes, the pH decreases (i.e., the water

³⁰ Bicarbonate is a weakly dissociated acid and, hence, is a buffer to pH changes.

³¹ In addition to having little buffer capacity, the total dissolved solids concentration was also very low making pH measurements extremely difficult due to a weak salt bridge between the reference electrode and the pH electrode.

column becomes more acidic). Conversely, if carbon dioxide decreases, usually from photosynthetic activity, the pH increases.

The incomplete mixing year of 1990-1991 for Lake Jocassee represents a year where pH extremes were most pronounced (see Figure E3.4-30 in Exhibit E, page 98, of the license application; Duke Energy, 2014a). Overall, though, differences in pH coincided with the gain or loss of DO. Lake Keowee pH profiles exhibited the same trends as Lake Jocassee pH profiles, except with greater pH fluctuations (primarily in the Little River Basin) (see Figures E3.4-31 and E3.4-32 in Exhibit E, pages E3-99 and E3-100, of license application; Duke Energy, 2014a). In addition, pH measured at the Greenville Water Intake on Lake Keowee from 2000-2010 was within state water quality standards (see Figure E3.4-33 in Exhibit E, page 101, of the license application; Duke Energy, 2014a).

Turbidity

Duke Energy intermittently measured turbidity in Lake Jocassee and Lake Keowee in the early years of the impoundment, with most measurements showing high turbidity levels (see Figures E3.4-34 and E3.4-35 in Exhibit E, page E3-103, of license application; Duke Energy, 2014a). Current turbidity levels, measured in 2008 and 2009, are low, well within South Carolina's turbidity standard of 25 ntu. Turbidity is also routinely measured at the Greenville Water Intake on Lake Keowee, which is shown on Figure E3.4-35 of the license application.

Nutrients and Chlorophyll-a

Total phosphorus, nitrate-nitrogen, and chlorophyll-a measurements have been collected by Duke Energy since the impoundment of Lake Keowee. Total Kjeldahl nitrogen³² was added to the nutrient analyses in 1990, and chlorophyll-a was added to the Lake Jocassee measurements in 1990.

Lake Jocassee and Lake Keowee total phosphorus concentrations (see Figures E3.4-36 and E3.4-37 in Exhibit E, pages E3-104 and E3-106, of the license application; Duke Energy, 2014a) reflect the temporal trend exhibited by turbidity. Phosphorus levels were initially high after impoundment of the reservoirs and construction of the Bad Creek Project. For the past 10-15 years, phosphorus levels have been generally below the State of South Carolina's numeric water quality standards (South Carolina DHEC, 2012b) for waters in the Blue Ridge, and far below the standards for Piedmont reservoirs.

³² Kjeldahl nitrogen is the total concentration of nitrogen from ammonia and organically bound nitrogen, but does not include nitrate or nitrite nitrogen.

Similar to phosphorus, nitrogen, measured both as nitrate-nitrogen and total Kjeldahl nitrogen, showed increases in both waterbodies after impoundment and construction of the Bad Creek Project (see Figures E3.4-38 and E3.4-39 in Exhibit E, pages E3-106 and E3-107, of the license application; Duke Energy, 2014a). The relative influence of the Bad Creek Project, though, is diminished in Lake Keowee.

Chlorophyll-a concentrations (a measure of algal standing crop) in Lake Jocassee and Lake Keowee (see Figures E3.4-40 and E3.4-41 in Exhibit E, pages E3-107 and E3-108, of the license application; Duke Energy, 2014a) showed a response parallel to the increases in turbidity, phosphorus, and nitrogen. Levels were high after impoundment and construction of the Bad Creek Project, with declines since that time. Chlorophyll-a levels in Lake Jocassee and Lake Keowee have been, and continue to be, below the 10 µg/L South Carolina DHEC (2012b) reference standard for Blue Ridge lakes, and far below the 40 µg/L reference standard for Piedmont reservoirs.

Groundwater Tritium Levels at Oconee Nuclear Station

In 2010, Duke Energy reported that samples from groundwater monitoring wells at Oconee Nuclear Station indicated groundwater had exceeded the nuclear industry's voluntary reporting level³³ of 20,000 picocuries per liter (pCi/L) for tritium at two monitoring wells (Duke Energy, 2010a).³⁴ Results from 52 other wells sampled at the site did not show tritium levels above the reporting criteria, indicating the tritium has not migrated to groundwater beyond Oconee Nuclear Station boundaries, and South Carolina DHEC sampled 5 residential wells around Oconee Nuclear Station in February 2008 and found no detectable levels of tritium in the wells tested (South Carolina DHEC, 2009). Duke Energy continues to monitor tritium as part of their monitoring program for Oconee Nuclear Station.

Fishery Resources

Lake Jocassee

As discussed above, Lake Jocassee is a deep (maximum depth of 351 feet; mean depth of 151 feet), low productivity reservoir, that thermally stratifies annually, but only

³³ This is also the level established by EPA for tritium concentrations in public water supplies.

³⁴ Details of the sampling program are provided in Duke Energy's response to a questionnaire issued by the Nuclear Regulatory Commission regarding the tritium groundwater contamination (Duke Energy, 2010b).

mixes completely in about 40 percent of years (Taylor and Bulak, 2011). Along the shoreline, the shallow water habitat is steeply sloped, with substrates composed mostly of rocky outcrops (77 percent), and small amounts of sand (8 percent), clay (3 percent), and cobble (1 percent) (Duke Energy, 2011). Large wood stumps are also present along some areas of the shoreline. Some emergent vegetation also exists in the shallow water area; however, substrates and water level fluctuations prevent the establishment of many native aquatic plants. Man-made structures, like residential piers and riprap are also present along 4 percent of the shoreline (Duke Energy, 2011).

As a result of the depth (and associated temperature range) and structural habitat diversity of Lake Jocassee, a variety of warm, cool, and coldwater fish species inhabit the lake (table 3-4). Warmwater centrarchids (sunfish and bass), such as redbreast sunfish, bluegill, and largemouth bass dominate the fish community, and primarily inhabit the shallow water areas. The redeye bass, a Conservation Species of Highest Priority, is another abundant centrarchid; however, it tends to occupy cool waters (discussed below in Special Status Aquatic Species). In the open water areas of Lake Jocassee, two clupeids (herrings and shads) blueback herring and threadfin shad are abundant (discussed below). Two coldwater species, rainbow trout and brown trout, also exist in the deeper (45 – 180 feet), colder (46° F – 68° F), and well oxygenated (greater than 5.0 mg/L) open water areas of the reservoir during summer and fall, but will occupy shallower open waters during cooler months (Barwick et al., 2004). Natural reproduction of rainbow trout and brown trout is negligible in Lake Jocassee, but South Carolina DNR maintains fishable populations through annual stocking (Taylor and Bulak, 2011).

Lake Keowee

Lake Keowee is shallower (maximum depth of 154 feet; mean depth of 52 feet) than Lake Jocassee, and has low to medium productivity. Like Lake Jocassee, Lake Keowee does thermally stratify annually, but unlike Lake Jocassee, Lake Keowee mixes completely each year during the fall. The shoreline and shallow water habitat also differs substantially from Lake Jocassee, with residential piers and riprap composing most of the shallow water area (33 percent), with substrates like clay (25 percent) and cobble (13 percent) composing a smaller area. As in Lake Jocassee, the volume of aquatic vegetation is minimal because water level fluctuations prevent establishment of native aquatic plants.

The fish community in Lake Keowee differs from Lake Jocassee, and is generally more typical of southeastern reservoirs. It primarily supports warmwater species. As such, the reservoir, including the Jocassee Dam tailwater, is dominated almost exclusively by centrarchids, especially bluegill and redbreast sunfish, but also hosts green sunfish, warmouth, redear sunfish, largemouth bass, spotted bass, and some redeye bass (table 3-4). Blueback herring and threadfin shad are also present (discussed below).

Keowee Dam Tailwater

Habitat in the tailwaters of Keowee Dam is represented by natural rock, clay, sand, woody debris, and riprap. The fish community in the tailwaters is dominated almost exclusively by centrarchids, particularly redbreast sunfish, bluegill, and redear sunfish (table 3-4). In addition, striped bass, a Conservation Species of Moderate Priority (see below), utilize the tailwaters. Striped bass are considered a Conservation Species of Moderate Priority; however, striped bass in the tailwaters come from the stocked population downstream in Hartwell Lake, and thus are not naturally occurring, nor self-sustained through natural reproduction.

Little River Bypassed Reach

The Little River Bypassed Reach is a wetland complex that consists of a basin where seepage from the dam collects, a slow moving, silty bottomed, and generally stagnant stream reach, and a sediment-laden pond impounded by Courtenay Mill Dam. Only 5 fish species were observed during electrofishing, minnow trap, and gill-net surveys conducted in July 2012. Most of the fish identified were centrarchids, but mosquitofish and flat bullhead (collected in gill-nets) were also observed (table 3-4).

Table 3-4. Fish species and average number collected during electrofishing surveys in the vicinity of the Keowee-Toxaway Project (Source: Duke Energy, 2014a with staff modifications).

Family and Common Name	Lake Jocassee ¹		Jocassee Dam	Lake Keowee ^a			Keowee Dam	Little River Bypass ^b		
	Upper	Lower	Tailwater ²	Upper	Middle	Lower	Tailwater ²	Basin	Stream	Pond
Lepisosteidae										
Longnose gar	0	0	0	0	0	0	4	0	0	0
Clupeidae										
Blueback herring ^c	137.8	75.8	17	16.7	7.3	49.2	0	0	0	0
Threadfin shad	150	19.6	0	0.2	6.2	0.3	0	0	0	0
Gizzard shad	0	0	0	0	0	0	1	0	0	0
Cyprinidae										
Whitefin shiner	43.2	69	32	30	56.3	139	0	0	0	0
Golden shiner	0.2	0.6	1	0.5	0.3	0.2	0	0	0	0
Common carp	5.6	7.4	0	9	9	16.2	1	0	0	0
Spottail shiner	0	0	0	0	153	3.8	7	0	0	0
Catostomidae										
Northern hogsucker	0	0	0	0	0.3	0.2	0	0	0	0
Notchlip redhorse ^d	0.6	0	0	0.3	0.7	0.2	0	0	0	0
Spotted sucker	0	0	0	0	0.2	0	0	0	0	0
Striped jumprock	0.2	0	0	0	0	0	0	0	0	0
Brassy jumprock	0.4	0	1	0.8	0	0	0	0	0	0

Family and Common Name	Lake Jocassee		Jocassee Dam Tailwater	Lake Keowee			Keowee Dam Tailwater	Little River Bypass		
	Upper	Lower		Upper	Middle	Lower		Basin	Stream	Pond
Ictaluridae										
Snail bullhead ^d	1.8	5	17	11.2	0.5	1	0	0	0	0
Flat bullhead ^d	4	0.8	0	2.7	3	4.7	0	0	0	0
White catfish ^d	0	0	0	0	0	0.2	0	0	0	0
Channel catfish	0	0	0	0	1.5	1.5	2	0	0	0
Flathead catfish	0	0	0	0	0	0	1	0	0	0
Poeciliidae										
Eastern mosquitofish	0	0	0	0	0.5	0.2	0	8	14	0
Salmonidae										
Rainbow trout	0	0.2	1	0.2	0	0	0	0	0	0
Brown trout	0.2	0.8	0	0.2	0	0	0	0	0	0
Moronidae										
Striped bass ^d	0	0	0	0	0	0	21	0	0	0
White/striped bass hybrid	0	0	0	0	0	0	6	0	0	0

Family and Common Name	Lake Jocassee		Jocassee Dam	Lake Keowee			Keowee Dam	Little River Bypass		
	Upper	Lower	Tailwater	Upper	Middle	Lower	Tailwater	Basin	Stream	Pond
Centrarchidae										
Redbreast sunfish	229.4	299.2	356	246	192	181	27	4	11	4
Green sunfish	25.2	30.6	93	45.8	84.2	99.8	1	0	0	0
Warmouth	5.8	6.8	6	37	28.3	33.3	0	7	0	13
Bluegill	292.6	217.2	368	549	565.8	670	27	23	1	77
Redear sunfish	0	0	2	12.2	29.5	9.5	22	1	0	0
Sunfish hybrid	3.8	3.8	19	17.7	25.7	22	0	0	0	0
Redeye bass ^c	74.8	51.2	1	11.5	5	6.5	1	0	0	0
Smallmouth bass	0.8	6	20	2.8	0.2	0.2	0	0	0	0
Spotted bass	0.6	2	4	18.2	17.3	42.3	6	0	0	0
Largemouth bass	41.8	9.4	7	33.3	16.5	17	4	3	9	16
Black bass hybrid	0.2	1.2	2	0.3	0	0	2	0	0	0
Black crappie	0.6	0	0	0	0.3	2.7	0	0	0	0
Percidae										
Blackbanded darter ^e	0	0.2	7	1.5	0.2	0	2	0	0	0
Yellow perch	0.4	0	0	0	0	0	0	0	0	0
Walleye	0.2	0	0	0	0	0	0	0	0	0

^a Fish collected in 1996, 1999, 2002, 2005, 2008.

^b Fish collected in 2012.

^c South Carolina Highest conservation species priority listing.

^d South Carolina Moderate conservation species priority listing.

^e North Carolina threatened species.

Open Water Forage Fish

Life-history

The open water forage fish community of both Lake Jocassee and Lake Keowee is composed mostly of blueback herring and threadfin shad (some gizzard shad have been observed in lower Keowee Basin). These warmwater clupeids were introduced into Lake Jocassee in the early 1970s, and now maintain self-reproducing populations (Davis and Foltz, 1991).

Threadfin shad generally inhabit larger rivers and reservoirs, and commonly school in the middle of the water column of open water areas of the reservoir (Rohde et al., 2009). The species generally prefers warmer waters, and has a lower lethal temperature around 41-45°F (Parsons and Kimsey, 1954). Threadfin shad spawn from April to July, during brief time intervals between first light to sunrise, near the shoreline, over aquatic plants and other submerged objects (Rohde et al., 2009). Although the life span of threadfin shad can be 2-3 years, in large reservoirs, it rarely lives past one year, and may not grow more than 3-4 inches (South Carolina DNR, 2013).

Native blueback herring populations are typically anadromous; however, introduced landlocked (or non-migratory) populations will reside in open water areas of reservoirs and spawn close to shore in the spring (Rohde et al., 2009). Blueback herring tolerate lower temperatures (down to 36°F; [Pardue, 1983]) than threadfin shad, and in southeastern reservoirs generally prefer cool (55°F – 75°F), deep water (Goodrich, 2002). The species generally mature at age three or four, and can live to age 8 (Rohde, 2009).

Population trends

In Lake Jocassee, Duke Energy characterized the open water forage fish community during spring and fall surveys (using hydroacoustics and purse seine) from fall 1997 to spring 2013. During that period, the lakewide spring and fall forage fish (blueback herring and threadfin shad combined) abundance experienced some variability, but in general the population has remained stable, with some increase in the most recent two years (figure 3-7). For a given year, the fall population abundance was always higher because of spring reproduction and recruitment of these young-of-the-year (YOY) fish to the fall population. In fact, the fall blueback herring population is predominantly composed of YOY fish and the fall threadfin shad population is completely composed of YOY fish (Rodriguez, 2013a). The fall population abundance also was generally more variable, and this too can be attributed to the composition of the population being primarily YOY fish. YOY generally exhibit high mortality rates, which are often determined by density independent factors (e.g. food availability, temperature, DO, water level), which also are variable from year to year. This variability was also evident when fall blueback herring abundance and fall threadfin shad abundance was separated (figure 3-8). Like the combined estimates, population estimates for both species was variable,

but overall relatively stable up until 2009, when blueback herring abundance increased and threadfin shad abundance declined. This apparent inverse trend in fall blueback herring and fall threadfin shad abundance suggests that the physical (e.g., temperature), chemical (e.g., DO), and/or biological (e.g., food resources) conditions in any year may not benefit each species YOY abundance equally.

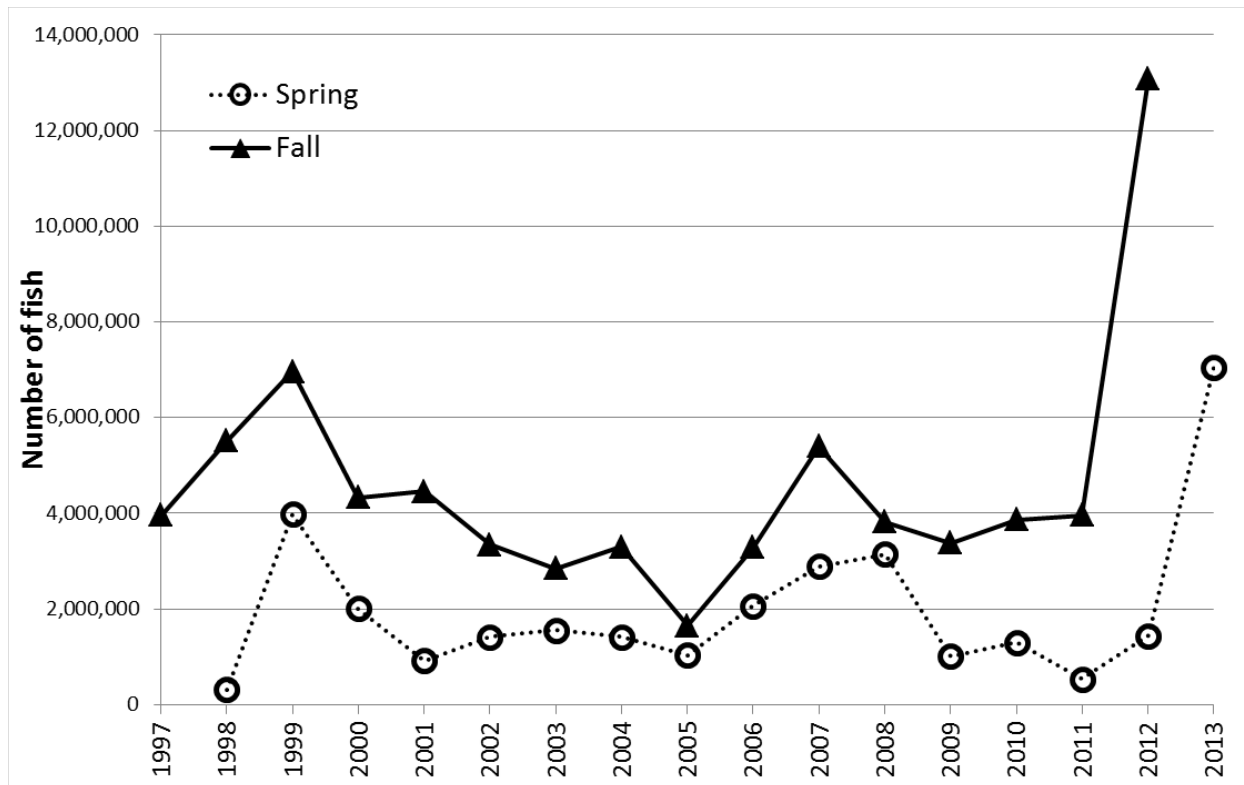


Figure 3-7. Open water forage fish community (blueback herring and threadfin shad) abundance estimates based on hydroacoustic sampling during spring and fall in Lake Jocassee (Source: Rodriguez, 2013a with staff modifications).

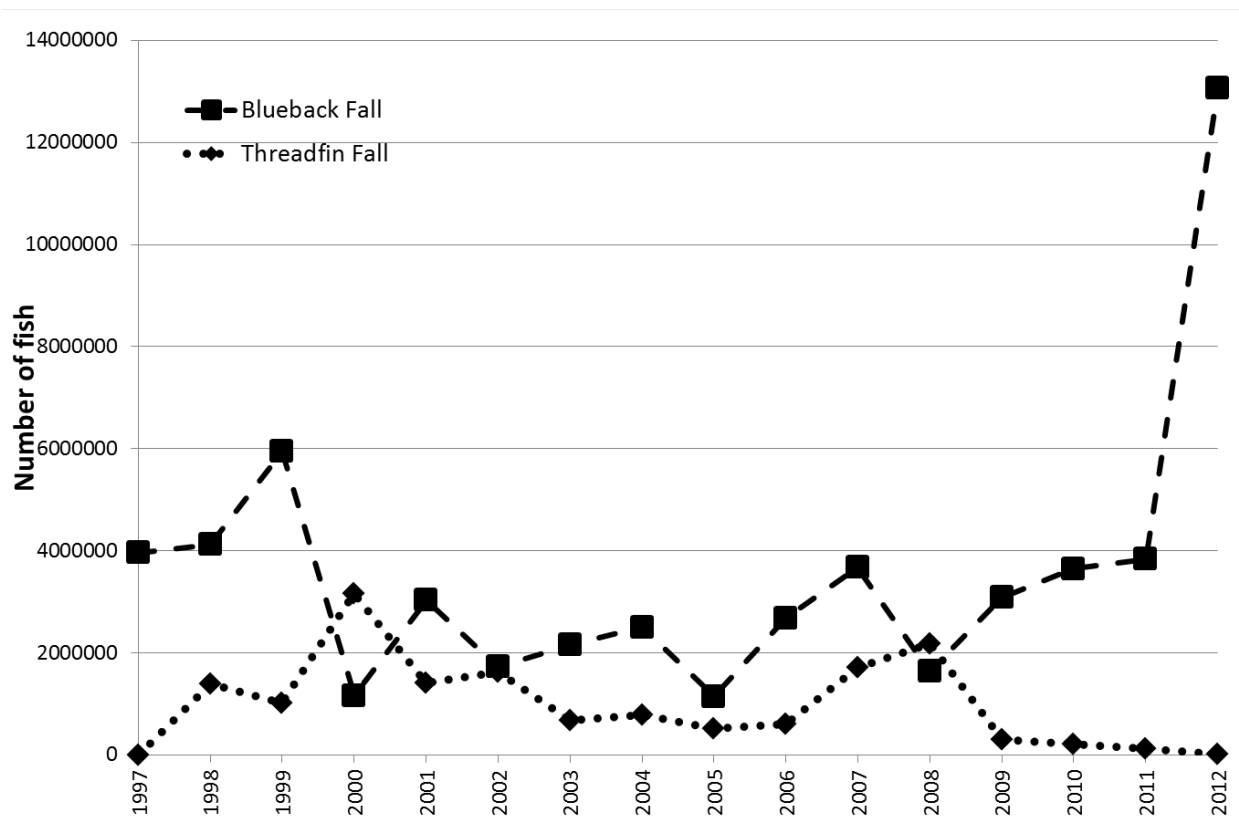


Figure 3-8. Blueback herring and threadfin shad fall abundance estimates based on hydroacoustic and purse seine sampling in Lake Jocassee (Source: Rodriguez, 2013a with staff modifications).

In Lake Keowee, Duke Energy characterized the open water forage fish community during spring and fall surveys from spring 1999 to spring 2013. Like Lake Jocassee, lakewide spring and fall forage fish abundance was variable (figure 3-9). Fall abundance appeared to exhibit higher variability than in Lake Jocassee and a declining trend; however the high variability and downward trend pattern was largely driven by data from 2000 and 2001. The high fall forage fish abundance (which, like Lake Jocassee, resulted from large numbers of YOY fish; [Rodriguez, 2013b]) in 2000 and 2001 suggests that conditions were optimal for reproduction and recruitment for one or both species in that year.³⁵ In contrast, in the preceding year (1999), which was also the first year of the survey, population abundance was more similar to more recent abundance estimates, suggesting that the apparent downward trend may simply be a function of the length of the available data series. Although separate fall abundance

³⁵ In the Lake Keowee forage fish survey results, Duke Energy did not provide separate estimates of abundance for blueback herring and threadfin shad separately, as it did for Lake Jocassee (Rodriguez, 2013b).

estimates were not available for blueback herring and threadfin shad, the percent composition was 18 percent threadfin shad and 82 percent blueback herring in upper Lake Keowee; 87 percent threadfin shad and 13 percent blueback herring in lower Lake Keowee; and 29 percent threadfin shad and 71 percent blueback herring in Little River Basin (Rodriguez, 2013b). Like Lake Jocassee, forage fish abundance was much less variable in the spring, and generally showed a stable population trend from 2002 to 2013. In 1999 and 2001, spring abundance was higher than in subsequent years, but without data for the preceding decade or beyond, it is not possible to ascertain whether the higher or lower population abundance is typical. Nevertheless, the population does appear to retain an ability to recover from declines, such as those observed between 2009 and 2010.

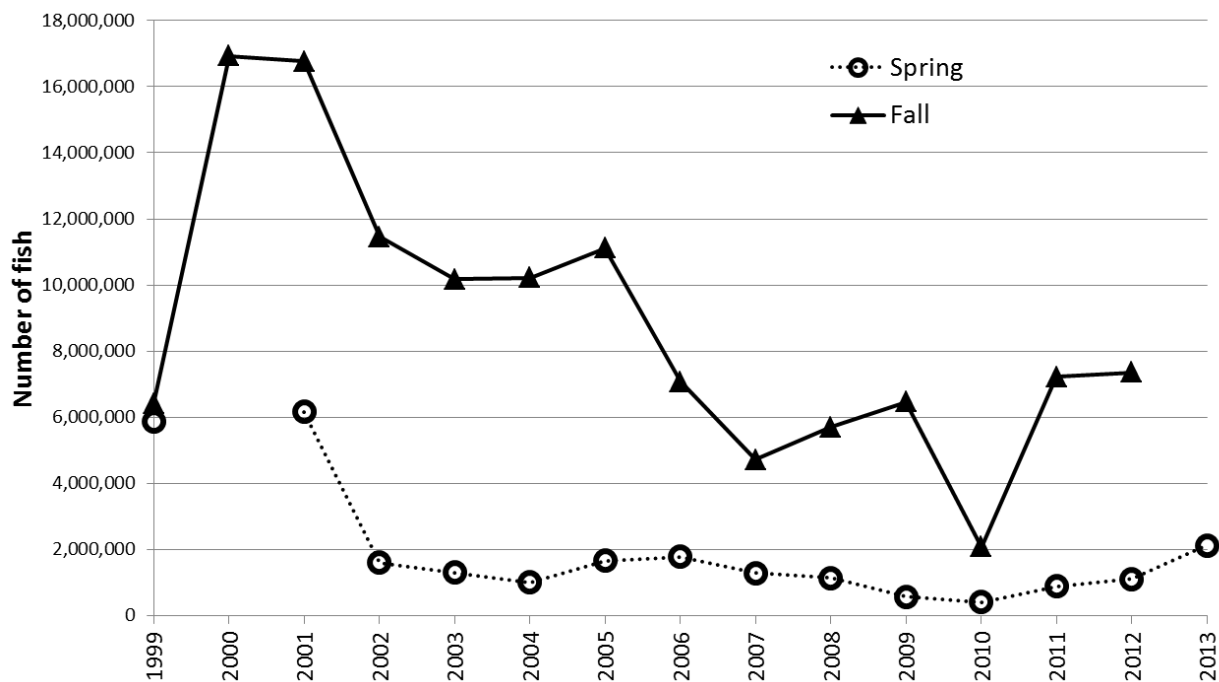


Figure 3-9. Open water forage fish community (blueback herring and threadfin shad) abundance estimates based on hydroacoustic sampling during spring and fall in Lake Keowee (Source: Rodriguez, 2013b with staff modifications).

Invasive Spotted Bass

The spotted bass is native to the Mississippi River basin from southern Ohio and West Virginia to southeastern Kansas and south to the Gulf and Gulf drainages from the Choctawhatchee River in Alabama and Florida, west to the Guadalupe River in Texas (Warren, 2009). The species has been widely introduced and is established outside of its range, including in multiple drainages in South Carolina and North Carolina. It is currently present in the upper Savannah River drainage. The spotted bass inhabits gravelly flowing pools and runs of creeks and small to medium rivers and reservoirs

(Stauffer et al., 1995). In southern US reservoirs, spotted bass are most abundant in low to moderate nutrient reservoirs or reaches of reservoirs, with abundance decreasing as nutrients increase (Maceina and Bayne, 2001). Hybridization and introgression³⁶ can be extensive when non-native spotted bass are introduced into native populations of other black basses, such as smallmouth bass and redeye bass. Furthermore, native black bass populations can decline dramatically after introduction. For example, in the mid-1980s, anglers introduced a subspecies of the spotted bass into Lake Keowee, and by the mid-1990s, this species was the most frequently caught sport fish in the impoundment (Barwick, 2006). In contrast, the abundance of redeye bass, which hybridizes with the spotted bass, has been declining over the last several years, and redeye bass were not observed in Lake Keowee in Duke Energy's most recent electrofishing survey conducted in 2008. Furthermore, no pure redeye bass strains were observed in Lake Keowee in 2004 (Bangs, 2011). Spotted bass, and spotted bass × redeye bass hybrids are also present in Lake Jocassee. Pure strain redeye bass are still present in Lake Jocassee (Bangs, 2011).

Freshwater Mussels

Paper pondshell, eastern floater, and Florida pondhorn are the only freshwater mussels recently documented in both Lake Jocassee and Lake Keowee (Alderman, 2009). In Lake Jocassee, paper pondshell has been observed only in the upper reaches of the lake, Florida pondhorn only in the lower reaches, and eastern floater, only in the upper reaches near the Toxaway River. Based on the total number of shells found, the paper pondshell (150) was the most abundant mussel in Lake Jocassee, followed by the Florida pondhorn (6), and the eastern floater (1) (Alderman, 2009).

In Lake Keowee, Florida pondhorn was only documented in the middle reaches of the lake, but paper pondshell and eastern floater were distributed throughout the lake. Based on the total number of shells and live animals found, the eastern floater (80) was the most abundant mussel in Lake Keowee, followed by the paper pondshell (62), and the Florida pondhorn (20) (Alderman, 2009).

Special Status Aquatic Species

No federally-listed threatened or endangered species of fish or mussels are known to occur in the project area. However, six fish species found in Lake Jocassee or Lake Keowee are listed as South Carolina Conservation species: blueback herring, notchlip

³⁶ Introgression is the breeding of hybrid individuals with one or both pure strain species that produced the hybrid. When introgression occurs, it indicates viability and fertility of hybrid individuals, which can be detrimental to pure strain species.

redhorse, snail bullhead, flat bullhead, striped bass, and redeye bass. Because blueback herring and striped bass populations found in both reservoirs, and the Keowee Dam tailwaters, respectively, do not contribute to the coastal populations of concern by South Carolina DNR (2005), we do not discuss them further in this section. In addition, blackbanded darter is a North Carolina protected species, listed as threatened in the state.

Notchlip redhorse is a South Carolina Conservation Species of Moderate Priority due to habitat degradation such as deforestation and siltation (South Carolina DNR, 2005). The species occurs in large creeks to large rivers on the inner Coastal Plain and Piedmont of South Carolina (Rohde et al., 2009). Its temporal spawning range may occur from March to early June, and it is thought to gather near shoals and flats to spawn over coarse gravel (Jenkins and Burkhead, 1993). Notchlip redhorse was found in upper Lake Jocassee and throughout Lake Keowee during recent electrofishing surveys (table 3-4).

Quillback is a South Carolina Conservation Species of High Priority as a result of habitat degradation from deforestation and urbanization; however, populations are considered stable throughout their range (South Carolina DNR, 2015). This species inhabits pools, backwaters, and main channels of clear to turbid creeks, rivers, and lakes (Rohde et al., 2009). Spawning generally occurs from March to September, in smaller tributary streams, where eggs are deposited over sand, in calm water (Rohde et al, 2009). Quillback was found in gill-net surveys conducted in Lake Jocassee from 1974-1999, but was not found in surveys from 2000-2007.

White catfish is a South Carolina Conservation Species of Moderate Priority as a result of population declines in the Neuse River, Cape Fear River, Pee Dee River, and Edisto River (South Carolina DNR, 2005). This species inhabits warm ponds, reservoirs, medium and large rivers, rarely small streams, and extends into brackish water (Jenkins and Burkhead, 1993). In South Carolina, white catfish spawn in June over nests constructed in sand or gravel (Jenkins and Burkhead, 1993; Mettee et al., 1996). White catfish were found in Lake Jocassee during gillnet surveys (1978-2007; Duke Energy, 2011), and in lower Lake Keowee during recent electrofishing surveys (table 3-4).

Flat bullhead is a South Carolina Conservation Species of Moderate Priority as a result of sedimentation, hydrologic modification, impoundments, nonpoint source pollution, and development, as well as competition with and predation by non-native catfish species like the flathead and blue catfish (South Carolina DNR, 2005). The species occupies a variety of habitats, including impoundments. Spawning biology is not well understood in stream or riverine environments, though spawning in Lake Norman, North Carolina occurs during June and July (Olmstead and Cloutman, 1979). Flat bullhead was found throughout Lake Jocassee and Lake Keowee during recent electrofishing surveys (table 3-4).

Snail bullhead is a South Carolina Conservation Species of Moderate Priority for the same reasons as flat bullhead. The species is frequently found in warm and medium-sized rivers, often in rocky runs and riffles, and appears to prefer shoals compared to pools (Kennon, 2007; Rohde et al., 2009). Little is known about snail bullhead biology, but it likely spawns from May to early June. Snail bullhead was found throughout Lake Jocassee and Lake Keowee during recent electrofishing surveys (table 3-4).

Redeye bass is a South Carolina Conservation Species of Highest Priority as a result of its restricted range, as well as competitive displacement and hybridization when found together with the introduced, non-native spotted bass (South Carolina DNR, 2005). The species typically inhabits small to medium sized headwater streams within the Appalachian foothills of Gulf and Atlantic Slope drainages (Boschung and Mayden, 1999). Though reported to poorly tolerate impoundments, redeye bass have persisted and even thrived in several reservoirs in the upper reaches of the Savannah drainage (Koppelman and Garret, 2002). These reservoir fish attain a much greater size than is seen in redeye in their native stream habitats, and the world record redeye bass was caught from Lake Jocassee, and weighed 5.2 pounds (NFWF, 2010). The species spawns in the spring (April-June) in headwater streams in gravel nests built in eddy waters at the heads of pools (Wallus and Simon, 2008). Outside of the spawning season, adult and juvenile redeye bass appear to prefer areas close to shorelines with heavy canopy cover (Knight, 2011).

Redeye bass was found in both reservoirs, and the Keowee Dam tailwaters during recent electrofishing surveys (table 3-4), and during gillnet surveys in Lake Jocassee (1975-2008). In Lake Keowee, redeye bass abundance has declined recently – possibly because of hybridization and competition with spotted bass (Barwick et al., 2006; Oswald, 2007), and no redeye bass were found in the most recent survey conducted in 2008. In Lake Jocassee, where spotted bass are less common, gillnet surveys indicate that redeye bass numbers and biomass have been increasing since 1975.

Blackbanded darter is a North Carolina Threatened Species because it is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The species is commonly found in habitats with at least moderate water flow over a variety of sediments, but usually over sand, gravel, or rubble substrates (Marcy et al., 2005). Spawning occurs from early May through June, and like others in the same genus, blackbanded darters probably bury their eggs in loose sand and gravel. In Lake Jocassee, one blackbanded darter was observed in the lower region of the reservoir during the most recent 2008 electrofishing survey, but none were observed in 1996, 1999, 2002, or 2005. In Lake Keowee, blackbanded darters were observed in 2005 and 2008 in the upper and middle regions of the reservoir.

3.3.2.2 Environmental Effects

The following section discusses the effects of proposed measures and enhancements on water quantity and quality, including lake level elevations as well as fishery resources.

Effects of Project Operation on Water Quantity

As described in section 2.2.2, *Proposed Project Operation*, during normal inflow conditions Duke Energy proposes to operate each development within a maximum elevation and Normal Minimum elevation, except during droughts when the LIP would be implemented. Operation of the project as proposed would result in continued daily and long-term fluctuations in reservoir elevations. Under normal inflows, Lake Jocassee could fluctuate up to 14 feet between the Normal Minimum and maximum elevation. During droughts the fluctuation could be as much as 30 feet between the maximum and minimum, although this extreme is expected to rarely occur. The average daily change in reservoir elevation is expected to be far less, between 1.5 and 2.9 feet, at Lake Jocassee. Under normal inflows Lake Keowee could fluctuate up to 4 feet between the maximum and Normal Minimum elevation. During droughts the fluctuations could be as much as 10 feet between the maximum and minimum elevation, although this extreme is expected to rarely occur. The average daily change in elevation is expected to be far less, between 1 and 1.8 feet, at Lake Keowee.

Duke Energy proposes a Normal Minimum elevation for Lake Jocassee and Lake Keowee, and an increase in the minimum elevation at Lake Keowee. Hydrologic modeling conducted by the Corps (2014) indicated that in normal flow years there would be no difference in average daily fluctuations between Duke Energy's existing and proposed operation in Lake Jocassee and Lake Keowee. The Corps' hydrologic modeling indicated that under drought conditions (i.e., LIP operations) proposed operation would result in no difference in average daily fluctuation in Lake Jocassee compared to current operation. In Lake Keowee, there would be no difference, except in May, when the average daily fluctuation would be 0.01 feet greater under proposed operation.

In comments on the license application, numerous entities expressed support for Duke Energy's proposal as outlined in the Relicensing Agreement, including South Carolina DNR, Greenville Water, and Oconee County Administration. Mr. James Vaughan, Mr. Ronald Davis, and the Petitioners provided comments requesting that Duke Energy consider a higher Critical Reservoir Elevation (minimum reservoir elevation which is expected to occur during Stage 4 of the LIP) for Lake Keowee of 793 feet, stating that the proposed Critical Reservoir Elevation of 790 feet would have negative effects on homeowners at Lake Keowee.

In reply comments, Duke Energy emphasized that the proposed minimum elevation of 790 feet would be in effect only during Stage 4 LIP conditions. Duke Energy also asserted that the commenters requesting a higher Critical Reservoir Elevation did not acknowledge the competing interests for water in the Savannah River Basin that contributed to the development of the operating regimes outlined in the Relicensing Agreement.

Our Analysis

Implementing the proposed Normal Minimum elevations at Lake Jocassee and Lake Keowee, in conjunction with the LIP which would be implemented during drought periods, is expected to decrease the amount of time the reservoirs experience deeper drawdowns than have occurred historically. Duke Energy proposes a Normal Minimum elevation at Lake Jocassee of 1,096 feet. Historically, Lake Jocassee has fallen below 1,096 feet approximately 23 percent of the time. Under the proposed operation this is expected to be reduced to 3 percent of the time. The minimum elevation for Lake Keowee would be increased from 775 to 790 feet. In addition, Duke Energy proposes a Normal Minimum of 796 feet. Lake Keowee elevations below 796 feet have occurred 32 percent of the time. This would be reduced to 7 percent of the time as proposed. In each case, elevations below the Normal Minimum would be guided by the LIP or MEP.

The proposed operation changes would have no effect on current water withdrawals at municipal intakes. Lake Jocassee has no existing municipal withdrawals and Duke Energy's proposed SMP prohibits construction of new major (in excess of 1 MGD) water withdrawals. There are two municipal water withdrawals on Lake Keowee, the City of Seneca, South Carolina and Greenville Water. These intakes are operational at elevations as low as 775 and 770 feet; therefore, both intakes would continue to be operational under the proposed operation. As required by Duke Energy's proposed SMP, new municipal water intakes or expansion of existing intakes would be designed to operate at elevations specified in the LIP. The proposed operation requires that Oconee Nuclear Station be modified to withdraw water from Lake Keowee at lower water levels (790 feet). Modifications to Oconee Nuclear Station are currently underway and estimated to be complete by December 1, 2019. The proposed operation provides that Lake Keowee be maintained at a higher elevation (794.6 feet) until the modifications to Oconee Nuclear Station are complete. Two water intakes on Lake Keowee are currently used for irrigation, The Reserve at Lake Keowee and the Cliffs Club at Keowee Vineyards. Easements for each of these withdrawals have provisions for water conservation measures during droughts.

For the period 1940 through 2011 Duke Energy also calculated the percent difference in flows released from the Keowee Development under the proposed operation. During drought periods the releases from Lake Keowee averaged 5.3 percent less. Together, these results indicate that Duke Energy's proposed operation would result

in little to no difference in average reservoir fluctuations and flows released from Lake Keowee compared to existing operation. This conclusion is further supported by the Corps' 2014 EA which concluded that Duke Energy's proposed operation would have little to no effect on any of the resources evaluated (Corps, 2014).

Effects of Project Operation on Dissolved Oxygen and Water Temperature

The intakes for the Jocassee Development are between elevations 1,043 and 1,067 feet and, like the Keowee Development, pull water with higher DO concentrations from the upper portion of the lake. Pumping operation at the Jocassee Development likewise accesses the well-oxygenated, near-surface water in Lake Keowee, resulting in pumping DO concentrations very similar to the hydroelectric flow releases within a similar timeframe. The withdrawal zone for the Keowee Development is influenced by an underwater weir, the top of which is at approximately 765 feet. Like the Jocassee Development, the Keowee Development pulls relatively oxygen-rich water from nearer the lake surface instead of water with lower DO concentrations from deeper in the lake. No violations of state DO standards have been observed in either of the lakes or in the water released from that Keowee Development under existing project operation, and all beneficial uses are supported in both reservoirs.

To evaluate potential changes in water quality conditions associated with proposed changes in project operation, Duke Energy conducted a Water Quality Modeling Study of Lake Keowee which included changes in reservoir operating levels, as well as the LIP and MEP (Sawyer et al., 2013). The results of this modeling were provided in the Keowee Reservoir Water Quality Modeling Study Report, which Duke Energy filed with the license application.

To ensure that the state standard for DO of 5.0 mg/L is met in the developments' tailwaters, Duke Energy proposes to continually monitor DO in the tailwaters of the Jocassee Development and the Keowee Development in August for the term of the new license. Duke Energy also would submit monitoring results to South Carolina DHEC and the Commission annually by November 30. Interior recommends the EA consider the need for permanent water quality monitoring stations in the tailwaters, bypassed reaches, and reservoirs. Interior also recommends that the water quality monitoring include, at a minimum, collecting data on DO, water temperature, turbidity, pH, and total dissolved gas on an hourly basis.

Our Analysis

Overall, the modeling results indicate that proposed project operation is consistent with the maintenance of suitable DO levels and water temperatures for the propagation of aquatic life in the Keowee Development releases. The Keowee Development releases water from the upper, well-oxygenated region of the water column, and this is not expected to change under proposed project operation. The excellent water quality in

Lake Keowee and the upper-level withdrawal from the reservoir are the primary reasons flow releases have consistently met, and are predicted to continue to meet, state water quality DO standards. Duke Energy's proposal to monitor DO annually in the Keowee and Jocassee Developments' tailwaters during the month of August, would only provide a means to confirm that outflows from the two developments continue to meet state DO standards.

Interior states that water quality is important for healthy fish and wildlife communities, and considers water quality in project waters to be one of the most significant issues to be addressed in this EA. Interior's recommendations for permanent monitoring stations in the tailwaters, bypassed reaches, and reservoirs, as well as the parameters to be monitored on an hourly basis reflect the importance of the issue. Implementing Interior's recommendations would afford Duke Energy the ability to gather a substantial amount of annual water quality data for Lakes Jocassee and Keowee, and downstream river reaches. This data would be used by Duke Energy and the resource agencies in making decisions regarding project operation and resource management.

Notwithstanding the information obtained by Duke Energy's proposed, and Interior's recommended monitoring effort, it is not clear, based on the evidence in the record, why the information obtained from either monitoring effort is needed to ensure maintenance of state water quality standards. Existing water quality in the reservoirs is considered excellent, and is meeting existing state standards and designated uses. In addition, the studies conducted during relicensing indicate that ongoing project operation has little influence on water quality in the reservoirs or the releases from the Jocassee and Keowee Developments. Furthermore, modeling results indicate that proposed project operation would maintain suitable DO and temperature in Lake Keowee and in the Keowee Development tailwaters. Therefore, there would be no benefit to monitoring water quality post-license.

Effects of Project Operation on Tritium Migration

In its scoping comments, Greenville Water raised concerns about whether the fluctuations in the reservoir level at Lake Keowee, or other factors associated with the future operation of the project, would induce groundwater with elevated levels of tritium to migrate from below Oconee Nuclear Station toward Lake Keowee. They further requested this subject be studied. Duke Energy evaluated tritium levels in the vicinity of Oconee Nuclear Station, and based on that evaluation, made no recommendations for the Keowee-Toxaway Project to address the issue.

Our Analysis

The first well to show tritium levels approaching the voluntary reporting limit³⁷ was well GM-7 (19,800 pCi/L measured on January 8, 2008; figure 3-11). Additional wells sampled and reported by S&ME (2008) indicate that the contamination is local to this well. The groundwater flow in this area is generally towards Pond 3 (or CTP3; figure 3-11) and its discharge conveyance, which flows toward the Keowee River, passing through a surface water monitoring station.

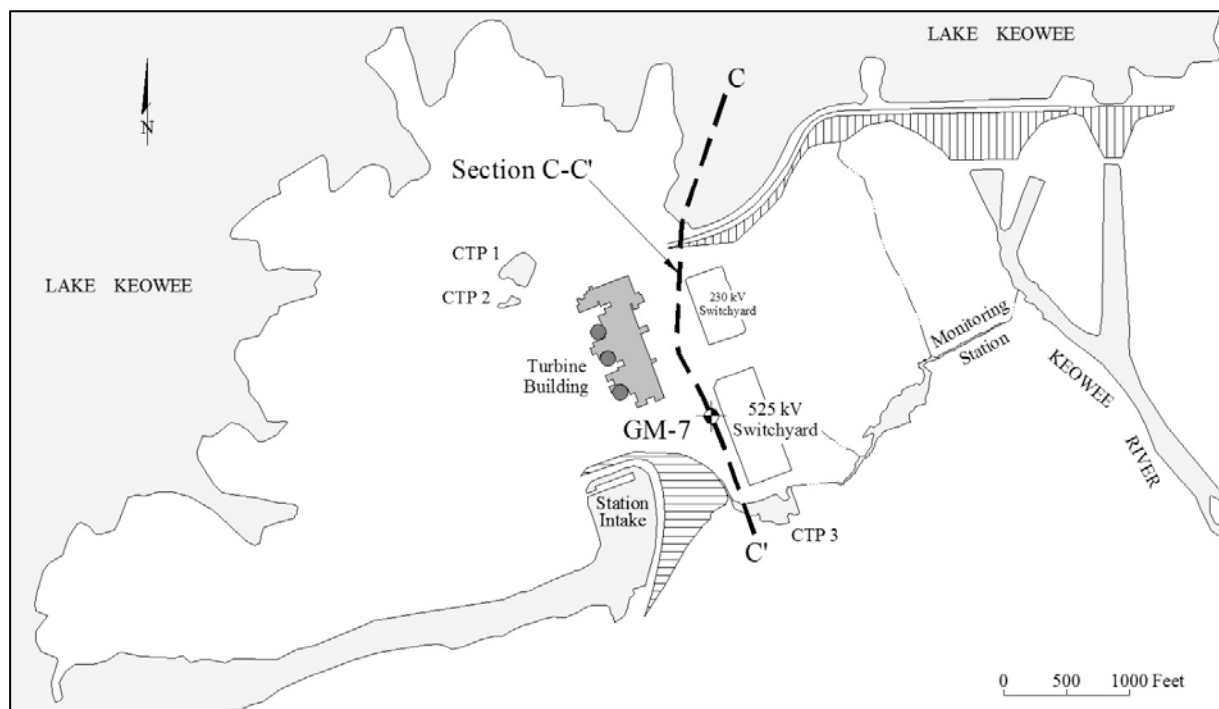


Figure 3-10. Plan view of Oconee Nuclear Station and surrounding areas (Source: S&ME, 2008; as modified by Duke Energy).

In addition, higher tritium levels have been reported in well GM-7R, which is deeper than well GM-7, and is situated in underlying partially-weathered fractured rock (figure 3-11). Duke Energy reported a maximum value of 45,000 pCi/L for this well on April 12, 2011. Duke Energy also reported a concentration of 35,400 pCi/L on January 25, 2010, for well GM-7DR, which is in the same general location as well GM-7R, but deeper (figure 3-11). Although the available data indicate groundwater flow is somewhat complex in the area where elevated tritium concentrations were observed, the data indicate tritium is moving away from Lake Keowee.

³⁷ The voluntary reporting limit is 20,000 pCi/L.

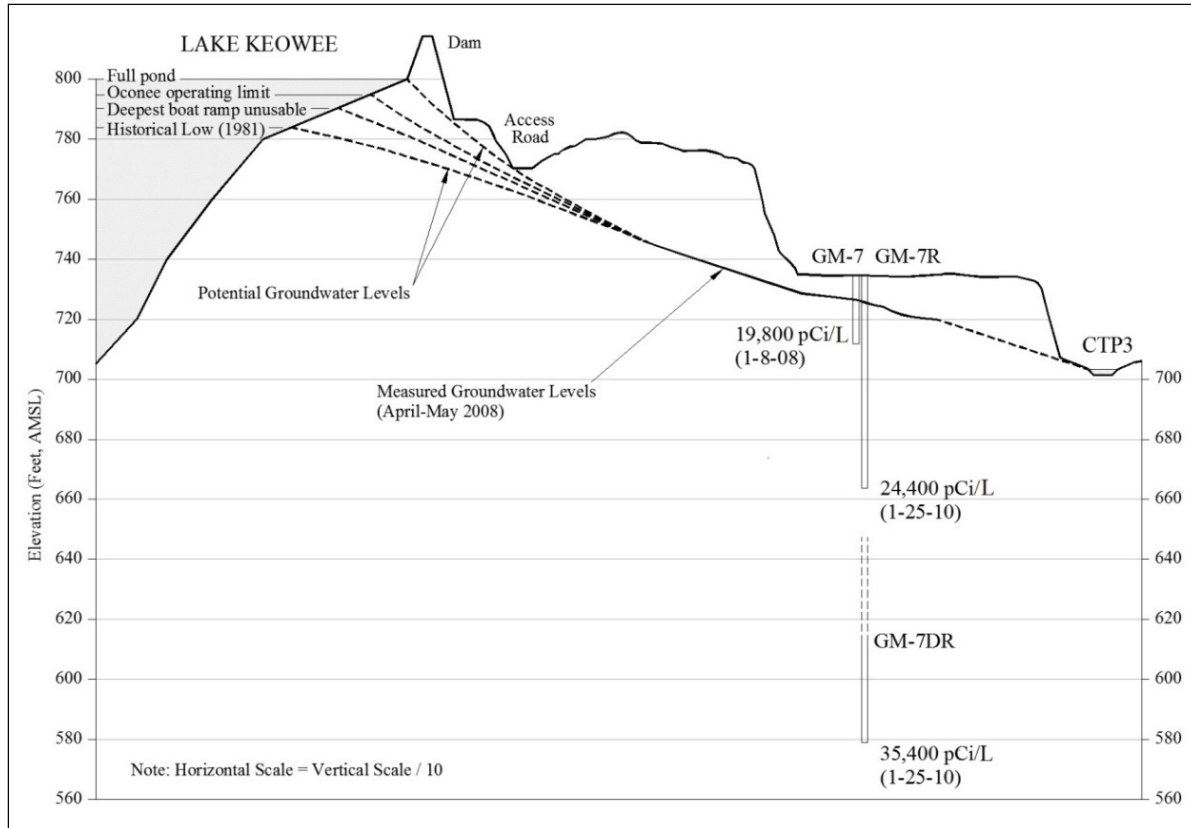


Figure 3-11. Hydrogeologic section C-C' at Oconee Nuclear Station (Source: S&ME, 2008; and Duke Energy, 2010b).

Importantly, groundwater levels throughout the affected area are far below the level of Lake Keowee. The lowest recorded reservoir level is above elevation 780 feet and the groundwater level in the vicinity of the elevated tritium concentrations is around elevation 725 feet, a vertical difference of 55 feet. Any increase in lake drawdowns resulting from changes in project operation would have the potential to slightly reduce the groundwater hydraulic gradients in the area and slowing the down-gradient movement of tritium towards Pond 3 and/or its downstream drainage (leading to the surface water monitoring station). However, changes in project operation are not expected to result in a reversal in groundwater flow direction toward Lake Keowee.

Effects of Project Operation on Fishery Resources

Fish Entrainment and Turbine Mortality

Water intake structures at hydropower projects can injure or kill fish that are able to pass through screens or trash racks (i.e., entrained) and through turbines. If fish are entrained, injury or mortality can result from collisions with turbine blades or exposure to pressure changes, sheer forces in turbulent flows, and water velocity accelerations created by turbines (Knapp et al., 1982). The number of fish entrained and at risk of turbine

mortality at a hydroelectric project is dependent upon site-specific factors, including physical characteristics of the project, as well as the size, age, and seasonal movement patterns of fish present within the impoundment (EPRI, 1992). Ultimately, fish that are entrained and killed are removed from the river population and no longer available for recruitment to the fishery.

At the Keowee-Toxaway Project facilities, fish entrainment can potentially occur during generation at the intakes of both the Jocassee and Keowee Developments,³⁸ and during pumping at the water intakes located in upper Lake Keowee. In the Relicensing Agreement, Duke Energy agreed to implement the following measures off-license to reduce fish entrainment at the Jocassee Development: (a) redesign and modify (e.g., replace white lights with red lights, illuminate signs from below) the lighting for the Commission required public safety devices on the intake towers to eliminate or reduce the amount of light shining on the lake surface; (b) redesign and modify lights that illuminate the tailwater area to eliminate or reduce the amount of light shining on the lake surface immediately downstream of the intake units; (c) consult with South Carolina DNR and FWS on the plan for lighting modifications; (d) incorporate the lighting modifications into the FERC Public Safety Plan; (e) implement the lighting modifications within one year; (f) when operating the project in pumping mode, use the following start-up sequence: unit 3, unit 4, unit 1, and unit 2 (see figure 3-12 for location of units) to the extent practicable, and implement the sequence within 60 days following the issuance of the new license.

The FWS recommended including the entrainment measures in the Relicensing Agreement as license conditions. In addition, the FWS recommended that Duke Energy develop a plan, in consultation with the FWS, to monitor fish communities in the reservoirs and adjacent tributaries, in order to detect effects of project operation on fish community composition and abundance.

Our Analysis

Fish in Lake Jocassee have the potential to be entrained at the two intake towers used for project generation, which are located about 317 feet above the lake bottom (full pond is about 360 feet above the lake bottom at the intake towers) in the open water areas. Fisheries surveys conducted by Duke Energy indicate that the Lake Jocassee fish community is predominantly composed of centrarchids in the shallow water area and clupeids in the open water areas (table 3-4), but also includes a coldwater fishery of rainbow trout and brown trout that generally occupies deeper, colder, open water during

³⁸ There was no evidence that entrainment was an issue at the Keowee Development, thus no analysis for this development is conducted below.

summer and fall, but will occupy shallow water during colder months. All of these fish have the potential to be impacted by entrainment, but because of the position of the generation intake in the open water areas, clupeids are particularly susceptible.

Fish in Lake Keowee have the potential to be entrained through each of four pump intake units located below Jocassee Dam. Fisheries surveys conducted by Duke Energy indicate that Lake Keowee is also predominantly composed of centrarchids in the shallow water area and clupeids in the open water areas (table 3-4). Fish surveys conducted near the pump intake (i.e., Jocassee tailwaters and upper Lake Keowee) indicate that bluegill and redbreast sunfish are the prominent shallow water species present, and blueback herring is the dominant open water species present (table 3-4). Given the location of the pump intakes (i.e., as much as 44 feet below the surface of the water), which are below the shallow water habitat occupied by centrarchids, it is possible that as with entrainment at the generation intakes, open water clupeids would be most susceptible to entrainment at the pump intakes.



Note: Pumping units 1, 2, 3, and 4 are shown in lower right section of photo

Figure 3-12. Jocassee Development (Source: Duke Energy, 2013d).

Intake Velocities and Burst Swim Speeds

Entrainment can occur if fish can pass between trashrack bars, and if water velocities in front of the intakes exceed a fish's burst swimming speed.³⁹ Using an Acoustic Doppler Current Profiler,⁴⁰ Duke Energy determined that the average water velocities in front of the generation intakes were below 1.0 feet per second (fps) with one unit generating and only slightly greater than 1.0 fps with two units generating (Rodriguez, 2013a). These water velocities are below the approximate burst swim speeds of blueback herring and threadfin shad, as well as rainbow trout, brown trout, and the four most common centrarchids found in Lake Jocassee (table 3-5), indicating minimal susceptibility to entrainment for each species.

Table 3-5. Burst swim speeds of eight species found in Lake Jocassee and Lake Keowee (Source: staff).

Species	Surrogate Species	Length (inches total length unless noted)	Burst swim speed (fps) ^a
Blueback herring ^{b,c}	not applicable	3.35 (FL) ^d	1.5
		3.50 (FL)	2.28
		8.07 (FL)	8.2
Threadfin shad	Blueback herring	3.35 (FL)	1.5
	Blueback herring	3.50 (FL)	2.28
	herring species ^e	5.98-11.02 (FL)	6.56
Rainbow trout ^f	not applicable	3.8	5
		8.0	5.5
		9.5	5.7
Brown trout ^g	not applicable	1.8	4.3
		3.9	5.3
Redeye bass	Largemouth bass ^h	2-4	3.2
		5.9-10.6	4.3

³⁹ Burst swimming speed is the maximum swimming speed that can only be sustained for a few seconds. It is usually used to escape danger (Murray, 1974).

⁴⁰ An Acoustic Doppler Current Profiler is an instrument to measure how fast water is moving across an entire water column.

Species	Surrogate Species	Length (inches total length unless noted)	Burst swim speed (fps) ^a
Largemouth bass	not applicable	2-4	3.2
		5.9-10.6	4.3
Redbreast sunfish	Bluegill ^h	2	1.8
		4-6	2.4
		6	4.3
Bluegill	not applicable	2	1.8
		4-6	2.4
		6	4.3

^a Burst swim speeds were not available for all species in our analysis. The surrogate species used were fish in the same family and with similar body morphometry to the species included in our analysis.

^b Source: Castro-Santos (2002) for fish greater than 3.50 inches (FL)

^c For fish less than or equal to 3.50 inches (FL), burst swim speeds are based on Richardson's (2004) estimation that burst swim speeds of blueback herring are 2 - 2.6 times the prolonged swim speeds. Estimates in table are based on 2 times the prolonged swim speeds.

^d FL is the acronym for fork length of a fish, which is the length of fish from the tip of the snout to the middle, forked portion of the tail fin.

^e Source: Bell (1991)

^f Source: Webb (1976)

^g Source: Ojanguren and Brana (2003)

^h Source: Appalachian Power (2009)

Duke Energy was unable to use the Acoustic Doppler Current Profiler to estimate average water velocities directly in front of the pump intakes because of high turbulence, and confined space in the discharge canal. However, Duke Energy was able to use the Acoustic Doppler Current Profiler to estimate water velocities above the pump intakes at 2.5 to 3.5 fps. Duke Energy also estimated water velocity through the trash racks at about 4 fps. Water velocities above the intakes and through the trash racks exceed the burst swim speeds for the smaller size classes (less than 6 inches) of the two most common centrarchids (bluegill and redbreast sunfish) in the Jocassee tailwaters, as well as the estimated burst swim speeds of smaller blueback herring (less than 8 inches) (table 3-5)(Reservoir Environmental Management, 2013). Consequently, small bluegill, redbreast sunfish, blueback herring, and, potentially, other less abundant species are susceptible to entrainment at the pump intakes.

Fish Entrainment and Turbine Mortality

Duke Energy used hydroacoustic monitoring⁴¹ to determine fish presence in front of the intakes, and to help estimate fish entrainment and turbine mortality at the Jocassee Development's generation intakes and pump intakes for one year (July 2012 – June 2013 [Degan and Mueller, 2013]). During a year of generation (4,595 hours of generation), Duke Energy estimated that 552,894 fish would be entrained, and 13,253 fish would be killed, with monthly average generation entrainment rates ranging from 55 to 189 fish per hour, and monthly percent mortality ranging from 1.98 percent to 3.10 percent. Among fish size-classes (ranging from two to greater than 24 inches), small fish were most likely to be entrained during generation (i.e., about 45 percent were between two and four inches long, and about 25 percent were between four and six inches long [Degan and Mueller, 2013]), and this is consistent with the slower burst swim speeds of smaller fish (table 3-5).

No species-specific estimates of entrainment or turbine mortality at the generation intakes were obtained during the study. However, the results above indicate that if all of the fish entrained and killed were blueback herring and threadfin shad (as discussed above, blueback herring and threadfin shad are the species most likely to be near the generation intakes in Lake Jocassee), then only 4 percent of the total fall 2012 forage fish population would have been entrained (552,894 fish entrained divided by 13,082,248 total forage fish estimated in fall 2012), and only 0.1 percent would have been killed by turbines (13,253 fish killed divided by 13,082,248 total forage fish estimated in fall 2012). In addition, up to 8 percent of the total spring 2012 forage fish population in Lake Jocassee would have been entrained (552,894 fish entrained divided by 7,055,096 total forage fish estimated in spring 2013), but only 0.2 percent would have been killed (13,253 fish killed divided by 7,055,096 total forage fish estimated in spring 2013) during generation. It is unlikely that all of the fish entrained and killed during generation would have been blueback herring and threadfin shad, thus these estimates are likely high.

Duke Energy used the same hydroacoustic methods described above to help estimate entrainment and turbine mortality at each of the four Jocassee Development's pump intake units. During a year of pumping (5,904 hours), 1,519,102 fish were estimated to have been entrained, and 24,328 fish were estimated to have been killed by turbines (Degan and Mueller, 2013), with monthly average pumping entrainment rates

⁴¹ Hydroacoustic monitoring uses sound waves, often produced using sonar, to detect underwater physical or biological objects. Duke Energy used this method to determine fish presence, size, depth, and movement. This information was then used to estimate the number and size of fish likely to be entrained and killed during generation and pumping.

ranging from 61 to 468 fish per hour, and monthly percent mortality ranging from 1.45 percent to 1.78 percent. Similar to generation entrainment, small fish were most likely to be entrained during pumping operation (i.e., about 50 percent were between two and four inches long, and about 35 percent were between four and six inches long [Degan and Mueller, 2013]). This result is consistent with the estimated water velocities in front of the pump intakes, and the approximate burst swim speeds of smaller bluegill, redbreast sunfish, and blueback herring, as discussed above.

No species specific estimates of entrainment and turbine mortality were obtained during the pumping operation component of this study. However, given the location of the pump intakes (i.e., as much as 44 feet below the surface of the water), which are deeper than the shallow water habitat occupied by centrarchids, it is possible that as with entrainment at the generation intakes, open water clupeids would be the species most impacted by entrainment at the pump intakes. If this is true, then 21 percent of the total fall 2012 forage fish population in Lake Keowee would have been entrained during pumping (1,519,102 fish entrained divided by 7,348,859 total forage fish estimated in fall 2012), but only 0.3 percent would have been killed by turbines (24,328 fish killed divided by 7,348,859 total forage fish estimated in fall 2012). In addition, up to 72 percent of the total spring 2012 forage fish population in Lake Keowee would have been entrained (1,519,102 fish entrained divided by 2,122,612 total forage fish estimated in spring 2013), but only 1 percent would have been killed (24,328 fish killed divided by 2,122,612 total forage fish estimated in spring 2013) during pumping. It is unlikely that all of the fish entrained and killed during pumping would have been blueback herring and threadfin shad, thus these estimates are conservative.

Influence of Generation and Pumping Flows on Forage Fish Density

Duke Energy conducted statistical analyses to evaluate the possible relationship between generation flows and forage fish density in Lake Jocassee (Rodriguez, 2013a). The analyses provide some support for a negative relationship between generation flows at the Jocassee Development and fall forage fish density in Lake Jocassee.⁴² Although the reliability of the results are not very strong given the small sample size of 16

⁴² The negative relationship described was based on a single regression model, which showed a negative relationship between the maximum daily generation flow at the Jocassee Development from May through October and fall forage fish density in zone 1 (i.e., area of lake closest to generation intakes) of Lake Jocassee. No other regression models that included generation flows were significant without other environmental or biological variables included (*see* Rodriguez, 2013a). We did not include models in which outlying data points were removed, because there was no justification for such removal.

observations,⁴³ the significant relationship did indicate that 37 percent of the variation in fall forage fish density was explained by pumping flows. However, this indicates that a larger proportion (63 percent) of the variation in fall forage fish density was explained by other non-project factors. For example, other non-project related factors that explained fall forage fish density included largemouth bass abundance (positive relationship) and lake level (positive relationship), which by themselves explained 36 percent and 32 percent of the variation in fall forage fish density, respectively. Thus, environmental and biological factors appear to have similar importance in driving the fall forage fish abundance trends; although, as discussed above, the certainty of results based on a sample size of 16 is low.

Patterns in spring forage fish densities in Lake Jocassee were not explained by generation flows by themselves (i.e., without other environmental or biological variables in the model), or by any single environmental or biological variable, indicating that project operation does not appear to have a strong influence on the abundance of the spring forage fish population.

Duke Energy also conducted statistical analyses to evaluate the possible relationship between pumping flows and forage fish density in Lake Keowee (Rodriguez, 2013b). Similar to the results for generation flows, the analyses provide some support for a negative relationship between pumping flows at the Jocassee Development and fall forage fish density.⁴⁴ As discussed above, the reliability of these analyses is not very strong because of the small sample size. Nevertheless, the significant relationships did indicate that 35-44 percent of the variation in fall forage fish density was explained by

⁴³ A small sample size leads to low statistical power, which means that there is a reduced likelihood that a statistical relationship or effect is genuinely true. In other words, a small sample size leads to less certainty that the relationship between project operation and forage fish density is real, and thus adding more data could result in a different relationship and conclusion.

⁴⁴ The negative relationship described was based on a two regression models. One model indicated a negative relationship between the maximum 30-day average pumping flow at the Jocassee Development from May through October and fall forage fish density in the Keowee River Basin of Lake Keowee. The other model indicated a negative relationship between the maximum 30-day average pumping flow at the Jocassee Development from May through October and the lakewide fall forage fish density in Lake Keowee. No other regression models that included generation flows were significant without other environmental or biological variables included (*see* Rodriguez, 2013b). We did not include models in which outlying data points were removed, because there was no justification for such removal.

pumping flows. However, this indicates that a larger proportion (56-65 percent) of the variation in fall forage fish density was explained by other non-project factors. For example, other non-project related factors that explained fall forage fish density included chlorophyll concentrations, water temperature, and zooplankton⁴⁵ density. Rotifer⁴⁶ density during May, in particular, explained 58 percent of the variation in fall forage fish density. Thus, biological factors, such as food resources for forage fish, are likely more important in driving the fall forage fish abundance trends. Pumping flows alone were not significantly related to spring forage fish density. However, February zooplankton density did explain up to 50 percent of the variation in spring forage fish density, suggesting that food resources may also be more important in driving the spring forage fish density.

The results above indicate that a very small proportion of the forage fish population in Lakes Jocassee and Keowee is likely to be removed by turbine mortality. In addition, given that up to 20 percent of a population can be safely removed in a sustainable clupeid fishery⁴⁷, less than or equal to 1 percent removal by turbine mortality is inconsequential to the sustainability of the forage fish community in Lakes Jocassee and Keowee. Furthermore, as discussed previously, abundance estimates for the spring and fall forage fish population in Lake Jocassee indicate that the population has been relatively stable from 1997 to 2013, and even increasing in the most recent two years (figure 3-7). The spring and fall forage fish population in Lake Keowee also has been relatively stable from 1999 to 2013 (figure 3-9). These results suggest that project operation and turbine mortality do not have any lasting effects on the sustainability of the forage fish population in Lakes Jocassee and Keowee.

Night-time Lighting Effects on Entrainment and Turbine Mortality

Using the hydroacoustic monitoring techniques described above, Duke Energy estimated that night-time generation entrainment rates would be higher than during the day (monthly average during day = 76 fish per hour, monthly average during night = 197 fish per hour). However, because 70 percent of generation hours occurred during the day, total generation entrainment and turbine mortality was similar for day (entrainment

⁴⁵ Microscopic planktonic animals that are a food source for blueback herring and threadfin shad.

⁴⁶ A type of small zooplankton.

⁴⁷ Fisherman in Great Bay and Little Bay, New Hampshire can sustainably remove 20 percent of the river herring annually (New Hampshire FG, 2011).

= 272,443 fish, mortality = 6,758 fish) and night (entrainment = 280,451 fish, mortality = 6,495 fish).

Similar to generation operation, entrainment rates during pumping were also higher at night compared to day (monthly average during day = 86 fish per hour, monthly average during night = 227 fish per hour). However, unlike generation, most pumping occurred at night (83 percent of the time). Consequently, at the pump intakes, most fish were entrained and killed at night (night entrainment = 1,425,247 fish, night turbine mortality = 22,846 fish, day entrainment = 93,855 fish, day turbine mortality = 1,481 fish).

One possible explanation for the higher night-time entrainment rates at both the generation intakes and pumping intakes could be fish attraction to night-time lighting near the intakes. Currently, night-time lighting illuminates the lake surface near the generation intake towers and the tailwater area of the Jocassee Development, and clupeids and other fish species are known to be attracted toward artificial light sources during the night (Haymes et al., 1984). To evaluate whether this potential night-time attraction to light could affect entrainment at the pumping intakes, Duke Energy conducted a month-long study during July 2013 to monitor entrainment at each of the intake units when tailrace lights were turned on and off. Study results indicated that at units 1 and 2, entrainment rates were 40 to 45 percent lower when lights were off, but there was little effect of lighting at units 3 and 4, which had the highest entrainment rates (table 3-6). Thus, there is evidence that night-time lighting in the Jocassee tailwaters does have the potential to increase entrainment, and eliminating or reducing the illumination of the tailwaters could reduce entrainment during pumping. However, because lighting had no effect on entrainment at units 3 and 4 (where entrainment is highest), and because current levels of entrainment and turbine mortality are unlikely to affect the sustainability of the forage fish populations, reducing illumination in the tailwaters would likely have only minor benefits to the population.

Although not studied, the results from the tailwaters suggests that illumination of the lake surface near the generation intake towers could also increase entrainment at night, and be responsible for higher entrainment rates at night compared to day during generation. Thus, eliminating or reducing illumination of the surface water near the generation intake towers could also reduce entrainment during generation. However, because night-time entrainment and turbine mortality is already very low at the intake towers, and because current levels of entrainment and turbine mortality are unlikely to affect the sustainability of the forage fish populations, the benefits of the lighting modifications would be minimal.

Table 3-6. Monthly fish entrainment rates during pumping at each of the four intake units during one year (Source: Degan and Mueller, 2013 with staff modifications).

Month	Fish entrainment rate (fish per hour)							
	Day				Night			
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 1	Unit 2	Unit 3	Unit 4
July 2012	35	0	48	80	270	123	278	484
August 2012	55	0	52	70	190	272	435	734
September 2012	34	3	49	91	127	128	236	537
October 2012	11	NA	0	125	137	169	258	680
November 2012	73	156	148	213	186	79	176	554
December 2012	59	39	150	255	129	46	122	451
January 2013	117	119	97	191	127	89	138	375
February 2013	37	38	10	89	24	0	12	49
March 2013	63	8	71	134	65	68	86	248
April 2013	30	11	132	140	43	60	84	113
May 2013	12	54	25	95	35	118	71	76
June 2013	31	59	42	39	107	160	193	151
<i>Average</i>	<i>46.4</i>	<i>44.3</i>	<i>68.7</i>	<i>126.8</i>	<i>120.0</i>	<i>109.3</i>	<i>174.1</i>	<i>371.0</i>

Start-up Sequence Effects on Entrainment

Unequal entrainment rates often occur among different turbine units within a hydro plant (FERC, 1995). At the Jocassee Development, entrainment rates were unequal among the four units, with entrainment highest at unit 4, followed by unit 3, unit 1, and unit 2 (table 3-6). When entrainment among units is unequal, overall project entrainment can be minimized by using a start-up sequence that begins with a unit that has a lower entrainment rate. At the Jocassee Development, the lowest entrainment occurred at unit 2. However, Duke Energy indicates that operational constraints prohibit the use of units 1 and 2 as priority in a start-up sequence for pumping, and requires units 3 and 4 be given start-up priority to ensure all four units can be dispatched.⁴⁸ Between units 3 and 4, unit 3 has the lowest entrainment, and could be used for initial start-up to minimize pumping entrainment. Based on the above described operating constraints, unit 4 would start next, followed by unit 1 or 2. This start-up sequence has the potential to reduce overall pumping entrainment compared to a start-up sequence that begins with unit 4, because unit 3 has lower entrainment than unit 4. However, the benefits of a start-up sequence that begins with units 3 and 4 likely would be minimal because these two units exhibit the highest entrainment rates among all units.

Effects of Project Operation on Trout Habitat in Lake Jocassee

Lake Jocassee is one of only a few reservoirs in South Carolina with the combination of water temperature and DO concentrations needed to ensure the survival of cold-water trout species year-round. South Carolina DNR established the present-day put-grow-and-take⁴⁹ trout fishery shortly after the impoundment of Lake Jocassee by stocking rainbow trout and brown trout into the reservoir. Continued annual stocking of both species has produced a productive cold-water fishery dependent on the maintenance of suitable temperature and DO in the open water areas.

Regression analysis indicates that increases in pumping and generating flows at Jocassee Development can result in warmer water reaching deeper into Lake Jocassee, and this has the potential to reduce adult trout habitat (Duke Energy, 2014a). Because proposed project operation is within the range of historical operation under which the

⁴⁸ The start-up sequence is constrained because the Jocassee Development utilizes sync-sync start, since paired units share a bifurcated single penstock. Units 3 and 4 require generation by unit 2 to start as a pump.

⁴⁹ A put-grow-and-take fishery is one in which juvenile fish are stocked, they grow to a fishable size, and are caught, and usually removed by anglers. Juveniles are then stocked again at regular intervals.

regression analysis was based, proposed operation at Jocassee Development could potentially affect adult trout habitat. In the Relicensing Agreement, Duke Energy agreed to monitor the depth of winter mixing (see section 3.3.2.1, *Aquatic Resources – Affected Environment*) in Lake Jocassee and model the projected amount of adult trout habitat.⁵⁰ If trout habitat is projected to be less than 32.8 feet thick by September, Duke Energy would measure the temperature and DO in June and August to monitor habitat thickness, and if needed, consult with the South Carolina DNR regarding management actions to preserve trout habitat thickness at 16.4 feet or greater.

Our Analysis

Brown trout and rainbow trout are non-native to South Carolina and North Carolina, and although they generally occur in cold-water streams, rivers, and natural lakes, they will survive in some southern reservoirs like Lake Jocassee, where water temperatures and DO meet their life-history requirements. Optimal temperatures for brown trout growth and survival are between 54°F and 66°F, but they can tolerate temperatures down to 32°F and up to 80°F (Raleigh et al., 1986). Optimal DO concentrations for brown trout are between 9 mg/L and 12 mg/L. Brown trout generally avoid DO concentrations less than 5 mg/L, and will not survive at DO concentrations near 3 mg/L (Raleigh et al., 1986). Rainbow trout prefer cooler water than brown trout, at temperatures between 45°F and 64°F, but they can tolerate temperatures down to 32°F and up to 77°F (Raleigh et al., 1984). Optimal DO concentrations for rainbow trout are between 7 mg/L and 9 mg/L. Rainbow trout also appear to avoid DO concentrations less than 5 mg/L, and will not survive at DO concentrations of 3 mg/L or less (Raleigh et al., 1984). When temperature and DO are outside the optimal or preferred range, both species may exhibit reduced growth, fecundity,⁵¹ and survival (Raleigh et al., 1984; Raleigh et al., 1986).

Duke Energy has been monitoring the temporal and spatial distribution of trout habitat in Lake Jocassee in the context of brown trout and rainbow trout temperature and DO requirements since 1973. Specifically, Duke Energy has used Oliver et al.'s (1977) definition of adult trout habitat, which is the volume of water with temperatures less than or equal to 68°F, and DO concentrations greater than or equal to 5.0 mg/L. Oliver et al.'s

⁵⁰ Adult trout habitat is defined as the band (or thickness) of water less than or equal to 68 °F and containing greater than or equal to 5 mg/L DO.

⁵¹ Natural reproduction of rainbow trout and brown trout is negligible in Lake Jocassee. South Carolina DNR maintains fishable populations through annual stocking (Taylor and Bulak, 2011), thus reduced fecundity is not necessarily a concern in Lake Jocassee.

(1977) definition is consistent with the documented temperature and DO preferences described above, and more recent descriptions of suitable trout habitat (i.e., Barwick et al., 2004). From 1973-2013, habitat was greatest during the winter cooling period when temperatures were well below 68°F, and DO levels generally exceeded 5.0 mg/L. As the seasons progressed and air temperatures increased, habitat gradually declined both horizontally and vertically within the reservoir because of warming of the upper water layers and depletion of DO in the middle and lower portions of the water column. Habitat was consistently at a minimum in late summer (September) just prior to fall cooling, coinciding with the height of thermal stratification in the reservoir. In most years, September adult trout habitat was restricted to the main body of the reservoir where water depths exceeded 230 feet.

The annual measurement of adult trout habitat⁵² varied considerably over the 1973–2013 period with no discernible increasing or decreasing long-term trends (figure 3-13). However, the raw data indicated a slight pattern of increasing depth (decreasing elevation) at which water temperature was 68°F in September (figure 3-14). Statistical analyses indicated that this pattern may be a result of project operation, because Jocassee Development operation was positively related to the depth at which water temperatures were 68°F in September, and explained 77 percent of the variation in this depth. Conversely, the depth at which DO concentrations were 5.0 mg/L exhibited strong variation, and no long-term trend (figure 3-14). Furthermore, the depth at which DO concentrations were 5.0 mg/L was not related to project operation.

⁵² Adult trout habitat is measured as difference in depth at which water temperature is less than or equal to 68°F, and the depth at which is DO greater than or equal to 5.0 mg/L. This measurement is occurs in September in the main body of Lake Jocassee, and is commonly expressed in vertical thickness.

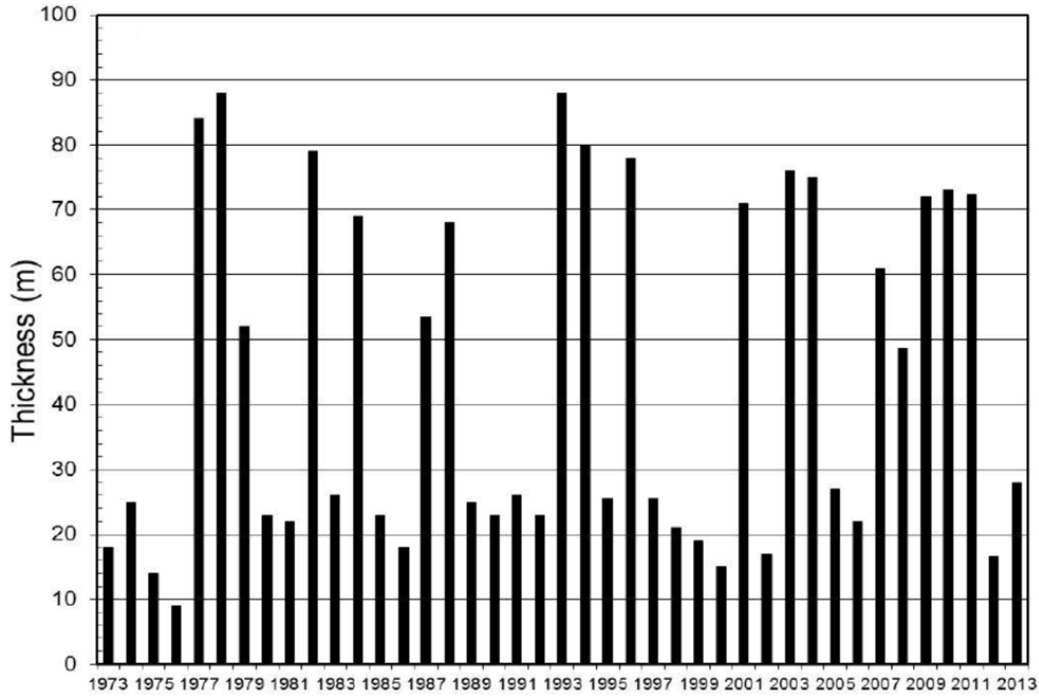
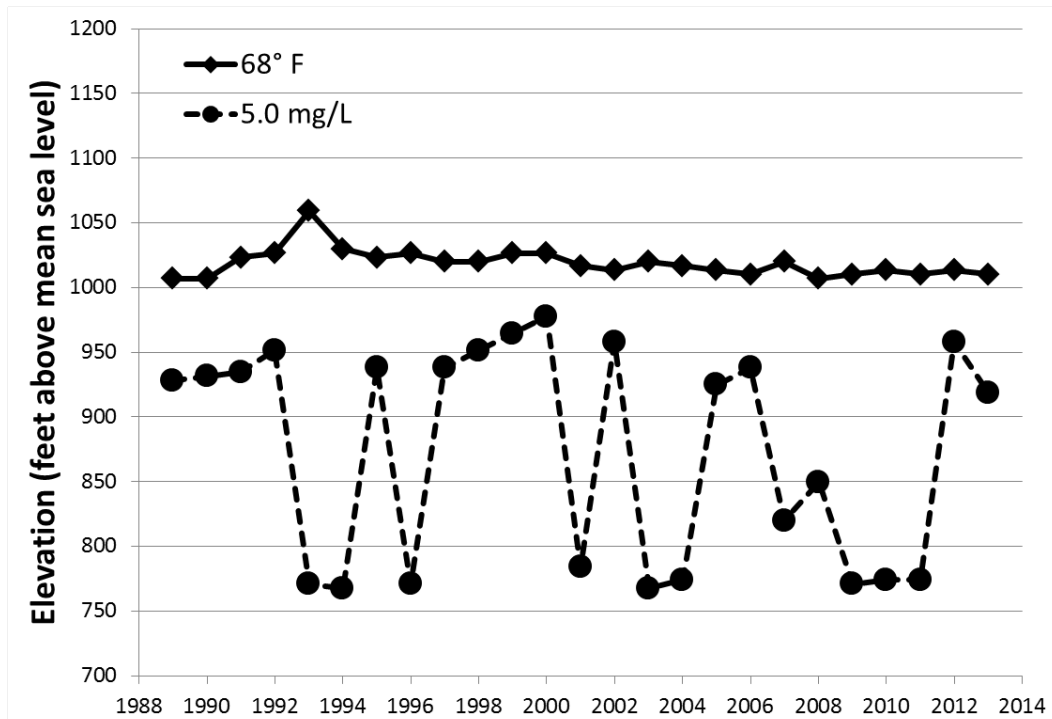


Figure 3-13. The amount (i.e., vertical thickness in meters (1 meter = 3.28 feet)) of adult trout habitat in Lake Jocassee (Source: Duke Energy, 2014a).



Note: Area below solid line and above dashed line represents the amount of suitable adult trout habitat.

Figure 3-14. Elevation at which water temperature is 68°F and DO concentration is 5.0 mg/L in the main body of Lake Jocassee (Source: Duke Energy, 2014 with staff modifications).

Statistical analyses did indicate that the amount of oxygen replenished at the middle and bottom portions of the water column during the preceding winter cooling period (i.e., an index of winter mixing and reoxygenation) was positively related to the depth at which DO concentrations were 5.0 mg/L the following September, and explained 89 percent of the variation in this depth. In addition, the depth and magnitude of winter reoxygenation was positively related to minimum winter water temperature, which in turn was positively related to winter air temperature. This indicates that winter air temperature, which influences winter mixing and reoxygenation of the water column, in turn influences the depth at which DO concentrations are 5.0 mg/L the following September. Because variation in the depth at which DO concentrations are 5.0 mg/L drives the variation in the thickness of adult trout habitat (as opposed to variation in the depth at which water temperature is 68°F; see figures 3-13 and 3-14), winter air temperature, not project operation (which only influences the depth at which water temperature is 68°F), appears to be the primary factor affecting the amount of adult trout habitat.

Jocassee Development operation appears to play only a very minor role in affecting the volume of trout habitat. Because proposed project operation would be within the range of historical operation, the thickness of trout habitat under Duke Energy's proposal would be unlikely to differ significantly from current conditions. Thus, Duke Energy's proposal to monitor the depth of winter mixing and model the projected thickness of adult trout habitat would have minimal benefit, because any management actions requiring changes to project operation would likely have only a minor effect on the volume of adult trout habitat.

Reduced Flows in Little River Bypassed Reach

Under existing operation, Duke Energy is not required to provide a minimum flow into the Little River Bypassed Reach, and Duke Energy does not propose to implement any specific flow releases into the Little River Bypassed Reach. Flows in the bypassed reach are provided through leakage (approximately 1 cfs) from Little River Dam. At such low flows, the habitat quantity is minimized, potentially leading to environmental conditions that are unable to support a diverse aquatic community.

Our Analysis

Aquatic habitat in the Little River Bypassed Reach consists primarily of wetland habitat fed by the leakage coming from Little River Dam. Only seven species of fish in three families were observed in the bypassed reach during electrofishing, gill-net, and minnow trap surveys, with warmwater centrarchids (i.e., bluegill, redbreasted sunfish, warmouth, largemouth bass) being the dominant family of fishes present (table 3-4). The diversity of species in the bypassed reach is in stark contrast to that observed in Lake Keowee, just upstream of Little River Dam, where 30 species of fish in eight families

were observed during electrofishing surveys (table 3-4). The shallow, slow moving, warm (79°F to 86°F in July), and sometimes oxygen-deficient water⁵³ associated with the bypassed reach, likely limits the abundance and diversity of fish that can survive and reproduce in this habitat. For example, fluvial specialist⁵⁴ species, such as spottail shiner, northern hogsucker, notchlip redhorse, spotted sucker, striped jumprock, brassy jumprock, snail bullhead, and blackbanded darter, which are present in Lake Keowee, and may have been present under historical, higher flowing stream conditions prior to construction of Little River Dam – can no longer successfully complete their life-cycle under existing conditions.

Although Duke Energy is not proposing to increase or decrease flows into the bypassed reach, Duke Energy’s proposal for a Normal Minimum elevation in Lake Keowee, which is higher than the current minimum, may result in slightly increased leakage flows compared to existing conditions. Any increase in leakage could help maintain, and possibly enhance habitat conditions in the bypassed reach compared to existing conditions.

Impoundment Fluctuations

Daily fluctuations in Lake Jocassee and Lake Keowee occur because of pumped-storage operation at the Jocassee Development and drawdowns from the Keowee Development when flow releases are needed to meet downstream water needs during low flow periods, in accordance with the 2014 Operating Agreement (see section 2.1.3, *Existing Project Operation*). In Lake Jocassee, about 88 percent of the daily fluctuations are less than 1.5 feet, and almost all fluctuations are less than 2.9 feet. In Lake Keowee, about 86 percent of daily fluctuations are less than 1.0 feet, and almost all daily fluctuations are less than 1.80 feet (Duke Energy, 2014a). Duke Energy does not propose to change the maximum elevations of either reservoir, but does propose to implement a Normal Minimum elevation of 796 feet for Lake Keowee. Duke Energy also proposes a LIP, which allows reservoir elevations lower than the proposed Normal Minimum

⁵³ During fish surveys in the Little River bypassed reach during July 2012, DO concentrations in the basin and stream locations ranged from 6.2 to 7.3 milligrams per liter; however, DO concentrations in the pond were only 4.0 milligrams per liter.

⁵⁴ Fluvial specialists are species that require flowing water for most or all of their life cycle (Galat *et al.*, 2005).

elevations (e.g., under most extreme drought conditions [Stage 4 of the LIP]⁵⁵, the minimum elevation for Lake Jocassee and Lake Keowee would be 1080 feet and 790 feet, respectively), when specific low inflow conditions exist.

Our Analysis

Fluctuating water levels in Lake Jocassee and Lake Keowee have the potential to produce unfavorable spawning and juvenile habitat conditions for the centrarchid fishes that dominate the shallow water fish community of both reservoirs. Centrarchids build nests and spawn at shallow depths along shore during spring and summer, and juveniles utilize the same habitat for rearing. High water levels will inundate shoreline cover, and provide increased foraging opportunities and reduced predation on juveniles. However, when water levels decrease during drawdowns, shoreline cover diminishes and predation on juveniles increases (Willis, 1986). In addition, nests become disturbed and exposed, and egg desiccation can occur (Maraldo and MacCrimmon, 1981). Furthermore, water fluctuations can disrupt the act of spawning altogether (Kohler et al., 1993).

Under existing conditions, most daily fluctuations in Lake Jocassee and Lake Keowee are less than 1.5 feet, and less than 1.0 feet, respectively. These fluctuations do have the potential to disrupt adult centrarchid spawning, and negatively affect survival of their eggs and juveniles in both reservoirs. However, standardized shoreline electrofishing surveys conducted in Lake Jocassee and Lake Keowee between 1996 and 2008 indicate that most centrarchid species are either increasing in abundance (e.g., redbreast sunfish, bluegill), or exhibit no upward or downward trend (e.g., largemouth bass). This suggests that existing project operation has had little or no negative impact on the abundance or sustainability of the centrarchid fish community in both reservoirs. This may be a result of centrarchids acclimating to daily reservoir fluctuations by selecting deeper spawning sites (Estes, 1971).

In section 3.3.2.2, *Aquatic Resources – Environmental Effects, Effects of Project Operation on Water Quantity*, staff concluded the proposed operation would result in little to no difference in reservoir fluctuations compared to existing operation. Thus, reservoir fluctuations under proposed operation are likely to have little or no negative effect on centrarchid reproductive success compared to existing conditions.

⁵⁵ Stage 4 of the LIP is triggered when the combined usable storage for Lake Jocassee, Lake Keowee, and Bad Creek Reservoir is less than 25 percent of total usable storage, and either streamflow is less than 40 percent of the 4-month long-term average streamflow, or the 12-week Area-weighted U.S. Drought Monitor for the Upper Savannah River Basin equals 4.

Invasive Aquatic Plant Species

Aquatic plants primarily occur in the shallow water habitats of lakes and reservoirs, where sunlight penetrates the water column. In the Savannah River Basin, most aquatic plants are non-native species introduced by humans. Although aquatic plants can be beneficial to fish and other aquatic organisms by providing habitat and refuge from predators, non-native species can outcompete native aquatic plants, and lead to habitat degradation and loss of recreation if not controlled.

Duke Energy, in cooperation with South Carolina DNR, addresses the management of nuisance aquatic plants within the project boundary, and monitors for such plants annually. Duke Energy also proposes in the SMP that Duke Energy Lake Services will manage for native aquatic plants.

Our Analysis

Aquatic vegetation is not abundant in either Lake Jocassee or Lake Keowee, and this is likely due to the sediment characteristics and water level fluctuations, which prevent establishment. During 2012 surveys, Duke Energy, did not observe any aquatic plants (native or non-native) in Lake Jocassee, and only observed very small populations of non-native invasive coontail and parrot feather in Lake Keowee (table 3-9)(Gaddy, 2013).⁵⁶ Historically, hydrilla (another non-native invasive aquatic plant) was observed in Lake Keowee; however, in cooperation with South Carolina DNR, it has since been eradicated through chemical and physical removal, and has not been observed since 2002.

Non-native-invasive aquatic plants like hydrilla, coontail, and parrot feather can displace native plants and adversely affect water quality, aesthetics, recreation, navigation, and the operation and maintenance of water intake structures. However, in Lake Jocassee and Lake Keowee, the negative effects of these three species are likely limited. For example, the preferred habitats of coontail and parrot feather are predominantly contained within the sandhills and coastal areas of South Carolina, and thus population expansion of these two species is unlikely because habitat in Lake Jocassee and Lake Keowee is so limited. Although hydrilla has been eradicated from Lake Keowee, there is still potential for reoccurrence. Nevertheless, Duke Energy, in cooperation with South Carolina DNR, does address the management of nuisance aquatic plants within the project boundary, and monitors for such plants annually. In addition, Duke Energy does not propose any changes in project operation that would be likely to contribute to the spread or dispersal of invasive aquatic plants. Thus, the introduction

⁵⁶ In Lake Keowee, 100 stems of coontail, and a few plants of parrot feather were observed (Duke Energy, 2013e).

and/or spread of hydrilla, coontail, parrot feather, and other non-native invasive aquatic plants is likely to be minimal under proposed project operation.

3.3.2.3 Cumulative Effects

Basin-wide Water Quantity

The Jocassee and Keowee Developments alter the timing and volume of flow to serve hydropower and other purposes. In addition to the Keowee-Toxaway Project, the Corps lists dozens of impoundments and major water withdrawals related to energy generation in the Savannah River Basin.⁵⁷ In coordination with these other impoundments, the Keowee-Toxaway Project contributes cumulatively to the major hydrological alteration of the entire landscape of this large river system. There are a variety of developmental and environmental effects associated with the hydrological alteration, including: developmental benefits such as electrical generation and water withdrawals; socioeconomic benefits such as tax revenue from waterfront property and opportunities for water-related business and recreation; and environmental factors, such as the maintenance of river-dependent ecosystems and species.

Duke Energy modeled operation of its Bad Creek Project, the Keowee-Toxaway Project, and the Corps' downstream projects (i.e., Hartwell, Russell, and Thurmond).⁵⁸ Duke Energy's modeling showed that the proposed operation of the Keowee-Toxaway Project would have infrequent, minor effects on lake levels and flow releases from the downstream Corps' reservoirs. The Corps' 2014 EA also analyzed the effects of water management in the upper Savannah River Basin on environmental resources, recreation, cultural resources, and socioeconomics. The Corps found that, among the alternatives considered, the water management plan put forth in the 2014 Operating Agreement is the best course of action, considering a number of environmental and developmental factors (Corps, 2014). Duke Energy's modeling and the Corps' analysis demonstrate that the cumulative effect of the Duke Energy's proposal for relicensing the Keowee-Toxaway Project, along with other activities in the Savannah River Basin, would be negligible.

Downstream Water Quality

Creation of the project has likely affected downstream water quality by increasing: (1) the residence time of water passing through this section of the river; (2) the proportion of biological processes that occur within impoundments relative to those that occur in

⁵⁷ See table 2.1-2 of the 2014 Corps' 2014 EA at page 2-4.

⁵⁸ See Exhibit E of License Application at E3-154.

ivers; (3) inundation of land; and (4) sediment retention. There was likely an initial increase in nutrients in water flowing from the project area derived from newly-inundated lands, followed by a continual and ongoing decrease in nutrients retained in sediments deposited within the reservoir, as well as a decrease in turbidity downstream of the project. The increase in residence time likely results in delayed warming in the spring and delayed cooling in the fall, compared to conditions that existed before the project was constructed, higher algal concentrations in surface waters than would be typical river, and altered chemistry.

Proposed project operation is unlikely to result in discernible effects on downstream water quality, because of both the relatively low contribution of project flow releases to total river flows, and the overwhelming influence of locally derived oxygen demand material (organics), particularly in the lower portion of the basin. Duke Energy's proposed shoreline stabilization measures at Lake Jocassee and Lake Keowee, as discussed in section 3.3.1, *Geology and Soil Resources*, may marginally enhance downstream water quality by slightly decreasing downstream nutrient loading. In addition, proposed project operation would maintain downstream flow releases into Lake Hartwell during drought conditions, most critically when usable storage in the downstream Corps reservoirs is substantially diminished. The net effect would be marginally improved downstream water quality and enhanced habitat conditions for downstream aquatic resources. Proposed project operation can potentially affect the magnitude and timing of generation releases from the Corps' J. Strom Thurmond Dam into the lower Savannah River,⁵⁹ but only under certain drought conditions. However, the volume of water released from the project over an extended period of time would not differ substantially from that released under existing project operation.

Project flow releases currently exhibit excellent water quality throughout the year, as documented by historical water quality monitoring. Water quality modeling indicates that the water quality in the Keowee Development's generation releases under proposed project operation would be comparable to water quality currently measured under existing operation, even when taking into account projected increases in withdrawals, hypothetical increased watershed and point source nutrient inputs to the reservoir, and potential influences of climate change. There are no discernable additional cumulative downstream water quality effects under proposed project operation.

⁵⁹ The Keowee-Toxaway Project's influence on flow releases from Thurmond Dam stems from the proposed reduction in storage volumes in the project lakes, reduced flows from the Keowee Development under the proposed LIP, differences in storage volumes between the Keowee-Toxaway Project and the Corps' reservoirs, attenuation of and lag-time between flow releases from the Keowee-Toxaway Project, and variability in inflows to the project lakes versus the Corps' reservoirs.

The Savannah River Water Resource Planning funding⁶⁰ included as an off-license measure in the Relicensing Agreement would be used to support initiatives approved by Duke Energy to improve water quantity planning and management in the Savannah River Basin in the project area and downstream from Lake Keowee. Such efforts are expected to improve basin-wide water resource planning and management goals of the Corps and other agencies. Indirectly, this could benefit water quality in the basin. In addition, the Source Water Protection Program described below would fund initiatives to protect and enhancement basin water quality. Providing the funding for these initiatives would support watershed management goals of resource agencies, though the exact benefits of the program are unknown at this time.

Nutrient Loading

Duke Energy, at the request of stakeholders, evaluated the potential effects of project operation with hypothetical future increases in nutrient loads from non-project non-point and point sources. The water quality model (CE-QUAL-W2) was used to run selected operating scenarios with the following modifications: (1) double the concentration of total phosphorus entering Lake Keowee from the Cane and Little Creek watersheds; (2) double the nutrients from all tributaries and distributed inflows throughout the reservoir (excluding inflows from Lake Jocassee); and (3) the addition of a hypothetical 8.0-MGD wastewater treatment facility in the Little River tributary to Lake Keowee. DO and water temperature in the flow releases from the Keowee Development were modeled for each of the above scenarios. The results show that there were no notable effects on DO and water temperature observed in the simulated Keowee Development flow releases with increased non-point or point nutrient loadings to Lake Keowee (see Figures E3.4-55 and E3.4-56 in Exhibit E, pages E3-175 and E3-176, of the license application; Duke Energy, 2014a).

As part of the Relicensing Agreement and as an off-license measure, Duke Energy plans to contribute \$1 million to fund a Source Water Protection Program. This program would reduce the risks of adverse effects associated with future increases in nutrient loading. The program is to focus on activities associated with protecting water quality of the project reservoirs through improving the water quality of incoming water. The initial funding for the program would be used to further development the existing water quality models. Such models may be used to provide early warning of potential eutrophication

⁶⁰ The Savannah River Water Resource Planning funding of \$438,000 is included in the Relicensing Agreement, and is further described in the Memorandum of Understanding between Duke Energy, the Corps, and SEPA for the proposed New Operating Agreement for the basin.

and algal bloom threats and to evaluate the relative effectiveness of alternative regulatory and technological water quality protection strategies.

Duke Energy's contribution to the program could support initiatives such as: (1) relocating, and cost-share the repair of, failed septic systems and cost-share repair/replacement/sewer-hookup (if feasible) with the system owners; (2) educational outreach; and (3) collaborative development with state and local governments of comprehensive plans for effective implementation of storm sewer upgrades and controlling non-point source pollution. Each of these initiatives has the potential to ameliorate potential future increases in nutrient loading associated with additional non-project development in the watershed.

Fish Resources

Upstream of the project there is one dam (associated with the Bad Creek Project), and downstream from the project there are six dams along the mainstem of the Savannah River (i.e., Hartwell Dam [Corps], Richard B. Russell Dam [Corps], J. Strom Thurmond Dam [Corps], Stevens Creek Dam [FERC No. 2535], Augusta Diversion Dam [FERC No. 11810], New Savannah Bluff Lock and Dam [Corps]), and seven dams on tributaries that feed the Savannah River (North Georgia FERC Project No. 2354 [i.e., Yonah Dam on Tugalo River, Tugalo Dam, Tallulah Falls Dam, Mathis Dam, Nacoochee Dam, and Burton Dam on Tallulah River], Abbeville Dam [FERC No. 11286 on Rocky River]). These dams and their impoundments exert cumulative effects on fisheries and aquatic resources in the Savannah River system in a variety of ways, including: modifying and regulating the natural flow regime; impeding upstream passage, and in some instances downstream passage, of resident and migratory fishes; influencing water quality characteristics; and subjecting downstream-moving fish to turbine entrainment and the risk of turbine-induced mortality.

The construction of dams, including Jocassee Dam and Keowee Dam, has fragmented and altered riverine habitats for native species of fish and freshwater mussels, such as the redeye bass and the paper pondshell mussel, as well as reduced the connectivity of mainstem riverine habitats to tributary habitats. Mainstem impoundments may impede the ability of tributary populations of fish and mussels to recolonize from neighboring tributary systems after local disturbances. Cumulative effects of these past actions combined with other anthropogenic disturbances within tributary watersheds (e.g., point and nonpoint sources) may threaten the persistence of some native species, such as robust redhorse (under review for federal listing) and Savannah lilliput mussel (under review for federal listing). In the Savannah River, especially below the Fall Line, dam construction also fragmented and eliminated much historic spawning habitat for some diadromous species, such as American shad, shortnose sturgeon, and Atlantic sturgeon.

Continued operation of the Keowee-Toxaway Project would contribute to cumulative effects on fisheries and aquatic resources in the Savannah River Basin. The project includes two of the sixteen dams within the Savannah River Basin that impede fish movement and limit tributary connectivity in the river basin. Also, the large federal reservoirs downstream from the project would continue to regulate the river flow in the Savannah River Basin.

The cumulative effects of Duke Energy's licensing proposal on diadromous fish migrations would be negligible, if any. Anadromous fish species including shortnose sturgeon, Atlantic sturgeon, striped bass, American shad, hickory shad, and blueback herring occur in the lower reaches of the Savannah River. Efforts are underway to restore passage of these species upstream into the Augusta Shoals reach by providing passage at the New Savannah Bluff Lock and Dam, Augusta Diversion Dam, and Stevens Creek Dam. However, no records suggest the historical distribution of these species extended to the project,⁶¹ and there are currently no plans to provide upstream fish passage at the three Corps dams immediately downstream of the project.

Cumulative entrainment mortality effects for the fish species inhabiting the Savannah River are likely to be relatively minor. Only a small proportion of the fish entrained at the Keowee-Toxaway powerhouses would likely not survive turbine passage, and the losses of these mostly small and young-of-year fish would be of minor significance to the existing fisheries resources (see section 3.3.2.2, *Environmental Effects*).

Invasive Spotted Bass

The construction of dams within the Savannah River Basin has shifted the aquatic environment from free-flowing, riverine habitats (e.g., riffles, runs, pools), to reservoir habitat. These changes in habitat have led to a conversion of the fisheries from riverine to lacustrine (lake) assemblages, dominated by warmwater species such as black bass, sunfish, and open water forage fish species such as threadfin shad and blueback herring.

⁶¹ American shad in the Savannah River Basin may have once migrated a distance similar to that between the ocean and Keowee Dam or further, but no records indicate they migrated to the Toxaway, Keowee, or Little Rivers. According to Welch (2000), the only record that could be found describing the inland distribution of American shad in the Savannah River Basin was from an 1899 report which places the historical inland migration of American shad at Tallulah Falls, on the Tallulah River, which is about 383 miles from the mouth of the Savannah River.

It appears that the introduction of spotted bass has had a strong negative effect on native redeye bass populations. Anglers introduced spotted bass into Lake Keowee in the mid-1980s, and by the mid-1990s spotted bass was the most frequently caught sportfish in the impoundment (Barwick, 2006; Oswald, 2007). During the same time period, spotted bass were found in Russell Lake – likely the result of a separate introduction (Oswald, 2007). Almost immediately after the introductions of spotted bass into Lake Keowee and Russell Lake, native pure strain redeye bass populations declined in abundance due to hybridization with spotted bass and subsequent introgression (Bangs, 2011).⁶² Spotted bass and/or hybrids have since moved into Lake Jocassee and the Corps' Hartwell Lake (Bangs, 2011). Pure strain redeye bass are now declining in Lake Jocassee and Hartwell Lake, and are absent, or nearly absent in Lake Keowee (Bangs, 2011).

The construction of impoundments in the upper Savannah River Basin created an opportunity for the introduction of spotted bass by anglers. Also, the connections between the reservoirs appear to have facilitated the early spread of the species. Duke Energy now proposes modest changes in lake levels under severe drought conditions. However, there is no indication that these changes would affect the spotted bass. Therefore, the presently proposed changes would not be likely to contribute to the existing cumulative effects on the spread of spotted bass and decline of the redeye bass.

3.3.3 Terrestrial Resources

3.3.3.1 Affected Environment

Vegetation

The project is located within the Southern Crystalline Ridges and Mountain sub-regions of the Blue Ridge Ecoregion along the North Carolina and South Carolina state border, and the Southern Inner Piedmont Ecoregion in South Carolina. These areas are mostly forested with some pastures and small croplands (Griffith et al., 2002). Forest types vary depending on local topography, moisture regime, and when and if the area was logged. Logging has been conducted in the watershed since before 1900. Generally, within the forested lands of the Jocassee and Keowee watersheds, very dry upland areas, such as ridge tops, upper slopes, and cliffs support upland oak-pine forests including such species as Virginia pine, shortleaf pine, pitch pine, white pine, chestnut oak, scarlet oak, black oak, and hickories. Mountain laurel and small leaf rhododendron are common on

⁶² Introgression is the breeding of hybrid individuals with one or both pure strain species that produced the hybrid. When introgression occurs, it indicates viability and fertility of hybrid individuals, which can be detrimental to pure strain species.

these sites. In contrast, areas with a moderate amount of moisture, such as lower hillslopes, small stream ravines, stream bottoms, and riparian areas, tend to support forests containing tulip poplar, red maple, white oak, Northern red oak, American beech, sweetgum, basswood, and sweet birch in the overstory with Eastern hemlock, rosebay, and rhododendrons frequently present in the understory. Other common understory species include flowering dogwood, Fraser magnolia, and Carolina silverbell.

In 2012, Duke Energy conducted a survey of botanical species and vegetation structure within the project boundary and surrounding Lake Jocassee and Lake Keowee. The study area included the project reservoirs and tailwaters, some state-owned terrestrial areas adjacent to the project boundary within 100 meters of the full pond elevation of the project reservoirs, the Little River Bypassed Reach, selected islands, and project access areas. Duke Energy surveyed a total of 80 plots and calculated dominance of woody and herbaceous plant species in upland and shallow water areas. The majority of the 14 cover types⁶³ identified in the project study area are forested. Within these cover types, the 2012 survey identified 32 different vegetation community associations, which can generally be combined into 4 major vegetated habitat types: mixed pine/hardwood forest, white pine forest, riparian/wetland, and disturbed/developed (table 3-7).

⁶³ The cover types included pine, pine-heath, pine-mixed hardwoods, pine-oak-heath, mixed hardwoods, cove mixed hardwoods, mixed hardwoods-heath, bottomland mixed hardwoods, hemlock-heath, hemlock-mixed hardwoods, white pine-mixed hardwoods, upland shrub, wetland shrub, and herbaceous.

Table 3-7. Major habitat cover types in the Keowee-Toxaway Project area. (Source: Duke Energy, 2014a, as modified by staff).

Habitat Type	General Locations at the Project	Characteristics	Common Species Present
<i>Mixed Pine/Hardwood Forest</i>	All mature Piedmont forests on south- and north-facing slopes; ravines; well-drained small stream bottoms; and forested islands	<ul style="list-style-type: none"> -Includes a large range of plant communities with species composition depending primarily on soils and management history -Uneven-aged forests with old growth trees and reproduction, including some shade-intolerant species, primarily in canopy gaps created by wind storms and other natural disturbances -Hydrology is mainly from rainfall and ground moisture 	Canopy- tulip poplar, loblolly pine, black cherry, white pine, white oak, and southern red oak, shortleaf pine, Virginia pine, water oak, black oak, sweetgum
<i>White Pine Forest</i>	<p>Slightly rolling terrain, gorge walls and other steep, exposed slopes with dense shrub layers</p> <p>Examples include the Horsepasture arm of Jocassee and along part of Crow Creek at Keowee</p>	<ul style="list-style-type: none"> -Includes both natural and planted white pine forests -White pine appears to respond well to disturbance and is often a successional tree in this habitat - Soils are often sandy or rocky and very acidic 	<p>Canopy- white and pitch pines, red maple, tulip poplar, American beech, southern red and chestnut oaks, black locust, white basswood</p> <p>Understory- sapling white pine, mountain laurel, withe-rod viburnum, Frazier's magnolia, sourwood, great laurel, blueberry, rhododendron</p> <p>Herbaceous- Oconee bells, sensitive fern, cross vine, Blue Ridge switchcane, long-spurred violet</p>

Habitat Type	General Locations at the Project	Characteristics	Common Species Present
<i>Riparian/Wetland</i>	<p><i>Jocassee</i>-Small palustrine emergent wetlands with limited palustrine scrub-shrub components; examples include the mouth of the Toxaway River and Rock Creek</p> <p><i>Keowee</i>-Large palustrine emergent and scrub/shrub wetlands with some palustrine forest and open water; small coves; fringe palustrine emergent wetlands on shoreline; examples include Little River Bypassed Reach and Crow Creek</p>	<p>-Includes all vegetated wetlands-scrub/shrub and emergent swamps with true shrubs, young trees, stunted trees or shrubs (scrub), and emergent, mostly perennial vegetation; some palustrine scrub/shrub areas are a successional stage leading to palustrine forested wetlands; others relatively stable communities</p> <p>-Temporary expansion of herbaceous fringe vegetation, dominated by obligate and facultative wet wetland species, on project shorelines during droughts/low water level conditions in 2012</p> <p>-Wetlands primarily supported by tributaries or side slope seeps at Jocassee, and by high groundwater table influenced by reservoir fluctuations or beaver dams near full pond elevation at Keowee; soils saturated for extended periods of time due to high groundwater table which is influenced by reservoir levels</p>	<p>Woody species- green ash, tag alder, river birch, sycamore, silky dogwood, red maple, buttonbush, black willow, sweetgum</p> <p>Herbaceous- Alleghany monkeyflower, cardinal flower, groundnut, various sedges and rushes, jewel weed, giant cane, bluestem, blackberry, and Nepalese browntop (a non-native invasive species)</p> <p>Ephemeral fringe areas- yellow-eyed grass, weakstalk bulrush, woolgrass rush, devil's beggartick, rice-cut grass, spikerush</p>
<i>Disturbed/Developed</i>	Occurs primarily along the shorelines of Lake Keowee but also some areas at Lake Jocassee	<p>-Includes natural communities affected to varying degrees by residential, commercial, energy/hydropower (including right-of-ways), and recreational/ infrastructure development</p> <p>-No commonality in disturbance location, soil type, vegetation, or hydrologic regime</p>	Vegetation typically includes maintained lawns, ornamental food-bearing shrubs and trees, and open field and edge habitats

Wetlands/Riparian Habitat

In 2012, Duke Energy mapped and classified wetlands⁶⁴ along the shorelines of Lake Keowee and Lake Jocassee. Wetland surveys included lands within the project boundary and state-owned lands adjacent to and within 100 meters of the project boundary, measured horizontally. Field surveyors classified wetlands using the Cowardin classification (Cowardin et al., 1979) and evaluated wetland function and values following the guidance of Corps New England District's Highway Methodology Workbook Supplement (Corps, 1999).

Considerably more wetlands surround Lake Keowee than Lake Jocassee largely because of differences in topography surrounding the two reservoirs. At Lake Keowee, the survey identified 45 wetland complexes, totaling 137.1 acres, which is 12.3 acres more than the wetlands identified in the FWS' National Wetlands Inventory (table 3-8). The mosaic of palustrine emergent and scrub/shrub wetlands interspersed with small pockets of palustrine forested wetlands and open water at Lake Keowee, provides good-to-excellent wildlife habitat, especially for waterfowl and aquatic fauna. These wetlands also provide some sediment and nutrient retention. Wetlands contributing to this habitat diversity at Lake Keowee include small cove wetlands, and large wetland complexes at low gradient floodplain confluences of Lake Keowee and several large tributaries such as those located on the Little River Bypassed Reach and Crow Creek. In addition, 23 of the 45 wetlands at Lake Keowee were more dependent on hydrologic conditions created by beaver dams near the full pond elevation than the lake elevation. Upstream of the beaver dams, forested bottomland hardwood wetlands associated with feeder channels above the full pond elevation generally transition to scrub-shrub dominated wetlands, which then transition to emergent vegetation wetlands downstream of the beaver dams. This mix of vegetation strata within and surrounding the beaver ponds, as well as the wildlife food sources, nesting/refuge areas, and good sediment and nutrient retention provides good to excellent wildlife habitat values.

At Lake Jocassee, the wetland study identified 4 palustrine emergent wetlands with very limited palustrine scrub-shrub components, totaling 48.2 acres (table 3-8), which is 7.5 acres more than the wetlands identified in the FWS' National Wetlands Inventory. No beaver activity, historical or current, was observed at any of the Lake Jocassee wetlands. The scarcity of wetlands on this reservoir is primarily a function of the steep topography in the area. Wetland functions at Lake Jocassee include some wildlife habitat and shoreline stabilization.

⁶⁴ The wetland surveys did not constitute formal wetland delineations.

Some of the palustrine emergent wetlands along the shorelines of both Lake Jocassee and Lake Keowee may have developed or expanded as a result of low water conditions prior to and during Duke Energy's field studies in 2012. Lake Jocassee was 22.3 feet below normal full pond elevation for 10 months and Lake Keowee had ranged between 2.5 and 5.0 feet below normal full pond elevation for 18 months prior to the wetlands study. Emergent herbaceous vegetation developed within the band of shoreline between the normal lake levels and the lower levels. Though generally lacking in species-diversity, these areas are ephemeral in nature and provide some measure of protection from shoreline erosion during drought/low water conditions.

Table 3-8. Wetland acreage at Lake Keowee and Lake Jocassee by wetland class.
(Source: Duke Energy, 2014a, as modified by staff).

Wetland Class	Number of Wetlands within Class		Acreage	
	Lake Keowee	Lake Jocassee	Lake Keowee	Lake Jocassee
Palustrine Emergent (PEM)	44	4	61.7	47.5
Palustrine Scrub-Shrub (PSS)	40	2	45.2	0.7
Palustrine Forested (PFO)	12	0	30.2	0
	Total		137.1	48.2

Non-native Invasive Plants

Duke Energy's 2012 botanical surveys identified 19 non-native invasive plant species and documented their locations in the study area. Some of these species are listed on the South Carolina Exotic Plant Pest Council's (South Carolina EPPC) Invasive Species List (2011, 2014). Populations were defined as clusters of a plant species covering more than 9 square meters and disrupting the natural ecology of the site in which they are found. Some non-native invasive plants, such as Japanese honeysuckle, found during the survey were widely scattered in woods and along roadsides.⁶⁵ Table 3-9 summarizes occurrences of state-listed invasive species identified within the project boundary.

The populations of non-native species identified during the botanical survey associated with Lake Keowee ranged from just a few plants in some areas to small

⁶⁵ Duke Energy determined that Japanese honeysuckle and the other widely dispersed non-native invasive plants do not appear to disrupt the ecology of the sites where they are found and did not consider them "problem areas" in the study area.

infestations in others. Three populations of Chinese privet, one population of kudzu, two mimosa trees, two populations of Russian olive, small populations of multiflora rose, a princess tree, and Japanese knotweed were noted. No notable populations of non-native invasive species were identified in or around Lake Jocassee during the botanical survey.

Non-native invasive plants were also identified at various survey stations⁶⁶ during Duke Energy's 2012 avian study. The species observed at avian survey stations include mimosa, princess tree, autumn olive, Chinese privet, Japanese knotweed, Japanese honeysuckle, kudzu, Nepalese browntop, and Chinese lespedeza. Table 3-9 provides the size⁶⁷ and general locations of populations of non-native invasive plants within the study area, as well as the South Carolina EPPC threat category.

Among these species classified as a severe threat, Japanese knotweed, kudzu, and Nepalese browntop, all of which are native to Asia, are particularly prolific invaders that thrive in disturbed habitats. Japanese knotweed is a semi-woody perennial that spreads quickly forming dense thickets from 4 to 10 feet high that thrives along waterways, can survive floods, and rapidly recolonizes with its large underground rhizomes, excluding native species. Kudzu is a deciduous vine with up to 30 vines per tap root that grow up to 1 foot per day each, or over 100 feet each season, and can grow over, shade out, and eventually kill other vegetation, including trees. Nepalese browntop is a species of grass that can out-compete native herbs through rapid spread, shading, and changes in soil organic matter and pH. These non-native invasive plants can change the structure, composition, and function of riparian and upland vegetation which can also alter fish and/or wildlife habitats (Kaufman and Kaufman, 2007).

⁶⁶ Table 3-8 lists occurrences reported during Duke Energy's botanical study first, then occurrences noted during Duke Energy's avian surveys (i.e., in appendix F of Duke Energy's avian study report: avian survey station descriptions). A map with the locations of Duke Energy's avian survey stations is attached in Appendix E of this EA.

⁶⁷ The number of stems/area covered by non-native invasive plants was not documented in the avian study report.

Table 3-9. Non-native invasive plant species identified within the study area in 2012 and South Carolina EPPC threat category. (Source: Gaddy, 2013; HDR, 2013; and South Carolina EPPC, 2011, 2014 as modified by staff).

Common Name (Scientific Name)	Population Size(s)	General Locations (avian survey station numbers)	South Carolina EPPC category
<i>Trees</i>			
Mimosa+ * (<i>Albizia julibrisin</i>)	1 tree, about 12 inches dbh	Stamp Creek Access Area; (Duke Energy removed one mimosa tree at Keowee Town Access Area in 2014)	Significant threat
	unknown	<u>Jocassee</u> : shoreline adjacent to Jocassee spillway (S-28); and unnamed cove on southern shoreline of the lower Whitewater River arm (S-32) <u>Keowee</u> : shoreline in the Cane Creek arm (S-4); shoreline adjacent to Keowee Town Access Area (S-18); and Eastatoe Creek arm (S-27)	
Princess tree+ * (<i>Paulownia tomentosa</i>)	1 tree, about 6 inches dbh	Stamp Creek Access Area	Severe threat
	unknown	<u>Jocassee</u> : adjacent Bad Creek Hydroelectric Project intake/tailrace (S-34)	
<i>Shrubs</i>			
Autumn olive+ * (<i>Elaeagnus umbellata</i>)	unknown	<u>Jocassee</u> : shoreline adjacent to intake structures (S-30)	Severe threat
Chinese privet+ * (<i>Ligustrum sinense</i>)	100s of stems; 10s of stems	Upper Fall Creek Access Area; and Keowee Town Access Area	Severe threat
	unknown	<u>Keowee</u> : shoreline adjacent to Keowee School Road/State Highway 188 (S-2); eastern shoreline of Keowee tailrace (S-10); banks of Little River Bypassed Reach (S-15); upper Stamp Creek arm (S-17); shoreline adjacent to Keowee Town Access Area (S-18); shoreline at Mile Creek Park/Access Area (S-19); adjacent to lake in upper Crow Creek arm (S-22); and shoreline in Jocassee tailrace (S-23)	

Common Name (Scientific Name)	Population Size(s)	General Locations (avian survey station numbers)	South Carolina EPPC category
Japanese knotweed+ (<i>Polygonum cuspidatum</i>)	Numerous stems	Near South Cove Access Area (outside the project boundary in 2012)	Severe threat
Multiflora rose+ * (<i>Rosa multiflora</i>)	About 10 plants	Stamp Creek Access Area	Significant threat
<i>Vines</i>			
Japanese honeysuckle* (<i>Lonicera japonica</i>)	unknown	<u>Jocassee</u> : shoreline adjacent to Jocassee spillway (S-28) <u>Keowee</u> : shoreline adjacent to Keowee School Road/State Highway 188 (S-2); unnamed cove in upper Crooked Creek (S-8); eastern shoreline of Keowee tailrace (S-10); shoreline at eastern end of Keowee Dam near spillway (S-11); upper Stamp Creek arm (S-17); adjacent to lake in upper Crow Creek arm (S-22); and shoreline in Jocassee tailrace (S-23)	Severe threat
Kudzu+ * (<i>Pueraria montana</i>)	Covers about ¼ acre	Keowee Town Access Area	Severe threat
	unknown	<u>Keowee</u> : eastern shoreline of Keowee tailrace (S-10); shoreline at eastern end of Keowee Dam near spillway (S-11); and shoreline adjacent to Keowee Town Access Area (S-18)	
<i>Grasses</i>			
Nepalese browntop* (<i>Microstegium vimineum</i>)	unknown	<u>Keowee</u> : banks of Little River Bypassed Reach (S-15); upper Stamp Creek arm (S-17); adjacent to lake in upper Crow Creek arm (S-22); and shoreline of Keowee-Toxaway State Park “15-acre lake”/upper arm of Cedar Creek (S-26)	Severe threat

Common Name (Scientific Name)	Population Size(s)	General Locations (avian survey station numbers)	South Carolina EPPC category
<i>Herbs</i>			
Chinese lespedeza* (<i>Lespedeza cuneata</i>)	unknown	<u>Jocassee</u> : unnamed cove on northern shoreline of Thompson River arm (S-35) <u>Keowee</u> : shoreline adjacent to Cane Creek Access Area (S-3); eastern shoreline of Keowee tailrace (S-10); shoreline at eastern end of Keowee Dam near spillway (S-11); near bridge over lake on south side of State Highway 183 (S-13); shoreline adjacent to Keowee Town Access Area (S-18); cove adjacent to Keowee-Toxaway State Park (S-45A); and small island at southeast end of lake (S-46)	Severe threat
<i>Aquatic plants</i> (discussed in section 3.3.2, <i>Aquatic Resources</i>)			
Coontail+ (<i>Ceratophyllum demersum</i>)	100s of stems; about ¼ acre	Frenge Creek where it enters Lake Keowee	N/A
Parrot feather+ (<i>Myriophyllum aquaticum</i>)	A few plants	In open bottom on Cedar Creek, Lake Keowee	N/A

Notes: + Species observed during Duke Energy's botanical survey

* Species observed during Duke Energy's avian study

dbh – diameter at breast height

Special Status Botanical Species and Communities

More than 80 special status botanical species have been observed in the project study area with approximately 60 percent of these species being recorded during the 2012 botanical survey. Table 3-10 includes special status botanical species that were identified in Duke Energy's 2012 botanical surveys, are historically known to occur in the study area, and/or were identified by the FWS⁶⁸ as known from Oconee or Pickens Counties, South Carolina, or Transylvania County, North Carolina. Federally listed botanical species are discussed further in section 3.3.4, *Threatened and Endangered Species*.

Duke Energy documented the current presence, density, and distribution of Oconee bells within the project boundary. Oconee bells is a federal species of concern and state-listed evergreen perennial plant species, endemic to the Blue Ridge Province of the Carolinas. Keowee-Toxaway valley was the heart of the historical distribution of this species and currently over 50 percent of known populations are found in or near the project area. Although Oconee bells are common around the project reservoirs, it is rare or non-existent throughout most of the Blue Ridge of the Carolinas. Approximately 75 sub-populations of Oconee bells were found along the shorelines of the project reservoirs.

Most of the special status plant species identified during the survey occurred on Lake Jocassee and upper Lake Keowee, and the predominant habitats of these species were coves, ravines, and in close proximity to seepages and waterfalls. The majority of upland slopes and ridgetop sites (the latter mostly islands in Lake Keowee) are dominated by young or middle-aged pine or pine-mixed hardwood forests and did not contain noteworthy botanical species or communities. At Lake Jocassee, areas which harbor more than one special status botanical species include: Glade Fern Ravine, Tall Fern Ravine, Bristle Fern Cove, Cascades Ravine, Whitewater Falls, Thompson River Slides and Cliffs, Coley Creek, Howard Creek/Devils Fork Creek, Laurel Fork Falls, Wright Creek Falls, Mill Creek Falls, Bearcamp Creek Falls, Horsepasture River, and Toxaway River/Rock Creek area. At Lake Keowee, areas with more than one special status botanical species at include Eastatoe Gorge, Upper Cane Creek, Fall Creek Island, and Miterwort Cove.

⁶⁸ See letter filed on April 3, 2015, from J. Stanley, Regional Environmental Protection Specialist, U.S. Department of Interior, Atlanta, Georgia, and letter filed on August 5, 2015, from T.D. McCoy, Field Supervisor, U.S. Fish and Wildlife Service, Charleston, South Carolina.

Table 3-10. Special status botanical species identified in Duke Energy’s 2012 survey, historically known to occur in the study area, or identified by FWS as known from Oconee or Pickens Counties, South Carolina, or Transylvania County, North Carolina. (Source: Gaddy, 2013, as modified by staff).

Common Name (Scientific Name)	Federal Status	State Status/ Rank	Distribution/Habitat Notes
Dutchman’s pipe (<i>Aristolochia macrophylla</i>)	--	SC-/S2	Peripheral; ⁶⁹ rich coves.
Single-sorus spleenwort (<i>Asplenium monanthes</i>)	--	NC-E/S1; SC-/S1	Tropical disjunct; ⁷⁰ rocky, moist ravines; outcrops near waterfalls in escarpment gorges (North Carolina DENR, 2014).
Black-stemmed spleenwort (<i>Asplenium resiliens</i>)	--	SC-/S1	Peripheral; calcareous rocks in rich coves.
Maidenhair spleenwort (<i>Asplenium trichomanes</i>)	--	SC-/S2	Peripheral; rocks in rich ravines.
Appalachian sedge (<i>Carex appalachia</i>)	--	SC-/S1	Peripheral; rich woods.
South Carolina sedge (<i>Carex austro-caroliniana</i>)	--	SC-/S3	Endemic ⁷¹ in the southern Appalachian Mountains (North and South Carolina, Georgia, and Tennessee); rich coves.
Biltmore sedge (<i>Carex biltmoreana</i>)	--	SC-/S1	Endemic in the southern Appalachian Mountains (North and South Carolina, and Georgia); granitic rock faces.
Manhart’s sedge (<i>Carex manhartii</i>)	--	SC-/S2	Endemic in the southern Appalachian Mountains (North and South Carolina, Georgia, Virginia, and Tennessee); rich coves. Known to occur in the study area, but not observed in 2012.

⁶⁹ Peripheral means that the occurrence is near the (southern) limit of its range.

⁷⁰ Tropical disjunct refers to species that are rarely found outside of the tropics.

⁷¹ Endemic species are unique to a defined geographic location.

Common Name (Scientific Name)	Federal Status	State Status/ Rank	Distribution/Habitat Notes
Plantain-leaved sedge (<i>Carex plantaginea</i>)	--	SC-/S2	Peripheral; rich, calcareous coves.
Radford's sedge (<i>Carex radfordii</i>)	--	NC-T/S1; SC-/S3	Endemic in the southern Appalachian Mountains (North and South Carolina, and Georgia); rich, rocky woods.
Blue cohosh (<i>Caulophyllum thalictroides</i>)	--	SC-/S2	Peripheral; rich coves. Known to occur in the project area but not observed in 2012.
Evan's cheilolejeunea (a liverwort) (<i>Cheilolejeunea evansii</i>)	--	SC-/S1	Endemic to southern Appalachian Mountains; rocks and bark of hardwood trees in shaded gorges (NatureServe, 2015) and rich coves. Known to occur in the study area but not observed in 2012.
Broad-leaved enchanter's nightshade (<i>Circaea lutetiana</i> <i>ssp. canadensis</i>)	--	SC-/SNR	Peripheral; rich coves.
Whorled horsebalm (<i>Collinsonia verticillata</i>)	--	NC-V/S2; SC-/S3	Southeast United States; rich coves.
Narrow-leaved glade fern (<i>Diplazium pycnocarpon</i>)	--	SC-/S1	Peripheral; Brevard Belt rich coves.
Fancy fern (<i>Dryopteris intermedia</i>)	--	SC-/S2	Peripheral; rich woods.
Smooth coneflower (<i>Echinacea laevigata</i>)	E	NC-E/ S1S2; SC-E/S3	Edaphically-limited; ⁷² open, woodlands and roadsides. Known to occur in the study area, but not observed in 2012.
Showy orchis (<i>Galearis spectabilis</i>)	--	SC-/S3	Peripheral; rich coves. Known to occur in the study area, but not observed in 2012.

⁷² Edaphically-limited means the species is found only on certain rare soil types.

Common Name (Scientific Name)	Federal Status	State Status/ Rank	Distribution/Habitat Notes
Piedmont barren strawberry (<i>Geum lobatum</i> [= <i>Waldsteinia lobata</i>])	FSC	NC-E/S1; SC-/S3	Endemic in the Blue Ridge and Piedmont of Georgia and South Carolina; Brevard Belt open woods; streambanks and ravines (North Carolina DENR, 2014).
Spreading avens (<i>Geum radiatum</i>)	E	NC-E/S2	High elevation rocky summits (North Carolina DENR, 2014). Known to occur in Transylvania County, North Carolina, but not observed in the study area.
Rock gnome lichen (<i>Gymnoderma lineare</i>)	E	NC-E/S3	Endemic to southern Appalachian Mountains; granitic boulders. Occurs in the project vicinity, but not observed in the study area.
Swamp pink (<i>Helonias bullata</i>)	T	NC-T/S2	Bogs (North Carolina DENR, 2014). Known to occur in Transylvania County, North Carolina, but not observed in the study area.
Acute-leaved liverleaf (<i>Hepatica acutiloba</i>)	--	SC-/S3	Peripheral; rich ravines and coves.
Grotto alumroot (<i>Heuchera parviflora</i>)	--	SC-/S2	Southeast United States, Illinois and Indiana; shaded cliffs and grottoes.
Dwarf-flowered heartleaf (<i>Hexastylis naniflora</i>)	T	NC-T/S3	Rich deciduous forests, bluffs, and ravines (North Carolina DENR, 2014). Known to occur in Pickens County, South Carolina, but not observed in the study area.
Black-spored quillwort (<i>Isoetes melanospora</i>)	E	SC-/S1	Shallow, temporary pools in granite outcrops. Extant populations in Georgia, historic population at Boggs Rock in Pickens County, South Carolina (Natureserve, 2015), but not observed in the study area.
Small whorled pogonia (<i>Isotria medeoloides</i>)	T	NC-T/ S1S2; SC-T/S2	Forests, especially white pine (North Carolina DENR, 2014). Known to occur in Transylvania County, North Carolina, and Oconee County, South Carolina, but not observed in the study area.
White walnut/ Butternut (<i>Juglans cinerea</i>)	FSC	SC-/S3	Pathogen (distribution limited by disease); rich coves.
Coville's rush (<i>Juncus gymnocarpus</i>)	--	SC-/S3	Southeast U.S. into Pennsylvania; shaded seepages.
Climbing fern (<i>Lygodium palmatum</i>)	--	SC-/S3	Peripheral; rich, open woods.

Common Name (Scientific Name)	Federal Status	State Status/ Rank	Distribution/Habitat Notes
Fraser's loosestrife (<i>Lysimachia fraseri</i>)	FSC	NC-E/S3; SC-/S3	Southeast U.S.; wet forest borders, roadsides, alluvial meadows (North Carolina DENR, 2014); disturbed, rich woods. Known to occur in areas surrounding the project, but not observed in the study area.
Miterwort (<i>Mitella diphylla</i>)	--	SC-/S1	Peripheral; rich ravines.
Sweet pinesap, pygmy-pipes (<i>Monotropsis odorata</i>)	FSC	NC-V/S3; SC-/S2	Southeast U.S., Delaware, and Maryland); dry, open calcareous woods. Known to occur in the study area, but not observed in 2012.
Indian olive (<i>Nestronia umbellula</i>)	--	SC-/S3	Southeast U.S. and Kentucky; open mixed hardwoods. Known to occur in the study area, but not observed in 2012.
Sweet cicely (<i>Osmorhiza claytonii</i>)	--	SC-/S2	Peripheral; rich coves
Allegheny spurge (<i>Pachysandra procumbens</i>)	--	NC-E/S1; SC-/S2	Southeast U.S.; rich, calcareous coves; cove forests (North Carolina DENR, 2014).
Ginseng (<i>Panax quinquefolius</i>)	--	SC-/S4	Exploited; ⁷³ rich coves.
Hairy mock-orange (<i>Philadelphus hirsutus</i>)	--	SC-/S2	Endemic in the southern Appalachian Mountains; calcareous cliffs.
Gorge leafy liverwort (<i>Plagiochila caduciloba</i>)	--	SC-/S1	Endemic in the southern Appalachian Mountains; rocky ravines. Known to occur in the study area, but not observed in 2012.
Anderson's gorge moss (<i>Plagiomnium carolinianum</i>)	--	SC-/S1	Endemic in southern Appalachian Mountains; moist rocks in ravines and near waterfalls. Known to occur in the study area, but not observed in 2012.

⁷³ Exploited in this context means the species are collected for personal use or commercial purposes.

Common Name (Scientific Name)	Federal Status	State Status/ Rank	Distribution/Habitat Notes
a liverwort (<i>Porella japonica</i> ssp. <i>appalachiana</i>)	--	SC-/S1	Peripheral; rich ravines on rocks. Known to occur in the study area, but not observed in 2012.
Mountain sweet pitcherplant (<i>Sarracenia rubra</i> ssp. <i>jonesii</i>)	E	NC-E/S1; SC-/S1S2	Bogs (North Carolina DENR, 2014). Known to occur in Transylvania County, North Carolina, and Pickens County, South Carolina, but not observed in the study area.
Mountain or branch lettuce (<i>Saxifraga micranthidifolia</i>)	--	SC-/S2	Southeast U.S. to West Virginia and Pennsylvania; seepage on waterfalls.
Oconee bells ^a (<i>Shortia galacifolia</i>)	FSC	NC-E-V/S2; SC-/S3	Blue Ridge endemic (North and South Carolina); outcrops in humid gorges (North Carolina DENR, 2014); ravines, coves, and north-facing slopes.
Virginia spiraea (<i>Spiraea virginiana</i>)	T	NC-T/S2	Riverbanks (North Carolina DENR, 2014). Known to occur in Transylvania County, North Carolina, but not observed in the study area.
Carolina tassel-rue (<i>Trautvetteria carolinensis</i>)	--	SC-/S3	Peripheral; streambanks and seepages. Known to occur in the study area, but not observed in 2012.
Dwarf filmy-fern (<i>Trichomanes petersii</i>)	--	SC-/S2	Southeast U.S. (and the neotropics); dry cliff overhangs in gorges. Known to occur in the study area, but not observed in 2012.
Faded trillium (<i>Trillium discolor</i>)	--	NC-T/S1; SC-/S4	Endemic in the Upper Savannah River drainage of North and South Carolina, and Georgia; rich woods and coves (North Carolina DENR, 2014).
Persistent trillium (<i>Trillium persistens</i>)	E	SC-/S1	On slopes or along streams in mixed pine-hemlock-hardwood forests (NatureServe, 2015). Known to occur in Oconee County, South Carolina, but not observed in the study area.
Smooth yellow forest violet (<i>Viola pubescens</i> var. <i>leiocarpon</i>)	--	SC-/S2	Peripheral; rich bottomlands and coves.
Three-part violet (<i>Viola tripartita</i>)	--	SC-/S3 ^b	Southeast U.S. (and Ohio and Pennsylvania); rich woods.

Notes: Shaded species were observed during Duke Energy's 2012 botanical surveys.

A state rank with two numbers indicates a range of uncertainty about the conservation rank.

^a In North Carolina, the northern variety of Oconee bells (i.e., var. *brevistyla*) is listed endangered and the southern variety (i.e., var. *galacifolia*) is of special concern-vulnerable.

^b S3 rank for three-part violet refers to *Viola tripartita* var. *tripartita*.

E – Endangered; T – Threatened; FSC – Federal Species of Concern; NC – North Carolina; SC – South Carolina; V – special concern-vulnerable; SNR – unranked/not assessed; S1 – critically imperiled (1 to 5 populations); S2 – imperiled (6 to 20 populations); S3 – vulnerable (21 to 100 populations); S4 – apparently secure (101 to 1,000 populations)

Wildlife

Wildlife Habitats

Within the project boundary at Lake Jocassee, there are approximately 104 acres of terrestrial shoreline habitat. Very limited commercial and residential development has occurred at Lake Jocassee. Therefore the majority of lands within the project boundary are forested with high habitat value.

Land use, topography, and development around Lake Keowee create a variety of terrestrial habitat types. In 2010, Duke Energy evaluated general, terrestrial wildlife habitat at Lake Keowee using aerial imagery from 2005 and 2006 geo-referenced shoreline videography. Within the project boundary at Lake Keowee, there are approximately 690 acres of terrestrial shoreline habitat. On average, this shoreline area at Lake Keowee is approximately 14 feet wide as measured from the full pond elevation upland to the project boundary. Of this shoreline, 37 percent provides high value habitat in the form of forested, diverse understory, diverse scrub, shrub, herbaceous vegetation, and undisturbed areas and 22 percent provides moderate habitat value with adjoining residential development, forested, some understory, leaf litter, no carpet grass, and lightly disturbed areas. There are also shoreline areas that provide low habitat value (29 percent) or no habitat value (12 percent) because of adjoining commercial or residential development, marinas, home sites, docks, piers, seawalls, pathways, landscape (non-native) plants, mulch, carpet grass, seawalls, and similar structures with little or no vegetation present.

Mammals

Most mammal species found within the project boundary include forest species that frequent shallow water or riparian zones and have grown accustomed to human presence and development. In 2012, Duke Energy conducted surveys of mammal species within and near the project boundary surrounding Lake Jocassee and Lake Keowee, including the reservoirs, some state-owned terrestrial areas adjacent to the project boundary within 100 meters, measured horizontally, of the full pond elevation of project reservoirs, tailwaters, the Little River Bypassed Reach, selected islands, and project access areas. Survey techniques included the use of pitfall traps, baited live traps, motion sensing cameras, and acoustical monitoring sites to identify bat species.

The surveys identified a total of 40 mammal species in the study area. Rodents and other small mammals identified in the study include pygmy shrew, northern long-tailed shrew, eastern mole, eastern chipmunk, eastern gray squirrel, southern flying squirrel, woodland jumping mouse, marsh rice rat, eastern harvest mouse, common deer mouse, white-footed mouse, golden mouse, hispid cotton rat, and eastern woodrat. Medium-sized mammals identified in the study included Virginia opossum, nine-banded armadillo, eastern cottontail, woodchuck, American beaver, common muskrat, red fox,

common gray fox, northern raccoon, American mink, North American river otter, striped skunk, bobcat, coyote, and feral hog. At the acoustic monitoring sites, the following bat species were identified: eastern small-footed myotis, little brown myotis, silver-haired bat, tricolored bat, big brown bat, eastern red bat, hoary bat, evening bat, and Rafinesque's big-eared bat. Large mammals identified in the study area include black bear and white-tailed deer.

Birds

The avian community in the vicinity of the project is diverse and is composed of spring, fall, and winter migrants; summer breeders; and year-round residents. Duke Energy conducted bird surveys at 46 established point count stations located in representative and high-value terrestrial and aquatic habitats within the project boundary surrounding Lake Jocassee and Lake Keowee, including the reservoirs, state-owned terrestrial lands adjacent to the project boundary within 100 meters, measured horizontally, of the full pond elevation of project reservoirs, tailwaters, the Little River Bypassed Reach, selected islands, and project access areas. Field observations were made in 2012 during the winter for winter migrants, residents, and waterfowl (January 24-30 and February 20-26); spring migration period (March 19-25 and May 7-14); summer breeding period (June 4-10 and June 19-26); and the fall migratory period (September 10-14 and October 9-15).

A total of 150 species of birds were identified during the surveys, 17 of which had not previously been recorded in the area. Seventy-two species were observed during the winter survey periods. Species commonly observed during the winter, include ring-billed gulls, blue jay, cedar waxwing, song sparrow, wood duck, and American goldfinch. The spring migration period had the greatest diversity with 127 species recorded including the following commonly observed species: turkey vulture, black vulture, song sparrow, northern rough-winged swallow, barn swallow, white-throated sparrow, and indigo bunting. Ninety-three species were observed during summer survey. Some of the most abundant species during summer were Canada geese, common grackle, eastern bluebird, cliff swallow, barn swallow, northern rough-winged swallow, and American goldfinch. During the fall surveys 94 species were recorded. Among the most abundant species during the fall were American goldfinch, black vulture, mourning dove, rock dove, blue jay, Carolina chickadee, American crow, American robin, house finch, and mallard.

Amphibians and Reptiles

The location of the Jocassee and Keowee watersheds at the Blue Ridge/Piedmont Ecoregion interface provides a variety of habitat types favorable to amphibians. The wetland habitats and seeps near confluences of streams with Lake Jocassee and Lake Keowee, including the Little River Bypassed Reach, provide excellent habitat for aquatic and semi-aquatic salamanders, while rocky outcrops and wet forests near Lake Jocassee constitute favorable habitat for terrestrial salamanders. In the Jim Timmerman Natural

Resource Area at Jocassee Gorges (Jocassee Gorges), adjoining Lake Jocassee, the combination of high rainfall and stream gorges creates spray cliffs and waterfalls, which, in combination with dense forest cover, provide a variety of habitats favorable to amphibians.

Thirty-seven species and subspecies of amphibians have been identified in the Jocassee and Keowee watersheds, of which 14 are frogs and toads and 23 are salamanders. The most common amphibian species in the vicinity of Lake Jocassee were salamanders, including the seal salamander, Ocoee salamander, three-lined salamander, and southern gray-cheeked salamander. Northern dusky salamander, Southern two-lined salamander, and spring salamander are also common. At Jocassee Gorges in South Carolina, red salamander, Southern Appalachian salamander, black-belly salamander, Ocoee salamander, eastern newt, seal salamander, wood frog, spring peeper, and American toad, Cope's gray tree frog, green frog, bull frog, and Fowler's toad are common. At Lake Keowee salamanders are relatively less common, but other amphibians such as northern cricket frog, spring peeper, bull frog, green frog, American toad, and eastern newt were abundant and Cope's gray tree frog and the pickerel frog were also common.

A total of 40 species and subspecies of reptiles are known to occur in the Jocassee and Keowee watersheds, including 7 turtles, 15 snakes, 8 lizards, and 5 skinks. Eastern painted turtle, common musk turtle, Eastern river cooter, and Eastern box turtle are common at Lake Keowee. Other turtles observed near the reservoirs and in the Little River Bypassed Reach include the snapping turtle, spiny softshell turtle, and yellow-bellied slider. Eastern box turtle is also present in Gorges State Park. Common snakes in the Jocassee and Keowee watersheds include the eastern garter snake, worm snake, black racer, ring-neck snake, eastern kingsnake, eastern milk snake, northern rough green snake, northern water snake, black rat snake, pine snake, queen snake, brown snake, and red-bellied snake. Two vipers are found in the watershed: copperhead, which typically inhabits shady areas near streams, and the much less common timber rattlesnake, which more typically inhabits dry ridges and rock outcrops in oak and oak-pine forests. Common lizards in the project area include green anole, northern fence lizard, and eastern six-lined racerunner. Among the skink species inhabiting the watershed are common five-lined skink, southeastern five-lined skink, broad-headed skink, ground skink, and southern coal skink.

Special Status Wildlife Species

Duke Energy compiled lists of sensitive wildlife species potentially occurring in the project study area as a component of its 2012 surveys. Special status wildlife species known or thought to occur in western North Carolina and South Carolina and have suitable habitat in the project area include 17 mammals, 2 amphibians, 2 reptiles, and 9

bird species. These species, descriptions of their preferred habitat, state classifications, and potential for presence in the project area are described in tables 3-11 and 3-12.

Table 3-11. Special status mammal, amphibian, and reptile species with potential to occur within the project boundary. (Source: Duke Energy, 2014a, NatureServe, 2015, and Webster, 2013 as modified by staff).

Common Name (Scientific Name)	Federal Status	State Status/Rank	Preferred Habitat	Distribution Note
Mammals				
Southern red-backed vole (<i>Myodes gapperi carolinensis</i>)	--	SC-/S2S3	Found in high elevation coniferous forests.	Reported in North and South Carolina. Not observed during project surveys.
Woodland jumping mouse (<i>Napaeozapus insignis roanensis</i>)	--	SC-/S4	Prefers spruce-fir, cove, and northern hardwood forests with dense ground cover.	Reported in North and South Carolina Appalachians.
Eastern woodrat (<i>Neotoma floridana</i>)	--	NC-T/S1; SC-/S3S4	Occurs in wooded areas, ravines, floodplain forest, swamps, and Osage orange and other hedges	Reported in southern Appalachians in North and South Carolina.
Rafinesque's big-eared bat (<i>Corynorhinus rafinesquii</i>)	FSC	NC-C/S3; SC-E/S2	Summer roosts often are in hollow trees and occasionally under loose bark or in abandoned buildings in or near wooded areas. Hibernates in caves.	Reported in southeastern United States including North and South Carolina.
Southeastern myotis (<i>Myotis austroriparius</i>)	FSC	NC-C/S2	Roosts in hollow trees, under loose bark, in foliage, and in clumps of Spanish moss within riparian forests in summer and winter.	Gulf Coast riparian species. Not observed during project surveys.

Common Name (Scientific Name)	Federal Status	State Status/ Rank	Preferred Habitat	Distribution Note
Gray bat (<i>Myotis grisescens</i>)	E	NC-E/ S1	Roosts in caves year round; winters in deep vertical caves with domed halls; roosts in caves with restricted rooms or domed ceilings that trap warm air during summer; maternity colonies often roost in caves with a stream flowing through them; males and yearlings roost in caves separate from adult females (NatureServe, 2015).	Primary range is Alabama, Arkansas, Kentucky, Missouri and Tennessee with smaller populations in adjacent states; growing population in an Indiana quarry (NatureServe, 2015). Not observed during project surveys.
Little brown myotis (<i>Myotis lucifugus</i>)	--	NC-R/ S3; SC- /S3	Winter hibernacula include caves and mines, whereas summer roosts also include buildings, tree cavities, and under rocks.	Alaska-Canada boreal forest south through most of the contiguous U.S.; largest known colonies in the northeastern and mid-western U.S. (NatureServe, 2015).
Eastern small-footed myotis (<i>Myotis leibii</i>)	FSC	NC-C/ S2; SC- T/S1	Reported in rugged Blue Ridge physiographic province. Hibernates in caves and mines in colder months and during warmer months it roosts in crevices in exposed rock outcrops and small gaps in concrete barriers on bridges.	Range spotty; Canada, eastern and some midwest U.S. states, largest populations in New York, Pennsylvania, West Virginia, and western Virginia (NatureServe, 2015).
Northern long-eared myotis (<i>Myotis septentrionalis</i>)	T-4(d)	NC-SR/ S2; SC- /S4	Prefers interior forested habitats	Broad, patchy range in southern Canada and eastern and northcentral U.S. (NatureServe, 2015); Blue Ridge Province.

Common Name (Scientific Name)	Federal Status	State Status/ Rank	Preferred Habitat	Distribution Note
Indiana bat (<i>Myotis sodalis</i>)	E	NC-E/S1S2; SC-E/S1	Roosts in small groups in hollow trees, snags, and under loose bark; maternity colonies, in particular, seem to prefer snags and loose bark.	Restricted to eastern half of U.S.; not a South Carolina resident; observed in Jackson, Macon, and Haywood counties, North Carolina; not observed during project surveys.
Tricolored bat (<i>Perimyotis s. subflavus</i>)	--	NC-SR/ S3	Hibernates in caves, mines, and culverts. Enters hibernacula earlier than other hibernating bat species, and leaves hibernacula after all other bat species have left. Summer roosts include hollow trees, foliage, caves, rock crevices, and buildings.	Reported in South and North Carolina but declining.
Appalachian cottontail (<i>Sylvilagus obscurus</i>)	FSC	NC-SR- G/S3; SC-/S3	Associated with dense cover and conifers at higher elevations.	Reported in the mountains of North and South Carolina. Not observed during project surveys.
Swamp rabbit (<i>Sylvilagus aquaticus</i>)	--	SC-/ S2S3	Usually restricted to floodplains, bottomlands, riparian areas. Prefers mature forests. Associated with dense, brushy thickets in wooded floodplains along borders of lakes, river, and swamps. Commonly seeks water to escape danger.	Not reported in North Carolina. Found in extreme western South Carolina. Not observed during project surveys.
Carolina northern flying squirrel (<i>Glaucomys sabrinus coloratus</i>)	E	NC-E/ S2	Prefers cool, moist, mature coniferous and mixed forest with abundant standing and down snags; also uses deciduous and riparian woods; prefers cavities in mature trees as dens; also uses or leaf nests, nest boxes, and underground burrows (NatureServe, 2015).	Southern Appalachian Mountains, Tennessee and North Carolina as well as isolated localities in Virginia (NatureServe, 2015). Not observed during project surveys.

Common Name (Scientific Name)	Federal Status	State Status/Rank	Preferred Habitat	Distribution Note
Least weasel (<i>Mustela nivalis allegheniensis</i>)	--	NC-SR-G/S2	Occurs in open forests, farmlands and cultivated areas, grassy fields and meadows, riparian woodlands, hedgerows, alpine meadows, scrub.	Found in southern Appalachian mountains in North Carolina. Not observed in South Carolina or during project surveys.
Eastern spotted skunk (<i>Spilogale putorius</i>)	--	NC-SR-G/ S2; SC-/S4	Occurs in mixed forest and grassland habitats.	Reported in western North and South Carolina. Not observed during project surveys.
American black bear (<i>Ursus americanus</i>)	--	SC-/S3	Occurs in various forested habitats and river floodplains.	Reported in North and South Carolina.
Amphibians				
Green salamander (<i>Aneides aeneus</i>)	FSC	NC-E/S2S3; SC-/S1	Occurs in oak or oak-pine deciduous forests on steep mountainsides, in crevices of large rock outcrops, shaded cliff faces, and behind the bark of large, old trees.	Found in the Jocassee and Keowee watersheds, including Jocassee Gorges. Not observed during project surveys.
Wood frog (<i>Rana sylvatica</i>)	--	SC-/S3	Found in mesic mixed hardwood and other forests.	Recorded in the Jocassee and Keowee watersheds, including Jocassee Gorges. Not observed during project surveys.
Reptiles				
Bog turtle (<i>Clemmys muhlenbergii</i>) (i.e., southern population, from Virginia south to Georgia)	T, S/A	NC-T/S2; SC-T/S1	Found in wetlands with several micro-habitats, including flooded, dry, and saturated areas that provide foraging, breeding, hibernating, basking, and shelter areas; often small, open-canopy, herbaceous sedge meadows or fens with thickly vegetated or wooded borders.	Known from Transylvania County, North Carolina, and Pickens County, South Carolina. Not observed during project surveys.

Common Name (Scientific Name)	Federal Status	State Status/ Rank	Preferred Habitat	Distribution Note
Southern coal skink (<i>Eumeces anthracinus pluvialis</i>)	--	SC-T/SNR	Found in oak and oak-pine forest, high elevation forests, and low-elevation mesic forests and occupies moist or wet habitats created by unique landforms.	Reported to occur near Jocassee Gorges. Not observed during project surveys.

Notes: Shaded species were observed during Duke Energy's 2012 surveys.

A state rank with two numbers indicates a range of uncertainty about the conservation rank.

E – Endangered; T – Threatened; 4(d) – Threatened, with a section 4(d) Rule (of the ESA); S/A – Similarity of Appearance; FSC – Federal Species of Concern; NC – North Carolina; SC – South Carolina; C – State Species of Special Concern; SR – Significantly Rare; SR-G – game animal or furbearer, and therefore (by law) cannot be listed for North Carolina state protection as E, T, or species of special concern; SNR – Unranked/Not assessed; S1 – critically imperiled (1 to 5 populations); S2 – imperiled (6 to 20 populations); S3 – vulnerable (21 to 100 populations); S4 – apparently secure (101 to 1,000 populations)

Table 3-12. Special status bird species with potential to occur within the project boundary. (Source: Duke Energy, 2014a and HDR, 2013, as modified by staff).

Common Name (Scientific Name)	Federal Status	State Status/ Rank	Preferred Breeding Habitat	Season of Concern	Project Area Habitat	Survey Occurrence
Bald eagle ^a (<i>Haliaeetus leucocephalus</i>)	BGEPA	NC-T/S3B, S3N; SC-T/S2	Mature forests near large body of water	Year-round resident, migration	Jocassee and Keowee Lakes	Jocassee and Keowee Lakes; both North and South Carolina
Cooper's hawk ^b (<i>Accipiter cooperii</i>)	--	NC-SR/S2B,S4N; SC-/S3	Breeds in deciduous, mixed, and coniferous forests	Year-round resident	Jocassee and Keowee Lakes-piedmont forest, bottomland and riverine areas	Jocassee and Keowee Lakes in all seasons
Barn owl (<i>Tyto alba</i>)	--	NC-SR/S2S3B, S3N; SC-/S4	Open grasslands, marshes, and agricultural fields	Year-round resident	Jocassee and Keowee Lakes-piedmont forest, bottomland and riverine areas	Not observed during surveys
Red-headed woodpecker ^b (<i>Melanerpes erythrocephalus</i>)	--	SC-/ SNR	Breeds in deciduous woodlands, open woods, wooded swamps with dead trees and stumps, and forest edges	Year-round resident	Jocassee and Keowee Lakes-piedmont forest, bottomland and riverine areas	Lake Keowee in all seasons
Brown creeper (<i>Certhia americana</i>)	--	NC-C/S3B,S5N	Mountainous high elevation forests, favoring spruce-fir mixed with hardwoods	Breeding	Lake Jocassee	Observed during spring migration and winter surveys in South Carolina
Cerulean warbler ^{a, b} (<i>Dendroica cerulea</i>)	FSC	NC-C/S2B	Mountainous mature hardwood forests, steep slopes, and coves	Breeding	Lake Jocassee	Not observed during surveys

Common Name (Scientific Name)	Federal Status	State Status/ Rank	Preferred Breeding Habitat	Season of Concern	Project Area Habitat	Survey Occurrence
Swainson's warbler ^{a, b} (<i>Limnothlypis swainsonii</i>)	--	SC-/S4	Breeds in southern forests with thick undergrowth, especially canebrakes and floodplain forests	Breeding and migration	Lake Jocassee piedmont forest	One occurrence during migration in Howard's Creek arm of Lake Jocassee
Golden-winged warbler ^a (<i>Vermivora chrysoptera</i>)	FSC	NC-C/ S2S3B	Mountainous old fields and successional hardwoods	Breeding	Appropriate habitat located within survey area	Not observed during surveys
Peregrine falcon ^a (<i>Falco peregrinus</i>)	--	NC-E/ S1B,S2N; SC-T/ SNR	Cliffs (for nesting); lakes (foraging in winter)	Year-round	Jocassee and Keowee Lakes	Jocassee and Keowee Lakes in South Carolina

Notes: Shaded species were recorded during licensing surveys.

^a Species included on FWS' Appalachian Mountain (28) regional list of Birds of Conservation Concern.

^b Species included on FWS' Piedmont (29) regional list of Birds of Conservation Concern.

BGEPA – Bald and Golden Eagle Protection Act; FSC – federal species of concern; NC – North Carolina; SC – South Carolina; E – endangered; T – threatened; C – State Species of Special Concern; SR – Significantly Rare; B – Rank of breeding population; N – Rank of non-breeding population; SNR – Unranked/Not assessed; S1 – critically imperiled (1 to 5 populations); S2 – imperiled (6 to 20 populations); S3 – vulnerable (21 to 100 populations); S4 – apparently secure (101 to 1,000 populations)

3.3.3.2 Environmental Effects

Vegetation

Effects of Reservoir Fluctuations

Project operation, including daily reservoir fluctuations and drawdowns associated with the LIP and MEP, could affect riparian vegetation and shoreline habitat at Lake Jocassee and Lake Keowee. Duke Energy proposes to operate the project in accordance with the proposed Normal Minimum and maximum elevations, except when operating in certain stages of the LIP or MEP, as specified in the Relicensing Agreement, and described in detail in section 2.2.2 Proposed Project Operation.

Our Analysis

Operation of the project as proposed would result in continued daily and long-term fluctuations in reservoir elevations. The daily changes in reservoir elevations would continue to result in frequent inundation and drying of soils along the project shorelines and would influence the composition and structure of vegetation growing within the fluctuation zones. These effects would generally be limited to a narrow band around the reservoirs consistent with current operation. As such, daily changes in reservoir elevations under proposed project operation would have minimal effects on vegetation at Lake Jocassee or Lake Keowee.

Under existing operation, there have been long-term drawdowns associated with droughts in the project area. Modeled results of Duke Energy's proposed project operation under historical climatic conditions show that there would likely be fewer severe drawdowns with shorter duration compared to past drawdowns at both Lake Jocassee and Lake Keowee.

The effects of LIP drawdowns on vegetation and vegetation dispersal would depend on a number of factors including time of year, existing vegetation characteristics, and the duration of lower reservoir levels, but are anticipated to be comparable to existing effects. Implementation of the LIP is unlikely to persist for sufficient duration to allow for the expansion of upland forest communities below the full pond elevation. After drought periods, as the reservoirs return to higher elevations, any areas colonized by upland vegetation would likely revert to riparian or wetland communities. These effects are generally consistent with existing project conditions.

Implementation of proposed project operation is also unlikely to affect vegetation dispersal. Plant seeds are typically dispersed by wind, water, animals, or vegetatively through rhizome growth or regenerative tissues, such as stems or roots broken off and transported away from the parent plant. Proposed project operation would reduce the operational range of both Lake Jocassee and Lake Keowee during non-drought periods,

with reduced duration and increased elevation of drawdowns during droughts. Vegetation that does establish in dewatered areas would be temporary and eliminated by inundation as reservoir levels returned to higher elevations. As such, these effects would be minor and would have minimal influence on community structure or botanical populations in the project area.

As discussed in section 3.3.1, *Geology and Soil Resources*, wave energy from wind, boat wakes, and to a lesser degree, project operation causes erosion at both Lake Jocassee and Lake Keowee. Geologic conditions in the project area minimize the potential for erosion at the reservoirs. Previous shoreline erosion has created 1- to 3-foot-high cliffs of exposed bedrock, and at full pond elevation, vegetation is stable along these eroded areas. Erosion in these areas is a relatively slow process –about three inches per year at Lake Jocassee and two inches per year at Lake Keowee. Although the Shoreline Erosion Study found project operation has little effect on erosion rates, the Relicensing Agreement provides for stabilization of 12,500 feet of actively eroding shoreline which is generally at scarps of 3 feet or higher. This stabilization is proposed at four cultural resource sites, nine Lake Keowee islands, the east side of the Fall Creek Access Area, and portions of two future project recreation sites: Mosquito Point and High Falls II Access Areas. Implementation of the proposed shoreline stabilization using the proposed enhanced riprap⁷⁴ and in accordance with the environmental protection measures in Duke Energy’s Shoreline Stabilization Technique Selection Process, a component of the SMP, would protect shallow water and upland vegetative communities (Duke Energy, 2014f).

Effects of Shoreline Maintenance

Project maintenance, including vegetation management within the project boundary could affect upland, riparian, and wetland vegetation at Lake Jocassee and Lake Keowee. Duke Energy proposes to implement its SMP to protect and enhance the environmental resources on project shorelines.

Our Analysis

Shoreline vegetation maintenance is an example of a non-project use of project lands typically requested by adjacent landowners to gain water access and/or improve

⁷⁴ Duke Energy’s definition of enhanced riprap is “a method of shoreline stabilization mainly consisting of riprap with live plants interspersed throughout the structure...typically consists of stones sized to the site, shoreline characteristics, and other requirements of the SMP. Exposed soil above, between, and below the rocks on the shoreline can accommodate live stakes or vegetative planting to produce a natural looking, protected shoreline” (Duke Energy, 2014a).

views of the reservoirs. Duke Energy would continue to evaluate these requests consistent with the stipulations of the proposed SMP. The SMP restricts adjoining property owners' vegetation management activities within the project boundary with the goal of maintaining existing vegetated forested buffers, typical of forested areas of the region around the project reservoirs. The SMP also prohibits the removal of vegetation within the project boundary adjacent to shoreline classified as Natural and Environmental to prevent erosion and protect sensitive vegetation resources in these areas. Limited clearing, thinning, spraying, planting, and sowing of vegetation is permitted within other shoreline classifications only if consistent with the SMP. Duke Energy also allows for the removal of hazardous trees in imminent danger of falling on an individual, a structure, or a proposed structure and removal of non-native invasive and poisonous plants. The SMP also includes conditions for native vegetation plantings. Duke Energy's SMP promotes plantings of native vegetation to supplement existing native vegetation and to protect and enhance important terrestrial and aquatic habitats. Implementation of the proposed SMP would provide protection for vegetation communities within the project boundary.

Non-project transmission lines, bridges, roads, and other utilities with conveyances crossing the project boundary and associated with facilities owned or managed by federal, state, or local governments, public utilities, or other entities providing public services are not subject to the vegetation management requirements of the SMP. However, the entities managing these non-project facilities are encouraged to conduct vegetation maintenance activities in a manner consistent with the requirements of the SMP, where practical. Voluntary implementation of vegetation maintenance techniques consistent with the SMP within non-project rights-of-way would enhance native vegetation and wildlife habitat and limit the spread of non-native vegetation.

Duke Energy's vegetation management activities include maintenance at project access areas and on lands associated with project structures on an as-needed basis. Vegetation on the faces of the dams and saddle dikes is removed to maintain structural stability. There are no project primary transmission lines requiring vegetation maintenance. The types of vegetation maintenance include, but are not limited to, mowing and tree clearing, using both mechanical and chemical applications typical for grounds maintenance in the region. Little would change under Duke Energy's proposal in regard to its vegetation management to maintain project facilities. Any effects that may result from project maintenance under a new license are expected to be minor and similar to existing conditions.

Non-Native Invasive Plants

Effects of Project Operation and Maintenance

Project operation, including daily reservoir fluctuations and drawdowns associated with the LIP and MEP, maintenance, and project-related recreation, could disturb existing

vegetation and promote the spread of non-native invasive plants at Lake Jocassee and Lake Keowee. Duke Energy proposes to operate the project in accordance within the proposed Normal Minimum and maximum elevations, except when operating in certain stages of the LIP or MEP, as specified in the Relicensing Agreement, and described in detail in section 2.2.2 *Proposed Project Operation*. Duke Energy also proposes to implement its SMP which contains provisions to minimize the spread of non-native invasive plants.

Our Analysis

Project Operation

During periods of regional drought, proposed project operation calls for lower reservoir levels, exposing shorelines to sunlight and drier conditions. These exposed soils could become suitable areas for non-native invasive species such as Japanese knotweed, Nepalese browntop, and Russia olive to colonize. Seeds from these species germinate on bare, mineral soils and sands. Many non-native invasive species are unlikely to persist after droughts end because they would not survive inundation when reservoir elevations return to higher elevations. Existing stands of Japanese knotweed on project shorelines could be an exception because this species thrives along waterways and its large underground rhizomes could allow it to recolonize when water levels recede (Kaufman and Kaufman, 2007). Other existing or non-native invasive plants that are tolerant of droughts and/or inundation, or become established on the shoreline above the fluctuation zone could persist and spread to new areas within the project boundary.

Proposed project operation, including maximum drawdown elevations in the LIP, would not differ substantially from existing operation. Under current operation, the reservoirs have experienced sustained drawdowns during drought. Existing operation has not led to wide distribution or large populations of non-native invasive and pioneer species⁷⁵ that are most likely to benefit from drawdowns. The effects of proposed project operation on vegetation are anticipated to be similar to past effects, and project operation is not expected to cause substantial spread of non-native invasive plants.

The large expanse and complexity of project shorelines is such that attempts to monitor and control all non-native invasive plants within the project boundary would likely be costly and ineffective. Some non-native invasive species known to occur within the project boundary, including multiflora rose, Chinese privet, and Japanese

⁷⁵ Pioneer species are typically annual herbaceous plants that colonize disturbed areas and are replaced over time by a more diverse group of species which remains stable until the next disturbance.

honeysuckle, are widely distributed in the region and the potential for successfully eradicating these species on project lands is unlikely because of a high probability for re-establishment. The extent of non-native invasive plant occurrences identified during Duke Energy's avian surveys was not documented, but Duke Energy reports that populations of non-native invasive plants currently occurring on project lands are small and their removal is not likely to substantially affect the spread of these species in the region because of the large populations existing outside the project boundary. However, monitoring existing stands/occurrences of the most rapidly spreading non-native invasive plants like Japanese knotweed, kudzu, and Nepalese browntop, at project facilities, recreation sites, and near sensitive resources, such as rare plants would ensure that ecological and other problems associated with these populations would be identified in a timely manner. As part of its native shoreline and aquatic vegetation management under the SMP,⁷⁶ Duke Energy, in cooperation with South Carolina DNR and other resource agencies, would monitor non-native invasive riparian plants annually and consult on appropriate management of these species, if necessary to protect native species and facilitate project uses.

Shoreline Maintenance

Shoreline maintenance activities permitted under the proposed SMP have potential to remove existing vegetation and disturb soils, creating suitable areas for non-native invasive plants to establish. These activities include excavations, vegetation management, new conveyances, construction of private facilities, and shoreline stabilization projects. While disturbances associated with such projects may be relatively small, establishment of non-native invasive species on these sites could persist and produce seed and propagules, furthering their spread within the project boundary. State-listed non-native invasive plants known to occur in the project area and with potential to colonize newly disturbed areas in project uplands include kudzu, Chinese privet, Japanese knotweed, Japanese honeysuckle, Nepalese browntop, and princess tree.

During the term of the existing license, non-native invasive plants on adjoining non-project lands have not led to large-scale infestations in the project boundary. Non-native invasive plants on adjoining non-project lands can and have been controlled by the property owners and these practices are expected to continue under a new license and with implementation of the proposed SMP. The SMP allows the removal of non-native invasive plants and only allows replacement with native species. In addition, annual monitoring associated with Duke Energy and South Carolina DNR's native shoreline and aquatic vegetation management program would ensure that any ecological or recreation-related conflicts caused by non-native invasive plants would be identified on a regular

⁷⁶ See page C-16 of Duke Energy's Shoreline Management Plan, Appendix C.

basis and could be addressed with appropriate management techniques. Therefore, vegetation maintenance within the project boundary is expected to continue to control non-native invasive plants, restricting their occurrence to small, isolated populations.

Recreation

Recreation activities, especially boating and hiking, have potential to transport non-native invasive plant seeds and propagules into the project area and/or disperse existing species to other areas. Such dispersal occurs when seeds or other plant material attach to clothing, boats, trailers, or vehicles and are then transported and deposited in other locations. During the botanical survey, the majority of non-native invasive species populations were observed at project access areas (table 3-9). Additionally, as part of this license application, Duke Energy proposes several upgrades and development at project recreation sites (see section 3.3.5, *Recreation Resources*). These activities would include removing vegetation and grading soils and could create areas of disturbed soils susceptible to colonization of invasive plants.

Under current operation, Duke Energy monitors non-native invasive plant populations at project access areas and also removes non-native invasive plant populations with potential to impede the public's use of the site or that occupy areas needed for additional facilities (Gaddy, 2013). Duke Energy also provides educational information on reducing the spread of non-native invasive aquatic plants at project access areas. Recreation activities at the project under a new license are expected to be consistent with existing uses. Given Duke Energy's monitoring, management, and educational efforts, introduction or spread of non-native invasive species within the project boundary during future recreation activities would be minimized.

Riparian Areas/Wetlands

Effects of Project Operation

Project operation causes changes to water elevations of Lake Jocassee and Lake Keowee, resulting in inundation and drying of project shorelines which could affect the extent and species composition of riparian areas and wetlands. Under proposed project operation, water level fluctuations would continue to occur both daily and over longer periods associated with local climate conditions.

Our Analysis

The areal extent of wetlands would continue to fluctuate during transitions from normal operation to drought conditions, as they do with natural climate variability. Given differences in reservoir topography and hydrology, these transitions would have greater effect on riparian areas and wetlands at Lake Keowee than at Lake Jocassee. Lake Jocassee wetlands are more influenced by tributary inflow and side slope seeps and

are therefore less affected by lower lake levels during periods of drought and/or reservoir drawdown. Most of the Lake Keowee wetland areas have formed as a result of the impoundment, and these wetlands exist in a state of constant ecological flux because of varying reservoir elevations associated with normal project operation as well as drawdowns during drought conditions. Generally, at project shoreline elevations near the upper end of the operational range, wetland species would benefit from high water periods. During subsequent drought conditions, seeds produced during a previous low water period may germinate on the exposed mudflats and palustrine emergent wetlands would likely return to those areas. Low water periods would expose large mudflats, and wetland acreage would expand. As reservoir levels return to the full pond elevation and these areas are inundated, wetland acreages would contract because the slopes above the full pond elevation are generally too steep and dry to support these species. Proposed project operation would not differ substantially from existing operation, although the frequency of drought-related drawdowns at Lake Keowee between 794.6 and 790 feet AMSL would increase slightly as compared to operation since the mid-1990s. Consequently, proposed project operation is not expected to affect the long-term stability of established wetlands at the project.

Special Status Botanical Species

Potential habitat for more than 80 special status botanical species occurs within the project boundary. Potential project-related effects in these areas include erosion, water level fluctuations, shoreline vegetation maintenance, collecting, trampling and competition with non-native invasive plants that may be introduced or spread through other project-related disturbances.

Duke Energy proposes to protect known sites of special status and priority botanical species within the project boundary by implementing the following measures consistent with the Relicensing Agreement, RMP, and SMP: (1) prohibiting activities that could adversely affect known sites of these species; (2) classifying shorelines harboring these species as Environmental or Natural; (3) ensuring recreation facility development avoids these species; and (4) providing appropriate signage for these species within the project boundary in proximity to project structures such as powerhouses, dams, and dikes. With regard to Oconee bells, Duke Energy would implement the aforementioned measures at Fall Creek Access Area and Devils Fork State Park. Interior supports Duke Energy's proposed measures to protect special status and priority botanical species.

Our Analysis

Project Operation

As with current operation, proposed project operation would cause fluctuating reservoir water levels that, in turn, would affect water availability for sensitive plant

species located near the normal full pond elevation. These plants also would be susceptible to erosion processes, as they are now. However, the area in which these effects would occur is relatively narrow and does not support large populations of sensitive plants. Sensitive plants at greatest risk of erosion-related effects are Oconee bells.

Approximately 75 to 90 percent of the Oconee bells populations present within the project area are located in upland areas away from potential effects caused by shoreline erosion. The remaining populations are located along shoreline areas that could be affected by shoreline erosion. In the past, shoreline erosion, specifically bank undercutting, has caused Oconee bells plants in the marginal shoreline populations to fall into the lake. The erosion was generally found to occur on steep banks and on peninsulas where Oconee bells hang on ledges and steep slopes. However, most current populations identified in the botanical study occur upslope of the project boundary, so project operation is not likely to affect them. Given the size and abundance of Oconee bells populations outside of the project boundary and the projected slow rate of shoreline erosion at Lake Jocassee, relocation of Oconee bells located along the shoreline does not appear to be warranted. During Stakeholder Team meetings in March and April 2013, South Carolina DNR concurred that such efforts are not needed to protect Oconee bells from project-related shoreline erosion (Gaddy, 2013).

Shoreline Maintenance

Vegetation management activities conducted by adjoining landowners adjacent to the project boundary could affect sensitive plants if these activities result in cutting, soil disturbance, or unearthing of special status species. Soil disturbing activities could promote the colonization or spread of non-native invasive plants that could compete with sensitive plants for light and nutrients. Vegetation maintenance could also alter existing micro-habitat conditions, either by changing drainage patterns by regrading topography, changing light availability and temperature through removal of canopy cover, or changing soil chemistry through addition of herbicides, pesticides, or fertilizers. These alterations could affect habitat suitability for existing special status plant populations.

To minimize potential adverse effects on special status plants, the Relicensing Agreement provides for classifying shoreline areas with special status plants as Environmental or Natural in the SMP's shoreline classification maps. Shorelines with Environmental or Natural classifications would be ineligible for most lake use permitting activities under the SMP, ensuring these areas are not disturbed by soil-disturbing or vegetation clearing activities, construction of water access facilities, or other activities regulated in the SMP. Duke Energy also encourages the establishment of additional native vegetation buffers on private land and any development adjacent to shorelines with these classifications. Planting and expanding native vegetation buffers would protect soil from erosion by slowing run-off from adjacent residential and commercial developments.

Native vegetation buffers could also act as a physical barrier, offering a measure of protection for existing populations of special status plants and/or creating conditions suitable for special status plants to become established.

Existing populations of non-native invasive plants are currently small, are primarily found near project recreation areas, and are not known to affect any special status plants. Further, introductions of non-native plants to new areas and spread of existing populations within the project boundary would be minimized by measures contained in the SMP. As noted above, the SMP allows adjacent landowners to remove non-native invasive plants and only allows replacement with native species. In addition, Duke Energy's active management of invasive species at project access areas (Gaddy, 2013) and annual monitoring associated with Duke Energy and South Carolina DNR's native shoreline and aquatic vegetation management program (Duke Energy, 2014f) would ensure that any effects of non-native invasive plants on special status species would be identified on a regular basis and could be addressed with appropriate management techniques. Therefore, implementation of the proposed SMP would ensure vegetation management activities do not affect special status plants.

Recreation

Recreation activities in the project area include camping, hiking, boating, and hunting. Potential effects of these activities on special status plants include unauthorized tree removal for firewood, trampling, or collection of rare plants. Currently, there is no evidence firewood cutting exists near project access areas and there are no records of special status tree species being removed. However, there is potential that unauthorized tree cutting for firewood could disturb populations of special status plants if branches or logs are dropped on or dragged across these resources. Campers walking off trails to gather fallen wood for fires could also inadvertently trample special status plants. Hikers and photographers visiting Oconee bells populations during flowering season could disturb these areas through inadvertent trampling. Some unauthorized collecting of rare plants may also occur. However, these effects have not been observed and, in general, potential effects of these activities on special status plants are likely to be infrequent, localized, and limited in extent.

Duke Energy proposes several enhancement measures at its project recreation sites, which could disturb special status plant species, if present. However, based on results of botanical surveys, the only project access areas known to support special status plants are the Fall Creek Access Area and Devils Fork State Park. The proposed RMP specifically addresses management of Oconee bells at Fall Creek Access Area⁷⁷ and

⁷⁷ See section 4.2 of the RMP.

Devils Fork State Park.⁷⁸ At these recreation sites Duke Energy would prohibit activities that could adversely affect known sites of this species, classify shorelines harboring this species as Environmental or Natural, ensure that recreation facility development avoids this species, and provide appropriate signage for this species within the project boundary in proximity to project structures. The RMP also includes general measures to minimize the potential impacts of future recreation site/facility development on special status species. These measures include: (1) incorporating the SMP requirements associated with project access area shoreline classifications into its facility development plans to the extent practicable; (2) minimizing vegetation removal to the extent practical and maintaining natural habitat; and (3) using low impact development designs and construction practices to minimize effects of stormwater runoff and erosion. Implementation of these measures would minimize the potential adverse effects of project-related recreation development and activities on existing populations of Oconee bells and other special status and priority botanical species within the project boundary.

Wildlife

Project Operation

Effects of proposed project operation on wildlife would generally be limited to the zone of the fluctuating reservoir levels. Proposed project operation could result in temporary increases in terrestrial habitat connectivity. Since the mid-1990s, Lake Keowee drawdowns have generally been limited to 794.6 feet to support the operation of ONS. Under proposed project operation, Lake Keowee may be drawn down to 790 feet during severe extended droughts. Several islands in Lake Keowee are narrowly isolated from adjoining islands or the mainland. During reservoir drawdowns, these islands are temporarily connected by exposed land bridges, and these bridges could be traversed by local wildlife otherwise confined to the islands. Species most likely to benefit from these drawdowns include terrestrial invertebrates unable to swim or fly across the normally inundated areas. With sustained drawdowns, emergent wetland or meadow habitats may develop on these land bridges, providing habitat corridors between islands and increasing gene flow between sub-populations.

Even though topography in Lake Jocassee differs considerably from that in Lake Keowee, an extended drawdown would have similar effects in both reservoirs. One such area is the upper Toxaway River arm. During extended droughts, this large flat has historically been dewatered, allowing the colonization of upland vegetation.

⁷⁸ See section 3.2 of the RMP.

During extended low-water periods associated with droughts, exposed reservoir banks may develop emergent wetland and herbaceous grassland/meadow habitat. These areas would provide additional habitat for small mammals, reptiles, and amphibians common in the project area. Moist meadows could also provide nesting cover for ducks, geese, and other ground-nesting birds. Vegetation, flowers, and seeds provide foraging opportunity for a variety of wildlife and also attract insects, which are preyed upon by birds, bats, and small mammals. Consequently, during low-water periods, these areas provide benefits to local wildlife. As drought conditions subside and reservoirs return to higher elevations, these habitats would be inundated, forcing wildlife to relocate to higher elevations. Rising water levels could inundate nests and burrows, potentially drowning some individuals or lowering reproductive success. However, water levels would be raised at rates conducive to wildlife relocation, and such incidents are expected to be rare. On a population scale, these effects would be minor, infrequent, and similar to existing effects under current operation. These effects would also be consistent with those of naturally occurring lacustrine habitats during drought conditions.

Project Maintenance and Shoreline Management

Effects of project maintenance on wildlife are generally limited to those associated with landscape maintenance in the immediate vicinity of project facilities and project recreation sites as well as vegetation management by adjacent landowners. There are no project transmission lines or associated rights-of-way. As under the existing license, landscape maintenance under proposed project operation would create increased noise levels that could disturb some species; however, these activities would be limited in duration and are consistent with existing practices. Wildlife species occurring in these areas are likely accustomed to human-generated noise, so effects would be minimal. Vegetation maintenance conducted along project shorelines by adjoining landowners is governed by the SMP, as discussed above. Such vegetation management could affect wildlife occurring in the immediate vicinity, resulting in nest disturbance, noise disturbance, and changes in localized habitat. These effects would likely be limited to individuals and are not expected to measurably affect local wildlife populations or dispersal patterns.

Special Status Wildlife Species

Potential habitat for special status wildlife species occurs within the project boundary. Project operation, maintenance and shoreline management, and project-related recreation could affect special status wildlife species by disturbing, altering, or eliminating habitat. Duke Energy does not propose any specific measures to protect

special status wildlife species.⁷⁹ However, Duke Energy's proposed SMP contains measures that protect native vegetation within the project boundary which would benefit wildlife in the project area.

Our Analysis

Project Operation

Special status wildlife species most likely to be affected by project operation include meadow jumping mouse, meadow vole, least weasel, and eastern spotted skunk. None of these species were recorded during the mammal survey study, and no historical record exists documenting their occurrences within the project boundary. However, if these mammal species were to colonize wet meadows that develop during low-water periods, there is potential for adverse effects during the subsequent rise in reservoir elevations. Least weasel and eastern spotted skunk would be the least likely to suffer these effects because these species are larger, more mobile, and less likely to construct nests or burrows in the temporary meadows. Meadow jumping mouse and meadow vole would be more likely to construct long-term residences in these areas. Rising water levels could flood burrows, causing injury and/or mortality to individuals and young, depending on the seasonality and rate of flooding. However, neither of these species has been reported to occur in the study area or within the project boundary.

The only other special status species potentially in wet marshes and meadows within the project boundary and subject to being impacted by rising reservoir elevations following a drought could be northern cricket frog. This species is at low risk of injury or disturbance during habitat inundation because it is accustomed to living at the edge of terrestrial and aquatic environments. Depending on the season of inundation, egg masses could potentially be disturbed, causing temporary reductions in reproduction success. Tadpoles and adults would relocate as water levels rise, so they are not expected to be affected. No effects of proposed project operation are expected in upland areas where the remaining special status species identified in tables 3-11 and 3-12 are likely to occur.

Project Maintenance and Shoreline Management

⁷⁹ Duke Energy's proposed Habitat Enhancement Program is intended to provide opportunities for resource agencies and other stakeholders to create, enhance, and protect aquatic and wildlife habitat within and outside of the project boundary. However, Duke Energy's role in the program would be to collect and manage its funding, and therefore it is proposed as an off-license measure and is not analyzed in this EA as part of the licensing proposal.

Project maintenance and shoreline management activities, including tree trimming, brush removal, trail construction, and construction of water access facilities, have potential to disturb special status wildlife species occurring in the immediate vicinity. These activities have the potential to change existing habitat conditions by increasing sunlight, changing drainage patterns, or changing the structure or composition of vegetation cover. Construction or vegetation maintenance could also disturb nests, burrows, or refugia; create noise disturbance; or cause direct injury to individuals.

To minimize the potential effects of shoreline maintenance on special status wildlife species, Duke Energy proposes to implement its proposed SMP which restricts activities that might adversely affect important wildlife habitat values along project shorelines through its shoreline classifications and permitting program. In addition, the removal of woody debris from Lake Jocassee shorelines, as required under the existing license, would be discontinued. Leaving woody debris in place would provide additional habitat complexity, creating cover for species along Lake Jocassee shoreline. Implementing these proposed measures would enhance wildlife habitat and minimize potential effects of ongoing project maintenance and shoreline management on special status wildlife species.

Recreation

Duke Energy evaluated project recreation sites during relicensing to document the presence of special status wildlife species. Special status bat species, including the little brown bat and tricolored bat, were recorded in the vicinity of the Cane Creek, Keowee Town, and Fall Creek Access Areas, and Devils Fork State Park. Bald eagles and woodland jumping mice were also observed within the Cane Creek drainage. Boating, hiking, and camping all have the potential to create noise disturbance for special status wildlife species in the immediate vicinity and could result in temporary relocation or interruptions in foraging activities. Duke Energy also proposes several enhancements to project access areas. Construction activities in these areas, including removal of trees and ground cover, could disturb or injure special status wildlife species, if present.

No evidence exists to indicate recreation at the project has adversely affected special status wildlife species over the term of the existing license. Under a new license, effects from project-related recreation on special status wildlife are expected to be minor and similar to existing conditions.

To minimize potential for disturbance to special status wildlife species during construction of recreation enhancements, Duke Energy's proposed RMP includes the following measures: (1) minimizing vegetation removal to the extent practical; (2) maintaining natural habitat integrity; (3) using shielded lighting where lighting is provided; and (4) using low impact development designs to minimize effects of stormwater runoff and erosion. Implementation of these measures would minimize the

potential adverse effects of project-related recreation development and activities on wildlife, including special status species that may use habitat within the project boundary.

3.3.3.3 Cumulative Effects

Operation of the project and the Bad Creek Project would result in daily and seasonal fluctuations in water levels that may affect riparian areas around the perimeter of the reservoirs. These reservoirs also influence land use patterns in the watershed by attracting residential and commercial development, recreation use, and associated transportation infrastructure. The operation of hydroelectric and nuclear generating facilities in the watershed also requires periodic clearing and maintenance of transmission corridors. Such development and maintenance activities require the clearing of vegetation and can result in the conversion of wildlife habitat from deciduous forest to higher intensity land uses due to the higher density of human activity and human influence.

Modifications to hydrologic flow regimes and changes in land use have cumulative effects on terrestrial habitats and special status species. Reservoirs, roads, transmission line corridors, recreation facilities, and commercial and residential development create breaks in contiguous forest habitat, increasing habitat fragmentation. In addition to effects on common wildlife species, habitat fragmentation can affect special status interior forest species, including black bear, woodland jumping mouse, woodrat, and brown creeper. Vegetation removal associated with commercial and residential development and potential erosion associated with reservoir fluctuations can create habitat conditions suitable for colonization and spread of non-native invasive plants.

Duke Energy's proposed measures, including implementation of the proposed SMP and shoreline stabilization would reduce potential for the project to contribute to cumulative effects on terrestrial resources. The SMP regulates where and how development occurs within the project boundary, preserving existing forested habitat along the shoreline and ensuring that development does not affect areas supporting special status botanical and wildlife species, as well as wetlands and priority wildlife habitats.

3.3.4 Threatened and Endangered Species

3.3.4.1 Affected Environment

In 2012, Duke Energy prepared a list of rare species, including state and federally listed species, using literature reviews, natural heritage/resource agency databases, habitat type maps, and agency consultations and then conducted a series of seasonal botanical, mammal, avian, fishery, and wetland surveys in an effort to document any occurrences of federally listed species with the project study area. No federally listed threatened or

endangered species were found during Duke Energy's 2012 studies. While no federally listed aquatic species are known to occur in the project area, three terrestrial species—the endangered rock gnome lichen, smooth coneflower, and Indiana bat—are known to occur in the vicinity of the project but have not been observed in the project boundary.

On April 3, 2015, DOI filed a letter which referenced a complete list of federally endangered and threatened species⁸⁰ known from Oconee and Pickens Counties, South Carolina, and Transylvania County, North Carolina. In addition to rock gnome lichen, smooth coneflower, and Indiana bat, Interior/FWS's list of species known to these counties includes the endangered Appalachian elktoe, persistent trillium, mountain sweet pitcher plant, spreading avens, black-spored quillwort, gray bat, and Carolina northern flying squirrel, as well as the threatened small whorled pogonia, dwarf-flowered heartleaf, swamp pink, Virginia spiraea, northern long-eared bat, and bog turtle. The following discussion addresses federally listed species with the potential to occur in the project area.

Aquatic Species

Appalachian Elktoe

Appalachian elktoe is a relatively thin-shelled freshwater mussel typically found in medium-sized streams with cool, clean, well-oxygenated, shallow, and moderate- to fast-moving water. This species is thought to be relatively sessile with only limited movement through its preferred stream substrates, including gravel, cobbles, and boulders or in bedrock cracks, unless dislodged during floods. Substrate stability is a critical factor for this species and it also prefers mostly silt-free conditions. Primary dispersal of this species occurs after glochidia are released by females into the water column, attach to their host fish during a short parasitic stage, and then fall off into new habitat. Possible host fish species include banded and mottled sculpins (NatureServe, 2015).

Historically, Appalachian elktoe occurred in most of the upper Tennessee River system in North Carolina. Extant populations are now very small and separated by large impoundments. Currently, this species occupies short sections of the Little Tennessee River near Franklin, North Carolina, the Toe River, and the mainstem of the Nolichucky River in North Carolina and Tennessee. Ongoing threats to this species include habitat alteration, fragmentation, and loss associated with impoundments, channelization, mining and dredging, pollution, siltation, drought condition, and loss of glochidial host

⁸⁰ The referenced species list was not attached to the electronic version of DOI's April 3, 2015 letter, but was subsequently filed by FWS on August 5, 2015.

(NatureServe, 2015). FWS has designated critical habitat for Appalachian elktoe, but none of it occurs within the Keowee-Toxaway Project area (FWS, 2015a).

Terrestrial Species

Rock Gnome Lichen

Rock gnome lichen⁸¹ is an endemic of the southern Appalachian Mountains and occurs only in areas of high humidity, such as on high-elevation vertical rock faces frequently shrouded in fog or in deep river gorges. It grows in dense colonies with typically small, overlapping scale-shaped lobes called squamules and appears to prefer areas with some canopy cover or other protection from direct sunlight if growing on south- or west- facing rocks. Colonies of rock gnome lichen appear to spread clonally. Much about this organism's life history is still unknown, including growth rates, means of dispersal, what constitutes a genetic individual, as well as the cause(s) of population declines and extirpations. However, some known threats include collection, logging, and habitat disturbance associated with hikers and climbers. Other threats may include indirect effects of exotic insects and air pollution. FWS has not designated critical habitat for this species (FWS, 1997).

Smooth Coneflower

Smooth coneflower is a rhizomatous perennial herb that grows to a height of about 4.5 feet with smooth stems, few leaves, and pink to purplish flowers. This species flowers from May to mid-July and fruits from late-June to September. Preferred habitats include openings in woods, such as cedar barrens and clear cuts, along roadsides and utility line rights-of-way, and on dry limestone bluffs. There are approximately 20 populations of smooth coneflower in a narrow band from Georgia, through North Carolina and South Carolina to Virginia. Ongoing threats include habitat loss and degradation from agriculture, silviculture, residential and industrial development, highway construction and maintenance, and collection for medicinal purposes (NatureServe, 2015). FWS has not designated critical habitat for this species (FWS, 2015a).

⁸¹ Lichens are symbiotic associations between a fungus and an algae or cyanobacteria. The algae produces food for the fungus through photosynthesis and the fungus gathers moisture and nutrients from the environment and provides the algae a protected space (i.e., within the filaments of the fungus).

Persistent Trillium

Persistent trillium is a narrowly endemic perennial herb found only within a four square mile area at Tallulah Gorge, with six subpopulations in Georgia and one in Oconee County, South Carolina. This species grows in mixed hemlock-pine-deciduous forests, typically on steep slopes or along streams near rhododendrons. It requires 7 to 10 years to produce a mature, 3-leaved, flowering plant. Single, pink flowers bloom from mid-March to mid-April just above a whorl of three leaves at the top of the stem. It is thought that the population was once contiguous within its watershed and that dams and reservoirs flooded former habitat and fragmented the population. Ongoing threats include logging, construction, trampling, collection, and other activities that cause habitat disturbance. In addition, it does not compete well with non-native invasive plants such as Japanese honeysuckle, which often become established after vegetation and/or soil disturbing activities (NatureServe, 2015). FWS has not designated critical habitat for this species (FWS, 2015b).

Mountain Sweet Pitcher Plant

Mountain sweet pitcher plant is an insectivorous perennial herb that is endemic to a few mountain bogs near seeps or waterfalls on both sides of the Blue Ridge in southwest North Carolina and northwest South Carolina. This species has green waxy leaves with maroon/purple veins and a single maroon and yellow nodding flower above a vase-shaped pitcher. Flowers bloom in spring and attract insects, some of which may feed on, live inside of, or fall into the pitchers and decay. This species may use the decaying insects as a source of micronutrients. Pollinator(s) are unknown but may include bumblebees. Seeds are dispersed via water. Mountain sweet pitcher plant can also reproduce vegetatively via rhizome fragments (NatureServe, 2015).

Known populations of mountain sweet pitcher plant include four in the French Broad River drainage in Henderson and Transylvania Counties, North Carolina; five in the Saluda River drainage in Greenville County, South Carolina; and one in the Enoree River drainage also in Greenville County, South Carolina. Ongoing threats to this species include habitat disturbances associated with impoundments, agriculture, development, collection, and ecological succession that could be a result of fire suppression, elimination of natural grazers, or absence of beaver activity (NatureServe, 2015). FWS has not designated critical habitat for this species (FWS, 2015c).

Spreading Avens

Spreading Avens is a perennial herb with showy, yellow flowers and large basal rosettes of leaves that grows primarily in crevices of northwest facing cliffs or bases of talus slopes. Reproduction is primarily vegetative. This species only occurs at elevations above 1310 meters in the southern Appalachian Mountains of Tennessee and North Carolina. Ongoing threats to spreading avens include human disturbance by trampling,

horticultural collection, rock climbing, and ski slope development. Other potential threats may include drought, acid precipitation, and other forms of pollution (NatureServe, 2015). FWS has not designated critical habitat for this species (FWS, 2015d).

Black-Spored Quillwort

Black-spored quillwort is a perennial fern ally that grows in temporary granite outcrop pools historically known to occur in Georgia and South Carolina. The pools are small depressions that usually contain about 2 centimeters of soil and may dry out during the summer. While other quillworts produce whitish spores, this species produces dark megaspores in early May to June. It appears that the only extant populations occur in Georgia. Ongoing threats include habitat destruction due to quarry operations, trash dumping, and disturbances related to recreation (NatureServe, 2015). FWS has not designated critical habitat for this species (FWS, 2015e).

Small Whorled Pogonia

Small whorled pogonia is an herb in the orchid family that grows in acidic, humus-rich soils, among mature beech, birch, maple, oak, hickory and sometimes hemlock and other softwood trees. It prefers forests with an open understory and is often found on slopes close to small streams. This species is named for the five- to six-leaf whorl topping the stem just below its greenish yellow flower(s) which bloom between mid-May to mid-June and last a few days to a week. While individuals of this species may not flower every year, when flowering, it appears to self-pollinate. Pollinated flowers form capsules with several thousand to over 9,000 tiny dust-like seeds per plant. However, this seed production is considered to be low to moderate and known populations are composed of less than 20 plants. Threats to the species include habitat loss and/or degradation due to urbanization and recreational activities and collection for commercial horticulture, research, or personal use (FWS, 2014; Center for Plant Conservation, 2010). Although it is widely distributed among 86 sites spread across 15 states and Ontario, Canada, it is rare throughout its range and has been extirpated from 13 to 15 sites and approximately 40 other sites are considered historical occurrences (FWS, 1992). FWS has not designated critical habitat for this species (FWS, 2015f).

Dwarf-Flowered Heartleaf

Dwarf-flowered heartleaf is a low-growing, perennial herbaceous species that is endemic to the western upper Piedmont of North and South Carolina. This species often grows in association with laurel or paw paw at the base of trees in dry to mesic oak-hickory-pine forests. Potentially suitable habitat includes acidic, sandy loam soils on north-facing slopes of ravines, bluffs, and hillsides in boggy areas adjacent to creeks and streams. Dwarf-flowered heartleaf flowers in April and May. Flies and other insects pollinate the small, jug-shaped flowers which are inconspicuous under the leathery,

evergreen leaves and/or forest leaf litter. Ants are thought to be this species' primary seed dispersal mechanism; however, existing plants also spread vegetatively via rhizomes below the soil surface. Ongoing threats to this species include habitat degradation and fragmentation, including that caused by forest management practices (NatureServe, 2015). FWS has not designated critical habitat for this species (FWS, 2015g).

Swamp Pink

Swamp pink is a perennial herb that grows in various high elevation, groundwater-influenced swamps, bogs, and/or stream headwaters with a stable water table at or near ground level and dominated by Atlantic white cedar, red maple, and mixed hardwood-evergreen trees. This species has evergreen leaves and showy clusters of pink flowers that bloom April through June, and are prolific seed producers, but usually only a few plants in a population flower and seeds are only viable for about two weeks. Seed dispersal may occur by gravity, wind, water, and/or ants. Swamp pink can also reproduce vegetatively via rhizomes. It tolerates some shade and may require some canopy to limit growth and competition with other plants. The majority of the extant populations occur in the Appalachian Mountains in New Jersey, with others in Delaware, Maryland, Virginia, North Carolina, South Carolina, and Georgia. The primary ongoing threat is direct or indirect habitat degradation from development and subsequent changes to the hydrological regime. Other threats include reduced water quality, trash, non-native invasive species, all-terrain vehicles, deer herbivory, trampling, collection, and potential for increased droughts (NatureServe, 2015). FWS has not designated critical habitat for this species (FWS, 2015h).

Virginia Spiraea

Virginia spiraea is a clonal shrub endemic to the southern Appalachian Mountains. This species grows in clumps, often among boulders and rock outcrops, along steep, periodically flood-scoured riparian areas with active erosion and deposition of sandy or clay soils. In June or July it may produce profuse clusters of small white flowers, but rarely produces seeds and primarily spreads vegetatively. While Virginia spiraea is widely distributed, it is rare with low genetic variability throughout its range which includes Ohio, West Virginia, Virginia, Kentucky, Tennessee, North Carolina, and Georgia. Among the threats to this species are a small number of isolated populations, lack of sexual reproduction, alterations in flooding regimes, clearing or disturbance of riparian vegetation, impacts from recreational activities, competition with non-native invasive plants, roadside and other rights-of-way maintenance activities, and damage from deer browse and beaver activity (NatureServe, 2015). FWS has not designated critical habitat for this species (FWS, 2015i).

Carolina Northern Flying Squirrel

Carolina northern flying squirrel's range spans northern North America from Alaska east to Labrador and southward in the Sierra Nevada and Rocky Mountains to southern California and Utah, Black Hills, and south from the Appalachian Mountains to eastern Tennessee and western North Carolina. This species distribution in the southern U.S. is patchy because it is restricted to rugged, high elevation conifer and mixed conifer-hardwood forests. In North Carolina, suitable habitat is found in the northern portion of Jackson and Transylvania Counties, within the mixed spruce-fir and northern hardwood forests of the southern Appalachian Mountains above 2000 feet elevation. No critical habitat has been designated for Carolina northern flying squirrels (FWS, 2015m).

Indiana Bat

Indiana bat is a temperate, insectivorous, migratory bat that hibernates colonially in caves and mines in the winter. Only a few limestone caves in Indiana, Kentucky, and Missouri harbor over half of the population of this species during hibernation. Spring migration to new habitat occurs from mid-March to mid-May. During spring months, females migrate, forming maternity colonies to raise their young in wooded areas. Males and non-reproductive females remain near winter hibernation sites during the spring or migrate to summer habitat. Summer colony roosts are typically located behind thick slabs of exfoliating bark of large, often dead, trees (typically greater than 5 inches diameter at breast height [dbh]) such as shagbark hickory and oaks. Individuals roost in similar smaller trees (as small as 3 inches dbh). Preferred roosting habitat is usually located within canopy gaps, along fence lines, and along wooded edges. Indiana bats typically roost in riparian zones, forested wetlands, and upland communities, and forage along forested edges and within forested and riparian areas. Between mid-August and mid-October, males and females return to their winter hibernation habitat (FWS, 2007).

Indiana bat is found in the eastern half of the United States, ranging from Florida north to Vermont extending as far west as Eastern Oklahoma. No occurrences of this species are known in South Carolina and the nearest records in North Carolina are from Jackson, Macon, and Haywood Counties. While the FWS has designated critical habitat for Indiana bat, it occurs outside of North and South Carolina. Ongoing threats to this species include human disturbance during hibernation, loss of mature trees for roosting due to deforestation, and mortality from white-nose syndrome, a fungal infection currently affecting many bat species.

Gray Bat

Gray bats are small—approximately 5-inches-long and with a wingspan of 11 to 13 inches. This species is characterized by its grayish-brown fur and slightly wooly appearance. Gray bats occupy caves year-round although they migrate to different caves during the summer and winter months. Prey includes a variety of small, night-flying

insects and preferred feeding grounds include wetlands and forested areas. FWS issued a recovery plan for this species on July 8, 1982. Threats to gray bats include habitat destruction and human modification through activities such as deforestation, chemical pesticides, and improper gating of caves (FWS, 1982). No critical habitat has been designated for gray bats (FWS, 2015j).

Northern Long-Eared Bat

Northern long-eared bat is a medium-sized migratory bat species with longer ears (average 17 millimeters mm or 0.7 inches) than other *Myotis* species. While foraging, this species uses high frequency echolocation to hawk⁸² and glean⁸³ moths, beetles, spiders, flies, and leafhoppers primarily between the understory and canopy in forested areas, but also in more open areas such as forest clearings, over water bodies, and along roads starting at dusk. During the winter, small groups of northern long-eared bats typically hibernate in cracks and crevices in the walls or ceilings of caves or abandoned mines with high humidity, cool temperatures, and no air currents, but this species has also been observed hibernating in buildings, railroad tunnels, and other man-made structures. Every two to three days during the summer, individuals or colonies switch roosts, which can include a wide variety of live and dead tree species and sizes, as well as the nooks and crannies of man-made structures. Northern long-eared bats breed from late July to October, but females store sperm during hibernation, delaying fertilization (i.e., of a single egg) until ovulation during the spring. Pups are typically born between late May and July and are raised in maternity colonies of 30 to 60 individuals,⁸⁴ and are most vulnerable to disturbances at maternal roosts before they learn to fly,⁸⁵ from 18 to 21 days after birth.⁸⁶

While northern long-eared bats' range includes much of the eastern and north central United States and all Canadian provinces west to the southern Yukon Territory and eastern British Columbia, its distribution is patchy and historically it has been

⁸² Hawking is a foraging technique in which predators catch and consume prey while in flight.

⁸³ Gleaning is a foraging technique in which predators pick prey from leaves and other surfaces.

⁸⁴ 78 Federal Register 61051, 61054-61058 (October 2, 2013).

⁸⁵ 80 Federal Register 2374 (January 16, 2015).

⁸⁶ 78 Federal Register 61057 (October 2, 2013).

observed more frequently in the northeastern United States and in Quebec and Ontario, Canada. There are recent records of this species in the Blue Ridge portion of Oconee, Pickens, and Greenville Counties, South Carolina, but these occurrences indicate a potential preference for forested habitats at higher elevations than those found within the Keowee-Toxaway Project boundary. No critical habitat has been designated for northern long-eared bats (FWS, 2015l).

Bog Turtle

With a carapace length of approximately 4 to 4.5 inches, bog turtles are one of the smallest North American turtles. This species usually occurs in small, discrete populations in wetlands that have several micro-habitats, including flooded areas, dry areas, and saturated areas that provide foraging, breeding, hibernating, basking, and shelter areas. Wetlands are variable by type, but are often small, open-canopy, herbaceous sedge meadows or fens with thickly vegetated or wooded borders. Denser vegetation provides shelter and hibernation habitat. Cattle pastures can also provide habitat for bog turtles because light grazing maintains some open areas/early succession vegetation in wetlands. Bog turtles feed primarily on insects, slugs, and earthworms, and, on occasion, crayfish, frogs, and vegetation. They lay eggs in the spring in cavities that they dig and then backfill, or on raised mounds of grass or sedges devoid of woody shrubs and generally sparsely vegetated. Females may lay their eggs on grass mounds in close proximity, clustering their nests within small nursery areas. Populations of bog turtles have declined due to loss, fragmentation, and degradation of habitat, incidental mortality (crossing roads), as well as loss of adults from wild populations to illegal wildlife trade (FWS, 2001). FWS has not designated critical habitat for bog turtles (FWS, 2015n).

3.3.4.2 Environmental Effects

Given that no federally listed species have been documented within the Keowee - Toxaway Project study area, Duke Energy does not currently propose any specific measures to protect federally listed species. However, in the Relicensing Agreement, Duke Energy proposes to develop formal species protection plans for any federally listed species that are identified in the project area in the future. In addition, Duke Energy's proposed SMP contains measures to protect and enhance existing habitat for native species within the project boundary.

FWS recommends the development of species protection plans for federally listed species potentially affected by the project and implementation of the SMP to protect special status species and natural communities. FWS requests that the Commission assess potential project-related impacts to all federally listed species as well as any designated critical habitat known to occur in Transylvania County, North Carolina, and Oconee and Pickens Counties, South Carolina.

*Our Analysis***Appalachian Elktoe**

Appalachian elktoe is not known to occur within the Keowee-Toxaway Project area of influence. In addition, there is no potential habitat for this species within the project boundary. If occurrences of Appalachian elktoe are identified within the project area of influence in the future, Duke Energy would develop a species protection plan to address any potential effects, including those associated with project operation and maintenance. Given their absence from the project area and lack of actions that might affect the species, we conclude that relicensing the project would have no effect on Appalachian elktoe.

Rock Gnome Lichen

The closest population to the project is less than one mile north of the project boundary below Windy Falls on the Horsepasture River in North Carolina. However, Windy Falls is within Gorges State Park, outside of the project boundary, and well above the normal full pond elevation. No effects of project operation or maintenance would occur in habitat for rock gnome lichen. Recreation activities in the vicinity of the existing Windy Falls population are regulated by the state park.

If occurrences of rock gnome lichen are identified within the project area of influence in the future, Duke Energy would develop a species protection plan to address any potential effects, including those associated with recreation within the project boundary. Additionally, Duke Energy's implementation of the vegetation management measures in its SMP would be protective of native botanical species and minimize indirect effects related to habitat disturbances within the project boundary. Given the lack of project-related activities that might affect this species, we conclude that relicensing the project would have no effect on rock gnome lichen.

Smooth Coneflower

Historically, smooth coneflower was known to occur near old Keowee Town, a location inundated following construction of the project. No extant populations are known to occur within the project boundary. While suitable habitat for this species may be present in upland areas adjacent to project lands, operation and maintenance of the project is not expected to have any effect on upland areas where this species could occur. If this species is found within the project boundary in the future, Duke Energy would develop a species protection plan to address any potential project-related effects, including those associated with vegetation management. Additionally, Duke Energy's implementation of the vegetation management measures in its SMP would be protective of, and benefit native vegetation within the project boundary. Therefore, we conclude that relicensing the project is not likely to adversely affect smooth coneflower.

Persistent Trillium

Persistent trillium is known from Oconee County, South Carolina, and potentially suitable habitat may occur in mixed hemlock-pine-deciduous forests in the vicinity of the project, but this species was not found within the study area during Duke Energy's 2012 surveys. If this species is identified within the project boundary in the future, Duke Energy would develop a species protection plan to address any potential project-related effects including the potential for trampling and collection by recreationists. Potential encroachment of non-native invasive plants on future occurrences of this species would also be addressed through implementation of the vegetation management measures in Duke Energy's SMP. We conclude that relicensing the project would not affect persistent trillium.

Mountain Sweet Pitcher Plant

Potentially suitable habitat for mountain sweet pitcher plant may occur in the project vicinity. However, there are no known occurrences of this species in the project boundary or within the project area of influence. Mountain sweet pitcher plant was not found during Duke Energy's 2012 surveys. If identified within the project boundary in the future, Duke Energy would develop a species protection plan to address any potential project-related effects to this species, including the potential for collection by recreationists. Additionally, implementation of the vegetation management measures in Duke Energy's SMP would protect native vegetation and habitat within the project boundary from disturbances related to development in the watershed. Therefore, we conclude that relicensing the project would not affect mountain sweet pitcher plant.

Spreading Avens

Spreading avens is known to occur in Transylvania County, North Carolina, but this species only occurs at elevations above 1310 meters. Potentially suitable habitat for this species does not occur within the project area of influence. In the event that occurrences of spreading avens are identified within the project boundary in the future, Duke Energy would develop a species protection plan to address any potential project-related effects to this species, including the potential for trampling or collection by recreationists. Additionally, implementation of the vegetation management measures in Duke Energy's SMP would protect native vegetation and habitat within the project boundary. We conclude that relicensing the project would not affect spreading avens.

Black-Spored Quillwort

FWS' list of at-risk, candidate, endangered, and threatened species for Pickens County, South Carolina includes black-spored quillwort, but this may be a historical occurrence since it appears that the only extant populations occur in Georgia. This species was not found during Duke Energy's 2012 surveys. Nevertheless, Duke Energy's

proposal to develop a protection plan for any federally listed species that may be identified within the project boundary in the future, would address any potential project-related effects to black-spored quillwort, including the potential for disturbances related to recreation. Additionally, implementation of the vegetation management measures in Duke Energy's SMP would protect native vegetation and habitat within the project boundary. Therefore, we conclude that relicensing the project would not affect black-spored quillwort.

Small Whorled Pogonia

Small whorled pogonia is known to occur in Transylvania County, North Carolina, and Oconee County, South Carolina, and potentially suitable habitat may occur in the mixed hardwood-coniferous forests in the vicinity of the project. However, this species was not found within the study area during Duke Energy's 2012 surveys. If identified within the project boundary in the future, Duke Energy would develop a species protection plan to address any potential project-related effects to small whorled pogonia, including the potential for habitat degradation during recreational activities. Additionally, implementation of the vegetation management measures in Duke Energy's SMP would protect native vegetation and habitat within the project boundary. We conclude that relicensing the project would not affect small whorled pogonia.

Dwarf-Flowered Heartleaf

FWS' list of at-risk, candidate, endangered, and threatened species for Pickens County, South Carolina includes dwarf-flowered heartleaf. Other sources define the known range of this species as Polk, Rutherford, Cleveland, Lincoln, Burke, Catawba, Caldwell, and Alexander Counties, North Carolina, and Greenville, Spartanburg, and Cherokee Counties South Carolina (NatureServe, 2015; USDA, 2015). Potentially suitable habitat for dwarf-flowered heartleaf may occur in the mixed hardwood-coniferous forests in the vicinity of the project, but it was not found during Duke Energy's 2012 surveys. If identified within the project boundary in the future, Duke Energy would develop a species protection plan to address any potential project-related effects to this species. Additionally, implementation of the vegetation management measures in Duke Energy's SMP would protect native vegetation and habitat within the project boundary. Therefore, we conclude that relicensing the project would not affect dwarf-flowered heartleaf.

Swamp Pink

Swamp pink is known to occur in Transylvania County, North Carolina, and potentially suitable habitat may occur in the mixed hardwood-coniferous forests in the vicinity of the project. However, this species was not found within the study area during Duke Energy's 2012 surveys. If identified within the project boundary in the future, Duke Energy would develop a species protection plan to address any potential project-

related effects to swamp pink, including the potential for habitat degradation due to during project-related recreational activities. Additionally, implementation of the vegetation management measures in Duke Energy's SMP would protect native vegetation and habitat within the project boundary. We conclude that relicensing the project would not affect swamp pink.

Virginia Spirea

Virginia spiraea is known to occur in Transylvania County, North Carolina, and potentially suitable habitat may occur along steep, periodically flood-scoured riparian areas in the vicinity of the project. This species was not found within the study area during Duke Energy's 2012 surveys and because it rarely produces seeds, it is unlikely to spread to the project area unless transplanted. Nevertheless, if identified within the project boundary in the future, Duke Energy would develop a species protection plan to address any potential project-related effects to Virginia spiraea, including the potential for habitat degradation due to project operation and maintenance, or during project-related recreational activities. Additionally, implementation of the vegetation management measures in Duke Energy's SMP would protect native vegetation by minimizing disturbance of riparian habitat within the project boundary and monitoring and managing non-native invasive plants at project access areas. We conclude that relicensing the project would not affect Virginia spiraea.

Carolina Northern Flying Squirrel

FWS' list of at-risk, candidate, endangered, and threatened species for Transylvania County, North Carolina, includes Carolina northern flying squirrel, but this species has not been documented in South Carolina or within the Keowee-Toxaway Project boundary. Suitable mixed spruce-fir and northern hardwood forest habitat above 2000 feet elevation occurs outside of the study area in northern Jackson and Transylvania Counties, North Carolina. Given the lack of project-related activities that might affect this species, we conclude that relicensing the project would have no effect on Carolina northern flying squirrels.

Indiana Bat

FWS' list of at-risk, candidate, endangered, and threatened species for Oconee County, South Carolina includes Indiana bat. This species was not among the bats recorded during Duke Energy's bat surveys in 2012. Although suitable foraging and roosting habitat for Indiana bat may be present in the project area, there is no evidence that this habitat is being used. Riparian areas with potential roosting and foraging habitat could be disturbed if vegetation management activities permitted under Duke Energy's SMP are conducted during late spring or summer or if a hazardous tree must be trimmed or removed to protect life and/or property. When evaluating permit applications for vegetation management, Duke Energy could consider the effects to potential habitat by

reviewing shoreline classifications and cover type maps. Duke Energy could also inspect the area of proposed vegetation management to determine the presence/absence and quality of potential roosting habitat for bats. If bats are observed or potentially suitable bat roosting habitat would be disturbed, Duke Energy could deny the permit application or avoid potential disturbance by ensuring that the proposed (i.e., non-emergency) vegetation management activities would be conducted from fall to early spring to avoid potential effects. If Indiana bats are documented occupying habitat within the project boundary in the future, Duke Energy would develop a species protection plan to address any potential project-related effects to this species, including the potential for habitat disturbances related to vegetation maintenance within the project boundary. Implementation of the vegetation management measures in Duke Energy's SMP would also minimize disturbance of potential foraging and roosting habitat within the project riparian areas. We conclude that relicensing the project is not likely to adversely affect Indiana bats.

Gray Bat

FWS' list of at-risk, candidate, endangered, and threatened species for Transylvania County, North Carolina, includes gray bat. However this species was not among the bats documented during Duke Energy's bat surveys in 2012. Although lacustrine and riparian habitats suitable for gray bat foraging and roosting may be present in the project vicinity, there is no evidence that this habitat is being used by this species.

Potential gray bat habitat could be affected by project operation and vegetation management. Duke Energy would continue project operation, maintain riparian habitat consistent with its proposed SMP, and does not currently propose any specific measures for the gray bat. Proposed project operation would result in more stable reservoir levels under normal inflow conditions. Operating the project with slightly reduced reservoir fluctuations under normal conditions would maintain and enhance existing lacustrine and riparian habitats because the existing vegetation is adapted to this hydroperiod and would continue to develop under the similar proposed hydroperiod.

Forested uplands and riparian areas with potential roosting and foraging habitat could be disturbed if vegetation management activities permitted under Duke Energy's SMP are conducted during late spring or summer or if a hazardous tree must be trimmed or removed to protect life and/or property. Duke Energy could review shoreline classifications and cover type maps and consider potential effects to suitable spring and summer habitat for gray bats as part of its evaluation of adjacent land owners' permit applications to conduct vegetation management. Duke Energy could also inspect the area of proposed vegetation management to determine the presence/absence and quality of potential roosting habitat for bats. If bats are observed or potentially suitable bat roosting habitat would be disturbed, Duke Energy could deny the permit application or avoid potential disturbance by ensuring that the proposed (i.e., non-emergency) vegetation

management activities would be conducted from fall to early spring to avoid potential effects.

If gray bats are documented occupying habitat within the project boundary in the future, Duke Energy would develop a species protection plan to address any potential project-related effects to this species, including the potential for habitat disturbances related to vegetation maintenance within the project boundary. The vegetation management measures in Duke Energy's proposed SMP would also minimize disturbance of potential foraging and roosting habitat within the project riparian areas. We conclude that relicensing the project is not likely to adversely affect gray bats.

Northern Long-Eared Bat

FWS' list of at-risk, candidate, endangered, and threatened species for Transylvania County, North Carolina, as well as Oconee and Pickens Counties, South Carolina includes northern long-eared bat. While thought to be widely distributed in central North America, including the Blue Ridge portion of Oconee and Pickens Counties, South Carolina, this species was not documented during Duke Energy's bat surveys in 2012. Although suitable foraging and roosting habitat may be present in the project vicinity, there is no evidence that this habitat is being used by northern long-eared bats.

Forested uplands and riparian areas with potential roosting and foraging habitat could be disturbed if vegetation management activities permitted under Duke Energy's SMP are conducted during late spring or summer or if a hazardous tree must be trimmed or removed to protect life and/or property. Duke Energy could review shoreline classifications and cover type maps and consider potential effects to suitable spring and summer habitat for northern long-eared bats as part of its evaluation of adjacent land owners' permit applications to conduct vegetation management. Duke Energy could also inspect the area of proposed vegetation management to determine the presence/absence and quality of potential roosting habitat for bats. If bats are observed or potentially suitable bat roosting habitat would be disturbed, Duke Energy could deny the permit application or avoid potential disturbance by ensuring that the proposed (i.e., non-emergency) vegetation management activities would be conducted from fall to early spring to avoid potential effects.

If northern long-eared bats are documented occupying habitat within the project boundary in the future, Duke Energy would develop a species protection plan to address any potential project-related effects to this species, including the potential for habitat disturbances related to vegetation maintenance within the project boundary. The vegetation management measures in Duke Energy's proposed SMP would also minimize disturbance of potential foraging and roosting habitat within the project riparian areas. We conclude that relicensing the project is not likely to adversely affect northern long-eared bats.

Bog Turtle

FWS' list of at-risk, candidate, endangered, and threatened species for Transylvania County, North Carolina, and Pickens County, South Carolina, includes bog turtle. Potentially suitable wetland habitat may occur in the project area; however this species has not been documented within the project boundary.

Potential bog turtle habitat could be affected by project operation and vegetation management. Duke Energy would continue project operation, maintain riparian habitat consistent with its proposed SMP, and does not currently propose any specific measures for bog turtles. Proposed project operation would result in more stable reservoir levels under normal inflow conditions. Operating the project with slightly reduced reservoir fluctuations under normal conditions would maintain and enhance existing aquatic and riparian habitats including emergent and palustrine wetlands primarily found at Lake Keowee. The existing vegetation is adapted to the current hydroperiod and would continue to develop under the similar proposed hydroperiod. Additionally, under Duke Energy's proposed SMP, wetlands at the project would generally be classified as Environmental or Natural areas and thereby protected from development, vegetation management, and associated habitat disturbances.

If bog turtles are documented occupying habitat within the project boundary in the future, Duke Energy would develop a species protection plan to address any potential project-related effects to this species, including the potential for habitat disturbances related to project operation and vegetation maintenance within the project boundary. We conclude that relicensing the project is not likely to adversely affect bog turtles.

3.3.5 Recreation Resources

3.3.5.1 Affected Environment

Statewide Recreation Goals

The South Carolina State Comprehensive Outdoor Recreation Plan (SCORP) (2008) and North Carolina Outdoor Recreation Plan (2015) identify outdoor recreation issues of statewide significance and evaluate recreation needs. The SCORPs provide guidance on developing and expanding outdoor recreation opportunities to meet future recreation demand. Neither plan contains specific recommendations for recreation improvements within the project boundary. The South Carolina SCORP encourages the development of facilities for equestrian use, boating, walking, hiking, backpacking, and backpacking in urban and rural settings. The plan also advises protecting shorelines, making more waterfront land available for public use, and updating recreation plans to accommodate for future recreation needs (South Carolina DPRT, 2008). The North Carolina Outdoor Recreation Plan identifies goals to maintain and enhance outdoor recreation resources and support conservation of natural resources and landscapes (North

Carolina DENR, 2015). The South Carolina State Trails Plan also recommends measures to support trail development, promote public health through exercise, provide opportunities for a variety of trail uses and abilities, and provide access to public natural resources (South Carolina DPRT, 2002).

Regional Recreation Resources

Upstate South Carolina and western North Carolina are home to a wide variety of outdoor recreation resources including: fishing, boating (flatwater and whitewater), hiking, camping, picnicking, swimming, and scenic viewing. Federally-owned recreation areas include Great Smoky Mountains National Park and the Chattahoochee, Cherokee, Nantahala, Oconee, Pisgah, and Sumter National Forests. Two rivers, the Chattooga and the Horsepasture, are federally-protected Wild and Scenic Rivers managed by the Forest Service. Numerous state, county, and local governments also provide regional recreation facilities such as parks, playgrounds, picnic areas. Within 60 miles of the project, several large reservoirs provide recreational opportunities similar to the project, including Hartwell Lake, Lake Burton, Lake Rabun, Lake Glenville, and Lake Toxaway. Hartwell Lake, located immediately downstream of Lake Keowee, is a 56,000-acre reservoir with significant recreation development (e.g., campgrounds, boat ramps, commercial marinas, and state and municipal recreation areas) associated with the approximate 962 miles of shoreline and 23,500 acres of public land. Hartwell Lake is one of the five most-visited Corps reservoirs in the United States.

Outside of the project boundary, but adjacent to the project, Gorges State Park in North Carolina and Jocassee Gorges in South Carolina provide visitors with opportunities for hiking, camping, fishing, hunting, scenic and wildlife viewing, and boating (flatwater and whitewater). The Foothills Trail, a 77-mile long National Recreation Trail though Upstate South Carolina and western North Carolina passes near the project, providing day- and through-hiking opportunities with scenic views of the Appalachian foothills (Foothills Trail Conference, 2015). Four boat-in locations on Lake Jocassee provide access to the Foothills Trail (Toxaway River Foothills Trail Access, Horsepasture River Foothills Trail Access, Laurel Creek Foothills Trail Access, and Canebrake Trail Access, which also provides access to the 5-mile Canebrake Trail in Gorges State Park). Upstream of the project, the Wild and Scenic Horsepasture River and Toxaway River provide high-quality whitewater paddling opportunities.

Recreation within the Project Boundary

The project is home to a variety of public recreation facilities that complement the other outdoor recreation offerings in the region. Duke Energy, state, and local governments manage 16 public access areas and 4 boat-in trailheads at the project. The project reservoirs also support businesses such as outfitters, guide shops, and commercial marinas. Figure 3-15 depicts the locations of the project and non-project recreation

facilities providing access to Lake Jocassee and Lake Keowee. Islands within the reservoirs do not have developed recreation facilities, but they are available to the public by boat for day use.

Each of the project's reservoirs affords a different visitor experience. Lake Jocassee is characterized by mountainous terrain, minimal residential development, and few developed recreation areas. Visitors to Lake Jocassee often use motorized personal watercraft, but the natural setting and clear waters also afford quality recreation experiences for kayakers and scuba divers. Devils Fork State Park and Double Springs Campground provide cabins and camping locations for overnight visitors. The most popular recreation activities at Lake Jocassee are fishing and swimming from boats (Kleinschmidt, 2013).

The recreation experience at Lake Keowee is more developed, with much greater residential density along the shoreline, higher boating densities on the reservoir, and higher boating speeds. Commercial marinas support this high-density recreation use. Swim beaches and picnic areas provide day-use opportunities for visitors. Both public and privately-owned campgrounds provide for overnight use. The most popular activities at Lake Keowee are motor/power boating, fishing from boats, swimming/ sunbathing from shore, and swimming/sunbathing from boats. The islands in Lake Keowee may be used for day-use recreation; in 2012 approximately 5 percent of visitors and 25 percent of residents surveyed reported recreating on a project island (Kleinschmidt, 2013).

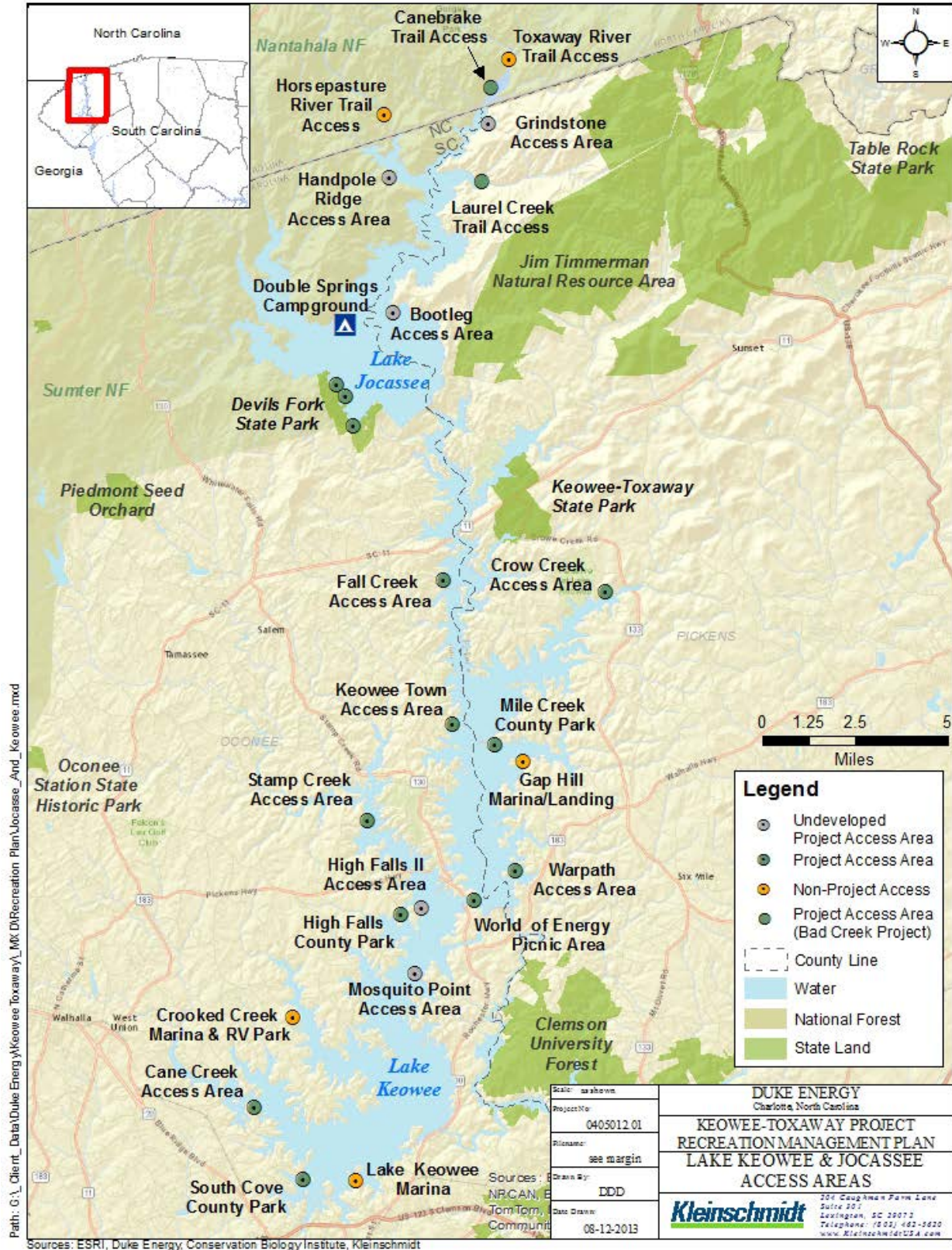


Figure 3-15. Public access to project reservoirs (Source: Duke Energy, 2014a).

Duke Energy's 2007 and 2012 RUN studies showed fairly similar trends in recreation use at both Lake Jocassee and Lake Keowee. The 2012 RUN Study indicated growth in passive recreation activities such as wildlife viewing, picnicking, nature hiking, and walking. These activities accounted for approximately 12 percent of project recreation use in 2012 (Kleinschmidt, 2013).

Project Recreation Facilities

Under its existing license, Duke Energy's Commission-approved RMP (2008 RMP) for the Keowee-Toxaway Project⁸⁷ identifies project recreation sites, which Duke Energy owns, operates, and maintains or owns and leases to third-parties to provide for operation and maintenance, as described in table 3-13. These recreation sites accommodate a wide variety of recreation amenities including flatwater boating, fishing, wildlife and scenic viewing, swimming, scuba diving, and recreational vehicle and tent camping. Developed recreation facilities at the project include boat ramps, campgrounds, picnic areas, and trails.

At the Jocassee Development, Duke Energy owns, and leases to the South Carolina DPRT, Devils Fork State Park and Double Springs Campground. Duke Energy also owns the undeveloped Bootleg, Grindstone, and Handpole Ridge Access Areas, which are reserved for future recreation development. Devils Fork State Park provides 7 boat ramps to access Lake Jocassee, which can provide access at reservoir levels of 1080 feet or greater.

At the Keowee Development, Duke Energy owns, operates, and maintains the Cane Creek, Crow Creek,⁸⁸ Fall Creek, Keowee Town, Stamp Creek, and Warpath Access Areas and World of Energy Picnic Area. Duke Energy owns, and leases to Oconee County, High Falls and South Cove County Parks. Duke owns, and leases to Pickens County, Mile Creek County Park. Nine access areas provide boat ramps for accessing Lake Keowee. The minimum reservoir elevations for boat ramp operations are provided in table 3-14, below.

⁸⁷ 132 ¶ FERC 62,045 (2010).

⁸⁸ Crow Creek Access Area is owned, operated, and maintained by Duke Energy. Most of the site is currently located outside the project boundary; however, it was included in Duke Energy's 2008 RMP. Duke Energy proposes to modify the project boundary to include Crow Creek Access Area as a project recreation site under the new license.

Table 3-13. Project recreation sites and amenities at the Keowee-Toxaway Project (Source: Duke Energy, 2014a as modified by staff).

Recreation Site Name	Development	Approximate Size (acres)	Amenities	Owner/ Manager
Bootleg Access Area	Jocassee	18	Undeveloped	Duke Energy/ Duke Energy
Devils Fork State Park	Jocassee	622	Parking area with 180 spaces, 7 boat ramps, 1 courtesy dock, 2 picnic areas, 2 hiking trails, campground with 84 sites	Duke Energy/ South Carolina DPRT
Double Springs Campground ^a	Jocassee	10	Campground with 20 sites	Duke Energy/ South Carolina DPRT
Grindstone Access Area	Jocassee	5	Undeveloped	Duke Energy/ Duke Energy
Handpole Ridge Access Area	Jocassee	5	Undeveloped	Duke Energy/ Duke Energy
Cane Creek Access Area	Keowee	30	Parking area with 34 spaces, 2 boat ramps	Duke Energy/ Duke Energy
Crow Creek Access Area ^b	Keowee	56	Parking area with 40 spaces, 2 boat ramps, 1 courtesy dock	Duke Energy/ Duke Energy
Fall Creek Access Area	Keowee	155	Parking area with 80 spaces, 5 boat ramps	Duke Energy/ Duke Energy
High Falls County Park	Keowee	46	Parking area with 110 spaces, 2 boat ramps, 1 courtesy dock, swimming area, picnic area, campground with 100 sites	Duke Energy/ Oconee County
Keowee Town Access Area	Keowee	31	Parking area with 41 spaces, 2 boat ramps	Duke Energy/ Duke Energy
Mile Creek County Park	Keowee	130	Parking area with 181 spaces, 3 boat ramps, 1 courtesy dock, swimming area, picnic area, campground with 69 sites	Duke Energy/ Pickens County
South Cove County Park	Keowee	46	Parking area with 185 spaces, 3 boat ramps, 2 courtesy docks, swimming area, campground with 88 sites	Duke Energy/ Oconee County

Recreation Site Name	Development	Approximate Size (acres)	Amenities	Owner/ Manager
Stamp Creek Access Area	Keowee	24	Parking area with 32 spaces, 2 boat ramps	Duke Energy/ Duke Energy
Warpath Access Area ^c	Keowee	63	Parking area with 38 spaces, 3 boat ramps, 2 courtesy docks	Duke Energy/ Duke Energy
World of Energy Picnic Area	Keowee	3	Parking area with 45 spaces (shared with Oconee Nuclear Station), boat dock, picnic area, fishing pier, hiking trail ^d	Duke Energy/ Duke Energy

^a In Duke Energy's 2008 RMP, Double Springs Campground is listed as a component facility at Devils Fork State Park. The license application identifies Double Springs Campground as a separate recreation site.

^b Crow Creek Access Area is owned, operated, and maintained by Duke Energy. Most of the site is currently located outside the project boundary; however, it was included in Duke Energy's 2008 RMP. Duke Energy proposes to modify the project boundary to include Crow Creek Access Area as a project recreation site under the new license.

^c In 2006, the Commission approved Duke Energy's proposal to lease the 63-acre Warpath Access Area to Warpath Development, Inc. to construct and maintain a public park/recreation area. In the Order Approving Non-project Use of Project Lands and Waters, the Commission required that the 15 acres underlying Warpath Development, Inc.'s proposed lodge and conference center be removed from the project boundary as a non-project use of project lands (115 FERC ¶ 62,327 (2006)). No facilities proposed by Warpath Development, Inc. have been constructed and Duke Energy terminated the lease for the site effective March 4, 2016 (Letter from J. Crutchfield, Director, Duke Energy Carolinas, LLC, to K.D. Bose, Secretary, FERC, Washington, D.C., March 7, 2016).

^d Letter from J. Crutchfield, Director, Duke Energy Carolinas, LLC to K.D. Bose, Secretary, FERC, Washington, D.C., March 2, 2015.

Table 3-14. Minimum reservoir elevations for operable boat ramps on Lake Keowee
(Source: Duke Energy, 2014a as modified by staff).

Access Area	Elevation (feet AMSL)
Cane Creek Access Area	788.6
Crow Creek Access Area	788.1
Fall Creek Access Area	789.6
High Falls County Park	791.4
Keowee Town Access Area	790.3
Mile Creek County Park	789.8
South Cove County Park	786.7
Stamp Creek Access Area	788.1
Warpath Access Area	789.3

Non-project Recreation Facilities

Several non-project recreation facilities also provide access to project lands and waters, as described in table 3-15. Duke Energy owns and manages four boat-in trailheads (Toxaway River Foothills Trail Access, Horsepasture River Foothills Trail Access, Laurel Creek Foothills Trail Access,⁸⁹ and Canebrake Trail Access), which provide access between Lake Jocassee and non-project recreation trails outside of the project boundary. South Carolina DPRT owns and operates Keowee-Toxaway State Park, which lies outside of the project boundary with the exception of 15-Acre Lake, an impounded portion of Lake Keowee and associated uplands that are located within the Keowee-Toxaway project boundary. In addition, privately-owned commercial recreation sites also enhance the recreation amenities at the project.

⁸⁹ The Commission approved these trails as part of the Bad Creek Project. Letter from R. Fletcher, Chief, Land Resources Branch, Division of Hydropower Administration and Compliance, FERC, to Jeff Lineberger, Director, Duke Energy Carolinas, LLC, January 29, 2015 (citing *Duke Power Co.*, 14 ¶ 62,026 (1981)).

Table 3-15. Non-project recreation facilities providing public access to the Keowee-Toxaway Project (Source: Duke Energy, 2014a as modified by staff).

Recreation Site Name	Development	Approximate Size (acres)	Amenities	Owner/ Manager
Boat-in Trail Access (Toxaway River, Horsepasture River, and Laurel Creek Foothills Trail Access and Canebrake Trail Access)	Jocassee	<1 each	Hiking trailheads, informal camping	Duke Energy/ Duke Energy
Crooked Creek Marina and Recreational Vehicle Park	Keowee	165	Parking area with 70 spaces, 1 boat ramp, 1 courtesy dock, a campground with 75 spaces	Private/ Private
Gap Hill Marina/Landing	Keowee	1.5	Parking area with 35 spaces, 1 boat ramp, 2 courtesy docks	Private/ Private
Keowee-Toxaway State Park	Keowee	1,011	Parking area with 47 spaces, picnic area, 4 hiking trails, campground with 24 sites	South Carolina DPRT/ South Carolina DPRT
Lake Keowee Marina	Keowee	17	Parking area with 102 spaces, 2 boat ramps, 1 courtesy dock	Private/ Private

Recreation Use

Access Area Use

In 2007 and 2012, Duke Energy conducted RUN Studies for the project (Louis Berger, 2008; Kleinschmidt, 2013). These studies form the basis for Duke Energy's estimates of visitor use and capacity. For the 2012 RUN Study, Duke Energy reported visitor use estimates at Lake Jocassee and Lake Keowee based on data collected at project recreation sites, commercial developments, and areas used by private property owners. Table 3-16 shows the number of recreation-days attributed to each of these areas by reservoir during the recreation season of March 15 to September 30, 2012. More than 90 percent of the estimated 5 million recreation-days occur at Lake Keowee and most of this use (about 4 million recreation-days) is associated with shoreline and back-lot property owners. Almost all visitor use at Lake Jocassee occurs at Devils Fork State Park (Kleinschmidt, 2013).

Table 3-16. Recreation use within the project boundary (Source: Duke Energy, 2014a as modified by staff).

Recreation Site	Recreation Days		
	Visitors	Private Owners	Total
Lake Jocassee			
Devils Fork State Park (including Double Springs Campground)	219,538		
Boat-in Trail Access	2,699		
Lake Jocassee Subtotal	222,237	12,303	234,540
Lake Keowee			
Cane Creek Access Area	45,087		
Crow Creek Access Area	35,379		
Fall Creek Access Area	119,255		
High Falls County Park	47,964		
Keowee Town Access Area	18,058		
Mile Creek County Park	84,167		
South Cove County Park	33,333		
Stamp Creek County Park	25,906		
Warpath Access Area	47,894		
World of Energy Picnic Area	79,057		
Crooked Creek Marina and Recreational Vehicle Park	3,072		
Gap Hill Marina/Landing	11,663		
Keowee-Toxaway State Park	18,213		
Lake Keowee Marina	43,855		
Lake Keowee Subtotal	612,902	4,204,864	4,817,766
Total	835,139	4,217,167	5,052,306

Parking lot use was used to estimate capacity at project recreation sites. During the 2012 study season, no parking areas exceeded 61 percent of capacity on weekends. The areas with the highest level of use were: Devils Fork State Park's main boat launch (42 percent), Fall Creek Access Area (57 percent), High Falls County Park (61 percent), and Warpath Access Area (60 percent). Warpath Access Area exceeded capacity (157 percent) during holiday weekends. All other access areas were below capacity at all times. Use was similar, on average, to the use estimates provided in the 2007 RUN Study. Use grew the most at Fall Creek Access Area and High Falls County Park between 2007 and 2012. Improvements were made at both recreation sites between the studies and may correspond to the increase in use (Kleinschmidt, 2013).

Boating Capacity

Boating is the most popular recreation activity at the project, accounting for over 59 percent of recreation use at Lake Jocassee and 60 percent of recreation use at Lake Keowee (Kleinschmidt, 2013). Motorized boat use is common, and fishing and swimming from boats are identified primary recreation activities on both reservoirs. Non-motorized boating like canoeing or kayaking is less popular, but does occur on both reservoirs.

Access to boat launch facilities is a primary concern of visitors to the project. As part of its 2012 RUN Study, Duke Energy evaluated facility occupancy in terms of parking availability and waiting times at boat launches. Data from the 2012 RUN Study indicate that between 8 and 42 percent of the parking spaces at the main ramp at Devils Fork State Park were occupied during the study season. At Lake Keowee, weekday and weekend parking occupancy rates at project recreation sites ranged from 3 percent to 61 percent. Warpath, Crow Creek, and Keowee Town Access Areas experienced the highest holiday parking levels. Of the visitors using trailered boats, 26 percent of those at Lake Jocassee and 31 percent of those at Lake Keowee reported having to wait to launch their boats. Of those visitors experiencing a wait time, 5 percent at Lake Keowee and 7 percent at Lake Jocassee had to wait longer than 15 minutes. Although more people indicated having to wait to launch their boats in 2012, the wait time was, on average, less than reported in 2007. Personal (visitor-type) interviews conducted at the project indicate that visitors tend to select boat access locations that are convenient, scenic, and less crowded and adjust their preferred boat launch location based on these factors (Kleinschmidt, 2013).

Duke Energy also examined boating capacity on the project reservoirs. Based on the mix of boating types observed on Lake Jocassee, Duke Energy estimated boating capacity at 944 boats (at any one time). Existing weekend and holiday use is only 13 to 16 percent of capacity. At Lake Keowee, estimated boating capacity is 1,615 boats. Weekend and holiday use is at 11 and 30 percent, respectively, of the estimated boating capacity of the reservoir.

As a component of its boating capacity assessment, Duke Energy also investigated boating use associated with nine constriction points in Lake Keowee. All constricted areas are located at naturally occurring narrow points of the lake and frequently used boating corridors. Four of the nine identified constricted areas are near public recreation areas (Cane Creek Access Area, Stamp Creek Access Area, Fall Creek Access Area and the Keowee Key Marina, a commercial development). The four southernmost constricted areas are at major bridge crossings with posted no-wake zone restrictions. The RUN Study results indicate most boaters did not feel unsafe when using these constricted areas, and some boaters attributed unsafe conditions to careless boat and personal watercraft operation (Kleinschmidt, 2013).

Future Recreation Use

Using the visitor use data collected in the 2012 RUN Study and population growth trends, Duke Energy was able to develop estimates of recreation use by user type through 2050. Recreation use is estimated to increase by approximately 53 percent at both reservoirs for the period 2012 through 2050. The largest change in recreation use is estimated to be in water-based recreation (an increase of 65 to 70 percent by 2050), while land-based recreation is projected to increase by 30 to 35 percent. These estimates do not consider limits on growth, such as facility parking capacities, changes in visitor preferences for activity type, or tolerance for crowding, nor do they consider the potential for technological change that could result in changing recreation behavior (Kleinschmidt, 2013).

Existing Recreation Management Plan

The 2008 RMP guides development and management of Duke Energy's project recreation facilities through the term of the existing license. The 2008 RMP replaced the previously-approved exhibit R,⁹⁰ which contained requirements for providing public recreation access to the project. The 2008 RMP includes a description of the recreation goals and objectives for the project, as well as proposed plans for existing project recreation sites. The plan also includes provisions for ongoing recreation use monitoring, and a description of the management policies associated with recreation sites operated and managed by Duke Energy as well as those associated with Duke Energy's AAI.⁹¹

⁹⁰ 36 FPC 683 (1966).

⁹¹ The AAI is a program established by Duke Energy to provide opportunities for tribes, state and local governments, and businesses to lease project recreation sites for operating and maintaining new and existing public recreation facilities.

The 2008 RMP included proposals for improvements at many of Duke Energy's project recreation sites, including boat ramp extensions and rehabilitation, courtesy docks, restrooms, parking, shoreline stabilization, accessibility modifications, trails, picnic areas, fishing piers and beaches. All new and enhanced amenities completed to date are reflected in table 3-13, above.

Of the planned enhancements described in the 2008 RMP, the Crow Creek Access Area and Warpath Access Area improvements have not been implemented. At Crow Creek Access Area, the plan describes new restrooms, a courtesy dock, picnic area, vehicle parking, bank fishing trail, and expanded vehicle-with-trailer parking to be completed by December 31, 2015.⁹² At Warpath Access Area, the plan describes a campground with trails, swim beach, restrooms, picnic areas, cabins, lodge, marina, dry boat storage, and lodge/conference center to be completed by December 31, 2015.⁹³

3.3.5.2 Environmental Effects

Effects of Project Operation on Reservoir Use

Project operation, including daily reservoir fluctuations and drawdowns associated with the LIP and MEP may affect the ability of residents and visitors to recreate within the project boundary. Duke Energy proposes to operate the project in accordance within the proposed Normal Minimum and maximum elevations, except when operating in

⁹² Crow Creek Access Area is adjacent to the project on Duke Energy-owned land, but located outside of the project boundary. The improvements to Crow Creek Access Area were described as part of a mitigation plan proposed by The Reserve at Lake Keowee to address encroachment of a golf course into the project boundary, and approved by the Commission in 2007. 120 FERC ¶ 62,060 (2007). Duke Energy included the site and proposed enhancements in the 2008 RMP, and the Commission ordered Duke Energy to include the area in its project boundary. 132 FERC ¶ 62,060, at P 25 (2010).

⁹³ In 2006, the Commission approved Duke Energy's proposal to lease the 63-acre Warpath Access Area to Warpath Development, Inc. to construct and maintain a public recreation area consisting of water-related facilities and services, outdoor recreation opportunities, a conference center, lodging, and dining. 115 FERC ¶ 62,327 (2006). The Commission directed Duke Energy to remove from the project boundary the 15 acres underlying the proposed commercial lodge and conference center, but include in the project boundary the proposed camping, picnicking, path and trail, boat launch, fishing, swimming, and other outdoor public recreation facilities. These recreation enhancement measures were included for the site in the Commission-approved 2008 RMP.

certain stages of the LIP or MEP, as specified in the Relicensing Agreement, and described in detail in section 2.2 *Proposed Operation*.

Our Analysis

Under normal conditions, proposed project operation would not inhibit recreational access to Lake Jocassee or Lake Keowee. According to analysis by the Corps (2014), the operating range for the reservoirs would be narrower and the reservoir levels would generally be higher than they have been historically.

The minimum elevation for Lake Jocassee is 1,080 feet; at that level, all public boat launches would remain operable. The proposed Normal Minimum Elevation of 1,096 feet is higher than the minimum, and thus would not change the amount of time those boat ramps are operable. Operating Lake Keowee under the proposed Normal Minimum Elevation of 796 feet would ensure that all boat ramps at the project recreation sites would be operable during normal, non-drought periods.

At Lake Keowee, Duke Energy would maintain the reservoir elevation at or above 791.5 feet for as long as possible, with a maximum drawdown to 790 feet under Stage 4 LIP conditions. Because the minimum operable elevation for the boat ramps at the Lake Keowee project recreation sites is between 786.7 and 791.4 feet, some, but not all, of these ramps would become inoperable as the reservoir approaches 790 feet. The boat ramps at High Falls County Park and Keowee Town Access Area would be inaccessible at 790 feet. Most project recreation sites would have at least one boat ramp operable; however, access would diminish causing longer wait times and the potential for overcrowding at launches that are operable during LIP conditions. Duke Energy's proposed RMP contains policies for the temporary closure of recreation facilities under LIP conditions, if necessary. These effects would be temporary, and launch accessibility would improve as normal operation resumed.

The proposed MEP specifies project operation under conditions of high flow, low flow, maintenance or emergencies, which could cause reservoir drawdowns that may result in temporary closures of project recreation sites. Duke Energy's proposed RMP contains policies for temporary closure of recreation facilities under MEP conditions, if necessary. Although such facility closures would reduce public access and preclude some recreational use, the proposed MEP with its notifications of agencies and user groups, provision of public notices, and Duke Energy's current practice of posting closure information on its website, would allow visitors time to adjust their trip expectations or even select another destination, thereby minimizing the temporary effects of closed recreation developments.

Project Effects on Whitewater Boating

Several tributaries to the project, including the Wild and Scenic Horsepasture River and Toxaway River provide opportunities for high-quality whitewater boating outside of the project boundary. Access to these rivers is limited, primarily due to steep terrain and lack of road access. Duke Energy proposes no measures to address whitewater boating at the project.

In scoping comments filed July 13, 2011, American Whitewater commented that the existence of the project reservoir (Lake Jocassee) and management for normal pool operation prohibits paddling down the Horsepasture and Toxaway Rivers to a point where public road egress is reasonable. The Foothills Paddling Club filed comments on July 15, 2011 supporting the comments of American Whitewater and requesting whitewater boating enhancements on the Little River.

Our Analysis

According to the 2012 RUN Study, visitors spent 4,886 recreation-days engaged in whitewater boating (canoe or kayak) activities, accounting for less than one percent of all recreation activity at the project (Kleinschmidt, 2013). Whitewater boating occurs on tributary reaches upstream of the project, outside of the project boundary through lands managed by a network of state and federal agencies, including the Nantahala National Forest, Sumter National Forest, Gorges State Park, and Toxaway Game Land. There is no vehicular access to the Horsepasture or Toxaway Rivers at the project; Duke Energy only provides boat-in access to the Foothills Trail at the Horsepasture River and Toxaway River. Duke Energy's proposed project operation and environmental measures would not change conditions for whitewater boating upstream of the project, and the 2012 RUN Study did not identify a need for recreation enhancements for whitewater boaters within the project boundary. Whitewater boating enhancement measures along the Horsepasture and Toxaway Rivers would be better provided by the network of state and federal agencies that manage the lands surrounding those rivers. Whitewater boating access enhancement measures as recommended by American Whitewater and the Foothills Paddling Club would not serve a project purpose or meet a need for public recreation access at the project.

Recreation Management Plan

Duke Energy proposes to implement an RMP, which provides guidance for managing existing and future public recreation areas for the term of a new license. The RMP contains: (1) management policies for the project recreation sites; (2) provisions for ongoing public recreation planning and monitoring; (3) a comprehensive inventory of existing public recreation areas; (4) proposed facility enhancements; and (5) maps depicting project recreation sites showing existing facilities and proposed enhancements.

The RMP informs the public of permitted and prohibited uses at three location types: (1) project recreation sites; (2) project lands other than project recreation sites; and (3) project islands. Bank fishing is permitted along the shoreline of all project recreation sites, except for areas where bank fishing is specifically prohibited for safety reasons, management problems, or to avoid conflicts with other user types. Duke Energy proposes to place signage in areas where bank fishing is prohibited. Hunting is not permitted at project recreation sites; however, hunting and trapping is allowed within the project boundary, outside of project recreation sites, subject to state and local regulations. Project islands are available from sunrise to sunset for permissible day-use activities including fishing, wading, picnicking, hiking and hunting. Overnight camping is prohibited on islands without specific authorization from Duke Energy. Duke Energy may also restrict island use to protect cultural resources or endangered species, or for public safety, security, or other management concerns.

In addition, the RMP describes how Duke Energy or its lessees would manage project recreation sites for the benefit of the public. The management policies include provisions for establishing operating hours; temporary closure of recreation sites; and user fees. The RMP also describes the standards that Duke Energy or its lessees will use for design and construction of recreation facility enhancements, including allowable amenity types for future recreation development.

The RMP specifies that Duke Energy would continue to provide recreation access at five project recreation sites at Lake Jocassee (Bootleg Access Area, Devils Fork State Park, Double Springs Campground, Grindstone Access Area, and Handpole Ridge Access Area) and nine project recreation sites at Lake Keowee (Cane Creek Access Area, Crow Creek Access Area, Fall Creek Access Area, High Falls County Park, Keowee Town Access Area, Mile Creek County Park, South Cove County Park, Stamp Creek Access Area, and Warpath Access Area). Duke Energy also proposes new recreation enhancements at 15-Acre Lake, a portion of Keowee-Toxaway State Park that is located in the project boundary. Duke Energy also proposes to designate two new areas at Lake Keowee (High Falls II and Mosquito Point Access Areas) for future public recreation. Recreation enhancement measures contained within the RMP are summarized in table 3-17. No recreation enhancement measures are proposed for Bootleg, Grindstone, or Handpole Ridge Access Areas. Duke Energy provides a general schedule for facility enhancements, with all construction complete by August 31, 2026.

Table 3-17. Proposed recreation enhancement measures (Source: Duke Energy, 2014d as modified by staff).

Recreation Site Name	Development	Enhancement Measures	Scheduled Completion Date
Devils Fork State Park	Jocassee	<ul style="list-style-type: none"> • Designated a location for diver access • Install a new courtesy dock at the main ramps • Construct a new boat and trailer parking area for the campground • Enhance the Roundhouse Point ramps or provide other access to facilitate non-motorized boating • Install bank fishing signage 	August 31, 2026
Double Springs Campground	Jocassee	<ul style="list-style-type: none"> • Expand by approximately 25 acres • Construct composting-type toilet • Construct 12 additional campsites 	August 31, 2026
Cane Creek Access Area	Keowee	<ul style="list-style-type: none"> • Designate shoreline areas and install appropriate signage to support bank fishing • Designate single-vehicle parking to support bank fishing 	August 31, 2026
Crow Creek Access Area	Keowee	<ul style="list-style-type: none"> • Install bank fishing signage <p>Unconstructed improvements from 2008 RMP^a</p> <ul style="list-style-type: none"> • Restrooms with lighting • Expanded and lighted vehicle-with-trailer parking • Courtesy dock • Picnic area/shelter • Vehicle parking • Bank fishing trail 	<p>August 31, 2025</p> <p>December 31, 2015 (extended to December 31, 2016)</p>
Fall Creek Access Area	Keowee	<ul style="list-style-type: none"> • Construct trails • Designated single-vehicle parking to support bank fishing • Install appropriate signage to support wildlife viewing and bank fishing • Stabilize approximately 1,000 feet of shoreline on the east side of the peninsula 	<p>August 31, 2026</p> <p>August 31, 2019</p>

Recreation Site Name	Development	Enhancement Measures	Scheduled Completion Date
High Falls County Park	Keowee	<ul style="list-style-type: none"> • Install bank fishing signage 	August 31, 2026
Keowee Town Access Area	Keowee	<ul style="list-style-type: none"> • Construct trails • Designate single-vehicle parking to support bank fishing • Install appropriate signage to support wildlife viewing and bank fishing 	August 31, 2026
Keowee-Toxaway State Park (15-Acre Lake)	Keowee	<ul style="list-style-type: none"> • Install a canoe/kayak launch • Install a fishing pier • Install a portage around the water-retaining structure at 15-Acre Lake to provide access to Lake Keowee 	August 31, 2026
Mile Creek County Park	Keowee	<ul style="list-style-type: none"> • Construct up to 10 primitive campsites • Construct up to 5 bank fishing stations with open air fishing shelters • Construct an install 10 camping cabins with septic systems • Install bank fishing signage 	August 31, 2026
South Cove County Park	Keowee	<ul style="list-style-type: none"> • Install bank fishing signage 	August 31, 2026
Stamp Creek Access Area	Keowee	<ul style="list-style-type: none"> • Install bank fishing signage 	August 31, 2026
Warpath Access Area	Keowee	<ul style="list-style-type: none"> • Install bank fishing signage <p>Unconstructed improvements from 2008 RMP^b</p> <ul style="list-style-type: none"> • Campground including trails • Swim beach • Restrooms • Picnic areas • Cabins • Lodge • Marina • Dry boat storage 	<p>August 31, 2026</p> <p>December 31, 2015 (Lease with Warpath Development, Inc. terminated March 4, 2016. Facilities will not be constructed.)</p>

Recreation Site Name	Development	Enhancement Measures	Scheduled Completion Date
High Falls II Access Area	Keowee	<ul style="list-style-type: none"> • Stabilize approximately 1,000 feet of shoreline 	August 31, 2019
Mosquito Point Access Area	Keowee	<ul style="list-style-type: none"> • Stabilize approximately 1,000 feet of shoreline 	August 31, 2019

^a If The Reserve at Lake Keowee fails to construct the facilities described, Duke Energy would maintain the existing facilities at Crow Creek Access Area.

^b If Warpath Development, Inc. fails to construct the facilities described, Duke Energy would maintain the existing facilities at Warpath Access Area.

The RMP also describes Duke Energy's existing AAI program and proposal for continuing the program under a new license. The RMP specifies lease extensions or offers of new leases to state and local governments and private businesses for the operation and maintenance of project recreation facilities. Duke Energy proposes to extend the existing lease terms for Devils Fork State Park, Double Springs Campground, High Falls County Park, Mile Creek County Park, South Cove County Park, and Warpath Access Area,⁹⁴ through the term of the New License. In addition, Duke Energy plans to offer new, low-cost AAI leases of project lands to maintain and enhance public recreation at Bootleg, Cane Creek, Crow Creek, Fall Creek, Keowee Town, and Stamp Creek Access Areas and 15-Acre Lake at Keowee-Toxaway State Park.

In comments filed March 13, 2015, South Carolina DPRT stated that Duke Energy's proposal complements the South Carolina SCORP and would ensure quality public recreation opportunities to the citizens of South Carolina and its visitors. No other comments or recommendations on the proposed RMP were provided in response to the Commission's public notice that the application was ready for environmental analysis.

Our Analysis

Duke Energy's proposal to implement the management policies and measures described in the RMP would protect, improve, and enhance recreation resources within the project boundary.

Management Policies— Duke Energy's policies for the use of project recreation sites, project lands outside of project recreation sites, and project islands are appropriate for the size, level of use, and variety of recreation experiences at the project. Retaining the islands for day-use recreation, unless otherwise designated off-limits, would meet a need of visitors wishing to have a more secluded or remote recreation experience on Lake Keowee. Improved signage designating bank fishing at project recreation sites and on project islands would benefit the large number of users who fish from the shoreline. By designating the areas where bank fishing is not allowed, Duke Energy would also ensure public safety and reduce potential conflicts between user groups (e.g., anglers and swimmers).

Project Recreation Sites – The proposed RMP lists World of Energy Picnic Area on Lake Keowee as a non-project recreation site, a change from the 2008 RMP. Duke Energy states that the change in the status of the facility is necessary because World of Energy Picnic Area is located on lands associated with Oconee Nuclear Station (letter

⁹⁴ Duke Energy terminated Warpath Development, Inc.'s lease for the site effective March 4, 2016.

from J. Crutchfield, Director, Duke Energy Carolinas, LLC to K.D. Bose, Secretary, FERC, Washington, D.C., March 2, 2015). World of Energy Picnic Area has historically been associated with the Keowee-Toxaway Project (approved as project recreation in the 2008 plan) and provides picnic facilities, a half-mile hiking trail, a boat slip and fishing pier on Lake Keowee, and parking that is shared with the Duke Energy's World of Energy Visitor's Center. World of Energy Picnic Area provides access directly to Lake Keowee for boating, fishing, and picnicking. By including World of Energy Picnic Area in the RMP and enclosing the recreation facilities within the project boundary, Duke Energy would ensure the continued operation and maintenance of this recreation site for the term of the license.

Recreation Facility Enhancement Measures— In the 2012 RUN Study, project visitors expressed high levels of satisfaction with the existing project recreation sites, including the condition, number, and type of recreation facilities offered and sense of safety at project recreation facilities. Duke Energy's capacity studies reveal that boating use on both reservoirs is well below maximum capacity. In general, project recreation sites had sufficient capacity to meet demand (as measured by available parking). Average boat launch wait times decreased between the 2008 and 2012 RUN Studies; however, the number of visitors reporting wait times of greater than 15 minutes increased. Parking demand only exceeded capacity at one project recreation site (Warpath Access Area) during holiday weekends.

The proposed facility enhancement measures would allow Duke Energy to continue to meet visitor needs associated with land- and water-based activities over the term of a new license. The proposed improvements to boat ramps, courtesy docks, and parking areas would improve the quality of the recreation experience for boaters by improving wait times to access the project's reservoirs, providing additional access for non-motorized boating use on reservoirs, and accommodating additional parking for land-based recreation. Constructing trails and installing interpretive signage for wildlife viewing would expand opportunities for passive recreation. The proposed facilities and enhancements would also improve visitors' access for bank fishing by providing shelters, a pier, signage, and additional parking. Providing these facilities is also consistent with guidance in the South Carolina SCORP and South Carolina State Trails Plan to provide appropriate facilities for non-motorized boating and trail use.

Duke Energy's enhancement measures would also address unmet needs. Duke Energy's proposal to provide access for divers at Devils Fork State Park would meet a demand identified in the 2012 RUN Study (Kleinschmidt, 2013). Additionally, providing a designated area for divers' access could prevent potential conflicts and related public safety issues from developing in the future between divers and other user groups (e.g., boaters).

During the 2012 RUN Study, regional residents and recreation agencies identified additional camping facilities, especially in Pickens County, as needed (Kleinschmidt, 2013). Duke Energy's proposed enhancement measures at Mile Creek County Park would increase overnight capacity and broaden the diversity of overnight experiences available at the project, and help meet current and future needs for overnight use. However, section 6.2.1.5 of the Relicensing Agreement indicates that Duke Energy's proposal to enhance facilities at Mile Creek County Park is contingent upon Pickens County agreeing to operate and maintain the facilities. Further, in the Relicensing Agreement, Duke Energy caps spending for the camping cabins at \$350,000. Project recreation facility enhancements described in the RMP and approved by the Commission should be based on documented needs, and should not be contingent upon participation by a third-party lessee. Further, a licensee cannot satisfy an obligation by a simple payment, nor can the obligation be limited to a particular dollar figure.⁹⁵ By providing 10 primitive campsites, 5 bank fishing stations, and 10 camping cabins, Duke Energy would meet the need for additional camping facilities in Pickens County.

As discussed in section 3.3.1, *Geology and Soil Resources*, Duke Energy's proposal to stabilize the shorelines of Fall Creek Access Area, High Falls II Access Area and Mosquito Point Access Area would protect these recreation sites from potential erosion, make them safer to use, and improve the aesthetic experience for visitors. In the Relicensing Agreement, as an off-license measure, Duke Energy also proposes to stabilize the shorelines of nine islands in Lake Keowee. Stabilizing the shorelines of these islands would reduce the likelihood of recreation-induced erosion caused by boat wakes, mooring boats, and accessing the islands for day use. Adopting this measure as part of the license would be consistent with the goals of protecting and enhancing recreation resources at the project.

More detailed schedules indicating the timing of construction for the various recreation amenities would aid in Commission administration of the license and help ensure that all recreation facilities are constructed by August 31, 2026, as proposed by Duke Energy.

Incomplete Recreation Facility Enhancements—As part of the 2008 RMP, Duke Energy identified recreation facility improvements at Crow Creek and Warpath Access Areas that are currently unconstructed, both with scheduled completion dates of December 31, 2015. In both instances, the RMP specified that if the designated third-party was unable to complete construction of the facilities, Duke Energy would maintain each facility with its existing amenities. Because the Commission does not have

⁹⁵ See the Commission's Policy Statement on Hydropower Licensing Settlements (116 FERC ¶ 61,207 (2006)) at paragraphs 20-21.

authority to require a third party to construct, operate, or maintain project recreation facilities, the licensee is ultimately responsible for ensuring that the provisions of the RMP are implemented, as specified. The Commission highlighted this policy in the approval of the 2008 RMP.⁹⁶

Duke Energy included the unconstructed amenities at Crow Creek and Warpath Access Areas in the proposed RMP, with the same provision that if the facilities are not constructed by the responsible third party, Duke Energy would maintain the existing facilities at each access area. In a letter filed September 24, 2015, Duke Energy requested a one-year extension for The Reserve at Lake Keowee to complete the improvements to Crow Creek Access Area, a scheduled completion date of December 31, 2016 (letter from J. Crutchfield, Director, Duke Energy Carolinas, LLC to K.D. Bose, Secretary, FERC, Washington, D.C., September 24, 2015). In a separate letter filed March 7, 2016, Duke Energy stated that the improvements to Warpath Access Area would not be constructed and that the lease with Warpath Development, Inc. was terminated effective March 4, 2016 (letter from J. Crutchfield, Director, Duke Energy Carolinas, LLC to K.D. Bose, Secretary, FERC, Washington, D.C., March 7, 2016).

Based on the 2012 RUN Study, recreation use at Crow Creek Access Area was approximately 5 percent of total project recreation use on Lake Keowee, and facility use was below capacity on weekends and holidays. Visitors surveyed indicated that the site needed improved parking and lighted restrooms and docks (Kleinschmidt, 2013). Duke Energy proposes to place bank fishing signage at the site, but does not propose to construct the amenities proposed by The Reserve at Lake Keowee in its mitigation plan (restrooms with lighting, expanded and lighted vehicle-with-trailer parking, courtesy dock, picnic area/shelter, single-vehicle parking, and bank fishing trail). These amenities would help meet the needs identified by visitors for improved parking and lighting at the site, which is open to the public 24 hours a day.

Warpath Access Area received 6 percent of all recreation use on Lake Keowee in 2012, and was the only recreation site where use exceeded capacity on holiday weekends. It was the second-most preferred boat launch area due to its location and availability of parking (Kleinschmidt, 2013). Since the approval of the 2008 RMP, Duke Energy has made no facility enhancements at Warpath Access Area because the site was scheduled for redevelopment by Warpath Development, Inc. Because Duke Energy has terminated the lease with Warpath Development, Inc. and there is no indication that Duke Energy intends to construct any of Warpath Development, Inc.'s proposed recreation enhancements, under the proposed RMP, Warpath Access Area would remain as-is until the RMP is updated (by December 31, 2033). This proposal would not address capacity

⁹⁶ 132 FERC ¶ 62,045 (2010).

issues or the potential effects of overuse associated with holidays during the recreation season. Monitoring the capacity and facility condition at Warpath Access Area annually during the summer recreation season would allow Duke Energy to adapt its management strategy for Warpath Access Area if demand for the site exceeds capacity thresholds during the term of the RMP. Additionally, provisions for addressing the effects of overuse (e.g., disturbance of terrestrial habitat, soil compaction, or erosion) would help protect environmental resources and reduce the likelihood that overuse of the recreation site would negatively affect the recreation experience.

Future Lands for Public Recreation—Duke Energy’s proposal to designate approximately 47 acres of additional land for future public recreation use at High Falls II and Mosquito Point Access Area supports the need to improve recreational access at the project as future needs arise and is consistent with guidance in the South Carolina SCORP to protect shorelines and make more waterfront land available for public use. As described in section 3.3.6., *Land Use*, Duke Energy’s proposal would ensure future public recreational access is maintained and provide opportunities for Duke Energy to develop new recreation areas in the future as the need arises.

AII Leases—Duke Energy’s proposal to continue implementing its AII program would help meet the high level of demand for developed recreation opportunities at the project and enhance Duke Energy’s ability to operate and maintain project recreation sites over the term of a license. However, as the Commission discussed when approving the 2008 RMP, Duke Energy is ultimately responsible for the oversight and management of project recreation sites, including those sites that are currently, or will potentially be leased to another entity through AII. Duke Energy is also expected to ensure that lessees adhere to the management policies described in the RMP, as well as applicable requirements of the project license.⁹⁷ Provisions in a license clarifying that all improvements made at project recreation sites, including those made by AII partners, must be part of the Commission-approved RMP would ensure that the enhancements made at project recreation sites as part of AII leases are appropriately constructed, operated, and maintained to meet public recreation demands over the term of a license.

Our recommendations are discussed in section 5.0, *Conclusions and Recommendations*.

Recreation Planning and Monitoring

To assess and provide for future recreation needs, over the term of a license, Duke Energy proposes two separate measures regarding recreation planning and monitoring.

⁹⁷ 132 FERC ¶ 62,045 (2010).

As a part of the RMP, Duke Energy proposes to consult with appropriate tribes, federal, state, and local resources and parks and recreation agencies, local governments, and resource- or recreation-based non-governmental organizations to identify future recreation needs at the project. In conjunction with the development of the Licensed Hydropower Recreation Development Report (FERC Form 80), due in 2027, Duke Energy proposes to convene a stakeholder group in 2025 to review recreation resources at the project and assess the need for conducting a RUN Study, similar to those conducted in 2007 and 2012. Duke Energy also proposes to file annually, for the first 10 years following license issuance, a report of the progress made on completing the measures in the RMP.

As a separate license requirement, Duke Energy also proposes to: (1) consult with the South Carolina DPRT and South Carolina DNR no later than December 31, 2031 to develop a plan for conducting a new RUN Study; (2) complete the RUN Study no later than December 31, 2032; and (3) update the RMP, if necessary based on the results of the study, by December 31, 2033. This proposal is provided in addition to the recreation planning provisions contained within the RMP, discussed above.

No recommendations regarding Duke Energy's recreation planning proposals were provided in response to the Commission's public notice that the application was ready for environmental analysis

Our Analysis

Duke Energy's proposed recreation planning measures would provide opportunities for stakeholders, including relevant state agencies and other interested parties, to assess recreation use and future needs at the project. Duke Energy's current RMP was designed to address recreation enhancement measures through 2026. By convening stakeholders in 2025, as the final recreation enhancement measures are implemented, Duke Energy will be able to assess the success of the current RMP and identify gaps where revisions may be necessary. If Duke Energy and the stakeholders do not identify a need to conduct a RUN Study in 2025, the Recreation Planning article would require a RUN Study no later than 2032. Duke Energy also anticipates collecting recreation use data to complete its FERC Form 80 in 2021. Combined, these measures would ensure that Duke Energy would review and monitor recreation use at the project and provide a mechanism for updating the RMP if new needs are identified.

3.3.5.3 Cumulative Effects

Since its construction, the Keowee-Toxaway Project has been a regional recreation destination. In addition to Lake Jocassee and Lake Keowee, the downstream Corps' reservoirs (Hartwell Lake, Russell Lake, and Thurmond Lake) provide comparable recreation experiences, including boating, swimming, fishing, and camping. Recreation

resources at these reservoirs may be cumulatively affected by project operation and Duke Energy's proposed recreation enhancement measures.

Project operation influences water levels in Lake Jocassee, Lake Keowee, and the Corps' downstream reservoirs, which, in turn, may affect recreation access. Cumulative effects of the proposed operating regime on water quantity are discussed in greater detail in section 3.3.2, *Aquatic Resources*. The Corps (2014) found that the 2014 Operating Agreement would have adverse effects on recreation access at the Corps' reservoirs, particularly under LIP operating provisions; however, the adverse effect was less than that of the no-action alternative. To mitigate the adverse effects, as part of the 2014 Operating Agreement, Duke Energy proposed recreation enhancements to improve boating access at Lake Hartwell and Lake Thurmond.

Duke Energy's RUN Study (Kleinschmidt, 2013) identified anticipated growth in recreation use of the project area of 53 percent by 2050. The project's reservoirs remain well below capacity for boating. The recreation enhancements provided under the RMP, in addition to those proposed at Lake Hartwell and Lake Thurmond, would expand the diversity of amenities and accommodate additional capacity as recreation use grows. Duke Energy's proposal to designate additional lands within the project boundary for recreation use would provide locations where future recreation demand may be accommodated. Duke Energy's proposals for recreation planning and monitoring would ensure that recreation resources are not negatively affected for the foreseeable future. Therefore, the proposed recreation enhancement and management measures at the project would likely result in a cumulative beneficial effect on regional recreation resources, mitigating the adverse effects of the 2014 Operating Agreement and enhancing the availability and diversity of recreation opportunities in the upper Savannah River Basin.

3.3.6 Land Use

3.3.6.1 Affected Environment

Land Use in the Project Vicinity

The project is located primarily in Upstate South Carolina in Oconee and Pickens Counties, with the most upstream portions of Lake Jocassee reaching into Transylvania County, North Carolina. The land surrounding the project is predominantly composed of second-growth forest with some stands of old-growth forest. The ridgetops are densely vegetated, with farming typically occurring on the broad valley floors outside of the immediate project area. Section 3.3.3, *Terrestrial Resources*, provides greater detail on the project's upland areas. Seneca, South Carolina is the nearest population center.

Lake Jocassee is situated in mountainous terrain, largely surrounded by forested lands, with minimal agricultural use and residential development. Less than 10 percent of the shoreline (approximately 8.4 miles) is currently classified for existing or future

residential development, with fewer than 50 existing shoreline residences. Protected lands adjacent to the project boundary include Gorges State Park in North Carolina and Jocassee Gorges and Sumter National Forest in South Carolina. These areas are managed for natural resources and low-impact recreation.

Lake Keowee is significantly more developed than Lake Jocassee, with approximately 4,500 shoreline residences. The surrounding area is characterized by rolling hills with mature forest and scattered rural housing and small towns. Pickens and Oconee Counties, South Carolina set land management objectives through county-wide comprehensive land use plans, which help guide development outside of the project boundary. Both county plans encourage a balance of natural resource protection and development associated with the scenic, historic, and recreation resources in the region.

There are no lands in the project boundary included in the national trails system or designated as wilderness lands. The Foothills Trail, portions of which are designated as National Recreation Trail,⁹⁸ passes by the project and can be accessed by several boat-in locations on Lake Jocassee. The Horsepasture Wild and Scenic River corridor terminates at the project boundary.⁹⁹ The Horsepasture Wild and Scenic River is managed by the Forest Service to maintain and enhance the scenic and riparian features and to provide for water-oriented recreation opportunities in a natural setting (Forest Service, 1987). Similarly, a section of the Toxaway River extending upstream from Lake Jocassee is listed on the Nationwide River Inventory¹⁰⁰ (NRI) as having outstanding scenic, recreation, geologic, and wildlife values (NPS, 2009). The NRI also includes portions of the Whitewater and Thompson Rivers in North Carolina, upstream of, and not affected by the project.

⁹⁸ National Recreation Trails are authorized by the National Trail System Act of 1968. Unlike National Scenic Trails and National Historic Trails, which must be designated by an act of Congress, National Recreation Trails may be designated by the Secretary of the Interior or Secretary of Agriculture. A 28-mile portion of Foothills Trail extending from Oconee State Park to Upper Whitewater Falls was designated as a National Recreation Trail in 1979 (American Trails, undated).

⁹⁹ The Horsepasture River is also designated as a North Carolina State Natural and Scenic River.

¹⁰⁰ The NRI, which was created in 1982 and amended in 1993, identifies free-flowing river segments in the United States that are believed to possess one or more "outstandingly remarkable" natural or cultural values judged to be of more than local or regional significance (NPS, 2011).

Shoreline Management

Duke Energy manages project lands and waters as specified in the existing Commission-approved SMPs for Lake Jocassee and Lake Keowee.¹⁰¹ The purpose of both SMPs is to protect and enhance the scenic, recreational, and other environmental values of the project. The SMPs are used by Duke Energy to guide development of project shoreline while protecting project operation, environmental resources, and public recreation opportunities.

The SMPs have three components: shoreline classification maps, lake use restrictions, and shoreline management guidelines. The shoreline classification maps identify protected shoreline (e.g., habitat), developed shoreline, and shoreline potentially eligible for future development. The lake use restrictions describe the allowable use for each shoreline classification type. Existing shoreline classifications are described in table 3-18. For Lake Jocassee, non-project use is primarily restricted to private docks and public recreation access; no marina facilities are permitted. New intakes for public or industrial water supplies are also not allowed on Lake Jocassee. On Lake Keowee, Duke Energy allows more intensive development, with allowable shoreline uses including private residential and residential multi-family boat slips and commercial marinas. Typically, more-restrictive uses are permitted in areas designated for higher-intensity use (e.g., residential docks in areas designated as “future commercial marina”).

¹⁰¹ 142 FERC ¶ 62,086 (2013) and 119 FERC ¶ 62,165 (2007).

Table 3-18. Existing shoreline classifications (Source: Duke Energy, 2008 and Duke Energy, 2006, as modified by staff).

Classification	Description	Lake Jocassee		Lake Keowee	
		Shoreline Miles	% of Total	Shoreline Miles	% of Total
Environmental	Undeveloped, vegetated areas or cove heads with stream confluence. No vegetation removal, construction, or excavation permitted.	6.1	6.6%	41.5	11.6%
Natural	Undeveloped areas with characteristics that make most development undesirable, such as shallow water, isolated berms, and significant cultural resource or terrestrial habitat areas. No vegetation removal, construction or excavation permitted	0.9	1.0%	7.1	1.8%
Impact Minimization Zone (IMZ)	Undeveloped areas with identified scenic, environmental, or cultural values where development may be permitted with conditions or restrictions. Development impacts are avoided or minimized and may require mitigation measures	7.5	8.1%	76.4	19.7%
IMZ Developed	Areas with existing development with identified scenic, environmental, or cultural values.	0.1	0.1%	7.9	2.0%
Commercial Marina	Areas with existing commercial facilities where boats can be launched or moored and where food or retail services are provided.	n/a	n/a	3.9	1.0%
Future Commercial Marina	Undeveloped areas where commercial marinas may be developed in the future. These new marinas may include facilities where boats can be launched or moored and where food or retail services are provided.	n/a	n/a	15.5	4.0%
Residential Marina	Areas with existing residential facilities where boats can be launched or moored for multiple use, private, or residential purposes. No commercial marinas allowed.	n/a	n/a	5.4	1.4%
Future Residential Marina	Undeveloped areas where residential marina facilities may be developed in the future. These new marinas may include facilities where boats can be launched or moored for private residential purpose. No commercial marinas allowed.	n/a	n/a	5.6	1.4%

Classification	Description	Lake Jocassee		Lake Keowee	
		Shoreline Miles	% of Total	Shoreline Miles	% of Total
Residential	Areas with existing private facilities (private docks) for single-family residences. No commercial or residential marinas allowed.	2.0	2.2%	127.7	32.9%
Future Residential	Undeveloped areas where private facilities (private docks) for single-family residences may be developed in the future. No commercial or residential marinas allowed.	6.4	7.0%	49.5	12.8%
Business/Industrial	Areas with existing development or use by private businesses with no connection to boating. No facilities that have an effect on boating permitted.	0.0	0.0%	2.3	0.6%
Project Operations	Areas currently associated with hydropower production and areas immediately downstream of project works. No new or expanded residential marinas, commercial marinas, or residential facilities permitted.	3.0	3.2%	3.8	1.0%
Public Recreation	Areas with existing public recreation amenities. No non-project uses allowed, except infrastructure.	0.9	1.0%	3.0	0.8%
Future Public Recreation	Undeveloped areas that may be developed with public recreation amenities in the future. No non-project uses allowed, except infrastructure.	62.1	67.2%	16.5	4.3%
Public Infrastructure	Existing non-recreation facilities (e.g., utility line corridors) that support regional needs. Now new or expanded residential marinas, commercial marinas, or residential facilities.	3.3	3.6%	18.2	4.7%

The shoreline management guidelines are a set of detailed procedures and criteria that Duke Energy uses to regulate activities at Lake Jocassee and Lake Keowee. The existing guidelines describe Duke Energy's lake use permitting processes, which are intended to ensure consistency in reviewing all permit applications and considering all requests for non-project use of project lands and waters, consistent with its FERC license. Duke Energy permits uses of project lands and waters in several program categories including: (1) marina facilities, (2) conveyances, (3) excavation, (4) private facilities, (5) shoreline stabilization, and (6) miscellaneous reservoir uses. The shoreline management guidelines also include sections that outline general lake use policies, vegetation management strategies, true public marina requirements, and the shoreline stabilization technique selection process. Table 3-19 summarizes the permitting programs addressed in Duke Energy's existing shoreline management guidelines for the Keowee-Toxaway Project.

Table 3-19. Summary of existing shoreline management guidelines (Duke Energy, 2008 and Duke Energy, 2006, as modified by staff).

Program	Description
Marina Facilities Program	Permitting requirement for developing commercial and residential marinas and rebuilding existing marina facilities. Describes the shoreline preservation incentive program, which allows higher numbers of boat slips at residential marina facilities in return for leaving at least 20 percent of the developable area undeveloped.
Conveyance Program	Permitting requirements for conveyances including submerged utility lines, overhead utility lines, water intakes, effluent outfalls, bridges, causeways, and roadways.
Excavation Program	Permitting requirements for excavation activities.
Private Facilities Program	Permitting requirements for construction of private docks and boat slips.
Shoreline Stabilization Program	Permitting requirements for shoreline stabilization including use of seawalls, bulkheads, rip-rap, and vegetative bioengineering,
Miscellaneous Reservoir Uses Program	Permitting requirements for signs, recreation equipment, fish attractors, special events, geo-thermal systems, minor water withdrawals, satellite dishes, ski ramps and slalom courses, private swimming areas, concession sales at public access areas, special use facilities, business staging areas, wildlife enhancement activities, project operation and public service facilities, explosives, and dry hydrants.

3.3.6.2 Environmental Effects

Shoreline Management Plan and Lake Use Permitting

Duke Energy's shoreline management program helps protect the unique characteristics of each reservoir. At Lake Jocassee, Duke Energy's land management strategy helps to maintain the natural and aesthetic character of the reservoir. At Lake

Keowee, Duke Energy must balance requests from private land owners and commercial businesses for accesses to project waters with needs for project operation and public recreation.

Duke Energy proposes to implement a SMP for the project that combines the Lake Jocassee SMP (approved by the Commission in 2013) and the Lake Keowee SMP (approved by the Commission in 2007) into a single document that manages land use at the project. The new SMP retains many requirements of the existing SMPs; however, Duke Energy, in consultation with resource management agencies and other stakeholders, modified several components of the existing plans, including the shoreline classification maps and shoreline management guidelines.

Duke Energy proposes no significant changes to the shoreline classification categories or associated lake use restrictions outlined in the existing SMPs for Lake Jocassee and Lake Keowee. Duke Energy's proposed SMP does contain a modification to the suitable use hierarchy associated with "future" land use classifications. In response to stakeholder comments, Duke Energy modified the existing hierarchy to remove Business/Industrial use as a suitable future use within the Future Public Recreation classification.

Although the shoreline classification categories did not change, Duke Energy's proposed SMP does reclassify portions of the project shorelines into other land use categories. Table 3-20 compares the percent of shoreline in each classification under the existing SMPs with the proposed shoreline classifications under the proposed SMP. The proposed SMP contains updates that reclassify shoreline to reflect new construction since the filing of the currently-approved SMPs (e.g., Future Residential to Residential). Other changes to the shoreline classification maps include converting portions of shoreline classified as Future Commercial Marina on Lake Keowee to Future Residential Marina and designating the proposed High Falls II and Mosquito Point Access Areas as Future Public Recreation.

Table 3-20. Comparison of existing and proposed shoreline classifications as a percent of total shoreline (Source: Duke Energy, 2014a, Duke Energy, 2008 and Duke Energy, 2006, as modified by staff).

Classification Type	Lake Jocassee		Lake Keowee	
	Existing %	Proposed %	Existing %	Proposed %
Environmental	6.6%	6.6%	11.6%	11.9%
Natural	1.0%	1.0%	1.8%	2.2%
Natural Isolated Berm ^a	n/a	n/a	0.0%	0.0%
IMZ	8.1%	8.1%	19.7%	15.2%
IMZ - Developed	0.1%	0.2%	2.0%	6.3%
Commercial Marina	n/a	n/a	1.0%	1.0%
Future Commercial Marina	n/a	n/a	4.0%	0.8%
Residential Marina	n/a	n/a	1.4%	1.7%

Classification Type	Lake Jocassee		Lake Keowee	
	Existing %	Proposed %	Existing %	Proposed %
Future Residential Marina	n/a	n/a	1.4%	1.9%
Residential	2.2%	2.3%	32.9%	37.2%
Future Residential	7.0%	6.8%	12.8%	10.4%
Business/Industrial	n/a	n/a	0.6%	0.6%
Project Operations	3.2%	3.3%	1.0%	1.0%
Public Recreation	1.0%	0.9%	0.8%	0.8%
Future Public Recreation	67.2%	67.2%	4.3%	4.0%
Public Infrastructure	3.6%	3.6%	4.7%	4.7%

^a 0.1 miles of the Lake Keowee shoreline is classified as Natural Isolated Berm, corresponding to less than 0.1 percent of the total shoreline area. The Natural Isolated Berm classification corresponds to areas that are higher in elevation than the adjoining areas landward of the reservoir, but lack vegetation along the shoreline necessary to be classified as Environmental.

The proposed SMP also contains modifications to the shoreline management guidelines, which describe Duke Energy's permitting process and requirements for private development within the project boundary. Table 3-21 summarizes the modifications made to the shoreline management guidelines in the proposed SMP. These modifications reflect stipulations outlined in the Relicensing Agreement.

Table 3-21. Summary of proposed modifications to the Shoreline Management Guidelines (Source: Duke Energy, 2014a, as modified by staff).

SMG Section	Description of new or modified policy or criteria
General	Removes references to the Lake Use Policy Statement.
Archeological and Historical Resources	Requires lake use permitting applicants to adhere to the guidelines outlined in the HPMP for protecting archeological and historic resources.
Commercial Marina Facilities: Proximity to Existing Facilities	Removed the requirement from the previous shoreline management guidelines that new Commercial Marina facilities would not be authorized in areas within a half-mile radius of an existing Commercial Marina facility or in areas where more than 50 percent of the shoreline was within a half-mile radius of shoreline classified as Existing Residential.
Conveyances: Water Intakes	Requires that all new, expanded, or rebuilt large water intakes (in excess of 1 million gallons/day) be fully operational at 1,080 feet on Lake Jocassee and 775 feet on Lake Keowee. Prohibits new water intakes for public or industrial water supply on Lake Jocassee.
Private Facilities: Floatation Materials	Requires that all uncoated, beaded polystyrene on existing residential docks be removed, properly disposed of, and replaced with acceptable floatation by September 1, 2018.
Private Facilities: Following the Water	Allows dock owners to "follow the water" to maintain usability of boats or docks during LIP operating conditions provided that the

SMG Section	Description of new or modified policy or criteria
	temporary relocation of boats or docks and any temporary anchoring of these facilities does not create safety, navigational, or other hazards. Dock owners may make minor modifications to docks that would facilitate following the water, provided the modification does not result in increased square footage for the dock or a modification to the configuration of the dock.
Private Facilities: Exceptions and Waivers for Facility Modification or Expansion to Reach Deeper Water	Subject to the conditions specified in the Relicensing Agreement, allows private facility owners to apply for approval of modifications or expansions to existing docks to reach deeper water. During a publicly-noticed 365 day period, eligible applicants may qualify for an exception to the maximum size limits for dock surface area, an exception to the normal build-out period limit, and waivers of certain fees.

The SMP also contains provisions for periodic review and update. Duke Energy proposes to review and update the SMP every 10 years, following license issuance and SMP approval, in consultation with the FWS, South Carolina DPRT, and South Carolina DNR. Duke Energy also includes within the SMP provisions to make minor changes to the shoreline management guidelines and the shoreline classification maps and associated lake use restrictions to protect newly discovered resources such as archaeological or historic sites, Threatened or Endangered Species, Special Concern Species, or to correct mapping errors.

In comments filed March 20, 2015 and March 24, 2015, respectively, Advocates for Quality Development, Inc. and Upstate Forever raised concern that, as defined in the SMP, Business/Industrial land use would be permissible in areas of shoreline classified as Future Residential. Advocates for Quality Development, Inc. recommends that Business/Industrial use not be permitted in areas classified as Future Residential, or that such uses be compatible with residential development and quality of life. Upstate Forever concurred with the comments of Advocates for Quality Development, Inc.

Duke Energy did not address the comments of Advocates for Quality Development, Inc. or Upstate Forever in reply comments, but did respond to similar concerns raised during review of the draft license application. In the response to comments on the draft license application, filed with the final license application, Duke Energy explained that Business/Industrial activities include golf course intakes, access roads, and other similar activities with little to no effect on boating and that such uses could be consistent with future residential activities. Duke Energy also states that the Business/Industrial classification is used infrequently and that developing a new future use classification for such activities does not appear warranted.

In comments filed on March 17, 2015 and March 23, 2015, the Petitioners raised concern about Duke Energy's proposed one-year window providing exceptions and

waivers for facility modifications or expansions to private docks to reach deeper water. The Petitioners contend that the timeframe is unnecessarily narrow and that dock owners may not know if they need an extension before the window closes. As discussed in section 3.3.2, *Aquatic Resources* and section 3.3.8, *Socioeconomics*, Duke Energy addressed comments from the Petitioners, but did not respond specifically to the comments regarding the exceptions and waivers for private dock modifications.

Our Analysis

Duke Energy's proposed SMP reflects the need to balance residential and commercial development with maintaining areas for natural resource protection and recreation at the project.

Shoreline Classification Maps—Duke Energy's proposed changes to the shoreline classification maps would affect the types of development permissible along the project's shorelines and the availability of lands for project recreation and non-project use within the project boundary.

For Lake Jocassee, Duke Energy's proposal is very similar to the existing shoreline classification maps. The most significant change in land use classification reflects an increase in the Residential classification commensurate with a decrease in the Future Residential classification. Duke Energy's prohibition of future commercial or residential marina development on Lake Jocassee would preserve the reservoir's natural and undeveloped appearance.

The shoreline classification maps for Lake Keowee reflect its more developed character. As discussed in section 3.3.5, *Recreation Resources*, Duke Energy proposes to include into the project boundary two new recreation areas, High Falls II and Mosquito Point Access Area. The shorelines of these areas would be classified as Future Public Recreation. Duke Energy's proposal would also result in a small increase in lands protected under the Natural and Environmental classifications. Duke Energy proposes to increase the amount of shoreline classified as Future Residential Marina and decrease the amount of shoreline classified as Future Commercial Marina. This modification reflects stakeholder desires to reduce the amount of land available for Commercial Marina development at Lake Keowee. Duke Energy's SMP retains approximately 0.8 percent (3.3 miles) of Lake Keowee's shoreline as appropriate for Future Commercial Marina development. As part of modifications to the shoreline management guidelines, Duke Energy also proposes to remove restrictions on constructing new commercial marinas within a half mile of existing commercial marinas, providing greater flexibility for commercial marina development in the designated areas.

Filing electronic versions of the shoreline classification maps, in GIS format, would allow detailed tracking of shoreline resources and uses, and facilitate future reviews by the Commission.

Shoreline Classifications and Lake Use Restrictions—Duke Energy’s proposed SMP would not significantly alter the types of land use within the project boundary. The proposed change to define more restrictively the suitable uses for areas identified as Future Public Recreation (i.e., project operations, public recreation, or public infrastructure) would protect shoreline areas classified as Future Public Recreation from private development.

We recognize the comments of Advocates for Quality Development, Inc. and Upstate Forever regarding the potential for Business/Industrial use in areas classified as Future Residential.¹⁰² While some Business/Industrial uses may be compatible with residential development, other uses may not. Duke Energy’s SMP provides no mechanism for directing Business/Industrial use to specific areas within the project boundary; however, the proposed shoreline management guidelines do establish a process for Duke Energy (and the Commission, if appropriate) to review specific permit requests for Business/Industrial use within the project boundary and approve or deny such permits, as consistent with the SMP. Additionally, as staff noted in the “Environmental Assessment for the Lake Keowee Shoreline Management Plan” (2007), adjoining local zoning restrictions may preclude certain uses adjacent to the project boundary.¹⁰³ Existing residential areas are unlikely to be affected by new Business/Industrial development because new permits for Business/Industrial activities would be limited to undeveloped areas assigned to a future use category. The proposed shoreline management guidelines would provide Duke Energy the flexibility to determine the compatibility of a Business/Industrial use with adjacent land uses during the permitting process.

Shoreline Management Guidelines—In general, the shoreline management guidelines provide a framework for permitting activities within the project boundary. The guidelines were previously approved as part of the existing SMPs for Lake Jocassee and Lake Keowee. Duke Energy’s proposed modifications to the shoreline management guidelines include new measures to that help protect environmental and cultural resources, direct development, and improve access to project waters.

¹⁰² Duke Energy’s Business/Industrial classification includes project lands and waters used by private businesses that would have no effect on boating such as “water intakes and discharges for factories, golf courses, sand mining operations, certain utility connections, plant/business access roads, and business staging areas.” Duke Energy considers Business/Industrial use suitable in areas classified as Future Commercial Marina, Impact Minimization Zone, Future Residential Marina, and Future Residential.

¹⁰³ 119 FERC ¶ 62,165 (2007).

Duke Energy's proposal to require the removal and disposal of unencapsulated foam floatation from docks would protect environmental resources by removing a potential pollution source from the reservoirs.

Duke Energy's measures requiring that large water intakes be operable at water levels as low as the operational limits of the project powerhouses would ensure availability for water users over the term of a license. Prohibiting additional water intakes for public or industrial water supplies on Lake Jocassee would maintain existing water storage in the reservoir and is consistent with the land management objectives and to protect water resources. Further analysis of this proposal is provided in section 3.3.2, *Aquatic Resources*.

Duke Energy's measures to protect archeological and historical resources within the project boundary would ensure that permitted activities do not have adverse effects on cultural resources. These measures are discussed in greater detail in section 3.3.7, *Cultural Resources*.

Duke Energy's SMP contains a proposal to allow private dock owners to "follow the water" to maintain the usability of boats and docks during LIP operating conditions, provided that the temporary relocation of boats or docks do not create safety, navigational, or other hazards. Dock owners would be allowed to make minor modifications to existing docks to facilitate following the water, provided that the modification did not result in increased square footage for the dock or modification to the permitted dock configuration. This proposal would mitigate for the potential effects of lower reservoir levels during Stage 2, 3, and 4 LIP conditions and is similar to existing programs in place at Corps' reservoirs downstream of the project. Although user conflicts (e.g., blocked access to adjacent docks and encroachment on swimming and protected shoreline areas) could develop when dock owners maneuver their docks to optimize access, the SMP contains specific guidelines to minimize such occurrences. All user conflicts may not be prevented by implementing the "follow the water" program; however, the program provides more flexibility for private dock owners than Duke Energy's current SMPs allow.

Duke Energy's SMP also contains a provision providing a 365-day period during which existing dock owners may apply for an exemption and waiver of fees to modify and/or expand private docks by up to 200 square feet to reach deeper water (above the existing and proposed SMP's maximum of 1,000 square feet per dock). Allowing existing dock owners¹⁰⁴ to expand their docks by up to 200 square feet to reach deeper water would help residents along Lake Keowee adjust to the changes in project operation

¹⁰⁴ As of December 1, 2013, as specified in the SMP.

proposed by Duke Energy, particularly under LIP conditions. Duke Energy would continue to review and approve the permits for dock expansion using the criteria specified in the SMP to reduce potential conflicts between dock construction and environmental and recreation resource protection. However, a one-year window for dock modification applications, particularly if implemented prior to December 31, 2019 when Oconee Nuclear Station would be modified to allow for reservoir levels as low as 790 feet, may not be sufficient for existing dock owners to adjust to new project operation. As the Petitioners assert, property owners may not know if expanding their docks by 200 square feet would be necessary or helpful in reaching deeper water. Modifying Duke Energy's proposal to allow existing dock owners to apply for 200-square foot dock expansions (up to a maximum of 1,200 square feet) through December 31, 2020 would provide residents additional time to understand the long-term implications of modifications to project operation. Extending the timeline would not affect the total number of docks eligible for extension, because only docks constructed prior to December 1, 2013, would be eligible for modification, and all proposed dock modifications must meet Duke Energy's criteria for eligibility as outlined in the SMP.

Review and Update Procedures—Duke Energy's proposed SMP review and update procedures allow for adjustments in response to changes in shoreline development, needs, and requirements at ten-year intervals following initial approval of the SMP. A ten-year update period would allow Duke Energy to establish land use goals for the project shoreline and provide sufficient time for development to occur in a manner consistent with the plan. Consultation with federal and state resource agencies and other stakeholders during plan review would ensure that future plan updates would balance demand for new development and the need to protect environmental resources. Duke Energy's proposed update procedures would also allow for minor changes to the shoreline management guidelines, shoreline classification maps, and associated lake use restrictions to protect newly discovered resources such as archaeological or historic sites, Threatened or Endangered Species, Special Concern Species, or to correct mapping errors. These modifications would be more restrictive than the existing SMP, and would be consistent with Commission practice allowing licensees to manage shoreline development to protect environmental resources. Requiring Duke Energy to file an annual report with the Commission specifying any minor changes made to the SMP and/or describing changes made to the shoreline classification maps to correct mapping errors would improve Commission oversight of shoreline management activities and assist in administration of the license.

Our recommendations are discussed in section 5.0, *Conclusions and Recommendations*.

Effects of the Project on Designated River Reaches

The Horsepasture Wild and Scenic River and NRI-designated Toxaway River reaches terminate at the project boundary, at the upstream end of Lake Jocassee. For Lake Jocassee, Duke Energy proposes the existing minimum elevation of 1,080 feet, but will add a Normal Minimum elevation which would be 1,096 feet. Duke Energy proposes no measures associated with the designated reaches of the Horsepasture or Toxaway Rivers. American Whitewater's scoping comments regarding whitewater boating on these reaches are discussed in section 3.3.5, *Recreation Resources*. No comments or recommendations were filed in response to the Commission's notice that the application was ready for environmental analysis

Our Analysis

By act of Congress, the Horsepasture River was entered into the National Wild and Scenic River system on October 27, 1986 (Public Law 99-530). The Toxaway River was listed on the NRI for North Carolina in 1995. Both designated river reaches terminate at the project boundary, where the impounded waters form Lake Jocassee. Duke Energy's proposal to maintain the current maximum elevations at each development would not affect upstream tributaries outside of the project boundary nor would it alter the characteristics that contribute to the outstandingly remarkable values of the designated river reaches.

Project Boundary

The existing project boundary encompasses Lake Jocassee and Lake Keowee, project infrastructure, and all but one existing project recreation site (Crow Creek Access Area). As described in section 2.2.4, *Proposed Project Boundary*, Duke Energy proposes to increase land within the project boundary to include the existing Crow Creek Access Area and the new High Falls II and Mosquito Point Access Areas and additional land at Double Springs Campground. Duke Energy also proposes to expand the project boundary to include lands necessary for project operation and to correct previous mapping errors.

No recommendations were provided in response to the Commission's public notice that the application was ready for environmental analysis

Our Analysis

Duke Energy's proposed modifications to the project boundary would help meet the Commission's requirement to include all lands necessary for project purposes, including those lands necessary for providing public recreation access, within the project boundary. By bringing the existing Crow Creek Access Area, World of Energy Picnic

Area, and new lands for recreation use within the project boundary, the Commission could ensure the adequacy of these facilities over the term of a license.

3.3.6.3 Cumulative Effects

The project has influenced land use in the surrounding area since its construction. Actions taken by Duke Energy, federal and state land managers, and private property owners have shaped existing development and may cumulatively affect land use in the project vicinity over the term of a new license. The presence of the reservoirs has created demand for residential development of the project shorelines and, simultaneously, a need to protect lands for recreation use and natural resource management.

As part of its current license, Duke Energy is required to provide lands for public recreation within the project boundary. Duke Energy manages lands within the project boundary as part of its SMPs for Lake Jocassee and Lake Keowee. Outside of the project boundary, Duke Energy has worked with federal and state partners to protect lands for resource management and recreation. In the 1970s, Duke Energy donated 1,011 acres to South Carolina to create Keowee-Toxaway State Park. Duke Energy also donated land to the South Carolina DNR to create the Eastatoe Gorge Heritage Preserve (approximately 376 acres) and also supported the creation of the Laurel Fork Heritage Preserve (approximately 998 acres). In the 1990s, Duke Energy, through its various subsidiary companies, sold approximately 47,000 acres to state and federal agencies for permanent protection. These lands were incorporated into Jocassee Gorges and Sumter National Forest in South Carolina and Gorges State Park, Nantahala National Forest, and Toxaway Game Land in North Carolina. In conjunction with this effort, Duke Energy placed land it retained for potential future power production and transmission needs under easements held by the South Carolina DNR and State of North Carolina. The easements allow the states to manage the lands for public recreation and wildlife management while reserving Duke Energy's options to use the property to meet future power generation and transmission needs. An additional transaction in the mid-1990s resulted in the transfer of approximately 1,771 acres to the South Carolina Forestry Commission. These properties are now available to the public for recreational use subject to the respective agencies' rules and regulations.

The Relicensing Agreement contains provisions which will continue to affect land use for the foreseeable future. Duke Energy's proposed SMP would direct land use within the project boundary, including specific areas designated for future residential (i.e., private boat docks) and commercial development (i.e., marinas) and recreation. By designating future land uses Duke Energy would ensure a balance of residential, commercial, and recreational development at the project. Duke Energy can also set aside areas with sensitive species or cultural resources for protection. Duke Energy also proposed off-license measures to lease lands to South Carolina DNR for natural resource management and recreation, provide funds to the Oconee County Conservation Bank for

funding land conservation measures, and support Naturaland Trust’s purchase of the 1,648-acre Nine Times Tract. These measures would have cumulatively beneficial effects on land use, ensuring that lands within the project vicinity are protected for wildlife, habitat, and recreation.

3.3.7 Cultural Resources

3.3.7.1 Affected Environment

Section 106 of the National Historic Preservation Act of 1966, as amended, requires the Commission to evaluate potential effects on properties listed or eligible for listing in the National Register prior to an undertaking. An undertaking means a project, activity, or program funded in whole, or in part, under the direct or indirect jurisdiction of a federal agency, including those carried out by, or on behalf of, a federal agency; those carried out with federal financial assistance; and those requiring a federal permit, license, or approval. In this case, the undertaking is the issuance of a new license for the Keowee-Toxaway Project. Potential effects associated with this undertaking include project-related effects associated with project operation and maintenance.

Historic properties are defined as districts, sites, buildings, structures, traditional cultural properties, and objects significant in American history, architecture, engineering, and cultural that are eligible for inclusion in the National Register. In this EA we also use the term “cultural resources” to include properties that have not been evaluated for eligibility for listing in the National Register. Generally, cultural resources less than 50 years old are not considered eligible for the National Register.

For the Keowee-Toxaway Project, section 106 also requires that the Commission seek concurrence with the South Carolina SHPO and the North Carolina SHPO on any finding involving project effects or no effects on historic properties, and allow the Advisory Council on Historic Preservation (Advisory Council) an opportunity to comment on any finding of effects on historic properties. If Native American properties have been identified, section 106 requires that the Commission consult with interested Native American tribes that might attach religious or cultural significance to such properties.

Area of Potential Effects

According to the Advisory Council’s regulations, the area of potential effects (APE) is defined as “the geographic area or areas which an undertaking may directly or

indirectly cause alterations in the character or use of historic properties, if any such properties exist.”¹⁰⁵

During a May 30, 2013, Cultural Resources Work Group (CRWG)¹⁰⁶ meeting, the participants agreed that the APE for the Keowee-Toxaway Project would be defined as lands within the project boundary and lands affected by project operation, which include lands within the full pond elevation of each reservoir, project recreation access areas, the islands within the reservoirs, and additional lands associated with each powerhouse and dam complex.

In a letter filed on April 3, 2015, the FWS comments that the geographic area should include all reaches between project facilities and tributaries of the main rivers affected by project operation. The FWS identified cultural resources as a resource to be addressed. The defined APE and associated cultural resources investigations, as discussed below, take into account the FWS’s comment.

Prehistoric and Historic Background

The prehistoric and historic background for the project area is divided into four primary periods: Paleoindian (10,000 to 8,000 Before Present [BP]), Archaic (8,000 to 1,000 BP), Woodland (1,000 BP to 900 Anno Domini [AD]), and Mississippian (900 to 1500 AD). The Archaic Period and the Woodland Period are generally divided into sub-periods: Early, Middle, and Late.

The Paleoindian Period represents the earliest known Native American presence within the project area (Duke Energy, 2014a). This period is generally associated with nomadic populations. Paleoindian remains have been associated with extinct Pleistocene fauna (mammoth and bison) and wild plants (Benson, et al., 2006). The Archaic Period represents development of seasonal settlements, a shift in hunting smaller prey (such as, deer, turkey), and the gathering and use of plants. Grinding implements, such as polished stone tools, were common. Research has shown the use of freshwater shellfish and development of pottery during the Archaic Period (Adams, et al., 2008). The Woodland Period represents agricultural communities and increased use of pottery. Subsistence focused on deer hunting and fishing. During this period, earthen mounds containing

¹⁰⁵ 36 C.F.R. section 800.16(d).

¹⁰⁶ The CRWG consists of the South Carolina SHPO, the North Carolina SHPO, the North Carolina Office of State Archaeology, Duke Energy, the Eastern Band of Cherokee Indians, the United Keetoowah Band of Cherokee Indians in Oklahoma, the Cherokee Nation, the Catawba Indian Nation, and includes Commission staff.

burials were constructed. Artifacts of the Woodland Period include ceramics and projectile points. The Mississippian Period represents villages, social rankings, and chiefdoms with permanent communities. Communities were reliant on agriculture with an emphasis on maize, beans, and squash (Adams, et al., 2008). Generally speaking, research has shown that each period is marked by climate change and/or technological changes that are reflected in soils, pollen, and artifacts including tools and pottery.

During the 1500s, Hernando de Soto, a Spanish explorer, and then 25 years later, Juan Pardo, led expeditions to the area in search of gold, as well as a route to Mexico to protect their ships from the English pirates on the sea (Adams, et al., 2008). The project area encompassed Cherokee towns known as the Lower Towns. By the 1700s, Keowee was the primary town of the Lower Towns, but there were other Lower Towns situated along a trade route through the area. In 1730, the British sent an emissary to the Cherokee Nation along the Keowee River to claim land for the King of England and discuss trade. The French entered the area in the 1730s and 1740s. To counter French influence, the British proposed to build forts on Cherokee land, one of which was Fort Prince George. In 1753, Fort Prince George was constructed at Keowee to protect British interests and to serve as a principal trading post among the Cherokee's Lower Towns (Norris and Grunden, 2007).

Many of the Cherokee Lower Towns were destroyed in early 1776; however, the Lower Towns were not abandoned until after 1790. According to Andre Michaux's 1878/1788 journal, he hired several Cherokees as guides near the abandoned Keowee Town, and met on at least one occasion several headmen from the reestablished Toxaway Town or Sugar Town. In 1785, the Treaty of Hopewell between the United States and the Cherokees ended hostilities among the Lower Towns and South Carolina (letter from Tyler B. Howe, THPO, Eastern Band of Cherokee Indians, Cherokee, North Carolina, to J. Huff, Duke Energy Carolinas, LLC, Charlotte, North Carolina, in Duke Energy, 2014b). The Indian Removal Act of 1838 forced the Cherokees to move from their land east of the Mississippi River via the Trail of Tears to present-day Oklahoma. The years thereafter brought settlers to the area, the Blue Ridge Railroad in the 1840s, textile mills, the timber industry, and agriculture.

An original license was issued to Duke Power Company (predecessor to Duke Energy), effective September 1, 1966, for the construction, operation, and maintenance of the Keowee-Toxaway Project. The Keowee and Jocassee facilities were placed in service on April 17, 1971 and December 19, 1973, respectively.

Cultural Resources Investigations

In the 1960s, the South Carolina Institute of Archaeology and Anthropology (South Carolina IAA) conducted a survey of the Lake Jocassee area and recorded five

archaeological sites near the headwaters of the Whitewater River. The five sites are inundated by Lake Jocassee (Duke Energy, 2014b).

Prior to project construction, South Carolina IAA conducted an archaeological survey of the Keowee River valley in the 1960s. Thirty-three archaeological sites were identified in the area (Duke Energy, 2014b). Of the 33 archaeological sites, six sites were subject to data recovery excavation. The fieldwork focused on the excavation of Fort Prince George (38PN1) and the Cherokee historic villages of Toxaway (38OC3) and Keowee (38OC1) (Beuschel, 1976 in Adams, et al., 2008; Benson, 2006). Benson (2006) concluded that “the records of the excavations at Keowee and Fort Prince George are of such poor quality that little can be stated regarding their findings or significance.” The 33 archaeological sites are inundated by Lake Keowee.

Duke Energy completed cultural resources surveys to identify properties within the project APE that could be adversely affected by project operations and activities. The results of the surveys are presented in reports entitled: (1) *Keowee-Toxaway Hydroelectric Project Historic Context, Oconee and Pickens Counties, South Carolina and Transylvania County, North Carolina* (Swanson and Adams, 2008); (2) *Cultural Resources Survey of the Lake Jocassee Shoreline (Keowee-Toxaway Hydroelectric Project FERC No. 2503), Oconee and Pickens Counties, South Carolina, and Transylvania County, North Carolina, January 2007* (Norris and Grunden, 2007); (3) *Archaeological Survey of Lake Keowee Shoreline, Recreation Areas, and Islands Oconee and Pickens Counties, South Carolina* (Adams, et. al., 2008); and (4) *NRHP Evaluation of the Keowee-Toxaway Hydroelectric Development, Oconee and Pickens Counties, South Carolina* (Stallings, 2012).

The archaeological surveys above identified 53 archaeological sites within the project APE. Of the 53 archaeological sites, three sites are located at Lake Jocassee and 50 sites are located at Lake Keowee (Duke Energy, 2014a). At Lake Jocassee, the archaeological survey encompassed 75 miles of shoreline and seven islands. Survey results indicate the three archaeological sites (31TV909/909; 31TV910/38 PN150; and 38PN151) contain prehistoric and historic components (e.g., a projectile point and ceramic) and there is one isolate find (quartz Morrow Mountain Point). Norris and Grunden (2007) concluded the three sites and the one isolate find are ineligible for the National Register. At Lake Keowee, the archaeological survey encompassed 251 miles of shoreline, eight project recreation areas totaling 464.59 acres, and 83 islands. Survey results indicate the archaeological sites contain prehistoric and historic components (e.g., lithic scatters, ceramic material). Adams, et al., (2008) concluded the archaeological sites are ineligible for the National Register, except for three prehistoric archaeological sites (38OC460, 38OC466, and 38OC467). Site 38OC460 and Site 38OC467 contain

prehistoric components (e.g., lithic scatters). Both sites are recommended as potentially eligible under Criteria D.¹⁰⁷ Site 38OC466 is a Native American burial ground, which overlooked the Cherokee historic village of Keowee (38OC1). This site contains 18th Century trade items and pottery, and is recommended as potentially eligible under Criteria B, C, and D.¹⁰⁸ Adams, et al., (2008) recommended further testing of the three prehistoric archaeological sites to determine National Register eligibility.

The South Carolina Department of Archives & History concurred with the findings above (letter dated August 21, 2007, from Frances R. Knight and letter dated June 11, 2008, from Rebekah Dobrasko, South Carolina Department of Archives & History, Columbia, South Carolina to J. Huff, Duke Energy Carolinas, LLC, Charlotte, North Carolina). The North Carolina State Historic Preservation Office concurred with the findings above (letter from Renee Gledhill-Early, Environmental Review Coordinator, North Carolina State Historic Preservation Office, Charlotte, North Carolina to J. Huff, Duke Energy Carolinas, LLC, Charlotte, North Carolina, November 13, 2007).¹⁰⁹

The Eastern Band of Cherokee Indians concurred with the findings on the three prehistoric archaeological sites (38OC460, 38OC466, and 38OC467) (letter dated April 21, 2008, from Tyler B. Howe, THPO, Eastern Band of Cherokee Indians, Cherokee, North Carolina to J. Huff, Duke Energy Carolinas, LLC, Charlotte, North Carolina, in Adams, et al., 2008). The Catawba Indian Nation did not have any questions or requests for changes to the Adams, et al., 2008 survey report (letter dated June 23, 2008, from Dr. Wenonah G. Haire, THPO, Catawba Indian Nation, Rock Hill, South Carolina to J. Huff, Duke Energy Carolinas, LLC, Charlotte, North Carolina, in Adams, et al., 2008).

Five cemeteries are located within the project APE at Lake Keowee: (1) Site 38OC461 and (2) Site 38OC462, both of which are 19th and 20th Centuries cemeteries; (3) Site 38PN175; (4) Stamp Creek Access Area Cemetery; and (5) South Cove County

¹⁰⁷ Criteria D - have yielded, or may be likely to yield, information important in prehistory or history. 36 C.F.R. section 60.4.

¹⁰⁸ Criteria B - are associated with the lives of persons significant in our past. Criteria C - embody the distinctive characteristics of a type, period, or method of construction, or that represents the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction. 36 C.F.R. section 60.4.

¹⁰⁹ The letters are included in Duke Energy's final license application for the Keowee-Toxaway Hydroelectric Project No. 2503-154, Appendix E-3.

Park Cemetery. Both Stamp Creek Access Area and South Cove County Park are project recreation sites. For further discussion, see section 3.3.5, *Recreation Resources*.

Additionally, the historic Alexander-Hill House is located within the project APE at High Falls County Park, a project recreation site. For further discussion on High Falls County Park, see section 3.3.5, *Recreation Resources*. Constructed in 1831, the Alexander-Hill House was restored in 1981 (e.g., installation of a new roof, replacement of windows in-kind). The house is architecturally significant because it is the “strongest existing architectural link between the present and Old Pickens, a frontier town important in South Carolina history” (Caughman, 1972).

Traditional Cultural Properties

In 2011, Commission staff consulted with the Catawba Indian Nation, the Eastern Band of Cherokee Indians, the Cherokee Nation, and the United Keetoowah Band of Cherokee Indians to determine if the tribes desired to participate in the relicensing process for the project. On August 11, 2011, Commission staff established a Restricted Service List to include the Advisory Council, the South Carolina SHPO, the North Carolina SHPO, the North Carolina Office of State Archaeology, the Eastern Band of Cherokee Indians, the Catawba Indian Nation, and Duke Energy to discuss the project’s cultural resources. This list was updated on April 29, 2013 to add the United Keetoowah Band of Cherokee Indians by request.

The Eastern Band of Cherokee Indians commented that the Keowee-Toxaway Project is located within the aboriginal territory of the Cherokee people and potential cultural resources important to the Cherokee people may be threatened due to adverse effects expected from ground disturbance required for the project (letter from Tyler B. Howe, THPO, Eastern Band of Cherokee Indians, Cherokee, North Carolina to K.D. Bose, Secretary, Federal Energy Regulatory Commission, Washington, D.C., August 1, 2011).

The Catawba Indian Nation commented that the tribe has no concerns regarding traditional cultural properties, sacred sites, or Native American archaeological sites within the project area. However, if Native American artifacts and/or human remains are located during project-related ground disturbance, the tribe must be notified (letter dated December 1, 2014, from Dr. Wenonah G. Haire, THPO, Catawba Indian Nation, Rock Hill, South Carolina to Jeffrey G. Lineberger, P.E., Duke Energy Carolinas, LLC, Charlotte, North Carolina, filed on December 11, 2014).

Evaluation of the Keowee-Toxaway Hydroelectric Development

Stallings (2012) conducted a National Register evaluation of the Keowee-Toxaway hydroelectric structures. At the Jocassee Development, the powerhouse, Jocassee Dam, two intake structures, and two saddle dikes were evaluated. At the

Keowee Development, the powerhouse, Little River Dam, Keowee Dam, intake structure, four saddle dikes, and Oconee Nuclear Station intake dike were evaluated. The National Register uses 50 years of age as a guideline to evaluate the historic significance of resources. Stallings (2012) concluded that the Keowee-Toxaway Project is less than 50 years of age and therefore, is not considered a historic resource. However, a property less than 50 years of age may be considered National Register-eligible if it rises to a level of “exceptional importance,” defined under Criteria G.¹¹⁰

Stallings (2012) concluded that while the Keowee-Toxaway Project possesses significance under Criteria A¹¹¹ for its historical association, it does not meet the threshold of “exceptional importance” to be considered National Register-eligible under Criteria G. In 2022 and 2021, the Jocassee Development and the Keowee Development, respectively, will reach the 50-year federal threshold for National Register eligibility. At that time, Duke Energy proposes, under the HPMP, to re-evaluate the structures for National Register eligibility.

The South Carolina SHPO concurred with the findings above and with Duke Energy’s proposal to re-evaluate the structures for National Register eligibility once the structures reach 50 years (letter dated May 15, 2014, from Elizabeth Johnson, Deputy SHPO, South Carolina Department of Archives & History, Columbia, South Carolina to B. Garrison, Duke Energy Carolinas, Seneca, South Carolina in HPMP, Keowee-Toxaway Hydroelectric Project No. 2503-147, filed on November 5, 2014).

3.3.7.2 Environmental Effects

Project-related effects on cultural resources within the APE can result from construction of, or improvements to, project recreation facilities; other project-related ground-disturbing activities; or non-project use of project lands, such as construction of a pier. W.F. Baird and Associates (2013) conclude that most shoreline erosion at the project is attributable to wind waves and boat wakes, not reservoir level fluctuations. However, as the Commission has explained, project-induced erosion is erosion caused primarily by daily flow fluctuations; that is, erosion not attributable to flood flows or

¹¹⁰ Criteria G - a property achieving significance within the past 50 years, if it is of exceptional importance. 36 C.F.R. section 60.4.

¹¹¹ Criteria A - associated with events that have made a significant contribution to the broad patterns of our history. 36 C.F.R. section 60.4.

phenomena, such as wind-driven wave action, run-off from steep terrain during storms, and loss of vegetation due to fire and other natural causes.¹¹²

The Jocassee Development and the Keowee Development will meet the federal threshold of 50 years for National Register eligibility in 2022 and 2021, respectively. If any of the system structures are determined eligible, future project activities and/or modifications to the system could affect the historic integrity of these structures.

In comments made during the scoping process, the Pickens County Historical Society, State Senator Larry A. Martin, State Representative David R. Hiott, Mayor David Owens on behalf of Pickens City Council, the Pendleton District Commission, and members of the public remarked on Pickens County Historical Society's effort to reconstruct the 1753 Fort Prince George. As discussed previously, the fort was inundated by Lake Keowee during original project construction. The entities recommend that Duke Energy provide funding and associated land to reconstruct Fort Prince George. In doing so, the entities assert that jobs would be created, the public would be informed of the history of the project area, and tourism would increase.

Historic Properties Management Plan

Duke Energy developed and proposes to implement, in consultation with the CRWG, a HPMP filed on November 5, 2014, that assures the preservation and long-term management of the following cultural resources located within the project APE:

(1) project structures at the Jocassee Development and the Keowee Development; (2) the Alexander-Hill House, which is listed in the National Register; (3) three archaeological sites (38OC460, 38OC466, and 38OC467) at Lake Keowee; and (4) five cemeteries at Lake Keowee. Also, Duke Energy proposes to re-evaluate the project hydroelectric structures for National Register eligibility once the structures reach 50 years.

In regard to the three archaeological sites at Lake Keowee, no soil erosion was observed at Site 38OC460 and at Site 38OC467, the site has been stabilized. Site 38OC466 is a Native American burial site, and Duke Energy (2014b, c), in consultation with the Eastern Band of Cherokee Indians, proposes to stabilize approximately 800 linear feet of the island shoreline. Under the HPMP, Duke Energy proposes to: (1) preserve in-place the three archaeological sites and manage each site as a historic property and (2) monitor the three archaeological sites annually.

Although determined ineligible for the National Register, the five cemeteries are protected by the State of South Carolina. Duke Energy proposes the following measures,

¹¹² 85 FERC ¶ 61,245 (1998).

which are included in the HPMP and clarified by Duke Energy (2014c): (1) at Cemetery Site 38OC461, stabilize approximately 1,000 linear feet of the island shoreline; (2) at Cemetery Site 38OC462, stabilize approximately 1,000 linear feet of the island shoreline; and (3) at Cemetery Site 38PN175, stabilize approximately 300 linear feet of the shoreline at Lake Keowee. Shoreline stabilization measures at these sites are also discussed in section 3.3.1, *Geology and Soil Resources*. At the other two cemeteries, Duke Energy proposes to map the Stamp Creek Access Area Cemetery and fence the perimeter. The South Cove County Park Cemetery remains intact, and no additional measures are necessary. Duke Energy proposes to monitor the cemeteries annually.

Duke Energy includes in a HPMP guidelines to protect known and unknown archaeological and historic resources that may be affected by lake use permitting activities. During development of a HPMP, the CRWG agreed that certain lake use permitting activities are exempt from section 106 consultation such as an activity associated with the maintenance of an existing facility, i.e., repairs to a dock. The guidelines are also included in Duke Energy's SMP. For further discussion, see section 3.3.7, *Land Use*.

Overall, the HPMP includes provisions for: (1) a description of the Keowee-Toxaway Project, including project operations; (2) identification of the project APE, with maps, and location of cultural resources and historic properties; (3) identification of the historic context of the project (time, place, and theme); (4) a description of project-related effects on cultural resources; (5) site treatment measures; (6) inadvertent discoveries, and treatment of human remains and/or funerary objects; (7) planned, extended drawdowns, and emergency situations; (8) a discussion of lake use permitting activities; (9) a list of activities categorically excluded from section 106 consultation; (10) public education and outreach that includes interpretive signage and a traveling exhibit on the history of the project area; (11) review and update of the plan; (12) a re-evaluation of the project hydroelectric structures for National Register eligibility once the structures reach 50 years; and (13) consultation with the CRWG.

Our Analysis

To meet the requirements of section 106 of the NHPA, the Commission executed a PA with the South Carolina SHPO on May 19, 2015, and the North Carolina SHPO on May 8, 2015, and invited Duke Energy, the Eastern Band of Cherokee Indians, the United Keetoowah Band of Cherokee Indians in Oklahoma, the Cherokee Nation, and the Catawba Indian Nation to concur with the stipulations of the PA. Duke Energy and the Catawba Indian Nation concurred. The PA requires Duke Energy to implement a HPMP, filed on November 5, 2014, for the term of the new license.

Implementation of the measures identified in the HPMP would ensure that archaeological and historic resources are protected. In the event that a project-related activity cannot be modified to avoid an adverse effect on an historic property within the

project APE, Duke Energy would consult with the South Carolina SHPO, the North Carolina SHPO, the North Carolina Office of State Archaeology, the Eastern Band of Cherokee Indians, the United Keetoowah Band of Cherokee Indians in Oklahoma, the Cherokee Nation, the Catawba Indian Nation, and Commission staff as provided for under the HPMP to identify, and if necessary implement, appropriate measures.

In regard to Fort Prince George, studies conducted during relicensing do not support the need to reconstruct Fort Prince George. As the Commission has explained, an evaluation and consideration of the appropriateness of requiring enhancement measures is done in the context of today's environment and in relation to today's needs and problems, not in the context of the world as it existed 50 years ago.¹¹³ The baseline for a relicense is the existing environment. Duke Energy already satisfied its responsibilities for mitigation of environmental effects of the previous license, including effects of the project on Fort Prince George. The HPMP contains provisions for Duke Energy to develop a traveling display regarding the history of the project and the project area, which would provide educational benefits to the public.

3.3.8 Socioeconomic Resources

3.3.8.1 Affected Environment

Population and Economic Data

The project is located in Oconee and Pickens Counties, South Carolina and Transylvania County, North Carolina. For the decade 2001-2010, both South Carolina and North Carolina ranked in the top 10 fastest growing populations in the United States. The populations of Pickens, Oconee, and Transylvania Counties have grown each year since the project's construction in the late 1960s, outpacing statewide population growth in some decades (table 3-22).

Table 3-22. Population growth rates in the Keowee-Toxaway Project area (Source: Duke Energy, 2014a as modified by staff).

Decade	South Carolina	Oconee County	Pickens County	North Carolina	Transylvania County
1961-1970	9%	1%	28%	12%	20%
1971-1980	21%	19%	34%	16%	19%
1981-1990	12%	18%	18%	13%	9%
1991-2000	15%	15%	18%	21%	15%
2001-2010	15%	12%	8%	18%	13%

¹¹³ 47 FERC ¶ 61,225 (1989).

Table 3-23 displays 2014 population and business data for the Keowee-Toxaway Project area. Pickens County is the most populous county in the project area. Major population centers in Pickens County include Clemson, Easley, Liberty, and Pickens. Seneca, in Oconee County, is the nearest city to the project. Transylvania County is the least densely populated; no shoreline residences are located in Transylvania County. In general, the counties surrounding the Keowee-Toxaway Project are economically similar to each other. In 2013, median household income was approximately \$41,500 and median home price ranged between \$123,000 and \$172,000, with the highest home values in Transylvania County, North Carolina (U.S. Census Bureau, 2015).

Table 3-23. 2014 population and business data for Oconee and Pickens County, South Carolina and Transylvania County, North Carolina (Source: U.S. Census Bureau, 2015; U.S. Bureau of Labor Statistics, 2015).

	Oconee County	Pickens County	Transylvania County
Area (square miles)	626	496	379
Total Population (estimated)	75,192	120,368	33,045
Population under 18	22.6%	19.8%	16.4%
Population Density (persons per square mile)	118.6	240.2	87.4
Median Household Income	\$41,394	\$41,788	\$41,781
Median Home Value	\$136,300	\$123,900	\$171,600
% Unemployment	8.0%	6.5%	8.1%
% Below Poverty	19.1%	18.9%	14.3%

Employment in the area is diverse. The primary industries in Oconee County are manufacturing; trade, transportation and utilities; and government, together accounting for 65 percent of the employed workforce. The largest employer in Oconee County is the Oconee County School District. The primary industries in Pickens County are state and local government, manufacturing, and leisure, together accounting for 56.4 percent of the employed workforce. The largest employer in Pickens County is the State of South Carolina, followed by Clemson University. In Transylvania County, the primary industries are health care and social assistance; and retail trade, together accounting for 25 percent of the employed workforce. The largest employer in Transylvania County is Transylvania Community Hospital, and the largest manufacturing employer is M-B Industries. Regionally, Duke Energy contributes to the employment base. The Keowee-Toxaway Project payroll was approximately \$5 million in 2013. Duke Energy employs approximately 3,800 additional workers at Oconee Nuclear Station.

Unemployment rates in the three counties have declined in recent years commensurate with a decline in nationwide unemployment. In Oconee County, unemployment fell from a high of 13.5 percent in 2009 to 8.0 percent in 2013. In Pickens County, the unemployment rate declined from 10.7 percent to 6.5 percent over the same

period. Unemployment rates fell from a high of 10.4 percent in 2010 to 8.1 percent in 2013 in Transylvania County (U.S. Bureau of Labor Statistics, 2015).

Recreation Value

The project's recreation resources draw economic activity into Oconee and Pickens Counties, through recreation-related expenditures by visitors and shoreline property owners. These expenses include food and drink, overnight lodging, camping, boating supplies, bait/tackle, transportation (e.g., auto/boat gasoline), marina services, guide/outfitter fees, and other miscellaneous recreation-related expenses.

During the 2012 RUN Study, visitors and residents were surveyed about their recreation-related spending. Average daily expenditure by visitors to the project was \$66.73 in 2012, of which over 60 percent (\$40.37) was spent in Oconee and Pickens Counties. Kleinschmidt (2013) inputted the survey data into the Minnesota IMPLAN regional economic modeling system to examine county economies. Based on the modeled data, visitation to the project's recreation areas resulted in a total of 674 jobs and over \$78.5 million in gross sales, of which \$25.2 million remained in Oconee and Pickens Counties in the form of employee compensation, proprietor income, and tax revenues (Kleinschmidt, 2013).

Shoreline and back-lot property owners spent less per day than visitors to the project (\$13.93 in 2012), but the majority of the expenses (\$13.47) stayed within Oconee and Pickens Counties. When modeled, expenditures by shoreline and back-lot property owners on recreation contributed to 395 jobs and \$40.8 million in gross sales, of which \$14.4 million remained in Oconee and Pickens Counties (Kleinschmidt, 2013).

3.3.8.2 Environmental Effects

Project-Related Effects on the Local and Regional Economy

Operation of the project contributes directly and indirectly to the local economy. Changes to reservoir water surface elevations could affect the economy in varying ways. Generally speaking, higher reservoir water levels year-round are more desirable to both visitors and residents, which may result in more recreational use, visitor spending, income to local recreation-related businesses, recreation-related employment, and higher property values and tax revenues. On the other hand, lower reservoir levels may be associated with less recreation use, spending, income, employment, property value, and tax revenue.

Duke Energy proposes to modify project operation as defined in the 2014 Operating Agreement, and described in section 2.2.2, *Proposed Project Operation*. Recreation facility enhancements are proposed for the project, which may also contribute

to the regional economy. Details on the proposed recreation enhancements are discussed in section 3.3.5, *Recreational Resources*.

Several entities concurred with Duke Energy’s proposal, as outlined in the Relicensing Agreement, including Oconee County Administration and Greenville Water. In comments on the license application, the Petitioners raised concerns that Duke Energy did not accurately represent the economic impact of the proposed Critical Reservoir Elevation for Lake Keowee (790 feet during Stage 4 of the LIP) on shoreline property values. The Petitioners cite a study conducted by Dr. David Wyman of Clemson University, which found a correlation between the lowest targeted lake floor level (790 feet) and property values (Wyman et al., 2013).

In reply comments, Duke Energy stated that although the LIP allows the reservoir level to be lowered to 790 feet during severe drought conditions, under normal project operation, reservoir levels at Lake Keowee will be higher, on average, than allowed under the current license. Duke Energy also states that the study by Wyman, et al. (2013) is preliminary, that Duke Energy provided comments to the author, and that the version filed by the Petitioners did not address those comments. Duke Energy cites three studies,¹¹⁴ conducted to support the 2014 Operating Agreement, that address the effects of project operation on regional economics.

Our Analysis

Many factors influence the regional economy in Upstate South Carolina, including operation of the Keowee-Toxaway Project. Net positive benefits to the economy exist because of direct spending and employment associated with the Keowee-Toxaway Project and Oconee Nuclear Station. Recreation amenities at the project provide additional value to the economy through visitor and resident spending on recreation-related purchases. Shoreline residences, particularly those developed on uplands associated with Lake Keowee, contribute to the property tax base of Oconee and Pickens Counties.

During the development of the 2014 Operating Agreement, Cary, et al. (2011) examined the effects of changing reservoir levels at Lake Keowee on the economies of Oconee and Pickens Counties using the Regional Dynamics (REDYN) economic

¹¹⁴ “An Economic Analysis of Low Water Levels in Hartwell Lake” (November 8, 2010); “Regional Economic Analysis of Changing Lake Levels in Lake Keowee” (October 28, 2011), and “Regional Economic Analysis of Changing Lake Levels in Lake Thurmond” (December 19, 2011), filed as appendices P, R, and S of Exhibit E, Appendix E-8 of the final license application.

modeling engine. Inputs to the model included selected lake, real estate, and economic data from 1998 to 2009. The study revealed that lower reservoir elevations adversely affect the economies of both Oconee and Pickens County but that the adverse effects are minor in relation to overall regional economic activity (loss of \$17,571 in net revenue and 0.69 jobs per month per foot decrease in lake level) (Cary, et al., 2011). The authors also applied the model to the four operating regime alternatives¹¹⁵ identified in the 2014 Corps' EA. The results indicated that all alternatives would produce comparable results (adverse economic impacts of less than \$20,000 region-wide and fewer than 6 jobs lost) (Corps, 2014).

Cary, et al. (2011) also examined the effect of changing reservoir levels on lakefront housing prices. In both Oconee and Pickens Counties, the study results indicated that a small, but statistically significant, relationship exists between reservoir levels and housing values, but that the relationship is nonlinear and complex. While the models for Oconee and Pickens Counties both indicated that housing prices would fall for every foot decrease in reservoir levels much of the time, sales prices increased with falling reservoir levels at both the very low and high ends of the proposed operating regime.

In the working paper cited by the Petitioners, Wyman et al. (2013) also explored the relationship between reservoir levels and housing prices at Lake Keowee. The study assumed that buyers would be willing to pay premiums for properties with docks or where docks can be constructed. The authors conclude that reduction in water levels at Lake Keowee to 790 feet would result in negative wealth impacts on property owners, in particular because some properties would become "undockable" at lower reservoir levels. As Duke Energy stated in its comments to the author, the study makes assumptions of the frequency of LIP conditions that do not correspond with Duke Energy's modeled reservoir levels, even under the more restrictive climate change hydrology¹¹⁶ (letter from

¹¹⁵ The four operating regimes include: (1) the no action alternative/alternative 1 – maximum drawdown of Lake Keowee to 778 feet, as allowed under the existing license; (2) alternative 2 – maximum drawdown of Lake Keowee to 794.6 feet, as Duke has operated the project since 1996; (3) alternative 3 – maximum drawdown to 790 feet during LIP conditions as Duke Energy proposed in the Relicensing Agreement; and (4) maximum drawdown to 796 feet, as proposed by Duke Energy in the Relicensing Agreement without LIP provisions.

¹¹⁶ Sawyer, et al. (2014), using the model developed for the water quality study (Sawyer, et al., 2013), analyzed the effects of a set of low- and high-impact climate change assumptions. Both the climate change test case years were characterized by air temperatures exceeding a 42-year (1968 to 2009) annual average air temperature. Under the low-impact climate change scenarios, the air temperature model inputs were increased (*Cont'd.*)

J. Lineberger, Director, Duke Energy Carolinas, LLC to D. Wyman, Clemson University, June 11, 2013). As discussed in section 3.3.2, *Aquatic Resources*, Duke Energy's modeling indicates that under proposed operation, reservoir levels at Lake Keowee would fall below 796 feet approximately 7 percent of the time, compared with 32 percent of the time under current operation. Elevations below 793 feet, as recommended by the Petitioners, would occur less than 4 percent of the time. The study also fails to consider Duke Energy's SMP when evaluating which properties would be "undockable" under lower lake levels. Further discussion of the SMP is provided in section 3.3.6, *Land Use*.

We discuss project economics in section 4.0, *Developmental Analysis*, and make our recommendation in section 5.0, *Conclusions and Recommendations*.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative the project would continue to operate as it has in the past. None of Duke Energy's proposed new measures, measures in the Relicensing Agreement, or the agencies' recommendations and mandatory conditions would be required. Recreation resources would be managed in their current condition, and Duke Energy's proposed recreation enhancements would not be constructed. Shoreline resources within the project boundary would be managed under the existing SMP and no additional protection measures would be adopted. Project operation would not be modified in accordance with the Relicensing Agreement and 2014 Operating Agreement.

by 3 °F, while for the high-impact climate change scenarios, 6 °F was added to air temperatures, coupled with a reduction in project inflows.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the Keowee-Toxaway Project's use of the Toxaway, Keowee, and Little Rivers for hydropower purposes to see what effect various environmental measures would have on the project's costs and power generation. Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in *Mead Corp.*,¹¹⁷ the Commission compares the current project cost to an estimate of the cost of obtaining the same amount of energy and capacity using the likely alternative source of power for the region (cost of alternative power). In keeping with Commission policy as described in *Mead Corp.*, our economic analysis is based on current electric power cost conditions and does not consider future escalation of fuel prices in valuing the hydropower project's power benefits.

For each of the licensing alternatives, our analysis includes an estimate of: (1) the cost of individual measures considered in the EA for the protection, mitigation, and enhancement of environmental resources affected by the project; (2) the cost of alternative power; (3) the total project cost (i.e., for construction, operation, maintenance, and environmental measures); and (4) the difference between the cost of alternative power and total project cost. If the difference between the cost of alternative power and total project cost is positive, the project produces power for less than the cost of alternative power. If the difference between the cost of alternative power and total project cost is negative, the project produces power for more than the cost of alternative power. This estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license. However, project economics is only one of many public interest factors the Commission considers in determining whether, and under what conditions, to issue a license.

4.1 POWER AND DEVELOPMENTAL BENEFITS OF THE PROJECT

Table 4.1 summarizes the assumptions and economic information we use in our analysis. Duke Energy provided most of this information in its license application. We find that Duke Energy's values are reasonable for the purposes of this analysis. Cost items common to all alternatives include: (1) taxes and insurance costs; (2) net investment (the total investment in power plant facilities remaining to be depreciated); (3) estimated future capital investment required to maintain and extend the life of plant equipment and facilities; (4) relicensing costs; (5) normal operation and maintenance

¹¹⁷ See *Mead Corporation, Publishing Paper Division*, 72 FERC ¶ 61,027 (July 13, 1995). In most cases, electricity from hydropower would displace some form of fossil-fueled generation, in which fuel cost is the largest component of the cost of electricity production.

cost; and (6) Commission fees. All costs are expressed in 2015 dollars, unless specified otherwise.

Table 4-1. Parameters for the economic analysis of the Keowee-Toxaway Project

Assumption	Value	Source
Period of economic analysis (years)	30	Staff
Current net investment ^a	\$137,195,370	Duke Energy
Current annual costs including O&M and FERC fees ^b	\$35,891,592	Duke Energy
Relicense application costs ^c	\$26,000,000	Duke Energy
Term of financing (years)	20	Staff
Cost of capital (percent) ^d	11.35	Duke Energy
Discount rate (percent) ^e	6.7	Duke Energy
Energy rate (\$/MWh) ^f	\$18.49	Duke Energy
Dependable Capacity (MW)	932	Duke Energy
Capacity rate (\$/kilowatt-year) ^g	\$135.73	Duke Energy

Notes:

- a** Provided by Duke Energy in Revised Exhibit D, section D2.2 filed December 17, 2014. The net investment value reflects the sum of net investments at the Jocassee Development (\$74,220,026) and the Keowee Development (\$62, 975,343).
- b** Provided by Duke Energy in Revised Exhibit D, Table D4-3, filed December 17, 2014. The figure includes O&M expenses, cost of capital, insurance, fees, taxes, and depreciation.
- c** Provided by Duke Energy in Revised Exhibit D, section D7, filed December 17, 2014. The figure accounts for stakeholder outreach, studies, consultants, internal management, and administrative costs from 2006 through mid-2014.
- d** Provided by Duke Energy in Revised Exhibit D, section H1, filed December 17, 2014.
- e** Provided by Duke Energy in Revised Exhibit D, section H1, filed December 17, 2014.
- f** Provided by Duke Energy in Revised Exhibit D, table D5-1, filed December 17, 2014. The energy rate is a composite value for on-peak and off-peak energy rates for the combined Jocassee and Keowee Developments.
- g** Provided by Duke Energy in Revised Exhibit D, table D5.1, filed December 17, 2014.

Under the current license, the Keowee-Toxaway Project has an installed capacity of 867.60 MW and generates an average of 1,018,258 MWh annually with a capacity value of \$135.73/kW-year (see table 4-1).

4.2 COMPARISON OF ALTERNATIVES

Table 4-2 compares the installed capacity, annual generation, cost of alternative power, estimated total project cost, and difference between the cost of alternative power and total project cost for each of the alternatives considered in this EA: (1) no action; (2) Duke Energy's proposal; and (3) the staff alternative.

Table 4-2. Comparison of alternatives for the Keowee-Toxaway Project

	No Action	Duke Energy's Proposal	Staff Alternative	Staff Alternative with Mandatory Conditions
Authorized installed capacity (MW)	867.6	867.6	867.6	867.6
Dependable capacity (MW)	932	932	932	932
Annual generation (MWh)	1,018,258	1,191,013	1,191,013	1,191,013
Annual power value \$ ^a	\$145,325,782	\$148,519,321	\$148,519,321	\$148,519,321
(\$/MWh)	\$142.72	\$124.70	\$124.70	\$124.70
Annual costs (\$) ^{b, c, d}	\$38,254,656	\$39,592,353	\$39,590,269	\$39,611,581
(\$/MWh)	\$37.57	\$33.24	\$33.24	33.25
Power benefit (i.e., power value minus costs)	\$107,071,126	\$108,926,968	\$108,929,052	\$108,907,740
(\$/MWh)	\$105.15	\$91.45	\$91.45	\$91.44

Notes:

- a** The annual power value includes a value for energy generated plus a value for dependable capacity. The value for energy is a composite of on-peak and off-peak rates for both developments.
- b** The annual cost for the No Action alternative includes the annual cost identified in Table 4-1 (\$35,891,592/year) plus the annual cost for preparing the license application (\$2,363,064/year).
- c** The annual cost for Duke Energy's Proposal includes the No Action costs plus the enhancement and mitigation measures proposed by Duke Energy which are within the project boundary. Duke Energy's settlement includes an additional \$780,910/year for measures outside the project boundary which are not included.

- d The annual cost for the Staff Alternative includes Duke Energy's proposed costs plus staff recommended additions, deletions, and modifications, as identified in Table 4-3.
- e This alternative includes \$21,312 per year to monitor dissolved oxygen during the month of August in the tailrace of each development, as required by the WQC.

4.2.1 No-action Alternative

Under the no-action alternative, the project would continue to operate as it does now. The project would have an installed capacity of 867.6 MW, and generate an average of 1,018,258 MWh of electricity annually valued at \$145,325,782, or about \$142.72/MWh. The average annual project cost would be \$38,254,656, or about \$37.57/MWh. Overall, the project would produce power at a cost that is \$107,071,126, or about \$105.15/MWh, less than the cost of alternative power.

4.2.2 Applicant's Proposal

Under Duke Energy's proposal, the project would have a total installed capacity of 867.6 MW, a dependable capacity of 932 MW, and an average annual generation of 1,191,013 MWh valued at \$148,519,321, or about \$124.70/MWh. The average annual project cost would be \$39,592,353, or about \$33.24/MWh. Overall, the project would produce power at a cost which is \$108,926,968 or about \$91.45 /MWh, less than the cost of alternative power.

4.2.3 Staff Alternative

The staff alternative has the same capacity and energy attributes as Duke Energy's proposal. Table 4-3 shows the staff-recommended additions, deletions, and modifications to Duke Energy's proposed environmental protection and enhancement measures and the estimated cost of each.

Based on a total installed capacity of 867.6 MW, a dependable capacity of 932 MW, and an average annual generation of 1,191,013 MWh, the value of alternative power would be \$148,519,321, or about \$124.70/MWh. The average annual project cost would be \$39,590,269 or about \$33.24 /MWh. Overall, the project would produce power at a cost which is \$1108,929,052, or about \$91.45/MWh, less than the cost of alternative power.

4.2.4 Staff Alternative with Mandatory Conditions

The staff alternative with mandatory conditions has the same capacity and energy attributes as Duke Energy's proposal. It includes all staff-recommended measures as well as the water quality measures required by the certification.

Based on a total installed capacity of 867.6 MW, a dependable capacity of 932 MW, and an average annual generation of 1,191,013 MWh, the value of alternative

power would be \$148,519,321, or about \$124.70/MWh. The average annual project cost would be \$39,611,581 or about \$33.25 /MWh. Overall, the project would produce power at a cost which is \$108,907,740, or about \$91.44/MWh, less than the cost of alternative power.

4.3 COST OF ENVIRONMENTAL MEASURES

Table 4-3 shows the cost of each of the environmental mitigation and enhancement measures considered in the analysis. We convert all costs to equal annual (levelized) values over a 30-year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost.

Table 4-3. Cost of mitigation and enhancement measures considered in assessing the environmental effects of the continued operation of the Keowee-Toxaway Project (Source: Duke Energy, as modified by staff).

Enhancement/ Mitigation Measures	Entities	Capital Cost (2015\$)	Average Annual Capital Cost (2015 \$)	Average Annual O&M Cost (2015\$)	Levelized Annual Cost (2015\$)
Modify the operating levels for Lake Keowee and Lake Jocassee as described in Settlement Agreement ^a	Duke Energy, Staff		172,755 MWh net gain in energy valued at \$3,194,240/year		-\$3,194,240
<u>Jocassee Development</u>					
Project Operation					
Jocassee portion of cost to implement the 2014 Operating Agreement between the Corps, SEPA, and Duke Energy	Duke Energy, Staff	\$1,806,024	\$102,464	\$5,209	\$107,673
Jocassee portion of cost to administer the MEP.	Duke Energy, Staff	\$0	\$0	\$5,209	\$5,209
Jocassee portion of costs to administer the LIP.	Duke Energy, Staff	\$10,506	\$672	\$16,894	\$17,566

Enhancement/ Mitigation Measures	Entities	Capital Cost (2015\$)	Average Annual Capital Cost (2015 \$)	Average Annual O&M Cost (2015\$)	Levelized Annual Cost (2015\$)
Aquatic Resources					
Monitor the Jocassee tailwater DO continuously during the month of August.	Duke Energy, South Carolina DHEC	\$4,203	\$238	\$10,418	\$10,656
Monitor Lake Jocassee and the Jocassee tailwater DO, temperature, turbidity, pH, and total dissolved gas hourly at permanent stations. ^b	FWS	\$50,000	\$2,836	\$25,000	\$27,836
Modify intake and tailwater lighting to reduce entrainment.	FWS	\$6,304	\$358	\$0	\$358
Operate the project in pumping mode using the following start-up sequence: unit 3, unit 4, unit 1, and unit 2	FWS	\$0	\$0	\$298	\$298

Enhancement/ Mitigation Measures	Entities	Capital Cost (2015\$)	Average Annual Capital Cost (2015 \$)	Average Annual O&M Cost (2015\$)	Levelized Annual Cost (2015\$)
Monitor fish community composition in Lakes Jocassee and Keowee, and adjacent tributaries to detect effects of project operation on fish community composition and abundance.	FWS	\$300,000	\$17,272	\$0	\$17,272
Terrestrial Resources					
Install signage for botanical species protection.	Duke Energy, Staff	\$2,627	\$149	\$0	\$149
Recreational Resources					
<u>Implement the RMP</u>					
Lease the Bootleg Access Area to the SCDNR.	Duke Energy	\$0	\$0	\$26,342	\$26,342
At Devils Fork State Park, designate diver access, construct new dock at the main ramp, construct new boat and trailer parking to serve campground; enhance boat ramps for non-motorized boating, and install bank fishing signage.	Duke Energy, Staff	\$1,260,750	\$74,459	\$110,381	\$184,840

Enhancement/ Mitigation Measures	Entities	Capital Cost (2015\$)	Average Annual Capital Cost (2015 \$)	Average Annual O&M Cost (2015\$)	Levelized Annual Cost (2015\$)
Expand the Double Springs Campground by 25 acres; construct 12 additional campsites; and install a composting restroom.	Duke Energy, Staff	\$116,149	\$6,860	\$27,595	\$34,455
Conduct a new Recreation and Use Needs Study and revise the RMP if needed.	Duke Energy, Staff	\$0	\$0	\$4,169	\$4,169
Land Use Implement the SMP and review and revise the SMP every 10 years as necessary.	Duke Energy, Staff	\$0	\$0	\$3,466	\$3,466
Modify the SMP to extend the provision for exemptions to the maximum size limit for private facilities from the time of license issuance through December 31, 2020.	Staff	\$0	\$0	\$0	\$0
File an annual report on any modifications made to the SMP. ^b	Staff	\$0	\$0	\$1,000	\$1,000

Enhancement/ Mitigation Measures	Entities	Capital Cost (2015\$)	Average Annual Capital Cost (2015 \$)	Average Annual O&M Cost (2015\$)	Levelized Annual Cost (2015\$)
Cultural Resources					
<u>Implement the HPMP</u>					
Install interpretive signage.	Duke Energy, CRWG, Staff	\$13,133	\$687	\$0	\$687
Develop a traveling display about the history of the project and project area.	Duke Energy, CRWG, Staff	\$7,880	\$413	\$0	\$413
Assess National Register-eligibility of the project structures.	Duke Energy, CRWG, Staff	\$0	\$0	\$975	\$975
<u>Keowee Development</u>					
Project Operation					
Keowee portion of cost to implement the 2014 Operating Agreement between Duke, the Corps, and SEPA.	Duke Energy, Staff	\$1,806,024	\$102,464	\$5,209	\$107,673
Keowee portion of cost to administer the MEP.	Duke Energy, Staff	\$0	\$0	\$5,209	\$5,209

Enhancement/ Mitigation Measures	Entities	Capital Cost (2015\$)	Average Annual Capital Cost (2015 \$)	Average Annual O&M Cost (2015\$)	Levelized Annual Cost (2015\$)
Keowee portion of costs to administer the LIP.	Duke Energy, Staff	\$21,012	\$1,344	\$16,894	\$18,238
Aquatic Resources					
Monitor the Keowee tailwater DO continuously during the month of August.	Duke Energy, South Carolina DHEC	\$4,203	\$238	\$10,418	\$10,656
Monitor Lake Keowee, the Keowee tailwater, and Little River Bypassed Reach DO, temperature, turbidity, pH, and total dissolved gas hourly at permanent stations. ^b	FWS	\$50,000	\$2,836	\$25,000	\$27,836
Terrestrial Resources					
Install signage for botanical species protection.	Duke Energy, Staff	\$2,627	\$149	\$0	\$149

Enhancement/ Mitigation Measures	Entities	Capital Cost (2015\$)	Average Annual Capital Cost (2015 \$)	Average Annual O&M Cost (2015\$)	Levelized Annual Cost (2015\$)
Recreational Resources					
<u>Implement the RMP</u>					
For the Cane Creek Access Area, designate shoreline areas by installing signage; add, where feasible, single vehicle parking to support bank fishing.	Duke Energy, Staff	\$15,759	\$931	\$27,595	\$28,526
For the Crow Creek Access Area, install bank fishing signage.	Duke Energy, Staff	\$34,446	\$2,035	\$27,595	\$29,630
At Fall Creek Access Area, construct trails; add single vehicle parking where feasible; install interpretive signage for wildlife viewing and bank fishing at Fall Creek Island/ Peninsula; and stabilize approximately 1,000 linear feet of shoreline on the east side of the Peninsula.	Duke Energy, Staff	\$103,311	\$6,102	\$27,595	\$33,697
For High Falls County Park: Install bank fishing signage.	Duke Energy, Staff	\$5,778	\$341	\$27,595	\$27,936

Enhancement/ Mitigation Measures	Entities	Capital Cost (2015\$)	Average Annual Capital Cost (2015 \$)	Average Annual O&M Cost (2015\$)	Levelized Annual Cost (2015\$)
At Keowee Town Access Area, construct trails; add single vehicle parking where feasible; install interpretive signage for wildlife viewing and bank fishing.	Duke Energy, Staff	\$15,759	\$931	\$27,595	\$28,526
At Keowee-Toxaway State Park, construct a canoe/kayak launch, fishing pier, and canoe portage.	Duke Energy, Staff	\$525,313	\$31,025	\$27,595	\$58,620
At Mile Creek County Park, construct campsites, bank fishing stations, install cabins, install bank fishing signage.	Duke Energy, Staff	\$367,719	\$20,041	\$24,554	\$44,595
At South Cove County Park, install bank fishing signage.	Duke Energy, Staff	\$5,778	\$341	\$27,595	\$27,936
At Stamp Creek Access Area, construct trails, add parking, install signage for bank fishing and wildlife viewing.	Duke Energy, Staff	\$15,759	\$931	\$27,595	\$28,526

Enhancement/ Mitigation Measures	Entities	Capital Cost (2015\$)	Average Annual Capital Cost (2015 \$)	Average Annual O&M Cost (2015\$)	Levelized Annual Cost (2015\$)
At Warpath Access Area, install bank fishing signage.	Duke Energy, Staff	\$3,152	\$186	\$27,595	\$27,781
At High Falls II Access Area, designate 36 acres for future public recreation needs; stabilize 1,000 feet of shoreline.	Duke Energy, Staff	\$7,231,803	\$410,294	\$15,627	\$425,921
At Mosquito Point Access Area, designate 10 acres for future public recreation needs, stabilize 1,000 feet of shoreline.	Duke Energy, Staff	\$134,306	\$7,620	\$15,627	\$23,247

Enhancement/ Mitigation Measures	Entities	Capital Cost (2015\$)	Average Annual Capital Cost (2015 \$)	Average Annual O&M Cost (2015\$)	Levelized Annual Cost (2015\$)
Revise the RMP to include: (1) provisions for recreation amenities at Crow Creek Access Area and Mile Creek County Park; (2) monitoring of capacity and condition of Warpath Access Area; (3) the addition of World of Energy Picnic Area as a project recreation site; (4) updated schedules for recreation enhancement measures; and (5) clarification about amenities constructed through the AAIL. ^b	Staff	\$175,000	\$9,940	\$5,000	\$14,940
Stabilize 6,250 feet of island shoreline in Lake Keowee.	Staff	\$525,313	\$28,630	\$0	\$28,630
Land Use Implement the SMP and review and revise the SMP every 10 years as necessary.	Duke Energy, Staff	\$0	\$0	\$3,466	\$3,466

Enhancement/ Mitigation Measures	Entities	Capital Cost (2015\$)	Average Annual Capital Cost (2015 \$)	Average Annual O&M Cost (2015\$)	Levelized Annual Cost (2015\$)
Modify the SMP to extend the provision for exemptions to the maximum size limit for private facilities from the time of license issuance through December 31, 2020.	Staff	\$0	\$0	\$0	\$0
File an annual report on any modifications made to the SMP. ^b	Staff	\$0	\$0	\$1,000	\$1,000
Cultural Resources					
<u>Implement the HPMP</u>					
Conduct annual monitoring and reporting.	Duke Energy, CRWG, Staff	\$0	\$0	\$5,209	\$5,209
Install interpretive signage.	Duke Energy, CRWG, Staff	\$13,133	\$687	\$0	\$687
Develop a traveling display about the history of the project and the project area.	Duke Energy, CRWG, Staff	\$7,880	\$413	\$0	\$413

Enhancement/ Mitigation Measures	Entities	Capital Cost (2015\$)	Average Annual Capital Cost (2015 \$)	Average Annual O&M Cost (2015\$)	Levelized Annual Cost (2015\$)
Implement a site treatment plan for the historic cemetery at Stamp Creek Access Area.	Duke Energy, CRWG, Staff	\$31,519	\$1,523	\$0	\$1,523
Stabilize island shoreline adjacent to historic cemeteries.	Duke Energy, CRWG, Staff	\$262,656	\$14,315	\$0	\$14,315
Assess National Register-eligibility of the project structures.	Duke Energy, CRWG, Staff	\$0	\$0	\$975	\$975

Notes:

- a** The net gain in energy is based on the difference in existing generation and proposed generation.
- b** Cost estimated by staff.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a) of the FPA require the Commission to give equal consideration to the power development purposes and to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife; the protection of recreational opportunities; and the preservation of other aspects of environmental quality. Any license issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses. This section contains the basis for, and a summary of, our recommendations for relicensing the Keowee-Toxaway Project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency and public comments filed on this project and our review of the environmental and economic effects of the proposed action and economic effects of the project and its alternatives, we selected the proposed action with staff-recommended modifications as the preferred alternative. We recommend this alternative because: (1) issuing a new license for the project would allow Duke Energy to continue to operate the project and provide a beneficial and dependable source of electric energy; (2) the public benefits of this alternative would exceed those of the no-action alternative; and (3) the recommended measures would protect and enhance water, fish, and wildlife resources, protect cultural resources, and provide improved recreation opportunities at the project.

In the following section, we make recommendations as to which environmental measures proposed by Duke Energy should be included in any new license issued for the project. In addition to Duke Energy's proposed environmental measures, we recommend additional staff-recommended environmental measures to be included in any license issued for the project. In Appendix A, we describe the draft license articles that we recommend, including in any new license for the project.

5.1.1 Measures proposed by Duke Energy

Based on our environmental analysis of Duke Energy's proposal, as discussed in section 3, and the costs discussed in section 4, we conclude that the following measures proposed by Duke Energy would protect and enhance environmental resources and would be worth the cost. Therefore, we recommend including these measures in any license issued for the project.

- Implement the project operation measures as proposed and identified in the Relicensing Agreement and included in Appendix D of this EA. These

measures include the Normal Minimum and maximum elevations for Lake Jocassee and Lake Keowee, the LIP which includes minimum elevations for Lake Jocassee and Lake Keowee, and the MEP, which are described in section 2.2, *Proposed Project Operation*;

- Implement a RMP and provisions for future recreation planning, as modified below;
- Implement a SMP and provisions for future SMP review and update , as modified below; and
- Implement a HPMP, filed on November 5, 2014, in accordance with the PA.

5.1.2 Additional Staff-Recommended Measures

Under the staff alternative, the project would be operated with Duke Energy's proposed measures, as identified above, and the following additions or modifications:

- Revise the RMP to: (1) clearly indicate that Duke Energy must complete construction of recreation amenities proposed at Crow Creek Access Area if the amenities are not constructed by The Reserve at Lake Keowee; (2) remove cost caps and contingencies associated with the recreation enhancements proposed for Mile Creek County Park; (3) include provisions for monitoring the capacity and condition of Warpath Access Area annually during summer recreation seasons and develop plans to address capacity issues or overuse, if necessary; (4) include a description of the existing facilities, drawings, and schedule of any recreation facility enhancements proposed over the term of a license at World of Energy Picnic Area; (5) require the stabilization of 6,250 feet of shoreline on certain islands in Lake Keowee to preserve the use of the islands for day-use recreation; (6) provide an implementation schedule with the anticipated year of construction for all recreation enhancement measures specified in the plan; and (7) clarify that all improvements made to project recreation sites as part of the AAI must be identified in the Commission-approved RMP.
- Modify the project boundary to enclose the recreation facilities at World of Energy Picnic Area.
- Modify the SMP to extend the provision for exemptions to the maximum size limit for private facilities (e.g., boat docks) from the time of license issuance through December 31, 2020.

- Require an annual report describing modifications made to the SMP to protect any newly discovered resources and corrections made to shoreline classification maps.

Below, we discuss the basis for our staff-recommended modifications, including the basis for our conclusion that the additional cost of these measures is justified given their benefit in protecting or enhancing resources affected by continued project operation.

Modifications to the Recreation Management Plan

World of Energy Picnic Area

Duke Energy's proposed RMP does not include World of Energy Picnic Area as a project recreation site. Duke Energy states that World of Energy is located on lands associated with Oconee Nuclear Station. However, in 2008 the Commission approved Duke Energy's RMP for the Keowee-Toxaway Project, which included World of Energy Picnic Area as a project recreation site. World of Energy Picnic Area provides access to Lake Keowee and includes a picnic area, boat dock, fishing pier, hiking trail, and parking. World of Energy Picnic Area is a popular location for bank fishing and walking, and provides easy access from Lake Keowee to Duke Energy's World of Energy Visitor's Center. Therefore, staff recommends that the recreation facilities at World of Energy picnic area be brought into the project boundary and that the RMP be updated to include World of Energy Picnic Area as a project recreation site. This modification would allow the Commission to ensure that this recreation site would be operated and maintained for public access to Lake Keowee over the term of a license.

Enhancement Measures at Mile Creek County Park

Duke Energy's proposed enhancement measures at Mile Creek County Park would increase overnight capacity, broaden the diversity of overnight experiences available at the project, and help meet current and future needs for overnight use as identified in the 2012 RUN Study. However, section 6.2.1.5 of the Relicensing Agreement indicates that Duke Energy's proposal to enhance facilities at Mile Creek County Park is contingent upon Pickens County agreeing to operate and maintain the facilities. Further, in the Relicensing Agreement, Duke Energy caps spending for the camping cabins at \$350,000.

As the Commission has explained, project recreation facility enhancements described in the RMP and approved by the Commission should be based on documented needs, and should not be contingent upon participation by a third-party lessee. Further,

a licensee cannot satisfy an obligation by a simple payment, nor can the obligation be limited to a particular dollar figure.¹¹⁸ We recommend that the RMP specify that the recreation enhancement measures for Mile Creek County Park will include the construction, operation, and maintenance of 10 primitive campsites, 5 bank fishing stations, and 10 camping cabins to meet the need for additional camping facilities in Pickens County, South Carolina. Duke Energy provides a cost for implementing this measure in its license application. Because it is anticipated that Pickens County would continue to operate and maintain Mile Creek County Park over the term of a license, at this time, we have no basis to conclude that altering the measure would substantially change Duke Energy's costs.

Enhancement Measures at Crow Creek Access Area

As part of the 2008 RMP, Duke Energy identified recreation facility improvements at Crow Creek Access Area, which had been proposed by The Reserve at Lake Keowee as mitigation for an encroachment within the project boundary. These facilities have not been constructed. On September 24, 2015, Duke Energy requested an extension of time to complete construction of these facilities by December 31, 2016. Duke Energy's proposed RMP specifies that if the designated third-party is unable to complete construction of the facilities, Duke Energy would maintain each facility with its existing amenities.

Duke Energy is ultimately responsible for project recreation and, consistent with Commission policy, staff does not recommend approving the portion of the proposed RMP excusing Duke Energy's responsibility for the unconstructed amenities at Crow Creek Access Area. If the Reserve at Lake Keowee fails to meet the proposed December 31, 2016 construction deadline, Duke Energy has not proposed any additional recreational enhancements at the site other than bank fishing signage.

During the 2012 RUN Study, visitors recommended easier parking and additional lighting (restrooms and dock areas) at Crow Creek Access Area. The facility is open for use 24 hours a day and receives 5 percent of total recreation use on Lake Keowee. Based on the findings of the 2012 RUN Study, we recommend that Duke Energy ensure the construction of the proposed recreation amenities (restrooms with lighting, expanded and lighted vehicle-with-trailer parking, courtesy dock, picnic area/shelter, single-vehicle parking, and bank fishing trail). Duke Energy should include in the revised RMP a schedule for constructing these facilities. We estimate the benefits of this measure to be worth the annual levelized cost of \$9,940.

¹¹⁸ See the Commission's Policy Statement on Hydropower Licensing Settlements (116 FERC ¶ 61,207 (2006)) at paragraphs 20-21.

Monitoring Provisions for Warpath Access Area

Similar to Crow Creek Access Area, Duke Energy's proposed RMP contains provisions for construction of recreation amenities at Warpath Access Area that were proposed by a third-party (Warpath Development, Inc.). However, in this situation, Duke Energy has terminated Warpath Development, Inc.'s lease of Warpath Access Area and, as described in the proposed RMP, Duke Energy would make no additional improvements to the site other than the addition of bank fishing signage.

We find that, over the term of any new license, there may be a need to increase recreation capacity or mitigate for overuse at Warpath Access Area. The 2012 RUN Study indicated that Warpath Access Area received 6 percent of all recreation use on Lake Keowee. Despite the 2012 RUN Study indicating that there were other viable alternatives, Warpath Access Area was the only recreation site where use exceeded capacity on holiday weekends. It was also identified as the second-most preferred boat launch area due to its location and availability of parking. Duke Energy estimates growth of 65 to 70 percent for water-based recreation use at the project over the next 30 to 50 years. Therefore, it is reasonable to expect that Warpath Access Area would continue to be used intensively and that, without provisions for additional enhancement measures, the high level of use may lead to adverse effects on environmental resources or reduce the quality of the recreation experience at the site. Duke Energy's proposal to maintain the site as-is and install bank fishing signage would not address capacity issues associated with peak recreation season use.

Staff recommends modifying the RMP to include provisions for monitoring capacity and facility condition at Warpath Access Area annually during the summer recreation season. If use at Warpath Access Area exceeds 90 percent of capacity (as measured by parking availability) on a non-holiday weekend, Duke Energy should file with the Commission, for approval, a plan for addressing excess demand at Warpath Access Area (e.g., provisions for directing users to other access areas, construction of overflow or permanent parking facilities, etc.). The RMP should also contain provisions to address the potential effects of overuse of Warpath Access Area on environmental resources. If use of the facility exceeds capacity at any time, Duke Energy should file a report with the Commission describing any adverse effects on environmental resources at the site (e.g., disturbance of terrestrial habitat, soil compaction, or erosion) and how Duke Energy will mitigate for these effects. These reports should be developed in consultation with the South Carolina DPRT and South Carolina DNR.

We recommend that these provisions remain in place over the term of the RMP until an update to the RMP is filed with the Commission. At that time, Duke Energy should reevaluate its proposal for Warpath Access Area in consultation with stakeholders. We further recommend that Duke Energy remove from the RMP the list

of proposed facilities designated to be constructed by Warpath Development, Inc. at Warpath Access Area as future project recreation facilities.

We estimate that the benefit of staff's recommended monitoring of Warpath Access area is worth the annual levelized cost of \$5,000.

Shoreline Stabilization

In the Relicensing Agreement, as an off-license measure, Duke Energy proposes to stabilize the shorelines of nine islands in Lake Keowee, totaling approximately 6,250 linear feet. Duke Energy allows day-use recreation of the islands unless otherwise designated off-limits to protect cultural resources or endangered species, or for public safety, security, or other management concerns. In surveys conducted as part of the 2012 RUN Study, approximately 25 percent of residents and 5 percent of visitors recreated on project islands.

Stabilizing the shorelines of these islands would reduce the likelihood of recreation-induced erosion caused by boat wakes, mooring boats, and accessing the islands for day use. We recommend that Duke Energy adopt this measure as part of the license to protect project islands as a recreation resources at the project. We conclude that the benefits of this measure are worth the annual levelized cost of \$28,630.

Access Area Improvement Initiative and Lease Agreements

As part of the RMP, Duke Energy proposes to continue implementing its AAI program. The AAI program helps Duke Energy meet demand for developed recreation opportunities at the project and enhances Duke Energy's ability to operate and maintain project recreation sites over the term of a license. As part of an AAI partnership, a state or local government or private business may enter into a low-cost lease with Duke Energy and assume operation and maintenance responsibility for a project recreation site. Under provisions of the AAI, partners may propose recreation enhancements at sites they lease from Duke Energy. However, as the Commission discussed when approving the 2008 RMP, Duke Energy is ultimately responsible for the oversight and management of all project recreation sites, including those sites that are currently, or will potentially be leased to another entity through the AAI. Duke Energy is also required to ensure that lessees adhere to the management policies described in the RMP, as well as applicable requirements of the project license.¹¹⁹ To improve the Commission's ability to administer license requirements, we recommend that the

¹¹⁹ 132 FERC ¶ 62,045 (2010).

license stipulate that all improvements at project recreation sites, including those made by AAI partners, be part of a Commission-approved RMP for the project.

Further, we also recommend that the cost for leasing Bootleg Access Area, an undeveloped project recreation site on Lake Jocassee, be removed in the staff alternative. We recommend this change because if the site were not leased to South Carolina DNR through the AAI program, Duke Energy would incur no cost for operation and maintenance of the undeveloped site. Duke Energy may continue to lease the site through the AAI program; however, we do not recommend including a license requirement to do so. This change would reduce the annual levelized cost of implementing the proposed RMP by \$26,342.

Modifications to the Shoreline Management Plan

Provisions for Dock Expansions

Duke Energy's SMP contains a provision providing a 365-day period during which existing dock owners may apply for an exemption and waiver of fees to modify and/or expand private docks by up to 200 square feet to reach deeper water (above the existing and proposed SMP's maximum of 1,000 square feet per dock). The Petitioners commented that this window was unnecessarily narrow, and that dock owners may not know if dock expansions would be necessary or helpful in reaching deeper water.

We find that, if implemented prior to December 31, 2019, when Oconee Nuclear Station would be modified to allow for reservoir levels as low as 790 feet, dock owners may not know if applying for a dock expansion would be necessary or helpful in reaching deeper water. This could result in unnecessary expenditures by dock owners on expansions or modifications that are unwarranted or insufficient. Therefore, staff recommends that Duke Energy modify the provision in their shoreline management guidelines to allow existing dock owners to apply for an exemption to modify and/or expand private docks by up to 200 square feet to reach deeper water through December 31, 2020. As specified in the shoreline management guidelines, this provision would only apply to existing dock owners as of December 1, 2013, and would be subject to the provisions for dock expansions outlined in the Relicensing Agreement and SMP. The standard land use article permits Duke Energy to charge (or waive) reasonable fees for permit applications and makes no recommendation for the length of time during which Duke Energy would waive fees associated with dock modifications or expansions. We find that this proposal would be administrative in nature, and that any additional costs incurred by Duke Energy through modification of their proposal could be offset through permitting fees.

Annual Report

Duke Energy's proposed SMP update procedures allow for minor changes to the shoreline management guidelines, shoreline classification maps, and associated lake use restrictions to protect newly discovered resources such as archaeological or historic sites, Threatened or Endangered Species, Special Concern Species, or to correct mapping errors. These modifications would be more restrictive than the existing guidelines within the SMP, allowing Duke Energy to manage shoreline development to protect environmental resources. We recommend that Duke Energy file annually, with the Commission, a report that documents any changes made to the SMP and its component maps, restrictions, and guidelines. If changes are made to the shoreline classification maps, we recommend that Duke Energy provide the Commission with a description of the change and its location (latitude and longitude). If no changes are made to the SMP or maps, Duke Energy should file a letter to that effect. This reporting requirement would improve Commission oversight of shoreline management activities and assist in administration of the license. We conclude that the benefits of this measure are worth the annual levelized cost of \$2,000.

5.1.3 Measures Not Recommended

Some of the measures recommended by Duke Energy and interested parties during the relicensing preceding would not address the project's environmental effects, or would not, in staff's estimation, provide benefits that would be worth their additional cost. The following discusses the basis for staff's decision not to recommend such measures.

Minimum Reservoir Elevation at Lake Keowee

The Petitioners are concerned that lowering the minimum lake level at Lake Keowee, as proposed by Duke Energy, would result in a greater frequency and duration of lower lake levels and lead to a decline in home values. The Petitioners recommend that the minimum lake level for Lake Keowee be set at 793 feet, rather than 790 feet as proposed by Duke Energy. The lowest practical operating elevation for Lake Keowee, currently 794.6 feet, is tied to the operational needs for Oconee Nuclear Station. Setting a minimum at 790 feet would have the potential to result in lower elevations in Lake Keowee when compared to how the Keowee Development now operates.

Duke Energy describes its proposal as raising the minimum elevation for Lake Keowee from the currently licensed minimum elevation of 775 feet to a new licensed minimum elevation of 790 feet. From this perspective, implementing Duke Energy's proposal would serve to improve elevations in Lake Keowee when compared to current license requirements. Duke Energy also points out that the Normal Minimum elevation would be set at 796 feet, which would be higher than the currently implemented minimum elevation of 794.6 feet.

Duke Energy used 73 years of historical flow data to model the effects of its proposal. With this model Duke Energy estimates that under its proposal, Lake Keowee would fall below 796 feet about 7 percent of the time. Under existing operation, the reservoir elevation is below 796 feet about 32 percent of the time.

When drought conditions warranted, the LIP would be implemented and lake levels could be drawn down to a minimum of 790 feet. The model indicates that under proposed operation, the reservoir elevation would fall below 795 feet about 4 percent of the time. Staff estimated that elevations below 793 feet would occur less often. The Petitioners' proposed minimum elevation of 793 feet would be reached in the fourth of five LIP stages. To drop to a level of 790 feet, the lowest elevation permitted under the LIP, the drought conditions and the response would have to pass through all five LIP stages.¹²⁰

The Petitioners raise the concern that the lower minimum elevation would reduce their property values. The Petitioners and Duke Energy provide different studies on the subject. Both the Petitioners and Duke Energy state that lake levels can influence home prices. Duke Energy makes the argument that the effect of its proposal would be very minor and would not translate into significant reductions in home values.

The Corps 2014 EA (Corps, 2014) provides a more comprehensive evaluation of socioeconomic effects, including recreational use at each reservoir, real estate transactions around each reservoir, and the sale of reservoir-related goods (e.g., sporting goods, bars, boating, stores etc.). The Corps considers losses at Hartwell Lake and Thurmond Lake, as well as Lake Keowee. The Corps estimates that the proposed operation would result in losses of \$6,000/year and 6 jobs at Lake Keowee. Alternative 2, current operation, would result in losses of \$4,000/year and 4 jobs. For Lake Keowee, the most adverse alternative would lose \$12,000/year and 12 jobs. The Corps concludes that none of four alternatives considered in its EA¹²¹ would have a significant effect on socioeconomics in the region.¹²²

¹²⁰ Stage 0 of the LIP would occur at 796 feet, Stage 1 at 796-795 feet, Stage 2 at 795-793 feet, Stage 3 at 793-792 feet, and Stage 4 at 792-790 feet.

¹²¹ The Corps four alternatives include both Duke Energy's proposal and the no-action alternative.

¹²² The Lake Keowee losses estimated by the Corps were minor in comparison to those for Lake Hartwell with a \$30,000/year loss and 26 jobs, and J. Strom Thurmond Reservoir with a \$510,000/year loss and 660 jobs.

Staff concludes that elevations below 793 feet would occur infrequently, and that Stages 0-3 of the LIP would serve to minimize the occurrence and effect of Lake Keowee water levels below 793 feet. Based on the studies conducted by Duke Energy during the relicensing, and by the Corps for its EA, staff concludes that the project-related effects of Duke Energy's proposed operation on the local economy of Lake Keowee would be minimal, and small in comparison to other regional economic factors. Because lake levels below an elevation of 793 feet would occur infrequently, and have little effect on socioeconomics in the region, staff does not recommend establishing a minimum elevation of 793 feet for Lake Keowee.

Duke Energy's Proposed Water Quality Measure

As part of proposed Water Quality Monitoring article of the Settlement Agreement, Duke Energy proposes to continually monitor DO in the tailwaters of the Jocassee Development and the Keowee Development each August for the term of the new license, and submit monitoring results to South Carolina DHEC and the Commission annually by November 30. Duke Energy estimates that the annual cost of DO monitoring in the tailwaters at both developments during August would be about \$21,312 per year.

In section 3.3.2.2, *Aquatic Resources – Environmental Effects*, we evaluated the need for Duke Energy's proposed water quality measures (and Interior's recommended water quality measures). Existing water quality in the reservoirs and tailwaters are meeting, or exceeding, state water quality standards and supporting designated uses, and no issues have been raised concerning pH and total dissolved gas. Water quality modeling results also indicate that the proposed project operation is consistent with the maintenance of suitable DO levels and water temperatures for the propagation of aquatic life in the Keowee Development releases. In addition, no proposed changes in project operation would alter water quality from existing conditions in the Jocassee Development tailwaters. Furthermore, the fishery at the project is considered excellent, and Lake Jocassee supports a productive cold-water fishery for brown and rainbow trout. There have been no complaints from anglers or others to the contrary.

Based on the reasons outlined above, we do not recommend including Duke Energy's proposed water quality monitoring in the tailrace of each development during August; however, South Carolina DHEC's certification requirements of section 401 of the CWA requires Duke Energy to operate the project in accordance with Section A-7.0 Water Quality Monitoring Article in the Relicensing Agreement. Therefore, Duke Energy's proposed water quality monitoring would be required in any new license issued for the project.

Interior's Recommended Water Quality Measures

Interior expresses concern regarding the influence of water quality on the health of fish and wildlife communities affected by the project. Interior recommends that Duke Energy establish permanent monitoring locations in the Jocassee and Keowee tailwaters, the bypassed reaches, and Lake Jocassee and Lake Keowee. Interior also recommends that Duke Energy monitor DO, water temperature, turbidity, pH, and total dissolved gas on an hourly basis.

In section 3.3.2.2, *Aquatic Resources – Environmental Effects*, we evaluated the merits of Interior's water quality recommendation. The merits are summarized above in section 5.1.3, *Measures Not Recommended, Duke Energy's Proposed Water Quality Measure*. Based on the reasons outlined above, we do not recommend including Interior's water quality measures, which would require permanent monitoring locations in Lake Jocassee and Lake Keowee as well as the tailraces of each development, in any new license issued for the project. The benefits of this measure would not be worth the levelized annual cost of \$55,672 for water quality monitoring at both developments.

Interior's Recommended Entrainment and Turbine Mortality Measures

The generation intakes (in Lake Jocassee) and pumping intakes (in Lake Keowee) for the Jocassee pumped storage system and the generation intakes at the Keowee Dam can entrain fish. Because the position of each of the generation intakes is in open water and each of the pump intakes is in deep water away from the shallow water areas, open water forage fish (i.e., blueback herring, threadfin shad) are most susceptible to entrainment and turbine mortality.

In the Relicensing Agreement, Duke Energy agreed to implement the following measures off-license to reduce fish entrainment at Jocassee Development: (a) redesign and modify the lighting for the Commission required public safety devices on the intake towers to eliminate or reduce the amount of light shining on the lake surface; (b) redesign and modify lights that illuminate the tailwater area to eliminate or reduce the amount of light shining on the lake surface immediately downstream of the intake units; (c) consult with South Carolina DNR and FWS on its plan for lighting modifications; (d) incorporate the lighting modifications into the FERC Public Safety Plan; (e) implement the lighting modifications within one year; (f) when operating the project in pumping mode, use the following start-up sequence: unit 3, unit 4, unit 1, and unit to the extent practicable, and implement this sequence within 60 days following the issuance of the new license.

FWS recommended that Duke Energy develop a plan, in consultation with FWS, to monitor fish communities in the reservoirs and adjacent tributaries, in order to detect effects of project operation on fish community composition and abundance.

Duke Energy determined that water velocities in front of the generation intakes were below burst swim speeds, leaving forage fish in Lake Jocassee at low risk of entrainment. However, water velocities in front of the pump intakes were higher than burst swim speeds, putting forage fish in Lake Keowee at risk of entrainment. Additional entrainment analysis using hydroacoustic monitoring to observe fish presence in front of the intakes, combined with purse seine estimates of forage fish population abundance, indicated that a maximum of 8 percent of the forage fish population in Lake Jocassee would be entrained and 0.2% would be killed. The analysis also indicated that a maximum of 72 percent of the forage fish population in Lake Keowee would be entrained and 1 percent would be killed. These estimates indicate that a very small proportion of the forage fish population in Lakes Jocassee and Keowee is likely to be removed through turbine mortality, and these levels of removal are inconsequential to the sustainability of the forage fish community (see section 3.3.2.2, Environmental Effects). Statistical analyses also support the finding that generation flows and pumping flows are not strongly related to variation in forage fish density in either lake.

Duke Energy also determined that entrainment rates were higher at night for both generation and pumping operations. In a study to evaluate whether night-time attraction to light could affect entrainment in the Jocassee tailwaters, Duke Energy determined that entrainment rates were 40-45 percent lower at units 1 and 2 when lights were off, but there was no effect at units 3 and 4, which had the highest entrainment rates.

Duke Energy also determined that entrainment rates were unequal among the four pumping units, with entrainment highest at unit 4, followed by unit 3, unit 1, and unit 2. When entrainment among units is unequal, overall project entrainment can be minimized by using a start-up sequence that begins with a unit that has a lower entrainment rate. Because of operational constraints, the optimal sequence to minimize entrainment would be unit 3, unit 4, then units 1 or 2 (see section 3.3.2.2, Environmental Effects).

The annual levelized cost of redesigning or modifying lighting as proposed by Duke Energy, and recommended by FWS would be \$358. The annual levelized cost to use a start-up sequence of unit 3, unit 4, unit 1, and unit 2 would be \$298. The annual levelized cost of developing a plan to monitor fish communities in the reservoirs and adjacent tributaries would be \$17,272.

The total annual levelized cost of \$17,928 to adopt FWS' proposed entrainment recommended measures is modest, but the benefits are minimal, uncertain, and complex. There would be some open water forage fish that would not be entrained, but no benefit at the population scale. The data on lighting effects are inconsistent across the pump-turbine units and the effectiveness of proposed changes uncertain. The optimal turbine start-up sequence for reducing entrainment also likely has minimal

benefits, and it conflicts with the best start-up sequence for increasing generation. Because entrainment of forage fish is minor, and the lighting and start-up sequence measures have uncertain and minimal benefits, FWS' proposal to monitor fish communities would be unnecessary in regard to understanding project effects. Given the small benefit and high degree of uncertainty surrounding FWS' proposed entrainment measures, and no need for monitoring, we do not recommend including those measures in any license issued for the project.

5.1.4 Conclusion

Based on our review of the agency and public comments filed on the project and our independent analysis pursuant to sections 4(e), 10(a)(1), and 10(a)(2) of the FPA, we conclude that licensing the Keowee-Toxaway Project, as proposed by Duke Energy with the additional staff-recommended measures, would be best adapted to a plan for improving or developing the Toxaway, Keowee, and Little Rivers. We do not recommend that the water quality monitoring provisions specified by South Carolina DHEC in the certification be included in the staff alternative. We recognize, however, that the Commission must include this condition in any license due to its mandatory nature.

5.2 UNAVOIDABLE ADVERSE EFFECTS

Unavoidable fish losses resulting from turbine entrainment mortality would continue to occur under proposed project operation. These losses, however, would not significantly affect fish populations in Lake Jocassee or Lake Keowee.

Under proposed project operation, during some LIP conditions, the boat ramps at High Falls County Park and Keowee Town Access Area would be inaccessible. Recreation access would diminish causing longer wait times and the potential for overcrowding at launches that are operable during LIP conditions. Duke Energy's proposed RMP contains policies for the temporary closure of recreation facilities under LIP conditions, if necessary. These effects would be temporary, and launch accessibility would improve as normal operation resumed.

Lower reservoir elevations, as specified under LIP conditions have the potential to negatively affect regional socioeconomic resources, including home values at Lake Keowee. The negative effects, however, are minor in relation to overall regional economic activity.

5.3 SUMMARY OF SECTION 10(j) RECOMMENDATIONS

5.3.1 Fish and Wildlife Agency Recommendations

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. No agency submitted fish and wildlife recommendations pursuant to section 10(j) of the FPA.

5.4 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2) of the FPA, 16 U.S.C., § 803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. We reviewed 16 comprehensive plans for the states of South Carolina and North Carolina that are applicable to the Keowee-Toxaway Project (Appendix F). No inconsistencies were found.

6.0 FINDING OF NO SIGNIFICANT IMPACT

If the Keowee-Toxaway Project is licensed as proposed with the additional staff-recommended measures, the project would operate while providing protective measures for water quantity and quality, fish, wildlife, terrestrial, recreation, and cultural resources in the project area.

Based on our independent analysis, issuance of new license for the Keowee-Toxaway Project, as proposed with additional staff-recommended measures, would not constitute a major federal action significantly affecting the quality of the human environment.

7.0 LITERATURE CITED

- Adams, Natalie, Elsa Heckman, Ricah Marques, and Mark Swanson. 2008. Archaeological Survey of Lake Keowee Shoreline, Recreation Areas, and Islands Oconee and Pickens Counties, South Carolina. New South Associates, Stone Mountain, Georgia. May 2, 2008.
- Alderman, J. M. 2009. Freshwater mussel survey of Lake Keowee in South Carolina and Lake Jocassee in North and South Carolina. Report to Duke Energy Carolinas, LLC, Huntersville, NC.
- American Trails. Undated. Foothills Trail. Available online at: <http://www.americantrails.org/NRTDatabase/trailDetail.php?recordID=2382>. Accessed July 1, 2015.
- Appalachian Power. 2009. Claytor Hydroelectric Project fish entrainment and impingement assessment. Prepared by Normandeau Associates, Inc., Drumore, PA.
- Bangs, M. R. 2011). Decline of the Savannah River Redeye Bass (*Micropterus Coosae*) Due to Introgressive Hybridization With Invasive Alabama Spotted Bass (*Micropterus Punctulatus Henshalli*). Master's thesis. University of South Carolina.
- Barwick, D.H., J.W. Foltz, and D.M. Rankin. 2004. Summer habitat use by rainbow trout and brown trout in Jocassee Reservoir. North American Journal of Fisheries Management 24:735–740.
- Barwick, D.H., K.J. Oswald, J.M. Quattro, and R.D. Barwick. 2006. Redeye bass (*Micropterus coosae*) and Alabama spotted bass (*M. punctulatus henshalli*) hybridization in Keowee Reservoir. Southeastern Naturalist, 5:661-668.
- Bell, M. 1991. Revised compendium of the success of passage of small fish through turbines. Prepared for the US Army Corps of Engineers, North Pacific Division, Portland, OR.
- Benson, Robert W., Thomas J. Pluckhahn, Thomas H. Gresham, Douglas S. Atkinson, and Karen Payne. 2006. Cultural resources overview of the Sumter National Forest: Francis Marion and Sumter National Forests. Southeastern Archeological Services, Inc. Athens, Georgia. April 2006. CRM Report 06-07
- Boschung, H.T., and R. L. Mayden. 2004. Fishes of Alabama. Smithsonian Books, Washington D.C.

- Cary, Robert T., Lori Dickes, Ellen W. Saltzman, and Jeffery Allen. 2011. Regional Economic Analysis of Changing Lake Levels in Lake Keowee. Strom Thurmond Institute of Clemson University. October 28, 2011.
- Castro-Santos, T. R. 2002. Swimming performance of upstream migrant fishes: new methods, new perspectives. PhD Dissertation, University of Massachusetts Amherst. 185 pp.
- Caughman, W. 1972. National Register of Historic Places Inventory Form, Alexander-Hill House. Oconee County, South Carolina. South Carolina Department of Archives & History. Filed with the National Register of Historic Places on May 26, 1972.
- Center for Plant Conservation. 2010. Center for Plant Conservation National Collection Plant Profile for *Isotria medeoloides*. Available at: http://www.centerforplantconservation.org/collection/CPC_ViewProfile.asp?CP_CNum=2350. Accessed August 12, 2015.
- Corps (U.S. Army Corps of Engineers). 2014. New Operating Agreement Between U.S. Army Corps of Engineers, Southeastern Power Administration, and Duke Energy Carolinas, LLC. Final Environmental Assessment. U.S. Army Corps of Engineers, Savannah District. October 2014.
- _____. 1999. New England District's Highway Methodology Workbook Supplement: Wetland Functions and Values: A Descriptive Approach. September 1999. Available at: <http://www.nae.usace.army.mil/Portals/74/docs/regulatory/Forms/HighwaySupplement6Apr2015.pdf>. Accessed July 30, 2015.
- Cowardin, L. M., V. Carter, F.C. Golet, E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U. S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page. Available at <http://www.fws.gov/wetlands/documents/classification-of-wetlands-and-deepwater-habitats-of-the-united-states.pdf>. Accessed July 30, 2015.
- Davis, B. M., and J. W. Foltz. 1991. Food of blueback herring and threadfin shad in Jocassee Reservoir, South Carolina. Transactions of the American Fisheries Society 120(5): 605-613.
- Degan, Donald and Anna-Maria Mueller. 2013. Chapter 1, Fish community assessment study plan – fish entrainment, Keowee-Toxaway Project, FERC No. 2503. Aquacoustics, Inc., Sterling, Alaska. July 2013.

- Dodson, S. 1990. Predicting diel vertical migration of zooplankton. *Limnology and Oceanography*, 35(5):1195-1200.
- Duke Energy (Duke Energy Carolinas, LLC). 2014a. Final license application for the Keowee-Toxaway Hydroelectric Project, FERC Project No. 2503. August 27, 2014.
- _____. 2014b. Historic Properties Management Plan, Keowee-Toxaway Hydroelectric Project FERC No. 2503. Charlotte, North Carolina. November 5, 2014. Public Version.
- _____. 2014c. Recreation Management Plan, Keowee-Toxaway Hydroelectric Project FERC No. 2503. Charlotte, North Carolina. August 27, 2014.
- _____. 2014d. Response to FERC's October 20, 2014, Additional Information Requests for the Keowee-Toxaway Hydroelectric Project FERC No. 2503. Charlotte, North Carolina. December 17, 2014.
- _____. 2014f. Shoreline Management Plan, Keowee-Toxaway Hydroelectric Project FERC No. 2503. Charlotte, North Carolina. August 27, 2014.
- _____. 2012a. Letter to Mr. Keith Collinsworth, South Carolina Department of Health and Environmental Control. Regarding: Oconee Nuclear Station Facility ID #00535-3, Certified Mail 7010 1870 0002 7976 8353. Seneca, SC. August 30, 2012.
- _____. 2010a. News Release. Regarding: Oconee Nuclear Station Reports Groundwater Sample Results. Charlotte, NC. February 9, 2010. Available online at: <http://www.duke-energy.com/news/releases/10020901.asp>. Accessed October 11, 2013.
- _____. 2010b. Oconee Ground Water Communication Supplemental Information, Questions and Answers. February 8, 2010. Available online at: pbadupws.nrc.gov/docs/ML1019/ML101930544.pdf. Accessed September 14, 2013.
- _____. 2011. Keowee-Toxaway Relicensing, FERC Project No. 2503, Pre-Application Document. Duke Energy Carolinas, LLC. Charlotte, NC. March 2011.
- _____. 2008a. Recreation Management Plan. Keowee-Toxaway Hydroelectric Project FERC No. 2503. December 23, 2008.
- _____. 2008b. Shoreline Management Plan for Lake Jocassee. December 2, 2008.
- _____. 2006. Shoreline Management Plan for Lake Keowee. December 29, 2006.

- Electric Power Research Institute (EPRI). 1992. Fish entrainment and turbine mortality review and guidelines. Prepared by Stone and Webster Environmental Services, Boston, Massachusetts. EPRI Report No. TR-101231, Project 2694-01. September 1992.
- Estes, R. D. 1971. The effects of the Smith Mountain Pump Storage Project on the fishery of the lower reservoir, Leesville, Virginia. Ph.D. Thesis, Virginia Polytechnic Institute and State University, Blacksburg. 151 pp.
- Federal Energy Regulatory Commission (FERC). 1995. Preliminary assessment of fish entrainment at hydropower projects: A report on studies and protective measures. Volume 1. Washington, D.C. June 1995.
- FWS (U.S. Fish and Wildlife Service). 2015a. Species profile for smooth coneflower (*Echinacea laevigata*). Available at <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?scode=Q293>. Accessed August 13, 2015.
- _____. 2015b. Species profile for persistent trillium (*Trillium persistens*). Available at <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?scode=Q23D>. Accessed August 13, 2015.
- _____. 2015c. Species profile for mountain sweet pitcher-plant (*Sarracenia rubra* ssp. *jonesii*). Available at <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?scode=Q2I0>. Accessed August 13, 2015.
- _____. 2015d. Species profile for spreading avens (*Geum radiatum*). Available at <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?scode=Q1WM>. Accessed August 13, 2015.
- _____. 2015e. Species profile for black spored quillwort (*Isoetes melanospora*). Available at <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?scode=S015>. Accessed August 13, 2015.
- _____. 2015f. Species profile for small whorled pogonia (*Isotria medeoloides*). Available at <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?scode=Q1XL>. Accessed August 13, 2015.
- _____. 2015g. Species profile for dwarf-flowered heartleaf (*Hexastylis naniflora*). Available at <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?scode=Q1XA>. Accessed August 13, 2015.
- _____. 2015h. Species profile for swamp pink (*Helonias bullata*). Available at <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?scode=Q2B8>. Accessed August 13, 2015.

- _____. 2015i. Species profile for Virginia spiraea (*Spiraea virginiana*). Available at <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?scode=Q2R1>. Accessed August 13, 2015.
- _____. 2015k. Species profile for gray bat (*Myotis grisescens*). Available at <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?scode=A04J>. Accessed August 13, 2015.
- _____. 2015l. Species profile for northern long-eared bat (*Myotis septentrionalis*). Available at <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?scode=A0JE>. Accessed August 13, 2015.
- _____. 2015m. Species profile for Carolina northern flying squirrel (*Glaucomys sabrinus coloratus*). Available at <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?scode=A09M>. Accessed August 13, 2015.
- _____. 2015n. Species profile for bog turtle (*Clemmys muhlenbergii*). Available at <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?scode=C048>. Accessed August 13, 2015.
- _____. 2014. Small whorled pogonia (*Isotria medeoloides*) fact sheet. Available at <http://www.fws.gov/midwest/endangered/plants/smallwhorledpogoniafs.html>. Accessed August 12, 2015.
- _____. 1997. Recovery plan for rock gnome lichen (*Gymnoderma lineare*) (Evans) Yoshimura and Sharp. Atlanta, GA. 30pp. Available at http://ecos.fws.gov/docs/recovery_plan/970930b.pdf. Accessed August 12, 2015.
- _____. 1992. Small whorled pogonia (*Isotria medeoloides*) recovery plan. Newton Corner, Massachusetts. 77 pp. Available at http://ecos.fws.gov/docs/recovery_plan/921113b.pdf. Accessed August 12, 2015.
- _____. 1982. Gray bat recovery plan. Available at http://ecos.fws.gov/docs/recovery_plan/820701.pdf. Accessed August 13, 2015.
- Foothills Trail Conference. 2015. The Foothills Trail, A National Recreation Trail. Available at: <http://www.foothillstrail.org/trail-overview>. Accessed June 30, 2015.
- Forest Service (U.S. Department of Agriculture Forest Service). 1987. Management Direction for the Horsepasture Wild and Scenic River. Forest Service, Southern Region. March 1987.

- Gaddy, L.L. 2013. Botanical Resources Study. Keowee-Toxaway Project (FERC Project No. 2503). Terra Incognita. Columbia, South Carolina. October 2013.
- Galat, D.L., C.R. Berry, E.J. Peters, and R.G. White. 2005. The Missouri River basin. In A.E. Benke, and C.E. Cushing (eds.), *Rivers of North America*. Elsevier Academic Press, San Diego, California.
- Goodrich, B. C. 2002. Dietary composition and habitat preferences of blueback herring, *Alosa aestivalis*, including observations of their role in the trophic ecology of Lake Chatuge NC/GA. Master's thesis. University of Tennessee, Knoxville, TN, as cited in Wheeler et al., 2004.
- Griffith, G.E., Omernik, J.M., Comstock, J.A., Schafale, M.P., McNab, W.H., Lenat, D.R., MacPherson, T.F., Glover, J.B., and Shelburne, V.B. 2002. Ecoregions of North Carolina and South Carolina, (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,500,000).
- Haymes G. T., Patrick P. H., and Onisto L. J. 1984. Attraction of fish to mercury vapor light and its application in a generating station forebay. *International Review of Hydrobiology* 69: 867–76.
- HDR, Inc. 2013. Final Avian Study Report. Keowee-Toxaway Project (FERC Project No. 2503). Prepared by HDR Engineering, Inc. of the Carolinas, for Duke Energy Carolinas, LLC. February 2013.
- Hutchinson, G. E. 1957. *A Treatise on Limnology, Vol. 1, Part 1 - Geography and Physics of Lakes*, pp. 540, John Wiley and Sons, New York.
- Janssen, J. and S. B. Brandt. 1980. Feeding ecology and vertical migration of adult alewives (*Alosa pseudoharengus*) in Lake Michigan. *Canadian Journal of Fisheries and Aquatic Sciences* 37(2):177-184.
- Jenkins, R.E., and N.M. Burkhead. 1993. *Freshwater fishes of Virginia*. American Fisheries Society, Bethesda, Maryland.
- Kaufman, S.R., and W. Kaufman. 2007. *Invasive plants: guide to identification and the impacts and control of common North American species*. Stackpole Books, Mechanicsburg, PA. 2007. 458 pp.
- Kennon, R.A. 2007. Effects of spatial and temporal variability of shoal habitat on stream fish assemblages in Chattahoochee tributaries, Alabama. M.S. Thesis, Auburn University, Auburn, Alabama.

- Kleinschmidt. 2013. Recreation Use and Needs Study for the Keowee-Toxaway Project FERC No. 2503. Prepared for Duke Energy Carolinas, LLC, Charlotte, North Carolina. Prepared by Kleinschmidt, Lexington, South Carolina. March 2013.
- Knapp, W.E., B. Kynard, and S.P. Gloss (eds.). 1982. Potential effects of Kaplan, Osseberger, and bulb turbines on anadromous fishes of the northeastern United States. FWS/OBS-82/62. U.S. Fish and Wildlife Service, Newton, Massachusetts. September 1982. 132 pp.
- Knight, J.R. 2011. Age, growth, home range, movement, and habitat selection of redeye bass (*Micropterus coosae*) from the middle Tallapoosa River tributaries (Alabama, USA). M.S. Thesis, Auburn University, Auburn, Alabama.
- Koppelman, Jeffrey B. and Gary P. Garrett. 2002. Distribution, biology, and conservation of the rare black bass species. Pages 333-341 in D. P. Philipp and M. S. Ridgeway, editors. Black bass: ecology, conservation, and management. American Fisheries Society, Symposium 31, Bethesda, Maryland.
- Kohler, C. C., R. J. Sheehan, and J. J. Sweatman. 1993. Largemouth bass hatching success and first-winter survival in two Illinois reservoirs. *North American Journal of Fisheries Management* 13:125–133.
- Louis Berger (The Louis Berger Group, Inc.) 2008. Recreation Use and Needs Study for the Keowee-Toxaway Project. Prepared for Duke Energy Carolinas, LLC., Charlotte, North Carolina. Prepared by The Louis Berger Group, Inc., Raleigh, North Carolina. May 2008.
- Maceina, M. J., and D. R. Bayne. 2001. Changes in the black bass community and fishery with oligotrophication in West Point Reservoir, Georgia. *North American Journal of Fisheries Management* 21:745-755.
- Maraldo, D.C., and H.R. MacCrimmon. 1981. Reproduction, distribution, and population size of largemouth bass, *Micropterus salmoides*, in an oligotrophic Precambrian Shield lake. *Canadian Field Naturalist* 95(3):298-306.
- Marcy, B. C., D. E. Fletcher, F. D. Martin, M. H. Paller and M. Reichert. 2005. Fishes of the Middle Savannah River Basin: With Emphasis on the Savannah River Site. University of Georgia Press. 462 pp.
- Mettee, M.F., P.E. O'Neil, and J.M. Pierson. 1996. Fishes of Alabama and the Mobile Basin. Oxmoor House, Birmingham, Alabama.

- Murray, D.E. 1974. A review of literature dealing with the swimming speeds of fishes of the Lake Erie vicinity. The Ohio State University Center for Lake Erie Area Research, Columbus, Ohio. Clear Technical Report No. 157.
- National Fish and Wildlife Federation (NFWF). 2010. A business plan for the conservation of native black bass species in the Southeastern US: A ten year plan. February 2010.
- NatureServe. 2015. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available <http://explorer.natureserve.org>. Accessed: August 9, 2015.
- New Hampshire Fish and Game (New Hampshire FG). 2011. New Hampshire ASMFC River Herring Sustainable Fishing Plan. March 2011.
- Norris, Sean and Ramona Grunden. 2007. Cultural Resources Survey of the Lake Jocassee Shoreline (Keowee-Toxaway Hydroelectric Project FERC No. 2503), Oconee and Pickens Counties, South Carolina, and Transylvania County, North Carolina, January 2007. TRC, Inc. Columbia, South Carolina. August 2007.
- North Carolina DENR (North Carolina Department of Environment and Natural Resources). 2015. North Carolina Outdoor Recreation Plan. Raleigh, North Carolina. May 2015.
- _____. 2014. Natural Heritage Program List of Rare Plant Species of North Carolina. October 2014. Available at http://portal.ncdenr.org/c/document_library/get_file?uuid=4eaaf9f2-e30b-4c19-809b-fcb12e0daff1&groupId=61587. Accessed August 6, 2015.
- North Carolina DWQ (North Carolina Department of Environment and Natural Resources, Division of Water Quality). 2007a. Savannah River Basin Water Quality Plan. March 2007. Raleigh, North Carolina. 194 pp.
- _____. 2007b. "Redbook" Surface Waters and Wetland Standards. May 2007. Raleigh, NC. 135 pp.
- NPS (National Park Service). 2011. Nationwide Rivers Inventory – Eligibility Descriptions. Available online at: <http://www.nps.gov/ncrc/programs/rtca/nri/eligb.html>. Accessed July 1, 2015.
- _____. 2009. Nationwide Rivers Inventory – North Carolina Segments. Available online at: <http://www.nps.gov/ncrc/programs/rtca/nri/states/nc.html>. Accessed July 1, 2015.

- Ojanguren, A.F. and Brana, F. 2003. Effects of size and morphology on swimming performance in juvenile brown trout (*Salmo trutta*). *Ecology of Freshwater Fish* 12: 241-246.
- Oliver, J. A., P. L. Hudson, and J. P. Clugston. 1977. Effects of a pumped storage hydroelectric plant on reservoir trout habitat. *Proceedings of the Annual Conference of Southeastern Association of Fish and Wildlife Agencies* 31:449–457.
- Olmsted, L.L., and D.G. Cloutman. 1979. Life history of the flat bullhead, *Ictalurus platycephalus*, in Lake Norman, North Carolina. *Transactions of the American Fisheries Society* 108:38-42.
- Oswald, K.J. 2007. Phylogeography and contemporary history of redeye bass (*Micropterus coosae*). Ph.D. Dissertation, University of South Carolina, Columbia, South Carolina.
- Pardue, G. B. 1983. Habitat suitability index models: alewife and blueback herring. United States Department of the Interior, Fish and Wildlife Service. FWS/OBS-82/10.58.
- Parsons, J. W., and J. B. Kimsey. 1954. A report on the Mississippi threadfin shad. *Progressive Fish-Culturist* 16:179–181.
- Raleigh, R. F., T. Hickman, R. C. Solomon, and P. C. Nelson. 1984. Habitat suitability information: Rainbow trout. U.S. Fish and Wildlife Service. FWS/OBS-82/10.60. 64 pp.
- Raleigh, R. F., L. D. Zuckerman, P. C. Nelson. 1986. Habitat suitability index models and instream flow suitability curves: Brown trout, revised. U.S. Fish and Wildlife Service Biological Report 82(10.124). 65 pp. [First printed as: FWS/OBS-82/10.71, September 1984].
- Richardson, J. E. 2004. Winnicut Dam removal feasibility study, hydraulic fish passage and alternatives analysis. Prepared for Woodlot Alternatives, Inc. Alden Research Laboratory, Inc., Holden, MA.
- Rodriguez, M.S. 2013a. Chapter 2, The pelagic forage fish community of Lake Jocassee, South Carolina: Relationships to operations at Jocassee and Bad Creek Pumped Storage Stations Fall 1997 – Spring 2013. Huntersville, NC. September 2013.
- _____. 2013b. Chapter 3, The pelagic forage fish community of Lake Keowee, South Carolina, Spring 1999 – Spring 2013. Huntersville, NC. October 2013.

- Rohde, F.C., R.G. Arndt, J.W. Foltz, and J.M. Quattro. 2009. Freshwater fishes of South Carolina. University of South Carolina Press, Columbia, South Carolina.
- Reservoir Environmental Management, Inc. 2013. Jocassee Forebay and Tailwater Water Quality Report. February 2013. Prepared for Duke Energy Carolinas, LLC. Charlotte, NC. March 2013.
- S&ME, Inc. 2013. Wetlands Study Report for Keowee-Toxaway Relicensing Project (FERC Project No. 2503). Prepared by S&ME, Inc. for Duke Energy Carolinas, LLC. January 2013.
- _____. 2008. Site Characterization Report, Groundwater Protection Initiative, Duke Energy Oconee Nuclear Station, Seneca, South Carolina, S&ME Project 1264-07-234. Spartanburg, SC. August 29, 2008. Available at: <http://pbadupws.nrc.gov/docs/ML1020/ML102010538.pdf>. Accessed September 14, 2012.
- Sawyer, A. F., R. J. Ruane, and J. C. Knight. 2014. Keowee Reservoir Water Quality Modeling Study Addendum. CE-QUAL-W2 Model Results from WQ4 Operations Under Climate Change Scenarios. Prepared for Duke Energy Carolinas, LLC. May 2014.
- _____. 2013. Keowee Reservoir Water Quality Modeling Study Report. Includes Appendices A–E. Prepared for Duke Energy Carolinas, LLC. March 2013.
- SERC (SERC Reliability Corporation). 2014. Reliability Review Subcommittee's 2014 Annual Report to the SERC Engineering Committee. July 2014. Available online at: <https://www.serc1.org/docs/default-source/committee/ec-reliability-review-subcommittee/rrs-annual-report/serc-2014-rrs-annual-report.pdf?sfvrsn=4>. Accessed July 20, 2015.
- South Carolina DHEC (South Carolina Department of Health and Environmental Control). 2013. South Carolina 2013 Fish Consumption Advisories. Available online at: <http://www.scdhec.gov/administration/library/ML-004042.pdf>. Accessed August 28, 2013.
- _____. 2012a. R.61-69 Classified Waters. Columbia, SC. June 22, 2012. Available online at: <http://www.scdhec.gov/environment/water/regs/R.61-69.pdf>. Accessed January 8, 2014.
- _____. 2012b. R.61-68 Water Classifications and Standards. Columbia, SC. June 22, 2012. Available online at: <https://www.scdhec.gov/environment/water/regs/R.61-68.pdf>. Accessed January 8, 2014.

- _____. 2010. Watershed Water Quality Assessment: Savannah River Basin. Technical Report No. 02F-10. Bureau of Water. Columbia, South Carolina.
- _____. 2009. DHEC Groundwater and Surface Water Screening Project for Radioactive Constituents Around South Carolina Nuclear Power Plants. Available online at: <http://www.scdhec.gov/environment/lwm/pubs/DHEC%20Groundwater%20and%20Surface%20Water%20Screening%20Report%202009.pdf>. Accessed October 15, 2013.
- _____. 2006a. State of South Carolina Integrated Report for 2006: Part 1: Listing of Impaired Waters. October 2006. 50 pp.
- _____. 2006b. The State of South Carolina's 2006 Integrated Report: Part II: Section 305(b) Assessment and Reporting. Columbia, SC. March 2006. 74pp.
- _____. 2003. Watershed Water Quality Assessment, Savannah River Basin. Technical Report No. 002-03. Columbia, SC. October 2003. 218pp.
- _____. 2003. Watershed Water Quality Assessment, Savannah River Basin. Technical Report No. 002-03. Columbia, SC. October 2003. 218pp.
- _____. 1993. Watershed Water Quality Management Strategy, Savannah-Salkehatchie Basin, Columbia, SC. Technical Report No. 002-93 April 1997. 289 pp.
- _____. 1991. South Carolina Lake Classification Survey, 1991. Technical Report No. 006-91. Columbia, SC. December 1991. 509 pp.
- South Carolina Department of Natural Resources (South Carolina DNR). 2015. South Carolina State Wildlife Action Plan Draft. Columbia, South Carolina.
- _____. 2013. Freshwater Fish – Species: Threadfin shad. Available online at: <http://www.dnr.sc.gov/fish/species/threadfinshad.html>. Accessed July 23, 2015.
- _____. 2005. South Carolina Comprehensive Wildlife Conservation Strategy: 2005-2010. Columbia, South Carolina. September 2005.
- South Carolina DPRT (South Carolina Department of Parks, Recreation, and Tourism). 2008. South Carolina State Comprehensive Outdoor Recreation Plan (SCORP). Columbia, South Carolina. April 2008.
- _____. 2002. South Carolina State Trails Plan. Columbia, South Carolina. 2002.
- South Carolina EPPC (South Carolina Exotic Plant Pest Council). 2014. South Carolina Exotic Pest Plan Council Terrestrial Exotic Invasive Species List 2014.

- Available at <http://www.se-eppc.org/southcarolina/invasivePlants.cfm>. Accessed June 21, 2015.
- _____. 2011. Invasive Plant Pest Species of South Carolina. July 2011. Available at <http://www.se-eppc.org/southcarolina/scinvasives.pdf>. Accessed July 30, 2015.
- Stallings, F. Patricia. 2012. National Register of Historic Places (NRHP) evaluation of the Keowee-Toxaway Hydroelectric Development, Oconee and Pickens Counties, South Carolina (FERC No. 2503). Brockington and Associates, Atlanta, Georgia. October 2012.
- Stauffer, Jr., J. R. 1995. Fishes of West Virginia. Academy of Natural Sciences of Philadelphia. Philadelphia, Pennsylvania.
- Swanson, Mark and Natalie Adams. 2008. Keowee-Toxaway Hydroelectric Project Historic Context, Oconee and Pickens Counties, South Carolina and Transylvania County, North Carolina. New South Associates, Stone Mountain, Georgia. May 2008.
- Taylor, B., and J. Bulak. 2011. Forage requirements of brown trout in Lake Jocassee. Study Completion Report. South Carolina Department of Natural Resources. January 2011.
- U.S. Bureau of Labor Statistics. 2015. Unemployment Rates for States. Available at: <http://www.bls.gov/lau/lastrk13.htm>. Accessed June 29, 2015.
- U.S. Census Bureau. 2015. State and County QuickFacts. Available online at: <http://www.quickfacts.census.gov>. Accessed June 29, 2015.
- USDA (United States Department of Agriculture), Natural Resources Conservation Service. 2015. Plants database: plant profile for dwarf-flower[ed] heartleaf (*Hexastylis naniflora*). Available at <http://plants.usda.gov/core/profile?symbol=HENA3>. Accessed August 12, 2015.
- W.F. Baird and Associates. 2013. Lake Keowee and Lake Jocassee shoreline erosion study, FERC Project No. 2503. Ontario, Canada. January 14, 2013.
- Wallus R., and T.P. Simon. 2008. Reproductive Biology and Early Life History of Fishes in the Ohio River Drainage. Volume 6: Elasmobranchii and Centrarchidae. CRC Press, Boca Raton, Florida, USA.
- Warren, Jr., M. L. 2009. Centrarchid identification and natural history. *In*: S. Cooke and D. P. Philip (editors). Centrarchid fishes: Diversity, biology, and Conservation. Blackwell Publishing, West Sussex, UK.

- Webb, P.W. 1976. The effect of size on the fast-start performance of rainbow trout *Salmo gairdneri*, and a consideration of piscivorous predator-prey interactions. *Journal of Experimental Biology* 65: 157-177.
- Webster, D. 2013. Mammalian survey for Keowee-Toxaway Relicensing Project (FERC Project No. 2503). Prepared by Webster, D. for Duke Energy Carolinas, LLC. March 2013.
- Welch, S. M. 2000. A Report on the Historical Inland Migrations of Several Diadromous Fishes in South Carolina Rivers. Clemson University, Department of Aquaculture, Fisheries and Wildlife. 19 pp.
- Wheeler, A. P., C. S. Loftis, and D. L. Yow. 2004. Preliminary investigation of blueback herring in Hiwassee Reservoir: Literature review, electrofishing methods, and diet characterization. North Carolina Resources Commission, Division of Inland Fisheries, Raleigh, NC.
- Willis, D.W. 1986. Review of water level management of Kansas reservoirs. In G.E. Hall and M.J. Van Den Avyle (eds.), *Reservoir fisheries management: strategies for the 80s* (pp. 110-114), American Fisheries Society, Southern Division, Reservoir Committee, Bethesda, Maryland.
- Wyman, David, Chris Post, and Elaine Worzala. 2013. *The Impact of Climate Change on Property Value: A Tale of Two Lakes*. Working Paper Presented at the 2013 American Real Estate Society Meetings. Kohala Coast, Big Island of Hawaii. 2013.

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APPENDIX A

DRAFT LICENSE CONDITIONS RECOMMENDED BY STAFF

We recommend including the following license articles in any license issued for the project.

Draft Article 301. *Project Modification Resulting from Environmental Requirements.* If environmental requirements under this license require modification that may affect the project works or operations, the licensee must consult with the Commission's Division of Dam Safety and Inspections (D2SI)–Atlanta Regional Engineer. Consultation must allow sufficient review time for the Commission to ensure that the proposed work does not adversely affect the project works, dam safety, or project operation.

Draft Article 401. *Use of Jocassee Reservoir.* The Jocassee Reservoir shall be available to the Bad Creek Pumped Storage Project, Project No. 2740, as a lower pool for pumped-storage operations.

Draft Article 402. *Reservoir Elevations.* Upon license issuance, the licensee must operate the Keowee-Toxaway Project within the Maximum Elevation and Normal Minimum Elevation limits indicated in the table below. The Minimum Elevation must be implemented in accordance with the Low Inflow Protocol (LIP), required by Appendix B of this order, or the Maintenance and Emergency Protocol (MEP), required in Article 403.

Reservoir	Maximum Elevation^a (ft. local datum/ ft. above mean sea level (AMSL))	Normal Minimum Elevation (ft. local datum/ ft. AMSL)	Minimum Elevation^b (ft. local datum/ ft. AMSL)
Lake Jocassee	100.00/1110.0	86.0/1096.0	70.0/1080.0
Lake Keowee	100.00/800.0	96.0/796.0	90.0/790.0 ^c

^a Also referred to as Normal Maximum Elevation or Full Pond Elevation. This is the elevation of the reservoir corresponding to the point at which water would first begin to spill from the reservoir dam, which is the lowest point along the top of the flood gates.

^b Also referred to as Critical Reservoir Elevation. This is the elevation below which any large water intake used for public water supply, industrial water supply, or any regional power plant water supply located on the reservoir may not operate at its licensed capacity.

- ^c The minimum elevation of 90.0/790.0 for Lake Keowee becomes effective December 1, 2019 to allow time for the Oconee Nuclear Station to be modified to support operation at lower elevations at Lake Keowee.

The Normal Minimum Elevations outlined in the table above may be temporarily modified if required because of emergencies (operating or otherwise) beyond the control of the licensee, for short periods during annual inspections and repairs, or by operating emergencies or maintenance needs as defined in the LIP or the MEP. The licensee must notify the Commission as soon as possible, but no later than 10 days after each event, and provide the reason for the change in reservoir elevations.

Draft Article 403. Maintenance and Emergency Protocol. Upon issuance of this license, the licensee must implement, “The Maintenance and Emergency Protocol” (MEP) included as Appendix E of the Relicensing Agreement, filed on August 27, 2014, and attached in Appendix C of this license.

Modifications of the MEP must be made in accordance with the procedures in the MEP. For all such modifications, or other conditions beyond the control of the licensee, the licensee must notify the Commission as soon as possible, but no later than 10 days after each such event, and provide the reason for the modification of the MEP.

The Commission reserves the right to require changes to the MEP, and upon Commission approval, the licensee must implement any changes required by the Commission.

Draft Article 404. Reservation of Authority to Prescribe Fishways. Authority is reserved to the Commission to require the licensee to construct, operate, and maintain, or to provide for the construction, operation, and maintenance of such fishways as may be prescribed by the Secretary of the Interior pursuant to section 18 of the Federal Power Act.

Draft Article 405. Recreation Management Plan. Within 90 days of license issuance, the licensee must file with the Commission for approval, a revision to the proposed Recreation Management Plan (RMP), filed on August 27, 2014. The revised plan must include provisions to continue to operate and maintain the existing recreation facilities at each of the following recreation sites for the term of the license: (1) at the Jocassee Development: Devils Fork State Park, Double Springs Campground, Bootleg Access Area, Grindstone Access Area, and Handpole Ridge Access Area; and (2) at the Keowee Development: Cane Creek Access Area, Crow Creek Access Area, Fall Creek Access Area, High Falls County Park, Keowee Town Access Area, Mile Creek County Park, South Cove County Park, Stamp Creek Access Area, Warpath Access Area, and World of Energy Picnic Area. The licensee must also reserve the existing Bootleg Access Area, Grindstone Access Area, and Handpole Ridge Access Area and the new High Falls II Access Area and Mosquito Point Access Area for future public recreation.

The licensee must modify the RMP to include: (1) provisions to construct restrooms with lighting, expanded and lighted vehicle-with-trailer parking, courtesy dock, picnic area/shelter, single-vehicle parking, and bank fishing trail at Crow Creek Access Area; (2) provisions to construct 10 primitive campsites, 5 bank fishing stations, and 10 camping cabins at Mile Creek County Park; (3) provisions to monitor the capacity and condition of Warpath Access Area annually during summer recreation seasons and develop (a) plans to address capacity issues, if non-peak weekend use exceeds 90 percent of capacity, and (b) plans to mitigate for overuse, if use exceeds capacity at any time; (4) a description of the existing facilities, site plans, capital and operation and maintenance costs, and schedule of any recreation facility enhancements proposed over the term of a license at World of Energy Picnic Area; (5) provisions for the stabilization of 6,250 feet of shoreline on islands in Lake Keowee; (6) an implementation schedule describing the anticipated year of construction for all recreation enhancement measures specified in the plan; and (7) clarification that all improvements made to project recreation sites as part of the Access Area Improvement Initiative must be identified in the Commission-approved RMP.

The revised RMP must also contain provisions for developing and implementing a Recreation Use and Needs Study no later than December 31, 2032 and the filing of an updated RMP no later than December 31, 2033.

The revised RMP must be developed after consultation with the South Carolina Department of Parks, Recreation, and Tourism and the South Carolina Department of Natural Resources. The licensee must include with the revised RMP documentation of consultation, copies of recommendations on the completed plan after it has been prepared and provided to the entities above, and specific descriptions of how the entities' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the entities to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific reasons.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Draft Article 406. Shoreline Management Plan. The Shoreline Management Plan (SMP) filed on August 27, 2014, is approved, with the following modification: the licensee must extend the provision in section 7.2.24 of the Shoreline Management Guidelines accepting applications for an exemption to the Maximum Size Limit for private facilities from the time of license issuance through December 31, 2020.

The licensee may make minor changes (i.e., minor alterations that are more restrictive or necessary to meet license obligations) to the Shoreline Management

Guidelines and Lake Use Restrictions to protect significant environmental resources, including newly discovered archaeological or historic sites, Threatened or Endangered Species, and Special Concern Species; and may make minor changes to Shoreline Classification Maps to correct mapping errors. The licensee must file an annual report with the Commission by December 31 each year describing any modifications made to the SMP, including the Shoreline Classification Maps. If no changes are made to the SMP or Shoreline Classification Maps, the licensee must submit a letter to that effect. If changes are made to the Shoreline Classification Maps, the report must include a description, location (latitude and longitude), and reason for each change. The Commission reserves the right to review such changes and may require changes to the SMP at any time during the term of the license.

Additionally, within 45 days of this order, the licensee must file, on CD or diskette, two separate sets of GIS data in a georeferenced electronic file format (such as ArcView shapefiles, GeoMedia files, MapInfo files, or a similar GIS format) with the Secretary of the Commission, ATTN: OEP/DHAC. The data must include a) polygon files of the surface areas of the project's reservoir(s) and tailrace(s), including separate polygons for each, and b) polyline files representing the linear extent of each shoreline management classification, by reservoir/tailrace. The data must match maps shown in the shoreline management plan. The attribute table for the polygon files must contain the name, water elevation, and elevation reference datum of each reservoir and tailrace. The attribute table for the polyline files must contain the name of each shoreline management classification and its associated reservoir/tailrace, consistent with the shoreline management plan.

A polygon GIS data file is required for the reservoirs/tailrace, with the reservoirs separately identified. The attribute table for the reservoirs/tailrace must include water elevation and elevation reference datum. A polyline GIS data file is required for the shoreline classifications associated with the reservoirs. The attribute table for the reservoirs must include at least the management classification description for each polyline, consistent with the shoreline management plan.

All GIS data must be positionally accurate to ± 40 feet in order to comply with National Map Accuracy Standards for maps at a 1:24,000 scale. The file name(s) must include: FERC Project Number, data description, date of this order, and file extension in the following format [P-2503, reservoir name polygon/or reservoir name shoreline polyline data, MM-DD-YYYY.SHP]. The filing must be accompanied by a separate text file describing the spatial reference for the georeferenced data: map projection used (i.e., UTM, State Plane, Decimal Degrees), the map datum (i.e., North American 27, North American 83), and the units of measurement (i.e., feet, meters, miles). The text file name must include: FERC Project Number, data description, date of this order, and file extension in the following format [P-2503, project reservoir/or shoreline classification metadata, MM-DD-YYYY.TXT].

Within ten years following license issuance, and every ten years thereafter for the term of the license, the licensee must file with the Commission, for approval, a revised SMP. The revised SMP must include a description of any proposed changes to the provisions and classification maps of the existing approved SMP based on an evaluation of the adequacy of the existing plan. The revised SMP must also include revised polyline data to correspond with the revised shoreline classification maps, including any necessary corrections to minor mapping errors. If changes are made to the SMP, the filing must include both a clean copy and a red-line copy of the revised SMP so that plan modifications can be easily identified; and include justification of such changes. In developing the revised SMP, the licensee must, at a minimum, consult with the U.S. Fish and Wildlife Service, South Carolina Department of Natural Resources, and South Carolina Department of Parks, Recreation, and Tourism to review the implementation of the SMP and to recommend potential modifications. The revised SMP must include documentation of consultation with the entities identified above and specific descriptions of how the entities' comments are accommodated. The licensee must allow a minimum of 30 days for the entities to comment and to make recommendations prior to filing the revised SMP with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons based on project-specific reasons. The Commission reserves the right to require changes to the revised SMP.

Draft Article 407. Programmatic Agreement and Historic Properties Management Plan. The licensee must implement the "Programmatic Agreement Among the Federal Energy Regulatory Commission, the North Carolina State Historic Preservation Officer, and the South Carolina State Historic Preservation Officer for Managing Historic Properties that May be Affected by Issuing a New License to Duke Energy Carolinas, LLC for the Continued Operation of the Keowee-Toxaway Hydroelectric Project in Transylvania County, North Carolina and in Pickens and Oconee Counties, South Carolina," executed on May 8, 2015, by the North Carolina State Historic Preservation Officer (SHPO) and on May 19, 2015, by the South Carolina SHPO, and including but not limited to the Historic Properties Management Plan (HPMP) for the project. In the event that the Programmatic Agreement is terminated, the licensee must continue to implement the provisions of its approved HPMP. The Commission reserves the authority to require changes to the HPMP at any time during the term of the license.

Draft Article 408. Use and Occupancy. (a) In accordance with the provisions of this article, the licensee must have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain types of use and occupancy, without prior Commission approval. The licensee may exercise the authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the licensee must also have continuing responsibility to supervise and control the use and

occupancies for which it grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interests that it has conveyed, under this article. If a permitted use and occupancy violates any condition of this article or any other condition imposed by the licensee for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the licensee must take any lawful action necessary to correct the violation. For a permitted use or occupancy, that action includes, if necessary, canceling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

(b) The type of use and occupancy of project lands and waters for which the licensee may grant permission without prior Commission approval are: (1) landscape plantings; (2) non-commercial piers, landings, boat docks, or similar structures and facilities that can accommodate no more than 10 water craft at a time and where said facility is intended to serve single-family type dwellings; (3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline; and (4) food plots and other wildlife enhancement. To the extent feasible and desirable to protect and enhance the project's scenic, recreational, and other environmental values, the licensee must require multiple use and occupancy of facilities for access to project lands or waters. The licensee must also ensure, to the satisfaction of the Commission's authorized representative, that the use and occupancies for which it grants permission are maintained in good repair and comply with applicable state and local health and safety requirements. Before granting permission for construction of bulkheads or retaining walls, the licensee must: (1) inspect the site of the proposed construction, (2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site, and (3) determine that the proposed construction is needed and would not change the basic contour of the impoundment shoreline. To implement this paragraph (b), the licensee may, among other things, establish a program for issuing permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the licensee's costs of administering the permit program. The Commission reserves the right to require the licensee to file a description of its standards, guidelines, and procedures for implementing this paragraph (b) and to require modification of those standards, guidelines, or procedures.

(c) The licensee may convey easements or rights-of-way across, or leases of project lands for: (1) replacement, expansion, realignment, or maintenance of bridges or roads where all necessary state and federal approvals have been obtained; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; (5) telephone, gas, and electric utility distribution lines; (6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone

distribution cables or major electric distribution lines (69-kV or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project impoundment. No later than January 31 of each year, the licensee must file three copies of a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar year, the type of interest conveyed, the location of the lands subject to the conveyance, and the nature of the use for which the interest was conveyed.

(d) The licensee may convey fee title to, easements or rights-of-way across, or leases of project lands for: (1) construction of new bridges or roads for which all necessary state and federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary federal and state water quality certification or permits have been obtained; (3) other pipelines that cross project lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary federal and state approvals have been obtained; (5) private or public marinas that can accommodate no more than 10 water craft at a time and are located at least one-half mile (measured over project waters) from any other private or public marina; (6) recreational development consistent with an approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed for a particular use is five acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from project waters at normal surface elevation; and (iii) no more than 50 total acres of project lands for each project development are conveyed under this clause (d)(7) in any calendar year. At least 60 days before conveying any interest in project lands under this paragraph (d), the licensee must file a letter with the Commission, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked Exhibit G map may be used), the nature of the proposed use, the identity of any federal or state agency official consulted, and any federal or state approvals required for the proposed use. Unless the Commission's authorized representative, within 45 days from the filing date, requires the licensee to file an application for prior approval, the licensee may convey the intended interest at the end of that period.

(e) The following additional conditions apply to any intended conveyance under paragraph (c) or (d) of this article:

(1) Before conveying the interest, the licensee must consult with federal and state fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer.

(2) Before conveying the interest, the licensee must determine that the proposed use of the lands to be conveyed is not inconsistent with any approved report on recreational resources of an Exhibit E; or, if the project does not have an approved

report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include the following covenants running with the land: (i) the use of the lands conveyed must not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; (ii) the grantee must take all reasonable precautions to ensure that the construction, operation, and maintenance of structures or facilities on the conveyed lands will occur in a manner that will protect the scenic, recreational, and environmental values of the project; and (iii) the grantee must not unduly restrict public access to project lands and waters.

(4) The Commission reserves the right to require the licensee to take reasonable remedial action to correct any violation of the terms and conditions of this article, for the protection and enhancement of the project's scenic, recreational, and other environmental values.

(f) The conveyance of an interest in project lands under this article does not in itself change the project boundaries. The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised Exhibit G drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including shoreline aesthetic values. Absent extraordinary circumstances, proposals to exclude lands conveyed under this article from the project must be consolidated for consideration when revised Exhibit G drawings would be filed for approval for other purposes.

(g) The authority granted to the licensee under this article must not apply to any part of the public lands and reservations of the United States included within the project boundary.

APPENDIX B

Water Quality Certificate Conditions for the Keowee-Toxaway Project Issued by the South Carolina Department of Health and Environmental Control on October 29, 2015

Conditions of Certification:

1. The applicant, Duke Energy Carolinas, LLC shall operate the Keowee-Toxaway Hydroelectric Project in accordance with the following parts of the Relicensing Agreement dated August 27, 2014 (RA). The following portions are hereby incorporated into this 401 Certification by reference:

RA – Appendix A:

Proposed License Articles

A-2.0 Low Inflow Protocol Article

A-7.0 Water Quality Monitoring Article

2. The applicant, Duke Energy Carolinas, LLC must take all necessary measures during Keowee-Toxaway Hydroelectric Project operation and maintenance to prevent fuel, oil, tar, trash, debris, and other pollutants from entering the adjacent waters or wetlands.
3. Any “large water intake” owner or “major water withdrawer” applicant to Duke Energy Carolinas, LLC for a large water intake or major water withdrawal from the project must comply with the Surface Water Withdrawal, Permitting, Use And Reporting Act, S.C. Code Ann. §§ 49-4-10 et seq. A “large water intake” means any water intake (e.g., public water supply, industrial, agricultural, power plant, irrigation, etc.) having a maximum instantaneous capacity greater than or equal to one million gallons per day, and a “major water withdrawer” means a person withdrawing surface water in excess of three million gallons during any one month from a single intake or multiple intakes under common ownership within a one mile radius from any one existing or proposed intake.

APPENDIX C – RELICENSING AGREEMENT

Relicensing Agreement

for the

**Keowee-Toxaway Hydroelectric Project
FERC Project No. 2503**

September 18, 2013

Signature Copy

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**STATE OF NORTH CAROLINA
COUNTY OF MECKLENBURG**

DUKE ENERGY CAROLINAS, LLC

AGREEMENT

THIS AGREEMENT ("Agreement" or "Relicensing Agreement"), made and entered into as of November 29, 2013, by and between DUKE ENERGY CAROLINAS, LLC, with its principal place of business in Mecklenburg County, North Carolina (the "Licensee"); ADVOCATES FOR QUALITY DEVELOPMENT, INC.; ANDERSON AREA CHAMBER OF COMMERCE; CITY OF SENECA; COMMISSIONERS OF PUBLIC WORKS OF THE CITY OF GREENVILLE; FRIENDS OF LAKE KEOWEE SOCIETY, INC.; OCONEE COUNTY, SOUTH CAROLINA; PICKENS COUNTY, SOUTH CAROLINA; PICKENS COUNTY WATER AUTHORITY; SOUTH CAROLINA DEPARTMENT OF ARCHIVES AND HISTORY; SOUTH CAROLINA DEPARTMENT OF NATURAL RESOURCES; SOUTH CAROLINA DEPARTMENT OF PARKS, RECREATION AND TOURISM; SOUTH CAROLINA WILDLIFE FEDERATION; THE CLIFFS AT KEOWEE VINEYARDS COMMUNITY ASSOCIATION, INC.; THE RESERVE AT LAKE KEOWEE; UPSTATE FOREVER; and WARPATH DEVELOPMENT, INC.; (collectively "Stakeholders"), (all referenced Stakeholders and the Licensee collectively "Parties" provided the duly authorized representative of each signs this Agreement), provides as follows:

WITNESSETH

WHEREAS, pursuant to a license issued by the Federal Energy Regulatory Commission ("FERC" or "Commission") (FERC Project No. 2503), the Licensee operates a hydroelectric power project, known as the Keowee-Toxaway Hydroelectric Project (the "Project") which is situated on the Keowee and Little Rivers in the South Carolina counties of Oconee and Pickens with a small portion extending into Transylvania County, North Carolina, the Project consisting primarily of the following major components. (See the Exhibit K drawings for the Existing License for the Project, which describe the Project Boundaries in more specific detail.)

- a) The Jocassee Development consisting principally of a powerhouse, two saddle dikes, two intake structures, water conveyance tunnels, a gated spillway, and the Jocassee Dam impounding the Keowee River to form Lake Jocassee; and
- b) The Keowee Development consisting principally of a powerhouse, an intake structure, gated concrete ogee spillway, four saddle dikes, the Keowee Dam impounding the Keowee River and the Little River Dam impounding the Little River, both of which form Lake Keowee; and

WHEREAS, beginning in August 2009, the Licensee and the Stakeholders, plus EASTERN BAND OF CHEROKEE INDIANS, formally met as the Keowee-Toxaway Hydroelectric Project Stakeholder Team ("Team") to begin the process of developing a

Keowee-Toxaway Hydroelectric Project (FERC No. 2503)
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non-binding Agreement-in-Principle (“AIP”) with regard to the issues related to the relicensing of the Project; and

WHEREAS, on March 11, 2011, the Licensee filed a timely Notice of Intent with the FERC to apply for a new license (“New License”) for the Project; and

WHEREAS, by July 25, 2013, the Licensee and the Stakeholders signed the non-binding AIP concerning most substantive matters of interest to them related to the relicensing of the Project, and the Licensee and the Stakeholders indicated in said AIP their desire to work together to convert the AIP into this binding Agreement; and

WHEREAS, EASTERN BAND OF CHEROKEE INDIANS, by electing not to sign the AIP was not afforded the opportunity to participate in the development of this Agreement but was afforded the opportunity to become a Party; and

WHEREAS, SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL, UNITED STATES ARMY CORPS OF ENGINEERS, and UNITED STATES FISH AND WILDLIFE SERVICE also participated in many of the meetings of the Team and were afforded the opportunity to become Parties to this Agreement; and

WHEREAS, on or before August 31, 2014, the Licensee will file an application, consistent with this Agreement in all respects, with the FERC for a New License for the Project; and

WHEREAS, the Licensee will include this Agreement and the accompanying Explanatory Statement in its Application for New License; and

WHEREAS, within 60 days following the FERC’s issuance of its Notice of Ready for Environmental Analysis, the Licensee will file an application, consistent with this Agreement in all respects, with the South Carolina Department of Health and Environmental Control (“SCDHEC”) for a Water Quality Certification for the Project pursuant to §401 of the Clean Water Act (“401 WQC”), as amended; and

WHEREAS, the Licensee, the United States Army Corps of Engineers (“USACE”), and the Southeastern Power Administration (“SEPA”) are currently parties to a water storage balancing agreement (“1968 Agreement”) requiring flow releases from the Keowee Development under certain circumstances and the 1968 Agreement will be replaced by a new agreement (“New Operating Agreement” or “NOA”) to be negotiated in conjunction with relicensing of the Project and said NOA will not be inconsistent with this Agreement; and

WHEREAS, the Parties agree that generating power at the Project’s powerhouses and managing the reservoirs’ levels and flows for public water supply support, fish habitat, public recreation, and other purposes are all important uses of the limited waters of the Keowee and Little rivers and their tributaries, and that the terms of this Agreement strike a reasonable balance among these uses and provide a basis for the Parties’ concurrence in the issuance of a New License for the Project to the Licensee, subject to the applicable terms, covenants, and provisions of this Agreement; and

WHEREAS, the Licensee’s Application for New License will include proposed facilities and actions to protect, mitigate, or enhance: public recreational opportunities at the Project’s reservoirs (“Project Reservoirs”), cultural resources, fish and wildlife resources, the regional economy, and other resource enhancement initiatives; and

WHEREAS, there are terms, phrases, and abbreviations specific to the Stakeholder Process that led to this Agreement and the significant terms, phrases, and abbreviations are defined in Appendix C; and

Keowee-Toxaway Hydroelectric Project (FERC No. 2503)
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WHEREAS, the Parties agree that sharing the burden during periods of low inflow and maintenance and emergency conditions is important, and that the Low Inflow Protocol ("LIP") for the Keowee-Toxaway Hydroelectric Project (Appendix D) and the Maintenance and Emergency Protocol ("MEP") for the Keowee-Toxaway Hydroelectric Project (Appendix E) are reasonable compromises by the Parties to define operational changes during these time periods; and

WHEREAS, the maps included in Appendix F are intended solely to assist in describing the locations and boundaries of specific tracts of land, but are not of survey quality; and

WHEREAS, the Parties understand that certain governmental Parties have independent statutory responsibilities and processes that may result in mandates that are not consistent with the terms of this Agreement, and that it is nonetheless necessary to preserve the integrity and independence of those responsibilities and processes, and this Agreement specifically does so; and

WHEREAS, this Agreement is the culmination of the Parties' desires, as set forth in the July 25, 2013, AIP, to draft from the AIP a binding agreement that embodies the intent of the Parties; and

WHEREAS, this Agreement faithfully sets forth in more detail and specificity, in contractual terms, the concepts described and to which the Parties agreed to in the AIP, with mutually agreeable adjustments as negotiated by the Parties after the AIP was signed; and

WHEREAS, the Parties have now reached full agreement on the resolution of all the material resource matters identified and at issue in the New License for the Project, specifically including but not limited to hydropower generation; watershed and hydro operation practices that protect and sustain the quality and quantity of the waters of the Keowee-Toxaway River Basin; a well-managed and adequate water supply to serve the region for years to come; safe and sufficient access for users of motorized and non-motorized boats and safe and sufficient areas for fishing, hiking, sightseeing, camping, and other public recreation opportunities; opportunities to support tourism; balanced shoreline uses to accommodate diverse interests including undisturbed areas; conservation of the fish and wildlife resources as well as the habitats supporting those resources; and protection of Historic Properties, all of which result in the Parties relinquishing certain arguments and potential outcomes in exchange for the certainty of the agreed-upon terms and conditions;

NOW, THEREFORE, IN CONSIDERATION of all other actions and undertakings as set forth herein below, the Parties contract and agree as follows.

Keowee-Toxaway Hydroelectric Project (FERC No. 2503)
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Keowee-Toxaway Hydroelectric Project (FERC No. 2503)
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RESOURCE AGREEMENTS

The Parties agree that, except for the provisions in Appendix A, the provisions in this Agreement should not be incorporated into the terms of the New License that the FERC is expected to issue for the Project. The Parties have listed their proposed License Articles in each relevant section and have provided the specific language of the proposed License Articles in Appendix A.

1.0 Agreements on Full Consensus

1.1 The Parties acknowledge that: (i) they have participated fully in the activities of the Keowee-Toxaway Stakeholder Process and have a good understanding of the issues resolved herein; (ii) this Agreement is developed from and is consistent with the AIP signed by the Parties by July 25, 2013, except to the extent that it contains mutually agreeable adjustments as negotiated by the Parties after the AIP was signed; (iii) they are requesting that the FERC issue a license for the Project with a term of at least 40 years; (iv) they are in agreement with the entirety of this Agreement; (v) they understand the Licensee will file this Agreement with the FERC and the SCDHEC for these agencies' consideration as they process applications for the New License and the 401 WQC for the Project; and (vi) the Licensee will also request that the FERC and the SCDHEC act consistently with the terms of this Agreement in issuing their licenses, certifications, and orders for the Project.

1.2 Actions of the Licensee

1.2.1 Application for New License – The Licensee shall develop and submit the Application for New License in a manner consistent with this Agreement and submit this Agreement with the Application for New License.

1.2.2 401 WQC – The Licensee shall submit its 401 WQC Request in a manner consistent with this Agreement and include this Agreement with the 401 WQC Request.

1.2.3 NOA – The Licensee shall negotiate with the USACE and the SEPA to replace the 1968 Agreement with a NOA that is not inconsistent with this Agreement.

1.2.4 Other Relicensing Filings – The Licensee shall ensure all other filings it makes as may be required for relicensing the Project are consistent with this Agreement.

1.3 Actions of Parties to this Agreement other than the Licensee

The Parties to this Agreement, excepting the Licensee, shall advocate for New License conditions, a 401 WQC, a NOA with the USACE and SEPA, and all other agency findings and documents associated with relicensing of the Project or implementation of the New License consistent with this Agreement by:

1.3.1 Submitting statements, individually or collectively, within open public comment periods for the Licensee's submittals identified in Section 1.2 above requesting the relevant agencies take actions wholly consistent with this Agreement;

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1.3.2 Undertaking reasonable efforts to obtain regulatory agency actions wholly consistent with this Agreement in a timely manner; and

1.3.3 Not supporting in any way entities seeking to obtain regulatory actions inconsistent with this Agreement or seeking to delay regulatory actions associated with relicensing of the Project.

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2.0 Normal Operating Ranges for Reservoir Levels Agreements

Reservoir Elevations Article – The Parties recommend the proposed Reservoir Elevations License Article, the full text of which is provided in Appendix A of this Agreement, be incorporated verbatim into any New License the FERC may issue for the Project.

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3.0 Actions to Support Water User Needs Agreements

3.1 Low Inflow Protocol (“LIP”) License Article – The Parties recommend the proposed Low Inflow Protocol for the Keowee-Toxaway Hydroelectric Project License Article, the full text of which is provided in Appendix A of this Agreement, be incorporated verbatim into any New License the FERC may issue for the Project.

3.2 Support of Relicensing Study Findings for Evaluating Proposed Increases in Water Withdrawal Amounts – The Parties acknowledge the water quantity effects of water intakes located in the Upper Savannah River Basin have been evaluated during the relicensing process based on the available facts, assumptions, and analytical methods and reported in the Water Supply Study, Final Report and Addenda, Keowee-Toxaway Hydroelectric Relicensing Project, December 5, 2012. This evaluation considered the capacities of existing water intakes and projected increases in withdrawals through the Year 2066. The Parties shall consider the results of this study when evaluating proposals for additional water use from the Project.

3.3 Protecting and Enhancing Usable Water Storage – The Licensee shall require all lake use permit applicants for new, expanded, or rebuilt water intakes (public, industrial, or power generation) to design and construct their water intakes to operate at full capacity with the lake drawn down to the hydro station operational limit (70 feet (“ft”) local datum / 1080 ft above Mean Sea Level (“AMSL”) for Lake Jocassee and 75 ft local datum / 775 ft AMSL for Lake Keowee). If a lake use permit applicant is unable to comply with this requirement, the Licensee shall require the lake use permit applicant to justify, to the satisfaction of the Licensee, a more shallow water intake with a feasibility evaluation conducted by a licensed professional engineer with water resources expertise, but the Licensee shall not authorize a new, expanded, or rebuilt water intake (public, industrial, or power generation) that requires a lake elevation to operate at full withdrawal capacity higher than the new Critical Reservoir Elevations defined in the LIP (Appendix D).

3.4 LIP

3.4.1 The Licensee shall file the LIP provided in Appendix D of this Agreement with its Application for New License and request the FERC incorporate it verbatim into the New License.

3.4.2 Importance of Human Health and Safety and the Integrity of the Public Water Supply and Electric Systems – Nothing in the LIP will limit the Licensee’s ability to take any and all lawful actions necessary at its hydro projects to protect human health and safety, to protect its equipment from damage, to ensure the stability of the regional electric grid, to protect the equipment of the Large Water Intake owners from damage, and to ensure the stability of public water supply systems; provided that nothing in this Agreement or LIP will obligate the Licensee to take any actions to protect the equipment of Large Water Intake owners from damage or to ensure the stability of the public water supply systems. It is recognized the Licensee may take such actions to provide this protection without prior consultation or notification.

3.4.3 Effective Date for LIP – The Parties agree to fully implement their water management responsibilities as applicable under the LIP beginning on the Effective Date of this Agreement.

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- 3.4.4 As a condition of the Licensee's written approval, the Licensee shall require all owners of new, expanded, or rebuilt water intakes who install an intake on Lake Keowee to comply with the requirements of the LIP.
- 3.4.5 Rainfall Data Collection – Within one year following the issuance of the New License, the Licensee shall upgrade its rainfall data collection and reporting system so rainfall amounts recorded at the Keowee and Jocassee Developments and the Bad Creek Project can be used on an updated daily basis for the purposes of the LIP.
- 3.4.6 Regional Drought Response – When the Project is operating in any stage of the LIP, the Parties shall encourage water intake owners located on the USACE Reservoirs (i.e., Hartwell, Russell and Thurmond) downstream of the Project and their customers to implement water conservation measures similar to the LIP.
- 3.4.7 Responsibilities of Parties – The Parties to this Agreement without specific responsibilities under the LIP shall support implementation of the LIP by the Licensee and other Large Water Intake owners by undertaking reasonable efforts to communicate: (1) the severity of drought and the restrictions associated with each LIP stage to their respective constituents; and (2) the efforts of the Licensee and other Large Water Intake owners to reduce water consumption.
- 3.4.8 Revising the LIP – The LIP revision process, including notification, consultation, and filing of any necessary New License amendments or 401 WQC modifications, is identified in the LIP. The filing of a revised LIP by the Licensee shall not constitute or require modification of this Agreement, and any Party to this Agreement may choose to be involved in the FERC's or SCDHEC's public processes for assessing the revised LIP, but may not oppose any part of a revised LIP that is consistent with the LIP included in this Agreement.
- 3.4.9 Lake Keowee Critical Reservoir Elevation – Provided Friends of Lake Keowee Society, Inc. ("FOLKS"), Advocates for Quality Development ("AQD"), The Reserve at Lake Keowee, and The Cliffs at Keowee Vineyards Community Association, Inc. are all Parties to this Agreement, the Licensee shall maintain Lake Keowee's Critical Reservoir Elevation no lower than 90.0 ft local datum / 790.0 ft AMSL for the term of the New License.
- 3.5 Negotiation of NOA – The Licensee shall negotiate with the USACE and the SEPA to develop a NOA that incorporates: (1) the applicable operating parameters to ensure the NOA is not inconsistent with this Agreement; (2) the usable water storage in all six hydro reservoirs owned by the Licensee and the United States of America in the Upper Savannah River Basin (i.e., Bad Creek, Jocassee, Keowee, Hartwell, Russell and Thurmond); and (3) an allowance in case lake levels at the USACE Reservoirs are intentionally maintained at lower levels (e.g., to support maintenance situations), so that the Licensee shall not have to provide a higher weekly flow release from the Keowee Development than would have otherwise been required. During the negotiation of the NOA, the Licensee shall also pursue any feasible opportunities to include requirements in the NOA promoting consistent drought response among water users throughout the Upper Savannah River Basin in a manner similar to the LIP.
- 3.6 Savannah River Water Resource Planning – Within two years following both i) the issuance of a New License that is not inconsistent with this Agreement, the end of all appeals, and the closure of all rehearing and administrative challenge periods and

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ii) the signing by the Licensee, USACE, and SEPA of a NOA that is not inconsistent with this Agreement, the Licensee after consultation with the Parties shall make available \$438,000 in funding for initiatives approved by the Licensee to improve water quantity planning and management in the Savannah River Basin.

3.7 Existing Water Withdrawals and Effluent Discharges – The Parties acknowledge the Licensee will include in its Application for New License a table(s) that identifies existing conditions with regard to Large Water Intakes and effluent discharges located within the Project Boundaries.

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4.0 Maintenance and Emergency Protocol (“MEP”) Agreements

4.1 MEP License Article – The Parties recommend the proposed Maintenance and Emergency Protocol for the Keowee-Toxaway Hydroelectric Project License Article, the full text of which is provided in Appendix A of this Agreement, be incorporated verbatim into any New License the FERC may issue for the Project.

4.2 MEP – The Licensee shall file the MEP provided in Appendix E of this Agreement with its Application for New License and request the FERC incorporate it verbatim into the New License.

4.3 Importance of Human Health and Safety and the Integrity of the Public Water Supply and Electric Systems – Nothing in the MEP will limit the Licensee’s ability to take any and all lawful actions necessary at its hydro projects to protect human health and safety, to protect its equipment from damage, to ensure the stability of the regional electric grid, to protect the equipment of the Large Water Intake owners from damage, and to ensure the stability of public water supply systems; provided that nothing in this Agreement or MEP will obligate the Licensee to take any actions to protect the equipment of Large Water Intake owners from damage or to ensure the stability of public water supply systems. It is recognized the Licensee may take such actions to provide this protection without prior consultation or notification.

4.4 Revising the MEP – The MEP revision process, including notification, consultation and filing of any necessary New License amendments or 401 WQC modifications, is identified in the MEP. The filing of a revised MEP by the Licensee will not constitute or require modification of this Agreement, and any Party to this Agreement may be involved in the FERC or SCDHEC public processes for assessing the revised MEP, but may not oppose any part of a revised MEP that is consistent with the MEP included in this Agreement.

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5.0 Historic Properties Agreements

5.1 Historic Properties License Article – The Parties recommend the proposed Historic Properties License Article, the full text of which is provided in Appendix A of this Agreement, be incorporated verbatim into any New License the FERC may issue for the Project.

5.2 Historic Properties Management Plan (“HPMP”) – The Licensee shall include the following actions in the proposed HPMP it files with the Application for New License:

5.2.1 Archaeological Site Monitoring – The Licensee will annually monitor sites 38OC460, 38OC461, 38OC462, 38OC466, 38OC467, and 38PN175 to document their status.

5.2.2 Access Area Cemetery Management – The Licensee in consultation with the SC State Historic Preservation Office (“SCSHPO”) and any lessees will develop specific management plans for the cemeteries at Stamp Creek Access Area and South Cove County Park.

5.2.3 Lake Use Permitting – The Licensee will incorporate the lake use permitting requirements regarding Historic Properties and Cultural Resources from the existing Programmatic Agreement into the HPMP.

5.2.4 Public Outreach – The Licensee in consultation with the SCSHPO, the Eastern Band of Cherokee Indians (“EBCI”) Tribal Historic Preservation Office (“THPO”), and the SC Department of Parks, Recreation and Tourism (“SCDPRT”) will develop interpretative signage or other materials for display at the Jocassee Gorges Visitor Center located at Keowee-Toxaway State Park and selected Project Access Areas regarding the history of the Project area. Topics will include, but will not be limited to, Cherokee history and hydropower development. The Licensee will provide drafts of the signage or other materials within two years and will install signage and complete other materials within three years following the issuance of the New License, the end of all appeals, and the closure of all rehearing and administrative challenge periods.

5.2.5 Traveling History Exhibit – The Licensee in consultation with the SCSHPO, the EBCI THPO, and the SCDPRT will develop a traveling exhibit on the history of the Project area to be used at various visitor centers, exhibits, schools, etc. Topics will include, but will not be limited to, Cherokee history and hydropower development. The Licensee will provide drafts of the materials associated with the exhibit within two years and complete exhibit development within three years following the issuance of the New License, the end of all appeals, and the closure of all rehearing and administrative challenge periods.

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6.0 Public Recreation Agreements

6.1 Public Recreation License Articles – The Parties recommend the proposed Recreation Management Plan License Article and the Recreation Planning License Article, the full text of which are provided in Appendix A of this Agreement, be incorporated verbatim into any New License the FERC may issue for the Project.

6.2 Recreation Management Plan (“RMP”) – The Licensee shall include the following activities in the RMP submitted with the Application for New License.

6.2.1 Specific Facility Enhancements and Construction Schedules – The Licensee shall include the following facility enhancements in the RMP and schedule their construction to occur during the first ten years of the New License.

6.2.1.1 Devils Fork State Park – The Licensee shall develop a designated location for diver access; install a new courtesy dock at the main ramps usable over a larger range of reservoir elevations than the existing courtesy dock; construct a new boat and trailer parking area to serve the existing campground; and enhance the Roundhouse Point ramps to facilitate non-motorized boating.

6.2.1.2 Expansion of Double Springs Campground – The Licensee shall add into the Project Boundary approximately 25 acres (“ac”) adjoining the existing campground currently leased and operated by the SCDPRT and shall designate it as reserved for public recreation. The Licensee shall also offer to lease this additional land to the SCDPRT, construct a composting-type toilet, and construct 12 additional campsites if the SCDPRT is a Party to this Agreement and accepts the offer of additional leased land within one year following the issuance of the New License, the end of all appeals, and the closure of all rehearing and administrative challenge periods.

6.2.1.3 Keowee Town Access Area – The Licensee shall construct trails and, where feasible, add single vehicle parking; and install appropriate signage to support wildlife viewing and bank fishing.

6.2.1.4 Fall Creek Access Area – The Licensee shall construct trails and, where feasible, add single vehicle parking; and install appropriate signage to support wildlife viewing and bank fishing at the Fall Creek Island/peninsula.

6.2.1.5 Mile Creek County Park

6.2.1.5.1 The Licensee shall construct up to ten primitive campsites and up to five bank fishing stations with open air fishing shelters if Pickens County is a Party to this Agreement and the County agrees to operate and maintain the new facilities.

6.2.1.5.2 If Pickens County is a Party to this Agreement, the Licensee shall support the development of ten pre-manufactured camping cabins by conducting any required archaeological investigations; working with Pickens County to develop a mutually agreeable schedule and design specification for the cabins and obtain firm quotes from cabin and septic tank manufacturers; and paying the materials costs for the cabins and septic tanks with the Licensee’s total cost not to exceed \$350,000. The Licensee’s funding shall be available within one year following FERC

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approval of the RMP. Pickens County shall be responsible for all other costs and all activities associated with the permitting, installation, operation, and maintenance of said cabins and shall ensure the camping cabins are available for public use consistent with the County's current Campsite Reservation Policies for Mile Creek County Park. The Licensee shall expedite its internal review of design plans provided by Pickens County.

6.2.1.6 Cane Creek Access Area – The Licensee shall designate shoreline areas by installing appropriate signage and, where feasible, add single vehicle parking to support bank fishing.

6.2.1.7 New Project Access Areas – The Licensee shall designate High Falls II (approximately 36.19 ac) and Mosquito Point (approximately 10.25 ac) as reserved for future public recreation needs as specified in Section 7.5.4.

6.2.1.8 Keowee-Toxaway State Park – The Licensee shall construct a canoe/kayak launch, fishing pier, and canoe portage as specified in Section 6.3.2.

6.2.1.9 Stamp Creek Access Area – The Licensee shall construct trails and, where feasible, add single vehicle parking; and install appropriate signage to support wildlife viewing and bank fishing.

6.2.2 Access Area Improvement Initiative (“AAIL”) Program

6.2.2.1 Existing AAIL Lease Terms – The Licensee shall offer to extend the leases for High Falls County Park, Mile Creek County Park, Warpath Marina, Devils Fork State Park, and South Cove County Park through the term of the New License if the current lessees are Parties to this Agreement and accept the offer of lease extension within one year following the issuance of the New License, the end of all appeals, and the closure of all rehearing and administrative challenge periods. The Licensee will offer an extension of the Warpath Marina lease only if the facilities have been constructed consistent with the requirements of and schedule in the Existing License RMP.

6.2.2.2 New AAIL Leases – The Licensee shall offer new, low-cost AAIL leases as follows to support development of additional facilities to enhance public recreation at the Project if the identified organization is a Party to this Agreement and accepts the offer of lease within two years following the issuance of the New License, the end of all appeals, and the closure of all rehearing and administrative challenge periods:

- Bootleg Access Area to be leased to the SCDNR;
- Crow Creek Access Area to be leased to Pickens County;
- 15-ac lake at Keowee-Toxaway State Park to be leased to the SCDPRT including upland Project lands and the existing water-retaining structure associated with the impoundment; and
- Fall Creek Access Area, Keowee Town Access Area, Stamp Creek Access Area, and Cane Creek Access Area to be leased to Oconee County.

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6.2.3 Bank Fishing at Project Access Areas – The Licensee shall ensure the shoreline of all Project Access Areas remains open for bank fishing for the term of the New License, except for those minimal shoreline areas where bank fishing is restricted for safety reasons, management problems, or to avoid conflicts with other access area users. The Licensee, in consultation with AAll lessees for those Project Access Areas subject to an AAll lease, shall designate with appropriate signage those portions of the shoreline within the Project Access Areas where bank fishing is prohibited.

6.2.4 Future RMP Revisions – The Licensee shall convene the Parties to assess the need for conducting a new Recreation Use and Needs (“RUN”) Study in conjunction with the development of the second FERC Form 80 Licensed Hydropower Development Recreation Report (“Form 80”) filing after the issuance of the New License and every second Form 80 filing thereafter. If it is determined that a new RUN Study is needed, the new study shall be conducted the following year. Based upon the findings of each RUN Study during the term of the New License, the Licensee shall revise the RMP as necessary for the Project and request FERC approval. The Licensee shall solicit input from the Parties in developing and implementing the RUN Study and in the revision of the RMP. The filing of a revised RMP by the Licensee will not constitute or require modification of this Agreement, and any Party may be involved in the FERC’s public process for assessing the revised RMP, but shall not oppose any part of a revised RMP that is consistent with the RMP filed with the Application for New License. If at any time during the term of the New License the FERC changes its schedule for or no longer requires filing Form 80, the Licensee shall convene the Parties for the purposes described in this Section 6.2.4 every twelfth year of the New License beginning from last convening of the Parties to determine the need for a RUN Study under the New License or the effective date of the New License, whichever is later. While scheduled RUN studies are the primary means of regularly updating needs and plans for public recreation facilities, nothing in this paragraph precludes the Licensee’s receiving and acting, in the Licensee’s sole discretion, upon unscheduled recommendations for new or improved public recreational facilities based on observations of the Licensee and others. The Licensee shall also not be obligated to formally respond to or act upon such recommendations.

6.2.5 Previous Recreation-related Agreement Superseded – The agreement between Duke Power Company (predecessor to the Licensee) and the South Carolina Wildlife Resources Department (predecessor to both the SCDNR and the SCDPRT), identified as Exhibit R-5 to the Existing License and dated July 29, 1965, regarding recreational access at the Project, is superseded by this Agreement.

6.2.6 Americans with Disabilities Act (“ADA”) Requirements – The Licensee shall ensure all facilities constructed at Project Access Areas comply with ADA requirements when so constructed.

6.2.7 Form 80s – The Licensee shall notify the Parties when the Form 80(s) has been filed.

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6.3 Non-Project Public Recreational Enhancements

6.3.1 The Parties to this Agreement acknowledge the measures in this Section 6.3 shall not be included in the RMP because they will be located outside the Project Boundaries.

6.3.2 Keowee-Toxaway State Park – The Licensee shall connect the park to municipal water, pave an access road to a new primitive camping area, and construct ten primitive campsites, three camping cabins, a canoe/kayak launch, a new parking area, an event cabin, an outdoor gathering space with firepit, a fishing pier using the existing bridge abutment, a picnic pavilion, a portage around the existing water-retaining structure impounding 15-ac lake, and two bathhouses all within ten years following the issuance of the New License, the end of all appeals, and the closure of all rehearing and administrative challenge periods provided the SCDPRT is a Party to this Agreement and enters into a lease agreement for the term of the New License for the Project lands as specified in Section 6.2.2.2 above.

6.3.3 Jocassee Gorges Wildlife Management Area – If the SCDNR is a Party to this Agreement, then for one year following the issuance of the New License, the end of all appeals, and closure of all rehearing and administrative challenge periods, the Licensee shall offer to the SCDNR a low-cost lease for the term of the New License of the Licklog (46 ac) and Dismal Creek (21 ac) properties (see Appendix F, Figure F-1) for inclusion in the Jocassee Gorges Wildlife Management Area. If the SCDNR declines the offer of lease or does not enter into the lease within the one-year offer period, the Licensee may offer a similar lease to another entity to manage the property for public recreation and conservation purposes.

6.3.4 Granny Gear Access Area – The Licensee shall maintain the existing Granny Gear Access Area (see Appendix F, Figure F-1) for the term of the New License if the SCDNR is a Party to this Agreement and for so long as the SCDNR continues to maintain the Dug Mountain Access Area.

6.3.5 Jocassee Spillway Tract – The Licensee shall retain the Jocassee Spillway Tract (approximately 124 ac; see Appendix F, Figure F-1) for the term of the New License and restrict its use during the New License term to the support of power production, power transmission, and public recreation.

6.3.6 Bad Creek South Tract – The Licensee shall retain the Bad Creek South Tract (approximately 300 ac; see Appendix F, Figure F-1) until the end of the Bad Creek Project license term in 2027 and restrict its use until then to the support of power production, power transmission, and public recreation.

6.3.7 Fishers Knob Tract – If the SCDNR is a Party to this Agreement, then for one year following the issuance of the New License, the end of all appeals, and closure of all rehearing and administrative challenge periods, the Licensee shall offer a low-cost lease of approximately 45 ac on Fishers Knob (see Appendix F, Figure F-1) to the SCDNR for the term of the New License. If the SCDNR accepts the offer of lease, the SCDNR shall be responsible for all administrative activities and costs associated with the management of the property. The SCDNR acknowledges there shall be no public access via Fishers Knob road to the property and that the Licensee may remove portions of the leased land to support power production, power transmission, and public recreation. If the

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SCDNR declines the offer of lease or does not enter into the lease within the one-year offer period, the Licensee is under no obligation under the terms of this Agreement to retain ownership of the tract or manage it in any particular way.

6.3.8 Jocassee East Tract – The Licensee shall retain approximately 158 ac east of the Jocassee Pumped Storage Station (see Appendix F, Figure F-1) for the term of the New License and restrict its use during the New License term to the support of power production, power transmission and public recreation.

6.3.9 Laurel Preserve Tract – If the SCDNR and Pickens County are both Parties to this Agreement, then for two years following the issuance of the New License, the end of all appeals, and closure of all rehearing and administrative challenge periods, the Licensee shall offer a low-cost lease of the Laurel Preserve Tract (approximately 504 ac; see Appendix F, Figure F-1) to the SCDNR for the term of the New License. If the SCDNR accepts the offer of lease, the SCDNR shall be responsible for all administrative activities and costs associated with the management of the property. If the SCDNR declines the offer of lease or does not enter into the lease within the two-year offer period, the Licensee may offer a similar lease to another entity to manage the property for public recreation and conservation purposes.

6.3.10 Eastatoe Creek Tract – If the SCDNR and Pickens County are both Parties to this Agreement, then for two years following the issuance of the New License, the end of all appeals, and closure of all rehearing and administrative challenge periods, the Licensee shall offer a low-cost lease of the Eastatoe Creek Tract (approximately 23 ac; see Appendix F, Figure F-1) to the SCDNR for the term of the New License. If the SCDNR accepts the offer of lease, the SCDNR shall be responsible for all administrative activities and costs associated with the management of the property. If the SCDNR declines the offer of lease or does not enter into the lease within the two-year offer period, the Licensee may offer a similar lease to another entity to manage the property for public recreation and conservation purposes.

6.3.11 Nine Times Tract – If the SCDNR, Upstate Forever, South Carolina Wildlife Federation, and Pickens County are all Parties to this Agreement, the Licensee shall provide \$1,044,000 to Naturaland Trust to be applied to the purchase price of the Nine Times Tract (approximately 1,648 ac) so long as Naturaland Trust enters into a Memorandum of Agreement (“MOA”) with the Licensee no later than December 3, 2013, to comply with the use, management, and ownership requirements of the U.S. Forest Service Community Forest and Open Space Conservation Program and the following stipulations:

6.3.11.1 The Licensee’s funding shall be used only to help purchase the Nine Times Tract consistent with the Naturaland Trust’s existing purchase option. The Licensee shall provide its funding after the MOA is signed by the Licensee and Naturaland Trust and not later than December 26, 2013.

6.3.11.2 MOA Stipulations – The Licensee shall include the following stipulations in its MOA with Naturaland Trust.

6.3.11.2.1 Management Plan – Naturaland Trust shall collaboratively develop a management plan (the U.S. Forest Service Community Forest Management Plan) for the property. The management plan shall, among other things, provide significant opportunities for public access to the vast

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majority of the property and shall allow for traditional recreational uses of the property, including but not necessarily limited to significant opportunities for public hunting for the term of the New License.

6.3.11.2.2 Parties' Involvement in Management Plan Development – Naturaland Trust shall invite the Parties to this Agreement to consult and have a meaningful role in the development of the management plan for the property. The initial management plan shall be completed within 120 days after the acquisition of the Nine Times Tract. If the management plan is modified at any point during the term of the New License, Naturaland Trust shall invite the Parties to this Agreement to review and comment on the proposed changes and Naturaland Trust will endeavor in good faith to accommodate reasonable input from Parties to this Agreement.

6.3.11.2.3 Ownership of Tract – Naturaland Trust shall maintain ownership of the property for the term of the New License or ensure it is transferred to an eligible governmental entity (as defined by then-current laws and regulations) that will maintain it for the term of the New License consistent with the collaboratively developed management plan. If permitted under the U.S. Forest Service Community Forest and Open Space Conservation Program, the Nine Times Tract shall be made subject to a permanent conservation easement held by Upstate Forever.

6.3.12 Oconee County Conservation Bank – If Oconee County, Upstate Forever, and the South Carolina Wildlife Federation are all Parties to this Agreement, the Licensee shall provide \$600,000 to the Oconee County Conservation Bank within two years following the issuance of the New License, the end of all appeals, and closure of all rehearing and administrative challenge periods.

6.3.13 World of Energy Picnic and Fishing Access Area – To the extent not prohibited by the Nuclear Regulatory Commission, the Licensee shall designate a trail for angler access to the Oconee Nuclear Station (“ONS”) discharge canal, and the Licensee shall operate and maintain the existing picnic and fishing facilities near the World of Energy for public recreation support. The Parties acknowledge this access area will be limited to day-use only, and it may be closed at the Licensee’s sole discretion without notice for security- and safety-related issues at ONS. The Parties also acknowledge this access area may be closed permanently at the Licensee’s sole discretion at the end of the New License term, during the term of the New License, or if either the World of Energy or ONS are permanently closed.

6.3.14 Exclusive Right to Purchase

6.3.14.1 Pickens County Tracts – If the SCDNR, SCDPRT, Upstate Forever, South Carolina Wildlife Federation, and Pickens County are all Parties to this Agreement, the Licensee shall grant to the SCDNR an Exclusive Right to Purchase the Jocassee East, Eastatoe Creek, and Laurel Preserve tracts at a price agreeable to both the Licensee and the SCDNR to be negotiated between the Licensee and the SCDNR prior to purchase. The Exclusive Right to Purchase shall be granted by the Licensee within three months following the issuance of the New License, the end of all appeals, and the closure of all rehearing and administrative challenge periods. The Licensee shall ensure any Exclusive Right to Purchase it enters into in

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accordance with this paragraph is provided to the Pickens County Register of Deeds Office for recordation within 90 days following signing of such Exclusive Right to Purchase by the Licensee and the SCDNR. The Exclusive Right to Purchase shall extend for the term of the New License. During the term of the New License, the Licensee may not offer to sell these identified tracts to anyone other than the SCDNR, its successor, or an assign that is mutually agreeable to the Licensee and the SCDNR.

6.3.14.2 Oconee County Tracts – If the SCDNR, SCDPRT, Upstate Forever, South Carolina Wildlife Federation, and Oconee County are all Parties to this Agreement, the Licensee shall grant to the SCDNR an Exclusive Right to Purchase the Bad Creek South, Jocassee Spillway, Licklog, and Dismal Creek tracts at a price agreeable to both the Licensee and the SCDNR to be negotiated between the Licensee and the SCDNR prior to purchase. The Exclusive Right to Purchase shall be granted by the Licensee within three months following the issuance of the New License, the end of all appeals, and the closure of all rehearing and administrative challenge periods. The Licensee shall ensure any Exclusive Right to Purchase it enters into in accordance with this paragraph is provided to the Oconee County Register of Deeds Office for recordation within 90 days following signing of such Exclusive Right to Purchase by the Licensee and the SCDNR. The Exclusive Right to Purchase shall extend until July 31, 2027, for the Bad Creek South Tract, and for the term of the New License for the remaining tracts referenced in this Section 6.3.14.2. During the term of the New License, the Licensee may not offer to sell these identified tracts to anyone other than the SCDNR, its successor, or an assign that is mutually agreeable to the Licensee and the SCDNR.

6.3.14.3 Purchase of any tract identified in this Section 6.3.14 by the SCDNR releases the Licensee from its obligation to retain, lease, or restrict use of the specific purchased tract only and does not affect the Licensee's obligation to retain, lease, or restrict use of any other lands identified in Section 6.3.

6.3.14.4 The Exclusive Right to Purchase the properties identified in this Section 6.3.14 will specify that the Licensee may elect to retain portions of said tracts adjoining FERC project boundaries or located within transmission line rights-of-way similar to previous property sales to South Carolina.

6.3.15 Sassafras Mountain Observation Tower – If the SCDNR, Upstate Forever, Greenville Water (“GW”), and Pickens County are all Parties to this Agreement, the Licensee shall provide \$350,000 to the SCDNR to support construction of an observation tower, restroom facilities, and interpretive signage at Sassafras Mountain within two years following the Effective Date of this Agreement. The SCDNR shall invite the Parties to this Agreement to consult and have a meaningful role in the development of the management plan for the property and the development of interpretive signage. If the management plan is modified at any point during the term of the New License, the SCDNR shall invite the Parties to this Agreement to review and comment on the proposed modifications. To the extent practical, the SCDNR will endeavor to accommodate reasonable input from the Parties to this Agreement.

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6.4 Recreation User Education and Outreach

6.4.1 The Licensee shall support the following recreation user education and outreach efforts for term of the New License.

6.4.1.1 The Licensee shall sponsor an annual community safe boating educational effort in the Project area in partnership with the SCDNR and other interested organizations.

6.4.1.2 If Oconee County is a Party to this Agreement, the Licensee shall provide \$10,000 per year to Oconee County to support school programs on environmental stewardship and litter prevention.

6.4.1.3 If Pickens County is a Party to this Agreement, the Licensee shall provide \$10,000 per year to Pickens County to support school programs on environmental stewardship and litter prevention.

6.4.1.4 If FOLKS is a Party to this Agreement, the Licensee shall support semiannual litter collection efforts at the Project in partnership with FOLKS by providing bags and disposing of collected trash deposited at Licensee-designated Project Access Areas. The Licensee shall invite other interested organizations, including the Friends of Jocassee, to participate in these litter collection efforts.

6.4.2 After the first ten years of the New License, the Licensee and the other Parties participating in the initiatives identified in Section 6.4.1 may jointly elect to modify or discontinue their cooperative education and outreach efforts identified in Section 6.4.1, and such modification or discontinuance will not constitute or require a modification of this Agreement.

6.5 Islands – The Licensee shall retain ownership of the islands within the Project for the term of the New License.

6.6 Commercial Recreation Area Amenities at Project Access Areas on Lake Keowee

6.6.1 Allowable Public Recreation Amenities at All Project Access Areas at Lake Keowee – The Parties shall not oppose the use by the Licensee or its lessees of all Licensee-owned Project Access Areas at Lake Keowee for the following public recreation support amenities: courtesy docks; facilities where boats can be launched, retrieved, and moored; picnic sites and shelters; hiking, nature, and bank fishing trails; fishing piers; restrooms, vault toilets, or bathhouses; parking and lighting; wildlife viewing platforms; swimming areas and associated changing facilities; fire, rescue, and law enforcement facilities; and playgrounds and playground equipment.

6.6.2 Restriction on Commercial Recreation Area Amenities at Project Access Areas on Lake Keowee – The Licensee shall neither use nor allow lessees to use Crow Creek, Cane Creek, and Stamp Creek Project Access Areas for any of the following Commercial Recreation Area amenities: multi-slip marinas; convenience retailing; food services; pump-out facilities; gas-dispensing and sales; dry stack and boat yard storage facilities; or lodging.

6.6.3 Allowable Commercial Recreation Area Amenities at Specified Project Access Areas on Lake Keowee – The Parties shall not oppose the use of Keowee Town, Fall Creek, High Falls County Park, High Falls II, Mile Creek County Park, Mosquito Point, and South Cove County Park Project Access Areas

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for the following commercial recreation amenities: multi-slip marinas; convenience retailing; food services; pump-out facilities; gas dispensing and sales; dry stack and boat yard storage facilities; lodging except hotels and motels; and the amenities identified in Section 6.6.1. The Parties to this Agreement reserve the right to comment on the details of future commercial lake use permit applications through various public comment opportunities.

6.7 Construction, Approvals and Permits – The Parties acknowledge that construction of the public recreation facilities described in this Section 6.0 and in the proposed RMP License Article is contingent upon the ability of the Licensee and/or other recreation facility providers to obtain any necessary federal, tribal, state, or local government approvals or permits required. If any of the facilities are not constructed because of the inability to obtain such permits or approvals, then the Licensee and/or other recreation facility providers shall endeavor in good faith to construct comparable facilities as a replacement within a reasonable time schedule. The Licensee and/or other recreation facility providers shall endeavor in good faith to find a suitable location and obtain the necessary approvals and permits for such replacement facilities that are acceptable to and approved by the FERC, if FERC approval is required.

6.8 Construction Feasibility – The Parties acknowledge that construction of the public recreation facilities described in this Section 6.0 is contingent upon the ability of the Licensee and/or other recreation facility providers to design and construct the facilities consistent with accepted recreation facility standards, user safety, and public infrastructure security requirements. If any of the facilities are not constructed because of feasibility problems, then the Licensee and/or other recreation facility providers shall endeavor in good faith to provide appropriate replacement alternatives for which they can obtain the necessary permits and approvals, including FERC approval, if FERC approval is required to be constructed within a reasonable time schedule.

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7.0 Shoreline Management Agreements

7.1 Shoreline Management License Articles – The Parties recommend that the proposed Shoreline Management Plan License Article and the Shoreline Management Plan Review and Update Procedures License Article, the full text of which are provided in Appendix A of this Agreement, be incorporated verbatim into any New License the FERC may issue for the Project.

7.2 Combined Project Shoreline Management Plan (“SMP”) – The Parties understand the Licensee will combine the Lake Keowee SMP approved by the FERC in 2007 and Lake Jocassee SMP approved by the FERC in 2013 into a single Project SMP it will submit with the Application for New License. The Parties understand it will be necessary for the Licensee to make a large number of formatting and other changes to combine the components of the Lake Jocassee and Lake Keowee SMPs into the Project SMP.

7.3 Shoreline Management Plan Effective Date – The SMP, including the revised Shoreline Classification Maps and associated Lake Use Restrictions and the revised Shoreline Management Guidelines (“SMG”), submitted with the Licensee’s Application for New License shall be effective on September 1, 2014.

7.4 Shoreline Classification Maps – The Licensee shall include the Shoreline Classification Maps made available to the Parties as drafts on September 13, 2013, with any corrections resulting from a quality assurance review conducted prior to filing the Application for New License.

7.5 SMG Revisions – The Licensee shall include the following changes in the revised SMG it will file with the Application for New License.

7.5.1 Unencapsulated Foam – Existing residential dock owners must remove and properly dispose of unencapsulated foam from their docks by September 1, 2018. No lake use permit application or Habitat Enhancement Program (“HEP”) fees will be charged for lake use permit applications that are only removing unencapsulated foam and replacing it with approved floatation.

7.5.2 Modification of Existing Docks to Reach Deeper Water – Property owners with a previously constructed or permitted dock may wish to modify their boat dock to reach deeper water and improve the dock’s usability during future extended droughts. Such modifications for the purpose of reaching deeper water must follow the then-current SMP, including but not limited to getting written approval from the Licensee before making such modifications. However, to facilitate boat dock modifications to reach deeper water, the Licensee will implement the following accommodations for the fixed period of time and applicability stated below.

7.5.2.1 Exception for Larger Dock Surface Area – The normal maximum size limit of 1,000 square ft for a boat dock approved under the Private Facilities Program is increased to 1,200 square ft if the larger size is needed to reach deeper water. The SMG restrict boat docks adjacent to certain properties to less than 1,000 square ft based on certain criteria. Boat docks with a maximum size limit of less than 1,000 square ft will be allowed a size limit that is 200 square ft larger if the larger size is needed to reach deeper water.

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7.5.2.2 Exception for Longer Build-out Period – To better handle the expected construction volume, the normal build-out period as stated in the applicable SMG program is increased by one year for boat dock modifications needed to reach deeper water.

7.5.2.3 Waiver of Certain Fees – For the fixed period identified in Section 7.5.2.4, the Licensee will not charge a lake use permit application fee or a HEP fee for permitting dock modifications needed to reach deeper water.

7.5.2.4 Window of Opportunity for Surface Area and Build-out Period Exceptions and Waiver of Certain Fees – The Licensee will accept lake use permit applications from property owners eligible for the surface area and build-out period exceptions and fee waivers stated herein following the completion of all of the events stated below, but no sooner than December 1, 2014.

7.5.2.4.1 This Agreement has been signed by the Licensee, FOLKS and AQD;

7.5.2.4.2 Any additional required regulatory actions are taken (e.g., issuance of a revised Permit for Construction in Navigable Waters by the SCDHEC, and General Permit to perform work in or affecting waters of the United States by the USACE for the Keowee-Toxaway Hydroelectric Project); and

7.5.2.4.3 A NOA that is not inconsistent with this Agreement has been signed by the Licensee, the USACE, and the SEPA.

The Licensee will provide broad public notification at least 30 days prior to the opening of this window of opportunity. Once the window of opportunity opens, then for a period of 365 days the Licensee will accept eligible lake use permit applications for the surface area and build-out period exceptions and fee waivers.

7.5.2.5 Applicability – Docks managed under any of the Licensee's Lake Use Permitting Programs are eligible for the accommodations listed herein, provided the pre-existence or pre-approval criteria are met and the proposed modifications are for the purpose of reaching deeper water. Modifications can include complete replacement of the dock, relocation of the dock along the approved shoreline, reconfiguration, simple extensions of gangways, or combinations of these. Only property owners having one of the following by the Effective Date of this Agreement are eligible for the surface area and build-out period exceptions and fee waivers stated above: (1) an existing Licensee-approved boat dock or (2) a Licensee-approved lake use permit for a not-yet-constructed boat dock issued less than 12 months prior to the Effective Date of this Agreement.

7.5.2.6 Modification of Docks to Reach Deeper Water Prior to or after the Window of Opportunity – Property owners who wish to modify their docks to reach deeper water either before or after the window of opportunity stated above may do so with the proper approvals including written approval from the Licensee. In such situations, the applicant is not eligible for the surface area and build-out period exceptions or fee waivers listed in this Section 7.5.2.

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7.5.3 Follow the Water – Dock owners, including owners of commercial and residential marinas and public recreation facilities, may “follow the water” in an effort to maintain usability of their boat or dock during LIP Stages 2, 3, or 4. The procedure and requirements that apply to following the water are included in Appendix G.

7.5.3.1 After experience is gained with this following-the-water process, the Licensee reserves the right to modify the procedures to follow the water in the future to protect human health and safety, to meet the tenets of the SMP, to meet the requirements in the USACE and SCDHEC General Permits, or if directed by the FERC. The Licensee shall consult with the Parties to this Agreement prior to making any such modifications and will file the modifications with the FERC and other regulatory agencies as required. Any such modification shall not require revision of this Agreement, and any Party to this Agreement may participate in the regulatory agencies’ review processes but shall not oppose any part of the revised following-the-water process that is consistent with the following-the-water process in this Agreement.

7.5.4 Commercial Marina Classification at Lake Keowee – The Licensee shall modify the Commercial Marina shoreline classification on Lake Keowee as follows.

7.5.4.1 The Parties acknowledge the Licensee has converted shoreline classified as Future Commercial Marina to Future Residential Marina on the draft SMP maps made available to the Parties on September 13, 2013, and this conversion to Future Residential Marina was applied to areas upstream of the Restriction Areas lines in Appendix F, Figures F-2 and F-3.

7.5.4.2 The Licensee shall eliminate the “Proximity to Existing Facilities” guideline (SMG: Section 1, B-2).

7.5.4.3 The Licensee shall classify the shoreline and the land area of the Licensee-owned property labeled High Falls II (approximately 36.19 ac) on Appendix F, Figure F-3 as “Future Public Recreation” and incorporate the land area into the Project Boundary in the Application for New License.

7.5.4.4 The Licensee shall classify the land area of the Licensee-owned property labeled Mosquito Point (approximately 10.25 ac) on Appendix F, Figure F-3 as “Future Public Recreation” and incorporate the land area into the Project Boundary in the Application for New License.

7.5.4.5 Available for Future Commercial Marinas – The Parties agree all Lake Keowee shoreline classified as Available for Future Commercial Marinas on Appendix F, Figures F-2 and F-3 shall remain classified as such until such time as the shoreline is developed. No Party will oppose the use of locations classified as Available for Future Commercial Marinas on Appendix F, Figures F-2 and F-3 for the following recreational amenities: multi-slip marinas; convenience retailing; food services; pump-out facilities; gas dispensing and sales; dry stack storage; boat yard storage; lodging except hotels and motels; courtesy docks; facilities where boats can be launched, retrieved, and moored; picnic sites and shelters; hiking, nature, and bank fishing trails; fishing piers; restrooms, vault toilets, or bathhouses; parking and lighting; wildlife viewing platforms; swimming areas and associated

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changing facilities; fire, rescue, and law enforcement facilities; and playgrounds and playground equipment. The Parties reserve the right to comment on the details of future commercial lake use permit applications through various public comment opportunities.

7.5.5 Commercial Marina Classification at Lake Jocassee – The Licensee shall not designate any shoreline as available for Future Commercial Marinas or Future Residential Marinas at Lake Jocassee.

7.5.6 Permitting of Water Intakes

7.5.6.1 Water Intakes on Lake Jocassee – The Licensee shall not authorize new water intakes for public or industrial water supplies on Lake Jocassee.

7.5.6.2 Permanent Large Water Intakes – Criterion 7 from the Conveyance Program in the SMG shall be changed to comply with the requirements of Section 3.3 of this Agreement to protect and enhance usable water storage.

7.5.7 Lake Use Policy Statements – The Licensee shall no longer apply the Lake Use Policy Statements at the Project and shall remove references to them from the SMG.

7.5.8 Archaeological and Historic Resources – The procedures for protecting known and unknown archaeological and historic resources outlined in the SMG shall be modified to reflect the requirements set forth in Section 5.2.3.

7.6 Future SMP Updates

7.6.1 The Parties to this Agreement agree the SMP shall be reviewed and updated no more frequently than every tenth year of the New License term and then only if necessary.

7.6.2 SMP Changes – All Parties agree that changes made to the SMP, which includes the SMG, pursuant to the proposed Shoreline Management Plan License Article or the proposed Shoreline Management Plan Review and Update Procedures License Article shall not constitute or require modification of this Agreement. The Licensee shall invite the Parties to participate in revisions of the SMP for the term of the New License, and any Party may be involved in the FERC's public process for assessing the revised SMP but shall not oppose any part of the revised SMP that is consistent with this Agreement.

7.7 Shoreline Erosion – The Licensee shall install enhanced rip-rap to stabilize approximately 12,500 ft of actively eroding shoreline (generally denoted by scarps of three ft or higher) on Lake Keowee Islands currently identified as 1C, 1E, 3B', 3C, 3C'', 5, 6, 8, and 16; on the east side of the Fall Creek Peninsula; and on portions of High Falls II and Mosquito Point (see Appendix F, Figures F-2 and F-3) within three years following the issuance of the New License, the end of all appeals, and the closure of all rehearing and administrative challenge periods.

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8.0 Species Protection Agreements

8.1 Federal Threatened and Endangered Species

8.1.1 The Licensee will implement species protection plans for all federally listed Threatened and Endangered species affected by the Project.

8.1.2 The Parties acknowledge the Existing License does not contain any specific requirements for the protection of federally listed Threatened and Endangered species and, as of the Effective Date of this Agreement, no Federal Threatened and Endangered Species Protection Plans have been filed in association with the Project because no such species has been found occurring within the Project Boundaries, nor shown to be affected by the Project. All Parties agree that any future filing by the Licensee of new or revised Species Protection Plans that may be required shall not constitute or require modification of this Agreement.

8.2 Shoreline Woody Debris at Lake Jocassee – The Parties agree shoreline woody debris at Lake Jocassee enhances shoreline habitat and should not be routinely removed as required under the Existing License.

8.3 Habitat Enhancement Program (“HEP”)

8.3.1 If the SCDNR, FOLKS and AQD are all Parties to this Agreement, the Licensee shall establish a HEP as described in Appendix H to create, enhance, and protect aquatic and wildlife habitat within the Project Boundaries, including the Project Reservoirs and islands, plus any part of the watershed draining into Project Reservoirs. The HEP will exist for the term of the New License.

8.3.2 HEP Fee – The HEP will be funded by a fee charged to those requesting lake use permits from the Licensee. The Licensee shall begin collecting the HEP fee upon the SMP Effective Date (September 1, 2014).

8.3.3 Licensee Contributions – Also beginning on the SMP Effective Date, the Licensee shall match HEP fee payments from lake use permit applicants for the first three years up to an annual cap of \$100,000. The Licensee shall provide \$1,000,000, less the total amounts provided in the matching payments, as the remainder of the start-up funding for the HEP. The Licensee shall provide the remainder of its contribution within two years following issuance of a New License, the end of all appeals, and the closure of all rehearing and administrative challenge periods.

8.3.4 Revising the HEP – The Parties acknowledge that the HEP fees and fee structure may be amended over time. Any fee changes will be determined after considering the recommendations from the Proposal Review Committee (“PRC”). It is the Licensee’s expectation that it will approve all PRC-recommended HEP fees, and the Licensee will consult with the PRC before rejecting PRC recommended HEP fee changes. Such changes will not constitute or require a modification of this Agreement. If the FERC requires the Licensee to file HEP fee changes with the FERC for approval, any Party to this Agreement may be involved in the FERC’s public process for assessing the revised HEP fees but shall not oppose any part of the revised HEP fees that is consistent with this Agreement.

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8.4 Botanical Species

8.4.1 The Licensee shall protect Special Status Species and botanical Priority Species at known sites within the Project Boundaries by:

8.4.1.1 Classifying shoreline with these species as Environmental or Natural;

8.4.1.2 Ensuring recreation facility development at Project Access Areas avoids these species; and

8.4.1.3 Providing appropriate signage for these species located within the Project Boundaries in proximity to Project structures (powerhouses, dams, and dikes).

8.5 Fish Species

8.5.1 SCDNR Tributary Stream Restoration – If the SCDNR is a Party to this Agreement, the Licensee shall provide a one-time contribution of \$100,000 to the SCDNR within two years following the issuance of the New License, the end of all appeals, and the closure of all rehearing and administrative challenge periods. The funds shall be used by the SCDNR as matching funds for obtaining grants associated with Project headwater streams.

8.5.2 Trout Habitat – If the SCDNR is a Party to this Agreement, the Licensee shall annually monitor (beginning in 2016 for the term of the New License) the depth of winter mixing in Lake Jocassee (February or March at Licensee Monitoring Station 558.0) and model the projected thickness of pelagic trout habitat (defined as a band of water ≤ 20 °C (68 °F) and containing ≥ 5 mg/L dissolved oxygen (“DO”)) expected to be present the following September. The Licensee shall provide this projected thickness of trout habitat to the SCDNR in May and verify the accuracy of this projection with a September measurement. If trout habitat is projected to be less than 10 meters (32.8 ft) thick by September, the Licensee shall measure temperature and DO in June and August to monitor habitat thickness. The Licensee shall then consult with the SCDNR regarding the modification of hydro operations to the extent practical so trout habitat thickness is not reduced to less than 5 meters (16.4 ft).

8.5.3 Fish Entrainment

8.5.3.1 If the SCDNR is a Party to this Agreement, the Licensee shall take the following actions to reduce fish entrainment at Jocassee Pumped Storage Station:

8.5.3.1.1 Intake Lighting Modifications – Redesign and modify lighting for the FERC-required public safety devices on the intake towers to eliminate or reduce the amount of light shining on the lake surface. Such modifications may include replacing white lights with red lights and illuminating signage from below rather than above the safety devices.

8.5.3.1.2 Tailwater Lighting Modifications – Redesign and modify lighting illuminating the tailwater area to eliminate or reduce the amount of light shining on the lake surface immediately downstream of the hydro units.

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8.5.3.1.3 Hydro Unit Starting Sequence Modifications – When operating the hydro units in pumping mode, use a start-up sequence of Unit 3, Unit 4, Unit 1, and Unit 2, to the extent practicable.

8.5.3.2 The following conditions and schedule apply to the fish entrainment reduction actions identified in Section 8.5.3.1 above:

8.5.3.2.1 The Licensee shall consult with the SCDNR and the US Fish and Wildlife Service (“USFWS”) on its plan for lighting modifications prior to implementation.

8.5.3.2.2 The design of the lighting modifications shall conform with FERC public safety requirements and shall provide for the continued safety of hydro station personnel and the continued security of hydro station personnel and facilities.

8.5.3.2.3 The Licensee shall implement the pumping start-up sequence within 60 days following the issuance of the New License, the end of all appeals, and the closure of all rehearing and administrative challenge periods.

8.5.3.2.4 The Licensee shall implement the lighting modifications within one year following the issuance of the New License, the end of all appeals, and the closure of all rehearing and administrative challenge periods. The Licensee shall incorporate the lighting modifications to the extent necessary into its FERC Public Safety Plan and file the plan with the FERC’s Atlanta Regional Office.

8.5.3.2.5 The Parties to this Agreement agree the operational test performed by the Licensee in July 2013 at the Jocassee Pumped Storage Station is adequate for testing the efficacy of the fish entrainment reduction actions identified in Section 8.5.3.1.

8.5.4 Reservoir Level Stability for Black Bass Spawning – If the SCDNR is a Party to this Agreement, the Licensee shall endeavor to maintain to the extent practical relatively stable water levels in Lake Keowee and Lake Jocassee during the April 1 to May 15 (stabilization) period beginning in 2016 for the term of the New License. To do this, the Licensee shall maintain reservoir levels consistent with the general reservoir elevation trends observed during the stabilization periods in 1996-1999, 2003-2007, and 2010. The Parties agree this informal stabilization program should not be included as an article in the New License. The Licensee shall not be obligated to implement this stabilization during an MEP event or during any stage of the LIP. If water levels drop greater than the reservoir level trends observed during the years listed above, the Licensee shall consult with the SCDNR on options for reservoir stability, to the extent practical, for the remainder of the then-current stabilization period.

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9.0 Water Quality Agreements

9.1 Water Quality License Article – The Parties recommend the proposed Water Quality Monitoring License Article, the full text of which is provided in Appendix A of this Agreement, be incorporated verbatim into any New License the FERC may issue for the Project.

9.2 Request for 401 WQC – The Licensee shall request that the SCDHEC issue a 401 WQC as required by the Clean Water Act. The Licensee’s request for a 401 WQC shall be consistent with this Agreement and propose the monitoring of DO levels as described in Section 9.3.

9.3 Project Tailwater DO Monitoring – During the first complete month of August occurring at least 60 days following the issuance of the New License, the end of all appeals, and the closure of all rehearing and administrative challenge periods, and during each subsequent August for the term of the New License, the Licensee shall continuously monitor DO concentrations in both the Keowee Hydro Station and Jocassee Pumped Storage Station tailwaters. The Licensee shall submit the results obtained from this annual monitoring to the SCDHEC each year by November 30.

9.4 Source Water Protection Program – If FOLKS, GW, and City of Seneca (“Seneca”) are Parties to this Agreement, the Licensee shall provide, within two years following the issuance of the New License, the end of all appeals, and the closure of all rehearing and administrative challenge periods, \$1,000,000 to a local, to-be-established Clean Water Group (“CWG”) to fund a Source Water Protection Program (“SWPP”), as described in Appendix I. Funding by the Licensee is contingent upon the establishment of this yet-to-be-formed CWG as a 501(c)(3) federally tax-exempt corporation prior to the receipt of funds. FOLKS shall take the lead in establishing the CWG and drafting its charter. FOLKS shall invite the Licensee to consult and have a meaningful role in the development of the charter. FOLKS will endeavor in good faith to accommodate reasonable input from the Licensee.

9.5 Water Quality Model and Data Provided to FOLKS – If FOLKS is a Party to this Agreement, the Licensee shall provide within 60 days following the Effective Date of this Agreement the existing calibrated CE-QUAL-W2 reservoir water quality model developed for Lake Keowee during the relicensing process. Data sets required to run the 2011 WQ4 calibrated model, including reservoir and stream water quality, lake bathymetry, meteorology, hydrology, and operational data will be included in the data package provided to FOLKS. The data provided to FOLKS shall be in compliance with terms of applicable data release policies of the Licensee effective at that time.

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10.0 Other Agreements

10.1 Requirement to be a Party to Receive Funding and Property Rights – The Parties agree that, unless the entity receiving the funding or property rights did not have the opportunity to sign this Agreement, all provisions of funding or granting to a specified entity of any rights associated with real property are contingent upon said recipient of funding or real property rights having signed this Agreement. In the event the intended recipient of Licensee funds or grants of real property rights was eligible to be a signatory Party to this Agreement but chose not to, the Parties acknowledge the Licensee is under no obligation to provide the funding, grants, or any provision of such benefits to any entity.

10.2 Reporting Requirements for Funding Recipients – Any entity that receives Licensee funding under this Agreement will be required to provide documentation to the Licensee within two years of receipt of such funding, including any installment funding that occurs over multiple years, specifying how the funding was used and how the funding recipient met any of the designated restrictions for the use of such funding. The funding recipient will also provide the Licensee copies of final research reports, project summaries, or other summaries of work.

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GENERAL AGREEMENTS AND PROCEDURES

11.0 Effective Date and Term of Agreement

11.1 This Agreement shall become effective for all Parties on December 1, 2013 ("Effective Date of this Agreement"). This Agreement shall remain in effect for the term of the New License and for any annual licenses issued subsequent thereto, unless terminated pursuant to Section 22.0.

11.2 If a rehearing of the FERC order issuing the New License is sought by any person or entity, including any Party, any Party may request a stay of the effective date of the order and/or any other dates or articles specified in the order until the resolution of the rehearing request and the expiration of the statutory periods for appeals. Any Party may oppose such request for stay.

11.3 The Parties agree to support a New License term that is at least 40 years.

12.0 Offer of Settlement

The Licensee shall, by December 6, 2013, provide to all Parties a draft "Explanatory Statement," which is required by FERC rules. Parties may provide comments to the Licensee within 45 days of receipt of the draft Explanatory Statement and the Licensee shall address such comments when filing this Agreement and the Explanatory Statement with the FERC.

13.0 Adoption by the FERC Without Material Modification

13.1 The Parties have entered into this Agreement with the express desire and expectation that the FERC will approve this Agreement as an Offer of Settlement and issue a New License for the Project that incorporates, without material modification, the proposed License Articles in Appendix A.

13.2 Except as provided herein, the Parties agree that, if the FERC incorporates the proposed License Articles into the New License without material modification, no Party will seek rehearing of the FERC order granting the New License for any issues covered by this Agreement or support in any way any such request for rehearing by any person or entity.

13.3 The Parties have entered into this Agreement with the express understanding that each term in this Agreement, including the proposed License Articles in Appendix A, is in consideration of each other term.

14.0 Statutory Responsibilities of Federal, Tribal, State and Local Governmental Bodies

14.1 Except as provided in this Section and elsewhere in this Agreement, by becoming Parties to this Agreement, all Parties that are governmental bodies, including Tribes, believe this Agreement is consistent with their statutory responsibilities.

14.2 Notwithstanding Section 14.1, nothing in this Agreement is intended or shall be construed to restrict any Party that is a governmental body or Tribe with responsibilities, duties, or obligations imposed by law from fulfilling its responsibilities, duties, and

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obligations under any applicable local, state, or federal law or regulation. Nothing in this Agreement is intended or shall be construed to restrict these governmental bodies and Tribes from fully and objectively considering any and all public comments received in any regulatory process related to the Project, from conducting an independent review of the Project under applicable statutes, or from providing comments to the FERC that are necessary to meet their responsibilities, duties, and obligations provided by law. All commitments and obligations of these governmental bodies and Tribes in, under, and pursuant to this Agreement shall be construed and interpreted as including, and meaning "to the extent allowed by local, state, and federal law and regulation, and consistent with local, state, and federal law and regulation."

14.3 Notwithstanding Section 14.1, nothing in this Agreement is intended or shall be construed to affect or limit in any way the authority of the SCDHEC pursuant to 33 U.S.C. § 1341, and related state statutes and rules, to issue a 401 WQC, or to alter its 401 WQC, with whatever conditions the SCDHEC determines should be included. Nothing in this Agreement shall limit the right of the SCDHEC from enforcing its 401 WQC and from taking any steps within its discretion to protect and defend its authority, such as seeking rehearing of any FERC action regarding issues related to the exercise of SCDHEC's authority with regard to its 401 WQC.

14.4 Nothing in this Agreement is intended or shall be construed to prevent any governmental body engaged in a public process from addressing issues included in this Agreement when raised before such governmental body in a public proceeding; provided, however, that addressing such issues in a public proceeding shall not relieve any Party that is a governmental body from its obligations to act consistently with this Agreement.

14.5 Nothing in this Agreement is intended to restrict, limit, interfere with, impede, or impair the rights, responsibilities, duties, or obligations of any governmental body in implementation of and in furtherance of its rights, responsibilities, duties, or obligations.

15.0 Parties' Rights, Obligations and Restrictions During the Period when the FERC is Developing the New License and/or the SCDHEC is Developing the Water Quality Certification

15.1 Parties' Rights, Obligations, and Restrictions Related to the FERC's Licensing Process for Developing the New License

15.1.1 The Parties reserve the right to be actively involved in the FERC licensing, including by intervention, in a manner consistent with this Agreement.

15.1.2 During the period of this relicensing prior to the FERC's issuance of the New License and the closure of all rehearing and administrative challenge periods, and except as allowed by Section 14.0, no Party may request or advocate by any means, including but not limited to intervention, filing comments with the FERC or any other agency, participating in public hearings or meetings, communicating with the media or in any public forum, encouraging, coaching or funding non-Parties to this Agreement, concurring with comments filed with the FERC or any agency, and communicating with or lobbying state or federal officials, for any New License requirements that would, if adopted by the FERC, be an Inconsistent Act.

15.1.3 Except as allowed by Section 14.0, during the period of this relicensing prior to the FERC's issuance of the New License and the closure of all rehearing

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and administrative challenge periods, no Party may request or advocate by any means, including but not limited to intervention, filing comments with the FERC or any other agency, participating in public hearings or meetings, communicating with the media or in any public forum, encouraging, coaching or funding non-Parties to this Agreement, concurring with comments filed with the FERC or any agency, and communicating with or lobbying state or federal officials, for New License reopeners of any kind beyond those that are included in the FERC's standard L-Form applicable to this Project.

15.2 Parties' Rights, Obligations and Restrictions during SCDHEC's Process for Developing the 401 WQC

15.2.1 The Parties reserve the right to be actively involved in any 401 WQC process in a manner consistent with this Agreement.

15.2.2 During the period of this relicensing prior to the FERC's issuance of the New License and the closure of all rehearing and administrative challenge periods, and except as allowed by Section 14.0, no Party may request or advocate by any means, including but not limited to intervention, filing comments with the FERC or any other agency, participating in public hearings or meetings, communicating with the media or in any public forum, encouraging, coaching or funding non-Parties to this Agreement, concurring with comments filed with the FERC or any agency, and communicating with or lobbying state or federal officials for, (i) any 401 WQC requirements or conditions that would result in an Inconsistent Act or (ii) 401 WQC reopeners of any kind other than a reopener for failure to comply with requirements of any 401 WQC.

16.0 Agreements on Action Steps when a Jurisdictional Body Imposes a Requirement that is an Inconsistent Act

16.1 If any Party believes the actions of a Jurisdictional Body, through the imposition of a requirement or the failure to impose any requirement on the Licensee, have resulted in an Inconsistent Act, the Party shall notify the other Parties pursuant to Section 23.0.

16.2 If notice is given pursuant to Section 16.1 the Licensee shall convene a meeting of all Parties to determine by consensus a course of action to: (i) work with the FERC and any appropriate Jurisdictional Body to pursue an alternative to the Inconsistent Act that is acceptable to all Parties and to the FERC and the Jurisdictional Body(ies); (ii) acceptably rebalance and modify this Agreement; or (iii) take such other actions as the Parties may agree upon to address the Inconsistent Act. If requested by any Party, mediation as described in Section 25.2 may be used to help reach consensus. The Parties shall use their best efforts to cooperatively implement this Section 16.2 to address the Inconsistent Act in a manner agreeable to all the Parties.

16.3 If the Parties modify this Agreement, pursuant to Section 19.0, to address the Inconsistent Act, the Licensee shall promptly file the Modified Agreement with the FERC, and any Party may take actions, such as submitting comments, consistent with the Modified Agreement. However, if all Parties do not agree to modify this Agreement to address the Inconsistent Act, then no Party may support the Inconsistent Act, and the Parties shall not modify this Agreement.

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16.4 Any Party may pursue any available legal remedies (i.e., administrative or judicial review) to alter a proposed or final Inconsistent Act to conform to this Agreement whether or not that Party is simultaneously following the procedures in this Section 16.0. No Party shall oppose such legal remedies that seek only to conform the Inconsistent Act to this Agreement.

17.0 Review of Inconsistent Act Imposed by Jurisdictional Body that Substantially Negatively Affects a Party

17.1 A Party may initiate or maintain an action (e.g., administrative or judicial review), to contest an Inconsistent Act imposed by a Jurisdictional Body. Because this Agreement itself is legally enforceable, the omission of any proposed License Article from any authorization (including the New License and any 401 WQC), notwithstanding Section 16.0, shall not, by itself, be deemed an Inconsistent Act that conflicts with this Agreement. However, any Party may petition the issuing agency to include such Article in such authorization and may exhaust such administrative and related judicial processes. Conversely, the inclusion of any requirement of this Agreement in any authorization (including the New License and any 401 WQC) shall not, by itself, be deemed an Inconsistent Act that conflicts with this Agreement. However, any Party may petition the issuing agency to exclude such Article in such authorization and may exhaust such administrative and related judicial processes. No Party except the relevant Jurisdictional Body may oppose another Party's action pursuant to this Section 17.1.

17.2 No Party will seek to use its status as a Party to this Agreement to establish standing or aggrieved-party status to challenge any action of any governmental agency that is also a Party to this Agreement when that governmental agency's actions are pursuant to fulfilling its statutory duties.

17.3 If, after exhausting any legal reviews initiated pursuant to Section 17.1, any Party still believes the Jurisdictional Body's action or omission is an Inconsistent Act and that it is substantially negatively affected by the Inconsistent Act, then that Party may initiate withdrawal pursuant to Section 21.0 by giving notice of its intent to withdraw from this Agreement pursuant to Section 23.0. No Party may give Notice of Intent to Withdraw until all administrative and judicial challenges regarding the issue over which the Party intends to withdraw have been finally resolved and until all time periods for further administrative or judicial review have expired when that governmental agency's actions are complete pursuant to fulfilling its statutory duties.

18.0 Agreements on Action Steps upon Breach by Any Party

18.1 If any Party is alleged by any other Party to be in breach of this Agreement, the Party alleging the breach shall immediately notify, pursuant to Section 23.0, all Parties to this Agreement of the alleged breach and shall consult with the allegedly breaching Party to discuss the breach and reach a resolution satisfactory to all Parties. To allow for consultation, no Party may seek relief from a court or any other forum, including the FERC, concerning the alleged breach until sixty days have elapsed following the notice required in the preceding sentence, except that a Party may seek relief prior to the passing of the sixty days if the Party's rights would be prejudiced by such delay.

18.2 If any Party has a credible reason to believe it or another Party may be unable to comply with any future obligation under this Agreement, including any schedule, the Party may inform the other Parties. The Licensee shall convene the Parties to attempt

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to ensure clear communications concerning the potential breach and to identify actions that may be acceptable to all the Parties that would eliminate the concern relative to the potential breach.

18.3 The Parties agree to use their best efforts to cure any alleged breach of this Agreement in a reasonable and timely manner. If such best efforts and consultation fail to resolve the alleged breach or alleged anticipatory breach, any Party may pursue its legal remedies for any alleged breach or alleged anticipatory breach once the sixty-day period set forth in Section 18.1 has elapsed.

18.4 When any Party withdraws from this Agreement or is found to have breached this Agreement, the withdrawing or breaching Party is obligated to return any benefits previously obtained under this Agreement, if such benefits consist of monetary funds or interests in real property. The Parties acknowledge that no withdrawing or breaching Party ought to be able to withdraw from or breach this Agreement and retain benefits bargained for, and the Parties agree that this remedy is to be specifically enforceable.

19.0 Modification of this Agreement

19.1 Except as provided in Sections 3.4.8, 4.4, 6.2.4, 6.3.14.3, 6.4.2, 7.5.3.1, 7.6.2, 8.1.2, 8.3.4, 19.2, 19.3, and 23.0, any modification of any provision of this Agreement to become effective must be made in writing and, after notice of the modification is provided pursuant to Section 23.0, signed by an authorized representative of each Party except that a Party who fails to respond to such notice within 60 days shall be deemed to have consented to the proposed modification. Except as provided herein, nothing in this Agreement is intended to limit the Parties' ability to modify this Agreement.

19.2 The Parties acknowledge that, for long-term clarity of this Agreement, it may be beneficial to remove from this Agreement those benefits and obligations that were conditioned on certain entities becoming Parties to this Agreement but are no longer benefits or obligations of this Agreement because these entities did not become Parties. The Parties agree that when considering modification of this Agreement, the Licensee shall also confer with the Parties to reform this Agreement for the limited purpose of reflecting accurately only the Parties' benefits and obligations hereunder by deleting specific benefits and obligations of entities that were signatories to the AIP but declined to become Parties to this Agreement. If any signatories to the AIP decline to become Parties to this Agreement, the Licensee will circulate a reformed Agreement to all Parties, pursuant to the notice provision of Section 23.0, and such reformed Agreement shall automatically supersede this Agreement unless any Party objects by giving notice to the Licensee within 60 days of notice of the reformed Agreement.

19.3 Prior to December 2, 2013, a Party to this Agreement may seek to initiate a process for rebalancing this Agreement if there is a loss of Agreement provisions conditioned upon the Party and at least one other AIP Signatory signing this Agreement, when at least one of said AIP Signatories does not sign this Agreement. If the attempt to rebalance this Agreement is unsatisfactory, the Party may seek to withdraw without following the procedures in Section 16.0.

20.0 Parties' Ability to Petition the FERC or SCDHEC

A Party may petition the FERC to amend the New License, pursuant to any reopener condition contained in the New License, or to take any other action with regard to the

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Licensee or the Project may petition the SCDHEC to amend its respective 401 WQC, pursuant to any reopener condition included in any 401 WQC, or to take any other action with regard to the Licensee or the Project, so long as the amendment or other action would not substantially conflict with this Agreement and would not directly result in an Inconsistent Act for any other Party; provided, however, that before filing any such petition, the petitioning Party shall notify all other Parties pursuant to Section 23.0 and consult with any Party that indicates that it may be substantially negatively affected, but under no circumstance shall such consultation prevent a Party from pursuing such relief before the FERC or the SCDHEC within the time required by law or regulation.

21.0 Withdrawal from this Agreement

21.1 A Party may initiate withdrawal from this Agreement if it is substantially negatively affected by an Inconsistent Act and has followed the procedures in Section 16.0, as applicable, to attempt to remedy the cause for the withdrawal.

21.2 A Party may initiate withdrawal from this Agreement without following the procedures in Section 16.0 if it is substantially negatively affected by: (i) withdrawal of another Party, as set forth in Section 21.11; (ii) a new law or regulation that requires a Party to act in a manner that breaches this Agreement, as set forth in Section 32.0; (iii) the invalidation of a portion of this Agreement, as set forth in Section 33.6; or (iv) transfer of the Existing or New License to a transferee that is not bound by all the terms of this Agreement, as set forth in Section 33.15.

21.3 A Party shall initiate the withdrawal process by providing Notice of Intent to Withdraw to all Parties in accordance with Section 23.0. This Notice must include a brief, non-binding statement setting forth:

21.3.1 The date and nature of the Inconsistent Act, or other event giving rise to the right to withdraw, including a reference to the specific section of this Agreement under which withdrawal is permitted; and

21.3.2 (i) If withdrawal is based on an alleged Inconsistent Act, how the alleged Inconsistent Act meets the definition of "Inconsistent Act" and how it conflicts with this Agreement; and (ii) how the alleged Inconsistent Act or event listed in Section 21.2 substantially negatively affects the withdrawing Party.

21.4 If any Party opposes the withdrawal, that Party shall submit a notice, pursuant to Section 23.0, to the withdrawing Party indicating that it opposes withdrawal and seeks arbitration of the Party's right to withdraw.

21.5 If, after 60 days from the Notice of Intent to Withdraw, no Party opposes the withdrawal, the withdrawal is final.

21.6 Within 30 days of the notice opposing withdrawal, the withdrawing Party shall post an Arbitration Escrow Fee of \$2,000. The Arbitration Escrow Fee shall be made payable to an acceptable escrow agent, which may be the Licensee, and shall bear a notation that it is to be held in escrow. Once the arbitrator is selected, the withdrawing Party shall ensure that the escrow agent may release the funds to the arbitrator upon proof of the withdrawing Party's failure to pay its share of the arbitration costs. If the withdrawing Party fails to post the Arbitration Escrow Fee in a timely manner, it shall thereby waive its right to withdraw based on the Inconsistent Act or other event cited in the withdrawal notice.

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21.7 The arbitrator shall be selected and the arbitration conducted pursuant to the procedures of the American Arbitration Association under its Commercial Arbitration Rules. The arbitrator's decision shall be binding only as to the Parties before it.

21.8 Withdrawal shall be allowed only if the arbitrator determines that the withdrawing Party substantially complied with all material procedural prerequisites to withdraw specified in this Agreement and:

21.8.1 A requirement imposed by a Jurisdictional Body (i) conflicts with this Agreement and (ii) is an Inconsistent Act that substantially negatively affects the withdrawing Party; or

21.8.2 The withdrawing Party was substantially negatively affected by the withdrawal of another Party, as set forth in Section 21.11; or

21.8.3 A new law or regulation requires a Party to act in a manner that breaches this Agreement, as set forth in Section 32.0, and that breach substantially negatively affects the withdrawing Party; or

21.8.4 A portion of this Agreement is invalidated which results in the withdrawing Party's being substantially negatively affected, as set forth in Section 33.6; or

21.8.5 The Existing or New License is transferred to a transferee that is not bound by all the terms of this Agreement which results in the withdrawing Party's being substantially negatively affected, as set forth in Section 33.15.

21.9 An effective withdrawal relieves the withdrawing Party of its performance obligations under this Agreement.

21.10 The costs of the arbitration shall be shared equally between the Party seeking withdrawal (50 percent) and the combination of Parties requesting arbitration (50 percent). The Parties shall request that the arbitrator invoice each Party separately. Any unused amounts of the Arbitration Escrow Fee will be returned to the withdrawing Party.

21.11 Upon withdrawal of any Party, any other Party (hereinafter "Second Party") may exercise its right to withdraw pursuant to the procedures set forth in this Section 21.0, except that, if the issue goes to arbitration, withdrawal shall be allowed only if the arbitrator determines that (i) the Second Party substantially complied with all procedural prerequisites to withdrawal specified in this Agreement; and (ii) the previous withdrawal of another Party will substantially negatively affect the Second Party.

21.12 No Party is required to pursue administrative or judicial remedies prior to withdrawing; however, no Party may give Notice of Intent to Withdraw until all administrative and judicial challenges, if any, regarding the issue over which the Party intends to withdraw have been finally resolved and until all time periods for further administrative or judicial review have expired. Any right to withdraw is waived if the Party does not give Notice of Intent to Withdraw within 180 days of the expiration of the last time period for administrative or judicial review of a matter related to the reason for withdrawal.

21.13 If a Party is prohibited by law from submitting to binding arbitration, then, after that Party has provided Notice of Intent to Withdraw and after another Party has given notice of its opposition to withdrawal, as set forth in Section 21.4, the Party seeking to withdraw shall give notice to all Parties pursuant to Section 23.0 that it is prohibited by law from submitting to binding arbitration and shall provide with such notice evidence of the legal prohibition and shall within 30 days following provision of its notice of

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prohibition to submit to arbitration, file an action for declaratory judgment: (i) seeking the court's determination of its legal right to withdraw pursuant to the terms of this Agreement; and (ii) naming the Party opposing withdrawal as the defendant. The withdrawing Party shall serve notice of its filing of the declaratory judgment action on all Parties to allow any Party the opportunity to intervene. The court shall use the criteria set forth in Section 21.0 and sections cross-referenced therein to determine whether a Party seeking to withdraw is entitled to withdraw under this Agreement. If the Party seeking to withdraw fails to file an action for declaratory judgment within 30 days following its notice to the Parties of its prohibition to submit to arbitration, then it shall thereby waive its right to withdraw based on the Inconsistent Act or other event cited in the withdrawal notice.

21.14 Any opposition to any withdrawal shall be ineffective if the arbitrator determines that the Party opposing withdrawal failed to give notice to the withdrawing Party as required in Section 21.4.

22.0 Termination of this Agreement

This Agreement, and all obligations arising hereunder, shall terminate and be of no further force or effect upon withdrawal of the Licensee, upon the expiration or other termination of the term of the New License and any annual licenses issued thereafter, or upon transfer of the license to a subsequent licensee that is not bound by any part of this Agreement.

23.0 Notice

Each Party shall designate a representative for the receipt of notices. All notices required to be given under this Agreement shall be in writing and be given by personal delivery, overnight express service, or U.S. mail to each Party using the contact information set forth in this Agreement and included as Appendix B. The sender shall retain proof of posting or delivery, and notices shall be effective upon the date and time identified on the proof of posting or delivery. The Licensee will be responsible for maintaining the contact information included as Appendix B. A Party may change the contact information or the designated representative by notifying the Licensee of such change, and such change will not be considered a modification of this Agreement. Each Party shall be responsible for providing the Licensee with their updated contact information in a timely and accurate manner. If a Party no longer exists at the time that notice is required to be given by this Agreement, notice to such Party is not required. If a Party required to give notice knows that another Party's designated representative is deceased or is no longer employed by and/or affiliated with such other Party, the Party required to give notice must make a reasonably diligent effort to provide notice to an appropriate person affiliated with such other Party. A "reasonably diligent effort" shall include notice to any person upon whom process could be served under the Federal Rules of Civil Procedure in effect at the time that notice is required to be given.

24.0 Licensed Project Cessation

24.1 In the event the Licensee decides to surrender the New License prior to its expiration or the United States takes over the Project, the Licensee agrees to take the following actions.

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24.1.1 Notify all Parties pursuant to Section 23.0 and convene a meeting for all Parties no later than 30 days after its decision to surrender the Project in whole or in part, or becoming aware that the United States may take over the Project in whole or in part.

24.1.2 Notify all Parties at least 60 days prior to the Licensee's filing at the Commission an application to surrender its License in whole or in part.

24.1.3 Negotiate in good faith with the SCDNR, the SCDPRT, and any other interested Party with the objective of ensuring continued public access to Project Reservoirs through the remaining period of the New License term for those properties designated for public access in the New License and that will continue to be owned by the Licensee.

24.1.4 Negotiate in good faith with the SCDNR, SCDPRT, and any other interested Party to develop a plan for managing lands and waters within the Project Boundaries.

24.1.5 Negotiate in good faith with each public water supplier authorized to withdraw water from any Project Reservoir to assure continued access by public water suppliers to such reservoir and other necessary facilities, including land through the remaining period of the New License term.

24.1.6 Within 180 days after becoming aware that any of the Project's developments will no longer be licensed by the FERC or after filing an application with the FERC to surrender the license for any of the Project's developments, and provided the Licensee desires to close and/or sell any affected Licensee-owned recreation land or facilities at the Project, then provide notice to all Parties that are tribal or governmental bodies, pursuant to Section 23.0, to offer to sell the affected Licensee-owned recreation land and facilities at the appraised market value, as determined by the average of two appraisals completed in accordance with Appraisal Institute standards, one appraisal to be paid for by Licensee and the other to be paid for by the first tribal or governmental entity that notifies the Licensee, pursuant to Section 23.0, of its desire to acquire Licensee-owned recreation land and facilities. Any said recreation land or facilities that are leased to a Party to this Agreement will first be offered for sale to the lessee under the same arrangements above in this Section 24.1.6 for a period of 60 days. An offer to acquire such facilities by a tribal or governmental entity may be for all or any portion of such Licensee-owned recreation land and facilities.

180 days after providing such notice of an offer to sell, the Licensee shall be free to sell to any entity any affected Licensee-owned recreation land or facilities for which the Licensee does not receive an acceptable purchase option from a Party that is a tribal or government entity.

25.0 Dispute Resolution

25.1 Dispute Resolution – Except as otherwise specifically provided in this Agreement, disputes among Parties arising under or related to this Agreement or the New License shall be resolved as follows.

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25.1.1 Consultation

25.1.1.1 Any Party alleging a dispute shall notify the Licensee. The Licensee shall notify all Parties pursuant to Section 23.0 and shall give at least 15 days notice of a meeting scheduled to resolve the dispute. The Party alleging a dispute and each Party that attends such meeting or notifies all other Parties pursuant to Section 23.0 of the Party's interest in the resolution of the alleged dispute shall be considered to be an "Interested Party." The meeting notice shall describe the dispute and shall provide the time and location of the meeting. All Parties who are Interested Parties agree to engage in good-faith negotiations to resolve the dispute for a period of at least 45 days ("Consultation Period") from the date of notice provided by the Party alleging a dispute in an effort to resolve the dispute; except that, in emergency situations, or if required to preclude the running of any applicable limitations period, an Interested Party may, for good cause, seek relief prior to the expiration of the 45-day period.

25.1.1.2 The Interested Parties may agree to extend the Consultation Period up to an additional 75 days and may employ a mediator. To the extent allowed by law, the Parties shall consider any applicable limitations period, whether arising by statute, regulation, contract, or otherwise to be tolled during the Consultation Period. No Party shall raise as a defense to any action, whether judicial or administrative, the running of any period of limitation, so long as the action was filed within the limitations period plus the Consultation Period.

25.1.1.3 The Consultation Period ends when the times described above expire or when all Interested Parties except one indicate that consultation is no longer useful, whichever is sooner.

25.1.2 Consensus – Upon resolution of a dispute, by agreement or otherwise, the Interested Parties shall notify all Parties of the resolution. A resolution based on consensus shall have the unanimous support of all Interested Parties and no opposition from any other Party. Any resolution that requires modification of this Agreement requires written approval signed by all Parties, pursuant to Section 19.0.

25.1.3 Remedies – If, after the Consultation Period, the Interested Parties have not reached consensus, or in the event a schedule to cure an alleged noncompliance has been established through Consultation and a Party has not cured the failure within the time established, any Interested Party may seek resolution as follows.

25.1.3.1 Provisions of this Agreement that are Also Included in the New License – For disputes related to License Articles, a Party shall petition the FERC to enforce the License Article with which the Licensee is alleged to have failed to comply. If FERC enforces any alleged failure to comply with a License Article, such enforcement action shall be the sole remedy under this Agreement. If the FERC finds that a violation occurred but affirmatively declines to enforce a License Article or fails to act within a reasonable time after a petition to enforce has been filed, which period of time shall not be less than 180 days from the date on which the petition was filed, then such Party may file with the FERC a petition for rehearing regarding the alleged failure and pursue any further remedies, including judicial review. Once the

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180-day period has expired or FERC has affirmatively indicated that it will not take enforcement action (whichever occurs sooner), any Party may seek to enforce, by any available means, any provision of this Agreement that was also incorporated into the New License, except that any Party may file such action sooner in order to preclude the running of any applicable limitations period. If any Party has sought direct review of any FERC action related to enforcement, the Party may not seek to enforce by other means until that action is resolved and any applicable review periods have expired.

25.1.3.2 Provisions of this Agreement that are Not Also Included in the New License – For disputes not related to License Articles, a Party shall seek resolution in a court or agency of competent jurisdiction.

25.2 Mediation Services

25.2.1 Any Party may propose the use of a professional mediator to facilitate dispute resolution. To initiate professional mediation, a Party shall notify all Parties pursuant to Section 23.0 and shall convene a meeting not sooner than 15 days nor more than 30 days following notice. Such notice shall state the date, time, and location of the initial meeting to consider mediation. At that initial meeting all Parties in attendance shall determine their interest in mediation. Mediation is purely voluntary, and no Party shall be compelled against its will to participate in mediation.

25.2.2 Those Parties agreeing to mediation shall execute a contractually binding agreement with a professional mediator, and such agreement shall determine both how the mediating parties will share the cost of mediation and the schedule to undertake and complete mediation. No Party that chooses not to participate in mediation shall be responsible for any costs related to mediation. No mediated resolution shall modify this Agreement unless all the Parties so modify this Agreement pursuant to Section 19.0.

26.0 Adjustment for Inflation / Deflation

26.1 Unless otherwise indicated in this Agreement, all costs or payment amounts in this Agreement that are specified in dollars and are to be paid by the Licensee shall be adjusted on an annual basis starting on January 1, 2015 and January 1 of each following year according to the following formula:

$$AD = (D \times (NGDP)) / IGDP$$

Where:

AD = Adjusted dollar amount as of January 1 of the year in which the adjustment is made (or, in the case of the first adjustment, 2015).

D = Dollar amount prior to adjustment.

NGDP = GDP-IPD for the third quarter of the year before the adjustment date (or, in the case of the first adjustment, 2014).

IGDP = GDP-IPD for the third quarter of the year before the previous adjustment date (or, in the case of the first adjustment, 2013).

26.2 "GDP-IPD" is the value published for the Gross Domestic Product Implicit Price Deflator by the U.S. Department of Commerce, Bureau of Economic Analysis in the

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publication "Survey of Current Business" (being on the basis of 2005 = 100), in the third month following the end of the applicable quarter. If that index ceases to be published, any reasonably equivalent index published by the Bureau of Economic Analysis may be substituted. If the base year for GDP-IPD is changed or if publication of the index is discontinued, the Licensee shall promptly make adjustments or, if necessary, select an appropriate alternative index to achieve the same economic effect. Adjusted amounts will be rounded to the nearest whole dollar.

27.0 Ability of Parties to Request FERC Approvals or New License Amendments Related to Non-Project Use Requests

27.1 Nothing in this Agreement shall impair or supersede the right of any Party to apply for and/or support, including by intervention, an amendment to the New License or other order from the FERC authorizing any entity to expand or modify an existing water intake or to add a new water intake, unless such amendment is specifically prohibited in this Agreement.

27.2 Unless such action is specifically prohibited in this Agreement, nothing in this Agreement shall impair or supersede: (i) any Party's right to file with the Licensee a Non-Project Use request that is in compliance with the SMG or to support (e.g., provide comments on individual lake use permit applications, such as marinas, multi-slip facilities, etc.), including by intervention, that request with the FERC; (ii) any Party's right to support, oppose, or request modification to such a request with the FERC; or (iii) any Party's legal obligations related to such requests.

27.3 Nothing in this Agreement is intended to or may be construed to alter, modify, amend, or in any way impact or affect state law applicable to the Non-Project Use requests.

28.0 Parties' Participation in Future Relicensings and 401 WQC

28.1 Nothing in this Agreement shall be construed to restrict any Party's participation or comments in future relicensings or 401 WQC related to licenses for this Project beyond the New License.

28.2 Nothing in this Agreement shall be construed to restrict any Party's participation in any other FERC licensing proceeding including any other project for which Duke Energy Carolinas, LLC is the licensee.

29.0 Early Implementation

Unless otherwise prohibited in the New License, the Existing License, or this Agreement, the Licensee at its own discretion may choose to voluntarily implement, partially or in full, any of the operational changes or its other obligations called for in this Agreement earlier than the dates indicated in this Agreement.

30.0 Coordination with the Licensee's Budgeting Cycle

Unless otherwise specified in this Agreement, the timing for financial contributions from the Licensee described in this Agreement will be coordinated with the Licensee's budgeting cycle. The Licensee's contributions will become available the latter of any of

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the following: (i) January 1 of the first calendar year after the issuance of the New License and the closure of all rehearing and administrative challenge periods if the date for financial contribution is on or before June 30; or (ii) January 1 of the second calendar year following the issuance of the New License and the closure of all rehearing and administrative challenge periods if the date for financial contribution is after June 30.

31.0 Assessments and Procedures for New Information or Material Mistakes

A Party that becomes aware of significant new information or a material mutual mistake may bring that information to the Licensee and/or may convene a meeting of all Parties pursuant to Section 23.0, inviting Parties to meet to discuss a modification of this Agreement pursuant to Section 19.0. No Party may use new information as a defense to an alleged breach of this Agreement, as a basis for taking an action inconsistent with this Agreement, or as a basis to withdraw from this Agreement.

32.0 Procedures for New Law or Regulation

Should any new law, regulation, or other regulatory action, such as a permit or License requirement, require a Party to breach this Agreement (including, without limitation, for a governmental Party, denying that Party's funds with which to fulfill its obligations under this Agreement), such Party shall not be liable for such breach. Should a new law or regulation require a Party to act in a manner that breaches this Agreement, then any other Party that believes it is substantially negatively affected thereby may withdraw from this Agreement by following the procedures in Section 21.0. If arbitration is initiated, withdrawal shall be allowed only if the arbitrator determines that: (i) the withdrawing Party substantially complied with all procedural prerequisites to withdrawal specified in this Agreement; (ii) there is no adequate remedy at law or in equity for the breach and the breach substantially negatively affects the withdrawing Party; and (iii) the breach was required by or the unavoidable result of the new law or regulation.

33.0 Miscellaneous Agreements

33.1 No Admission of Liability – This Agreement is a compromise of many interests. The actions taken pursuant to this Agreement are not intended nor shall they be construed as an admission on the part of any Party, or its agents, representatives, attorneys or employees that such Party was so obligated in any manner independent of this Agreement. Except as provided herein, no Party shall be prejudiced, prevented, or estopped from advocating in any manner or before any entity, including the FERC or any state agency, any position inconsistent with those contained in this Agreement regarding the licensing, permitting, and license compliance of this or any other hydropower project.

33.2 Agreement Terms Contractual – The terms of this Agreement are contractual and not mere recitals. This Agreement, including Appendices A through I, constitutes the entire Agreement between the Licensee and the other Parties with respect to the subject matter hereof, and all prior contemporaneous or other oral or written statements, representations or agreements by, between or among any of the Parties, including the AIP, are superseded hereby. However, nothing herein alters any valid easement, lease, user's agreement, or permit previously granted or issued by the Licensee to any entity that is a Party to this Agreement for use of Project land or Project waters including, without limitation: (i) the water removal easement granted to the City of Seneca in the

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Water Contract dated March 31, 1969, which is incorporated by reference, and (ii) the Indenture and Agreement, effective January 31, 1973, by and between the Licensee and Greenville Water, which is incorporated by reference.

33.3 Enforceability – As noted in Section 25.1.3, all terms of this Agreement not incorporated as License Articles shall be enforced through remedies available under applicable state or federal law.

33.4 Force Majeure – The Parties agree neither the Licensee, nor any other Party, shall be in breach of this Agreement to the extent any delay or default in performance is due to causes beyond the reasonable control of the delayed or defaulting Party; provided the delayed or defaulting Party notifies the other Parties as soon as possible of: (i) the event; (ii) the expected duration of the event; and (iii) the delayed or defaulting Party's plan to mitigate the effects of the delay or default. Such causes may include, but are not limited to, natural disasters, labor or civil disruption, acts of terrorism, the inability to secure any legal authorization from another entity (e.g., a permit or license) where such legal authorization is a prerequisite or requirement for complying with this Agreement, or breakdown or failure of the Project works, provided such causes are beyond the reasonable control of the delayed or defaulting Party.

33.5 Applicable Law and Venue – The Parties agree that all actions arising wholly within North Carolina must be litigated in courts located in the State of North Carolina and shall be governed by North Carolina law; those actions arising wholly within South Carolina must be litigated in courts located in the State of South Carolina and shall be governed by South Carolina law; where an action arises in both states, or in the case in which an act or omission giving rise to an action to enforce this Agreement occurred in neither state or its state of origin cannot be determined, the action must be litigated in courts located in either the State of North Carolina or the State of South Carolina, and laws of the state where the action is brought shall govern. The Parties agree that such courts are convenient forums and irrevocably submit to the personal jurisdiction of such courts, except that the governmental bodies who are Parties do not by entering into this Agreement waive sovereign immunity, and such Parties waive such defense only to the extent required by law, if at all.

33.6 Severability – Should any provision of this Agreement or part hereof be held under any circumstances in any jurisdiction to be invalid or unenforceable, such invalidity or unenforceability shall not affect the validity or enforceability of any other provision of this Agreement or other part of such provision. If such invalidity or unenforceability substantially negatively affects any Party, that Party may withdraw from this Agreement pursuant to the procedures established in Section 21.0. If arbitration is initiated, withdrawal shall be allowed only if the arbitrator determines that: (i) the withdrawing Party substantially complied with all procedural prerequisites to withdrawal specified in this Agreement; and (ii) the unenforceability or invalidity of the relevant part of this Agreement substantially negatively affects the withdrawing Party.

33.7 Waiver Independence – No consent to or waiver of any provision of this Agreement shall be deemed either a consent to or waiver of any other provision hereof, whether or not they are similar, or a continuing consent or waiver, unless otherwise specifically provided.

33.8 Definitions – The terms, phrases, and abbreviations defined in this Agreement and Appendix C, Appendix D, Appendix E, and Appendix I hereto, when used in this Agreement, shall have the meanings as defined in this Agreement and Appendix C, Appendix D, Appendix E, and Appendix I.

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33.9 Water Rights Unaffected – This Agreement does not release, deny, grant or affirm any property right, license, or privilege in any waters or any right of use in any waters nor impact or affect any requirements or obligations under state law. This Agreement does not authorize any person or entity to interfere with the riparian rights, littoral rights, or water use rights of any other kind of any other person or entity. No person or entity shall interpose this Agreement as a defense in an action respecting the determination of riparian or littoral rights or other water use rights.

33.10 Parties' Own Costs – Except as expressly provided for in this Agreement, all Parties are to bear their own costs of participating in this Agreement.

33.11 Existing Laws – Unless otherwise noted, any reference to any statute, regulation, or other document refers to the statute, regulation, or document as it exists on the date of the first signature on this Agreement. No changes to any document to which this Agreement refers are incorporated into this Agreement, unless explicitly provided for in this Agreement or unless such change is made in accordance with Section 19.0.

33.12 No Third-Party Beneficiary – This Agreement shall not create any right in any individual or entity that is not a Party hereto or in the public as a third-party beneficiary. This Agreement shall not be construed to authorize any such third party to initiate or to maintain a suit in law or equity or other administrative proceeding.

33.13 No Commitment of Funds – Nothing in this Agreement shall be construed as obligating any federal, tribal, state, or local agency to expend in any fiscal year any sum in excess of appropriations made by Congress, tribal councils, or state or local legislatures; administratively allocated for the purpose of this Agreement for the fiscal year or to involve any federal, tribal, state, or local agency in any contract or obligations for the future expenditure of money in excess of such appropriations or allocations.

33.14 No Government Agency Delegation – Nothing in this Agreement shall be construed as requiring or involving the delegation by any governmental agency to any other body of any authority entrusted to it by Congress, tribal council, or by the legislature of any state.

33.15 Successors and Assigns – This Agreement shall apply to, and be binding on, the Parties and their successors and assigns. No change in ownership of or transfer of the New License for the Project, or any of its developments shall in any way modify or otherwise affect any Party's interests, rights, responsibilities, or obligations under this Agreement. Unless prohibited by applicable law, the Licensee of the Project shall provide that, in any transfer of the Existing or New License for the Project, such subsequent licensee shall be bound by, and shall assume the rights and obligations of, this Agreement upon completion of the change of ownership and, as applicable, approval by the FERC of the license transfer. The Licensee shall provide notice to the other Parties at least 90 days prior to completing such transfer of the Existing or New License. Notwithstanding the foregoing provisions of this Section, if any subsequent licensee is only partially bound by the terms of this Agreement, any Party that believes that it is substantially negatively affected by the fact that the subsequent licensee is only partially bound by this Agreement may initiate withdrawal from this Agreement pursuant to the procedures established in Section 21.0. If arbitration is initiated, withdrawal shall be allowed only if the arbitrator determines that: (i) the withdrawing Party substantially complied with all procedural prerequisites to withdrawal specified in this Agreement; and (ii) the fact that the subsequent licensee is only partially bound by this Agreement substantially negatively affects the withdrawing Party.

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33.16 Damages – Damages at law are an inadequate remedy to redress any prospective or continuing breach of this Agreement and any Party shall be entitled to specific performance only regarding such breach, and no Party may bring an action seeking monetary damages but shall be limited to seeking specific performance, injunctive, or declaratory relief. This Section shall not be construed to prohibit any Party from receiving money in settling any claim arising from a prospective or continuing breach.

33.17 Limitation of Applicability – This Agreement is made on the express understanding that it constitutes a negotiated settlement of issues specific to the Project. No Party shall be deemed, by virtue of execution of this Agreement, to have established precedent, or admitted or consented to any fact, opinion, approach, methodology, or principle except as expressly provided herein. In the event this Agreement is approved by the FERC, such approval shall not be deemed precedential or controlling regarding any particular issue or contention in any other proceeding.

33.18 Execution in Counterparts – This Agreement may be executed in separate counterparts, with each counterpart deemed to be an original having the full force and effect thereof, but with all such counterparts, taken together, constituting but one and the same document.

33.19 Full Legal Authority – Each Party to this Agreement represents that it has the full legal authority to execute this Agreement and that its signatory is authorized to bind the Party (principal) that it represents, and that by such representative's signature, such principal shall be bound upon full execution of this Agreement.

33.20 Timing – In various places throughout this Agreement, the following phrase related to timing of actions appears: “*within ___ year(s) following the issuance of the New License, the end of all appeals, and the closure of all rehearing and administrative challenge periods.*” The Parties acknowledge and agree that this phrase is intended to define the end of all periods during which someone may contest the validity of the New License or the 401 WQC, and it is further intended to make clear that certain required actions, described by this phrase, do not become requirements obligating Parties to act until all opportunities to contest or appeal the New License or the 401 WQC have come to a complete and final end.

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SIGNATURES OF THE PARTIES

DUKE ENERGY CAROLINAS, LLC

By: _____
Steven D. Jester (Date)
Vice President, Water Strategy, Hydro Licensing & Lake Services

ADVOCATES FOR QUALITY DEVELOPMENT, INC.

By: _____
Joseph M. Smith (Date)
President

ANDERSON AREA CHAMBER OF COMMERCE

By: _____
Howard D. Spencer (Date)

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CITY OF SENECA

By: _____

(Date)

COMMISSIONERS OF PUBLIC WORKS OF THE CITY GREENVILLE

By: _____
David Bereskin
Chief Executive Officer

(Date)

FRIENDS OF LAKE KEOWEE SOCIETY, INC.

By: _____
Ben Turetzky
Executive Director

(Date)

OCONEE COUNTY, SOUTH CAROLINA

By: _____
Joel Thrift
Chairman, Oconee County Council

(Date)

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PICKENS COUNTY, SOUTH CAROLINA

By: _____ (Date)
G. Neil Smith, Chairman
Pickens County Council

PICKENS COUNTY WATER AUTHORITY

By: _____ (Date)

SOUTH CAROLINA DEPARTMENT OF ARCHIVES AND HISTORY

By: _____ (Date)
Dr. W. Eric Emerson
Director

SOUTH CAROLINA DEPARTMENT OF NATURAL RESOURCES

By: _____ (Date)
Alvin A. Taylor
Director

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SOUTH CAROLINA DEPARTMENT OF PARKS, RECREATION AND TOURISM

By: _____
Duane Parrish (Date)
Director

SOUTH CAROLINA WILDLIFE FEDERATION

By: _____
Wes Cooler (Date)

THE CLIFFS AT KEOWEE VINEYARDS COMMUNITY ASSOCIATION, INC.

By: _____
(Date)

THE RESERVE AT LAKE KEOWEE

By: _____
(Date)

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UPSTATE FOREVER

By: _____ (Date)

WARPATH DEVELOPMENT, INC.

By: _____ (Date)
Tim Roberson

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APPENDIX A

PROPOSED LICENSE ARTICLES

This Agreement represents a balance of many interests and is the culmination of years of negotiation by the Parties. While the Parties recognize the FERC is not constrained by this Agreement, the Parties wish to emphasize that, if the FERC acts inconsistently with this Agreement, it may result in the withdrawal from this Agreement of one or more Parties and could result in the termination of this Agreement. To avoid that result, the Parties respectfully request the following proposed License Articles in this Appendix A be incorporated without material modification into any New License the FERC may issue for the project and that the New License term be at least 40 years.

A-1.0 Reservoir Elevation Article

ARTICLE – Reservoir Elevations

(A) Reservoir Elevations – Within 60 days following the issuance of this license, to protect and enhance the project's values that may be affected by reservoir level fluctuations, the Licensee shall maintain the elevations of the project reservoirs between the Normal Minimum and Normal Maximum Elevations indicated in the table below.

Reservoir	Normal Maximum Elevation (ft local datum / ft AMSL)	Normal Minimum Elevation (ft local datum / ft AMSL)
Lake Jocassee	100.0 / 1110.0	86.0 / 1096.0
Lake Keowee	100.0 / 800.0	96.0 / 796.0

(B) Temporary Variances – The reservoir elevation requirements outlined in Paragraph (A) above may be temporarily modified if required by conditions beyond the control of the Licensee, for short periods during annual inspection and repairs, or by operating emergencies or maintenance needs as defined in the Commission-approved Low Inflow Protocol (LIP) or Maintenance and Emergency Protocol (MEP). When implementing the LIP or MEP, the Licensee shall notify the Commission of modifications to the reservoir elevation requirements in accordance with the requirements of the LIP or MEP. For all other modifications in reservoir elevation requirements, the Licensee shall notify the Commission as soon as possible, but no later than 10 days after each event and shall provide the reason for the change in reservoir levels.

END OF PROPOSED LICENSE ARTICLE

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A-2.0 Low Inflow Protocol Article

ARTICLE – Low Inflow Protocol for the Keowee-Toxaway Hydroelectric Project

(A) The Low Inflow Protocol (LIP) for the Keowee-Toxaway Hydroelectric Project filed with the license application as Appendix D of the Relicensing Agreement is approved and incorporated into this license and the Licensee shall implement the LIP.

(B) The Licensee may modify the LIP in accordance with the procedures in the LIP. The Licensee may also make temporary modifications to the LIP to account for any changed physical conditions at the Keowee and Jocassee developments. The Licensee shall notify the Commission of any such modifications in accordance with the LIP. Any modifications may be subject to Commission approval.

END OF PROPOSED LICENSE ARTICLE

A-3.0 Maintenance and Emergency Protocol Article

ARTICLE – Maintenance and Emergency Protocol for the Keowee-Toxaway Hydroelectric Project

Hydroelectric Project

(A) The Maintenance and Emergency Protocol (MEP) for the Keowee-Toxaway Hydroelectric Project filed with the license application as Appendix E of the Relicensing Agreement is approved and incorporated into this license and the Licensee shall implement the MEP.

(B) The Licensee may make minor changes as necessary to the MEP for the Keowee-Toxaway Hydroelectric Project. The Licensee may also make temporary modifications to the MEP to account for any changed physical conditions at the Jocassee and Keowee developments. The Licensee shall notify the Commission of any such temporary modifications in accordance with the MEP. Any modifications may be subject to Commission approval.

END OF PROPOSED LICENSE ARTICLE

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A-4.0 Historic Properties Article

ARTICLE – Historic Properties

The Licensee shall implement any existing Programmatic Agreement for the project regarding Historic Properties management and protection including, but not limited to, the Historic Properties Management Plan (HPMP) for the project. In the event that the Programmatic Agreement is terminated, the Licensee shall continue to implement the provisions of its approved HPMP. The Commission reserves the authority to require changes to the HPMP at any time during the term of the license.

END OF PROPOSED LICENSE ARTICLE

A-5.0 Public Recreation Articles

ARTICLE – Recreation Management Plan

(A) The Recreation Management Plan (RMP) filed with the license application is approved and incorporated into this license and the Licensee shall implement the RMP.

(B) For the first 10 years following the issuance of this license, the Licensee shall file with the Commission by March 1 of each year a report of the progress made by the Licensee on completing the measures in the RMP during the previous calendar year.

(C) The Commission reserves the right to require changes to the RMP and the Licensee shall implement the changes.

END OF PROPOSED LICENSE ARTICLE

ARTICLE – Recreation Planning

(A) No later than September 1, 2031, the Licensee shall consult with the South Carolina Department of Parks, Recreation and Tourism (SCDPRT) and the South Carolina Department of Natural Resources (SCDNR) to develop a plan to conduct a Recreation Use and Needs Study. The Recreation Use and Needs Study shall include at least the following: (1) a review of existing recreation resources, (2) an analysis of recreational use at the Project Access Areas and the need for additional recreation amenities, (3) a review of agency current recreation and/or land use management plans relevant to the project, and (4) a discussion of the need for any changes to the Recreation Management Plan.

(B) The Licensee shall complete the Recreation Use and Needs Study no later than December 31, 2032, and provide a draft of the study report to the agencies in Paragraph (A) for review and comment. The Licensee shall allow at least 30 days for the agencies to review and comment. The Licensee shall file the report with the Commission for approval and include documentation of consultation including copies of comments and recommendations on the draft report.

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(C) Based upon the results of any Recreation Use and Needs Study conducted in accordance with Paragraph (B), the Licensee shall file a revised and updated Recreation Management Plan (RMP) no later than December 31, 2033. The Licensee shall include with its RMP documentation of consultation with the above agencies, local governments and other interested parties; copies of comments and recommendations on the draft RMP; and specific descriptions of how the agencies', local governments', and other interested parties' comments and recommendations are accommodated by the draft new RMP. The Licensee shall allow a minimum of 30 days for the agencies, local governments, and other interested parties to comment on the draft revised and updated RMP prior to filing it with the Commission for approval. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons.

(D) The Commission reserves the right to require changes to any revised and updated RMP developed in accordance with the above. The Licensee shall implement any revised and updated RMP as approved by the Commission, including any changes required by the Commission.

END OF PROPOSED LICENSE ARTICLE

A-6.0 Shoreline Management Articles

ARTICLE – Shoreline Management Plan

(A) The Shoreline Management Plan (SMP) filed with the license application is approved and incorporated into this license and the Licensee shall implement the SMP.

(B) The Licensee may make minor changes to the Shoreline Management Guidelines (SMG) and the Shoreline Classification Maps and associated Lake Use Restrictions to protect newly discovered resources such as archaeological or historic sites, Threatened or Endangered Species, Special Concern Species, or to correct mapping errors. The Commission reserves the right to review such changes.

(C) The Commission may require changes to the SMP at any time during the term of this license.

END OF PROPOSED LICENSE ARTICLE

ARTICLE – Shoreline Management Plan Review and Update Procedures

(A) At ten years following the issuance of this license, and every ten years thereafter for the term of this license, the Licensee shall file with the Commission, for approval, a revised Shoreline Management Plan (SMP). In developing the revised SMP, the Licensee shall, at least one year prior to the due date for each revised SMP submittal, convene and consult with a workgroup consisting of the South Carolina Department of Parks, Recreation and Tourism, the South Carolina Department of Natural Resources, and the U.S. Fish and Wildlife Service to review the implementation of the SMP and to recommend potential modifications. The Licensee shall include with the revised SMP filing documentation of consultation with the above agencies; copies of comments and

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recommendations on the revised SMP, after it has been prepared and provided to the agencies; and specific descriptions of how comments and recommendations received are accommodated by the revised SMP. The Licensee shall allow a minimum of 30 days for the agencies participating in the workgroup to comment prior to filing the revised SMP with the Commission for approval. If the Licensee does not adopt a recommendation, the revised-SMP filing shall include the Licensee's reasons.

(B) The Commission reserves the right to require changes to any revised and updated SMP developed in accordance with the above. The Licensee shall implement any revised and updated SMP as approved by the Commission, including any changes required by the Commission.

END OF PROPOSED LICENSE ARTICLE

A-7.0 Water Quality Article

ARTICLE – Water Quality Monitoring

(A) During the first full month of August occurring at least 60 days following issuance of this license and during every subsequent August for the term of this license, the Licensee shall continuously monitor dissolved oxygen concentrations in both the Keowee Hydro Station and Jocassee Pumped Storage Station tailwaters to demonstrate compliance with South Carolina's water quality certification.

(B) The Licensee shall submit the results obtained from this annual monitoring to the Commission and the South Carolina Department of Health and Environmental Control each year by November 30.

END OF PROPOSED LICENSE ARTICLE

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APPENDIX B: PARTIES AND DESIGNATED REPRESENTATIVES

Party¹	Designated Representative	Mailing Address	Overnight Express Address
Duke Energy Carolinas, LLC and Duke Energy Corporation	Jennifer R. Huff Keowee-Toxaway Hydro Project Licensing Manager	Duke Energy PO Box 1006 Mail Code EC12Y Charlotte, NC 28201	Duke Energy 526 S. Church St Mail Code EC12Y Charlotte, NC 28202
Advocates for Quality Development, Inc.	Chuck Smith	PO Box 802 Seneca, SC 29679	211 N Harbour Drive Seneca, SC 29672-6822
Anderson Area Chamber of Commerce	Howard D. Spencer	1719 Circle Road Powdersville, SC 29642	1719 Circle Road Powdersville, SC 29642
City of Seneca	Bob Faires	PO Box 4773 Seneca, SC 29679	225 E North 1 st Street Seneca, SC 29679
Friends of Lake Keowee Society, Inc.	Ben Turetzky Executive Director	4065 Keowee School Road Seneca, SC 29672	4065 Keowee School Road Seneca, SC 29672
Greenville Water	David Bereskin	PO Box 687 Greenville, SC 29602	406 W. Broad Street Greenville, SC 29601
Oconee County, SC	Art Holbrooks	415 S. Pine Street Walhalla, SC 29691	415 S. Pine Street Walhalla, SC 29691
Pickens County, SC	Chris Brink	222 McDaniel Avenue, B-10 Pickens, SC 29671	222 McDaniel Avenue, B-10 Pickens, SC 29671

¹ These entities are Parties to this Agreement provided their duly authorized representatives sign this Agreement. All Parties shall notify the Licensee of changes to the contact information for the Party's Designated Representative.

Party¹	Designated Representative	Mailing Address	Overnight Express Address
Pickens County Water Authority	Steve Jewsbury	222 McDaniel Avenue, B-1 Pickens, SC 29671	222 McDaniel Avenue, B-1 Pickens, SC 29671
South Carolina Dept. of Archives and History	Elizabeth M. Johnson Director, Historical Services, D-SHPO	8301 Parklane Rd. Columbia, SC 29223	8301 Parklane Rd. Columbia, SC 29223
South Carolina Dept. of Natural Resources	Bill Marshall	P.O. Box 167 Columbia, SC 29202	1000 Assembly Street Columbia, SC 29202
South Carolina Dept. of Parks, Recreation and Tourism	Phil Gaines	1205 Pendleton Street Columbia, SC 29201	1205 Pendleton Street Columbia, SC 29201
South Carolina Wildlife Federation	Ben Gregg Executive Director	2711 Middleburg Dr, Ste 101 Columbia, SC 29204	2711 Middleburg Dr, Ste 101 Columbia, SC 29204
The Cliffs at Keowee Vineyards Community Association, Inc.	Jim Burgner	309 Wake Robin Drive Sunset, SC 29685-2247	309 Wake Robin Drive Sunset, SC 29685-2247
The Reserve at Lake Keowee	Tony Niemeyer	100A Village Green Loop Sunset, SC 29685	100A Village Green Loop Sunset, SC 29685
Upstate Forever	Van Whitehead	507 Pettigru Street Greenville, SC 29601	507 Pettigru Street Greenville, SC 29601
Warpath Development, Inc.	Tim Roberson	335 Blue Water Way West Union, SC 29696	335 Blue Water Way West Union, SC 29696

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APPENDIX C: ABBREVIATIONS, ACRONYMS, AND DEFINITIONS

1968 Agreement	An agreement between the Licensee, the US Army Corps of Engineers, and Southeastern Power Administration that attempts to balance usable water storage between the Project and the USACE's Hartwell and J. Strom Thurmond hydroelectric projects
401 WQC	401 Water Quality Certification
AAII	Access Area Improvement Initiative
ac	acre(s)
ac-ft	acre-feet
ADA	Americans with Disabilities Act
AIP	Agreement-in-Principle
AMSL	above mean sea level
AQD	Advocates for Quality Development, Inc.
°C	degrees Celsius
cfs	cubic feet per second
Commercial Recreation Area	Recreation areas provided and maintained by the private sector not including the Licensee, which are available to the general public
Critical Reservoir Elevation	Unless otherwise defined herein, the level of water in a reservoir (measured in ft AMSL or ft relative to the full pond contour with 100.0 ft corresponding to full pond) below which any Large Water Intake used for public water supply, industrial water supply or regional power plant water supply located on the reservoir will not operate at its Licensee-approved capacity
CWG	Clean Water Group
DCP	Drought Contingency Plan: the plan used by the USACE to manage water quantity in the USACE Reservoirs in the Savannah River Basin during drought
DMAG, KT-DMAG	Keowee-Toxaway Drought Management Advisory Group
DO	dissolved oxygen
EAP	Emergency Action Plan
EBCI	Eastern Band of Cherokee Indians

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Existing License	License document issued to the Licensee for the Keowee-Toxaway Hydroelectric Project (FERC Project No. 2503) with an effective date of September 1, 1966, and including all license amendments since that time, with requirements relative to the Licensee's operation of the Project through the license expiration date of August 31, 2016, and as extended by an annual license(s)
°F	degrees Fahrenheit
FERC or Commission	Federal Energy Regulatory Commission (Note: The FERC refers to itself in license articles, other documents, and conversation as the "Commission.")
FOLKS	Friends of Lake Keowee Society, Inc.
Form 80	Licensed Hydropower Development Recreation Report: a form submitted by licensees to the FERC providing data on recreation amenities at FERC-licensed hydropower projects; Form 80 submittals required every six years beginning in 2015
ft	foot / feet
Full Pond Elevation	The level of a reservoir corresponding to the point at which water would first begin to spill from the reservoir's dam(s) or exceed the safety margin for a reservoir's dam(s) if the Licensee took no action; the level corresponds to the lowest point along the top of the floodgates for both Lake Jocassee and Lake Keowee
GA	Georgia
GW or Greenville Water	Legally known as the Commissioners of Public Works of the City of Greenville
HEP	Habitat Enhancement Program
Historic Properties	Sites, buildings, and structures included in or eligible for inclusion in the National Register of Historic Places
HPMP	Historic Properties Management Plan
Inconsistent Act	Any action by a Jurisdictional Body that increases the burden upon or cost or risk to a Party substantially beyond the burden, cost, or risk assumed by the Party in this Agreement, or deprives a Party of a substantial benefit promised by another Party in this Agreement, such as by relieving another Party of a substantial bargained-for obligation
Jurisdictional Body	A governmental body that has the authority to place requirements on the Licensee in accordance with statutory mandates (e.g., FERC, USFWS, NMFS, SCDHEC)
KT	Keowee-Toxaway
KT Basin	Keowee-Toxaway River Basin

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Large Water Intake	Any water intake (e.g., public water supply, industrial, agricultural, power plant, irrigation, etc.) having a maximum instantaneous capacity greater than or equal to one million gallons per day (MGD)
Large Water Intake owner	The owner of a Large Water Intake (e.g., Greenville Water, City of Seneca, Licensee, etc.)
Licensee	Duke Energy Carolinas, LLC
Licensee's Reservoirs	Bad Creek Reservoir, Lake Jocassee, and Lake Keowee
LIP	Low Inflow Protocol; the plan used by the Licensee and others to manage water quantity in the Licensee's Reservoirs in the Savannah River Basin during drought
MEP	Maintenance and Emergency Protocol
MGD	million gallons per day
mg/L	milligrams per liter
MLCA	Mountain Lakes Community Association
MOA	memorandum of agreement
NC	North Carolina
NCSHPO	NC State Historic Preservation Office
New License	The license anticipated to be issued by the FERC to replace the Existing License
NMFS	National Marine Fisheries Service
NOA	New Operating Agreement; an agreement anticipated to replace the 1968 Agreement between the Licensee, USACE, and SEPA regarding required flow releases from the Keowee Development into the USACE's Hartwell Project
Normal Maximum Elevation	The level of a reservoir (measured in ft AMSL or feet relative to the full pond contour with 100.0 ft corresponding to full pond) that defines the top of the reservoir's Normal Operating Range for a given day of the year
Normal Minimum Elevation	The level of a reservoir (measured in ft AMSL or feet relative to the full pond contour with 100.0 ft corresponding to full pond) that defines the bottom of the reservoir's Normal Operating Range for a given day of the year
Normal Operating Range	The band of reservoir levels, between the Normal Maximum and Normal Minimum Elevations, within which the Licensee normally attempts to maintain a given reservoir on a given day
NRHP	National Register of Historic Places

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ONS	Oconee Nuclear Station
Park	Recreation areas provided and maintained by a county or state government which are available to the general public
PRC	Proposal Review Committee
Priority Species	Species given a priority status by the SCDNR's Comprehensive Wildlife Conservation Plan
Project	Keowee-Toxaway Hydroelectric Project
Project Access Area	Recreation land owned by the Licensee within the Project Boundaries which is available to the general public
Project Boundary (ies)	The line(s) demarking lands designated by the FERC as necessary for operation of the Project and therefore subject to FERC jurisdiction
Project Reservoirs	Lake Keowee and Lake Jocassee
RA or Agreement	Relicensing Agreement
RMP	Recreation Management Plan
RTE	Rare, Threatened or Endangered
RUN	Recreation Use and Needs
SC	South Carolina
SCDHEC	SC Department of Health and Environmental Control
SCDNR	SC Department of Natural Resources
SCDPRT	SC Department of Parks, Recreation and Tourism
SCSHPO	SC State Historic Preservation Office
SCWF	South Carolina Wildlife Federation
Seneca or Seneca Light & Water	City of Seneca
SEPA	Southeastern Power Administration
SHPO	State Historic Preservation Office
SMG	Shoreline Management Guidelines

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SMP	Shoreline Management Plan: the Licensee's process for evaluating requests for lake use permits which includes the following components: digital orthographic aerial photography; GPS-based geo-videography; consultation materials; process for challenges to shoreline classification; Structure Renovation / Removal Process; riparian zone management information; Shoreline Stabilization Technique Selection Process ("SSTSP"); consultation process with the EBCI; True Public Marina requirements; SMG; and Shoreline Classification Maps and Lake Use Restrictions
Special Status Species	State- and federally listed RTE species and others listed as Species of Concern and Special Concern Species
SWPP	Source Water Protection Program
TBD	to be determined
THPO	Tribal Historic Preservation Office
True Public Marina	A commercial recreation area that provides for the public's use of Project lands and waters with facilities where boats can be launched, retrieved, or moored and where activities customarily associated with marinas are provided to the general public with no predetermination of user groups for the use of any of the land or water-based facilities, no membership requirements, and transient services (e.g., use of gas dock, restrooms, or pump-out facilities) do not require wet slip or dry storage rental
Upper Savannah River Basin	The portion of the Savannah River Basin draining into J. Strom Thurmond Lake
U.S. or US	United States
USACE	U.S. Army Corps of Engineers
USACE Reservoirs	Hartwell Lake, Richard B. Russell Lake, and J. Strom Thurmond Lake
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

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APPENDIX D

LOW INFLOW PROTOCOL (LIP) FOR THE KEOWEE-TOXAWAY HYDROELECTRIC PROJECT

Purpose

To establish a joint management plan that Duke Energy Carolinas, LLC (Licensee); Seneca Light & Water (Seneca), Greenville Water (GW), any public water suppliers that add Large Water Intakes withdrawing water from Project Reservoirs (Jocassee and Keowee); and any public water suppliers with Large Water Intakes on the U.S. Army Corps of Engineers' (USACE) Reservoirs (Hartwell, Russell and Thurmond) that choose to participate, will follow in response to drought conditions.

Key Facts and Assumptions

1. Importance of Human Health and Safety and the Integrity of the Public Water Supply and Electric Systems – Nothing in this LIP will limit the Licensee's ability to take any and all lawful actions necessary at the Keowee-Toxaway Hydroelectric Project ("Project") to protect human health and safety, to protect its equipment from damage, to ensure the stability of the regional electric grid, to protect the equipment of the Large Water Intake owners from damage, and to ensure the stability of public water supply systems; provided that nothing in the Relicensing Agreement (RA) or LIP obligates the Licensee to take any actions to protect the equipment of Large Water Intake owners from damage or to ensure the stability of public water supply systems. It is recognized that the Licensee may provide this protection without prior consultation or notification.
2. This LIP is intended to support management of the Licensee's Reservoirs (Bad Creek, Jocassee and Keowee) in the Upper Savannah River Basin for the Licensee's operations, while meeting the water resource needs of the public.
3. As of the date of this LIP, only five entities have Large Water Intakes withdrawing water from the Project. GW and Seneca are public water suppliers. The Licensee's Large Water Intake at Oconee Nuclear Station (ONS) is used for thermal power plant cooling. The Reserve at Lake Keowee and The Cliffs Club at Keowee Vineyards, LLC each use Large Water Intakes for irrigation. The Reserve at Lake Keowee and The Cliffs Club at Keowee Vineyards, LLC have easements with clauses permitting the Licensee to require water conservation measures during droughts.
4. Any public water supplier owning a Large Water Intake that intends to locate a new intake, expand an existing intake, or rebuild an existing intake on Lake Keowee will be required to abide by the applicable portions of this LIP, except as provided for in existing agreements (e.g., easements, leases, lake use permits or other written agreements) between the Large Water Intake owner and the Licensee.
5. Nothing in this LIP amends or replaces any other contract or agreement to which the Licensee and/or any other Large Water Intake owner is a party.
6. Revising the LIP – During the term of the New License, the Keowee-Toxaway Drought Management Advisory Group (KT-DMAG) will periodically review and recommend updates to the LIP to ensure continuous improvement of the LIP and its implementation. These evaluations and modifications will be considered at least

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once every ten (10) years during the New License term. Any modifications must be approved by the Licensee and all of the applicable public water suppliers with Large Water Intakes on Project Reservoirs. If such unanimous approval cannot be reached, then the dispute resolution procedures set forth in the RA will apply. Approved modifications will be incorporated through revision of the LIP, and the Licensee will file the revised LIP with the Federal Energy Regulatory Commission (FERC). If any modifications of the LIP require amendment of the New License, the Licensee will: (i) provide notice to all Parties to the RA, pursuant to Section 23.0 of the RA, advising them of the New License amendment and the Licensee's intent to file it with the FERC; (ii) submit a modification request to the South Carolina Department of Health and Environmental Control (SCDHEC) for formal review and approval if required; and (iii) file a license amendment request for FERC approval if required. The filing of a revised LIP by the Licensee will not constitute or require modification of the RA, and any Party to the RA may be involved in the FERC's or SCDHEC's public processes for assessing the revised LIP, but may not oppose any part of a revised LIP that is consistent with the LIP included in the RA.

7. Transitioning to a Lower Critical Reservoir Elevation on Lake Keowee – The Licensee will operate in accordance with the provisions of the LIP, except Lake Keowee's Critical Reservoir Elevation will remain at or above 94.6 ft local datum / 794.6 ft above Mean Sea Level (AMSL) until December 1, 2019, to allow time for ONS to be modified to support its operation at lower Lake Keowee levels. The Licensee may also, in its sole discretion, decide to maintain Lake Keowee's Critical Reservoir Elevation at or above 94.6 ft local datum / 794.6 ft AMSL until both of the following are complete:
 - a. A New License that is consistent with the RA has been issued, the end of all appeals, and all rehearing and administrative challenge periods have closed; and
 - b. The Licensee, the USACE, and the Southeastern Power Administration (SEPA) have signed a New Operating Agreement (NOA) that is not inconsistent with the RA.
8. The following table provides storage volumes at various lake elevations in the Licensee's Reservoirs. Data for the Bad Creek Reservoir are from original licensing data. Data for Lakes Jocassee and Keowee are from a 2010 bathymetric study performed by the Licensee. These data are for planning purposes and not of physical survey quality.

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Reservoir	Elevations (ft local datum / ft AMSL)		Storage Increment (ac-ft)	Storage Increment (%)
	Elevation From	Elevation To		
Bad Creek	100.0 / 2310	-60.0 / 2150	30,229	7
	Total Bad Creek		30,229	
Jocassee	100.0 / 1110	86.0 / 1096	108,738	54
	86.0 / 1096	82.0 / 1092	30,000	
	82.0 / 1092	77.0 / 1087	36,687	
	77.0 / 1087	73.0 / 1083	28,730	
	73.0 / 1083	70.0 / 1080	21,233	
	Total Jocassee		225,387	
Keowee	100.0 / 800.0	96.0 / 796.0	67,636	39
	96.0 / 796.0	95.0 / 795.0	16,249	
	95.0 / 795.0	94.6 / 794.6	6,434	
	94.6 / 794.6	93.0 / 793.0	25,368	
	93.0 / 793.0	92.0 / 792.0	15,565	
	92.0 / 792.0	91.5 / 791.5	7,700	
	91.5 / 791.5	90.0 / 790.0	22,775	
	Total Keowee		161,727	
Total for Licensee's Reservoirs			417,343	100

Definitions

1. **Critical Reservoir Elevation** – Unless otherwise defined herein, the Critical Reservoir Elevation is the level of water in a reservoir (measured by reference to local datum or in ft AMSL) below which any Large Water Intake used for public water supply, industrial water supply, or any regional power plant water supply located on the reservoir will not operate at its Licensee-approved capacity. The Critical Reservoir Elevations are:

Reservoir	Critical Reservoir Elevation (ft local datum / ft AMSL)	Type of Limit
Lake Keowee	90.0 ¹ / 790.0 ¹	Power Production
Lake Jocassee	70.0 / 1080.0	Power Production
Bad Creek	-60.0 / 2150.0	Power Production

Note 1 – This new Critical Reservoir Elevation will become effective December 1, 2019, to allow time for ONS to be modified to support its operation at lower Lake Keowee levels. See Item 7 under Key Facts and Assumptions for guidance prior to converting to this new Critical Reservoir Elevation.

2. **Total Usable Storage** – For the Licensee's Reservoirs (Keowee, Jocassee, and Bad Creek), Total Usable Storage is the sum of the volume of water contained between

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each reservoir's Critical Reservoir Elevation and its Full Pond Elevation, expressed in acre-feet (ac-ft). For the USACE Reservoirs in the Upper Savannah River Basin (Hartwell, Richard B. Russell, and J. Strom Thurmond), Total Usable Storage is the sum of the volume of water contained between each reservoir's bottom-of-power-pool elevation (top of inactive pool) and the guide curve elevation denoting the top of conservation storage for any particular time of year, expressed in ac-ft.

3. Remaining Usable Storage – The sum of the volume of water contained between each reservoir's Critical Reservoir Elevation and the actual reservoir elevation at any given point in time, expressed in ac-ft, for the Licensee's Reservoirs. The Remaining Usable Storage calculation for the Licensee's Reservoirs is based on a maximum drawdown elevation of 90 ft local datum / 790 ft AMSL for Lake Keowee, a maximum drawdown elevation of 70 ft local datum / 1080 ft AMSL for Lake Jocassee, and a maximum drawdown elevation of -60 ft local datum / 2150 ft AMSL for the Bad Creek Reservoir. For the USACE Reservoirs in the Upper Savannah River Basin (Hartwell, Richard B. Russell, and J. Strom Thurmond), Remaining Usable Storage is the sum of the volume of water contained between each reservoir's bottom-of-power-pool elevation (top of inactive pool) and the actual elevation, expressed in ac-ft.
4. Storage Index – The ratio, expressed in percent, of Remaining Usable Storage to Total Usable Storage at any given point in time.
5. Large Water Intake – Any water intake (e.g., public water supply, industrial, agricultural, power plant, irrigation, etc.) having a maximum instantaneous capacity greater than or equal to one million gallons per day (MGD).
6. Keowee-Toxaway Drought Management Advisory Group (KT-DMAG) – The KT-DMAG is a voluntary advisory group to be formed and tasked with working with the Licensee when the LIP is initiated. This KT-DMAG will also meet as necessary to foster a basin-wide response to a Low Inflow Condition (see Specific Actions at Each LIP Stage). The KT-DMAG will consist of a representative from each of the following organizations that decides to form or join the KT-DMAG. By agreeing to form or join the KT-DMAG, each Member agrees to comply with all applicable requirements of this LIP. Each KT-DMAG Member may have a primary representative and an alternate representative, who may act in the absence of the primary representative.
 - a. SC Department of Natural Resources (SCDNR);
 - b. SCDHEC;
 - c. US Geological Survey (USGS);
 - d. USACE;
 - e. Each owner of a Large Water Intake used for municipal, industrial, or power plant water supply located on the Project Reservoirs;
 - f. Each owner of a Large Water Intake used for municipal, industrial, or power plant water supply located on any tributary stream within the Keowee-Toxaway River Basin that ultimately drains to Lake Keowee and that agrees to coordinate its drought planning and management under the KT-DMAG;
 - g. Each owner of a Large Water Intake used for municipal, industrial, or power plant water supply located on the USACE Reservoirs that agrees to coordinate its drought planning and management under the KT-DMAG; and
 - h. Licensee (KT-DMAG Coordinator).

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Members of the KT-DMAG will adopt a Charter to guide the operation of the KT-DMAG, as set forth in part below, and said Charter will require KT-DMAG Members to comply with the applicable requirements of this LIP. The KT-DMAG will meet at least annually (typically during the month of June), beginning in 2014 and continuing throughout the term of the New License, regardless of the Low Inflow Condition status, to review prior year activities, discuss data input from public water suppliers that are Large Water Intake owners, and discuss other issues relevant to the LIP. The Licensee will lead the formation of the KT-DMAG, will call meetings and set agendas, and will maintain an active roster of the KT-DMAG and update the roster as needed. The Licensee will prepare meeting summaries of all KT-DMAG meetings, make these meeting summaries available to the public by posting on its website, and notify Parties to the RA without specific responsibilities under the LIP of the availability of information on the current LIP status and possible actions.

Basic Responsibilities

Licensee's Responsibilities

The Licensee accepts the following basic responsibilities in furtherance of this LIP.

1. Monitor the following drought triggers and relevant data at least monthly or as specified for each LIP Stage.
 - Remaining Usable Storage in the Licensee's Reservoirs
 - Composite average of selected USGS streamflow gages (Twelvemile Creek near Liberty, SC (USGS Gage # 02186000); Chattooga River near Clayton, GA (USGS Gage # 02177000); French Broad River near Rosman, NC (USGS Gage # 03439000))
 - U.S. Drought Monitor for the Upper Savannah River Basin (i.e., from Thurmond Dam upstream)
 - Composite average of the Licensee's rainfall gauge readings at the Jocassee Pumped Storage Station, Keowee Hydro Station, and the Bad Creek Project
 - Oconee County USGS groundwater gage (USGS Gage # 345051083041800 OC-233) (Note: Data from other groundwater gages can be added in the future if beneficial.)
 - Remaining Usable Storage in the USACE Reservoirs downstream
 - USACE Savannah River Basin drought status
2. Coordinate KT-DMAG meetings including those noted for the particular drought stage. Provide to the KT-DMAG trigger updates, composite rainfall gauge readings, and operational and meteorological projections. Meetings can be in person, telephonic or by use of other appropriate communications. In consultation with KT-DMAG members, select and publicly communicate the LIP Stage based on the triggers established in this LIP.
3. Provide to the KT-DMAG the estimated water consumption rate by ONS (average for the current month and projections for the next month) and the estimated natural evaporation rate by reservoir from the Licensee's Reservoirs for the current month and projections for the next month.

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4. Quantify total weekly flow releases (hydro generation, flood gate releases, hydro unit leakage, and dam seepage) made from the Keowee Development for the previous four weeks and provide to the KT-DMAG.
5. Coordinate with the USACE to make flow releases from Lake Keowee in accordance with the NOA between the Licensee, USACE, and SEPA regarding flow releases from the Keowee Development into the USACE's Hartwell Project and this LIP.
6. Depending on the LIP Stage, request voluntary or require mandatory water use restrictions for withdrawing water from the Licensee's Reservoirs to irrigate lakeside properties.
7. When operating in the LIP near Stage Minimum Elevations, except for flow releases required for ONS operations or situations covered by the Maintenance and Emergency Protocol (MEP), the Licensee will not make an intentional flow release from Keowee Dam if that flow release would reduce the level of Lake Jocassee or Lake Keowee below its Stage Minimum Elevation as specified for the applicable LIP stage.
8. When operating in the LIP, the Licensee will limit weekly flow releases from the Keowee Dam to no more than the maximum weekly flow release for the applicable LIP Stage except for flow releases required for ONS operations or situations covered in the MEP. The weekly flow release amount includes the sum of all water released downstream from the Keowee Dam (i.e., hydro unit generation plus hydro unit leakage plus dam seepage plus any flood gate releases).
9. Stage Minimum Elevations are defined for each Stage of the LIP. When a subsequent Stage of the LIP is reached, the Licensee agrees both Project Reservoirs must be within 0.25 ft of the Stage Minimum Elevation of the previous Stage of the LIP before each reservoir can be lowered to the next Stage Minimum Elevation.

Responsibilities of Large Water Intake Owners that are Public Water Suppliers

Large Water Intake owners that are public water suppliers withdrawing water from the Licensee's Reservoirs agree to the following basic responsibilities in furtherance of this LIP.

1. Provide to the Licensee current month and projections for next month's water use from the Licensee's Reservoirs and from any alternative water supply sources.
2. Provide to the Licensee an overview of system conditions related to water use from the Licensee's Reservoirs (i.e., leaks, status of alternative water sources, new or potential large water users, etc.).
3. Request or require water use restrictions from water customers and/or make greater use of alternative water sources for the purpose of reducing water withdrawals from the Licensee's Reservoirs below what those withdrawals would have been otherwise, consistent with best practices and operating principles for those Large Water Intake owners' systems in accordance with the specific actions listed in this document at each LIP stage.

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LIP Stage Triggers

For the purposes of this LIP, the following triggers will define the LIP Stage.

Stage 0 (Low Inflow Watch) Drought Trigger Levels

1. Storage Index in USACE Reservoirs and Storage Index in the Licensee's Reservoirs are both less than 90% (using the Critical Reservoir Elevations defined above); and
2. One of the following triggers:
 - a. Twelve-week average of the area-weighted U.S. Drought Monitor for Upper Savannah River Basin (Thurmond Dam and upstream) is greater than or equal to 0; or
 - b. Streamflow based on composite average of selected USGS streamflow gages (Twelvemile Creek near Liberty, SC; Chattooga River near Clayton, GA; and French Broad River near Rosman, NC) is less than 85% of long-term average for the previous four months.

Stage 1 Drought Trigger Levels

1. USACE implements Level 1 of its existing Drought Contingency Plan (DCP); and
2. One of the following triggers:
 - a. Twelve-week average of the area-weighted U.S. Drought Monitor for Upper Savannah River Basin (Thurmond Dam and upstream) is greater than or equal to 1; or
 - b. Streamflow based on composite average of selected USGS streamflow gages (Twelvemile Creek near Liberty, SC; Chattooga River near Clayton, GA; and French Broad River near Rosman, NC) is less than 75% of long-term average for the previous four months.

Stage 2 Drought Trigger Levels

1. USACE implements Level 2 of its existing DCP; and
2. One of the following triggers:
 - a. Twelve-week average of the area-weighted U.S. Drought Monitor for Upper Savannah River Basin (Thurmond Dam and upstream) is greater than or equal to 2; or
 - b. Streamflow based on composite average of selected USGS streamflow gages (Twelvemile Creek near Liberty, SC; Chattooga River near Clayton, GA; and French Broad River near Rosman, NC) is less than 65% of long-term average for the previous four months.

Stage 3 Drought Trigger Levels

1. USACE implements Level 3 of its existing DCP; and
2. One of the following triggers:
 - a. Twelve-week average of the area-weighted U.S. Drought Monitor for Upper Savannah River Basin (Thurmond Dam and upstream) is greater than or equal to 3; or

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- b. Streamflow based on composite average of selected USGS streamflow gages (Twelvemile Creek near Liberty, SC; Chattooga River near Clayton, GA; and French Broad River near Rosman, NC) is less than 55% of long-term average for the previous four months.

Stage 4 Drought Trigger Levels

1. Storage Index in the Licensee's Reservoirs is less than 25%; and
2. One of the following triggers:
 - a. Twelve-week average of the area-weighted U.S. Drought Monitor for Upper Savannah River Basin (Thurmond Dam and upstream) is equal to 4; or
 - b. Streamflow based on composite average of selected USGS streamflow gages (Twelvemile Creek near Liberty, SC; Chattooga River near Clayton, GA; and French Broad River near Rosman, NC) is less than 40% of long-term average for the previous four months.

Specific Actions at Each LIP Stage

Stage 0

The Licensee will:

1. Notify the KT-DMAG members and the South Carolina Department of Parks, Recreation and Tourism (SCDPRT) that LIP Stage 0 has been reached;
2. Initiate drought meetings (typically monthly) among the KT-DMAG members and any other interested water system managers;
3. Provide detailed updates to the KT-DMAG on drought triggers and other relevant data, as noted in the Basic Responsibilities section;
4. Provide data to the KT-DMAG on the amount of water released from Lake Keowee for the previous four weeks;
5. Provide flow releases from Keowee Dam in accordance with the following limitations:
 - a. When the Storage Index for the Licensee's Reservoirs is below 90% but greater than or equal to 85%, limit the total maximum weekly flow release (i.e., hydro unit flow releases, flood gate flow releases, hydro unit leakage, and dam seepage) to 25,000 ac-ft (1800 cfs on a weekly average basis) or a lesser amount if required to avoid driving the level of Lake Jocassee or Lake Keowee below its Normal Minimum Elevation except flow releases required for ONS operations or situations covered by the MEP;
 - b. When the Storage Index for the Licensee's Reservoirs is below 85% but greater than or equal to 80%, limit the total maximum weekly flow release (i.e., hydro unit flow releases, flood gate flow releases, hydro unit leakage, and dam seepage) to 20,000 ac-ft (1440 cfs on a weekly average basis) or a lesser amount if required to avoid driving the level of Lake Jocassee or Lake Keowee below its Normal Minimum Elevation except flow releases required for ONS operations or situations covered by the MEP; and
6. Provide the drought stage and other relevant information on the Licensee's lake information website and toll-free telephone system.

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Large Water Intake owners that are public water suppliers will provide detailed updates to the Licensee on relevant data as noted in the Basic Responsibilities section.

Stage 1

The Licensee will:

1. Notify the FERC, KT-DMAG members and the SCDPRT that LIP Stage 1 has been reached;
2. Coordinate drought meetings (typically monthly) among the KT-DMAG members and any other interested water system managers;
3. Continue to provide detailed updates on drought triggers and other relevant data to the KT-DMAG, as noted in the Basic Responsibilities section;
4. Provide data to the KT-DMAG on the amount of water released from Lake Keowee for the previous four weeks;
5. Request those lake neighbors withdrawing water from the Licensee's Reservoirs for irrigating lakeside residential properties voluntarily limit their withdrawals to no more than two days per week, with the days to be specified by the Licensee;
6. Reduce the Minimum Elevation for Lake Keowee to 95.0 ft local datum / 795.0 ft AMSL (Stage 1 Minimum Elevation);
7. Reduce the Minimum Elevation for Lake Jocassee to 82.0 ft local datum / 1092.0 ft AMSL (Stage 1 Minimum Elevation);
8. Limit flow releases from Keowee Dam to a total maximum weekly flow release (i.e., hydro unit flow releases, flood gate flow releases, hydro unit leakage, and dam seepage) of 18,750 ac-ft (1350 cfs on a weekly average basis) or a lesser amount if required to avoid driving the level of Lake Jocassee or Lake Keowee below its Stage 1 Minimum Elevation except flow releases required for ONS operations or situations covered by the MEP; and
9. Provide the drought stage and other relevant information on the Licensee's lake information website and toll-free telephone system.

Large Water Intake owners that are public water suppliers will:

1. Notify their water customers of the Low Inflow Condition through public outreach and communication;
2. Reduce water withdrawals from Lake Keowee, as a goal, by 3-5% (or more) from the withdrawal amounts otherwise expected; and
3. Provide detailed updates on relevant data to the Licensee as noted in the Basic Responsibilities section.

Stage 2

The Licensee will:

1. Notify the FERC, KT-DMAG members and the SCDPRT that LIP Stage 2 has been reached;
2. Coordinate drought meetings (typically bi-weekly) among the KT-DMAG members and any other interested water system managers;

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3. Continue to provide detailed updates on drought triggers and other relevant data to the KT-DMAG, as noted in the Basic Responsibilities section;
4. Provide data to the KT-DMAG on the amount of water released from Lake Keowee for the previous two weeks;
5. Require those lake neighbors withdrawing water from the Licensee's Reservoirs for irrigating lakeside residential properties to limit their withdrawals to no more than two days per week, with the days to be specified by the Licensee;
6. Reduce the Minimum Elevation for Lake Keowee to 93 ft local datum / 793.0 ft AMSL (Stage 2 Minimum Elevation), but no lower than the appropriate Critical Reservoir Elevation;
7. Reduce the Minimum Elevation for Lake Jocassee to 77.0 ft local datum / 1087.0 ft AMSL (Stage 2 Minimum Elevation);
8. Limit flow releases from Keowee Dam to a total maximum weekly flow release (i.e., hydro unit flow releases, flood gate flow releases, hydro unit leakage, and dam seepage) of 15,000 ac-ft (1080 cfs on a weekly average basis) or a lesser amount if required to avoid driving the level of Lake Jocassee or Lake Keowee below its Stage 2 Minimum Elevation except flow releases required for ONS operations or situations covered by the MEP; and
9. Provide the drought stage and other relevant information on the Licensee's lake information website and toll-free telephone system.

Large Water Intake owners that are public water suppliers will:

1. Notify their water customers of the Low Inflow Condition through public outreach and communication with emphasis on the need to conserve water;
2. Reduce water withdrawals from Lake Keowee, as a goal, by 5-10% (or more) from the withdrawal amounts otherwise expected; and
3. Provide detailed updates on relevant data to the Licensee as noted in the Basic Responsibilities section.

Stage 3

The Licensee will:

1. Notify the FERC, KT-DMAG members and the SCDPRT that LIP Stage 3 has been reached;
2. Coordinate drought meetings (typically bi-weekly) among the KT-DMAG members and any other interested water system managers;
3. Continue to provide detailed updates on drought triggers and other relevant data to the KT-DMAG, as noted in the Basic Responsibilities section;
4. Provide data to the KT-DMAG on the amount of water released from Lake Keowee for the previous two weeks;
5. Require those lake neighbors withdrawing water from the Licensee's Reservoirs for irrigating lakeside residential properties to limit their withdrawals to no more than one day per week, with the day to be specified by the Licensee;

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6. Reduce the Minimum Elevation for Lake Keowee to 92.0 ft local datum / 792.0 ft AMSL (Stage 3 Minimum Elevation), but no lower than the appropriate Critical Reservoir Elevation;
7. Reduce the Minimum Elevation for Lake Jocassee to 73.0 ft local datum / 1083.0 ft AMSL (Stage 3 Minimum Elevation);
8. Limit flow releases from Keowee Dam to a total maximum weekly flow release (i.e., hydro unit flow releases, flood gate flow releases, hydro unit leakage, and dam seepage) of 10,000 ac-ft (720 cfs on a weekly average basis) or a lesser amount if required to avoid driving the level of Lake Jocassee or Lake Keowee below its Stage 3 Minimum Elevation except flow releases required for ONS operations or situations covered by the MEP; and
9. Provide the drought stage and other relevant information on the Licensee's lake information website and toll-free telephone system.

Large Water Intake owners that are public water suppliers will:

1. Notify their water customers of the Low Inflow Condition through public outreach and communication with increased emphasis on the need to conserve water;
2. Reduce water withdrawals from Lake Keowee, as a goal, by 10-20% (or more) from the withdrawal amounts otherwise expected; and
3. Provide detailed updates on relevant data to the Licensee as noted in the Basic Responsibilities section.

Stage 4

The Licensee will:

1. Notify the FERC, KT-DMAG members and the SCDPRT that LIP Stage 4 has been reached;
2. Coordinate bi-weekly (or more frequently if needed) drought meetings among KT-DMAG members and any other interested water system managers;
3. Continue to provide detailed updates on drought triggers and other relevant data to the KT-DMAG, as noted in the Basic Responsibilities section;
4. Provide data to the KT-DMAG on the amount of water released from Lake Keowee for the previous two weeks;
5. Require those lake neighbors withdrawing water from the Licensee's Reservoirs for irrigating lakeside residential properties to cease all such withdrawals;
6. Reduce the Minimum Elevation for Lake Keowee to 90.0 ft local datum / 790.0 ft AMSL (Stage 4 Minimum Elevation), but no lower than the appropriate Critical Reservoir Elevation;
7. Reduce the Minimum Elevation for Lake Jocassee to 70.0 ft local datum / 1080.0 ft AMSL (Stage 4 Minimum Elevation);
8. Limit flow releases from Keowee Dam to the following:
 - a. When the Storage Index for the Licensee's Reservoirs is below 25% but greater than 12%, except for flow releases required by the FERC, for ONS operations, or situations covered by the MEP, limit the total maximum weekly flow release (i.e.,

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- hydro unit flow releases, flood gate flow releases, hydro unit leakage, and dam seepage) to 7,500 ac-ft (540 cfs on a weekly average basis) or a lesser amount if required to avoid driving the level of Lake Jocassee below its Stage 4 Minimum Elevation and to maintain the level of Lake Keowee at or above 91.5 ft local datum / 791.5 ft AMSL or its Critical Reservoir Elevation, whichever is higher;
- b. When the Storage Index for the Licensee's Reservoirs is at or below 12%, cease making hydro unit and floodgate flow releases, except for flow releases required by the FERC, for ONS operations, or situations covered by the MEP.
9. Provide the drought stage and other relevant information on the Licensee's lake information website and toll-free telephone system.

Large Water Intake owners that are public water suppliers will:

1. Notify their water customers of the Low Inflow Condition through public outreach and communication with increased emphasis on the need to conserve water;
2. Reduce water withdrawals from Lake Keowee by 20-30% (or more) from the withdrawal amounts otherwise expected; and
3. Provide detailed updates on relevant data to the Licensee as noted in the Basic Responsibilities section.

Recovery from LIP Stages

Recovery under this LIP as conditions improve will be accomplished by reversing the staged approach outlined above, except the only trigger to recover from a stage is for either the storage index for the Licensee's Reservoirs or the USACE drought trigger to be exceeded for the current stage as described below. The following table provides the storage levels required for recovery from a higher numbered "Stage Y" to a lower numbered "Stage X":

Recovery from Stage Y to Stage X	Required Storage
From Stage 4 to Stage 3	Storage Index for the Licensee's Reservoirs is greater than or equal to 25%
From Stage 3 to Stage 2	Storage for the USACE Reservoirs recovers to amount for initial implementation ¹ of Level 2 of its DCP
From Stage 2 to Stage 1	Storage for the USACE Reservoirs recovers to amount for initial implementation ¹ of Level 1 of its DCP
From Stage 1 to Stage 0	Storage for the USACE Reservoirs returns to amount required for Normal operations ¹
From Stage 0 to Normal	Storage Index for the Licensee's Reservoirs is greater than or equal to 90%

Note 1 – These are USACE storage amounts that indicate when the USACE increases its drought level (Normal to 1, 1 to 2 or 2 to 3) which is not the same storage amount that indicates when USACE decreases its drought level (3 to 2, 2 to 1 or 1 to Normal). The USACE requires greater storage amounts when recovering from drought (decreasing drought levels).

APPENDIX E**MAINTENANCE AND EMERGENCY PROTOCOL (MEP) FOR THE KEOWEE-TOXAWAY HYDROELECTRIC PROJECT****Introduction**

Under some emergency, equipment failure, power plant maintenance, and other situations, certain license conditions may be impractical or even impossible to meet and may need to be suspended or modified temporarily to avoid taking unnecessary risks. The objectives of this protocol are to define the most likely situations of this type, identify the potentially impacted license conditions, and outline the general approach the Licensee will take to mitigate the impacts to license conditions and to communicate with the resource agencies and affected parties.

Note: Due to the potential variability of these situations, this protocol is not intended to give an exact step-by-step solution for all situations. It does, however, provide basic expectations for the Licensee's approach to dealing with such situations. Specific details will vary and will be determined on a case-by-case basis as the protocol is implemented.

The Licensee will review the requirements of this protocol each time it is used and may revise the MEP from time to time as noted below.

Key Facts and Definitions

1. Human Health and Safety and the Integrity of the Public Water Supply and Electric Systems – Nothing in this protocol will limit the Licensee's ability to take any and all lawful actions necessary at the Keowee-Toxaway Hydroelectric Project (Project) to protect human health and safety, to protect its equipment from damage, to ensure the stability of the regional electric grid, to protect the equipment of the Large Water Intake owners from damage, and to ensure the stability of public water supply systems; provided that nothing in the Relicensing Agreement ("RA") or MEP obligates the Licensee to take any actions to protect the equipment of Large Water Intake owners from damage or to ensure the stability of public water supply systems. It is recognized the Licensee may provide this protection without prior consultation or notification.
2. Normal Full Pond Elevation – Also referred to simply as "full pond," this is the level of a reservoir corresponding to the point at which water would first begin to spill from the reservoir's dam(s) if the Licensee took no action. This level corresponds to the lowest point along the top of the floodgates for Project Reservoirs (i.e., Lake Jocassee and Lake Keowee). To avoid confusion among the many reservoirs the Licensee operates, it has adopted the practice of referring to the Full Pond Elevation for all of its reservoirs as equal to 100.0 ft relative to local datum. The Full Pond Elevations for the Project Reservoirs are:

Reservoir	Full Pond Elevation	
	Local Datum (ft)	Above Mean Sea Level (ft AMSL)
Lake Jocassee	100.0	1110.0
Lake Keowee	100.0	800.0

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3. **Normal Minimum Elevation** – The level of a reservoir (measured in ft AMSL, or feet relative to the full pond contour with 100.0 ft corresponding to full pond) that defines the bottom of the reservoir's Normal Operating Range for a given day of the year. If inflows and outflows to the reservoir are kept within some reasonable range of the average or expected amounts, hydroelectric project equipment is operating properly, and neither the Low Inflow Protocol (LIP) nor MEP has been implemented, reservoir level excursions below the Normal Minimum Elevation should not occur.
4. **Normal Maximum Elevation** – The level of a reservoir (measured in ft AMSL, or feet relative to the full pond contour with 100.0 ft corresponding to full pond) that defines the top of the reservoir's Normal Operating Range for a given day of the year. If inflows and outflows to the reservoir are kept within some reasonable range of the average or expected amounts, hydroelectric project equipment is operating properly, and neither the LIP nor MEP has been implemented, reservoir level excursions above the Normal Maximum Elevation should not occur.
5. **Normal Operating Range** – The band of reservoir levels within which the Licensee normally attempts to maintain a given reservoir on a given day. Each Project Reservoir has its own specific Normal Operating Range bounded by a Normal Maximum Elevation and a Normal Minimum Elevation. If inflows and outflows to the reservoir are kept within some reasonable range of the average or expected amounts, hydroelectric project equipment is operating properly and neither the LIP nor MEP has been implemented, reservoir level excursions outside of the Normal Operating Range should not occur. The New License for the Project includes the Normal Operating Ranges for the Project Reservoirs (i.e., Normal Minimum, Normal Maximum) as listed in the proposed Reservoir Elevations License Article and as follows.

Reservoir	Normal Maximum Elevation (ft local datum / ft AMSL)	Normal Minimum Elevation (ft local datum / ft AMSL)
Lake Jocassee	100.0 / 1110.0	86.0 / 1096.0
Lake Keowee	100.0 / 800.0	96.0 / 796.0

6. **Returning to Normal** – Some of the situations noted in this MEP can impact the Licensee's ability to operate the Project in the most efficient and safest manner for power production. The Licensee will therefore endeavor in good faith to repair existing Project equipment and facilities and return them to service within a reasonable period of time, commensurate with the severity of the equipment / facility repair requirements. If the Licensee decides that repair is not cost-effective or that hydro station or dam retirement is necessary, the Licensee will notify the Parties to the RA, pursuant to Section 23.0 of the RA and consult with them as well as with the Federal Energy Regulatory Commission (FERC) to determine any necessary modifications of the New License and / or the RA.
7. **Incidental Maintenance** – This is a maintenance activity at the Project works that is very brief in nature or that requires minimal if any deviation from normal license conditions and that does not require deviation from any license conditions related to prescribed flow releases from Project structures, or the Normal Operating Ranges for reservoir levels, or that is less than 72 hours in duration and will not require any excursions below any applicable Critical Reservoir Elevations. Except for the notification steps identified in the tables below for communication with resource agencies and affected parties for conditions

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that impact prescribed flow releases, Incidental Maintenance is exempt from the requirements of this protocol.

8. Notification Guidance

- a. Scheduled Maintenance that Affects License Conditions – Typically, scheduled maintenance is planned in advance. Once a likely maintenance schedule has been established, the Licensee will endeavor in good faith to provide as much advance notice as possible to the affected parties identified in this protocol.
- b. Unscheduled Maintenance and Emergencies that Affect License Conditions – It is not possible for the Licensee to assure any level of advance notice. For these situations, the Licensee will endeavor in good faith to inform the affected parties identified in this protocol within some reasonable amount of time after the situation has been identified.

9. Relationship Between this MEP and the LIP – The LIP provides for reductions in Project water use and modification of the Normal Operating Ranges for reservoir levels when water demands on Project Reservoirs substantially exceed net inflow. Lowered reservoir levels caused by situations addressed under this MEP will not invoke implementation of the LIP. Also, if the LIP has already been implemented at the time this MEP is initiated, the Licensee will typically suspend its implementation of the LIP requirements until the MEP situation has been eliminated. The Licensee may however choose to continue with the LIP.

10. Peak Recreation Period – The period when recreation use on Project Reservoirs is generally at the highest levels (i.e., April 1 through September 30).

11. Critical Reservoir Elevation – Unless otherwise defined herein, the Critical Reservoir Elevation is the level of water in a reservoir (measured by reference to local datum or in ft AMSL) below which any Large Water Intake used for public water supply, industrial water supply, or any regional power plant water supply located on the reservoir will not operate at its Licensee-approved capacity. The Critical Reservoir Elevations are as follows.

Reservoir	Critical Reservoir Elevation (ft local datum / ft AMSL)	Type of Limit
Lake Jocassee	70.0 / 1080.0	Power Production
Lake Keowee	90.0 ¹ / 790.0 ¹	Power Production

Note 1 - This new Critical Reservoir Elevation of 90.0 / 790.0 will become effective December 1, 2019 to allow time for ONS to be modified to support its operation at lower Lake Keowee levels. See Item 12 below for guidance prior to converting to this new Critical Reservoir Elevation.

12. Transitioning to a Lower Critical Reservoir Elevation on Lake Keowee – The Licensee will operate in accordance with the provisions of the MEP, except Lake Keowee's Critical Reservoir Elevation will remain at or above 94.6 ft local datum / 794.6 ft AMSL until December 1, 2019, to allow time for ONS to be modified to support its operation at lower Lake Keowee levels. The Licensee may also, in its sole discretion, decide to maintain Lake Keowee's Critical Reservoir Elevation at or above 94.6 ft local datum / 794.6 ft AMSL until both of the following are complete:
- a. A New License that is consistent with the RA has been issued, the end of all appeals, and all rehearing and administrative challenge periods have closed; and

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- b. The Licensee, the United States Army Corps of Engineers, and the Southeastern Power Administration have signed a New Operating Agreement (NOA) that is not inconsistent with the RA.
13. Abbreviations for Organizational Contacts – Greenville Water (GW); North Carolina State Historic Preservation Office (NCSHPO); Seneca Light and Water (Seneca); South Carolina Department of Natural Resources (SCDNR); South Carolina Department of Health and Environmental Control (SCDHEC); South Carolina State Historic Preservation Office (SCSHPO); United States Fish and Wildlife Service (USFWS); the Eastern Band of Cherokee Indians (EBCI); US Army Corps of Engineers - Savannah District (USACE); South Carolina Department of Parks, Recreation and Tourism (SCDPRT); Friends of Lake Keowee Society (FOLKS), Advocates for Quality Development (AQD), and Mountain Lakes Community Association (MLCA).
 14. Voltage and Capacity Emergencies – The electric transmission system serving the Project area is part of the Licensee's main transmission system. The Licensee's system is connected to other large transmission systems located in the southeast. If the Licensee's system reliability is at risk due to Voltage and Capacity Emergencies, the ability to provide secure and continuous electric service to the Licensee's electric customers becomes compromised. The Licensee continuously monitors the electric transmission system. Therefore, for the purposes of this protocol, a Voltage or Capacity Emergency shall exist when declared by the Licensee.
 15. Large Water Intake – Any water intake (e.g., public water supply, industrial, agricultural, power plant, irrigation, etc.) having a maximum instantaneous capacity greater than or equal to one million gallons per day (MGD).
 16. Preparation for High Inflow Events – With modern forecasting, it is possible to forecast many high inflow events days in advance and to increase hydro generation hours to lower reservoir levels to reduce the potential for spilling and high water. This type of advance action is typically taken from one to five days or more before the expected arrival of the storm. The Normal Operating Ranges of reservoir levels may not allow for this type of reservoir level reduction under anticipated heavy inflow circumstances, and therefore, allowances are made in this MEP to lower reservoir levels below the Normal Minimum Elevations if needed in preparation for such events.
 17. Revising the MEP – The Licensee will review the requirements of this MEP each time it is used and will consult with the organizations listed in Item 13 above if the Licensee determines modifications are warranted. If the MEP is modified, the Licensee will inform the Parties to the RA. If any modifications of the MEP require amendment of the New License, the Licensee will: (i) provide notice to all Parties to the RA, pursuant to Section 23.0 of the RA, advising them of the proposed New License amendment and the Licensee's intent to file it with the FERC; (ii) request the SCDHEC formally review and approve modification of the 401 WQC if required; and (iii) file a license amendment request for FERC approval if required. The filing of a revised MEP by the Licensee will not by itself constitute or require modification of the RA, and any Party to the RA may be involved in the FERC's or SCDHEC's public processes for assessing the revised MEP, but may not oppose any part of a revised MEP that is consistent with the MEP included in the RA.

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Guidance for Responding to MEP Conditions

This section provides guidance for responding to the most likely MEP conditions (see Table 1 below) when this protocol will be enacted. Required flow releases and normal reservoir operating ranges are the license requirements most likely to be affected by MEP conditions.

Table 1: Conditions and Potential Impacts to License Requirements

Condition	Condition Name	Indications
MEP1	Hydro Unit Maintenance	Maintenance will require hydro unit shutdown
MEP2	Dam Safety Emergency	Condition A or B per the Emergency Action Plan (EAP) (i.e., dam failure has occurred, is imminent or a potentially hazardous situation exists) or some other dam safety concern is identified
MEP3	Voltage or Capacity Emergency	Voltage or capacity conditions on the electric grid in the Licensee's system or the larger regional electric grid cause the Licensee's system reliability and safety to be at risk and a voltage or capacity emergency is declared by the Licensee
MEP4	Reservoir Drawdown Below Normal Minimum Elevation due to maintenance, emergency or other reasons (not due to low or high inflow)	The reservoir level is below Normal Minimum Elevation
MEP5	Expected or existing high inflow event	The water level at a reservoir is or is projected to be significantly above or below the Normal Operating Range

Communication with Resource Agencies and Affected Parties

The Licensee will implement the appropriate communications based on the potential license requirements affected by the MEP condition. Communications include the following:

- Notification – The Licensee notifies the organization of the MEP event and the Licensee's planned actions; and
- Consultation – The Licensee notifies the organization of the MEP event and the Licensee's planned actions. The Licensee also requests input from the consulting organizations about options and alternatives to lessen the environmental, cultural, and human impacts of the MEP condition.

Generally, for unplanned and unscheduled MEP conditions, notifications occur as conditions unfold and will be followed by consultation.

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Condition MEP1.1 – Scheduled Hydro Unit Maintenance

Mitigating Actions

1. Scheduling – To the extent practical, the Licensee will avoid scheduling hydro unit maintenance requiring drawdowns of the Project Reservoirs below the Normal Minimum Elevation during the period April 1 to May 15 to protect black bass spawning and to avoid hindering the Licensee’s ability to provide recreation access during the Peak Recreation Period as defined above.
2. Drawing Down the Affected Reservoir –To minimize the impacts to its electric customers, the Licensee may choose to draw down a reservoir using its hydro units to minimize spillage from the dam during maintenance operations. The Licensee may draw down reservoir levels below the Normal Minimum Elevations, but not to levels below the applicable Critical Reservoir Elevations, unless such deeper drawdown is essential for access or safety.

Communication with Resource Agencies and Affected Parties

Condition MEP1.1 – Scheduled Hydro Unit Maintenance		
Notification	Consultation	Comments
FERC	AQD FOLKS Large Water Intake owners SCDHEC SCDNR SCDPRT USACE USFWS	If the maintenance will affect any Normal Operating Range for Project Reservoir levels, provide notification and initiate consultation when maintenance schedules are determined, but at least 30 days prior to beginning any reservoir drawdown or the hydro unit maintenance.
	NCSHPO ¹ SCSHPO EBCI	Consult no less than 30 days prior to the planned activity if required by the Historic Properties Management Plan.
AQD FOLKS MLCA Project Access Area Lessees ²		The Licensee will implement notification procedures for any temporary closures of recreation facility/access areas (e.g., closure due to extended low reservoir levels) in accordance with the Recreation Management Plan.
General Public		When the Licensee determines the response to a MEP condition will potentially impact license conditions, the Licensee will add appropriate messages to its public information Web site and its reservoir level toll-free phone system plus implement other appropriate measures to inform the general public.

Note 1 - If Lake Jocassee is the reservoir being drawn down

Note 2 - If affected by the maintenance

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Condition MEP1.2 – Unscheduled Hydro Unit Maintenance

Mitigating Actions

1. Drawing Down the Affected Reservoir –To minimize the impacts to its electric customers, the Licensee may choose to draw down a reservoir using its hydro units to minimize spillage from the dam during maintenance operations. The Licensee may draw down reservoir levels below the Normal Minimum Elevations, but not to levels below the applicable Critical Reservoir Elevations, unless such deeper drawdown is essential for access or safety.

Communication with Resource Agencies and Affected Parties

Condition MEP1.2 – Unscheduled Hydro Unit Maintenance		
Notification	Consultation	Comments
FERC AQD FOLKS Large Water Intake owners MLCA SCDHEC SCDNR SCDPRT USACE USFWS	AQD FOLKS Large Water Intake owners SCDHEC SCDNR SCDPRT USACE USFWS	If the maintenance will affect any Normal Operating Range for Project Reservoir levels, perform notification promptly after the unscheduled maintenance begins, but no longer than 10 days afterwards. Initiate consultation within 10 days.
NCSHPO ¹ SCSHPO EBCI	NCSHPO ¹ SCSHPO EBCI	Consult if required by the Historic Properties Management Plan.
AQD FOLKS MLCA Project Access Area Lessees ²		The Licensee will implement notification procedures for any temporary closures of recreation facility/access areas (e.g., closure due to extended low reservoir levels) in accordance with the Recreation Management Plan.
General Public		When the Licensee determines the response to a MEP condition will potentially impact license conditions, the Licensee will add appropriate messages to its public information Web site and its reservoir level toll-free phone system and implement other appropriate measures to inform the general public.

Note 1 - If Lake Jocassee is the reservoir being drawn down

Note 2 - If affected by the maintenance

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Condition MEP2 – Dam Safety Emergency

Mitigating Actions

1. Safety Must Come First – If a Condition A or B is declared per the Licensee’s EAP, or if other dam safety concerns arise, the Licensee may modify or suspend any license conditions immediately and for as long as necessary to restore the dam to a safe condition.

Communication with Resource Agencies and Affected Parties

Condition MEP2 – Dam Safety Emergency	
Timing of Communication	Comments
During EAP Condition A or B	Conducted strictly in accordance with the Licensee’s EAP. In cases where dam safety concerns arise that are not a Condition A or B per the Licensee’s EAP, consultation with resource agencies and affected parties will occur as soon as practical after the dam safety concern arises.
Once Dam Safety Conditions Have Stabilized	When the Licensee determines the response to a MEP condition will potentially impact license conditions, the Licensee will add appropriate messages to its public information Web site and its reservoir level toll-free telephone system to inform the general public.
Access Area Closure Notification	The Licensee will implement notification procedures for any temporary closures of recreation facility/access areas (e.g., closure due to extended low reservoir levels) in accordance with the Recreation Management Plan.

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Condition MEP3 – Voltage and Capacity Emergencies

Mitigating Actions

1. Suspension of the Normal Operating Ranges for Reservoir Levels – If a voltage or capacity emergency (as defined above) occurs, the Licensee may modify or suspend reservoir level operating limitations immediately and for as long as necessary, if doing so would allow additional hydro station operation needed to restore the electric grid to a stable condition. Reservoir levels will not be reduced below the applicable Critical Reservoir Elevations.

Communication with Resource Agencies and Affected Parties

Condition MEP3 – Voltage and Capacity Emergencies		
Notification	Consultation	Comments
FERC SCDNR SCDHEC SCDPRT USFWS USACE Large Water Intake owners	Large Water Intake owners SCDHEC SCDNR SCDPRT USACE USFWS	Perform notification as soon as practical, but no longer than 10 days following the deviation from a license condition for Voltage or Capacity Emergency reasons. Initiate consultation as soon as practical.
NCSHPO ¹ SCSHPO EBCI	NCSHPO ¹ SCSHPO EBCI	Consult if required by the Historic Properties Management Plan.
AQD FOLKS MLCA Project Access Area Lessees ²		The Licensee will implement notification procedures for any temporary closures of recreation facility/access areas (e.g., closure due to extended low reservoir levels) in accordance with the Recreation Management Plan.
General Public		When the Licensee determines the response to a MEP condition will potentially impact license conditions, the Licensee will add appropriate messages to its public information Web site and its reservoir level toll-free telephone system plus implement other appropriate measure to inform the general public.

Note 1 - If Lake Jocassee is the reservoir being drawn down

Note 2 - If affected by the maintenance

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Condition MEP4.1 – Reservoir Drawdown (Planned)

Mitigating Actions

1. Scheduling – To the extent practical, the Licensee will avoid scheduling drawdowns of the Project Reservoirs below the Normal Minimum Elevations during the period from April 1 to May 15 to protect black bass spawning and to avoid hindering the Licensee’s ability to provide recreation access during the Peak Recreation Period as defined above.
2. Avoid Falling Below Critical Reservoir Elevations – To the extent practical, the Licensee will avoid falling below the applicable Critical Reservoir Elevations as noted above.

Communication with Resource Agencies and Affected Parties

Condition MEP4.1 – Reservoir Drawdown (Planned)		
Notification	Consultation	Comments
FERC AQD FOLKS Large Water Intake owners SCDHEC SCDNR SCDPRT USACE USFWS	Large Water Intake owners SCDHEC SCDNR SCDPRT USACE USFWS	Provide notification and consult when approximate drawdown dates are determined, but at least 30 days prior to beginning drawdown.
	NCSHPO ¹ SCSHPO EBCI	Consult no less than 30 days prior to the planned activity if required by the Historic Properties Management Plan.
MLCA Project Access Area Lessees ²		The Licensee will implement notification procedures for any temporary closures of recreation facility/access areas (e.g., closure due to extended low reservoir levels) in accordance with the Recreation Management Plan.
General Public		When the Licensee determines the response to a MEP condition will potentially impact license conditions, the Licensee will add appropriate messages to its public information Web site and its reservoir level toll-free telephone system implement other appropriate measures to inform the general public.

Note 1 - If Lake Jocassee is the reservoir being drawn down

Note 2 - If affected by the maintenance

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Condition MEP4.2 – Reservoir Drawdown (Unplanned)

Mitigating Actions

1. Avoid Falling Below Critical Reservoir Elevations – To the extent practical, the Licensee will avoid falling below the applicable Critical Reservoir Elevations as noted above.

Communication with Resource Agencies and Affected Parties

Condition MEP4.2 – Reservoir Drawdown (Unplanned)		
Notification	Consultation	Comments
FERC AQD FOLKS Large Water Intake owners SCDHEC SCDNR SCDPRT USACE USFWS	Large Water Intake owners SCDHEC SCDNR SCDPRT USACE USFWS	Perform notification as soon as practical, but no longer than 10 days after the drawdown begins. Begin consultation within 10 days after the drawdown begins.
NCSHPO ¹ SCSHPO EBCI	NCSHPO ¹ SCSHPO EBCI	Consult if required by the Historic Properties Management Plan.
MLCA Project Access Area Lessees ²		The Licensee will implement notification procedures for any temporary closures of recreation facility/access areas (e.g., closure due to extended low reservoir levels) in accordance with the Recreation Management Plan.
General Public		When the Licensee determines the response to a MEP condition will potentially impact license conditions, the Licensee will add appropriate messages to its public information Web site and its reservoir level toll-free telephone system and to implement other appropriate measures to inform the general public.

Note 1 - If Lake Jocassee is the reservoir being drawn down

Note 2 - If affected by the maintenance drawdown

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Condition MEP5 – Expected or Existing High Inflow Event

Mitigating Actions

- As outlined in the Key Facts and Definitions section of this protocol, in preparation for high inflow events and to minimize the potential for unplanned spillage the Licensee may reduce reservoir levels below the Normal Minimum Elevation, but not below the applicable Critical Reservoir Elevations. Reservoir levels may also rise significantly above Normal Maximum Elevations as a result of high inflow events. The reservoir levels may be below Normal Minimum Elevations or above Normal Maximum Elevations for as long as necessary to minimize the effects of the high inflow event on the Project Reservoirs and downstream reservoirs and to manage reservoir elevations during high inflow events.

Communication with Resource Agencies and Affected Parties

Condition MEP5 – Expected or Existing High Inflow Event	
Notification	Comments
FERC SCDHEC SCDNR SCDPRT USACE USFWS	The Licensee will perform notification as soon as practical following or prior to a deviation from license requirements for an existing or expected high inflow event.
AQD FOLKS MLCA Project Access Area Lessees	The Licensee will implement notification procedures for any temporary closures of recreation facility/access areas (e.g., closure due to extended low or high reservoir levels) in accordance with the Recreation Management Plan.
General Public	When the Licensee determines the response to a MEP condition will potentially impact license conditions, the Licensee will add appropriate messages to its public information Web site and its reservoir level toll-free phone system plus implement other appropriate measure to inform the general public.

APPENDIX F MAPS

Figure F-1 Property Map

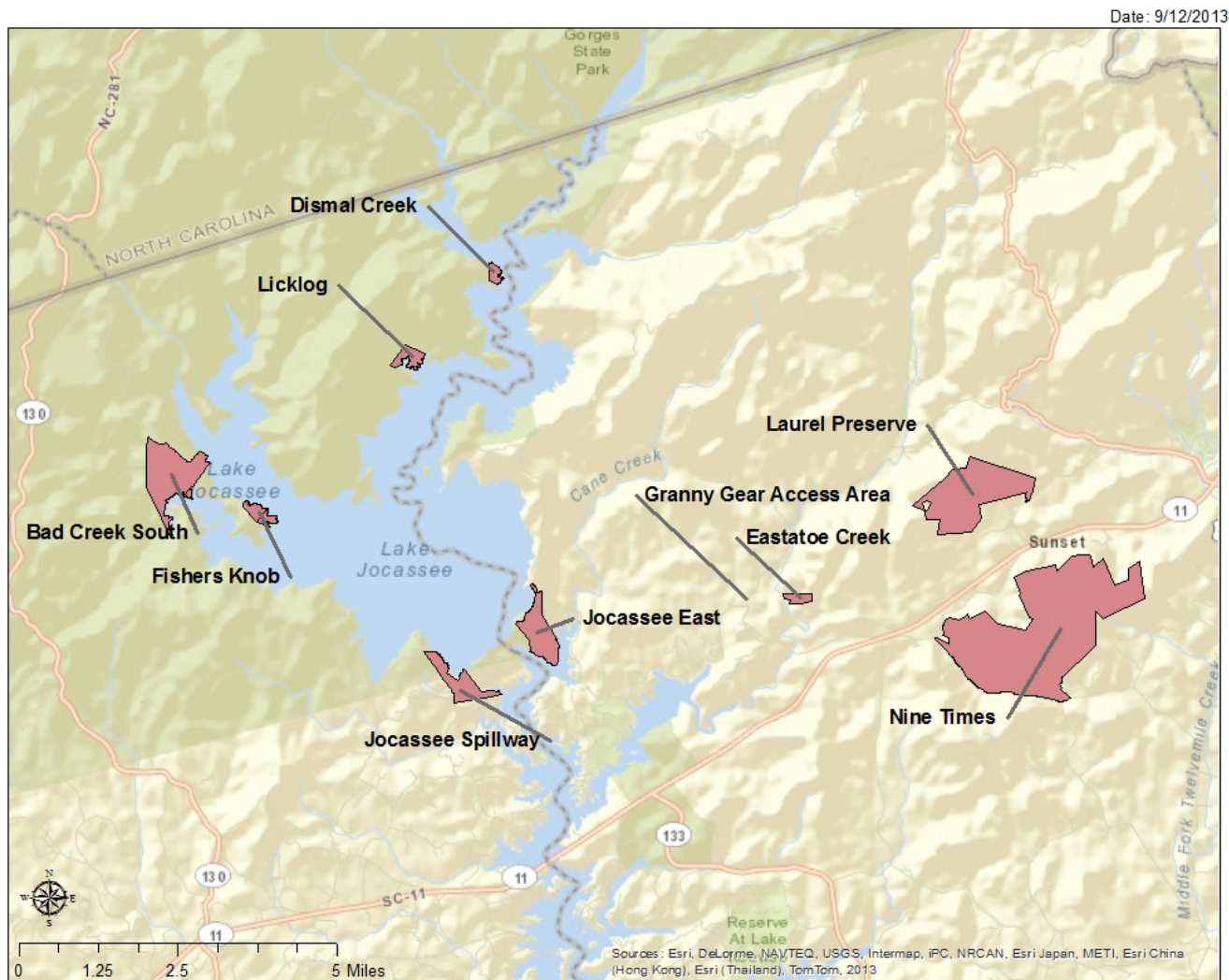


Figure F-2 Lake Keowee (north)

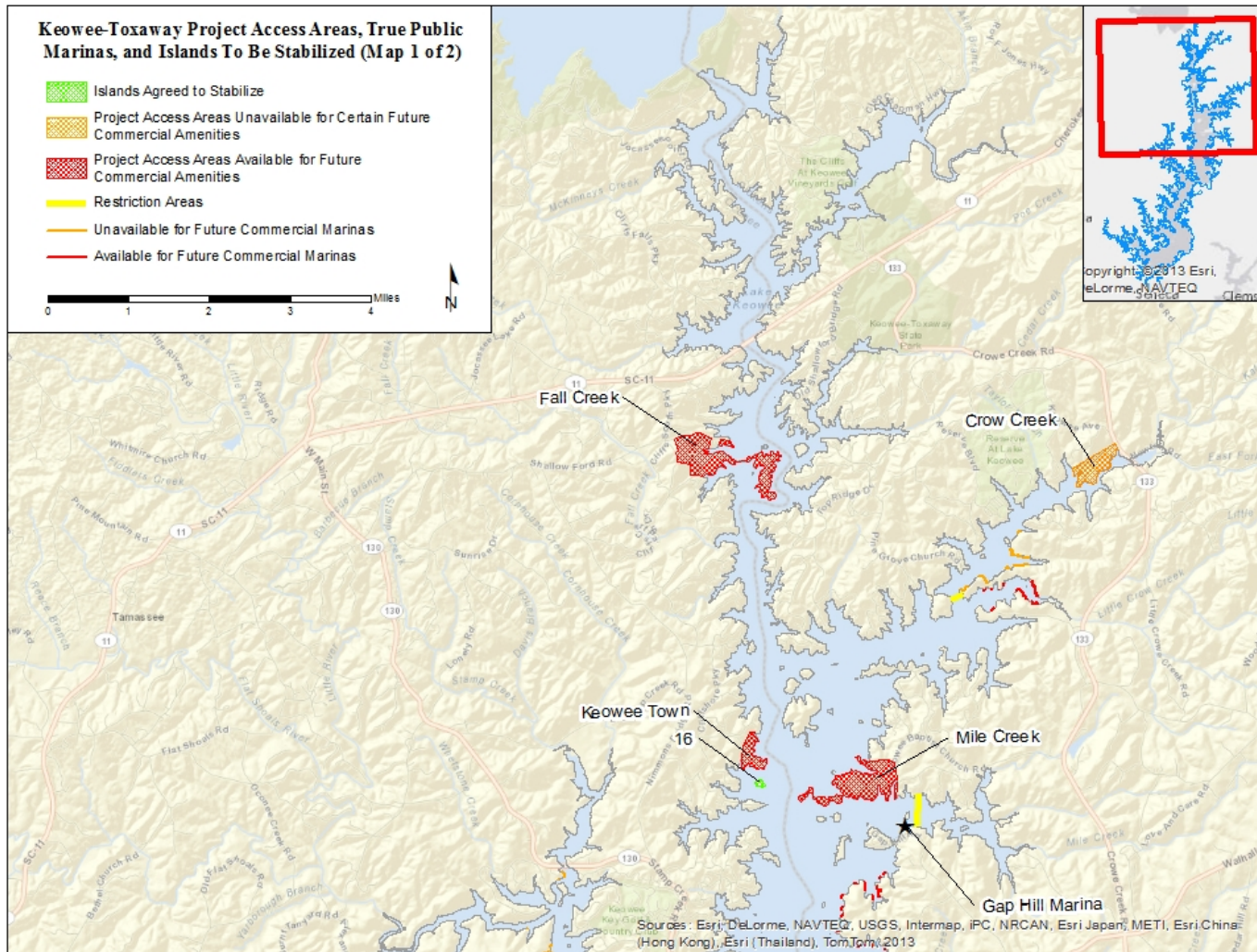
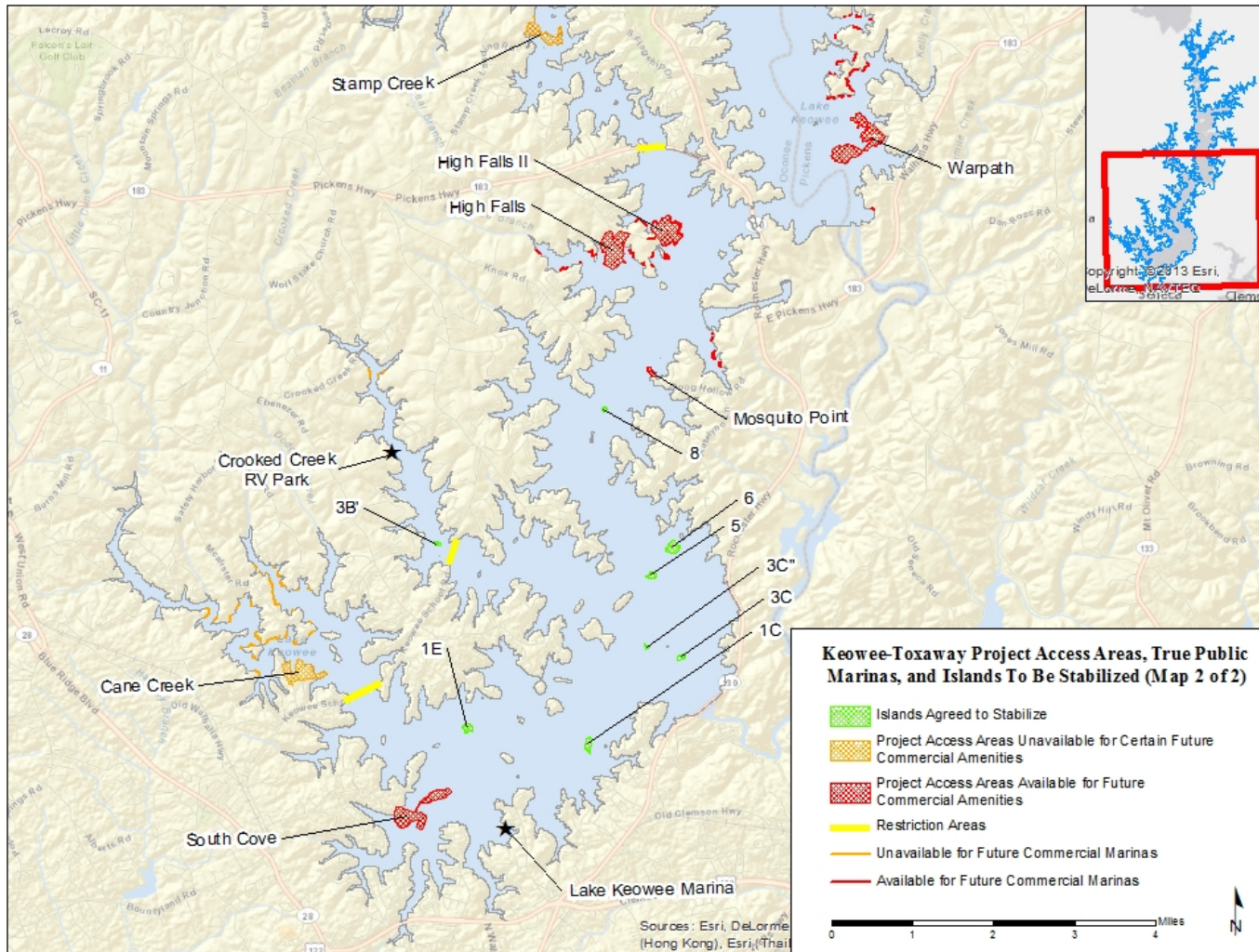


Figure F-3 Lake Keowee (south)



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APPENDIX G

PROCEDURE TO ALLOW DOCKS TO FOLLOW THE WATER

Purpose

Dock owners, including owners of commercial and residential marinas and public recreation facilities, may “follow the water” in an effort to maintain usability of their boats or docks during LIP Stages 2, 3, or 4. The requirements stated below apply to following the water.

Procedure

1. The Licensee shall work with the SCDHEC and the USACE to obtain revised General Permits for construction in navigable waters, to allow following the water on Lake Jocassee and Lake Keowee. The Parties acknowledge the Licensee may not allow following the water prior to issuance of said General Permits.
2. Following the water is authorized upon the Licensee’s public declaration of LIP Stage 2, 3 or 4. Following the water is no longer allowed once the Licensee publicly declares LIP Stage 1, 0 or Normal.
3. Dock owners shall return their boats or docks to their permitted locations and orientations and remove all temporary anchor pins within 14 calendar days following the Licensee’s public declaration of returning to LIP Stage 1, 0, or Normal.
4. During periods where following the water has been authorized, the Licensee may waive strict application of the then-current SMG requirements that would conflict with following the water (e.g., maximum distance from shoreline, one-third of the cove width, projection of property lines, maximum number of boats moored, etc.).
5. The Licensee reserves the right to require boat and dock owners to immediately restore their boats and docks to their original permitted locations if the owner is not meeting one or more of the requirements for following the water in this Appendix G or one or more of the then-current SMG requirements not waived by the Licensee.
6. Following the water shall not prevent or block access to existing docks or coves or negatively impact shoreline classified as Environmental or Natural under the Licensee’s SMP.
7. Dock owners choosing not to move their docks may moor their boats at docks belonging to other property owners during periods when following the water is allowed if prior permission is obtained from the property owner.
8. The temporary relocation of boats or docks and temporary anchoring of these facilities must not create public safety hazards, navigational hazards, or other issues.
9. No electricity-carrying lines coming from the shoreline can be connected to docks while they are following the water.
10. The Licensee shall not require a lake use permit application or charge any lake use permit-related fees to dock owners to follow the water or to make minor modifications to the docks that would facilitate moving them closer to the water

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(e.g., adding wheels or sleds to gangways, or the like), provided the modification does not result in increased square footage for the dock.

11. The Licensee shall provide information and best-management suggestions for following the water on its website and direct callers to its recorded telephone message line to access the website for such suggestions.

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APPENDIX H

HABITAT ENHANCEMENT PROGRAM (HEP) FOR THE KEOWEE-TOXAWAY HYDROELECTRIC PROJECT

Purpose

The purpose of the HEP is to create, enhance, and protect aquatic and wildlife habitat within the Project Boundaries, including Keowee-Toxaway Hydroelectric Project (Project) Reservoirs and islands, plus any part of the watershed draining into Project Reservoirs by encouraging, reviewing, evaluating, and funding proposals to accomplish this purpose.

HEP Administration

The HEP will be administered in accordance with a Charter that will be developed by the Licensee in cooperation with other interested Parties to the Relicensing Agreement (RA) no later than the SMP Effective Date (defined in Section 7.3 of the RA). Charter development will begin no later than May 1, 2014. The Charter will include the following elements.

- Establishment of a Proposal Review Committee (PRC) – The PRC will consist of at least five voting members with knowledge of habitat issues representing Parties to the RA and one Licensee non-voting member to act as a facilitator. The PRC will be established and functioning prior to the distribution of any HEP funds.
- HEP Proposal Evaluation Schedules – Proposals requesting HEP funds may be submitted to the Licensee between May 1 and July 31 of each year beginning in 2015. In August of the same year, the Licensee will forward all proposals to the PRC for evaluation and funding recommendations. Funding for successful proposals will be awarded in October of the same year.
- HEP Proposal Evaluation – The PRC will establish an approach for evaluating and ranking proposals based on their potential to create, enhance, or protect aquatic and wildlife habitat. The PRC will have the flexibility to identify priority areas for funding plus specific criteria and other mechanisms for evaluating proposals. Proposals with cost sharing and/or in-kind support will be favored.
- HEP Proposal Recommendations – The PRC will review and evaluate all HEP proposals and recommend to the Licensee those worthy of funding. All PRC decisions will be by simple majority vote.
- Funding Decisions – The Licensee will determine final funding decisions for HEP proposals after considering PRC recommendations. It is the Licensee's intent to approve all PRC-recommended proposals and the Licensee will review reasons for not accepting a recommended proposal with the PRC.
- Periodic HEP Fee Evaluations – The PRC will evaluate the HEP fee schedule in conjunction with each SMP update to determine if the HEP fees should be changed. The Licensee will determine final HEP fee changes after considering the PRC's recommendations. It is the Licensee's expectation that it will approve all PRC-recommended HEP fees, and the Licensee will consult with the PRC before rejecting PRC recommended HEP fee changes. Such changes will not constitute or require a modification of the RA. Any Party to the RA may be involved in any Federal Energy Regulatory Commission (FERC) public process for assessing any HEP fee changes, but

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may not oppose any part of a revised HEP fee schedule that is consistent with the HEP included in the RA.

- **Licensee's HEP and PRC Responsibilities** – The Licensee will be responsible for collecting fees, selecting PRC meeting dates, providing PRC meeting agendas, providing proposal copies to all PRC members in advance of the PRC meeting, producing PRC meeting summaries, requesting dispersal of HEP funds from the fund manager (see below), and collecting and distributing annual reports for funded projects.

HEP Funding

To help establish the HEP, the Licensee will provide start-up funding which will be supplemented by fees assessed to anyone applying for lake use permits within the Project as outlined below.

Table 1 – Applicable Fee Payments Into HEP

Permit Type ¹	HEP Fee ²
Commercial marina (except True Public Marina)	\$500 per slip
True Public Marina	\$500 per slip – first 100 slips \$250 per slip – all other slips
Private residential dock ³	\$500
Private residential marina	\$500 per slip
Shoreline stabilization except for bioengineering stabilization	\$500
Bioengineering shoreline stabilization ⁴	no HEP fee
Conveyances	\$5,000
Line crossings	\$500
Private excavations	\$500
All other excavations	\$5,000

¹ For combined permits, the highest listed fee will be required. For example, if a lake neighbor submits a combined application to the Licensee for a private dock and shoreline stabilization with rip-rap, the HEP fee would be \$500.

² Fee is only for the HEP and is in addition to any permit application fee, user fee, etc.

³ Including dock expansions and other alterations requiring a permit under the SMP.

⁴ HEP fees will be waived only for dock modifications needed to reach deeper water during the window of opportunity (see Section 7.5.2) and bioengineering shoreline stabilization defined in the SMG in effect at the time of proposal implementation and including techniques such as live staking, live fascines, brush mattresses, and reed clumps. HEP fees will also be waived for stabilization using coconut fiber rolls, hay bales, or spot rocks used to reduce wave energy

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until vegetation is established. Enhanced rip-rap and crib walls will not qualify for a HEP fee waiver.

HEP fee collection as identified in Table 1 will begin on the SMP Effective Date. Initiating this program prior to the issuance of the New License will accelerate habitat improvements beneficial to the Project area.

All HEP fees will be collected by the Licensee at the time a final lake use permit request is submitted to the Licensee for evaluation. A separate check made payable to the KT HEP Fund must be received by the Licensee prior to processing any applicable final lake use permit request. If the permit is not approved for any reason, the HEP fee will be refunded to the permit requester.

Complete permit applications post-marked to the Licensee after the SMP Effective Date will be subjected to the applicable HEP Fee, including all marina facility and conveyance applications that have not been approved in writing or filed with the FERC, if applicable. Other than fees listed in Table 1 and the Licensee's HEP contribution, no contributions will be accepted by the HEP without the Licensee's approval at its sole discretion.

All HEP monies will be deposited and held by a local 501(c)(3) non-profit organization and dispersed for charitable purposes to implement Licensee-approved HEP proposals.

HEP Proposal Funding Eligibility

Any HEP proposal for areas within the Project Boundaries, including the Project Reservoirs and islands, or any part of the watershed flowing into Project Reservoirs will be eligible for HEP funds. Proposals located within or immediately adjoining the Project Boundaries will be given the highest priority. Proposals along or in perennial tributary streams entering the Project Boundaries will be given the next highest priority. Proposals with cost-sharing and/or in-kind support will be favored.

Only entities undertaking Licensee-approved HEP project proposals may receive HEP funding. Organizations may submit proposals to bundle small projects from other types of entities. The Licensee will maintain a list of appropriate HEP fund recipients.

The Licensee will be responsible for any habitat enhancements at Project Access Areas that are not leased to another party. No funds for these enhancements will be provided by the HEP.

Proposals for projects within the Project Boundaries must conform to the then-current SMP when the enhancement will be implemented.

PRC members will not be precluded from submitting proposals, but must be recused from voting on their own proposals.

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APPENDIX I

SOURCE WATER PROTECTION PROGRAM

Purpose

The purpose of the Source Water Protection Program (SWPP) is to protect water quality within the Keowee-Toxaway Hydroelectric Project (Project) Reservoirs, and watersheds draining into Lakes Keowee and Jocassee, through a comprehensive, multi-faceted collaborative program described as follows.

SWPP Administration

The SWPP will be administered by a Clean Water Group (CWG), a 501(c)(3) non-profit organization to be formed consistent with achieving the focus areas specified below. Until such time as all of the Licensee's funding has been disbursed, the CWG will provide an annual report to the Licensee detailing how the Licensee's funds were spent and how such activities were consistent with the stated purpose of the SWPP. The annual report to the Licensee will include statements affirming that any limitations on use of the Licensee's funding as stated in this Appendix I were met.

SWPP Focus Areas

The SWPP will focus on activities associated with protecting water quality at the Project Reservoirs. Initial activities are described below; additional activities intended to protect Project water quality may be identified throughout the New License term by the CWG consistent with the purpose of the SWPP. The CWG charter, members, and availability of matching grants, and/or collaborative funding or program participation will dictate the scope and priority of activities.

- The Licensee's contribution to the SWPP will be initially dedicated to the further development of water quality models that will allow for more detailed, state-of-the-art assessment of potential impacts of watershed-derived nutrients, reactive carbon and sediment loads on the water quality in Lake Keowee. Development of a calibrated watershed model using the United States Environmental Protection Agency (USEPA)-supported BASINS/HSPF² software is proposed to provide the point and non-point source loadings of water, reactive carbon, nutrients and sediments to a proposed EFDC³-based, three-dimensional reservoir model. The EFDC model will allow for both assessments of the impacts on water quality in shallower coves of nutrients, carbon and sediment loads draining from the watershed and the lake shoreline and assessments of flow exchange between the coves and main channel of the reservoir. The existing calibrated CE-QUAL-W2 reservoir water quality model developed for Lake Keowee during the relicensing process and the calibrated BASINS model will also be linked to the existing (Cane Creek embayment) or modified BATHUB model for more easily estimating lakewide potential future effects of stream sediment, reactive carbon and nutrient inputs from all five major tributaries to Lake Keowee (i.e., Cane Creek, Little Cane Creek, Little River, Eastatoe River, and Little Eastatoe Creek) and the lakeshore. These linked models may be used

² BASINS: Better Assessment Science Integrating point & Non-point Sources; HSPF: Hydrological Simulation Program-Fortran

³ EFDC: Environmental Fluid Dynamics Code

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to provide early warning of the eutrophication and algal bloom threats in the major drainage watershed inlet coves/lake arms which may be caused by development in the watersheds over the New License term. The models can also be used to evaluate the relative effectiveness of alternative regulatory and technological water quality protection strategies. Other models may be substituted for those specifically listed above as future modeling options may change.

The Licensee's contribution to the SWPP may also be used to support SWPP initiatives such as the following which are illustrative and not exclusive.

- Development of a "Find-and-Fix Failed Septic Systems" program to locate failed systems and cost-share repair/replacement/sewer-hookup (if feasible) with the system owners. The SWPP will prioritize its funding based on the potential impact of the failed system on the Project tributaries and Reservoirs. System owners with demonstrated limited financial resources to implement septic system repairs will be given a higher priority than those without demonstrable financial constraints. The Licensee's funding will not be used to offset repair or replacement costs for septic systems of financially capable owners.
- Educational outreach to provide information on water quality topics such as septic system maintenance; appropriate animal waste management; and methods to reduce non-point source pollution.
- Collaborative development with state and local governmental bodies of comprehensive plans for effective implementation of storm sewer upgrades and controlling non-point source pollution as development proceeds.

SWPP Funding

Following implementation of the SWPP per Section 9.4 of the RA, Licensee funds in support of the SWPP will be provided to the CWG. The Licensee's funding will not be used to pursue legislative or regulatory changes or for litigation. The CWG may seek matching grants and additional funding partners to implement the activities described above.

APPENDIX D – 2014 OPERATING AGREEMENT

Rev Date: 10/10/2014

OPERATING AGREEMENT

executed by

THE UNITED STATES OF AMERICA

acting by and through the

SAVANNAH DISTRICT, U.S. ARMY CORPS OF ENGINEERS

and the

SOUTHEASTERN POWER ADMINISTRATION

and

DUKE ENERGY CAROLINAS, LLC

THIS OPERATING AGREEMENT, executed as of the last date noted on the signature pages, between the UNITED STATES OF AMERICA (hereinafter called the Government), acting by and through the SAVANNAH DISTRICT ENGINEER (hereinafter called the District Engineer), and the SOUTHEASTERN POWER ADMINISTRATOR (hereinafter called the Administrator), and DUKE ENERGY CAROLINAS, LLC (hereinafter called the Company), a limited liability company organized and existing under the laws of the State of North Carolina, with the District Engineer, the Administrator, and the Company hereinafter singularly called Party and collectively called the Parties;

- 0.1 WHEREAS the Company pursuant to the original 50-year license issued by the Federal Power Commission, predecessor to the Federal Energy Regulatory Commission (hereinafter called FERC), constructed on certain tributaries of the Savannah River a project known as the Keowee-Toxaway Hydroelectric Project, designated as FERC Project No. 2503 (hereinafter called the Keowee-Toxaway Project); and
- 0.2 WHEREAS the Keowee-Toxaway Project is composed of two adjoining developments, the most downstream of which is called the Keowee Development, which includes a reservoir (Lake Keowee) and a conventional hydroelectric station (Keowee Hydro Station), and the other the Jocassee Development, which includes a reservoir (Lake Jocassee) and a pumped storage hydroelectric station (Jocassee Pumped Storage Station); and
- 0.3 WHEREAS the Company also owns and operates the Bad Creek Pumped Storage Project, which includes the Bad Creek Reservoir and Bad Creek Pumped Storage Station, operated under a separate FERC license (Project No. 2740, hereinafter called the Bad Creek Project) on a tributary to Lake Jocassee in the Savannah River Basin; and
- 0.4 WHEREAS the Company operates the Keowee-Toxaway Project and the Bad Creek Project (hereinafter collectively called the Company Projects) in coordination with one another; and

- 0.5 WHEREAS the Government has three existing hydroelectric reservoir projects on the Savannah River downstream of the Keowee-Toxaway Project known as the J. Strom Thurmond (hereinafter called Thurmond), Richard B. Russell (hereinafter called Russell), and Hartwell projects (hereinafter collectively called the Federal Projects); and
- 0.6 WHEREAS the Federal Projects are operated and maintained by the District Engineer and the Administrator markets the available power and energy from the Federal Projects; and
- 0.7 WHEREAS Article 32 of the original FERC license for the Keowee-Toxaway Project required the Company to enter into an agreement with an authorized representative of the Chief of Engineers, Department of the Army, and an authorized representative of the Department of the Interior, assuring the Keowee-Toxaway Project would be operated so the capability of those downstream Federal Projects in existence at the time to meet power generating requirements would not be impaired, and further recognizing the requirement for water releases from Thurmond Lake (the most downstream reservoir) for low flow control and other responsibilities in connection with the Hartwell and Thurmond lakes, including flood control, and such agreement was executed in 1968 (hereinafter called the 1968 Agreement); and
- 0.8 WHEREAS the Company and 16 other organizations entered into a binding contract (hereinafter called the Relicensing Agreement) with an effective date of December 1, 2013, and which Relicensing Agreement includes among other things a Low Inflow Protocol (hereinafter called the LIP) specifying operating procedures for the Company Projects during periods of drought; and
- 0.9 WHEREAS the District Engineer instituted a Drought Plan (hereinafter called the DP) in 1989 to address operation of the Federal Projects during droughts and said DP was last updated in 2012; and
- 0.10 WHEREAS the Parties desire to enter into an Operating Agreement that is consistent with both the LIP and the DP; and
- 0.11 WHEREAS the District Engineer, the Administrator, and the Company are terminating the 1968 Agreement and simultaneously executing this Operating Agreement, developed after comprehensively assessing potential effects of this Operating Agreement and in conjunction with the FERC relicensing of the Keowee-Toxaway Project; and
- 0.12 WHEREAS the functions of the Administrator have been transferred from the Department of the Interior to the Department of Energy; and
- 0.13 WHEREAS the District Engineer and the Administrator have been authorized as representatives of the Department of the Army and the Department of Energy, respectively, to enter into the said Operating Agreement with the Company;

NOW, THEREFORE, the Parties hereto mutually covenant and agree as follows:

Section 1. Principle of Operation of the Company Projects in Conjunction with the Downstream Federal Projects

- 1.1 The principle of equalizing the percentage of combined remaining usable water storage in the Company Projects with the percentage of combined remaining usable water storage in the Federal Projects will be followed to determine the minimum weekly water release requirement from the Keowee Development, subject to the following provisions.
- 1.2 For purposes of this Operating Agreement, the usable storage in the respective projects is as defined by the reservoir elevation curves shown on Exhibit 1 with all reservoir elevations stated in feet above Mean Sea Level (AMSL) using National Geodetic Vertical Datum of 1929 (NGVD 29), attached hereto and by reference made a part hereof, and described as follows:
 - (a) Bad Creek Project. The volume in the Bad Creek Reservoir between elevation 2150 feet AMSL and 2310 feet AMSL.
 - (b) Jocassee Development. The volume in Lake Jocassee between elevation 1080 feet AMSL and 1110 feet AMSL. Note the elevation curves for the Jocassee Development also identify Stage Minimum Elevations for each Stage (i.e., Stage 0 through 4) of the LIP.
 - (c) Keowee Development. The volume in Lake Keowee between elevation 790 feet AMSL and 800 feet AMSL. Note the elevation curves for the Keowee Development also identify Stage Minimum Elevations for each Stage (i.e., Stage 0 through 4) of the LIP.
 - (d) Hartwell Project. The volume in Hartwell Lake between elevation 625 feet AMSL and the curve denoting top-of-power pool and minimum flood control pool.
 - (e) Russell Project. The volume in Russell Lake between elevation 470 feet AMSL and 475 feet AMSL.
 - (f) Thurmond Project. The volume in Thurmond Lake between elevation 312 feet AMSL and the curve denoting top-of-power pool and minimum flood control pool.
- 1.3 For purposes of this Operating Agreement, remaining usable storage at any time for the Company Projects is the sum of the volume of water contained between each reservoir's lowest elevation as described in subsection 1.2 and its actual reservoir elevation as measured in the forebay of each reservoir by the Company. The remaining usable storage for the Federal Projects at any time is the sum of the volume of water contained between each reservoir's lowest elevation as described in subsection 1.2 and the actual reservoir elevation as measured in the forebay of each reservoir by the District Engineer. The remaining usable storage for the Company Projects is expressed as a percentage of the sum of the total usable storage in the Company Projects. The remaining usable storage for the Federal Projects is expressed as percentage of the sum of the total usable storage in the Federal Projects.

Section 2. Determination of Minimum Weekly Water Release Requirement from the Keowee Development

- 2.1 The minimum weekly water release requirement from the Keowee Development will be calculated by the District Engineer as described below, subject to the concurrence of the other Parties. The minimum weekly water release requirement will be calculated based on the remaining usable water storage at each reservoir at midnight Tuesday and the water shall be released during the following seven days (i.e., Wednesday through Tuesday), unless the District Engineer requests a lesser amount.
- 2.2 For purposes of this Operating Agreement, water releases from the Keowee Development include hydroelectric generation flows, calculated flood gate releases, leakage through the Keowee Hydro Station and dam seepage, with such leakage and seepage estimated to total 650 acre-feet per week.
- 2.3 Whenever the remaining usable storage at the Federal Projects is 90 percent or above or the remaining usable storage at the Company Projects is an equal or lower percentage than the remaining usable storage at the Federal Projects at Tuesday midnight, there shall be no required minimum weekly water release from the Keowee Development during the following seven days. Further, if the remaining usable storage at the Federal Projects is below 90 percent for reasons other than reduced inflow to the Federal Projects, there shall be no required minimum weekly water release from the Keowee Development during the following seven days. If the Federal Projects are intentionally maintained at lower levels (e.g., to support maintenance situations), the Company shall not be required to provide a greater volume of minimum weekly water releases from the Keowee Development than would have otherwise been required.
- 2.4 Whenever the remaining usable storage at the Federal Projects is below 90 percent and equal to or greater than 85 percent (e.g., 88 percent) at Tuesday midnight, the minimum weekly water release requirement from the Keowee Development during the following seven days shall be calculated so the remaining usable storage at the Company Projects will be twice as many percentage points below 100 percent (e.g., 4 percent below or usable storage of 96 percent) as the remaining usable storage at the Federal Projects was below 90 percent on Tuesday midnight, except the minimum weekly water release required in the following seven days from the Keowee Development shall not exceed 25,000 acre-feet.
- 2.5 Whenever the remaining usable storage at the Federal Projects is below 85 percent and equal to or greater than 80 percent (e.g., 82 percent) at Tuesday midnight, the minimum weekly water release requirement from the Keowee Development during the following seven days shall be calculated so the remaining usable storage at the Company Projects will be twice as many percentage points below 100 percent as the remaining usable storage at the Federal Projects was below 90 percent on Tuesday midnight (e.g., 16 percent below, or usable storage of 84 percent), except the minimum weekly water release required in the following seven days from the Keowee Development shall not exceed 20,000 acre-feet.
- 2.6 Whenever the remaining usable storage at the Federal Projects is below 80 percent (e.g., 79 percent) or the DP is in Level 1 at Tuesday midnight, the minimum weekly water release requirement from the Keowee Development during the following seven days shall be determined so the remaining usable storage at the Company Projects will be the same

- percentage as the remaining usable storage at the Federal Projects was at Tuesday midnight (e.g., 79 percent), except the minimum weekly water release required in the following seven days from the Keowee Development shall not exceed 18,750 acre-feet.
- 2.7 Whenever the DP is in Level 2 at Tuesday midnight, the minimum weekly water release requirement from the Keowee Development during the following seven days shall be calculated so the remaining usable storage at the Company Projects will be the same percentage as the remaining usable storage at the Federal Projects was at Tuesday midnight, except the minimum weekly water release required in the following seven days from the Keowee Development shall not exceed 15,000 acre-feet.
- 2.8 Whenever the DP is in Level 3 and the remaining usable storage at the Federal Projects is at or above 25 percent at Tuesday midnight, the minimum weekly water release requirement from the Keowee Development during the following seven days shall be calculated so the remaining usable storage at the Company Projects will be the same percentage as the remaining usable storage at the Federal Projects was at Tuesday midnight, except the minimum weekly water release required in the following seven days from the Keowee Development shall not exceed 10,000 acre-feet.
- 2.9 Whenever the remaining usable storage at the Federal Projects is below 25 percent but greater than 12 percent at Tuesday midnight, the minimum weekly water release requirement from the Keowee Development during the following seven days shall be calculated so the remaining usable storage at the Company Projects will be the same percentage as the remaining usable storage at the Federal Projects was on Tuesday midnight, except the water release required in the following seven days from the Keowee Development shall not exceed 7,500 acre-feet.
- 2.10 Whenever the remaining usable storage at the Company Projects is at or below 12 percent at Tuesday midnight, Keowee Hydro Station leakage and dam seepage (estimated at 650 acre-feet per week) will be released from the Keowee Development, but no other releases will be required during the following seven days.
- 2.11 Notwithstanding the above Sections 2.3 through 2.10, prior to December 1, 2019, the Company shall not be required to provide any water releases from the Keowee Development that would cause the remaining usable storage in the Company Projects to drop below 71,408 acre-feet consistent with the LIP. This represents the volume of water in the Keowee Development between elevations 794.6 feet AMSL and 790.0 feet AMSL. The period prior to December 1, 2019, provides time for the Company to modify its Oconee Nuclear Station to allow its normal operation at Lake Keowee levels below 794.6 feet AMSL. In the event by June 1, 2018, both a new FERC license replacing the original FERC license referenced in Section 0.7 is issued and the identified modifications to the Oconee Nuclear Station are completed, Duke Energy will pursue written concurrence from the signatories to the Relicensing Agreement to modify the LIP to allow the full requirements for water releases from the Keowee Development to go into effect prior to December 1, 2019. If all the signatories to the Relicensing Agreement provide such written concurrence to a modification of the LIP, then Duke Energy will pursue the LIP revision process as described in the Relicensing Agreement, to revise the LIP and will implement such revised LIP when the required governmental approvals are received.

- 2.12 Notwithstanding the above Sections 2.3 through 2.10, the Company shall not be required to provide water releases from the Keowee Development that would cause the elevation of either Lake Jocassee or Lake Keowee to fall below its respective Stage Minimum Elevations as required by the LIP and as shown in Exhibit 1.

Section 3. Operation of the Keowee-Toxaway Project during Floods and for Navigation

- 3.1 The Company will operate the Company Projects during flood periods so as not to cause peak discharges downstream of the Keowee Development greater than those which would have occurred in the absence of the Company Projects, except due to Acts of God or other Force Majeure events, in accordance with ER 1110-2-241 and the Flood Control Act of 1944. During flood periods, close cooperation between the Company and the District Engineer will be exercised.
- 3.2 Except during floods or other Force Majeure events, the Company shall release water from the Keowee Development at such rate or such volume as the Secretary of the Army may prescribe in the interest of navigation in accordance with ER 1110-2-241 and the Flood Control Act of 1944, but only in so far as such operation and water releases are in compliance with the effective hydropower operating license issued by the FERC to the Company.

Section 4. Exchange of Information

On Wednesday of each week, the Parties hereto will exchange information on current and proposed water releases, pool elevations and other operating conditions pertinent to the operation of the Company Projects and the Federal Projects for the purpose of carrying out the provisions of this Operating Agreement. The Company will provide daily (midnight) reservoir elevation levels for the Company Projects and Keowee Development discharge volumes for the previous week to the District Engineer.

Section 5. Protection of Water Supply

- 5.1 The District Engineer will require any owner of a Large Water Intake (i.e., water intake with a maximum capacity greater than or equal to one million gallons per day) who is allocated water from the Federal Projects after the Effective Date of this Operating Agreement to implement coordinated water conservation measures when the DP is in effect similar to the water conservation measures required by the LIP for Large Water Intake owners on the Company Projects. Only that portion of the water allocated after the Effective Date of this Operating Agreement will be subject to the requirements of this subsection 5.1.
- 5.2 The Company will require owners of Large Water Intakes on the Company Projects to comply with the LIP.
- 5.3 The District Engineer and the Company will require whenever feasible that all Large Water Intakes used for municipal, industrial and power generation purposes that are constructed, expanded or rebuilt on the Company Projects and the Federal Projects after

the Effective Date of this Operating Agreement be capable of operating at their permitted capacities at reservoir elevations as low as the applicable hydroelectric station can operate.

- 5.4 The District Engineer and the Company will encourage all water users withdrawing water from their respective reservoirs to conserve water in a coordinated manner when the DP is in effect similar to the water conservation measures required by the LIP on the Company Projects.

Section 6. Term of Agreement

This Operating Agreement shall become effective with the date of the last signature (the Effective Date of this Operating Agreement) and terminate with the expiration of the first non-annual FERC license for the Keowee-Toxaway Project issued after 2014.

Section 7. Modification of Operating Agreement and Handling of New Data

- 7.1 Any Party to this Operating Agreement can request modification of this Operating Agreement by notifying the other Parties in writing. Within 30 days following such written notice, the Party requesting the modification will convene a meeting of the Parties to discuss the proposed modification. Each Party shall use its best effort to reach timely agreement on the requested modification. This Operating Agreement can be modified only when all Parties agree with and sign the proposed modification.
- 7.2 As a minimum, the Parties shall meet to review this Operating Agreement and consider if modifications are needed if: (i) the LIP is modified in such a manner as to further restrict the Company's ability to make flow releases from the Keowee Development during droughts or (ii) the DP is modified in such a manner as to allow the District Engineer to make greater flow releases from the Thurmond Project during droughts. For the purposes of this subsection 7.2, short-term, modest increases in flow releases (e.g., releasing 3,800 cubic feet per second (cfs) instead of 3,100 cfs for three months while in DP Level 3) from the Thurmond Project as a result of implementing adaptive management requested by other state and / or federal agencies to improve water quality in Savannah Harbor will not trigger a need to review the Operating Agreement.
- 7.3 If the Company or the District Engineer acquires new data revising the usable water storage volumes or Keowee Hydro Station leakage and dam seepage rates used in implementing this Operating Agreement, these new data may be provided to the other Parties by written notice for review. If the Parties agree to use these new data in calculations required by this Operating Agreement, they shall formally modify (i.e., with signatures) this Operating Agreement.

Section 8. Filing of Agreement

Once it becomes effective, the Company shall file a copy of this Operating Agreement with the FERC.

Section 9. Miscellaneous Agreements


- 9.1 Notice. Each Party shall designate a representative for the receipt of notices and communicate its representative's contact information to the other Parties. All notices required to be given under this Operating Agreement shall be in writing and be given by personal delivery, overnight express service, or U.S. mail to each Party. The sender shall retain proof of posting or delivery, and notices shall be effective upon the date and time identified on the proof of posting or delivery. As designated representatives change over time, each Party shall be responsible for providing the other Parties with their updated contact information in a timely and accurate manner.
- 9.2 Human Health and Safety. Nothing in this Operating Agreement shall limit any Party's ability to take any and all lawful actions at its projects to protect human health and safety, to protect its equipment from damage, to ensure the stability of the regional electric grid, to protect the equipment of Large Water Intake owners from damage, and to ensure the stability of public water supply systems; provided nothing in this Operating Agreement obligates any Party to protect the equipment of Large Water Intake owners from damage or to ensure the stability of public water supply systems. The Parties acknowledge such protection measures may be implemented without prior consultation or notification. In the event the Company takes such protective measures, the Company will consult with the District Engineer to determine how to best release any water in the amounts identified in Section 2 that was not released due to the Company's protective measures when such protective measures are no longer needed.
- 9.3 Protection of Legal Obligations. Nothing in this Operating Agreement shall require any Party to take actions inconsistent with its obligations under existing contracts (including but not limited to the Relicensing Agreement for the Company), licenses, other existing legal obligations, or Congressional authorizations. Each Party represents it possesses the requisite authority to enter into this Operating Agreement and to fulfill its requirements. If a Party subsequently determines a requirement of this Operating Agreement prevents compliance with an existing legal obligation, it may request modification of the Operating Agreement pursuant to Section 7.
- 9.4 Force Majeure. Force Majeure shall mean: (a) war, riots, insurrection, rebellion, floods, hurricanes, tornadoes, earthquakes, storms, and other natural calamities excluding drought; or (b) acts or inaction of any government authority which directly affect the operation of the Company Projects or its Oconee Nuclear Station. Such acts, events or conditions listed in (a) and (b) above shall only be deemed a Force Majeure to the extent they: (i) directly impact the Company's ability to release water to the Federal Projects while continuing to operate the Company Projects or its Oconee Nuclear Station in compliance with its operating licenses or the Relicensing Agreement and are beyond the reasonable control of the Company when claiming a delay or inability to perform, and (ii) are not the result of the willful misconduct or negligent act or omission of the Company. Any delays in performance, including the inability to perform, by the Company shall not constitute a default or breach hereunder if and to the extent such delays of performance, including the inability to perform, are caused by a Force Majeure event.

- 9.5 1968 Agreement is Terminated. The Parties agree and acknowledge the 1968 Agreement is hereby terminated and of no further force or effect coincident with the affixing of the last of the three Party's signatures on this Operating Agreement.
- 9.6 Mitigation. The Company will provide the mitigation identified in the Government's Finding Of No Significant Impact for this Agreement prior to December 1, 2019.

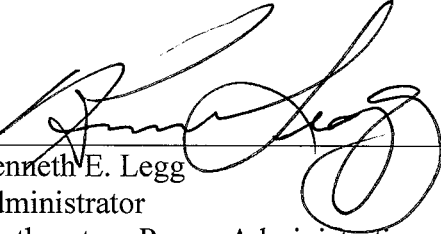
IN WITNESS WHEREOF, the Parties hereto have caused this Operating Agreement to be executed in several counterparts as of the day and year last written below.

UNITED STATES OF AMERICA

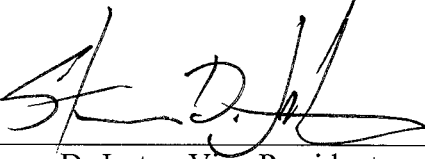
Department of the Army

By  10/17/14
Date
Thomas J. Tickner
Colonel, U.S. Army Corps of Engineers
District Engineer

Department of Energy

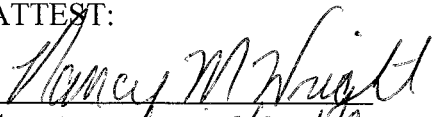
By  10/17/14
Date
Kenneth E. Legg
Administrator
Southeastern Power Administration
Elberton, Georgia 30635

DUKE ENERGY CAROLINAS, LLC

By  10/17/14
Date
Steven D. Jester, Vice-President
Water Strategy, Hydro Licensing, and
Lake Services
Duke Energy Carolinas, LLC
Charlotte, North Carolina 28201

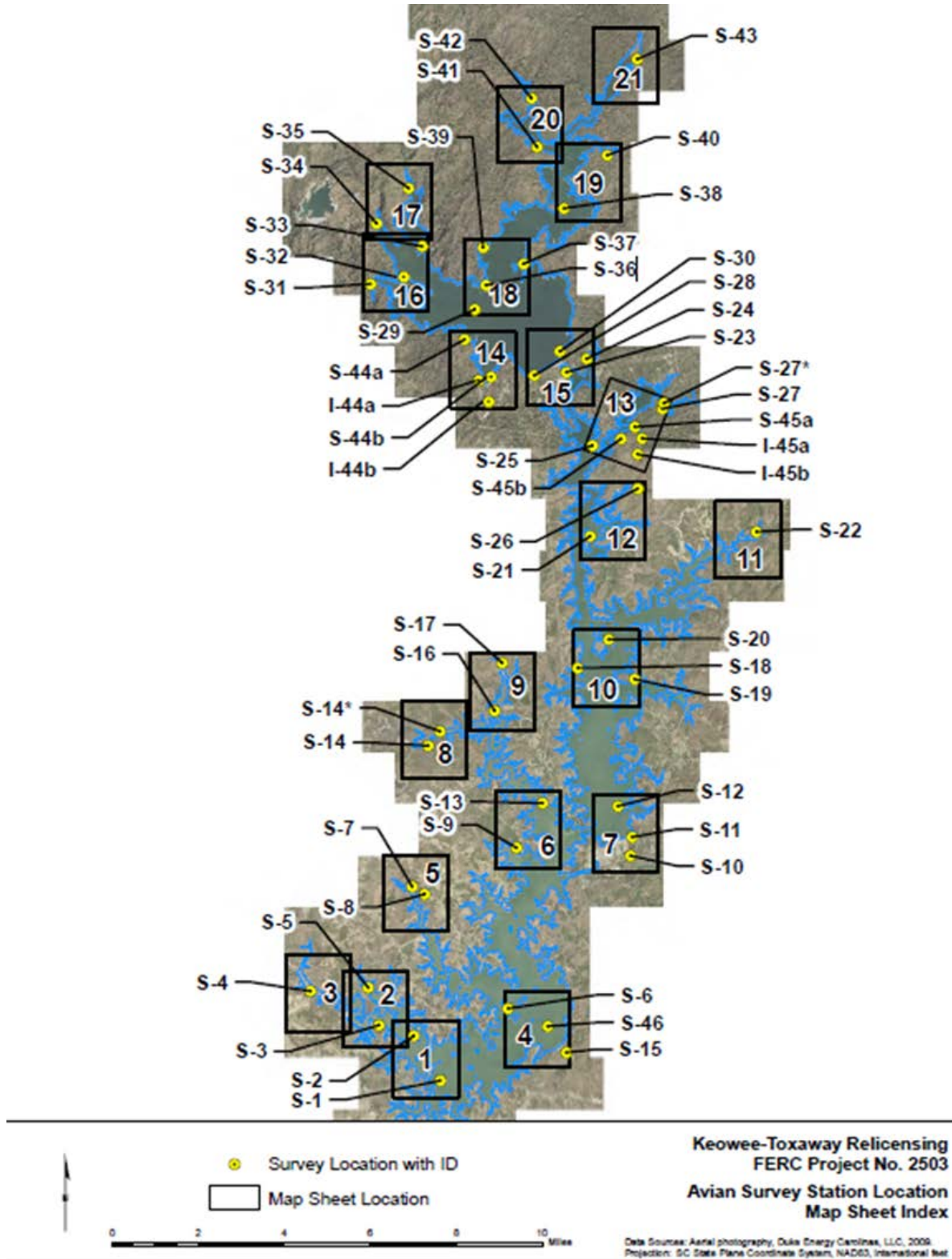
(SEAL)

ATTEST:


Secretary Assistant Corporate Secretary

APPENDIX E

Map of Duke Energy's Avian Survey Station Locations



APPENDIX F

APPLICABLE COMPREHENSIVE PLANS

Section 10(a)(2) of the Federal Power Act (FPA), 16 U.S.C. section 803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with federal and state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by a project. Staff has identified 16 comprehensive plans relevant to the proposed Keowee-Toxaway Project.

South Carolina¹

South Carolina Department of Health and Environmental Control. 1989. Assessment of Non-point Source Pollution for the State of South Carolina. Columbia, South Carolina. April 1989.

South Carolina Department of Health and Environmental Control. 1989. Non-point source management program for the State of South Carolina. Columbia, South Carolina. April 1989.

South Carolina Department of Natural Resources. 2005. South Carolina comprehensive wildlife conservation strategy: 2005-2010. Columbia, South Carolina. September 28, 2005.

South Carolina Department of Natural Resources. 2004. South Carolina Water Plan – Second edition. Columbia, South Carolina. January 2004.

South Carolina Department of Parks, Recreation, and Tourism. 2008. South Carolina State Comprehensive Outdoor Recreation Plan (SCORP). Columbia, South Carolina. April 2008.

South Carolina Department of Parks, Recreation, and Tourism. 2002. The South Carolina State Trails Plan. Columbia, South Carolina. 2002.

¹ In the revised scoping document (SD2), staff identified one currently-approved comprehensive plan for the State of South Carolina that has been superseded by a more recent plan: “Water classifications and standards, and classified waters” (1985). We request that the State of South Carolina file the revised water classifications and standards for approval under section 10(a)(2)(A) of the FPA. For the purposes of relicensing, we have reviewed the updated document under section 10(a) of the FPA.

South Carolina Water Resources Commission. National Park Service. 1988. South Carolina rivers assessment. Columbia, South Carolina. September 1988.

South Carolina Wildlife and Marine Resources Department. 1989. South Carolina instream flow studies: a status report. Columbia, South Carolina. June 1, 1989.

U.S. Forest Service. 2004. Sumter National Forest Revised Land and Resource Management plan. Department of Agriculture, Columbia, South Carolina. January 2004.

North Carolina²

North Carolina Department of Environment, Health & Natural Resources. 2000. Water Quality Progress in North Carolina 1998-1999 305(b) Report. Raleigh, North Carolina. 2000.

North Carolina Wildlife Resources Commission. 2005. North Carolina Wildlife Action Plan. Raleigh North Carolina.

Southern Appalachian Forest Coalition and Pacific Rivers Council. Undated. Protection of aquatic biodiversity in the Southern Appalachian National Forests and their watersheds.

U.S. Forest Service. 1994. Nantahala and Pisgah National Forest Land and Resource Management Plan- Amendment 5. Department of Agriculture, Asheville, North Carolina. March 1994.

General

National Park Service. 1982. The Nationwide Rivers Inventory. Department of the Interior, Washington, D.C. January 1982.

² In SD2, staff identified three currently-approved comprehensive plans for the State of North Carolina that have been superseded by more recent plans: “Subchapter 2B-Surface Water and Wetland Standards” (2000); “Little Tennessee River Basin & Savannah River Drainage Area (Classifications and Water Quality Standards)” (2004); and “North Carolina State Outdoor Recreation Plan (SCORP): 2009-2013” (2008). We request that the State of North Carolina file the revised water quality standards and SCORP for approval under section 10(a)(2)(A) of the FPA. For the purposes of relicensing, we have reviewed the updated plans under section 10(a) of the FPA.

U.S. Fish and Wildlife Service. Canadian Wildlife Service. 1986. North American Waterfowl Management Plan. Department of the Interior. Environment Canada. May 1986.

U.S. Fish and Wildlife Service. Undated. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C.

APPENDIX G

**STAFF RESPONSES TO COMMENTS ON THE DRAFT ENVIRONMENTAL
ASSESSMENT**

Commission staff issued its draft environmental assessment (EA) for the relicensing of the Keowee-Toxaway Hydroelectric Project (Keowee-Toxaway Project) on October 1, 2015. Staff requested comments on the draft EA be filed within 30 days from the issuance date.¹ The following entities filed comments pertaining to the draft EA.

<u>Commenting Entity</u>	<u>Date Filed</u>
U.S. Fish and Wildlife Service (FWS)	October 30, 2015
Duke Energy Carolinas, LLC (Duke Energy)	October 30, 2015
Duke Energy	November 2, 2015
South Carolina Department of Natural Resources (South Carolina DNR)	November 2, 2015
Oconee County Administration	November 2, 2015
Friends of Lake Keowee Society (FOLKS)	November 2, 2015
Advocates for Quality Development, Inc.	November 3, 2015
Upstate Forever	November 10, 2015

Below, we summarize the substantive comments, provide responses to those comments, and explain how we modified the text of the draft EA, as appropriate, to address the comments. Changes addressing editorial comments were made to the final EA, but are not discussed below. The comments are grouped by topic for convenience.

Relicensing Agreement

Comment: South Carolina DNR, Oconee County Administration, FOLKS, Advocates for Quality Development, Inc., and Upstate Forever state that additional measures included in the staff alternative recommended in the draft EA are inconsistent with the Relicensing Agreement signed by Duke Energy and the stakeholders. These entities state that the Relicensing Agreement represents a balanced approach to

¹ Because October 31, 2015 fell on a weekend, comments received on November 2, 2015 were considered timely.

operation of the project and effects on environmental resources. They also request that the staff-recommended measures be removed as license requirements to avoid restructuring of the relicensing agreement.

Response: Although the Commission looks favorably on development of settlement agreements during the relicensing process, the FPA requires that the Commission independently review settlement proposals to ensure that such proposals look not only to the wishes of the settling parties, but also at the greater public interest. In addition, the FPA requires the Commission to independently determine whether the settlement proposals sufficiently meet the comprehensive development/equal consideration standard of section 10(a)(1) of the Federal Power Act (FPA) or whether additional or modified measures are needed. The Commission must also ensure that its decisions on settlements are supported by substantial evidence and that proposed license conditions are enforceable.

Though the Commission may not, whether as a matter of law or policy, include certain settlement provisions in licenses, that does not mean that the provisions are precluded from being included in a settlement. Settling parties are free to enter into “off-license” agreements with respect to matters that will not be included in a license. However, the Commission has no jurisdiction over such agreements and their existence will carry no weight in the Commission’s consideration of a license application under the FPA.² Therefore, except where off-license measures inform staff’s cumulative effects analysis, we are unable to consider off-license agreements as part of our balancing consideration under the FPA.

The staff alternative represents, in our judgement, the proposal most consistent with the comprehensive development of the river basin for all beneficial public uses. Specific modifications to the draft EA, based on Duke Energy and stakeholders’ comments, are discussed below.

Project Operation

Comment: Duke Energy, in its supplemental comments, stated that prescribed water releases to the U.S. Army Corps of Engineers’ (Corps) Hartwell Lake are for the interests of all the federal project’s purposes, not just navigation.

Response: We have revised section 2.2.2 accordingly.

² See Policy Statement on Hydropower Licensing Settlements, 116 FERC ¶61,270 (2006).

Geology and Soils

Comment: South Carolina DNR comments that the record does not support staff's statement that South Carolina DNR's "concerns were adequately addressed by the Shoreline Erosion Study conducted by W.F. Baird and Associates." Rather, South Carolina DNR states that the study provided useful information to address a number of questions relating to shoreline erosion, but that South Carolina DNR's comments speak to the adequacy of the Relicensing Agreement and not the study.

Response: The EA has been updated to reflect that South Carolina DNR did not comment on the adequacy of the Shoreline Erosion Study, but rather that South Carolina DNR found that the protection, mitigation, or enhancement measures proposed in the Relicensing Agreement adequately address their interests and mitigate for project effects of concern.

Aquatic Resources

Comment: Duke Energy comments that because the 401 water quality certification issued by South Carolina DHEC requires Duke Energy to incorporate water quality monitoring into the new license, the levelized annual cost of \$31,336 for conducting monitoring at each project development (or \$61,672 for the project), should be incorporated into the economic analysis of the project environmental measures.

Response: Duke Energy refers to a levelized annual cost of \$31,336 for conducting DO monitoring at each project development (or \$61,672 for the project). These costs are associated with the FWS recommendation to monitor Lake Jocassee and the Jocassee tailwater DO, temperature, turbidity, pH, and total dissolved gas hourly at permanent stations, and monitor Lake Keowee, the Keowee tailwater, and Little River Bypassed Reach DO, temperature, turbidity, pH, and total dissolved gas hourly at permanent stations. These measures were not recommended by Commission staff and are not required by the 401 water quality certification issued by South Carolina DHEC.

The 401 water quality certification issued by South Carolina DHEC requires Duke Energy to operate the project in accordance with Article A-7.0 Water Quality Monitoring in the Relicensing Agreement. Article A-7.0 Water Quality Monitoring only requires monitoring the Jocassee and Keowee tailwater DO continuously during the month of August. The levelized annual cost of monitoring DO in each tailwater is \$10,656, and the total levelized annual cost of monitoring DO at the project is \$21,312. These costs were included in section 4.3, *Cost of Environmental Measures*, and are now included in Table 4.2 under the staff alternative with mandatory conditions.

Comment: FWS and South Carolina DNR comment that Commission staff did not recommend including Duke Energy's proposed water quality monitoring measures in any license issued by the Commission for the project. Both agencies also state that

the 401 water quality certification (certification) issued by the South Carolina Department of Health and Environmental Control (South Carolina DHEC) requires implementation of Section A-7.0 of the Relicensing Agreement, which includes implementation of the water quality monitoring provisions.

Response: The EA has been updated to include the certification requirements as part of the staff alternative with mandatory conditions.

Comment: FWS comments that they support development of a Habitat Enhancement Program (HEP) to create, enhance, and protect aquatic and wildlife habitat within the project boundary. However, FWS also comments that they believe that prioritization of the HEP proposals should not be pre-set, should not be based on location (within or outside of the project boundary), and should be decided by the Proposal Review Committee.

Response: The Relicensing Agreement includes the establishment of a fund to support habitat enhancement measures as an off-license provision. Because the HEP relates to unspecified actions taken by Duke Energy and stakeholders both inside and outside of the project boundary, and because actions taken under the HEP are not designed to address project-related effects on fish and wildlife resources, we cannot recommend inclusion of this measure as a license provision. As such, the Commission would have no jurisdiction over Duke Energy and the stakeholder's management of the HEP, unless its implementation would interfere with other license conditions. No changes have been made in the EA.

Comment: FWS comments that in the interest of protecting fish and wildlife resources, it maintains its recommendation that the Commission include the lighting³ and start-up sequence modifications⁴ for minimizing entrainment and turbine mortality, and a fish monitoring plan as new license terms. The FWS's reasons for including these measures are that: (1) the impacts to fisheries resources resulting from the proposed project operations are uncertain and complex; (2) although impacts from turbine

³ Lighting modifications refer to the off-license measures to redesign and modify the lighting for the Commission required public safety devices on the intake towers to eliminate or reduce the amount of light shining on the lake surface; and redesign and modify lights that illuminate the tailwater area to eliminate or reduce the amount of light shining on the lake surface immediately downstream of the intake units.

⁴ Start-up sequence modifications refer to the off-license measure to begin operating the project in pumping mode using the following start-up sequence: unit 3, unit 4, unit 1, and unit 2.

mortality on the forage fish population would be minimal, the impacts to less abundant or rare fish species may lead to population level declines during the new license term; and (3) information from fish monitoring would be used to monitor the status of fish populations in the reservoir and tributaries, and guide prudent adaptive fisheries management and HEP measures in a way that cannot be predicted currently.

Response: In reference to the need for lighting modifications, our analysis in section 3.3.2.2, *Environmental Effects* indicates that eliminating or reducing lighting in the Jocassee tailwaters and at the intake towers in Lake Jocassee would provide little or no reduction in entrainment, and thus would provide only a minor benefit to forage fish populations. Further, because current levels of entrainment and turbine mortality are unlikely to affect the sustainability of the forage fish population (discussed further below), we believe that reducing illumination under a new license at the project is unsupported.

Regarding the need for start-up sequence modifications, our analysis in section 3.3.2.2, *Environmental Effects* indicates that entrainment rates can be minimized by using a start-up sequence by beginning with a unit that has a lower entrainment rate. However, because of operational constraints, the start-up sequence would have to begin with units 3 and 4, which have the highest entrainment rates among all units. Combined with the already low levels of turbine mortality (discussed further below), the benefits of the start-up sequence would be minimal, and thus including this measure on a new license is unsupported.

In reference to item (1), discussing uncertainty around entrainment, our analysis in section 3.3.2.2, *Environmental Effects* supports our conclusion that entrainment and turbine mortality at the Jocassee development would have minimal effects on the fish community in Lake Jocassee and Lake Keowee. First, because of the position of the generation intake near the surface in open water areas of Lake Jocassee, and the location of the pump intake in deep water of the tailrace, forage fish species (blueback herring and threadfin) would be most susceptible to entrainment and turbine mortality.⁵

⁵ Other dominant fish in Lake Jocassee includes rainbow trout and brown trout, which typically occupy deeper, colder water, and centrarchids, which occupy near-shore shallow water. As a result, both trout and centrarchids are likely to have minimal encounters with the generation intakes. In addition, our analysis indicated that the water velocities in front of the generation intakes are below the burst swim speeds of rainbow trout, brown trout, and centrarchids, indicating minimal susceptibility to entrainment even if there were encounters at the generation intakes. Centrarchids are also common in the Jocassee tailwaters and upper Lake Keowee; however, due to their preference for near-shore shallow water habitat, encounters with the pump intakes would be minimal.

Further, hydroacoustic monitoring demonstrated that a very small proportion (0.2 percent in Lake Jocassee; 1 percent in Lake Keowee) of the forage fish population would be killed by turbines, and these levels of removal are inconsequential to the sustainability of the forage fish community. Statistical analyses also support the finding that generation flows and pumping flows were not strongly related to variation in forage fish density in either lake. In addition, there is no indication that entrainment and turbine mortality under existing operations is having significant adverse effects on the resident fish populations, because the project reservoirs support robust fish populations⁶ and an excellent sport fishery. Because proposed project operation is within the range of historical operation, the evidence above strongly suggests that the project would continue to have minimal effects on the fish communities in Lake Jocassee and Lake Keowee. Therefore, we found that the impacts to fisheries resources resulting from the proposed project operations are well understood.

In reference to item (2), regarding entrainment and rare species, we are unaware of any low-abundance or rare species that would be especially susceptible to entrainment (i.e., there were no low-abundance or rare pelagic species collected during fish surveys at the project). Further, even if a low-abundance pelagic species were present, the fact that none were encountered during fish surveys conducted in Lake Jocassee or Lake Keowee suggests that there would also be a very low probability that they would encounter project intakes, and then become entrained (assuming their swim speeds did not exceed water velocities in front of the intakes) and killed by turbines. This line of reasoning is supported by a review of entrainment studies conducted at 45 sites, which documented only one instance of a rare species (i.e., state-listed threatened species) being entrained by a hydropower project (FERC, 1995). Thus, we do not believe there is any evidence to suggest that less abundant or rare fish species would experience population level declines as a result of turbine mortality during the new license term.

In reference to item (3), regarding the overall recommendation for fish monitoring, there is no evidence that monitoring the status of fish populations in Lakes Jocassee or Keowee is necessary. As indicated above, both project reservoirs support robust fish populations, and the forage fish populations that are most susceptible to entrainment and turbine mortality have remained relatively stable during existing operations. Proposed project operations are within the range of existing operations, and thus there is no evidence to suggest that project effects on entrainment and turbine

⁶ In addition, the forage fish populations that would be the most susceptible to turbine mortality also are either increasing in abundance (i.e., Lake Jocassee) or have maintained relatively stable numbers from 1997 to 2013.

mortality would change under a new license. Therefore, there is no need to monitor fish populations.

Comment: In its supplemental comments, Duke Energy states that it is speculative to state in sections 3.3.2 and 3.3.2.3 of the draft EA that the presence of spotted bass, and spotted bass × redeye bass hybrids in Lake Jocassee is most likely as a result of movement from Lake Keowee via pumpback operation at the Jocassee Development. Duke Energy comments that these fish may have been introduced by fisherman, and thus the statement should be deleted.

Response: We agree that the source of Lake Jocassee's spotted bass and spotted bass × redeye bass hybrids is not fully understood. Therefore, in section 3.3.2 *Aquatic Resources* and 3.3.2.3 *Cumulative Effects*, we have removed the language implicating pumpback operations as the most likely cause for introduction to Lake Jocassee.

Threatened and Endangered Species

Comment: FWS provides concurrence with the determinations of effect on federally listed threatened and endangered species made by Commission staff in the draft EA. FWS comments that the agency believes the requirements of section 7 of the Endangered Species act are fulfilled unless: (1) new information reveals that the impacts of the identified actions may affect listed species or critical habitat in a manner not considered in the draft EA; (2) the actions are subsequently modified in a manner that was not considered in the draft EA; or (3) a new species is listed or critical habitat is determined that may be affected by the actions identified in the draft EA.

Response: We have updated the EA accordingly.

Recreation

Comment: In comments filed on October 30, 2015, Duke Energy states that the proposed RMP does not reclassify the boat-in trail access at Lake Jocassee as the Commission stated in the draft EA. Duke Energy clarifies that the Commission addressed the boat-in trail access points in a January 29, 2015 issuance and agreed that the sites were not part of the Keowee-Toxaway Project. These sites were included in the 2008 Recreation Management Plan (RMP) for the Keowee-Toxaway Project and the 2012 Recreation Use and Needs Study (RUN Study).

Response: We have removed the reference to reclassifying the boat-in trail access sites.

Comment: In comments filed on October 30, 2015, Duke Energy states that it should not be required to construct additional recreation facilities at Warpath Access Area within the first few years after a new license is issued. Duke Energy states that the

need for additional facilities at Warpath Access Area could be identified in the future through filings of the Licensed Hydropower Development Recreation Report (FERC Form 80) or Recreation Use and Needs Studies, both of which are license requirements. Duke Energy states that the amenities recommended by staff are not necessary to alleviate overcrowding, the site is well below capacity for a majority of the time, and during holiday weekends, parking use at other project access areas ranged from 24 to 70 percent, suggesting viable alternatives for recreation access near Warpath Access Area. Duke Energy also clarifies that the lease with Warpath Development, Inc. for Warpath Access was intended to extend through September 12, 2045; however, in a subsequent filing on March 7, 2016, Duke Energy states that the lease with Warpath Development, Inc. was terminated effective March 4, 2016.

Response: Regarding additional staff recommended measures at Warpath Access Area, we find that the 2012 RUN Study provided sufficient information to suggest that Warpath Access Area is a popular and highly-used recreation site. Although we agree that viable alternatives do exist for recreation use, the site was identified as over-capacity on holiday weekends, non-holiday weekend use was as high as 60 percent, and that Duke Energy estimates growth of 65 to 70 percent for water-based recreation use at the project over the next 30 to 50 years. Therefore, it is reasonable to expect that Warpath Access Area would continue to be used intensively, and that without additional enhancement measures, the high level of use may result in adverse effects on environmental resources or reduce the quality of the recreation experience at the site.

In 2006, the Commission approved plans, filed by Duke Energy, for Warpath Development, Inc. to redevelop Warpath Access Area as a lodge and conference center with a variety of recreation amenities including a campground, swim beach, picnic area, fishing piers, and trails. These provisions were also included as part of the 2008 RMP for the project, which the Commission approved in 2010. In the 2006 approval, Commission staff found that the recreation components of the proposed development partially met the provisions of the existing license's Exhibit R Recreation Use Plan. The Exhibit R was superseded by the 2008 RMP for the project, which specifies that "the licensee is ultimately responsible for oversight and management of project recreation sites, including those sites that are currently, or will potentially be, leased to another entity through the [Access Area Improvement Initiative (AAII)]...please note that Duke is accountable for carrying out these duties should the lessee fail to do so."⁷

As explained in the EA, Duke Energy's visitor use and needs surveys do not indicate a need for construction of the various recreation amenities proposed by Warpath Development, Inc., and we do not recommend that a new license require Duke

⁷ 132 FERC ¶ 62,060 (2010).

Energy to construct these facilities. However, the surveys do indicate the need for additional protection or enhancement measures at Warpath Access Area over the term of a new license (and possibly before Duke Energy would be required to file a revised RMP in 2033). Therefore, we recommend that Duke Energy incorporate into its RMP provisions for monitoring capacity and facility condition at Warpath Access Area during the summer recreation season. If use at Warpath Access Area exceeds 90 percent of capacity (as measured by parking availability) on a non-holiday weekend, Duke Energy should file with the Commission, for approval, a plan for addressing excess demand at Warpath Access Area (e.g., provisions for directing users to other access areas, construction of overflow or permanent parking facilities, etc.). The RMP should also contain provisions to address the potential effects of overuse on environmental resources. If use of the facility exceeds capacity at any time, Duke Energy should file a report with the Commission describing any adverse effects on environmental resources at the site (e.g., disturbance of terrestrial habitat, soil compaction, or erosion) and how Duke Energy will mitigate for these effects. These reports should be developed in consultation with South Carolina Department of Parks, Recreation, and Tourism and the South Carolina DNR. These provisions would allow Duke Energy to address the effects of use of Warpath Access Area on environmental and recreation resources more effectively than the simple use monitoring provisions of a Form 80 requirement.

We recommend that these provisions remain in place over the term of the RMP until an update to the RMP is filed with the Commission, at which time Duke Energy should reevaluate its proposal for Warpath Access Area in consultation with stakeholders. The EA has been updated to reflect this recommendation. We continue to recommend that Duke Energy remove from the RMP the list of proposed facilities designated for construction by Warpath Development, Inc. at Warpath Access Area as future project recreation facilities.

We also have received Duke Energy's clarification about the status of the lease with Warpath Development, Inc. and have updated the EA accordingly.

Comment: In comments filed October 30, 2015, Duke Energy states that it should not be required to construct additional recreation facilities at Crow Creek Access Area, including expanded and lighted vehicle-with-trailer parking, a picnic shelter, additional vehicle parking, and a bank fishing trail. Duke Energy reiterates that this work was required as part of a FERC-approved mitigation plan associated with The Reserve at Lake Keowee's (The Reserve) construction of a golf course within the project boundary without proper approval. Currently, the scheduled deadline for completion of the recreation amenities is December 31, 2016. In the draft EA, staff recommended that Duke Energy construct the facilities if The Reserve fails to do so. Duke Energy does not believe that it should be required to develop the additional facilities because the existing facilities are adequate. Duke Energy believes that the

need for the additional facilities should be evaluated as part of future recreation planning efforts.

Response: As with the recreation amenities proposed for Warpath Access Area, the Commission's approval of the 2008 RMP required Duke Energy to execute the proposed recreation enhancement measures at the Crow Creek Access Area and did not accept Duke Energy's proposal to maintain the site as-is. Regarding measures proposed to be constructed by third parties, the Commission has been consistent in explaining that Duke Energy is "accountable for carrying out these duties" should a lessee fail to do so.⁸

We understand Duke Energy's distinction that the recreation facilities in question were originally approved as part of a mitigation plan proposed by The Reserve and approved by the Commission. However, with Commission approval of the 2008 RMP, the recreation amenities proposed for Crow Creek Access Area became license requirements. Duke Energy did not argue at the time the 2008 RMP was approved that the facilities were unwarranted. Duke Energy has also not provided sufficient information describing why the facilities are no longer necessary, despite being previously approved by the Commission.

We also understand that Duke Energy included the provisions for the recreation amenities at Crow Creek Access Area in the 2008 RMP because it assumed the facilities would be constructed on schedule by The Reserve, and that The Reserve has failed to construct the amenities in a timely manner. We recommend that Duke Energy continue to work with The Reserve to ensure that the facilities are constructed, as required, by December 31, 2016. However, if it becomes clear that The Reserve will fail to construct the facilities, Duke Energy should propose a reasonable schedule for completion of the amenities as part of a revised RMP and ensure that the facilities are constructed (whether by Duke Energy or by The Reserve).

Comment: In comments filed October 30, 2015, Duke Energy states that it should not be required to incorporate World of Energy Picnic Area into the project boundary or treat it as a project access area. Duke Energy states that excluding World of Energy Picnic Area as a project recreation site is not expected to have any significant effect on either the use of the recreation site or recreation access at the project. Duke Energy explains that the 2008 RMP did not distinguish between "project access areas" and "non-project public recreation areas" and that Duke Energy does not consider World of Energy Picnic Area to be a project facility. Duke Energy cites to Keowee-Toxaway State Natural Area, which was also included in the 2008 RMP, but is a non-

⁸ 132 FERC ¶ 62,060 (2010).

project recreation area owned and operated by the South Carolina Department of Parks, Recreation, and Tourism.

Duke Energy also states that World of Energy Picnic Area is used less often than visitor use counts reported in the 2012 RUN Study would indicate. Duke Energy clarifies that the visitor use numbers for World of Energy Picnic Area reported in the final license application and used by staff in the EA may be inflated, because use was measured by car counts that also captured visitors and employees of World of Energy Visitor's Center, which shares a parking lot with the picnic area.

Duke Energy states that because of World of Energy Picnic Area's proximity to Oconee Nuclear Station, public access to the site can be eliminated with no advance notice for safety and security reasons.

Last, Duke Energy specifies that World of Energy Picnic Area is managed differently than other Duke Energy owned and operated recreation facilities, including being reserved for use for private and other business functions where alcohol consumption is permitted.

Response: Regarding Duke Energy's assertion that it does not consider World of Energy Picnic Area to be a project recreation site, we find that the Commission has already taken action and determined that the World of Energy Picnic Area is a project recreation site and should be enclosed in the project boundary. In a letter issued January 29, 2015, Commission staff found that the July 19, 2010 order approving the 2008 RMP effectively approved World of Energy Picnic Area as a project recreation site (letter from R. Fletcher, Chief, Land Resources Branch, FERC, Washington, D.C. to J. Lineberger, Duke Energy Carolinas, LLC, Charlotte, North Carolina). In the same letter, Commission staff also distinguished between World of Energy Picnic Area and Keowee-Toxaway State Natural Area, clarifying that the Commission's July 19, 2010 order specifically stated that it was only the Keowee-Toxaway State Natural Area that was not considered a project recreation area. The 2010 order also required Duke Energy to bring into the project boundary all project recreation sites, and submit updated exhibit G drawings reflecting the modified project boundary, pursuant to sections 4.39 and 4.41 of the Commission's regulations. To date, however, Duke Energy has not filed exhibit G drawings that incorporate World of Energy Picnic Area into the project boundary.

Regarding Duke Energy's comments that visitor use number may be misleading, we have modified the EA text to remove references to World of Energy Picnic Area as being the third-most popular recreation site on Lake Keowee. However, Duke Energy has not provided sufficient information to support a finding that the recreation amenities provided at World of Energy Picnic Area do not serve a project purpose and are not needed to ensure adequate public access at the project. Rather, as Duke Energy states in

the 2008 RMP, World of Energy Picnic Area “receives modest use however it is popular for use by bank anglers and walkers.”

Regarding World of Energy Picnic Area’s proximity to Oconee Nuclear Station, we agree with Duke Energy that the Nuclear Regulatory Commission permits Duke Energy to establish a buffer zone around Oconee Nuclear station to protect safety in which no public access of any kind would be permissible. If, in the future, Duke Energy undertakes safety measures associated with the operation of Oconee Nuclear Station that restrict the use of World of Energy Picnic Area, Duke Energy should file, with the Commission for approval, an amendment to the RMP describing the need for closure or modification to World of Energy Picnic Area and addressing how Duke Energy would accommodate recreation use from World of Energy Picnic Area in other ways.

Regarding Duke Energy’s comments that it manages World of Energy Picnic Area differently than other project recreation sites on Lake Keowee, we note that Duke Energy may establish management policies for its project recreation facilities. The Commission has requirements for public access, but those policies do not specify how a specific site may be managed. Licensees may develop their own policies for permissible uses, including alcohol consumption.

Based on Duke Energy’s comments, we have clarified our findings in the EA, but we have made no changes to our recommendations.

Comment: Duke Energy, in comments filed October 30, 2015, states that the proposed island shoreline stabilization should not be incorporated into the RMP. Duke Energy reiterates that erosion of islands at Lake Keowee is not a project effect but is caused primarily by wind- and boat-caused waves. Duke Energy believes there is no project purpose for including shoreline stabilization of islands in the RMP.

Response: We agree that Duke Energy’s shoreline erosion study for the project indicates that the primary cause of island erosion is wind- and boat-caused wakes. Our rationale for recommending island shoreline stabilization as a license measure associated with the RMP does not relate to the primary cause of the erosion, but rather to the protection of the islands for day-use recreation as described in Duke Energy’s license application. Duke Energy’s proposed RMP also includes, as license measures, provisions for stabilizing the shorelines of two sites designated for future recreation use – High Falls II and Mosquito Point Access Areas as well as at the existing Falls Point Access Area. At these sites, Duke Energy did not draw a distinction about the need for the measure and the cause of the erosion. Rather, shoreline stabilization is intended to protect these areas, which have highly-erodible soil and have been designated for existing or future recreation use. Using similar reasoning, because Duke Energy has designated the project’s islands for day-use recreation, and because stakeholders

(through the Relicensing Agreement) identified stabilization of a portion of the islands as important for protecting these resources, we recommend that the island shoreline stabilization measures remain a license requirement associated with the RMP.

Comment: South Carolina DNR comments that leasing Bootleg Access Area from Duke Energy allows the area to be managed by South Carolina DNR under its Wildlife Management Area (WMA) Program. This program enables South Carolina DNR's law-enforcement officers to enforce WMA regulations at the area which serve to protect the natural resources and character of the area.

Response: We appreciate the clarification to the South Carolina DNR's role in managing Bootleg Access Area as part of its WMA Program. We assume that South Carolina DNR's comments were provided in response to the staff recommendation to remove the cost of maintaining the lease at Bootleg Access Area from the staff alternative. Primarily, this modification to Duke Energy's proposal is administrative in nature. We are not recommending the lease of Bootleg Access Area as part of a license for the Keowee-Toxaway Project because the Commission does not have jurisdiction to place license requirements on third-party entities such as South Carolina DNR. Duke Energy may continue to lease Bootleg Access Area to South Carolina DNR as an off-license measure. We have clarified this issue in the EA text.

Land Use

Comment: In comments filed on October 30, 2015, Duke Energy states that it should not be required to extend the time period during which owners of existing piers are allowed to request modifications to reach deeper water. Duke Energy states that the Relicensing Agreement provides a number of measures designed to allow (but not require) existing pier owners to take actions to modify their piers to make them usable over a wider range of reservoir elevations. The stakeholder team chose a one-year period of opportunity for existing owners to apply for approval, combined with a two-year opportunity to modify their docks, as a reasonable approach which would not unduly complicate the lake use permitting process.

Duke Energy states that there is "absolutely no reason" to believe a longer window of time (through December 1, 2020 as modified by staff) will afford existing pier owners additional information to use in decision-making. As discussed in the EA, lake levels would only be lowered below the current minimum elevation of 794.6 feet under Low Inflow Protocol (LIP) conditions. Duke Energy has no control over the external factors, such as rainfall, that would lead to the project operating under the LIP and extending the window does not guarantee the project would be operated at lake levels below 794.6 feet prior to December 1, 2020. Duke Energy also states that existing pier owners do not need the reservoir drawn down to determine the depth of water surrounding their piers; they currently have the ability to measure it.

Further, Duke Energy states that to implement the dock extension measure, they have requested and obtained new general permits from South Carolina DHEC and the Corps. These permits expire before December 31, 2020 and the proposal for the extended timeframe does not comply with the general permits. Duke Energy also states that the proposal would create an additional burden on lake use permitting staff with no additional benefit.

Response: As part of its environmental analysis, Commission staff must review Duke Energy's proposal (including the conditions specified in the Relicensing Agreement) as well as the comments of stakeholders who may not be signatories to the agreement. On March 23, 2015, Mr. Douglas Barker and 1,286 petitioners requested that the Commission review Duke Energy's proposal for allowing a one-year timeframe for applications to expand existing docks because they believed the timeframe was unnecessarily narrow and that dock owners may not know if they need an extension before the window closes.

We agree with Duke Energy that extending the window for permitting provides no guarantee that the project will be operated at the lower reservoir levels specified in the LIP (a condition over which Duke Energy has little or no control) and that dock owners may measure water depths at their piers to assess the potential impacts of lower lake levels on their docks. However, we note that throughout its license application and in the SMP, Duke Energy has tied the dock extension measure to the modifications at Oconee Nuclear Station which are not scheduled for completion until December 1, 2019. Opening and closing the window for dock modifications well in advance of the timeframe for modifications to Oconee Nuclear Station, as Duke Energy intended,⁹ seems arbitrary in relation to the change in project operations and unnecessarily forecloses on the possibility that residents may experience operations under the lower LIP operating regime prior to applying for or constructing their dock modifications.

Regarding Duke Energy's comments that they have already received general permits for dock expansions from South Carolina DHEC and the Corps, which will expire prior to December 31, 2020, we remind Duke Energy that it is within the Commission's jurisdiction to approve and require modifications to the SMP, including the proposed dock expansion provision. The proposed SMP is still under consideration by the Commission at this time. Duke Energy obtained permits allowing for dock expansions prior to Commission approval of the SMP at its own risk.

⁹ See Memo to Public Files from R. McNamara, FERC, Washington, D.C., August 21, 2015.

Last, regarding the burden on Duke Energy's lake use permitting staff, we note that under both Duke Energy's proposal and Commission staff's recommended modification, the total number of dock owners eligible to make modifications does not change (only those residents with existing docks as of December 1, 2013 are eligible to apply). Under Duke Energy's proposal, all applications to modify docks must be processed in one year. Under Commission staff's proposal, these applications may filter in from the time of SMP approval to December 31, 2020. The Commission's modification to the measure does not require Duke Energy to change conditions for dock expansion approval and allows Duke Energy to collect reasonable fees for the processing of dock modification applications, if it desires.

Comment: In comments filed on October 30, 2015, Duke Energy states that staff's proposed annual update of SMP maps is unnecessary and more costly than presented in the draft EA. Duke Energy proposes to update the SMP and shoreline classification maps every ten years, which would incorporate the numerous minor changes identified during the implementation of the SMP including corrections, conversion of shoreline from future use classifications, and the protection of newly identified resources. Duke Energy estimates that the cost would be significantly greater than the \$1,000 annually estimated by staff. Duke Energy estimates that, as written, the submittal would cost approximately \$6,000 per year for Lake Jocassee and \$9,000 per year for Lake Keowee.

Response: The purpose of staff's modification to Duke Energy's SMP update procedures is to provide the Commission's Division of Hydropower Administration and Compliance with sufficient information about Duke Energy's incremental changes to the SMP and associated shoreline classification maps to monitor compliance with license requirements. As described in the EA, staff recommends that Duke Energy be allowed to make minor changes to Shoreline Classification Maps to correct mapping errors without prior Commission approval.

We have revised our recommendation to say that Duke should file new shoreline classification maps (polyline GIS data) when Duke Energy files a revised SMP, every 10 years. If Duke Energy makes changes to the shoreline classification maps during any given year because they have identified mapping errors the annual report on modifications to the SMP should include a description of the change. We have also increased the cost estimated for this measure to reflect the need to track and report map corrections as part of the annual reporting requirement.

Comment: In its supplemental comments, Duke Energy states that the increase in shoreline classified as Future Residential Marina is a byproduct of the reduction in shoreline classified as "Future Commercial Marina" and not because of a "need to improve dock availability" as stated in staff's analysis.

Response: We have updated section 3.3.6.2, accordingly.

Socioeconomics

Comment: In comments filed on October 30, 2015, Duke Energy states that although the socioeconomic studies conducted during the relicensing process did find a small relationship between reservoir elevations and property sales price, there was no attempt to assess whether such effects were incorporated into the counties' real estate valuation process. Duke Energy recommends that the EA be revised to remove statements implying a direct link between lake levels at the project and tax revenues.

Response: We agree that no studies conducted during relicensing evaluated the direct effect of project lake levels and property tax revenue. We have updated section 3.3.8.2, accordingly.

Document Content(s)

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