ENVIRONMENTAL ASSESSMENT FOR HYDROPOWER LICENSE

Parr Hydroelectric Project
FERC Project No. 1894-211
South Carolina

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

April 2020

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

APE	area of potential effects
BMP	best management practice
°C	degrees Celsius
certification	Water Quality Certificate
CFR	Code of Federal Regulation
cfs	cubic feet per second
Commission (or FERC)	Federal Energy Regulatory Commission
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DO	dissolved oxygen
Dominion Energy	Dominion Energy South Carolina, Inc.
EA	environmental assessment
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
°F	degrees Fahrenheit
Fairfield Development	Fairfield Pumped Storage Development
Forest Service	U.S. Forest Service
FPA	Federal Power Act
fps	feet per second
FWS	U.S. Fish and Wildlife Service
HEP	Habitat Enhancement Program
HPMP	Historic Properties Management Plan
IFIM	Instream Flow Incremental Methodology
IFTWC	Instream Flow Technical Working Committee
Interior	U.S. Department of the Interior
IPaC	Information, Planning, and Conservation system
kV	kilovolt
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
msl	mean sea level
MW	megawatt
MWh	megawatt-hour
National Register	National Register of Historic Places
NAVD 88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NTU	Nephelometric Turbidity Unit
NWI	National Wetlands Inventory
PA	Programmatic Agreement

Parr Development	Parr Shoals Development
Parr Project or project	Parr Hydroelectric Project
RMP	Recreation Management Plan
ROW	right-of-way
SCANA Environmental	SCANA Corporate Environmental Services
SCE&G	South Carolina Electric & Gas Company
SCIAA	South Carolina Institute of Archaeology and Anthropology
SERC-E	SERC Reliability Corporation, east sub-region
Settlement Agreement	Comprehensive Relicensing Settlement Agreement
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
Turbine Venting Plan	Parr Shoals Turbine Venting Plan
TWC	Technical Working Committee
USGS	U.S. Geological Survey
West Channel AMP	Enhancements to the West Channel Downstream of Parr Shoals Dam Adaptive Management Plan
WQ Committee	Water Quality Technical Working Committee
WMA	Wildlife Management Area
WNS	White-nose Syndrome
WUA	Weighted Usable Area

EXECUTIVE SUMMARY

Proposed Action

On June 28, 2018, South Carolina Electric & Gas Company (SCE&G, now identified as Dominion Energy South Carolina, Inc. [Dominion Energy]) filed an application with the Federal Energy Regulatory Commission (Commission or FERC) to continue to operate and maintain the Parr Hydroelectric Project (Parr Project or project). The project has an existing capacity of 526.08 megawatts (MW) and includes two developments, the 511.2-MW Fairfield Pumped Storage Development (Fairfield Development) and the 14.88-MW Parr Shoals Development (Parr Development), on the Broad River in in Newberry and Fairfield Counties, South Carolina. The project occupies 162.61 acres of federal land in Sumter National Forest, which is administered by the U.S. Department of Agriculture, Forest Service (Forest Service).

With its license application, Dominion Energy filed a Comprehensive Relicensing Settlement Agreement (Settlement Agreement), which included Dominion Energy's proposal for relicensing the project. The Settlement Agreement was signed by Dominion Energy, the National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (FWS), South Carolina Department of Natural Resources (South Carolina DNR), American Rivers, American Whitewater, Congaree Riverkeeper, and Mr. Jeffrey Carter.

Project Description

Fairfield Development

The Fairfield Development impounds Frees Creek, a small tributary of the Broad River to create Monticello Reservoir and operates as a pumped storage facility. Monticello Reservoir serves as the reservoir for pumped storage operations and is impounded by four earthen dams (A, B, C, and D). A 265-foot-long gated intake channel is located between dams B and C. The intake leads to four 800-foot-long surface penstocks bifurcating into eight penstocks connected to the generating station. The generating station is located underground and houses eight reversible pump-turbine units. Parr Reservoir, described below, is the lower reservoir the Fairfield Development. The transmission facilities consist of two 230-kilovolt (kV) 7,000-foot-long lines extending from the Fairfield Development switch station to a switchyard located at the non-project Virgil C. Summer Nuclear Power Station.

Parr Development

The Parr Development impounds the Broad River to create the Parr Reservoir and operates as a conventional run-of-river facility. The 2,690-foot-long Parr Shoals Dam, which impounds the reservoir, includes several non-overflow sections, a 2,000-foot-long, gated spillway section with ten 200-foot-long bottom-hinged spillway gates, and a 300-

foot-long powerhouse intake section. A concrete powerhouse is integral with the dam and contains six generating units. The transmission facilities include three 950-foot-long, 13.8-kV lines extending from the hydro station to the non-project Parr sub-station.

Project Operation

Fairfield Development

Dominion Energy operates the Fairfield Development as a pumped storage facility to provide peaking and emergency reserve capabilities for its electrical generating system. Dominion Energy pumps water from the lower reservoir (Parr Reservoir) to the upper reservoir (Monticello Reservoir) during periods of low electrical demand (at night) and generates energy from the head of the upper reservoir through four penstocks during periods of peak demand. The pump-generation cycle occurs almost daily, resulting in a maximum daily fluctuation of 4.5 feet in Monticello Reservoir. As a result of pumped storage operation, water levels in Parr Reservoir may fluctuate up to 10 feet.

During times of low flow in the Broad River, the Fairfield Development continues its daily pump/generation cycles subject to the availability of water in Parr Reservoir. During times of high flow, releases from the Fairfield Development may be completely suspended until flows recede.

Parr Development

The Parr Development is operated in a modified run-of-river mode and generates as a baseload facility using available flows up to 4,800 cubic feet per second (cfs). When inflows are below 4,800 cfs, the project turbines are operated to meet the minimum flow for striped bass spawning, as required by the project's existing license. When inflows exceed 4,800 cfs, the gates on the spillway are systematically lowered to release flows in excess of 4,800 cfs to maintain the reservoir elevation at no higher than 265.3 feet.

During periods of low flow in the Broad River, the Parr Development generates continuously using one or more generating units to pass the natural river flow downstream and meet any minimum flow requirements. During times of high inflow to the Broad River, Dominion Energy incrementally lowers the crest gates at Parr Shoals Dam until 40,000 cfs passes at the dam, at which time all gates are lowered to pass all flood flows entering the project.

Proposed Facility Modifications

Dominion Energy proposes to upgrade all six generating units at the Parr Development, either by rewinding the stators or replacing the generators. Replacing all six generators has the potential to increase the hydraulic capacity of the Parr Development from 4,800 cfs up to 7,764 cfs and increase the installed capacity at the Parr

Development from 14.88 MW to a maximum of 22.7 MW. Rewinding the generators would result in smaller increases to hydraulic and installed capacity.

Proposed Project Operations

Dominion Energy proposes to continue operating the project as it has under the existing license, with modification to the minimum flow requirements as specified by the Settlement Agreement. Dominion Energy also proposes to implement a Flow Fluctuations Downstream of Parr Dam Adaptive Management Plan (Flow Fluctuations AMP), which is intended to reduce daily fluctuations in flows downstream of the Parr Shoals Dam.

Proposed Project Boundary

The existing project boundary encloses both Monticello and Parr Reservoirs up to the elevation of the reservoir high water marks; lands adjacent to each reservoir, four earthen dams and an underground generating station at the Fairfield Development, Parr Shoals Dam, a spillway and powerhouse at Parr Shoals Dam, and other appurtenances; and the project's six recreation sites. The project boundary extends downstream to the base of Parr Shoals Dam. Under the Settlement Agreement, Dominion Energy proposes to develop three new recreation sites at the Parr Development, one new recreation site at the Fairfield Development, and expand the Cannon's Creek site at the Parr Development. In total, these new facilities would require adding about 22.67 acres to the project boundary.

Proposed Environmental Measures

Dominion Energy proposes the following measures, as detailed in the Settlement Agreement, license application, and supplemental filings:

Geology and Soils

- Implement an Erosion Monitoring Plan, under which Dominion Energy would continue to monitor shoreline erosion along 57 miles of shoreline at Monticello Reservoir twice yearly, and along 88 miles of shoreline at Parr Reservoir annually, and repair severely eroding shoreline with riprap under certain conditions.

Aquatic Resources

- Implement an Enhancements to the West Channel Downstream of Parr Shoals Dam Adaptive Management Plan (West Channel AMP), under which Dominion Energy would establish a review committee to evaluate

and provide recommendations to enhance water quality and aquatic habitat in the west channel, located downstream of the Parr Shoals Dam.

- Implement a Parr Shoals Dam Turbine Venting Plan, under which Dominion Energy would use turbine venting procedures at the Parr Shoals Development from June 15 through August 31 each year to improve dissolved oxygen (DO) concentrations in the tailrace of the Parr Shoals Dam and in the Broad River downstream from the dam.
- Implement a Flow Fluctuations AMP, to minimize flow fluctuations downstream of Parr Shoals Dam year-round, including for two 14-day periods during the spring to improve spawning habitat for shortnose sturgeon, striped bass, American shad, and robust redhorse.
- Implement a Minimum Flows Downstream of Parr Shoals Dam Adaptive Management Plan (Minimum Flows AMP) to improve aquatic habitat downstream of the project by increasing minimum flows. In general, minimum flow downstream from Parr Shoals Dam, would vary seasonally between the flow equal to the inflow of the Broad River into Parr Reservoir and 2,300 cfs, as measured at the Parr Shoals Dam.
- Implement a Monticello Reservoir Fisheries Habitat Enhancement Plan to mitigate any effect of reservoir fluctuations on fish habitat by placing spawning, nursery, and deep habitat structures in Monticello Reservoir.
- Implement an American Eel Abundance Monitoring Plan to address the need for an upstream eel ramp at the Parr Shoals Development by monitoring the number of American eel downstream of the Parr Shoals Dam.
- Implement a Freshwater Mussel Monitoring Plan to monitor the number, distribution, and species composition of mussels in Monticello Reservoir and downstream of Parr Shoals Dam, with emphasis on the Carolina creekshell mussel.
- Turn off tailrace lighting during normal project operations to protect fish during pump-back operation of the Fairfield Development to minimize the potential for entrainment.
- Continue to participate in the Santee Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement.

- Annually fund a Habitat Enhancement Program (HEP) at a funding amount based on the level of pumped storage operation each year,[1] or a minimum of $50,000. The funds would be used to restore, protect, and enhance aquatic, wetland, and riparian habitats in the project area and outside the project boundary in portions of the Broad, Saluda, and Congaree River watersheds.

Terrestrial Resources

- Initiate informal consultation with FWS prior to any tree removal related to recreation construction for protection of northern long-eared bat, and prior to forest management activities if the northern long-eared bat's presence in Fairfield and Newberry Counties is established.

Recreation and Land Use

- Implement a Recreation Management Plan (RMP) that includes measures to: (1) continue to operate and maintain the project's six existing recreation sites (Cannon's Creek, Heller's Creek, Scenic Overlook, Highway 215, Highway 99 West, and Recreation Lake); (2) construct enhancements at five existing project recreation sites (Cannon's Creek, Scenic Overlook, Highway 215, Highway 99 West, and Recreation Lake); and (3) develop four new project recreation sites (Highway 99 East at the Fairfield Development and Parr Shoals Dam canoe portage, Highway 34, and Enoree River Bridge at the Parr Development).
- Implement a Monticello Reservoir Shoreline Management Plan (SMP) to identify existing land uses and appropriate future uses, protect natural resources, and provide plans and programs for managing public use and access to project lands, including the Monticello Reservoir shoreline.
- Implement a Parr Reservoir SMP to identify existing land uses and appropriate future uses, protect natural resources, and provide plans and programs for managing public use and access to project lands, including the Parr Reservoir shoreline.

Cultural Resources

- Implement a Historic Properties Management Plan (HPMP) for the protection of historic properties eligible for listing on the National Register of Historic Places (National Register).

[1] Appendix A-8 of the Settlement Agreement provides a formula and example for calculating the level of funding to be provided.

Public Involvement

Before filing the final license application, Dominion Energy conducted pre-filing consultation under the Commission's Traditional Licensing Process. The intent of the Commission's pre-filing process is to initiate public involvement early in the project planning process and to encourage citizens, governmental entities, tribes, and other interested parties to identify and resolve issues prior to an application being formally filed with the Commission. During prefiling, Dominion Energy developed its Settlement Agreement. The Forest Service also provided preliminary terms and conditions pursuant to section 4(e) of the Federal Power Act (FPA), which were filed on August 29, 2017. Dominion Energy filed its license application on June 28, 2018.

Commission staff distributed Scoping Document 1 to interested agencies and others on March 6, 2019. Dominion Energy, NMFS, South Carolina DNR, and American Rivers filed scoping comments. Those scoping comments are reflected in this Environmental Assessment (EA). On July 31, 2019, the Commission issued a notice accepting the application and determining that the application was ready for environmental analysis. The U.S. Department of the Interior (Interior) filed a notice of intervention and did not oppose issuance of a new license. Interior also reserved authority to prescribe fishways and NMFS provided preliminary fishway prescriptions under section 18 of the FPA. South Carolina DNR and NMFS also filed comments on the license application, which are considered in this EA.

Alternatives Considered

This EA analyzes the effects of continued project operation and recommends conditions for any license that may be issued for the project. In addition to the licensee's proposal, we consider four alternatives: (1) the licensee's proposal, as described above; (2) the licensee's proposal with staff modifications (staff alternative); (3) the staff alternative with mandatory agency conditions; and (4) no action, meaning that the licensee would continue to operate the project with no changes.

Staff Alternative

Under the staff alternative, the project would be operated and maintained as proposed by Dominion Energy, except for the HEP. The staff alternative does not include the HEP because this measure would require funding for non-specific, and as yet unidentified, measures that could benefit resources that are not affected by the project.

The staff alternative also includes some staff-recommended modifications to Dominion Energy's proposal and additional staff recommended measures. The staff recommended measures include some, but not all measures, required by NMFS's section 18 fishway prescriptions and the Forest Service's 4(e) conditions. All staff-

recommended measures, including staff-recommended mandatory conditions, are identified, below.

These additional and modified measures include:

- Develop a final design plan and construction schedule for upgrading all six generating units at the Parr Development.
- Modify the Erosion Monitoring Plan to include: (1) all requirements of Forest Service 4(e) Condition 20; and (2) annual monitoring of erosion downstream from Parr Shoals Dam at the canoe portage put-in.
- Develop a Hazardous Substances Plan to address use or storage of hazardous substances on national forest system lands, including spill prevention and cleanup methods (Forest Service 4(e) Condition 11)
- Modify the Freshwater Mussel Monitoring Plan by removing the provisions for monitoring in Monticello Reservoir.
- Continue to participate in the Santee Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement, with the added provision that operation of any newly constructed fishways would not begin until fishway evaluations indicate that fishways are operating properly.
    - Conduct a fish passage feasibility assessment for upstream and downstream passage at the Parr Development, as defined in the Santee Basin Accord. (NMFS Fishway Prescription Condition 1)
    - Include in the fish passage feasibility assessment, design and construction schedules that would be reviewed and approved by NMFS, in consultation with the Fishery Technical Committee. (NMFS Fishway Prescription Condition 1)
    - Commence and complete construction of upstream and downstream fishways at the Parr Development, as defined in the Santee Basin Accord. (NMFS Fishway Prescription Condition 1)
- Construct, operate, and maintain fishways at the Parr Development to provide safe, timely, and effective passage for American shad and blueback herring. (NMFS Fishway Prescription Condition 2)
- Construct and implement the fishway as directed by NMFS. Should new information, such as any results from studies or monitoring, changes to the upstream fishway at the Columbia Diversion Dam, changes to recreational fishing regulations, warrant changes to the fishway prescription schedule, NMFS may direct Dominion Energy to delay or modify the construction and implementation. Also, notify and obtain NMFS's approval for any

modifications to schedules or extensions of time to comply with the provisions included in the prescription for fishways at the Parr Development. (NMFS Fishway Prescription Condition 3)

- Maintain and operate fishways at the Parr Development during the upstream migration period for American shad and blueback from March 1 to May 15. (NMFS Fishway Prescription Condition 4)
- Keep all fishways in proper order and fishway areas clear of trash, logs, and material that would hinder passage. (NMFS Fishway Prescription Condition 5)
- Conduct fishway maintenance with enough time before a fish migration period such that the facilities can be tested and inspected, and will operate effectively prior to and during the migratory periods. (NMFS Fishway Prescription Condition 5)
- Develop a fishway operation and maintenance plan for each fishway describing the anticipated operational protocols, maintenance, maintenance schedule, and contingencies. (NMFS Fishway Prescription Condition 5)
- Develop a detailed fishway evaluation plan in consultation with NMFS, FWS and South Carolina DNR. (NMFS Fishway Prescription Condition 7)
- Develop plans with schedules for conducting upstream and downstream fishway effectiveness monitoring for at least three passage seasons, in consultation with the Fishery Technical Committee. (NMFS Fishway Prescription Condition 8)
- Implement pesticide use restrictions on national forest system lands. (Forest Service 4(e) Condition 12)
- Develop (1) an Aquatic Invasive Species Management and Monitoring Plan; and (2) a Vegetation and Invasive Weed Management Plan for all national forest system lands potentially affected by the project. (Forest Service 4(e) Condition 18)
- Modify the Vegetation and Non-Native Invasive Plant Management Plan required by Forest Service 4(e) Condition 18 to include provisions for addressing vegetation and non-native invasive plant management at all project recreation areas, in addition to those actions directly affecting national forest system lands.
- Limit tree removal related to recreation construction and forest management activities to November 1 through March 31 to minimize any

potential adverse effects to northern long-eared bats during the pup season and the broader active season.

- Develop a Fire and Fuels Management Plan. (Forest Service 4(e) Condition 21)
- Consult with the Forest Service, prior to erecting signs related to safety issues on national forest system lands covered by the license. (Forest Service 4(e) Condition 17)
- Modify the Monticello Shoreline Management Plan to include a provision for quarterly monitoring surveys of the Monticello Reservoir shoreline.

Staff Alternative with Mandatory Conditions

We recognize that the Commission is required to include all section 18 prescriptions and section 4(e) conditions in any license issued for the project. The staff alternative with mandatory conditions includes all 8 fishway prescriptions, including the 2 not recommended by staff, and all 23 preliminary 4(e) conditions filed by Forest Service, including the 5 not recommended by staff.

The additional mandatory conditions include:

- Maintain and operate fishways at the Parr Development during the downstream (late summer to fall) migration periods for American shad and blueback herring, which would be subject to change based on annual monitoring of migration runs. (NMFS Fishway Prescription Condition 4)
- Provide FWS, NMFS, and South Carolina DNR access to the Parr Project site and to pertinent Parr Project records for the purpose of inspecting the fishways, determining compliance with the fishway prescriptions, and for general evaluation and oversight. (NMFS Fishway Prescription Condition 6)
- Consult with the Forest Service, prior to April 15 of each year. (Forest Service 4(e) Condition 13)
- Establish a consultation group, whose primary purpose is to provide a forum for the licensee to consult with resource agencies and other interested entities regarding: (1) the annual meeting required by Condition No. 13; (2) any plans that are developed under the license; and (3) any proposed temporary or permanent modifications to license conditions. (Forest Service 4(e) Condition 14)
- Prepare and submit to the Forest Service a biological evaluation prior to taking actions to construct new project features on national forest system

lands that may affect special status species or their critical habitat on national forest system land and annually review the lists of special status species and assess the presence of new species on federal land. (Forest Service 4(e) Condition 19)

- Provide annual employee awareness training regarding special status species, noxious weeds and sensitive areas that are known to occur within or adjacent to the project boundary on national forest system lands, and the procedures for reporting and complying with license requirements. (Forest Service 4(e) Condition 22)

- Develop, in consultation with the Forest Service, a vehicle turn-around with parking area for six vehicles and a non-motorized canoe/kayak step down facility at the Enoree River Bridge Recreation Site (i.e., Keitts Bridge Landing). (Forest Service 4(e) Condition 23)

No-Action Alternative

Under the no-action alternative, the project would continue to operate under the terms and conditions of the existing license. Dominion Energy would not implement its proposed generator upgrades and no new environmental protection, mitigation, or enhancement measures would be implemented.

Environmental Effects of the Staff Alternative with Mandatory Conditions

The primary issues associated with relicensing the Parr Project include maintaining good water quality and DO levels downstream from the Parr Shoals Development; low-flow management downstream from the Parr Shoals Development; maintaining and improving aquatic habitat; improving fish passage; invasive vegetation management; constructing new recreation sites and enhancing existing recreation areas; and cultural resource management. Below, we briefly discuss the anticipated environmental effects of issuing a new license for the project under the staff alternative with mandatory conditions.

Geology and Soils

Soils around the Parr Project are moderately-to-severely erodible and continued pumped-storage operation and maintenance of the project, recreation use, and shoreline development have the potential to increase erosion around the project shoreline. Dominion Energy's proposed Erosion Monitoring Plan includes provisions for monitoring, prioritizing, and repairing shoreline erosion that may affect project operations or encroach upon sensitive environmental or cultural resources. Under the staff alternative, modifications to Dominion Energy's plan would include provisions for monitoring shoreline erosion at the Parr Dam Canoe Portage. Implementing this measure

would allow Dominion Energy to identify and resolve, in a timely manner, any erosion that could affect use of the portage.

Staff also recommends modifying Dominion Energy's Erosion Monitoring Plan to be consistent with the provisions of Forest Service 4(e) Condition 20. The provisions of Forest Service 4(e) Condition 20 are generally consistent with the contents of Dominion Energy's Erosion Monitoring Plan, but Condition 20 also includes developing protocols for site-specific erosion and sediment control during construction or emergencies. Including these provisions in an Erosion Monitoring Plan would improve Dominion Energy's ability to manage erosion and sedimentation of the project reservoirs. The staff-recommended modifications, the Erosion Monitoring Plan would also be protective of aquatic and terrestrial resources by minimizing erosion, sedimentation, and sloughing of soil into the project reservoirs to protect and maintain water quality, and aquatic and littoral habitat.

Aquatic Resources

Project operations currently cause flow reductions and flow fluctuations downstream of the Parr Development that can decrease DO and the availability of aquatic habitat. Increasing flows, water depth, and DO concentrations in the west channel through implementation of the West Channel AMP would improve aquatic habitat and support aquatic resources in the west channel year-round. Increasing the DO concentration in the turbine discharge at the Parr Development through implementation of the Turbine Venting Plan would improve water quality for aquatic resources in the tailrace and potentially in the west channel. Increasing minimum flows downstream of the Parr Development through implementation of the Minimum Flows AMP would improve aquatic habitat and give Dominion Energy the flexibility to manage storage and variable inflows. Reducing project-induced flow fluctuations downstream of the Parr Development through implementation of the Flow Fluctuations AMP would improve aquatic habitat for aquatic resources, including spawning shortnose sturgeon, American shad, striped bass, and robust redhorse.

Dominion Energy's proposal to continue operating the Fairfield Development by fluctuating the Monticello Reservoir by up to 4.5 feet daily would continue to alter littoral fish habitat. However, installing fish spawning and nursery habitat structures through implementation of the Monticello Reservoir Fisheries Habitat Enhancement Plan would increase habitat availability and the potential for improved spawning and fish production in Monticello Reservoir.

American eel occur in low abundance downstream of the Parr Development, where upstream eel passage does not exist. The current low abundance of American eel does not warrant installation of an upstream eel ramp at this time. Nonetheless, conducting American eel surveys downstream of the Parr Development through

implementation of the American Eel Monitoring Plan would help to identify if, and when, American eel abundance reaches levels that would warrant installation of an upstream eel ramp and passage of eels into upstream habitat.

Freshwater mussels occur in Monticello Reservoir and downstream of the Parr Development. Dominion Energy is not proposing any operational changes that would affect mussels in Monticello Reservoir, but is proposing to implement four plans that would involve operational changes or habitat modifications to improve minimum flows (Minimum Flows AMP), reduce flow fluctuations (Flow Fluctuations AMP), and increase DO (Turbine Venting Plan and West Channel AMP) in aquatic habitat downstream of the Parr Development. Implementing the Freshwater Mussel Monitoring Plan downstream of Parr Shoals Dam would help confirm the benefits of these measures. If benefits are not confirmed, the monitoring results could help inform the need for adaptive management during the license term. However, there is no clear benefit to monitoring in Monticello Reservoir where Dominion Energy proposes no changes to operation or aquatic habitat. Staff recommends modifying the Freshwater Mussel Monitoring Plan to remove requirements for monitoring in Monticello Reservoir.

There is no indication that entrainment mortality at the Fairfield Development is excessive, but entrainment mortality does occur, and it is estimated to be highest during pump-back operation. Shutting off the lights at the Fairfield Development pump-back intake during the night could reduce the concentration of fish at the intake, which would in turn reduce entrainment and turbine mortality of fish in Parr Reservoir and the Broad River.

The American shad and blueback herring restoration effort is ongoing in the Santee River Basin through implementation of the Santee Basin Diadromous Fish Restoration Plan, which includes a goal of restoring these species to habitats upstream Parr Shoals Dam, where passage does not currently exist. Continued participation in the Santee Basin Accord would ensure that Dominion Energy begins upstream and downstream fish passage feasibility assessments and initiates fish passage construction for American shad and blueback herring, when the abundance of these species downstream of the Parr Development reaches targets specified in the Santee Basin Accord. In addition, implementing several of the conditions of NMFS's fishway prescription would help to guide the design, construction, operation, maintenance, and monitoring of upstream and downstream fishways, should American shad and/or blueback herring reach the targets that would trigger the design and construction of fishways.

Terrestrial Resources

The project's peaking and pumped storage operations result in the routine inundation and dewatering of littoral and wetland habitats. While reservoir fluctuations

would continue under the new license, outflows from the Parr Shoals Dam would be managed though the implementation of Dominion Energy's proposed Flow Fluctuations AMP and Minimum Flows AMP. Implementation of these plans would limit the intensity of flow fluctuations and increase minimum flows downstream of Parr Shoals Dam. These plans would potentially benefit littoral and wetland habitat and associated wildlife downstream of the project by reducing unnatural flow fluctuations.

Construction activities associated with enhancements to existing project recreation sites and building new recreation sites have the potential to affect terrestrial resources. In general, most effects be temporary, except for permanent loss of riparian vegetation as a result of the construction of proposed parking facilities and access at the Highway 34 and Enoree River Bridge Recreation Sites. Construction of the proposed parking facilities and improved access at the Highway 34 Recreation Site would require the removal of 0.16 acre of mature trees and understory vegetation to accommodate additional parking for 12 vehicles. Although staff do not recommend parking improvements at the Enoree River Bridge Recreation Site, Forest Service 4(e) Condition 23 would require constructing a vehicle turn-around with parking area for six vehicles (the Forest Service refers to this area as Keitts Bridge Landing), which would also result in permanent removal of riparian habitat. Effects of construction on terrestrial resources would be minimized through the implementation of site-specific erosion and sediment control measures, required in the Erosion Monitoring Plan, as modified by staff.

Dominion Energy has an established protocol for maintaining vegetation within the project's transmission line right-of-way. For national forest system land within the project boundary, developing a Vegetation and Non-Native Invasive Plan Management Plan, as required by Forest Service 4(e) Condition 18, would facilitate coordinated vegetation management in the project area that meets the objectives of both Dominion Energy and the resource agencies. Staff also recommends expanding the Vegetation and Non-Native Invasive Plant Management Plan to apply to all project recreation areas, in addition to national forest system lands. Expanding the area covered by the plan would further protect native vegetation and associated wildlife in the project area from the impacts of recreation use and maintenance of project recreation sites.

Staff also recommends developing an Aquatic Invasive Species Management and Monitoring Plan, as required by Forest Service 4(e) Condition 18. Dominion Energy's proposed SMPs include provisions for education and outreach about aquatic invasive species. In combination, Dominion Energy's educational outreach efforts and the Aquatic Invasive Species Management and Monitoring Plan for project waters would provide a comprehensive, systematic approach to aquatic invasive species management and would reduce the introduction and spread of aquatic invasive plant species and the associated adverse effects to native aquatic species in the project area.

Forest Service 4(e) Condition 12, pertaining to pesticide-use restrictions on national forest system lands, would require Dominion Energy to coordinate with the Forest Service on any pesticide applications that would occur in recreational areas within, or adjacent to, national forest land, or that is managed by the Forest Service. This measure would help protect vegetation and wildlife, including any sensitive species, from potential adverse effects of these chemicals. Implementing the Fire Management and Response Plan required by Forest Service 4(e) Condition 21 would be consistent with Dominion Energy's existing forest management strategy. Developing a formal plan to manage fire hazards and respond to forest fires would be helping to protect public safety at the project and prevent fires that could spread to land adjacent to the project boundary.

Threatened and Endangered Species

In the Santee River Basin, where the Parr Project is located, the federally endangered shortnose sturgeon occurs downstream from the Columbia Diversion Dam (located 23 miles downstream of the Parr Development) and spawning has been documented on the Congaree River near the City of Columbia about 3.6 miles downstream from the Columbia Diversion Dam. Federally endangered Atlantic sturgeon also occur in the Santee River Basin, but only in the Santee and Cooper rivers (located downstream from the Parr Project), where they are unable to pass upstream of dams in the two rivers. However, there is the potential for effective passage to be installed at Santee Dam during the term of any new license issued for the Parr Project, which, if successful, would give Atlantic sturgeon unimpeded access to habitat on the Congaree River up to the Columbia Diversion Dam. Implementing the Flow Fluctuations AMP would eliminate project-induced flow fluctuations that currently occur downstream of the Parr Development during the spawning season and improve spawning habitat conditions for shortnose sturgeon and Atlantic sturgeon in the Congaree River. With implementation of the Flow Fluctuations AMP, staff find that relicensing the project is not likely to adversely affect the shortnose sturgeon and Atlantic sturgeon.

The federally endangered Carolina heelsplitter also occurs in the Santee River Basin, but recent surveys indicate that the Carolina heelsplitter is not present in the vicinity of the project, or in any part of the Broad or Congaree rivers. In addition, there are no efforts to relocate Carolina heelsplitter to areas that could be affected by project operation. Therefore, staff find that relicensing the project would have no effect on the Carolina heelsplitter.

The federally endangered wood stork has not been documented in the Monticello or Parr Reservoirs, though periodic occurrences of wood stork have been documented in the adjacent Saluda River Basin. The project reservoirs, particularly in the upper reaches of the Parr Reservoir and the Broad River and Enoree River WMAs, provide suitable foraging habitat for wood stork. Wood stork could periodically use portions of project lands and waters for seasonal foraging (primarily by post-dispersal migrants during the

summer months); but shallow backwaters, including the upper reaches of the Parr Reservoir, would not be altered by proposed project operations, and shallow ponds in the WMAs would continue to be maintained as waterfowl habitat. Therefore, staff find that relicensing the project would have no effect on wood stork.

Although the project is outside of the current range of the northern long-eared bat and the WNS zone per the final 4(d) rule, the northern long-eared bat is known to occur in both coastal and upstate South Carolina, including counties that border the project. These observations suggest that the species could occur in Newberry and Fairfield Counties, which are situated between areas where both the northern long-eared bat and WNS have been documented. FWS has no records of maternity roost trees or hibernaculum sites within Fairfield or Newberry Counties; however, undocumented maternity roost trees may be present. Suitable roosting and foraging habitat for the northern long-eared bat exists within the project boundary.

To account for any changes in the range of northern long-eared bat and WNS zone, and lack of information about the occurrence of the northern long-eared bat within the project boundary, Dominion Energy proposes to consult with the FWS and South Carolina DNR staff prior to implementing the proposed construction at the Highway 34 Recreation Site, which would disturb a 0.16 acre and remove approximately 20 mature box elder and 8 mature American sycamore, as well as understory vegetation that includes immature water oak. Dominion Energy also proposes to consult with the FWS prior to forest management activities if the northern long-eared bat's presence in Fairfield and Newberry Counties is established.

Staff instead recommend that Dominion Energy limit tree removal within the project boundary to November 1 through March 31 to minimize any potential adverse effects to northern long-eared bats during the pup season and the broader active season given that: (1) there are no known hibernacula in the vicinity of the project; (2) suitable summer roosting and foraging habitat is present within the project boundary and northern long-eared bat may use this habitat during their active season; (3) the project is adjacent to counties with the range of the NLEB; and (4) the project is adjacent to counties with documented WNS, which is known to spread rapidly to adjacent areas. Our recommended measure would ensure that any effects on NLEB would be discountable, and therefore, if this requirement is in the license, relicensing the project would not likely adversely affect northern long-eared bat.

Three federally endangered plant species, Candby's dropwort, rough-leaved loosestrife, and smooth coneflower, are known to occur in Richland County, outside of the project boundary. None of these terrestrial plant species is known to occur in counties overlapping the project boundary. Each species has specific habitat requirements that are not present in the project area. Given that the project area would likely not provide suitable habitat for these terrestrial species, and they are not known to

occur in the counties within project boundary, we find that relicensing the project would have no effect on Canby's dropwort, rough-leaf loosestrife, and smooth coneflower.

Recreation and Land Use

Dominion Energy proposes to implement an RMP that includes provisions for enhancing existing project recreation sites and constructing four new project recreation sites. The recreation enhancement measures include adding shelters, benches, and picnic tables; fishing piers, boat docks, and signage. The four new recreation sites would include one at the Fairfield Development (Highway 99 East Recreation Site) and three at the Parr Development (Parr Shoals Dam canoe portage, Highway 34 Recreation Site, and Enoree River Bridge Recreation Site). These facilities would improve the overall recreation user experience and would help meet recreation demand in the project area, preserve existing high-quality outdoor recreation opportunities, and meet a need for increased future recreational use and demand.

Dominion Energy's RMP includes provisions to construct a canoe/kayak step-down facility at Keitts Bridge Landing (as part of the proposed Enoree River Bridge Recreation Site). Forest Service 4(e) Condition 23 also requires construction of a concrete vehicle turn-around with a parking area for six vehicles and a hardened path from the parking area to the step-down location at Keitts Bridge Landing. The only existing amenity at this location is an unimproved bank area used primarily by waterfowl hunters and paddlers to access the Enoree River. Adding the canoe/kayak step-down facility would allow for easier non-motorized access these users to the Enoree River and still maintain its mainly undeveloped, natural character. While the additional facilities required by Forest Service 4(e) Condition 23 (e.g., roadway and parking improvements) would provide even greater access improvements for waterfowl hunters and paddlers to this site, they are not consistent with the low levels of use and remote nature of the site. Further, unlike the cost for installing a canoe/kayak step-down facility, the construction costs for the concrete vehicle turn around, parking area for six vehicles and a hardened path are disproportionately high for the low levels of use at the site. Staff does not recommend constructing these facilities, although they would be included in the staff alternative with mandatory conditions.

Implementing the proposed SMPs would help to protect water quality, aquatic habitat, recreation, and cultural resources at the Parr Project by specifying permitted and prohibited activities and structures and establishing expectations for enforcement. Dominion Energy proposes to conduct periodic monitoring of the Monticello Reservoir shoreline to inventory and inspect docks, access paths, and shoreline erosion control structures/projects for compliance with the Monticello Reservoir SMP, but does not provide a description how the monitoring would occur or the frequency of shoreline monitoring. Visually monitoring the shoreline on a quarterly basis would help Dominion

Energy detect unauthorized uses and structures within the project boundary, allowing for efficient resolution of permit violations on Monticello Reservoir.

Cultural Resources

Within the project's area of potential effects, there are five historic properties, including the project facilities associated with the Parr Development; ten properties that need additional evaluation to determine National Register eligibility; and one property that may become eligible for listing on the National Register in 2028 (Fairfield Dam Pumped Storage Facility). Reservoir fluctuations, vegetation management, construction of new recreation facilities, and recreation activities could cause adverse effects to these resources. Dominion Energy's proposed HPMP outlines protection measures, management and consultation protocols, and measure to avoid, reduce, or mitigate the effects of such activities.

To meet section 106 of the National Historic Preservation Act requirements, the Commission intends to execute a programmatic agreement (PA) with the South Carolina State Historic Preservation Officer for the project for the protection of historic properties that would be affected by project construction, operation, and maintenance activities. The terms of the PA would require Dominion Energy to implement the HPMP. Implementing the HPMP, including specific treatments to address issues that have been identified to date, as well as any resources that are discovered during the term of any license issued, and consultation with the South Carolina State Historic Preservation Officer and potentially-affected tribes before conducting activities that may have the potential to affect historic properties, would ensure that historic properties are protected from erosion, recreational use, and looting over the license term.

Environmental Effects of the No Action Alternative

Under the no-action alternative, the project would continue to operate as it has in the past. Dominion Energy would not upgrade its generator capacity at the Parr Development and turbine operation would continue to be generator-limited. Dominion Energy would continue to operate the turbines at 50 percent wicket gate opening, which contributes to flow fluctuations downstream from Parr Shoals Dam.

None of Dominion Energy's proposed environmental measures or the resource agencies' recommendations and mandatory conditions would be required. Dominion Energy would not implement the measures required by the Settlement Agreement, including plans to monitor and repair erosion; reduce flow fluctuations, increase minimum flows, and improve water quality downstream from Parr Shoals Dam; improve aquatic habitat in the reservoirs and downstream from Parr Shoals Dam; improve recreation access; manage shoreline development; and protect cultural resources. NMFS's fish passage prescriptions would not be adopted, nor would the Forest Service's conditions. None of the staff-recommended measures would be required, including

measures to monitor for and repair shoreline erosion at the Parr Dam canoe portage; manage vegetation for protection of the northern long eared bat; and treat non-native invasive plants; or expand monitoring for violations of the Monticello Reservoir SMP.

Conclusions

Based on our analysis, we recommend licensing the project as proposed by Dominion Energy, with staff modifications and additional measures (i.e., the staff alternative). However, as noted previously, we recognize that the Commission is required to include all section 18 prescriptions and section 4(e) conditions in any license issued for the project (i.e., the staff alternative with mandatory conditions).

In section 4.2 of the EA, we estimate the likely cost of alternative power for each of the four alternatives (i.e. no action, Dominion Energy's proposal, the staff alternative, and the staff alternative with mandatory conditions). Our analysis shows that during the first year of operation under the no-action alternative, project power would cost $289,462,017 (about $404 per megawatt-hour [MWh]) less than the cost of alternative power. Under Dominion Energy's proposal, project power would cost $288,151,050 (about $394/MWh) less than the cost of alternative power. Under the staff alternative, project power would cost $288,239,401 (or $43.50/MWh) more than the likely cost of alternative power. Under the staff alternative with mandatory conditions, project power would cost $288,200,138 (or $43.50/ MWh) more than the likely cost of alternative 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 (732,092 MWh annually); (2) the 533.9 MW of electric capacity comes from a renewable resource that does not contribute to atmospheric pollution, including greenhouse gases; and (3) the recommended environmental measures proposed by the licensees, as modified by and enhance fish and wildlife resources, improve recreation opportunities at the project, and protect cultural resources. The overall benefits of the staff alternative would be worth the cost of the proposed and recommended environmental measures.

ENVIRONMENTAL ASSESSMENT

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

Parr Hydroelectric Project
FERC Project No. 1894-211 – South Carolina

1.0 INTRODUCTION

1.1 APPLICATION

On June 28, 2018, South Carolina Electric & Gas Company (SCE&G, now identified as Dominion Energy South Carolina, Inc. [Dominion Energy])[2] filed an application to relicense its 526.08-megawatt (MW) Parr Hydroelectric Project (Parr Project or project)[3] with the Federal Energy Regulatory Commission (Commission or FERC). The project consists of two developments: the Parr Shoals Development and the Fairfield Pumped Storage Development. The project is located on the Broad River, in Newberry and Fairfield Counties, South Carolina (figure 1-1). The project occupies about 162.61 acres of federal land within Sumter National Forest administered by the U.S. Forest Service (Forest Service).

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the Parr Project is to provide a source of hydroelectric power. Under the provisions of the Federal Power Act (FPA), the Commission must decide whether to issue a new license to Dominion Energy for the 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 (such as flood control, irrigation, and water supply) for which licenses are issued, the Commission must give equal consideration to the purposes of: (1) energy conservation; (2) the protection, mitigation of damage to, and

[2] Effective April 29, 2019, SCE&G changed the company name to Dominion Energy South Carolina, Inc. On July 29, 2019, the Commission approved the name change. *See* 168 FERC ¶ 62,053 (2019).

[3] The current license for the Parr Project was issued on August 28, 1974 and expires on June 30, 2020. *See South Carolina Electric & Gas Co.,* 52 F.P.C. 537 (1974).

enhancement of fish and wildlife (including related spawning grounds and habitat); (3) the protection of recreational opportunities; and (4) the preservation of other aspects of environmental quality.

Issuing a new license for the Parr Project would allow Dominion Energy to continue to generate electricity at the project for the term of the new license, making electric power from a renewable resource available to its customers.

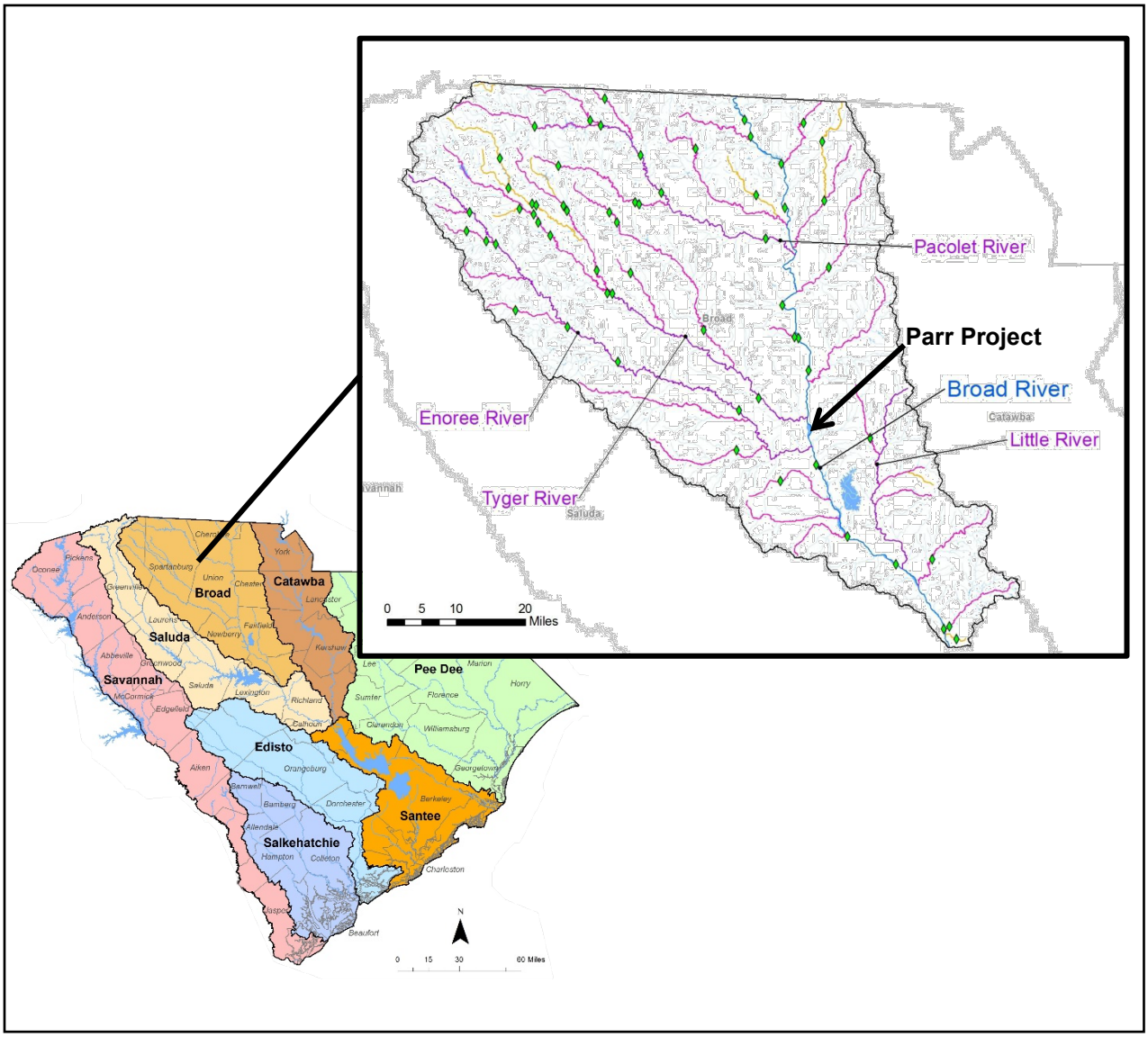

Figure 1-1. Location of the Parr Hydroelectric Project within the Broad River Basin (Source: Allen, *et al.* (2015); as modified by staff).

This environmental assessment (EA) has been prepared in compliance with the National Environmental Policy Act (NEPA) of 1969 to assess the environmental and economic effects associated with operation of the project, alternatives to the project, and

makes recommendations to the Commission on whether to issue a new license, and if so, recommends terms and conditions to become a part of any license issued for the project.

In this EA, we assess the environmental and economic effects of continued project operation: (1) as proposed by the applicant, Dominion Energy, and as specified in the Comprehensive Relicensing Settlement Agreement (Settlement Agreement; proposed action);[4] (2) as proposed by Dominion Energy with our recommended measures (staff alternative); and (3) the staff alternative with mandatory conditions. We also considered the effects of a no-action alterative. The primary issues addressed in the EA include water quality and dissolved oxygen (DO) enhancement downstream from the Parr Shoals Development; low-flow management downstream from the Parr Shoals Development; aquatic habitat; fish passage; invasive vegetation management; new recreation sites and improvements to existing recreation areas; and cultural resource management.

1.2.2 Need for Power

The Parr Project has a generating capacity of 526.08 MW and has a net generation of approximately 716,475 megawatt-hours (MWh) per year.

The North American Electric Reliability Corporation (NERC) annually forecasts electrical supply and demand nationally, and regionally for a 10-year period. The Parr Project is located in the SERC Reliability Corporation (SERC) region of NERC,[5] in the east sub-region (SERC-E).

NERC's 2019 Long-Term Reliability Assessment shows the projected growth in capacity demand for the period 2019-2028. The summer period is typically the heaviest demand period for Dominion Energy. The capacity growth trends for the SERC-E assessment area for the period 2019 to 2028, for the summer peak season demand, show that the SERC-E region will need to add 2,933 MW of capacity. This represents a demand increase of 6.5 percent over the 10-year period, or an annual growth rate of about 0.72 percent.

The power from the Parr Project would help meet the need for power in the SERC-E in both the short and long term. In addition, most of the power generated by the pumped storage development of the project would be available during daily peak demand

[4] The Settlement Agreement was filed with the license application on June 28, 2018 and was signed by Dominion Energy, American Rivers, American Whitewater, Congaree Riverkeeper, Mr. Jeffrey Carter, National Marine Fisheries Service, South Carolina Department of Natural Resources, and the U.S. Fish and Wildlife Service.

[5] The SERC region includes all or portions of 16 southeastern and central states, and is divided geographically into four assessment areas that are identified as SERC-E, SERC-N, SERC-SE, and SERC-FP.

periods and help meet the variable load requirements of the region. The project provides power that can displace non-renewable, fossil-fired generation, and contribute to a diversified generation mix. Displacing the operation of non-renewable facilities may avoid some power plant emissions, thus creating an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

Any new license for the Parr Project is subject to numerous requirements under the FPA, and other applicable statutes. The major regulatory 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 the construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of the U.S. Department of Commerce or the U.S. Department of the Interior (Interior). On September 30, 2019, National Marine Fisheries Service (NMFS) timely filed a preliminary prescription for the project to include certain fish passage measures and a request that the Commission include a reservation of authority to prescribe fishways under section 18 in any license issued for the project. On September 30, 2019, Interior also filed a request that the Commission include a reservation of authority to prescribe fishways under section 18 in any license issued for the project.

1.3.1.2 Section 4(e) Conditions

Section 4(e) of the FPA provides that any license issued by the Commission for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation. The Forest Service filed preliminary conditions on August 29, 2017 (Appendix C). These conditions are described under section 2.2.4, *Modifications to Applicant's Proposal – Mandatory Conditions*, are summarized in table 5-2, and are discussed in section 5.3.2, *Forest Service's Section 4(e) Conditions*.

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.

On September 30, 2019, NMFS filed timely recommendations under section 10(j). These recommendations are summarized in table 5-1, and discussed in section 5.3.1, *Fish and Wildlife Agency Recommendations*. In section 5.3.1, we also discuss how we address the agency recommendations and comply with section 10(j).

1.3.2 Clean Water Act

Under section 401 of the Clean Water Act (CWA),[6] a license applicant must obtain either a water quality certification (certification) from the appropriate state pollution control agency verifying that any discharge from a project would comply with applicable provisions of the CWA, or a waiver of such certification. A waiver occurs if the state agency does not act on a request for certification within a reasonable period of time, not to exceed one year, after receipt of such request.

On August 16, 2019, Dominion Energy applied to the South Carolina Department of Health and Environmental Control (South Carolina DHEC) for section 401 certification for the project. South Carolina DHEC received this request on the same day. South Carolina DHEC has not yet acted on the application.

1.3.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA)[7] requires federal agencies to ensure that 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.

U.S. Fish and Wildlife Service's (FWS) Information, Planning, and Conservation (IPaC) system[8] did not identify any federally listed species as occurring in the project vicinity. However, the federally endangered Carolina heelsplitter does occur in nearby river systems (Saluda and Catawba river systems) of the Santee River Basin, and has the potential to be affected by project operation. No designated critical habitat for Carolina

[6] 33 U.S.C. § 1341(a)(1) (2018).

[7] 16 U.S.C. § 1536 (2018).

[8] *See* FWS's official list of threatened and endangered species accessed by staff using the IPaC website (https://ecos.fws.gov/ipac/) on November 7, 2018, and April 1, 2020 (FWS, 2018a, 2020a).

heelsplitter occurs within project-affected lands.[9] FWS also indicates that the federally endangered shortnose sturgeon may occur downstream of the Parr Development in Richland County, South Carolina.[10] No critical habitat has been designated for shortnose sturgeon. The federally endangered Carolina Distinct Population Segment (Carolina DPS) of Atlantic sturgeon also occurs downstream of the project in the Santee and Cooper Rivers (NMFS *et al*., 2017). Critical habitat for the Carolina DPS of Atlantic sturgeon was designated on August 17, 2017, but does not include the project area, or any habitat in Broad or Congaree Rivers.[11]

Dominion Energy, acting as the Commission's non-federal representative for informal consultation under the ESA, consulted with FWS, state agencies, and other stakeholders, and conducted a rare, threatened, and endangered species desktop study that included Richland County.[12] In addition to the species discussed above, Dominion Power included the federally endangered red-cockaded woodpecker, Candby's dropwort, rough-leaved loosestrife and smooth coneflower (all known occurrences in Richland County), and the federally threatened northern long-eared bat and wood stork in their review. The northern long-eared bat is not documented as occurring within the project boundary (Fairfield or Newberry Counties); however, it is likely that the species may occur in appropriate habitat within the project area.[13] The wood stork is known to occur in the adjacent Saluda River Basin, and suitable foraging habitat for transient individuals is present in the project area. No critical habitat for any federally listed threatened and endangered, or proposed species occurs within project-affected lands.

Our analysis of project effects on threatened and endangered species is presented in section 3.3.4, *Threatened and Endangered Species*, and our recommendations are

---

[9] *Id*.

[10] See the South Carolina list of at-risk, candidate, endangered, and threatened species by county (https://www.fws.gov/southeast/pdf/fact-sheet/south-carolina-species-list-by-county.pdf).

[11] 82 Fed. Reg. 39,160-39,274 (August 17, 2017). All critical habitat in the Santee-Cooper system is located downstream of lakes Marion and Moultrie.

[12] The desktop assessment included areas within the project boundary (Fairfield and Newberry Counties), as well as the reach of the Broad River from Parr Shoals Dam through Frost Shoals, near Boatwright Island (Richland County). Known ranges, life history and habitat requirements for each of these species were evaluated to determine the potential for occurrence and to identify potential project effects (Kleinschmidt, 2017c).

[13] Appendix A of Dominion Energy's September 18, 2019 filing includes the most recent consultation with the FWS and South Carolina DNR on the potential presence of the northern long-eared bat in the project area.

included in section 5.1, *Comprehensive Development and Recommended Alternative*. Based on the available information, we conclude that relicensing the Parr Project, with implementation of the proposed measures would have no effect on the Carolina heelsplitter, red-cockaded woodpecker, wood stork, Canby's dropwort, rough-leaved loosestrife and smooth coneflower, and is not likely to adversely affect the shortnose sturgeon, Atlantic sturgeon, and northern long-eared bat.

1.3.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA),[14] the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state's 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 180 days of its receipt of the applicant's certification.

Dominion Energy's application, filed May 31, 2017, included a letter from South Carolina DHEC, dated March 16, 2017, which states that the project is outside of the coastal zone and would not cause spillover effects to coastal resources. Therefore, CZMA consistency certification is not required.

1.3.5 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA)[15] requires that a federal agency "take into account" how its undertakings 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).

Dominion Energy consulted with the South Carolina State Historic Preservation Officer (SHPO) and potentially affected Indian tribes to identify historic properties, determine National Register-eligibility, and assess potential adverse effects on historic properties within the project's area of potential effects (APE). This consultation, and other investigations conducted to date, identified 13 archeological sites and certain project facilities as eligible, or potentially eligible, for listing in the National Register. Two additional sites are listed in the National Register. To address potential effects to historic properties identified within the project's APE, Dominion Energy proposes to implement a Historic Properties Management Plan (HPMP) for the Parr Project. The final HPMP was filed on January 10, 2017 and is a component of the Settlement Agreement. The HPMP, which was developed in consultation with the Commission, the South Carolina SHPO, Forest Service, the Chickasaw Nation, the Choctaw Nation of

[14] 16 U.S.C. § 1456(c)(3)(A) (2018).
[15] 54 U.S.C. § 306108 (2018).

Oklahoma, the Jena Band of Choctaw Indians, the Muscogee (Creek) Nation, the Seminole Indian Tribe of Florida, the Catawba Indian Nation, and the United Keetoowah Band of Cherokee Indians, would direct the preservation and long-term management of historic properties and archeological sites within the project's APE, including measures to avoid, minimize, or mitigate adverse effects on historic properties throughout the term of a new license.

To meet the requirements of section 106, the Commission intends to execute a Programmatic Agreement (PA) with the South Carolina SHPO for the protection of historic properties within the project's APE from the effects of continued operation and maintenance of the Parr Project. The terms of the PA would ensure that Dominion Energy addresses and treats all historic properties identified within the project's APE through the implementation of its HPMP. A draft PA was issued on February 1, 2017, and Dominion Energy and the South Carolina SHPO both filed responses stating that they had no comments on the draft.

1.4 PUBLIC REVIEW AND CONSULTATION

The Commission's regulations[16] require applicants to 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,[17] the ESA, the NHPA, and other federal statutes. Pre-filing consultation must be complete and documented according to the Commission's regulations.

1.4.1 Scoping

Before preparing this EA, we conducted scoping to determine what issues and alternatives should be addressed. We distributed Scoping Document 1 to interested agencies and others on March 6, 2019. The following entities provided written comments. The comments were minor and are addressed in this EA.

Commenting Entity	Date filed
Dominion Energy	March 26, 2019
American Rivers	April 4, 2019
South Carolina DNR	April 5, 2019
NMFS	April 8, 2019

1.4.2 Interventions

On July 31, 2019, the Commission issued a notice accepting the application and determining that the application was ready for environmental analysis. This notice set

[16] 18 C.F.R. §§ 5.1 to 5.16 (2019).
[17] 16 U.S.C. §§ 661 *et seq*. (2018).

September 30, 2019, as the deadline for filing protests and motions to intervene. On September 19, 2019, Interior filed a notice of intervention. Interior does not oppose issuance of a new license.

1.4.3 Comments on the License Application

The July 31, 2019 notice also requested comments, recommendations, preliminary terms and conditions, and preliminary prescriptions. The following entities responded:

Commenting Entity	Date Filed
Forest Service	August 29, 2017
South Carolina DNR	September 27, 2019
Interior	September 30, 2019
National Marine Fisheries Service	September 30, 2019

1.5 COMPREHENSIVE RELICENSING SETTLEMENT AGREEMENT

On June 28, 2018, Dominion Energy filed a Settlement Agreement which includes all of Dominion Energy's proposed measures. The Settlement Agreement was signed by the following federal and state agencies, non-governmental organizations, and individuals: Dominion Energy, NMFS, FWS, South Carolina Department of Natural Resources (South Carolina DNR), American Rivers, American Whitewater, Congaree Riverkeeper, and Mr. Jeffrey Carter.

On July 11, 2018, the Commission issued a Notice of Settlement Agreement and Soliciting Comments, setting August 13, 2018 as the deadline for filing comments, and August 27, 2018 as the deadline for reply comments. Interior filed a response on August 13, 2018, stating that it has no comments.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

Under the no-action alternative, the project would continue to operate under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented. We use this alternative as the baseline environmental condition for comparison with other alternatives.

2.1.1 Existing Project Facilities

The Parr Project consists of two developments: the 511.2-MW Fairfield Pumped Storage Development (Fairfield Development) and the 14.88-MW Parr Shoals Development (Parr Development). The Fairfield Development impounds Frees Creek, a small tributary of the Broad River to create Monticello Reservoir and operates as a pumped storage facility. The Parr Development impounds the Broad River, creating the Parr Reservoir, and operates as a conventional run-of-river facility.

The Fairfield Development includes the 6,600-acre Monticello Reservoir, which serves as the upper reservoir and has a normal maximum elevation of 424.3 feet North American Vertical Datum of 1988 (NAVD 88).[18] Monticello Reservoir is also the primary source of cooling water for the Virgil C. Summer Nuclear Power Station. The Monticello Reservoir is impounded by four earthen dams (A, B, C, and D). A 265-foot-long gated intake channel is located between dams B and C. The intake leads to four 800-foot-long surface penstocks bifurcating into eight penstocks connected to the generating station. The generating station is located underground and houses eight reversible pump-turbine units. The Parr Reservoir (discussed further, below) is the lower reservoir for the Fairfield Development. The transmission facilities consist of two 230-kilovolt (kV) 7,000-foot-long lines extending from the Fairfield Development switch station to a switchyard located at the non-project Virgil C. Summer Nuclear Power Station (V.C. Summer Nuclear Station).

The Parr Development includes the 15-mile-long, 4,250-acre Parr Reservoir at full pond elevation (265.3 feet). The 2,690-foot-long Parr Shoals Dam, which impounds the reservoir, includes several non-overflow sections, a 2,000-foot-long, gated spillway section with ten 200-foot-long bottom-hinged spillway gates, and a 300-foot-long powerhouse intake section. A concrete powerhouse is integral with the dam and contains

[18] Unless otherwise noted, all elevations referenced are North American Vertical Datum of 1988 (NAVD 88). Conversion to National Geodetic Vertical Datum of 1929 (NGVD29), often referred to as mean sea level (msl) in supporting studies, requires the addition of 0.7 feet to NAVD 88-referenced elevations.

six generating units. The transmission facilities include three 950-foot-long, 13.8-kV lines extending from the hydro station to the non-project Parr sub-station.

Dominion Energy currently owns, operates, and maintains, or provides for the operation and maintenance of, six project recreation sites within the project boundary as part of the Parr Project. These sites include: Cannon's Creek and Heller's Creek at the Parr Development; and Scenic Overlook, Highway 215, Highway 99 West, and Recreation Lake[19] at the Fairfield Development. Amenities at the sites include dock and bank fishing, picnicking, camping, swimming, restrooms, playground and sport facilities, and hiking trails.

2.1.2 Existing and Proposed Project Boundary

The project boundary is defined by compass bearings and distances in most areas, and elevations in other areas. The project boundary encloses the 6,600-acre Monticello Reservoir and the 4,250-acre Parr Reservoir up to the elevation of the reservoir high water marks; lands adjacent to each reservoir, four earthen dams and an underground generating station at the Fairfield Development, Parr Shoals Dam, a spillway and powerhouse at Parr Shoals Dam, and other appurtenances; and the project's six recreation sites. The project boundary extends downstream to the base of Parr Shoals Dam. The project boundary encloses about 162.61 acres of Forest Service lands within the Sumter National Forest administered by the Forest Service, located along the Parr Reservoir and Broad River.

As part of the Settlement Agreement, Dominion Energy proposes to develop three new recreation sites at the Parr Development, one new recreation site at the Fairfield Development, and expand an existing recreation site (Cannon's Creek at the Parr Development) which would require modifying the project boundary by an additional 22.67 acres. Dominion Energy filed, with their application, a revised project boundary map which fully encloses the new and expanded recreation sites (figure 2-1). The project boundary contains 151 acres around the Monticello Reservoir (Fairfield Development) and 2,131 acres around the Parr Reservoir (Parr Development) which have been set aside by Dominion Energy for future recreation use.

[19] Recreation Lake is a 300-acre sub-impoundment of Monticello Reservoir, located at the north end of Monticello Reservoir. Recreation Lake is hydraulically separated from the main reservoir by an embankment which allows the sub-impoundment to remain at a relatively constant elevation regardless of the daily water level changes in the main reservoir.

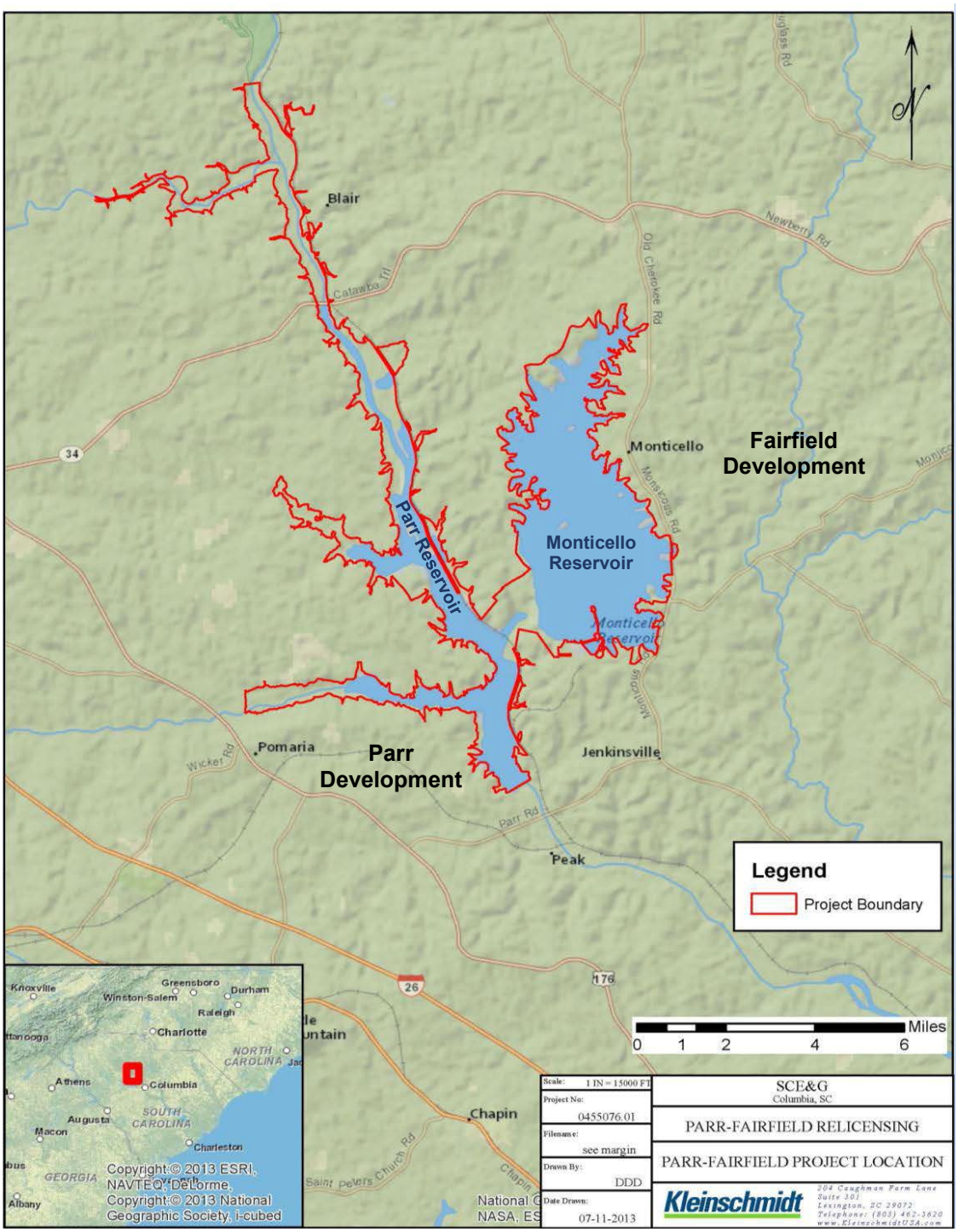

Figure 2-1. Parr Project Boundary and surrounding areas (Source: Dominion Energy, 2018b; as modified by staff).

2.1.3 Project Safety

The Parr Project has been operating for more than 45 years under the existing license. During this time, Commission staff has conducted operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, 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 the consultant's safety reports have been submitted for Commission review.

As part of the relicensing process, Commission staff will evaluate the continued adequacy of the project's facilities under a new license. Special articles will be included in any license issued, as appropriate. Commission staff will continue to inspect the project during the term of the new license to ensure continued adherence to Commission-approved plans and specifications, special license articles relating to construction (if any), operation and maintenance, and accepted engineering practices and procedures.

2.1.4 Existing Project Operation

2.1.4.1 Fairfield Development

Dominion Energy operates the Fairfield Development as a pumped storage facility to provide peaking and emergency reserve capabilities for its electrical generating system. Dominion Energy pumps water from the lower reservoir (Parr Reservoir) to the upper reservoir (Monticello Reservoir) during periods of low electrical demand (at night) and generates energy from the head of the upper reservoir through four penstocks during periods of peak demand. When the project is in pumping mode, it can be stopped quickly and reversed to generate electricity. When not in a pumping mode, it can be brought online when needed for system generation and stability. These pumped storage capabilities allow Dominion Energy to quickly respond to peak power demand, or to help replace power lost as a result of an outage at another generating facility.

Dominion Energy operates the Fairfield Development from a control room located in the Fairfield powerhouse, which is staffed continuously. At the Fairfield Development Dominion Energy generates energy and pumps water using a storage volume in the upper Monticello Reservoir of up to 29,000 acre-feet between elevation 424.3 feet (full pool) and elevation 419.8 feet. The pump-generation cycle occurs almost daily, resulting in a maximum daily fluctuation of 4.5 feet in Monticello Reservoir.

2.1.4.2 Parr Development

The Parr Development is operated in a modified run-of-river mode and generates as a baseload facility using available flows up to 4,800 cubic feet per second (cfs) at 50-percent wicket gate opening. Although the hydraulic capacity of the turbines is

approximately 6,000 cfs, this flow exceeds the rated capacity of the generators, and therefore, Dominion Energy typically does not pass more than 4,800 cfs through the turbines. When inflows are below 4,800 cfs, the project turbines are operated to meet the minimum flow requirements as required by Article 14 of the project's existing license, described below. When inflows exceed 4,800 cfs, the gates on the spillway are systematically lowered to release flows in excess of 4,800 cfs to maintain the reservoir elevation no higher than 265.3 feet.

Article 14 of the existing license requires Dominion Energy to provide minimum flows at the Parr Development. For striped bass spawning, Dominion Energy is required to release from Parr Shoals Dam the lesser of a 1,000 cfs instantaneous minimum flow from March to May, or the average daily inflow to Parr Reservoir, minus evaporation losses from the Parr and Monticello Reservoirs. In the remaining months, Dominion Energy is required to release from Parr Shoals Dam, the lesser of a 150 cfs instantaneous flow and 800 cfs daily average flow, or the average daily inflow minus evaporation losses from Parr and Monticello Reservoirs. Minimum flows are generally released through the project turbines.

As discussed previously, Parr Reservoir serves as the lower reservoir for the Fairfield Development. Water levels in Parr Reservoir may fluctuate up to 10 feet as a result of pumped storage operation. The normal maximum elevation for Parr Reservoir is 265.3 feet.

Dominion Energy staffs the Parr Development 5 days per week, 8 hours per day. The turbine units are operated remotely; however, spillway gate adjustments are conducted manually only during times when the station is staffed. Dominion Energy adjusts the spillway gates incrementally to release all flows which exceed the generator capacity of 4,800 cfs.

2.1.4.3 Drought/Low-Flow Operation

During periods of low flow in the Broad River, the Parr Development generates continuously using one or more generating units to pass the natural river flow downstream and meet any minimum flow requirements. The Fairfield Development continues its daily pump/generation cycles subject to the availability of water in Parr Reservoir. During extremely low flow periods, there may not be enough inflow to Parr Reservoir to allow complete replenishment of Monticello Reservoir during its pump/generation cycle, in which case generation from the Fairfield Development would be reduced during the following generation cycle.

2.1.4.4 Flood Flow Operations

Article 39 of the existing license requires Dominion Energy operate the project so that releases from Parr Reservoir during flood flows are no greater than flows which

would have occurred in the absence of the project.[20] Dominion Energy has observed that flooding downstream of Parr Shoals Dam may occur when flows reach 40,000 to 45,000 cfs. When flows exceed the hydraulic capacity of the turbines at Parr Development (6,000 cfs), Dominion Energy incrementally lowers the crest gates at Parr Shoals Dam until 40,000 cfs passes at the dam, at which time all gates are lowered to pass all flood flows entering the project. In addition, releases from the Fairfield Development may be completely suspended until flows recede.

2.1.5 Existing Environmental Measures

Under the current license, Dominion Energy:

- Provides the minimum flows required by Article 14, as described above, to protect aquatic resources downstream of Parr Shoals Dam.
- Operates the Fairfield and Parr Developments to minimize flooding downstream of Parr Shoals Dam when inflows to the project exceed 6,000 cfs.
- Monitors erosion of the shoreline of Monticello Reservoir twice per year, and the Parr Reservoir annually. Where areas of erosion are identified, Dominion Energy installs rip rap to protect the shoreline.
- Operates and maintains six project recreation facilities, which provide for a variety of recreational opportunities and access to the project. The facilities include day-use areas, boat ramps, picnic tables, rest rooms, campgrounds, and swimming beaches. These facilities are described in section 3.3.5, *Recreation and Land Use*.
- Manages project shorelines in accordance with a Shoreline Management Plan (SMP), which provides guidance to adjacent residents on permitting and constructing shoreline structures within the project boundary. The guidelines provide: (1) specific requirements for tree removal, mechanical clearing, and other activities along the shoreline in order to minimize shoreline disturbance; (2) restrictions for constructing private boat docks and hunting; and (3) information about protecting and enhancing the scenic, recreational, and environmental values of Monticello and Parr Reservoirs.

[20] Flows in excess of 40,000 cfs downstream of the Parr Shoals Dam cause the river to inundate low lying areas outside the main river channel and are referred to as flood flows. In addition, the project boundary does not extend downstream of Parr Shoals Dam. Therefore, Dominion operates the project to prevent operations from affecting low lying areas outside of the project boundary.

2.2 APPLICANT'S PROPOSAL

2.2.1 Proposed Project Facilities

Dominion Energy proposes no modification to the facilities at the Fairfield Development. As described in the Settlement Agreement, Dominion Energy proposes to upgrade all six generating units at the Parr Development, either by rewinding the stators or replacing the generators (Condition 4a of the Settlement Agreement). The first upgrade would be completed within 3 years of license issuance, and the last of the six upgrades completed within 10 years of license issuance. Replacing all six generators could increase the hydraulic capacity of the Parr Development from 4,800 cfs to 7,764 cfs, and increase the installed capacity at the Parr Development from 14.88 MW to a maximum of 22.7 MW. Rewinding the generators would have a lesser increase in hydraulic capacity and installed capacity.

2.2.2 Proposed Project Operation

Dominion Energy proposes to continue operating the Parr Project as it has under the existing license (see section 2.1.4, Existing Project Operation and Environmental Measures), which includes shutting down Fairfield Development generation when flows downstream of Parr Shoals Dam are equal to or greater than 40,000 cfs.

Dominion Energy also proposes modifications to existing operations, which include increasing the minimum flows released from Parr Shoals Dam, as described in the Settlement Agreement. In addition, Dominion Energy's proposed Flow Fluctuations Downstream of Parr Dam Adaptive Management Plan (Flow Fluctuations AMP) may result in reduced daily fluctuations in flows downstream of the Parr Shoals Dam (see section 2.2.3, Proposed Environmental Measures).

2.2.3 Proposed Environmental Measures

Dominion Energy proposes the following measures, as detailed in appendices A-1 through A-16 of the Settlement Agreement, the license application, and supplemental filings:

- Implement an Erosion Monitoring Plan, under which Dominion Energy would continue to monitor shoreline erosion along 57 miles of shoreline at Monticello Reservoir twice yearly, and along 88 miles of shoreline at Parr Reservoir annually, and repair severely eroding shoreline with riprap under certain conditions.
- Implement an Enhancements to the West Channel Downstream of Parr Shoals Dam Adaptive Management Plan (West Channel AMP), under which Dominion Energy would establish a review committee to evaluate

and provide recommendations to enhance water quality and aquatic habitat in the west channel, located downstream of the Parr Shoals Dam. (Settlement Agreement Condition 3a)

- Implement a Parr Shoals Dam Turbine Venting Plan (Turbine Venting Plan), under which Dominion Energy would use turbine venting procedures at the Parr Shoals Development from June 15 through August 31 each year to improve DO concentrations in the tailrace of the Parr Shoals Dam and in the Broad River downstream from the dam. (Settlement Agreement Condition 3b)

- Implement a Flow Fluctuations AMP, to minimize flow fluctuations downstream of Parr Shoals Dam year-round, including for two 14-day periods during the spring to improve spawning habitat for shortnose sturgeon, striped bass, American shad, and robust redhorse. (Settlement Agreement Condition 2a)

- Implement a Minimum Flows Downstream of Parr Shoals Dam Adaptive Management Plan (Minimum Flows AMP) to improve aquatic habitat downstream of the project by increasing minimum flows. In general, minimum flow downstream from Parr Shoals Dam, would vary seasonally (as specified in table 3-14) between the flow equal to the inflow of the Broad River into Parr Reservoir and 2,300 cfs, as measured at the Parr Shoals Dam. (Settlement Agreement Condition 2b)

- Implement a Monticello Reservoir Fisheries Habitat Enhancement Plan to mitigate any effect of reservoir fluctuations on fish habitat by placing spawning, nursery, and deep habitat structures in Monticello Reservoir. (Settlement Agreement Condition 2c)

- Implement an American Eel Abundance Monitoring Plan to address the need for an upstream eel ramp at the Parr Shoals Development by monitoring the number of American eel downstream of the Parr Shoals Dam. (Settlement Agreement Condition 2d)

- Implement a Freshwater Mussel Monitoring Plan to monitor the number, distribution, and species composition of mussels in Monticello Reservoir and downstream of Parr Shoals Dam, with emphasis on the Carolina creekshell mussel. (Settlement Agreement Condition 2e)

- Turn off tailrace lighting during normal project operations to protect fish during pump-back operation of the Fairfield Development to minimize the potential for entrainment. (Settlement Agreement Condition 2h)

- Continue to participate in the Santee Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement.[21] (Settlement Agreement Condition 2f)

- Annually fund a Habitat Enhancement Program (HEP) at a funding amount based on the level of pumped storage operation each year,[22] or a minimum of $50,000. The funds would be used to restore, protect, and enhance aquatic, wetland, and riparian habitats in the project area and outside the project boundary in portions of the Broad, Saluda, and Congaree River watersheds. (Settlement Agreement Condition 2g)

- Initiate informal consultation with FWS prior to any tree removal related to recreation construction for protection of northern long-eared bat, and prior to forest management activities if the northern long-eared bat's presence in Fairfield and Newberry Counties is established.

- Implement a Recreation Management Plan (RMP) that includes measures to: (1) continue to operate and maintain the project's six existing recreation sites (Cannon's Creek, Heller's Creek, Scenic Overlook, Highway 215, Highway 99 West, and Recreation Lake); (2) construct enhancements at five existing project recreation sites (Cannon's Creek, Scenic Overlook, Highway 215, Highway 99 West, and Recreation Lake); and (3) develop four new project recreation sites (Highway 99 East at the Fairfield Development and Parr Shoals Dam canoe portage, Highway 34, and Enoree River Bridge at the Parr Development). (Settlement Agreement Condition 1a)

- Implement a Monticello Reservoir SMP to identify existing land uses and appropriate future uses, protect natural resources, and provide plans and programs for managing public use and access to project lands, including the Monticello Reservoir shoreline. (Settlement Agreement Condition 5b)

- Implement a Parr Reservoir SMP to identify existing land uses and appropriate future uses, protect natural resources, and provide plans and

[21] The Santee Basin Accord, signed by Dominion Energy on April 18, 2008, requires Dominion Energy to conduct a Fish Passage Feasibility Assessment within 1 year following successful passage of 50 percent of the American shad or blueback herring target restoration numbers for any 3 years in a 5-year period at the Columbia Diversion Dam Fish Passage Facility. Construction of a fishway at the Parr Shoals dam would be required once passage of 75 percent of the target restoration numbers for American shad or blueback herring were met at the Columbia Diversion Dam Fish Passage Facility.

[22] Appendix A-8 of the Settlement Agreement provides a formula and example for calculating the level of funding to be provided.

programs for managing public use and access to project lands, including the Parr Reservoir shoreline. (Settlement Agreement Settlement Agreement Condition 5a)

- Implement a HPMP for the protection of historic properties eligible for listing on the National Register. (Settlement Agreement Condition 6a – HPMP)

2.2.4 Modifications to Applicant's Proposal – Mandatory Conditions

The following mandatory conditions have been provided and are summarized below.

2.2.4.1 Section 18 Fishway Prescriptions

NMFS submitted a preliminary fishway prescription, which is included in Appendix B. NMFS's fishway prescription includes eight conditions relevant to fish passage for American shad and blueback herring. Regarding fish passage feasibility and construction, NMFS's fishway prescription would require Dominion Energy to:

- Conduct a fish passage feasibility assessment for upstream and downstream passage at the Parr Development, as defined in the Santee Basin Accord. (NMFS Fishway Prescription Condition 1)
- Include in the fish passage feasibility assessment, design and construction schedules that would be reviewed and approved by NMFS, in consultation with the Fishery Technical Committee,[23] at the 30, 60, and 90 percent design stages. (NMFS Fishway Prescription Condition 1)
- Construct, operate, and maintain fishways at the Parr Development to provide safe, timely, and effective passage for American shad and blueback herring. (NMFS Fishway Prescription Condition 2)
- Develop a detailed construction plan and provide a minimum of 90 days for NMFS in coordination with FWS and South Carolina DNR to review and approve the plan. (NMFS Fishway Prescription Condition 7)

[23] NMFS's fishway prescription does not define who would be included in the Fishery Technical Committee. However, we assume the committee will be composed of other resource agencies and stakeholders with an interest in successful passage at Parr Shoals Dam.

- Commence and complete construction of upstream and downstream fishways[24] at the Parr Development, as defined in the Santee Basin Accord. (NMFS Fishway Prescription Condition 1)

- Develop a detailed fishway evaluation[25] plan and provide a minimum of 90 days for NMFS in coordination with FWS and South Carolina DNR to review and approve the plan. (NMFS Fishway Prescription Condition 7)

Regarding fish passage design, Condition 7 of NMFS's fishway prescription would require Dominion Energy to:

- Develop design plans and provide a minimum of 90 days for NMFS, in coordination with FWS and South Carolina DNR, to review and approve the plans;

- Develop original plans and subsequent modifications according to guidance and specified criteria provided by NMFS for the design of fish screens, fishways, and other fish passage structures;

- Submit final design plans to the Commission for final approval prior to the commencement of construction activities and following NMFS's approval;

- Consult with FWS and NMFS, in coordination with South Carolina DNR throughout the entire design process;

- Have all designs reviewed by the Fishery Technical Committee;

- Commence initial design meetings at the pre-design, or conceptual-level design phase;

- Obtain concurrence from FWS and NMFS, in coordination with South Carolina DNR, on all preferred alternatives for each independent facility, or any major feature of a facility prior to advancing to the feasibility-level of design; and

[24] NMFS's fishway prescription and the Santee Basin Accord do not specifically state that fishway construction would be for upstream and downstream fishways. However, because the Santee Basin Accord does state that the fish passage feasibility assessment would be for upstream and downstream fishways, we assume that this prescription is for the construction of upstream and downstream fishways at the Parr Development.

[25] NMFS's fishway prescription does not define the term "evaluation"; however, we assume that "evaluation" refers to the process of ensuring proper operation and design of fishways prior to opening the fishways for passage.

- Implement any design modifications as required by FWS and NMFS, as necessary to fulfill the objective of safe, timely, and effective passage for all target species.

Regarding fish passage maintenance and operation, NMFS's fishway prescription would require Dominion Energy to:

- Develop a fishway operation and maintenance plan for each fishway describing the anticipated fishway operational protocols, maintenance, maintenance schedule, and contingencies (NMFS Fishway Prescription Condition 5);
- Submit the fishway operation and maintenance plan to NMFS, FWS, and South Carolina DNR for review and approval prior to filing with the Commission (NMFS Fishway Prescription Condition 5);
- Maintain and operate fishways at the Parr Development during the upstream (March 1 to May 15) and downstream (late summer to fall) migration periods for American shad and blueback herring, which would be subject to change based on annual monitoring of migration runs (NMFS Fishway Prescription Condition 4);
- Keep all fishways in proper order and fishway areas clear of trash, logs, and material that would hinder passage (NMFS Fishway Prescription Condition 5); and
- Conduct maintenance with enough time before a fish migration period such that the fishways can be tested and inspected, and the fishways will operate effectively prior to and during the migratory periods (NMFS Fishway Prescription Condition 5).

Regarding fish passage effectiveness monitoring, Condition 8 of NMFS's fishway prescription would require Dominion Energy to:

- Develop plans with schedules for conducting upstream and downstream fishway effectiveness monitoring for at least three passage seasons,[26] in consultation with the Fishery Technical Committee;
- Submit plans and effectiveness monitoring results to the Fishery Technical Committee prior to filing with the Commission; and

[26] NMFS's prescription would require effectiveness monitoring for three passage seasons, but NMFS also adds that additional monitoring may be necessary depending on unforeseen circumstances such as weather conditions.

- Include in the filed plans, explanations of any disagreements the licensee may have regarding comments or recommendations made by the resource agencies.

NMFS's fishway prescription would also require Dominion Energy to implement the following general provisions:

- NMFS's reserves the authority to defer the timing of construction and/or implementation of fishways at the Parr Development based on new information that may warrant a change to prescription schedules, such as any results from studies or monitoring, changes to the upstream fishway at the Columbia Diversion Dam, changes to recreational fishing regulations, or petitions from the licensee for an extension that is approved by NMFS (NMFS Fishway Prescription Condition 3);
- Notify and obtain NMFS's approval for any modifications to schedules or extensions of time to comply with the provisions included in the prescription for fishways at the Parr Development (NMFS Fishway Prescription Condition 3); and
- Provide FWS, NMFS, and South Carolina DNR access to the Parr Project site and to pertinent Parr Project records for the purpose of inspecting the fishways, determining compliance with the fishway prescriptions, and for general evaluation and oversight (NMFS Fishway Prescription Condition 6).

2.2.4.2 Section 4(e) Conditions

The Forest Service filed 23 preliminary terms and conditions under section 4(e) of the FPA, which we include in Appendix C and summarize below.[27]

- Forest Service Condition 11 prohibits the storage of hazardous substances on national forest system lands without prior approval of the Forest Service and requires submittal of a spill prevention and cleanup plan for approval by the Forest Service as part of any request to store hazardous substances.

[27] Preliminary 4(e) Conditions 1 – 10, 15, and 16 are administrative in nature, and not considered further in this EA. The remaining 11 conditions are considered in this EA. Condition 19 is administrative in that it only requires the drafting of a report and reviewing existing special status species lists; no specific protective measures are provided that can be evaluated in this EA. However, the condition stipulates that should a new special status species be identified that may be potentially affected by the licensee's actions, appropriate protection measures would be developed and implemented. This would potentially require a future amendment to the project license.

- Forest Service 4(e) Condition 12 prohibits the use of pesticides on national forest system lands to control undesirable woody and herbaceous vegetation, aquatic plants, insects, rodents, non-native fish, etc., without prior Forest Service approval.
- Forest Service 4(e) Condition 13 requires that the licensee consult with the Forest Service, prior to April 15 of each year.
- Forest Service 4(e) Condition 14 requires that the licensee, within 3 months of license issuance, establish a consultation group, whose primary purpose is to provide a forum for the licensee to consult with resources agencies and other interested entities regarding: (1) the annual meeting required by Condition No. 13; (2) any plans that are developed under the license; and (3) any proposed temporary or permanent modifications to license conditions.
- Forest Service 4(e) Condition 17 requires the licensee to consult with the Forest Service, prior to erecting signs related to safety issues on national forest system lands covered by the license.
- Forest Service 4(e) Condition 18 requires the licensee, within 1 year of license issuance, to develop: (1) an Aquatic Invasive Species Management and Monitoring Plan; and (2) a Vegetation and Invasive Weed Management Plan for all national forest system lands potentially affected by the project.
- Forest Service 4(e) Condition 19 requires the licensee to: (1) prepare and submit to the Forest Service a biological evaluation prior to taking actions to construct new project features on national forest system lands that may affect special status species or their critical habitat on national forest system land; and (2) annually review the lists of special status species and assess the presence of new species on federal land.
- Forest Service 4(e) Condition 20 requires the licensee within 1 year of license issuance, to develop an Erosion and Sediment Control Plan to provide direction for treating erosion and controlling sedimentation with the project boundary and project-affected national forest system lands during the term of the new license.
- Forest Service 4(e) Condition 21 requires the licensee, within 1 year of license issuance, to develop a Fire and Fuels Management Plan.
- Forest Service 4(e) Condition 22 requires the licensee, beginning in the first full year after license issuance, to provide annual employee awareness training regarding special status species, noxious weeds and sensitive areas that are known to occur within or adjacent to the project boundary on

national forest system lands, and the procedures for reporting and complying with license requirements.

- Forest Service 4(e) Condition 23 requires the licensee to develop, in consultation with the Forest Service, a vehicle turn-around with parking area for six vehicles and a non-motorized canoe/kayak step down facility at the Enoree River Bridge Recreation Site.[28] As part of design and construction of the facility, the licensee would be required to: (1) coordinate with the Forest Service to determine the location of flowage easements relative to the improvements; (2) prepare detailed construction plans and specifications for the improvements; (3) prepare and submit a biological evaluation regarding the potential impacts of facility development on affected special status species; and (4) prepare and submit an archaeological evaluation to minimize or avoid adverse effects to cultural sites.

2.3 STAFF ALTERNATIVE

Under the staff alternative, the Parr Project would be operated as proposed by Dominion Energy in the Settlement Agreement except for the HEP and with the following additional staff-recommended measures and modifications:

- Require Dominion Energy to develop a final design plan and construction schedule for the proposed generator upgrades, which would include an increase in installed capacity from 14.88 MW to 22.7 MW, which is consistent with replacing all six generating units.
- Modify the Erosion Monitoring Plan to incorporate all requirements of Forest Service 4(e) Condition 20, and also to require annual monitoring of erosion downstream from Parr Shoals Dam at the canoe portage put-in following the same protocol established in the plan for Parr Reservoir.
- Modify the Freshwater Mussel Monitoring Plan by removing all provisions for monitoring in Monticello Reservoir.
- Continue to participate in the Santee Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement, with the added provision that operation of any newly constructed fishways would not begin until fishway evaluations indicate that fishways are operating properly.
- Modify the Vegetation and Non-Native Invasive Plant Management Plan required by Forest Service 4(e) Condition 18 to include provisions for

[28] The Forest Service refers to this site as Keitts Bridge Landing.

addressing vegetation and non-native invasive plant management at all project recreation areas, in addition to those actions directly affecting national forest system lands.

- Limit tree removal related to recreation construction and forest management activities to November 1 through March 31 to minimize any potential adverse effects to northern long-eared bats during the pup season and the broader active season.

- Modify the Monticello Shoreline Management Plan to include a provision for quarterly monitoring surveys of the Monticello Reservoir shoreline.

Staff does not recommend adopting Condition 2g of the Settlement Agreement. Condition 2g of the Settlement Agreement specifies that Dominion Energy to annually fund a HEP to restore, protect, and enhance aquatic, wetland, and riparian habitats in the project area and outside the project boundary in portions of the Broad, Saluda, and Congaree River watersheds. This measure provides the payment of funds for non-specific and as yet unidentified measures that could benefit resources outside of the project area and not having a direct nexus to project effects.[29]

The staff alternative would include all but the following NMFS's Section 18 Fishway Prescription conditions:

- Condition 4, in part, requiring operation of a downstream fishway during a non-specific late-summer to fall migratory period, and implementing unspecified modifications to upstream and downstream fishway operating schedules. This condition would allow fishway operations to occur on a schedule without limits, and therefore provides no information to determine whether a particular downstream operating schedule would or would not provide benefits to American shad or blueback herring, or be in the public interest.

- Condition 6, requiring that Dominion Energy provide FWS, NMFS, and South Carolina DNR access to the Parr Project site and to pertinent Parr Project records for the purpose of inspecting the fishways, determining compliance with the fishway prescriptions, and for general evaluation and

[29] In order to include a specific environmental measure in a license, the Commission needs to be able to conclude that the measure relates to project impacts or project purposes. This is why the Commission has expressed a preference for specific measures and that, where possible, such measures be implemented within the project boundary or close to the project and the area that it affects. *See* the Commission's *Policy Statement on Hydropower Licensing Settlements*, Docket No. PL06-5-000, issued September 21, 2006.

oversight, because with proper operation and maintenance, there is no reason to believe that the fishways would not perform as designed.

The staff alternative would include all but the following Forest Service 4(e) conditions:

- Condition 13, requiring annual consultation with the Forest Service, as consultation is already a requirement of each resource-specific plan.

- Condition 14, requiring organizing a Consultation Group, as licensees are already required to consult with federal and state agencies, including the Forest Service, through the preparation of reports as part of Commission-approved plans.

- Condition 19, requiring that Dominion Energy prepare a Biological Evaluation and annually review the list of special status species, as annual review of special status species is unnecessary. Should Dominion Energy propose new construction or modifications to the project in the future, such consultation would take place in the context of any application to amend the license.

- Condition 22, requiring annual employee training. Although we recognize that annually training project operation and maintenance staff in the identification of special status species, noxious weeds, sensitive areas, and reporting requirements would benefit environmental resources, all licensees are expected to train their employees to the extent needed to comply with the terms of a license.

- Condition 23, requiring that Dominion Energy construct a vehicle turn-around area, parking area for six vehicles, and an access path at the Keitts Bridge Landing site, as use at the site is low.

2.4 STAFF ALTERNATIVE WITH MANDATORY CONDITIONS

We recognize that the Commission is required to include all section 18 prescriptions and section 4(e) conditions in any license issued for the project. Therefore, the staff alternative with mandatory conditions includes all eight fishway prescriptions, including the two not included in the staff alternative discussed in section 2.3. The staff alternative with mandatory conditions also includes all 23 preliminary 4(e) conditions

filed by Forest Service, including the 5 not included in the staff alternative discussed in section 2.3. [30]

2.5 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

The following alternatives were considered, but have been eliminated from further analysis, because they are not reasonable in the circumstances of this case: (1) issuing a non-power license; (2) Federal Government takeover of the project; and (3) decommissioning 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.

2.5.2 Federal Government Takeover of the Project

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 currently 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 Project Decommissioning

As the Commission has previously held, decommissioning is not a reasonable alternative to relicensing a project in most cases, when appropriate protection, mitigation, and enhancement measures are available.[31] The Commission does not speculate about

[30] The Staff Alternative with Mandatory Conditions includes operating the project under existing operations with environmental measures as proposed by Dominion Energy, modified by staff, and any mandatory conditions required in the NMFS's Section 18 Fishway Prescriptions and Forest Service Section 4(e) Conditions not otherwise recommended by staff.

[31] See, e.g., *Eagle Crest Energy Co.*, 153 FERC ¶ 61,058, at P 67 (2015); *Public Utility District No. 1 of Pend Oreille County*, 112 FERC ¶ 61,055, at P 82 (2005); *Midwest Hydro, Inc.*, 111 FERC ¶ 61,327, at PP 35-38 (2005).

possible decommissioning measures at the time of relicensing, but rather waits until an applicant actually proposes to decommission a project, or there are serious resource concerns that cannot be addressed with appropriate measures, making decommissioning a reasonable alternative.[32] This is consistent with the National Environmental Policy Act and the Commission's obligation under section 10(a) of the FPA to issue licenses that balance developmental and environmental interests.

Project decommissioning could be accomplished with or without dam removal.[33] Either alternative would involve denial of the relicense application and surrender or termination of the existing license with appropriate conditions. No participant has recommended decommissioning, and we have no basis for recommending it.

[32] *See generally Project Decommissioning at Relicensing; Policy Statement*, FERC Stats. & Regs., Regulations Preambles (1991-1996), ¶ 31,011 (1994); *see also City of Tacoma, Washington*, 110 FERC ¶ 61,140 (2005) (finding that unless and until the Commission has a specific decommissioning proposal, any further environmental analysis of the effects of project decommissioning would be both premature and speculative).

[33] In the event that the Commission denies relicensing, a project or a licensee decides to surrender an existing project, the Commission must approve a surrender "upon such conditions with respect to the disposition of such works as may be determined by the Commission." 18 C.F.R. § 6.2 (2018). This can include simply shutting down the power operations, removing all or parts of the project (including the dam), or restoring the site to its pre-project condition.

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 recommended environmental measures. Sections are organized by resource area (aquatic, recreation, etc.). Historic and current conditions are described for each resource area. The existing conditions are 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 cumulative effects of the proposed action and alternatives. Our conclusions and recommended measures are discussed in section 5.1, *Comprehensive Development and Recommended Alternative*.[34]

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The Parr Shoals Dam is located at river mile 24 on the Broad River. The Broad River originates in the Blue Ridge Mountains, and flows generally south-southeastwardly, through North Carolina and South Carolina (figure 3-1) approximately 150 miles to its confluence with the Congaree River. In North Carolina, the Broad River is impounded by Lake Lure Dam to form Lake Lure, which is operated by the Town of Lake Lure for hydropower generation and recreation.[35] In South Carolina it passes through the Sumter National Forest before joining the Saluda River to form the Congaree River in the city of Columbia. The Congaree River joins the Wateree River where it flows into Lake Marion. Lake Marion empties into two separate drainages, the Santee River, which empties into the Atlantic Ocean, and Lake Moultrie, which empties to the Cooper River and ultimately to the Atlantic Ocean.

Parr Shoals Dam is one of seven dams on the main stem of the Broad River in South Carolina. From upstream to downstream these include:

- P-2332, Gaston Shoals, hydropower license expires on May 31, 2036;
- P-2880, Cherokee Falls, hydropower license expires July 31, 2021;
- P-2331, Ninety-Nine Island, hydropower license expires May 31, 2036;
- P-2620, Lockhart, hydropower license expires on March 31, 2040;
- P-2315, Neal Shoals, hydropower license expires on May 31, 2036;

[34] Unless otherwise indicated, the source of our information is Dominion Energy's license application.

[35] Lake Lure Hydropower Project is not subject to FERC jurisdiction. *See* 60 FERC ¶ 62,005 (1992).

- P-1894, Parr, hydropower license expires June 30, 2020; and
- The Columbia Diversion Dam, which is part of the Columbia Project (P-1895), hydropower license expires April 30, 2042.

The Neal Shoals Project (P-2315) is the first project located upstream (about 30 RM) of Parr Shoals Dam. The Columbia Project (P-1895) is the first project downstream (about 24 RM) from Parr Shoals Dam, on the Congaree River.

Figure 3-1. Saluda, Broad River, and Catawba River Basins (Source: Dominion Energy, 2018).

The Parr Project area has a subtropical to temperate climate. Temperatures range from an average daily low of 52 degrees Fahrenheit (°F) in January to an average daily

high of 88 °F in July. Rainfall averages 48 inches per year, with average monthly precipitation between 4 and 6 inches. There is no distinct wet or dry season, although late winter and early spring tend to be the wettest parts of the year, while early fall tends to be the driest. The Midlands of South Carolina, where the project is located, is generally the driest portion of the state.

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations for implementing NEPA,[36] a cumulative effect is the impact on the environment which 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 actions. Cumulative effects can result from individually minor, but collectively significant, actions taking place over a period of time, including hydropower and other land and water development activities.

Based on our review of the relicense application, as well as agency and public comments, we have identified geology and soils, water quantity, water quality, and fisheries as resources that could be cumulatively affected by continued operation of the project.

3.2.1 Geographic Scope

The geographic scope of the cumulative effects analysis defines the physical limits or boundaries of the proposed action's effects on the resource and contributing effects from other hydropower and non-hydropower activities within the Broad and Congaree River Basins. We have identified the Broad River Basin and Congaree River Basin[37] as our geographic scope of analysis for geology and soils, water quantity and water quality.

---

[36] 40 C.F.R. § 1508.7 (2019).

[37] The geographic scope for water quality and quantity in Scoping Document 1 only included the Broad River Basin. NMFS in a letter filed April 8, 2019, South Carolina DNR in a letter filed April 5, 2019, and American Rivers in a letter filed April 4, 2019 requested that the geographic scope for water quality and quantity be extended to include the Congaree River. South Carolina DNR stated that the Parr Project has been shown to cause daily flow fluctuations in the Congaree River, as noted in Exhibit E of the license application. South Carolina DNR also stated that the proposed 14-day period for minimizing flow fluctuations downstream from Parr Shoals Dam coincides with releases from the Saluda Project No. 516, and this proposed measure is intended to protect and enhance spawning conditions for striped bass in the Congaree River. Staff agrees that these operational effects of the Parr Project have the potential to influence water quantity and quality in the Congaree River, and now include the Congaree River in the geographic scope for water quality and quantity.

We chose this geographic scope because other activities, such as water uses, in combination with the operation of the project, may influence movement of soils and erosion, as well as water quantity and quality, but the effect is generally not observable downstream of the Congaree River.

For fishery resources the geographic scope of analysis includes the Broad River from the project dam downstream to the Atlantic Ocean, including the Congaree**,** Cooper**,** and Santee Rivers. We chose this geographic scope because anadromous and catadromous species may use habitat in these rivers from the Atlantic Ocean up to Parr Shoals Dam and would be exposed to a number of other hydroelectric projects and flow diversions that could have a cumulative effect on the fishery.

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 quality, downstream aquatic habitat, and fish resources. Based on the potential new license term, the temporal scope looks 30 to 50 years into the future, concentrating on the effect on the resources from reasonably foreseeable future actions. The historical discussion is limited, by necessity, to the amount of available information for each resource. 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 project-specific effects 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 project 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 resources (water quantity, water quality, and fish), terrestrial resources, threatened and endangered species, recreation access and facilities, land use, and cultural resources may be affected by the proposed action and alternatives. We have not identified any substantive issues related to aesthetic resources or socioeconomics associated with the proposed action; therefore, these resources are not addressed in the EA. We present our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

3.3.1 Geology and Soils

3.3.1.1 Affected Environment

The Parr Project is located in Fairfield and Newberry Counties, South Carolina, which are within the Piedmont physiographic region. This region is characterized by gently rolling hills with narrow stream and river valleys. Forests, farms, and orchards dominate most of the landscape. The elevations range from approximately 400 feet to 1,000 feet (Griffith *et al*., 2002). Typical rock types associated within this region are gneiss, schist, and granite covered with deep saprolite and red, clayey subsoils (EOE, 2008). In South Carolina, the Piedmont physiographic region is divided into four unique ecoregions. The project is located in the Southern Outer Piedmont ecoregion. In comparison to South Carolina's other Piedmont ecoregions, this region tends to have lower elevations, less relief, and irregular plains instead of plains with hills.

In general, the soils surrounding the project consist of sandy clay and sandy loams, which overlay the bedrock at depths of 25 to 75 feet (NRC and Corps, 2011). The soils with the greatest representation within the project area include those from the Cecil (23 percent), Madison (15 percent), Pacolet (12 percent), Hiwassee (8 percent), Wynott-Winnsboro (6 percent), Hard Labor (5 percent), and Rion (5 percent) families. The remaining 26 percent of soils are of various families each representing less than five percent of the total project area (EOE, 2008). The most common soil types are characterized as follows:

- Cecil family soils, consisting of sandy clay and sandy loam, are well drained with a 2-percent to 15percent slope and exhibit moderate erodibility.
- Madison family soils, consisting of sandy clay and sandy loam, are well drained with a 2-percent to 25-percent slope and exhibit severe erodibility.
- Pacolet family soils, consisting of sand, clay, and sandy clay loam, are well drained with a 10-percent to 50-percent slope and exhibit severe erodibility.
- Hiawassee family soils, consisting of sandy clay and sandy loam, are well drained with a 2-percent to 10-percent slope and exhibit moderate erodibility.
- Wynott-Winnsboro family soils, consisting of sandy clay loam, are well drained with a 2-percent to 10-percent slope and exhibit moderate erodibility.
- Hard Labor family soils, consisting of sandy loam, are moderately well drained with a 2-percent to 10-percent slope and exhibit moderate erodibility.

- Rion family soils, consisting of sandy loam, are well drained with a 7-percent to 50-percent slope and exhibit moderate erodibility (NRCS, 2014).

Erosion

The shorelines within the project area have been disturbed by construction of roadways near the waterline and structures to support recreational and project-related activities. Shorelines surrounding project structures are armored with concrete embankments and riprap to prevent erosion. Vegetation surrounding the project area varies, but forested shorelines are the most prevalent feature within the project boundary. The eastern shoreline area of the Monticello Reservoir is more developed than the remaining project shoreline and has less forested area and more homes with grassy lawns that extend into the project boundary.

Dominion Energy monitors the shoreline of Monticello Reservoir twice a year (during the second and fourth quarters of the year), and the shoreline of Parr Reservoir every year (during the second quarter of the year). During the surveys, areas of erosion are identified, classified, and mapped into one of three categories: slight, moderate, or severe. During the October 2017 survey, 51.8 percent of the Monticello Reservoir shoreline exhibited slight erosion, 24.0 percent exhibited moderate erosion, and 9.5 percent exhibited severe erosion. 14.7 percent of the shoreline was hardened or otherwise not subject to active erosion (Chapman, 2017). The survey noted a shift in the amount and severity of shoreline affected by erosion from 2016 to 2017, with the shoreline receding toward the project boundary (Stoudemire, 2017). At the time the license application was filed, Dominion Energy was evaluating repair methods for the shoreline areas exhibiting severe erosion.

On the Parr Reservoir, 93.2 percent of the shoreline exhibited slight erosion, 3.3 percent exhibited moderate erosion, and no shoreline exhibited severe erosion. The remaining 3.5 percent of the shoreline was hardened or otherwise not subject to active erosion. Dominion Energy found that, during the 2017 survey, the Parr Reservoir shoreline was well-vegetated, and no areas were identified as needing corrective action (Chapman, 2017).

Sedimentation

Soil types in the project area tend to be high in sand. As these soils erode, eroded sediment, including sand, accumulates in the impoundments behind dams on the Broad River. In 2019, there were 20 active sand mine dredging permits within the Broad River Basin. Of these, 16 were located upstream of the project on the Broad River. One permitted sand mine dredging location is located within the project boundary on the Parr Reservoir. Newberry Sand, Inc. owns and operates the Blair Sand Mine, located in Fairfield County. The Blair Sand Mine is located on property owned by Dominion Energy, adjacent to Parr Reservoir. Since 2008, Newberry Sand, Inc. has dredged a

3,000-foot segment of the Broad River, within the project boundary, to extract sand that is screened and stockpiled at the mine. The dredging operation removes about 22,500 tons of sand from the Parr Reservoir annually, resulting in total of about 190,700 tons of sand removed since 2008. (Kleinschmidt, 2018). The sand mine was approved by the Commission as a non-project use in December 2019.[38]

3.3.1.2 Environmental Effects

Project Operation

Dominion Energy proposes to continue operating the Parr Project as it has under the previous license. The Fairfield Development would operate as a pumped storage facility for peaking and emergency reserve, with a maximum daily fluctuation of 4.5 feet in Monticello Reservoir, which serves as the upper pool for pumped storage operation. Parr Reservoir, which serves as the lower pool, could fluctuate up to 10 feet as a result of pumped storage operation. As proposed, the Parr Development would continue to operate in a modified run-of-river mode using available flows up to 4,800 cfs. When inflows exceed 4,800 cfs, Dominion Energy would systematically open the gates on the spillway to release flows up to 40,000 cfs. Condition 2a of the Settlement Agreement requires implementation of Dominion Energy's proposed Flow Fluctuations AMP, which would manage flow fluctuations downstream of Parr Shoals Dam through improved system control when the plant is unmanned (e.g., through remote monitoring and/or spillway gate automation) and upgrades in generators at the Parr Development to allow use of flows greater than 4,800 cfs for power generation (up to 7,264 cfs once Dominion Energy implements its proposed generator upgrades). NMFS recommends adopting the proposed Flow Fluctuations AMP.

Under the existing license, Dominion Energy monitors project shorelines, tracks changes in erosion over time, and ranks erosion severity. Dominion Energy has established a protocol for shoreline hardening, used where erosion is severe. Dominion Energy proposes an Erosion Monitoring Plan to continue monitoring the shoreline at both the Monticello and Parr Reservoirs and to repair severe erosion that either encroaches on the existing project boundary or threatens infrastructure or significant natural or cultural resources. Settlement Agreement Condition 5c requires implementation of the proposed Erosion Monitoring Plan.

Forest Service 4(e) Condition 20 requires Dominion Energy to develop and implement an Erosion and Sediment Control Management Plan for the project. The plan would include: (1) methods for initial and periodic inventory and monitoring of the entire project area and project-affected national forest system lands; (2) criteria for ranking and treating erosion sites; (3) erosion control measures that (a) incorporate

[38] 169 FERC ¶ 62,146 (2019).

current standards, (b) follow Forest Service regulations and guidance, (c) are customized to site-specific conditions, and (d) are approved by Forest Service; (4) a schedule for treatment (e.g., repair, mitigate, monitor) of erosion sites; (5) effectiveness monitoring of completed erosion control measures after implementation; (6) protocols for emergency erosion and sediment control; (7) a process for documenting and reporting inventory and monitoring results, including periodic plan review and revision;[39] and (8) site-specific, temporary erosion control measures for individual construction projects.

Our Analysis

During normal operations, fluctuations in impoundment levels and instream flows downstream from hydropower projects have the potential to contribute to shoreline erosion. South Carolina's Piedmont region, including the project area, is characterized by sandy soils and substrates, which are susceptible to erosion from wind and wave action. The extent of the erosion can be influenced by the timing, magnitude, and frequency of impoundment or instream flow fluctuations. Fluctuations of up to 4.5 feet in Monticello Reservoir and 10 feet in Parr Reservoir, which occur as a result of pumped storage operation, as well as instream flow fluctuations downstream of Parr Shoals Dam, which occur when the project's spillway gates are opened, have the potential to influence the location and timing of shoreline erosion.

Soils around the Monticello and Parr Reservoirs are moderately to severely erodible, as indicated in the NRCS soil survey for the project. Dominion Energy actively monitors and manages shoreline erosion at both developments. Dominion Energy's proposal to continue monitoring the reservoir shorelines and repair areas of erosion over the term of a new license, as required in the Erosion Monitoring Plan, would allow Dominion Energy to track changes in shoreline erosion over time and address areas of active erosion that encroach on environmental and cultural resources or infrastructure.

Dominion Energy does not currently monitor for erosion downstream from Parr Shoals Dam. However, project operation (i.e., downstream flow fluctuations) has the potential to affect shoreline erosion downstream from the dam. Annual monitoring of erosion downstream from Parr Shoals Dam limited to the proposed Parr Shoals Dam canoe portage would allow Dominion Energy to track changes in downstream shoreline erosion over time and make prompt repairs should erosion affect use of the canoe portage.

Forest Service 4(e) Condition 20's requirements for inventorying, monitoring, and treating erosion sites are consistent with those of Condition 5c of the settlement

[39] Documentation would include a Forest Service-compatible GIS database for maps keyed to a narrative description of detailed site-specific, erosion treatment measures and sediment monitoring results.

agreement and Dominion Energy's proposed Erosion Monitoring Plan. Adding protocols for emergency erosion and sediment control, as required by Forest Service 4(e) Condition 20, would facilitate Dominion Energy's response to unanticipated instances where a high volume of run-off leads to significant erosion and sedimentation along the lake's shoreline. The construction-specific requirements of Forest Service 4(e) Condition 20 are discussed further, below.

Construction-Related Activities

Dominion Energy proposes recreation enhancements at five existing recreation sites and development of four new recreation sites including construction of fishing piers, docks, parking areas, and shelters. Additionally, Forest Service 4(e) Condition 23 requires Dominion Energy to construct recreation amenities (parking and a canoe/kayak step-down facility) at the non-project Keitts Bridge Recreation Site. Constructing the proposed recreation facilities would result in ground-disturbing activities.

In the SMPs for both Monticello and Parr Reservoirs, Dominion Energy describes a number of best management practices (BMPs) for erosion and sediment control during shoreline development activities, which apply to all lands within the project boundary. Implementation of the SMPs is required by Settlement Agreement Conditions 5a and 5b. Additionally, Forest Service 4(e) Condition 20 would require Dominion Energy to implement site-specific, temporary erosion control measures for individual construction projects.

Our Analysis

Construction of the proposed recreation amenities has the potential to contribute to erosion and sedimentation in adjacent waters. Vegetation removal, ground clearing, grading, and construction of the recreation enhancements along the project shoreline may cause localized erosion of shorelines and an increase in sedimentation in the Monticello and Parr Reservoirs. Use of proper erosion control and restoration practices during, and immediately following, all construction activities would minimize any effects. The SMPs for the Monticello and Parr Reservoirs require BMPs to prevent soil erosion and sedimentation during construction on project lands, which would guide Dominion Energy's development of the recreation facilities. By implementing site-specific, temporary erosion control measures, as required by Forest Service 4(e) Condition 20, Dominion Energy could minimize erosion, sedimentation, and mass movement of soil into the reservoirs during periods of ground-disturbance (e.g., construction of recreation facilities).

Shoreline Development

As discussed above, Dominion Energy proposes to implement SMPs for both Monticello and Parr Reservoirs. These documents classify the project's shorelines into

developable and protected areas and outline permitting procedures for a variety of public and private shoreline uses at the project. The shoreline classifications are discussed in greater detail in section 3.3.5, *Recreation and Land Use*. In general, the Monticello Reservoir shoreline is more intensively developed than that of Parr Reservoir (i.e., private dock construction is permitted). The SMPs reflect the difference in development intensity. Both SMPs provide specific BMPs for construction, maintenance, and placement of docks, shoreline vegetation, stabilization, lake access pathways, and other shoreline development on lands within the project boundary. As part of SMP implementation, Dominion Energy would routinely monitor shoreline development to ensure compliance with the requirements of the SMPs. The SMPs are required by Settlement Agreement Conditions 5a and 5b.

Our Analysis

Implementation of Dominion Energy's proposed SMPs would help protect the project's shorelines from erosion and sedimentation caused by development of private facilities such as docks and pathways on project lands. Under the SMPs, residential homeowners living adjacent to the project would be required to receive permits from Dominion Energy and follow the BMPs outlined in the SMPs for any near-shore and shoreline construction within the project boundary. The SMPs also provide guidance for homeowners on vegetation management and bioengineering techniques, which have the potential to reduce the effects of upland non-project residential development on shoreline erosion. Routine monitoring would ensure landowner compliance with the SMPs. Overall, the SMPs would help Dominion Energy manage and mitigate for land disturbances caused by shoreline development through its permitting program and implementation of the required BMPs.

3.3.1.3 Cumulative Effects

Operation of the project, when combined with non-project activities occurring in the Broad River watershed, has the potential to cumulatively affect shoreline erosion around the Monticello and Parr Reservoirs. As discussed previously, operation of the project may influence the extent of shoreline erosion occurring at the project. Use of public recreation areas and private docks and walkways within the project boundary may also contribute to localized erosion of the shoreline. Agriculture, timber production, and upland residential development contribute to shoreline erosion by decreasing natural vegetative cover and increasing surface runoff. Taken in combination with the natural topography and erodibility of the soils around the reservoirs, these factors result in a cumulatively negative effect on shoreline erosion. By regularly monitoring and tracking shoreline erosion, implementing BMPs for vegetation management on project lands, and, when necessary, hardening shorelines with riprap, Dominion Energy may minimize and mitigate for the cumulative effects of erosion on reservoir shorelines.

Once eroded soil enters a reservoir, all but the finest of the sediment particles will settle out, much of it near the erosion site. This relatively coarse sediment could change local habitat or influence navigation access and, over time, would reduce the overall reservoir storage volume. Continued operation of the Blair Sand Mine in the Parr Reservoir has the potential to reduce the effects of sedimentation by removing over 20,000 tons of accumulated sediment per year. Particles fine enough to stay suspended in the slow-moving waters of the reservoirs could pass though the project and would be carried away quickly in the energetic, velocity-driven environment of the receiving water, resulting in almost no effect on the river downstream of Parr Shoals Dam.

3.3.2 Aquatic Resources

3.3.2.1 Affected Environment

Water Quantity

Streamflow

Dominion Energy reported monthly mean, minimum, and maximum daily flow data for the project in cfs as recorded at the U.S. Geological Survey (USGS) Gage 02161000 (Broad River at Alston). USGS gage 02161000 is located downstream of the project and reflects total releases from both reservoirs. Any evaporation occurring from the reservoirs is accounted for in the flow data. These flows are depicted in in Table 3-1, below. Figure 3-2 shows the annual flow duration curve for the Parr Project.

Table 3-1. Monthly mean, maximum, and minimum daily flows from the Parr Project (Water Years 1981-2015) (Source: Dominion Energy, 2018b; as modified by staff).

	Mean (cfs)	Max (cfs)	Min (cfs)
January	7,252	17,790	2,106
February	7,722	16,960	1,985
March	8,862	21,560	3,170
April	6,682	18,040	2,821
May	4,926	14,829	1,782
June	3,715	8,909	763
July	3,125	12,440	600
August	3,412	10,210	546
September	2,703	14,740	624
October	3,504	17,360	638
November	3,973	14,499	725
December	5,715	14,190	1,251

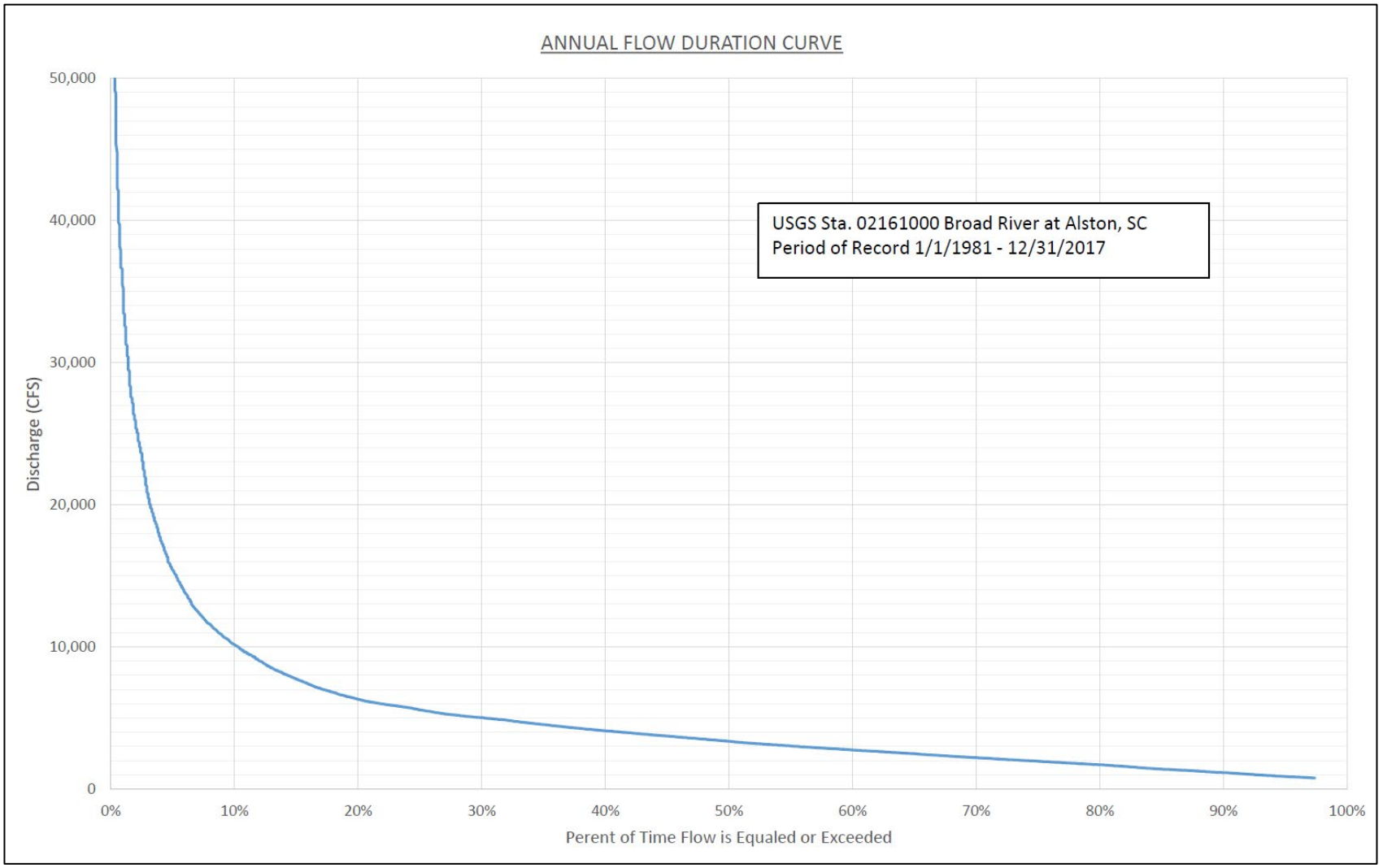

Figure 3-2. Annual flow duration curve for the Parr Project (USGS Gage 02161000) for the Period of Record from January 1, 1981 to December 31, 2017 (Source: Dominion Energy, 2018b, Exhibit B).

East Channel and West Channel Flow Distribution

Immediately downstream from Parr Shoals Dam, the Broad River divides into two channels; the east channel that receives the generation releases from the Parr Powerhouse, and the west channel. The two channels are separated by Hampton Island, which extends upstream nearly to the base of Parr Shoals Dam. The west channel receives little flow, except under high flow conditions when the spillway gates are open.

On February 17 and 24, 2017, Dominion Energy collected water level and discharge measurements downstream from Parr Shoals Dam to investigate the relationship between powerhouse discharge (i.e., east channel discharge) and west channel discharge. Dominion Energy recorded water levels at 15-minute intervals at four locations: upper sites 1, 2, 4, and 5 (*see* figure 3-3).[40] Discharge measurements were collected at four powerhouse operation levels, including one-, two-, three-, and five-unit operation. The discharge measurements were collected during stable conditions, with no spill at upper sites 1 and 2. Tailwater elevations and river discharge were obtained from USGS gage 02160991 (Broad River at Jenkinsville) and USGS gage 022161000 (Broad River at Alston), respectively.[41]

The discharge information in table 3-2 shows that the discharge from the Parr Powerhouse influences flow in the west channel. However, the flows measured in the east and west channels change disproportionately as the Parr Powerhouse discharge changes as units are brought on line.

[40] The green triangles in figure 3-3 represent water level monitoring sites, while the red circles and yellow squares, YSI and HOBO sites, respectively, denote water quality monitoring sites.

[41] USGS gage 02160991 is located within the Parr Shoals tailrace, to the east of the hand measurement sites directly downstream from Parr Dam, and USGS gage 022161000 is located on the Broad River, downstream of the confluence of the east and west channels.

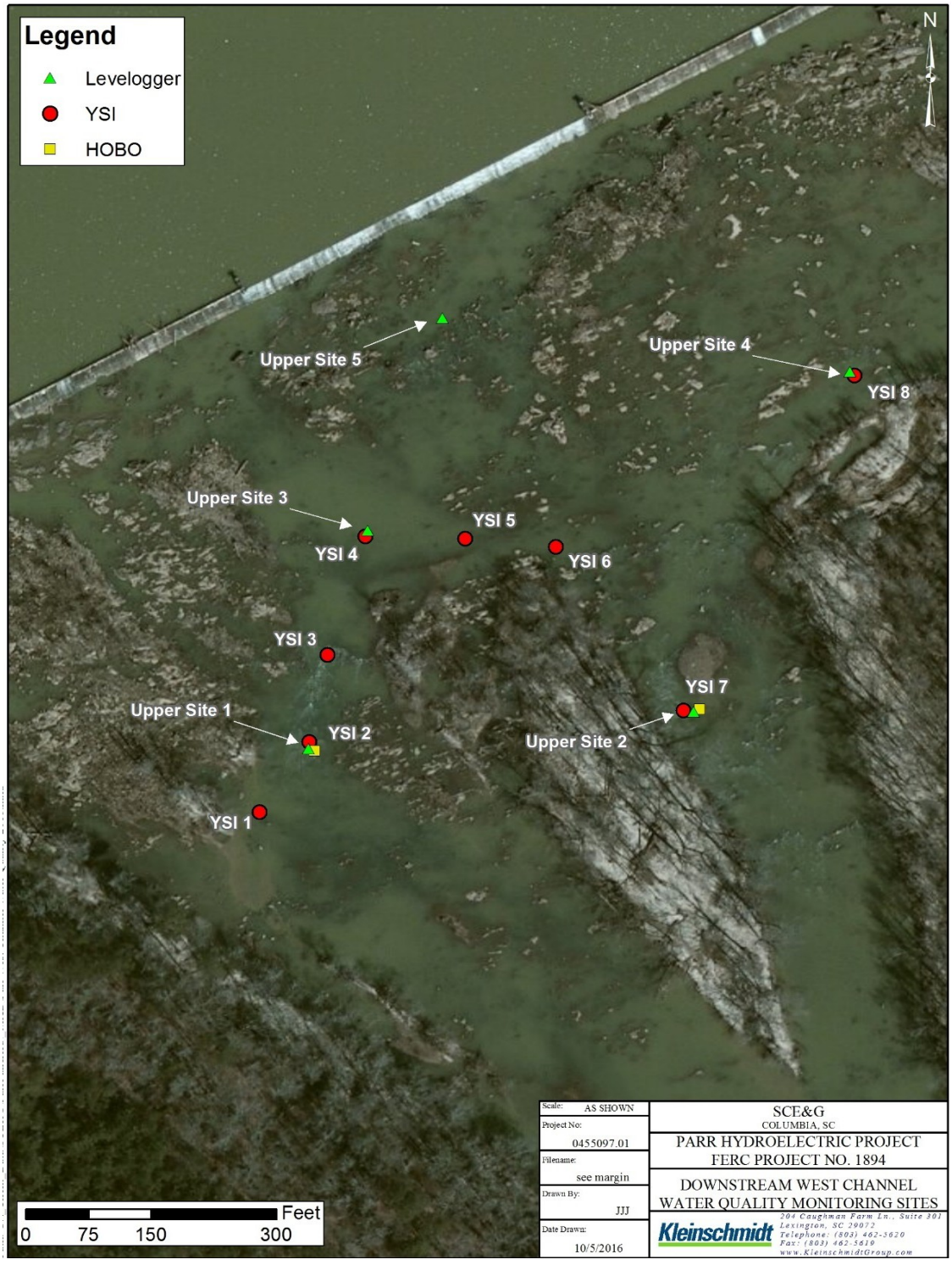

Figure 3-3. Parr Shoals baseline water quality monitoring sites (Source: Dominion Energy, 2018b, Exhibit E-4 Water Resources – Adaptive Management Plan for Enhancements to the West Channel Downstream from Parr Shoals Dam).

Table 3-2. Discharge measurements in the west channel, collected over the two day period of February 17 and 24, 2017 (Source: Dominion Energy, 2018 – Exhibit E-4 Water Resources – Adaptive Management Plan for Enhancements to the West Channel Downstream from Parr Shoals Dam).

Operations	Upper Site 1 Discharge (cfs)	Upper Site 2 Discharge (cfs)	Total West Channel Discharge (cfs)	Broad River at Alston (cfs)
1 Unit	2	0	2	924
2 Unit	23	10	33	1,746
3 Unit	47	32	78	2,134
5 Unit	100	171	271	3,438

Water Withdrawals

Monticello Reservoir provides cooling water for the V.C. Summer Nuclear Station. The V.C. Summer Nuclear Station uses a once-through cooling water system that withdraws water from the Monticello Reservoir into its condensers. After the water cools the condensers, the heated water is transferred to a discharge bay and then flows back into the Monticello Reservoir via a 1,000-foot-long discharge channel. About 1,190 cfs is withdrawn and returned to Monticello Reservoir through this once through operation.

Water Quality

South Carolina DHEC classifies project waters as freshwater, which are considered suitable for primary and secondary contact recreation and as a source for drinking water supply, fishing, the survival and propagation of a balanced indigenous aquatic community of fauna and flora, and industrial and agricultural uses. Table 3-3 lists the South Carolina DHEC water quality standards applicable to project waters (South Carolina DHEC, 2014).

Table 3-3. South Carolina DHEC Water Quality Standards for freshwater in South Carolina (Source: South Carolina DHEC, 2014).

Parameter	Standard
Temperature	The water temperature of all freshwaters which are free flowing shall not be increased by more than 5° Fahrenheit (F) above natural temperature conditions and shall not exceed a maximum of 90°F [*32.2°C*] as a result of the discharge of heated liquids unless a different site-specific temperature standard is established by South Carolina DHEC, a mixing zone is granted, or a Section 316(a) determination under the Federal Clean Water Act has been completed.
Dissolved oxygen (DO)	Daily average not less than 5.0 mg/L with a low of 4.0 mg/L.
pH	Between 6.0 and 8.5
Turbidity	Not to exceed 25 NTUs for reservoirs and not to exceed 50 NTUs for non-reservoirs.

Key: °F – Fahrenheit; °C – Celsius
mg/L – milligrams per liter
NTU – Nephelometric Turbidity Unit

Monticello Reservoir

Water Quality Monitoring

Dominion Energy compiled information on common water quality indicators such as water temperature, DO, pH, and turbidity. Existing data, extending back to 1999, were compiled from several sources, including USGS, South Carolina DHEC, South Carolina DNR, and SCANA Corporate Environmental Services (SCANA Environmental). Figure 3-4 shows the locations of the water quality monitoring stations within Monticello Reservoir, the Broad River upstream of Parr Reservoir, and the Parr Reservoir.

SCANA Environmental and South Carolina DHEC monitored water quality in Monticello Reservoir. SCANA Environmental collected vertical profile water quality data at three sites on Monticello Reservoir, including: (a) in the vicinity of the intake and discharge of the V.C. Summer Nuclear Station on Monticello Reservoir; and (b) in the

upper end of reservoir (*see* figure 3-4).[42] Data on water temperature, DO, and pH were collected on a monthly basis from January 2003 through December 2012 (Kleinschmidt, 2014).

As shown in figure 3-4, South Carolina DHEC has two permanent monitoring stations on Monticello Reservoir (i.e., B-327 and B-328). South Carolina DHEC also randomly selected four additional monitoring sites in 2004, 2008, and 2011 (i.e., RL-11031, RL-04370, RL-04374, and RL-08055). Water quality data (e.g., water temperature, DO, pH, and turbidity) were collected at these sites using grab samples on a monthly or bi-monthly basis, depending on individual sites and year.

[42] Data were collected using a YSI 650 MDS Water Quality Logger. Field measurements were collected at each location beginning at the surface and at 3-foot intervals to the reservoir bottom.

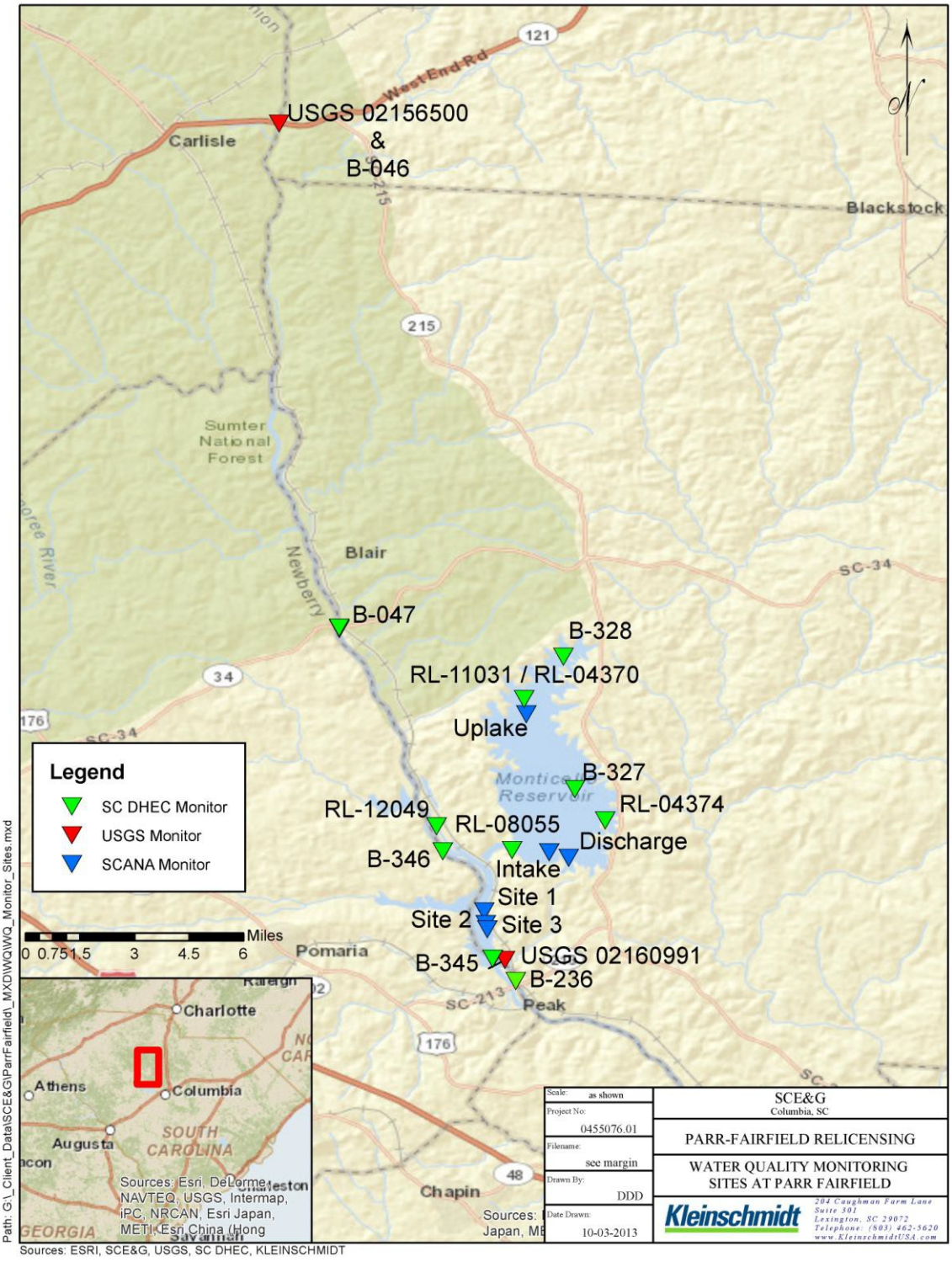

Figure 3-4. Map of water quality monitoring locations for the Parr Project (Source: Kleinschmidt, 2014).

Water Temperature

Water temperatures in Monticello Reservoir at the monitoring site near the cooling water intake of the V.C. Summer Nuclear Station and the monitoring site located at the north end of the reservoir follow a typical trend of increasing during the summer months and decreasing with depth of the reservoir (*see* figure 3-61 through figure 3-72 in Kleinschmidt [2014]). Temperatures at these two locations ranged from around 48.2 °F (9.0°C) during the winter months up to 86.0 °F (30.0°C) during the summer months. Water temperature near the discharge area the V.C. Summer Nuclear Station shows a slightly different trend, with surface temperatures being consistently warmer than the other two monitoring locations. However, at increasing depth, these higher temperatures quickly drop back to what is normal for the reservoir (according to monitoring data from the intake and the upper reservoir monitoring locations). Table 3-4 provides the maximum, minimum, and mean water temperature values on Monticello Reservoir for each collection year at each collection location.

For the period 1999 through 2013, South Carolina DHEC's data showed that water temperature in Monticello Reservoir, as measured at its six monitoring sites, varied from a low of about 46.4 °F (8.0 ºC) to a high of nearly 91.4 °F (33 ºC) (*see* figures 3-109, 3-112, 3-115, 3-118, 3-121, and 3-124 in Kleinschmidt [2014]). Average water temperature varied little depending on location in the reservoir, but it exhibited typical seasonal patterns for the southeast.

Dissolved Oxygen

DO in Monticello Reservoir typically range between 5.0 mg/L and 8.0 mg/L in the hotter, summer months, and between 13.0 mg/L and 15.0 mg/L in the cooler, winter months (*see* figure 3-73 through figure 3-84 in Kleinschmidt [2014]). This pattern is expected given the documented fluctuations in water temperatures. DO concentrations at the upper lake monitoring site can drop below 5.0 mg/L at the greatest depths of the reservoir in the summer months (i.e., May through September). Table 3-4 provides the maximum, minimum, and mean DO concentrations on Monticello Reservoir for each collection year at each collection location. The low DO concentrations are attributed to the depth of the reservoir, where less oxygen is dissolved in the water due to natural reservoir processes, and the fact that the upper lake monitoring location is located well upstream of the mixing zone created by the intake and discharge for the V.C. Summer Nuclear Station and the Fairfield Pumped Storage Station intakes.

Table 3-4. Summary of water quality data for Monticello Reservoir from 2003 through 2012 (Source: Kleinschmidt, 2014; as modified by staff).

		Intake [a]		Discharge [b]		Upper Lake [c]	
		Temp (°F) [d]	DO mg/L	Temp (°F)	DO mg/L	Temp (°F)	DO mg/L
2003	Max	80.11	13.39	83.79	12.96	85.91	13.98
	Min	47.52	7.13	52.66	7.17	50.68	9.60
	Avg	65.25	9.60	68.94	9.92	68.54	11.41
2004	Max	84.23	14.28	84.69	14.59	85.80	14.07
	Min	43.70	4.70	49.03	5.13	44.17	7.53
	Avg	62.82	9.06	64.80	11.19	65.35	11.72
2005	Max	83.28	12.34	88.32	14.01	88.74	12.79
	Min	49.35	5.30	50.83	5.28	51.30	7.72
	Avg	67.86	8.32	70.57	8.76	69.42	9.83
2006	Max	84.16	12.09	85.12	13.08	87.24	12.16
	Min	51.58	4.84	51.00	5.10	52.90	7.45
	Avg	66.27	8.62	67.28	9.36	68.47	9.59
2007	Max	85.93	11.21	89.01	11.85	86.74	11.82
	Min	49.14	5.45	55.92	5.32	50.94	6.62
	Avg	69.10	8.06	73.44	8.57	71.22	9.41
2008	Max	82.22	11.55	83.19	12.49	82.90	12.51
	Min	50.80	5.96	52.14	5.30	50.86	5.56
	Avg	66.78	8.55	68.25	9.12	67.39	9.75

		Intake [a]		Discharge [b]		Upper Lake [c]	
		Temp (°F) [d]	**DO mg/L**	**Temp (°F)**	**DO mg/L**	**Temp (°F)**	**DO mg/L**
2009	Max	84.80	11.68	85.41	13.01	86.59	11.73
	Min	50.32	5.64	51.58	5.61	52.83	6.85
	Avg	67.41	8.65	70.36	9.07	69.01	9.57
2010	Max	86.90	16.31	88.75	15.35	89.83	14.27
	Min	48.02	5.83	47.35	5.81	47.86	7.99
	Avg	68.94	9.93	71.47	9.57	71.56	10.00
2011	Max	85.57	12.49	90.70	13.56	87.21	12.25
	Min	48.20	4.98	48.45	5.03	48.04	5.82
	Avg	69.58	8.50	73.56	8.86	70.59	9.06
2012	Max	83.73	11.73	86.52	12.15	87.03	12.75
	Min	53.33	4.48	54.36	4.57	54.01	5.31
	Avg	67.44	9.05	69.30	8.95	69.22	9.95

[a] Intake refers to the monitoring location in the channel near the circulating water intake for the V.C. Summer Nuclear Station (*see* figure 3-4 for location).

[b] Discharge refers to the monitoring location just outside the northern end of the circulating water discharge canal for the V.C. Summer Nuclear Station (*see* figure 3-4 for location).

[c] Upper Lake refers to the monitoring location near the northern end of Monticello Reservoir (*see* figure 3-4 for location).

[d] The formula to convert Fahrenheit to Celsius is: C = 5/9 x (F-32).

For the period 1999 through 2013, South Carolina DHEC's data showed that DO concentrations in Monticello Reservoir, as measured at its six monitoring sites, varied from a low of about 4.5 mg/L to a high of about 13.5 mg/L (*see* figures 3-109, 3-112, 3-115, 3-118, 3-121, and 3-124 in Kleinschmidt [2014]). Average DO was generally higher in the upper end of the reservoir compared to the mid- and lower-reservoir monitoring sites. Otherwise, DO concentrations exhibited typical seasonal patterns for the southeast.

Turbidity

For the period 1999 through 2013, South Carolina DHEC's data showed that turbidity in Monticello Reservoir, as measured at its six monitoring sites, was generally below 10 NTUs (*see* figures 3-111, 3-114, 3-117, 3-120, 3-123, and 3-126 in Kleinschmidt [2014]). Turbidity was higher at the two mid-reservoir monitoring sites, ranging from 10 to 20 NTUs.

Broad River Upstream of Parr Reservoir

Water Quality Monitoring

Water quality data for the Broad River upstream of Parr Reservoir were compiled from USGS, South Carolina DHEC, and South Carolina DNR data sources. USGS gage 02156500, located on the Broad River at Route 121 near Carlisle, South Carolina (*see* figure 3-4) collects data on DO, water temperature, and pH.[43] South Carolina DHEC maintains a permanent water quality monitoring site upstream of Parr Reservoir near USGS gage 02156500. Data from this site were based on grab samples collected monthly until late 2009 and bi-monthly thereafter.

The South Carolina Geological Survey, a division of South Carolina DNR, obtained turbidity data from USGS gage 02156500 from June 2012 through August 2013. Water samples were collected with a USGS DH-74.[44] Samples were retrieved using calculated transit rates descending and ascending through the water column to collect depth integrated samples. Turbidity was measured (average of three samples) in the lab with a benchtop turbidity meter. Course sediment was separated from fine sediment, and data on grain size and total mass was obtained.

[43] Daily averaged values for DO, water temperature, and pH from 2003 through 2012 were reported in Kleinschmidt (2014).

[44] A USGS DH-74 is a cable-suspended, suspended-sediment sampler. The sampler is lowered and raised by means of a suspension system such as a reel and crane, or bridge board. (*see* https://water.usgs.gov/fisp/products/4101006.html).

Water Temperature and Dissolved Oxygen

Water temperature measured by SCANA Environmental at USGS gage 02156500 ranged from about 39.2°F (4.0°C) during the winter months to about 91.4 °F (33.0°C) during the summer. DO concentrations typically varied from 10.0–12.0 mg/L during the cooler winter months to 6.0–7.0 mg/L during the hotter, drier summer months (s*ee* figure 3-127 through figure 3-136 in Kleinschmidt [2014]). For the period 1999 through 2012, South Carolina DHEC's data showed that water temperature varied from around 41.0 °F (5.0°C) in the winter months to about 86.0 °F (30.0°C) in the summer months. DO concentrations were above 10 mg/L in the winter and 7 mg/L in the summer months, except for concentrations that dropped to 4.0 mg/L and lower in the summer of 1999, 2001, and 2002 (*see* figure 3-157 in Kleinschmidt [2014]).

Turbidity

South Carolina DHEC's monitoring station on the upper Broad River showed that turbidity was generally less than 125 NTUs from 1999 through 2012 (*see* figure 3-159 and table 3-27 in Kleinschmidt [2014]). Turbidity was over 250 NTU's on three occasions over the 15-year period.

Parr Reservoir

Water Quality Monitoring

SCANA Environmental and South Carolina DHEC monitor water quality in Parr Reservoir. SCANA Environmental, collected vertical profile water quality data at three sites in the vicinity of the planned discharge on Parr Reservoir associated with proposed new units at the V.C. Summer Nuclear Station. Data on water temperature, DO, specific conductivity, and pH were collected on a monthly basis at these sites.[45] SCANA Environmental continues to collect vertical profile data at the three sites on Parr Reservoir (*see* figure 3-4).

As shown in figure 3-4, South Carolina DHEC has established three permanent monitoring stations on Parr Reservoir (i.e., B-047, B-346, and B-345). In 2012, South Carolina DHEC selected an additional monitoring site randomly, as well (i.e., RL-12049). Water quality data were collected at these sites using grab samples on a monthly or bi-monthly basis, depending on individual sites and year.

[45] Data from January 2011 through December 2013 are included in Kleinschmidt (2014).

Water Temperature

Water temperature in Parr Reservoir exhibits patterns typical of large reservoirs in the southeast. For example, water temperature was as low as 50.9 °F (10.5°C) at the surface of the reservoir in January, increasing to a peak of about 86 °F (30.0°C) during the summer (i.e., July and August) (*see* figure 3-1 through figure 3-12 in Kleinschmidt [2014]). Water temperature also decreased with increasing depth in the reservoir. Table 3-5 provides the maximum, minimum, and mean water temperature values on Parr Reservoir for each collection year at each collection location.

For the period 1999 through 2012, South Carolina DHEC's data showed that water temperature in Parr Reservoir, as measured at its four monitoring sites, varied from a low of about 41.0 °F (5.0 ºC) to a high of 90.5 °F (32.5 ºC) (*see* figures 3-49, 3-52, 3-55, and 3-58 in Kleinschmidt [2014]). Average water temperature varied little depending on location in the reservoir.

Dissolved Oxygen

Like water temperature, DO concentration in Parr Reservoir exhibits patterns typical of large southeast reservoirs. DO concentrations decrease during the summer months, dropping to as low as 5.0 mg/L (*see* Figure 3-13 through Figure 3-24 in Kleinschmidt [2014]). DO concentrations also tend to decrease with an increase in the depth of the reservoir, where less oxygen is dissolved in the water due to natural reservoir processes. Table 3-5 provides the maximum, minimum, and mean DO concentrations on Parr Reservoir for each year at each sampling location.

For the period 1999 through 2013, South Carolina DHEC's data showed that DO concentrations in Parr Reservoir, as measured at its four monitoring sites, varied from a low of about 4.5 mg/L to a high of about 13.0 mg/L (*see* figures 3-49, 3-52, 3-55, and 3-58 in Kleinschmidt [2014]). Average DO was generally higher in the upper end of the reservoir compared to the mid- and lower-reservoir monitoring sites, and it exhibited typical seasonal patterns for the southeast.

Table 3-5. Summary of Water Quality Data for Parr Reservoir from 2011 through 2013 (Source: Kleinschmidt, 2014; as modified by staff).

		Site 1 [a]			**Site 2** [b]			**Site 3** [c]		
		Temp (°F) [d]	**DO mg/L**		**Temp (°F)**	**DO mg/L**		**Temp (°F)**	**DO mg/L**	
2011	Max	78.69	13.46		85.71	14.43		86.04	14.42	
	Min	47.41	5.11		47.77	5.46		47.44	5.30	
	Avg	68.09	8.84		68.05	8.84		68.05	8.86	
2012	Max	83.88	12.24		83.41	12.32		83.59	12.63	
	Min	51.31	6.73		51.30	7.98		50.79	7.30	

		Site 1 [a]			Site 2 [b]			Site 3 [c]		
		Temp (°F) [d]	**DO mg/L**		**Temp (°F)**	**DO mg/L**		**Temp (°F)**	**DO mg/L**	
	Avg	65.08	9.30		65.17	9.69		65.01	9.70	
2013	Max	81.59	11.96		81.68	11.90		82.22	11.92	
	Min	49.32	6.23		47.52	5.02		46.98	5.18	
	Avg	65.57	8.48		65.08	8.49		64.89	8.67	

[a] Site 1 refers to the monitoring site located approximately 1,500 feet upstream of the proposed discharge site for the new units 2 and 3 at the V.C. Summer Nuclear Station.

[b] Site 2 refers to the monitoring site located at the proposed discharge site for the proposed new units 2 and 3 for the V.C. Summer Nuclear Station.

[c] Site 3 refers to the monitoring site located approximately 900 feet downstream from the proposed discharge site for the proposed new units 2 and 3 for the V.C. Summer Nuclear Station.

[d] The formula to convert Fahrenheit to Celsius is: C = 5/9 x (F-32).

Turbidity

For the period 1999 through 2012, South Carolina DHEC's data showed that turbidity in Parr Reservoir, as measured at its four monitoring sites, generally remained below 25 NTUs, with no clear trends from year-to-year (*see* figures 3-51, 3-54, 3-57, and 3-60 in Kleinschmidt [2014]). Turbidity exceeded 50 NTUs on a few occasions during the monitoring period, with a peak of about 130 NTUs late in 2009 and early 2010.

Sediment Constituents

In 2012, sediment samples were collected from two transects located within Parr Reservoir. Transect 1 was located approximately 4 miles upstream of the cooling water discharge for the V.C. Summer Nuclear Station and upstream of the water intake the Fairfield Pumped Storage Station. Transect 2 was located approximately 600 feet downstream from the cooling water discharge and downstream from the Fairfield intake (figure 3-5). Sampling along each transect consisted of collecting one grab sample from each of five sample points. Constituents tested for included aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, silver, strontium, thallium, zinc, and phosphorus. All sample points are inundated at the reservoir's low pool elevation of 256 feet.

Mercury, beryllium, silver, and thallium were not detected at either transect. Cadmium was detected at low concentrations at both transects. Antimony, arsenic, and calcium were not detected at Transect 1, but were found in higher concentration at Transect 2. Lead, nickel, copper, chromium, zinc, barium, manganese, potassium, magnesium, aluminum, and iron were detected at both transects, with higher

concentrations, in some cases significantly higher, found at Transect 2. Phosphorous levels were higher at Transect 2 (350 milligrams per kilogram [mg/kg]) compared to Transect 1 (150 mg/kg).

Figure 3-5. Sediment sampling locations in Parr Reservoir (Source: Kleinschmidt, 2014; Appendix A).

Downstream of Parr Development – Tailrace

Water Quality Monitoring

The USGS has monitored DO concentrations and water temperature at a gage (USGS 02160991), located about 600 feet downstream of the Parr Development powerhouse, from 1985 to present.[46] Dominion Energy collected additional DO data

[46] In 2011, USGS replaced the DO sensor at USGS gage 02160991.

from July to September 2014 at the discharge of each turbine unit, at a site adjacent to the USGS gage 02160991, and at an eighth location approximately 400 feet downstream of Parr Shoals Dam.[47] Data were collected 3 times per day (i.e., starting 1 hour before sunrise, at sunrise, and 1 hour after sunrise) on one day during each week of the monitoring period. Dominion Energy collected these data to: (1) verify the accuracy of the USGS gage 02160991; and (2) determine if DO could be correlated to early morning DO sags or to which turbine units were running at the time of data collection.

Dissolved Oxygen

Over the last 10 years (January 1, 2009 to December 31, 2019) the average daily DO concentration at USGS gage 02160991 was greater than or equal to 5.0 mg/L on all but 39 days during this period. The minimum DO concentration was greater than 4.0 mg/L on all but 28 days. Thus, there were days when DO in the tailrace was not consistent with the state standards listed in table 3-3.

Data collected by Dominion Energy from July to September 2014 were consistent with USGS data collected during the same time period. Both data sets indicated that DO levels stayed above 4.0 mg/L at all sites sampled in the tailrace. Results did not reveal a correlation between operation of the turbines and DO concentrations downstream.

Water Temperature

Over the last 10 years the average water temperature at USGS gage 02160991 was 67°F (19.4°C), and the maximum water temperature was below 90°F (32.2°C) on all days except two (on July 26, 2010 and July 30, 2010 water temperature reached 90.3°F [32.4°C]). Thus, water temperature was at a level consistent with the state standard on most days during the last 10 years.

[47] *See* Appendix A, Parr Hydroelectric Project Water Quality Baseline Memorandum – Water Quality Report – Supplemental Dissolved Oxygen Data. Attachment to Comprehensive Settlement, Appendix A-11, Parr Shoals Dam Turbine Venting Plan.

Downstream of Parr Development – East Channel[48]

Water Quality Monitoring

Immediately downstream of Parr Shoals Dam, the Broad River is naturally divided into two channels (east channel and west channel), which extend about 1.25 miles downstream along Hampton Island (figure 3-6). In 2015, Kleinschmidt monitored water temperature and DO concentrations in the east channel at hourly intervals from May 11 through August at a site located about 4,000 feet downstream from the Parr Development.[49]

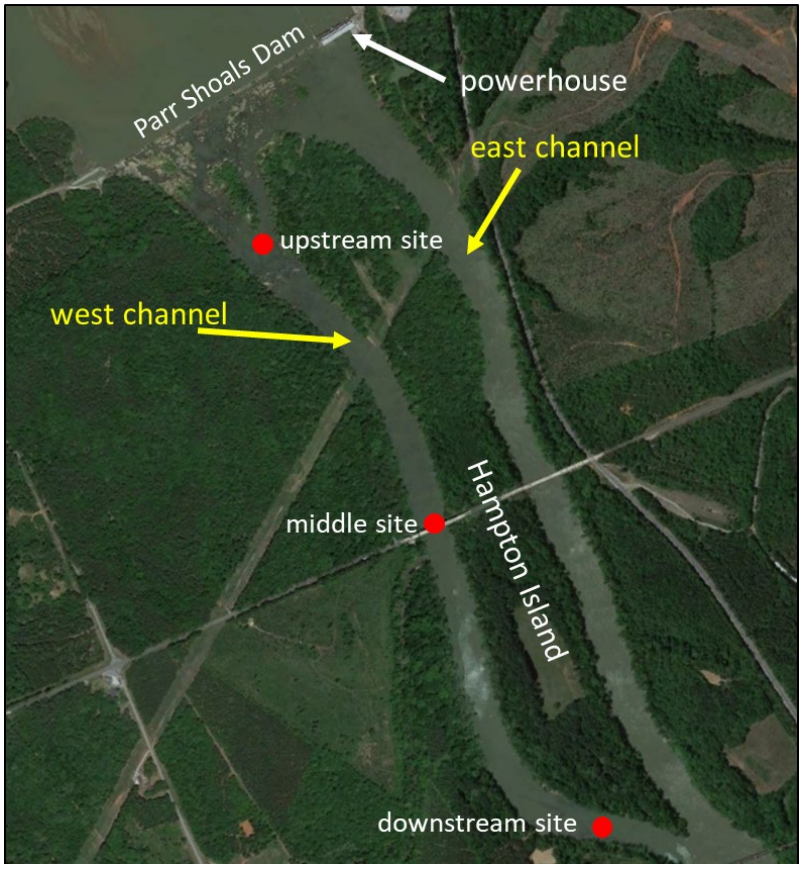

Figure 3-6. Water quality monitoring sites for the Broad River downstream from Parr Shoals Dam (Source: staff).

[48] Unless otherwise noted, all information in this section is based the FLA, exhibit E-4 [Water Quality in Downstream West Channel Study Report (Kleinschmidt, 2016a) and West Channel Water Quality Second Year Study Report (Kleinschmidt, 2017a)].

[49] The intended monitoring was to occur from May through October; however, data collected from April through May 11 were not accurate because the east channel monitor was originally located in an area subject to fouling and dewatering. In addition, the monitor was lost during a flood that occurred in October prior to data being retrieved for the months of September and October.

Dissolved Oxygen

From May through August, DO exhibited daily swings that caused DO to drop below 4.0 mg/L during periods of at least one day per month. DO concentrations dropped below 4.0 mg/L during 18 days in July, which was the highest frequency for any month during the monitoring period. As a result, there were numerous periods when DO in the east channel was not consistent with the state standard of no less than 4.0 mg/L.

Water Temperature

Mean water temperature in the east channel was lowest in May and peaked during July and August (table 3-6). Maximum water temperature was greater than 90°F (32.2°C) during June and July and thus water temperature was consistently below the state standard of 90°F state standard.

Table 3-6. Maximum, minimum, and average temperatures (°F) for the East Channel in May, June, July, and August 2015 (Source: Kleinschmidt, 2016a).

Month	**East Channel Water Temperature**		
	Max	Mean	Min
May	85.8	73.9	62.9
June	109.7	82.9	74.3
July	92.1	86.0	78.2
August	89.6	85.8	82.7

Downstream of Parr Development – West Channel[50]

Water Quality Monitoring

In 2015, Kleinschmidt (2016a) monitored water temperature and DO at hourly intervals from April 1 to October 15 at three sites (upstream, middle, downstream) in the west channel (*see* figure 3-6, above). In 2016, Kleinschmidt (2017a) conducted additional water quality monitoring in the west channel to determine whether the high magnitude of daily swings in DO concentrations measured in 2015 accurately represented baseline conditions in the west channel. DO and water temperature were monitored at 15-minute intervals from August 1, 2016 to August 29, 2016 at four sites, including the same middle and downstream sites as 2015 (figure 3-6), and two new sites (upstream site 1 and upstream site 2) in the upstream west channel (figure 3-7).

[50] Unless otherwise noted, all information in this section is based on the FLA, exhibit E-4 (Water Quality in Downstream West Channel Study Report and West Channel Water Quality Second Year Study Report).

Figure 3-7. Water quality monitoring sites for the Upstream West Channel – 2016 (Source: staff).

Kleinschmidt (2017a) also evaluated the potential for pulsed flow releases through the spillway gates to improve water quality in the west channel in 2016. On August 8, August 15, and August 18, Dominion Energy released 22-24 acre-feet of water through spillway gates 1 and 2 for about 3 hours. Before and during each pulse event, Dominion Energy took point measurements of DO concentration and water temperature at eight locations in the upstream west channel and one each in the middle and downstream west channel.

Dissolved Oxygen

In 2015, DO in the west channel varied from upstream to downstream, with DO concentrations being lowest at the most upstream site, immediately downstream of Parr Shoals Dam (i.e., upstream site), and highest at the most downstream site. During April and May of 2015, DO concentrations were greater than 4.0 mg/L at all three sites in the west channel except during 3 days at the upstream site and 2 days at the middle site. Beginning in mid-June 2015 and continuing through September 2015, DO concentrations at the upstream site began to exhibit daily drops in DO below 4.0 mg/L, including daily

swings that ranged from as low as 0 mg/L to concentrations as high as 20 mg/L (e.g., *see* data collected in August 2015; figure 3-8). Thus, DO concentrations at the upstream site were frequently at levels inconsistent with the state standard of no less than 4.0 mg/L. These swings in DO were likely associated with dense growth of filamentous algae that resulted in DO concentrations rising rapidly at sunrise and throughout the day (i.e., period of net oxygen production) and dropping quickly after dark (i.e., period of only oxygen consumption). At the middle and downstream sites, DO concentrations dropped below 4.0 mg/L less consistently than at the upstream site from mid-June through September 2015, and the phenomenon did not occur daily.

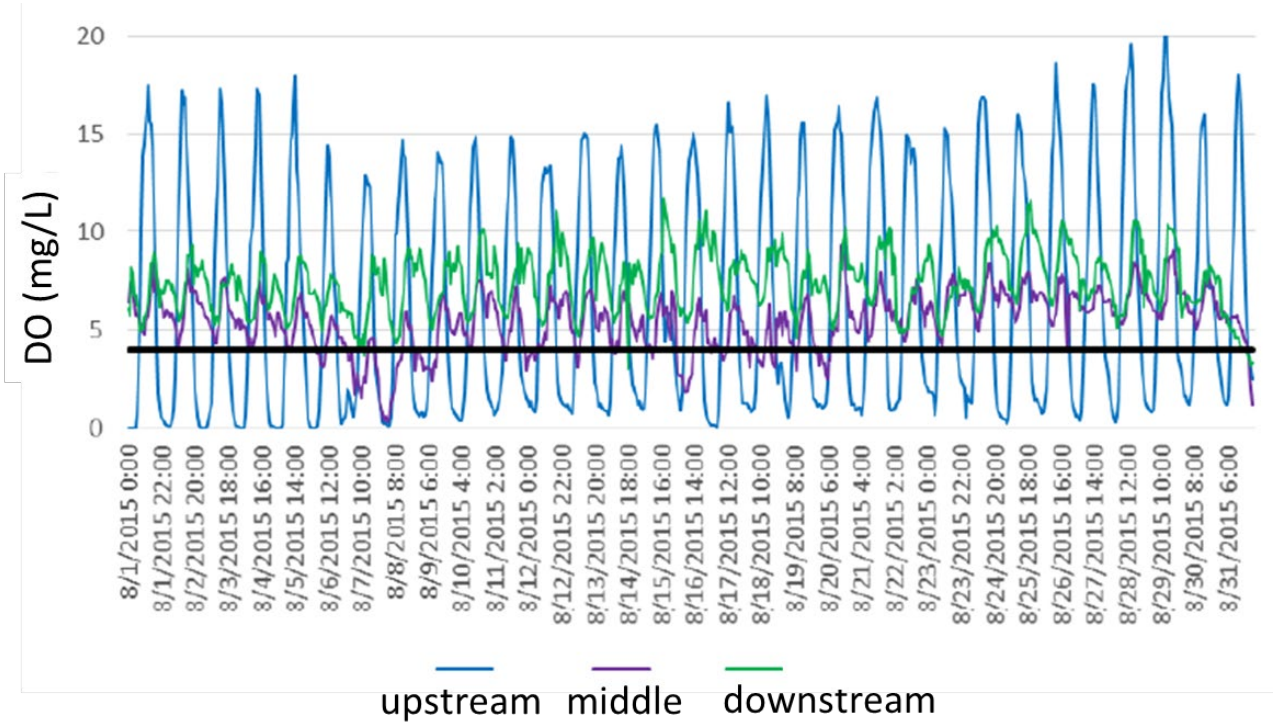

Figure 3-8. Dissolved oxygen at the Upstream, Middle, and Downstream West Channel monitoring locations – 2015 (Source: Kleinschmidt, 2016a).

Continuous water quality monitoring conducted during August 2016 at upstream site 1 and upstream site 2 revealed daily swings in DO concentrations; however, the magnitude of daily variation was generally less than that observed in 2015 (figure 3-9). During the 29 days of monitoring in August 2016, DO dropped below 4.0 mg/L on 7 days at upstream site 1 and 14 days at upstream site 2. At the middle site, DO dropped below 4.0 mg/L on 10 days during the August 2016 monitoring, but unlike the upstream sites, daily variation in DO was greater than August 2015 (figure 3-10). At the downstream site, DO never dropped below 4.0 mg/L during August 2016 monitoring and daily variation in DO was similar to August 2015 (figure 3-11).

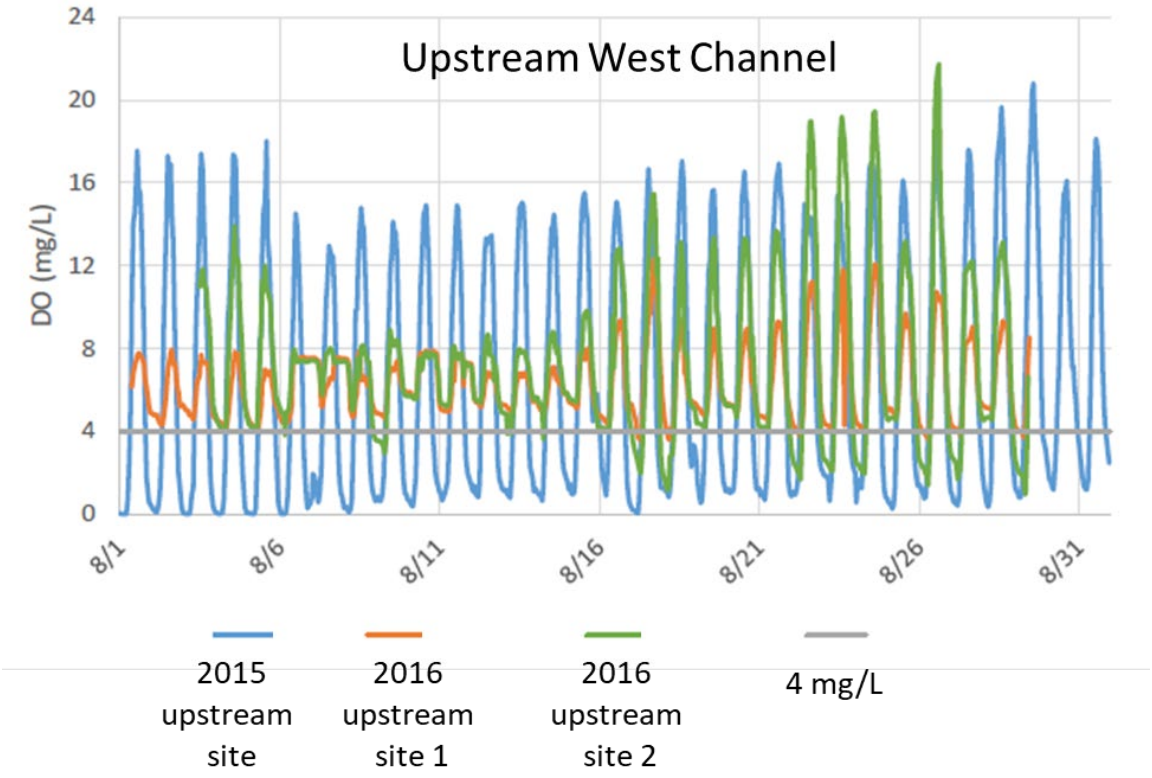

Figure 3-9. Dissolved oxygen at the Upstream West Channel water quality monitoring locations – August 2015 and 2016 (Source: Kleinschmidt, 2017a).

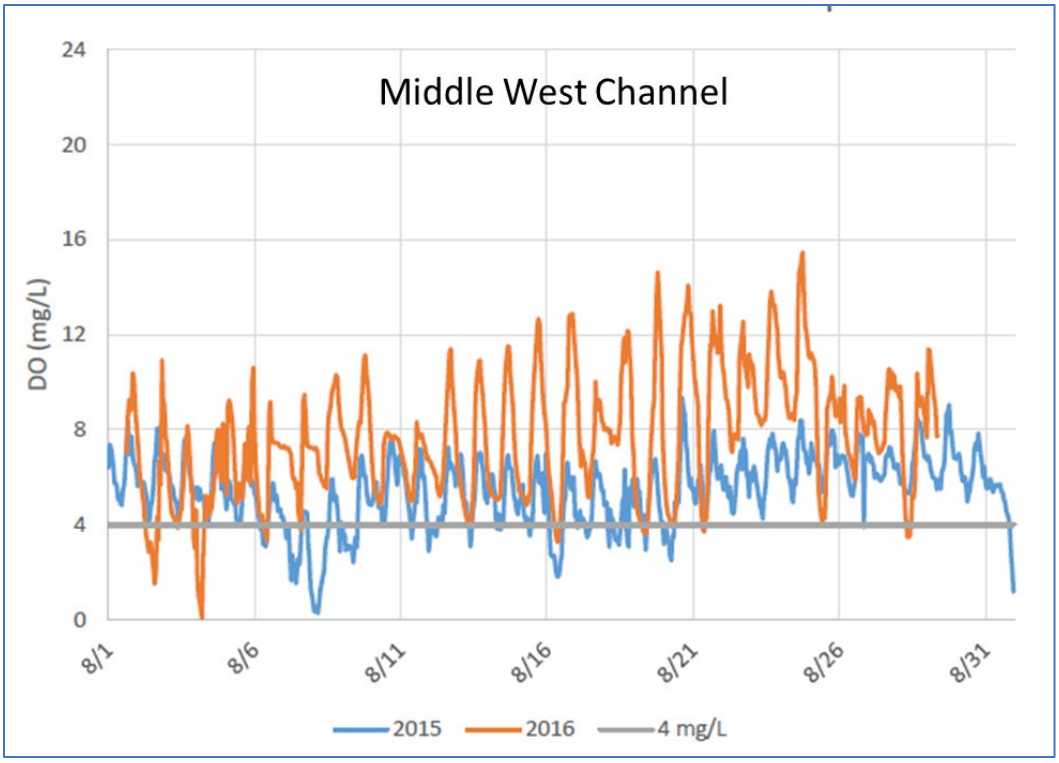

Figure 3-10. Dissolved oxygen at the Middle West Channel water quality monitoring location – August 2015 and 2016 (Source: Kleinschmidt, 2017a).

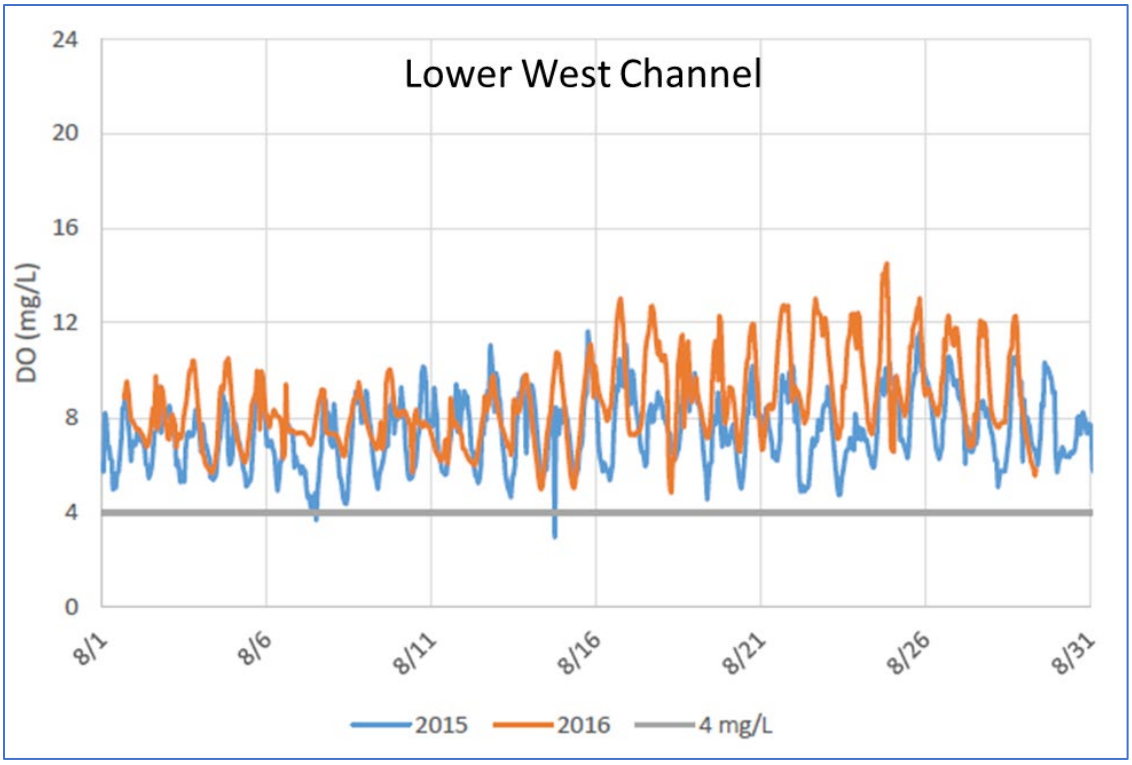

Figure 3-11. Dissolved oxygen at the Downstream West Channel water quality monitoring location – August 2015 and 2016 (Source: Kleinschmidt, 2017a).

Water Temperature

In 2015, mean and maximum water temperature at all sites steadily increased from April through July and August, before decreasing in September and October (table 3-7). Water temperature was consistently highest at the upstream, site and lowest at the middle site. Maximum water temperatures exceeded 90°F (32.2°C) at each site during the monitoring period, indicating that water temperature was not always at levels consistent with the state standard.

Table 3-7. Maximum and average monthly (April through October) water temperatures (°F) for the Upstream, Middle, and Downstream water quality monitoring locations on the west channel downstream from Parr Shoals Dam (Source: Kleinschmidt, 2016a).

Month	Upstream		Middle		Downstream	
	Max	Mean	Max	Mean	Max	Mean
April	77.3	65.3	70.0	64.5	76.8	68.9
May	86.5	73.5	81.4	72.5	82.0	74.2
June	98.2	82.4	87.7	79.6	89.6	81.6
July	96.7	85.7	89.7	85.9	92.8	86.4
August	95.4	85.1	90.0	84.2	90.9	85.5
September	88.7	77.7	83.4	76.0	87.6	78.1
October	76.8	67.7	76.4	67.8	76.7	67.7

In 2016, mean and maximum water temperatures in the west channel were similar among all sites, with the exception of upstream site 2 which tended to have higher maximum temperatures (table 3-8). Maximum water temperatures exceeded 90°F at each site during the monitoring period, indicating that water temperature was not at levels consistent with the state standard.

Table 3-8. Maximum and average water temperatures (°F) for the Upstream Site 1, Upstream Site 2, Middle, and Downstream water quality monitoring locations on the West Channel Downstream from Parr Shoals Dam (Source: Kleinschmidt, 2017a).

Month	Upstream Site 1		Upstream Site 2		Middle		Downstream	
	Max	Mean	Max	Mean	Max	Mean	Max	Mean
August 1-7	90.9	86.7	95.1	86.8	92.8	86.6	91.5	87.3
August 8-14	87.9	86.0	90.7	85.9	92.6	86.4	90.9	86.7
August 15-21	92.4	87.0	96.6	86.9	93.8	86.8	92.6	87.8
August 22-29	92.7	86.4	95.7	85.4	89.9	86.2	90.3	86.7

Aquatic Habitat

Reservoir Habitat

In 2015, Kleinschmidt (2016b) conducted a study in which technical working committee[51] (TWC) members visually characterized the nearshore aquatic habitat in the

[51] The technical working group included a variety of stakeholders including state and federal resource agencies, state and local government, and non-governmental organizations.

Parr and Monticello Reservoirs. In addition, Kleinschmidt (2016b) collected digital imagery of the reservoirs during a 9.9-foot drawdown from full pool in Parr Reservoir, and 2.25-foot drawdown from full pool in Monticello Reservoir. The study results indicate that the nearshore aquatic habitat in Parr Reservoir is composed of mud/silt, sand, or gravel/cobble, as well as areas of structure (trees, stumps, stream channels, submerged vegetation). In Monticello Reservoir, the TWC did not characterize the substrate composition in detail but did identify a general lack of structure and stable substrates in shallow areas that would be used by warmwater fish species.

Downstream Habitat

As part of an Instream Flow Incremental Methodology (IFIM) study, Kleinschmidt (2016c) characterized habitat downstream of Parr Shoals Dam. The study results indicate that habitat immediately downstream of the dam in the west channel consists of large pools, with a boulder-dominated riffle-run complex just downstream from the pools. In the project tailrace on the east side of the dam, habitat consists of a cobble and gravel dominated run-glide-riffle complex. Habitats downstream from the west channel and tailrace also contain pools, glides, and runs, with higher gradient bedrock drops and more pronounced riffles. There are also several islands with pronounced side channels and/or braids, including Haltiwanger, Bookman, and Huffman islands.

Fish Community

Monticello Reservoir Fish Community

Fish surveys were conducted in the Monticello Reservoir during recent spring (2007), summer (2008), fall (2006), and winter (2009) seasons using both electrofishing and gill nets[52] during each survey.[53] The surveys documented the presence of 24 species of fish and indicated that the Monticello Reservoir supports a warmwater fish community (table 3-9). Gizzard shad, channel catfish, blue catfish, largemouth bass, bluegill, and white perch dominated the fish community in Monticello Reservoir. The surveys in Monticello Reservoir also indicated the presence of six fish species on the South Carolina Priority Species list (table 3-9).

[52] Hoop nets were also used during the fall 2006 and spring 2007 surveys, but were not used in subsequent surveys, because they were ineffective.

[53] Summaries of the results are included in the final license application, exhibit E-5, Baseline Fisheries Resources Report (Dominion Energy, 2018).

Parr Reservoir Fish Community

Electrofishing and gill net surveys were conducted in Parr Reservoir during the same time periods as those in Monticello Reservoir, with the addition of a spring and fall survey conducted only in Parr Reservoir in during 2012. The surveys indicated that Parr Reservoir also supports a warmwater fish community composed of 30 species of fish (table 3-9). The fish community in Parr Reservoir was dominated by the same species as Monticello Reservoir, except channel catfish tended to be a more dominant species in Parr Reservoir. The surveys in Parr Reservoir also indicated the presence of seven fish species on the South Carolina Priority Species list (table 3-9).[54]

Table 3-9. Fish collected in Parr and Monticello Reservoirs during surveys conducted between 2007 and 2012 (Source: Dominion Energy, 2018b, Exhibit E-5 Baseline Fisheries Resource Report; as modified by staff).

Family	Common name	South Carolina Priority Species	Monticello Reservoir	Parr Reservoir
			✓ = Present	
Lepisosteidae	Longnose gar			✓
Clupeidae	Gizzard shad		✓	✓
Clupeidae	Threadfin shad		✓	✓
Cyprinidae	Golden shiner		✓	✓
Cyprinidae	Sandbar shiner	Moderate priority		✓
Cyprinidae	Spottail shiner		✓	✓
Cyprinidae	Whitefin shiner		✓	✓
Catostomidae	Highfin carpsucker	Highest priority		✓
Catostomidae	Northern hogsucker		✓	✓
Catostomidae	Notchlip redhorse	Moderate priority	✓	✓
Catostomidae	Quillback	High priority	✓	✓
Catostomidae	Robust Redhorse	Highest priority	✓	✓
Catostomidae	Shorthead redhorse		✓	✓
Ictaluridae	Blue catfish		✓	✓
Ictaluridae	Channel catfish		✓	✓
Ictaluridae	Flat bullhead	Moderate priority	✓	✓
Ictaluridae	Flathead catfish			✓
Ictaluridae	Snail bullhead	Moderate priority	✓	
Ictaluridae	White catfish	Moderate priority	✓	✓

[54] Species on the South Carolina Priority Species list are given priority for implementing conservation actions by the South Carolina DNR's Comprehensive Wildlife Conservation Plan.

Family	Common name	South Carolina Priority Species	Monticello Reservoir	Parr Reservoir
			✓ = Present	
Ictaluridae	Yellow bullhead		✓	✓
Moronidae	White bass			✓
Moronidae	White perch		✓	✓
Centrarchidae	Black crappie		✓	✓
Centrarchidae	Bluegill		✓	✓
Centrarchidae	Largemouth bass		✓	✓
Centrarchidae	Pumpkinseed		✓	✓
Centrarchidae	Redbreast sunfish		✓	✓
Centrarchidae	Redear sunfish		✓	✓
Centrarchidae	Smallmouth bass		✓	✓
Centrarchidae	Warmouth			✓
Percidae	Yellow perch		✓	✓

Fish Community Downstream of Parr Shoals Dam

South Carolina DNR conducted electrofishing surveys at four locations downstream of Parr Shoals Dam between 2009 and 2013. The four locations include: (1) the tailrace, which is the channel on the east side of Hampton Island that extends about 1.37 miles from Parr Shoals Dam to the Palmetto Trail trestle crossing; (2) the west channel, which is the channel on the west side of Hampton Island that extends about 1.37 miles Parr Shoals Dam to the Palmetto Trail trestle crossing; (3) a reach (hereafter called downstream reach 1) that extends from the Palmetto Trail trestle crossing to the downstream side of Huffman Island (about 9.3 river miles downstream of Parr Shoals Dam); and (4) a reach (hereafter called downstream reach 2) that extends from the downstream side of Huffman Island to the downstream side of Boatrights Island (about 20 river miles downstream of Parr Shoals Dam).

Resident Fish Community

South Carolina DNR's survey indicated that, like the project reservoirs, downstream habitats also supported a warmwater fish community (table 3-10). The fewest number of species were collected in the west channel (13 species), where redbreast sunfish and bluegill made up 85 percent of the catch (table 3-10). South Carolina DNR collected 40 species at each of the other sampling locations, but the species composition varied among those sites (table 3-10). Despite the overall variation, each of those sites was dominated by centrarchids (i.e., sunfish, bass), catostomids (i.e., suckers), cyprinids (i.e., shiners), and ictalurids (i.e., bullheads, catfish) (table 3-10). Fifteen of the species observed downstream of Parr Shoals Dam are on the South

Carolina Priority Species list, including resident robust redhorse, and the diadromous[55] American eel and American shad (discussed below).

Diadromous Fish Species

American shad

American shad is an anadromous[56] species that spends most of its life at sea, but returns to natal rivers along the Atlantic Coast of North America to reproduce (Melvin *et al*., 1986). In South Carolina, the American shad spawning run can begin as early as mid-January (ASMFC, 2009), with spawning occurring from March to April (Greene *et al*., 2009). The majority of spawners die after just one spawning season (ASMFC, 2009). Typically, spawning occurs in mid-river runs with moderate to high current velocity (Ross *et al*., 1993) at temperatures between 54°F (12°C) and 70°F (21°C) (Leggett and Whitney, 1972). After eggs and larval development is complete, juvenile shad generally remain in river habitats for a few months before out-migrating to the sea during late summer and early fall (ASMFC, 2009).

Historical records of population abundance in the area are non-existent, but it is known that prior to dam construction, American shad ascended all of the major sub-basins in the Santee River Basin (including the Broad River), and were able to migrate and spawn throughout habitats upstream of the fall line and into North Carolina (NMFS *et al.*, 2001; South Carolina DNR, 2014). Today the American shad distribution is reduced because of past dam construction and mostly occurs downstream of the fall line (NMFS *et al.*, 2001), which is located downstream near the Columbia Project (FERC No. 1895). Although the American shad population in the Santee River Basin has grown substantially over the last several decades and is one of the largest on the Atlantic Coast, it remains depleted compared to historical levels (ASMFC, 2007). However, restoration of American shad is ongoing through implementation of the Santee Basin Diadromous Fish Restoration Plan, which includes a goal of restoring American shad to habitats upstream and downstream of Parr Shoals Dam (NMFS *et al*., 2017).

Surveys conducted by South Carolina DNR indicate that American shad are present immediately downstream of the Parr Shoals Dam (table 3-10). The source of the American shad located downstream of Parr Shoals Dam is likely a combination of recent stocking efforts by South Carolina DNR and passage at the upstream fishway[57] at the

[55] A diadromous species migrates between freshwater and the ocean for the purpose of reproduction.

[56] An anadromous species spends most of its life feeding and growing in the ocean before migrating to freshwater to spawn as an adult.

[57] In 2006, a vertical slot fishway was installed at the Columbia Diversion Dam (City of Columbia, 2018).

Columbia Diversion Dam, located on the Lower Broad River approximately 23 miles downstream of the Parr Shoals Dam. The fishway was designed to provide upstream passage for American shad and blueback herring to historical spawning and maturation habitats upstream of the Columbia Diversion Dam, including areas of the Lower Broad River downstream of the Parr Shoals Dam. The most recent monitoring data suggest that an estimated 925 American shad were passed upstream during the 2018 migration season (City of Columbia, 2018).

Blueback herring

Blueback herring is an anadromous species, and like American shad, spends most of its life at sea, but returns to natal rivers along the Atlantic Coast of North America to reproduce (Bigelow *et al.*, 2002). In South Carolina, blueback herring will begin their spawning run up rivers as early as February and will spawn from March to April (Meador *et al*., 1984; ASMFC, 2009). Typically, spawning occurs over gravel and clean substrates where flow is swift and at water temperatures between 55°F (13°C) and 79°F (26°C) (Bozeman and Van Den Avyle, 1989; ASMFC, 2009). After eggs and larval development is complete, juvenile blueback herring spend 3 to 9 months in their natal rivers before returning to the ocean (ASMFC, 2009).

Historical records of population abundance in the area are non-existent, but it is known that prior to dam construction, blueback herring did occur in the Broad River (NMFS *et al*., 2001). Today the blueback herring distribution is reduced because of past dam construction and the population in the Santee River Basin is currently considered depleted, but increasing (ASMFC, 2012). Restoration of blueback herring is ongoing through implementation of the Santee Basin Diadromous Fish Restoration Plan, which includes a goal of restoring blueback herring to habitats upstream and downstream of Parr Shoals Dam (NMFS *et al*., 2017).

South Carolina DNR did not collect blueback herring during electrofishing surveys conducted between 2009 and 2013, and no blueback herring have been observed in the upstream fishway at the Columbia Diversion Dam (City of Columbia, 2018).

American eel

The American eel is a catadromous[58] species that occurs throughout warm and cold waters of the Atlantic Ocean and Atlantic coastal drainages in North America (Boschung and Mayden, 2004; Shepard, 2015). Spawning occurs in the Atlantic Ocean (specifically the Sargasso Sea), and eggs and larvae drift with the Gulf Stream currents along the east coast of the U.S. (Jenkins and Burkhead, 1993). Juveniles "glass" eels

[58] The term "catadromous" is used to describe a life history strategy where fish reproduce and spend early life stages in the ocean, move into freshwater to rear as sub-adults, then move back to the ocean to spawn as adults.

migrate into estuaries and tidal rivers in late winter/early spring, develop pigments as elvers (young yellow eels), and eventually reach the primary growth phase (yellow eels) at about 4 inches in length. Yellow eels may gradually move upstream in rivers over many years, with most movement occurring during spring and fall when water temperatures are moderate (NMFS *et al*., 2017). At maturity (about 7 to 13 years old), yellow eels stop feeding, take on a silvery cast and begin downstream migrations during the fall to the Sargasso Sea.

On the east coast of the U.S., American eel abundance has declined over the last several decades due to several factors including loss of access to habitat from dams and urbanization, turbine mortality during downstream migrations, pollutants, a swim-bladder parasite, and overfishing (ASMFC, 2017, NMFS *et al.*, 2017). In the Santee River Basin, backpack electrofishing surveys have indicated that American eels are more abundant closer to the coast and downstream of Pinopolis and Santee Dams on the Cooper and Santee Rivers, respectively, with very low numbers upstream of the fall line (Bulak *et al.*, 2011, NMFS *et al.*, 2017). Near the project, South Carolina DNR observed few eels at three of the four survey sites located immediately downstream of the Parr Shoals Dam, and no eels at the fourth site in the west channel (table 3-10).

Striped bass

Striped bass is an anadromous species that typically occurs in rivers where it has access to the ocean. The striped bass that occur in the lower Broad River, however, are part of the dam-locked Santee-Cooper lakes population (Rohde *et al*., 2009), and thus are not truly anadromous. Spawning migrations in the Santee River Basin occur in the spring, generally from March through May. During spawning, striped bass occupy shallow rocky and gravelly areas with strong turbulent flow.

The species is listed as a South Carolina Priority Species and the landlocked population is managed by South Carolina DNR through stocking. Upstream migrations of these landlocked striped bass have been observed at the St. Stephen fish lock, the Pinopolis Navigation lock, and the Columbia Diversion Dam fishway, but the extent to which the coastal river populations (i.e., lower Santee and Cooper rivers) use the Broad River is unknown. Nonetheless, striped bass are present in the reach between the Parr Development and the Columbia Diversion Dam, and South Carolina DNR observed them in the Parr Development tailrace during the 2009-2013 surveys (table 3-10).

Special Status Fish Species

Robust redhorse

Robust redhorse is a rare sucker restricted to the southeastern U.S. that exhibits potamodromous[59] behavior. Robust redhorse occupy pool habitats with low velocity during most of the year, and migrate to shoals and spawn on gravel bars generally during April and May (Fisk *et al*., 2015). The species is listed as a South Carolina Priority Species because of low abundance and limited distribution believed to be caused by habitat loss, disruption of spawning migrations resulting from dams, and significant deterioration of water quality due to sedimentation and pollution (South Carolina DNR, 2005).

Because of the threats to the species and its rarity, it is the focus of conservation and recovery efforts by the Robust Redhorse Conservation Committee (RRCC),[60] which includes Dominion Energy. A major element of the recovery effort has involved stocking over 25,000 fingerling robust redhorse into the Broad River upstream of Parr Shoals Dam from 2004 to 2012 (Dominion Energy, 2018). Through 2012, a total of seven robust redhorse have been captured in the Broad River drainage upstream of the Parr Development, including in Parr Reservoir and Monticello Reservoir (table 3-9; Dominion Energy, 2018). In addition, South Carolina DNR observed 14 robust redhorse in the project tailrace and 4 in downstream reach 1 (table 3-10) and Instream Flow Technical Working Committee (IFTWC) [61] stakeholders have observed robust redhorse demonstrating behavior consistent with spawning immediately downstream of the Parr Shoals powerhouse.[62]

---

[59] Potamodromous species make migrations entirely within freshwater to complete their lifecycle.

[60] The RRCC is cooperative, voluntary partnership formed under a memorandum of understanding between state and federal resource agencies, private industry, and the conservation community.

[61] The IFTWC included representatives from Dominion Energy, South Carolina DNR, South Carolina DHEC, FWS, NMFS, American Rivers, and Congaree Riverkeeper.

[62] See Robust Redhorse Spawning Habitat Memorandum dated April 29, 2014 in exhibit E5-a.

Table 3-10. Fish collected by electrofishing downstream of Parr Shoals Dam between 2009 an 2013 (Source: Dominion Energy, 2018b, Exhibit E-5 Baseline Fisheries Resource Report; as modified by staff).

Family	Common name	South Carolina Priority Species	West channel		Tailrace		Downstream reach 1		Downstream reach 2	
			Number	Percent	Number	Percent	Number	Percent	Number	Percent
Anguillidae	American eel	Highest			10	0.32	5	0.13	2	0.03
Lepisosteidae	Longnose gar				156	4.94	78	2.05	93	1.57
Clupeidae	Threadfin shad				5	0.16	7	0.18	128	2.16
Clupeidae	Gizzard shad				57	1.8	44	1.16	5	0.08
Clupeidae	American shad	Highest			19	0.6	30	0.79	25	0.42
Cyprinidae	Whitefin shiner				134	4.24	305	8.02	1042	17.61
Cyprinidae	Sandbar shiner				18	0.57	236	6.2	294	4.97
Cyprinidae	Spottail shiner				51	1.61	85	2.23	181	3.06
Cyprinidae	Bluehead chub						10	0.26	11	0.19
Cyprinidae	Coastal shiner				23	0.73	17	0.45	75	1.27
Cyprinidae	Greenfish shiner	Moderate			2	0.06	18	0.47	38	0.64
Cyprinidae	Thicklip chub	Moderate							49	0.83
Cyprinidae	Highback chub						4	0.11	42	0.71
Cyprinidae	Swallowtail shiner				14	0.44				
Cyprinidae	Common carp				4	0.13	4	0.11		
Cyprinidae	Grass carp						2	0.05		
Cyprinidae	Santee chub	High							1	0.02
Catostomidae	Brassy jumprock		1	0.1	521	16.5	153	4.02	90	1.52
Catostomidae	Notchlip redhorse	Moderate			130	4.12	78	2.05	77	1.3
Catostomidae	Shorthead redhorse				236	7.47	33	0.87	16	0.27
Catostomidae	V-lip redhorse	Moderate			64	2.03	41	1.08	43	0.73
Catostomidae	Northern hogsucker				27	0.85	15	0.39	50	0.85

Family	Common name	South Carolina Priority Species	West channel		Tailrace		Downstream reach 1		Downstream reach 2	
			Number	Percent	Number	Percent	Number	Percent	Number	Percent
Catostomidae	Spotted sucker		1	0.1			1	0.03	12	0.2
Catostomidae	Quillback	High			22	0.7			4	0.07
Catostomidae	Robust redhorse	Highest			14	0.44	4	0.11		
Catostomidae	Striped jumprock						2	0.05	13	0.22
Catostomidae	Creek chubsucker						1	0.03		
Ictaluridae	Snail bullhead	Moderate	81	8.25	604	19.13	830	21.81	1026	17.34
Ictaluridae	Magined madtom				10	0.32	208	5.47	144	2.43
Ictaluridae	Flat bullhead	Moderate	17	1.73	19	0.6	66	1.73	86	1.45
Ictaluridae	Channel catfish				122	3.86	16	0.42	28	0.47
Ictaluridae	Blue catfish				65	2.06	2	0.05		
Ictaluridae	White catfish	Moderate	3	0.31	12	0.38				
Ictaluridae	Flathead catfish				1	0.03	1	0.03	5	0.08
Ictaluridae	Tadpole madtom						2	0.05		
Poeciliidae	Mosquitofish		5	0.51			1	0.03	17	0.29
Moronidae	White perch				26	0.82				
Moronidae	Striped bass	Moderate			2	0.06				
Moronidae	White bass				1	0.03				
Centrachidae	Redbreast sunfish		595	60.59	505	15.99	1090	28.65	1701	28.75
Centrachidae	Bluegill		253	25.76	86	2.72	156	4.1	138	2.33
Centrachidae	Largemouth bass		3	0.31	93	2.94	79	2.08	87	1.47
Centrachidae	Redear sunfish		9	0.92	55	1.74	54	1.42	47	0.79
Centrachidae	Smallmouth bass				11	0.35	46	1.21	78	1.32
Centrachidae	Green sunfish								33	0.56
Centrachidae	Warmouth		2	0.2	2	0.06			4	0.07

Family	Common name	South Carolina Priority Species	West channel		Tailrace		Downstream reach 1		Downstream reach 2	
			Number	Percent	Number	Percent	Number	Percent	Number	Percent
Centrachidae	Black crappie				3	0.09	3	0.08	4	0.07
Percidae	Piedmont darter	High	3	0.31	21	0.66	46	1.21	180	3.04
Percidae	Seagreen darter	High			10	0.32	31	0.81	12	0.2
Percidae	Tessellated darter		9	0.92	3	0.09	1	0.03	34	0.57
Percidae	Blackbanded darter								1	0.02
Percidae	Yellow perch				1	0.03				

Freshwater Mussels

Freshwater mussels are filter feeding bivalves that exhibit a unique life cycle. During most of their lives, mussels are independent, free living organisms, but in nearly all species, the mussel larvae parasitize fish (often specific host species) during a few weeks to complete larval development (Haag, 2012). Mussels occur in a variety of freshwater environments, but are most abundant in well-oxygenated, shallow waters of medium to large rivers (Dillon, 2000; Smith, 2001). Mussels also typically occupy stable substrates including different combinations of silt, sand, gravel, cobble, and boulder (Smith, 2001).

Monticello Reservoir

Visual freshwater mussel surveys[63] were conducted in Monticello Reservoir on September 16 and 17, 2015 and November 6, 2015 at 25 survey sites located along the shoreline at depths between 0 feet and 18 feet (Three Oaks Engineering, 2016). Six species of freshwater mussels were found in Monticello Reservoir during the survey (table 3-11), and multiple size/age classes were observed for all species except Carolina creekshell. Mussels were also observed at all 25 survey sites. Three of the species found during the study (Carolina creekshell, Carolina lance, and eastern creekshell) are on the South Carolina Priority Species list (table 3-11), but none are federally listed. Seven individual mussels were tentatively identified as Carolina creekshell. The Carolina creekshell has a highest priority status and has not previously been identified as occurring within Monticello Reservoir and has not been previously reported from other reservoirs.[64]

Parr Reservoir

In 2007, South Carolina DNR conducted a freshwater mussel survey that included sites in Parr Reservoir (Price *et al.*, 2010). Survey methods included snorkeling, SCUBA diving (for deeper areas of the reservoir), and bathyscopes. During the survey, four

[63] Visual surveys involved the use of SCUBA and snorkeling.

[64] John Alderman and Art Bogan (personal communication, See Three Oaks Engineering, 2016) indicate that Carolina creekshell is usually restricted to small, or medium size streams and is rarely found in large bodies of water, and has not previously been reported from reservoirs. Three Oaks Engineering (2016) indicates that given that it is uncommon to find this species outside of stream habitats, it is possible that these individuals are simply unusual specimens of the eastern creekshell, which was the fourth most abundant species found in Monticello Reservoir (137 individuals). Three Oaks Engineering explains that they identified mussels as Carolina creekshell based on conchological (shell) and soft part anatomy characteristics, and that the identification should be considered as Carolina creekshell until further study proves otherwise.

mussel species were observed, including two on the South Carolina Priority Species list (table 3-11).

Downstream from Parr Development

Recent mussel surveys were conducted downstream of Parr Shoals Dam in 2007 (Price *et al.*, 2010), 2012 (Alderman and Alderman, 2012), and 2016 (Price *et al.*, 2016). During the surveys a total of nine freshwater mussel species were observed in the Parr Shoals tailrace and eight species were observed in habitats between the tailrace and the Columbia Diversion Dam (table 3-11). Dense mussel populations and suitable mussel habitat have been observed throughout the reach of the Broad River downstream of Parr Shoals Dam (Price *et al.*, 2010). None of the freshwater mussels observed in the tailrace, or downstream from the tailrace are federally listed. However, seven species in the tailrace and six species downstream from the tailrace are on the South Carolina Priority Species list (table 3-11).

Table 3-11. Freshwater mussel species observed during surveys conducted at the Parr Project (Source: staff).

Common name	Species name	South Carolina Priority Status	Monticello Reservoir[a]	Parr Reservoir[b]	Parr Tailrace[c]	Downstream from Parr Tailrace[d]
			✓ = Present			
Common elliptio	*Elliptio complanate*	moderate		✓	✓	✓
Carolina slabshell	*Elliptio congaraea*	moderate				✓[f]
Roanoke slabshell	*Elliptio roanokensis*	high			✓	✓[f]
Variable spike	*Elliptio icterina*	moderate			✓[e]	
Carolina lance	*Elliptio angustata*	moderate	✓		✓	✓[f]
Northern lance	*Elliptio fisheriana*	high			✓[e]	
Yellow lance	*Elliptio lanceolate*	none		✓		✓
Eastern floater	*Pyganadon catacta*	none	✓			
Florida pondhorn	*Uniomerus carolinianus*	none	✓	✓	✓	✓
Paper pondshell	*Utterbackia imbecillis*	none	✓		✓[e]	
Eastern creekshell	*Villosa delumbis*	moderate	✓	✓	✓	✓
Carolina creekshell	*Villosa vaughaniana*	highest	✓			
Yellow lampmussel	*Lampsilis cariosa*	highest			✓	✓[f]

[a] Survey conducted in 2015 (Three Oaks Engineering, 2016).

[b] Survey conducted in 2007 (Price *et al.*, 2010).

[c] Surveys conducted in 2012 (Alderman and Alderman, 2012) and 2016 (Price *et al.*, 2016).

[d] Surveys conducted in 2007 (Price *et al.*, 2010) and 2016 (Price *et al.*, 2016).

[e] Not observed in 2016 survey.

[f] Not observed in 2007 survey.

3.3.2.2 Environmental Effects

Hazardous Substances Plan [4(e) Condition 11]

Construction of new project facilities, modification of existing project facilities, and routine and non-routine maintenance could affect water quality if pollutants (e.g., fuels, lubricants, herbicides, pesticides, and other hazardous materials) are discharged into project waterways. To minimize the potential for contamination on project lands and waters, Forest Service 4(e) Condition 11 would require Dominion Energy to develop and implement a Hazardous Substance Plan for locations on, or directly affecting, Forest Service lands.

Forest Service 4(e) Condition 11 stipulates that no hazardous substances are to be stored on national forest system lands without prior approval of the Forest Service. As part of any request to store hazardous substances, Dominion Energy would be required to submit a Spill Prevention and Cleanup Plan for Forest Service approval. The plan would contain, at a minimum: (1) the licensee's procedures for reporting and responding to releases of hazardous substances; (2) a provision to maintain, in the project area, a cache of spill cleanup equipment; (3) a schedule to periodically inform Forest Service of the location of the spill cleanup equipment, and of the location, type, and quantity of oil and hazardous substances stored in the project area; and (4) a provision to notify Forest Service immediately of the nature, magnitude, time, date, location, and action taken for any spill. The plan would also include a monitoring component that details the corrective measures taken for a spill, and a provision to submit a weekly report during any construction activities that documents the results of monitoring.

Dominion Energy does not propose to implement a hazardous substances plan for the project.

Our Analysis

The plan included in Forest Service 4(e) Condition 11 would help to minimize or prevent the likelihood of accidental spills and address any discharges of hazardous substances to Forest Service lands, as well as project lands and waters. Specifically, this plan would address the prevention of hazardous substance spills, ensure protocols and equipment are in place to contain any spills, and ensure appropriate notification procedures are followed.

Condition 11 does not identify specific measures to be taken by Dominion Energy. Rather, it would require Dominion Energy to consult with federal, state, and local agencies in developing the plan, including identifying the specific measures necessary for addressing hazardous materials. Despite the lack of specific measures, Condition 11's proposed consultation would likely assist Dominion Energy in effectively identifying and managing risk associated with the project's use of hazardous materials. Spills of

hazardous materials could be more efficiently prevented or address if: (1) the storage locations for hazardous materials were identified; (2) staff received training in how to manage and clean up hazardous material spills; and (2) measures were in the plan that address consultation, reporting, and notification processes.

Sediment Mobilization in Parr Reservoir

Daily operation of the Fairfield Development has two distinct effects on Parr Reservoir: (1) daily fluctuations in the water level of Parr Reservoir; and (2) the potential reversal of flow in Parr Reservoir depending on flows in the Broad River. Dominion Energy does not propose, nor does any other entity recommend, specific measures to addresses any such effects.

Our Analysis

Dominion Energy sampled the sediment in two locations in Parr Reservoir for metals and other contaminants. Several elements were found at detectable levels in the Parr Reservoir, including cadmium, antimony, arsenic, calcium, lead, nickel, copper, chromium, zinc, barium, manganese, potassium, magnesium, aluminum, iron, and phosphorous. Concentrations of all these elements were higher, and in some cases significantly higher, in the lower portion of the reservoir (nearer the dam) as compared to the sampling location in the upstream portion of the reservoir.

Fluctuating water levels, especially on an hourly or daily basis, have the potential to resuspend sediment in Parr Reservoir. This fluctuation could mobilize metals and other contaminants in the sediment, which could then bioaccumulate[65] in aquatic organisms, as well as birds and other terrestrial mammals that feed on the aquatic organisms. All sampling locations were inundated at the Parr Reservoir's low pool elevation of 256 feet, which is the maximum drawdown for the Fairfield Pumped Storage Development's operation. Since most accumulated sediment in Parr Reservoir would likely be deeper that the elevation of the maximum drawdown, fluctuations in the reservoir's elevation are not expected to resuspend sediment or mobilize metals and other constituents in the sediment.

Generation and pump-back cycles at the Fairfield Development could result in movement of sediment and mobilize the constituents in the sediment. However, there is no evidence in the record to suggest that this is happening in any significant way that would lead to bioaccumulation and associated adverse effects on the aquatic and

[65] Bioaccumulation is the gradual accumulation of substances, such as pesticides, or other chemicals in an organism. Bioaccumulation occurs when an organism absorbs a substance at a rate faster than that at which the substance is lost by catabolism and excretion.

terrestrial communities in and around Parr Reservoir (e.g., fish consumption advisories, fish health issues, etc.).

Tailrace and West Channel Water Quality

During the project's relicensing process, the Water Quality Technical Working Committee[66] (WQ Committee) expressed concerns regarding the water quality in the west channel of the Broad River, downstream from Parr Shoals Dam. As documented in the license application, baseline water quality studies show that DO occasionally drops below South Carolina's instantaneous standard of 4.0 mg/L. To address the water quality concerns raised by the WQ Committee, Dominion Energy developed, and proposes to implement, two plans: the West Channel AMP, which is required by Settlement Agreement Condition 3a; and Turbine Venting Plan, which is required by Settlement Agreement Condition 3b. We analyze each plan, in turn, below.

Our Analysis

West Channel AMP

Baseline water quality data was collected in the west channel during 2015 and 2016 (Kleinschmidt, 2016a; 2017a). In 2015, continuous DO and temperature data were collected from April 1 through October 15 at three locations in the west channel and one location in the east channel (*see* figure 3-6). In August 2016, DO and water temperature data were collected at four monitoring locations in the upstream west channel (*see* figure 3-3) to verify 2015's monitoring results, as was as evaluate how discrete spillway releases or pulses through the spillway gates affect water quality in the west channel.

As indicated previously, monitoring in 2015 and 2016 showed that: (1) DO concentrations in the west channel periodically fall below South Carolina's DO standard of 4.0 mg/L; (2) DO in the upstream west channel (immediately downstream from Parr Shoals Dam) is consistently lower than DO further downstream in the west channel and in the east channel; (3) diel fluctuations[67] in both water temperature and DO exist, with greater DO fluctuations occurring later in the summer when flow is the lowest and where abundance of aquatic vegetation is greatest; and (4) flow and the resulting changes in water levels in the west channel are influenced by flows released from the Parr

[66] Members of the WQ Committee included representatives from South Carolina DNR, South Carolina DHEC, FWS, SCE&G (now Dominion Energy), American Rivers, and the Congaree Riverkeeper.

[67] Diel fluctuations refer to day/night fluctuations in a water quality parameter that occur over a period of time that involve 24 hours, which usually includes a day and the adjoining night.

Powerhouse, where increases in flow in the west channel would improve flushing of water and likely lead to enhanced DO concentrations in the channel.

The water temperature and DO monitoring data for this area of the Broad River are indicative of a southern river system. The shallow nature of the Broad River in this area; the presence of dense algal mats; and low-flow conditions in the west channel, especially during summer months, all influence the water quality in the channel. The observed diel fluctuations in DO, with DO concentrations rising rapidly at sunrise and throughout the day (i.e., period of oxygen production and consumption) and dropping quickly after dark (i.e., period of oxygen consumption only), are likely associated with the algal and plant growth. This natural process can be exacerbated by natural low-flow conditions that occur in the summer.

Dominion Energy worked with the WQ Committee to develop the proposed West Channel AMP to address the water quality concerns (particularly DO). The goal is to enhance aquatic habitat in the west channel of the Broad River through increased year-round minimum flows to the west channel. More specifically, the objectives of the West Channel AMP are to: (1) improve year-round water quality (i.e., raise DO concentrations to the level of the state standards for DO and improve DO levels in the west channel during summer/fall periods); (2) provide a more natural water temperature profile; and (3) improve water depth and velocity.

The West Channel AMP outlines measures that would be implemented to improve habitat and water quality conditions in the channel. These measures include flows varying from 50 cfs to 200 cfs, and potential channel modifications in the upstream west channel (figure 3-12),[68] directly downstream from Parr Shoals Dam. In addition, there are presently instances where inflow is insufficient to provide flow of any consequence to the west channel (*see* table 3-2). When such naturally occurring inflows decrease to a point that outflows from Parr Shoals Dam provide little, if any, flow to the west channel, Dominion Energy proposes, as part of the West Channel AMP, to assess the feasibility of using spillway gate(s) to provide periodic flow pulses to "refresh" the west channel flow during periods when DO is expected to fall below acceptable levels.

Releasing a new minimum flow from the Parr Powerhouse is expected to provide a more consistent amount of water flowing into the west channel from the east channel. The extent of the benefit(s) is not known at this time. However, the 5-year monitoring provision of the West Channel AMP would provide a mechanism for Dominion Energy and the WQ Committee to determine the benefits of the proposed new minimum flow, and whether channel modifications are needed to ensure adequate flow reaches the west

[68] Potential channel modifications could include notching or deepening of a small channel at the north tip of Hampton Island, and/or removal of material that currently serves as a hydraulic control closer to Parr Shoals Dam.

channel. The proposal to assess the feasibility of pulse flow releases during low-flow periods, along with the provision(s) in the West Channel AMP to monitor the flow releases, would ensure that there would adequate flows in the west channel during dry, hot periods when DO would be at its lowest. Implementing the West Channel AMP would likely improve aquatic habitat, including water quality (water temperature and DO), in the west channel of the Broad River.

Figure 3-12. Potential areas for channel modification in the West Channel of the Broad River (Source: Dominion Energy, 2018b; Exhibit E-4 Water Resources – Adaptive Management Plan for Enhancements to the West Channel Downstream from Parr Shoals Dam).

Turbine Venting Plan

Dominion Energy prepared a Baseline Water Quality Report for the project in 2014. The Baseline Water Quality Report included an analysis of existing upstream and downstream water quality data for project and associated waters. Dominion Energy reported that project operations could affect water quality downstream from Parr Shoals Dam, as periodic excursions of DO concentrations less than 4.0 mg/L occurred in the Parr Shoals tailrace (Kleinschmidt, 2014). To better understand these excursions, Dominion Energy collected additional water quality data in the Parr Shoals Dam forebay and tailrace in 2014 and 2015, including testing the venting[69] capabilities of each generating unit at the Parr Shoals Powerhouse. Based on the turbine venting tests, Dominion Energy proposes to implement the Turbine Venting Plan.

Dominion Energy's DO data collected in the Parr Shoals Dam forebay in 2015 (May through October) was compromised by bio-fouling (from debris, sediment, and algae), and therefore, is not a completely reliable representation of DO in the Parr Shoals Dam forebay. Nonetheless, the 1-week period following each download shows that DO in the forebay drops to 4.0 mg/L and below from late June through early September (*see* Figures 4-1 through 4-6 in Kleinschmidt [2016a]). The data collected in the Parr Shoals Dam tailrace showed that DO remained around 5.0 to 6.0 mg/L throughout the monitoring period (May through October 2015).

In 2014 and 2015, Dominion Energy tested each of the Parr Shoals Powerhouse turbines for their ability to self-vent and potentially increase the DO in the tailrace during specific periods of the year. Five of powerhouse's six turbine units (Units 1-5) have vacuum breakers to facilitate dewatering the draft tube. Unit 6, which is nearest to the shore, does not have a vacuum breaker. In 2014, Units 1, 3, and 4 were tested, and the measured increase in DO was 0.16 mg/L and 0.17 mg/L. Units 1, 2, 3, and 5 were tested in 2015,[70] and the results indicated that self-venting Unit 3 resulted in the most significant increase in DO, following by Units 1, 5, and 2 (table 3-12).

[69] The act of "venting" requires both the presence of vacuum breakers (which are used during de-watering operations), as well as the proper turbine vertical setting and sufficient gross head to draw air into the turbine during operation. With the turbine operating, the vacuum breaker valve is opened, and venting (drawing in of air) can be audibly determined. Aeration of the water can also be visually observed, as air bubbles are entrained in the water.

[70] Unit 4 was inoperable due to ongoing maintenance, and, therefore, was not tested.

Table 3-12. DO measurements for the turbine venting tests in 2014 and 2015 (Source: Kleinschmidt, 2016a).

Unit No.	DO with Vent Closed (mg/L)	DO with Vent Open (mg/L)	Increase in DO (mg/L)
1	4.65	5.04	0.39
2	4.60	4.80	0.20
3	4.70	5.15	0.45
4 *	5.66	5.82	0.16
5	4.84	5.20	0.36
6 **	5.10	N/A	N/A

* Test data from 2014.

** Unit 6 is not equipped with a vacuum breaker.

Based on the tests, Dominion Energy developed a turbine venting plan in consultation with South Carolina DHEC, which was tested in 2016 and proposed for inclusion in Dominion Energy's license application. The objective of the plan is to increase DO concentrations downstream from Parr Shoals Dam during the low DO season. The plan involves operating turbines on a first on/first off basis. During the venting period in 2016 (June 15 through July 31) the turbines were operated in the following order; Unit 3, Unit 1, Unit 5, Unit 2, Unit 4, and Unit 6. The 2016 testing showed no excursions of DO concentrations below 4.9 mg/L (table 3-13 and *see* Figure 4-10 in Dominion Energy [2018b]).

Table 3-13. Minimum and maximum DO concentrations and temperature in the Parr Shoals tailrace during June 15 – July 31, 2016 (Source: Dominion Energy, 2018b).

	June		July	
	DO (mg/L)	Temperature (°F)	DO (mg/L)	Temperature (°F)
Maximum	7.3	86.2	8.2	88.7
Minimum	5.6	79.7	4.9	68.7

Key:
DO = Dissolved Oxygen
F = Fahrenheit
mg/L = milligrams per liter

The two turbine tests at the Parr Project demonstrated that five of the six turbines have the capacity to self-aerate by opening vacuum breaker valves. The effectiveness of the venting varied between turbine units. At no time, however, did DO drop below 4.0 mg/L, which the U.S. Environmental Protection Agency (EPA) considers as the minimum DO necessary to protect freshwater aquatic life (EPA, 1986) and is the minimum level stipulated by South Carolina under its water quality standards. The tests

indicated that self-venting the turbines during the hot, dry summer months provided some enhancement in DO concentrations in the Parr Shoals tailrace.

Dominion Energy's proposed plan would enhance the overall water quality in the tailrace, and potentially in the west channel as well, as flow in the west channel is influenced by tailrace discharges to the east channel. Enhancing DO concentrations would improve habitat conditions for fish and other aquatic organisms (e.g., macroinvertebrates, freshwater mussels, etc.), as well as recreational fishing opportunities, and support applicable water quality standards throughout the hottest months of the year.

Shoreline Management Practices and Erosion Monitoring and Management

Shoreline development activities, as well as water level fluctuations in the Monticello and Parr Reservoirs, caused by the operation of the Fairfield Development, have the potential to cause localized shoreline erosion and sedimentation within the reservoirs. Erosion and sedimentation can affect the aquatic ecosystem in a variety of ways, including: (1) decreasing the littoral-zone habitat complexity;[71] (2) introducing toxic contaminants to the aquatic environment; and (3) decreasing the survival of aquatic organisms that use littoral zone habitats for spawning and rearing.[72] In addition, suspended sediment (i.e., turbidity) could increase, which is known to (a) decrease light penetration in the water column, which affects plant growth, and (b) hinder foraging opportunities for filter-feeders like freshwater mussels and clams, and otherwise disrupt predator-prey relationships.[73]

To address the effects mentioned above, Dominion Energy, as part of the Settlement Agreement, proposes to implement an Erosion Monitoring Plan and updated SMPs for both Parr and Monticello Reservoirs. The signatories to the Settlement Agreement also recommend that Dominion Energy implement these plans. In addition, Forest Service 4(e) Condition 20 requires Dominion Energy to develop and implement an Erosion and Sediment Control Management Plan for the project, including Forest Service lands. We discuss each of the two plans below.

[71] The littoral zone is defined as that part of a lake or river that is close to the shoreline. The littoral zone typically extends from the highwater mark, which is rarely inundated, to the biologically productive shoreline areas that are permanently submerged.

[72] The introduction of sediment can smother eggs deposited in littoral zone areas affected by erosion.

[73] For example, high levels of sediment can interfere with the ability of some fish species that rely on site to locate food.

Our Analysis

Erosion Monitoring Plan

As discussed in section 3.3.1, *Geology and Soils*, the shorelines within the project area have been disturbed by construction of roadways near the waterline and structures to support recreational and project-related activities. Dominion Energy's on-going monitoring of Monticello Reservoir and Parr Reservoir shows that Monticello Reservoir exhibits active erosion, to varying degrees (slight to severe), along about 85 percent of the shoreline. Parr Reservoir exhibited slight to moderate erosion along 96.5 percent of its shoreline.

Dominion Energy's proposed Erosion Monitoring Plan for Monticello Reservoir and Parr Reservoir is described in detail in section 3.3.1, *Geology and Soils*. Generally, as part of the Erosion Monitoring Plan, Dominion Energy would annually monitor[74] erosion along the Parr Reservoir shoreline and twice-yearly monitor erosion along the Monticello Reservoir shoreline. The plan also sets forth and defines survey methods, the erosion repair procedure(s),[75] and a monitoring schedule, as well as documentation and reporting standards. Forest Service 4(e) Condition 20 includes similar elements but would also require periodic monitoring of shoreline areas that have been repaired.

Implementing an erosion and sediment control plan for the project, with the components outlined in Dominion Energy's proposed plan and in Forest Service 4(e) Condition 20, would provide Dominion Energy an integrated and comprehensive approach to effectively minimize erosion, sedimentation, and sloughing[76] of soil into the project reservoirs during periods of ground-disturbance, as well as during other activities associated with public use of the project land(s) and waters. The measures included in such a plan would help Dominion Energy prevent or minimize the introduction of new localized sources of pollution (i.e., sediment) to the reservoirs, which would help minimize (a) local areas of turbidity, (b) the potential introduction of heavy metals and other toxic chemicals, and (c) the release of oxygen-demanding nutrients (e.g., nitrogen

[74] Shorelines are visually monitored from a boat and then tracked using a GPS-enabled data collector. Investigators then classify the level of erosion into one of four categories: slight, moderate, severe, or rip-rap.

[75] Erosion repair is triggered when an identified erosion area is found to be encroaching on the project boundary, project infrastructure, or significant natural or cultural resources.

[76] Sloughing or "sluffing" of soil refers to soiling falling off banks and slopes due to a loss in cohesion.

and phosphorous) to the project reservoir. The plan, then, would help protect and maintain water quality at the project.

Shoreline Management Plan

Dominion Energy developed separate SMPs for Monticello and Parr Reservoirs. The proposed SMPs are described in detail in section 3.3.5, *Recreation and Land Use*. Generally, the SMPs set forth and define permitting procedures and best management practices[77] for a wide variety of shoreline activities for each project land classification, as well as guidance for construction, maintenance, and placement of docks, shoreline stabilization, lake access pathways, and other shoreline activities. The provisions of the SMPs would provide a mechanism for Dominion Energy to protect water quality in Parr Reservoir and Monticello Reservoir through the mitigation and management of erosion and land disturbances around the reservoirs. This would be done by encouraging landowners adjacent to the reservoirs to implement best management practices that preserve bank integrity and minimize non-point sources of pollution and contamination.

Minimum Flows Downstream from Parr Development

Low flows released by hydropower projects have the potential to affect the quality of downstream habitat for fish and aquatic organisms and potentially create fish migration barriers by reducing the depth and volume of water in a river channel. When inflows are less than the maximum hydraulic capacity of the Parr Development, Dominion Energy currently releases a minimum flow of 1,000 cfs, or daily average inflow if less than 1,000 cfs, during March, April, and May. During the remainder of the year, Dominion Energy releases a daily average minimum flow of 800 cfs or daily average inflow if less, and no less than 150 cfs at any time.

Under any new license issued, Dominion Energy proposes to finalize and implement the Minimum Flows AMP, which includes measures to release new minimum flows downstream from the Parr Development. Settlement Agreement Condition 2b requires this plan.

[77] Examples of BMPs include: (1) using permeable paving materials and reduce the area of impervious surfaces; (2) disposing of vehicle fluids, paints, and/or household chemicals as indicated on their respective labels; (3) using soap sparingly when washing vehicles and wash them on a grassy area; (4) using hose nozzles with triggers to save water and disposing of used soapy water in sinks or other vessels that direct the materials into sewer systems; (5) maintaining septic tanks and drain fields in accordance with the guidelines and regulations of appropriate regulatory authorities; (6) removing and disposing of pet waste appropriately; and (7) using only low or no phosphorous fertilizer on lawns near the reservoir.

The minimum flows in the plan include a set of target flows and compliance limit flows that the IFTWC recommended (see table 3-14). The target flow is the primary minimum flow that Dominion Energy would release from Parr Development. The compliance limit flow is less than the target and could be released for up to 6 hours per day (and a maximum of 3 consecutive hours) without triggering a non-compliance event. The compliance limit flow is intended to give Dominion Energy the flexibility to adjust the balance of storage between Monticello and Parr Reservoirs, and to allow for variation in flow caused by equipment or human-related factors.

A goal of the Minimum Flows AMP is to reduce the number of hours per day and the number of consecutive hours of flows between the target and compliance limit to the extent that a reduction is shown to be possible based on operational experience during the term of the AMP. Dominion Energy would implement the proposed target and compliance flows during the first year of any new license issued. In years 2 through 5 of any new license issued, a review committee[78] would evaluate the flow record at USGS gage 02161000 (Broad River at Alston, South Carolina)[79] to determine how well Dominion Energy is meeting the target and compliance limit flows in relation to inflow and recommend that Dominion Energy implement any recommended changes in minimum flows. At the end of the 5-year Minimum Flows AMP, the review committee would provide final recommendations to the Commission on extension or completion of the AMP.

[78] The review committee includes Dominion Energy, NMFS, FWS, Forest Service, South Carolina DHEC, South Carolina DNR, and South Carolina SHPO.

[79] USGS gage 02161000 is about 1.4 miles downstream from the Parr Development.

Table 3-14. Minimum flows proposed in the Minimum Flows AMP (Source: Dominion Energy, 2018b).

Time period		Net inflow[a]	Target minimum flow	Compliance limit minimum flow
High flow period	February 1 - April 30	greater than 2,300 cfs	2,300 cfs	2,100 cfs
		less than or equal to 2,300 cfs and greater than 2,200 cfs	Net inflow	2,100 cfs
		less than or equal to 2,200 cfs and greater than or equal to 600 cfs	Net inflow	550 cfs, unless net inflow minus 100 cfs is greater
		less than 600 cfs	Net inflow	Net inflow minus 50 cfs
Transitional flow periods	December 1 - January 31 & May 1 - May 31	greater than 1,500 cfs	1,500 cfs	1,300 cfs
		less than or equal to 1,500 cfs and greater than 1,400 cfs	Net inflow	1,300 cfs
		less than or equal to 1,400 cfs and greater than or equal to 600 cfs	Net inflow	550 cfs, unless net inflow minus 100 cfs is greater
		less than 600 cfs	Net inflow	Net inflow minus 50 cfs
Low flow period	June 1 - November 30	greater than 1,000 cfs	1,000 cfs	900 cfs
		less than or equal to 1,000 cfs and greater than or equal to 600 cfs	Net inflow	550 cfs, unless net inflow minus 100 cfs is greater
		less than 600 cfs	Net inflow	Net inflow minus 50 cfs

[a] Net inflow is defined as the previous day's daily average inflow minus evaporation from the reservoirs.

Our Analysis

To help identify adequate minimum flows under any new license issued, Kleinschmidt (2016c) conducted an IFIM study. Dominion Energy designed the IFIM study with direction from a technical working committee[80] using standard procedures[81] to provide quantitative estimates of available habitat (i.e., weighted useable area [WUA])[82] at various flows for 11 fish species[83] located at seven study sites between Parr Shoals Dam and Bookman Island (about 14 river miles downstream).[84] Using the results from the IFIM, the IFTWC identified target flows that would more consistently provide water to the west channel from the east channel to enhance flows and improve water quality and habitat in the west channel compared to existing conditions (see section 3.3.2.2, *Tailrace and West Channel Water Quality*).[85] In addition, and as discussed more thoroughly below, the IFTWC also identified target flows for low, transitional, and high flow periods with particular consideration for providing adequate habitat for specific fish species that occur downstream of Parr Shoals Dam.

For the low flow period, the IFTWC recommended a target minimum flow of 1,000 cfs when inflows exceed 1,000 cfs,[86] based on the need to provide adequate habitat

[80] The technical working committee included individuals from American Rivers, Congaree Riverkeeper, FWS, NMFS, U.S. National Park Service, South Carolina DNR, and South Carolina DHEC.

[81] Available habitat was evaluated using standard field procedures and Physical Habitat Simulation (PHABSIM) modeling techniques of the IFIM, which were developed by the National Ecology Center of the National Biological Survey (Bovee, 1982; Bovee *et al.*, 1998).

[82] WUA is an index of available aquatic habitat as determined by the IFIM.

[83] The 11 target species included American shad, whitefin shiner, Santee chub, robust redhorse, brassy jumprock, channel catfish, snail bullhead, striped bass, smallmouth bass, and piedmont darter, all at multiple life-stages (i.e., juvenile, adult, spawning).

[84] There was a total of ten sites included in the study, but two sites were deemed unsuitable for estimating WUA (sites 1 and 4) and site 9 was considered similar enough to site 10, such that the habitat suitability of site 9 could be addressed through a flow demonstration (i.e., visual observation among experts).

[85] See the meeting notes from the January 24, 2019 IFTWC meeting, which is in the FLA, exhibit E5-a.

[86] When inflow is less than 1,000 cfs during the low flow period, the minimum flow would equal net inflow, and thus there would be no flow reduction downstream of Parr Shoals Dam.

to adult smallmouth bass.[87] Smallmouth bass are an important recreational species in the Broad River and were observed in all habitats surveyed downstream of the project, except the west channel. Thus, providing adequate habitat downstream of Parr Shoals Dam would be beneficial to the Broad River smallmouth bass fishery. Based on the results of the IFIM study, a flow of 1,000 cfs would provide an average of about 74 percent of the maximum available habitat for adult smallmouth bass among study sites, indicating that adequate habitat would be provided (Kleinschmidt, 2016c). Further, the IFIM study results indicated that releasing a flow of 1,000 cfs would provide at least 50 percent of the maximum available habitat for the majority of other species/guilds[88] at each study site.

During the low flow period, Dominion Energy currently releases a daily average flow of 800 cfs, and no less than 150 cfs at any time (table 3-15). Based on the results of the IFIM study, a minimum flow of 800 cfs provides an average of about 66 percent of the maximum available habitat for adult smallmouth bass, which is slightly less than the amount of habitat provided by 1,000 cfs (74 percent). In addition, a flow of 150 cfs only provides an average of about 30 percent of maximum available habitat for smallmouth bass. Thus, Dominion Energy's proposed target flow of 1,000 cfs during the low flow period would improve the availability of habitat for smallmouth bass compared to existing conditions while also providing suitable habitat for other fish species.

For the transitional flow period, the IFTWC recommended a target minimum flow of 1,500 cfs when inflows exceed 1,500 cfs,[89] based on the need to provide adequate habitat for adult smallmouth bass and spawning robust redhorse.[90] As discussed in section 3.3.2.1, *Fish Community*, robust redhorse has been observed downstream of Parr Shoals Dam, and is a South Carolina Priority Species that is the focus of conservation and recovery efforts in the Broad River. In addition, IFTWC stakeholders identified the habitat immediately downstream of the Parr Shoals powerhouse (i.e., IFIM study site 3) as likely spawning habitat for robust redhorse. Thus, in addition to benefits of providing adequate habitat for smallmouth bass, there are benefits to providing adequate habitat for robust redhorse. Based on the results of the IFIM study, a flow of 1,500 cfs would provide an average of about 86 percent of the maximum available habitat for adult smallmouth bass and an average of about 68 percent of the maximum available spawning

[87] *See* n. 85.

[88] In the IFIM study, some species were grouped together into "guilds" or groups of species with similar habitat requirements.

[89] When inflow is less than 1,500 cfs during the transitional flow period, the minimum flow would equal net inflow, and thus there would be no flow reduction downstream of Parr Shoals Dam.

[90] *See* n. 85.

habitat for robust redhorse among study sites, indicating that adequate habitat would be provided for both species.[91] In addition, the IFIM study results indicated that releasing a flow of 1,500 cfs would provide at least 50 percent of the maximum available habitat for the majority of other species/guilds at each study site.

In comparison, during the same transitional flow period, Dominion Energy currently releases a daily average flow of 800 cfs, and no less than 150 cfs at any time from December 1 to January 31, and during May releases no less than 1,000 cfs (table 3-15). Based on the results of the IFIM study, a minimum flow of 1,000 cfs, 800 cfs, and 150 cfs provides an average of about 74 percent, 66 percent, and 29 percent, respectively, of the maximum available habitat for adult smallmouth bass, which is 12 to 57 percent less habitat compared to the proposed target flow of 1,500 cfs during the same time period. Robust redhorse generally spawn during April and May (Fisk *et al.*, 2015), thus the existing minimum flow of 1,000 cfs is most appropriate for comparison to the proposed transitional minimum flow of 1,500 cfs (see table 3-15). A minimum flow of 1,000 cfs would provide an average of about 73 percent of the maximum available spawning habitat for robust redhorse, which provides 5 percent more available habitat compared to the proposed minimum flow of 1,500 cfs. Despite the slightly lower available spawning habitat for robust redhorse during May compared to existing conditions, Dominion Energy's proposed target flows during the transitional period are still suitable for robust redhorse spawning and are substantial improvements for adult smallmouth bass compared to existing conditions.

[91] The estimates of percent of maximum available habitat are based on the "Habitat Suitability" tables in section 4.0 of the Instream Flow Study Report (Dominion Energy, 2018) and are based on the percent values in the tables at flows of 1,500 cfs, except at site 2 where flows of 1,400 cfs were used because estimates at 1,500 cfs were not available.

Table 3-15. A comparison of existing and proposed minimum flows downstream released from the Parr Development (Source: staff).

Months	**Proposed minimum flows[a]**			**Existing minimum flows**
	Flow Period	Target	Compliance	
January	Transitional	no less than 1,500 cfs	no less than 1,300 cfs	No less than 150 cfs & daily average no less than 800 cfs
February	High	no less than 2,300 cfs	no less than 2,100 cfs	No less than 150 cfs & daily average no less than 800 cfs
March - April	High	no less than 2,300 cfs	no less than 2,100 cfs	No less than 1,000 cfs
May	Transitional	no less than 1,500 cfs	no less than 1,300 cfs	No less than 1,000 cfs
June - November	Low	no less than 1,000 cfs	no less than 900 cfs	No less than 150 cfs & daily average no less than 800 cfs
December	Transitional	no less than 1,500 cfs	no less than 1,300 cfs	No less than 150 cfs & daily average no less than 800 cfs

[a] Proposed flows shown in this table are the highest minimum flows proposed during the respective flow period (see table 3-14).

For the high flow period, the IFTWC recommended a target minimum flow of 2,300 cfs when inflows exceed 2,300 cfs,[92] based on the need to provide adequate spawning habitat for robust redhorse and American shad.[93] As discussed in section 3.3.2.1, *Fish Community*, American shad occur and spawning habitat exists downstream from Parr Shoals Dam. The population in the Santee River Basin is currently depleted compared to historical abundance and is targeted for restoration to spawning and rearing habitats both upstream and downstream of Parr Shoals Dam. Thus, there are benefits to providing adequate spawning habitat for American shad and robust redhorse (discussed above) downstream of Parr Shoals Dam. Based on the results of the IFIM study, a flow of 2,300 cfs would provide an average of about 93 percent of the maximum available spawning habitat for American shad and an average of about 62 percent of the maximum available spawning habitat for robust redhorse at the study sites, indicating that adequate habitat would be provided for both species.[94] In addition, the IFIM study results indicated that releasing a flow of 2,300 cfs would provide at least 50 percent of the maximum available habitat for the majority of other species/guilds at each study site.

In comparison, during the same high flow period, Dominion Energy currently releases a daily average flow of 800 cfs, and no less than 150 cfs at any time during February, and no less than 1,000 cfs from March through April (table 3-15). Based on the results of the IFIM study, a minimum flow of 1,000 cfs, 800 cfs, and 150 cfs provides an average of about 86 percent, 82 percent, and 54 percent, respectively, of the maximum available spawning habitat for American shad, which is 7 to 39 percent less available habitat compared to the proposed target flow of 2,300 cfs during the same time period. With respect to robust redhorse, the existing minimum flow of 1,000 cfs is most appropriate for comparison to the proposed minimum flow of 2,300 cfs during the high flow period, because they generally spawn during April and May (see table 3-15). A minimum flow of 1,000 cfs would provide an average of about 73 percent of the maximum available spawning habitat for robust redhorse, which provides 11 percent more available habitat compared to the proposed minimum flow of 2,300 cfs. Despite the slightly lower available spawning habitat for robust redhorse during April and May compared to existing conditions, Dominion Energy's proposed target flows during the

[92] When inflow is less than 2,300 cfs during the transitional flow period, the minimum flow would equal net inflow, and thus there would be no flow reduction downstream of Parr Shoals Dam.

[93] *See* n. 85.

[94] The estimates of percent of maximum available habitat are based on the "Habitat Suitability" tables in section 4.0 of the Instream Flow Study Report (Dominion Energy, 2018). No estimates were available at 2,300 cfs, thus we based our analysis on flows nearest to 2,300 (i.e., 2,000 cfs [sites 2, 6, 7, 8, 10], 2,250 cfs [site 3], or 2,500 cfs [site 5]).

high flow period would still provide suitable spawning habitat for robust redhorse and would provide substantial improvements to spawning habitat for American shad.

In addition to the proposed target flows, Dominion Energy also proposes compliance limit flows that would allow them to release flows that could be up to 50 cfs to 200 cfs less than the target flows for a limited period of time each day. The purpose of the compliance limit flows is to give Dominion Energy the flexibility to adjust the balance of storage between Monticello and Parr reservoirs, and to allow for variation in flow caused by equipment or human related factors. Compliance limit flows would minimally reduce downstream flows compared to the target flows. Compliance flows would also be greater than the minimum flows that Dominion Energy provides under existing conditions, and thus more protective of aquatic resources compared to existing minimum flows. The compliance limit flows would also only occur for up to 6 hours per day, with a maximum of 3 hours occurring consecutively. Further, because a goal of the Minimum Flows AMP is to reduce the number of hours per day and the number of consecutive hours of flows between the target and compliance limit, the duration of flow reductions may be reduced further during the term of any new license issued.[95] Thus, the flow reduction caused by releasing compliance flows for a limited period of time each day is unlikely to negatively affect aquatic resources downstream of Parr Shoals Dam.

Our analysis above indicates that implementation of the proposed target flow in year one of any new license issued would be protective as evidenced by the results of the IFIM study, which the IFTWC confirmed during field observations.[96] Compliance flows would allow Dominion Energy to operate with an adequate level of flexibility to manage storage and variable inflows, while still protecting downstream habitat and fish. Further, through implementation of the Minimum Flows AMP, Dominion Energy could reduce the duration of the compliance flows during the first 5 years to more frequently meet the target flows. Thus, implementation of the Minimum Flows AMP would allow Dominion Energy to protect aquatic resources, while providing operational flexibility, and an opportunity to evaluate whether additional protection is possible during the first 5 years of any new license issued.

[95] If modifications to compliance flows are determined to be necessary subsequent to any new license being issued, Dominion Energy would need to file an application to amend the license and get Commission approval prior to implementing any modifications as part of the Minimum Flows AMP.

[96] The IFTWC conducted field observations of the target flows and confirmed that they would be suitable (See Settlement Agreement, Appendix A-3).

Flow Fluctuations Downstream of Parr Development

During current operations, when inflow to the Parr Development is 40,000 cfs or greater, all inflows pass downstream without modification by project operation. When inflow to the project is less than 40,000 cfs, there are two operational scenarios that cause flows to fluctuate unnaturally downstream of the project by as much as 5,000 cfs to 10,000 cfs daily.[97] One scenario occurs when Dominion Energy releases flows downstream of Parr Development during a practice it refers to as inventory management.[98] Inventory management releases result in large, short duration pulses being released downstream. A second scenario occurs when the spillway gates are left down over extended periods (e.g., overnight, or over a weekend when the there are no onsite operators to raise the gates). In this latter scenario, the fluctuations are caused by generation and pumping at the Fairfield Development, which leads to fluctuating discharge being released into the Parr Reservoir and subsequently downstream of the Parr Development. Flow fluctuations under both scenarios have the potential to affect areas as far downstream as the Congaree River.[99]

To reduce project-induced flow fluctuations downstream of the Parr Development, Dominion Energy proposes to finalize and implement a Flow Fluctuations AMP. Condition 2a of the Settlement Agreement requires the Flow Fluctuations AMP. Dominion Energy proposes to implement the Flow Fluctuations AMP during the first 5 years of any new license issued, with the option to extend implementation beyond year 5 with Commission approval. During the first year of any new license issued, Dominion

---

[97] Kleinschmidt evaluated the occurrence of project induced flow variation downstream of Parr Development and determined that the percent occurrence of hourly flow variation greater than 2,000 cfs, 3,000 cfs, 5,000 cfs, and 10,000 cfs was 20 percent, 11.5 percent, 4.7 percent, and 0.9 percent, respectively, from 2010 to 2015 during the months of January to May (*See* December 16, 2015 Downstream Flow Fluctuations memorandum included in exhibit E1-e of the FLA).

[98] Inventory management is the practice of: (1) allowing water levels to slowly rise in the Parr Reservoir when the spillway gates are up and inflows exceed the hydraulic capacity of the Parr Shoals Development; (2) releasing water by lowering the spillway gates when water levels approach the maximum elevation of 265.3 feet; and (3) closing the spillway gates and allowing the reservoir to refill.

[99] Kleinschmidt's analysis of flows at USGS gages both upstream and downstream of the Parr Project, including the Saluda River and Congaree River, indicated that operations at the Parr Shoals Development have the potential to affect flows in the Congaree River near Highway 601 (about 47 river miles downstream from the Columbia Diversion Dam) (*See* December 16, 2015 Downstream Flow Fluctuations memorandum included in exhibit E1-e of the FLA).

Energy proposes to reduce year-round downstream flow fluctuations through implementation of new operating guidelines. During the first year, Dominion Energy also proposes to implement additional operational modifications to further reduce downstream flow fluctuations[100] during the spring spawning periods of shortnose sturgeon, American shad, striped bass, and robust redhorse.[101] By the end of the second calendar year of any new license issued,[102] Dominion Energy also is proposing to add remote control operation of crest gates 1 and 2 at Parr Development and a remote camera on the west side of Parr Shoals Dam to allow system control operators to modify year-round inventory management releases and reduce downstream flow fluctuations when onsite operators are not present.[103] To guide operational changes toward the goal of reducing flow fluctuations year-round and during the spring spawning period, Dominion Energy proposes to use compliance criteria[104] that would be set by a review committee.[105] Compliance criteria would be set prior to each of the first 5 years of implementing the plan.[106] At the end of year 5 of any new license issued, the review committee would recommend final compliance criteria to be implemented during the remaining license term, or to extend the Flow Fluctuations AMP for an additional period of time.

[100] The goal during the spring spawning period is to modify operations such that outflow approximately equals inflow.

[101] For shortnose sturgeon, Dominion Energy proposes operational modifications for 14 days during the period from March 15 through March 31, and for American shad, striped bass, and robust redhorse, operational modifications are proposed for two, 7-day periods from April 1 through May 10.

[102] Dominion Energy describes the timing as the end of the first calendar year following the year of license issuance.

[103] Under existing operations, onsite plant operators set the gates at 3:00 PM and go home for the night (*See* October 18, 2016 Water Quality, Fish and Wildlife Resource Conservation Group memorandum included in exhibit E1-e of the FLA).

[104] Examples of compliance criteria would include annual target reductions in fluctuations based on metrics such as the mean hourly deviation of outflow from inflow over a specific time period (e.g., entire year, spring spawning period, or monthly) (See Appendix A-2 of the Settlement Agreement).

[105] The review committee would direct the implementation of the plan and would include signatories to the Settlement Agreement, as well as the Forest Service, South Carolina SHPO, and South Carolina DHEC.

[106] To reduce fluctuations during the first year of the plan, Dominion Energy proposes to implement compliance criteria that the review committee would develop within 120 days of license issuance. The review committee would set the compliance criteria for each of the 4 subsequent years of the plan based on operations and flow data collected during the preceding year and recommend operational changes.

NMFS includes the proposed Flow Fluctuations AMP as one of its section 10(j) recommendations.

Our Analysis

The existing flow fluctuations occur throughout the year and can affect both resident and migratory aquatic biota that use habitats downstream from the Parr Development. As discussed in section 3.3.2.2, *Minimum Flows Downstream from Parr Development*, many fish display a preference for particular types of habitats such as pools, riffles, or runs. Flow fluctuations alter the quality and quantity of these preferred habitats (Valentin *et al.*, 1994 as cited by Bunn and Arthington, 2002). Such fluctuations could strand and isolate fish in back channels and on gravel bars, causing increased risk of predation and natural mortality, or dewater fish nests located in nearshore habitat, leaving eggs vulnerable to predation and desiccation (Young *et al.*, 2011).

Flow fluctuations may also affect the spawning migration or spawning behavior of migratory fish species that use habitat downstream of the Parr Development. For example, robust redhorse will use spawning habitat (i.e., gravel bars within shoals) downstream of hydropower facilities when operations result in elevated flows, but will leave spawning habitat and move to pools when operations cause flow reductions that make the spawning habitat unsuitable (Fisk *et al*., 2015). Suitable habitat for striped bass spawning is generally characterized as having large volumes of moving water and uniform flows (Fish and McCoy, 1959 as cited by Setzler-Hamilton, 1980). Studies conducted in the Connecticut River also indicate that shortnose sturgeon will terminate spawning and leave the spawning grounds during rapid increases or decreases in flow downstream of hydropower peaking facilities (Kieffer and Kynard, 2012). For American shad, the effects of fluctuations are not well understood, but studies indicate that the upstream spawning migration of American shad may be slowed and spawning site selection may be inhibited by flows that are lower than average (Leggett, 1976; Dutterer *et al.*, 2011), and the IFIM study conducted by Dominion Energy (2018b) indicates that higher flows provide more suitable spawning habitat. Thus, fluctuating flows could negatively affect the quality of fish habitat and the spawning activities of migratory fish that occupy habitat downstream of Parr Development.

Year-round Flow Fluctuation Reductions

During the first year of any new license issued, Dominion Energy proposes to reduce year-round flow fluctuations downstream of Parr Development and minimize the above described effects on aquatic resources through implementation of new operating guidelines using onsite system control (i.e., no remote-control operation during the first year) that would be identified in a final Flow Fluctuations AMP. A review committee would then evaluate the ability of the project to reduce flow fluctuations during the first year and set compliance criteria for the second year. Reducing flow fluctuations during

the first year by using an onsite system control would provide more suitable habitat to fishery resources compared to existing conditions. In addition, reviewing data from the first year would help Dominion Energy identify modifications that they could implement in year 2 of any new license issued, using compliance criteria set by the review committee.

By the end of the second year of any new license issued, Dominion Energy proposes to add remote control operation of crest gates 1 and 2 at Parr Development and a remote-control camera on the west side of Parr Shoals Dam to allow system control operators to modify year-round inventory management releases and reduce downstream flow fluctuations when onsite operators are not present. Under existing conditions, the Parr Shoals Dam spillway gates are only operated when an operator is present on weekdays during daytime hours (i.e., no operator is present after 3:00 PM or on weekends).[107] Operating the gates under this schedule can result in downstream flow pulses if the gates are left up overnight, because the volume of water built-up overnight in the reservoir may need to be released the next day to keep water levels from exceeding the maximum elevation of 265.3 feet. In addition, when Dominion Energy leaves the gates down overnight or over a weekend, the generation and pumping at the Fairfield Development leads to fluctuating discharge being released into the Parr Reservoir and subsequently downstream of the Parr Development. Dominion Energy's proposal to enable remote-control operation of the crest gates would allow the licensee to make around-the-clock adjustments based on real-time inflow and reservoir level data, whether or not an operator is present at the development. In addition, Dominion Energy's proposal to install a remote camera would allow offsite system control operators to determine if conditions are safe to raise or lower the crest gates. Remote-control operation and cameras would allow Dominion Energy to more closely monitor and manage inflows and outflows, which would facilitate implementation of new operating guidelines to reduce flow fluctuations and meet the compliance targets set by the review committee.

Separate from the Flow Fluctuations AMP, Dominion Energy is also proposing in the Upgrade/Replacement of Generators at Parr Development Implementation Plan to modify or replace the generators at the Parr Development within 10 years of any new license issued to increase the hydraulic capacity of the development to 6,000 cfs at low pond and 7,254 cfs when the reservoir is full. Under existing conditions, the generators limit the hydraulic capacity of the project to 4,800 cfs. Increasing the generator capacity would increase the hydraulic capacity of the development and reduce the need to pass

[107] Plant operators set the gates at 3:00 and go home for the night (*See* October 18, 2016 Water Quality, Fish and Wildlife Resource Conservation Group memorandum included in exhibit E1-e of the FLA).

inflows using spillway gates. Dominion Energy estimates that increasing the hydraulic capacity of the development would reduce use of the spillway gates by as much as 26 percent.[108] Because use of the spillway gates contributes to flow fluctuations, decreasing their use would reduce downstream flow fluctuations and improve downstream habitat for aquatic resources.

Spawning Flow Stabilization

In addition to the year-round flow reductions described above, during the first year, Dominion Energy also proposes to provide outflows downstream from Parr Development that approximately equal inflows (i.e., flow stabilization) during the spring spawning periods for shortnose sturgeon, American shad, striped bass, and robust redhorse as part of the Flow Fluctuations AMP. The goal of flow stabilization is to reduce the negative effects of fluctuating flows on spawning behavior. For shortnose sturgeon that spawn in the Congaree River downstream from the Columbia Diversion Dam (see section 3.3.4.1, *Threatened and Endangered Species, Affected Environment*), Dominion Energy proposes to stabilize downstream flows for 14 days during the period between March 15 and March 31. Shortnose sturgeon spawning generally occurs at water temperatures between 48°F (9°C) and 59°F (15°C), and historical water temperature data near the spawning habitat in the Congaree River indicate that these temperatures regularly occur between March 15 and March 31.[109] Thus, Dominion Energy's proposal to stabilize flows during a 14-day period between March 15 and March 31 each year, could improve spawning habitat conditions and spawning activity for shortnose sturgeon in the Congaree River.

To reduce the negative effects of fluctuating flows on the spawning behavior of the American shad, striped bass, and robust redhorse that occur downstream from Parr Development, Dominion Energy proposes to stabilize downstream flows during two, 7-day periods that would occur between April 1 and May 10. As discussed in section 3.3.2.1, *Fish Community*, American shad, striped bass and robust redhorse currently occur downstream of the Parr Shoals Dam where spawning habitat is present. In addition, each of these species has a spawning period that overlaps with the April 1 to May 10 period when Dominion Energy would stabilize flows. Thus, Dominion Energy's proposal to stabilize downstream flows during two, 7-day periods that would occur between April 1 and May 10, could improve spawning habitat conditions for American

[108] See Appendix A-2 of the Settlement Agreement.

[109] Water temperature data are collected in the Saluda River at USGS gage 02169000, which is located about 3.3 river miles upstream from a location on the Congaree River near Blossom Street Bridge, Columbia, South Carolina, where migrating shortnose sturgeon have been observed and where there is evidence of spawning.

shad, striped bass, and robust redhorse that attempt to spawn downstream of Parr Shoals Dam.

Dominion Energy states in the Flow Fluctuations AMP that the periods of flow stabilization for spawning discussed above would be determined annually by a review committee prior to the spawning season, and may vary from year to year, but will generally occur within the date ranges specified above. Our interpretation is that the period of flow stabilization for shortnose sturgeon spawning would occur during the specified dates of March 15 through March 31, and the period for American shad, striped bass, and robust redhorse would occur during the specified dates of April 1 through May 10. We do not interpret Dominion Energy's proposal or NMFS's 10(j) recommendation to include the option to extend the period of flow stabilization for spawning to dates outside those specified in the proposal. Nonetheless, Dominion Energy could adjust the periods of flow stabilization for spawning to occur outside the specified date ranges, but any changes in the date range would require final approval from the Commission if and when dates outside the specified range are identified as necessary.

Evaluating Downstream Flow Fluctuation Reductions

During each of the first 5 years of any new license issued, Dominion Energy proposes to meet in February to have a review committee evaluate Dominion Energy's ability to reduce flow fluctuations during the entire year and during the period of spawning flow stabilization. The assessment of Dominion Energy's ability to reduce flow fluctuations would be based on metrics such as the mean hourly deviation of outflow from inflow over a specific time period and/or comparing the inflow and outflow hydrographs, as determined by the review committee. Dominion Energy also proposes to use the metrics to establish compliance criteria, such as targeted reductions in the mean hourly deviation of outflow from inflow. The metrics and compliance criteria would guide changes in the operating guidelines for Parr Development, and help to reduce fluctuations for years 2 through 5 of any new license issued.[110] In addition, the metrics and compliance criteria would help Dominion Energy and the review committee provide final compliance criteria to be approved by the Commission, which would be designed to reduce flow fluctuations during the term of any new license issued and protect aquatic resources. Alternatively, if the review committee determines that an extension of the Flow Fluctuations AMP is necessary beyond the first 5 years after any new license issued, Dominion Energy proposes to seek Commission approval to continue implementation of the plan to reduce flow fluctuations. Together, the use of metrics, compliance criteria, and an adaptive approach to reducing flow fluctuations downstream of the Parr Development would improve aquatic habitat and protect the fish and mussels present downstream. However, any changes to compliance criteria or operations

[110] Dominion Energy proposes that the review committee would determine the compliance criteria for year 1 of any new license within 120 days of license issuance.

designed to meet the compliance criteria during the term of any new license issued would require final approval from the Commission.

Effects of Reservoir Fluctuations

Monticello Reservoir

Some hydropower facilities that operate with variable reservoir surface elevations cause littoral (near-shore) habitat to temporarily dewater, which can negatively affect the reproduction of littoral spawning species.

Dominion Energy proposes to continue operating the Fairfield Development by fluctuating the Monticello Reservoir by up to 4.5 feet daily. To mitigate the effects of these fluctuations on fish (primarily black bass and sunfish) habitat in Monticello Reservoir and potentially improve recreational fishing, Dominion Energy proposes to install spawning, nursery, and deep-water habitat enhancement structures in coves of Monticello Reservoir through implementation of the Monticello Reservoir Fisheries Habitat Enhancement Plan.[111] Implementation of the plan is required by Condition 2c of the Settlement Agreement. The plan includes provisions to install, within the first 5 years of any new license issued: (1) 111 Mossback Safe-Haven (or equivalent) structures for nursery habitat enhancements; and (2) 143 Mossback Trophy Tree (or equivalent) structures and 52 Mossback Trophy Tree XL (or equivalent) structures for deep-water habitat enhancements.[112] The plan also includes a provision to install spawning habitat enhancements using an adaptive management approach that would begin by installing 120, 3-foot diameter plastic pools (or more permanent structures) filled with substrate within the first 3 years of any new license issued. Dominion Energy indicates that the type (e.g., pea gravel, sand), size, and depth of spawning substrate added to the pools may vary among pools and this variability could be evaluated as part of the adaptive management approach. After two spawning seasons, Dominion Energy would inspect the spawning habitat enhancements for condition of the structures and evidence of use for spawning and report the findings to South Carolina DNR. Dominion Energy would subsequently consult with South Carolina DNR, and based on the findings, would install up to an additional 240 spawning habitat enhancements during years 4 and 5 of any new license issued.

[111] Details of the Monticello Reservoir Fisheries Habitat Enhancement Plan are in Appendix A-4 of the Settlement.

[112] The Mossback structures are composed of polyvinyl chloride (PVC) and resemble a trunk with numerous branching limbs.

Our Analysis

Dominion Energy's proposal to continue operating the Fairfield Development by fluctuating the Monticello Reservoir by up to 4.5 feet daily would continue to alter littoral fish habitat. Warmwater species, such as black bass and sunfish, use littoral habitat for spawning and rearing from February through April, when average daily fluctuations in Monticello Reservoir can range from 1.6 to 2.4 feet. These fluctuations could dewater up to 333 acres[113] of potential spawning and nursery habitat and inhibit fish reproduction. Monticello Reservoir also has a general lack of habitat structure and stable substrates in shallow areas of the reservoir that warmwater fish species typically use. Thus, under existing conditions, Monticello Reservoir provides less than ideal habitat conditions for warmwater fish species, especially black bass and sunfish, which prefer structure for spawning and rearing.

To improve black bass and sunfish habitat and potentially improve recreational fishing opportunities in Monticello Reservoir, Dominion Energy is proposing to install spawning, nursery, and deep-water habitat enhancement structures through implementation of the Monticello Reservoir Fisheries Habitat Enhancement Plan. The installation of artificial fish habitat enhancement structures to aquatic systems can benefit fish communities and recreational fisheries, particularly in systems like Monticello Reservoir, which lack existing structure (Rogers and Bergersen, 1999). For example, adding artificial spawning habitat has been shown to support mating, egg hatching, and nesting success at levels similar to naturally occurring structure (Hunt and Annett, 2002). The addition of artificial spawning habitat may also improve fish population spawning success by increasing nest density (Miranda, 2017). Artificial structures designed for young fish also provide refuge from predation (Moring and Nicholson, 1994). Further, attracting fish to artificial structures makes it easier for anglers to locate fish and can increase catch rates (Bohnsack, 1989).

Dominion Energy's would add the proposed fish habitat enhancement structures to Monticello Reservoir, primarily to improve habitat for black bass and sunfish species, which dominate the fish community and are recreationally important. Fish enhancement structures are generally very effective at attracting black bass and sunfish (Daugherty *et al.*, 2014). In part, this is because black bass and sunfish prefer nesting near structure. Structure offers protection from nest predators and has been shown to enhance the reproduction of black bass in systems where naturally occurring structure is limiting (Hunt and Annett, 2002).

Dominion Energy is proposing to install the habitat enhancement structures in coves. Coves have the potential to offer some protection from storms and winds, which

[113] *See* Fisheries Technical Working Committee Meeting Notes, April 1, 2014 (FLA, exhibit E-1).

can destroy centrarchid nests and negatively affect spawning success (Steinhart *et al.*, 2005). In addition, because coves are located away from the Fairfield Powerhouse, attraction to enhancement structures has the potential to reduce entrainment and turbine mortality.

Based on our analysis above, installing spawning and nursery habitat enhancement structures would increase habitat availability and the potential for improved spawning and fish production in Monticello Reservoir. Further, installing deep-water habitat enhancements likely would attract centrarchids, and other species to specific areas that anglers could target for an improved fishing experience. In addition, installing the structures in coves would encourage reproduction in protected habitat and could reduce entrainment by attracting fish away from Fairfield Development.

Parr Reservoir

Parr Reservoir serves as the lower reservoir for the Fairfield Development. Dominion Energy proposes to continue pumped storage operation at the Fairfield Development, which causes water levels in the Parr Reservoir to fluctuate by up to 10 feet daily below the maximum water elevation of 265.3 feet.[114] No measures were proposed or recommended to mitigate the effects of fluctuations in Parr Reservoir.

Our Analysis

Continued pumped storage operations at the Fairfield Development would result in water level fluctuations of up to 10 feet in Parr Reservoir, which would continue to expose littoral zone habitat on a daily basis and could negatively affect nest spawning black bass and sunfish. Habitat enhancements like those proposed for Monticello Reservoir could mitigate the negative effects of water level fluctuations, but such structures could pose a navigation risk in the Broad River, where Parr Reservoir occurs. Further, there is the potential for some black bass to spawn at depths greater than 10 feet (Edwards *et al.*, 1983; Jenkins and Burkhead, 1993) and avoid the negative effects of fluctuations in Parr Reservoir. Thus, given the potential risks of habitat enhancements to navigation and the ability of black bass to spawn even with water level fluctuations of up to 10 feet, there would be minimal benefit to improving littoral zone habitat with habitat enhancement structures.

American Eel Monitoring

As discussed in section 3.3.2.1, *Fish Community*, the American eel is a diadromous species that occurs in low abundance downstream of Parr Shoals Dam. Eels migrate up rivers and streams as juveniles (i.e., elvers and yellow eels) to reach habitat

[114] Operation at Fairfield Development ceases when flow downstream of Parr Development reach 40,000 cfs.

used to feed and grow into adults, before migrating downstream and out to the Sargasso Sea to spawn. Hydroelectric dams can block passage to these upstream habitats, and thus eels often require a fishway to migrate upstream of dams.

To address the need for an upstream fishway (or eel ramp) at the Parr Development, Dominion Energy is proposing to finalize and implement an American Eel Abundance Monitoring Plan[115] to monitor the distribution and abundance of American eels downstream of the Parr Shoals Dam for the duration of any new license issued. Condition 2d of the Settlement Agreement requires implementation of the American Eel Abundance Monitoring Plan. The plan includes provisions to conduct electrofishing surveys immediately downstream of Parr Shoals Dam and powerhouse on 3 days, during the first year after any new license is issued and then every 5 years thereafter. Electrofishing surveys would be increased to once every 3 years upon completion of an eel fishway at the Santee Cooper Project (FERC No. 199).[116] The plan also includes provisions to report the results of the surveys to a review committee[117] within 2 months after the end of monitoring, conduct a review committee meeting during the February following each year surveys are conducted, and file a report with the Commission by April 30 following each year surveys are conducted. The review committee would use the data collected during the surveys to determine the trigger for construction and implementation of an upstream eel ramp at the Parr Shoals Dam, or inclusion an eel ramp as part of the construction of any fishway that would be triggered by passage of American shad and/or blueback herring (see section 3.3.2.2, *American Shad and Blueback Herring Passage*).

Our Analysis

Recent surveys indicate that American eels do not currently occur upstream of the Parr Development, but do occur in low abundance downstream. From 2010 through 2012, the South Carolina DNR collected 13 eels downstream of the Columbia Diversion Dam (located on the Broad River 23.5 miles downstream of Parr Shoals Dam) using multiple methods (including, ramp traps, electrofishing, Fukui traps[118]). In separate surveys conducted between 2009 through 2014, the South Carolina DNR collected a total of 21 eels in the Broad River using boat electrofishing, with 12 of those eels collected immediately downstream of Parr Shoals Dam. More recently, Dominion Energy

[115] See Appendix A-5 of the Settlement Agreement for full details of the American Eel Monitoring Plan.

[116] NMFS's modified fishway prescription for the Santee Cooper Project, filed on January 27, 2020, would require the licensee to install and operate an upstream American eel fishway at the dam by year 3 of the license order.

[117] Members of the review committee include signatories of the Settlement Agreement.

[118] A Fukui trap is a type of baited fish trap.

conducted surveys during the spring of 2015 and 2016, and fall of 2015 using multiple methods (i.e., ramp traps, hoop nets, and electrofishing [boat and backpack]). During these surveys, Dominion Energy observed only 3 eels. Between 2007 and 2012, Dominion Energy also conducted surveys in Parr and Monticello reservoirs, and they observed no American eels. Although young American eels do have the ability to pass upstream of dams by climbing wetted surfaces at leakage locations and dam abutments (Shepard, 2015), these results indicate that the eels present downstream are not passing upstream or are passing upstream in very low numbers. The survey results also indicate that American eels are not abundant downstream of Parr Shoals Dam, and thus, there is currently no identifiable benefit to installing an upstream eel ramp at the Parr Development.

Although there are no identifiable benefits to installing an upstream eel ramp at this time, federal and state management efforts in the basin will likely result in eels becoming more abundant over time, and eels may reach levels that would warrant installation of an upstream eel ramp during the term of any new license issued. Dominion Energy's proposal to finalize and implement the provisions in the American Eel Monitoring Plan would help to identify if, and when, installation of an upstream eel ramp is warranted during the term of any new license issued.

Freshwater Mussel Monitoring

Some hydropower facilities that operate with variable reservoir surface elevations have the potential to reduce water levels in the reservoir, causing littoral habitat to dewater. Some hydropower operations can also cause unnatural flow fluctuations downstream of the dam, leading to dewatering and reduced DO when operations reduce flows downstream and scouring when operations increase flows downstream. These changes in water quality and habitat, in turn, can create poor conditions for reproduction and survival of freshwater mussels. As discussed above, Dominion Energy proposes to continue operating the project with fluctuations of up to 4.5 feet and 10 feet daily, in Monticello and Parr Reservoirs, respectively. Dominion Energy also proposes to increase the minimum flows (i.e., Minimum Flows AMP), decrease flow fluctuations (i.e., Flow Fluctuations AMP), and increase DO (i.e., West Channel AMP and Turbine Venting Plan) downstream of the Parr Development.

To monitor the effects of project operation on freshwater mussels located in Monticello Reservoir and downstream of the Parr Development, Dominion Energy proposes to finalize and implement the Freshwater Mussel Monitoring Plan.[119] Condition 2e of the Settlement Agreement requires implementation of the plan. Dominion Energy proposes to monitor specific areas of Monticello Reservoir with the goal of tracking the

[119] See Appendix A-6 of the Settlement Agreement for full details of the Freshwater Mussel Monitoring Plan.

distribution and abundance of freshwater mussel species, especially the Carolina creekshell, which is a species of highest priority in the South Carolina DNR's Comprehensive Wildlife Conservation Plan. In addition, Dominion Energy proposes to monitor the abundance, distribution, and species composition of mussels located downstream of Parr Shoals Dam (i.e., the tailrace and west channel) to assess how proposed changes in operations at the Parr Development affect mussel populations.

The plan includes provisions to: (a) conduct surveys in Monticello Reservoir and downstream of Parr Shoals Dam during the first and seventh year of any new license issued, and then every 10 years thereafter for the duration of any license issued; (b) allow the frequency and location of studies to be adjusted, in consultation with a Mussel Review Committee,[120] if fish passage is installed at Parr Shoals Dam[121] or if mussel populations show evidence of decline; (c) file an annual report with the Commission after each study year; and (d) allow the survey methods to be altered if FWS develops new standard mussel sampling methods during the term of the license.

Our Analysis

Monticello Reservoir

Freshwater mussels occur in Monticello Reservoir under existing conditions. During a 2015 survey, Three Oaks Engineering (2016) identified five mussel species that were present throughout Monticello Reservoir in multiple age/size classes. The presence of multiple age/size classes indicates that mussels are able to survive and grow under existing project operation at the Fairfield Development. Three Oaks Engineering (2016) also tentatively identified seven individual mussels as Carolina creekshell (a potential sixth species), which South Carolina DNR identifies as a species of highest conservation priority. However, given that it is uncommon to find Carolina creekshell outside of stream habitats, the seven individuals identified as Carolina creekshell may be unusual specimens of eastern creekshell, which South Carolina DNR identifies as a species of moderate conservation priority (Three Oaks Engineering, 2016).

Dominion Energy's proposal to monitor mussels in Monticello Reservoir could help determine whether mussel populations are increasing or decreasing during the term of any new license issued. However, Dominion Energy is not proposing any changes in

[120] Members of the Mussel Review Committee include signatories of the Settlement Agreement and South Carolina DHEC.

[121] Fish passage installation at Parr Shoals Dam would potentially allow mussel host fish species to move larval mussels upstream into Parr Reservoir. Consequently, Dominion Energy indicates that fish passage installation could be a factor in determining whether they update the plan to include additional monitoring, such as in Parr and Reservoir.

project operation at the Fairfield Development, and as discussed above, existing operation supports healthy mussel populations that successfully survive and grow. Therefore, there would be no benefit to monitoring mussels during the term of any new license issued. Further, monitoring mussels in Monticello Reservoir would not protect mussels, or mitigate any effects of continued operation at the Fairfield Development on mussels, including Carolina creekshell, if it is present.

Downstream from Parr Development

Under existing conditions, freshwater mussels also occur downstream of the Parr Development. Surveys conducted in 2007, 2012, and 2016 indicate that at least eleven mussel species occur in the river reach between the Parr Development tailrace and the Columbia Diversion Dam, including eight priority species (table 3-11). Biologists observed nine species in the tailrace alone. Like Monticello Reservoir, biologists observed multiple size/age classes of mussels (Price *et al.*, 2016). Thus, existing operations support the successful survival and growth of several mussel species downstream of the Parr Development.

As discussed above, Dominion Energy proposes to implement four plans that would involve operational changes or habitat modifications (i.e., west channel) to improve minimum flows (Minimum Flows AMP), reduce flow fluctuations (Flow Fluctuations AMP), and increase DO (Turbine Venting Plan and West Channel AMP) in aquatic habitat downstream of the Parr Development. Implementation of the plans would occur during at least the first 5 years of any new license issued, with the potential for additional changes after year 5 to complete implementation of the West Channel AMP, Minimum Flows AMP, and Flow Fluctuations AMP. As discussed in section 3.3.2.2, *Tailrace and West Channel Water Quality*, implementing the Turbine Venting Plan and the West Channel AMP would help to improve DO concentrations downstream, which would benefit mussels occurring in the tailrace and west channel. Implementation of the Minimum Flows AMP would increase minimum flows and ensure greater wetted habitat for mussels. Implementation of the Flow Fluctuations AMP would help minimize the exposure of mussels to heat, desiccating conditions, and predators by reducing fluctuations and limit the periodic dewatering of nearshore habitat.

Although the Minimum Flows AMP, Flow Fluctuations AMP, Turbine Venting Plan, and West Channel AMP are intended to improve water quality and habitat, the plans also involve changing the existing conditions downstream of the Parr Development. Conducting mussel surveys to identify the effects of changes in water quality and flow on the mussel populations downstream of Parr Development would help determine how proposed operational changes and potential habitat modifications affect mussels and could help to inform any adaptive management that may continue after year 5 of any new

license issued.[122] Further, conducting the mussel surveys in the tailrace and west channel, as proposed, would keep the monitoring focused on habitats that are likely to exhibit the greatest change in water quality from implementation of the Turbine Venting Plan and West Channel AMP, as well as changes in flow associated with implementation of the Minimum Flows AMP and the Flow Fluctuations AMP.

Dominion Energy is proposing to conduct the mussel monitoring during year 1 and year 7, and then every 10 years thereafter during the term of any new license issued. This monitoring frequency would allow Dominion Energy to establish baseline conditions for the mussel community in year 1, and subsequently determine the potential effects of changes in project operation and habitat modification in the west channel (i.e., West Channel AMP) on the mussel community during the term of the license. Although West Channel AMP, Minimum Flows AMP, and Flow Fluctuations AMP have the potential to be complete in year 5 of any new license issued, the response of mussel populations to these multiple changes may be slow and undetectable during the first several years after completion of the plans. Freshwater mussel populations respond more slowly to environmental changes than other aquatic biota like fish, because of their low mobility, complete dependence on specific fish species for reproduction and dispersal, low reproductive success, and slow growth (Sethi *et al.*, 2004; FWS, 2010a). Thus, conducting surveys during the proposed timeframe and frequency (i.e., first and seventh year of any new license issued, and then every 10 years thereafter for the duration of any license issued) would allow for the identification of the effects of the proposed operational changes and habitat modifications over a timeframe and frequency relevant to mussel life history.

A provision of the Mussel Monitoring Plan would allow Dominion Energy to adjust the frequency and location of mussel surveys, in consultation with a Mussel Review Committee, if fish passage is installed at Parr Shoals Dam, or if mussel populations show evidence of decline. Installation of fish passage would represent a project modification that could affect fish that serve as hosts for mussel larvae, and therefore could affect mussel populations in the project vicinity. Further, declines in mussel populations downstream of the Parr Development could indicate that the proposed operational changes and/or west channel habitat modifications are negatively affecting mussel populations. Allowing changes in the frequency and location of mussel surveys could help Dominion Energy conduct mussel surveys at times and locations relevant to any fish passage Dominion Energy might install. Allowing changes in the frequency and location of mussel surveys could also help identify the pace of any identified declines and specific locations of declines, which could help determine causes and necessary

[122] The Minimum Flows AMP, Flow Fluctuations AMP, and West Channel AMP all have provisions that would allow Dominion Energy to continue adaptive management after year 5 of any new license issued, if necessary, with approval from the Commission.

responses to such declines. Any potential changes in the frequency and location of mussel monitoring would require final Commission approval.

Another provision of the Mussel Monitoring Plan would allow Dominion Energy to alter the survey methods if FWS develops new standard mussel sampling methods during the term of any new license issued. New scientific methodologies have the potential to improve the speed, quality, and accuracy of collected data. Thus, allowing Dominion Energy to alter the survey methods as proposed, could be beneficial to understanding the effects of proposed operational changes and habitat modifications on mussel populations. However, any potential changes in survey methods would require final Commission approval.

Based on our analysis above, there would be a benefit to implementing the Mussel Monitoring Plan downstream of the Parr Development because Dominion Energy would implement it over a timeframe relevant to mussel life history, which would help confirm the analysis in this EA that the effects of Dominion Energy's proposed operational changes and west channel habitat modifications would improve water quality and aquatic habitat. If water quality and aquatic habitat improvements are not confirmed by the mussel monitoring, then the results of the monitoring could help inform the need for any adaptive management during the license term.

Impingement, Entrainment, and Turbine Mortality

Water intake structures at hydropower projects can injure or kill fish that come into contact with intake screens/trash racks or turbines. Fish that have body widths greater than the clear spacing between the trash rack bars, and/or have burst swim speeds[123] lower than approach velocities[124] can become trapped against intake screens or bars of a trash rack. This process is known as impingement and can cause physical stress, suffocation, and death of some organisms (EPRI, 2003).

Entrainment into the intake structure occurs if fish are small enough to pass between trash rack bars, and they are unable to overcome the approach velocity, or if they choose to pass downstream through the trash rack. Even if fish are small enough to fit through trash rack bars, they are likely to behaviorally avoid entrainment if their burst

[123] Burst swimming speed is the maximum swimming speed that fish can only sustain for a few seconds. Fish usually use burst swimming speed to avoid predators, capture prey, or negotiate high flow (Beamish, 1978).

[124] Approach velocity is the calculated water flow velocity component perpendicular to the trash rack face and is the velocity experienced by a fish as it swims freely near the front of the trash rack (EPRI, 2000).

swim speeds exceed the approach velocity in front of the trash racks (Knapp *et al.*, 1982). If entrainment occurs, fish injury or mortality can result from collisions with turbine blades, exposure to pressure changes, shear forces in turbulent flows,[125] or water velocity accelerations created by turbines (Rochester *et al*., 1984). The number of fish entrained and at risk of turbine mortality is dependent upon site-specific factors, including physical characteristics of the project (*e.g.*, head, approach velocity, turbine type, turbine speed, number of runner blades), as well as the size, age, and seasonal movement patterns of fish present within the impoundment (EPRI, 2003). Fish that are entrained and killed are removed from the river population and no longer available for recruitment to the fishery.

Fairfield Development

Dominion Energy proposes to continue using trash racks that have 6-inch clear bar spacing at both the generation intake located in Monticello Reservoir and at the pump-back intake, located in Parr Reservoir. In addition, Dominion Energy is proposing to shut off the lights that shine onto the pump-back intake area at night during normal operating conditions, as required by Settlement Agreement Condition 2h. Dominion Energy is not proposing to shut off the generation intake lights during normal generation operation, in part because there is only a single light at the intake and there was no indication that it was attracting fish.[126]

Our Analysis

To estimate the risk of impingement at the Fairfield Development, we identified the most common fish species in Monticello Reservoir and Parr Reservoir based on the surveys discussed in section 3.3.2.2, *Fish Community*, and determined which species had body widths greater than the 6-inch clear bar spacing at the generation intake and pump-back intake trash racks (table 3-16). As indicated in table 3-16, none of the most common fish species have body widths greater than the 6-inch clear bar spacing at both trash racks. Thus, no fish would be impinged on the trash racks located at the Fairfield Development.

To quantitatively evaluate the effects of continuing to operate the Fairfield Development on fish entrainment and turbine mortality, the applicant conducted a desktop study to estimate the number of fish that could be entrained and killed during

[125] Shear stress occurs when force acts parallel to a surface (Gordon *et al.*, 2004). Fish can experience shear stress as they pass between two water masses of different velocities, or when a fish slides along a solid structure, such as a wall or turbine blade (commonly termed abrasion) (Neitzel *et al.*, 2000).

[126] See Appendix A-9 of the Settlement Agreement.

project operation.[127] Based on the analysis, 814,143 fish and 2,474,822 fish are estimated to be entrained at the generation intake and pump-back intake, respectively (tables 3-17 and 3-18). The analysis also indicated that of those entrained, 42,161 fish and 114,350 fish would be killed annually at the generation intake and pump-back intake, respectively. Clupeids (gizzard shad and threadfin shad) if entrained, are the most likely to be killed and represent 76 percent and 92 percent of all fish estimated to be killed annually as they pass through the generation intake and pump-back intake, respectively (tables 3-17 and 3-18).

Based on the impingement and entrainment analyses above, there is no evidence to suggest that the estimated level of entrainment and turbine mortality would negatively affect the fish populations in Monticello and Parr Reservoirs. This is because the species (i.e., gizzard shad, threadfin shad) most likely to be killed if entrained, exhibit relatively high reproductive rates because of their ability to spawn early and often throughout their lifespan. High reproductive rates give these species' populations a natural mechanism to buffer against any instance (natural or manmade) of high mortality, which makes these species resilient to population declines. In addition, the fish surveys conducted in Monticello and Parr Reservoirs (see section 3.3.2.1, *Fish Community*) provide no indication that the entrainment mortality that occurs under existing operation at the Fairfield Development negatively affects the fish populations.

Although there is no indication that entrainment mortality at the Fairfield Development is excessive, entrainment mortality does occur, and it is estimated to be highest during pump-back operation. Dominion Energy is proposing to reduce entrainment mortality at the Fairfield Development by shutting off the intake lights during normal pump-back operation. During August 2017, Dominion Energy conducted a hydroacoustic study to evaluate the density of fish present in front of the Fairfield pump-back intakes when the intake lights were on and off after sunset. The study indicated that higher densities of fish were present at the pump-back intake when the lights were on (12,946 fish per hectare) compared to when the lights were off (3,980 fish per hectare). These results indicate that shutting off the lights at the pump-back intake during the night would reduce the concentration of fish at the intake, which could in turn reduce entrainment and turbine mortality at the Fairfield Development. Thus, shutting off the lights at the pump-back intake at night has the potential to benefit the fish community in Parr Reservoir and the Broad River.

[127] See FLA, exhibit E-5, Desktop Entrainment Report and Revised Fairfield Entrainment Mortality Memo.

Table 3-16. Minimum fish total lengths excluded by trash racks at the Fairfield and Parr developments, for common fish species found in project reservoirs (Source: staff).

				Fairfield Development	**Parr Development**
Species	Surrogate species	Scaling factor for body width[a]	Maximum total length (inches)[b]	Minimum fish total length (inches) excluded by trash rack clear bar spacing of 6 inches	Minimum fish total length (inches) excluded by trash rack clear bar spacing of 2.25 inches
Gizzard shad	none	0.12	20.5	NE[c]	19
Channel catfish	none	0.156	50	NE	14
Blue catfish	Channel catfish	0.156	65	NE	14
Bluegill	none	0.132	16.1	NE	NE
Largemouth bass	none	0.134	25.6	NE	17
White perch	White crappie	0.085	13.8	NE	NE

[a] Scaling factor expresses body width as a proportion of total length for each species (Smith, 1985).

[b] Maximum total lengths are based on Rohde *et al.* (2009).

[c] Fish that are NE (not excluded) do not grow to have body widths great enough to be impinged on the project trash racks.

Table 3-17. Estimated entrainment and turbine mortality at the Fairfield Development's generation intake (Source: Dominion Energy, 2018b, and staff).

Fish family	Estimated annual entrainment (number)	Estimated annual turbine mortality (number)	Estimated annual turbine mortality (percent)
Catostomidae (suckers)	102	10	0.02
Centrarchidae (bass)	149	15	0.04
Centrarchidae (sunfish)	24,844	1,006	2.39
Clupeidae (shad, herring)	621,572	32,048	76.01
Cyprinidae (minnows, carp)	2,695	201	0.48
Ictaluridae (catfish)	42,220	2,714	6.44
Lepisosteidae (gars)	34	2	0.005
Moronidae (temperate bass)	9,055	484	1.15
Percidae (perch, darters)	113,472	5,681	13.47
TOTAL	**814,143**	**42,161**	**100**

Table 3-18. Estimated entrainment and turbine mortality at the Fairfield Development's pump-back intake (Source: Dominion Energy, 2018b, and staff).

Fish family	Estimated annual entrainment (number)	Estimated annual turbine mortality (number)	Estimated annual turbine mortality (percent)
Catostomidae (suckers)	57	5	0.004
Centrarchidae (black bass)	8,726	633	0.55
Centrarchidae (sunfish)	50,001	2,019	1.77
Clupeidae (shad, herring)	2,306,475	105,495	92.26
Cyprinidae (minnows, carp)	7,872	594	0.52
Ictaluridae (catfish)	16,575	1,028	0.90
Lepisosteidae (gars)	26	2	0.002
Moronidae (white bass, white perch)	75,279	4,081	3.57
Percidae (perch, darters)	9,570	472	0.41
Fundulidae (topminnows)	172	16	0.01
Esocidae (pike)	69	5	0.004
TOTAL	**2,474,822**	**114,350**	**100**

Parr Development

Dominion Energy is proposing to continue using the existing trash racks with 2.25-inch clear bar spacing located in front of all six turbine intakes at the Parr Development. Dominion Energy also proposes to upgrade all six of the generating units at the Parr Development within 10 years after license issuance. The existing turbines have a 6,000-cfs hydraulic capacity. However, the development only generates with up to 4,800 cfs, because of the generator limits, which results in an approach velocity of 1.12 feet per second (fps). Dominion Energy proposes a schedule to replace or upgrade up to 6 generators at the Parr Development over a 10-year period, with the first upgrade to be completed within 3 years of license issuance. The proposed upgrades could increase the hydraulic capacity of the Parr Development to 7,254 cfs, which would result in an approach velocity of 1.70 fps. Dominion Energy does not propose any measures to reduce mortality related to fish impingement or entrainment.

Our Analysis

To estimate the risk of impingement at the Parr Development, we identified the most common fish species in Parr Reservoir based on the surveys discussed in section 3.3.2.2, *Fish Community*, and determined which species had body widths greater than the 2.25-inch clear bar spacing at the intakes (table 3-16). As indicated in table 3-16, gizzard shad, channel catfish, blue catfish, and largemouth bass could grow to have body widths greater than the 2.5-inch clear bar spacing and therefore have the potential to be impinged at the Parr Development. Under existing conditions, and up to 3 years post-license (i.e., prior to any generator upgrades), the maximum hydraulic capacity of the development would be 4,800 cfs and approach velocities in front of the Parr Development intakes would be 1.12 fps. As shown in table 3-19, all of the species susceptible to impingement have burst swim speeds that exceed an approach velocity of 1.12 fps, indicating that these representative species could swim to avoid impingement prior to any turbine upgrades. However, Dominion Energy's proposal to upgrade all six generators would increase the maximum hydraulic capacity of the development to 7,254 cfs and the approach velocity would increase to 1.70 fps. As shown in table 3-19, all species except the smallest largemouth bass have burst swim speeds greater than 1.70 fps, indicating that there would be little risk of impingement at the Parr Development after any new license is issued and any generator upgrades are complete.

To quantitatively evaluate the effects of operating the Parr Development on entrainment and turbine mortality, the applicant conducted a desktop study to estimate the number of fish that could be entrained and killed during project operation.[128] Based on the analysis, 398,398 fish are estimated to be entrained at Parr Development annually,

[128] See FLA, exhibit E-5, Desktop Entrainment Report and Revised Fairfield Entrainment Mortality Memo.

with 23,893 fish killed (table 3-20). Sunfish, minnows, and suckers are the fish groups most likely to be entrained and killed and represent 79.8 percent of all fish estimated to be killed annually as they pass through the Parr Development turbines.

Based on the impingement and entrainment analysis above, there is no evidence to suggest that the estimated level of entrainment and turbine mortality would negatively affect fish populations in the Parr Reservoir or the Broad River. In part, this is because the burst swim speeds of all representative species except the smallest largemouth bass exceed the approach velocities that currently exist or have the potential to exist after generator upgrades at the development. Further, the fish groups most likely to have the highest entrainment mortality, as indicated by the desktop analysis (i.e., sunfish, minnows, suckers), exhibit relatively high reproductive rates, making them resilient to the loss of individuals from the population. Consequently, Dominion Energy's proposal to operate the Parr Development at the hydraulic capacities that would exist both during and after any final generator upgrades, would likely have little to no adverse effect on the fish community in Parr Reservoir or the Broad River.

Table 3-19. Burst swim speeds of common fish species present in Parr Reservoir (Source: staff).

Species	Surrogate species	Fish length (inches)	Burst swim speed (fps)	Reference
Gizzard shad	Alewife	2.5-3.0 (TL)[a]	3	Bell (1991)
		10.7 - 12.3 (TL)	13.6 - 15.9	Dow (1962)[d]
Channel catfish	none	9 (TL)	3.9	Beecham *et al.* (2007)
Blue catfish	none	6.3 - 9 (SL)[b]	3.6	Beecham *et al.* (2009)
Bluegill	none	2 (TL)	1.8[c]	Beamish (1978)
		6 (TL)	4.3	Webb (1998)
Largemouth bass	none	2-4 (TL)	1.2 - 2.8[c]	Larimore and Deuver (1968)[d]
		5.9-10.6 (TL)	3.0 - 4.3[c]	Beamish (1970)[d]
White perch	none	8.8-10.4 (TL)	3.26 - 3.34[c]	Katopodis and Gervais (2016)

[a] TL = total length

[b] SL = standard length

[c] Staff estimated the burst swim speed as 2 times the prolonged/critical swim speed (i.e., Bell, 1991).

[d] Cited in Beamish (1978).

Table 3-20. Estimated entrainment and turbine mortality at the Parr Development (Source: Dominion Energy, 2018b, and staff).

Fish family	Estimated annual entrainment (number)	Estimated annual turbine mortality (number)	Estimated annual turbine mortality (percent)
Catostomidae (suckers)	34,942	4,341	18.2
Centrarchidae (sunfish)	144,425	9,445	39.5
Centrarchidae (bass)	5,537	1,107	4.6
Clupeidae (shad, herring)	68,557	1,496	6.3
Cyprinidae (minnows, carp)	38,942	5,269	22.1
Ictaluridae (catfish)	98,325	1,117	4.7
Moronidae (temperate bass)	2,072	415	1.7
Percidae (perch, darters)	5,309	703	2.9
TOTAL	**398,398**	**23,893**	**100**

American Shad and Blueback Herring Passage

As discussed in section 3.3.2.1, *Fish Community*, American shad and blueback herring are anadromous species that occur in the Santee River Basin. Hydroelectric dams can impede both the upstream and downstream migration of anadromous fish, which can prevent adults from accessing suitable spawning habitat upstream of a dam and prevent juveniles from migrating downstream and out to sea. Since 2006 when a vertical slot fishway was installed at the Columbia Diversion Dam, American shad have been passing upstream (but no blueback herring have passed) into the reach located immediately downstream of the Parr Shoals Dam. Currently, there is no upstream or downstream passage at the Parr Shoals Dam, and thus the dam is impassable to the existing American shad population and would also be impassable to any blueback herring if they were to successfully pass downstream dams.

Fish Passage Feasibility and Construction

Dominion Energy is proposing to continue participating in the Santee River Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement (Santee Basin Accord)[129] per the terms specific to the Parr Development. The Santee Basin Accord is a

[129] The Santee Basin Accord is in Appendix A-7 of the Settlement Agreement.

cooperative agreement that Dominion Energy, Duke Energy, FWS, South Carolina DNR, and North Carolina Wildlife and Resources Commission signed in 2008 to protect, restore, and enhance diadromous fishes in the Santee River Basin. Dominion Energy has agreed with the terms of the Santee Basin Accord to conduct a fish passage feasibility assessment[130] for upstream and downstream passage at the Parr Development, within 1 year of 46,400 American shad or 185,600 blueback herring annually passing upstream of the Columbia Diversion Dam for any 3 years in a 5-year period.[131] Dominion Energy has also agreed to initiate construction of upstream and downstream fishways[132] at the Parr Development within 3 years of 69,600 American shad or 348,000 blueback herring annually passing upstream of the Columbia Diversion Dam for any 3 years in a 5-year period.[133]

NMFS has a section 18 fishway prescription that includes multiple conditions relevant to fish passage for American shad and blueback herring. Regarding fish passage feasibility and construction, NMFS's fishway prescription would require Dominion Energy to: (1) conduct a fish passage feasibility assessment for upstream and downstream passage at the Parr Development, as defined in the Santee Basin Accord (Condition 1); (2) include in the fish passage feasibility assessment, design and construction schedules that would be reviewed and approved by NMFS, in consultation with the Fishery Technical Committee,[134] at the 30, 60, and 90 percent design stages (Condition 1); (3) construct, operate, and maintain fishways at the Parr Development to provide safe, timely, and effective passage for American shad and blueback herring

[130] The Santee Basin Accord defines the feasibility assessment as an evaluation of the upstream and downstream passage alternatives and their conceptual designs.

[131] 46,400 American shad and 185,600 blueback herring represents 50 percent of the targeted restoration numbers for the reach between the Columbia Diversion Dam and Parr Shoals Dam.

[132] The Santee Basin Accord does not specifically state that fishway construction would be for upstream and downstream fishways. However, because the Santee Basin Accord does state that the fish passage feasibility assessment would be for upstream and downstream fishways, we assume that fishway construction is for upstream and downstream fishways at the Parr Development.

[133] 69,600 American shad and 348,000 blueback herring represents 75 percent of the targeted restoration numbers for the reach between the Columbia Diversion Dam and Parr Shoals Dam.

[134] NMFS's fishway prescription does not define who would be included in the Fishery Technical Committee. However, we assume the committee will be composed of other resource agencies and stakeholders with an interest in successful fish passage at Parr Shoals Dam.

(Condition 2); (4) develop a detailed construction plan and provide a minimum of 90 days for NMFS in coordination with FWS and South Carolina DNR to review and approve the plan (Condition 7); (5) commence and complete construction of upstream and downstream fishways[135] at the Parr Development, as defined in the Santee Basin Accord (Condition 1); and (6) develop a detailed fishway evaluation[136] plan and provide a minimum of 90 days for NMFS in coordination with FWS and South Carolina DNR to review and approve the plan (Condition 7).

Our Analysis

From 2007 to 2018, the City of Columbia estimated that between 102 and 3,733 American shad migrated upstream through the Columbia Diversion Dam fishway and into spawning habitat that extends unimpeded for 24 miles to the Parr Shoals Dam (City of Columbia, 2018). These migration runs represent between 0.01 and 4 percent of the 92,800 adult American shad[137] targeted for restoration and capable of using habitat in the reach between the Columbia Diversion Dam and Parr Shoals Dam (see Santee Basin Accord). During the same time period, no blueback herring have been observed passing upstream of the Columbia Diversion Dam and into the same reach, where 464,000 blueback herring[138] are targeted for restoration. Thus, the current abundance of

---

[135] NMFS's fishway prescription and the Santee Basin Accord do not specifically state that fishway construction would be for upstream and downstream fishways. However, because the Santee Basin Accord does state that the fish passage feasibility assessment would be for upstream and downstream fishways, we assume that this prescription is for the construction of upstream and downstream fishways at the Parr Development.

[136] NMFS's fishway prescription does not define the term "evaluation"; however, we assume that "evaluation" refers to the process of ensuring proper operation and design of fishways prior to opening the fishways for passage.

[137] The 92,800 adult American shad target is based on restoring densities to 50 fish per acre into the 1,758 acres of available habitat between Parr Shoals Dam and the Columbia Diversion Dam (See Santee Basin Accord). A target of 50 fish per acre is based on historical average densities of American shad in other systems (e.g., Susquehanna River, Connecticut river) where historical data were available (NMFS *et al.*, 2001), and thus is based on the best available information for restored densities of American shad.

[138] The 464,000 adult American shad target is based on restoring densities to 50 fish per acre into the 1,758 acres of available habitat between Parr Shoals Dam and the Columbia Diversion Dam (See Santee Basin Accord). A target of 250 fish per acre is based on a ratio of 5 blueback herring to 1 American shad, which is within the range

American shad and blueback indicates that spawning habitat downstream of Parr Shoals Dam is underutilized and could support considerably more spawners.

Because the number of American shad and blueback herring migrating into the reach downstream of Parr Shoals Dam is low compared to the amount of accessible and available spawning habitat, constructing upstream and/or downstream fishways at the Parr Development at this time would provide minimal benefit to American shad and blueback herring. Dominion Energy's proposal and NMFS's fishway prescription also indicate that the existing numbers of American shad and blueback herring do not necessitate a need to construct upstream or downstream passage at the Parr Development at this time. Instead, Dominion proposes and NMFS's fishway prescription would require a fish passage feasibility assessment for upstream and downstream passage at the Parr Development, within 1 year of 46,400 American shad or 185,600 blueback herring annually passing upstream of the Columbia Diversion Dam for any 3 years in a 5-year period. Conducting a fish passage feasibility assessment would allow Dominion Energy to evaluate the upstream and downstream passage alternatives and their conceptual designs that would be most suitable for effective passage at the Parr Shoals Dam. The trigger for initiating the feasibility assessment also is relevant because 46,400 American shad and 185,600 blueback herring represents 50 percent of the numbers targeted for restoration into the reach between the Columbia Diversion Dam and Parr Shoals Dam. The presence of 50 percent of the restoration targets for American shad or blueback herring downstream of Parr Shoals Dam would indicate that the habitat is still underutilized, but that densities are beginning to approach the restoration targets. Further, conducting a fish passage feasibility assessment within 1 year of passing 50 percent of the targeted numbers for any 3 years in a 5-year period would allow Dominion Energy to identify the most suitable fish passage designs so that effective fishways would be constructed and likely be operating by the time the targeted numbers of American shad and/or blueback herring are present downstream of Parr Shoals Dam.

NMFS's fishway prescription would also require that the fish passage feasibility assessment include design and construction schedules that they would review and approve, in consultation with a Fishery Technical Committee, at the 30, 60, and 90 percent design stages. Including design and construction schedules in the assessment, and consulting with and seeking approval from the resource agencies on the design and construction of fishways would help to guide the design and construction process, and the implementation of upstream and downstream passage. Nevertheless, the Commission would have final approval of any design and construction schedules.

---

observed in other systems (e.g., Susquehanna River, Connecticut river) where historical data were available (NMFS *et al.*, 2001), and thus is based on the best available information for restored densities of blueback herring.

Dominion Energy proposes and NMFS's fishway prescription would also require Dominion Energy to initiate construction of upstream and downstream fishways at the Parr Development within 3 years of 69,600 American shad or 348,000 blueback herring annually passing upstream of the Columbia Diversion Dam for any 3 years in a 5-year period. The 69,600 American shad and 348,000 blueback herring represents 75 percent of the numbers targeted for restoration into the reach between the Columbia Diversion Dam and Parr Shoals Dam. The presence of 75 percent of the restoration targets for American shad or blueback herring downstream of Parr Shoals Dam would indicate that abundance is high and very close to reaching the targeted capacity. Thus, functional upstream and downstream passage may be warranted soon after the 75 percent threshold is met. Initiating construction within 3 years of meeting the 75 percent threshold for American shad or blueback herring during any 3 years in a 5-year period would allow Dominion Energy to begin constructing fishways at a time that would likely allow construction to be completed and fishways to be operational when habitat downstream of Parr Shoals Dam is at or near its targeted capacity for restoration. Completed construction of an upstream fishway would allow adult American shad and blueback herring to access nearly 4,500 acres of habitat upstream of Parr Shoals Dam in the Broad, Enoree, and Tyger rivers (NMFS *et al.*, 2017), where they can spawn and produce offspring during the spring. Because juvenile American shad and blueback herring generally migrate out to sea in less than a year after hatching, completing construction of downstream passage at Parr Shoals Dam during the same time period as upstream passage, would allow adults to spawn upstream during the first year that passage is operational and their offspring to successfully migrate out to sea within the same year.

NMFS's fishway prescription would also require Dominion Energy to develop a detailed construction plan and fishway evaluation plan, and provide a minimum of 90 days for NMFS, in coordination with FWS and South Carolina DNR, to review and approve the plans. Developing a construction plan would help to guide fishway construction and implementation of upstream and downstream passage. Developing an evaluation plan would help ensure that Dominion Energy evaluates any fishways for proper operation prior to opening for passage. In addition, consulting with and seeking approval from the resource agencies on the plans would help guide the development of the plans. Nevertheless, the Commission would have final approval of any fishway construction or evaluation plans. Further, because fishways are not currently present and construction is not imminent, there would be no benefit to filing the construction and evaluation plans until after fishway construction is triggered by the fishway prescription and approved by the Commission.

Fish Passage Design

Regarding fish passage design, Condition 7 of NMFS's fishway prescription would require Dominion Energy to: (1) develop design plans and provide a minimum of 90 days for NMFS, in coordination with FWS and South Carolina DNR, to review and

approve the plans; (2) develop original plans and subsequent modifications according to guidance and specified criteria provided by NMFS for the design of fish screens, fishways, and other fish passage structures; (3) submit final design plans to the Commission for final approval prior to the commencement of construction activities and following NMFS's approval (4) consult with FWS and NMFS, in coordination with South Carolina DNR throughout the entire design process; (5) have all designs reviewed by the Fishery Technical Committee; (6) commence initial design meetings at the pre-design, or conceptual-level design phase; (7) obtain concurrence from FWS and NMFS, in coordination with South Carolina DNR, on all preferred alternatives for each independent facility, or any major feature of a facility prior to advancing to the feasibility-level of design; and (8) implement any design modifications as required by FWS and NMFS, as necessary to fulfill the objective of safe, timely, and effective passage for all target species.

Our Analysis

The installation of upstream and downstream fishways would require careful design considerations to ensure the fishways are able to pass fish effectively. If constructed, the upstream and downstream fishways would be new structures at the project that would require design considerations, such as proper placement along the dam and necessary attraction flows to provide adequate passage for American shad and blueback herring. Fishway design would also require consideration of the intended performance standards[139] that might be needed. Developing a fishway design plan and implementing the additional fishway design provisions that would be required by NMFS's fishway prescription would help guide the design process and ensure fishways are constructed to operate safely and effectively. Nevertheless, the prescription includes a provision to implement any design modifications as required by FWS and NMFS, as necessary to fulfill the objective of safe, timely, and effective passage for all target species. Any design modifications from FWS and NMFS may be needed and beneficial for effective passage; however, the Commission would have final approval of any design modifications. Further, because fishways are not currently present and construction is not imminent, there would be no benefit to filing the design plans until after it is determined that fishway construction would be necessary.

Fish Passage Maintenance and Operation

Regarding fish passage maintenance and operation, NMFS's fishway prescription would require Dominion Energy to: (1) develop a fishway operation and maintenance

[139] Final fishway prescriptions generally require that a specific percentage of upstream migrating fish successfully pass upstream and a specific percentage of downstream migrating fish survive as they pass downstream. These passage requirements are usually referred to as performance standards.

plan for each fishway describing the anticipated fishway operational protocols, maintenance, maintenance schedule, and contingencies (Condition 5); (2) submit the fishway operation and maintenance plan to NMFS, FWS, and South Carolina DNR for review and approval prior to filing with the Commission (Condition 5); (3) maintain and operate fishways at the Parr Development during the upstream (March 1 to May 15) and downstream (late summer to fall) migration periods for American shad and blueback herring, which would be subject to change based on annual monitoring of migration runs (Condition 4); (4) keep all fishways in proper order and fishway areas clear of trash, logs, and material that would hinder passage; and (5) conduct maintenance sufficiently before a migratory period such that the fishways can be tested and inspected, and the fishways will operate effectively prior to and during the migratory periods.

Our Analysis

Except for the condition regarding fishway operating schedules, NMFS's fishway prescription conditions related to fishway operation and maintenance have identifiable benefits to American shad and blueback herring. Specifically, the development of a fishway operation and maintenance plan and additional fishway operation and maintenance provisions would ensure that routine cleaning and maintenance occur on an appropriate schedule so that the fishways operate safely and effectively for American shad and blueback herring. However, because fishways are not currently present and construction is not imminent, there would be no benefit to filing the fishway operation and maintenance plan until after it is determined that fishway construction would be necessary.

With respect to the fishway operating schedules, the provision to operate the upstream fishway from March 1 to May 15 encompasses the typical spawning period for American shad and blueback herring and would allow them to migrate upstream of Parr Shoals Dam during the period when they are most likely to need passage. The provision to operate the downstream fishway from late summer to fall also generally encompasses the period when American shad and blueback herring juveniles are likely to be migrating downstream and out to sea. Nonetheless, the period of late summer to fall is not specifically defined by a start and end date. Thus, downstream fishway operation could occur on a schedule without limits. In the absence of such limits to the operational window, we have no information to determine whether a particular downstream operating schedule would or would not provide benefits to American shad or blueback herring.

NMFS also includes in its fishway prescription a provision to allow unspecified changes in the upstream and downstream operating schedules that would be based on annual monitoring of migration runs. Allowing unspecified changes in the upstream and downstream fishway operating schedules creates operating schedules without limits. As discussed above, in the absence of such limits we have no information to determine whether a particular change in the operating schedule would or would not provide

benefits to American shad or blueback herring. More clearly defined limits (e.g., day of year or water temperature) for the downstream fishway operating schedule and for potential changes to either the upstream or downstream fishway operating schedules would help to identify the benefits of potential changes in the schedules.

Fish Passage Effectiveness Monitoring

Regarding fish passage effectiveness monitoring, Condition 8 of NMFS's fishway prescription would require Dominion Energy to: (1) develop plans with schedules for conducting upstream and downstream fishway effectiveness monitoring for at least three passage seasons,[140] in consultation with a Fishery Technical Committee; (2) submit plans and effectiveness monitoring results to a Fishery Technical Committee prior to filing with the Commission; and (3) include in the filed plans, explanations of any disagreements the licensee may have regarding comments or recommendations made by the resource agencies.

Our Analysis

Upstream and downstream passage effectiveness studies would verify whether any upstream or downstream fishways constructed are operating as designed. Conducting effectiveness studies during three passage seasons would provide sufficient information for determining whether the fishways are operating as designed. Thus, developing and filing fishway effectiveness monitoring plans as prescribed in Condition 8 would help to ensure proper fishway function. However, because fishways are not currently present and construction is not imminent, there would be no benefit to filing fish passage effectiveness monitoring plans until after fishway construction is triggered by the fishway prescription and approved by the Commission.

Fish Passage General Provisions

NMFS's reserves the authority to defer the timing of construction and/or operation[141] of fishways at the Parr Development based on new information that may warrant a change to prescription schedules, such as any results from studies or monitoring, changes to the upstream fishway at the Columbia Diversion Dam, changes to recreational fishing regulations, or petitions from the licensee for an extension that is approved by NMFS (Condition 3). NMFS's fishway prescription would also require

[140] NMFS's prescription would require effectiveness monitoring for three passage seasons, but NMFS also adds that additional monitoring may be necessary depending on unforeseen circumstances such as weather conditions.

[141] Here we replaced NMFS's word "implementation" with our word "operation". We assume that implementation of a fishway, as described by NMFS, is analogous to operation of a fishway.

Dominion Energy to implement the following provisions: (1) notify and obtain NMFS's approval for any modifications to schedules or extensions of time to comply with the provisions included in the prescription for fishways at the Parr Development (Condition 3); and (2) provide FWS, NMFS, and South Carolina DNR access to the Parr Project site and to pertinent Parr Project records for the purpose of inspecting the fishways, determining compliance with the fishway prescriptions, and for general evaluation and oversight (Condition 6).

Our Analysis

Dominion Energy is proposing and NMFS's fishway prescription would require that the timing of fishway construction be based on passing specific numbers of American shad or blueback herring (as discussed above). NMFS is reserving the authority to defer the timing of construction and/or implementation of the fishways based on new information that may warrant a change. New information from studies, changes to the upstream fishway at the Columbia Diversion Dam, and changes to recreational fishing regulations are among some factors that may support the need to delay construction and/or implementation of fishways at the Parr Development. Nonetheless, the Commission would have final approval of any changes to the timing of construction and/or implementation of fishways.

NMFS's fishway prescription to notify and obtain NMFS's approval for any modifications to schedules or extensions of time to comply with the provisions included in the prescription for fishways at the Parr Development would help to ensure that any changes in design, construction, operation, or plan review schedules would be to the benefit of American shad and blueback herring. Nonetheless, the Commission would have final approval of any modifications to schedules or requests for extensions of time.

NMFS's fishway prescription would also require Dominion Energy to provide FWS, NMFS, and South Carolina DNR access to the Parr Project site and to pertinent Parr Project records for the purpose of inspecting the fishways, determining compliance with the fishway prescriptions, and for general evaluation and oversight. However, the Commission has sole oversight authority over all licensed facilities; therefore, there is no project-related reason to provide access to the Parr Project site and to pertinent Parr Project records.

Habitat Enhancement Program (HEP)

Dominion Energy proposes to implement a HEP for the purpose of restoring, enhancing, and protecting aquatic, wetland, and riparian habitats and the associated natural resources of the Parr Project area, as well as areas outside the project area in the Broad, Saluda, and Congaree river watersheds. Dominion Energy proposes to fund the

HEP at a funding amount based on the level of pumped storage operation each year,[142] or a minimum of $50,000. The HEP would exist for the term of any new license issued and Dominion Energy would administer the HEP to encourage, review, evaluate and fund project proposals to accomplish this purpose. Settlement Agreement as Condition 2g includes the HEP.

Our Analysis

As discussed in sections above, Dominion Energy is proposing to implement measures to improve downstream water quality (i.e., West Channel AMP, Turbine Venting Plan), increase downstream minimum flows (i.e., Minimum Flows AMP), reduce downstream water level fluctuations (i.e., Flow Fluctuations AMP), enhance fish habitat (i.e., Monticello Reservoir Fisheries Habitat Enhancement Plan), minimize fish entrainment mortality (i.e., turn off tailrace lighting at the Fairfield Development), identify the need for American eel passage (i.e., American Eel Monitoring Plan), and construct fish passage for American shad and blueback herring if necessary (i.e., Santee Basin Accord). Thus, while project operation could affect aquatic resources in the project area, the above measures proposed by Dominion Energy would minimize project effects and protect aquatic resources that occur in the project area.

Implementation of the HEP would potentially include restoring, enhancing, and protecting aquatic, wetland, and riparian habitats and the associated natural resources outside the project area in the Broad, Saluda, and Congaree river watersheds. However, implementation of the HEP for those areas outside the project area and unaffected by project operation would lack a nexus to any project effect.

3.3.2.3 Cumulative Effects

During the 18th Century, dams began appearing in the Santee River Basin to provide power to sawmills, gristmills, and cotton gins (NMFS *et al.*, 2017). By the 19th Century, a diversion dam was constructed near Columbia to provide navigation around shoals on the Broad River, and during the 20th Century hydroelectric dams were constructed on the Catawba, Broad, Saluda, Santee, and Cooper Rivers (NMFS *et al.*, 2017). Today, hundreds of small dams are still present on many tributaries, particularly in the upper reaches of the basin (South Carolina DNR, 2009). In addition, there are currently 14 dams associated with FERC hydroelectric projects (licensed and exempt) in the Broad River Basin and downstream along the mainstem of the Congaree River, Santee River, and Cooper River, as well as one Corps dam (i.e., St. Stephen Dam).

[142] Appendix A-8 of the Settlement Agreement provides a formula and example for calculating the level of funding Dominion Energy would provide.

The construction of dams in the Broad River Basin and downstream along the mainstem of the Congaree River, Santee River, and Cooper River during the last 200 years converted a once free-flowing system into a series of impoundments, resulting in decreased flow and increased water depth, which in turn likely led to some lowering of DO and increases in water temperature. Installing hydropower turbines also likely resulted in fish mortality, and dam structures impeded the migrations of diadromous species (i.e., American shad, blueback herring, American eel, shortnose sturgeon, Atlantic sturgeon, striped bass). Today, the Parr Project, in combination with the other hydropower and non-hydropower dams that still exist in the Broad River Basin and downstream to the ocean, cumulatively affects water quantity, water quality, downstream aquatic habitat, fish mortality, and passage of diadromous species.

Cumulative effects occur from the operation of multiple hydroelectric projects within the Broad River Basin and downstream, which can degrade water quality and habitat through alteration of flows. As discussed in section 3.3.2.2, *Minimum Flows Downstream from Parr Development* and *Flow Fluctuations Downstream of Parr Development*, existing project operation can cause flows downstream of the Parr Development to be lower than inflow (i.e., minimum flows) and to have greater fluctuations (e.g., inventory management). Dominion Energy's proposal to implement the Minimum Flows AMP would increase flows downstream and based on an IFIM study, would be protective of fishery resources. In addition, Dominion Energy's proposal to implement the Flow Fluctuations AMP would reduce flow fluctuations downstream of the Parr Development and improve habitat for fish and mussels, including spawning habitat for shortnose sturgeon, American shad, striped bass, and robust redhorse. Together, Dominion Energy's proposed measures to improve flows downstream of the Parr Development are likely to be cumulatively beneficial to aquatic resources.

Cumulative effects also occur from multiple dams within the Broad River Basin and downstream and include injuries and mortality from turbine passage. Most of the species likely to be entrained and killed at the Fairfield Development (i.e., gizzard shad, threadfin shad) and Parr Development (i.e., sunfish, minnows, suckers) exhibit relatively high reproductive rates, making them resilient to population declines. Thus, the project's contribution to cumulative effects on fish mortality in the Guadalupe River would be minimal.

The cumulative effects of multiple dams in the river basin also include impeded upstream and downstream passage for American shad, blueback herring, American eels, shortnose sturgeon, Atlantic sturgeon, and striped bass. Shortnose sturgeon, Atlantic sturgeon, and striped bass do not currently occur upstream of the Columbia Diversion Dam because fish passage at downstream dams is either absent or ineffective. However, American shad and American eels do pass upstream of the Columbia Diversion Dam and occur in low abundance immediately downstream of the Parr Development, and blueback herring will likely occur as the population increases downstream of the Columbia

Diversion Dam. Parr Shoals Dam, however, currently blocks the migration of these species. To address the need for an upstream fishway (or ramp) for American eels at the Parr Development, Dominion Energy is proposing to finalize and implement an American Eel Monitoring Plan to monitor the distribution and abundance of American eels downstream of the Parr Shoals Dam for the duration of any new license issued. To allow passage of American shad and blueback herring, Dominion Energy is proposing and NMFS's fishway prescription would require that Dominion Energy install upstream and downstream passage when 75 percent of the targeted restoration numbers for either species pass into the reach between the Columbia Diversion Dam and Parr Shoals Dam. Together, the proposed measures related to the passage of American shad, blueback herring, and American eels are likely to be cumulatively beneficial for these migratory species.

3.3.3 Terrestrial Resources

3.3.3.1 Affected Environment

Vegetation

The Parr Project is located within the Southern Outer Piedmont Ecoregion where typical land cover includes pine plantations, deciduous forest, mixed forest, and pasture, and land uses include agricultural production (Griffith *et al*., 2002). The landscape in the Piedmont ecoregion has a long history of forest/wood clearing and other economic uses that date back to the earliest European settlements, resulting in a contemporary mosaic dominated by agricultural land, managed woodlands, and forests (South Carolina DNR, 2005). Upland habitats within the project boundary and surrounding area are primarily forested. Some limited pasturelands and residential development occur around the Monticello Reservoir.

Primary vegetative cover types found within the project boundary include planted pine, naturally vegetated pine, mixed pine-hardwood, and hardwood forests. Pine forests are primarily comprised of second growth stands of either naturally propagated or planted loblolly pine. Mixed pine-hardwood forests occurring in the project vicinity consist primarily of loblolly pine and longleaf pine accompanied by a variety of other species, including tulip poplar, red maple, winged elm, persimmon, eastern redcedar, black gum, American beech, American holly, black cherry, and sweetgum (Dominion Energy 2018b; NRC and Corps, 2011). Hardwood forests predominately occur along stream bottoms and in ravines and make up a relatively small portion of the forested communities in the project vicinity. Typical canopy species present include white oak, southern red oak, black gum, and some American beech. Flowering dogwood is a dominant understory species, and herbaceous species such as hepatica, golden alexander, sanicle, Christmas fern, and little nut-rush are also common along small streams. Dominion Energy manages approximately 858 acres of forest within the Project boundary. Details on the

timber management in these areas are discussed in detail below under *Forest Management*.

Dominion Energy did not conduct terrestrial species surveys in the project area. Dominion Energy staff, however, did identify botanical species present at the location of proposed site improvements at the Highway 34 Recreation Area, discussed in detail in section 3.3.5, *Recreation and Land Use*. Mature vegetation at the site includes box elder and American sycamore trees. Understory vegetation at the site consists of the following species: Virginia creeper; trumpet vine; greenbrier; bladder sedge; immature water oak; ground ivy; jumpseed; fox grape; dog fennel; wingstem; poison oak; privet; Indian wood oat; smartweed; copperleaf; and pokeberry (Dominion Energy, 2019).

Wetlands

Wetlands in the project area are typical of those found in the South Carolina Piedmont consisting of both palustrine[143] and lacustrine[144] wetlands. Forested wetlands in the project vicinity include those species typically found in the mixed pine-hardwood and hardwood cover types discussed above, as well as tulip poplar, sweetgum, white ash, black cherry, sedge, and red maple. Limited freshwater marsh habitat occurs in shallow backwaters along the Parr Reservoir. Marsh habitat contains emergent wetland species, such as cattail bulrushes, rushes, sedges, smartweed, pickerelweed, lizard's tail, water primrose, and water pennywort.

The National Wetlands Inventory (NWI) provides reconnaissance level information on the location, type, and size of wetlands and deepwater habitats (FWS, 2020b).[145] The NWI indicates that wetland and deepwater habitats occurring within the project vicinity include freshwater emergent, freshwater forested and shrub wetlands, freshwater ponds and lakes, and riverine habitat (figure 3-13). Most of the mapped wetlands in the project area are classified as L1UBHh, which are lacustrine, permanently flooded wetlands with unconsolidated bottoms, typical of the impounded habitat located in both Monticello and Parr Reservoirs. Recreation Lake, a sub-impoundment of Monticello Reservoir, is approximately 300 acres in size with 10.2 miles of shoreline. It

[143] Palustrine wetlands are non-tidal wetlands dominated by trees, shrubs, emergent plants, mosses or lichens.

[144] Lacustrine wetlands are wetlands and deepwater habitats situated in a topographic depression or a dammed river channel lacking trees, shrubs, persistent emergent plants, emergent mosses or lichens with greater than 30% areal coverage (Cowardin *et. al*, 1979).

[145] Source data for the wetland maps in the project area are from the 1980s and 1990s.

is maintained at a stable water level and is not affected by pumped storage operations at the Fairfield Development.

The project is bordered by palustrine emergent, palustrine forested and/or palustrine shrub, and palustrine unconsolidated bottom systems. Palustrine wetlands occur along the shores of the reservoirs and are defined as having a water depth of less than 6.5 feet and salinity of less than 0.5 percent (Cowardin *et. al*, 1979). The Broad River and Enoree River Wildlife Management Areas (WMAs), situated in the northern portion of the Parr Reservoir, include vegetated impoundments that are flooded to provide habitat for waterfowl (see details below under *Wildlife*).

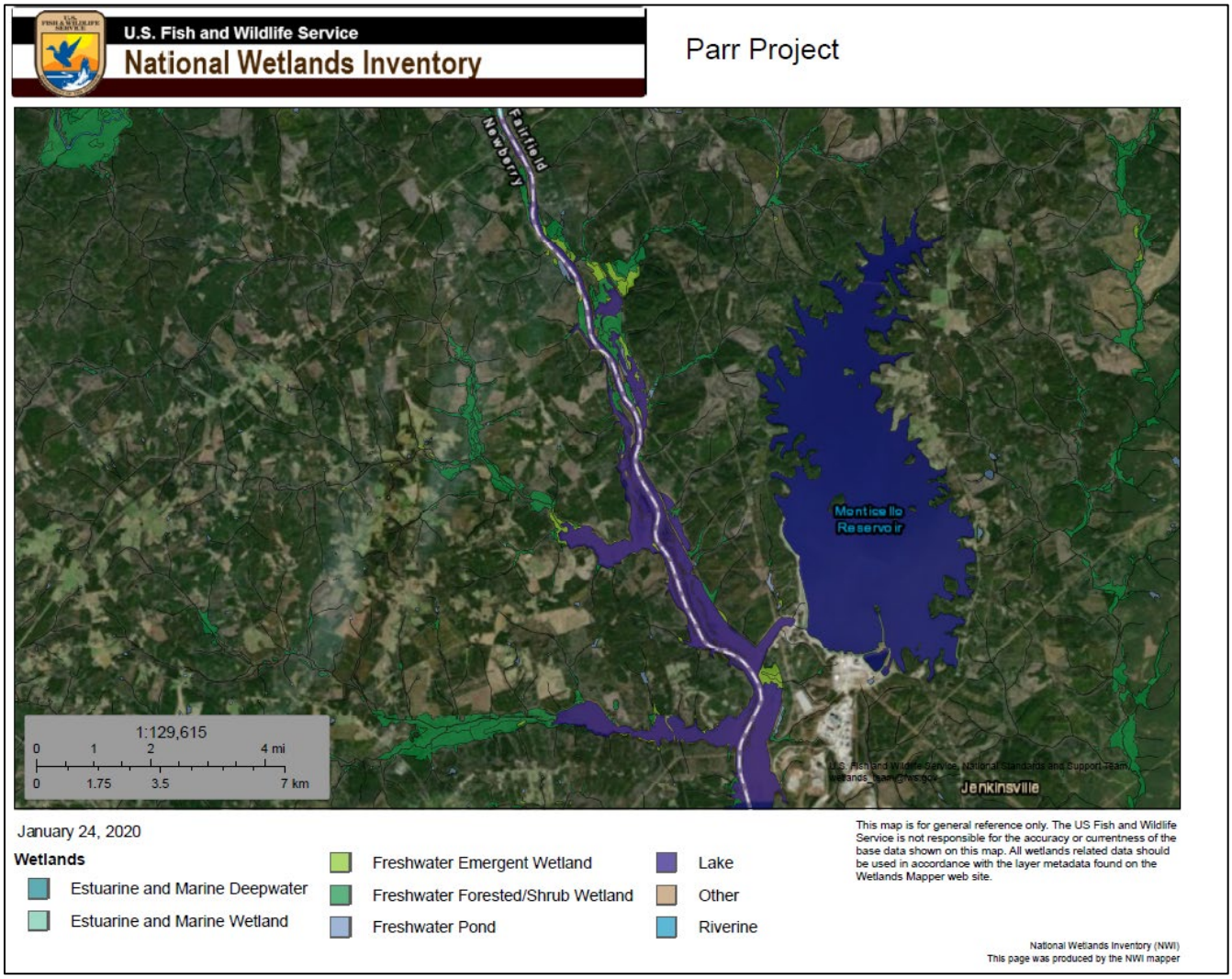

Figure 3-13. NWI wetland map for the Parr Project area (Source: FWS, 2020b).

Non-native Invasive Vegetation

Non-native (also referred to as exotic), invasive upland plants are prevalent in the Piedmont ecoregion and are likely to occur within the project area. The South Carolina Exotic Pest Plant Council identifies 27 plants as severe exotic plant pest species in the Piedmont ecoregion (table 3-21; South Carolina EPPC, 2014). These species may occur in the project area, and several of the more ubiquitous species (e.g., kudzu, mimosa, Japanese honeysuckle, and Wisteria spp.) are likely to occur in abundance. Common terrestrial invasive exotic species known to occur in the project area include kudzu, mimosa, and Japanese honeysuckle. Dominion Energy staff identified privet as occurring at the Highway 34 Recreation Area (Dominion Energy, 2019), but no other site species data are available. Common aquatic invasive species found in the vicinity of the Project include hydrilla and several species of pondweed.

Table 3-21. Severe exotic plant pest species in the Piedmont Ecoregion (Source: South Carolina EPPC, 2014).

COMMON NAME	SCIENTIFIC NAME
Trees	
tree of heaven+	*Ailanthus altissima*+
Chinaberry	*Melia azedarach*
princess tree/royal paulownia+	*Paulownia tomentosa*+
Chinese tallow tree+	*Triadica sebifera*+
Shrubs	
Scotch Broom, English Broom+	*Cytisus scoparius*+
thorny olive	*Elaeagnus pungens*
autumn olive+	*Elaeagnus umbellata*+
two-color bush clover, shrub lespedeza	*Lespedeza bicolor*
Chinese privet	*Ligustrum sinense*
Japanese knotweed+	*Polygonum cuspidatum*+
trifoliate orange, hardy orange	*Poncirus trifoliata*
Vines	
English ivy+	*Hedera helix*+
Japanese climbing fern+	*Lygodium japonicum*+
Japanese honeysuckle	*Lonicera japonica*
kudzu+	*Pueraria montana*+
Cherokee rose	*Rosa laevigata*
Chinese wisteria	*Wisteria sinensis*
bigleaf periwinkle	*Vinca major*
Grasses/Sedges	
Cogongrass*^	*Imperata cylindrica**^
Japanese stilt grass, Nepalese browntop+	*Microstegium vimineum*+

COMMON NAME	SCIENTIFIC NAME
Chinese silvergrass+	*Miscanthus sinensis*+
common reed, phragmites ^+	*Phragmites australis ssp. australis*^+
itchgrass*^+	*Rottboellia cochinchinensis**^+
Johnson grass+	*Sorghum halepense*+
Herbs	
Sericea, Chinese Bush Clover+	*Lespedeza cuneata*+
wart removing herb+, marsh dewflower, aneilema	*Murdannia keisak*+
tropical soda apple*^+	*Solanum viarum**^+

species is on the federal noxious weed list
^ species is on the South Carolina noxious weed List
+ = species is on other state noxious weed list

Vegetation Management on Project Lands

Routine Vegetation Management in Project Area

Vegetation surrounding the project varies, but the shorelines are predominately forested within the project boundary. The shoreline of the Monticello Reservoir is more developed the Parr Reservoir, with more manicured lawns extending into the project boundary. Dominion Energy maintains vegetation at project facilities such as the powerhouse, dam, and most project buildings as manicured lawns with some limited landscaped areas that contain trees and/or shrubs. Project transmission line right-of-way (ROW) corridors consist of early successional habitats (i.e., grasses and low growing vegetation). Project recreation sites consist of both manicured areas, primarily surrounding public amenities, and areas left in a natural state (Dominion Energy, 2019). Manicured areas are maintained as needed through mowing and other mechanical means. Recreation areas, such as the proposed canoe portage, may have tree limbs cut along access paths.

Forest Management

As discussed previously, there are approximately 858 acres of forest actively managed within the project boundary for forest health, recreation, and timber. Dominion Energy (and SCE&G, the previous licensee) have actively managed forest lands over the term of the existing license, with areas managed differently based upon topography, access, and general forest type. The areas of managed forest exclude riparian areas, streamside management zones, and areas that are set aside for wildlife (Dominion Energy, 2019). Figure 3-14 shows the location of the eight forest management areas within the project boundary. Table 3-22 provides a description of each area (i.e., acreage,

composition, and, age of forest) and the current management regime including time of last harvest and future harvest schedule.

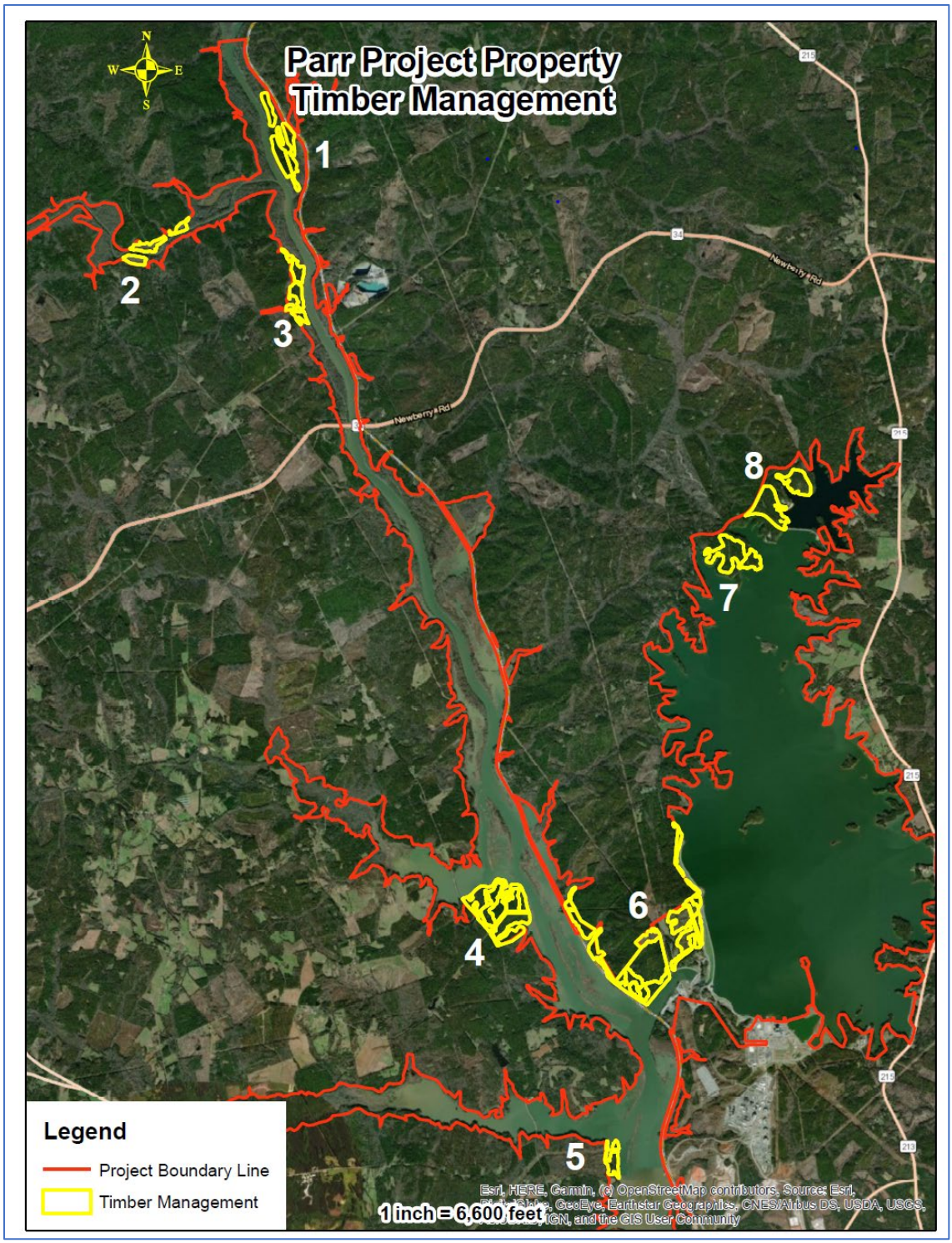

Figure 3-14. Timber management areas within the Parr Project boundary (Source: Dominion Energy, 2019; as modified by staff).

Table 3-22. Size, age, and harvesting regime of the forest management areas within the project boundary (Source: Dominion Energy, 2019).

Map Area	*Name*	*Description*	*Management Regime*
1	Blair Bottoms	73 acres of planted pine; planted in 1986	last harvest-thinning operation in 2001; future harvest - complete harvest on about 40 acres in the next 3 years
2	Enoree River	36 acres of planted pine; planted in 2014	last harvest -complete harvest in 2013; future harvest - thinning operation in about 10 years
3	Helen Counts/USFS	47 acres of planted pine; planted in 1992	fast harvest -thinning operation in 2011 future harvest- thinning operation in the next 5 years
4	Heller's Creek	185 acres that includes:	
		65 acres of natural pine; estimated age- 65 years old	managed only for tree health and aesthetics for recreation
		100 acres of planted pine; planted in 2017	last harvest -complete harvest in 2017; future harvest- thinning operation in approximately 12-15 years
		20 acres of planted pine; planted in 2007	future harvest- thinning operation within the next 5 years
5	Hope Tract	23 acres of planted pine; planted in 1981	last harvest-thinning operation around 2010; future harvest - complete harvest in the next 5 years.
6	Minna Lynn	318 acres that includes:	
		13 acres of planted pine; planted in 1981	No plans to harvest unless selective thinning for forest health[a]
		91 acres of planted pine; planted in 2007	last harvest -complete harvest in 2006; future harvest – thinning operation in 5 years.

Map Area	*Name*	*Description*	*Management Regime*
6	Minna Lynn (continued)	20 acres of natural pine estimated 30 years old	No plans to harvest unless selective thinning for health of the forest[a]
		27 acres of natural pine estimated 35 years old.	No plans to harvest unless selective thinning for health of the forest[a]
		14 acres of planted pine; planted in 2003	future harvest-date not set- will coincide with harvest of other areas
		63 acres of planted pine; planted in 2013	Past harvest was a complete harvest in 2012. Future harvest- thinning operation in ab 10 years.
		46 acres of natural pine estimated 65 years old	Future harvest will be selective thinning for health of the forest.
		17 acres of planted pine; planted in 2015	past harvest -complete harvest in 2014; future harvest thinning operation in about 10-15 years.
		27 acres of planted pine; planted in 1969	past harvest- thinning operation in 2011; future harvest - selective thinning for forest health
7	Ladd's	78 acres that includes:	
		58 acres of planted pine; planted in 2007	future harvest thinning operation in the next 5 years
		20 acres of planted pine; planted in 1986	future harvest-selective thinning for forest health
8	Monticello Rec Lake	98 acres of natural pine; estimated age- 50 years old	future harvest -selective thinning for forest health, and aesthetics for recreation

[a] Selective thinning for forest health is only done in the cases of disease, pine beetles or overstock/overcrowding.

Wildlife

The Monticello and Parr Reservoirs, including the Broad River and Enoree River WMAs, the Sumter National Forest, and public parks and recreational facilities discussed in section 3.3.5, *Recreation and Land Use*, provide habitat for many wildlife species typical of the Piedmont, including numerous waterfowl species (Kleinschmidt, 2017b).

Mammals, Reptiles, and Amphibians

Mammals, amphibians, and reptiles that occur in the project vicinity are those commonly found in the Piedmont region. Habitat in the project area supports mammals such as white-tailed deer, raccoon, gray squirrel, eastern cottontail, muskrat, bobcat, beaver, opossum, hispid cotton rat, eastern mole, house mouse, white-footed mouse, gray fox, and eastern spotted skunk (South Carolina DNR, 2005). While the Piedmont of South Carolina is not as rich in herpetofauna[146] as other parts of the state (South Carolina DNR, 2005), several species of reptiles and amphibians are known to occur in the project vicinity from surveys done at the at the adjacent V.C. Summer Nuclear Station. Common species observed include the black racer snake, ringneck snake, rat snake, Carolina anole, fence lizard, and various skinks and toads.

Avian Species

Habitat for a variety of wading birds, songbirds, birds of prey, and other migratory and non-migratory birds is present within the project boundary. Birds known to occur in the project vicinity include various species of dabbling ducks (e.g., wood duck, mallard, black duck and green-winged teal) that use the freshwater marsh habitat in the Parr Reservoir. The Monticello Reservoir also supports a resident population of Canada geese. Dominion Energy conducted open water waterfowl surveys in both the Monticello and Parr Reservoirs over a two-year period (Kleinschmidt, 2017b). Bald eagles are known to nest near the site and are observed frequently during the surveys. Only waterfowl species were surveyed in the project's reservoirs. Table 3-23 lists 59 avian species observed during surveys completed at the adjacent V.C. Summer Nuclear Station, all of which are also likely to occur in the project area (Kleinschmidt, 2017c). Some of these species are identified as South Carolina's Priority Species[147] (South Carolina DNR, 2015a).

[146] Herpetofauna are the reptiles and amphibians that inhabit a given area.
[147] Priority species are species of greatest conservation need (SGCN).

Table 3-23. Avian species observed in the project vicinity (Source: Dominion Energy, 2018b; as modified by staff).

Wading Birds, Shorebirds, and Other Water Birds	
Blue-winged teal	Green heron
Mallard	Killdeer
Black duck	**Little blue heron**
Great egret	Herring gull
Great blue heron	Double-crested cormorant
Canada goose	
Birds of Prey and Soaring Birds	
Cooper's hawk	Turkey vulture
Red-tailed hawk	Black vulture
Red-shouldered hawk	**Bald eagle**
Passerines and Other Birds	
Red winged blackbird	Wild turkey
Ruby-throated hummingbird	Song sparrow
Great horned owl	Northern mockingbird
Northern cardinal	Great crested flycatcher
Pine siskin	Tufted titmouse
Northern bobwhite	Carolina chickadee
Yellow-bellied cuckoo	Indigo bunting
Northern flicker	Downy woodpecker
Eastern wood pewee	Rufous-sided towhee
American crow	Summer tanager
White-throated sparrow	**Golden-crowned kinglet**
Mourning dove	Eastern phoebe
Blue jay	Eastern bluebird
Yellow-rumped warbler	**Brown-headed nuthatch**
Prairie warbler	Yellow-bellied sapsucker
Pine warbler	Northern rough-winged swallow
Pileated woodpecker	Barred owl
Passerines and Other Birds (continued)	
Dark-eyed junco	Carolina wren
Loggerhead shrike	Brown thrasher
Belted kingfisher	White-eyed vireo
Red-bellied woodpecker	

Note: Taxa in bold represent South Carolina Priority Species (South Carolina DNR, 2015a).

Aerial Waterfowl Surveys

Open water and shallow water habitats within the project area support a variety of waterfowl species, particularly during the fall and winter months of their annual migration. Dominion Energy conducted aerial waterfowl surveys documenting the type and abundance of overwintering waterfowl in the Monticello and Parr Reservoirs over a two-year period between 2015 and early 2016, and late 2016 and early 2017. Nine aerial surveys were completed during each period (Kleinschmidt, 2017b). Parr Reservoir surveys included the Enoree and Broad River WMAs discussed in more detail below.

During the first waterfowl survey period (2015 – 2016) approximately 2,200 waterfowl, representing nine species, were observed at the Monticello Reservoir and approximately 4,900 waterfowl, representing 11 species, were recorded at the Parr Reservoir (Kleinschmidt, 2017b). Table 3-24 lists species observed during the two-year surveys. During the second survey period (2016 – 2017), approximately 1,250 waterfowl (10 species) were documented at the Monticello Reservoir and more than 3,000 waterfowl (11 species), were documented at Parr Reservoir. The final survey report concluded that there was no significant difference in the diversity and number of dabbling ducks[148] at Monticello Reservoir than at Parr Reservoir during the two-year period evaluated. However, the number of diving ducks[149] observed in the first year of the study was significantly greater than the total number of waterfowl observed during the second year of the survey.

In both years of the survey, Canada geese (*Branta canadensis*) were seen at Monticello Reservoir more consistently and in higher numbers than at Parr Reservoir. Snow geese (*Chen caerulescens*) were only seen at Parr Reservoir and only in the first year. At the Monticello Reservoir, waterfowl concentration locations were spread widely around the reservoir, but flocks appeared to favor the western half of the reservoir, and coves and islands elsewhere, that provided protection from the prevailing winds. Most waterfowl seen at Parr Reservoir were found at Broad River and Enoree WMAs (Kleinschmidt, 2017b). Other non-game species were observed during the aerial surveys on both reservoirs. Among these additional species, most frequently recorded were non-specific gulls/terns and double-crested cormorants. Bald eagles occur in the project area year-round, and both adults and juveniles were observed during the waterfowl surveys.

[148] Dabbling ducks are freshwater ducks that typically feed in shallow water by dabbling and upending, such as the mallard, teal, and shoveler.

[149] Diving ducks feed by diving beneath the surface of the water, such as ring-neck duck, lesser scaup, and bufflehead.

Table 3-24. Waterfowl and other bird species observed at the Monticello and Parr Reservoirs during aerial surveys conducted by Dominion Energy between late 2015 and early 2016, and late 2016 and early 2017 (Source: Kleinschmidt, 2017b; as modified by staff).

Guild	Common Name	Scientific Name	Monticello	Parr
Waterfowl:				
Geese				
	Canada Goose	*Branta canadensis*	**X**	**X**
	Snow Goose	*Chen caerulescens*	**-**	**X**
		Dabbling Ducks		
	Mallard	*Anas platyrhynchos*	**X**	**X**
	Gadwall	*Anas Strepera*	**-**	**X**
	American Wigeon	*Anas Americana*	**-**	**X**
	Green-winged Teal	*Anas crecca*	**-**	**X**
	Blue-winged Teal	*Anas discors*	**X**	**X**
	Northern Shoveler	*Anas clypeata*	**-**	**X**
	Wood Duck	*Aix sponsa*	**X**	**X**
Diving Ducks				
	Ring-necked Duck	*Aythya collaris*	**X**	**X**
	Lesser Scaup	*Aythya affinis*	**X**	**X**
	Bufflehead	*Bucephala albeola*	**X**	**X**
Mergansers				
	Hooded Merganser	*Lophodytes cucullatus*	**X**	**-**
	Other Merganser	*Mergus sp*.	**X**	**-**
Rails				
	American Coot	*Fulica Americana*	**X**	**X**
Other Birds:				
	Anhinga	*Anhinga*	**-**	**X**
	Bald Eagle	*Haliaeetus leucocephalus*	**X**	**X**
	Common Loon	*Gavia immer*	**X**	**X**
	Double-crested Cormorant	*Phalacrocorax auratus*	**X**	**X**
	Pied-billed Grebe	*Podilymbus podiceps*	**X**	**X**
	Horned Grebe	*Podiceps auratus*	**X**	-
	Gulls/Terns		**X**	**X**
	Shorebirds		-	**X**

Broad River and Enoree River WMAs

The Broad River and Enoree River WMAs, which are both situated within the project boundary on Parr Reservoir, provide important habitat for overwintering waterfowl and recreational waterfowl hunting opportunities (South Carolina DNR, 2016a).

The Broad River WMA, located in Fairfield County, is owned by Dominion Energy and managed by the South Carolina DNR. It has five impoundments, totaling approximately 130 acres of waterfowl habitat, including one green-tree reservoir[150] with an oak canopy, and four impoundments planted in corn and millet that are seasonally flooded (figure 3-15). The remaining 500 acres is comprised of upland or uncontrolled backwater habitats. A wide variety of duck species may be present in the area, but the primary species harvested are ring-necked ducks, wood ducks, mallards and green-winged teal (South Carolina DNR, 2016a). In addition to ducks, the area supports many wildlife species associated with wetlands and rivers, including several species of wading birds and various species of hawks. Mammals that frequent the area include deer, bobcat, fox, coyote, muskrat, rabbit, and raccoons.

The 85-acre Enoree River WMA, located in Newberry County at the northern end of the project boundary, includes a combination of open fields planted seasonally with corn and millet, and flooded hardwood forest (figure 3-16). Suber Creek is used to flood a 50-acre green-tree impoundment within the WMA. The land is owned by the Forest Service and cooperatively managed by the Forest Service and the South Carolina DNR (South Carolina DNR, 2016b). Wood ducks, ring-necked ducks, and green-winged teal are the primary species harvested on the Enoree River Waterfowl Management Area (South Carolina DNR, 2016b). Other wildlife-related activities include bird watching, deer hunting and small game hunting. Many bird species frequent the area and mammals such as deer, beaver, raccoon and squirrel may be observed.

[150] Green-tree reservoirs are seasonal impoundments, created by the construction of levees, in bottomland hardwood forests that are flooded during late fall and winter to provide waterfowl habitat.

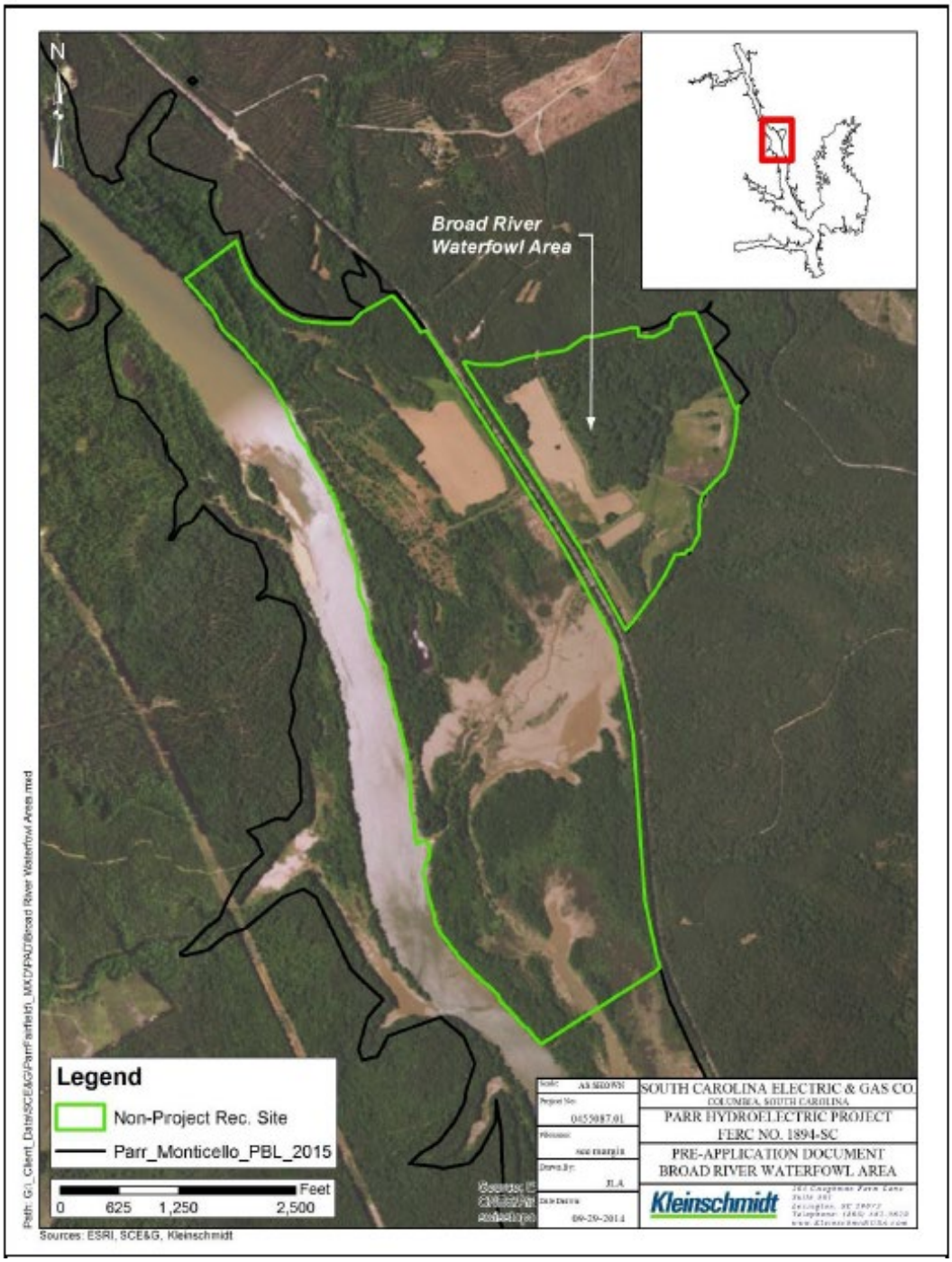

Figure 3-15. Broad River Wildlife Management Area (Source: Kleinschmidt, 2017b).

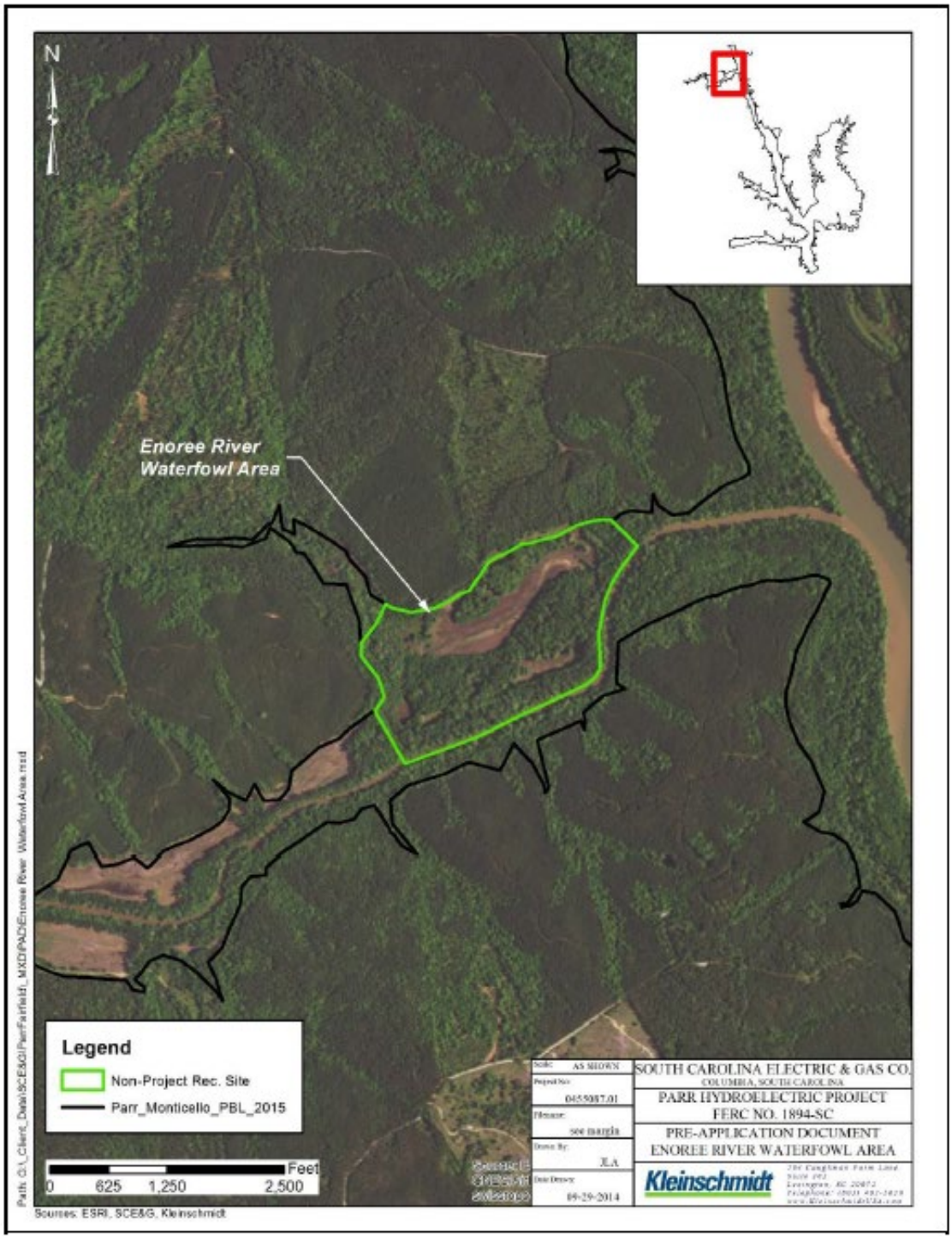

Figure 3-16. Enoree Wildlife Management Area (Source: Kleinschmidt, 2017b; as modified by staff).

Special Status Terrestrial Species

Dominion Energy, in consultation with the FWS, state agencies, and other stakeholders, identified and evaluated federally- and state-protected species, and species of concern that may occur within the project boundary and immediate vicinity (Fairfield and Newberry Counties), and downstream[151] of the project (Richland County), including species considered priority species in South Carolina DNR's State Wildlife Action Plan (South Carolina DNR, 2015a). Dominion Energy evaluated the known ranges, life history and habitat requirements for each of these species to determine the potential for occurrence, and to identify potential project effects (Kleinschmidt, 2017c). Six federally listed species potentially occur within the tri-county area evaluated, including the endangered red-cockaded woodpecker, Canby's dropwort, rough-leaved loosestrife, and smooth coneflower, and the threatened wood stork and northern long-eared bat. Federally listed species are discussed further in section 3.3.4, *Threatened and Endangered Species*.

Table 3-25 describes the special-status species with known occurrences in the tri-county area (i.e., Fairfield, Newberry, and Richland Counties) evaluated by Dominion Energy.

[151] Dominion Energy evaluated the Broad River downstream of Parr Shoals dam through Frost Shoals, near Boatwright Island (Richland County), approximately 20 miles downstream of the project.

Table 3-25. Special status terrestrial species documented in Fairfield, Newberry, and Richland Counties (Sources: Kleinschmidt, 2017c, as modified by staff; FWS, 2019b; South Carolina DNR, 2019a).

Common Name (*Scientific Name*)	Federal Status	State Status/ 2015 Priority Species[152]	Occurrence Counties/Project Occurrence Data	Habitat/Distribution Notes	Suitable Habitat at the Project
Amphibians and Reptiles					
Southern hognose snake (*Heterodon simus*)	ARS	T/ Highest Priority	Richland Co./ No records in project vicinity.	Well-drained, dry, sandy soils where longleaf pine and/or scrub oaks are the characteristic woody vegetation. Also found in wiregrass, fallow-fields, and fire-maintained areas.	Yes
Chamberlain's dwarf salamander (*Eurycea chamberlaini*)	ARS	-/ Highest Priority	Richland Co./ No records in project vicinity/ Distribution unknown.	Found in wet areas, such as seepages near small streams and wetlands, under leaf litter and small debris	Yes
Pine Barrens tree frog (*Hyla andersonii*)		T/ Highest Priority	Richland Co./ No records in project vicinity	Pocosin[a] or evergreen shrub swamps along seeps and small streams within longleaf pine-oak forest. Breeding habitat in South Carolina has been described as low vegetation with dense growth of Sphagnum mosses.	No

[152] Refers to conservation priority level as listed in South Carolina DNR's State Wildlife Action Plan (South Carolina DNR 2015a).

Common Name (*Scientific Name*)	Federal Status	State Status/ 2015 Priority Species[152]	Occurrence Counties/Project Occurrence Data	Habitat/Distribution Notes	Suitable Habitat at the Project
Birds					
Bald eagle (*Haliaeetus leucocephalus*)	BGEPA	T/ S2/ High Priority	Fairfield, Newberry, and Richland Co./ Observed during waterfowl surveys, nests in the project vicinity.	Widespread distribution and large numbers of occurrences in North America. Nests and perches in tall living trees, especially pines, in mature forests near large open water where foraging occurs.	Yes
Red-cockaded woodpecker (*Picoides borealis*)[153]	E	E	Richland Co./ No records in project vicinity	Large expanses of mature, open pine forest, particularly longleaf, slash, or loblolly pine; nests in old living pines.	No
Wood stork (*Mycteria americana*)	T	E/ S1S2/ Highest Priority	Richland Co./FWS data.	Forages in freshwater marshes depressions, swamps, lagoons, ponds, flooded fields and ditches, as well as brackish wetlands. Nests in canopies of cypress trees, mangroves, or dead hardwoods over or adjacent to shallow water bodies (NatureServe, 2019a).	Yes

[153] Some taxonomic authorities place this species in the genus *Picoides* and others place it in the genus *Leuconotopicus*.

Common Name (*Scientific Name*)	Federal Status	State Status/ 2015 Priority Species[152]	Occurrence Counties/Project Occurrence Data	Habitat/Distribution Notes	Suitable Habitat at the Project
Mammals					
Little brown bat (*Myotis lucifugus*)	ARS	--/ Highest Priority	Richland Co./ No records in project vicinity	Found in trees, rock crevices, and under bridges known to initially feed along margins of lakes and streams and in and out of vegetation, and later in the evening forage over the surface of water in groups	Yes
Northern long-eared bat (*Myotis septentrionalis*)	T	--/ Highest Priority	/No records in project vicinity.	Individuals or colonies roost in a wide variety of live and dead trees of variable sizes in summer, and typically hibernate in cracks and crevices of caves or manmade structures.	Yes
Tricolored bat (*Perimyotis subflavus*)	ARS	S1S2/ Highest Priority	Fairfield, Newberry, and Richland Co./ No records in project vicinity	Hibernate in mines and caves in the winter; roosts in trees and structures in summer. Associated with forested landscapes, often in open woods and over water and adjacent to water edges. In South Carolina, sparse vegetation and early successional stands were found to be the best predictor of foraging habitat use (FWS, 2019a).	Yes

Common Name (*Scientific Name*)	Federal Status	State Status/ 2015 Priority Species[152]	Occurrence Counties/Project Occurrence Data	Habitat/Distribution Notes	Suitable Habitat at the Project
Rafinesque's big-eared bat (*Corynorthinus rafinesquii*)	--	E/S2/ Highest Priority	Richland Co./ No records in project vicinity	Found in large hollow trees, rock crevices, and under bridges in mountainous regions, and coastal zone and sandhills habitats in South Carolina.	No
Plants					
Bog spicebush (*Lindera subcoriacea*)	ARS*	S3/High Priority	Richland Co./ No records in project vicinity	Found throughout the southeast Coastal Plain including sandhills of the Carolinas. Inhabits permanently moist to wet, shrub-dominated seepage wetlands, open, quaking bogs in pinelands, shrub thickets of seepages, typically near the heads of streams and along the banks of small braided streams. Plants are restricted to stream pocosins in South Carolina. Plants are under increased stress from competing shrubs and trees due to lack of fires in habitat.	No
Canby's dropwort (*Oxpolis canbyi*)	E	S2/Highest Priority	Richland Co./ No records in project vicinity	Perennial plant that grows in coastal plain habitats including wet meadows, wet pineland savannas, ditches, sloughs, and around the edges of cypress-pine ponds. (FWS, 2010b). The healthiest	No

Common Name (*Scientific Name*)	Federal Status	State Status/ 2015 Priority Species[152]	Occurrence Counties/Project Occurrence Data	Habitat/Distribution Notes	Suitable Habitat at the Project
				populations seem to occur in open bays or ponds, which are wet most of the year and have little or no canopy cover. Ideal soils for Canby's dropwort have medium to high organic content and a high water table. They are also acidic, deep, and poorly drained.	
Carolina-birds-in-a-nest (*Macbridea caroliniana*)	ARS	S3/High Priority	Richland Co./ No records in project vicinity	Occurs in wet longleaf pine or pond pine savannas and acidic (blackwater) swamp forests, seepages, and disturbed wet sites like right of ways and roadsides. Range extends from southeastern North Carolina to southern Georgia, with unconfirmed reports from Florida, Alabama, and Mississippi (NatureServe, 2019b)	Yes
Ciliate-leaf tickseed (*Coreopsis integrifolia*)	ARS*	--/High Priority	Richland Co./ No records in project vicinity	Habitat for ciliate-leaf tickseed is generally described as forested wetlands (NatureServe, 2019c). This species can be found along streambanks and floodplains of blackwater streams; edges of swamp forests bordering longleaf pinelands or bordering brackish	No

Common Name (*Scientific Name*)	Federal Status	State Status/ 2015 Priority Species[152]	Occurrence Counties/Project Occurrence Data	Habitat/Distribution Notes	Suitable Habitat at the Project
				marshes; moist sand banks and low flat floodplains of rivers and creeks	
Georgia aster (*Symphyotrichum georgianum*)	ARS*	--/Highest Priority	Fairfield and Richland Co./ No records in project vicinity	Habitat consists of dry, rocky woodlands, woodland borders, roadbanks, and powerline rights-of-way; known from several locations on the nearby Sumter National Forest and suitable habitat exists on the adjacent V.C. Summer Nuclear Station site.	Yes
Purple balduina (*Balduina atropurpurea*)	ARS	S1/High Priority	Richland Co./ No records in project vicinity	Habitat classified as spring brook, forested wetland, herbaceous wetland, scrub/shrub wetland, forest/woodland, savanna, and woodland-conifer. Often associated with longleaf pine or slash pine and in wet pine flatwoods, savannahs, peaty hillside seepage bogs, and pitcher plant bogs. Distributed in southeastern and southcentral Georgia and northeast Florida, and also historically found in southeast North Carolina and northcentral South Carolina	Yes

Common Name (*Scientific Name*)	Federal Status	State Status/ 2015 Priority Species[152]	Occurrence Counties/Project Occurrence Data	Habitat/Distribution Notes	Suitable Habitat at the Project
Rock Shoals Spider Lily		R/S1	Fairfield and Richland Co./Documented downstream of the Parr dam	Requires a specialized habitat of swift, shallow flowing water over rocks and direct sunlight.	Yes
Rough-leaved loosestrife (*Lysimachia asperulaefolia*)	E	S1/Highest Priority	Richland Co./ No records in project vicinity	Found along edges between longleaf pine uplands and pond pine pocosins (areas of dense shrub and vine growth usually on a wet, peaty, poorly drained soil), on moist to seasonally saturated sands, and on shallow organic soils overlaying sand (NatureServe, 2019d).	No
Sandhills lily *(Lilium pyrophilum)*	ARS	S1	Richland Co./ No records in project vicinity	Almost exclusively restricted to narrow transition zones between dry longleaf pine uplands and wet, wooded creeks and streamheads. May occur on herb and shrub-dominated side slopes and floodplains in streamhead and small depression pocosins, sandhill seeps, Coastal Plain small stream swamps, and wet, maintained rights-of-way. Ranges from southeastern Virginia to southcentral South Carolina, with most populations occurring in the	Yes

Common Name (*Scientific Name*)	Federal Status	State Status/ 2015 Priority Species[152]	Occurrence Counties/Project Occurrence Data	Habitat/Distribution Notes	Suitable Habitat at the Project
				Sandhills region on the interior Coastal Plain of southeastern North Carolina.	
Smooth coneflower (*Echinacea laevigata*)	E	S3/Highest Priority	Richland Co./ No records in project vicinity	Found in open woods, cedar barrens, roadsides, clearcuts, dry limestone bluffs, and power line rights-of-way,	No
Spathulate seedbox *Ludwigia spathulata*	ARS	S2	Richland Co./ No records in project vicinity	Habitat includes bogs, forested wetlands, herbaceous wetlands, and riparian area; often found along exposed shores and bottoms of sinkhole ponds, bogs and depression meadows.	Yes
Wire-leaved dropseed (*Sporobolus teretifolius*)	ARS		Richland Co./ No records in project vicinity	Perennial grass that found in bog, forested wetland, herbaceous wetland, forest-conifer, forest/woodland, and savanna. Occurs southeastern North Carolina and northeastern South Carolina, south to southern Georgia, and west to extreme southeastern Alabama.	Yes

[a] Pocosins are palustrine wetlands that have deep, acidic, sandy, peat soils.

-- — Not listed

Federal Status

E — Listed Endangered; a species that may become extinct or disappear from a significant part of its range if not immediately protected.

T — Listed Threatened; a species that may become endangered if not protected.

BGEPA — Protected by the Bald and Golden Eagle Protection Act

State Status

ARS— Species that the FWS has been petitioned to list and for which a positive 90-day finding has been issued (listing may be warranted); information.

ARS*— Species that are either former Candidate Species or are emerging conservation priority species.

E — Listed Endangered; a species which is in danger of extinction throughout all or part of its range.

T — Listed Threatened; a species which is likely to become an endangered species in the foreseeable future throughout all or parts of its range.

R — Listed Rare; a species which should be protected because of its scarcity.

U — Listed Unusual, and thus deserving of special consideration (e.g., plants subject to commercial exploitation).

S1 — Critically imperiled in South Carolina because of extreme rarity or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state.

S2 — Imperiled in South Carolina because of rarity due to very restricted range, very few populations, steep declines, or other factors making it very vulnerable to extirpation from state.

S3 — Vulnerable in the state due to a restricted range, relatively few populations, recent and widespread declines, or other factors making it vulnerable to extirpation.

S4 — Apparently Secure; Uncommon but not rare; some cause for long-term concern due to declines or other factors.

S#S# — A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or ecosystem.

Amphibians and Reptiles

Dominion Energy evaluated special-status amphibian and reptile species, which included Chamberlain's dwarf salamander, southern hognose snake, pine barrens tree frog (table 3-25). Chamberlain's dwarf salamander is a distinct species similar to the more common dwarf salamander. It is known to occur in Richland County, outside the project boundary. The full range of the species is not completely known (South Carolina DNR, 2015b). Southern hognose snake occurs in many counties throughout South Carolina, including Richland County. It has been declining throughout its range likely due to habitat loss, conversion and fragmentation resulting in the loss of longleaf pine savanna habitat (FWS, 2018b). There are no records of southern hognose snake occurring within the project boundary. The pine barrens tree frog is known to occur in Richland County. The area surrounding the project lacks the Carolina sandhills habitat and associated bogs and pocosins[154] required by this species.

Birds

The bald eagle was removed from the federal list of threatened species in 2007 but remains protected as a state endangered species under the South Carolina Nongame and Endangered Species Conservation Act, and federally under the Bald and Golden Eagle Protection Act[155] and Migratory Bird Treaty Act.[156] Bald eagles are commonly observed in the project area, with Monticello and Parr Reservoirs, and the lower Broad River providing abundant foraging habitat. The remaining avian species in Table 3-25, the federally endangered red-cockaded woodpecker, and the federally threatened wood stork, are discussed in section 3.3.4, *Threatened and Endangered Species*.

Mammals

Four special-status bat species are known to occur in the tri-county area: Rafinesque's big-eared bat, tricolored bat, little brown bat, and northern long-eared bat. Rafinesque's big-eared bat is an uncommon species with scattered populations throughout its range. Rafinesque's big-eared bat populations have declined in the past century, contributing to its listing as a special-status species in the State of South Carolina (South Carolina DNR, 2019b). In the state, its range includes the coastal plain and sandhills regions and the extreme northwestern Blue Ridge, and it is currently known to occur in Richland County, but it has not been found in the Piedmont of South Carolina (South Carolina DNR, 2019b). The federally at-risk tricolored bat ranges throughout

[154] Pocosins are palustrine wetlands that have deep, acidic, sandy, peat soils.
[155] Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d).
[156] Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712).

most of the eastern United States, southeastern Canada, and into eastern Mexico and Central America. White-nose syndrome (WNS)[157] is a major threat to tricolored bats, and populations have greatly declined since 2006 (FWS, 2019a). Disturbance or destruction of natural and artificial roost structures also pose threats to the species, especially to hibernacula and maternity roosts. The federally at-risk little brown bat is found primarily in the Blue Ridge mountains in South Carolina. It is not often found in the Piedmont ecoregion (FWS, 2019b), but it is known to occur in Richland County, downstream of the project. The federally threatened northern long-eared bat is discussed in section 3.3.4, *Threatened and Endangered Species*.

Plant Species

Of the eight at-risk plant species in the tri-county area only the Georgia aster is known to occur in Fairfield County in the vicinity of the project. No site-specific occurrence data are available within the project boundary. Rocky shoals spider lily is not state or federally listed, but it is considered rare by South Carolina DNR, and it is tracked by the agency's Heritage Trust Program. Rocky shoals spider lily occurs in significant numbers downstream of Parr Project in the Broad River (Kleinschmidt, 2017c). The remaining plant species listed in table 3-25 are only known to occur in Richland County, outside of the project area. The federally endangered Canby's dropwort, rough-leaved loosestrife, and smooth coneflower are discussed in section 3.3.4, *Threatened and Endangered Species*.

3.3.3.2 Environmental Effects

Project Operation

Project operations with fluctuating reservoir surface elevations have the potential to reduce water levels in the reservoir, resulting in the dewatering of littoral and wetland habitats. Project operations can also cause unnatural flow fluctuations downstream of the dam, which could impact downstream habitats and species. Dominion Energy proposes no changes in project operation. As described in section 2.1.4, *Existing Project Operation*, the Fairfield Development operates as a pumped storage facility, with a maximum daily fluctuation of 4.5 feet in Monticello Reservoir (upper pool), while the Parr Reservoir (lower pool) may fluctuate up to 10 feet as a result of pumped storage operation. Dominion Energy would continue operating the Parr Development in a modified run-of-river mode using available flows up to 4,800 cfs. Implementation of Dominion Energy's proposed Flow Fluctuations AMP (Settlement Agreement Condition 2a) would manage flow fluctuations downstream of Parr Shoals Dam using remote

[157] White-nose syndrome is a fungal infection that agitates hibernating bats, causing them to rouse prematurely and burn fat supplies. Mortality results from starvation or, in some cases, exposure.

monitoring of flows and spillway gate automation, and upgrades in generators at the Parr Development to allow use of flows greater than 4,800 cfs for power generation (up to 7,254 cfs with Dominion Energy's proposed generator improvements). To increase minimum flows downstream of Parr Shoals Dam, Dominion Energy proposes to implement the Minimum Flows AMP (Settlement Agreement Condition 2b), which is summarized in detail in section 3.3.2.2, *Minimum Flows Downstream from Parr Development*.

Our Analysis

Project operations can affect littoral, wetland, riparian habitat by modifying the natural flows through the river basin and maintaining segments of streams as regulated lacustrine[158] systems. The daily fluctuations in water levels in the Monticello and Parr Reservoirs, and unnatural flow fluctuations downstream of the Parr Shoals Dam have the potential dewater habitat and contribute to erosion and sedimentation of the reservoir shorelines and downstream areas of the Broad River. The wetlands and riparian habitat in the project area, however, developed under the hydroperiod[159] established by existing project operations, which are not proposed to change. Vegetation in project wetlands and shoreline areas is adapted to the daily fluctuations of 4.5 feet in Monticello Reservoir, and up to 10 feet in Parr Reservoir as a result of pumped storage operations. Continued operation of the project as proposed is unlikely to result in loss of or degradation to existing wetlands and littoral habitat within the project boundary.

The project's reservoirs also provide habitat for a variety of wildlife species, as indicated by the species observed during Dominion Energy's waterfowl surveys described above in 3.3.3.1, *Affected Environment*. Unlike the majority of the Monticello and Parr Reservoirs, wetland, littoral and riparian habitats in the Broad River and Enoree River WMAs are seasonally flooded, and vegetated areas are not exposed to daily project-related water fluctuations. Recreation Lake, the 300-acre recreation sub-impoundment at the north end of Monticello Reservoir, is also hydraulically isolated from the project by an earthen embankment. The Monticello and Parr Waterfowl Aerial Survey Final Report (Kleinschmidt, 2017b) evaluated the effects of fluctuating reservoir water levels on waterfowl numbers. While there was greater variation observed for water levels during the waterfowl aerial surveys at Parr Reservoir (range > 7 feet) than at Monticello Reservoir (range < 3 feet), there was no relationship found between water levels at the time of aerial surveys and numbers of dabbling ducks, diving ducks, or total waterfowl for either reservoir. Therefore, continued project operations would likely not affect wildlife that use the project reservoirs to forage, breed, and/or overwinter, as they are adapted to reservoir condition and occur in large numbers.

[158] Lacustrine refers to permanently or temporarily flooded lakes and reservoirs.
[159] A hydroperiod is the seasonal pattern of water levels within a wetland.

While reservoir fluctuations would continue under the new license, outflows from the Parr Shoals Dam would be managed though the implementation of Dominion Energy's proposed Flow Fluctuations AMP, and Minimum Flows AMP to regulate the intensity of flow fluctuations and to increase minimum flows (see section 3.3.2.2 *Aquatic Resources- Affected Environment*). These plans would potentially benefit littoral and wetland habitat and associated wildlife downstream of the project by reducing unnatural flow fluctuations.

Construction and Maintenance Activities

In addition to project operation, construction activities associated with modification to existing project facilities and building new facilities, as well as routine maintenance, have the potential to affect terrestrial resources at the project. Dominion Energy proposes recreation enhancements at five existing recreation sites and development of four new recreation sites including construction of fishing piers, docks, parking areas, and shelters as part of the RMP for the project (Settlement Agreement Condition 1a), discussed in detail in section 3.3.5, *Recreation and Land Use-Environmental Effects*. Forest Service 4(e) Condition 23 also requires Dominion Energy to develop a vehicle turn-around with parking area for six vehicles and canoe/kayak step-down facility at the Keitts Bridge Landing (i.e., proposed Enoree River Bridge Recreation Site), which is located on land managed by the Forest Service. Dominion Energy would also allow private development of the Monticello Reservoir shoreline (outside of the project boundary) through implementation of the Monticello Reservoir SMP (Settlement Agreement Condition 5b).

To limit the effects of construction activities at the project, Dominion Energy proposes to implement the Monticello Reservoir SMPs (Settlement Agreement Conditions 5b and 5a, respectively), which include BMPs for erosion and sediment control during shoreline development activities. Similarly, Forest Service 4(e) Condition 20 requires Dominion Energy to implement site-specific, temporary erosion control measures for individual construction projects. Dominion Energy would also be required to prepare detailed construction plans for the recreation improvements and prepare and submit a biological evaluation regarding potential impacts of facility development on affected special status species at the Keitts Bridge Recreation Site as part of Forest Service 4(e) Condition 23.

Forest Service 4(e) Condition 11 would require Dominion Energy to develop and implement a Hazardous Substance Plan for locations on, or directly affecting, national forest system lands. Details of the plan are described in section 3.3.2.2, *Aquatic Resources – Environmental Effects*.

Forest Service 4(e) Condition 18 requires Dominion Energy to develop a Vegetation and Non-Native Invasive Plant Management Plan for all national forest lands

potentially affected by the project that would address terrestrial non-native invasive plant species, and revegetation within the project boundary and adjacent to project features.

Our Analysis

The proposed construction of recreation enhancements and new recreation facilities has the potential to affect shoreline and nearshore vegetation and associated wildlife along the Monticello and Parr Reservoirs, as well as contribute to shoreline erosion and sedimentation in project waters. These recreation enhancements are described in detail in section 3.3.5, *Recreation and Land Use*. Many of the recreation enhancements proposed at the existing recreation sites (i.e., shelters, modifications to existing ramps or paths), would be constructed in areas that have previously been disturbed or would occupy the same footprint of the existing facilities, thus minimizing the potential to disturb vegetation and wildlife. Disturbances from the construction of other amenities such as fishing piers and docs, would be minimized using proper erosion control and restoration practices during and following all construction activities. Using the BMPs outlined in the Monticello and Parr Reservoir SMPs, such as revegetation of temporarily disturbed shoreline area with native vegetation, following construction would help restore vegetation to riparian areas and benefit wildlife communities. By implementing site-specific, temporary erosion control measures, as required by Forest Service 4(e) Condition 20, Dominion Energy could minimize erosion, and sedimentation that could harm littoral habitat during and following construction of these facilities.

Construction of the proposed parking facilities and improved access at the Highway 34 Recreation Site would require the removal of 0.16 acre of mature trees and understory vegetation to accommodate additional parking for 12 vehicles (see figure 3-20 in section 3.3.5.2, *Recreation and Land Use – Environmental Effects*). While the loss of riparian habitat would be permanent, Dominion Energy proposes to expand this site by an additional 18.13 acres, which would be used for recreation activities and protected under the new license (Dominion Energy, 2019). Constructing a vehicle turn-around with parking area for six vehicles at Keitts Bridge Landing, required under Forest Service 4(e) Condition 23, would also result in permanent removal of riparian habitat. Preparing detailed construction plans for the proposed improvements and a biological evaluation of special status species potentially affected by the development would help identify measures to protect these species and their habitats over the term of any new license.

Construction of new project facilities, modification of existing project facilities, and maintenance activities could affect shoreline and wetland habitat if any herbicides, pesticides, or other hazardous materials are discharged into project area. Implementing a Hazardous Substance Plan, as required by Forest Service 4(e) Condition 11 would minimize the potential for contamination on project lands and waters.

Developing a Vegetation and Non-Native Invasive Plant Management Plan as required by Forest Service 4(e) Condition 18 would also protect native species and habitats in which they occur. Managing non-native, invasive species would benefit native plants and wildlife by controlling species that could change the structure and function of their habitats (e.g., invasive species can reduce populations of native species, which provide forage and shelter for native wildlife species). Expanding the Vegetation and Vegetation and Non-Native Invasive Plant Management Plan to address invasive plant mitigation at all recreational areas developed or improved at the Parr Project would further protect native vegetation and associated wildlife in the project area.

Implementing erosion and sediment control at the project, as outlined in Dominion Energy's proposed plan (Settlement Agreement Condition 5c) and in Forest Service 4(e) Condition 20, would help to minimize erosion, sedimentation, and the input of material into the project's reservoirs during project related activities (i.e., recreation facility construction or improvements, and vegetation management), as well as during activities associated with public use of the project lands and waters.

Vegetation Management

Dominion Energy's proposed vegetation management activities in the project area include: (1) routine mechanical and chemical treatments at project facilities and within the project's transmission line ROW; (2) shoreline management conducted by both Dominion Energy and adjacent private landowners following policies outlined in the proposed SMPs for the Monticello and Parr Reservoirs; and (3) forestry and timber management in designated areas.

As described in section 3.3.3.1, *Terrestrial Resources - Affected Environment*, Dominion Energy maintains vegetation at project facilities such as the powerhouse, dam, and most project buildings as manicured lawns with some limited landscaped areas that contain trees and/or shrubs. Dominion Energy proposes to continue these maintenance procedures under any new license issued. Within transmission line ROWs, Dominion Energy proposes to continue its existing maintenance protocol, which includes: (1) annual danger tree[160] patrol, to identify dead, dying or leaning trees, which will be removed, as necessary; (2) woody vegetation herbicide spraying every three years, targeting trees starting to grow under the transmission lines, but leaving grasses and low growing plants in place and undisturbed (applying an EPA-approved aquatic mix spray in riparian areas); and (3) a 5-year tree trimming program, targeting trees on the sides of the transmission line rights-of-ways to assure that branches do not infringe on the transmission lines.

[160] A danger tree is any tree on or off the ROW that could contact electric supply lines.

Dominion Energy proposes to use the SMPs for Monticello and Parr Reservoirs to address vegetation management around the reservoir shorelines. Settlement Conditions 5a and 5b require implementation of the SMPs, which are described in detail in section 3.3.5, *Recreation and Land Use*. Both SMPs have provisions for vegetation management on the reservoirs. When permitted, adjacent shoreline landowners may also engage in vegetation management within the project boundary for authorized activities, including maintenance of access paths. The proposed SMPs also include guidelines for adjacent landowners' voluntary use of vegetative shoreline stabilization techniques. Settlement Agreement Condition 5c also requires Dominion Energy to implement their proposed Erosion Monitoring Plan that includes provisions to monitor shoreline erosion, and to repair severe erosion, including instances where erosion may affect environmentally sensitive areas.

Forest Service 4(e) Conditions 12, 18, 20, and 21, would require Dominion Energy to implement measures that relate to vegetation management. Forest Service Condition 12 requires Dominion Energy to implement Pesticide-Use Restrictions on national forest lands. Forest Service 4(e) Condition 18 requires Dominion Energy to develop a Vegetation and Invasive Weed Management Plan[161] for all national forest lands potentially affected by the project. Forest Service Condition 20 requires Dominion Energy to develop and implement an Erosion and Sediment Control Management Plan for the project, including national forest system lands. Lastly, Forest Service Condition 21 requires Dominion Energy to develop and implement of Fire Management and Response Plan. We discuss conditions for each type of vegetation management activity below.

Our Analysis

Routine Vegetation Management at Project Facilities

Dominion Energy has an established protocol for maintaining vegetation within the project's transmission line ROW. These practices minimize vegetation disturbance by allowing grasses and low growing vegetation to remain in the corridors. Continuing to implement its procedures for vegetation management within the transmission line ROW would maintain the existing, early succession vegetation that is compatible with power generation and transmission land uses at the project.

Dominion Energy's general vegetation management procedures at the powerhouse, dam, and other project facilities (e.g., project recreation areas) are not as

[161] The plan also includes a provision for special status species management, which is discussed in more detail in the Special Status Species discussion below.

well defined as the vegetation management procedures for the project transmission line ROW. In general, these areas are maintained as lawn, with some landscaping. Forest Service 4(e) Condition 18 would require Dominion Energy to develop a Vegetation and Non-Native Invasive Plant Management Plan for all national forest lands potentially affected by the project. [162] Specific provisions for general vegetation management include: (1) revegetation implementation and monitoring; (2) treatment protocols for vegetation management (e.g., hazardous fuels reduction and hazard tree management); (3) pesticide/herbicide use approval and restrictions; and (4) annual reporting guidelines. This plan would apply to national forest system lands within the project boundary. Developing a vegetation management plan for project areas that potentially affect national forest lands would facilitate coordinated vegetation management in the project area that meets both Dominion Energy and the resource agencies' goals and objectives for the lands they each maintain. Specifically, the plan could benefit terrestrial resources at project recreation sites, which are geographically isolated from the project's hydropower and transmission facilities and are located on or adjacent to national forest system lands. This plan could be developed in coordination with any plans for non-native invasive vegetation management, which is discussed further under *Non-Native, Invasive Species Management*.

Forest Service 4(e) Condition 12, pertaining to pesticide-use restrictions on national forest system lands, applies to pesticide applications (i.e., to control undesirable woody and herbaceous vegetation, aquatic plants, insects, rodents, etc.) on lands within the national forest or in areas affecting national forest land. Dominion Energy would be required to request the Forest Service's permission prior to using pesticides in these areas. Any request to use pesticides would include: (1) a determination as to whether pesticide applications are essential for use on national forest system lands; and (2) the specific proposed locations, herbicides, timeframes for application, application rates, dose and exposure rates, and safety risk. The project dam, powerhouse, and transmission line ROW are not located within, or adjacent to, national forest system lands. However, implementing this measure would allow Dominion Energy to coordinate with the Forest Service on any pesticide applications that would occur in recreational areas within, or adjacent to, national forest land, or that is managed by the Forest Service to protect vegetation and wildlife, including any sensitive species, from potential adverse effects of these chemicals.

[162] Forest Service 4(e) Condition 18 also requires treatment measures for non-native invasive species and special status species. These components of Condition 18 are discussed in the *Non-Native Invasive Species* and *Special Status Species* sections, below.

Shoreline Management

Ongoing project operations and maintenance could affect terrestrial resources along the project's shoreline. Implementing the proposed Monticello and Parr Reservoir SMPs would allow Dominion Energy to maintain areas for natural resource protection through specific requirements for construction, maintenance, shoreline stabilization, docks, lake access pathways, and other shoreline activities during the license term. Approximately 17 percent of shoreline miles in the Monticello Reservoir and 90 percent of shoreline miles in the Parr Reservoir are protected from any development (see table 3-30 in section 3.3.5.2 *Recreation and Land Use- Environmental Effect*s. Non-development areas preserve environmental resources along the shoreline.

The proposed SMPs limit vegetation disturbance by private landowners to areas designated for permitted use. Dominion Energy maintains a policy of non-disturbance of any vegetation on shoreline lands up to the 270-foot contour, or 50 feet (measured horizontally) from the Parr Reservoir's 266-foot contour, whichever is greater, and shoreline lands up to the 430-foot contour interval, or 50 feet (measured horizontally) from Monticello Reservoir's 425-foot contour, whichever is greater, or on project property without approval by Dominion Energy. For example, actions such as clearing access paths must be completed according to permit requirements, and maintenance must be done using hand-held tools and without the use of herbicides, to minimize ground disturbance and protect vegetation and wildlife. Removal of trees greater than 10-inches in diameter at breast height is also prohibited. Dominion Energy may require mitigation (i.e., plantings and/or shoreline manipulation) for violations of a permit.

Dominion Energy's proposed Erosion Monitoring Plan for the project reservoirs, as described in detail in section 3.3.1, *Geology and Soils*, includes provisions for the annual monitoring for erosion along the Parr Reservoir shoreline and twice yearly monitoring for erosion along the Monticello Reservoir shoreline, and shoreline repair where erosion is severe. Dominion Energy also supports voluntary efforts to address shoreline erosion in the immediate area of docks or access path for adjacent property owners, providing that the shoreline stabilization practices used are appropriate for the specific situation, as detailed in the permitting handbook[163] for each reservoir. Dominion Energy recommends using vegetative shoreline stabilization techniques using native plants to address soil erosion problems, wherever possible. By monitoring and limiting erosion of environmentally sensitive areas (i.e., those found to be occupied by rare, threatened or endangered species, or species in the South Carolina State Wildlife Action Plan, including any wetlands or littoral areas determined to be critical for native species), Dominion Energy would improve shoreline and near-shoreline habitat. Establishing

[163] Permitting Handbooks were developed with the SMPs, in consultation with stakeholders and agencies, to address activities requiring consultation with and/or permits from Dominion Energy.

diverse plant communities to stabilize erosion prone areas would also benefit wildlife communities that depend on these areas.

The Erosion and Sediment Control Plan required by Forest Service 4(e) Condition 20 would enable the identification and treatment of erosion and control sedimentation within the project boundary and on project-affected national forest system lands. Implementing Dominion Energy's erosion monitoring and repair methods, as outlined in the proposed Erosion Monitoring Plan for the project, and Forest Service 4(e) Condition 20, would provide Dominion Energy an integrated approach to minimize impacts from project-related sedimentation and erosion on riparian and littoral habitat and the wildlife that depend on these areas.

Forest Management

Dominion Energy's ongoing forest management, as described in section 3.3.3.1, *Terrestrial Resources - Affected Environment*, would continue to be conducted in accordance with the forestry policies and practices in South Carolina's BMPs for Forestry publication.[164] Some forested areas are strictly managed for recreational use, where the understory is controlled through prescribed burning and thinning operations, with no final harvests. Other areas are planted pine forests that are harvested for timber (see table 3-22). Managed acreage excludes riparian areas, streamside management zones, and areas that are set aside for wildlife (Dominion Energy, 2019).

Continuing to implement the South Carolina Forestry Commission's BMPs would ensure that the forests within the project boundary are maintained and would continue to provide multiple uses and benefits such as conserving forest resources, providing shoreline buffers for water quality protection, and allowing for some timber production, while protecting wildlife habitat and providing recreation opportunities (Dominion, 2019). Forest management measures for protecting wildlife include leaving mast[165] producing trees, providing travel corridors, having age and species diversity, having supplemental food plots, leaving snags for cavity-dependent species, using prescribed fire for habitat, and enhancing the measures taken to protect water quality. Timing of harvest is dependent on weather, the availability of a contractor, and demand. Dominion Energy avoids rutting of the landscape during harvesting.

Timber harvesting, especially complete harvesting of large tracks, has the potential to result in significant loss of topsoil through erosion when vegetation is removed, or heavy equipment is introduced into the area. Forest Service 4(e) Conditions 20 requires Dominion Energy to develop an Erosion and Sediment Control Plan, which would align

[164] Publication available online at https://www.state.sc.us/forest/refbmp.htm.

[165] Tree species such as oak, hickory, and beech that produce a hard mast (i.e., acorns, hickory nuts, and beechnuts).

with Dominion Energy's silvicultural practices at the project. Erosion and sedimentation could occur during and/or after Dominion Energy's forest management activities. Implementing a site-specific Erosion and Sediment Control Plan would facilitate the timely identification and treatment of erosion, and control sedimentation within the project boundary and on project-affected land, and would minimize the associated damage to forest vegetation, wildlife, and their habitats.

Fire hazards could be created during project operation and maintenance, including silvicultural activities. The Fire Management and Response Plan required by Forest Service 4(e) Condition 21 would include provisions for: (1) preventing potential fires (e.g., through fuels treatment/vegetation management, regular maintenance to prevent spread of potential project-induced fires, and reviewing fire risks associated with recreation); (2) emergency response preparedness; (3) reporting any fires to the Forest Service; and (4) investigation of fires related to project operations. Fire management and response is a key element of forest management and is also consistent with Dominion Energy's current silvicultural BMPs (e.g., South Carolina Forestry Commission's *South Carolina's Best Management Practices for Forestry*). A formal plan to manage fire hazards and respond to forest fires would be prudent to ensure public safety at the project and to protect terrestrial resources from potentially catastrophic fires that could spread to land adjacent to the project boundary.

Non-Native, Invasive Species Management

Dominion Energy does not monitor for or actively manage invasive terrestrial or aquatic vegetation within the project boundary. However, section 11.3 of both the Monticello and Parr Reservoir SMPs outline strategies for controlling the spread of the aquatic invasive species hydrilla. These strategies are part of the 2018 Aquatic Plant Management Plan developed by the South Carolina DNR and the South Carolina Aquatic Plant Management Council, which identified hydrilla as problem plant species in Recreation Lake, a sub-impoundment of Monticello Reservoir. The plan contains long-term management strategies which emphasize the management of aquatic plant populations at levels that benefit the environment and other water uses, and public education (South Carolina DNR, 2018). Conditions 5a and 5b of the Settlement Agreement require implementation of the SMPs.

Forest Service 4(e) Condition 18 requires Dominion Energy to develop and implement an Aquatic Invasive Species Management and Monitoring Plan for the project. The Aquatic Invasive Species Management and Monitoring Plan would consist of: (1) a public education program; (2) implementing BMPs; (3) monitoring and reporting; and (4) reviewing and updating the plan, as necessary. The public education program would include appropriate signage and information pamphlets at designated public boat access sites, as well as aquatic invasive species information made available on the project's website. BMPs would include: (1) developing a list of invasive species with potential to

be introduced and identifying control points; (2) implementing control or preventative measures; (3) monitoring invasive species to ensure BMPs are being followed; and (4) identifying actions to be taken if an invasive species is found. The monitoring program would encompass both the Monticello Reservoir and Parr Reservoir.

Forest Service 4(e) Condition 18 also requires Dominion Energy to develop a Vegetation and Non-Native Invasive Plant Management Plan for all national forest lands potentially affected by the project. Components of this plan were addressed above, in section 3.3.3.2, *Environmental Effects – Vegetation Management*. The Vegetation and Vegetation and Non-Native Invasive Plant Management Plan would include the following elements related to non-native, invasive plants: (1) methods for managing non-native, invasive plant species (e.g., frequency of surveys, guidelines for prevention, treatment, internal education, monitoring, reporting, and guidelines for conducting weed risk assessment for new project feature development); (2) methods to ensure early detection and treatment of non-native, invasive plants; (3) guidelines for treatment of non-native invasive plant populations on federal lands within the project boundary;[166] (4) guidelines for conducting Dominion Energy's inspections of equipment and vehicles for non-native, invasive plants; (5) a list of target[167] non-native, invasive plants agreed to, and approved by, Forest Service; (6) pesticide/herbicide use approval and restrictions; and (7) reporting guidelines for the annual meeting.[168]

Our Analysis

Aquatic Invasive Species Management and Monitoring Plan

The Parr Project supports popular recreational activities that provide frequent opportunities for boats and trailers to inadvertently transfer aquatic invasive species into the Monticello and Parr Reservoirs (described in greater detail in section 3.3.5, *Recreation and Land Use*). Dominion Energy's proposed SMPs provide provisions and BMPs to minimize the spread of aquatic invasive species in the project area and

[166] Non-native, invasive plant treatments would extend up to ¼ mile beyond the project boundary in areas where the populations are determined to be project related. If project-related noxious weed populations extend more than ¼ mile from the project boundary, Dominion Energy would consult with Forest Service to determine the appropriate treatment methods, if necessary.

[167] Target non-native invasive plant species include those species defined by the Regional Forester Southern Region, Southern Research Station and South Carolina Exotic Plant Pest Council or identified as Forest Service species of concern.

[168] We assume that Forest Service is referring to the annual meeting of the Consultation Group that would be required by Forest Service 4(e) Condition 14.

encourages visitors and property owners to consult with Dominion Energy and the South Carolina DNR if invasive species are encountered.

Proposed BMPs for preventing the spread of aquatic invasive species in the Monticello Reservoir and Parr Reservoir SMPs include: draining water from boat, motor, bilge, live well and bait containers before leaving a water access site; cleaning and drying boats and fishing equipment using accepted protocols for the prevention of all invasive species before entering any waterbody area; disposing of unwanted bait in trash; avoiding the release of plants and animals into a waterbody unless they originally came from that waterbody; inspecting all equipment and vehicles used at the project for non-native invasive plants and animals; removing visible plants, animals and mud from boat before leaving waterbody; and, avoiding the disturbance of native vegetation. Public education and outreach are a component Dominion Energy's proposed SMPs. Dominion Energy proposes to maintain a website to provide information on the SMPs, including a permitting handbook, examples and information on BMPs, and alternative and example designs for shoreline stabilization.

Aquatic invasive plant species may be spread or introduced inadvertently to the project's reservoirs or the Parr Shoals Dam tailrace area through various project operation, maintenance, and recreational activities. Implementation of an Aquatic Invasive Species Management and Monitoring Plan as required by Forest Service 4(e) Condition 18 would be consistent with Settlement Agreement Condition 5a and 5b regarding public education and the development of BMPs to prevent the introduction of aquatic invasive species into project-affected waters. Adding provisions of the Aquatic Invasive Species Management and Monitoring Plan for placing signage and information pamphlets at recreation areas, developing a list of invasive species with potential to be introduced and identifying control points, control measures, and monitoring would further help control aquatic invasive species at the project. Implementing Dominion Energy's proposed SMPs and educational outreach efforts, as well as an Aquatic Invasive Species Management and Monitoring Plan for the project waters would provide a comprehensive, systematic approach to aquatic invasive species management and likely be more effective in minimizing the introduction and potential spread of aquatic invasive plant species and the associated adverse effects to native aquatic species in the project area.

Terrestrial Invasive Species

Non-native, invasive plant species known to occur in the project area include kudzu, mimosa, and Japanese honeysuckle, and privet identified at the Highway 34 Recreation Area, and more are likely to occur (*see* table 3-21 in section 3.3.3.1, *Affected Environment*). Invasive plant species can spread vegetatively or be dispersed by wind, water, wildlife, and/or recreation activities, and threaten native plants and wildlife by altering ecosystem structure and function. Implementing the Vegetation and Vegetation

and Non-Native Invasive Plant Management Plan as required by Forest Service 4(e) Condition would provide a mechanism to minimize the potential introduction and spread of non-native invasive plant species on national forest lands within, and adjacent to, the project boundary during project operation and maintenance, and recreation-related activities.

Developing methods for routine monitoring and BMPs for Dominion Energy's operation and maintenance activities would provide a means for early detection and effective treatment and/or control of non-native, invasive plants throughout the project area. Implementing BMPs would provide a comprehensive and systematic approach to the management of non-native invasive species to minimize the potential spread of these species to new areas within and outside of the project boundary. Managing non-native, invasive species would also benefit native species and potentially improve the quality of recreation access and aesthetics at the project. Expanding the Vegetation and Vegetation and Non-Native Invasive Plant Management Plan to address invasive plant mitigation at all project recreation sites, by applying the measures established for actions directly affecting national forest system lands, would further protect native vegetation and associated wildlife in the project area.

Special Status Species

Project operation, maintenance, and construction of recreation enhancements have the potential to affect special status species occurring within the project boundary. As identified in table 3-25, suitable habitat for the bald eagle, tricolored bat, and Georgia aster occurs at the Parr Project. Of these, only bald eagle has been documented within the project boundary to date. The rocky shoals spider lily is known to occur in significant numbers on islands in the Broad River downstream of Parr Shoals Dam, outside of the project boundary, but in a segment of the Broad River that may be affected by project operation. Six additional federally listed species (i.e., northern long-eared bat, red-cockaded woodpecker, wood stork, Candy's dropwort, rough-leaved loosestrife, and smooth coneflower) also have potential to occur within the project area, and are discussed in section 3.3.4, *Threatened and Endangered Species*.

Of the four special status species that may occur or be affected by the project, Dominion Energy proposes to implement measures specific to the bald eagle. As part of Dominion Energy's implementation of the Monticello and Parr Reservoir SMPs required by Settlement Agreement Conditions 5a and 5b, Dominion Energy proposes to track bald eagles and refrain from issuing shoreline permits for activities within 660 feet of an active nest during the nesting season (September through May) and 330 feet during the non-nesting season, in adherence to the FWS habitat guidelines for nesting bald eagles (FWS, 2007a). Dominion Energy would also consult with the FWS regarding proposed activities in the vicinity of known bald eagle nests.

Dominion Energy proposes no changes in project operation. Dominion Energy does propose to implement a Flow Fluctuations AMP (Settlement Agreement Condition 2a), discussed in detail in section 3.3.2.2 *Flow Fluctuations Downstream of Parr Development*, to manage flow fluctuations in the Broad River downstream of Parr Shoals Dam. To increase minimum flows downstream of Parr Shoals Dam, Dominion Energy proposes to implement the Minimum Flows AMP, discussed in detail in section 3.3.2.2*, Minimum Flows Downstream from Parr Development*.

Dominion Energy does not propose any changes to its vegetation or forest management practices within the project boundary. These practices are described above in section 3.3.3.2, *Environmental Effects – Vegetation Management.* Dominion Energy would continue to manage forests in accordance with South Carolina Forestry Commission's BMPs to ensure that the forests within the project boundary are maintained and would continue to provide multiple uses and benefits such as conserving forest resources, providing shoreline buffer(s) for water quality protection, and allowing for some timber production, while protecting wildlife habitat.

Forest Service 4(e) Conditions 11and 12 require Dominion Energy to develop a Hazardous Substances Plan and Pesticide-Use Restrictions on national forest system lands, respectively, that would help protect special status species from unnecessary exposure to pesticides and other hazardous substances that may be used at the project. Forest Service 4(e) Condition 18 requires Dominion Energy to develop a Vegetation and Non-Native Invasive Plant Management Plan, with provisions for special status species management. Forest Service 4(e) Conditions 20 and 21, provide a mechanism for Dominion Energy to minimize potential damage to special status species habitats from erosion and wildfires or accidental fires by developing an Erosion and Sediment Control Plan and a Fire Management and Response Plan. These measures are summarized in detail in section 2.2.4, *Modifications to Applicant's Proposal – Mandatory Conditions*.

Our Analysis

Implementing Dominion Energy's proposed environmental measures together with the required Forest Service 4(e) conditions would likely minimize potential effects to any special status species that may become established within the project boundary. Managing shorelines in accordance with the proposed Monticello and Parr Reservoir SMPs would maintain vegetative buffers and wildlife habitat around project reservoirs. Based on our review of the species and their habitat needs, continued project operation and maintenance, as proposed by Dominion Energy, would not be expected to adversely affect any state protected plant and wildlife species and species of concern described in table 3-25. Discussion of effects on individual special status species are described below.

Bald Eagle

The bald eagle was removed from the federal list of threatened species in 2007 (FWS, 2007b) but remains protected as a state endangered species under the South Carolina Nongame and Endangered Species Conservation Act, and federally under the Bald and Golden Eagle Protection Act[169] and Migratory Bird Treaty Act.[170] As proposed, Dominion Energy would continue to avoid disturbance to bald eagles and their active nest sites through its BMPs for land management activities in the project area following the FWS's National Bald Eagle Management Guidelines (FWS, 2007b) pertaining to prescribed distance buffers, natural or landscape buffers, and activity-specific guidelines, where applicable. Additionally, by continuing to consult with the FWS on activities in vicinity of known nests and implementing avoidance measures when making shoreline management decisions, as outlined in the Monticello and Parr Reservoir SMPs, Dominion Energy would help ensure protection of bald eagles, and their habitats in the project area throughout any new license term.

Tricolored Bat

The tricolored bat is found throughout the state, but hibernating populations have greatly declined since 2006 due to WNS (FWS, 2019a), and it is listed as a highest priority species in the South Carolina 2015 State Wildlife Action Plan (South Carolina DNR, 2015a). No known hibernacula[171] occur in the project area. Disturbance or loss of natural and artificial roost structures also pose threats to the species. Suitable foraging and roosting habitat are present in the project area (e.g., forested landscapes, often in open woods and found over water and adjacent to water edges). By continuing to manage forests in the project area in accordance with South Carolina Forestry Commission's BMPs and implementing shoreline development restriction as outlined the project's SMPs, Dominion Energy would minimize potential impacts to tricolored bat habitat. Additionally, implementing a Hazardous Substances Plan and Pesticide-Use Restrictions (Forest Service 4(e) Conditions 11 and 12) on national forest lands, or affecting national forest lands, would help protect the bats from unnecessary exposure to pesticides and other hazardous substances that may be used at the project. Managing non-native, invasive species would indirectly benefit bats by controlling species that could change the structure and function of their foraging and roosting habitats (Forest Service 4(e) Condition 18). Developing an Erosion and Sediment Control Plan and a Fire Management Fire Management and Response Plan would provide a mechanism for

[169] Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c).

[170] Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712).

[171] Hibernacula provide bats shelter during the colder winter months and are typically found in cool, humid caves or abandoned mines in temperate climate zones.

Dominion Energy to protect sensitive species habitat from erosion and wildfires or accidental fires.

Georgia Aster

Habitat for the Georgia aster has been identified on the adjacent V.C. Summer Nuclear Station site and Forest Service lands in the project vicinity, and suitable habitat likely exists in the project area (Kleinschmidt, 2017c). Potential occurrences of Georgia aster would be limited to terrestrial sites, such as the Parr Project transmission line ROW. Dominion Energy's vegetation management practices in transmission line corridors, such as leaving grasses and low growing plants in place and only using EPA-approved aquatic mix herbicide spray in riparian areas, would help minimize potential effects to the Georgia aster and its potential habitat within the project boundary. Pesticide-use restrictions, required by Forest Service 4(e) Conditions 12, would align with Dominion Energy's vegetation management practices in transmission line corridors, further protecting potential Georgia aster habitat. Implementing a Vegetation and Non-Native Invasive Plant Management Plan for national forest lands, or adjacent land potentially affecting national forest lands, as required by Forest Service Condition 18, would likely benefit potential Georgia aster habitat by controlling non-native species, as discussed previously. Developing an Erosion and Sediment Control Plan and a Fire Management Fire Management and Response Plan (Forest Service 4(e) Conditions 20 and 21) would provide Dominion Energy a way to additional protection to sensitive habitat from erosion and wildfires or accidental fires.

Rocky Shoals Spider Lily

Surveys done downstream of the Parr Project documented the rocky shoals spider lily downstream of Parr Shoals Dam (Kleinschmidt, 2015). A recognized species of concern for South Carolina, the rocky shoals spider lily an aquatic, perennial flowering plant easily identified by its large white flowers. The plant develops from a bulb and grows to be approximately 3 feet tall and requires a specialized habitat of swift, shallow flowing water over rocks and direct sunlight. The Broad River downstream of the Parr Shoals Dam contains shoal areas which provide the necessary habitat for this species. Large flow fluctuations and low flow conditions could affect rocky shoals spider lily habitat. Implementation of Dominion Energy's proposed Flow Fluctuations AMP (Settlement Agreement Condition 2a), and Minimum Flows AMP (Settlement Agreement Condition 2b) would help manage flow fluctuations and minimum flows downstream of Parr Shoals Dam, potentially benefitting the habitat required for this species.

Habitat Enhancement Program

As discussed in section 3.3.2 *Aquatic Resources*, Dominion Energy proposes to implement a HEP for the purpose of restoring, enhancing, and protecting aquatic, wetland, and riparian habitats and the associated natural resources of the Parr Project

area, as well as areas outside the project area in the Broad, Saluda, and Congaree river watersheds. The HEP would exist for the term of any new license issued and be administered by Dominion Energy to encourage, review, evaluate and fund project proposals to accomplish this purpose (Settlement Agreement Condition 2g).

Our Analysis

Project operation and maintenance activities could affect terrestrial resources in the project area, including special status species. In addition to the proposed aquatic habitat measures for water quality, minimum flows, water level fluctuations, and fish habitat described in section 3.3.2 *Aquatic Resources*, Dominion Energy proposes to implement measures to improve wetland and riparian habitats through management and monitoring of the shoreline (i.e., the Monticello and Parr Reservoir SMPs), and erosion monitoring (i.e., Erosion Monitoring Plan). Dominion Energy's proposed measures, along with Forest Service 4(e) Condition 20, which includes protocols for emergency erosion and sediment control, would provide additional protection to riparian and wetland habitat. Forest Service 4(e) Condition 18 requires Dominion Energy to develop plans for aquatic invasive species management and monitoring, and vegetation and non-native invasive plant management for areas that may directly affect national forest lands. Together, these conditions minimize project effects and protect wetlands and riparian resources that occur within the project boundary. Additionally, expanding the Vegetation and NNIP Management Plan to cover all recreational areas developed or improved at the Parr Project would further protect riparian habitat in the project area. Implementation of the HEP, however, would potentially include restoring, enhancing, and protecting areas outside the project area in the Broad, Saluda, and Congaree river watersheds, which would lack a nexus to any project effect.

3.3.4 Threatened and Endangered Species

3.3.4.1 Affected Environment

On April 1, 2020, FWS's IPaC system did not identify any federally listed species as occurring in the project vicinity. [172] However, we included the shortnose sturgeon (federally endangered), Atlantic sturgeon (federally endangered), and Carolina heelsplitter (federally endangered) in our analysis of federally threatened and endangered species because they all occur in the Santee River Basin, and have the potential to be affected by project operation. In addition, Dominion Power included in its desktop study

[172] The IPaC report includes the two counties in which the project is located (Fairfield and Newberry Counties). Dominion Energy's rare, threatened and endangered species study included the counties within the project boundary, as well as the reach of the Broad River from Parr Shoals Dam through Frost Shoals, near Boatwright Island in Richland County (Kleinschmidt, *Revised September* 2017).

of rare, threatened, and endangered species the federally endangered red-cockaded woodpecker, Candby's dropwort, rough-leaved loosestrife and smooth coneflower which are all known to occur in Richland County. Dominion Power also included the federally threatened northern long-eared bat and wood stork in its review (Kleinschmidt, 2017c). The northern long-eared bat is not documented as occurring within Fairfield or Newberry Counties; however, it is likely that the species may occur in appropriate habitat within the project area.[173] Additionally, the wood stork is known to occur in the adjacent Saluda River Basin, and suitable foraging habitat for transient individuals is present in the project area. No critical habitat for any federally listed threatened and endangered, or proposed species occurs within project-affected lands (FWS, 2018a, 2020a).

Aquatic Resources

Shortnose sturgeon

The shortnose sturgeon was federally listed as endangered throughout its range on March 11, 1967,[174]. The Final Recovery Plan for shortnose sturgeon was issued by NMFS in 1998 (NMFS, 1998). No critical habitat has been designated for this species.

The shortnose sturgeon is an anadromous species that occurs along the Atlantic Coast of North America, primarily in rivers and estuaries and rarely in the ocean. Shortnose sturgeon spawn in freshwater and generally remain in natal rivers, but will move between freshwater and low salinity estuaries to feed (Kynard, 1997; Buckley and Kynard, 1985). Mature adults begin migrating to spawning areas of inland riverine reaches in the spring (typically mid-February through March in South Carolina) when water temperatures rise above 48°F (9°C) (Kynard, 1997, Hall *et al.*, 1991) and spawning generally occurs at temperatures between 48°F (9°C) and 59°F (15°C) (Dadswell, 1979; Kynard 1997).

Shortnose sturgeon likely occurred historically in the reach of the Broad River encompassed by the Parr Project (Welch 2000, Newcomb and Fuller 2001 as cited in FLA exhibit E). Today, the nearest shortnose sturgeon population occurs within Lakes Marion and Moultrie, the upstream reaches of the Congaree River, and the lower reaches of the Wateree River,[175] but there is no evidence that shortnose sturgeon pass upstream of

[173] Dominion Energy's response to the FERC August 7, 2019 Additional Information Request Appendix A, dated September 18, 2019, includes the most recent consultation with the FWS and South Carolina DNR on the potential presence on the northern long-eared bat in the project area.

[174] 32 Fed. Reg. 4,001 (March 11, 1967).

[175] See Preliminary Prescription filed by NMFS on September 30, 2019.

the Columbia Diversion Dam.[176] Radiotelemetry studies have documented migration of shortnose sturgeon as far upstream on the Congaree as the Blossom Street Bridge (about 3.6 river miles downstream from the Columbia Diversion Dam) (Finney *et al.* 2006). However, South Carolina DNR suggests that this occurrence was based on a small number of observations (2 fish) and that their radiotelemetry data suggest that shortnose sturgeon activity is primarily limited to areas downstream of Granby Lock and Dam (about 5 river miles downstream from the Columbia Diversion Dam) (Dominion Energy, 2018). Nonetheless, shortnose sturgeon spawning has been documented in the Congaree River near the City of Columbia over substrates of sand, gravel and rock (Collins *et al.*, 2003; Shortnose Sturgeon Status Review Team, 2010).

Atlantic sturgeon[177]

Five distinct population segments (DPS) of Atlantic sturgeon were listed as endangered or threatened on February 6, 2012.[178] The Carolina DPS includes the Santee River Basin population and is listed as endangered. Critical habitat was designated on August 17, 2017, but does not include the Broad or Congaree rivers.[179]

The Atlantic sturgeon is an anadromous species that occurs along the Atlantic Coast of North America. Mature adults spawn in fresh flowing water at temperatures ranging from 55°F (13°C) to 79°F (26°C) (Balazik and Musick, 2015). In South Carolina rivers, spawning occurs in the spring and fall around April and October (Collins *et al.* 2000, Balazik and Musick 2015, Farrae *et al.* 2017). Atlantic sturgeon remain in natal waters during their early-life stages to fully develop into juveniles before migrating to the ocean, where they mix with adults.

[176] The fishway was designed to provide passage of blueback herring and American shad to historic spawning grounds in the Broad River downstream of Parr Shoals Dam and was intended to be "sturgeon friendly". However, shortnose sturgeon have not been documented upstream of the Blossom Street Bridge in recent history, nor have any been documented passing through the fishway since annual monitoring began in 2007 (Dominion, 2018b).

[177] All information about the Atlantic sturgeon in this section is from 82 Fed. Reg. 39,160-39,274 (August 17, 2017) unless otherwise noted.

[178] 77 Fed. Reg. 5,880-5,912 (February 6, 2012).

[179] 82 Fed. Reg. 39,160-39,274 (August 17, 2017). All critical habitat in the Santee-Cooper system is located downstream of lakes Marion and Moultrie.

In the Santee River Basin, Atlantic sturgeon occur in low abundance in the Santee and Cooper Rivers, but there is no evidence that they occur elsewhere in the system outside of these two rivers (NMFS *et al.*, 2017).

Carolina heelsplitter[180]

The Carolina heelsplitter mussel was federally listed as endangered throughout its range on June 30, 1993.[181] FWS finalized a recovery plan on January 17, 1997. Critical habitat was designated on July 2, 2002, but does not include the Broad or Congaree rivers.[182] The life history of the inflated heelsplitter is largely unknown, but is likely similar to other freshwater mussels. Fertilized eggs are held in the female's gills where they develop into glochidia (i.e., larvae). The glochidia are discharged into the water where they attach to a fish host and metamorphose into juvenile mussels that fall to suitable substrate, grow, and develop into adults. This species is found in a variety of substrates (i.e., mud, clay, sand, gravel, and cobble/boulder/bedrock) without significant silt accumulations, along stable, well-shaded stream banks. In South Carolina, there are ten remaining populations that occur in either the Catawba, Pee Dee, Saluda, and Savannah River systems. No populations are known to occur in the Broad or Congaree rivers. Recent surveys indicate that the Carolina heelsplitter is not present in the vicinity of the project.[183]

Terrestrial Resources

Northern long-eared bat

The northern long-eared bat was listed as a federally threatened species under the ESA on May 4, 2015. In January 2016, the FWS finalized the 4(d) rule for this species which focuses on preventing effects on bats in hibernacula associated with the spread of WNS and effects of tree removal on roosting bats or maternity colonies (FWS, 2017). As part of the 4(d) rule, FWS proposes that take incidental to certain activities conducted in accordance with three specific habitat conservation measures, as applicable, would not be prohibited. Those habitat conservation measures are that the activity: (1) occurs more than 0.25 mile from a known, occupied hibernacula; (2) avoids cutting or destroying known, occupied maternity roost trees during the pup-rearing season (June 1 – July 31); and (3) avoids clearcuts within 0.25 mile of known, occupied maternity roost trees during

[180] All information about the Carolina heelsplitter in this section is from 67 Fed. Reg. 44,502-44,522 (July 2, 2002) unless otherwise noted.

[181] 58 Fed. Reg. 34,926-34,932 (June 30, 1993).

[182] 67 Fed. Reg. 44,502-44,522 (July 2, 2002).

[183] Recent mussel surveys were conducted in Monticello Reservoir in 2016 (Three Oaks Engineering, 2016), Parr Reservoir in 2007 (Price *et al.*, 2010), and between Parr Shoals Development and the Columbia Project Dam in 2015/2016 (Price *et al.*, 2016).

the pup season (June 1 - July 31). The 4(d) rule provides flexibility to landowners, land managers, government agencies, and others as they conduct activities in areas that could be northern long-eared bat habitat.

Northern long-eared bat is a medium-sized migratory bat species with longer ears than other *Myotis* species (average 17 millimeters, or 0.7 inches). It uses high frequency echolocation to forage on 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, emerging to feed 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.

During the summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags (dead trees), varying in size[184] as well as man-made structures, and will switch roosts every 2 to 3 days. 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. Typically born between late May and July, pups are raised in maternity colonies of 30 to 60 individuals[185] and are most vulnerable to disturbances at maternal roosts before they learn to fly,[186] from 18 to 21 days after birth.[187]

While the range of the northern long-eared bat includes much of the eastern and north central U.S. and all Canadian provinces west to the southern Yukon Territory and eastern British Columbia, its distribution is patchy and historically it has been observed more frequently in the northeastern U.S. and in Quebec and Ontario, Canada than elsewhere in the range. WNS[188] has caused northern long-eared bat populations to plummet in recent years (FWS, 2015).

---

[184] Trees 3 inches in diameter or greater at breast height can provide suitable habitat for northern long-eared bats.

[185] 78 Fed. Reg. 61051, 61054-61058 (October 2, 2013).

[186] 80 Fed. Reg. 2374 (January 16, 2015).

[187] 78 Fed. Reg. 61057 (October 2, 2013).

[188] White-nose syndrome is the main threat to the northern long-eared bat species, and it has caused a precipitous decline in bat numbers (in many cases, 90 – 100 percent) where the disease occurs. FWS identifies the WNS Zone as the set of counties within the range of the northern long-eared bat within 150 miles of the boundaries of U.S. counties or Canadian districts where the white-nose syndrome had been detected.

Red-cockaded woodpecker

The red-cockaded woodpecker is endemic to open, mature and old growth pine ecosystems in the southeastern United States (FWS, 2003). Over 97 percent of the pre-colonial era population has been eradicated, leaving only roughly 14,000 red-cockaded woodpeckers living in approximately 5,600 colonies scattered across eleven states, including South Carolina. Red-cockaded woodpecker decline is generally attributed to a loss of suitable nesting and foraging habitats, including longleaf pine systems, due to logging, agriculture, fire suppression, and other factors (FWS, 2003). Suitable nesting habitat generally consists of open pine forests and savannahs with large, older pines and minimal hardwood midstory or overstory. Living longleaf pine trees, especially older trees that are susceptible to redheart disease making them more easily excavated, provide the woodpecker its preferred nesting cavities. There are no known reports of red-cockaded woodpecker in areas surrounding the project or along the lower Broad River. Moreover, there is no known longleaf pine savanna habitat in the project boundary.

Wood Stork

The wood stork is a large, colonial wading bird and is the only stork species that breeds in the United States (FWS, 1997). It was federally listed as endangered in 1984,[189] primarily due to loss of wetland habitat throughout its range, but after documenting increases in breeding population and range, FWS reclassified the population from endangered to threatened on July 30, 2014. It uses a variety of wetlands for nesting, feeding, and roosting. Nesting colonies (rookeries) in South Carolina are typically surrounded by extensive palustrine forested wetlands (South Carolina DNR, 2015b). Nests are usually located in the upper branches of large black gum or cypress trees, and several nests are typically located in each tree. Like most wading birds, storks feed primarily on small fish. Foraging occurs in shallow, open water and wetland depressions where prey concentrations are high enough to ensure successful feeding. Wood storks locate small prey fish by opening their bills partially and then probing and sweeping sideways through the water (FWS, 1997).

The wood stork's range includes Alabama, Florida, Georgia, Mississippi, North Carolina, and South Carolina; the center of the breeding range has shifted north since the 1970s, and recent breeding has occurred in Florida, Georgia, and South Carolina (NatureServe, 2019a). In Georgia and South Carolina, wood storks tend to lay eggs from March through May and fledging occurs in July and August. Individuals from colonies in Florida, Georgia, and South Carolina generally disperse after the breeding season,

[189] Based on genetic information, satellite-telemetry studies, and other marking studies, FWS concluded that the U.S. breeding population is a distinct population segment because it is markedly separated from populations in South America, Central America, Mexico, Cuba, and Hispaniola.

across the coastal plain and coastal marshes in the Southeast. No critical habitat has been designated for wood stork.

Ongoing threats to wood stork recovery include loss of foraging habitat, water level manipulations that affect natural hydrological conditions, predation, and human disturbance (FWS, 2014). FWS's recovery plan for the U.S. breeding population of wood stork identifies four primary recovery actions including: (1) protecting currently occupied habitat; (2) restoring and enhancing habitat; (3) conducting applied research necessary to accomplish recovery goals; and (4) increasing public awareness (FWS, 1997).

Canby's dropwort

Canby's dropwort is a perennial plant that grows in coastal plain habitats including wet meadows, wet pineland savannas, ditches, sloughs, and around the edges of cypress-pine ponds (FWS, 2010b). The healthiest populations seem to occur in open bays or ponds, which are wet most of the year and have little or no canopy cover. Ideal soils for Canby's dropwort have a medium to high organic content, a high water table, and are acidic, deep, and poorly drained. Canby's dropwort is a coastal plain species and thus would not be expected to occur in the portion of Richland County in the vicinity of the project. It also was not detected in surveys documenting the occurrence of the species on the V.C. Summer Nuclear Plant site adjacent to the project area (Kleinschmidt, 2017c).

Rough-leaf loosestrife

Rough-leaf loosestrife generally occurs in the ecotones[190] between longleaf pine uplands and pond pine pocosins on moist to seasonally saturated sands, and on shallow organic soils overlaying sand (FWS, 1994). Rough-leaf loosestrife has been found on deep peat in the low shrub community of large Carolina bays (shallow, elliptical, poorly drained depressions of unknown origin). The grass-shrub ecotone, where rough-leaf loosestrife is found, is fire maintained, as are the adjacent plant communities (longleaf pine-scrub oak, savanna, flatwoods and pocosin). Suppression of naturally occurring fire in these ecotones results in shrubs increasing in density and height and expanding to eliminate the open edges required by this plant. The pine pocosin and Carolina bay environments required by this species do not occur in the Piedmont; therefore, rough-leaf loosestrife is extremely unlikely to occur in the project vicinity.

Smooth coneflower

Smooth coneflower is a perennial herb, which grows to a height of about 1.5 meters, with smooth stems, few leaves and pink to purplish flowers. It is typically found in open woods, cedar barrens, roadsides, clearcuts, dry limestone bluffs, and power line

[190] A region of transition between two biological communities.

rights-of-way, usually on magnesium and calcium rich soils (NatureServe, 2019e). Smooth coneflower occurs in plant communities that have been described as xeric, hardpan forests, diabase glades, or dolomite woodlands. Optimal sites are characterized by abundant sunlight and little competition in the herbaceous layer. Natural fires, as well as large herbivores, historically influenced the vegetation in this species' range. Many of the herbs associated with smooth coneflower are sun-loving species that depend on periodic disturbances to reduce the shade and competition of woody plants. It is not known to occur in areas around Monticello and Parr Reservoirs or along the lower Broad River. Surveys have not been done in the project boundary, but surveys of adjacent areas indicate that appropriate habitat for the smooth coneflower does not occur on the site (Kleinschmidt, 2017c).

3.3.4.2 Environmental Effects

Aquatic Resources

Shortnose sturgeon

As discussed in section 3.3.2.2, *Flow Fluctuations Downstream of Parr Development*, operation of the Parr Project causes flow fluctuations downstream of the Parr Development that can alter the quality of aquatic habitat downstream, including spawning habitat for shortnose sturgeon. To reduce the project induced flow fluctuations that occur downstream of the Parr Development, Dominion Energy is proposing to develop and implement a final Flow Fluctuations AMP. Section 3.3.2.2, *Flow Fluctuations Downstream of Parr Development*, fully summarizes the Flow Fluctuations AMP, which includes a provision to implement operational modifications to reduce downstream flow fluctuations during the shortnose sturgeon spawning period (i.e., for 14 days during the period from March 15 through March 31).

Our Analysis

As discussed in section 3.3.4.1, *Aquatic Resources*, shortnose sturgeon likely occurred historically in the reach of the Broad River encompassed by the Parr Project (Welch 2000, Newcomb and Fuller 2001 as cited in FLA exhibit E), but have not been documented upstream of the Columbia Diversion Dam in recent history (Dominion Energy, 2018b, City of Columbia, 2018). Today, the nearest shortnose sturgeon population occurs within Lakes Marion and Moultrie, the upstream reaches of the Congaree River, and the lower reaches of the Wateree River.[191] Further, shortnose sturgeon spawning has been documented in the Congaree River downstream from the Columbia Diversion Dam near the City of Columbia (Collins *et al.*, 2003; Shortnose Sturgeon Status Review Team, 2010).

[191] See Preliminary Prescription filed by NMFS on September 30, 2019.

As discussed in section 3.3.2.2, *Flow Fluctuations Downstream of Parr Development*, existing operations can cause flows downstream of the Parr Development to fluctuate as much as 5,000 cfs to 10,000 cfs daily. These flow fluctuations have the potential to affect areas downstream from Parr Shoals Dam, as well as downstream from the Columbia Diversion Dam on the Congaree River.[192] Studies conducted in the Connecticut River indicate that shortnose sturgeon will terminate spawning and leave the spawning grounds during rapid increases or decreases in flow downstream of hydropower facilities (Kieffer and Kynard, 2012). Thus, there is the potential for Parr Project operations (i.e., existing operation fluctuations) to negatively affect the spawning behavior of shortnose sturgeon that occur in the Congaree River downstream from the Columbia Diversion Dam. There also is the potential for existing operational fluctuations to negatively affect any shortnose sturgeon that may successfully pass upstream of the Columbia Diversion Dam fishway.[193]

To eliminate the effects of project operations on shortnose sturgeon spawning behavior, Dominion Energy proposes to implement its Flow Fluctuations AMP, which includes a provision to stabilize downstream flows for 14 days during the period between March 15 and March 31. Shortnose sturgeon spawning generally occurs at water temperatures between 48°F (9°C) and 59°F (15°C), and historical water temperature data near the spawning habitat in the Congaree River indicate that these temperatures regularly occur between March 15 and March 31.[194] Dominion Energy's proposal to stabilize flows during a 14-day period between March 15 and March 31 each year would improve spawning habitat conditions and spawning activity for shortnose sturgeon in the Congaree River, as well as in the Broad River, if they were to begin passing upstream through Columbia Diversion Dam fishway.

---

[192] Kleinschmidt Associates analysis of flows at USGS gages both upstream and downstream of the Parr Project, including the Saluda River and Congaree River, indicated that operations at the Parr Shoals Development have the potential to affect flows in the Congaree River near Highway 601 (*See* December 16, 2015 Downstream Flow Fluctuations memorandum included in exhibit E1-e of the FLA).

[193] The fishway was designed to provide passage of blueback herring and American shad to historic spawning grounds in the Broad River downstream of Parr Shoals Dam, but was also intended to be "sturgeon friendly" (Dominion, 2018b).

[194] The USGS collects water temperature data in the Saluda River at USGS gage 02169000, which is located about 3.3 river miles upstream from a location on the Congaree River near Blossom Street Bridge, Columbia, South Carolina, where migrating shortnose sturgeon have been observed and where there is evidence of spawning.

With implementation of the Flow Fluctuations AMP , we find that relicensing the project is not likely to adversely affect the shortnose sturgeon.

Atlantic Sturgeon

As discussed in section 3.3.2.2, *Aquatic Resources*, *Environmental Effects*, operation of the Parr Project has the potential to affect resident and migratory fishes and their habitat within the project area through changes in flow and water quality. No Atlantic sturgeon are known to occur in the project area, and Dominion Energy does not propose any specific measures to mitigate potential project effects on Atlantic sturgeon.

Our Analysis

The Atlantic sturgeon is an anadromous species that spawns in freshwater but spends most of its adult life in the ocean. Although Atlantic sturgeon may have historically migrated above the fall line[195] and into habitat near the Parr Project, today, Atlantic sturgeon do not occur in the project area. In addition, although critical habitat has been designated for the Carolina DPS of Atlantic sturgeon, no critical habitat occurs in the project area. In the Santee River Basin, the Carolina DPS of Atlantic sturgeon occurs in low abundance in the Santee and Cooper rivers, but there is no evidence that they occur outside of these rivers, including the Broad River. The absence of Atlantic sturgeon upstream of the Santee and Cooper rivers is likely caused by the lack of upstream passage at the Santee Dam[196] and ineffective upstream passage at both the navigation lock at the Pinopolis Dam[197] and the Corps' St. Stephen Hydroelectric Project.[198, 199]

Although successful passage upstream of the Santee and Cooper Rivers does not currently occur, there is the potential for effective passage to be installed at Santee Dam during the term of any new license issued for the Parr Project. On January 27, 2020, NMFS filed its modified fishway prescription for the Santee-Cooper Project, which

---

[195] *See* draft Biological Opinion (BO) for the Santee-Cooper Hydroelectric Project (P-199) filed on July 12, 2019.

[196] The Santee Dam is part of the Santee-Cooper Hydroelectric Project, FERC No. 199 located on the Santee River.

[197] The Pinopolis Dam is part of the Santee-Cooper Hydroelectric Project located on the Cooper River.

[198] The St. Stephen Hydroelectric Project is located on a rediversion canal between Lake Moultrie and the Santee River.

[199] *See* draft Biological Opinion (BO) for the Santee-Cooper Hydroelectric Project (P-199) filed on July 12, 2019.

requires that upstream and downstream passage for sturgeon be installed at the Santee Dam when NMFS determines that passage is warranted. If upstream passage at the Santee Dam is completed during the term of any new license issued for the Parr Project, any sturgeon that pass upstream of the Santee Dam would have unimpeded access to habitat on the Congaree River up to the Columbia Diversion Dam. Habitat downstream of the Columbia Diversion Dam includes shoals, which typically provide conditions suitable for Atlantic sturgeon spawning.[200]

As discussed above, existing Parr Project operation causes downstream flow fluctuations that could affect habitat in the Congaree River where Atlantic sturgeon might occur during the term of any new license issued if they pass upstream of Santee Dam. Further, flow fluctuations have the potential to negatively affect Atlantic sturgeon spawning (ASSRT, 2007). To eliminate the effect of these fluctuations on shortnose sturgeon, American shad, striped bass, and robust redhorse spawning behavior, Dominion Energy proposes to implement the Flow Fluctuations AMP to stabilize downstream flows during these species' spawning periods. Dominion Energy did not specify the spawning period for Atlantic sturgeon in the Flow Fluctuations AMP. Nonetheless, as discussed in section 3.3.2.2, *Flow Fluctuations Downstream of Parr Development*, Dominion Energy is proposing to stabilize downstream flows during two, 7-day periods that would occur between April 1 and May 10.[201] Historical water temperature data in habitat near the Columbia Diversion Dam indicate that water temperatures corresponding to the Atlantic sturgeon spawning period (i.e., 55°F [13°C] to 79°F [26°C]) regularly occur between April 1 and May 10.[202] Thus, implementation of the Flow Fluctuations AMP would improve habitat that Atlantic sturgeon might use for spawning during the term of any new license issued, if they were to begin migrating upstream of the Santee Dam and into habitat downstream of the Columbia Diversion Dam.

With implementation of the Flow Fluctuations AMP, we find that relicensing the project is not likely to adversely affect the Carolina DPS of Atlantic sturgeon.

Carolina heelsplitter

As discussed in section 3.3.2.2, *Environmental Effects*, existing operation of the Parr Project causes fluctuating water levels in the project reservoirs and downstream of Parr Shoals Dam, and reduced flows and DO downstream of Parr Shoals Dam, which could, generally, adversely affect any freshwater mussels present in the project reservoir

[200] See Preliminary Prescription filed by NMFS on September 30, 2019.

[201] In the Flow Fluctuations AMP, the period from April 1 to May 10 was designated as a period to protect American shad, striped bass, robust redhorse spawning.

[202] Water temperature data are collected in the Saluda River at USGS gage 02169000, which is located about 3.3 river miles upstream from a location on the Congaree River near Blossom Street Bridge, Columbia, South Carolina.

and downstream of Parr Shoals Dam. To minimize water level fluctuations downstream of Parr Shoals Dam, Dominion Energy proposes to implement the Flow Fluctuations AMP, which we summarize in detail in section 3.3.2.2, *Flow Fluctuations Downstream of Parr Development*. To increase minimum flows downstream of Parr Shoals Dam, Dominion Energy proposes to implement the Minimum Flows AMP, which we summarize in detail in section 3.3.2.2, *Minimum Flows Downstream from Parr Development*. To improve DO concentrations downstream of Parr Shoals Dam, Dominion Energy proposes to implement the Turbine Venting Plan, as well as the West Channel AMP, which we summarize in section 3.3.2.2, *Tailrace and West Channel Water Quality*.

Our Analysis

The Carolina heelsplitter does occur in the Santee River Basin (i.e., Saluda and Catawba River systems), but the FWS does not list the Carolina heelsplitter as occurring in the vicinity of the Parr Project. In addition, recent surveys indicate that the Carolina heelsplitter is not present in the vicinity of the project.[203] Critical habitat has been designated for the species, but there is no critical habitat present in the vicinity of the project.

As discussed in section 3.3.2.2, *Freshwater Mussel Monitoring*, Dominion Energy is proposing several measures to improve habitat and water quality downstream of the Parr Development and these improvements would likely improve habitat for freshwater mussels. Nonetheless, the Carolina heelsplitter does not occur in the project vicinity or in any part of the Broad or Congaree rivers and we are unaware of any efforts to relocate Carolina heelsplitter mussels to areas that could be affected by project operation.

Given that: (1) Carolina heelsplitter does not currently occur in the Broad and Congaree Rivers, including the vicinity of the Parr Project; and (2) there are no efforts to relocate Carolina heelsplitter to areas that could be affected by project operation, we find that relicensing the project would have no effect on the Carolina heelsplitter.

Terrestrial Resources

Red-cockaded woodpecker

As discussed in section 3.3.3.2, *Environmental Effects*, project operation, maintenance, and construction of recreation enhancements have the potential to affect special status species occurring within the project boundary. There are no known

[203] Biologists conducted recent mussel surveys in Monticello Reservoir in 2016 (Three Oaks Engineering, 2016), Parr Reservoir in 2007 (Price *et al.*, 2010), and between Parr Shoals Development and the Columbia Project Dam in 2015/2016 (Price *et al.*, 2016).

occurrences of red-cockaded woodpecker in the project area, or along the lower Broad River. Dominion Energy does not propose any specific measures to mitigate potential project effects on the red-cockaded woodpecker in the project boundary.

Our Analysis

Red-cockaded woodpecker require open, forested landscapes of mature preferably old-growth longleaf or loblolly pines. Red-cockaded woodpecker is the only woodpecker that excavates its nesting and roosting cavities in living trees, and lives within a tight-knit extended family community of breeding birds and helper birds. Home ranges depending on habitat quality, namely the presence of open pine stands that have been frequently burned. Given that the red-cockaded woodpecker are not known to occur in Newberry and Fairfield Counties (i.e., the counties in which the project is located), and the project area does not provide suitable habitat, we find that relicensing the project would have no effect on red-cockaded woodpecker.

Wood Stork

Wood stork have not been documented in the Monticello and Parr Reservoirs, though periodic occurrences of wood stork have been documented in the adjacent Saluda River Basin (Kleinschmidt, 2017c), and the project reservoirs provide suitable foraging habitat. Dominion Energy does not propose any specific measures to mitigate potential project effects on the wood stork. Dominion Energy proposes to use the SMPs for Monticello and Parr Reservoirs to manage shoreline development and protect shoreline vegetation. Dominion Energy also proposes to monitor shoreline erosion in the project reservoirs, as described in section *3.3.1.2, Geology and Soils – Environmental Effects*. Settlement Conditions 5a, 5b and 5c require implementation of the SMPs, and Settlement Condition 5c requires implementation of the Erosion Monitoring Plan. Forest Service 4(e) Condition 20 requires Dominion Energy to develop an Erosion and Sediment Control Plan for the treating erosion and controlling sedimentation within the project as well as project affected nation forest lands.

Our Analysis

Wood stork primarily occur in the Coastal Plain physiographic province and are not known to breed in the Piedmont province, where the project is located. However, shallow backwaters in the project area, particularly in the upper reaches of the Parr Reservoir, and the Broad River and Enoree River WMAs provide suitable foraging habitat for transient wood stork. As discussed in section 3.3.3.1, *Terrestrial Resources-Affected Environment*, the WMAs are seasonally flooded and not affected by daily project water level fluctuations.

Minimizing vegetation disturbance along the shoreline protects the shallow water habitat from erosion and sedimentation. Monitoring for and implementing erosion and

sediment control would further protect this shallow littoral habitat. Protecting shoreline vegetation and limiting shoreline development around the project reservoirs, along with controlling erosion and minimizing sedimentation would help maintain the ecosystem structure and function of the existing shallow water impoundments and wetlands that could serve as potential foraging habitat for wood stork in the future.

Given: (1) that wood stork are transient visitors to the Piedmont region, and they could periodically use portions of project lands and waters for seasonal foraging (primarily by post-dispersal migrants during the summer months); but also (2) that the shallow backwaters, particularly in the upper reaches of the Parr Reservoir, would not be altered by proposed project operations, and shallow ponds in the WMAs would continue to be maintained as waterfowl habitat; the project would have no effect on wood stork.

Northern long-eared bat

As discussed in section 3.3.3.2, *Environmental Effects – Special Status Species*, project operation, maintenance, construction of recreation enhancements, and forest management activities have the potential to affect special status species occurring within the project boundary. During certain times of the year (i.e., April 1 to October 31), the removal of live or dead woody vegetation could potentially disturb summer roosting and foraging habitat for the northern long-eared bat and newly born pups in undocumented maternity roosts.

Proposed recreation enhancements in the RMP, required by Settlement Agreement Condition 1a, include constructing facilities that require permanent removal of mature deciduous and understory vegetation, which is potential habitat for sensitive species including the northern-long eared bat. Additionally, Forest Service 4(e) Condition 23 requires Dominion Energy to develop a vehicle turn-around with parking area for six vehicles and canoe/kayak step-down facility at Keitts Bridge Landing (i.e., proposed Enoree River Bridge Recreation Site), which is located on land managed by the Forest Service, which would also require vegetation clearing and potentially disturb sensitive habitat.

Dominion Energy's ongoing forest management, described in section 3.3.3.1, *Terrestrial Resources – Affected Environment*, would continue to be conducted in accordance with the forestry policies and practices in South Carolina's BMPs for Forestry publication. Some forested areas are strictly managed for recreational use, where the understory is controlled through prescribed burning and thinning operations, with no final harvests. Other areas are planted pine forests that are harvested for timber (see table 3-22).

To account for any changes in the range of northern long-eared bat and the WNS zone and lack of information about the occurrence of the northern long-eared bat in the project boundary, Dominion Energy proposes to consult with the FWS and South

Carolina DNR prior to implementing the proposed recreation enhancements at the Highway 34 Recreation Site. FWS and the South Carolina DNR concur with Dominion Energy's proposal regarding the Highway 34 Recreation Site. Dominion Energy also proposes to consult with the FWS prior to forest management activities if the northern long-eared bat's presence in Fairfield and Newberry Counties is established.[204]

Our Analysis

Although the project is outside of the current range of the northern long-eared bat and the WNS zone per the final 4(d) rule, the northern long-eared bat is known to occur in both upstate and coastal South Carolina, including counties that border Fairfield and Newberry Counties, where the project is located (South Carolina DNR, 2015b; Kleinschmidt, 2017c). These observations suggest that the species could occur in Newberry and Fairfield Counties, which are situated between the areas where the northern long-eared bat and WNS have been documented. FWS has no records of maternity roost trees or hibernaculum sites within Fairfield or Newberry Counties. However, undocumented maternity roosts may be present. Suitable summer roosting habitat (i.e., underneath bark, in cavities or in crevices of both live trees and snags (dead trees)) and foraging habitat (i.e., generally the understory of forested areas) for the northern long-eared bat exists in the project boundary.

Construction of the proposed recreation facility enhancements at the Highway 34 Recreation Site would require the permanent removal of approximately 20 mature box elder, and 8 mature American sycamore, as well as understory vegetation that includes immature water oak, within the proposed 0.16 acre area. During construction, project-related vegetation removal could potentially affect northern long-eared bat roost trees.

Avoiding tree removal[205] between April 1 to October 31 would reduce the likelihood of disturbing roosting and foraging habitat of northern long-eared bats and their newly born pups if there are any undocumented maternity roosts within 150 feet of the area. Tree removal in the cooler winter months, specifically November 1 through March 31, would coincide with the period when northern long-eared bats are likely

[204] Dominion Energy's proposal for consultation prior to tree removal at the Highway 34 Recreation Site was made in an Additional Information Request Response filed June 26, 2019. On September 18, 2019, Dominion Energy filed proof that FWS and South Carolina DNR supported Dominion Energy's proposal. In the same filing, Dominion Energy also proposed consulting with FWS prior to forest management activities after the northern long-eared bat's presence in Fairfield and Newberry Counties is established.

[205] Tree removal is defined as cutting down, harvesting, destroying, trimming, or manipulating in any other way the trees, saplings, snags, or any other form of woody vegetation likely to be used by northern long-eared bats.

hibernating in caves, and it is highly unlikely that northern long-eared bats would be present in the project boundary during this time. Otherwise, in the remaining months (April 1 through October 31) bats could use the existing suitable roosting and foraging habitat. Implementing a seasonal tree removal restriction would allow Dominion Energy to minimize potential adverse effects to northern long-eared bats that could be in the project boundary.

Regarding implementation of Forest Service 4(e) Condition 23, constructing a vehicle turn-around with parking area for six vehicles at Keitts Bridge Landing (Dominion Energy's proposed Enoree River Bridge Recreation Site), would also result in permanent removal of riparian habitat. Preparing detailed construction plans for the proposed improvements and a biological evaluation of special status species potentially affected by the development, as stipulated in Forest Service 4(e) Condition 23, would help identify measures to protect the northern long-eared bat, if present, over the term of any new license (e.g., limit tree removal associated with recreation enhancements at the project to November 1 through March 31, to minimize adverse effects to northern long-eared bats during the pup season and the broader active season).

Dominion Energy's proposed forest management and timber harvesting would also have the potential to affect the northern long-eared bat. Dominion Energy has not consulted with the FWS on their proposed forest management and timber harvesting activities, but proposes to consult with agencies on these activities if the northern long-eared bat is known to occur in the project area. Since Dominion Energy manages more than 850 acres of forest within the project boundary, implementing time-of-year restrictions on tree removal related to proposed forest management and timber harvesting (e.g., limiting tree removal to November 1 through March 31) would reduce the likelihood of disturbing northern long-eared bats in summer roosting and foraging habitat and adult females and their newly born pups in any undocumented maternity roosts, and would allow Dominion Energy to minimize potential adverse effects to northern long-eared bats related to timber harvesting.

Given that (1) there are no hibernacula known to occur in the vicinity of the project; (2) suitable summer roosting and foraging habitat is present in the project boundary and northern long-eared bat may use this habitat during their active season; (3) the project is adjacent to counties with the range of the NLEB; and (4) the project is adjacent to counties with documented WNS, which is known to spread rapidly to adjacent areas; we recommend that the applicant limit tree removal in the project boundary to November 1 through March 31 to minimize any potential adverse effects to northern long-eared bats during the pup season and the broader active season. These time of year restrictions are consistent with the 4(d) rule's time of year restrictions. We find that, with implementation of these measures, relicensing the project would not likely adversely affect northern long-eared bat.

Terrestrial Plants

As discussed in section 3.3.3.2, *Environmental Effects*, project operation, maintenance, and construction of recreation enhancements has the potential to affect special status species occurring within the project boundary. The federally endangered Candby's dropwort, rough-leaved loosestrife and smooth coneflower are known to occur in Richland County outside of the project boundary. None of these terrestrial plant species is known to occur in counties within the project boundary. Dominion Energy does not propose any specific measures to mitigate potential project effects on terrestrial species downstream of the project.

Our Analysis

The Candby's dropwort, rough-leaved loosestrife, and smooth coneflower all have specific habitat requirements that are not present in the project area. Canby's dropwort is a coastal plain species, and thus it would not be expected to occur in the portion of Richland County immediately downstream of the project. Pine pocosin and Carolina bay environments required by rough-leaf loosestrife also do not occur in project vicinity; therefore, it is extremely unlikely to occur within the project boundary. The smooth coneflower is known from open woods, cedar barrens, roadsides, dry limestone bluffs, and other sunny to partly sunny areas (FWS, 1995). The diabase[206] glade habitat required by this species is not known to occur in areas around Monticello and Parr reservoirs or along the lower Broad River.

Although Dominion Energy did not conduct site-specific surveys for rare, threatened or endangered plants, surveys conducted at the adjacent V. C. Summer Nuclear Station Project area concluded that appropriate habitat for the smooth coneflower does not occur in the area (Kleinschmidt, 2017c). Given that the project area would likely not provide suitable habitat for these terrestrial species, and they are not known to occur in the counties within project boundary, we find that relicensing the project would have no effect on Canby's dropwort, rough-leaf loosestrife, and smooth coneflower.

3.3.5 Recreation and Land Use

3.3.5.1 Affected Environment

Regional Recreation Resources

Federal and state recreation lands within a 40-mile radius of the project vicinity include Dreher Island State Park, Chester State Park, Kings Mountain National Military Park, Sumter National Forest, Lake Greenwood State Park, and Lake Wateree State Park.

[206] Diabase, or dolerite, is a mafic, holocrystalline, subvolcanic rock equivalent to volcanic basalt or plutonic gabbro.

These lands provide opportunities for boating, fishing, hiking, picnicking, swimming, and camping.

Sumter National Forest is a 371,000-acre national forest providing walking, horseback riding, and camping opportunities. Lake Greenwood State Park provides access to the 11,400-acre Lake Greenwood along the southwestern border of Newberry County with several miles of shoreline and public access. Lake Wateree State Park is a 72-acre state park containing outdoor and water-oriented facilities, a campground, picnic areas, and a boat ramp.

Lake Murray is an 80-square-mile reservoir located 10 miles south of the project on the Saluda River. Lake Murray is the impoundment for the Saluda Hydroelectric Project No. 516, operated by Dominion Energy. Lake Murray supports numerous water-based recreation opportunities through 15 public access sites situated around the reservoir. Lake Murray also hosts several national and regional fishing tournaments. The lower Saluda River, which extends 10 miles downstream from the Lake Murray Dam to its confluence with the Broad River, supports an active recreational fishery and provides flatwater to whitewater paddling experiences.

Fairfield and Newberry Counties contain numerous municipal recreation areas, providing multi-use trails, playgrounds, picnic areas, boat launching for hand-carried and trailered boats, swimming pools, and birding and wildlife watching opportunities. Fairfield County has 16 public parks and recreation facilities encompassing approximately 90 acres. Newberry County has 45 public parks and recreation facilities encompassing more than 530 acres. Lynch's Woods Park is a 260-acre woodland area county park in the city of Newberry which has hiking, biking, and equestrian trails, a primitive camp site, and picnic tables. Lake Monticello Park is a 25-acre county park on its eponymous lake containing sports courts, a fishing pier, and a walking trail.

Project Recreation Sites

The project provides a diverse range of recreational opportunities, including waterfowl hunting areas and areas that support many day-use activities such as picnicking, hiking, and beach swimming. Dominion Energy maintains six project recreation sites that are distributed within the project boundary, on Monticello and Parr Reservoirs. On Monticello Reservoir, the sites are: Scenic Overlook, Highway 215, Highway 99 West, and Recreation Lake Access Area. On Parr Reservoir, the sites are: Cannon's Creek and Heller's Creek. Dominion Energy's Exhibit R, approved as part of the current license, requires maintenance of the six project recreation sites, including their facilities, and provides public access to project waters and adjacent project lands for navigation and outdoor recreational purposes. Table 3-26 lists the amenities at each site and figure 3-17 depicts their locations.

Table 3-26. Existing Dominion Energy-operated project recreation sites within the Parr Project boundary (Source: Dominion Energy, 2018; as modified by staff).

Recreation Site	Parking Spaces	Boat Ramps	Boat Docks	Trail Length (miles)	Amenities/ Activities
Monticello Reservoir					
Scenic Overlook	100	-	1	1	Picnicking, camping, swimming, fishing, restrooms, barrier free amenities, shelters
Highway 215	30	2	1	-	Picnicking, fishing
Highway 99 West	80	3	1	-	Picnicking, camping, fishing, restrooms
Recreation Lake Access Area	105	1	-	0.3	Picnicking, swimming, fishing, restrooms, barrier-free amenities
Total	315	6	3	1.3	
Parr Reservoir					
Cannon's Creek	30	1	-	-	Picnicking, camping, fishing, restrooms
Heller's Creek	25	1	-	-	Picnicking, camping, fishing, restrooms
Total	55	2	0	0	

Non-Project Recreation Sites

In addition to the project recreation sites, there are three informal recreation sites at the project: the Highway 99 East Recreation Site, the Enoree River Bridge Recreation Site, and the Highway 34 Recreation Site. Also, Fairfield County leases property within the project boundary and manages Lake Monticello Park, a multiple-use recreational area adjacent to the Scenic Overlook site. The area includes a baseball field, tennis courts, basketball courts, a walking trail, and picnic facilities. South Carolina DNR maintains two areas for public waterfowl hunting access within the project boundary adjacent to the Parr Reservoir: Broad River WMA and Enoree River WMA.

Dominion Energy also allows passive[207] public recreation use of all islands in Monticello Reservoir, and those islands in Parr Reservoir that are owned by Dominion Energy. Overnight camping is allowed on islands within Monticello Reservoir. Hunting is allowed on islands and shoals at both reservoirs in accordance with state hunting regulations.

Forest Service Lands

The Parr Project includes 162 acres of lands within the Sumter National Forest that are administered by the Forest Service. Dominion Energy maintains flowage rights on Forest Service lands along the Broad and Enoree Rivers within the Parr Project boundary, which includes segments of the Broad River and Enoree River WMAs. The Enoree River Bridge Recreation Site, primarily on Forest Service land in Newberry County, provides paddlers and other recreationists access to project waters through a primitive boat ramp. Access to this site is provided by a naturally-surfaced access road.

[207] Passive recreation use can be defined as recreation activities that are generally non-consumptive in nature, require a minimum of facilities, and/or have a minimal environmental impact, such as walking and canoeing.

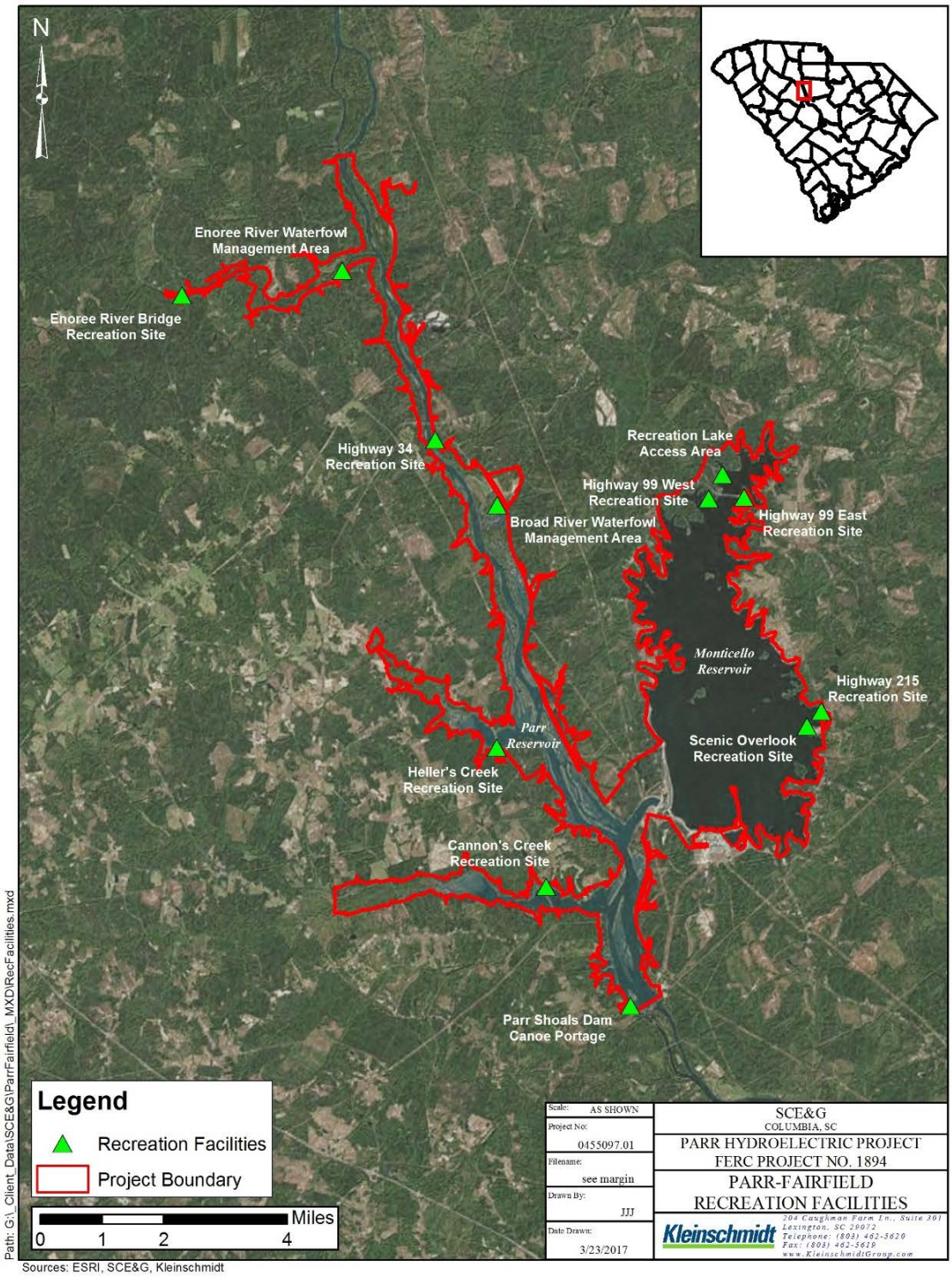

Figure 3-17. Recreation areas at the Parr Project (Source: Dominion Energy, 2018b).

Recreational Use

Kleinschmidt (2016d) conducted a recreation use study at the project during the 2015 and 2016 recreation seasons. The 2015 study was conducted from April 1 through Labor Day, while the 2016 season captured data for February and March. The consultant inventoried existing project recreation facilities, identified patterns of recreation use, user needs and preferences at each site, and estimated future recreational use and needs at the project for a new license term. The study employed exit interviews, mail-in surveys and spot counts. All project recreation sites, the two WMAs (Broad River and Enoree River), and three informal recreation areas (Highway 99 fishing area, Highway 34 primitive ramp, and Enoree River Bridge access area) were included. 454 surveys were completed on Monticello Reservoir, and 227 were completed on Parr Reservoir.

The sites were reported to be in good to very good condition at both impoundments. However, site conditions, use levels, and desired improvements differed between the two reservoirs.

Monticello Development

Surveys were administered at the Scenic Overlook site, the Highway 215 boat ramp, the Highway 99 boat ramp, the Recreation Lake access area, and the Highway 99 informal fishing area (Kleinschmidt, 2016d). Visitors indicated a variety of reasons why they chose to recreate on Monticello Reservoir, with most noting that they chose it due to its proximity to their home, or because it provided good fishing opportunities. Respondents interviewed at Monticello Reservoir sites were primarily from a four-county area (Fairfield, Newberry, Lexington, and Richland). Study results indicate that the Monticello Reservoir sites provided an estimated 126,525 recreation days during the 2015 recreation season.[208] Monticello Reservoir was shown to support significant recreational use during the early crappie fishing season in 2016 (February 1 through March 31) with an estimated 26,895 recreation days during February 1 through March 31.

Study results indicate that recreation sites on Monticello Reservoir received the most use on weekends, with the Scenic Overlook Recreation Site receiving the most use. Boat fishing was the most popular activity observed at Monticello Reservoir, followed by bank and pier fishing. Density estimates for Monticello Reservoir sites indicated that some sites may be used at rates approaching or at capacity during peak periods. Overall, perceptions of crowding at Monticello Reservoir sites were low to moderate and site

[208] A recreation day is one visit by a person to a development for purposes of recreation during any 24-hour period.

conditions were rated very high. Restrooms were indicated as being the most needed additional facility at Monticello Reservoir. Other facility and amenity recommendations included additional picnic tables, shelters, lighting, and fishing piers or docks. No Monticello Reservoir recreation site received below a 4 condition rating.[209]

Parr Development

Surveys were administered at Cannon's Creek and Heller's Creek public access areas, the Highway 34 primitive ramp, the Broad River and Enoree River WMAs, and the Enoree Bridge informal access area (Kleinschmidt, 2016d). Respondents interviewed at Parr Reservoir sites were also primarily local, with a large representation from Newberry County (over 75 percent). Most Parr Reservoir respondents noted that they chose to recreate there because it provided good fishing or boating opportunities. Study results indicate that the Parr Reservoir sites provided an estimated 26,184 recreation days during the 2015 recreation season.

Study results at Parr Reservoir indicated that Cannon's Creek Recreation Site receives the greatest amount of use. Most of the use at Parr Reservoir occurs on weekdays. The predominant activity on Parr Reservoir was boat fishing at 75 percent, followed by bank fishing at 12 percent. Density estimates calculated for the Cannon's and Heller's Creek Recreation Sites suggest that these areas are consistently being used below their design capacities and can accommodate additional use, with the exception of peak hours during the occasional weekend day. This was also reflected in the low to moderate crowdedness ratings for these sites. Additional boat launching or docking facilities were some of the most requested additional facilities, along with lighting and additional restrooms. No Parr Reservoir recreation site received below a 3.81 condition rating.

A second goal of the recreation use study was to characterize existing use of the WMAs within the project boundary and project recreation lands by waterfowl hunters during designated hunting seasons. Results from surveys distributed on vehicles parked at Monticello Reservoir recreation sites during Canada Geese hunting season indicated that the majority of hunters are local residents who prefer to hunt on Saturday mornings. Waterfowl focus groups were also conducted by Dominion Energy and attendees noted that they prefer to hunt during weekday mornings, as there are fewer hunters on Parr Reservoir during those days. The Broad River WMA is used mostly on weekend mornings and does not become crowded due to its draw-hunt, or lottery-type nature. The Enoree River WMA is well-used and can become crowded at times (Kleinschmidt, 2016d).

[209] On a scale of 1 to 5 where 1 is poor and 5 is excellent.

Future Recreation Use

The population of the 4-county area (Fairfield, Lexington, Newberry, and Richland) is projected to increase by 4.5 percent from 2015 to 2020, 4.58 percent by 2025, 4.41 percent by 2030, and 7 percent between 2040 and 2050. Lexington County is projected to have the fastest population growth of the area, at an average of 6.3 percent through 2030. Fairfield County's projected population growth for the same year range is 0.5 percent.

Overall recreation use at the project is forecasted to increase by 12.4 percent between 2015 and 2050. Future recreational use is projected to be approximately 208,207 recreation days in 2050 (table 3-27). The State Comprehensive Outdoor Recreation Plan for South Carolina (South Carolina DPRT, 2019) includes two relevant strategies for future use: (1) prioritizing projects that adapt existing recreational facilities to meet the needs of changing population demographics; and (2) prioritizing projects that address over-capacity issues by establishing new parks or recreation areas, or by expanding existing parks or recreation areas.

On Monticello Reservoir, the Highway 99 informal fishing area was shown to approach capacity on weekend days, and the Highway 215 boat ramp potentially exceeded capacities during peak hours on some weekend days. On Parr Reservoir, no sites were nearing capacity.

Table 3-27. Estimated annual recreational use (recreation visits) between 2020 and 2050 (Source: Dominion Energy, 2018; as modified by staff).

Reservoir	**2020**	**2030**	**2040**	**2050**
Monticello	132,213	144,365	157,810	172,507
Parr[a]	27,361	29,876	32,658	35,700
Total	159,574	174,241	190,468	208,207

[a] Includes the broad River and Enoree River WMAs

Land Use

Newberry and Fairfield Counties are predominately rural, consisting of forest and grassland areas. Land uses within these counties are specified in table 3-28, below. The largest urban development and closest city to the project is the City of Newberry, which is the county seat of Newberry County. Newberry is located along the I-26 corridor connecting the Columbia metropolitan area and the Greenville-Spartanburg metropolitan area. The City of Newberry is surrounded by forested and agricultural land to the west and south. In Newberry, parks and open space is the predominant land use type at 30.6 percent; single-family residential land use is the second predominant land use type at 29.3 percent, followed by public and institutional land use at 14.4 percent.

Table 3-28. Land uses in Newberry and Fairfield Counties (Source: Dominion Energy, 2018; as modified by staff).

Land Use	Square Miles	Percent
Forestland	921.32	67.87
Grasslands	250.63	18.46
Open Space	57.18	4.21
Open Water	47.26	3.48
Wetlands	37.56	2.76
Barren Land	18.35	1.35
Developed	14.11	1.039
Shrub/Scrub	10.78	0.79
Agriculture	0.19	0.01
Total	1357.36	100

Project operations, maintenance, and recreation are the primary activities on project lands. The land cover types within the project boundary consist mostly of open water, wooded wetlands and evergreen forest. Lands adjacent to the project boundary are dominated by forestland, deciduous forest and grassland types. Only a small percentage of lands within the project vicinity are developed. Private development is restricted on some lands to protect important habitat and aesthetic values. Protected lands total 2,131 acres around the Parr Reservoir and 151 acres around the Monticello Reservoir.

In addition to these land uses, a non-project, Commission-approved sand mining operation[210] is located on the Parr Reservoir, on the Fairfield County side of the Broad River, just downstream of Highway 34. The Blair Sand Mine is located on property owned by Dominion Energy. Since 2008, Newberry Sand, Inc. has dredged a 3,000-foot segment of the Broad River, within the project boundary, to extract sand that is screened and stockpiled at the mine. Sand mining facilities occupy 3.3 acres within the project boundary.

Shoreline Management

Dominion Energy manages the shoreline of Monticello and Parr Reservoirs in accordance with its existing SMP. This plan was developed in response to the existing license's requirement to protect shoreline lands (articles 20 and 48). The most recent SMP was approved by the Commission in 2001. The SMP primarily addresses activities associated with the more-developed Monticello Reservoir. The existing SMP addresses private boat dock requirements, nuclear exclusion zone restrictions, public access and recreation, access path construction, vegetation removal, water withdrawal, erosion control, and prohibited activities.

[210] Order issued December 12, 2019. *See* 169 FERC ¶ 62,146 (2019).

3.3.5.2 Environmental Effects

Project Recreation

Dominion Energy proposes to implement improvements to existing project recreation sites, and proposes to develop new project recreation sites, as detailed in its final RMP, filed as part of the Settlement Agreement, and summarized in table 3-29. Implementation of the RMP is required by Condition 1a of the Settlement Agreement.

The plan includes provisions to develop four new project recreation sites. The Highway 99 East Recreation Site would be located on Monticello Reservoir. Three new sites would be located on Parr Reservoir: (1) the Parr Shoals Dam canoe portage; (2) the Highway 34 Recreation Site; and (3) the Enoree River Bridge Recreation Site. The total number of project recreation sites would increase from six to ten. The RMP provides for the continued operation and maintenance of the existing and proposed project recreation sites.

Table 3-29. Proposed improvements and schedule for the Parr Project recreation sites (Source: Dominion Energy, 2018).

Recreation Site	Measures[a]
Parr Reservoir	
Cannon's Creek Recreation Site (existing site; to be completed within 4 years of license issuance)	Install one fishing pier Install one courtesy dock Install two additional lights, one near road, and one near restroom Pave two barrier free parking spaces and access paths, upgrade restroom Install at least one interpretive display on cultural and historic resources Bring 4.43 acres of land into the project boundary
Heller's Creek Recreation Site (existing site)	No proposed enhancements
Parr Shoals Dam Canoe Portage (proposed new site; to be completed upon license issuance)	Formalize this experimental canoe portage Bring 0.11 acre of land into the project boundary
Highway 34 Recreation Site (proposed new site; to be completed within 2 years of license issuance)	Improve boat ramp with geogrid, and stabilize bank Grade and add gravel to improve parking area Remove large trees that hinder vehicle access to ramp Install recreation sign on Highway 34

Recreation Site	Measures[a]
	Bring 18.13 acres of land into the project boundary
Enoree River Bridge Recreation Site (proposed new site; to be completed within 2 years of license issuance, dependent upon Forest Service approval)	Build canoe/kayak step down access Install recreation sign on Maybinton Road
Monticello Reservoir	
Scenic Overlook Recreation Site (existing site; to be completed within 10 years of license issuance)	Add one light at existing fishing pier Modify existing fishing pier for barrier free use, pave two barrier free parking spaces and access paths to fishing pier Construct a barrier free shelter with one barrier free picnic table, pave one barrier free parking space and access path to new barrier free shelter Pave one barrier free parking space and access path
Highway 215 Recreation Area (existing site; enhancement completed)	Install at least one interpretive display on cultural and historic resources of the project area
Highway 99 West Recreation Site (existing site; to be completed within 6 years of license issuance)	Add one fishing pier Improve boat ramp in cove Change two existing lights from standard to flood-type lights Pave access paths or build ramps and platforms to courtesy dock, fishing pier, and restrooms; convert four existing parking spaces into two barrier free parking spaces Modify restrooms to allow year-round access
Recreation Lake Access Area (existing site; to be completed within 6 years of license issuance)	Install one courtesy dock
Highway 99 East Recreation Site (proposed new site; to be completed within 8 years of license issuance)	Add one fishing pier Add two benches Add two picnic tables Add two lights, one for fishing area, and one for parking area

[a] Dominion Energy's measures also include monitoring and routine maintenance.

Forest Service 4(e) Condition 17 requires Dominion Energy to consult and receive Forest Service approval before erecting any public safety-related signs on national forest system lands. Dominion Energy would also be required to maintain any such signs to Forest Service standards.

Our Analysis

The recreation measures described in Dominion Energy's RMP would enhance recreation by: (1) adding a shelter, fishing piers and boat docks; (2) upgrading restroom facilities; (3) upgrading access paths to fishing piers and docks; (4); installing signs, including signs to notify visitors of historic and cultural resources; and (5) adding benches and picnic tables. The number of project recreation facilities would increase from six to ten facilities. Moreover, Dominion Energy's proposed recreation measures would: (1) help meet a need for protecting natural resources; (2) preserve existing high-quality outdoor recreation opportunities; and (3) meet a need for future recreational use and demand.

Constructing the new project recreation facilities (i.e., the Parr Shoals Dam canoe portage, the Highway 34 Recreation Site, the Enoree River Bridge Recreation Site, and the Highway 99 East Recreation Site) would allow for increased boat and bank fishing access to Monticello and Parr Reservoirs, add more picnicking and passive recreation opportunities, and increase canoeing and kayaking opportunities at the project. Most of these opportunities were requested during the relicensing process. The recreation study report showed that some sites were at or nearing capacity. There are, however, alternative sites in the vicinity that provide similar amenities with lower density ratings. Adding the proposed sites will assist in dispersing use.

The new project recreation facilities would help to absorb a portion of the forecasted increase in recreation use. As part of the RMP, in consultation with stakeholders, Dominion Energy proposes to conduct recreation assessments during the term of a new license. The first assessment would be conducted approximately 12 years after a new license would be issued. Depending on the term of a new license, Dominion Energy would complete one or two additional recreation assessments, approximately 10 and 20 years after the conclusion of the first recreation assessment. Conducting the proposed recreation assessments would allow Dominion Energy and the stakeholders to assess recreation use, facility conditions, and user preferences. Based on the findings of the recreation assessments, Dominion Energy, with input from stakeholders, would revise the RMP, as necessary, and submit RMP amendments for Commission approval.

Construction of the proposed recreation facilities and enhancements could cause temporary disturbances in the form of construction-related noise and limited recreation access at the project recreation facilities. Construction would be limited to the direct project recreation facility areas. Dominion Energy proposes a ten-year staggered

construction timetable for the enhancements, which was developed in consultation with stakeholders. Using a staggered construction timeline would reduce construction-related effects on recreation use. As discussed in section 3.3.1, *Geologic and Soil Resources*, a measure to annually monitor erosion downstream of the proposed Parr Shoals Dam canoe portage would assist in tracking changes in downstream shoreline erosion over time and making prompt repairs should erosion affect use of the canoe portage.

Forest Service 4(e) Condition 17 requires Dominion Energy to place recreation-related safety signage on lands managed by the Forest Service. In addition to this requirement, Part 8 of the Commission's regulations require licensees to erect signs at recreational public access points required by a license.[211] Part 12 of the Commission's regulations give the Regional Engineer the authority to require public safety-related devices, including signs, at recreation areas to restrict public access and/or warn the public of dangers at hydroelectric projects.[212] Together, Forest Service 4(e) Condition 17 and Commission regulations at Part 8 and 12 would ensure that the licensee installs adequate signage to protect the public when using project recreation sites.

In the Commission's environmental assessment[213] for the approved Blair Sand Mine facility, it was noted that navigability is not affected by the presence of the dredging equipment, and that angling and boating opportunities are unlikely to be hindered by the presence of the sand mining operation.

Keitts Bridge Recreation Measures [4(e) Condition]

Dominion Energy proposes to construct a non-motorized canoe/kayak step-down facility at Keitts Bridge and formalize this site as the Enoree River Bridge Recreation Site as part of its RMP, required by Condition 1a of the Settlement Agreement.

Forest Service 4(e) Condition 23 requires Dominion Energy to develop, in consultation with the Forest Service, a vehicle turn-around with parking area for six vehicles and a non-motorized canoe/kayak step down facility at Keitts Bridge, which is located within the Forest Service's Enoree River Bridge Recreation Area. As part of Forest Service 4(e) Condition 23, Dominion Energy would be required to: (1) coordinate with the Forest Service to determine the location of flowage easements relative to the improvements; (2) prepare detailed construction plans and specifications for the improvements; (3) prepare and submit a biological evaluation regarding the potential impacts of facility development on affected special status species; and (4) prepare and submit an archaeological evaluation to minimize or avoid adverse effects to cultural sites.

[211] 18 C.F.R. § 8.1 (2019).
[212] 18 C.F.R. § 12.42 (2019).
[213] Issued December 12, 2019.

Our Analysis

Dominion Energy proposes, as part of its RMP, to construct a canoe/kayak step-down facility at Keitts Bridge (as part of the proposed Enoree River Bridge Recreation Site) but does not propose the vehicle turn-around with a parking area for six vehicles, or the hardened path from the parking area to the step-down location. The recreation use study found this area to be utilized by waterfowl focus group attendees. The only existing amenity at this location is an unimproved bank area used to access the Enoree River. Adding the canoe/kayak step-down facility would allow for easier non-motorized access to the Enoree River. As discussed previously, the new canoe/kayak step down facility would be located within the project boundary at the Enoree Bridge Recreation Site and operated and maintained by Dominion Energy.

While the additional facilities required by Forest Service 4(e) Condition 23 (e.g., roadway and parking improvements) would allow for improved access to this site, they are not consistent with the low levels of use and remote nature of the site. Less intensive development, like roadside parking and a natural surface access path would be less intensive (i.e., construction would disturb and displace less habitat), less costly and more consistent with the existing and expected use of the site for waterfowl hunting and wildlife viewing.

Recreational Flows

During consultation, stakeholders expressed concern over the recreation navigability of the Broad River downstream of Parr Shoals Dam. Dominion Energy conducted a downstream navigational flow assessment, where the two most constricted points (known as ledge 1 and ledge 2) of the Broad River downstream of Parr Shoals Dam were evaluated according to the state issued navigation recommendations. The results of the assessment suggested that a flow of 1,000 cfs is necessary to meet state navigation criteria at both constriction points. These results were considered along with the results of the IFIM Study (discussed above, in section 3.3.2, *Aquatic Resources*) in developing a minimum flow recommendation for the new license. The stakeholders determined that the proposed downstream minimum flows would likely cover the lower ranges of flows, which would be ideal for activities such as wade-fishing. Condition 2b of the Settlement Agreement specifies minimum flows needed for one-way (downstream) navigation in the Broad River as part of the Minimum Flows AMP.

Our Analysis

The project is proposed to be operated in a modified run-of-river mode, and it is infeasible for Dominion Energy to provide high recreation flows during the peak recreation season. As described in section 3.3.2.2, *Minimum Flows Downstream for Parr Development,* Dominion Energy proposes minimum flows downstream of the Parr

Development, as part of the Minimum Flows AMP. This plan provides for minimum flows of at least 1,000 cfs (and up to 2,300 cfs), unless net inflow upstream of the project is less than 1,000 cfs. Minimum flow requirements vary seasonally, with the low flow period lasting from June 1-November 30 (target of 1,000 cfs or inflow); the transitional flow period lasting from December 1-January 31 and May 1-May 31 (target of 1,500 cfs or inflow); and the high flow period lasting from February 1-April 30 (target of 2,300 cfs or inflow). The Minimum Flows AMP allows for deviations from these flows, but any deviations would be short-term.

The proposed minimum flow regime would provide improved flows for recreation over conditions under the existing license, which requires a minimum flow release into the Broad River of 1,000 cfs or inflow during March, April, and May and a minimum flow of 150 cfs and a minimum daily average flow of 800 cfs or inflow for the remainder of the year. The proposed downstream minimum flows would provide flows necessary to pass a 14-foot Jon-boat, canoes, and kayaks at ledges 1 and 2, unless net inflow upstream of the project is less than 1,000 cfs. Therefore, existing downstream recreational and navigational flow opportunities would be either unaffected or improved under the proposed minimum flows.

Future Recreation Areas

Dominion Energy has reserved 933 acres of undeveloped land within the project boundary for future recreation development. Further, 2,131 acres around the Parr Development and 151 acres around the Monticello Reservoir have been held within the project boundary as non-development areas (shown below, in figures 3-18 and 3-19), which are available for passive public recreational use. Retention of these lands is required by Conditions 5a and 5b of the Settlement Agreement.

Our Analysis

Continuing to reserve the designated areas for future recreation development would allow for growth in quality recreation opportunities to occur in the future at a pace with growth in population. These areas could help disperse future use, and ease potential crowdedness at existing recreation areas resulting from projected increases in recreation use. Continuing to reserve the non-development areas would allow for passive recreation to occur, which would help to alleviate potential high use from the project recreation areas. These lands would also help protect the environmental and aesthetic integrity of the shoreline.

Shoreline Management

The existing SMP primarily covers activities on Monticello Reservoir and its shoreline. Under a new license, Dominion Energy proposes two new SMPs, one for

Monticello Reservoir and another for Parr Reservoir. Conditions 5a and 5b of the Settlement agreement require implementation of the SMPs.

The proposed SMP for each reservoir was developed in consultation with stakeholders. Each SMP identifies existing and appropriate future uses and provides directions for responsible future use and management of project lands and waters, as well as associated natural resources. Also, each SMP includes detailed descriptions, management prescriptions and mapping of land classifications, summary information on the permitting handbook and fee policies, BMPs, public education and outreach functions, reservoir monitoring protocols, and a review process. Both SMPs have stipulations for vegetation management on the reservoirs. Table 3-30 lists the land management classifications, shoreline miles and acreages for each reservoir.

Table 3-30. Shoreline miles and acreages by land use classification (Source: Dominion Energy; as modified by staff, 2019).

Classification	Shoreline Miles	Acres
Monticello		
Project operations	4.90	186
Nuclear exclusion zone (NEZ)	6.43	203
Shoreline permitting	22.36	235
Public recreation	19.49*	927*
Non-development areas	10.72	151
Total	**63.90**	**1,701**
Parr		
Project operations	0.90	10
Public recreation	6.97	857
Non-development areas	67.05	2,131
Total	**74.91**	**2,998**

* Includes the shoreline surrounding the Recreation Lake and all islands.

As components of the SMPs, Dominion Energy developed shoreline management and permitting handbooks to address specific requirements for construction, maintenance, shoreline stabilization, docks, lake access pathways, and other shoreline activities, including hunting and water withdrawals. The handbooks describe the consultation and/or permits required for non-project development within the project boundary. Dominion Energy conducts periodic surveys of the Monticello Reservoir shoreline to inventory and inspect docks, access paths, and shoreline erosion control structures/projects.

Monticello Development

The proposed Monticello SMP has five distinct land management classifications: Project Operations, Nuclear Exclusion Zone, Shoreline Permitting; Public Recreation, and Non-Development Areas (figure 3-18). Project Operations lands include Dominion-owned and managed lands required for operation of the Fairfield Development. The Nuclear Exclusion Zone is a defined area surrounding the V.C. Summer Nuclear Station, which is located on the shoreline of Monticello Reservoir. Dominion Energy has responsibility and authority to control all activities within this zone and has the absolute right to exclude or remove persons and property. Shoreline Permitting lands may be eligible for certain private residential uses, such as vegetation management of access paths, upon approval by Dominion Energy. Public Recreation lands includes lands managed for public recreation and lands set aside for future recreation development. Last, Non-Development Areas are protected from development to preserve environmental resources and aesthetic values.

Docks are permitted in the shoreline permitting areas only. Access path construction, and other shoreline activities, including water withdrawals are allowed by permit on Monticello Reservoir. Hunting may be allowed on specific Public Recreation lands in accordance with state hunting regulations.

Parr Development

The proposed Parr SMP has three land management classifications, including Project Operations, Public Recreation, and Non-development Areas (figure 3-19). No docks are allowed on the Parr Reservoir. Reservoir access paths are allowed by permit on the Parr Reservoir. Other shoreline activities, including water withdrawal for non-commercial agricultural/landscaping irrigation purposes are allowed by permit on Parr Reservoir. Hunting may be allowed on specific Public Recreation lands in accordance with state hunting regulations.

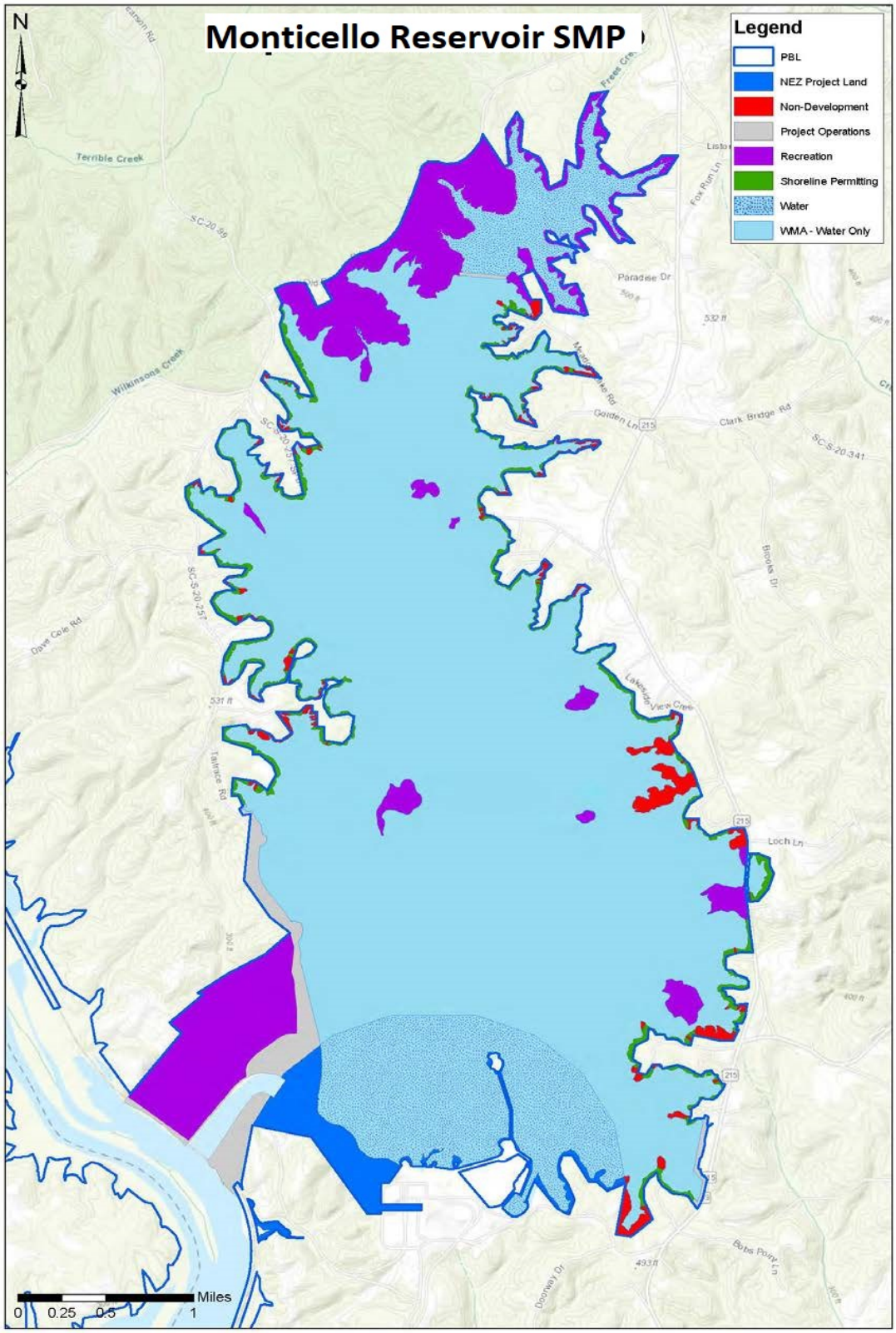

Figure 3-18. Monticello Reservoir shoreline land use classifications (Source: Dominion Energy, 2018b).

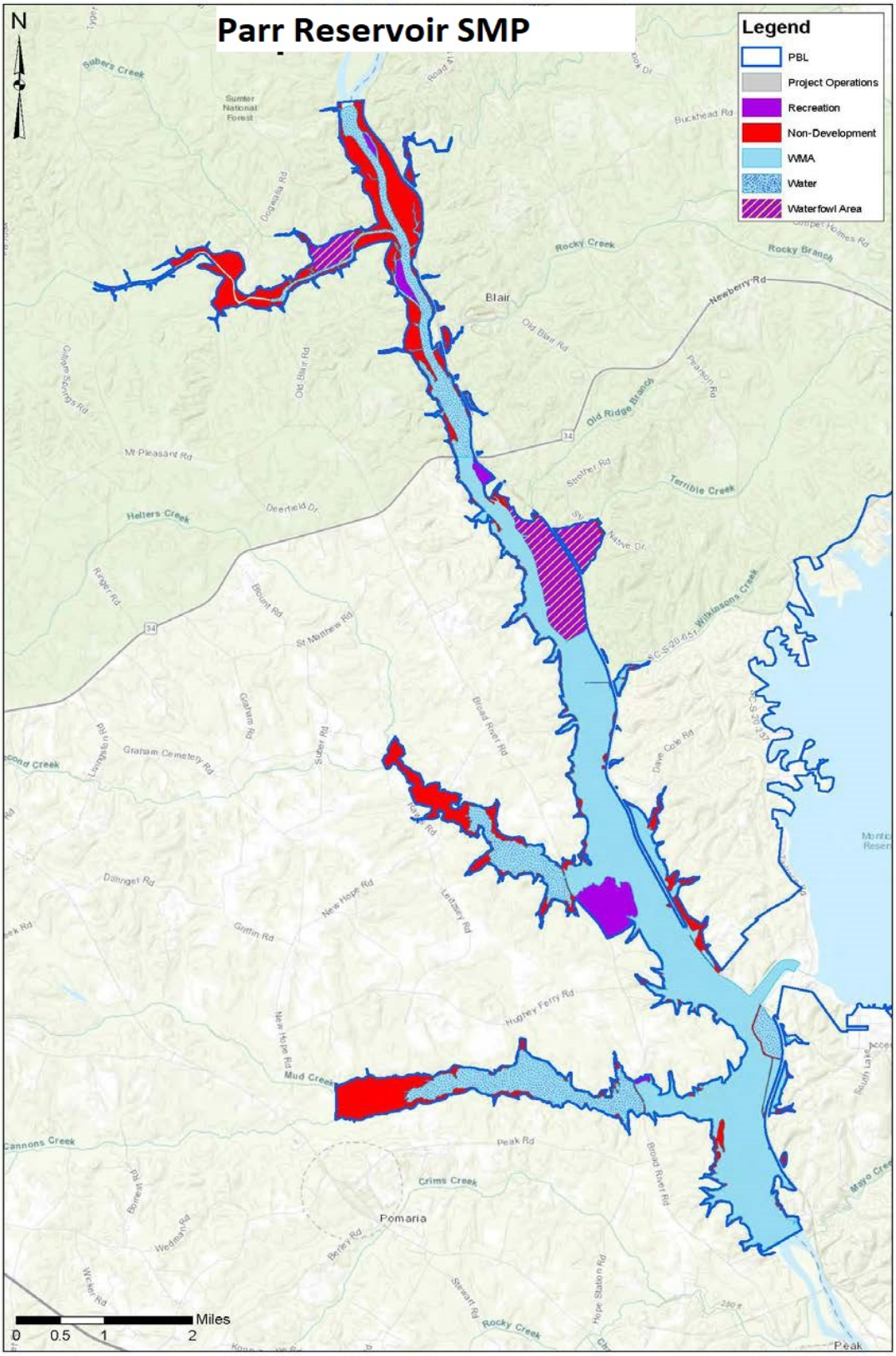

Figure 3-19. Parr Reservoir shoreline land use classifications (Source: Dominion Energy, 2018b).

Our Analysis

Implementing the proposed SMPs would allow Dominion Energy to continue to balance residential development with maintaining areas for natural resource protection and recreation at the project by specifying the requirements for certain activities and structures. The SMPs would help to protect water quality, aquatic habitat, recreation, cultural and aesthetic resources at the Parr Project by specifying permitted activities and structures, as well as prohibited activities and structures. The SMPs each provide for the protection of lands within the project boundary because they may provide important habitat or aesthetic values. These non-development areas are available for passive public recreational use only. Dominion Energy would not permit private shoreline development for project lands classified as non-development areas. Dominion Energy proposes continued management of timber in each SMP, in accordance with South Carolina Forestry best management practices, as discussed in section 3.3.3.1, *Terrestrial Resources – Affected Environment*.

Under the SMPs, Dominion Energy would continue monitoring project lands on a 10-year interval cycle by comparing GIS layers over time to ensure that no unauthorized uses occur within the project boundary, and to resolve any issues that may arise with respect to unauthorized structures. Dominion Energy would also review the plans every 10 years to determine their adequacy and the need for potential amendments. Dominion Energy would also report on changes in land use for the various land management classifications. The 10-year update period would allow Dominion Energy, in consultation with stakeholders, to continue to specify land use within the project boundary, provide time for development to occur in a staggered manner consistent with the plan, and deliberately assess new issues that arise as a result of development. Procedures to conduct public outreach and update the permitting handbook, as proposed, would help to ensure that residents and property owners are aware of any proposed changes to the shoreline permitting process.

Dominion Energy proposes to conduct periodic monitoring of the Monticello Reservoir shoreline to inventory and inspect docks, access paths, and shoreline erosion control structures/projects, but does not provide a description how the monitoring would occur or the frequency of shoreline monitoring. At a minimum visually monitoring the shoreline on a quarterly basis (in March, June, September, and December) would help Dominion Energy detect unauthorized uses and structures within the project boundary in a timely manner, allowing for efficient resolution of permit violations on Monticello Reservoir.

Project Boundary Modification

As discussed in section 2.1.2, *Existing and Proposed Project Boundary*, the current project boundary encloses all project features and the six existing recreation

facilities around Monticello and Parr Reservoirs, but does not include all land necessary for the proposed recreation sites. The project boundary extends downstream to the base of Parr Shoals Dam. Dominion Energy proposes to modify the project boundary to accommodate the proposed and existing recreation sites. Lands within the project boundary would be managed in accordance with Dominion Energy's proposed SMPs. Project boundary modifications are proposed to allow for the inclusion of Cannon's Creek Recreation Site (4.43 acres) and the expansion of the Highway 34 Recreation Site (18.13 acres), and the Parr Shoals Dam canoe portage (0.11 acres).

Our Analysis

The proposed modifications to the Parr Project boundary are necessary to support recreation-related project purposes. Currently, the Cannon's Creek Recreation Site is not fully contained within the project boundary. The site is not proposed to be expanded; instead, the project boundary would be expanded to fully contain the recreation site.

The expansion of the Highway 34 Recreation Site would allow for future primitive camping opportunities, as identified by stakeholders during formulation of the RMP. The expansion would also cause the Commission-approved, non-project sand mine to be completely contained within the project boundary (figure 3-20). Use of project lands for sand mining was approved by the Commission on December 12, 2019. By designating the land on which the sand mine is located for future recreation, Dominion Energy would effectively restrict use of the land from other non-project uses in the future. Should sand mining operations cease, the lands underlying the sand mine would convert to recreational use, in accordance with the proposed SMP.

Figure 3-20. Highway 34 Recreation Site expansion and Blair Sand Mine lands (Source: Dominion Energy, 2018a).

3.3.6 Cultural Resources

3.3.6.1 Affected Environment

Section 106 of the NHPA requires that the Commission take into account the effects of its actions on historic properties and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking.[214] Historic properties are those that are listed or eligible for listing in the National Register. The regulations implementing Section 106 of the NHPA also require that the Commission seek concurrence with the SHPO on any finding involving effects or no effects on historic properties, and consult with interested Indian tribes or Native Hawaiian organizations that attach religious or cultural significance to historic properties that may be affected by an undertaking. In this document, we also use the term "cultural resources" for properties that have not been determined eligible for listing in the National Register. Cultural resources represent things, structures, places, or archaeological sites that can be either prehistoric or historic in origin. In most cases, cultural resources less than 50 years old are not considered historic.

Area of Potential Effects

Pursuant to section 106, the Commission must take into account whether any historic property could be affected by the issuance of a proposed license within a project's APE. The APE is determined in consultation with the SHPO and is defined as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist.[215] The APE for the project is defined as: (1) lands within the project boundary that include the Fairfield Pumped Storage Development, which impounds the 6,800-acre Monticello Reservoir (upper reservoir); and the Parr Development, which impounds the 4,400-acre Parr Reservoir (lower reservoir) on the Broad River between Henderson Island to the north and Hampton Island to the south; and (2) land around the powerhouses, dams, appurtenant facilities, and project recreation sites, including a 300-acre recreation sub-impoundment (Recreation Lake) at the north end of Monticello Reservoir created by an

[214] 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." 36 C.F.R. § 800.16(y). Here, the undertaking is the potential issuance of a new license for the Parr Project.

[215] 36 C.F.R. § 800.16(d).

earthen embankment. The South Carolina SHPO concurred with the APE, via a telephone conference of its Cultural Resources Work Group,[216] on February 25, 2016.[217]

Prehistoric and Historic Background

The prehistoric and historic background in South Carolina is generally divided among four stages, or periods. The primary periods are (a) Paleo-Indian (10,000 to 8,000 BC), (b) Archaic (8,000 to 1,000 BC), (c) Woodland (1,000 BC to AD 1000, and (d) Mississippian (AD 1000 to 1600).

The Paleo-Indian Period represents initial colonization, early hunting, and gathering. Population density was low during the Paleo-Indian Period, and social structure likely consisted of small mobile groups following a hunting and gathering subsistence pattern. The Archaic Period represents development of regional territories, a shift in hunting smaller prey (such as deer and turkey), gathering, and use of cultivated plants. The Woodland Period represents agricultural communities and development of pottery. The Mississippian Period is characterized by large villages, ceremonial mounds, and trade networks. Research has shown that each period or stage is marked by climate change and/or technological changes that are reflected in soils, pollen, and artifacts, including tools and pottery.

During the early eighteenth century, many of South Carolina's European immigrants initially settled in the state's low country. These coastal areas developed into structured societies with local governments and institutions such as courts, schools, and churches. Governor Robert Johnson's township program, which began in the 1730s , allowed immigrants to begin settling the midland section of the state. The program provided fifty acres of land for each family member, funding for food and transportation, and exemption from land rents for ten years.

The program sought to encourage population growth in an attempt to provide a buffer from Native American and Spanish incursion and to balance the increasing slave population. Eleven settlements formed between the Broad and Saluda Rivers including present day Newberry, Laurens, Union, and Spartanburg Counties. The area, which had once been hunting grounds for the Cherokee, enticed large numbers of settlers with its landscape rich in forests, hickory, oak, and pine trees. The newly formed townships were in a large part independent from the settlements of the low country, and the two populations only had occasional contact.

---

[216] Participating members included: Elizabeth M. Johnson, Deputy SHPO, Emily Dale, South Carolina Department of Archives and History; William Argentieri, Amy Bresnahan, Dominion Energy; Jim Bates, Forest Service; Bill Green, Nancy McReynolds, Terracon.

[217] Filed as privileged information on April 5, 2016.

The population of South Carolina doubled within a 30-year period during the early nineteenth century. Construction of a statewide railroad network was underway by the middle of the nineteenth century. During the late 1800s, hydropower development began in the United States. Construction of the Parr Shoals Dam began in 1912. On May 30, 1914, the Parr Shoals Dam and hydroelectric plant were officially commissioned and put into service. The Fairfield Development was permitted in September 1974 and all units were operational by December 1978.

Archaeological and Historic-era Properties

The first systematic archaeological investigation of the Parr Hydroelectric Project was conducted in 1972 by the South Carolina Institute of Archaeology and Anthropology (SCIAA). That investigation found 31 sites, including McMeekin Rockshelter (38FA41) and Blair Mound (38FA48). Both sites were subsequently listed in the National Register in 1974. McMeekin Rockshelter is a small rockshelter that was completely excavated by SCIAA and then subsequently inundated by the construction of Monticello Reservoir. Blair Mound, a mound and prehistoric lithic and ceramic scatter, was only partially excavated, but was subsequently impacted by construction of a duck pond (unrelated to the project). Human remains were found at Blair Mound during the 1972 excavations.

In May 2013, an Initial Historic and Archaeological Resources Study was submitted for review to the Commission, the South Carolina SHPO, the Forest Service, the Catawba Indian Nation, and the Eastern Band of Cherokee Indians. Based on the initial study recommendations, between August 13 and December 16, 2013, S&ME conducted an initial survey to determine the presence of cultural resources (Phase I survey) of approximately 3,375 acres in 70 different areas having a high potential for containing significant archaeological resources. A total of 57 new archaeological sites, 8 previously recorded sites, 32 isolated finds, and two above-ground historic resources were investigated. Of these resources, Lyles Ford (38FA592/38NE16) and the Parr Development Facility (Structure 39-0081) were recommended as being eligible for the National Register, and 11 archaeological sites were recommended for additional work to determine their National Register status (38FA568, 38FA569, 38FA571, 38NE8, 38NE10, 38NE1068, 38NE1077, 38NE1079, 38NE1080, 38NE1082, and 38NE1085).

These sites consist of a possible 18th/19th century canal, artifact scatters,[218] lithic and ceramic scatters, a cemetery, camps, a historic house site, and habitation sites. Sites 38FA568 (historic canal), 38FA569 (prehistoric lithic and ceramic scatter), 38FA571 (prehistoric quarry; historic artifact scatter), 38NE1068 (prehistoric lithic scatter; 19th/20th century cemetery), 38NE1077 (Late Archaic camp; historic house site), 38NE1079 (Middle Woodland—Mississippian habitation site), 38NE1080 (Middle-Late Archaic habitation site), 38NE1082 (Middle Woodland lithic and ceramic scatter), and 38NE1085

[218] A group of artifacts within a specified area.

(Late Archaic—Mississippian camp) are not experiencing any project related effects, and the final HPMP states that nothing currently needs to be done to protect these resources, and this undertaking. The Fairfield Pumped Storage Facility (Structure 39-0082) was recommended to be eligible for inclusion in the National Register in 2028 when it reached 50 years of age. The remaining sites and isolated finds were recommended as being ineligible for the National Register. The SHPO concurred with these recommendations in a letter dated July 29, 2014.

In January of 2016, Terracon Consultants, Inc. (Terracon) conducted additional surveys to determine the National Register eligibility (Phase II Survey) of archaeological sites 38NE8 (Middle Archaic to Late Woodland Camp) and 38NE10 (Middle Woodland Camp), two of the three significant sites being affected by project operations. These sites were previously identified by the SCIAA in 1972, during construction of the Fairfield Development. Neither site was assessed for National Register eligibility during that time. Site 38NE8 was determined to be eligible, whereas site 38NE10 was determined to be ineligible, due to a lack of site integrity.

Site 38NE8 is an Early Archaic through Mississippian period seasonal camp that could contribute to the prehistoric knowledge of the Broad River watershed. The site was determined to be eligible for inclusion in the National Register under Criterion D[219] because of the density and variety of artifacts found at the site and the presence of two possible Middle Archaic features. The investigation noted that site 38NE8 was experiencing some erosion, and mitigation or stabilization measures were recommended for the site.

Lyle's Ford (38FA592/38NE16) was also being affected by project operations. Its location in the Broad River, however, precluded any further archaeological investigation. Multiple historic maps and aerial photographs were reexamined during the Phase II study. This site was ultimately determined to be ineligible, because of doubts that the site was the actual location of Lyle's Ford.

The Parr Development Facility was evaluated in 2013 by S&ME and was found to be eligible for the National Register under Criterion A,[220] because of its significance to hydroelectric development in South Carolina and the increased power demand in the midlands in the early 1900s. It was also found to be eligible for the National Register

[219] Criterion D is used in assessing sites or objects that have yielded, or may be likely to yield, information important in history or prehistory.

[220] Criterion A is used in assessing events that have made a significant contribution to the broad patterns of history.

under Criterion C,[221] because of the powerhouse architecture and dam and hydroelectric engineering components. Although the facility is not actively impacted by project operations, there is still a potential for adverse effects during the term of the license.

The Fairfield Pumped Storage Facility was identified in 2013 by S&ME as being eligible for listing in the National Register once it reaches the 50-year age threshold. In 2028, once the Fairfield Pumped Storage Facility reaches 50 years of age, it will also become eligible for the National Register under Criterion A, because of its importance to power consumption and growth in the midlands of South Carolina during the 1970s, and Criterion C, for its pumped storage engineering components. S&ME recommended that in the case that adverse effects occur after 2028, the facility should be reevaluated for National Register eligibility.

3.3.6.2 Environmental Effects

Project-related effects on cultural resources within the APE can result from modifications to project facilities or project operations; project-related ground-disturbing activities; construction, modification, or maintenance of project recreation facilities and use of such facilities by visitors; project-induced shoreline erosion;[222] and vandalism. Dominion Energy does not propose to modify project operation, with the exception that minimum flows released from Parr Shoals Dam will be increased as described in the Settlement Agreement. In addition, Dominion Energy's proposed Flow Fluctuations AMP may result in reduced daily fluctuations in flows downstream of the Parr Shoals Dam. To avoid, minimize, or mitigate for adverse effects on historic properties that may be affected by relicensing the project, Dominion Energy proposes to implement an HPMP which directs the management of historic properties within the project's APE. The HPMP was developed in consultation with the Commission, the South Carolina SHPO, Forest Service, the Catawba Indian Nation, and the United Keetoowah Band of Cherokee Indians. The Muscogee (Creek) Nation and the Seminole Indian Tribe of Florida were contacted and requested to be notified if cultural resources are found. The SHPO reviewed the draft HPMP and filed comments on September 27, 2016. The Commission issued comments on the draft HPMP, on October 11, 2016. Dominion

[221] Criterion C is used in assessing the distinctive characteristics of a type, period, or method of construction, or representing the work of a master, or possessing high artistic values, or representing a significant and distinguishable entity whose components may lack individual distinction.

[222] Project-induced shoreline erosion does not include shoreline erosion attributable to flood flows or phenomena, such as wind-driven wave action, erodible soils, and loss of vegetation due to natural causes.

Energy filed the final HPMP on January 10, 2017. Implementation of the HPMP is required by Condition 6a of the Settlement Agreement.

The HPMP would address the following items: (1) potential effects on historic properties resulting from the continued operation and maintenance of the project; (2) management and treatment measures, including monitoring, for 13 archeological sites, as well as the two potentially historically significant buildings and structures of the Parr Shoals and Fairfield Developments, as specified above, and stabilization/mitigation measures for Site 38NE8;[223] (3) procedures for the review of proposed future ground-disturbing activities or other activities within the project's APE which would have the potential to adversely affect historic properties; (4) protection of historic properties threatened by direct or indirect project-related activities, including routine project maintenance; (5) resolution of unavoidable adverse effects on historic properties; (6) treatment and disposition of any human remains that may be discovered within the project's APE; (7) provisions for unanticipated discoveries of previously unidentified cultural resources within the project's APE; (8) a dispute resolution process; (9) a list of categorical exclusions from further review of effects; (10) a schedule for implementing the HPMP; (11) roles and responsibilities for the licensee, the South Carolina SHPO, THPOs, and other individuals and organizations in regards to implementation of the HPMP; and (12) coordination with the South Carolina SHPO, Forest Service, the Chickasaw Nation, the Choctaw Nation of Oklahoma, the Jena Band of Choctaw Indians, the Muscogee (Creek) Nation, the Seminole Indian Tribe of Florida, the Catawba Indian Nation, the United Keetowah Band of Cherokee Indians, the Commission, and other consulting parties during implementation of the HPMP.

Our Analysis

Relicensing the project, with the proposed HPMP, with measures for continued use and maintenance of historic properties and treatment of historic properties affected by project-related activities, developed in consultation with the South Carolina SHPO, Forest Service, the Catawba Indian Nation, and the United Keetoowah Band of Cherokee Indians, would ensure that continued operation and maintenance of the project would either have no effect on known historic properties or that any unavoidable effects would be minimized and appropriately mitigated. The HPMP describes the protection of the historic properties that have been listed or determined to be eligible for listing in the National Register, and includes provisions to address any historic properties discovered during the license term. The HPMP would also provide guidance specific to the maintenance and upkeep of the dams, powerhouses, and other significant buildings with

[223] During a meeting with the SHPO on January 12, 2016, Dominion Energy agreed to prepare public education materials/signage to mitigate potential adverse effects to Lyles Ford and the Parr Development Facility. The signage was installed in 2018.

respect to the project facilities' historic character. The HPMP would ensure that appropriate consultation occurs prior to any activity that could affect the historic properties in the APE. In addition, the consultation provisions in the HPMP (with the South Carolina SHPO), where it concerns unanticipated discovery of historic resources and otherwise effects to historic properties at the project would ensure that such properties are adequately protected at the project over the term of any license.

To meet the requirements of section 106 of the NHPA, the Commission intends to execute a PA with the South Carolina SHPO, Forest Service, the Catawba Indian Nation, and the United Keetoowah Band of Cherokee Indians for the proposed project for the protection of historic properties that would be affected by the continued operation and maintenance of the project. The terms of the PA would require Dominion Energy to implement a final HPMP, for the term of any license issued for the project.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, the Parr Project would continue to operate as it has in the past. None of Dominion Energy's proposed measures or the resource agencies' recommendations, prescriptions, and mandatory conditions would be required. Minimum flows would not improve, and flow fluctuations would not decrease downstream from Parr Development. The DO in the project tailwaters would not be improved and flows in the west channel would not be enhanced. Fish habitat in Monticello Reservoir would not improve. Entrainment into the Fairfield Development pump-back intake would not have the potential to decrease. Control measures for exotic, invasive aquatic species and vegetation would not be implemented. No improvements to or development of additional project recreation sites would occur. No additional avoidance, protection, or mitigation measures would be implemented to protect historic properties.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the Parr Project's use of the Broad River 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.*,[224] the Commission compares the current project cost to an estimate of the cost of obtaining the same amount of energy and capacity using a likely alternative source of power for the region (cost of alternative power). In keeping with Commission policy as described in *Mead*, 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 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 ECONOMIC BENEFITS OF THE PROJECT

Table 4-1 summarizes the assumptions and economic information we use in our analysis for the project. This information was provided by Dominion Energy in its license application or estimated by staff. Cost items common to all alternatives include: taxes and insurance costs; net investment (the total investment in power plant facilities remaining to be depreciated); estimated future capital investment required to maintain and extend the life of plant equipment and facilities; relicensing costs; normal operation and maintenance cost; and Commission fees.

[224] See *Mead Corporation, Publishing Paper Division*, 72 FERC ¶ 61,027 (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.

Table 4-1. Parameters for the economic analysis of the Parr Project (Source: staff).

Assumption	Value	Source
Period of economic analysis (years)	30	Staff
Current net investment (2020 dollars) [a]	165,894,339	Dominion Energy
Current annual costs including O&M (2020 dollars) [b]	30,023,676	Dominion Energy
Relicense application costs (2020 dollars) [c]	$4,151,000	Dominion Energy
Term of financing (years)	20	Staff
Escalation rate for environmental measures[d]	2.1	Dominion Energy
Energy rate Peak and Non-peak ($/MWh)[f]	$33.12MWh $25.46/MWh	Dominion Energy
Capacity rate($/MWh) [g]	286	Dominion Energy

[a] The net investment value of the Project was provided by Dominion Energy in Exhibit D2 of its application.

[b] Annual costs and O&M costs were provided by Dominion Energy in Exhibit D4 of its application.

[c] The cost to develop the license application was provided by Dominion Energy in Exhibit D7 of its application.

[d] The cost for environmental measures was increased at a rate of 2.1% per year as provided by Dominion Energy in Exhibit D4.1 of its application.

[f] The energy rate was provided by Dominion Energy in Exhibit D8 of its application.

[g] The dependable capacity rate was estimated by Dominion Energy in Exhibit D5 of its application.

4.2 COMPARISON OF ALTERNATIVES

Table 4-2 summarizes the installed capacity, annual generation, cost of alternative power, estimated total project cost, and the difference between the cost of alternative power and total project cost for each of the alternatives considered in this EA: no-action; Dominion Energy's proposal; the staff alternative, and the staff-alternative with mandatory conditions.

Table 4-2. Summary of the annual cost of alternative power and annual project cost for the three alternatives for the Parr Project (Source: staff).

	No Action	**Dominion Energy's Proposal**	**Staff Alternative[d]**	**Staff Alternative with Mandatory Conditions[e]**
Installed capacity (MW)	511.2 MW for Fairfield Development, 14.88 MW for Parr Development, 526.08 MW total	511.2 MW for Fairfield Development, 22.7 MW for Parr Development, 533.9 MW total [a]	Same as proposed	Same as proposed
Dependable capacity (MW)	1.4 MW for Parr Development 511.2 MW for Fairfield Development	1.4 MW for Parr Development 511.2 MW for Fairfield Development	Same as proposed	Same as proposed
Net Annual generation (MWh)	716,475	732,092 [b]	Same as proposed	Same as proposed
Annual cost of alternative power[c] ($ and $/MWh)	$319,624,060 (446)	$320,077,650 (437)	Same as proposed	Same as proposed
Annual project cost ($ and $/MWh)	$30,162,043 ($42.1)	$31,926,600 ($43.6)	$31,838,249 ($43.5)	$31,877,467 ($43.5)
Difference between cost of alternative power and project cost ($ and $/MWh)	$289,462,017 (404)	$288,151,050 (394)	$288,239,401 (394)	$288,200,138 (394)

[a] Dominion Energy's proposed upgrades to the turbine/generating units at the Parr Development are expected to increase the authorized installed capacity of the project by 7.82 MW.

[b] The proposed project assumes a 16,055-MWh increase in generation at the Parr Development valued at $470,250; a 503-MWh loss in generation at the Fairfield Development valued at -$16,660; and a 65-MWh increase in generation at the Fairfield Development valued at $2,153, as provided by Dominion Energy in Exhibit D9.1 and D9.2 of the license application.

[c] The power value is a combined value for generation and dependable capacity. The power value assumes the least cost of replacement power is an advanced combustion turbine at a cost of $160.50/MWh, and a storage value of $205,380,000, as provided by Dominion Energy in Exhibit D5 of the application.

[d] The Staff Alternative includes operating the project under existing operations with environmental measures as proposed by Dominion Energy and modified by staff.

[e] The Staff Alternative with Mandatory Conditions includes operating the project under existing operations with environmental measures as proposed by Dominion Energy, modified by staff, and any mandatory conditions required in the NMFS's Section 18 Fishway Prescriptions and Forest Service Section 4(e) Conditions not otherwise recommended by staff.

4.2.1 No Action Alternative

Under the no-action alternative, the project would continue to operate as it does now, with no new environmental protection, mitigation, or enhancement measures. The project would have an installed capacity of 526.08 MW and generate an average of 716,475 MWh of electricity annually. The average annual cost of alternative power would be $319,624,060, or about $446/MWh. The average annual project cost would be $30,162,043, or about $42.1/MWh. Overall, the project would produce power at a cost that is $289,462,017, or about $404/MWh, less than the cost of alternative power.

4.2.2 Dominion Energy's Proposal

Under Dominion Energy's proposal, as shown in table 4-2, the project would have an installed capacity of 533.9 MW and generate an average of 732,092 MWh of electricity annually. The average annual cost of alternative power would be $320,077,650, or about $437/MWh. The average annual project cost would be $31,926,600 or about $43.6/MWh. Overall, the project would produce power at a cost that is $288,151,050, or about $394/MWh, less than the cost of alternative power.

4.2.3 Staff Alternative

The staff alternative would have the same capacity and energy attributes as Dominion Energy's proposal but would include the staff environmental measures shown in table 4-3. The average annual project cost would be $31,838,249, or about

$43.5/MWh. Overall, the project would produce power at a cost that is $288,239,401, or about $394/MWh, less than the cost of alternative power.

4.2.4 Staff Alternative with Mandatory Conditions

This alternative is similar to the staff alternative, with the exception of incorporating the NMFS Fishway Prescription Conditions 4 and 6, and Forest Service Conditions 13, 14, 19, and 22. This alternative would have the same installed capacity and energy attributes as the Staff Alternative, but would include the cost of the above conditions. The average annual project cost would be $31,877,467, or about $43.5/MWh. Overall, the project would produce power at a cost that is $288,200,138, or $394/MWh, less than the cost of alternative power.

4.3 COST OF ENVIRONMENTAL MEASURES

Table 4-3 provides the cost for each of the measures considered in our 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 environmental mitigation and enhancement measures considered in assessing the environmental effects of continuing to operate the Parr Project (Source: Dominion Energy, 2018b; as modified by staff).

Protection, Mitigation, Enhancement, and Capital Improvement Measures	Recommending Entities	Settlement Condition (if applicable)	Levelized Annual Cost (2020$)[a]
Capital Improvements			
1. Six turbine upgrades within first 10 years ($18,022,501 total over 10 years)	Dominion Energy, Staff	4a	948,987
2. Develop a generator upgrade design plan and construction schedule.	Staff	NA	0
Geology and Soils			
3. Erosion Monitoring Plan	Dominion Energy, Staff	5c	7,608
4. Modification to Erosion Monitoring Plan to include requirements of Forest Service 4(e) Condition 20 for site-specific erosion and sediment control during construction activities or emergencies ($5,000)	Forest Service, Staff	NA	680
5. Modifications to Erosion Monitoring Plan to include erosion monitoring at Parr Dam canoe portage ($2,500 plus $500/yr)	Staff	NA	840
Aquatic Resources			
6. Prepare a Hazardous Substances Plan in accordance with Forest Service 4(e) Condition 11 ($5,000 plus $500/yr)	Forest Service, Staff	NA	1,180

Protection, Mitigation, Enhancement, and Capital Improvement Measures	Recommending Entities	Settlement Condition (if applicable)	Levelized Annual Cost (2020$)[a]
7. West Channel Monitoring Implementation ($22,300/yr for 5 years)	Dominion Energy, Staff	3a	4,212
West Channel Modifications ($5,000 first year, $25,000 second year, $24,700 fourth year)	Dominion Energy, Staff	3a	10,628
8. Turbine venting plan	Dominion Energy, Staff	3b	5,000
9. Minimum Flows AMP Implementation (16,055 MWh gain from Parr, 503 MWh loss from Fairfield)	Dominion Energy, Staff	2b	-493,990
Minimum Flows AMP Measures	Dominion Energy, Staff	2b	43,653
10. Flow Fluctuations AMP Implementation (98,450 MWh generation loss from Fairfield)	Dominion Energy, Staff	2a	0[b]
Flow Fluctuations AMP Measures	Dominion Energy, Staff	2a	107,103
Low Inflow Storage Recovery Plan Generation Gain (65MWh/yr gain in generation)	Dominion Energy, Staff	2a	-2,345
11. Monticello Reservoir Fisheries Habitat Enhancement ($219,099)	Dominion Energy, Staff	2c	7,457
12. American Eel Monitoring ($11,000 per survey occurrence)	Dominion Energy, Staff	2d	5,869
13. Mussel monitoring in Monticello Reservoir and downstream from the Parr Development ($15,000 per survey occurrence)	Dominion Energy	2e	2,955

Protection, Mitigation, Enhancement, and Capital Improvement Measures	Recommending Entities	Settlement Condition (if applicable)	Levelized Annual Cost (2020$)[a]
14. Modify Dominion Energy's Freshwater Mussel Monitoring Plan to require monitoring only downstream from the Parr Development ($15,000 per survey occurrence)	Staff	NA	1,478
15. Shut off lights in the Fairfield pump-back intake area at night during normal operating conditions to reduce entrainment	Dominion Energy, Staff	NA	N/A
16. Continue to participate in the Santee River Basin Accord, which includes terms for constructing upstream and downstream fishways at the Parr Development for American Shad and blueback herring (Cost incurred by Saluda Project)	Dominion Energy, NMFS, Staff	2f	0
17. Begin operation of any fishways constructed under the terms of the Santee River Basin Accord would begin operation after fishway evaluations indicate that the fishways are operating properly.	Staff	NA	0
18. Fishway prescription conditions regarding fish passage feasibility and construction (see section 2.2.4.1, *Section 18 Fishway Prescriptions*)	NMFS, Staff	NA	0[c]
19. Fishway Prescription Condition 7 regarding fish passage design (see section 2.2.4.1, *Section 18 Fishway Prescriptions*)	NMFS, Staff	NA	0[c]

Protection, Mitigation, Enhancement, and Capital Improvement Measures	Recommending Entities	Settlement Condition (if applicable)	Levelized Annual Cost (2020$)[a]
20. Fishway prescription conditions regarding fish passage maintenance and operation (see section 2.2.4.1, *Section 18 Fishway Prescriptions*)	NMFS	NA	0[c]
21. Fishway prescription conditions regarding fish passage maintenance and operation, except the part of Condition 4 requiring that the maintenance and operation schedule for fishways be subject to change based annual monitoring of migration runs.	Staff	NA	0[c]
22. Fishway prescription Condition 8 regarding fish passage effectiveness and monitoring (see section 2.2.4.1, *Section 18 Fishway Prescriptions*)	NMFS, Staff	NA	0[c]
23. Fishway prescription conditions regarding general provisions (see section 2.2.4.1, *Section 18 Fishway Prescriptions*)	NMFS	NA	0[c]
24. Fishway prescription conditions regarding general provisions, except Condition 6, which would require FWS, NMFS, and South Carolina DNR access to the Parr Project site and to pertinent Parr Project records for the purpose of inspecting the fishways, determining compliance with the fishway prescriptions.	Staff	NA	0[c]
25. Habitat Enhancement Fund (Minimum $50,000/yr up to $98,221/yr)	Dominion Energy	2g	98,221

Protection, Mitigation, Enhancement, and Capital Improvement Measures	Recommending Entities	Settlement Condition (if applicable)	Levelized Annual Cost (2020$)[a]
Terrestrial Resources			
26. Restrict pesticide use on Forest Service lands	Forest Service, Staff	NA	500
27. Develop an Aquatic Invasive Species Management and Monitoring Plan	Forest Service, Staff	NA	840
28. Develop a Vegetation and Non-Native Invasive Plant Management Plan for national forest system affected lands	Forest Service	NA	840
29. Modify the Vegetation and Non-Native Invasive Plan Management Plan to include provisions for vegetation management and non-native invasive plant management at project recreation areas.[e]	Staff	NA	0
30. Require restrictions on tree removal related to recreation construction and forest management and timber harvesting activities for protection of northern long-eared bat.	Staff	NA	0
31. Develop a Fire Management and Response Plan for national forest system lands in the project boundary	Forest Service, Staff	NA	2,680
32. Prepare a Biological Evaluation prior to take actions to construct new project features that may affect special status species and annually review and assess the presence of special status species within the project boundary	Forest Service	NA	4,500

Protection, Mitigation, Enhancement, and Capital Improvement Measures	Recommending Entities	Settlement Condition (if applicable)	Levelized Annual Cost (2020$)[a]
Recreation and Land Use			
33. Recreation Management Plan	Dominion Energy, Staff	1a	238,884
Survey Future Recreation Sites	Dominion Energy, Staff	1a	1,294
O&M all Recreation sites ($130,000/yr)	Dominion Energy, Staff	1a	210,604
Cannons Creek Improvements ($163,446)	Dominion Energy, Staff	1a	5,563
Parr Shoals Canoe Portage ($0)	Dominion Energy, Staff	1a	0
Highway 34 New Site ($28,812)	Dominion Energy, Staff	1a	981
Enoree River Bridge New Site ($131,726)	Dominion Energy, Staff	1a	4,483
Scenic Overlook Improvements ($120,125)	Dominion Energy, Staff	1a	4,088
Highway 215 Improvements ($26,138)	Dominion Energy, Staff	1a	890
Highway 99 West Improvements ($277,049)	Dominion Energy, Staff	1a	9,429
Recreation Lake Access Area Improvements ($41,514)	Dominion Energy, Staff	1a	1,413
Highway 99 East New Site ($73,656)	Dominion Energy, Staff	1a	2,507

Protection, Mitigation, Enhancement, and Capital Improvement Measures	Recommending Entities	Settlement Condition (if applicable)	Levelized Annual Cost (2020$)[a]
34. Develop, in consultation with the Forest Service, a vehicle turn-around and parking area for the new non-motorized canoe/kayak step down facility at Keitts Bridge/Enoree River Bridge Site ($225,000)	Forest Service	NA	8,320
35. Consult with Forest Service prior to erecting signs related to safety issues on national forest system lands.	Forest Service, Staff	NA	$0
36. Monticello Shoreline Management Plan	Dominion Energy, Staff	5b	22,680
37. Modify Dominion Energy's Monticello Shoreline Management Plan to conduct shoreline monitoring surveys on a quarterly basis.	Staff	NA	7,608
38. Parr Shoreline Management Plan	Dominion Energy, Staff	5a	9,720
39. Lost Revenue to bring land into project boundary ($136,000)	Dominion Energy	NA	4,533[d]
Cultural Resources			
40. Implement the HPMP	Dominion Energy, South Carolina SHPO, Staff	NA	0

Protection, Mitigation, Enhancement, and Capital Improvement Measures	Recommending Entities	Settlement Condition (if applicable)	Levelized Annual Cost (2020$)[a]
Archaeological Site Recovery	Dominion Energy, South Carolina SHPO, Staff	6a	3,776
Reporting	Dominion Energy, South Carolina SHPO, Staff	6a	1,553
Training	Dominion Energy, South Carolina SHPO, Staff	6a	466
Other Forest Service 4(e) Conditions			
41. Annually consult, prior to April 15, regarding project operation and maintenance activities at the project, as well as on the results of any environmental monitoring conducted the previous year[f]	Forest Service	NA	2,000
42. Establish a Consultation Group to provide a forum for Georgia Power to consult, under item 1 above, on (a) the annual meeting, (b) plans that are prepared, and (c) proposed modifications to license conditions[f]	Forest Service	NA	25,000

Protection, Mitigation, Enhancement, and Capital Improvement Measures	Recommending Entities	Settlement Condition (if applicable)	Levelized Annual Cost (2020$)[a]
43. Annually train project operation and maintenance staff in recognizing special status species, invasive plants, and sensitive areas that are known to occur in the project boundary[f]	Forest Service	NA	7,718

[a] The levelized annual cost includes all capital costs and recurring annual costs which are converted to equal annual costs over a 30-year period to give a uniform basis for comparing costs.

[b] While staff recommends this measure, we do not agree with Dominion Energy's estimated cost for implementing the measure; $3,260,664 as provided in Exhibit D 9.3 of its application. Dominion Energy's estimate assumes that project releases would be limited to 20% above inflow, rather than the project discharge being limited to 40,000 cfs. The Settlement Agreement does not specify a 20% limit on project releases, nor does the settlement specify any changes in project operation which would be implemented upon issuance of a license. Settlement Condition 2a is an adaptive management plan which requires a committee be formed to evaluate potential changes in operation which could reduce downstream fluctuations in flows. When specific changes in operation are recommended by the committee, it would be appropriate to consider the cost of those changes.

[c] Staff assigned $0 cost for this measure because the triggers for conducting a fish passage feasibility assessment and fishway construction, as defined in the Santee River Basin Accord and in NMFS's preliminary fishway prescription, have not been met.

[d] Dominion Energy estimated the costs due to lost land sale revenue for land which would be added to the project boundary. Staff does not include "lost opportunity" costs in its analysis.

[e] Under the Staff Alternative, this measure includes expanding the Forest Service's recommended Vegetation and Non-Native Invasive Plant Management Plan to address all recreation areas within the project boundary, not only those on land managed by the Forest Service. Because the cost estimate is based only on preparation of the plan, we assume that costs to include additional areas in the plan would be negligible.

[f] Staff assigned $0 cost for this measure because (a) insufficient detail was provided to estimate the cost, (b) it would involve an unknown number of future meetings and consultations among Dominion Energy and other state and federal agencies, (c) the recommendation has been addressed in the licensee's proposal, and/or (d) the costs would be negligible.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a)(1) of the FPA require the Commission to give equal consideration to the power development purposes and to the purposes of energy conservation; the protection of, 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 Parr 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 the project, and our review of the environmental and economic effects of the proposed project and its alternatives, we selected the staff alternative as the preferred alternative. We recommend this option because: (1) issuance of a new hydropower license by the Commission would allow Dominion Energy to operate the project as an economically beneficial and dependable source of electrical energy for its customers; (2) the public benefits of this alternative would exceed those of the no-action alternative; and (3) the proposed and recommended measures would protect and enhance fish and wildlife resources, improve recreation opportunities at the project, and protect cultural resources.

In the following section, we make recommendations as to which environmental measures proposed by Dominion Energy or recommended by agencies and other entities (including staff) should be included in any license issued for the project. We also discuss which measures we do not recommend including in the license.

5.1.1 Generator Upgrades at the Parr Development

Dominion Energy proposes to upgrade all six generating units at the Parr Development by either rewinding the existing stators or replacing the existing generators. Upgrades to all six units would be completed within 10 years of license issuance, and the first unit upgrade would be completed within 3 years of license issuance. The proposed upgrades have the potential to increase the installed capacity and hydraulic capacity of the Parr Development. By replacing all six units, the total installed capacity would increase from 14.88 MW to 22.7 MW, and the hydraulic capacity would increase from

4,800 cfs[225] to as high as 7,264 cfs. Rewinding the existing units, rather than replacement, would result in a smaller increase in installed capacity and hydraulic capacity.

The increased generator capacity would allow Dominion Energy to pass more water through the turbines for generation, and thus improve efficiency in generation. Under current operation all flows not passed through the turbines are passed from the spillway gates on Parr Dam. Increasing the hydraulic capacity of the turbines would reduce the frequency of spillage from the gates on Parr Dam and allow a quicker response time to changing inflows, when inflows are in the 4,800 to 7,264 cfs range. Thus, there is the potential for reducing the frequency of downstream flow fluctuations. As discussed in Section 3.3.2, *Aquatic Resources*, staff recommends the proposed Flow Fluctuations AMP to reduce fluctuations downstream of Parr Shoals Dam (Settlement Condition 2a). One component of the Flow Fluctuations AMP plan is that a review committee would be established to develop guidelines for plant operators to ensure that flows are released on a more even schedule. Increasing the hydraulic capacity of the turbines, either through complete replacement, or partial rewinding, would contribute to that goal of reducing downstream fluctuations in flows. For these reasons, staff recommends that any license issued for the project include a provision to increase the authorized installed capacity of the Parr Development from 14.88 MW to 22.7 MW, which is consistent with replacing each of the six generating units.

5.1.2 Environmental Measures Proposed by Dominion Energy

Based on our environmental analysis of Dominion Energy's proposal in section 3.0, *Environmental Analysis*, and the costs discussed in section 4.0, *Developmental Analysis*, we conclude that the following environmental measures proposed by Dominion Energy would protect and enhance environmental resources in the project area, and would be worth the cost. Therefore, we recommend including these measures in any new license issued for the project.

- Modify and then implement the Erosion Monitoring Plan, as described below.
- Implement the West Channel AMP.
- Implement the Turbine Venting Plan.
- Implement the Flow Fluctuations AMP.

[225] Although the hydraulic capacity of the turbines is approximately 6,000 cfs, this flow exceeds the rated capacity of the generators, and therefore, Dominion Energy typically does not pass more than 4,800 cfs through the turbines.

- Implement the Minimum Flows AMP.
- Implement the Monticello Reservoir Fisheries Habitat Enhancement Plan.
- Implement the American Eel Abundance Monitoring Plan.
- Modify and then implement the Freshwater Mussel Monitoring Plan, as described below.
- Turn off tailrace lighting during normal project operations to protect fish during pump-back operation of the Fairfield Development to minimize the potential for entrainment.
- Continue to participate in the Santee Basin Accord, as modified below.
- Implement the RMP.
- Implement the Monticello Reservoir SMP.
- Implement the Parr Reservoir SMP.
- Implement the HPMP.

5.1.3 Additional Measures Recommended by Staff

In addition to Dominion Energy's proposed measures listed above, we recommend including the following additional staff-recommended measures in any license issued for the Parr Shoals Project:

- Develop a final design plan and construction schedule for upgrading all six generating units at the Parr Development.
- Revise the Erosion Monitoring Plan to: (1) include annual assessment of erosion at the Parr Dam canoe portage as part of the proposed erosion monitoring for Parr Reservoir and (2) to address all requirements of the Forest Service 4(e) Condition 20, including site-specific provisions for erosion and sediment control BMPs during construction.
- Revise the Freshwater Mussel Monitoring Plan to remove any provisions for monitoring for mussels in Monticello Reservoir.
- Continue to participate in the Santee Basin Accord, with the added provision that operation of any newly constructed fishways would not begin until fishway evaluations indicate that fishways are operating properly.
- Modify the Vegetation and Non-Native Invasive Plant Management Plan required by Forest Service 4(e) Condition 18 to include provisions for addressing vegetation and non-native invasive plant management at all

project recreation areas, in addition to those actions directly affecting national forest system lands.

- Limit tree removal related to recreation construction and forest management activities to November 1 through March 31 to minimize any potential adverse effects to northern long-eared bats during the pup season and the broader active season.

- Modify the Monticello Shoreline Management Plan to include a provision for quarterly monitoring surveys of the Monticello Reservoir shoreline.

In addition, we are recommending all of the conditions of NMFS's fishway prescription, with the exception of those conditions discussed in section 5.1.3, *Measures Not Recommended*. We discuss, below, our rationale for our additional staff recommended measures.

Generator Upgrade Plan

As discussed above, in section 5.1.1, *Generator Upgrades at the Parr Development*, staff recommends adopting Dominion Energy's proposal to increase the authorized installed capacity of the Parr Development from 14.88 MW, to a maximum of 22.7 MW, which is consistent with replacing each of the development's six generating units. However, Dominion Energy's proposal does not identify or include any detail on which of the units would be replaced and which would be repaired. More details on the specific design and an updated construction schedule are necessary for Commission staff to be able to administer the upgrade terms of any license issued for the project. Therefore, staff recommends that Dominion Energy develop a final design plan and construction schedule for the proposed generator upgrades. Once the upgrades are completed, the installed capacity and hydraulic capacity of the project would be adjusted to match the as-built upgrades. We estimate that there would be no additional cost for Dominion Energy to develop the design plan and construction schedule because the cost would be captured in Dominion Energy's capital cost for the generator upgrades and/or replacements.

Erosion Monitoring Plan

The soils around Monticello and Parr Reservoirs are moderately to severely erodible, and operation of the project contributes to erosion by affecting water levels and exposing bare soils to erosive forces, including water, waves, and wind. Further, project-related recreation and shoreline development contribute to shoreline erosion through removal of vegetation and use. To address shoreline erosion, Dominion Energy proposes, and the Settlement Agreement includes a provision for, monitoring of the Monticello and Parr Reservoir shorelines for erosion as part of the Erosion Monitoring Plan. This plan is discussed in greater detail in section 3.3.1, *Geology and Soils*.

If implemented, Dominion Energy's RMP would require Dominion Energy to construct, operate, and maintain a portage facility around Parr Dam. The 0.11-acre put-in would be located below Parr Dam on the Broad River. The proposed Erosion Monitoring Plan contains no provisions for monitoring erosion along the Broad River downstream of Parr Dam. Implementation of the Flow Fluctuations AMP, as well as recreation use, may contribute to erosion at this site. Therefore, annual monitoring for erosion at the canoe portage put-in would allow Dominion Energy to identify and resolve any conditions that could affect use of the portage in a timely manner. Revising the Erosion Monitoring Plan to include monitoring of the Parr Dam canoe portage would be worth the additional annual levelized cost of $840.

Forest Service 4(e) Condition 20 includes provisions for inventorying, monitoring, and treating erosion sites that are consistent with those proposed in Dominion Energy's Erosion Monitoring Plan. Forest Service 4(e) Condition 20 also includes protocols for developing site-specific erosion and sediment control during construction or emergencies. By incorporating these provisions into the Erosion Monitoring Plan, Dominion Energy could better manage erosion and sediment control at the project through a single plan. Therefore, we find that revising the Erosion Monitoring Plan to include protocols for erosion and sediment control during construction or emergencies would be worth the additional annual levelized cost of $680.

Freshwater Mussel Monitoring

To monitor the effects of project operations on freshwater mussels located in Monticello Reservoir and downstream of the Parr Development, Dominion Energy proposes to finalize and implement the Freshwater Mussel Monitoring Plan, which we summarize more completely in section 3.3.2.2, *Freshwater Mussel Monitoring*. The plan includes provisions for Dominion Energy to monitor specific areas of Monticello Reservoir with the goal of tracking the distribution and abundance of freshwater mussel species, especially the Carolina creekshell, which is a species of highest priority in the South Carolina DNR's Comprehensive Wildlife Conservation Plan. In addition, the plan includes provisions to monitor the abundance, distribution, and species composition of mussels located downstream of Parr Shoals Dam in the tailrace and west channel to assess how proposed changes in operations at Parr Development affect mussel populations.

Freshwater mussels are present in Monticello Reservoir, and Dominion Energy's proposal to monitor the mussels in Monticello Reservoir could help determine whether mussel populations are increasing or decreasing during the term of any new license issued. However, periodically monitoring mussels to identify any population changes does not serve a specific project purpose in that such generalized monitoring is not tied to any specific project-related effect or project-related action. As discussed in section 3.3.2.2, *Freshwater Mussel Monitoring*, existing operation supports healthy mussel

populations that successfully survive and grow in Monticello Reservoir, and Dominion Energy is not proposing any changes in project operation at the Fairfield Development that would change these conditions. Therefore, there would be no project-related benefit to monitoring mussels, including any Carolina creekshell located in the reservoir, during the term of any new license issued.[226]

Therefore, we recommend that Dominion Energy revise the Freshwater Mussel Monitoring Plan to remove any provisions related to monitoring freshwater mussels in Monticello Reservoir.

American Shad and Blueback Herring Fishway Operation

Dominion Energy is proposing, and NMFS's fishway prescription would require, that Dominion Energy follow the terms of the Santee Basin Accord to: (1) conduct a fish passage feasibility assessment for upstream and downstream passage at the Parr Development, within 1 year of 46,400 American shad or 185,600 blueback herring annually passing upstream of the Columbia Diversion Dam for any 3 years in a 5-year period and (2) initiate construction of upstream and downstream fishways at the Parr Development within 3 years of 69,600 American shad or 348,000 blueback herring annually passing upstream of the Columbia Diversion Dam for any 3 years in a 5-year period.

As discussed in section 3.3.2.2, *American Shad and Blueback Herring Passage*, the triggers for initiating the fishway feasibility assessment and fishway construction would enable construction of fishways when upstream migrating American shad and/or blueback herring reach densities that are near the capacity of habitat downstream of Parr Shoals Dam. However, Dominion Energy does not propose, NMFS's fishway prescription does not require, and the Santee Basin Accord does not specify a trigger to initiate operation of any constructed upstream or downstream fishways at Parr Shoals Dam. So that Commission staff can effectively administer the terms of the fishway prescriptions for Parr Shoals Dam under any new license issued for the project, we recommend that any newly constructed fishways designed for the passage of American shad and blueback herring begin operating after the fishway evaluations have been completed and a report of the results has been approved by the Commission.

Vegetation and Non-Native Invasive Plant Management Plan

Dominion Energy proposes to use the SMPs for Monticello and Parr Reservoirs to address vegetation management around the reservoir shorelines. Settlement Conditions

[226] As discussed in section 3.3.2.2, *Freshwater Mussel Monitoring*, Three Oaks Engineering (2016) tentatively identified seven individual mussels in Monticello Reservoir as Carolina creekshell. However, we are unaware of any confirmation that Carolina creekshell occur in Monticello Reservoir.

5a and 5b require implementation of the proposed SMPs, which are described in detail in section 3.3.5*, Recreation and Land Use*. Both SMPs have provisions for vegetation management on the reservoirs. Dominion Energy does not, however, monitor for or actively manage invasive terrestrial vegetation in the project boundary.

Non-native, invasive plant species known to occur in the project area include kudzu, mimosa, and Japanese honeysuckle, and privet identified at the Highway 34 Recreation Area. Implementing the Vegetation and NNIP Management Plan as required by Forest Service 4(e) Condition 18 would provide a mechanism to minimize the potential introduction and spread of non-native invasive plant species on national forest system lands within, and adjacent to, the project boundary during project operation and maintenance, and recreation-related activities. Components of this plan are described in section 3.3.3.2, *Environmental Effects – Vegetation Management*. We recommend adding provisions to the Vegetation and NNIP Management Plan required by Forest Service 4(e) Condition 18 to include invasive plant mitigation (e.g., identification, monitoring, and control) at all project recreation areas, in addition to those actions directly affecting national forest system lands (see Appendix C for minimum components of the NNIP Management Plan). Construction of recreation enhancement measures and continued recreation use has the potential to spread non-native, invasive plants. Managing non-native, invasive species would benefit native species and potentially improve the quality of recreation access and aesthetics at the project. We estimate that no additional cost would be associated with this recommendation.

Time of Year Restrictions on Tree Removal

Dominion Energy's RMP, if implemented, would require permanent removal of approximately 20 mature box elder, and 8 mature American sycamore, as well as understory vegetation on 0.16 acres at the Highway 34 Recreation Site to construct additional parking facilities. As proposed, Dominion Energy would not construct the parking facilities for two years. In addition to construction-specific tree removal, Dominion Energy proposes to continue its ongoing forest management, described in section 3.3.3.1, *Terrestrial Resources - Affected Environment*, which includes managing some areas for recreational use, where the understory is controlled through prescribed burning and thinning operations. Other areas are planted pine forests that are harvested for timber.

Although the project is outside of the current range of the northern long-eared bat and the WNS zone per the final 4(d) rule, the northern long-eared bat is known to occur in both coastal and upstate South Carolina, including counties that border the project. These patterns suggest that the species could occur in Newberry and Fairfield Counties, which are situated between areas where the northern long-eared bat and WNS have been documented. FWS has no records of maternity roost trees or hibernaculum sites within Fairfield or Newberry Counties; however, undocumented maternity roost trees may be

present. Suitable roosting and foraging habitat for the northern long-eared bat exists in the project boundary.

Dominion Energy proposes to conduct informal consultation with FWS on northern long-eared bat prior to tree removal at the Highway 34 Recreation Site, and regarding forest management activities if the presence of the northern long-eared bat is established in Fairfield and Newberry Counties. Given the proximity of the project to the NLEB's range and documented WNS, and because suitable roosting and foraging habitat exists in the project boundary, and unknown maternity roosts may be present, we recommend that the applicant limit tree removal in the project boundary to November 1 through March 31 to minimize any potential adverse effects to northern long-eared bats during the pup season and the broader active season. These time of year restrictions are consistent with the 4(d) rule's time of year restrictions. Our recommended measure would ensure that any effects on NLEB would be discountable, and therefore, if this requirement is in the license, relicensing the project would not likely adversely affect northern long-eared bat. We estimate that no additional cost would be associated with this recommendation.

Monticello Shoreline Management Plan

Dominion Energy proposes to conduct periodic surveys of the Monticello Reservoir shoreline to inventory and inspect docks, access paths, and shoreline erosion control structures/projects. The proposed Monticello Shoreline Management Plan is discussed in detail in section 3.3.5.2, *Recreation and Land Use—Environmental Effects.* Dominion Energy does not state the frequency of its proposed shoreline monitoring.

To ensure prompt detection and remediation of unauthorized use of lands within the project boundary, we recommend that Dominion Energy modify the Monticello SMP to require visual monitoring on a quarterly basis (in March, June, September, and December) to help prevent and identify any unauthorized uses and the construction of unauthorized structures. Revising the Monticello SMP to include a provision for shoreline surveys on a quarterly basis would be worth the additional annual levelized cost of $3,804 for routine monitoring.

NMFS's Fishway Prescription and Forest Service 4(e) Conditions

In addition to Dominion Energy's proposed measures and staff's additional measures, we recommend including, in any license issued for the Parr Project, all but the

two NMFS's preliminary fishway prescriptions and five Forest Service preliminary 4(e) conditions discussed below in section 5.1.3, *Measures Not Recommended by Staff*.[227]

5.1.4 Measures not Recommended by Staff

Staff finds that some of the measures recommended by Dominion Energy or other interested parties would not contribute to the best comprehensive use of water resources, do not exhibit sufficient nexus to project environmental effects, or would not result in benefits to non-power resources that would be worth their cost. The following discusses the basis for staff's conclusion not to recommend such measures.

Habitat Enhancement Program (HEP)

Dominion Energy proposes to implement a HEP for the purpose of restoring, enhancing, and protecting aquatic, wetland, and riparian habitats and the associated natural resources of the Parr Project area, as well as areas outside the project area in the Broad, Saluda, and Congaree river watersheds. Dominion Energy proposes to fund the HEP at a funding amount based on the level of pumped storage operation in a given year, or a minimum of $50,000. The measure is also a requirement of the Settlement Agreement.

As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, Dominion Energy is proposing to implement measures to improve downstream water quality (i.e., West Channel AMP, Turbine Venting Plan), increase downstream minimum flows (i.e., Minimum Flows AMP), reduce downstream water level fluctuations (i.e., Flow Fluctuations AMP), enhance fish habitat (i.e., Monticello Reservoir Fisheries Habitat Enhancement Plan), minimize fish entrainment mortality (i.e., turn off tailrace lighting at the Fairfield Development), identify the need for American eel passage (i.e., American Eel Monitoring Plan), and construct fish passage for American shad and blueback herring if necessary (i.e., Santee Basin Accord). Dominion Energy is also proposing to implement measures to protect wetland and riparian habitats through shoreline and erosion management and monitoring (i.e., Monticello and Parr Reservoir

[227] Although we do not recommend some of Forest Service's 4(e) conditions (i.e., Conditions 13, 14, 19, and 22) and NMFS's fishway prescription measures (i.e., fishway operating schedules and fishway oversight), we recognize that the Commission is required to include all 4(e) conditions and fishway prescriptions in any license issued for the project. Moreover, the four 4(e) conditions and one of the two fishway prescription measures seem largely administrative; but each have the potential to result in measures that could benefit environmental resources. Thus, this EA evaluated the potential environmental benefits of the measures. In this EA, the staff alternative with mandatory conditions is the action alternative for section 7 consultation under the Endangered Species Act.

SMPs, Erosion Management Plan) as discussed in section 3.3.2.3, *Terrestrial Resources, Environmental Effects*. Forest Service 4(e) Condition 18, which we also recommend, requires an Aquatic Invasive Species Management and Monitoring Plan, as well as a Vegetation and NNIP Management Plan for areas that may directly affect national forest lands. Our recommendation to expand the Vegetation and NNIP Management Plan to cover all recreational areas developed or improved at the Parr Project would further protect wetlands and riparian habitat in the project area. Implementation of these measures would minimize project effects and protect aquatic and terrestrial resources that occur in the project area. Thus, there would be no benefit to implementing the HEP for resources in the project area. This measure provides the payment of funds for non-specific and as yet unidentified measures that could benefit resources outside of the project area and not having a direct nexus to project effects.[228] For these reasons, we have no basis for recommending that Dominion Energy implement the HEP.

American Shad and Blueback Herring Fishway Operating Schedules

Condition 4 of NMFS's fishway prescription would require Dominion Energy to maintain and operate fishways at the Parr Development during the upstream (March 1 to May 15) and downstream (late summer to fall) migration periods for American shad and blueback herring, all of which would be subject to change based on annual monitoring of migration runs.

As discussed in section 3.3.2.2, *American Shad and Blueback Herring Passage*, the provision to operate any newly constructed upstream fishway from March 1 to May 15 encompasses the typical spawning period for American shad and blueback herring and would allow them to migrate upstream of Parr Shoals Dam during the period when they are most likely to need passage. The provision to operate any newly constructed downstream fishway from late summer to fall generally encompasses the period when American shad and blueback herring juveniles are likely to be migrating downstream and out to sea. Nonetheless, the period of late summer to fall is not specifically defined by a start and end date. Thus, downstream fishway operation could occur on a schedule without limits. In the absence of such limits to the operational window, we have no information to determine whether a particular downstream operating schedule would or would not provide benefits to American shad or blueback herring.

[228] In order to include a specific environmental measure in a license, the Commission needs to be able to conclude that the measure relates to project impacts or project purposes. This is why the Commission has expressed a preference for specific measures and that, where possible, such measures be implemented within the project boundary or close to the project and the area that it affects. *See* the Commission's *Policy Statement on Hydropower Licensing Settlements*, Docket No. PL06-5-000, issued September 21, 2006.

Similarly, allowing unspecified changes in upstream and downstream fishway operating schedules creates an operating schedule without limits. As discussed above, in the absence of such limits we have no information to determine whether a particular change in the operating schedule would or would not provide benefits to American shad or blueback herring. More directly, we are unable to determine whether the potential schedule modifications would be in the public interest.

Therefore, we do not recommend the elements of condition 4 of NMFS's fishway prescription that would allow Dominion Energy to: (1) operate any constructed downstream fishway during an unspecified late-summer to fall period; and (2) modify, without limits, the operating schedules of any upstream or downstream fishways that Dominion Energy might construct during the term of any new license issued.

American Shad and Blueback Herring Fishway Oversight

Condition 6 of NMFS's fishway prescription would require Dominion Energy to provide NMFS, FWS, and South Carolina DNR access to the Parr Project site and to pertinent Parr Project records for the purpose of inspecting the fishways, determining compliance with the fishway prescriptions, and for general evaluation and oversight. However, with proper operation and maintenance, there is no reason to believe that the fishways would not perform as designed. Thus, there would be no benefit to providing access to the Parr Project site and to pertinent Parr Project records. Therefore, we do not recommend requiring Dominion Energy to provide NMFS, FWS, and South Carolina DNR access to the Parr Project site and to pertinent Parr Project records for the purpose of inspecting the fishways, determining compliance with the fishway prescriptions, and for general evaluation and oversight.

Additional Consultation and Review

Forest Service 4(e) Condition 13 stipulates that the licensee annually consult with Forest Service and other stakeholders on project operation and license implementation. Forest Service 4(e) Condition 14 stipulates that the licensee establish a Consultation Group to provide a forum for consulting with resource agencies and other interested stakeholders. Forest Service 4(e) Condition 19 would require the licensee to complete an annual review of special status species. When a species is added to the special status list, Dominion Energy would consult with the Forest Service to evaluate if the species or its suitable habitat is likely to occur on Forest Service land within the project boundary. If a species is determined likely to occur on project land, Forest Service recommends the licensee develop and implement a study plan to assess the effects of the project on the species. As part of the process, Dominion Energy would prepare a Biological Evaluation. The Biological Evaluation would evaluate the potential effect of the action on the species and/or its habitat. Dominion Energy is not opposed to these 4(e) Conditions.

Dominion Energy's proposed plans and implementation strategy for other measures include agency review and consultation for reports, prior to Commission approval. Conducting an annual consultation meeting with resource agencies would be redundant because there is already a mechanism for agency comment. Although we have no objection to Dominion Energy conducting this agency consultation, the standard license article would provide a similar level of protection to Forest Service's conditions 13, 14, and 19. Therefore, we do not recommend including these measures as part of any new license issued for the project. Forest Service 4(e) Condition 19 specifies that the licensee prepare and submit a biological evaluation for Forest Service approval before taking actions to construct new project features on Forest Service land that may affect special status species or their critical habitat on Forest Service land. Such a measure concerns a Forest Service administrative matter unrelated to the Commission's administration of any license issued for the project. Therefore, we have no justification for recommending the measure as a condition of any Commission-issued license for the project.

On a related matter, we note that any action or construction not explicitly authorized by the license may require prior Commission approval after the filing of an application to the amend the license. Should a license amendment be filed, any need for ESA consultation for the proposed amendment action would be determined as part of the processing of the license amendment application.

Annual Training

Implementation of project operation and maintenance activities would require interactions between the licensee's staff and sensitive resources. To minimize the potential for inadvertent effects of operation and maintenance on sensitive resources, Forest Service 4(e) Condition 22 stipulates that the licensee annually train its staff to recognize special status species, invasive plants, and sensitive areas that are known to occur in the project boundary. While Dominion Energy does not oppose the condition, no components of this type of training have been identified in any resource management plans to date, nor is the extent of the full training curriculum clear. Nevertheless, licensees are expected to train their employees to the extent needed for the licensees to maintain compliance with a license issued for their projects. Therefore, we do not recommend a condition incorporating this measure in any license issued for the project.

Keitts Bridge Parking Measures

Forest Service 4(e) Condition 23 would require Dominion Energy to construct a vehicle turn-around area, parking area for six vehicles, and an access path to a proposed step-down location. Dominion Energy proposes to build the steps down to the water but does not propose to construct the additional facilities. While parking facilities at this site would improve access, this site receives very little use, as shown in the recreation study

results. Construction of a concrete parking area, vehicle turn-around, and paved access path would disturb the surrounding environment (including requiring tree removal), have significant costs, and unclear public benefits. The Forest Service has not documented a clear need for the proposed facilities, and Dominion Energy is already proposing less expensive and less intensive upgrades to the site that will improve access for waterfowl hunters and paddlers that is commensurate with the current and anticipated use of the site. Therefore, we do not recommend a condition incorporating the parking area and paved path in any license issued for the project.

5.2 UNAVOIDABLE ADVERSE EFFECTS

Operation of the Fairfield Development and Parr Development would continue to entrain and impinge fish to some degree during operation. Most adult fish could avoid involuntary entrainment, but entrainment of some small fish or young-of-year fish could still occur. However, the fish involved would likely be composed of species that have the ability to compensate for the expected level of losses, and any such loss is not expected to significantly affect fish populations and recreational fishing opportunities in Monticello Reservoir, Parr Reservoir, or the Broad River.

Fluctuations in reservoir water levels would continue at present levels, and associated effects would continue to occur. Water level fluctuations are unavoidable at projects that include pumped storage. Large fluctuations over short periods of time have the potential to limit the reproductive success of littoral spawning fish and increase mortality of fry in rearing areas. In addition, the fluctuations potentially could disrupt the natural behavior of the fish within the project reservoirs.

There would be temporary, unavoidable shoreline disturbance associated with the proposed shoreline construction and stabilization activities. In addition, some minor, unavoidable effects associated with land disturbances in upland and riparian areas during construction of the proposed recreation enhancements. However, these disturbances and effects would be mostly temporary, apart from the permanent loss of riparian vegetation to improve proposed parking facilities and access at the Highway 34 and Enoree River Bridge Recreation Sites. Effects on aquatic and terrestrial resources would be minimized through the implementation of BMPs for minimizing soil disturbance, controlling erosion, restoring natural contours, and re-vegetating disturbed areas following construction.

5.3 FISH AND WILDLIFE AGENCY RECOMMENDATIONS and SECTION 4(e) CONDITIONS

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. Section 10(j) of the FPA states that whenever the Commission finds that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

In response to our July 31, 2019 notice accepting the application to relicense the project and soliciting motions to intervene, protests, comments, recommendations, preliminary terms and conditions, and preliminary fishway prescriptions, South Carolina DNR, by letter filed September 27, 2019, stated that the proposed measures in the Settlement Agreement adequately address the agency's concerns, and did not offer any additional recommendations. NMFS, by letter filed on September 30, 2019, submitted two recommendations for the Parr Project that are included in the Settlement Agreement. Table 5-1 lists the recommendations filed subject to section 10(j) and indicates whether the recommendations are included under the staff alternative.

Table 5-1. Fish and wildlife agency recommendations for the Parr Project (Source: staff).

Recommendation	Agency	Within the scope of section 10(j)	Annualized cost	Adopted?
1. Finalize and implement a Flow Fluctuations AMP to minimize flow fluctuations downstream of Parr Shoals Dam year-round, including for two 14-day periods during the spring to improve spawning habitat for shortnose sturgeon, striped bass, American shad, and robust redhorse. (Settlement Agreement Condition 2a – Flow Fluctuations AMP).	NMFS	Yes	$0	Yes
2. Finalize and implement an American Eel Monitoring Plan to monitor the distribution and abundance of American eels downstream of the Parr Shoals Dam for the duration of any new license issued (Settlement Agreement Condition 2d – American Eel Abundance Monitoring Plan).	NMFS	Yes	$5,869	Yes

5.3.2 Forest Service's Section 4(e) Conditions

In section 2.2.4, Modifications to Applicant's Proposal – Mandatory Conditions, we list the preliminary 4(e) conditions submitted by the Forest Service, and note that section 4(e) of the FPA provides that any license issued by the Commission "for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation." Thus, any 4(e) condition that meets the requirements of the law must be included in any license issued by the Commission, regardless of whether we include the condition in our staff alternative.

Of the Forest Service's 24 4(e) conditions, we consider 12 of the conditions (Conditions 1 through 10, 15, and 16) to be administrative or legal in nature and not specific environmental measures. We, therefore, have not analyzed these conditions in this EA.

Table 5-2 summarizes our conclusions with respect to the 12 4(e) conditions that we consider to be environmental measures or otherwise include provisions that we consider in this EA. We include, in the staff alternative, eight conditions specified by the agency, and did not recommend five conditions. The measures not adopted are discussed in more detail in section 5.1, *Comprehensive Development and Recommended Alternative*. We recognize, however, that the Commission is required to include valid 4(e) conditions in any license issued for the project. As such, Forest Service conditions that we do not recommend would be included in a new license.

Table 5-2. Forest Service preliminary section 4(e) conditions for the Parr Project (Source: staff).

Condition	Annualized Cost	Adopted?
Condition 11. Prepare a Hazardous Substances Plan	$1,180	Yes
Condition 12. Comply with Pesticide-Use Restrictions	$500	Yes
Condition 13. Consult with Forest Service and other stakeholders on project operation	$2,000	No
Condition 14. Establish Consultation Group	$25,000	No
Condition 17. Implement Public Safety Signage	$0	Yes

Condition	Annualized Cost	Adopted?
Condition 18. Prepare an Aquatic Invasive Species Management and Monitoring Plan and Vegetation and Invasive Weed Management Plan	$1,680	Yes
Condition 19. (a) prepare a Biological Evaluation on special status species prior to constructing new project features, and (b) annually review the list of special status species and assess presence within the project boundary	$4,500	No
Condition 20. Prepare a Sediment and Erosion Control Plan	$680	Yes
Condition 21. Prepare a Fire Management and Response Plan	$2,680	Yes
Condition 22. Annual Employee Training	$7,718	No
Condition 23. Non-project Areas (Keitts Bridge Landing and Enoree River Bridge Recreation Area)	$8,320	No

5.4 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2)(A) of the FPA[229] 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 the following 25 comprehensive plans that are applicable to the Parr Project. No inconsistencies were found.

Atlantic States Marine Fisheries Commission. 1998. Amendment 1 to the Interstate Fishery Management Plan for Atlantic sturgeon (Acipenser oxyrhynchus oxyrhynchus). (Report No. 31). July 1998.

Atlantic States Marine Fisheries Commission. 1999. Amendment 1 to the Interstate Fishery Management Plan for shad and river herring. (Report No. 35). April 1999.

[229] 16 U.S.C. § 803(a)(2)(A).

Atlantic States Marine Fisheries Commission. 2000. Interstate Fishery Management Plan for American eel (Anguilla rostrata). (Report No. 36). April 2000.

Atlantic States Marine Fisheries Commission. 2000. Technical Addendum 1 to Amendment 1 of the Interstate Fishery Management Plan for shad and river herring. February 9, 2000.

Atlantic States Marine Fisheries Commission. 2008. Amendment 2 to the Interstate Fishery Management Plan for American eel. Arlington, Virginia. October 2008.

Atlantic States Marine Fisheries Commission. 2009. Amendment 2 to the Interstate Fishery Management Plan for shad and river herring, Arlington, Virginia. May 2009.

Atlantic States Marine Fisheries Commission. 2010. Amendment 3 to the Interstate Fishery Management Plan for shad and river herring, Arlington, Virginia. February 2010.

Atlantic States Marine Fisheries Commission. 2013. Amendment 3 to the Interstate Fishery Management Plan for American eel. Arlington, Virginia. August 2013.

Atlantic States Marine Fisheries Commission. 2014. Amendment 4 to the Interstate Fishery Management Plan for American eel. Arlington, Virginia. October 2014.

Forest Service. 2004. Sumter National Forest revised land and resource management plan. Department of Agriculture, Columbia, South Carolina. January 2004.

National Marine Fisheries Service. 1998. Final Recovery Plan for the shortnose sturgeon (Acipenser brevirostrum). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. December 1998.

National Marine Fisheries Service, North Carolina Wildlife Resources Commission, South Carolina Department of Natural Resources, and U.S. Fish and Wildlife Service. 2017. Santee Basin Diadromous Fish Passage Restoration Plan. 2017.

National Park Service. The Nationwide Rivers Inventory. Department of the Interior, Washington, D.C. 1993.

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 Parks, Recreation, & Tourism. 2008. South Carolina State Comprehensive Outdoor Recreation Plan (SCORP). Columbia, South Carolina. April 2008.

South Carolina Department of Parks, Recreation, & Tourism. 2002. The South Carolina State Trails Plan. Columbia, South Carolina. 2002.

South Carolina Department of Natural Resources. 2014. South Carolina's State Wildlife Action Plan 2015. Columbia, South Carolina. October 2014.

South Carolina Department of Natural Resources. 2004. South Carolina Water Plan-Second Edition. Columbia, South Carolina. January 2004.

South Carolina Exotic Pest Plant Council (South Carolina EPPC). 2014. Invasive Plant List https://www.se-eppc.org/southcarolina/invasivePlants.cfm Accessed January 9, 2020

South Carolina Water Resources Commission. 1985. Instream flow study - Phase I: identification and priority listing of streams in South Carolina for which minimum flow levels need to be established. Report No. 149. Columbia, South Carolina. June 1985.

South Carolina Water Resources Commission. 1988. Instream flow study - Phase II: determination of minimum flow standards to protect instream uses in priority stream segments. Report No. 163. Columbia, South Carolina. May 1988.

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. 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. n.d. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C.

6.0 FINDING OF NO SIGNIFICANT IMPACT

If the Parr Project is issued a new license as proposed with the additional staff-recommended measures, the project would continue to operate while providing enhancements to water quality and aquatic resources, improvements to recreation facilities, and protection of cultural and historic resources in the project area.

Based on our independent analysis, we find that the issuance of a license for the Parr Project, with additional staff-recommended environmental measures, would not constitute a major federal action significantly affecting the quality of the human environment.

7.0 LITERATURE CITED

Alderman, J. M., and J. D. Alderman. 2012. Freshwater Mussel Surveys within the Broad River, East of Hampton Island. Prepared for SCANA Services, Inc. Alderman Environmental Inc. Pittsboro, NC.

Allen, J., K. Buckley, L. Dickes, D. London, and T. Walker. 2015. Broad River Basin Surface Water Availability Assessment. Presentation given August 5, 2015. Available at: https://www.clemson.edu/public/water-assessment/downloads/broad_cu_ppt_0815.pdf. Accessed January 28, 2020.

ASMFC (Atlantic States Marine Fisheries Commission). 2007. American shad stock assessment report. ASMFC, Report 07-01, Washington, D.C.

_____. 2009. Atlantic coast diadromous fish habitat: A review of utilization, threats, recommendations for conservation, and research needs. Habitat Management Series #9. January 2009.

_____. 2012. River Herring Benchmark Stock Assessment. Stock Assessment Report No. 12-02 of the Atlantic States Marine Fisheries Commission. Volume II**.** 707 pp.

_____. 2017. 2017 American Eel Stock Assessment Update. October 2017.

ASSRT (Atlantic Sturgeon Status Review Team). 2007. Status Review of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). Report to National Marine Fisheries Service, Northeast Regional Office. February 23, 2007. 174 pp.

Balazik, M. T., & Musick, J. A. (2015). Dual annual spawning races in Atlantic Sturgeon. PloS one, 10(5), e0128234.

Beamish, F. W. H. 1970. Oxygen consumption of largemouth bass, *Micropterus salmoides*, in relation to swimming speed and temperature. Canadian Journal of Zoology, 48: 1221-1228.

Beamish, F. W. H. 1978. Swimming capacity. In: Hoar, W.S. and D.J. Randall, eds. Fish Physiology, Volume 7, Locomotion. Academic Press, NY. 576 pp.

Beecham, R. V., C. D. Minchew, and G. R. Parsons. 2007. Comparative swimming performance of juvenile pond-cultured and wild-caught channel catfish. North American Journal of Fisheries Management, 27:729-734.

Beecham, R. V., C. D. Minchew, G. R. Parsons, and S. B. LaBarre. 2009. Comparative swimming performance of juvenile blue catfish and hybrid catfish. North American Journal of Aquaculture, 71(4), 348-353.

Bell, M. C. 1991. Fisheries Handbook of Engineering Requirements and Biological Criteria. Prepared for U.S. Army Corps of Engineers, North Pacific Division, Fish Passage Development and Evaluation Program, Portland, OR. Third Edition.

Bigelow, A. F., W. C. Schroeder, B. B. Collette, and G. Klein-MacPhee. 2002. Bigelow and Schroeder's Fishes of the Gulf of Maine. Smithsonian Institution Press.

Bohnsack, J. A. 1989. Are high densities of fishes at artificial reefs the result of habitat limitation or behavioral preference?. Bulletin of Marine Science, 44(2), 631-645.

Boschung, H.T. and R.L. Mayden. 2004. Fishes of Alabama. Smithsonian Institution, Washington, D.C.

Bovee, K.D. 1982. A guide to stream habitat analysis using the instream flow incremental methodology. Office of Biol. Serv., USFWS, U.S. Dept. Of Interior, Wash., DC. FWS/OBS-82-26. 248 pp.

Bovee, K.D., B.L. Lamb, J.M. Bartholow, C.B. Stalnaker, J. Taylor and J. Henriksen. 1998. Stream habitat analysis using the instream flow incremental methodology. U.S. Geological Survey, Biological Resources Division Information and Technology Report USGS/BRD-1998-0004/ viii + 131 pp.

Bozeman, E. L., and M. J. Van Den Avyle. 1989. Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (South Atlantic): Alewife/Blueback Herring.

Buckley, J., and B. Kynard. 1985. Yearly movements of shortnose sturgeons in the Connecticut River. Transactions of the American Fisheries Society 114:813-820.

Bulak, J., J. Bettinger, K. Kubach, J. Leitner, C. Marion, W. Poly, M. Scott, and B. Taylor. 2011. Statewide Research – Freshwater Fisheries, Annual Progress Report.

Bunn, S. E., and A. H. Arthington. 2002. Basic principles and ecological consequences of altered flow regimes for aquatic biodiversity. Environmental management, 30(4), 492-507.

Chapman, M. 2017. Parr Hydroelectric Project Annual Shoreline Inspection FERC Project No. 1894-01. Memo. SCE&G. Columbia, South Carolina. October 23, 2017.

City of Columbia. 2018. 2018 Columbia Fishway Report. Columbia Hydroelectric Project, FERC No. 1895. Filed January 30, 2019.

Collins, M. R., T. I. J. Smith, W. C. Post, and O. Pashuk. 2000. Habitat Utilization and Biological Characteristics of Adult Atlantic Sturgeon in Two South Carolina Rivers. Transactions of the American Fisheries Society 129(4): 982-988.

Collins, M. R., D. W. Cooke, B. Post, J. Crane, J. Bulak, T. I. J. Smith, T. W. Greig, and J. M. Quattro. 2003. Shortnose sturgeon in the Santee Cooper Reservoir system, South Carolina. Transactions of the American Fisheries Society 132:1244-1250.

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 Online. Available at: http://www.npwrc.usgs.gov/resource/wetlands/classwet/index.htm (Version 04DEC1998). Accessed January 24, 2020.

Dadswell, M. J. 1979. Biology and population characteristics of the shortnose sturgeon, *Acipenser brevirostrum* LeSueur 1818 (Osteichthyes: Acipenseridae), in the Saint John River estuary, New Brunswick, Canada. Canadian Journal of Zoology, 57(11), 2186-2210.

Daugherty, D. J., M. T. Driscoll, D. E. Ashe, and J. W. Schlechte. 2014. Effects of structural and spatiotemporal factors on fish use of artificial habitat in a Texas reservoir. North American journal of fisheries management, 34(2), 453-462.

Dillon, R. T. 2000. The Ecology of Freshwater Molluscs. United Kingdom: Cambridge University Press.

Dominion Energy. 2018a. Application for Non-Project Use of Project Lands, FERC Project Number 1894. Dominion Energy.

_____. 2018b. License Application for the Parr Hydroelectric Project, FERC Project Number 1894. Dominion Energy.

_____. 2019. Memo dated September 18, 2019, Parr Hydroelectric Project, FERC Project No. 1894-211, Response to FERC Additional Information Request dated August 7, 2019.

Dow, R. L. 1962. Swimming speed of river herring *Pomolobus pseudoharengus* (Wilson). Journal du Conseil, Conseil Permanent International pour l'Exploration de la Mer, 27: 7-80.

Dutterer, A. C., M. S. Allen, and W. E. Pine, III. 2011. Spawning habitats for American shad at the St. Johns River, Florida: Potential for use in establishing MFLs.

Completion Report, November 2011. Submitted to the Florida Fish and Wildlife Conservation Commission and St. Johns River Water Management District.

Edwards, E. A., G. Gebhart, and O. E. Maughan. 1983. Habitat suitability information: Smallmouth bass. U.S. Department of Interior, Fish and Wildlife Service/OBS-82/10.36. 47 pp.

Encyclopedia of Earth (EOE). 2008. Ecoregions of North and South Carolina. Available at: http://www.eoearth.org/view/article/152148/. Accessed on January 14, 2020.

EPA (U.S. Environmental Protection Agency). 1986. *Quality Criteria for Water*. EPA 440/5-86-001. EPA, Office of Water Regulations and Standards. May 1, 1986.

EPRI (Electric Power Research Institute). 2000. Technical evaluation of the utility of intake approach velocity as an indicator of potential adverse environmental impact under Clean Water Act Section 316(b). Prepared by Alden Research Laboratory, Inc., Holden, Massachusetts. EPRI Report No. TR- 1000731. December 2000.

_____. 2003. Evaluating the effects of power plant operations on aquatic communities: Summary of impingement survival studies. Palo Alto, CA. EPRI Report No. 1007821.

Farrae, D. J., W. C. Post, and T. L. Darden. 2017. Genetic Characterization of Atlantic Sturgeon, *Acipenser oxyrinchus*, in the Edisto River, South Carolina and Identification of Genetically Discrete Fall and Spring Spawning. Conservation Genetics 18: 813.

Finney, S.T., J.J. Isely, and D.W. Cook. 2006. Upstream Migration of Two Pre-Spawning Shortnose Sturgeon Passed Upstream of the Pinopolis Dam, Cooper River, South Carolina. Southeastern Naturalist 5(2):369-37.

Fish, F. F., and E. G. McCoy. 1959. The river discharges required for effective spawning by striped bass in the rapids of the Roanoke River of North Carolina. North Carolina Wildlife Resources Commission, Raleigh, 38 p.

Fisk, J. M., T. J. Kwak, and R. J. Heise. 2015. Effects of regulated river flows on habitat suitability for the robust redhorse. Transactions of the American Fisheries Society, 144(4), 792-806.

FWS (U.S. Fish and Wildlife Service). 1994. Rough-leaved Loosestrife Recovery Plan. U.S. Fish and Wildlife Service. Atlanta, GA. 32 pp.

_____. 1995. Smooth Coneflower Recovery Plan. Atlanta, GA. 31 pp. https://ecos.fws.gov/docs/recovery_plan/950418.pdf. Accessed February 4, 2020.

_____. 1997. Revised Recovery Plan for the U.S. Breeding Population of the Wood Stork. U.S. Fish and Wildlife Service, Atlanta, Georgia. 41 pp.

_____. 2003. Recovery plan for the red-cockaded woodpecker (Picoides borealis): second revision. U.S. Fish and Wildlife Service, Atlanta, Georgia.

_____. 2007a. National Bald Eagle Management Guidelines. May 2007, 23 pp.

_____. 2007b. Endangered and Threatened Wildlife and Plants: Removing the Bald Eagle in the Lower 48 States from the List of Endangered and Threatened Wildlife, Final Rule, Federal Register, Volume 72, No. 130, Washington, D.C., July 9, 2007.

_____. 2010a. Scaleshell Mussel Recovery Plan (*Leptodea leptodon*). U.S. Fish and Wildlife Service, Fort Snelling, Minnesota. 118 pp.

_____. 2010b. Canby's Dropwort (*Oxypolis canbyi*), 5-Year Review: Summary and Evaluation. USFWS South Carolina Ecological Services Field Office, Charleston, South Carolina. <http://ecos.fws.gov/docs/five_year_review/doc3282.pdf.> Accessed February 3, 2020.

_____. 2014. Endangered and threatened wildlife and plants; reclassification of the U.S. breeding population of the wood stork from endangered to threatened. Final Rule, Federal Register. 79(125): 37078-37103.

_____. 2015. Northern Long-Eared Bat. (*Myotis septentrionalis*) Fact Sheet. http://www.fws.gov/midwest/endangered/mammals/nleb/nlebFactSheet.html.

_____. 2017. Northern Long-Eared Bat Final 4(d) Rule, White-Nose Syndrome Zone Around WNS/Pd Positive Counties/Districts. Created May 1, 2017. Available at http://www.fws.gov/Midwest/endangered/mammals/nleb/pdf/WNSZone.pdf. Accessed February 3, 2020

_____. 2018a. IPaC Official Species List for the Parr Project, FERC Project No. 1894. Filed November 7, 2018, in response to Commission staff's use of FWS's IPaC system. Available at: https://ecos.fws.gov/ipac. Accessed November 6, 2018.

_____. 2018b. Southern hognose snake. Species profile. https://www.fws.gov/southeast/wildlife/reptiles/. Accessed February 27, 2020.

_____. 2019a. U.S. Fish & Wildlife Service Tricolored bat (*Perimyotis subflavus*) Fact Sheet. https://www.fws.gov/southeast/pdf/fact-sheet/tricolored-bat.pdf. February 2019.

_____. 2019b. South Carolina List of At-Risk, Candidate, Endangered, and Threatened Species by County. https://www.fws.gov/southeast/pdf/fact-sheet/south-carolina-species-list-by-county.pdf. Accessed September 9, 2019.

_____. 2020a. IPaC Official Species List for the March 31, 2020, in response to Commission staff's use of FWS's IPaC system. Available at: https://ecos.fws.gov/ipac. Accessed March 31, 2020.

_____. 2020b. National Wetlands Inventory, https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/ Accessed January 24, 2020.

Gordon, N. D., T. A. McMahon, B. L. Finlayson, and C. J. Gippel. 2004. Stream hydrology: an introduction for ecologists, 1st edition. John Wiley and Sons.

Greene, K. E., J. L. Zimmerman, R. W. Laney, and J. C. Thomas-Blate. 2009. Atlantic Coast Diadromous Fish Habitat: A review of Utilization, Threats, Recommendations for Conservation, and Research Needs. Atlantic States Marine Fisheries Commission Habitat Management Series No. 9. Washington, D.C. 484.

Griffith, G., J. Omernik, and J. Comstock. 2002. Ecoregions of South Carolina. Prepared for the Natural Resources Conservation Service (NRCS). Available at: https://www.nrc.gov/docs/ML1127/ML112710639.pdf. Accessed on January 14, 2020.

Haag, W. R. 2012. North American Freshwater Mussels: Natural History, Ecology, and Conservation. United Kingdom: Cambridge University Press.

Hall, J.W., T.I.J. Smith, and S.D. Lamprecht. 1991. Movements and habitats of shortnose sturgeon, *Acipenser brevirostrum* in the Savannah River. Copeia 1991: 695- 702.

Hunt, J., and C. A. Annett. 2002. Effects of habitat manipulation on reproductive success of individual largemouth bass in an Ozark reservoir. North American Journal of Fisheries Management, 22(4), 1201-1208.

Jenkins, R.E. and N.M. Burkhead. 1993. Freshwater fishes of Virginia. American Fisheries Society, Bethesda, Maryland.

Katopodis, C., and R. Gervais. 2016. Fish swimming performance database and analyses. Department of Fisheries and Oceans, Canadian Science Advisory Secretariat Research Document 2016/002.

Kieffer, M., and B. Kynard. 2012. Spawning and non-spawning migrations, spawning, and the effect of river regulation on spawning success of Connecticut River Shortnose Sturgeon. *In*, Life history and behaviour of Connecticut River shortnose and other sturgeons. B. Kynard, P. Bronzi and H. Rosenthal (Eds.). World Sturgeon Conservation Society Special Publication, No. 4. 73-113. ISBN 978-3-8448-2801-6. Books on Demand, Norderstedt, Germany.

Kleinschmidt. 2014. Water Quality Report – Parr Fairfield Hydroelectric Project, FERC No. 1894. Report prepared for South Carolina Electric & Gas Company, Cayce, South Carolina. May 2014. Filed June 28, 2018.

_____. 2015. Rocky Shoals Spider Lily Report. Prepared for South Carolina Electric & Gas Co. November 2015

_____. 2016a. Water Quality in Downstream West Channel Study Report – Parr Fairfield Hydroelectric Project, FERC No. 1894. Report prepared for South Carolina Electric & Gas Company, Cayce, South Carolina. April 2016. Filed June 28, 2018.

_____. 2016b. Parr and Monticello Reservoir Fluctuation Study. Parr Fairfield Hydroelectric Project, FERC No. 1894. Report prepared for South Carolina Electric & Gas Company, Cayce, South Carolina. April 2016. Filed June 28, 2018.

_____. 2016c. Instream Flow Study Report. Parr Fairfield Hydroelectric Project, FERC No. 1894. Report prepared for South Carolina Electric & Gas Company, Cayce, South Carolina. October 2016. Filed June 28, 2018.

_____. 2016d. Recreation and Land Use Study Report. Parr Fairfield Hydroelectric Project, FERC No. 1894. Report prepared for South Carolina Electric & Gas Company, Cayce, South Carolina. November 2016. Filed June 28, 2018.

_____. 2017a. West Channel Water Quality Second Year Study Report – Parr Fairfield Hydroelectric Project, FERC No. 1894. Report prepared for South Carolina Electric & Gas Company, Cayce, South Carolina. January 2017. Filed June 28, 2018.

_____. 2017b. Waterfowl Aerial Surveys of Monticello and Parr Reservoirs, South Carolina: Final Report. Prepared by Savannah River Ecology Lab (SREL) and Kleinschmidt Associates (Kleinschmidt). April 2017.

_____. 2017c. Rare, Threatened, and Endangered Species Desktop Assessment, Parr Hydroelectric Project, FERC Project Number 1894. Prepared by Kleinschmidt. Revised September 2017.

_____. 2018. Environmental Assessment. SCE&G Blair Sand Mine. Fairfield County, South Carolina. Prepared for Newberry Sand, Inc. Woodruff, South Carolina. October 2018. Filed October 26, 2018.

Knapp, W. E., B. Kynard, and S. P. Gloss. 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.

Kynard, B. 1997. Life history, latitudinal patterns, and status of the shortnose sturgeon *Acipenser brevirostrum*. Environmental Biology of Fishes 48:319-334.

Larimore, R. W., and M. J. Duever. 1968. Effects of temperature acclimation on the swimming ability of smallmouth bass fry. Transactions of the American Fisheries Society, 97:175-184.

Leggett, W. C., and R. R. Whitney. 1972. Water temperature and the migrations of American shad. Fishery Bulletin, 70(3), 659-670.

Leggett, W. C. 1976. The American shad (*Alosa sapidissima*), with special reference to its migration and population dynamics in the Connecticut River. The Connecticut River ecological study: the impact of a nuclear power plant. American Fisheries Society Monograph No. 1:169-225.

Meador, M. R., Eversole, A. G., & Bulak, J. S. 1984. Utilization of portions of the Santee River system by spawning blueback herring. North American Journal of Fisheries Management, 4(2), 155-163.

Melvin, G.D., M.J. Dadswell, and J.D. Martin. 1986. Fidelity of American shad, *Alosa sapidissima* (Clupeidae), to its river of previous spawning. Canadian Journal of Fisheries and Aquatic Sciences 43:640-646.

Miranda, L.E. 2017. Reservoir fish habitat management. Lightning Press, Totowa, New Jersey. 306 pp.

Moring, J. R., and P. H. Nicholson. 1994. Evaluation of three types of artificial habitats for fishes in a freshwater pond in Maine, USA. Bulletin of Marine Science, 55(2-3), 1149-1159.

Natural Resource Conservation Service (NCRS). 2014. Web Soil Survey. Available at: https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx. Accessed on January 14, 2020.

NatureServe. 2019a. Wood Stork (*Mycteria americana*). NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available at: http://explorer.natureserve.org. Accessed: January 8, 2020.

_____. 2019b. Carolina Birds-in-a-nest (*Macbridea caroliniana*). NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available at: http://explorer.natureserve.org. Accessed: January 8, 2020.

_____. 2019c. Ciliate-leaf Tickseed *(Coreopsis integrifolia*). NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available at: http://explorer.natureserve.org. Accessed: February 11, 2020.

_____. 2019d. Bog Spicebush (*Lindera subcoriacea*) - B.E. Wofford. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://explorer.natureserve.org. (Accessed: February 11, 2020).

_____. 2019e. Smooth Coneflower (*Echinacea laevigata*) -. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://explorer.natureserve.org. (Accessed: February 1, 2020).

Neitzel, D. A., M. C. Richmond, D. D. Dauble, R. P. Mueller, R. A. Moursund, C. S. Abernethy, G. R. Guensch, and G. F. Cada. 2000. Laboratory studies on the effects of shear on fish. Final Report. Pacific Northwest National Laboratory, U.S. Department of Energy.

Newcomb, T.J. and J.S. Fuller. 2001. Anadromous and Catadromous Fish Survey of Santee/Cooper Basin in North Carolina and South Carolina. Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University, Blacksburg, Virginia. Final Report, Prepared for Duke Power. June 25, 2001. 25 pp.

NMFS (National Marine Fisheries Service). 1998. Recovery Plan for the Shortnose Sturgeon (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. 104 pages

NMFS, FWS, and South Carolina DNR (South Carolina Department of Natural Resources. 2001. Santee-Cooper Basin Diadromous Fish Passage Restoration Plan.

NMFS, North Carolina Wildlife Resources Commission, South Carolina DNR, and U.S. Fish and Wildlife Service. 2017. Santee Basin Diadromous Fish Restoration Plan.

NRC and Corps (U.S. Nuclear Regulatory Commission and U.S. Army Corps of Engineers). 2011. Final Environmental Impact Statement for Combined Licenses for Virgil C. Summer Nuclear Station Units 2 and 3. Washington, D.C. and Charleston, South Carolina. April 2011.

Price, J., C. Eads, and J. Raley. 2010. Fish Passage on the Broad River: an assessment of the benefits to freshwater mussels. Completion Report to the Broad River Mitigation Fund.

Price, J., C. Eads, and J. Levine. 2016. Fish Passage on the Broad River: and Assessment of freshwater mussel distribution after 9 years of fish passage operation. Progress Report to the Broad River Mitigation Fund.

Rochester, H., Jr., T. Lloyd, and M. Farr. 1984. Physical impacts of small scale hydroelectric facilities and their effects on fish and wildlife. FWS/OBS-84/19. U.S. Fish and Wildlife Service. 191 pp.

Rogers, K. B., and E. P. Bergersen. 1999. Utility of synthetic structures for concentrating adult northern pike and largemouth bass. North American Journal of Fisheries Management, 19(4), 1054-1065.

Rohde, F. C., R. G. Arndt, J. W. Foltz, and J. M. Quattro. 2009. Freshwater Fishes of South Carolina. Columbia, South Carolina. University of South Carolina Press.

Ross, R. M., Bennett, R. M., & Backman, T. W. H. 1993. Habitat use by spawning adult, egg, and larval American shad in the Delaware River. Rivers, 4(3), 227-238.

Sethi, S. A., A. R. Selle, M. W. Doyle, E. H. Stanley, and H. E. Kitchel. 2004. Response of unionid mussels to dam removal in Koshkonong Creek, Wisconsin (USA). Hydrobiologia, 525(1-3), 157-165.

Setzler-Hamilton, E. M., Boynton, W. R., Wood, K. V., Zion, H. H., Lubbers, L., Mountford, N. K., P. Frere, L. Tucker, and J. A. Mihursky. 1980. Synopsis of biological data on striped bass, *Morone saxatilis* (Walbaum). NOAA Technical Report, NMFS Circular 433. FAO Synopsis No. 121.

Shepard, S. L. 2015. American Eel Biological Species Report. U.S. Fish and Wildlife Service, Hadley, Massachusetts, xii+120 pages.

Shortnose Sturgeon Status Review Team. 2010. A Biological Assessment of shortnose sturgeon (*Acipenser brevirostrum*). Report to National Marine Fisheries Service, Northeast Regional Office. November 1, 2010. 417 pp.

Smith, C. L. 1985. The inland fishes of New York State. The New York State Department of Environmental Conservation, Albany, New York.

Smith, D. G. 2001. Pennak's Freshwater Invertebrates of the United States: Porifera to Crustacea, 4th Edition. John Wiley & Sons.

South Carolina DHEC (South Carolina Department of Health and Environmental Control). 2014. R.61-68, Water Classifications & Standards.

South Carolina DNR (South Carolina Department of Natural Resources). 2005. South Carolina Comprehensive Wildlife Conservation Strategy: 2005-2010. Columbia, South Carolina. September 2005. http://www.dnr.sc.gov/cwcs/. Accessed January 7, 2020.

____. 2009. South Carolina State Water Assessment, Second Edition. Edited by Andrew Wachob, A. Drennan Park, and Roy Newcome, Jr.

_____. 2014. South Carolina Habitat Plan for American Shad. Submitted to the Atlantic States Marine Fisheries Commission as a requirement of Amendment 3 to the Interstate Management Plan for Shad and River Herring.

____. 2015a. State Wildlife Action Plan (2015 revision). http://dnr.sc.gov/swap/index.html. Accessed January 27, 2020.

____. 2015b. State Wildlife Action Plan, Supplemental Volume: Species of Greatest Conservation Need (Priority Species). http://dnr.sc.gov/swap/species2015.html.

_____. 2016a. South Carolina DNR Managed Lands: Broad River Waterfowl Management Area. https://www2.dnr.sc.gov/ManagedLands/ManagedLand/ManagedLand/68. Accessed January 13, 2020.

_____. 2016b. South Carolina DNR Managed Lands: Enoree River Waterfowl Management Area https://www2.dnr.sc.gov/ManagedLands/ManagedLand/ManagedLand/70. Accessed January 13, 2020.

_____.2018. 2018-2019 Annual South Carolina Aquatic Plant Management Plan. Prepared by the Aquatic Nuisance Species Program South Carolina Department of Natural Resources and Approved by the South Carolina Aquatic Plant Management Council 2018.

_____. 2019a. South Carolina Rare, Threatened, and Endangered Species by County. http://www.dnr.sc.gov/species/county.html. Accessed September 9, 2019.

____. 2019b. South Carolina Bat Conservation Plan. Columbia, South Carolina. 204 pp. http://www.dnr.sc.gov/wildlife/bats/SCBatConservationPlanChapter2.pdf Accessed January 30, 2020.

South Carolina DPRT (South Carolina Department of Parks, Recreation & Tourism). 2019. South Carolina Comprehensive Outdoor Recreation Plan. Available at https://www.scprt.com/recreation/statewide-comprehensive-outdoor-recreation-plan. Accessed January 9, 2020.

South Carolina Exotic Pest Plant Council (South Carolina EPPC). 2014. Invasive Plant List https://www.se-eppc.org/southcarolina/invasivePlants.cfm Accessed January 9, 2020.

Steinhart, G. B., N. J. Leonard, R. A. Stein, and E. A. Marschall. 2005. Effects of storms, angling, and nest predation during angling on smallmouth bass *(Micropterus dolomieu*) nest success. Canadian Journal of Fisheries and Aquatic Sciences, 62(11), 2649-2660.

Stoudemire, C. 2017. FERC Project No. 1894 Fairfield Pumped Storage Facility Monticello Reservoir Routine Shoreline Surveillance. Memo. SCE&G. Columbia, South Carolina. November 2, 2017.

Three Oaks Engineering. 2016. Freshwater Mussel Survey Report in Monticello Reservoir. Prepared for South Carolina Electric and Gas Company & Kleinschmidt Associates.

Webb, P. W. 1998. Swimming. *In* The Physiology of Fishes (ed. D. H. Evans), pp.3 -24. Boca Raton: CRC Press.

Welch, S. M. 2000. A Report on the Historical Inland Migrations of Several Diadromous Fishes in South Carolina Rivers. Department of Aquaculture, Fisheries and Wildlife, Clemson University, Clemson, South Carolina. Report prepared for Mr. Douglas W. Cook, South Carolina Department of Natural Resources. December 4, 2000. 19 pp.

Valentin, S., Y. Souchon, and J. G. Wasson. 1994. Evaluation of hydro-peaking effects on fish community and habitat. Pages 138–151 *in* I. G. Crown (eds.), Rehabilitation of freshwater fisheries. Fishing News Books, Oxford.

Young, P. S., J. J. Cech, and L. C. Thompson. 2011. Hydropower-related pulsed-flow impacts on stream fishes: a brief review, conceptual model, knowledge gaps, and research needs. Reviews in Fish Biology and Fisheries, 21(4), 713-731.

8.0 LIST OF PREPARERS

Allan Creamer – Water Quality (Fisheries Biologist; B.S. and M.S., Fisheries Science)

Rachel McNamara – Project Coordinator, Geology and Soils (Outdoor Recreation Planner; B.A., Public Policy and Environment Studies; M.C.P., Land Use and Environmental Planning)

Adam Peer – Fisheries, Threatened and Endangered Aquatic Species (Fisheries Biologist; B.S., Biology; M.S., Fisheries Science; Ph.D., Marine, Estuarine, and Environmental Science)

Kristine Sillett – Terrestrial Resources, Threatened and Endangered Species (Wildlife Biologist; B.S., Zoology; M.S. Biological Sciences)

Monte TerHaar – Engineering Resources, Developmental Resources (Environmental Engineer; M.S., Environmental Engineering; M.S., Aquatic/Fisheries Biology)

Dustin Wilson – Recreation, Land Use, and Cultural Resources (Outdoor Recreation Planner; B.S., Parks and Recreation Management; M.P.A., Master of Public Affairs; Ph.D. Parks, Recreation, and Tourism Management)

APPENDIX A– Comprehensive Relicensing Settlement Agreement

PARR HYDROELECTRIC PROJECT
COMPREHENSIVE RELICENSING SETTLEMENT AGREEMENT

PARR HYDROELECTRIC PROJECT
(FERC NO. 1894)

SOUTH CAROLINA ELECTRIC & GAS COMPANY

1.0 INTRODUCTION

South Carolina Electric & Gas Company (SCE&G), as the holder of the current license for the Parr Hydroelectric Project (Project) (FERC No. 1894) and the applicant for a new license, hereby files the following Offer of Settlement Agreement pursuant to Rule 602 of the Rules of Practice and Procedure of the Federal Energy Regulatory Commission (FERC or Commission) 18 C.F.R. § 385.602. This Comprehensive Relicensing Settlement Agreement (CRSA) has been entered into among SCE&G, state and federal resource agencies, NGOs, individuals and other entities who have been parties to the relicensing proceeding. The obligations and agreements presented in this CRSA are incorporated in appendices A and B. Furthermore, the signatories to the CRSA request that the Commission incorporate the obligations and agreements as illustrated in Appendix A without material modification into the terms and conditions of the new license, as proposed in Appendix E.

2.0 BACKGROUND

2.1 PROJECT DESCRIPTION

The Project is an existing licensed hydroelectric project located on the Broad River in Newberry and Fairfield counties, South Carolina approximately 26 river miles upstream from the City of Columbia. The Project consists of two developments: the 14.88-megawatt (MW) Parr Shoals Development (Parr Development) and the 511.2-MW Fairfield Pumped Storage Development (Fairfield Development). Parr Reservoir is a 4,400-acre impoundment formed by the Broad River and the Parr Shoals Dam and serves as the lower reservoir for the Fairfield Development. Monticello Reservoir is a 6,800-acre impoundment formed by a series of four earthen dams and serves as the upper reservoir for the Fairfield Development. The Parr Development consists of a powerhouse with six generators, a 2,390 foot long dam (including spillway and non-overflow

sections), Parr Reservoir, and transmission and appurtenant facilities. The Fairfield Development consists of four earthen dams, an intake channel, a gated intake structure, four surface penstocks bifurcating into eight concrete-encased penstocks, a generating station housing eight pump-turbine units, Monticello Reservoir, and transmission and appurtenant facilities.

2.2 PROJECT OPERATIONS

The Parr Development operates in modified run of river mode, and generates as a baseload facility using available inflows up to 4,800 cfs. This flow is associated with turbines set at approximately 50 percent gate opening, as the full hydraulic capacity of 6,000 cfs results in power output that exceeds the rated capacity of generators. SCE&G is planning to complete generator upgrades following issuance of a new Project license. This will result in a generating capacity increase of approximately 17 percent.

The Fairfield Development is utilized as a peaking resource, and also as a reserve generation asset to the extent it is not being used to meet peak demand of SCE&G's system. Fairfield generates and pumps using an active storage of 29,000 acre-feet of water. During the generation cycle, active storage in the upper Monticello Reservoir is released from the powerhouse into the lower Parr Reservoir. During the pumping cycle, the active storage is transferred from the Parr Reservoir back into the Monticello Reservoir. This cycle occurs daily, and the transfer of the full active storage results in an upper reservoir maximum fluctuation of 4.5 feet, and a corresponding lower reservoir fluctuation of 10 feet. Monticello Reservoir also serves as a source of cooling water for the V.C. Summer Nuclear Station.

If Project operations are materially changed during the term of the new license, the signatories will meet to discuss potential revisions to the Adaptive Management Plans.

2.3 LICENSING HISTORY

The existing Project license was issued by FERC on August 28, 1974 for a period of 46 years, terminating on June 30, 2020. SCE&G initiated the formal relicensing process on January 5, 2015 by filing with the Commission the Notice of Intent, Pre-Application Document, and request

to use the Traditional Licensing Process. Since that date, SCE&G has worked cooperatively with agencies and non-agency stakeholders through numerous resource group meetings to do the following: establish the scope of studies needed to address issues raised at the Project and develop study reports; conduct agreed upon studies; provide draft copies of study reports to agencies and stakeholders for review and comment; revise study reports to reflect agency/stakeholder comments; and complete follow-up studies deemed necessary to accomplish study goals. Resource Conservation Group (RCG) meetings and Technical Working Committee (TWC) meetings have also served to provide a forum for discussion of Project related concerns among stakeholders. These discussions have continued through the filing of the Draft License Application on May 31, 2017, the development of the Final License Application, and to facilitate development of this CRSA, resulting in the proposals set forth below.

3.0 PURPOSE OF THE CRSA

The purpose of this CRSA is to set forth resolutions reached among the signatories of this CRSA to issues raised during the relicensing process for the Project. The resolutions presented in Appendix A are respectfully proposed for consideration by FERC as it develops terms for the new license and have been structured in accordance with Federal Power Act (FPA) section 10(a)(1), 16 U.S.C. § 803(a)(1), for the balance of both developmental and non-developmental resources.

The purpose of Appendix B to this CRSA is to reflect off-license agreements made between CRSA signatories. These agreements have been proposed as off-license as they concern matters over which the Commission asserts no jurisdiction.

4.0 TERMS AND IMPLEMENTATION

4.1 TERMS

4.1.1 GENERAL

This CRSA is in no way intended to conflict with the legal responsibilities of the CRSA signatories, nor be in conflict with any lawful statutory or regulatory responsibility of or authority held by the signatories. Furthermore, signatories to this CRSA are representing their belief that the issues resolutions developed through good faith efforts and presented herein do not conflict with these responsibilities.

4.1.2 FOR THE NEW LICENSE

The signatories to this CRSA recognize that the Commission will incorporate into the new license those articles required by 18 C.F.R. 2.9 (L-Forms), as well as such other articles as the Commission believes are necessary to fulfill its responsibilities in the administration and enforcement of the new license. With these considerations, the signatories respectfully request that the Commission incorporate the terms set forth in this CRSA as presented in Appendix A as conditions of the new license without material modification. Based on the significant efforts made to achieve the agreements reflected in this CRSA, and subject to the Commission's approval of the various adaptive management programs underlying the signatories' consensus on a number of issue resolutions, SCE&G respectfully request that the Commission consider issuing a new license for a term of 50 years.

4.1.3 FISH PASSAGE

A Prescription for Fishways referenced within section 18 of the FPA, 15 U.S.C. § 811, is not included in this CRSA. A provision for Reservation of Authority by the Secretary of the Interior for the new license has been established and is included in the Santee River Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement (Accord) (Attached as Appendix A-7). The Accord was entered into by SCE&G, Duke Energy Carolinas, LLC, South Carolina Department of Natural Resources (SCDNR), North Carolina Wildlife Resources Commission, and United States Fish & Wildlife Service (USFWS). Fishway prescriptions filed with the

Commission will be consistent with the Accord. Although not a signatory to the Accord because of their position that they may not bind themselves in any way that might infringe upon their various statutory authorities and obligations, the National Marine Fisheries Service (NMFS) and the South Carolina Department of Health and Environmental Control (SCDHEC) were integral members of the team that developed the Accord, and each will participate in its natural resource protection role as it determines appropriate.

4.1.4 ENDANGERED SPECIES ACT

Through cooperation, the signatories to this CRSA have developed Minimum Flow and Downstream Flow Fluctuations Adaptive Management Plans (AMPs) (attached as Appendix A-3 and Appendix A-2) for the Project, which include measures for stabilizing flows downstream of the Project in an effort to improve spawning conditions for several species of fish, including anadromous American shad, as well as striped bass and shortnose sturgeon (Congaree River population). By the signing of this agreement, the USFWS and NMFS each believes, based on currently known information, that the measures specified by the CRSA will protect rare, threatened and endangered (RT&E) species and that it intends to issue a Biological Opinion (BO) consistent with such measures. This CRSA is in no way intended to compromise the authority of the USFWS and NMFS and their determination of conditions for compliance with the Endangered Species Act (ESA), 7 U.S.C. §136; 16 U.S.C. §1531 et seq., or preclude any standard conditions pursuant to applicable law.

In the event that a BO is inconsistent with this CRSA, the agency issuing the BO may withdraw after discussion as described in Section 4.2.6.

4.2 IMPLEMENTATION

4.2.1 COMMITMENTS OF SIGNATORIES

By the signing of this CRSA, signatories are expressing their support for the components herein, some of which represent compromise resolutions but all of which are acceptable given the interests, rights, and obligations of the signatories. The signatories, by signing, also are expressing their support for the incorporation of these components into the new license. Once

the CRSA is signed, all signatories commit to supporting this CRSA to the extent allowable by their authority and based on currently available information.

Should the FERC's draft National Environmental Policy Act (NEPA) document be inconsistent with the CRSA, the signatories will work cooperatively to develop appropriate responses to address the inconsistencies. Within 30 days after the draft NEPA document is issued by the FERC, SCE&G has the option to convene a meeting with the signatories to address any inconsistencies.

Should the final NEPA document and/or license be inconsistent with the CRSA, the signatories will work cooperatively to develop appropriate responses to address the inconsistencies, within the limits of each signatory's authority. Within 14 days after the issuance of the final NEPA document and/or the new license, SCE&G has the option to give notice of its intent to convene a meeting with the signatories to address any inconsistencies.

Upon acceptance of the license, SCE&G will request a transition meeting with the FERC Division of Hydropower Administration and Compliance (DHAC) and the FERC Division of Hydropower Licensing which would include the licensee and all interested signatories to the CRSA.

All signatories believe that this CRSA is consistent with all applicable laws and regulations. However, nothing in this CRSA is intended to abrogate the regulatory or statutory responsibilities of the signatories under applicable law.

Participation in the Adaptive Management Plan (AMP) Review Committees is on a voluntary basis. Expenses incurred by AMP member organizations will not be reimbursed by SCE&G.

Signatories agree to provide current and updated contact information (e-mail, mail, and phone) to SCE&G during the term of the new license. SCE&G agrees to maintain and share the provided contact information.

This CRSA is made with the express understanding that it constitutes a negotiated resolution of issues specific to the Project. No Party will be deemed, by virtue of execution of this CRSA, to have established precedent or admitted or consented to any approach, methodology, or principle, except as it relates to the Project. In the event this CRSA is approved by FERC, such approval will not be deemed precedential or controlling regarding any particular issue or contention in any other proceeding.

4.2.2 LEGAL AUTHORIZATION OF SIGNATORIES

By the signing of this CRSA each signatory represents that he/she has the authorization from the party or parties he/she represents legally to bind that party or those parties to this CRSA. Moreover, upon signature, parties represented by the signing person(s) shall be legally bound to the terms expressed herein, and nothing herein shall be construed as binding any individual signatory on any matter beyond its individual authorities and responsibilities.

4.2.3 SIGNING PERIOD

SCE&G distributed the final CRSA with a signature page to each and every relicensing Party on June 14, 2018. Based on stakeholder feedback, SCE&G will receive a majority of fully executed signature pages to the CRSA by June 26, 2018. SCE&G will add all of the fully executed signature pages to the original CRSA for filing with the Commission, and will provide copies of all completed signature pages to each of the signatories. Several stakeholders' legal departments are still evaluating the CRSA and intend to provide their signature page after that review is complete. These additional stakeholder signature pages will be filed with the Commission once they are provided to SCE&G.

4.2.4 EFFECTIVE DATE OF THE CRSA

This CRSA becomes binding on the signatories on the date that SCE&G files the CRSA with the Commission, or the date upon which signatures are received if they are received after the CRSA is filed with the Commission.

4.2.5 MODIFICATION OF THE CRSA

After the signing period has ended, the signatories may by Unanimous Consent, modify the agreement. In the event Unanimous Consent is required, a signatory must respond to contact within three (3) documented attempts over the course of 30 days, or the consent process will move forward without them.

In the event environmental analysis, pre-license investigation, or post-license investigation yields material new information which may warrant changes to the CRSA, any signatory may request and SCE&G will convene a meeting with the signatories to discuss whether and/or how to modify the CRSA to address the material new information.

4.2.6 WITHDRAWAL OF SIGNATORIES

A signatory may withdraw from this CRSA if his/her/its interests are materially affected by an Inconsistent Act by a Jurisdictional Body. An example of an Inconsistent Act is a new license requirement for downstream flows and/or reservoir fluctuations materially different from those in the CRSA.

Any signatory intending to withdraw from this CRSA will notify all other signatories in writing with the basis for the withdrawal no less than 60 days prior to the withdrawal. With notice to all signatories, any other signatory may require a meeting of the withdrawing signatory to have the matter discussed prior to withdrawal from the CRSA.

Any signatory (with the exception of NMFS, USFWS, USFS, SCDNR, SCSHPO, and SCDHEC) that withdraws from this CRSA will also lose its membership to the AMP Review Committees. Initial AMP Review Committee members must be signatories to this CRSA, or one of the above listed agencies.

4.2.7 MODIFICATION OF ADAPTIVE MANAGEMENT PLAN REVIEW COMMITTEE MEMBERSHIP

Inasmuch as the term of the new license will extend over decades, it may be appropriate that new interests be represented or accounted for in the future. Because some signatory organizations

may be transitional, and since new interest groups may arise, the current signatories agree that Adaptive Management Plan (AMP) Review Committee membership may benefit from modification. Therefore, membership changes will be considered, but no sooner than 5 years from the date of the FERC Order granting a new license. With consensus of the AMP members, but subject to SCE&G's (licensee) agreement, membership in the AMP Review Committee may be expanded or otherwise modified. Any member added to the AMP Review Committee must abide by the requirements of the CRSA.

4.2.8 TERMINATION OF THE CRSA

Termination of this CRSA will occur under the following circumstances: (a) expiration of the term of the new license; (b) the termination or surrendering of the new license to FERC by SCE&G pursuant to the requirements of the FPA.

If the License were to be transferred, the new Licensee would be bound to the requirements of the CRSA.

4.2.9 SUBMITTAL OF THE CRSA TO THE COMMISSION

This CRSA shall be submitted to the Commission with the Final License Application, or as soon thereafter as reasonably possible.

4.2.10 COMMISSION REVIEW OF THE CRSA

Should the Commission have any questions or concerns with regards to the CRSA during the process of drafting the new license, the signatories request that the Commission arrange for the convening of a technical conference to discuss these questions.

4.2.11 OFF-LICENSE AGREEMENTS

Appendix B to this CRSA constitutes off-license agreements made between CRSA signatories. These agreements have been proposed as off-license as they concern matters over which the Commission asserts no jurisdiction, their existence carries no weight in the Commission's consideration of the license application under the Federal Power Act, or there is not a clear and

demonstrated nexus between the agreement and the impacts of the Project. The off-license agreements constitute valuable consideration in the parties' agreement to sign the CRSA and enforceability of off-license conditions is controlled by the law of the State of South Carolina.

4.2.12 LICENSE AMENDMENTS

SCE&G will consult with signatories prior to requesting any license amendment that may be inconsistent with the CRSA.

5.0 DEFINITIONS AND ACRONYMS

The definitions set forth in the following sections are applicable to this CRSA and associated appendices and are fundamental to their understanding and interpretation. When appropriate, these definitions may be adopted by the Commission into the articles of the new license.

- Acre-foot – A volume of water equal to one foot depth over an area of one acre, or 43,560 cubic feet.
- Adaptive Management – A process that allows for the review of protection, mitigation and enhancement programs incorporated into the terms of the new license. This process may allow for program modifications based upon unforeseen circumstances or conditions.
- Area of Potential Effects – The geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist.
- Compliance Limit – The instantaneous minimum flow required by FERC to be released from the Project.
- Cubic feet per second (CFS) – A measurement of water flow representing one cubic foot of water moving past a given point in one second. One CFS is equal to 0.0283 cubic meters per second and 0.646 million gallons per day.
- Cultural resources – Includes items, structures, etc. of historical, archaeological, or architectural significance.

- Dissolved oxygen concentration (DO) – One of the most commonly employed measures of water quality, DO is the amount of gaseous oxygen in a liquid. Low DO levels can adversely affect fish and other aquatic life. DO is generally expressed in units of parts per million (ppm) or milligrams per liter (mg/L)
- Elevation – References in this CRSA are given in North American Vertical Datum 1988 (NAVD 88); conversion to National Geodetic Vertical Datum of 1929 (NGVD 29), used in numerous supporting studies for the license application (and often erroneously referred to as MSL) requires the addition of 0.7 feet to elevation values referenced to NAVD88.
- Flow – The volume of water passing a given point per unit of time.
- Generator Capacity – The maximum amount of electricity that can be produced within the safety limitation of a generator.
- Head – The difference in elevation of the upstream reservoir in relation to the tailrace elevation.
- Hydraulic Capacity – The maximum amount of water that can be passed through the Project turbines.
- Hydrologic Condition – The volume and distribution of precipitation, runoff, and streamflow into the Broad River basin which affect the amount of inflow to Parr and Monticello reservoirs at a given time.
- Inconsistent Act – Any action by a Jurisdictional Body that increases the burden upon or cost or risk to a Signatory substantially beyond the burden, cost or risk reasonably assumed by the Signatory to this CRSA, or that deprives a Signatory of a substantial benefit promised by another Signatory in this CRSA.
- Installed Capacity – The nameplate megawatt rating of a generator or group of generators.
- Jurisdictional Body – Any governmental body which has the authority to prevent the implementation of any part of this CRSA, or to require specific steps be followed prior to implementing any part of this CRSA or to require any other activity or activities that may result in an Inconsistent Act.
- Littoral – Associated with shallow (shoreline area) water (e.g., the littoral zone of an impoundment).
- Lotic – Flowing or actively moving water including rivers and streams.

- Low Inflow Protocol – An agreement between a licensee and stakeholders that provides instructions to the licensee on how to manage flows during low inflow periods.
- Material – Important; affecting the merits of a case; causing a particular course of action; significant; substantial.
- Minimum Flow – A continuous flow, measured in CFS that is required to be released from the Project dam during specified periods of time.
- Net Inflow – The previous day's daily average inflow as calculated using the sum of the three upstream USGS gages (USGS 02156500, Broad River near Carlisle, SC; USGS 02160105, Tyger River near Delta, SC; and USGS 02160700, Enoree River at Whitmire, SC) minus evaporation from the reservoirs.
- Non-Governmental Organization (NGO) – An organization that has been created by an individual or group of individuals containing no official membership of participation by any governmental entity.
- Non-Project Property – Lands not contained within the Project boundary. Unless clear in the context of its use that it is referring to non-SCE&G owned property, all uses herein shall be deemed to refer to SCE&G-owned properties outside the Project boundary.
- Normal Operating Capacity – The maximum MW output of a generator or group of generators under normal maximum head and flow conditions.
- Pre-Application Document (PAD) – A document, representing a collection of documents as compiled into a single unit, containing detailed information on a hydroelectric project; the document is used to describe the project and its resources and to start the applicant's consultation process with resource agencies and the public.
- Project – One or more hydroelectric plants collectively included in a single license issued by the FERC. A Project typically consists of a dam or dams, reservoir(s), powerhouse(s), and appurtenant facilities. As used in this document, the capitalized term "Project" refers specifically to the Parr Hydroelectric Project (FERC Project No. 1894).
- Project Area – All lands and waters within and outside of the Project boundary that may influence materially or be influenced materially by Project operations.
- Project Boundary or Project Boundary Line (PBL) – A demarcation line established by the FERC within which some level of interest in or control over lands, waters and structures are deemed necessary to operate a licensed hydroelectric project.

- Project Vicinity – The general geographic area in which the Project is located for the purposes of describing the existing environment around the Project.
- Recreation site – A land and associated water surface area which people use for leisure activities, whether formally designated or used informally.
- Regulatory agency – A governmental agency that has statutory authority to regulate human or business activities.
- Resource agency – Federal, state, or interstate agency with responsibilities relative to flood control, navigation, irrigation, recreation, fish or wildlife, water resource management, or cultural or other relevant resources of the governmental jurisdiction(s) in which a project is located.
- Review Committee – A group, including SCE&G and stakeholders, formed to direct the implementation of various AMPs and monitoring plans. Members of the Review Committee must be signatories to the CRSA.
- Service List – A list of parties who have formally intervened in a proceeding that is compiled and maintained by FERC; once FERC establishes a Service List, any documents filed with FERC must be sent to all entities on the Service List.
- Signatories – Organizations and/or individuals signed on to the CRSA and not ceased to be by death or dissolution.
- Stakeholder – Any individual or organization (government or non-governmental) with an interest in the management and/or operation of the Parr Project.
- Streamflow – The rate at which water passes a given point in a stream, usually expressed in CFS.
- Tailrace – The tailrace is an area of river downstream of a dam where the impounded water re-enters the river after passing through the turbines.
- Target Flow – The instantaneous minimum flow recommended by the Instream Flow Technical Working Committee (IFTWC) to be released from the Project.
- Unanimous Consent – A vote with no dissenting votes. Abstention or non-response by a signatory is not a dissenting vote.
- Wildlife Management Area (WMA) – An area established as allowed by law through the cooperative agreement of private landowners and the SCDNR to provide for the

enjoyment of all wildlife enthusiasts. Seasonal hunting is allowed on these areas with the purchase of a WMA permit and hunting license.

ACRONYMS

ADA	Americans with Disabilities Act
APE	Area of Potential Effect
AR	American Rivers
AIR	Additional Information Request
AMP	Adaptive Management Plan
AW	American Whitewater
BIA	Bureau of Indian Affairs, an agency of the DOI
BLM	Bureau of Land Management, an agency of the DOI
BO	Biological Opinion
CFR	Code of Federal Regulations
CFS	Cubic feet per second
CNP	Congaree National Park
CRK	Congaree Riverkeeper
CRSA	Comprehensive Relicensing Settlement Agreement
CWA	Clean Water Act
DLA	Draft License Application
DO	Dissolved Oxygen concentration
DOE	US Department of Energy
DOI	US Department of Interior
EA	Environmental Assessment
EAP	Emergency Action Plan
EIS	Environmental Impact Statement
EPA	US Environmental Protection Agency
ESA	Federal Endangered Species Act
FEA	Final Environmental Assessment
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FLA	Final License Application
FPA	Federal Power Act
FTWC	Fisheries Technical Working Committee
GIS	Geographic Information System
GPS	Global Positioning System
HEC-RAS	Hydrologic Engineering Center's River Analysis System
HEC-ResSim	Hydrologic Engineering Center's Reservoir System Simulation
Hp	Horsepower
HPMP	Historic Properties Management Plan
HSI	Habitat Suitability Index
Hz	Hertz (cycles per second)
IFIM	Instream Flow Incremental Methodology
IFTWC	Instream Flow Technical Working Committee
KW	Kilowatt
KWh	Kilowatt-hour
kV	Kilovolts

kVA	Kilovolt-ampere
LLM TWC	Lake and Land Management Technical Working Committee
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MSL	Mean Sea Level
MW	Megawatt
MWh	Megawatt-hour
NAVD	North American Vertical Datum
NEPA	National Environmental Policy Act
NGO	Non-Governmental Organization
NGVD	National Geodetic Vertical Datum
NMFS	National Marine Fisheries Service, also known as NOAA Fisheries
NOAA	National Oceanic & Atmospheric Administration, including NMFS
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NOI	Notice of Intent to file an application for license
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
NWS	National Weather Service
PA	Programmatic Agreement
PAD	Pre-Application Document
PM&E	Protection Mitigation & Enhancement
PMF	Probable Maximum Flood
PPM	Parts per million
RCG	Resource Conservation Group
RTWC	Recreation Technical Working Committee
REA	Ready for Environmental Assessment
SCDHEC or DHEC	South Carolina Department of Health and Environmental Control
RD	Ranger District
RM	River mile
RMP	Recreation Management Plan
RT&E	Rare, Threatened and Endangered
RTE TWC	Rare, Threatened and Endangered Species Technical Working Committee
RSSL	Rocky Shoals Spider Lily
SCDNR or DNR	South Carolina Department of Natural Resources
SCE&G	South Carolina Electric & Gas Company
SCORP	South Carolina Comprehensive Outdoor Recreation Plan
SCPRT	South Carolina Department of Parks, Recreation and Tourism
SCSHPO or SHPO	South Carolina State Historic Preservation Office
SMP	Shoreline Management Plan
THPO	Tribal Historic Preservation Officer
TLP	Traditional Licensing Process
TWC	Technical Working Committee
USACE	US Army Corps of Engineers
USDA	US Department of Agriculture
USFS	US Forest Service

USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
WMA	Wildlife Management Area
WQC	Water Quality Certification, issued under Section 401 of the Federal CWA
WQ TWC	Water Quality Technical Working Committee
WQFW RCG	Water Quality, Fish and Wildlife Resource Conservation Group
WUA	Weighted Usable Area

APPENDIX A

PROPOSED LICENSE CONDITIONS

The following conditions outlined in this Appendix serve to set forth the terms and conditions agreed to by the CRSA signatories for the protection, mitigation, and enhancement of resources affected by the Project. These conditions are incorporated into CRSA Appendix E: Proposed License Articles. Subsequent to the issuance of the new license by the Commission, SCE&G will implement the FERC-approved plans included in this Appendix.

1. RECREATION

a. Recreation Management Plan (Appendix A-1)

2. FISH AND WILDLIFE

a. Flow Fluctuations Downstream of Parr Shoals Dam Adaptive Management Plan (Appendix A-2)

b. Minimum Flows Downstream of Parr Shoals Dam Adaptive Management Plan (Appendix A-3)

c. Monticello Reservoir Fisheries Habitat Enhancement Plan (Appendix A-4)

d. American Eel Abundance Monitoring Plan (Appendix A-5)

e. Freshwater Mussel Monitoring Plan (Appendix A-6)

f. Continue Involvement in the Santee Basin Accord for Diadromous Fish Protection (Appendix A-7)

g. Habitat Enhancement Program (Appendix A-8)

h. **Hydroacoustic Estimates and Distribution of Fish in Monticello and Parr Reservoirs in August 2017 – Protection, Mitigation, Enhancement Measure Recommendation (Appendix A-9)**

3. **WATER QUALITY**

   a. **Enhancements to the West Channel Downstream of Parr Shoals Dam Adaptive Management Plan (Appendix A-10)**

   b. **Parr Shoals Dam Turbine Venting Plan (Appendix A-11)**

4. **OPERATIONS**

   a. **Upgrade/Replacement of Generators at Parr Shoals Development Implementation Plan (Appendix A-12)**

5. **LAKE AND LAND MANAGEMENT**

   a. **Parr Reservoir Shoreline Management Plan (Appendix A-13)**

   b. **Monticello Reservoir Shoreline Management Plan (Appendix A-14)**

   c. **Erosion Monitoring Plan (Appendix A-15)**

6. **CULTURAL RESOURCES**

   a. **Historic Properties Management Plan (Appendix A-16)**

APPENDIX B – National Marine Fisheries Service Preliminary Fishway Prescriptions

Preliminary Fishway Prescriptions Pursuant to Section 18 of the Federal Power Act[1]

filed on September 30, 2019

General Terms and Conditions

1. As defined in the Santee Accord, a Fish Passage Feasibility Assessment shall be initiated when the Columbia Fishway annually passes 46,400 American shad or 185,600 blueback herring for any three years in a five-year period. Construction of a fishway shall commence and shall be completed within three years of the Columbia Fishway annually passing 69,600 American shad or 348,000 blueback herring for any three years in a five year period. The Fish Passage Feasibility Assessment shall include design and construction schedules with the NMFS, in consultation with the Fishery Technical Committee (FTC), having opportunities to review and approve the 30, 60, and 90 percent designs before construction begins.

2. Fishways shall be constructed, operated, and maintained to provide safe, timely, and effective passage for American shad and blueback herring at the Licensee's expense.

3. The NMFS reserves the authority to defer the timing of construction and/or implementation of fishways based on new information that may warrant a change to prescription schedules such as any results from studies or monitoring, changes to the Columbia Fishway, or changes to recreational fishing regulations, or petitions from the 38 Licensee for an extension that is approved by the NMFS. The Licensee shall (1) notify, and (2) obtain approval from the NMFS for any modifications to schedules or extensions of time to comply with the provisions included in the prescription for fishways.

4. Fishways shall be maintained and operated, at the Licensee's expense throughout the upstream and downstream migration periods for the target species. The migration periods for target species are as follows, subject to change by the FTC, based on annual monitoring of fish runs: Current Target Species Upstream Migration Downstream Migration American shad March 1 to May 15 late summer to fall Blueback herring March 1 to May 15 late summer to fall

5. The Licensee shall keep all Parr Shoals fishways in proper order and shall keep fishway areas clear of trash, logs, and material that would hinder passage. Anticipated

[1] The entire filing of the National Marine Fisheries Service is not duplicated herein. This appendix includes only the exact text of the substantive parts of the preliminary fishway prescription, filed by the National Marine Fisheries Service.

maintenance shall be performed sufficiently before a migratory period such that the fishways can be tested and inspected, and the fishway will operate effectively prior to and during the migratory periods. In consultation with the FTC, the Licensee shall develop a fishway operation and maintenance plan (O&M plan) for each fishway, including a fishway and overall facility operational log, describing the anticipated fishway operational protocols, maintenance, maintenance schedule, and contingencies. The plans shall be submitted to the FWS, NMFS, and SCDNR for review and approval. Upon such approval, the plans shall be submitted to the Commission. 39

6. The Licensee shall provide the FWS, NMFS, and SCDNR personnel access to the Parr Project site and to pertinent Parr Project records for the purpose of inspecting the fishways, as needed, to determine compliance with the fishway prescriptions and for general evaluation and oversight observations.

7. The Licensee shall develop detailed design, construction, evaluation, and monitoring plans for review and approval by the NMFS in coordination with the FWS and SCDNR prior to construction. All original plans and subsequent modifications shall be conducted according to guidance and specified criteria provided by NMFS for the design of fish screens, fishways, and other fish passage structures. The Licensee shall have all designs reviewed by the FTC. The Licensee and its agents must establish close consultation with the FWS and NMFS fisheries engineering and fish passage specialists in coordination with SCDNR at the outset of design and throughout the entire process. The initial design meetings shall commence at the pre-design, or conceptual-level design phase. Prior to advancing to feasibility-level of design, the Licensee must obtain concurrence from the FWS and NMFS in coordination with SCDNR all preferred alternatives for each independent facility or any major feature of a facility. The Licensee shall schedule and provide a minimum of 90 days for the FWS and NMFS in coordination with SCDNR to review and approve these comprehensive plans. Shorter review periods may be possible, depending on the nature of the subject, as approved by the FWS and NMFS. The Licensee shall implement any design modifications as required by the FWS and NMFS as necessary to fulfill the objective of safe, timely, and effective passage for all target species considered. Following NMFS approval, the Licensee shall submit final design 40 plans to the Commission for final approval prior to the commencement of construction activities.

8. The Licensee shall develop plans and schedules and conduct fishway effectiveness studies in consultation with the FTC on both upstream and downstream facilities for three fish passage seasons. Additional seasonal sampling may be necessary depending on unforeseen circumstances such as weather conditions. The plans and results of effectiveness studies shall be submitted to the FTC prior to being filed with the Commission. If the Licensee disagrees with any of the comments or recommendations

from the fishery resource agencies, it shall provide an explanation in its filing with the Commission.

APPENDIX C – U.S. Forest Service Section 4(e) Conditions

U.S. Forest Service Standard Section 4(e) Conditions[1]
filed on August 29, 2017

INTRODUCTION

The USDA Forest Service (Forest Service) submits the following Preliminary Section 4(e)Conditions for the Parr Hydroelectric Project, FERC No. 1894-SC, in accordance with 18 CFR 4.34(b)(1)(i). Section 4(e) of the Federal Power Act (FPA), which states the Commission may issue a license for a project within a reservation only if it finds that the License will not interfere or be inconsistent with the purpose for which such reservation was created or acquired. This is an independent threshold determination made by the Commission, with the purpose of the reservation defined by the authorizing legislation or proclamation (see Rainsong v. FERC, 106 F.3d 269 (9th Cir. 1977)). Forest Service, for its protection and utilization determination under Section 4(e) of the FPA, may rely on broader purposes than those contained in the original authorizing statutes and proclamations in prescribing conditions (see Southern California Edison v. FERC, 116F.3d 507 (D.C. Cir. 1997)).

The following terms and conditions are based on those resource and management requirements enumerated in the Organic Administration Act of 1897 (30 Stat. 11), the Multiple-Use Sustained Yield Act of 1960 (74 Stat. 215), the National Forest Management Act of 1976 (90 Stat. 2949), and any other law specifically establishing a unit of the National Forest System or prescribing the management thereof (such as the Wild and Scenic Rivers Act), as such laws may be amended from time to time, and as implemented by regulations and approved by Land and Resource Management Plans prepared in accordance with the National Forest Management Act.

Specifically, the 4(e) conditions in this document are based on the Land and Resource Management Plan (as amended) for the Sumter National Forest, as approved by the Regional Forester of the Southern Region.

Pursuant to Section 4(e) of the Federal Power Act, the Secretary of Agriculture, acting by and through FS, considers the following conditions necessary for the adequate protection and utilization of the land and resources of the Sumter National Forest. License articles contained in the Federal Energy Regulatory Commission's (Commission's) Standard Form L-1 (revised October 1975) issued by Order No. 540, dated October 31, 1975, cover general requirements.

Part I of this document includes standard administrative conditions deemed necessary for the administration of National Forest System lands. Part II of this document includes standard resource conditions deemed necessary for protection and utilization of National Forest System

[1] The entire filing of the Forest Service is not duplicated herein. This appendix includes only the exact text of the substantive parts of the 4(e) conditions filed by the U.S. Forest Service.

lands. Part III of this document includes specific resource requirements for protection and utilization of National Forest System lands related to the Parr Hydroelectric Project.

PART I: STANDARD ADMINISTRATIVE CONDITIONS

Condition No. 1 – Revision of Forest Service Conditions

Forest Service reserves the right, after notice and opportunity for comment, to require changes in the Project and its operation through revision of the Section 4(e) conditions to accomplish protection and utilization of National Forest System lands and resources. Forest Service also reserves the right to modify these conditions, if necessary, to respond to any significant changes in the assessed effects of the Project on national forest resources that warrant a revision of these conditions, for example, a Final Biological Opinion issued for this Project by the National Marine Fisheries Service or United States Fish and Wildlife Service; or any Certification issued for this Project by the State Water Resources Control Board.

Condition No. 2 - Surrender of License or Transfer of Ownership

Prior to any surrender of this license, Licensee shall provide assurance acceptable to Forest Service that Licensee shall restore any project area directly affecting National Forest System lands to a condition satisfactory to Forest Service upon or after surrender of the license, as appropriate. To the extent restoration is required, Licensee shall prepare a restoration plan for Forest Service approval, which shall identify the measures to be taken to restore such National Forest System lands and shall include adequate financial mechanisms to ensure performance of the restoration measures.

In the event of any transfer of the license or sale of the project, Licensee shall assure that, in a manner satisfactory to Forest Service Licensee or transferee will provide for the costs of surrender and restoration. If deemed necessary by FS to assist it in evaluating Licensee's proposal, Licensee shall conduct an analysis, using experts approved by Forest Service, to estimate the potential costs associated with surrender and restoration of any project area directly affecting National Forest System lands to Forest Service specifications. In addition, Forest Service may require Licensee to pay for an independent audit of the transferee to assist Forest Service in determining whether the transferee has the financial ability to fund the surrender and restoration work specified in the analysis.

Condition No. 3 - Requirement to Obtain a Forest Service Special Use Authorization for Use of National Forest System Lands

Requirement to Obtain a Forest Service Special Use Authorization Based on the Energy Policy Act of 1992

Licensee shall obtain a special use authorization from Forest Service for the occupancy and use of lands included in the licensed project boundary. Licensee shall obtain the executed authorization prior to beginning any ground disturbing activities on National Forest System lands to be covered by the special use authorization and shall file that special use authorization with

the Commission. Licensee shall be responsible for the costs of collecting all information directly related to the evaluation of the effects of the proposed occupancy and use that Forest Service needs in order to make a decision concerning issuance of the special use authorization.

Requirement to Obtain a Forest Service Special Use Authorization Based on Issuance of Previous Special Use Authorization(s)

Licensee shall obtain a special use authorization from Forest Service for the occupancy and use of lands previously covered by a special use authorization in any previous license. Licensee shall obtain the executed authorization within 6 months of license issuance and prior to beginning any ground disturbing activities on National Forest System lands to be covered by the special use authorization and shall file that special use authorization with the Commission.

Licensee shall be responsible for the costs of collecting all information directly related to the evaluation of the effects of the proposed occupancy and use that Forest Service needs in order to make a decision concerning issuance of a special use authorization.

Requirement to Obtain a Forest Service Special Use Authorization for Projects That Involve the Use of Additional National Forest System Lands That do not have a Special Use Authorization

Licensee shall obtain a special use authorization from Forest Service for the occupancy and use of National Forest System lands that are (1) not part of the existing license but are added to the FERC boundary by the Commission and (2 not previously covered by a special use authorization. Licensee shall obtain the executed authorization within 6 months of license issuance and prior to beginning any ground disturbing activities on National Forest System lands to be covered by the special use authorization and shall file that special use authorization with the Commission. Licensee shall be responsible for the costs of collecting all information directly related to the evaluation of the effects of the proposed occupancy and use that Forest Service needs in order to make a decision concerning issuance of a special use authorization.

Condition No. 4 - Requirement to Obtain a Short-Term Forest Service Special Use Authorization

If, during the term of the License, Licensee proposes to perform any project construction work, the Licensee shall obtain a short-term special use authorization prior to beginning any ground disturbing activities on National Forest System land. Licensee shall be responsible for the costs of collecting and analyzing all information directly related to the evaluation of the effects of the proposed project that Forest Service needs in order to make a decision concerning issuance of a short-term special use authorization. Licensee may commence ground disturbing activities authorized by the License and short-term special use authorization no sooner than 60 days following the date Licensee files the Forest Service short-term special use authorization with the Commission, unless the Commission prescribes a different commencement schedule. In the event there is a conflict between any provisions of the License and Forest Service special use authorization, the special use authorization shall prevail to the extent that Forest Service, in consultation with the Commission, deems the terms of the special use authorization necessary to protect and utilize National Forest System resources.

The short-term special use permit shall address but not be limited to:

- Safety.
- Use and storage of equipment.
- Properly licensed construction personnel.
- Inspections.

Before any construction occurs on National Forest System lands, Licensee shall obtain prior written approval of Forest Service for all final design plans for Project components, which Forest Service deems as affecting or potentially affecting National Forest System resources.

Condition No. 5 - Compliance with Regulations

Licensee shall comply with the regulations of the Department of Agriculture for activities on National Forest System lands, and all applicable Federal, State, county, and municipal laws, ordinances, or regulations in regards to the area or operations on or directly affecting National Forest System lands, to the extent those laws, ordinances or regulations are not preempted by federal law.

Condition No. 6 - Protection of United States Property

Licensee, including any agents or employees of Licensee acting with the scope of their employment, shall exercise diligence in protecting from damage the land, property, and interests of the United States from damage arising from Licensee's construction, maintenance, or operation of the project works or the works appurtenant or accessory thereto under the license. Licensee's liability for fire and other damages to National Forest System lands shall be determined in accordance with the Federal Power Act and standard Form L-1 Articles 22 and 24 or correct current form.

As part of the occupancy and use of the project area, Licensee has a continuing responsibility to reasonably identify and report all known or observed hazardous conditions on or directly affecting National Forest System lands that would affect the improvements, resources, or pose a risk of injury to individuals. Licensee will abate those conditions, except those caused by third parties or not related to the occupancy and use authorized by the License. Any non-emergency actions to abate such hazards on National Forest System lands shall be performed after consultation with Forest Service. In emergency situations, Licensee shall notify Forest Service of its actions as soon as possible, but not more than 48 hours, after such actions have been taken.

Whether or not Forest Service is notified or provides consultation, Licensee shall remain solely responsible for all abatement measures performed. Other hazards should be reported to the appropriate agency as soon as possible.

Licensee shall maintain all its improvements and premises on National Forest System lands to standards of repair, orderliness, neatness, sanitation, and safety acceptable to Forest Service. Licensee shall comply with all applicable Federal, State, and local laws and regulations, including but not limited to, the Federal Water Pollution Control Act, 33 U.S.C. 1251 et seq., the

Resources Conservation and Recovery Act, 42 U.S.C. 6901 et seq., the Comprehensive Environmental Response, Control, and Liability Act, 42 U.S.C. 9601 et seq., and other relevant environmental laws, as well as public health and safety laws and other laws relating to the siting, construction, operation, and maintenance of any facility, improvement, or equipment. Disposal of all materials will be at an approved existing location, except as otherwise agreed by Forest Service.

Condition No. 7 - Existing Claims

License shall be subject to all valid claims and existing rights of third parties. The United States is not liable to Licensee for the exercise of any such right or claim.

Condition No. 8 – Indemnification

Licensee shall indemnify, defend, and hold the United States harmless for:

- any violations incurred under any laws and regulations applicable to, or
- judgments, claims, penalties, fees, or demands assessed against the United States caused by, or
- costs, damages, and expenses incurred by the United States caused by, or
- the releases or threatened release of any solid waste, hazardous substances, pollutant, contaminant, or oil in any form in the environment related to the construction, maintenance, or operation of the project works or of the works appurtenant or accessory thereto under the license.

Licensee's indemnification of the United States shall include any loss by personal injury, loss of life or damage to property caused by the construction, maintenance, or operation of the project works or of the works appurtenant or accessory thereto under the license. Indemnification shall include, but is not limited to, the value of resources damaged or destroyed; the costs of restoration, cleanup, or other mitigation; fire suppression or other types of abatement costs; third party claims and judgments; and all administrative, interest, and other legal costs. Upon surrender, transfer, or termination of the license, Licensee's obligation to indemnify and hold harmless the United States shall survive for all valid claims for actions that occurred prior to such surrender, transfer or termination.

Condition No. 9 – Access Within the License Area

The United States shall have unrestricted use of any part of the licensed area on National Forest System lands for any purpose, including permitting uses by third parties or members of the public, provided such use does not interfere with the rights and privileges authorized for the license.

Condition No. 10 – Use of National Forest System Roads

If the Project requires use of roads on National Forest System lands, Licensee shall obtain suitable authorization for all project access roads and National Forest System roads needed for

Project access. The authorization shall require road maintenance and cost sharing in reconstruction commensurate with Licensee's use and project-related use. The authorization shall specify road maintenance and management standards that provide for traffic safety, minimize erosion, and minimize damage to natural resources and that are acceptable to Forest Service, as appropriate.

Licensee shall pay Forest Service for its share of maintenance cost or perform maintenance or other agreed to services, as determined by Forest Service, for all use of roads related to project operations, project-related public recreation, or related activities. The maintenance obligation of Licensee shall be proportionate to total use and commensurate with its use. Any maintenance to be performed by Licensee shall be authorized by and shall be performed in accordance with an approved maintenance plan and applicable Best Management Practices (BMPs). In the event a road requires maintenance, restoration, or reconstruction work to accommodate Licensee's needs, Licensee shall perform such work at its own expense after securing Forest Service road maintenance, restoration, or reconstruction standards and authorization.

Licensee shall complete a condition survey and a proposed maintenance plan subject to Forest Service, review and approval as appropriate once each year. The plan may take the format of a road maintenance agreement provided all the above conditions are met as well as the conditions set forth in the proposed agreement.

In addition, all National Forest System roads used as Project Access roads (PAR) and Right-of-Way access roads (ROW) shall have:

- Current condition survey.
- Map(s) at a scale to allow identification of specific routes or segments.
- FS assigned road numbers are used for reference on the maps, tables, and in the field.
- GIS compatible files of GPS alignments of all roads used for Project access are provided to Forest Service.
- Adequate signage is installed and maintained by Licensee at each road or route, identifying the road by Forest Service road number.

Licensee shall confine all vehicles being used for project purposes, including but not limited to administrative and transportation vehicles and construction and inspection equipment, to roads or specifically designed access routes, as identified in the authorization described above. Forest Service, reserves the right to close any and all such routes where damage is occurring to the soil or vegetation or to require reconstruction/construction by Licensee to the extent needed to accommodate Licensee's use. Forest Service, agrees to provide notice to Licensee prior to road closures, except in an emergency, in which case notice will be provided as soon as practicable.

Licensee shall maintain suitable crossings as required by FS, for all roads and trails that intersect the right-of-way occupied by linear Project facilities (powerline, penstock, ditch, and pipeline).

Condition No. 11 - Hazardous Substances Plan

Hazardous substances may not be stored on National Forest System lands without prior approval of Forest Service, Licensee shall submit a spill prevention and cleanup plan for approval by Forest Service, as part of any request to store hazardous substances. The plan shall show evidence of consultation with Forest Service. The plan shall be filed with the Commission.

At a minimum, the plan must (1) outline the Licensee's procedures for reporting and responding to releases of hazardous substances, including names and phone numbers of all emergency response personnel and their assigned responsibilities; (2) maintain in the project area, a cache of spill cleanup equipment suitable to contain any spill from the project; (3) include a schedule to periodically inform Forest Service, of the location of the spill cleanup equipment on National Forest System lands and of the location, type, and quantity of oil and hazardous substances stored in the project area; and (4) include a requirement to inform Forest Service immediately of the magnitude, nature, time, date, location, and action taken for any spill. Procedures for chemicals are outlined in the Department of Transportation's Emergency Response Guide Book (Orange book) and in the MSDS/SDS for each chemical.

For DRY spills:

- Immediately cover with plastic or a tarpaulin to prevent the chemical from becoming airborne
- Sweep the material together, rolling the tarp back slowly
- Shovel the material into doubled plastic bags
- Identify product name for the chemical(s) spilled and apply this information to the outside of the containment bags, along with the time, date, location and amount of spill.

For LIQUID spills:

- Use absorbent material, such as kitty litter or sawdust, to soak up the spill. Begin spreading the absorbent material around the edge of the spill and then work toward the center. Use only enough material to absorb the spill
- Shovel the absorbent material and chemical, along with any contaminated soil, into doubled plastic bags
- Identify product name for the chemical(s) spilled and apply this information to the outside of the containment bags, along with the time, date, location and amount of spill.

The plan shall include a monitoring plan that details corrective measures that will be taken if spills occur. The plan shall include a requirement for a weekly written report including maps, documenting the results of the monitoring to be sent to the Forest Service-Francis Marion and Sumter National Forest-MAZMAT Coordinator.

Condition No. 12 - Pesticide-Use Restrictions on National Forest System Lands

Pesticides may not be used on National Forest System lands or in areas affecting National Forest System lands to control undesirable woody and herbaceous vegetation, aquatic plants, insects, rodents, non-native fish, etc., without the prior written approval of Forest Service. Any request by Licensee to use pesticides shall be accompanied by the following:

A determination as to whether pesticide applications are essential for use on National Forest System lands;

- Specific locations of use;
- Specific pesticides proposed for use;
- Application rates;
- Dose and exposure rates; and
- Safety risk and timeframes for application.

Exceptions to this schedule may be allowed only when unexpected outbreaks of pests require control measures that were not anticipated at the time the report was submitted. In such an instance, an emergency request and approval may be made.

On National Forest System lands, Licensee shall only use those materials registered by the U.S. Environmental Protection Agency and consistent with those applied by Forest Service and approved through Forest Service review for the specific purpose planned. Licensee must strictly follow label instructions in the preparation and application of pesticides and disposal of excess materials and containers. Licensee may also submit Pesticide Use Proposal(s) with accompanying risk assessment and other Forest Service required documents to use pesticides on a regular basis. Submission of this plan will not relieve Licensee of the responsibility of annual notification and review.

Condition No. 13 – Consultation

Licensee shall annually consult with Forest Service. The date of the consultation meeting will be mutually agreed to by Licensee and Forest Service but in general should be held by April 15. At least 30 days in advance of the meeting, Licensee shall notify other interested stakeholders, confirming the meeting location, time and agenda. At the same time, Licensee shall also provide notice to South Carolina Department of Natural Resources and United States Fish and Wildlife Service, who may choose to participate in the meeting. Licensee shall attempt to coordinate the meeting so interested agencies and other stakeholders may attend.

Licensee shall make the following information available to Forest Service and other meeting participants at least 30 days prior to the meeting:

- An operations plan for the year in which the meeting occurs, including planned outages.
- A description of planned maintenance projects for the year in which the meeting occurs.
- Any records of non-compliance with the License.

- The hydrology record for the previous year, if available, including any variances.
- Results of any monitoring conducted the previous year.
- Safety reports, including geologic and seismic reports.
- A document that tracks the status of the Section 4(e) Conditions that require action in the year in which the meeting occurs.

Consultation shall include, but not be limited to:

- A status report regarding implementation of license conditions.
- Results of any monitoring studies performed over the previous year in formats agreed to by Forest Service and Licensee during development of implementation plans.
- Review of any planned maintenance.
- Discussion of any foreseeable changes to Project facilities or features.
- Discussion of any necessary revisions or modifications to implementation plans approved as part of this license.
- Discussion of needed protection measures for species newly listed as threatened, endangered, or sensitive, or changes to existing management plans that may no longer be warranted due to delisting of species or, to incorporate new knowledge about a species requiring protection. Discussion of needed protection measures for newly discovered cultural resource sites.
- Discussion of elements of current year maintenance plans, e.g. road and trail maintenance.
- Discussion of any planned pesticide use.

A record of the meeting shall be kept by Licensee and shall include any recommendations made by Forest Service for the protection of National Forest System lands and resources. Licensee shall file the meeting record, if requested, with the Commission no later than 60 days following the meeting.

Condition No. 14 - Consultation Group

The Licensee shall, within 3 months of license issuance, establish a Consultation Group as follows.

Purpose

The primary purpose of Consultation Group is to provide a forum for the Licensee to consult with resource agencies and other interested parties on the following:

The Annual Meeting as described in Condition No. 13, Consultation. To the extent topics covered in Condition No. 13 affect project-affected areas outside Forest Service jurisdiction, consultation with appropriate resource agencies on those same topics will occur at the Annual Meeting, other Consultation Group meetings, or as otherwise agreed with the Licensee and appropriate resource agencies. License shall provide copies of the meeting materials to those who request it.

Plans that are developed as required by the new license and plans that require specific consultation processes during implementation.

Proposed temporary or permanent modifications to license conditions.

Licensee shall also provide notification of license compliance deviations to the current members of the Consultation Group.

Decision Making

The Licensee will ensure that the Consultation Group reports its recommendations to the Forest Service, South Carolina Department of Natural Resources and United States Fish and Wildlife Service. The Forest Service shall be responsible for final addressing matters covered by the Section 4(e) Conditions. Other agencies shall be responsible for final decisions within their jurisdictions. Licensee shall also ensure that consultation, permitting, and any necessary approvals within the jurisdiction of other agencies are completed. Licensee shall implement license conditions as approved and directed by the Commission.

Participation

In addition to the Licensee, Forest Service, South Carolina Department of Natural Resources and United States Fish and Wildlife Services, Consultation Group meetings shall be open to any organization or individual that notifies the Licensee in writing of interest in participating in the Annual Meeting or Consultation Group meetings. The Consultation Group should establish mutually agreeable process guidelines for conducting effective and efficient meetings no later than 1 year after license issuance. Each organization or individual shall be responsible for providing notification information to the Licensee and shall be responsible for keeping current a single point of contact for purposes of notification related to the Consultation Group. If a participant is interested in a particular meeting or topic, the participant is responsible for ensuring they are represented.

Condition No. 15 - Approval of Changes

Notwithstanding any license authorization to make changes to the Project, when such changes directly affect National Forest System lands, Licensee shall obtain written approval from Forest Service prior to making any changes in any constructed Project features or facilities, or in the uses of Project lands and waters or any departure from the requirements of any approved exhibits filed with the Commission. Following receipt of such approval from Forest Service, and a minimum of 60 days prior to initiating any such changes, Licensee shall file a report with the Commission describing the changes, the reasons for the changes, and showing the approval of Forest Service for such changes. Licensee shall file an exact copy of this report with Forest Service at the same time it is filed with the Commission. This condition does not relieve Licensee from the amendment or other requirements of Article 2 or Article 3 of this license.

Condition No. 16 - Surveys, Land Corners

Licensee shall avoid disturbance to all public land survey monuments, private property corners, and forest boundary markers. In the event that any such land markers or monuments on National Forest System lands are destroyed by an act or omission of Licensee, in connection with the use and/or occupancy authorized by this license, depending on the type of monument destroyed, Licensee shall reestablish or reference same in accordance with (1) the procedures outlined in the "Manual of Instructions for the Survey of the Public Land of the United States," (2) the specifications of the County Surveyor, or (3) the specifications of Forest Service. Further, Licensee shall ensure that any such official survey records affected are amended as provided by law.

Condition No. 17 – Signs

Licensee shall consult with Forest Service prior to erecting signs related to safety issues on National Forest System lands covered by the license. Prior to Licensee erecting any other signs or advertising devices on National Forest System lands covered by the license, Licensee must obtain the approval of Forest Service as to location, design, size, color, and message. Licensee shall be responsible for maintaining all Licensee-erected signs to neat and presentable standards.

PART II: STANDARD RESOURCE CONDITIONS

Condition No. 18 – Invasive Species Management

Aquatic Invasive Species Management and Monitoring Plan

Within one year of license issuance, Licensee shall develop an Aquatic Invasive Species (AIS) Plan that meets applicable State and Federal laws and regulations. The plan shall be approved by Forest Service after consultation with US Fish and Wildlife Service. The applicable State and Federal resource agencies shall be responsible for making the determination as to whether the AIS Plan complies with the State and/or Federal regulations of their respective agencies.

Public Education Program

The AIS Plan shall include a public education program, including appropriate signage and information pamphlets at designated public boat access. The following shall be addressed:

- Draining water from boat, motor, bilge, live well and bait containers before leaving a water access site.
- Removing visible plants, animals and mud from boat before leaving waterbody.
- Cleaning and drying boats and fishing equipment using accepted protocols for the prevention of all AIS before entering any waterbody area.
- Disposing of unwanted bait in trash, including earthworms.
- Avoiding the release of plants and animals into a waterbody unless they originally came from that waterbody.

AIS information shall be included on Project websites that provide public information on Project facilities. The public information website will also include information on the amphibian chytrid fungus.

Best Management Practices

The AIS Plan shall specify that Licensee is responsible for developing BMPs for individual Project O&M activities, performed by Licensee and/or its contractors, which activities have the potential to introduce AIS into a Project reservoir, to prevent the spread of AIS, and submitting them to Forest Service for review at the Annual Consultation Meeting required in the FERC license.

Development of BMPs for Project activities shall include but not be limited to the following:

- List of AIS with potential to be introduced.
- Control or preventive measures for AIS.
- Identification of critical control points in the Project activity sequence at which to prevent the introduction of AIS.
- Any necessary implementation monitoring for potential AIS to ensure BMPs are followed.
- Actions that will be taken if an introduction of AIS is found.

If invasive aquatic species are detected within any reservoir or river, Licensee will consult with the appropriate agencies and institute an appropriate plan of action.

Monitoring and Reporting

The AIS Plan shall include a specific monitoring program that addresses all reservoirs that have a boat launch, or identified as having boating access, and that follows State and/or Federal laws, regulations, and policies. Mapping and monitoring results shall be provided to Forest Service, US Fish and Wildlife Service and SC Department of Natural Resources.

Plan Revisions

Licensee, in consultation with Forest Service, US Fish and Wildlife Service and SC Department of Natural Resources shall review, update, and/or revise the AIS Plan, as determined necessary by Forest Service in consultation with US Fish and Wildlife Service and SC Department of Natural Resources, when substantial changes in the existing conditions occur. Additional monitoring may be part of any plan revisions. Changes or revisions to the Plan would be expected if AIS conditions change as a result of unforeseen effects, either from new or existing Project-related activities, the potential for new AIS to occur, the discovery of a new AIS within the Project, or from natural events or if other regulatory or legal requirements are established.

Licensee shall include all relevant documentation of coordination/consultation with the updated Plan filed with the Commission.

Vegetation and Invasive Weed Management Plan

Within 1 year of license issuance, Licensee shall complete, in consultation with Forest Service and approved by Forest Service, a Vegetation and Non-Native Invasive Plant Management (NNIP) Management Plan (Plan) for all National Forest System lands potentially affected by the Project. Targeted NNIP will be those species defined by the Regional Forester Southern Region, Southern Research Station and South Carolina Exotic Plant Pest Council or identified as Forest Service species of concern.

The Plan will address special status species, terrestrial NNIP species, and revegetation within the Project boundary and adjacent to Project features directly affecting National Forest System lands including Project and project related roads, facilities, and distribution and transmission lines.

Minimum components of the Plan shall include, but may not be limited to:

- Special status species management: protection, monitoring, frequency of surveys, internal education, reporting, and adaptive management.
- Sensitive area protection, including guidelines for conducting activities that reduce the effects to sensitive resources.
- Non-native invasive plant (NNIP) species management: frequency of surveys, guidelines for prevention, treatment, internal education, monitoring, reporting, guidelines for conducting weed risk assessment for new project feature development, including an adaptive management element to implement methods for prevention of aquatic invasive weeds, as necessary.
- Methods that ensure early detection and treatment of NNIP.
- Guidelines for treatment of NNIP populations on Federal lands within the FERC Project boundary. In areas where NNIP populations that are determined to be project-related extend outside the FERC Project boundary, treatments would extend up to ¼ mile beyond the FERC Project boundary. If noxious weed populations extend more than ¼ mile from the FERC Project Boundary, and are determined to be Project-related, Licensee will consult with Forest Service or Bureau of Land Management (BLM) to determine if the populations should be treated and, if so, the appropriate treatment methods. The same treatments are recommended on Licensee lands.
- Guidelines for conducting Licensee's inspections of equipment and vehicle for NNIPs.
- List of target NNIPs agreed to and approved by BLM and Forest Service.
- Revegetation implementation and monitoring.
- Treatment protocols for vegetation management, hazardous fuels reduction, and hazard tree management for protection of Project facilities and Project-affected resources within the Project affected area.
- Pesticide/herbicide use approval and restrictions.
- Annual reporting guidelines for the Annual Meeting.

Licensee, in consultation with Forest Service, will review, update, and/or revise the Plan if substantial changes in vegetation management occur. Changes may be implemented if monitoring feedback indicates that resource objectives are not being met.

Any updates to the Plan would be prepared in coordination and consultation with Forest Service. The Licensee shall allow the Forest Service at least 60 days, unless waived by the Forest Service, to comment and make recommendations before Licensee files the updated plan with the Commission. Any changes to the Plan shall be approved by Forest Service. Licensee would include all relevant documentation of coordination/consultation with the updated Plan filed with the Commission.

Condition No. 19 - Special Status Species

Biological Evaluations

Before taking actions to construct new project features on National Forest System lands that may affect Forest Service special status species or their critical habitat on National Forest System land, Licensee shall prepare and submit a biological evaluation (BE) for Forest Service approval. Forest Service special status species are defined as species designated by the Regional Forester as sensitive species or species of conservation concern. The BE shall evaluate the potential impact of the action on the species or its habitat. Forest Service may require mitigation measures for the protection of the affected species on National Forest System land.

The BE shall:

- Include procedures to minimize or avoid adverse effects to Forest Service special status species.
- Ensure project-related activities shall meet restrictions included in site management plans for Forest Service special status species.
- Develop implementation and effectiveness monitoring of measures taken or employed to reduce effects to special status species.

Annual Review of Special-Status Species Lists and Assessment of New Species on Federal Land

Licensee shall, beginning the first full calendar year after license issuance, in consultation with Forest Service , annually review the current lists of special status species (species that are Federally Endangered or Threatened, Proposed Threatened or Endangered, Forest Service Sensitive, or Francis Marion-Sumter National Forest Watch Lists, and State Threatened or Endangered, State Species of Special Concern) that might occur on National Forest System lands, as appropriate, in the Project area that may be directly affected by Project operations.

When a species is added to one or more of the lists, Forest Service, in consultation with Licensee shall determine if the species or un-surveyed suitable habitat for the species is likely to occur on such National Forest System lands, as appropriate. For such newly added species, if Forest Service determines that the species is likely to occur on such National Forest System lands, Licensee shall develop and implement a study plan in consultation with Forest Service to reasonably assess the effects of the project on the species. Licensee shall prepare a report on the study including objectives, methods, results, recommended resource measures where appropriate, and a schedule of implementation, and shall provide a draft of the final report to the Forest Service for review and approval. Licensee shall file the report, including evidence of

consultation, with the Commission and shall implement those resource management measures required by the Commission.

If new occurrences of Forest Service special status species as defined above are detected prior to or during ongoing construction, operation, or maintenance of the Project or during Project operations, Licensee shall immediately notify Forest Service. If Forest Service determines that the Project-related activities are adversely affecting FS sensitive or watch list species, Licensee shall, in consultation with Forest Service, develop and implement appropriate protection measures.

If new occurrences of state or federally listed or proposed threatened or endangered species are detected prior to or during ongoing construction, operation, or maintenance of the Project or during Project operations, Licensee shall immediately notify the Commission, Forest Service and the relevant Service Agency for consultation or conference in accordance with the Endangered Species Act. If state listed or fully protected species are affected, Forest Service and US Fish and Wildlife Service shall be notified.

Condition No. 20– Erosion and Sediment Control and Management

Within 1 year of license issuance, Licensee shall file with the Commission an Erosion and Sediment Control Management Plan developed in consultation with Forest Service and other interested parties, and approved by Forest Service that will provide direction for treating erosion and controlling sedimentation within the Project and Project-affected National Forest System lands during the term of the new license. Upon Commission approval, Licensee shall implement the Plan.

The Plan shall include at a minimum the components included in the referenced by this condition, unless otherwise agreed to by Forest Service during Plan finalization. Minimum components include, but may not be limited to:

Erosion Control Guidelines for Existing Project-Affected Areas

- Methods for initial and periodic inventory and monitoring of the entire Project area and Project-affected National Forest System lands to identify erosion sites and assess site condition for each. Periodic monitoring and inventory will include recording effectiveness of erosion treatment measures, and identification of new erosion sites for the term of the new license.
- Criteria for ranking and treating erosion sites including a risk rating and hazard assessment for scheduling erosion treatment measures and monitoring at each site.
- Erosion control measures that incorporate current standards, follow Forest Service regulations and guidance (e.g. LRMP, RMOs, BMPs), are customized to site-specific conditions, and approved by Forest Service.
- Develop and implement a schedule for treatment (e.g. repair, mitigate, monitor) of erosion sites, including a list of sites requiring immediate mitigation and schedule for their implementation.

- Effectiveness monitoring of completed erosion control treatment measures after treatment in order to determine if further erosion control measures are needed. If erosion control measures are not effective, Licensee will implement additional erosion control measures approved by Forest Service and continue monitoring until the site has stabilized.
- Protocols for emergency erosion and sediment control.
- Process for documenting and reporting inventory and monitoring results including periodic plan review and revision. Documentation shall include a Forest Service compatible GIS database for maps keyed to a narrative description of detailed, site-specific, erosion treatment measures and sediment monitoring results.

Erosion Control Guidelines for New Construction or Non-Routine Maintenance

Licensee shall develop site-specific temporary erosion control measures for each project to be approved by Forest Service for each project. These temporary measures will prevent erosion, stream sedimentation, dust, and soil mass movement during the period of ground disturbance until replaced by permanent measures.

Condition No. 21– Fire Management and Response Plan

Within one year of license issuance, Licensee shall complete, in consultation with Forest Service and approved by Forest Service, a Fire and Fuels Management Plan (FFMP). The plan shall set forth in detail Licensee's responsibility for the prevention (including fuels treatment), reporting, emergency response, and investigation of fires related to Project operations. Upon Commission approval, Licensee shall implement the Plan.

Minimum components include, but may not be limited to:

- Fuels Treatment/Vegetation Management: Identification of fire hazard reduction measures and reoccurring maintenance measures to prevent the escape of project-induced fires.
- Fire Prevention and Patrol: Address fire danger and public safety associated with project induced recreation, including fire danger associated with dispersed camping, existing and proposed developed recreation sites, trails, and vehicle access. Identify water drafting sites and other fire suppression resources.
- Emergency Response Preparedness: Analyze fire prevention needs including equipment and personnel availability.
- Reporting: Licensee shall report any project related fires immediately to Forest Service.
- Fire Control/Extinguishing: Provide Forest Service a list of the locations of available fire suppression equipment and the location and availability of fire suppression personnel.

Condition No. 22 – Annual Employee Training

Licensee shall, beginning in the first full calendar year after license issuance, annually perform employee awareness training and shall also perform such training when a staff member is first assigned to the Project. The goal of the training shall be to familiarize Licensee's operations and maintenance (O&M) staff with special-status species, noxious weeds and sensitive areas (e.g.,

special-status plant populations and noxious weed populations) that are known to occur within or adjacent to the Commission Project Boundary on National Forest System lands, and the procedures for reporting to each agency, as appropriate, to comply with the license requirements. It is not the intent of this measure that Licensee's O&M staff perform surveys or become specialists in the identification of special-status species or noxious weeds. Licensee shall direct its O&M staff to avoid disturbance to sensitive areas, and to advise all Licensee contractors to avoid sensitive areas. If Licensee determines that disturbance of a sensitive area is unavoidable, License shall consult with Forest Service to minimize adverse effects to sensitive resources.

This measure applies to employee training that is not otherwise covered by a specific plan.

Condition No. 23 – Non Project Areas (Keitts Bridge Landing Enoree River Bridge Recreation Area)

The Licensee will coordinate with Forest Service surveyor to determine location of flowage easements and determine Project Area Boundary along with consultation with Forest Service to determine the exact location above the flowage easement in relation to the improvements.

Licensee shall complete, in consultation with Forest Service and approved by Forest Service, a set of detailed construction plans and specifications with drawings for design and construction of a vehicle turn-around area with parking area for six vehicles and a non-motorized canoe/kayak step down facility along with hardened path from parking area to step down location. The present river access (Keitts Bridge) is very steep and unless a gentler slope can be found in the vicinity, steps will need to be designed/constructed to access the river that are sustainable and maintains bank stability. If possible the improvements to the site need to be Architectural Barriers Act compliant. Any recreational signs installed on Maybinton Road, State Hwy 45, per FERC regulations shall be designed in accordance with Forest Service regulations and approved by Forest Service.

Before taking actions to construct new project features on National Forest System lands that may affect Forest Service special status species or their critical habitat on National Forest System land, Licensee shall prepare and submit a biological evaluation (BE) for Forest Service approval. The BE shall evaluate the potential impact of the action on the species or its habitat. Forest Service may require mitigation measures for the protection of the affected species on National Forest System land.

The BE shall:

- Include procedures to minimize or avoid adverse effects to special status species.
- Ensure project-related activities shall meet restrictions included in site management plans for special status species.
- Develop implementation and effectiveness monitoring of measures taken or employed to reduce effects to special status species.

Licensee shall obtain a special use authorization (Organic Act Permit) from the Forest Service Cultural Resource Coordinator prior to construction of new project features on National Forest

System lands that may affect Forest Service cultural resource sites. Licensee shall obtain the required special use authorization (Organic Act Permit) prior to any ground disturbing activities on National Forest System lands, and the. Licensee shall file that special use authorization with the Commission. Licensee shall prepare and submit an Archaeological Evaluation for Forest Service approval.

The Archaeological Evaluation shall:

- Include procedures to minimize or avoid adverse effects to cultural sites.
- Ensure project-related activities shall meet restrictions included in site management plans for cultural site.
- Develop implementation and effectiveness monitoring of measures taken or employed to reduce adverse effects to newly discovered cultural resource sites.