DRAFT LICENSE APPLICATION

PARR HYDROELECTRIC PROJECT

FERC NO. 1894

Prepared for:

South Carolina Electric & Gas Company
Cayce, South Carolina

Prepared by:

Kleinschmidt

Pittsfield, Maine
www.KleinschmidtGroup.com

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May 2017

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Parr Hydroelectric Project **FERC Project No. 1894**

APPLICATION FOR NEW LICENSE
FOR A MAJOR WATER POWER PROJECT
EXISTING DAM

INITIAL STATEMENT
(Pursuant to 18 C.F.R. §4.51)

1. South Carolina Electric & Gas Company (hereinafter the "Applicant") applies to the Federal Energy Regulatory Commission (hereinafter "FERC" or "Commission") for a New License for the Parr Hydroelectric Project ("Project"),

2. The location of the Project is:

State:	South Carolina
County:	Fairfield and Newberry
Township or nearby Towns:	Town of Jenkinsville
Stream or other body of water:	Broad River

3. The exact name, business address, and telephone number of the Applicant are:

South Carolina Electric & Gas Company
220 Operation Way
Mail Code A221
Cayce, SC 29033-3701
Telephone: 803.217.9162

The exact name, business address, and telephone number of each person authorized to act as agent for the Applicant in this application are:

Mr. James Landreth
Vice President
Fossil & Hydro Operations
South Carolina Electric & Gas Company
220 Operation Way
Mail Code A221
Cayce, SC 29033-3701
Telephone: 803.217.7224

Mr. William R. Argentieri, P.E.
Manager of Civil Engineering
South Carolina Electric & Gas Company
220 Operation Way
Mail Code A221
Cayce, SC 29033-3701

Telephone: 803.217.9162
Mr. Raymond R. Ammarell
Consulting Engineer
South Carolina Electric & Gas Company
220 Operation Way
Mail Code A221
Cayce, SC 29033-3701
Telephone: 803.217.7322

4. The Applicant is a domestic corporation organized under the laws of the State of South Carolina and is not claiming preference under section 7(a) of the Federal Power Act.

5. (i) The statutory or regulatory requirements of the State of South Carolina, in which the project is located, which would, assuming jurisdiction and applicability, affect the Project as proposed with respect to bed and banks and the appropriation, diversion, and use of water for power purposes, and with respect to the right to engage in the business of developing, transmitting, and distributing power and in any other business necessary to accomplish the purposes of the license under the Federal Power Act are:

    a. <u>Water Quality Permit</u> from the South Carolina Department of Health and Environmental Control to assure compliance with Section 401 of the Federal Clean Water Act.

    (ii) The steps the Applicant has taken, or plans to take, to comply with each of the laws cited above, are:

    a. <u>Water Quality Permit:</u> The Applicant will apply for the 401 Water Quality Certification as required by 18 C.F.R. §5.23(b).

6. The Project encompasses 162.61 acres of Federal lands owned by the U.S. Forest Service. The Applicant has an agreement with the U.S. Forest Service for use of their lands for the Project and pays annual charges for that use. Additional information on these lands is included in Exhibits A, E and G.

7. Currently, the 13.8/24.9-kV Parr distribution substation is located within the Project Boundary. However, since it is the point of connection to the Applicant's distribution system, and it is not operated or maintained by Project personnel, the Applicant is proposing to remove it from the Project Boundary. Additional information on this substation is included in Exhibit A.

8. The Applicant is requesting a 50 year license for several reasons including a proposed generator upgrades, the potential costs associated with protection, mitigation, and enhancement measures (as described in Exhibit E), lost generation, and estimated cost to develop the new license application.

ADDITIONAL GENERAL INFORMATION PURSUANT TO

18 C.F.R. § 4.32

GENERAL INFORMATION

1. South Carolina Electric & Gas Company has obtained and will maintain any proprietary rights necessary to construct, operate, or maintain the Parr Hydroelectric Project (FERC No. 1894) (Project).

2. Identify (providing names and addresses):

   (i) The County in which any part of the Project, and any Federal facilities that would be used by the Project, would be located: The Project is located within Newberry and Fairfield counties, South Carolina and encompasses U.S. Forest Service lands. Their addresses are as follows:

   Wayne Adams
   Newberry County Administrator
   1309 College Street
   PO Box 156
   Newberry, SC 29108

   Jason C. Taylor
   Fairfield County Administrator
   350 Columbia Road
   PO Drawer 60
   Winnsboro, SC 29180

   Mary Maercklein
   District Ranger
   U.S. Forest Service
   Enoree Ranger District
   20 Work Center Road
   Whitmire, SC 29178

   (ii) Every city, town, or similar political subdivision:

   (a) In which any part of the Project is or is to be located and any Federal facility that is or is to be used by the Project is located:

   Mayor Gregrey Ginyard
   Town of Jenkinsville
   PO Box 40
   Jenkinsville, SC 29065-0040

   (b) That has a population of 5,000 or more people and is located within 15 miles of the existing or proposed Project:

Mayor Foster Senn
City of Newberry
PO Box 538
Newberry, SC 29108

(iii) There are no irrigation districts, drainage districts, or similar special purpose political subdivisions affected by the Project.

(iv) There are no other political subdivisions in the general area of the Project that would likely be interested in, or affected by, the application.

(v) All Indian Tribes that may be affected by the Project:

Native American tribes listed below may or may not be present in the immediate Project vicinity but may have tribal interests and potential concern for traditional cultural resources, sacred sites and cultural hunting and gathering areas in the Project vicinity:

Dr. Wenonah G. Haire
Catawba Indian Nation
Tribal Historic Preservation Office
1536 Tom Steven Road
Rock Hill, SC 29730

Mr. Bill John Baker
Eastern Band of Cherokee Indians
PO Box 948
Tahlequah, OK 74454

Joe Bunch, Assistant Chief
United Keetoowah Band of Cherokee
Indians in Oklahoma
PO Box 746
Tahlequah, OK 74465

3. The Applicant has, in accordance with 18 C.F.R. § 4.32(a)(3)(i), made a good-faith effort to notify the following entities of the filing of this application:

(a) Every property owner of record of any interest within the bounds of the Project;
(b) The entities listed in (2) above;
(c) Other governmental agencies that would likely be interested in or affected by the application.

4. In accordance with 18 C.F.R. §4.51, the following Exhibits are attached to and made part of this application:

Exhibit A – Project Description
Exhibit B – Project Operation
Exhibit C – Construction History and Proposed Construction Schedule
Exhibit E – Environmental Report

Exhibit F – General Design Information (write-up only)
Exhibit G – Project Maps (includes current Exhibit K drawings with description of proposed changes)
Exhibit H – Additional Information (Information Required by 18 C.F.R. §16.10)
Exhibits D (Cost and Financing), G (Project Maps) and F (General Design Drawings) are not being submitted at this time as they are still in the process of being prepared. They will be filed with the Final Application for New License.

SUBSCRIPTION
To Be Signed in Final Application

This Application for License for the Parr Hydroelectric Project, FERC No. 1894, is executed in the State of South Carolina, County of _____________, by ____________________ , _____________________of South Carolina Electric & Gas Company, 220 Operation Way, Cayce, SC 29033-3701, who, being duly sworn, deposes and says that the contents of this application are true to the best of his/her knowledge or belief. The undersigned has signed this application this ____ day of _____________, 2017.

SOUTH CAROLINA ELECTRIC & GAS COMPANY

By ___________________________

James M. Landreth
Vice President – Fossil & Hydro Operations
South Carolina Electric & Gas Company

VERIFICATION

Subscribed and sworn to before me, a Notary Public of the State of South Carolina, this ____ day of ___________, 2017.

____
(Notary Public)

(My Commission Expires _______________)/seal

CERTIFICATE OF SERVICE

I, Henry Mealing, Project Manager, Kleinschmidt Associates, hereby certify that I have this day served upon each person designated on the attached Distribution List notice of availability, and/or a copy, of the Parr Hydroelectric Project, FERC No. 1894, Draft Application for License. Dated this 31 day of May 2017.

By: ______________________________

Henry Mealing
Project Manager
Kleinschmidt Associates

Distribution List

Parr Distribution List
May 2017

Alex Pellett
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311 Natural Resources Drive
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Parr Distribution List
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EXHIBIT A

PROJECT DESCRIPTION

PARR HYDROELECTRIC PROJECT
(FERC NO. 1894)

APPLICATION FOR NEW LICENSE
FOR MAJOR WATER POWER PROJECT > 5 MW

EXHIBIT A
PROJECT DESCRIPTION

TABLE OF CONTENTS

ATTACHMENTS

PARR HYDROELECTRIC PROJECT
(FERC NO. 1894)

APPLICATION FOR NEW LICENSE
FOR MAJOR WATER POWER PROJECT > 5 MW

EXHIBIT A
PROJECT DESCRIPTION

1.0 DESCRIPTION OF THE PARR HYDROELECTRIC PROJECT

The Parr Hydroelectric Project, Federal Energy Regulatory Commission (FERC) Project No. 1894, is owned and operated by South Carolina Electric & Gas Company (SCE&G) and consists of Parr Shoals and Fairfield Pumped Storage Hydroelectric Developments. The Project is located on the Broad River in Fairfield and Newberry Counties of South Carolina, approximately 25 miles northwest of the city of Columbia, and near the towns of Jenkinsville and Monticello. The 4,750 square mile watershed area, drained by the Broad, Enoree, and Tyger Rivers and other tributaries above Parr Dam, provides water for Parr and Monticello Reservoirs and for the two developments.

Exhibit A-1 provides a location map of the Project, and Exhibit A-2 is a table of project standard numbers.

2.0 PARR SHOALS DEVELOPMENT

The Parr Shoals Development is located on the Broad River, in Fairfield and Newberry Counties, near Jenkinsville, South Carolina. The Development is approximately 25 miles northwest (upstream) of Columbia, South Carolina. The Parr Shoals Dam, also referred to as Parr Dam, is a modified conventional run-of-river facility and consists of an east non-overflow wall, integrated non-overflow intake structure and powerhouse, gated concrete ogee spillway, and a non-overflow earth embankment section at the west abutment.

2.1 PROJECT STRUCTURES

An integrated non-overflow concrete gravity section, intake, and powerhouse are located between the east (left[1]) non-overflow wall and the 2,000 ft. long gated concrete ogee spillway. The integrated non-overflow section of the powerhouse is approximately 300 ft. long. The east non-overflow wall between the powerhouse non-overflow section and the east (left) abutment is approximately 90 ft. long with a crest elevation of 270.4[2] feet ft-NAVD88, which is also the elevation of the intake deck of the powerhouse. The earth embankment between the gated spillway and the west abutment is approximately 300 ft. long. The total length of water retaining structures at the development is approximately 2,690 ft.

2.1.1 SPILLWAY

The gated concrete gravity ogee spillway is approximately 2,000 ft. long and 37 ft. high and spans the Broad River between the non-overflow section on the east (left) and the earthen embankment on the west (right) ends of the dam. The dam crest was modified to accommodate ten bottom-hinged bascule type crest gates added to the crest of the spillway between 1975 and 1977 to raise the Parr Reservoir approximately 9 ft. from el. 256.3 ft. (original crest of the ogee spillway) to el. 265.3 ft.

2.1.2 INTAKE AND OUTLET WORKS

The Development's intake and outlet works are integral with the powerhouse substructure, and consist of the headrace, trash rake system, intake gates, trash racks, powerhouse water

[1] Unless otherwise noted, all references to left and right in this Exhibit are assumed to be looking downstream.
[2] Unless otherwise noted, all elevation references in this Exhibit are referenced to the North American Vertical Datum of 1988 (NAVD 88); conversion to National Geodetic Vertical Datum of 1929 (NGVD29), used in numerous supporting studies for this license application and often erroneously referred to as MSL) requires the addition of 0.7 feet to elevation values referenced to NAVD88.

passages, turbine wicket gates, draft tubes, and the tailrace channel. There are six sluice gates located in the east section of the dam adjacent to the powerhouse. Two of the gate tunnels have been filled with concrete, and the remaining four are not useable due to the level of siltation in the reservoir. There are no draft tube gates.

2.1.3 POWERHOUSE

The powerhouse is approximately 60 feet wide by 300 feet long, constructed of concrete and steel framed masonry. There are ten turbine bays within the powerhouse, two of which are smaller, former exciter turbines. Six of the larger turbine bays have vertical Francis type turbines installed with a total installed capacity of 14.88 MW. Two of the eight larger turbine bays are empty with the original head gates being replaced with reinforced concrete arch walls. The two exciter turbines are no longer used, and have been abandoned in place.

2.2 EARTHEN EMBANKMENT

An earthen embankment approximately 300 ft. long and 45 ft. high at the maximum section is located on the west (right) abutment of the dam. The crest of the earthen embankment is at elevation 271.4 ft. The earthen embankment and spillway are separated by a concrete wing wall, which has a key wall extending approximately 20 ft. into the earthen embankment.

2.3 RESERVOIR

The Parr Reservoir, created by the Parr Shoals Dam, is the lower reservoir for the Fairfield Pumped Storage Development intake, which is located approximately three miles upstream of the Parr Shoals Dam on Frees Creek, a tributary to the Broad River. The approximately 15-mile-long reservoir covers 4,400 acres and impounds 32,000 acre feet of gross storage, 29,000 acre-feet being useable storage. Full pond elevation is 265.3 ft. with a total depth of the drawdown about 10 ft.

2.4 BYPASS REACH

There is no bypass reach associated with this Development.

2.5 GENERATING EQUIPMENT

The Parr Hydroelectric Plant was initially built to house eight vertical-shaft turbine-generator units. Six units were installed and are in operation. The Parr Shoals Development generating equipment consists of the following:

2.5.1 TURBINES

The six installed turbines are Francis-type, manufactured by Allis-Chalmers Company. They are rated at 3600 HP with 35 feet of head. The two smaller excitation turbines are no longer operated.

2.5.2 GENERATORS

The six generators, manufactured by Allis-Chalmers Company, are rated at 3100 kVA, 0.8 PF, 2300 volts, 60 cycles alternating current. They are directly coupled to the turbines, and operate at a synchronous speed of 100 rpm. The two smaller excitation generators are no longer operated.

2.5.3 EXCITERS

The two original turbine-driven vertical-shaft exciters rated at 300 kW, 125 volts DC, manufactured by Allis-Chalmers are no longer used. Normal excitation for the main generators is provided by solid-state exciters installed in 1995.

2.5.4 POWER TRANSFORMERS

There are three step-up transformers in the plant, each being connected to two generators. They are rated at 6000/6720 KVA (OA), 2400/13,800 V at 55 °C/65 °C rise and 7500/8400 KVA (FA), 2400/13,800 volt at 55 °C/65 °C rise. All are oil insulated and forced-air cooled.

2.5.5 GOVERNORS

All six turbines have dedicated hydraulically controlled gate positioning systems.

2.5.6 MISCELLANEOUS EQUIPMENT

The Parr plant is equipped with a 50-ton Toledo bridge crane for equipment maintenance.

3.0 FAIRFIELD PUMPED STORAGE DEVELOPMENT

The Fairfield Pumped Storage Development (FFPS) was completed in 1978 as a modification to the original Parr Hydroelectric Project. The original Parr Reservoir serves as a lower reservoir, and Monticello Reservoir was constructed to serve as the upper reservoir. Monticello Reservoir was created by impounding Frees Creek, a small tributary to the Broad River, by constructing four earth dams and two perimeter embankments on the east side of the reservoir. A reinforced concrete intake structure is located on natural ground between two of the earth dams, and is connected by four steel penstocks to a reinforced concrete powerhouse constructed largely below grade. The powerhouse discharges into a tailrace channel which joins Parr Reservoir about 3 miles upstream of Parr Dam. Monticello Reservoir is authorized as a source of cooling water for the V. C. Summer Nuclear Station (VCSNS), which is not part of the Project.

3.1 PROJECT STRUCTURES

3.2 DAMS

The four main earth dams impounding Monticello Reservoir are denoted as Dams A, B, C, and D, with Dam A being the northernmost structure and Dam D being the southernmost structure.

3.2.1 DAM A

Dam A is constructed of random fill with an impervious upstream blanket and core, founded on natural soil. Dam A is approximately 3,130 ft. long at the crest (el 433.3 ft.) and 85 ft. high at its maximum section. The upstream face of the dam is protected with riprap and the downstream slope is grassed.

3.2.2 DAM B

Dam B is the largest of the four dams at the Fairfield Pumped Storage Development and is located south of Dam A. The crest for this embankment is at 433.3 ft. The length at the crest is about 4,700 ft, and the height of the dam is approximately 160 ft. (200 ft. above prepared foundation). The dam is constructed of random fill with an impervious upstream blanket and core, and is founded on bedrock. The upstream slope of the dam is protected by riprap and the downstream slope is grassed. Dams B and C are separated by an approximately 300-foot-long segment of natural ground, on which the upper reservoir intake structure is located.

3.2.3 Dam C

Dam C is constructed of random fill with an impervious upstream blanket and core, and is founded on natural soils. Dam C is approximately 2,000 ft. long at the crest (El. 433.3 ft.), and is approximately 60 ft. high at its maximum section. The upstream slope is protected with riprap and the downstream slope is grassed. Dams C and D are separated by an approximately 300-foot-long segment of natural ground. The upstream slope of this natural ground segment is protected with riprap.

3.2.4 Dam D

Dam D is constructed of random fill with an impervious upstream blanket and core, and is founded on natural soil. The dam is approximately 1,300 ft. long at the crest (El 433.3 ft.), and approximately 30 ft. high at its maximum section. The upstream slope is protected with riprap and the downstream slope is grassed. A rock berm is constructed at the downstream toe of Dam D to enhance stability.

3.2.5 Perimeter Embankments

Two earth embankments carry S.C. Highways 99 and 215 over the northern and eastern extremities of the reservoir, respectively. The paved crest of the embankment for S.C. Highway 99 is maintained by the South Carolina Department of Transportation (SCDOT), while the upstream face, downstream face, and a water control structure are maintained by SCE&G. The upstream face of this embankment is vegetative covered, while the downstream face is protected by riprap. This embankment separates Monticello Reservoir from an approximately 300 acre recreation sub-impoundment.

The SCDOT maintains the S.C. Highway 215 Relocation Embankment, which is located on the east side of Monticello Reservoir, just south of the Highway 215 Public Boat Ramp site.

An earth embankment (Highway 215 Dike) located at the southeast end of Monticello Reservoir provides freeboard protection for structures west of Highway 215 in that area. This embankment is approximately 3,050 feet long with a maximum height of 31 feet. The crest of the dike embankment is at el. 433.3 ft. The embankment is protected with riprap on the upstream face, and is maintained by SCE&G.

3.3 INTAKE STRUCTURE

The upper reservoir intake structure is located between the left abutment of Dam B and the right abutment of Dam C, and is constructed of reinforced concrete. The intake's approach channel is a flared, open concrete-lined channel 300 ft. long with a maximum width of 260 ft. and a minimum width of 132 ft. The intake structure is 265 ft. long, starting with a maximum width of 132 ft. at the end of the approach channel, tapering to a minimum width of 115 ft. The intake structure has an invert at 359.3 ft., and has four 225-foot long water passages tapering in width from 30 ft. wide by 50 ft. high at the trash racks (approach channel end) down to 17 feet-8 inches wide by 30 ft. high at the gate sections (start of enclosed section). An enclosed 40-foot long section containing four, 26 ft. diameter concrete channels transitions to 26 ft. diameter steel exposed surface penstocks.

3.4 PENSTOCKS

Four, 800-foot long steel penstocks fan out and extend down a graded slope to convey flow from the intake structure to the powerhouse. The exposed sections of the penstock are supported by ring girders on concrete pedestals with reinforced concrete caissons founded on bedrock. Each penstock is 26 ft. in diameter for the upper 550 ft. length, after which each section bifurcates into two 18 feet 7 inch diameter sections that connect directly to the pump-turbine units. Approximately the last 270 ft., which include the bifurcation and lower penstock sections, are encased in concrete.

3.5 POWERHOUSE

The powerhouse structure is constructed of reinforced, mass, and lean fill concrete, and is 520 ft. long by 150 feet wide by 108 feet high (from deepest sump to top deck). The powerhouse lies mostly below ground and below the tailwater surface. The powerhouse is divided into eight 65 ft. wide bays, each bay containing one reversible pump-turbine unit with a capacity of 63.9 MW, for a total station capacity of 511.2 MW. There are 16 draft tube gates on the downstream side of the powerhouse to facilitate dewatering.

3.6 RESERVOIR

Monticello Reservoir, which is impounded by the Fairfield dams, is the upper reservoir for the pumped storage facility, and also serves as a source of cooling water for the V.C. Summer nuclear facility. The lower pool for the development is the Parr Reservoir, impounded by Parr Shoals Dam.

The maximum pool elevation (full pond) of the Monticello Reservoir is 424.3 ft. The reservoir's gross storage at full pond is approximately 400,000 acre-feet with a surface area of approximately 6,800 acres. The reservoir's operating range is between 419.8 ft. and 424.3 ft., with a usable storage of 29,000 acre-feet. All or a part of this volume is utilized on a daily basis for pumped storage operation.

A 300-acre recreation sub-impoundment, included in the 6,800 acres of Monticello Reservoir, is located at the northern end on the reservoir, separated from the main reservoir by an embankment, on which SC Hwy. 99 is located. A hydraulic control structure allows the recreation sub-impoundment to remain at a relatively constant elevation regardless of the daily fluctuations in the main reservoir.

3.7 GENERATING EQUIPMENT

3.7.1 PUMP-TURBINES

The eight Allis-Chalmers Francis-type pump-turbines were overhauled between 2001 and 2004, with new runners provided by American Hydro Corporation. Each turbine has a rated capacity of 95,375 hp at the minimum net head of 150 feet, and rotational speed of 150 rpm. The turbine discharge at 150 feet of net head is 6,300 cfs per unit, and each unit is capable of pumping an average of 5,225 cfs over the total dynamic head range of 158-173 feet.

3.7.2 MOTOR-GENERATORS

The pump-turbines are each direct-coupled to a 3 phase, 60-hertz Allis-Chalmers motor-generator rotating at 150 RPM. The motor-generators are rated as follows:

Generator Rating	71 MVA, 0.9 PF, 13.8kV at 60°C rise 81.5 MVA, 0.9 PF, 13.8kV at 80°C rise
Motor Rating	90,000 HP, 1.0 PF, 13.2 kV at 60°C rise 103,500 HP, 1.0 PF, 13.2 kV at 80°C rise

A draft tube water level depression system is used to facilitate starting the motors at reduced voltage.

3.8 EXCITERS

Static exciters are provided for all 8 units.

3.9 GOVERNORS

Each unit is equipped with a Woodward cabinet actuator governor.

3.10 POWER TRANSFORMERS

There are four step-up transformers, each connected to two generating units. The transformers are rated 160/80/80 MVA, type FOA, with 55 °C rise, 179.2/89.6/89.6 MVA (FOA) with 65 °C rise, three-phase, 60 Hz.

3.11 SWITCHYARD

The 230 KV Fairfield switchyard consists of two 230 KV buses, both connected to two power transformers via a single circuit transmission line.

3.12 MISCELLANEOUS EQUIPMENT

One 185-ton outdoor gantry crane on rails at the powerhouse deck elevation is used for equipment maintenance; it is equipped with an auxiliary hoist capacity of 30 tons. Miscellaneous powerhouse accessory equipment includes instrumentation, batteries, and switchgear.

4.0 PROJECT TRANSMISSION LINES

Electricity from the Parr Shoals Development is transmitted via multiple overhead conductors to two separate grid interconnection points:

- (3) 13.8-kV conductors from the hydro station to the non-project Parr 115 kV substation, with each conductor having a total line length of approximately 950 feet to the point of system interconnection;
- (3) 13.8-kV conductors from a pole carrying the conductors described above to the 13.8/24.9-kV Parr distribution substation, with a total line length of approximately 40 feet. This very small substation is currently within the Project Boundary, however since it is the point of connection to the Applicant's distribution system, and is not operated or maintained by Project personnel, the Applicant proposes to remove it from the Project Boundary. This will be consistent with the other grid interconnection points at the Parr Project, where the Project Boundary ends at the point where the primary lines enter the non-project substation(s).

At the Fairfield Development, two three-conductor transmission lines connect the Fairfield switchyard with the non-project V.C. Summer switchyard, which is the point of connection with the Applicant's transmission system. Each line has a total length of approximately 7,000 feet.

5.0 PROJECT FEDERAL LANDS

There are 162.61 acres of Federal lands administered by the US Forest Service which are part of the Parr Hydroelectric Project. Exhibit A-3 contains a tabulation of Federal Lands within the Project Boundary, by tract number, along with a designation as to which Exhibit G map sheet each tract is shown on.

EXHIBIT A-1

PROJECT LOCATION MAP

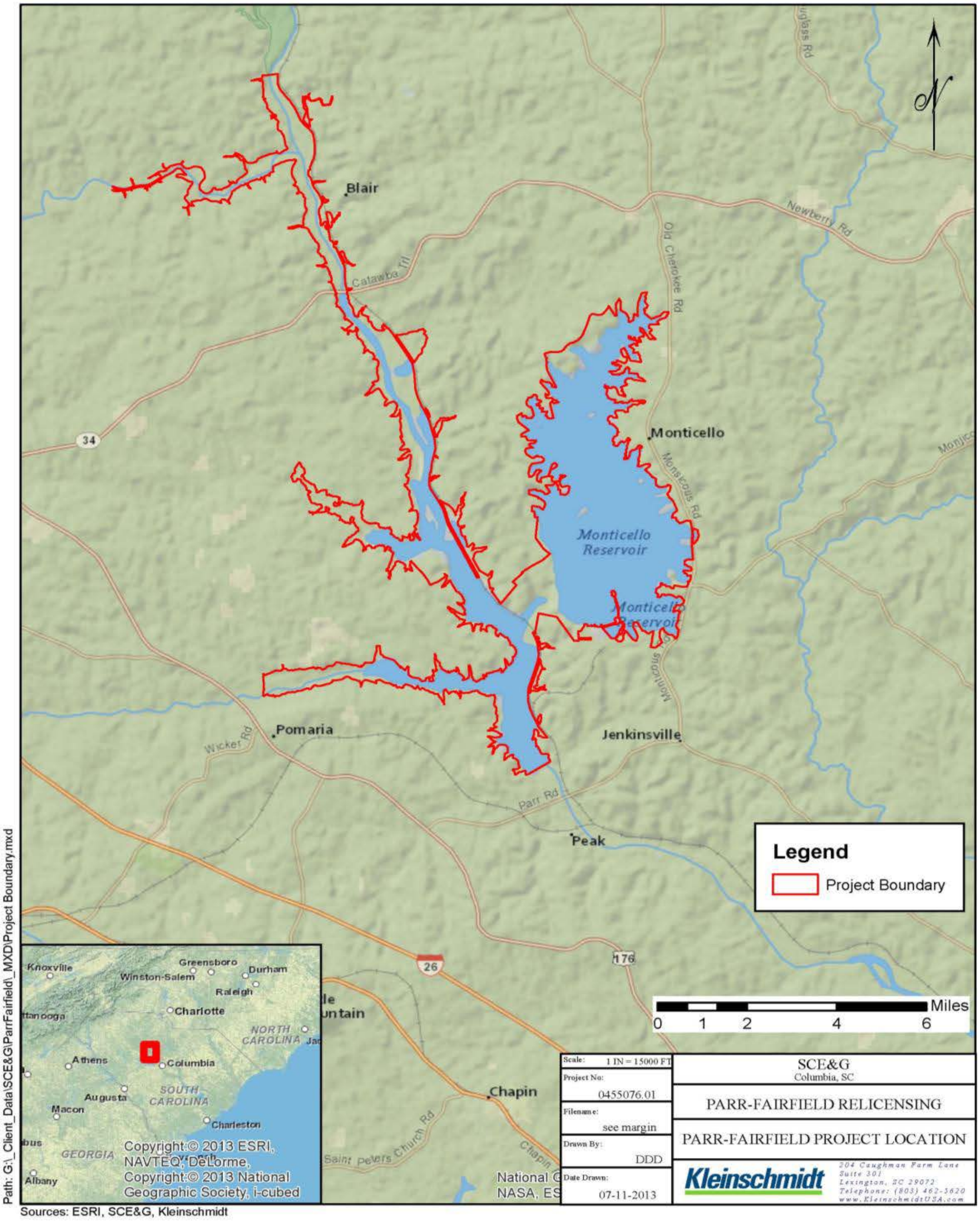


EXHIBIT A-1 PROJECT LOCATION MAP

EXHIBIT A-2

PARR HYDRO PROJECT STANDARD NUMBERS

Parr Hydroelectric Project P-1894

Table of Standard Project Numbers

DESCRIPTION	NUMBER OR FACT (PARR SHOALS DEVELOPMENT)	NUMBER OR FACT (FAIRFIELD PUMPED STORAGE DEVELOPMENT)
Project Location	25 mi northwest of City of Columbia; Fairfield and Newberry Counties	27 mi northwest of City of Columbia; Fairfield County
GENERAL		
Project drainage area	4,750 sq. miles	4,750 sq. miles (lower res.) 9,400 acres (upper res.)
Station rated generating capacity	14,880 kW	511,200 kW
Estimated reliable capability	7,000 kW	511,200 kW
Annual gross generation	59,003 MWh (2000 thru 2010)	773,058 MWh (2000 thru 2010)
Discharge at rated capacity	6,000 CFS	50,400 CFS (Generating); 41,800 CFS (Pumping)
Minimum recorded daily average flow	800 CFS (at USGS Alston Gage Site)	0 CFS (into Parr Reservoir)
DAM & RESERVOIR		
Dam Type & Dimensions	Concrete gravity spillway, 37 ft. high, 2000 ft. long, crest el. 257.0 ft. NGVD29	(4) Primary earth embankments, all with crest el. 434.0 ft. NGVD29: Dam A: 85 ft. high, 3,130 ft long Dam B: 160 ft. high, 4,700 ft. long Dam C: 60 ft. high, 2,000 ft. long Dam D: 30 ft. high, 1,300 ft. long (2) Perimeter freeboard embankments on east side of reservoir
Max. Res. Oper. Level (Full Pool) & Area	El. 266.0 ft. NGVD29; 4,400 ac.	El. 425.0 ft. NGVD29; 6,800 ac. Sub-impoundment (recreation lake), 300 ac.
Min. Res. Oper. Level	El. 256.0 ft. NGVD29	El. 420.5 ft. NGVD29
Total storage at full pool	32,000 ac-ft	400,000 ac-ft
Active storage	29,000 ac-ft in 10 ft. operating range	29,000 ac-ft in 4.5 ft. operating range
SPILLWAY		
Spillway Gates Number and Type	(10) Bottom hinged bascule crest gates, each 200 ft. long and 9 ft. high.	None
Discharge Capacity	230,000 CFS (Inflow Design Flood) 427,000 CFS (Probable Maximum Flood)	N/A
POWERHOUSE		
Construction type	Steel framed brick masonry	Reinforced concrete
Dimensions	300 ft. long, 60 ft. wide, 50 ft. high	520 ft. long, 150 ft. wide, 108 ft. high (below grade)
INTAKE STRUCTURE		
Type and Dimensions	Integral with powerhouse	Reinforced concrete, 300 ft. long, 260 ft. wide, 50 ft. high
Head Gates Number and Type	(6) Bottom hinged steel	(4) Vertical lift steel had gates; (8) vertical lift steel tail gates

Parr Hydroelectric Project P-1894

Table of Standard Project Numbers

DESCRIPTION	NUMBER OR FACT (PARR SHOALS DEVELOPMENT)	NUMBER OR FACT (FAIRFIELD PUMPED STORAGE DEVELOPMENT)
PENSTOCKS		
Number, Type and Dimensions	(6) Concrete, integral with powerhouse	(4) Steel, 800 ft. long, 26 ft. diameter (each serves 2 units)
TURBINES		
Number & Manufacturer	(6) Allis Chalmers	(8) American Hydro
Type	Vertical Francis	Vertical Francis Reversible Pump-Turbines
Rated net head/TDH	35 ft.	150 to 167 ft. (Turbine mode); TDH 158 to 173 ft. (Pump mode)
Approximate min. discharge capacity	150 CFS	2,500 CFS
Rated maximum discharge capacity	1,000 CFS	6,300 CFS (generating); 5,225 CFS (avg. pumping)
Draft tube invert elevation	El. 203.6 ft. NGVD29	El. 189.0 ft. NGVD29
HP rating at rated head	3,600	95,375 to 108,570
Synchronous speed (rpm)	100	150
GENERATORS		
Manufacturer	Allis Chalmers	Allis Chalmers
Type	AC	AC Motor-Generators
Phases	3	3
Voltage	2,300	13,800/13,200 V @ 60° C/80° C
Frequency	60 Hz	60 Hz
KVA rating	3,100	71,000 (generating); 74,570 (pumping, 100,000 HP equiv.)
Power factor	0.8	0.9 (generator); 1.0 (pump)
KW output	2,480	63,900
TRANSFORMERS		
Number & Type	(3) OA/FA	(4) FOA (each serves 2 units)
Voltage (Primary/Secondary)	2.4/13.8-kV	13.8/230-kV
Phases	3	3
KVA Rating @ Temp. Rise	6,000/6,720 KVA (OA), @ 55 °C/65° C rise 7,500/8,400 KVA (FA), @ 55 °C/65° C rise	160/80/80 MVA @ 55° C rise (160 MVA 230 kV primary wye connected, 2-80 MVA 13.8 kV secondaries each connected to 1 motor-generator); 179.2/89.6/89.6 MVA @ 65° C rise

EXHIBIT A-3

FEDERAL LANDS

EXHIBIT A-3

PARR HYDROELECTRIC PROJECT P-1894

FEDERAL ACREAGE WITHIN THE PROJECT BOUNDARY

Exhibit G Sheet No.	**Tract No.**	**Federal Acreage**
G-17	198	17.88
G-15/16	200	120.55
G-17	226	3.09
G-16/17	227	12.52
G-17	232	3.14
G-17	248	0.33
G-17	264	0.93
G-15	266	0.05
G-10	271	4.12
		Total 162.61

EXHIBIT B

PROJECT OPERATION AND RESOURCE UTILIZATION

PARR HYDROELECTRIC PROJECT
(FERC NO. 1894)

APPLICATION FOR NEW LICENSE
FOR MAJOR WATER POWER PROJECT > 5 MW

EXHIBIT B

PROJECT OPERATION AND RESOURCE UTILIZATION

TABLE OF CONTENTS

ATTACHMENTS

1.0 PROJECT OPERATION

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[1]. When inflows are below 4,800 CFS, the Parr Development's turbines are operated to meet the minimum flow requirements. The minimum flow required to be released from the Project during the months of March, April, and May is the lesser of 1,000 CFS or daily average inflow (minus evaporative losses from both reservoirs). During the remainder of the year, the minimum flow requirements are 150 CFS instantaneous flow and 800 CFS daily average flow, or the daily average inflow (minus evaporative losses), whichever is less.

The Fairfield Pumped Storage Development (Fairfield) 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 the Applicant'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. When inflows to the Project begin to exceed 6,000 CFS, the

[1] The turbines operate at a maximum head of 44 feet, but original design was 35 feet prior to raising the Parr Reservoir the additional 9 feet. Power output exceeds the generator ratings at full gate opening, and the gate settings are therefore limited to prevent equipment damage.

allowable maximum reservoir elevation is reduced from el. 265.3[2] and Bascule gates on the Parr spillway dam are systematically lowered to prevent upstream inundation at critical sections due to backwater effects. Generation from the Fairfield Development is also partially curtailed during these conditions to prevent total project flow releases from contributing to downstream flooding. When inflows reach a threshold that causes flooding downstream of the Project, all spillway gates are fully lowered to pass natural inflows, and Fairfield generation is completely suspended until flows recede. Fairfield pumping operations may occur with any flow in the Broad River. On the falling leg of a flood event, the gates are gradually raised to retain active storage while preventing the reservoir from exceeding the normal maximum elevation.

As a reserve asset, in the event of a loss of generation on the Applicant's system, available Fairfield units can be started and brought to full load within 15 minutes. This allows a rapid response to emergencies on the Applicant's system, and also helps fulfill the Applicant's reserve share obligation as a member of the Virginia-Carolinas Electric Reliability Council (VACAR) under the VACAR Reserve Sharing Arrangement (VRSA). It should be noted that, in order to be considered a reserve generation asset at any given time, Fairfield units must be on standby and cannot be providing generation for other purposes.

1.1 MANUAL OR AUTOMATIC OPERATION

The Parr Development units normally are dispatched remotely from SCE&G's System Control Center in Cayce. Once started, the units are under automatic control. Units can also be operated manually from the powerhouse. The plant is manned five days per week, eight hours per day, with plant checks conducted on weekends and holidays. Personnel are also available for call out should a problem arise outside of plant personnel normal working hours.

Fairfield Development units are operated from a local control room in the Fairfield powerhouse that is manned continuously.

1.2 ESTIMATE OF PLANT CAPACITY FACTOR

The annual plant capacity factor (the ratio of the average load on the plant for a certain period of time to the capacity rating of the plant) for the Parr Development is estimated to be

[2] Unless otherwise noted, all elevation references in this Exhibit are referenced to the North American Vertical Datum of 1988 (NAVD 88); conversion to National Geodetic Vertical Datum of 1929 (NGVD29), used in numerous supporting studies for this license application and often erroneously referred to as MSL, requires the addition of 0.7 feet to elevation values referenced to NAVD88.

43 percent, based on average annual gross generation of 56,409 MWH for the period 2000 through 2016, as shown in Exhibit B-1.

The annual plant capacity factor for the Fairfield Development is estimated to be 15 percent, based on average annual gross generation of 676,971 MWH for the period 2000 through 2016. Average annual pumping energy for this same period for the Fairfield Development is 941,093 MWH, as shown in Exhibit B-1.

1.3 PROPOSED OPERATION DURING ADVERSE, MEAN, AND HIGH WATER YEARS

Adverse Flow Years: During periods of low flow in the Broad River, Parr Hydro will generate continuously using one or more units to pass the natural river flow and provide any prescribed downstream flows. Fairfield Pumped Storage will be dispatched each day in both generation and pumping modes to meet the Applicant's system peak demand and energy storage requirements, subject to the availability of water in Parr Reservoir. During periods of extremely low flow, it is sometimes not possible to completely replenish Monticello Reservoir each day due to evaporative and other losses (e.g. leakage) from the project reservoirs, and the energy dispatched from Fairfield must be reduced each day during the following generation cycle to account for this.

Mean Flow Years: Operation of the Project in mean flow years will generally consist of continuous generation at Parr Hydro to pass the natural river flow, with flows that exceed the hydraulic capacity of the powerhouse spilled using the crest gates. Fairfield Pumped Storage will be dispatched each day in both generation and pumping modes to meet the Applicant's system peak demand and energy storage requirements.

High Flow Years: Operation of the Project in high flow years will generally consist of continuous generation at Parr Hydro with all available units to pass the natural river flow, with flows that exceed the hydraulic capacity of the powerhouse spilled using the crest gates. Fairfield Pumped Storage will be dispatched each day in both generation and pumping modes to meet the Applicant's system peak demand and energy storage requirements, subject to the requirements (based on Article 39 of the current license) to curtail generation at Fairfield during floods so as not to add to downstream flood flows. The maximum elevation limits on the Parr Reservoir will be reduced as inflow increases to prevent upstream flooding from backwater effects during high inflows. This requires additional management of usable storage via gate operations throughout a high inflow event. Operation during high flow events is described in more detail in Exhibit H.

2.0 GENERATION AND HYDROLOGY

2.1 ESTIMATE OF DEPENDABLE CAPACITY

Dependable capacity as defined by the Energy Information Administration is “The load-carrying ability of a station or system under adverse conditions for a specified period of time.” For the Parr Shoals Development, adverse conditions are extended periods of low inflow, with the headpond near the minimum level following a Fairfield Development pumping cycle. During the lowest flow month of September, the adverse condition selected for this estimate is the flow that is met or exceeded 90 percent of the time, which is approximately 800 cfs[3]. This is sufficient flow for a single turbine-generator to generate at 50 percent gate, and at minimum headpond produces an estimated dependable capacity of 1.4 MW.

Because Fairfield operates within a range of available head using storage from the upper reservoir, adverse conditions are not associated with river flow. Rather, the lower end of the head range is the adverse condition. At minimum head conditions, Fairfield has a rated capacity of 511.2 MW, which is considered the dependable capacity.

2.2 GROSS GENERATION

Annual gross generation for Parr Hydro and Fairfield Pumped Storage for the years 2000 through 2016 is shown in Exhibit B-1. The average gross annual generation over this period was 56,409 MWH for the Parr Development, and 676,971 MWH for the Fairfield Development. Average annual energy consumption by the Fairfield Development over the same period was 941,093 MWH, resulting in a net consumption of 264,122 MWH.

2.3 STREAMFLOW DATA & FLOW DURATION CURVES

The Parr Hydroelectric Project is located on the Broad River near Jenkinsville, SC. The total contributing drainage area at the Parr Dam is 4,750 square miles. The monthly and annual flow regime data was collected from a United States Geological Survey (USGS) gauge (02161000, Broad River at Alston, SC) located on the Broad River downstream of Parr Dam. The contributing drainage area for this gauge is 4,790 square miles with an average annual flow of 5,122 CFS (USGS 2016). The data from this gauge was used to develop the curves shown in Exhibits B-2 through B-14. The period of record for the data that is used in these graphs dates from 1981 through 2015.

[3] USGS Annual Statistics for station 02161000, Broad River at Alston.

The flood of record for the Broad River at the Project location occurred on October 3, 1929, and was estimated by the USGS at 228,000 CFS. The minimum daily average flow is 48 cfs, which occurred on September 12, 2002.

2.4 Area Capacity Curves

Area-capacity curves for Parr Reservoir are given in Exhibit B-15, with a corresponding table presented as Exhibit B-16. Area-capacity curves for Monticello Reservoir (Fairfield Development) are given in Exhibit B-17, with a corresponding table presented as Exhibit B-18.

Parr Reservoir has gross storage of approximately 32,000 acre feet at full pool elevation 265.3’, and usable storage (for pumped storage operation) of approximately 29,000 acre feet between elevation 265.3’ (full pool) and elevation 255.3’. Parr Reservoir surface area is approximately 4,400 acres at full pool elevation 265.3’, and is approximately 1,400 acres at an elevation of 255.3’.

Monticello Reservoir has gross storage of approximately 400,000 acre feet at full pool elevation 424.3’, and usable storage (for pumped storage operation) of approximately 29,000 acre feet between elevation 424.3’ (full pool) and elevation 419.8’. Monticello Reservoir surface area is approximately 6,800 acres at full pool elevation 424.3’, and is approximately 6,400 acres at an elevation of 419.8’.

2.5 Reservoir Guide Curves

This project is a combination of modified run of river and pumped storage, and as such does not utilize reservoir guide or rule curves for either project reservoir.

2.6 Estimated Hydraulic Capacity

The estimated hydraulic capacity of the Parr Shoals Development is 4,800 CFS at 44 feet of head and approximately 50 percent gate opening. At full gate opening, the estimated capacity is 6,000 cfs; however, the power output exceeds the generator capacity, and therefore gate openings are currently limited to prevent equipment damage. The hydraulic capacity of the Fairfield Pumped Storage development is 50,400 CFS in generating mode and 41,800 CFS when pumping (all 8 units operating).

2.7 SPILLWAY RATING CURVE

A spillway rating curve for Parr Dam with all crest gates in the fully down position is given in Exhibit B-19.

2.8 TAILWATER RATING CURVE

A tailwater rating curve for Parr Hydro is given in Exhibit B-20.

2.9 POWERPLANT CAPABILITY VS. HEAD CURVES

Net head-capacity curves for Parr Hydro and reservoir elevation – capacity curves for Fairfield Pumped Storage are given in Exhibits B-21 and B-22. For Parr Hydro, these represent the Applicant's estimate of the development's generating capacity based on operating experience and the installed turbine and generator nameplate ratings. The curve represents the current limitation of operating the turbines at 50 percent gate opening. For Fairfield Pumped Storage, these curves are derived from plant performance testing conducted after installation of new turbine runners.

3.0 POWER UTILIZATION

3.1 PARR SHOALS DEVELOPMENT

Parr Hydro normally operates as a baseload, modified run of river plant using available natural flow in the Broad River. Energy generated is utilized in the Applicant's system to serve customer demand.

3.2 FAIRFIELD DEVELOPMENT

3.3 PEAKING POWER

The primary use for the Fairfield Development is to provide peaking generation each day during periods of high customer demand, and to store energy produced by baseload plants during off peak periods by pumping water from Parr Reservoir into Monticello Reservoir. The peaking power produced is used in the Applicant's system to serve customer demand.

3.4 GENERATION FOR APPLICANT'S SYSTEM RESERVE

When Fairfield Pumped Storage is utilized to replace the sudden loss of power from another generation asset on the Applicant's own system, the power produced is used in the Applicant's system to serve customer demand, usually for periods of one to several hours, until such time as other generation assets can be brought on line, or purchased off-system power becomes available to balance the Applicant's system load.

3.5 GENERATION FOR REGIONAL RESERVE SHARING OBLIGATIONS

When Fairfield is utilized in fulfillment of all or a portion of the Applicant's reserve sharing obligation under the VRSA, the power produced by Fairfield represents excess generation above the requirements of the Applicant's own customer demand. The excess power is made available through the interconnected regional transmission system (the "grid"), to balance generation and load over the interconnected system. Compensation to the Applicant for reserve generation provided to other VRSA member systems is made according to the terms of the VRSA.

4.0 FUTURE DEVELOPMENT

A resource utilization study was conducted in 2015 to determine the feasibility of increasing capacity and/or energy production at both developments of the Project. The results indicate that the Parr Shoals Development may benefit from new generators to allow full turbine capacity to be utilized. The current limit of 50 percent gate opening results in lower efficiency than higher gate settings. Therefore, higher capacity generators would result in both higher station capacity, estimated to be 22 MW, and additional energy generation. The Applicant is currently evaluating the cost of generator replacements, as well as other turbine-generator components that may require replacement for increased capacity.

At Fairfield, the capacity of the generators and the hydraulic capacity of the penstocks are at or near capacity. No additional development or capacity increases are currently planned.

EXHIBIT B-1

CURVES

EXHIBIT B-1

Parr Hydroelectric Project P-1894

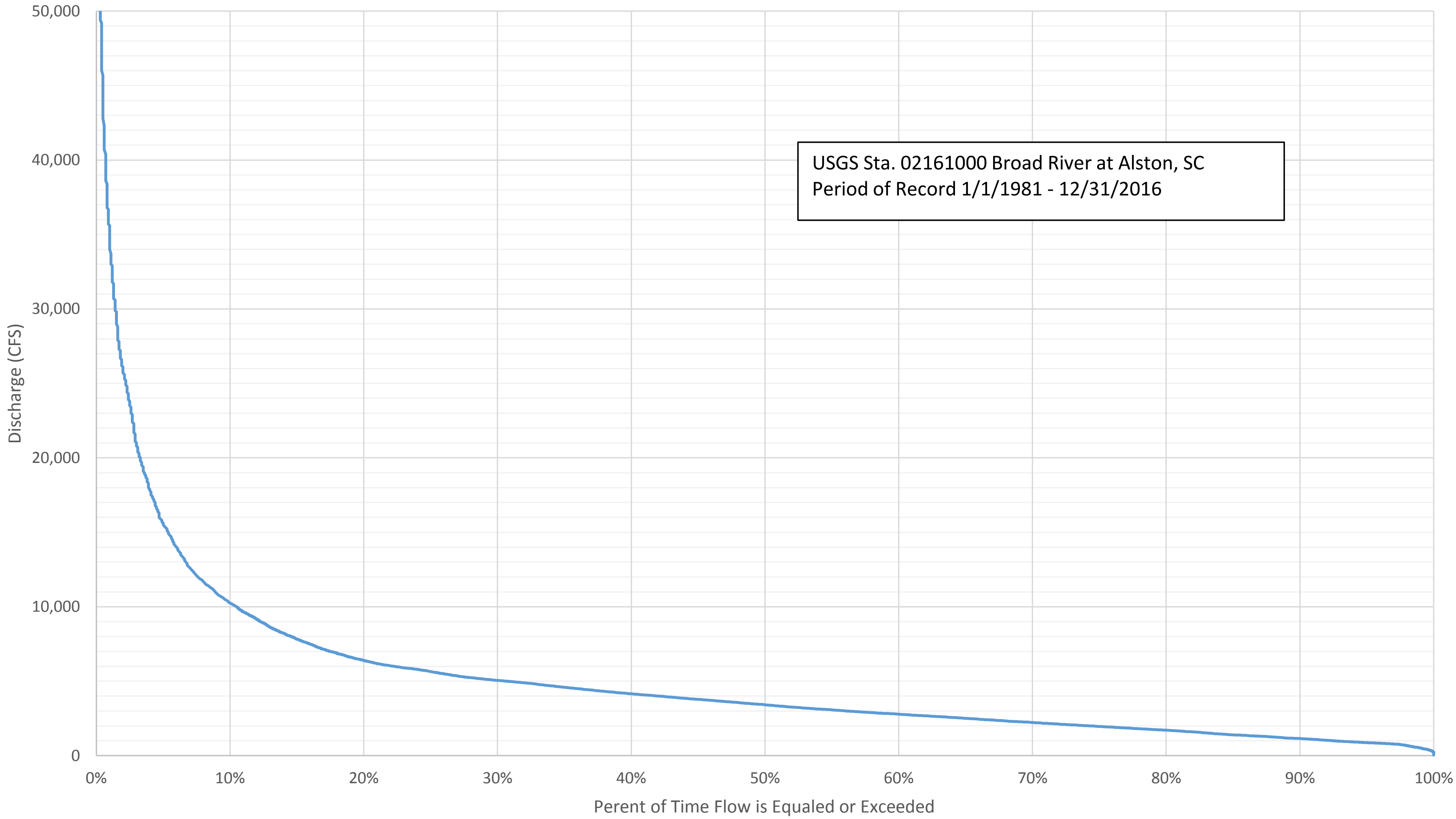
Gross Annual Generation for the Period 2000 - 2016

YEAR	PARR DEVELOPMENT GROSS ANNUAL GENERATION (MWH)	FAIRFIELD DEVELOPMENT GROSS ANNUAL GENERATION (MWH)	FAIRFIELD DEVELOPMENT ANNUAL PUMPING ENERGY (MWH)
2000	51,798	715,569	1,010,759
2001	44,609	682,301	959,575
2002	50,517	741,217	1,024,706
2003	82,557	821,300	1,130,655
2004	78,631	894,179	1,243,560
2005	81,945	903,183	1,236,325
2006	56,144	834,824	1,140,710
2007	41,536	824,684	1,126,602
2008	40,221	808,870	1,111,636
2009	61,762	658,252	911,209
2010	59,314	619,254	859,595
2011	45,556	587,692	812,356
2012	48,402	639,920	890,357
2013	72,327	424,295	599,449
2014	50,306	372,498	524,880
2015	48,948	461,014	644,241
2016	44,387	519,448	771,958
AVERAGE 2000 - 2016	**56,409**	**676,971**	**941,093**

EXHIBIT B-2

PARR HYDROELECTRIC PROJECT P-1894

ANNUAL FLOW DURATION CURVE



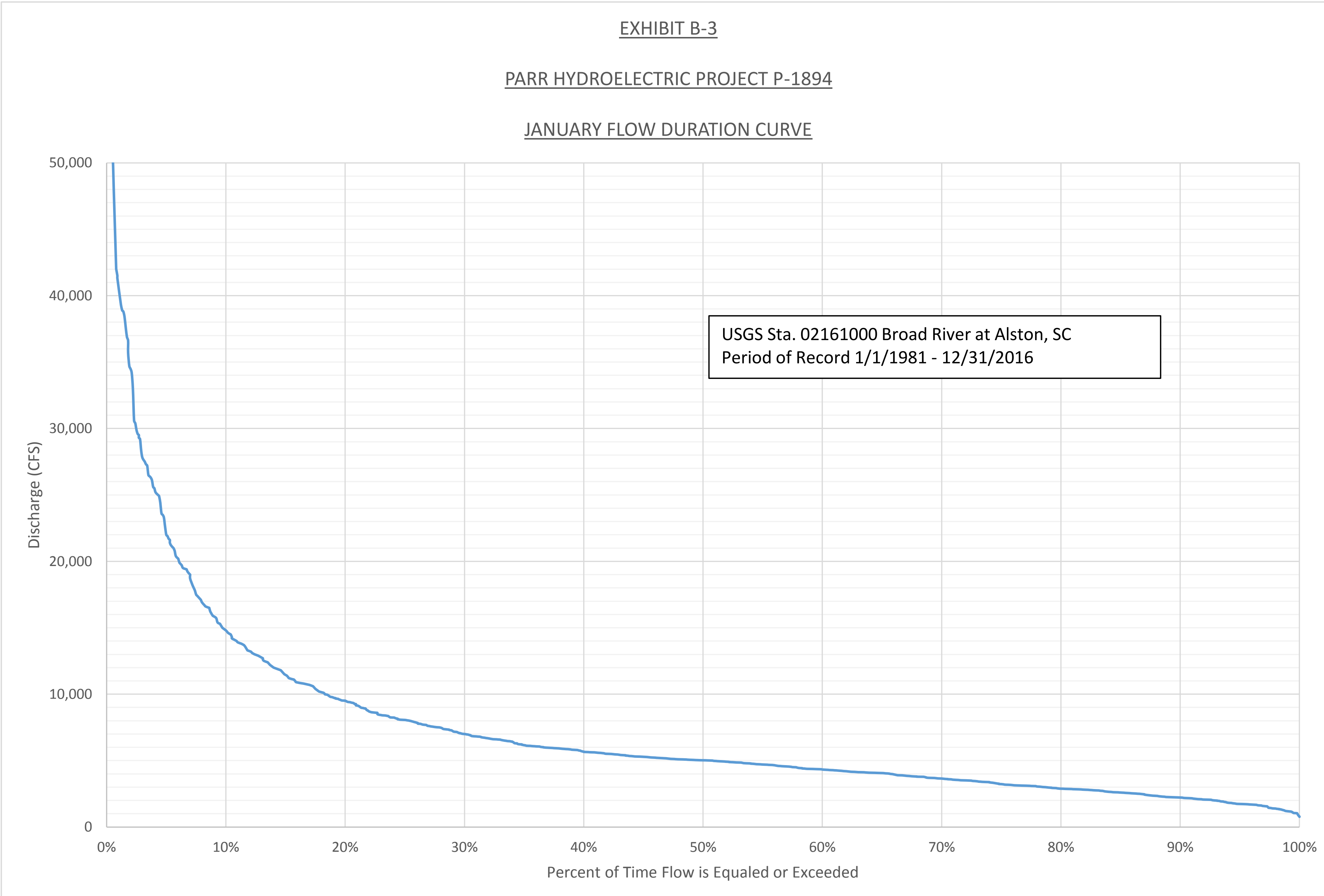
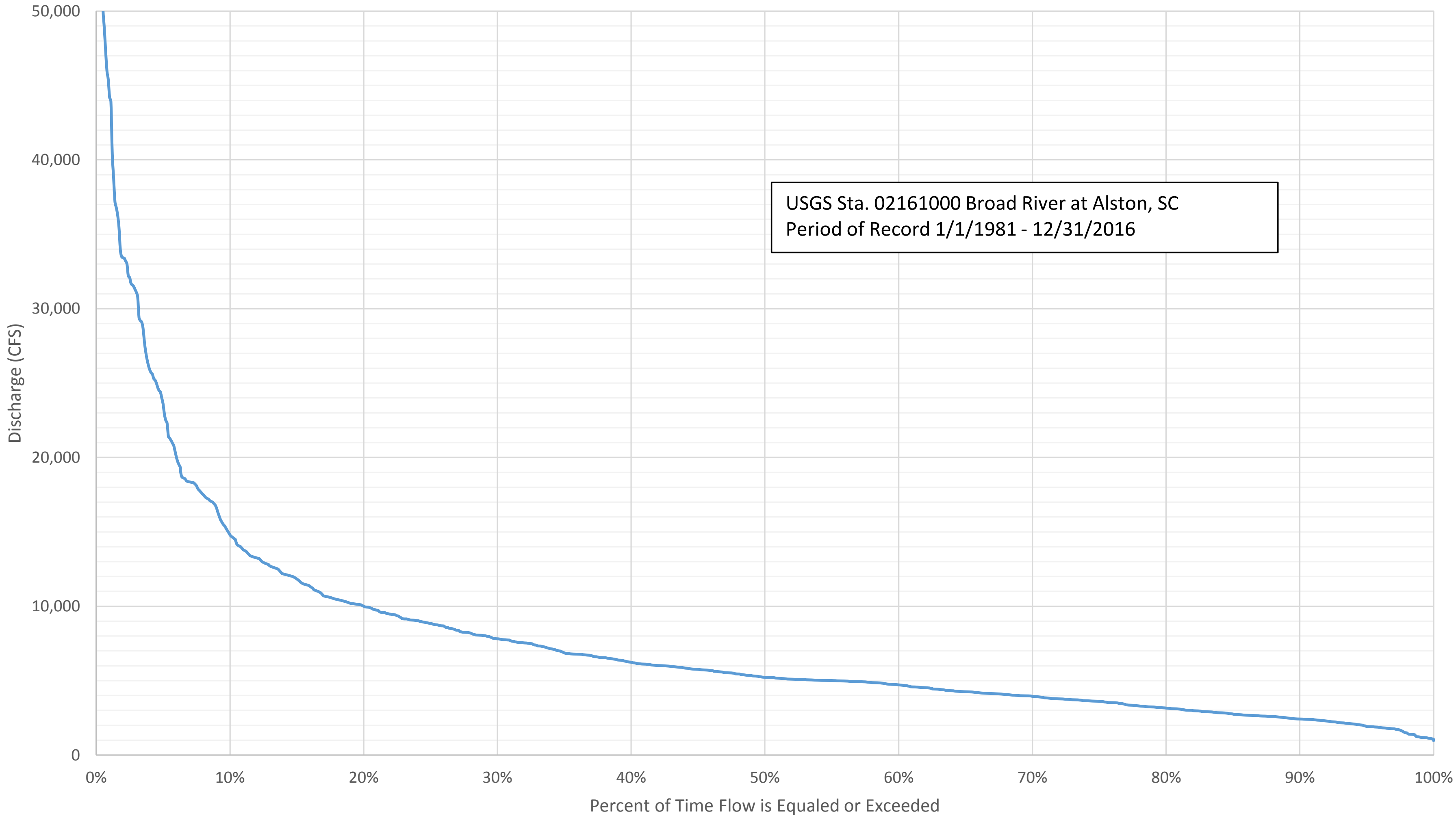


EXHIBIT B-3
PARR HYDROELECTRIC PROJECT P-1894
JANUARY FLOW DURATION CURVE
USGS Sta. 02161000 Broad River at Alston, SC
Period of Record 1/1/1981 - 12/31/2016
Discharge (CFS)
50,000
40,000
30,000
20,000
10,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Flow is Equaled or Exceeded

EXHIBIT B-4

PARR HYDROELECTRIC PROJECT P-1894

FEBRUARY FLOW DURATION CURVE



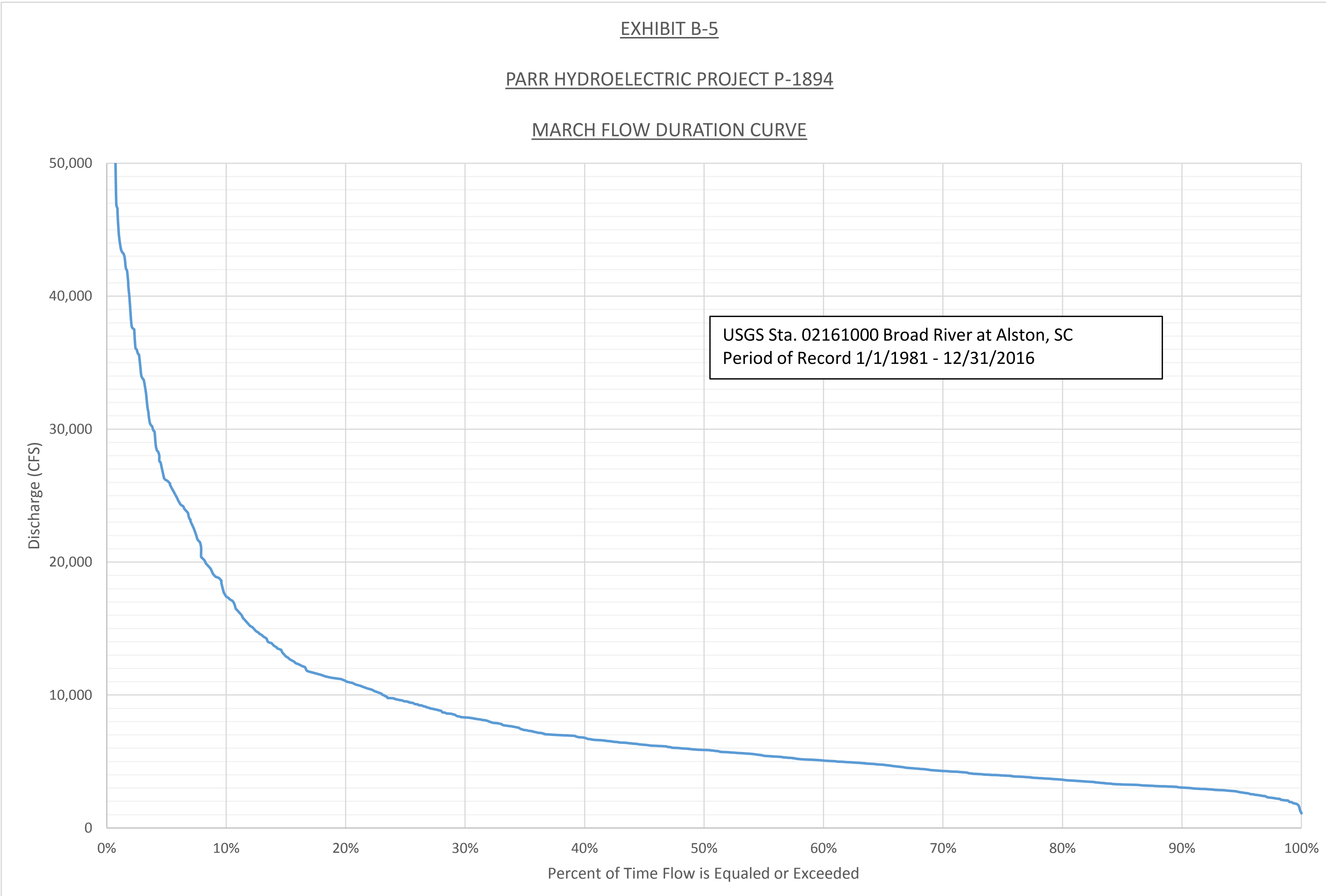


EXHIBIT B-5
PARR HYDROELECTRIC PROJECT P-1894
MARCH FLOW DURATION CURVE
USGS Sta. 02161000 Broad River at Alston, SC
Period of Record 1/1/1981 - 12/31/2016
Discharge (CFS)
50,000
40,000
30,000
20,000
10,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Flow is Equaled or Exceeded

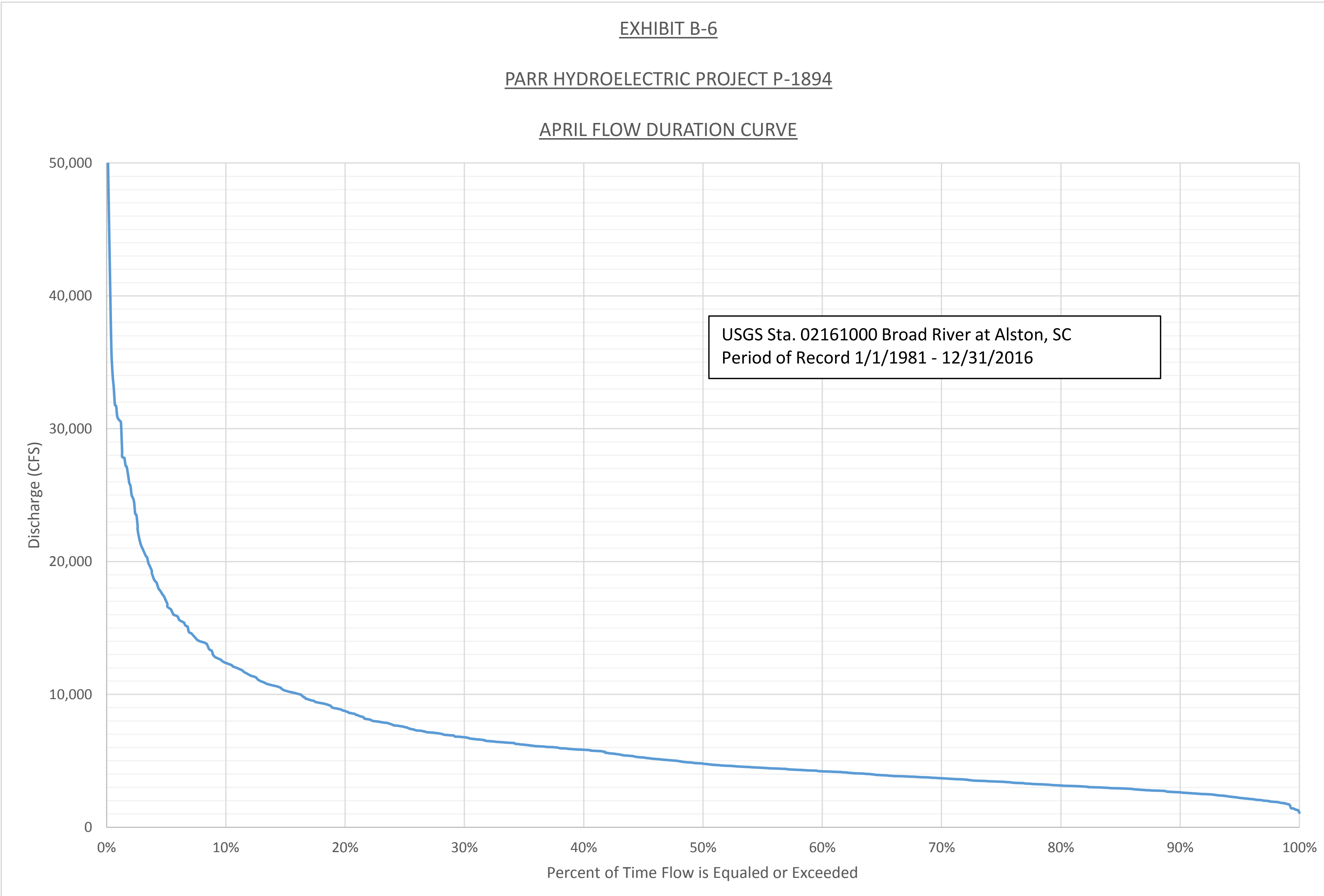


EXHIBIT B-6
PARR HYDROELECTRIC PROJECT P-1894
APRIL FLOW DURATION CURVE
USGS Sta. 02161000 Broad River at Alston, SC
Period of Record 1/1/1981 - 12/31/2016
Discharge (CFS)
50,000
40,000
30,000
20,000
10,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Flow is Equaled or Exceeded

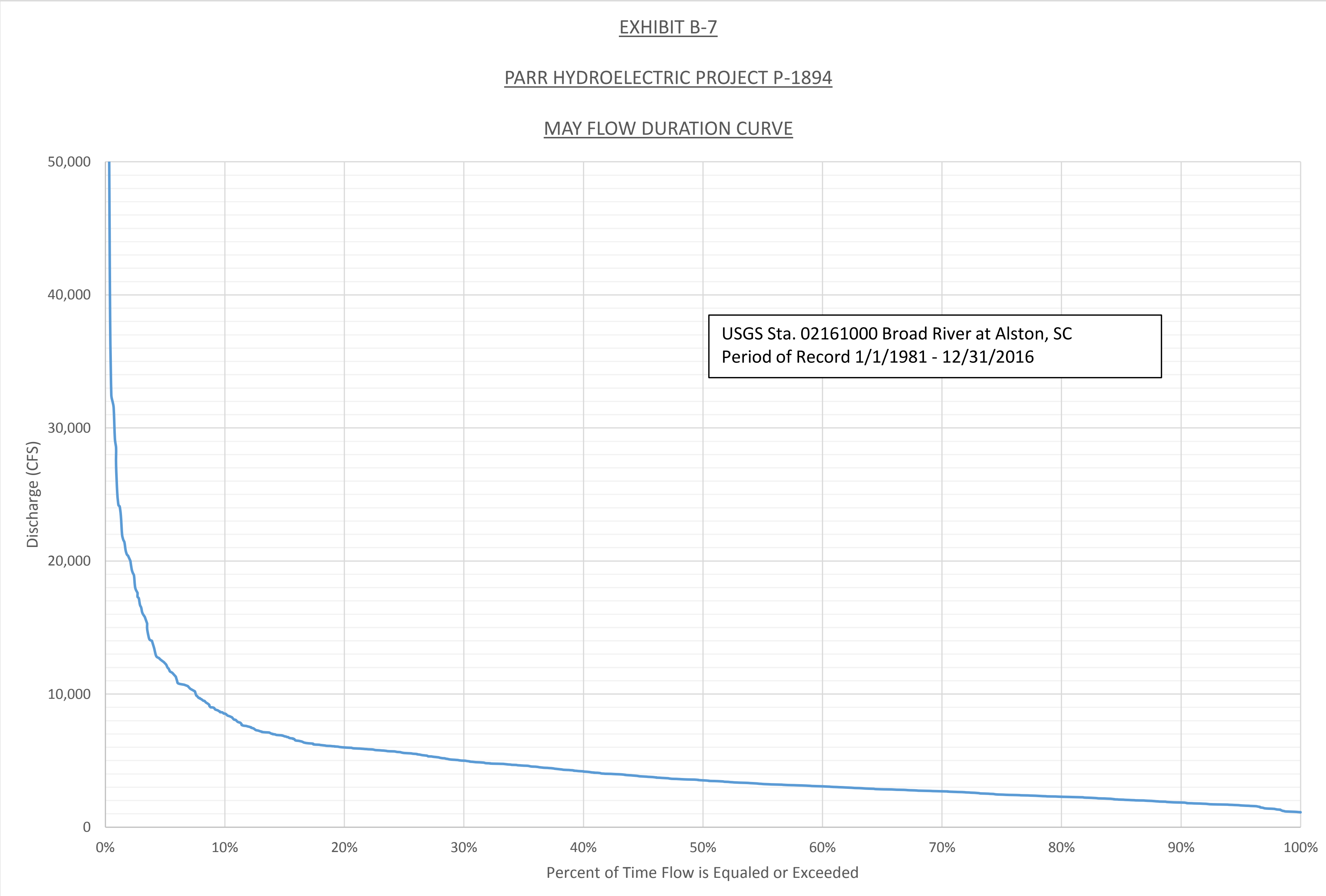


EXHIBIT B-7
PARR HYDROELECTRIC PROJECT P-1894
MAY FLOW DURATION CURVE
USGS Sta. 02161000 Broad River at Alston, SC
Period of Record 1/1/1981 - 12/31/2016
Discharge (CFS)
50,000
40,000
30,000
20,000
10,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Flow is Equaled or Exceeded

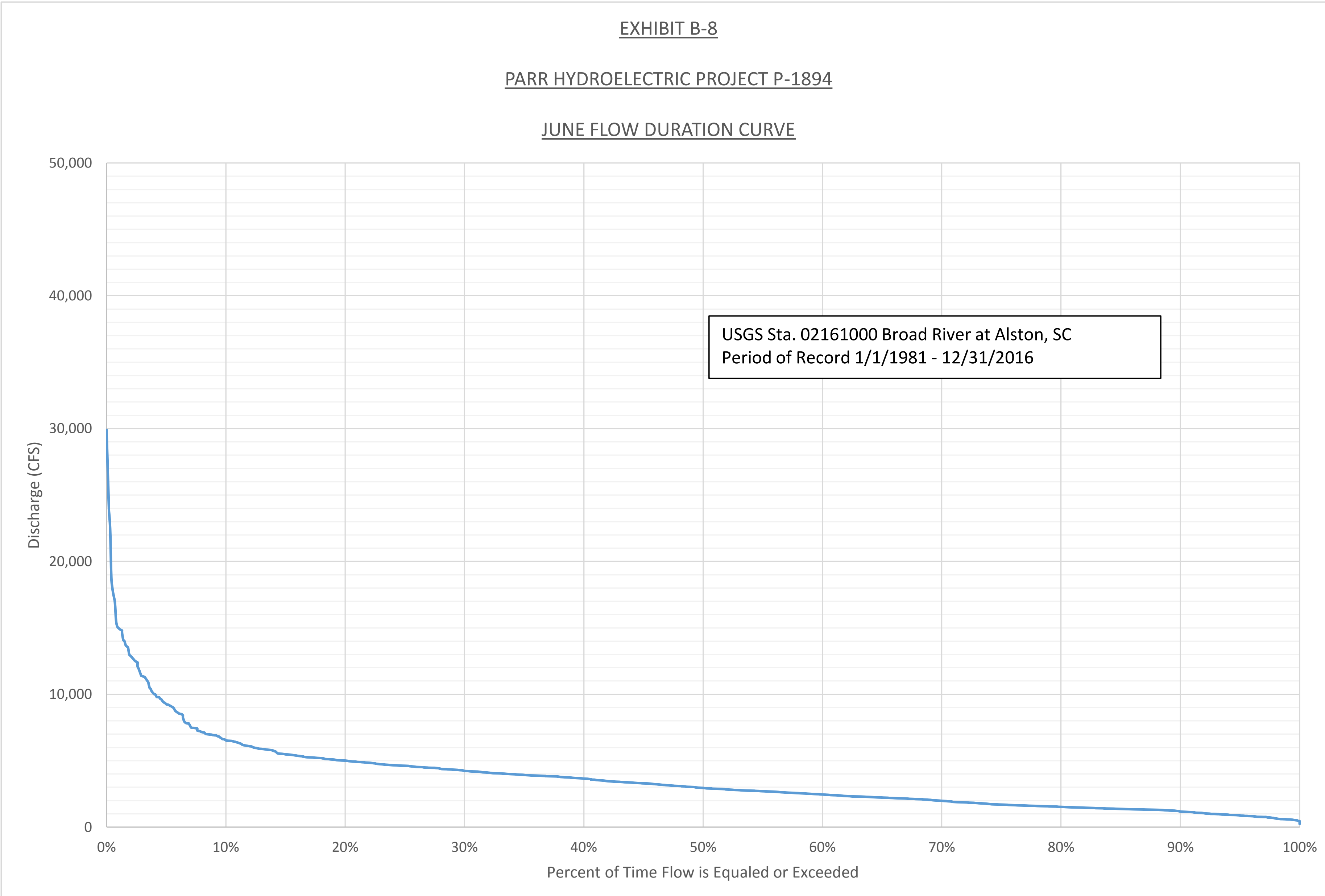


EXHIBIT B-8
PARR HYDROELECTRIC PROJECT P-1894
JUNE FLOW DURATION CURVE
USGS Sta. 02161000 Broad River at Alston, SC
Period of Record 1/1/1981 - 12/31/2016
Discharge (CFS)
50,000
40,000
30,000
20,000
10,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Flow is Equaled or Exceeded

EXHIBIT B-9

PARR HYDROELECTRIC PROJECT P-1894

JULY FLOW DURATION CURVE

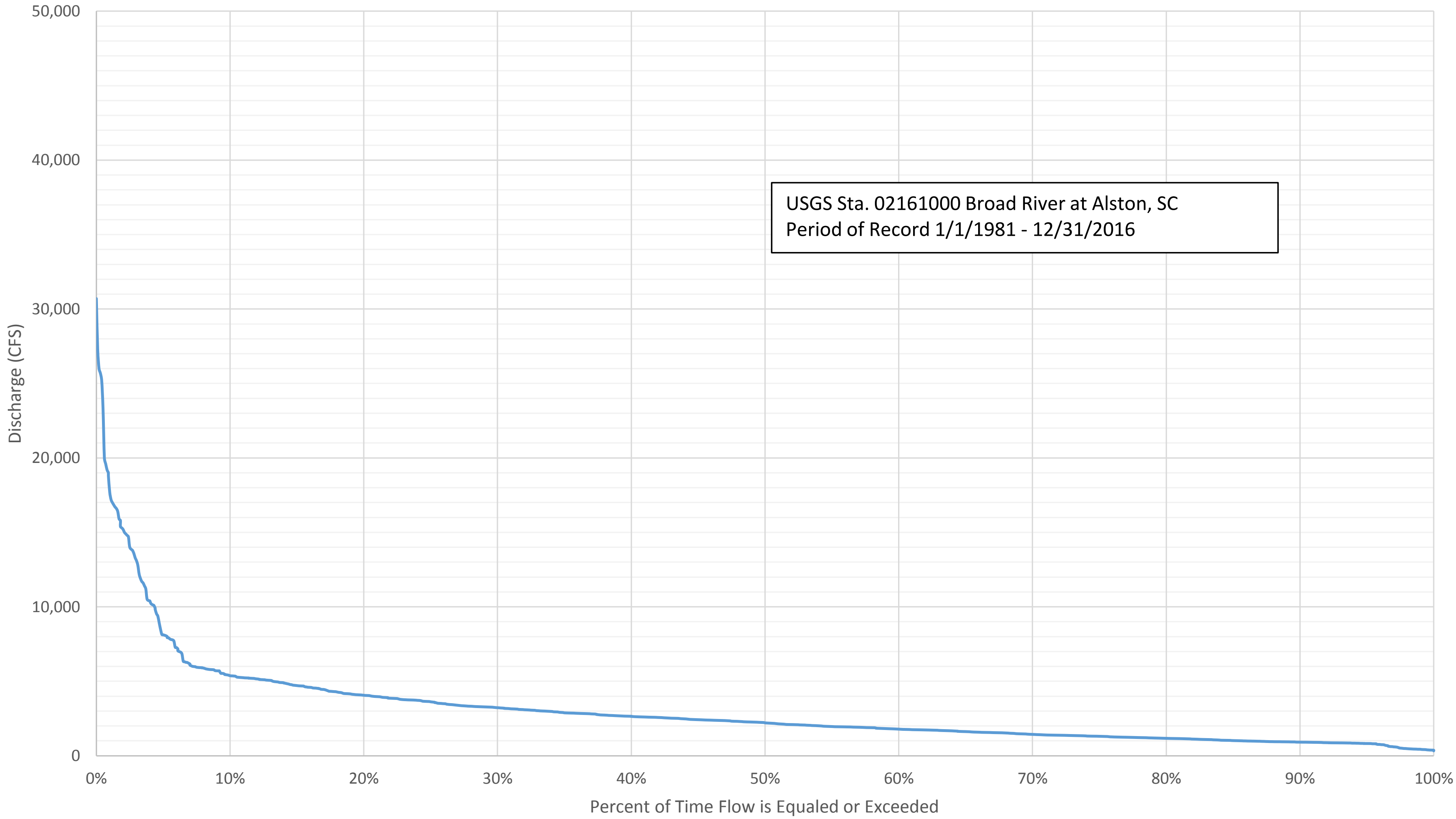


EXHIBIT B-10

PARR HYDROELECTRIC PROJECT P-1894

AUGUST FLOW DURATION CURVE

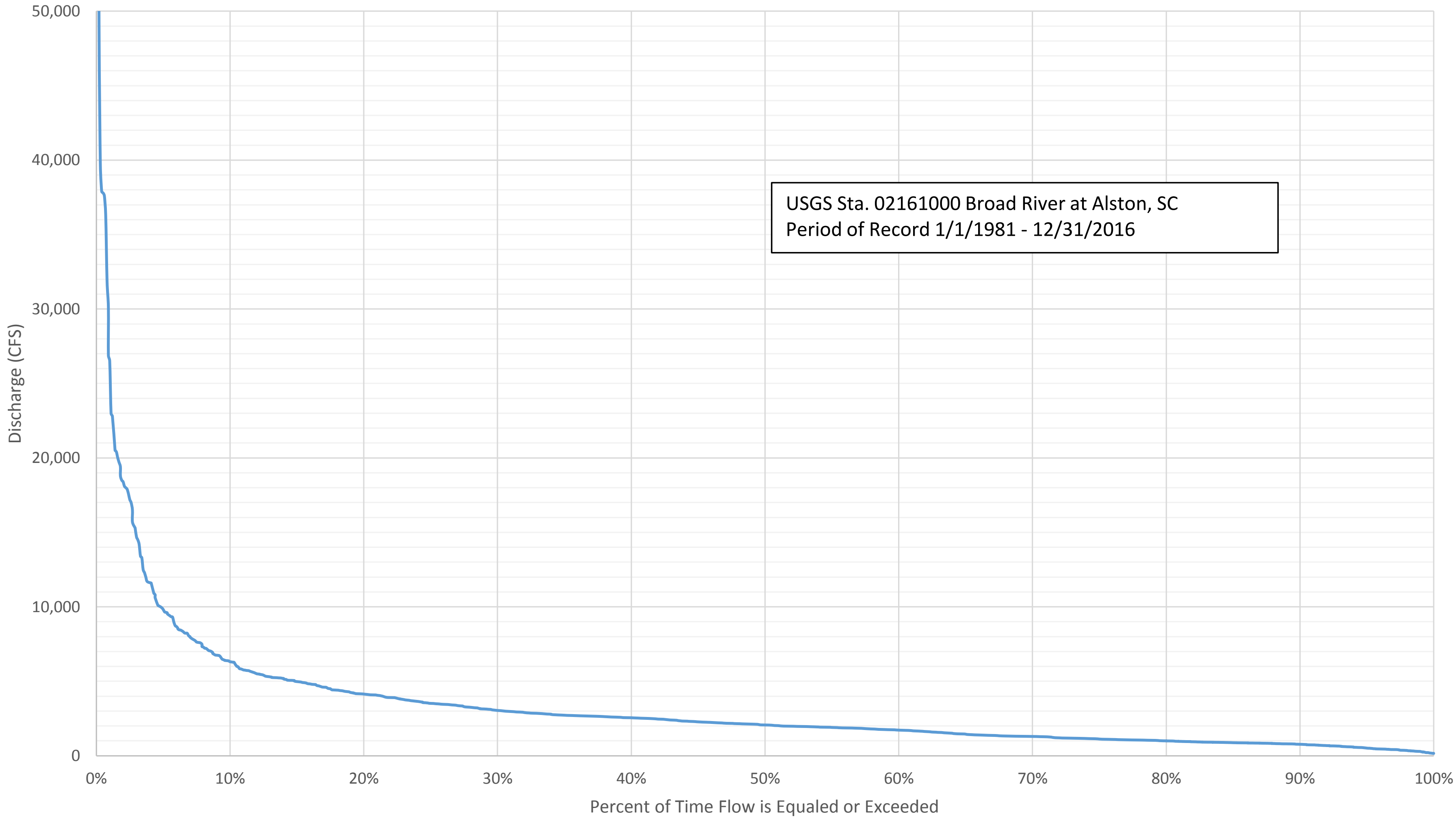
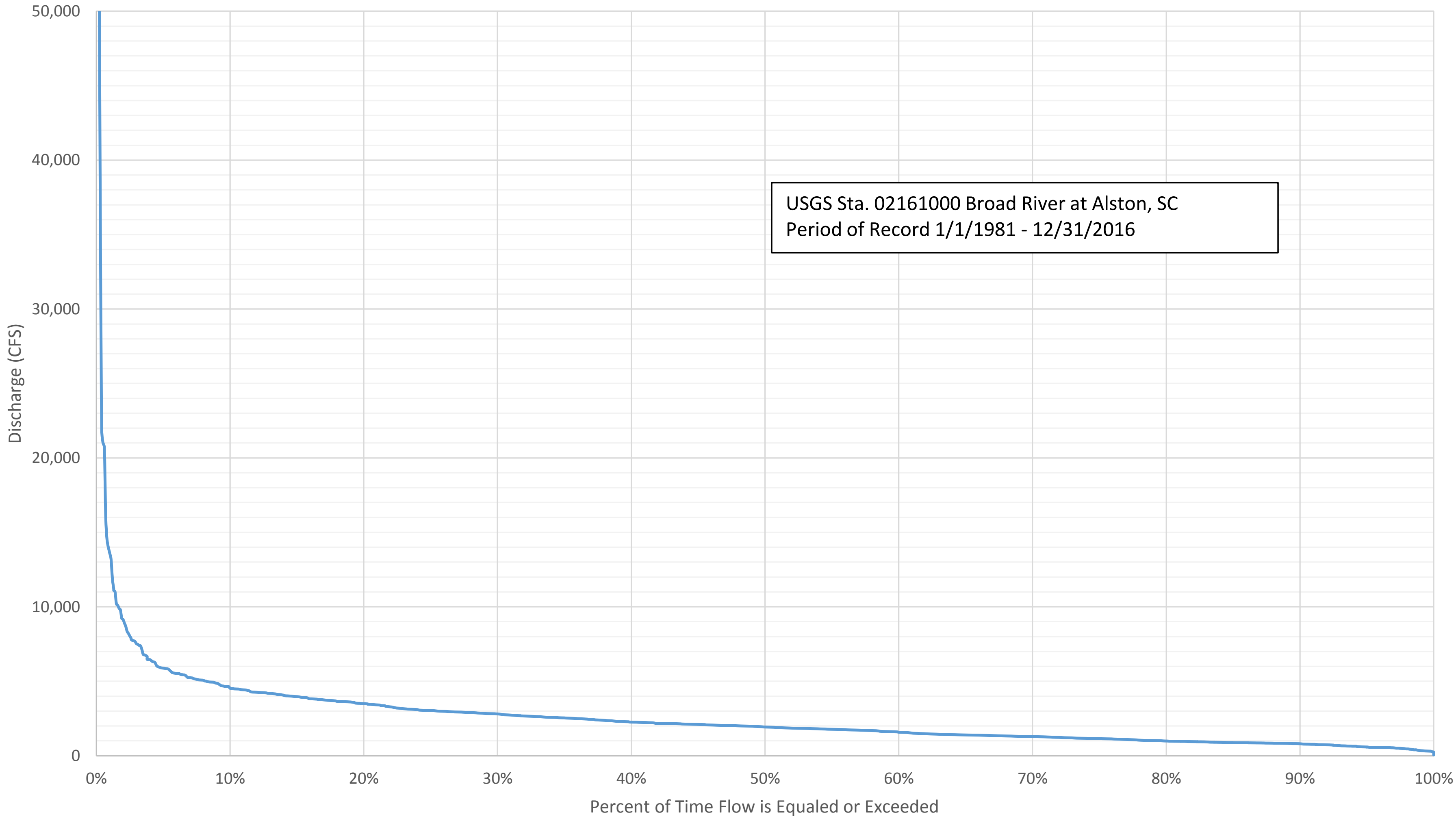


EXHIBIT B-11

PARR HYDROELECTRIC PROJECT P-1894

SEPTEMBER FLOW DURATION CURVE



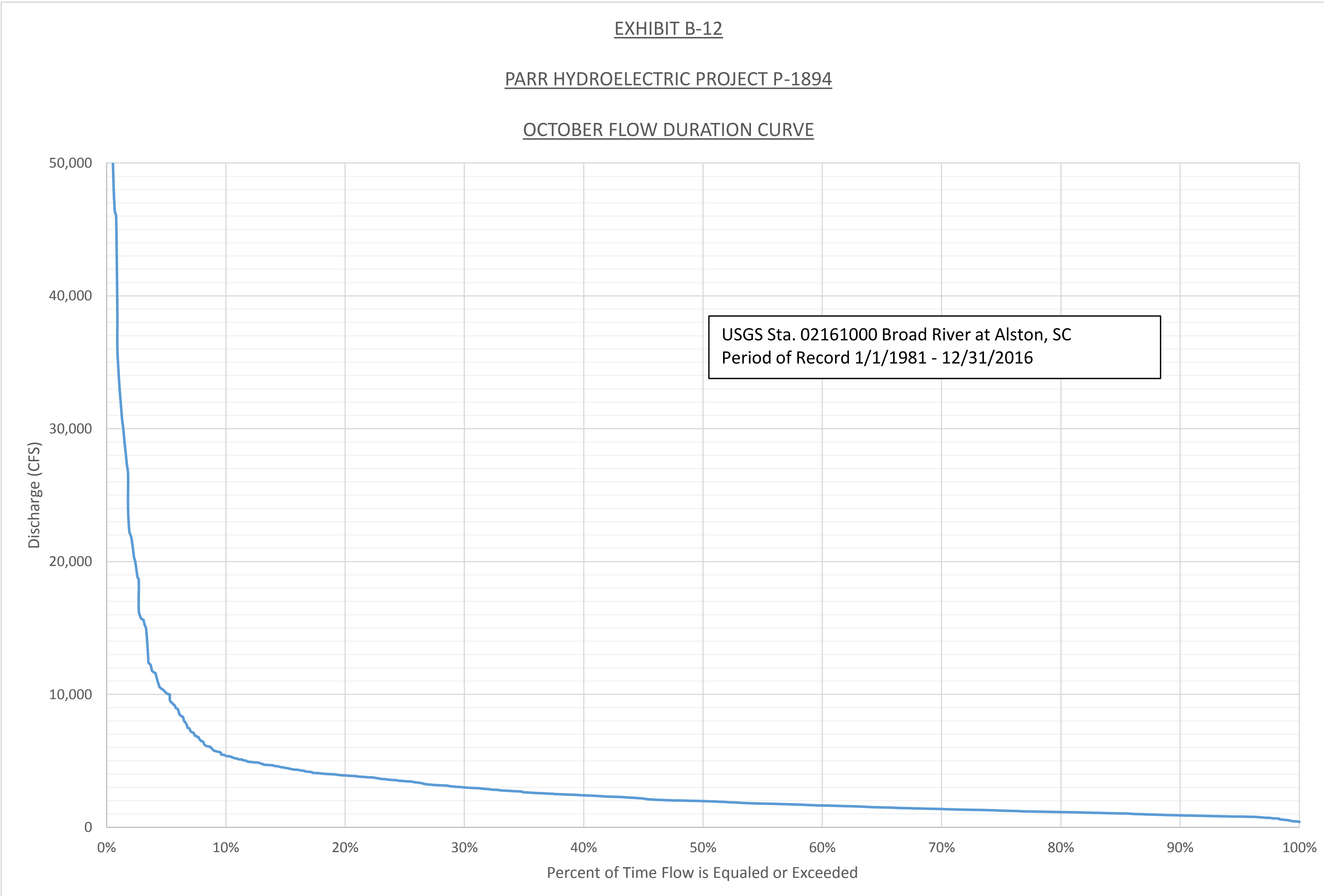


EXHIBIT B-12
PARR HYDROELECTRIC PROJECT P-1894
OCTOBER FLOW DURATION CURVE
USGS Sta. 02161000 Broad River at Alston, SC
Period of Record 1/1/1981 - 12/31/2016
Discharge (CFS)
50,000
40,000
30,000
20,000
10,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Flow is Equaled or Exceeded

EXHIBIT B-13

PARR HYDROELECTRIC PROJECT P-1894

NOVEMBER FLOW DURATION CURVE

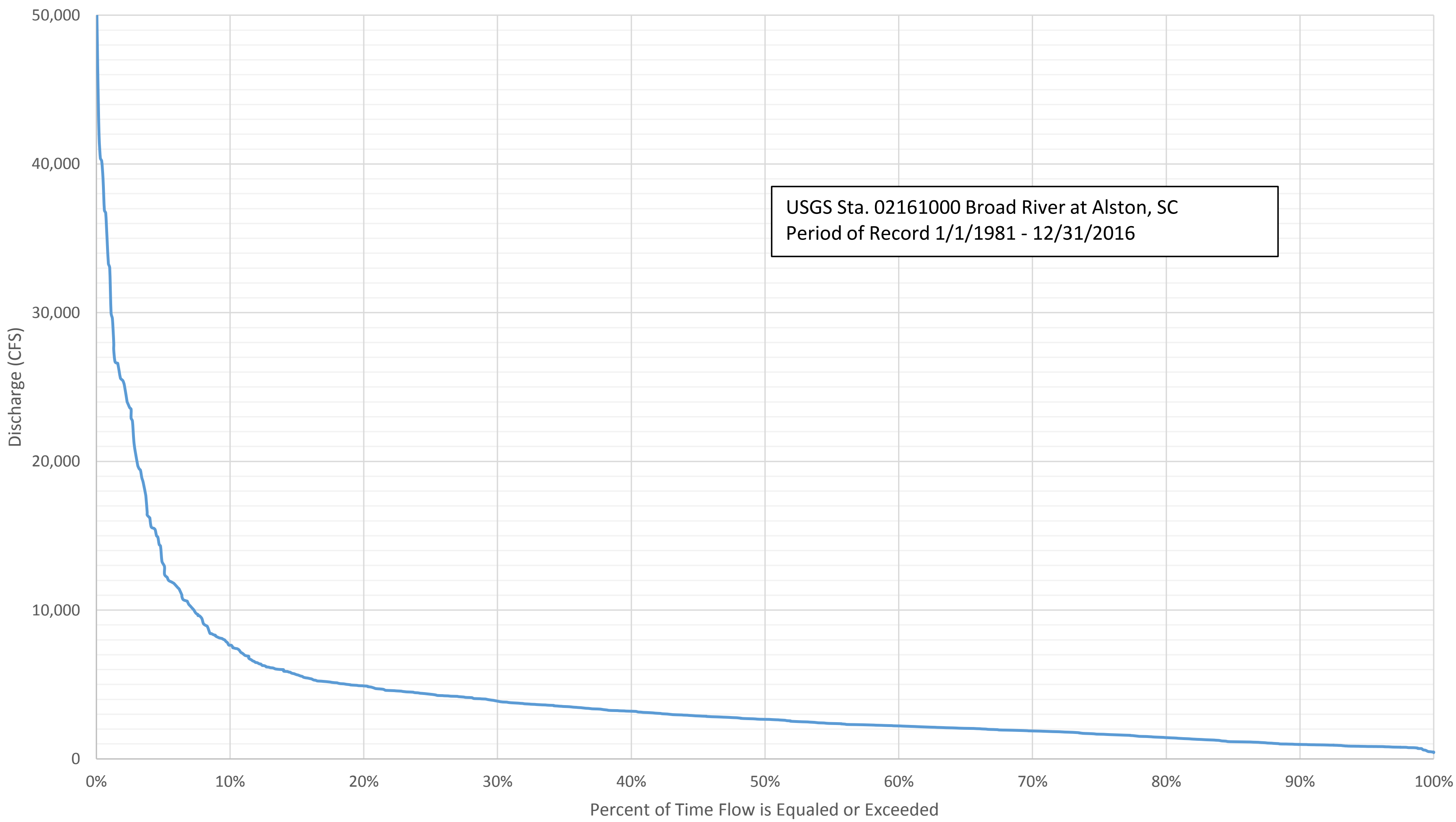


EXHIBIT B-14

PARR HYDROELECTRIC PROJECT P-1894

DECEMBER FLOW DURATION CURVE

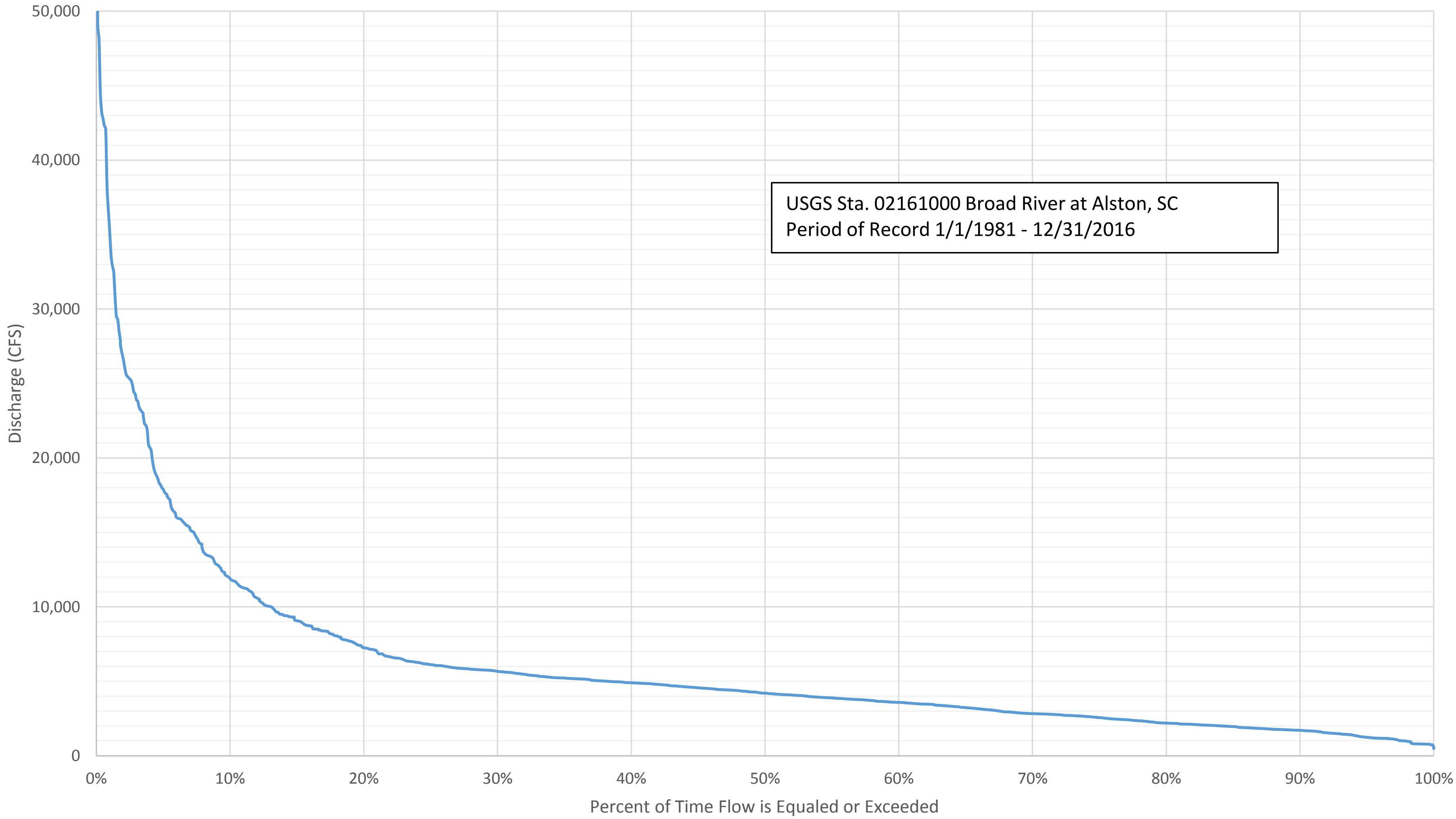


EXHIBIT B-15

PARR HYDROELECTRIC PROJECT P-1894

PARR RESERVOIR AREA CAPACITY CURVES

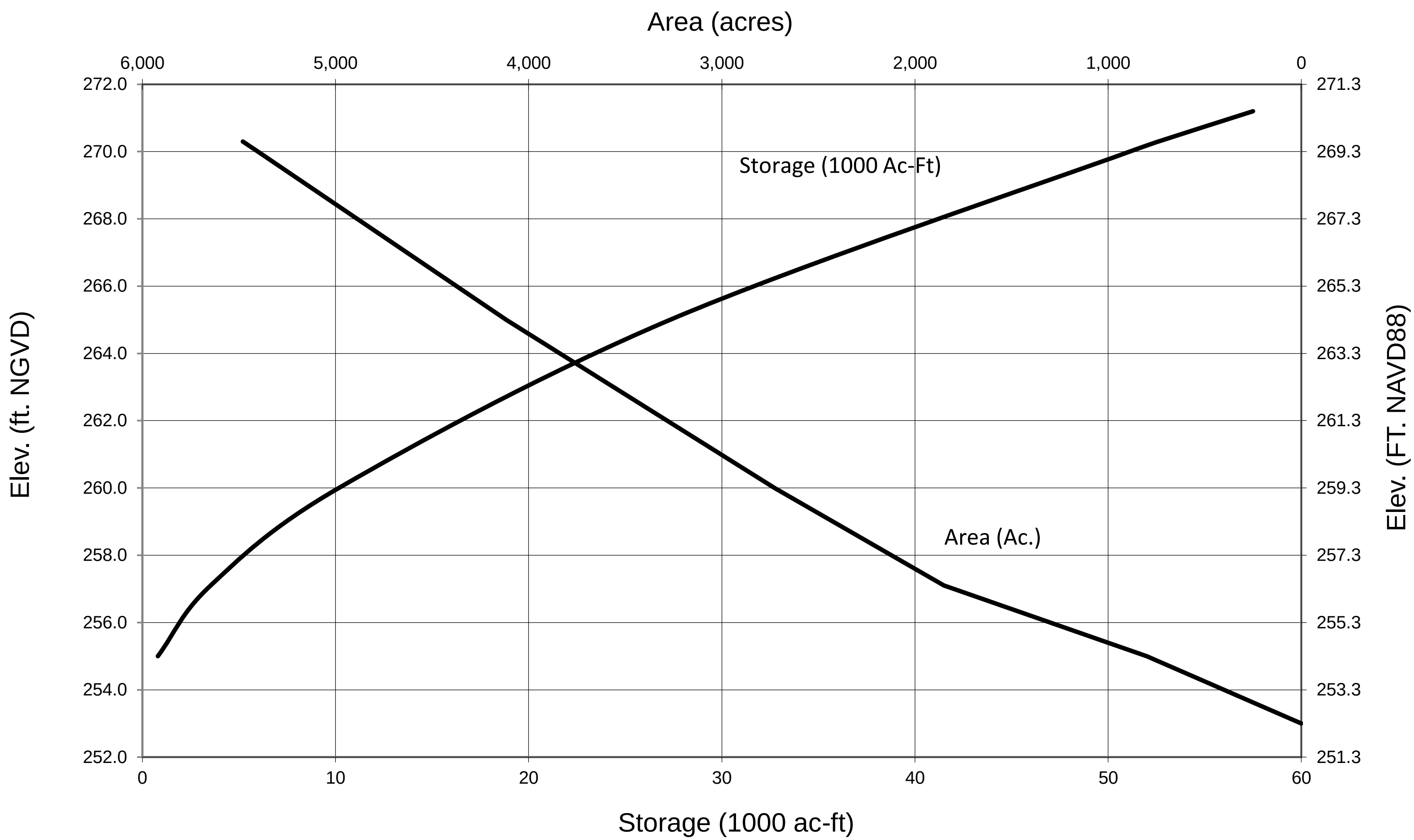


EXHIBIT B-16

PARR HYDROELECTRIC PROJECT P-1894

PARR RESERVOIR AREA CAPACITY TABLE

Reservoir Elevation (FT. NGVD 1929)	Reservoir Elevation (FT. NAVD 1988)	Reservoir Area (acres)	Reservoir Storage (ac-ft)
253.0	252.3	-	-
255.0	254.3	800	800
257.1	256.4	1,850	3,533
260.0	259.3	2,727	10,171
265.0	264.3	4,116	27,321
270.0	269.3	5,402	51,116

EXHIBIT B-17

PARR HYDROELECTRIC PROJECT P-1894

MONTICELLO RESERVOIR AREA CAPACITY CURVES

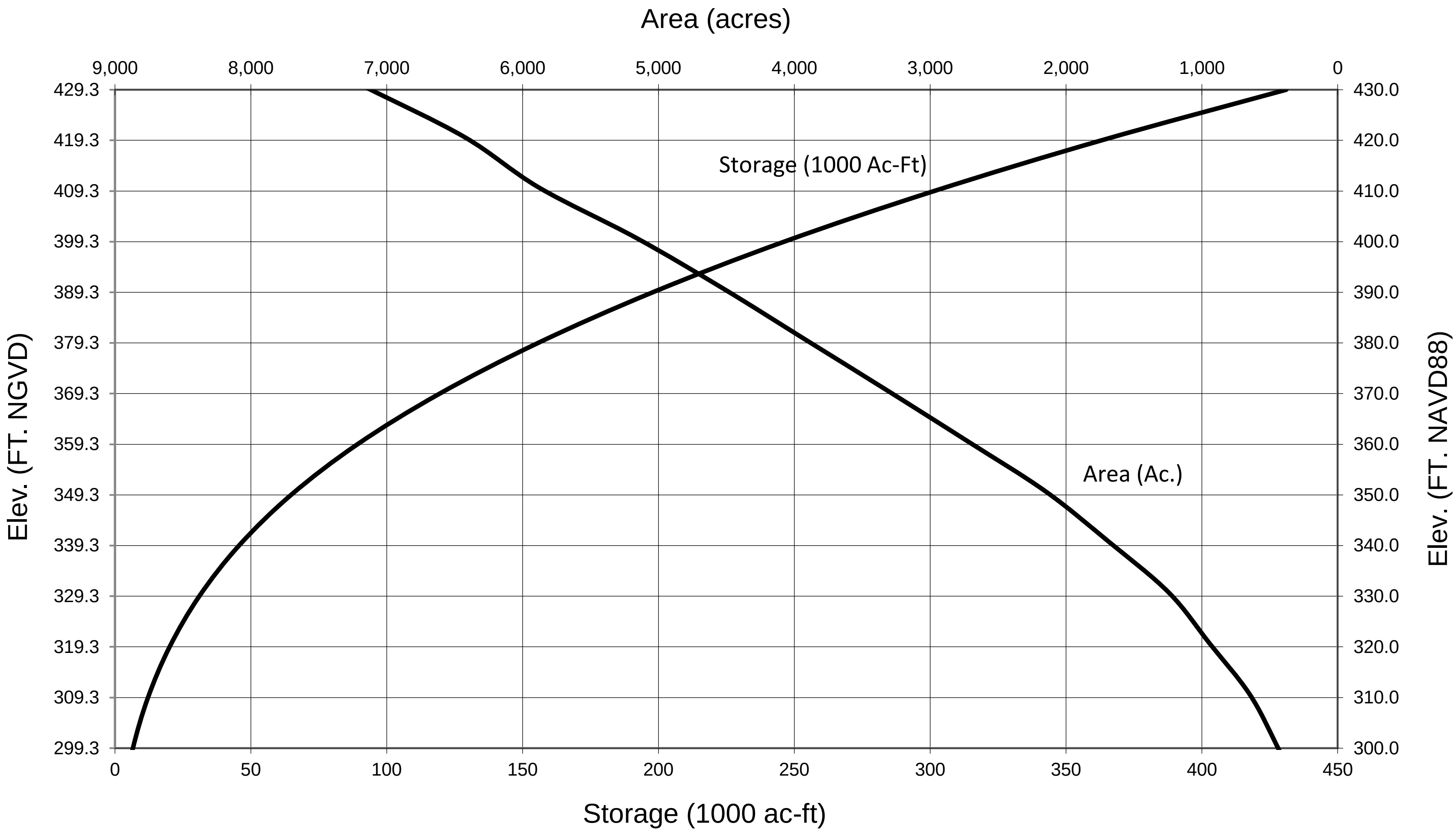


EXHIBIT B-18

PARR HYDROELECTRIC PROJECT P-1894

MONTICELLO RESERVOIR AREA CAPACITY TABLE

Reservoir Elevation (ft. NGVD 1929)	Reservoir Elevation (ft. NAVD 1988)	Area (acres)	Storage (ac-ft)
270.0	269.3	37	0
280.0	279.3	137	870
290.0	289.3	279	2,950
300.0	299.3	451	6,600
310.0	309.3	649	12,150
320.0	319.3	943	20,110
330.0	329.3	1,242	31,030
340.0	339.3	1,682	45,650
350.0	349.3	2,150	64,810
360.0	359.3	2,730	89,250
370.0	369.3	3,320	119,500
380.0	379.3	3,920	155,700
390.0	389.3	4,520	197,900
400.0	399.3	5,160	246,300
410.0	409.3	5,880	301,500
420.0	419.3	6,430	363,050
430.0	429.3	7,170	431,050

EXHIBIT B-19

PARR HYDROELECTRIC PROJECT P-1894

PARR HYDRO SPILLWAY RATING CURVE (GATES DOWN)

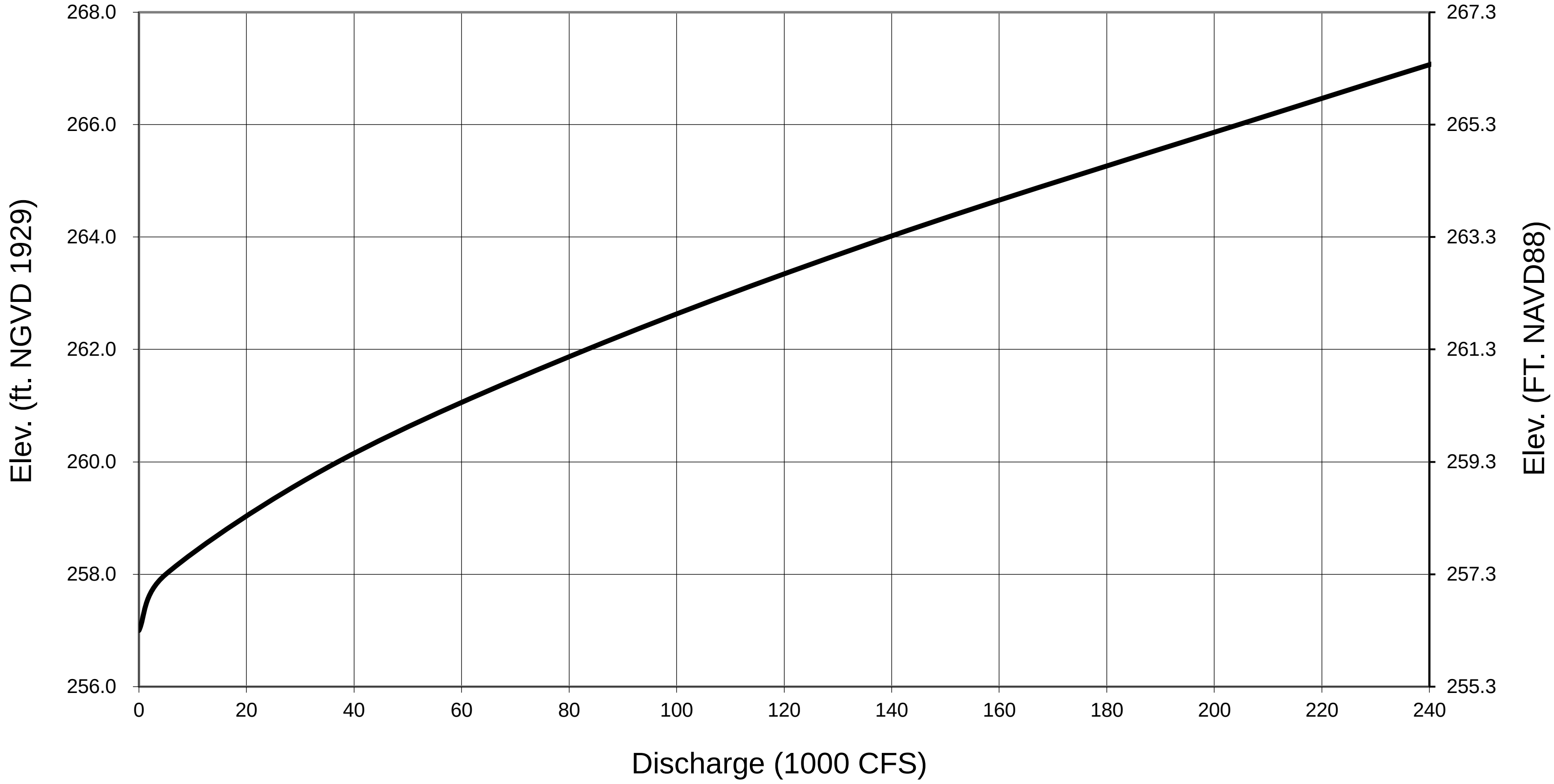


EXHIBIT B-20

PARR HYDROELECTRIC PROJECT P-1894

PARR HYDRO TAILWATER RATING CURVE

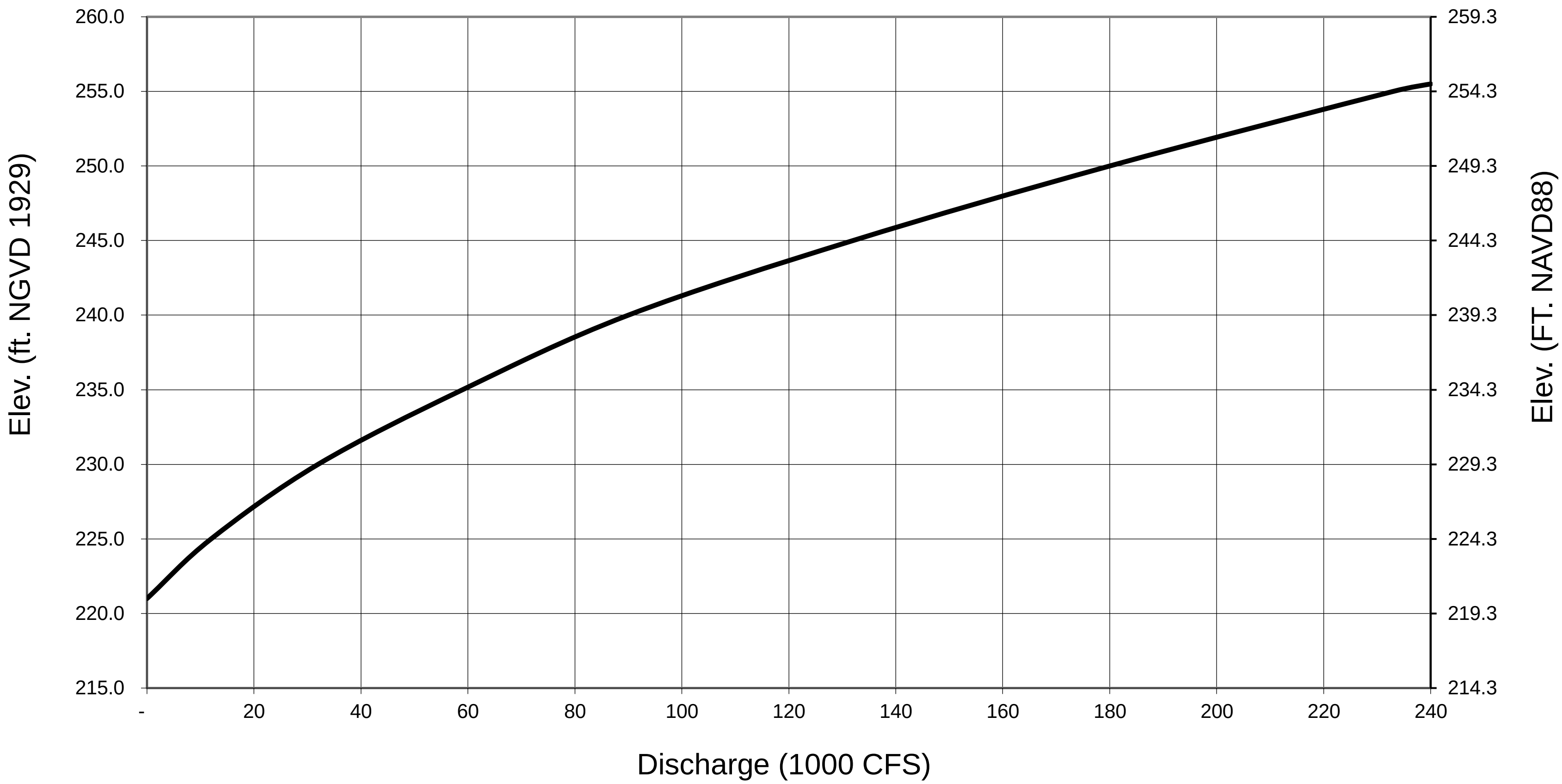


EXHIBIT B-21

PARR HYDROELECTRIC PROJECT P-1894

PARR SHOALS DEVELOPMENT CAPABILITY CURVE

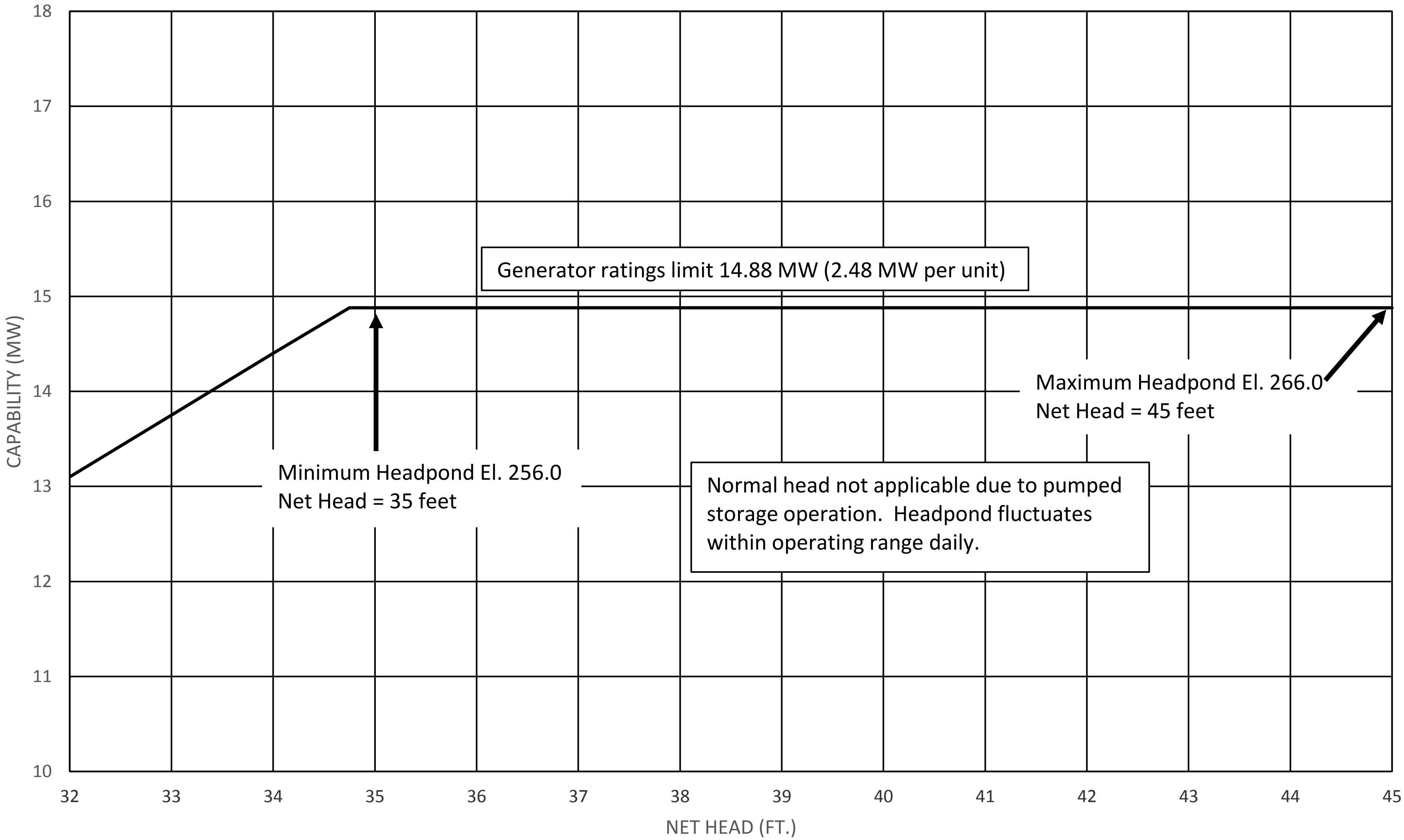


EXHIBIT B-22

PARR HYDROELECTRIC PROJECT P-1894

FAIRFIELD PUMPED STORAGE DEVELOPMENT CAPABILITY CURVE

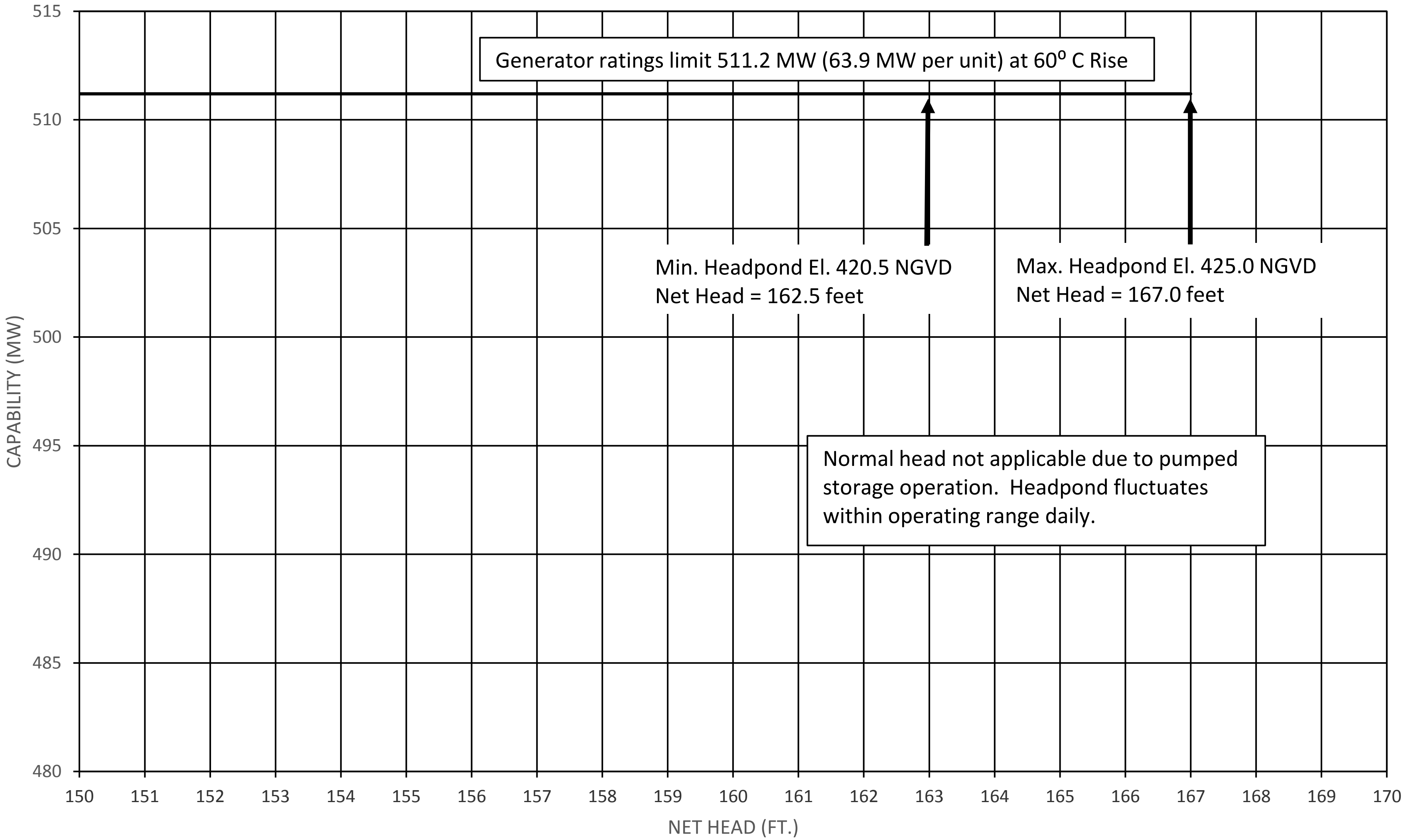


EXHIBIT C

PROJECT HISTORY

PARR HYDROELECTRIC PROJECT
(FERC NO. 1894)

APPLICATION FOR NEW LICENSE
FOR MAJOR WATER POWER PROJECT > 5 MW

EXHIBIT C

PROJECT HISTORY

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1.0 PARR SHOALS DEVELOPMENT

Parr Hydro Plant was constructed 1912-1914 by J. G. White Engineering Corporation for Parr Shoals Power Company, a subsidiary of Columbia Railway Gas and Electric Company. Initially constructed with five main turbine-generators, Unit No. 6 was installed in 1921. As of July 1, 1925, the Parr Shoals Power Company was transferred to Broad River Power Company, now South Carolina Electric and Gas Company (SCE&G).

In the early 1960s, automatic control equipment was installed at Parr Hydro giving the system dispatcher operational control over the generating units through the use of remote means from the central dispatching office in Columbia.

Between 1975 and 1977, the spillway section of the Parr Shoals Dam was raised 9 feet by the addition of ten hydraulically-operated, bottom hinged bascule-type spillway crest gates. Two rows of post-tensioned rock anchors were installed during gate installation to increase dam stability under the higher reservoir load conditions. These modifications were in conjunction with the construction of the Fairfield Pumped Storage Development, located upstream of the Parr Shoals Development. Parr Reservoir has subsequently been used as the lower reservoir for the pumped storage project.

In 2007, an automated trash rake system was installed at the Parr Shoals powerhouse, which resulted in improved operation of the units and less intake loss due to rack obstruction.

In 2011, the three crest gate hydraulic cylinders for gate no. 8 were replaced.

In 2012, the three crest gate hydraulic cylinders for gate no. 7 were replaced, along with the hydraulic power unit (HPU) for the crest gates.

In 2012-13, the plant control system was upgraded to a PLC based system.

In 2014, the six crest gate hydraulic cylinders for gates no. 5 and 6 were replaced. In 2015, the seals for gate no. 5 were replaced/repaired, and the three crest gate hydraulic cylinders for gate no. 2 were replaced. In 2016, the three crest gate hydraulic cylinders for gate no. 1 were replaced.

2.0 FAIRFIELD DEVELOPMENT

On August 28, 1974, the Federal Power Commission (later renamed Federal Energy Regulatory Commission, or "FERC") issued a new license to SCE&G to permit continued operation of the Parr Shoals Hydroelectric Project. The new license authorized construction of the Fairfield Pumped Storage Development and modifications to the Parr Shoals Development, with both developments constituting the Parr Shoals Hydroelectric Project. Construction of Fairfield Pumped Storage Development began on September 3, 1974 and was completed on December 22, 1978. Filling of the Monticello Reservoir commenced on December 3, 1977 and full pond elevation of 425.0 ft-NGVD29 was reached on February 8, 1978. The first four units of the Development (Units 1 through 4) began commercial operation on June 15, 1978 and the last four units (Units 5 through 8) began commercial operation on December 22, 1978.

Several modifications have been made over the life of the Fairfield Development and are described below.

Seepage through construction joints and shrinkage cracks in both the powerhouse and intake structures have been sealed or pressure grouted by various methods throughout the life of the project on an as-needed basis. Similarly, the expansion joints in the penstocks are periodically resealed on an as-needed basis.

Minor modifications were made to the draft tube gates and bottom seals in 1978 and 1980 to allow the gates to be raised and lowered more easily, to allow them to be stored at the top of the gate slots, and to facilitate sealing when closed.

Turbine wicket gates and bushings were modified from 1981 to 1982 to better meet the accuracy required for unit control.

Frames were built from 1983 to 1984 to suspend the intake head gates above their slots when not in use, to alleviate gates moving in the slots and impacting the walls.

The original turbine shaft seals, which required frequent maintenance, were replaced with mechanical shaft seals from 1984 to 1986.

A downstream rock berm was added to Dam D in 1985 to enhance stabilization following 1983 updated stability analysis.

From 1986 to 1992, various types of drainage features were constructed downstream of the toes of Dams A, C, and D to allow these areas to be more easily maintained.

From 1987 to 1989, all of the original generator circuit breakers were upgraded.

In 1992, wicket gate bushings and seals on Units 3 and 4 were replaced or refurbished.

Between 2000 and 2005, new stainless steel turbine runners were installed, generators were re-wedged, rotor poles were replaced, controls and governors were upgraded, and excitation were replaced on all units. Servo systems were replaced on unit 5 and 6, and tailrace trash racks were replaced on Units 1, 2, 7 and 8.

EXHIBIT E

ENVIRONMENTAL EXHIBIT

PARR HYDROELECTRIC PROJECT
FERC PROJECT NO. 1894

APPLICATION FOR NEW LICENSE
FOR MAJOR PROJECT – EXISTING DAM

DRAFT EXHIBIT E
ENVIRONMENTAL EXHIBIT

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EXECUTIVE SUMMARY

South Carolina Electric & Gas Company (SCE&G) (Licensee or Applicant) proposes to continue to operate the existing 526.08-megawatt (MW) Parr Hydroelectric Project, FERC No. 1894 (Project) located on the Broad River near the Town of Jenkinsville in Fairfield and Newberry counties, South Carolina. The Project includes the 14.88 MW Parr Shoals Development (Parr Development) and the 511.2 MW Fairfield Pumped Storage Development (Fairfield Development). The Parr Development operates in a modified run of river mode, and generates using available inflows up to the maximum station hydraulic capacity of 4,800 cfs. The Fairfield Development operates in a peaking mode, and as a reserve generation asset when it is not being used to meet peak demand, providing important regulating services within the Licensee's own system and within the interconnected regional transmission system. The Project Boundary currently encompasses 162.61 acres of federal land owned by the United States Forest Service (USFS).

PROPOSED ACTION

The Project consists of the Parr Development, which includes a 4,400 acre impoundment that serves as the lower reservoir for the pumped storage facility (Parr Reservoir), generating facilities within the Parr Development powerhouse, Parr Shoals Dam, and transmission and appurtenant facilities; and the Fairfield Development, which includes a 6,800 acre impoundment that serves as the upper reservoir for the pumped storage facility (Monticello Reservoir), pumping and generating facilities contained within the Fairfield Development powerhouse, four earthen dams, an intake channel, a gated intake structure, four surface penstocks that bifurcate into eight concrete-encased penstocks, and appurtenant facilities. The Project is operated as a modified run of river and a pumped storage project. The Licensee is proposing a capacity increase of approximately 17 percent through generator upgrades. Details on the generator upgrades and associated capacity increase will be included in the FLA. In addition to these proposed changes, the following Protection, Mitigation and Enhancement (PM&E) measures have been presented to SCE&G and are being considered in consultation with relicensing stakeholders. A final list of PM&E measures will be included in the Final License Application.

1. Revised downstream minimum flows to account for aquatic species/habitat, fish passage, and navigational needs. This will be accomplished through implementation of the Minimum Flow Adaptive Management Plan (AMP) that SCE&G is developing with stakeholders.

2. Reduced downstream flow fluctuations during spring spawning periods via reductions in the mean deviation of inflows. SCE&G has developed and will implement a Downstream Flow Fluctuation AMP that outlines their proposed actions for stabilizing downstream flow during spring spawning periods during the term of the new license.
3. Reduced downstream flow fluctuations year round through the following measures:
    a. Reduce excess inventory releases or release excess inventory over a longer period of time.
    b. Install a remote control camera on the west abutment of Parr Shoals Dam to allow System Control operators to determine if conditions are safe to raise or lower the Crest Gates 1 and 2 when the plant is not manned.
    c. Allow operation of those crest gates viewable by the camera in item 1 by the System Control operators, to facilitate required adjustments in gate settings based on changes in inflows or reservoir levels.
    d. Modify or replace the generators at the Parr Development to allow the turbines to operate at increased hydraulic capacity, thereby potentially reducing the frequency of spillage at Parr Shoals Dam.

    SCE&G is developing a Downstream Flow Fluctuation AMP that outlines their proposed actions they will implement for stabilizing downstream flow year round during the term of the new license.
4. Increase dissolved oxygen levels downstream of the Parr Shoals Dam in the "west channel" area. SCE&G is developing a West Channel AMP that includes proposed actions they will implement to improve water quality during the term of the new license.
5. Implement the *Turbine Venting Plan*, where turbines will be vented from June 15-August 31 in an effort to increase DO levels downstream of the dam in the tailrace area.
6. Implement the *Historic Properties Management Plan* and *Programmatic Agreement.*
7. Prepare cultural resources educational material/signage and maintain on SCE&G's website and place in publicly accessible areas around the Project. Stabilize/mitigate for one additional archaeological site.
8. Implement the new *Parr and Monticello Shoreline Management Plans*.
9. Install fish habitat enhancements in Monticello Reservoir, to provide enhanced fish production and recreational fishing in Monticello Reservoir.
10. Conduct American eel monitoring throughout the term of the new license.
11. Habitat Enhancement Fund – SCE&G has requested details from the SCDNR regarding a potential enhancement fund that may be considered as a PM&E measure. The details of this request have not been received at this time.
12. Implementation of a Recreation Management Plan, Project recreational facilities enhancements at five existing sites, addition of three recreational sites with facilities and formally designating the new canoe portage at Parr Shoals Dam.
13. Continue efforts already in place, including:
    a. Erosion monitoring and control,
    b. Recreation site monitoring and maintenance,
    c. Participation in the Santee River Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement program (Accord).

PUBLIC INVOLVEMENT

Before filing its draft license application, the Licensee conducted pre-filing consultation processes under the Traditional Licensing Process (TLP). A Pre-Application Document (PAD) was filed and provided to agencies and stakeholders in January 2015. A Joint Agency Meeting (JAM) was conducted on April 14, 2015. The Licensee has hosted numerous study plan and study report meetings with Resource Conservation Groups and Technical Working Committees, beginning in 2013 and continuing through the present date. A detailed listing of public involvement is provided in Section 1.3, and meeting notes from the various study plan and study report meetings are included in Appendix A.

PROJECT EFFECTS

Resources potentially affected by the proposed action are summarized below:

Geology and Soils – Under the Licensee's proposal, geology and soils would not be materially affected. There may be minor ground disturbances during implementation of the Monticello Reservoir Fish Habitat Enhancements, and installation of the proposed recreation enhancements. Erosion monitoring and control will continue during the term of the new license.

Water Resources and Water Quality – The Licensee's proposal to modify an existing rock channel on the northern end of Hampton Island to provide flows in the west channel downstream of Parr Dam and the implementation of the *Turbine Venting Plan* will likely result in higher dissolved oxygen levels in the "west channel" and tailrace areas downstream of the Project.

Fishery – The Licensee's proposal to install the Monticello Reservoir Fish Habitat Enhancements will likely increase fish production in the Monticello Reservoir. Downstream flow fluctuation modifications and new minimum flows (as determined by the Instream Flow Incremental Methodology Study) will also have a positive effect on fisheries downstream of the Project.

Terrestrial – Under the Licensee's proposal, terrestrial resources would be largely unaffected.

Rare, Threatened and Endangered Species – Under the Licensee's Proposal, rare, threatened and endangered species should not be affected.

Recreation – Under the Licensee's proposal, the public would have increased access to the Broad River and improved downstream canoeing/kayaking opportunities as a result of the implementation of the canoe portage at the Parr Shoals Dam. The public also will have improved recreational experiences by virtue of recreation enhancements proposed at many of the existing public access sites throughout the Project. Recreational fishing will also be improved on Monticello Reservoir because of fish habitat enhancements. The public will also be better informed about recreation opportunities in the Project boundary and general area through the development of recreation resource maps.

Land Use and Aesthetics – Under the Licensee's proposal, improvements to the management of reservoir shorelines and education of adjacent owners will occur through the implementation of the new Parr Reservoir Shoreline Management Plan and the new Monticello Reservoir Shoreline Management Plan.

Cultural – Implementation of the Licensee's proposed Historic Properties Management Plan should improve protections for and awareness of cultural and historic resources.

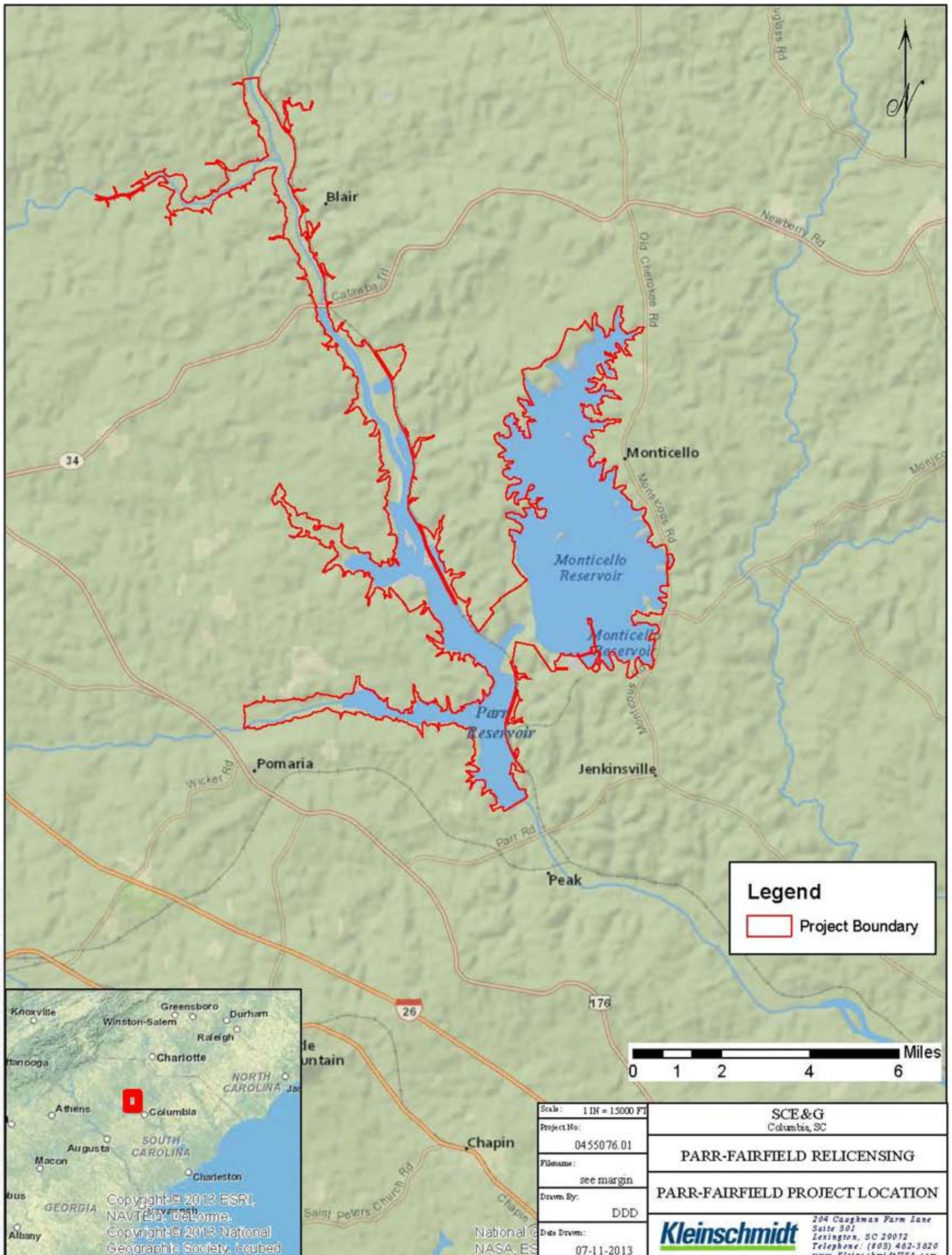
Socioeconomics – The Licensee's proposal for increased recreational opportunities through the implementation of the canoe portage and other recreation enhancements will support the potential for increased tourism in the Project area and thereby benefit socioeconomic resources.

Under a "no action" alternative, environmental conditions would remain the same and no enhancement of environmental resources would occur.

1.0 INTRODUCTION

1.1 APPLICATION

This application is for a new license for the existing Parr Hydroelectric Project, FERC No. 1894 (Project), which includes the 14.88-megawatt (MW) Parr Shoals Development (Parr Development) and the 511.2-MW Fairfield Pumped Storage Development (Fairfield Development) (Figure 1-1). 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 Pumped Storage 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. Average annual gross generation for the Parr Development is 56,409 MWH for the period 2000 through 2016 and average annual gross generation for the Fairfield Development is 676,971 MWH for the same period. Currently, the Project encompasses 162.61 acres of federal lands, owned by the U.S. Forest Service. The Licensee proposes to continue to operate the existing Project, located on the Broad River in Fairfield and Newberry counties, South Carolina. The existing Project license was issued by the Federal Energy Regulatory Commission (FERC or Commission) on August 28, 1974 for a period of 46 years, terminating on June 30, 2020. SCE&G intends to file for a new license with FERC on or before May 31, 2018.



Path: G:_Client_Data\SCE&G\ParrFairfield_MXD\Project Boundary.mxd

Sources: ESRI, SCE&G, Kleinschmidt

FIGURE 1-1 PROJECT LOCATION MAP

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 PURPOSE OF ACTION

The Commission must decide whether to issue a license to the Licensee for continued operation of the Project and what conditions should be placed in any license issued. When deciding whether to issue a license for a hydroelectric project, the Commission must determine that the Project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued, the Commission must give equal consideration to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of fish and wildlife, the protection of recreational opportunities and the preservation of other aspects of environmental quality. Issuing a new license for the Project would allow the Licensee to generate electricity at the Project for the term of the new license, making electric power from a renewable resource available to SCE&G customers. This Environmental Report assesses the environmental and economic effects associated with continued operation of the Project with proposed PM&E measures, and makes recommendations to the Commission on conditions to be included in the new license. This Environmental Report also considers the effects of the no-action alternative. Important issues that are addressed include minimum flows, water quality, rare, threatened and endangered species, recreation access, and fish resources.

1.2.2 NEED FOR POWER

The Project includes a run-of-river generating facility at the Parr Development and a pumped storage facility at the Fairfield Development. The Fairfield Development provides pumped storage generation during periods of peak electricity demand and acts as a load on the system during non-peak periods. Parr Development has an installed capacity of 14.88-MW and Fairfield Development has an installed capacity of 511.2-MW. The Project's dependable capacity estimate is based on the Fairfield Development, since low-inflow conditions diminish the contributions of the Parr Development. The dependable capacity of the Project is the capacity of Fairfield Development at the minimum head, which is 511.2-MW, which occurs at the end of a full generating cycle. From 2000 through 2016, average annual gross generation was 56,409 MWH for the Parr Development and 676,971 MWH for the Fairfield Development. The Fairfield Development accounted for over 90 percent of the Project's total gross generation.

In addition to meeting peak energy needs, the Project's ability to use base load electricity during periods of low demand for pumping operations provides important grid stabilization benefits to SCE&G. This will be increasingly important as the V.C. Summer Nuclear Station increases its generating capabilities in the coming years with the construction of two new nuclear units.

Likewise, the Fairfield Development is often relied on as a reserve asset, as units can be started and brought to full load within 15 minutes. Because of this, the Licensee has a very short response time to emergencies within the Licensee's system. This also helps fulfill the Licensee's reserve share obligation as a member of the Virginia-Carolinas Electric Reliability Council (VACAR) under the VACAR Reserve Sharing Agreement (VRSA).

1.3 PUBLIC REVIEW AND COMMENT

Section 16.8 of the Commission's regulations (18 CFR § 16.8) requires that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a new license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, the Endangered Species Act (ESA), the National Historic Preservation Act (NHPA), and other federal statutes. Pre-filing consultation must be complete and documented according to the Commission's regulations. A list of names and addresses of every federal, state, and interstate resource agency, Indian tribe, NGO, and individual, unaffiliated member of the public with which the Licensee consulted in preparation of this document is provided in Section 7.0. SCE&G's actions with respect to each stage of consultation are discussed in greater detail in the subsequent paragraphs.

1.3.1 INITIAL ISSUES SCOPING

Prior to the issuance of the PAD, SCE&G formed Resource Conservation Groups (RCGs) and Technical Working Committees (TWCs) with representatives from federal and state agencies, NGOs, and interested members of the public. Three RCGs and six TWCs were created including the Water Quality, Fish and Wildlife RCG; Recreation and Lake and Land Management RCG; Operations RCG; Fisheries TWC; Instream Flows TWC; Rare, Threatened and Endangered Species (RTE) TWC; Water Quality TWC; Lake and Land Management TWC; and Recreation TWC. These RCGs and TWCs met on a regular basis prior to, and throughout all three stages of consultation, to identify and discuss Project issues and to develop recommendations for addressing and resolving these issues (meeting notes included in Appendix A). In consultation with the RCGs and TWCs, SCE&G developed proposed study plans to perform the following studies:

- Water Quality in Downstream West Channel Study
- Monticello Reservoir Freshwater Mussel Reconnaissance Survey Study
- Reservoir Fluctuation Study
- Instream Flow Study

- Desktop Fish Entrainment Study
- American Eel Abundance Study
- Monticello Reservoir and Parr Reservoir Waterfowl Survey Study
- Rare, Threatened and Endangered Species Study
- Rocky Shoals Spider Lily Study
- Broad River Spiny Crayfish Study
- Recreation Use and Needs Study
- Downstream Recreational Flow Assessment Study
- Downstream Navigational Flow Assessment Study
- Parr Shoreline Management Plan
- Monticello Shoreline Management Plan
- Hydraulic & Project Operations Model Study

Proposed study plans were distributed with the PAD on January 5, 2015, as discussed below.

1.3.2 First-Stage Consultation

On January 5, 2015, SCE&G filed a Notice of Intent (NOI) to relicense the Project as well as the PAD and request to use the TLP. Additionally, SCE&G published public notice of its filing of the NOI and PAD and request to use the TLP in the *Newberry Observer* and *Herald Independent* on December 26, 2014 and *The State* on January 14, 2015. Comments on the request to use the TLP were due to FERC within 30 days of the PAD filing, making them due on or before February 4, 2015. FERC approved SCE&G's request to use the TLP on February 20, 2015. In accordance with deadlines set by FERC, SCE&G held the JAM and site visit on April 14, 2015 at two times, 2:00 pm and 6:00 pm, in order to accommodate as many people as possible. Notice of the JAM was published in *The State*, the *Newberry Observer*, and the *Herald Independent*, on March 22, 2015, March 25, 2015, and March 27, 2015 respectively. FERC was notified of this meeting on March 20, 2015. A court reporter recorded all comments and statements made at the two JAM meetings, and these are part of the Commission's public record for the Project. In addition to comments provided at the JAM, the following entities provided written comments:

Commenting Entity	Date Filed
Mr. William B. Hendrix, Jr.	June 9, 2015
USFWS	June 15, 2015
SCDNR	June 15, 2015
NMFS	June 15, 2015

Comments and study requests are discussed within each respective resource section of this Environmental Report and summarized in the consultation table included in Appendix A.

1.3.3 SECOND-STAGE CONSULTATION

Resource studies were performed in 2015 through 2017 per agreed-upon study plans. Study reports have been distributed to consulting parties upon completion of each study, as specified in the study plan. Study reports were discussed during RCG and TWC meetings. Notes from the various meetings are included in Appendix A.

The Draft License Application (DLA), which includes this Environmental Report, is being submitted to consulting parties for review and written comment within 90 days of the date of this filing (**comments due on August 29, 2017**).

1.3.4 THIRD-STAGE CONSULTATION

SCE&G plans to file a Final License Application (FLA) with FERC by May 30, 2018. The FLA will incorporate and/or discuss any comments submitted in response to this DLA by consulting parties.

2.0 STATUTORY AND REGULATORY REQUIREMENTS

SCE&G, as Licensee for the Project, is subject to the requirements of the Federal Power Act (FPA) as well as other applicable statutes. The major regulatory and statutory requirements are summarized below.

2.1 FEDERAL POWER ACT

2.1.1 SECTION 18 FISHWAY PRESCRIPTIONS

Under section 18 of the FPA, the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) have the authority to prescribe fishways at federally regulated hydropower projects. At this time, no preliminary prescriptions have been filed by either agency. USFWS is a member of the Accord[1] and has agreed that a Fish Passage Feasibility Assessment (an evaluation of the upstream and downstream passage alternatives and their conceptual designs) will be conducted pursuant to the Accord, by SCE&G, and will commence upon attainment of the biological triggers as set out in the Accord.

2.1.2 SECTION 4(E) CONDITIONS

Section 4(e) of the FPA provides that any license issued by FERC 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 Project currently encompasses 162.61 acres of federal land administered by the USFS. SCE&G has been in consultation with the USFS throughout the process to date. At this time, no preliminary 4(e) conditions have been provided for inclusion in this Environmental Report.

2.1.3 SECTION 10(J) RECOMMENDATIONS

Under section 10(j) of the FPA, FERC must consider 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 prior to issuing the new license. FERC will include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. At this time, no preliminary 10(j) recommendations have been provided for inclusion in this Environmental Report. Moreover, SCE&G is working towards the

[1] The Accord is an agreement among SCE&G, Duke Energy Carolinas, LLC, SCDNR, North Carolina Wildlife Resources Commission (NCWRC), and the USFWS for the protection, restoration, and enhancement of diadromous fish in the Santee River Basin. The Accord is discussed further in Section 3.2.1.

development of a Comprehensive Settlement Agreement to be filed with the FLA that will address potential Project effects upon fish and wildlife resources through the implementation of PM&E measures.

2.2 CLEAN WATER ACT – SECTION 401

The Licensee is subject to the Water Quality Certification under Section 401(a)(1) of the federal Clean Water Act of 1977. The South Carolina Department of Health and Environmental Control (SCDHEC) establishes water quality standards consistent with South Carolina Code Section 48-1-10 et seq. SCE&G will file an application for 401 Water Quality Certification within 60 days of the Commission's notice requesting terms and conditions and recommendations, as required under Commission regulations.

2.3 ENDANGERED SPECIES ACT

Under provisions of Section 7(a)(2) of the ESA, a federal agency that authorizes, permits, or carries out activities must consult with the USFWS to ensure that such actions will not jeopardize the continued existence of any listed species. A federal agency is required to consult USFWS if an action "may affect" listed species or designated critical habitat, even if the effects are expected to be beneficial. A "may affect" determination includes actions that are "not likely to adversely affect," as well as "likely to adversely affect" listed species. If the action is "not likely to adversely affect" listed species (i.e., the effects are beneficial, insignificant, or discountable), and the USFWS agrees with that determination, the USFWS provides concurrence in writing and no further consultation is required. If the action is "likely to adversely affect" listed species, then the federal action agency must request initiation of formal consultation. This request is made in writing to the USFWS, and must include a complete initiation package. Formal consultation concludes with the USFWS's issuance of a biological opinion to the federal action agency.

On January 5, 2015, with the filing of the Notice of Intent, SCE&G requested that FERC designate it as the non-federal representative for purposes of consultation under Section 7 of the ESA. On February 20, 2015, FERC granted this request. Currently, there are no federally threatened and endangered species known to occur within the Project boundary. Federally threatened and endangered species known to occur within the two counties where the Project is located and one additional county that is influenced by the Project are discussed in Section 4.6 Rare, Threatened, and Endangered Species. SCE&G will consult with the USFWS on any potential effects to these species.

2.4 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

This act is the primary law governing marine fisheries management in U.S. federal waters. First passed in 1976, the Magnuson-Stevens Act fosters long-term biological and economic sustainability of our nation's marine fisheries out to 200 nautical miles from shore.

Although areas along the coast of South Carolina are subject to the Magnuson-Stevens Fishery Conservation and Management Act, the Project is not located in one of these areas. Therefore the act does not apply to this Project.

2.5 COASTAL ZONE MANAGEMENT ACT

Pursuant to section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 U.S.C. Section 1456(3)(A), the Commission must receive concurrence from the state CZMA agency that the project is not within or affecting the state's coastal zone prior to issuing a license for the Project.

The Project is not located within a Coastal Zone, however the Licensee submitted a CZMA consistency determination letter to SCDHEC on March 9, 2017. SCDHEC replied on March 16, 2017, informing SCE&G that the Project relicensing will not cause spillover effects to coastal resources, as the Project is located outside of South Carolina's Coastal Zone. Both letters are included in Appendix A.

2.6 NATIONAL HISTORIC PRESERVATION ACT

The NHPA (Public Law 89-665; 16 U.S.C. § 470 et seq.) is legislation intended to preserve historical and archaeological sites in the United States of America. Section 106 of the NHPA and its implementing regulation (35 C.F.R. Part 800) require federal agencies to take into account the effect of any proposed undertaking on properties listed or eligible for listing in the National Register of Historic Places (NRHP). If an agency determines that an undertaking may have adverse effects on properties listed or eligible for listing in the NRHP, the agency must afford an opportunity for the Advisory Council on Historic Preservation (ACHP) to comment on the undertaking.

On February 20, 2015, FERC designated SCE&G as the non-federal representative for informal consultation regarding Section 106 of the NHPA. SCE&G is in the process of coordinating with the South Carolina State Historic Preservation Officer (SHPO) relative to the Project, as detailed in Section 4.8.

2.7 WILD AND SCENIC RIVERS AND WILDERNESS ACTS

The Wild and Scenic Rivers Act was created by Congress in 1968 (Public Law 90-542; 16 U.S.C. 1271 et seq.) to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. The Wilderness Act of 1964 (Public Law 88-577; 16 U.S.C. 23 et seq.) created the National Wilderness Preservation System. It also defined wilderness as “an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain” and “an area of undeveloped Federal land retaining its primeval character and influence without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions.”

There are no rivers designated under the Federal Wild and Scenic Rivers Act within the Project boundary. Furthermore, the Project is not located on or adjacent to nor will it affect any areas designated under the Wilderness Act of 1964.

2.8 FEDERAL LANDS

The Project encompasses 162.61 acres of land owned by the USFS. The Licensee has an agreement with the USFS for use of their lands for the Project, and pays annual charges for that use.

3.0 PROPOSED ACTION AND ALTERNATIVES

3.1 NO-ACTION ALTERNATIVE

The no-action alternative is the baseline from which to compare the proposed action and all action alternatives that are assessed within this document. Under the no-action alternative, the Project would continue to operate under the terms and conditions of the current license.

The Project is more thoroughly described in Exhibit A of this DLA. However, a brief description of the Project is provided below as a reference for later discussions.

3.1.1 PROJECT DESCRIPTION

The Project is located in Newberry and Fairfield counties, South Carolina, on the Broad River, approximately 26 river miles upstream from the City of Columbia, South Carolina (see Figure 1-1). The FERC Project boundary is depicted in the Exhibit G drawings.

3.1.1.1 EXISTING PROJECT FACILITIES AND OPERATIONS

The Project includes the existing Parr Development, which consists of powerhouse with six generators, a 2,390 foot long dam (including spillway and non-overflow sections), a 4,400 acre reservoir and transmission and appurtenant facilities. The Project also includes the existing Fairfield Development, which is composed of a 6,800 acre reservoir, 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 and transmission and appurtenant facilities.

3.1.1.2 POWERHOUSES, DAMS, SPILLWAYS AND PENSTOCKS

Parr Development

Parr Shoals Dam is situated across the Broad River, oriented in a northeast-southwest direction, and consists of the northeast non-overflow section and integral powerhouse, the gated spillway, and the southwest non-overflow embankment.

The northeast non-overflow section is a concrete gravity structure that includes a 90 foot long non-overflow wall and the 300 foot long powerhouse. The adjacent powerhouse is concrete with a steel-framed superstructure, and is approximately 60 feet wide by 300 feet long. The powerhouse substructure has an integral intake with eight primary turbine bays and two smaller bays cast into the concrete. Six turbine-generator units occupy the primary bays, and the two bays nearest the shore are empty. The two smaller bays contain turbine-generators for excitation of the primary generators, but those are no longer required and have been abandoned in place. A trash raking system mounted on the intake deck is used to clean debris from the forebay area and the trashracks.

At the southwest end of the powerhouse, the gated spillway section of the dam extends for 2,000 feet across the river. Six abandoned sluice gate bays occupy the 112-foot section adjacent to the powerhouse. Two have been filled with concrete, and sedimentation in the impoundment prevents the use of the other four. The spillway dam is a concrete gravity structure approximately 37 feet high, with a permanent crest elevation (El.) of 256.3[2] feet. Ten bottom-hinged Bascule gates mounted on the crest of the dam are used to raise the impoundment to El. 265.3 feet.

The non-overflow earthen embankment with crest el. 271.4 feet is located at the southwest end of the spillway and extends approximately 300 feet to the southwest abutment. A concrete wing-wall retains the embankment, separating it from the adjacent spillway section.

Fairfield Development

The Fairfield Development consists of four earthen embankment dams that impound Monticello Reservoir, an intake channel and structure in the upper impoundment, four penstocks, and the Fairfield powerhouse with a tailrace channel connected to the Parr Reservoir. There are also two highway relocation embankments and a freeboard protection dike located on the reservoir perimeter.

The four dams are constructed of random fill and have crests at El. 433.3 feet. Each has an impervious blanket on the reservoir side, as well as a low permeability clay core wall. Fairfield Dam A is located on the west side of the impoundment, and has a crest length of 3,130 feet, and a maximum structural height of 85 feet. Dam B is located to the south of Dam A and is the largest of the four dams at a total length of 4,700 feet and a maximum height of 160 feet. Dam C abuts the south side of the intake structure and has a crest length of approximately 2,000 feet and a maximum height of 60 feet. Dam D is located just south of Dam C and has a crest length of approximately 1,300 feet and a maximum height of about 30 feet. All four dams have riprap protection on the upstream slopes and grassed downstream slopes.

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[2] Unless otherwise noted, all elevation references in this Exhibit are referenced to the North American Vertical Datum of 1988 (NAVD 88); conversion to National Geodetic Vertical Datum of 1929 (NGVD29), used in numerous supporting studies for this license application and often erroneously referred to as MSL, requires the addition of 0.7 feet to elevation values referenced to NAVD88.

The intake feature in the Monticello Reservoir is located between Dam B and Dam C and consists of an open-channel intake and adjacent intake structure. The concrete-lined intake channel is approximately 300 feet long and tapers from 260 feet wide at the mouth to 132 feet wide at the interface with the intake structure. The reinforced concrete intake structure is 265 feet long; the first 225 feet consist of four separate water passages that taper uniformly from the upstream trash racks down to the headgate end. The final 40-foot length of the intake is a transitional section with 26-foot-diameter, concrete water passages at the gated end leading to the top of the penstocks. The trashracks, which are connected to the intake structures, consist of 6 inches of clear space and 1 inch bars.

The four steel penstocks are 26 feet in diameter and approximately 800 feet long and fan out horizontally as they extend down the slope to the powerhouse on the Parr Reservoir. The penstocks are above ground, and the lower 270 feet are encased in concrete. The penstocks bifurcate within the encased section of the conveyance, transitioning to a total of eight water conveyances approximately 18.5 feet in diameter, each connected to a turbine scroll case in the powerhouse.

The powerhouse is a reinforced concrete structure approximately 520 feet long by 150 feet wide with a total structural height of 108 feet. The powerhouse has eight bays, each 65 feet wide and each containing one reversible pump-turbine unit. There are 16 draft tube gates at the downstream end of the elbow draft tubes, and center support piers split the draft tube exits. A 185-ton gantry crane sits over the powerhouse, outdoors and above the surrounding grade.

3.1.1.3 UPPER RESERVOIR

Monticello Reservoir serves as the upper reservoir for the pumped storage facility. It has a surface area of 6,800 acres and a gross storage of 400,000 acre-feet. The normal maximum water level in Monticello Reservoir is El. 424.3 feet, although it can fluctuate up to 4.5 feet daily as part of the pumped storage operations. An active storage of up to 29,000 acre-feet can be transferred between the Monticello Reservoir and Parr Reservoir, which acts as the lower reservoir, by the pumped storage operations.

A 300-acre portion of Monticello Reservoir, known as the Recreation Lake, is separated from the main body of the reservoir by an embankment. The Recreation Lake’s sole purpose is to provide recreation to the public and is not affected by the operation of the pumped storage facility and thus maintained at a stable water level.

3.1.1.4 LOWER RESERVOIR

Parr Reservoir has a surface area of 4,400 acres and a gross storage of approximately 32,000 acre-feet. The normal maximum water level is at El. 265.3 feet, although the reservoir may fluctuate up to 10 feet daily as part of the pumped storage operations.

3.1.1.5 PROJECT TRANSMISSION

Primary transmission lines associated with the Parr Development include the generator lead and 2.3-kV lines for six units, the three 2.4/13.8-kV transformers at the hydro station, the 13.8-kV tie from the hydro station to the Parr Steam Plant 115 kV substation, the 13.8-kV tie from the hydro station to nearby 13.8/24.9-kV Parr distribution substation[3], and appurtenant facilities at the existing Parr Hydroelectric Project. Primary transmission lines at the Fairfield Development include the generator leads, the step-up facilities, the two 230-kV lines from Fairfield powerhouse to the V.C. Summer Nuclear Station switchyard and appurtenant facilities. All other lines connected to the V.C. Summer Nuclear Station switchyard are part of the Applicant's interconnected system.

Single line drawings for the Project are included in Exhibit F, and a map of the Applicant's transmission system is included in Exhibit H. These drawings and maps are CEII and will be filed as part of the FLA.

3.1.1.6 EXISTING PROJECT OPERATION

The Parr Development generates using available inflows up to the maximum station hydraulic capacity of 4,800 cfs[4]. When inflows are below 4,800 cfs, the Parr Development's turbines are operated to meet the minimum flow requirements. The minimum flow required to be released from the Project during the months of March, April and May is the lesser of 1,000 cfs or daily average inflow (minus evaporative losses from both reservoirs). During the remainder of the year, the minimum flow requirements are 150 cfs instantaneous flow and 800 cfs daily average flow, or the daily average inflow (minus evaporative losses), whichever is less.

The Fairfield Development generates and pumps using an active storage of 29,000 acre-feet. During the generation cycle, active storage in the upper Monticello Reservoir is released from the

[3] The 13.8/24.9-kV Parr distribution substation is currently within the Project Boundary, however since it is the point of connection to the Licensee's distribution system, and is not operated or maintained by Project personnel, the Licensee proposes to remove it from the Project Boundary. This will be consistent with the other grid interconnection points at the Project, where the Project Boundary ends at the point where the primary lines enter the non-project substation(s).
[4] See Section 1.0 of Exhibit B.

powerhouse into the lower Parr Reservoir. During the pumping cycle, all or a portion of 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.

When inflows to the Project are projected to exceed 4,800 cfs, the bascule gates on the Parr spillway dam are systematically lowered to prevent the Parr Reservoir from exceeding the maximum elevations shown in Exhibit H-6. Generation from the Fairfield Development is also partially curtailed during these conditions to prevent total project flow releases from contributing to downstream flooding. When inflows reach a threshold that causes flooding downstream of the Project, all spillway gates are fully lowered to pas natural inflows, and the Fairfield generation is completely suspended until flows recede. Fairfield pumping operations may occur with any flow in the Broad River. On the falling leg of a flood event, the gates are gradually raised to retain active storage while preventing the reservoir from exceeding the maximum elevations shown in Exhibit H-6.

3.1.1.7 EXISTING ENVIRONMENTAL MEASURES

Currently, the Licensee is required to maintain the lesser of a minimum flow of 150 cfs and a minimum daily average flow of 800 cfs, or the daily natural inflow to the Parr Reservoir (minus evaporative losses from the Parr and Monticello reservoirs), except during March, April and May. During these months, a minimum flow of the lesser of 1,000 cfs or the average daily natural inflow into the Parr Reservoir (minus evaporative losses from the Parr and Monticello reservoirs), is required to protect striped bass spawning.

The Licensee also provides public access to Project waters and adjacent Project lands for navigation and outdoor recreational purposes. In addition, the Licensee controls Project lands and waters, primarily Monticello Reservoir, through the existing Shoreline Management Plan.

SCE&G monitors erosion of the shoreline of Parr Reservoir on an annual basis and at Monticello Reservoir on a bi-annual basis. When areas of severe erosion are noted, SCE&G addresses the erosion by installing riprap, following United States Army Corps of Engineers (USACE) permitting procedures as required.

3.2 APPLICANT'S PROPOSAL

The following sections list Project facility and operational modifications and potential PM&E measures that the Licensee is presently considering. The Licensee is still actively consulting with stakeholders on all of these items. Final proposed Project facility and operational modifications and PM&E measures will be included in the FLA.

3.2.1 PROPOSED PROJECT FACILITIES AND OPERATIONS AND PM&E MEASURES

Downstream Minimum Flows

Stakeholders are requesting a minimum flow at the Parr Development that takes into account aquatic species/habitat and fish passage needs. SCE&G conducted an Instream Flow Incremental Methodology (IFIM) study to determine what flows are needed to ensure the protection of aquatic life. SCE&G is developing a Minimum Flow AMP in consultation with stakeholders to address the implementation of new downstream minimum flows. The AMP includes three minimum flow periods and a series of minimum flow targets for each period. The recommendation includes a "Target Flow" and a "Compliance Limit." Because the Project is not a storage project and outflows should be related to inflow to the Project, the Target Flow is a minimum flow based on habitat data from the IFIM study results and the Compliance Limit is based on inflow exceedance values. These two items will be evaluated as part of the AMP, which is anticipated to last for the first 5 years of the new license. The AMP also includes a series of low flow scenarios within each flow period that would allow for operations during low flow periods. This recommendation provides the basis for a Low Inflow Protocol.

Below is the Minimum Flow Recommendation for the Project. This recommendation includes specifics on how Target Flow and Compliance Limits would be set in relation to net inflows into the Project. The draft Minimum Flow AMP is included in Appendix D.

Low Flow Period

June 1 through November 30 - Target Flow of 900 cfs with a Compliance Limit of 600 cfs

- If net inflow is greater than 900 cfs, then the daily target flow is 900 cfs, but could fall to 600 cfs compliance limit on an infrequent basis (TBD frequency).
- If net inflow is 800 cfs then the new target flow is 800 cfs, but could fall to 600 cfs compliance limit on an infrequent basis (TBD frequency).
- If net inflow is 700 cfs then the new target flow is 700 cfs, but could fall to 600 cfs compliance limit on an infrequent basis (TBD frequency).
- If net inflow is 600 cfs then the new target flow is 600 cfs, but could fall to 500 cfs compliance limit on an infrequent basis (TBD frequency).
- If net inflow is 500 cfs then the new target flow is 500 cfs, but could fall to 400 cfs compliance limit on an infrequent basis (TBD frequency).

Medium Flow Periods

December 1 through January 31 & May 1 through May 31 - Target Flow of 1,500 cfs with a Compliance Limit of 1,200 cfs

- If net inflow is greater than 1,500 cfs then the daily target flow is 1,500 cfs, but could fall to 1,200 cfs compliance limit on an infrequent basis (TBD frequency).
- If net inflow is 1,400 cfs then new target flow is 1,400 cfs, but could fall to 1,200 cfs compliance limit on an infrequent basis (TBD frequency).
- If net inflow is 1,300 cfs then the new target flow is 1,300 cfs, but could fall to 1,200 cfs compliance limit on an infrequent basis (TBD frequency).
- If net inflow is 1,200 cfs then the new target flow is 1,200 cfs, but could fall to 1,100 cfs compliance limit on an infrequent basis (TBD frequency).
- If net inflow is 1,100 cfs then the new target flow is 1,100 cfs, but could fall to 1,000 cfs compliance limit on an infrequent basis (TBD frequency).

High Flow Period

February 1 through April 30 - Target Flow of 2,300 cfs with a Compliance Limit of 2,000 cfs

- If net inflow is greater than 2,300 cfs, then the daily target flow is 2,300 cfs, but could fall to 2,000 cfs compliance limit on an infrequent basis (TBD frequency).
- If net inflow is 2,200 cfs then the new target flow is 2,200 cfs, but could fall to 2,000 cfs compliance limit on an infrequent basis (TBD frequency).
- If net inflow is 2,100 cfs then the new target flow is 2,100 cfs, but could fall to 2,000 cfs compliance limit on an infrequent basis (TBD frequency).
- If net inflow is 2,000 cfs then the new target flow is 2,000 cfs, but could fall to 1,900 cfs compliance limit on an infrequent basis (TBD frequency).
- If net inflow is 1,900 cfs then the new target flow is 1,900 cfs, but could fall to 1,800 cfs compliance limit on an infrequent basis (TBD frequency).

SCE&G is still finalizing the Minimum Flow AMP with the various RCGs and TWCs and a final recommendation for new downstream minimum flows will be included in the FLA.

Navigation Flows

The Recreation TWC expressed concern over the navigability of the Broad River downstream of Parr Shoals Dam. They requested that a minimum flow take into account flows necessary for navigation. SCE&G conducted a Downstream Navigational Flow Assessment (included in Appendix B), where the two most constricted points 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 between 700-1000 cfs is sufficient for downstream navigation at both of the constriction points investigated. These results were considered along with the results of the IFIM Study in developing a minimum flow recommendation for the new license. The minimum flows described above and included in the Minimum Flow AMP take into account navigation needs at the Project. SCE&G is still finalizing the Minimum Flow AMP with the various RCGs and TWCs and a final recommendation for new downstream minimum flows will be included in the FLA.

Downstream Flow Fluctuations

Stakeholders have requested that SCE&G reduce flow fluctuations downstream of the Parr Shoals Dam associated with operation of the Fairfield Development. The stakeholders seek two types of flow reductions: spring spawning stabilization and general, year round reductions of flow fluctuations. SCE&G is currently developing a Downstream Flow Fluctuation AMP that outlines their proposed actions for stabilizing downstream flow, as described below. The draft Downstream Flow Fluctuation AMP is included in Appendix D. A final proposal on downstream flow fluctuations will be included in the FLA.

<u>Spring Spawning Stabilization:</u>

During the spawning periods listed below, the goal is for inflow (based on a summary of flows from the Carlisle, Tyger and Enoree USGS gages) to equal outflow (based on flow from the Alston gage). The Fisheries TWC is requesting the following:

- Shortnose sturgeon spawning – for 14 days during the last two weeks in March (March 15-March 31), SCE&G will greatly regulate or reduce effects of the Fairfield Development operations (generating and pumping) from the Parr Development discharge, however, the Fairfield Development may still be used for reserve purposes and when project inflow is less than hydraulic capacity of the Parr Development. SCE&G will determine how to reduce the Fairfield Development effects.
- Striped bass, American shad, and robust redhorse (among other species) spawning– for two 7-day blocks (during April 1 through May 10, to be determined annually by a technical team) SCE&G will control discharge from Parr Shoals Dam to match inflow. During this time, Fairfield Development may operate normally (generate and pump) to meet daily demands and reserve purposes without restriction.

<u>General Year Round Flow Fluctuation Reductions:</u>

SCE&G will take the following measures with the goal of reducing fluctuations in downstream flow due to Project operations:

- System Controllers will more closely monitor the water inventory in Parr Reservoir to release spills over a longer period and use multiple sets of gates to provide a lower flow “spike”. This inventory management will be implemented by the end of the first calendar year following the year of License issuance.
- Install a remote control camera on the west abutment of Parr Shoals Dam to allow System Control operators to determine if conditions are safe to raise or lower the crest gates when the plant is not manned. Also, install controls to allow System Controllers the ability to operate the crest gates based on changes in inflow or reservoir level. This will be implemented by the end of the second calendar year following the year of License issuance.
- Modify or replace the generators at the Parr Development so as to allow the turbines to operate at their original designed hydraulic capacity and potentially reduce the frequency of spillage at Parr Shoals Dam. All generators will be upgraded or replaced by the end of the tenth calendar year following the year of License issuance. Inflow will be computed as the sum of flows measured at the three USGS gage stations upstream of Parr Shoals Dam:
    - 02156500 Broad River Near Carlisle, SC
    - 02160105 Tyger River Near Delta, SC
    - 02160700 Enoree River Near Whitmire, SC

The hourly discharge measured at these three stations will be summed to compute inflow to the Project. No correction will be made for travel time, and the measured discharge will not be prorated to account for un-gaged areas between the gage stations and Parr Shoals Dam.

Parr Shoals Dam Generator Upgrades

Over time, the equipment at the Parr Development has become less efficient at controlling Project flows. SCE&G is proposing an upgrade on the generators to ensure they can pass flows up to at least 6,000 cfs. Further details of the generator upgrades will be included in the FLA.

West Channel Water Quality Improvement

Stakeholders expressed concern about potential low dissolved oxygen (DO) levels downstream of Parr Shoals Dam in the “west channel” area. SCE&G is developing a West Channel AMP in consultation with stakeholders to deal with this issue (Appendix D). As part of the AMP, SCE&G has identified several measures to increase DO levels in the west channel that will be implemented in the new operating license. These measures are listed below.

- The AMP Review Committee will determine an approximate target flow that it believes will adequately maintain DO levels in the west channel.
- The implementation of new instantaneous minimum flows for the Project should result in a more consistent amount of water flowing into the west channel from the east channel, compared to the previous license requirement of daily average minimum flows. Monitoring

during initial implementation of these minimum flows will determine the extent of the benefits to the west channel DO levels.

- If the AMP Review Committee determines that new instantaneous minimum flows will not provide a sufficient flow into the west channel to maintain DO levels, it will direct efforts to physically modify existing channel(s) leading into the west channel. Once the appropriate permits are obtained, the channel will be modified to provide the identified target flow during low minimum flow periods, exclusive of low-inflow periods. 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 the Parr Shoals Dam.
- If inflows to Parr Reservoir decrease to a point that outflows from the dam do not provide any flows to the west channel, SCE&G will investigate the use of spillway gates to provide periodic flow pulses to "refresh" the west channel during periods when dissolved oxygen levels are expected to fall below acceptable levels. During the low inflow period, SCE&G will discuss the use of pulses with the Review Committee to make sure that all downstream resources are considered and releases are distributed in a balanced manner between the main channel and the west channel.
- During each year of the AMP, monitoring will be conducted from May 15 to September 30.

This AMP is still being developed with stakeholders and final proposals will be included in the FLA.

Turbine Venting Plan

Stakeholders expressed concern over occasional instances of DO levels below the state standard in the tailrace area downstream of Parr Shoals Dam. In an effort to increase DO levels in this area, SCE&G developed a Turbine Venting Plan (included in Appendix D), where turbines will be vented from June 15-August 31.

Cultural Resources PMEs

As part of relicensing, SCE&G completed Phase I and Phase II studies to determine if the Project has any impact on cultural resources in the Project area. As a result of these studies SCE&G is completing several PM&E measures to address cultural resources.

Historic Properties Management Plan (HPMP) and Programmatic Agreement (PA)

In consultation with FERC, the South Carolina State Historic Preservation Office (SHPO), and appropriate tribes, SCE&G developed a Historic Properties Management Plan (HPMP) that includes information regarding the identification, management, and protection of historic properties located within the Project Area of Potential Effect. The HPMP was filed with FERC on

January 4, 2017. The FERC initiated development of a Programmatic Agreement (PA) with SCE&G, SHPO and appropriate tribes, which has yet to be finalized.

Cultural Resources Educational Material/Signage

The Phase I study found that the Lyles Ford site has been impacted by Project operations and therefore recommended that SCE&G consult with FERC and the SHPO on ways to mitigate for this adverse effect. SCE&G is currently preparing educational material/signage that will be maintained on SCE&G's website and placed in publicly accessible areas around the Parr Development and Fairfield Development. This information will include: 1) historical information about the Lyles family, Lyles Ford, and if appropriate, the ruins of a mill/store and a canal built and run by the Lyles family in the eighteenth/nineteenth century; and 2) historical information about the Parr Development and the Fairfield Development facilities. Additionally, there is one archaeological site that will either be stabilized or have the adverse effects mitigated (e.g., through data recovery excavations). This stabilization or mitigation will be completed after the new license is issued.

Parr and Monticello Shoreline Management Plans

The existing Shoreline Management Plan (SMP) primarily covers activities on Monticello Reservoir and its shoreline. The Lake and Land Management TWC decided that the existing SMP needed to be updated and a separate SMP needed to be created for Parr Reservoir. SCE&G has developed two new SMPs, one for Monticello Reservoir and one for Parr Reservoir. SCE&G plans to meet with stakeholders on a regular basis throughout the term of the new license to discuss any potential upgrades needed to those documents. More information on the proposed SMPs is included in Section 4.10: Land Use and Aesthetics. Draft SMPs are included in Appendix D.

Monticello Reservoir Fish Habitat Enhancements

Stakeholders expressed concern over how the fluctuations of Monticello Reservoir, due to the pumped storage operation, are affecting fish populations. Specifically, SCDNR is concerned about the impacts of reservoir fluctuation to littoral zones and spawning and juvenile rearing habitats and any loss of fish from turbine mortality. SCE&G worked with SCDNR and other agencies to develop a plan for the installation of habitat enhancements in Monticello Reservoir. The habitat enhancement structures could provide enhanced fish production within Monticello Reservoir and they could also concentrate fish as an enhancement for recreational fishermen.

Additional details on this enhancement effort can be found in the Monticello Reservoir Habitat Enhancement Report in Appendix D.

American Eel Monitoring

During an American Eel Study conducted during relicensing, juvenile eels were found downstream of Parr Shoals Dam. NMFS requested that additional monitoring be conducted during the term of the new license to determine if eel presence downstream of Parr Shoals Dam is increasing. SCE&G is proposing to continue periodic American eel monitoring downstream of Parr Shoals Dam, and is developing an American Eel Monitoring Plan in consultation with stakeholders. SCE&G is proposing to conduct surveys during the first year after the new license is issued and then every 10 years thereafter. During each sampling year, sampling efforts will be conducted one day each in March, April and May. Monitoring frequency will be increased if the total number of eels collected during a sampling event reaches a “Target Threshold.” The draft American Eel Monitoring Plan is included in Appendix D. Additional discussion is needed with stakeholders to finalize the specifics of this monitoring plan. SCE&G will have a final proposal for the FLA.

Canoe Portage

At the request of SCDNR, SCE&G built an experimental canoe portage on the Newberry (west) side of the Parr Shoals Dam. An approximately 1600 foot trail was cleared and appropriate signage was installed. Following testing of usage and feedback from agencies, SCE&G plans to formalize the canoe portage and maintain it as an additional recreational facility.

Recreation Management Plan and Associated Recreation Improvements

SCE&G is developing a Recreation Management Plan (RMP) in consultation with stakeholders, using the results of the 2016 Recreation Use and Needs Study. The RMP includes an adaptive management process to address Project related recreation issues that arise during the term of the new license. The draft RMP is included in Appendix D. SCE&G is also planning several recreation site enhancements at the Project, including enhancements at five existing Project Recreation Sites and three new proposed Project Recreation Sites. More information on these enhancements can be found in Section 4.8.2: Environmental Effects – Proposed Action.

Erosion Monitoring and Control

Daily fluctuations of Parr and Monticello Reservoirs, related to operation of the Fairfield Development, contribute to some erosion of the shoreline over time. SCE&G currently monitors the erosion on Parr Reservoir’s shoreline on an annual basis and Monticello Reservoir’s shoreline on a bi-annual basis. When and if areas of severe erosion are identified, SCE&G takes action to address the erosion, primarily through the placement of riprap to reinforce the shoreline. SCE&G will continue this practice through the term of the new license and has developed a formal Erosion Monitoring Plan, which is included in Appendix D.

Recreation Site Monitoring/Maintenance

Over time, recreation sites require maintenance to preserve quality and functionality. Additionally, some recreation sites may need upgrades to stay in compliance with FERC's barrier free requirements. SCE&G will continue to monitor their recreation sites on Parr and Monticello reservoirs for damage, destruction, and ordinary wear and tear and will make repairs, perform maintenance, and make improvements as needed. Monitoring and maintenance of Project Recreation Sites will occur as outlined in the RMP.

Santee River Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement

Agencies were concerned about diadromous fish in the Santee River Basin, specifically their ability to pass upstream in a river system heavily segmented by hydro facilities. In 2008, SCE&G and Duke Energy signed the Santee River Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement (Accord) with the SCDNR, the North Carolina Wildlife Resources Commission (NCWRC), and the USFWS, thus agreeing to a 10-year action plan, funding a variety of diadromous fish studies, and implementing fish passage at hydro facilities in the Santee River Basin based on biological triggers. Specifically for Parr, SCE&G will perform a Fish Passage Feasibility Assessment when 50% of the specified total restoration numbers for adult anadromous American shad or blueback herring being passed at Columbia Dam (CAP 2008). When 75% of the specified total restoration numbers for adult anadromous American shad or blueback herring are being passed at Columbia dam in accordance with the Accord criteria, SCE&G will initiate construction of a Fish Passage Facility at Parr Shoals Dam (CAP 2008).

3.2.2 ADDITIONAL PM&ES OR OFF-LICENSE AGREEMENTS UNDER EVALUATION

The Licensee is still evaluating the following PM&Es requested by stakeholders.

- The Congaree Riverkeeper requested that SCE&G provide public outreach and public education of the Rocky Shoals Spider Lily (RSSL).
- SCDNR requested that SCE&G establish a mitigation fund for continuing unavoidable impacts to aquatic resources in addition to the operational changes being proposed for the downstream flow fluctuations and Parr Reservoir fluctuations.
- SCDNR requested that measures be implemented to avoid or minimize fish entrainment at the Fairfield Development, both generation and pump back.

- USFWS requested a Mussel Monitoring Plan during the new license period.
- To offset impacts to water based recreation from the combined operation of the Fairfield and Parr developments, American Rivers requested that SCE&G provide funding for developing, printing and distributing high quality, waterproof paddling maps for the Broad and Enoree rivers in Richland, Lexington, Fairfield, Newberry, Laurens and Union counties.
- SCDNR requested that SCE&G and SCDNR develop a new Memorandum of Understanding (MOU) similar to the May 15, 1979 MOU. Specifically, they would like the MOU to include the following:
  - Marking of hazards on Monticello Reservoir.
  - Expand the MOU to include marking of the access channel in Cannon's and Heller's creeks.
  - Establish an SCE&G-SCDNR communications protocol to address coordination of SCDNR's water management needs at Broad River Waterfowl Management Area with the operations and water elevations of Parr Reservoir.
- SCDNR recommended significant, additional non-Project lands be placed under protection for habitat conservation and non-Project recreational use. It is suggested that preferred land areas to serve as mitigation for aquatic resource impacts will contain a significant portion of riparian and wetland habitats.

3.3 Alternatives Considered but Eliminated from Detailed Study

3.3.1 Federal Takeover of Project Facilities

A federal takeover of the Project has not been raised as an alternative by any federal agency, nor has it thus far been raised as a reasonable alternative during relicensing by any party involved. Although further consideration of this alternative may occur, a federal takeover of a project requires congressional approval and there is no evidence that indicates a federal takeover should be recommended to Congress.

3.3.2 Issuance of Non-Power License

A non-power license is a temporary license that is issued by FERC when it is determined that another governmental agency will assume regulatory authority and supervision over the lands and facilities covered under the non-power license. Thus far, this option has not been proven necessary or suggested as a viable option during relicensing. There is no basis for concluding that the operation of the Parr Project should not continue to occur for the purpose of power production. Because of this, the issuance of a non-power license has not been deemed a reasonable alternative and has not been analyzed as part of this report.

3.3.3 PROJECT DECOMMISSIONING

The decommissioning of a power project could include either the partial or complete removal of the dam. Through the relicensing process, project decommissioning has not been presented as an issue by any entity involved and is not considered a reasonable alternative. The Project as operated for electricity generation, especially as operationally connected to a supply of non-emitting nuclear power that replaces and forestalls the need for fossil generation, is an important and reliable source of clean, renewable energy. Were it to be decommissioned, replacement power would need to be identified. Additionally, the Project provides many recreational opportunities and socioeconomic benefits to the surrounding region. Consequently, Project decommissioning is not an alternative that is evaluated in this report.

3.3.4 PROPOSED PM&ES ELIMINATED FROM FURTHER ANALYSIS UNDER THE DLA

Dam Removal in the Santee Basin

American Rivers requested that SCE&G consider funding for dam removals in the Broad River Basin throughout the term of the new license. American Rivers believes that removal of dams in the basin would help restore stream connectivity and help to offset the impacts of habitat fragmentation and reservoir fluctuation caused by the Parr Shoals Dam and Project operations. SCE&G realizes that there are many continuing project impacts associated with the Project. However, SCE&G does not agree that removal of relict or active dams in the basin will help offset Project impacts in or adjacent to the Project. Therefore, SCE&G will not provide funding for dam removals or floodplain restorations.

Palmetto Trail Contribution

NGOs and agencies have expressed a desire to have additional recreation access downstream of Parr Shoals Dam on the Broad River. The lands located in this area are not included in the Project boundary. Therefore, the stakeholders are asking that a one-time monetary contribution be made to the Palmetto Trail to help fund the construction of a new recreation site. SCE&G already provides funding and easements to this organization through non-hydro avenues. Therefore, SCE&G is not planning to support this request.

Recreation Flows

The Recreation TWC requested that SCE&G consider scheduling flows specifically for recreational purposes. SCE&G performed a Downstream Recreational Flows Assessment (included in Appendix B) where it collected information on recreational flow preferences from TWC members and other interested individuals. The TWC suggested having recreation flows between

2,000 cfs and 3,500 cfs on holidays and weekends between 8am and 2pm, May through September. However, the Project cannot store sufficient water to allow the scheduling of releases at specific times and inflows normally will not support these releases during peak recreation times of the year. For these reasons, SCE&G is not planning to support this request.

RSSL Monitoring and Restoration

The Congaree Riverkeeper requested that SCE&G perform periodic monitoring and restoration of RSSL populations located downstream of Parr Shoals Dam but upstream of Columbia Dam and join in the ongoing efforts for restoration at the Columbia Hydro Project throughout the term of the new license. SCE&G does not plan to perform monitoring and restoration as requested because the RSSL populations are outside of the Project boundary and access to these populations is limited and difficult. In addition, SCE&G already plans to participate in the Columbia Hydro RSSL restoration efforts as part of the Saluda Hydro new license due to the proximity of the plants to that project. SCE&G also believes that new minimum flows at the Parr Project will encourage the downstream RSSL populations to thrive.

Minimum Flow Mitigation Payment

SCDNR requested that SCE&G provide mitigation payment to compensate for not delivering target flows when inflow to the Project is available to meet or exceed the target flow. SCE&G views this as a “fine” against the Project. The FERC has the ability of placing a fine on the Licensee that violates a license article whether it is associated with minimum flows or some other compliance issue. SCE&G does not believe it should be fined by both the FERC and the state if a license article is violated.

Boat Launch on Broad River

To offset impacts to water based recreation from the combined operation of the Fairfield and Parr developments, American Rivers requested that SCE&G provide funding and donate land for a non-motorized boat launch on the west bank of the Broad River in the vicinity of Haltiwanger Island. SCE&G believes it is providing sufficient recreational opportunities within the Project boundary. SCE&G is providing improvements to the existing Project recreation sites and is proposing new Project recreation sites within the Project boundary. SCE&G reiterates its position that it will not provide recreational sites outside of the FERC approved Project boundary.

Recreation Website

To offset impacts to water based recreation from the combined operation of the Fairfield and Parr developments, American Rivers requested that SCE&G provide funding to develop a website that promotes recreation opportunities at the Broad and Enoree rivers in Richland, Lexington, Fairfield, Newberry, Laurens, and Union counties. SCE&G does not plan to provide this funding as it will use its own website for documents it agrees to provide for public use as part of the relicensing process.

3.4 REFERENCES

Cooperative Accord Partnership (CAP). 2008. Santee River Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement. Santee River Basin Accord: Final Administrative and Policy Document. April 9, 2008.

4.0 ENVIRONMENTAL ANALYSIS

4.1 GENERAL DESCRIPTION OF THE RIVER BASIN

Beginning in the Blue Ridge region and extending across the Piedmont region of North and South Carolina, the Broad River basin includes a total of 4,691 stream miles and 18,533 acres of lake waters. In South Carolina, the Broad River basin incorporates 27 watersheds and some 2.5 million acres (SCDHEC 2007).

The Project is located within the lower Broad River basin, a sub-basin of the larger Broad River basin. The lower Broad River basin forms at the confluence of the Broad and Pacolet rivers, approximately 34 miles northwest of the Project Area, and has a total drainage area of nearly 824,000 acres (NRCS 2010). The Project is situated on the Broad River. From its headwaters in the Blue Ridge Mountains of North Carolina to where it joins the Saluda River to form the Congaree River in Columbia, South Carolina, the Broad River flows for approximately 153 miles. Approximately 67 miles of the southern extent of the river is included in the Lower Broad River basin (USGS 2014). The Tyger and Enoree rivers are the two major tributaries that join the Broad River in the lower Broad River Basin. The confluence of the Enoree River with the Broad River occurs within the Project boundary, while the Tyger River joins the Broad River less than 4 miles north of the Project boundary. Minor tributaries joining the Broad River in this sub-basin include Turkey Creek, approximately 32 miles north of the Project; the Sandy River, approximately 9 miles north of the Project; and the Little River, about 13 miles southeast of the Project (USGS 2014).

4.1.1 TOPOGRAPHY

The Broad River basin lies within the Blue Ridge and Piedmont physiographic provinces of North and South Carolina. The Blue Ridge province is comprised of a diverse landscape of rugged terrain ranging from narrow ridges to hilly plateaus to more mountainous areas with high peaks. Elevations generally range from 900 feet to 3,000 feet, with Sassafras Mountain marking the highest peak in South Carolina at 3,560 feet (Griffith et. al. 2002). The Piedmont province consists of gently rolling hills with stream-cut valleys and only a few floodplains. Elevations range from approximately 400 feet to 1,000 feet (SCDNR 2014). Figure 4-1 depicts the general topography.

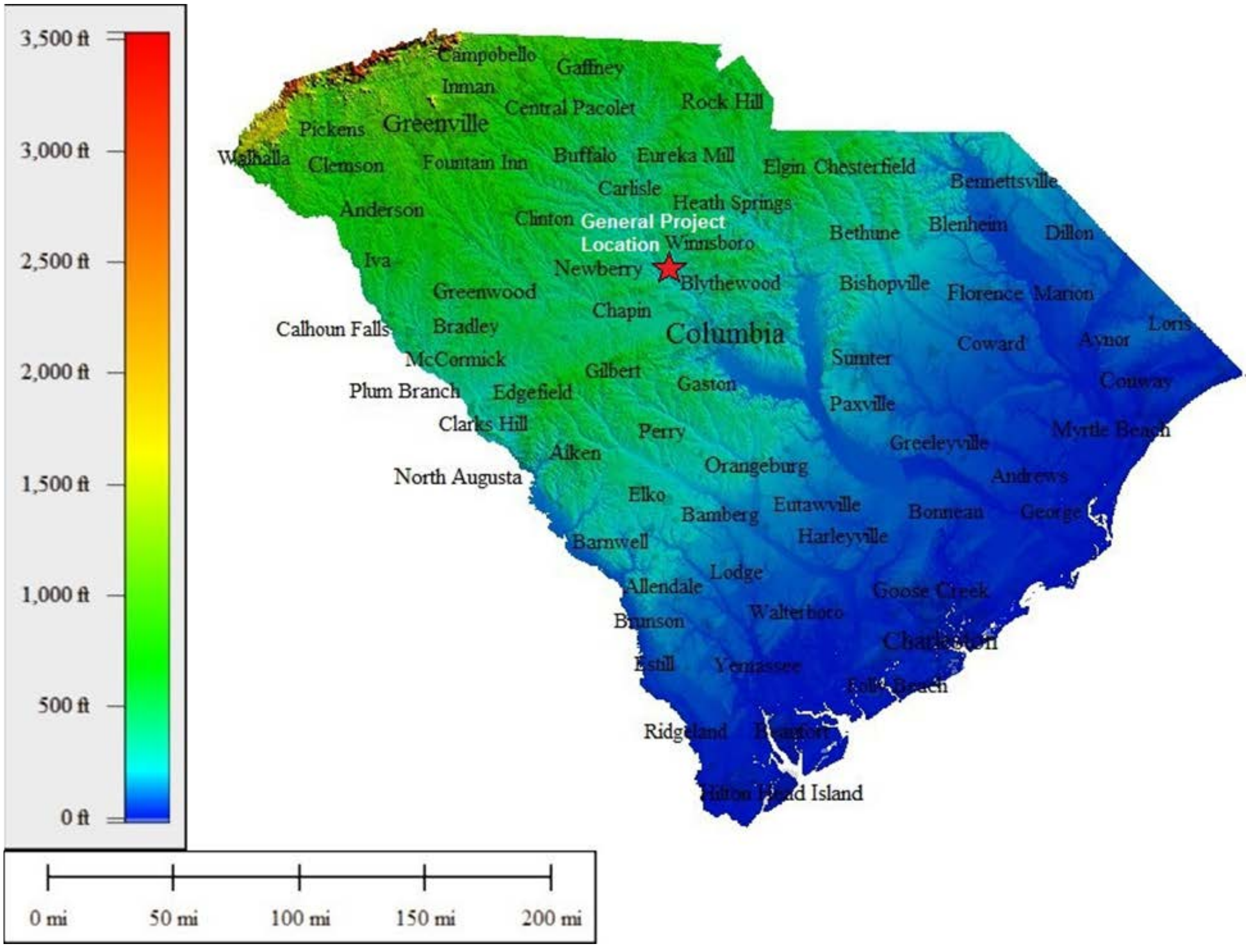


FIGURE 4-1 GENERAL TOPOGRAPHY SURROUNDING THE PROJECT

Source: http://topocreator.com/download_city_a.php#SC 2014

4.1.2 CLIMATE

Climate within the Broad River basin is subtropical to temperate. Temperatures can range from a low daily average of 52°F in January to a high daily average of 88°F in July. Although there is no wet or dry season, late winter and early spring tend to be the wettest parts of the year, while early fall tends to be the driest. Rainfall averages 48 inches per year with average monthly precipitation between 4 and 6 inches. The Midlands of South Carolina, where the Project is located, is generally the driest portion of the state (Furman 2016) (SCDNR 2016).

4.1.3 MAJOR LAND USES

The Broad River basin is dominated by forestland, which encompasses approximately 60.6 percent of the total land cover, followed by agriculture at approximately 23.8 percent of the land cover. Overall, only a small percentage of the Broad River basin is developed (9.8 percent). The cities of Spartanburg, Gaffney, and Chester, and portions of the cities of York, Union, and Columbia comprise most of the developed land in the basin (SCDHEC 2007). None of the several mining operations within the Broad River basin are located within the Project vicinity.

Within the Project vicinity, forestland is the dominant land cover. Portions of Sumter National Forest are found in Newberry and Fairfield counties, where the Project is located. Agricultural land covers about 12,000 acres in both counties; cropland and hayland are the dominant agricultural land types in Newberry and Fairfield counties, respectively. Developed land in the Project vicinity is generally limited to the city of Winnsboro, approximately 14 miles east of the Project; and the city of Columbia, approximately 12 miles southeast of the Project (NRCS 2014).

4.1.4 ECONOMIC ACTIVITIES

The Project is located in Newberry and Fairfield counties. Between 2010 and 2014, Newberry County had 14,230 households with 2.56 people in each household. The median household income was $41,971, which was slightly lower than the state median ($45,033). Approximately 19.4 percent of the population in Newberry County lives below the poverty level (U.S. Census 2014). During the same time period, Fairfield County had 9,402 households with 2.44 people in each household. The median household income was $36,213, which was significantly lower than the state median. Approximately 23.1 percent of the population in Fairfield County lives below the poverty level (U.S. Census 2014).

The largest sources of employment in Newberry County are educational services, health care, and social assistance. The second largest employment sector is manufacturing. Retail trade is the third largest employment sector in Newberry County, and the smallest source of employment is the information sector, representing 2.1 percent of the employed population (U.S. Census 2014). Similar to Newberry County, the largest sources of employment in Fairfield County are educational services, health care, and social assistance. The second largest employment sector is manufacturing. Public administration is the third largest employment sector in Fairfield County, and the smallest source of employment is also the information sector, representing 0.5 percent of the employed population (U.S. Census 2014).

4.1.5 REFERENCES

Griffith, G.E., Omernik, J.M., Comstock, J.A., Schafale, M.P., McNab, W.H., Lenat, D.R., MacPherson, T.F., Glover, J.B., and Shelburne, V.B., 2002, Ecoregions of North Carolina and South Carolina, (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,500,000).

Natural Resources Conservation Service (NRCS). 2010. An Assessment of the Lower Broad Subbasin: hydrologic Unit Code (8 digit): 03050106.

South Carolina Department of Health and Environmental Control (SCDHEC). 2007. Watershed Water Quality Assessment: Broad River Basin. Technical Report No.006-07. Bureau of Water, Columbia, S.C.

South Carolina Department of Natural Resources (SCDNR). 2016. South Carolina Climate. [Online] URL: http://www.dnr.sc.gov/climate/sco/ClimateData/cli_sc_climate.php Accessed on October 12, 2016.

South Carolina Department of Natural Resources (SCDNR). 2014. Piedmont Ecoregion Aquatic Habitats. [Online] URL:https://www.dnr.sc.gov/cwcs/pdf/habitat/PiedmontAquatic.pdf Accessed on February 27, 2014.

U.S. Census. 2014. QuickFacts: South Carolina. [Online] URL: http://quickfacts.census.gov/qfd/states/45000.html. Accessed October 20, 2016.

U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS). 2014. Web Soil Survey. [Online] URL: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx Accessed March 4, 2014.

U.S. Geological Survey (USGS), 2014. 200301, HYDROGL020 - U.S. National Atlas Water Feature Areas: aqueducts, canals, dams, intercoastal waterways, rivers, and streams: U.S. Geological Survey, Reston, VA.

4.2 CUMULATIVE EFFECTS

A cumulative effect is defined as an 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 or person undertakes such other actions (40 CFR §1508.7). 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. Fisheries is the only resource identified that could be cumulatively affected by the proposed relicensing of the Project. Fisheries was selected because hydroelectric developments along the waterway have affected the fishery and habitat by altering the flow regime, blocking or delaying fish movement, and entraining fish into diversion canals or penstocks.

The geographic scope of the analysis defines the physical limits or boundaries of the proposed action’s effect on the resources. The geographic scope for fisheries resources encompasses the Broad River from the upstream end of the Parr Development boundary, including the Monticello Reservoir, and extending downstream to river reaches affected by releases from waters at Parr Shoals Dam.

The temporal scope of the cumulative effects analysis includes a discussion of past, present, and future actions and their respective effects on each resource that could be cumulatively affected. Based on the potential term of any new licenses issued for a project, the temporal scope will last 30-50 years into the future, concentrating on the effects on the resources from reasonably foreseeable future actions. The historical discussion will be limited to the amount of information available for fisheries within the geographic scope.

4.3 GEOLOGY AND SOILS

The Project is located in both Fairfield and Newberry counties, South Carolina, in the Piedmont physiographic region. This region is comprised of gently rolling hills dissected by 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 (SCDNR 2014). Typical rock types associated within this region are gneiss, schist, and granite covered with deep saprolite and generally red, clayey subsoils (EOE 2014).

4.3.1 AFFECTED ENVIRONMENT

4.3.1.1 GEOLOGY

In South Carolina the Piedmont physiographic region is further 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. This ecoregion is adjacent to the Carolina Slate Belt ecoregion, which comprises metavolcanic and metasedimentary rocks that are less metamorphosed than those in most Piedmont regions. Many areas of this region are more rugged and are distinguished by trellised drainage patterns with silt and silty clay soils, and streams that tend to desiccate (EOE 2014). Figure 4-2 and Figure 4-3 depict physiographic regions and ecoregions and general geology surrounding the Project area.

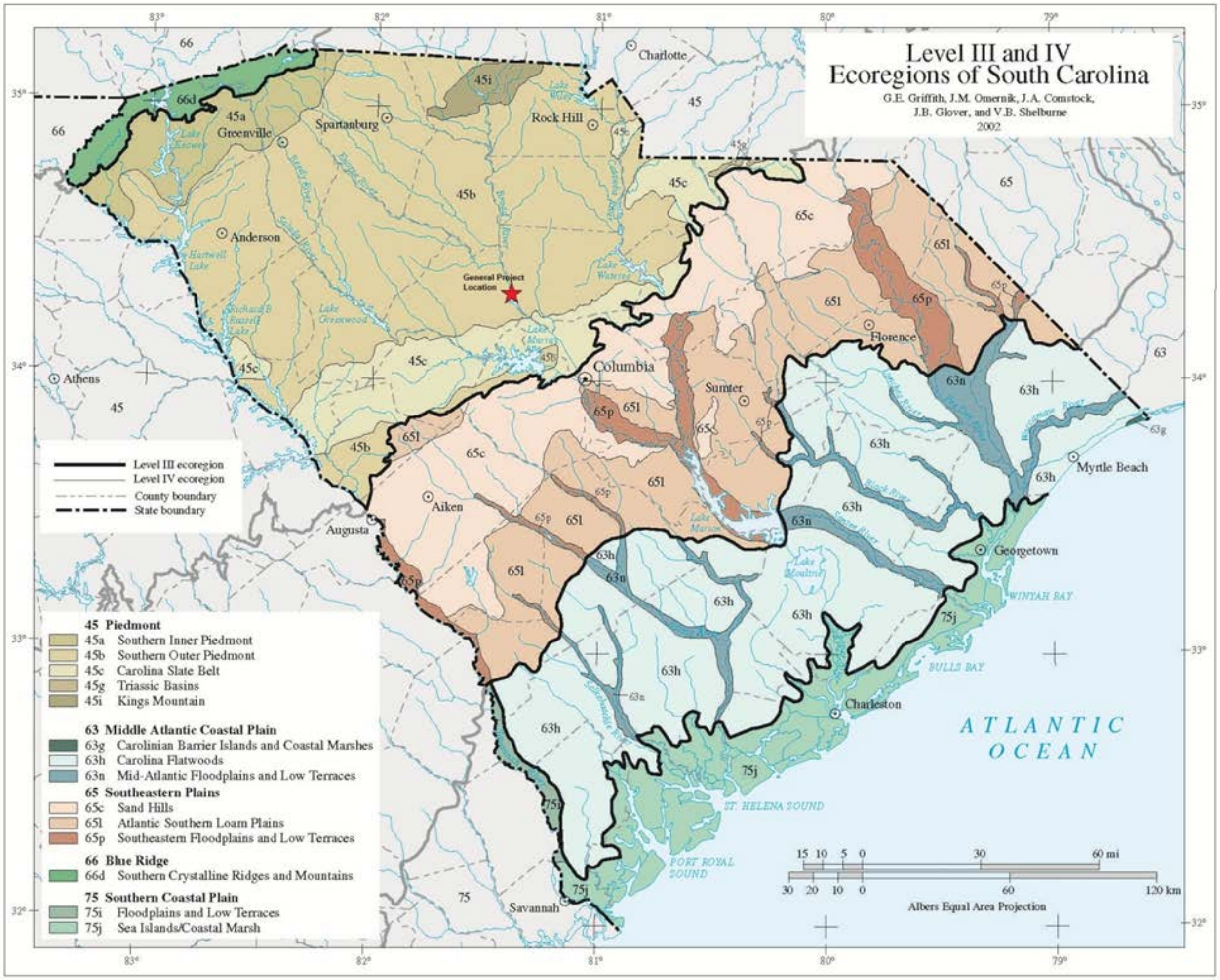


FIGURE 4-2 PHYSIOGRAPHIC REGIONS AND ECOREGIONS SURROUNDING THE PROJECT

Reference: (Griffith et. al 2002)

GGMS-1

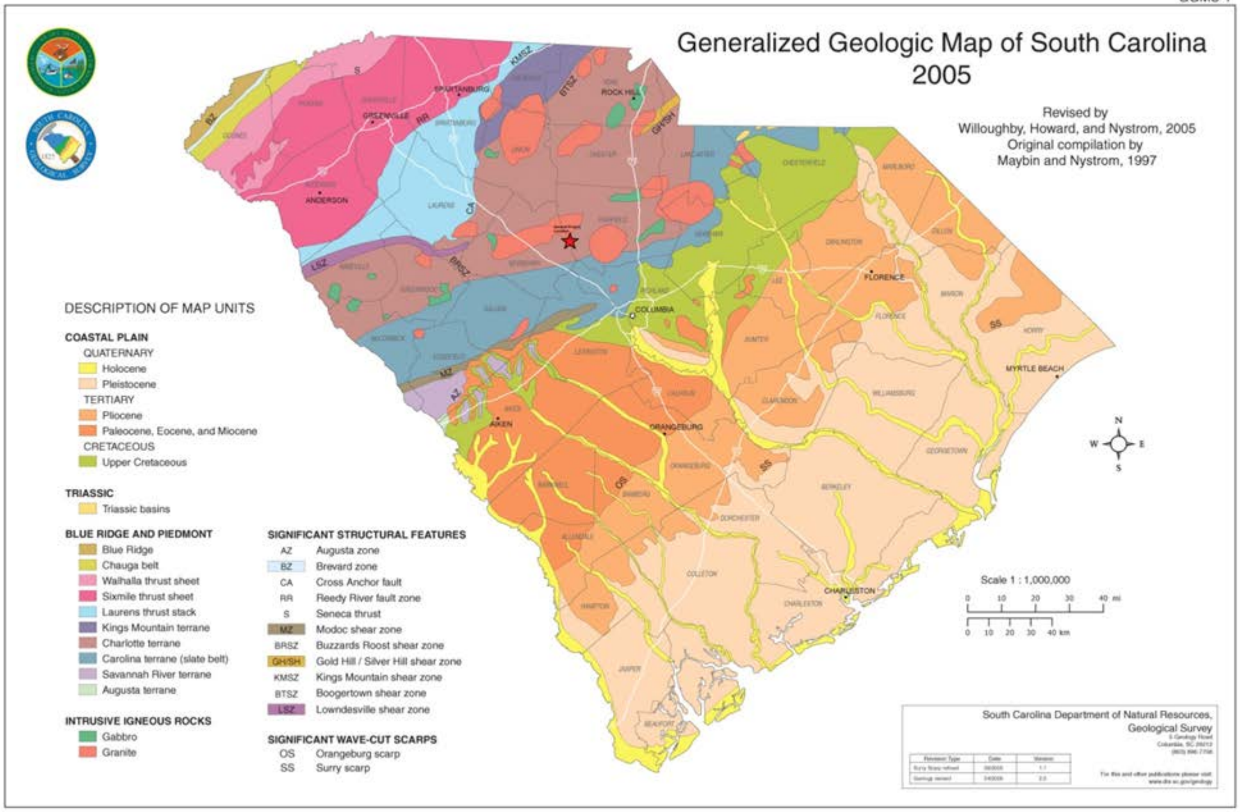


FIGURE 4-3 GENERAL GEOLOGY SURROUNDING THE PROJECT

4.3.1.2 SOILS

Table 4-1 and Figure 4-4 depict the soil types in the general area surrounding the Project. Generally, the soils surrounding the Project consist of sandy clay and sandy loams. The soils with the greatest representation within the Project area include those from the Cecil, Pacolet, Hiwassee, Wynott-Winnsboro, Hard Labor, and Madison families. Cecil family soils, consisting of sandy clay and sandy loam, are well drained with a 2-percent to 15-percent slope. Pacolet family soils, consisting of sand, clay, and sandy clay loam, are well drained with a 10-percent to 50-percent slope. Hiawassee family soils, consisting of sandy clay and sandy loam, are well drained with a 2-percent to 10-percent slope. Wynott-Winnsboro family soils, consisting of sandy clay loam, are well drained with a 2-percent to 10-percent slope. Hard Labor family soils, consisting of sandy loam, are moderately well drained with a 2-percent to 10-percent slope. Madison family soils, consisting of sandy clay and sandy loam, are well drained with a 2-percent to 25-percent slope. Table 4-1 lists the various soil types in the area surrounding the Project and describes the extent to which they occur. In general, soils within the Project area consist of sandy loams with slopes ranging from 0 percent to 50 percent with a slight to moderate erosion potential (NRCS 2014).

TABLE 4-1 LIST OF SOILS BY TYPE, SIZE (ACRES), AND PERCENT SURROUNDING THE PROJECT

FAIRFIELD COUNTY, SOUTH CAROLINA (SC039)			
MAP UNIT SYMBOL	MAP UNIT NAME	ACRES IN AOI	PERCENT OF AOI
ApB	Appling loamy sand, 2 to 6 percent slopes	95.9	0.20%
ApC	Appling loamy sand, 6 to 10 percent slopes	167.5	0.30%
CaB	Cataula sandy loam, 2 to 6 percent slopes	90.7	0.20%
CcC2	Cataula sandy clay loam, 6 to 10 percent slopes, eroded	585.6	1.20%
CeB	Cecil sandy loam, 2 to 6 percent slopes	142.4	0.30%
CnB2	Cecil sandy clay loam, 2 to 6 percent slopes, eroded	528.8	1.10%
CnC2	Cecil sandy clay loam, 6 to 10 percent slopes, eroded	1073.0	2.20%
Cw	Chewacla loam, 0 to 2 percent slopes, frequently flooded	1812.6	3.70%
DuB	Durham loamy sand, 2 to 6 percent slopes	31.2	0.10%
HaB	Helena sandy loam, 2 to 6 percent slopes	41.3	0.10%
HsB	Hiwassee sandy loam, 2 to 6 percent slopes	796.5	1.60%
HsC	Hiwassee sandy loam, 6 to 10 percent slopes	274.9	0.60%
HwB2	Hiwassee sandy clay loam, 2 to 6 percent slopes, eroded	1226.0	2.50%
HwC2	Hiwassee sandy clay loam, 6 to 10 percent slopes, eroded	1962.1	4.00%
IdB	Iredell fine sandy loam, 1 to 6 percent slopes	44.4	0.10%
MaB	Madison sandy loam, 2 to 6 percent slopes	445.7	0.90%
MdC2	Madison sandy clay loam, 6 to 10 percent slopes, eroded	546.9	1.10%
MdE2	Madison sandy clay loam, 10 to 25 percent slopes, eroded	1820.9	3.70%
MeB	Mecklenburg fine sandy loam, 2 to 6 percent slopes	179.2	0.40%
MkC2	Mecklenburg sandy clay loam, 6 to 10 percent slopes, eroded	140.2	0.30%
PaE	Pacolet sandy loam, 10 to 25 percent slopes	4007.4	8.10%
RnF	Rion loamy sand, 15 to 40 percent slopes	486.8	1.00%
To	Toccoa loam	1041.5	2.10%
UD	Udorthents, loamy and clayey	51.8	0.10%
VnC2	Vance sandy clay loam, 6 to 10 percent slopes, eroded	22.9	0.00%
W	Water	862.0	1.70%
WaD	Wateree-Rion complex, 6 to 15 percent slopes	21.7	0.00%
WaF	Wateree-Rion complex, 15 to 40 percent slopes	188.5	0.40%
WkD	Wilkes sandy loam, 6 to 15 percent slopes	704.4	1.40%
WkF	Wilkes sandy loam, 15 to 40 percent slopes	1189.7	2.40%

Fairfield County, South Carolina (SC039)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
WnB	Winnsboro sandy loam, 2 to 6 percent slopes	12.6	0.00%
WnC	Winnsboro sandy loam, 6 to 10 percent slopes	375.0	0.80%
WnE	Winnsboro sandy loam, 10 to 25 percent slopes	233.8	0.50%
Subtotals for Soil Survey Area		**21204.0**	**42.80%**

Newberry County, South Carolina (SC071)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1B	Appling loamy sand, 2 to 7 percent slopes	6.8	0.00%
5A	Cartecay sandy loam, 0 to 2 percent slopes, occasionally flooded	2.3	0.00%
8C2	Cataula sandy clay loam, 7 to 15 percent slopes, moderately eroded	9.2	0.00%
10B	Cecil sandy loam, 2 to 7 percent slopes	10.7	0.00%
11B2	Cecil sandy clay loam, 2 to 7 percent slopes, moderately eroded	425.1	0.90%
11C2	Cecil sandy clay loam, 7 to 15 percent slopes, moderately eroded	595.2	1.20%
12C3	Cecil clay loam, 7 to 15 percent slopes, severely eroded	1.0	0.00%
13A	Chenneby silt loam, 0 to 2 percent slopes, occasionally flooded	47.8	0.10%
15A	Shellbluff silty clay loam, 0 to 2 percent slopes, occasionally flooded	124.7	0.30%
23B2	Winnsboro sandy clay loam, 2 to 7 percent slopes, moderately eroded	11.6	0.00%
23C2	Winnsboro sandy clay loam, 7 to 15 percent slopes, moderately eroded	40.5	0.10%
23D2	Winnsboro sandy clay loam, 15 to 25 percent slopes, moderately eroded	50.6	0.10%
28B	Santuc loamy coarse sand, 2 to 7 percent slopes	18.8	0.00%
28C	Santuc loamy coarse sand, 7 to 15 percent slopes	38.2	0.10%
32B2	Hiwassee sandy clay loam, 2 to 7 percent slopes, moderately eroded	27.6	0.10%
40B	Mecklenburg sandy loam, 2 to 7 percent slopes	9.8	0.00%
41C2	Mecklenburg sandy clay loam, 7 to 15 percent slopes, moderately eroded	3.7	0.00%
44D2	Pacolet sandy clay loam, 15 to 25 percent slopes, moderately eroded	190.3	0.40%
44E3	Pacolet sandy clay loam, 25 to 50 percent slopes, moderately eroded	45.7	0.10%

Fairfield County, South Carolina (SC039)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
45E4	Pacolet clay loam, 25 to 50 percent slopes, severely eroded	22.6	0.00%
47C2	Rion sandy loam, 7 to 15 percent slopes, moderately eroded	70.6	0.10%
47D2	Rion sandy loam, 15 to 25 percent slopes, moderately eroded	275.1	0.60%
47E3	Rion sandy loam, 25 to 50 percent slopes, moderately eroded	98.0	0.20%
49A	Toccoa sandy loam, 0 to 2 percent slopes, occasionally flooded	60.4	0.10%
60D2	Wilkes sandy loam, 15 to 25 percent slopes, moderately eroded	2.5	0.00%
CcA	Cartecay sandy loam, 0 to 2 percent slopes, frequently flooded	6.3	0.00%
CdB2	Cataula sandy loam, 2 to 6 percent slopes, moderately eroded	5.3	0.00%
CdC2	Cataula sandy loam, 6 to 10 percent slopes, moderately eroded	1.0	0.00%
CeB	Cecil sandy loam, 2 to 6 percent slopes	35.6	0.10%
CfB2	Cecil sandy clay loam, 2 to 6 percent slopes, moderately eroded	6417.6	13.00%
CfC2	Cecil sandy clay loam, 6 to 10 percent slopes, moderately eroded	2685.9	5.40%
CfD2	Cecil sandy clay loam, 10 to 15 percent slopes, moderately eroded	2.8	0.00%
CnA	Chenneby silt loam, 0 to 2 percent slopes, frequently flooded	1536.0	3.10%
CyA	Chenneby silt loam, 0 to 2 percent slopes, ponded	275.0	0.60%
HaB	Hard Labor sandy loam, 2 to 6 percent slopes	1977.9	4.00%
HaC	Hard Labor sandy loam, 6 to 10 percent slopes	846.6	1.70%
HeB	Helena sandy loam, 2 to 6 percent slopes	605.0	1.20%
HeC	Helena sandy loam, 6 to 10 percent slopes	211.1	0.40%
HwB2	Hiwassee sandy loam, 2 to 6 percent slopes, moderately eroded	1.0	0.00%
MeB2	Mecklenburg sandy clay loam, 2 to 6 percent slopes, moderately eroded	2.3	0.00%
MeC2	Mecklenburg sandy clay loam, 6 to 10 percent slopes, moderately eroded	25.5	0.10%
PaD2	Pacolet sandy clay loam, 10 to 15 percent slopes, moderately eroded	419.5	0.80%
PaE2	Pacolet sandy clay loam, 15 to 25 percent slopes, moderately eroded	1303.2	2.60%
PaF2	Pacolet sandy clay loam, 25 to 50 percent slopes, moderately eroded	166.5	0.30%

Fairfield County, South Carolina (SC039)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
PcC3	Pacolet clay loam, 6 to 10 percent slopes, severely eroded	1.2	0.00%
PmB	Prosperity-Bush River-Helena complex, 2 to 6 percent slopes	21.2	0.00%
PmC	Prosperity-Bush River-Helena complex, 6 to 10 percent slopes	197.8	0.40%
RnC2	Rion sandy loam, 6 to 10 percent slopes, moderately eroded	101.2	0.20%
RnD2	Rion sandy loam, 10 to 15 percent slopes, moderately eroded	209.7	0.40%
RnE2	Rion sandy loam, 15 to 25 percent slopes, moderately eroded	1145.5	2.30%
RnF2	Rion sandy loam, 25 to 50 percent slopes, moderately eroded	351.8	0.70%
SaB	Santuc loamy coarse sand, 2 to 6 percent slopes	79.8	0.20%
SaC	Santuc loamy coarse sand, 6 to 10 percent slopes	120.0	0.20%
ShA	Shellbluff silty clay loam, 0 to 2 percent slopes, frequently flooded	70.0	0.10%
ToA	Toccoa sandy loam, 0 to 3 percent slopes, frequently flooded	881.7	1.80%
W	Water	2056.2	4.20%
WnB	Winnsboro sandy loam, 2 to 6 percent slopes	244.6	0.50%
WwD2	Wynott-Wilkes complex, 10 to 15 percent slopes, moderately eroded	241.8	0.50%
WwE2	Wynott-Wilkes complex, 15 to 25 percent slopes, moderately eroded	804.5	1.60%
WyB2	Wynott-Winnsboro complex, 2 to 6 percent slopes, moderately eroded	1100.1	2.20%
WyC2	Wynott-Winnsboro complex, 6 to 10 percent slopes, moderately eroded	1948.4	3.90%
Subtotals for Soil Survey Area		**28288.3**	**57.20%**
Totals for Area of Interest		**49492.2**	**100.00%**

Source (NRCS 2014)

FIGURE 4-4 SOILS SURROUNDING THE PROJECT AREA OF INTEREST

Source (NRCS, 2014)

Most of the Project area consists of gradual slopes ranging from 0 percent to 15 percent, as depicted in Figure 4-5.

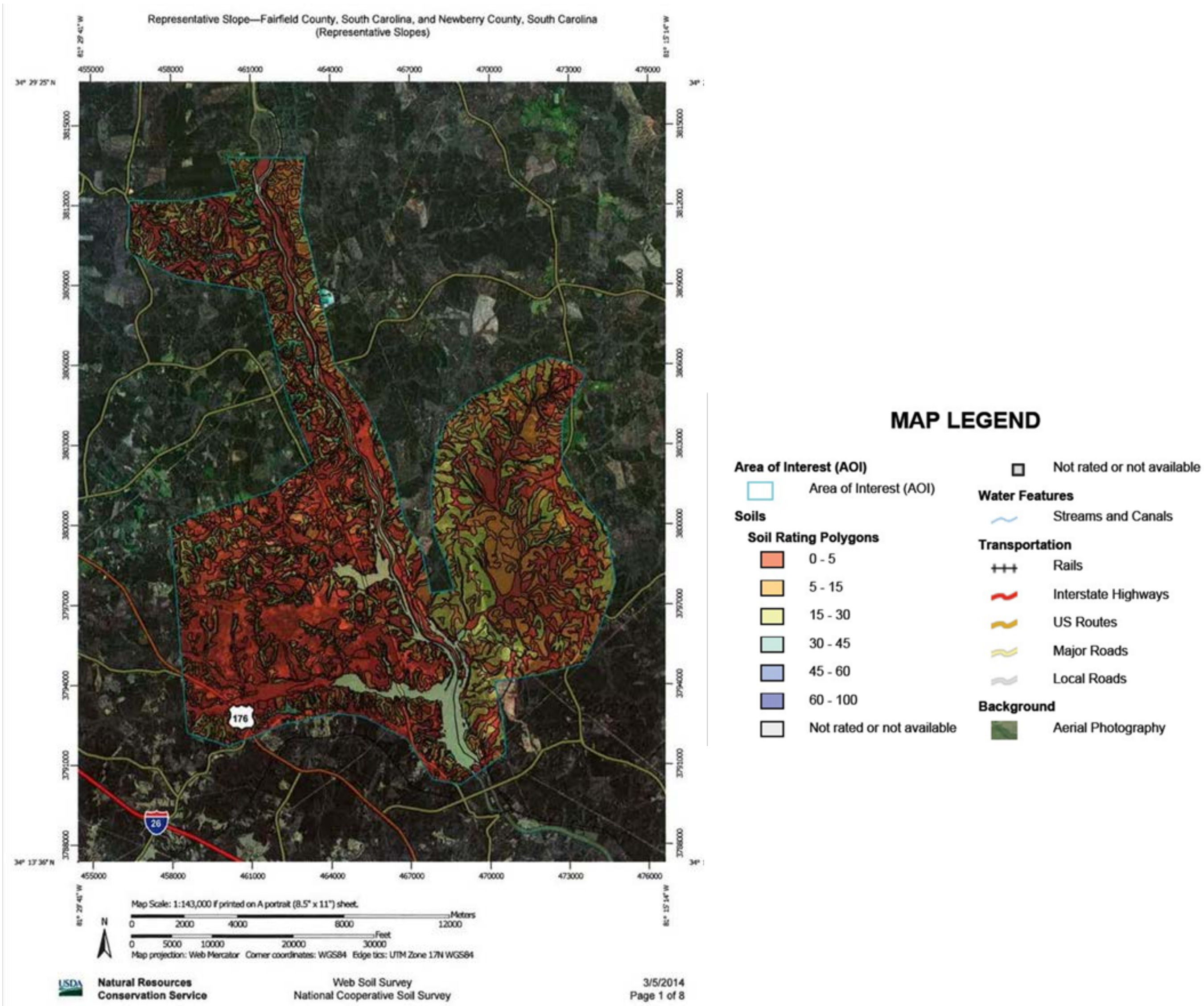


FIGURE 4-5 REPRESENTATIVE SLOPE RATINGS WITHIN THE PROJECT AREA OF INTEREST
(NRCS, 2014)

The shorelines within the Project area are subject to anthropogenic disturbances, including roadways near the waterline and structures to support recreational and Project-related activities. Shorelines surrounding Project structures are armored with concrete embankments and rip-rap. Vegetation surrounding the Project area varies, but forested shorelines are the most prevalent feature throughout most of the landscape. The eastern shoreline area of the Monticello Reservoir is more developed compared to that of the remaining Project shoreline and has less forested area and more homes with grassy lawns.

4.3.2 ENVIRONMENTAL EFFECTS

4.3.2.1 COMPLETED STUDIES

PARR RESERVOIR EROSION MONITORING SURVEYS

The shoreline of Parr Reservoir is monitored annually for erosion by SCE&G. Parr Reservoir was last surveyed in May of 2016 using standards developed by SCE&G. Areas of erosion were identified and classified into one of three categories; slight, moderate, or severe. Results of the May 2016 survey is located in Table 4-2 (Stoudemire 2016b). An illustration of the shoreline erosion is located in Figure 4-6 (Stoudemire 2016b).

TABLE 4-2 EROSION AT PARR RESERVOIR IN MAY 2016

Erosion	Amount of Erosion (ft.)	Amount Shoreline Eroded (%)
Slight	381,723 ft.	94.5%
Moderate	7,402 ft.	1.6%
Severe	0 ft.	0%
Total	389,125 ft.	96.5%

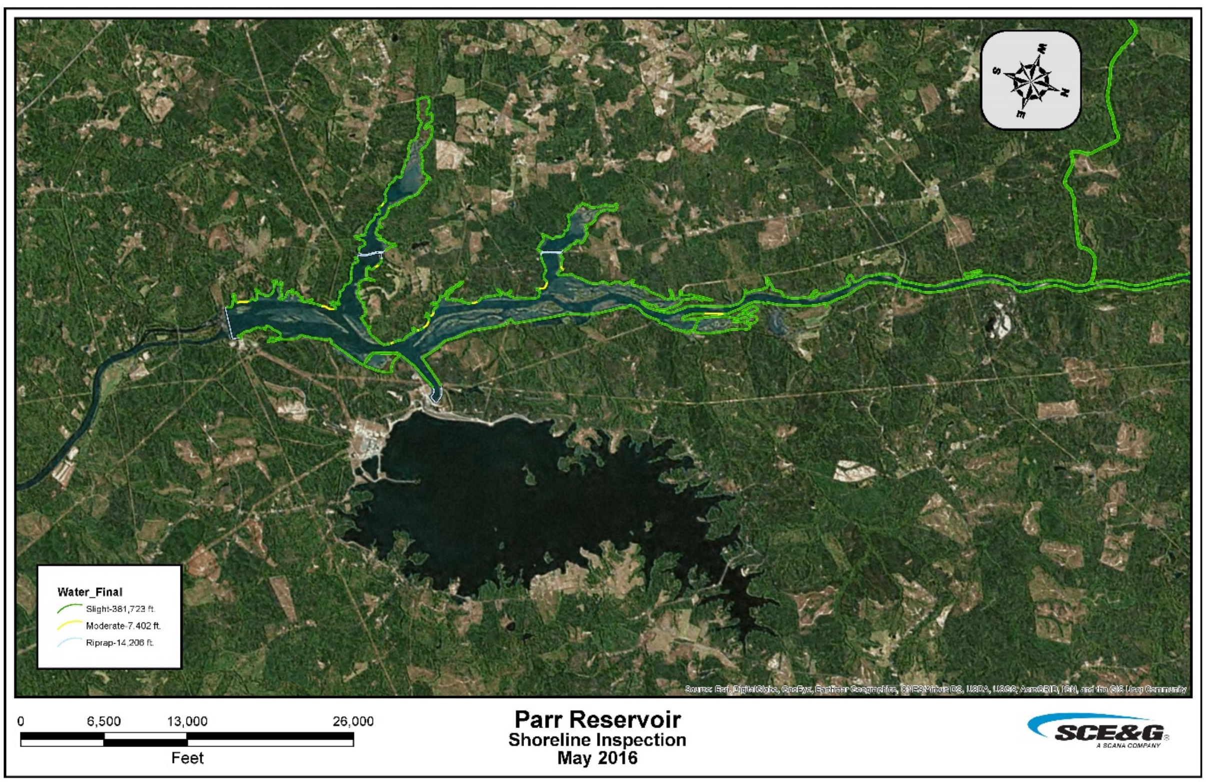


FIGURE 4-6 EROSION AT PARR RESERVOIR IN MAY 2016

During the 2016 survey, no areas were identified as needing corrective action (Stoudemire 2016b). The surveys noted that the backwater shoreline as well as the main-stem shoreline is well vegetated, protecting the shorelines from significant erosion due to plant operations. SCE&G will continue their annual monitoring of Parr Reservoir for erosion consistent with previous surveys.

MONTICELLO RESERVOIR EROSION MONITORING SURVEYS

The shoreline of Monticello Reservoir is monitored bi-annually for erosion by SCE&G. Monticello Reservoir was last surveyed in May and October of 2016 using standards developed by SCE&G. Areas of erosion were identified and classified into one of three categories: slight, moderate, or severe. Results of the May and October 2016 surveys are included in Table 4-3 and Table 4-4 (Stoudemire; 2016a, 2016c). Illustrations of shoreline erosion from these surveys are shown in Figure 4-7 and Figure 4-8 (Stoudemire; 2016a, 2016c).

TABLE 4-3 EROSION AT MONTICELLO RESERVOIR IN MAY 2016

Erosion	Amount of Erosion (ft.)	Amount Shoreline Eroded (%)
Slight	145,633 ft.	64.8%
Moderate	37,779 ft.	16.8%
Severe	8,140 ft.	3.6%
Total	191,552 ft.	85.3%

TABLE 4-4 EROSION AT MONTICELLO RESERVOIR IN OCTOBER 2016

Erosion	Amount of Erosion (ft.)	Amount Shoreline Eroded (%)
Slight	124,880 ft.	55.6%
Moderate	47,050 ft.	20.1%
Severe	19,670 ft.	8.8%
Total	191,600 ft.	85.3%

FIGURE 4-7 EROSION AT MONTICELLO RESERVOIR IN MAY 2016

FIGURE 4-8 EROSION AT MONTICELLO RESERVOIR IN OCTOBER 2016

There was a slight shift in the amount and severity of shoreline affected by erosion in May and October 2016. There were isolated areas identified that were marked as requiring corrective action. It was noted in the October 2016 report that the erosion occurring has been in depth, slowly advancing in the direction of the PBL (Stoudemire). SCE&G will continue their bi-annual monitoring of Monticello Reservoir for erosion consistent with previous surveys.

4.3.2.2 PROPOSED ACTION

The fluctuations of Parr Reservoir and Monticello Reservoir caused by the operation of the Fairfield Development do contribute to some localized shoreline erosion and siltation in each reservoir. The Applicant currently monitors the shoreline of Parr and Monticello reservoirs regularly for signs of erosion as part of their Dam Safety, Surveillance and Monitoring Report. SCE&G has developed a formal Erosion Monitoring Plan based on their existing program, which is included in Appendix D.

4.3.3 Environmental Effects – No Action Alternative

Under the No Action alternative, conditions would remain as they presently exist under the current license. Shoreline erosion and siltation on both reservoirs related to Project fluctuations would likely continue at their current levels. There would be localized limited negative impacts on shoreline areas. Mitigation of erosion by SCE&G would continue as part of their Dam Safety, Surveillance and Monitoring Report and the Erosion Monitoring Plan.

4.3.4 Unavoidable Adverse Effects

Reservoir fluctuations, wave, and wind action will continue to have adverse impacts on erodible soils around the shoreline areas and siltation within the reservoirs. Continued mitigation and armoring of these areas by SCE&G would likely reduce the extent of these continuing adverse impacts.

4.3.5 References

Griffith, G.E., Omernik, J.M., Comstock, J.A., Schafale, M.P., McNab, W.H., Lenat, D.R., MacPherson, T.F., Glover, J.B., and Shelburne, V.B., 2002, Ecoregions of North Carolina and South Carolina, (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,500,000).

South Carolina Department of Natural Resources (SCDNR). 2014. Piedmont Ecoregion Aquatic Habitats. [Online] URL:https://www.dnr.sc.gov/cwcs/pdf/habitat/PiedmontAquatic.pdf Accessed on February 27, 2014.

Stoudemire, Chad. 2016a. “FERC Project No. 1894 Fairfield Pumped Storage Facility Monticello Reservoir Routine Shoreline Surveillance.” Memo. SCE&G. Columbia, SC. May 28, 2016.

Stoudemire, Chad. 2016b. “Parr Hydroelectric Project Annual Shoreline Inspection FERC Project No. 1894-01.” Memo. SCE&G. Columbia, SC. May 31, 2016.

Stoudemire, Chad. 2016c. “FERC Project No. 1894 Fairfield Pumped Storage Facility Monticello Reservoir Routine Shoreline Surveillance.” Memo. SCE&G. Columbia, SC. October 18, 2016.

The Encyclopedia of Earth (EOE). 2014. Ecoregions of North Carolina and South Carolina (EPA). [Online] URL: http://www.eoearth.org/view/article/152148/ Accessed on February 27, 2014.

U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS). 2014. Web Soil Survey. [Online] URL: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx Accessed March 4, 2014.

4.4 WATER RESOURCES

The Project consists of two developments including the Parr Development and the Fairfield Development. Parr Reservoir is formed by the Broad River and Parr Shoals Dam and serves as the lower reservoir for the Fairfield Development. Monticello Reservoir is formed by a series of four earthen dams that serves as the upper reservoir for the Fairfield Development.

4.4.1 AFFECTED ENVIRONMENT

4.4.1.1 WATER QUANTITY

Parr Reservoir has a surface area of approximately 4,400 acres and a total storage capacity of approximately 32,000 acre-feet. Monticello Reservoir has a surface area of approximately 6,800 acres with a total storage capacity of approximately 400,000 acre-feet. The drainage area for the Parr Development is 4,750 square miles, and the drainage area for the Fairfield Development is 15 square miles.

The monthly mean, minimum and maximum flows for the Project are listed below. Flows are recorded downstream of the Project (USGS 02161000 Broad River at Alston) as total releases, and therefore evaporation that occurs from the reservoirs is already accounted for in the statistics.

TABLE 4-5 MONTHLY MEAN, MAXIMUM AND MINIMUM DATA FOR THE USGS GAGE AT ALSTON (02161000), FOR WATER YEARS 1981-2015, BY WATER YEAR (WY) (IN CUBIC FEET PER SECOND)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Mean	3,504	3,973	5,715	7,252	7,722	8,862	6,682	4,926	3,715	3,125	3,412	2,703
Max	17,360	14,499	14,190	17,790	16,960	21,560	18,040	14,829	8,909	12,440	10,210	14,740
(WY)	(1991)	(1993)	(2010)	(1993)	(1990)	(1993)	(2003)	(2003)	(2003)	(2013)	(1995)	(2004)
Min	638	725	1,251	2,106	1,985	3,170	2,821	1,782	763	600	546	624
(WY)	(2008)	(2008)	(2008)	(2011)	(2009)	(2006)	(2012)	(2001)	(2008)	(2008)	(2002)	(2007)

Source: USGS, 2016

Private development around the Parr and Fairfield developments is minimal and generally consists of rural communities (FERC, 2011). The primary use of Project waters, excluding hydropower, is for a cooling water system at the V.C. Summer Nuclear Station Unit 1. SCE&G applied for a renewal of its National Pollutant Discharge Elimination System (NPDES) permit for V.C. Summer Nuclear Station Unit 1 and the new permit was issued on May 7, 2014 (effective June 1, 2014). 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 (SCE&G, 2012). Approximately 1,190 cfs is withdrawn and returned to Monticello Reservoir through this once-through operation.

SCE&G is expanding their V. C. Summer Nuclear Station with the construction of units 2 and 3 (NRC 2012) and (137 FERC ¶ 62,033, issued October 12, 2011). Once these units are online, there will be a daily withdrawal of 83 cfs from Monticello Reservoir for use in the cooling towers. Sixty-two cfs will be lost through evaporation and drift, and a daily discharge of 21 cfs will be released into Parr Reservoir (NRC 2010).

The existing Project license requires a minimum flow release into the Broad River from the Parr Development of 1,000 cubic feet per second (cfs), or the average daily natural inflow into the Parr Reservoir, whichever is the lesser amount, during the months of March, April, and May. During all other months of the year the license requires a minimum flow of 150 cfs and a minimum daily average flow of 800 cfs, or the daily natural inflow into Parr Reservoir, whichever is the lesser amount (FERC, 2011). Existing minimum flows are designed to protect instream flow uses of the Broad River, which include recreation, navigation, and aquatic resources.

4.4.1.2 Water Quality

Project waters are classified as freshwater (FW), which SCDHEC identifies as; suitable for primary and secondary contact recreation and as a source for drinking water supply after conventional treatment in accordance with SCDHEC requirements; suitable for fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora; and suitable for industrial and agricultural uses. Table 4-6 and Table 4-7 list the SCDHEC water quality standards applicable to Project waters (SCDHEC, 2012).

Table 4-6 SCDHEC Water Quality Standards for Freshwaters

Parameter[1]	Standard
Temperature	The water temperature of all freshwaters which are free flowing shall not be increased more than 5°F (2.8°C) 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 as provided in C.12. Has been established, a mixing zone as provided in C.10. Has been established, or a Section 316(a) determination under the Federal Clean Water Act has been completed.
pH	Between 6.0 and 8.5
Dissolved oxygen	Daily average not less than 5.0mg/l with a low of 4.0 mg/l

PARAMETER[1]	STANDARD
Turbidity (reservoirs only)	Not to exceed 25 NTUs provided existing uses are maintained
Turbidity (excluding reservoirs)	Not to exceed 50 NTUs provided existing uses are maintained
E. coli	Not to exceed a geometric mean of 126/100 ml based on at least four samples collected from a given sampling site over a 30 day period, nor shall a single sample maximum exceed 349/100 ml.
Garbage, cinders, ashes, oils, sludge, or other refuse	None allowed.
Treated wastes, toxic wastes, deleterious substances, colored or other wastes except garbage, cinders, ashes, oils, sludge, or other refuse	None alone or in combination with other substances or wastes in sufficient amounts to make the waters unsafe or unsuitable for primary contact recreation or to impair the waters for any other best usage as determined for the specific waters which are assigned to this class.
Stormwater, and other nonpoint source runoff, including that from agricultural uses, or permitted discharge from aquatic farms, concentrated aquatic animal production facilities, and uncontaminated groundwater from mining.	Allowed if water quality necessary for existing and classified uses shall be maintained and protected consistent with anti-degradation rules.

[1]Water quality standards for toxic pollutants can be found in Section E and the appendix of the SCDHEC R. 61-68, Water Classifications & Standards

Source: SCDHEC, 2012

TABLE 4-7 SCDHEC NUTRIENT STANDARDS FOR WATERS IN THE PIEDMONT AND SOUTHEASTERN PLAINS ECOREGIONS1

PARAMETER	STANDARD
Total nitrogen	≤1.50 mg/l
Total phosphorus	≤0.06 mg/l
Chlorophyll *a*	≤40 ug/l

[1]Listed are the nutrient standards for lakes and reservoirs. Currently, there are no nutrient standards for streams and rivers.

Source: SCDHEC, 2012

SCDHEC has also identified several "core indicator" metals considered to be essential for indicating the ability of a body of water to support aquatic life:

- cadmium
- chromium
- copper
- lead
- mercury
- nickel
- zinc

Federal and state water quality standards for the state of South Carolina are guided through implementation of Sections 303(d) and 305(b) of the Clean Water Act (CWA). The CWA directs individual states to monitor and report on the condition of their water resources. SCDHEC is charged with monitoring water quality for the state. Pursuant to section 305(b) of the CWA, the SCDHEC prepares a biennial integrated report on its assessment of the condition of water quality and water pollution control programs. It also publishes a companion document containing a list of waters impaired, as required by section 303(d) (SCDHEC, 2016a, 2016b). Water bodies not meeting standards are included on South Carolina's list of water bodies impaired as required by section 303(d). South Carolina has a program for water bodies listed as impaired that establishes total maximum daily loads (TMDLs) (which includes point and non-point sources and controls) that are managed through the NPDES permitting program, with the objective of bringing water quality to within set criteria.

In the 2014 303(d) list for the state of South Carolina, several point locations in both Parr and Monticello reservoirs were listed as impaired. SCDHEC lists point locations based on water quality sampling stations but specifies that the impairment is considered to extend to the surrounding waters upstream and downstream of the sampling station. Table 4-8 lists the impaired waters in the Project area along with the cause for the impaired listing (SCDHEC, 2016a). Figure 4-9 is a map of the SCDHEC monitoring stations at the Project.

TABLE 4-8 SCDHEC MONITORING STATIONS LISTED AS IMPAIRED WITHIN THE PROJECT BOUNDARY AND DOWNSTREAM OF PARR SHOALS DAM

STATION	LOCATION	USE	CAUSE FOR IMPAIRMENT LISTING	TARGET YEAR FOR TMDL DEVELOPMENT
B-327	Monticello Lake[1] - lower impoundment between large islands	Aquatic life	pH	2019
RL-04370	Monticello Lake- 1.7 miles northwest of Monticello	Aquatic life	pH	2019
RL-04374	Monticello Lake- 3.5 miles north of Jenkinsville	Aquatic life	pH	2019
B-346 (inactive site)	Parr Reservoir- 4.8 kilometers north of dam, upstream Monticello Lake	Aquatic life	Total phosphorus	2019
RL-12049	Parr Reservoir approx 0.7 mi NNW OF B-346 and approx 0.9 mi SE of mouth of Hellers Creek	Aquatic life	Total phosphorus	2019
B-236 (inactive site)	Broad River at So. Railroad Trestle, 0.5 miles downstream of SC213	Aquatic Life	Copper	2020

STATION	LOCATION	USE	CAUSE FOR IMPAIRMENT LISTING	TARGET YEAR FOR TMDL DEVELOPMENT
B-151	Hellers Creek at SR 97	Aquatic Life	Bio (macroinvertebrate)	2017

[1]SCDHEC defines a lake as any water of the State that is a freshwater pond, reservoir, impoundment, or similar body of water located wholly or partially within the state (SCDHEC, 2012). Therefore, SCDHEC classifies Monticello Reservoir as a lake.

Source: SCDHEC, 2016a

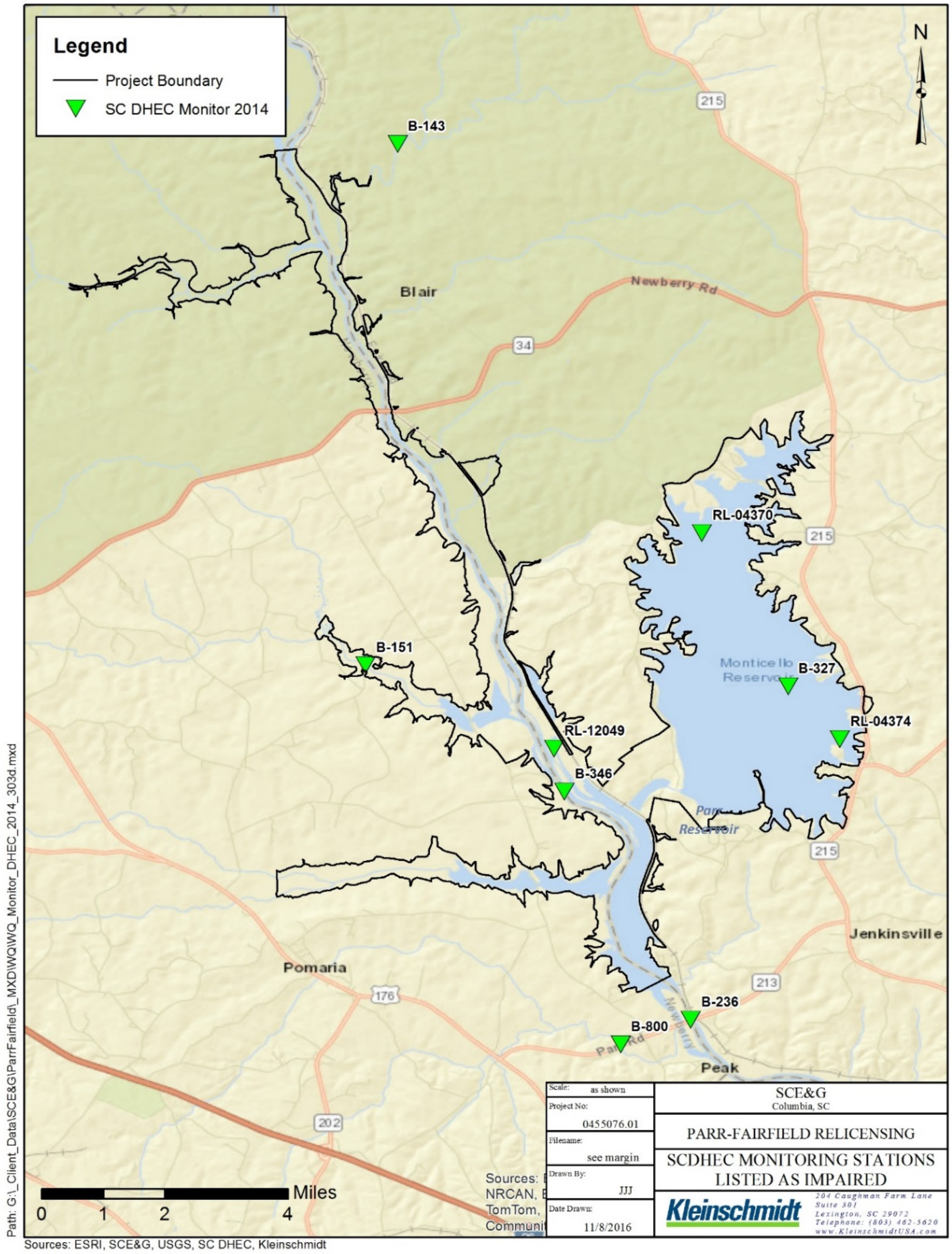


FIGURE 4-9 SCDHEC MONITORING STATIONS WITHIN THE PROJECT BOUNDARY AT PARR RESERVOIR

In January 2014, SCE&G prepared a Baseline Water Quality Report in anticipation of relicensing the Project. The report used existing water quality data available for the waters associated with the Project to establish a water quality baseline for the Project and identify any water quality trends that may be associated with Project operations. The report focused on the following indicators of water quality:

- dissolved oxygen
- conductivity
- pH
- turbidity
- nitrogen and phosphorus
- chlorophyll *a*
- metals

The Baseline Water Quality Report included a detailed analysis of the water quality data and was filed with FERC on January 5, 2015 as part of the PAD.

The Baseline Water Quality Report included analysis of upstream and downstream waters associated with the Project along with the Project waters and concluded that Project operations could affect water quality below Parr Shoals Dam (Kleinschmidt 2014). At the Water Quality TWC meeting on February 4, 2014, the TWC noted that the Baseline Water Quality Report identified period excursions of DO levels below 4.0 mg/l in the Parr Shoals Dam tailrace, as reported by the USGS station 02160991. The TWC agreed that SCE&G would consolidate historic USGS data to examine those excursions and provide any operations that might be associated with the data. DO, temperature and river flow data from 2004 through 2013 were consolidated from the following USGS stations: USGS 02160991 Broad River near Jenkinsville, SC, USGS 02156500 Broad River near Carlisle, SC, USGS 02160700 Enoree River at Whitmire, SC, USGS 02160105 Tyger River near Delta, SC. Review of the data verified that there are periodic excursions of DO levels less than 4.0 mg/L at the Jenkinsville gage. These events were not consistent from year to year and did not typically have a long duration. Table 4-9 illustrates a typical excursion event in the Parr Shoals Dam tailrace.

TABLE 4-9 PARR SHOALS DAM TAILRACE TYPICAL DO EXCURSION: JULY 2010

DATE	TIME	DO (MG/L)	TEMPERATURE (°C)	FLOW (CFS)
7/19/2010	9:00 pm	4.3	29.5	901
7/19/2010	10:00 pm	4.0	29.4	901
7/19/2010	11:00 pm	3.7	29.4	901
7/20/2010	12:00 am	3.9	29.3	901
7/20/2010	1:00 am	3.8	29.3	901
7/20/2010	2:00 am	3.8	29.2	888
7/20/2010	3:00 am	3.7	29.2	875
7/20/2010	4:00 am	3.6	29.1	863
7/20/2010	5:00 am	3.3	29.1	863
7/20/2010	6:00 am	3.7	29.0	838
7/20/2010	7:00 am	4.0	29.1	838
7/20/2010	8:00 am	4.5	29.2	825

Source: Kleinschmidt 2014

4.4.2 ENVIRONMENTAL EFFECTS

4.4.2.1 WATER QUANTITY – COMPLETED STUDIES

SCE&G did not conduct any studies directly relating to water quantity at the Project. However, the IFIM study, which is discussed in detail in the Fisheries Resources Section 4.5.2.1, will determine new minimum flows.

4.4.2.2 WATER QUANTITY - PROPOSED ACTION

Upon issuance of the new license, SCE&G will begin releases of the newly identified minimum flows, as determined through the IFIM study. This will result in more consistent flows for the protection of aquatic resources and enhancement of recreation and navigation downstream of the Project. In addition, SCE&G will implement the updated shoreline management plans for both reservoirs. This will allow SCE&G to continue to monitor and regulate water withdrawals, thus protecting the resource.

4.4.2.3 WATER QUALITY - COMPLETED STUDIES

In comments received on the PAD, the USFWS indicated a concern over water quality in Parr and Monticello reservoirs, as well as immediately downstream of the Project. Additionally, prior to the filing of the PAD during early consultation with stakeholders, SCDNR indicated a concern over water quality in the west channel area of the Broad River, immediately downstream of the Project. In a response to these concerns, SCE&G conducted several studies to examine water quality in the Parr Shoals Dam forebay and tailrace and in the west channel downstream of the dam. These studies resulted in the creation of the Turbine Venting Plan and PM&E measures for the west channel area.

PARR SHOALS DAM FOREBAY AND TAILRACE WATER QUALITY STUDIES

In June of 2011, the USGS installed a new sensor at the Jenkinsville Gage (station 02160991). From January 2011 through December 2014, there were approximately 13 hourly excursions in DO below the 4.0 mg/l SCDHEC standard, which is approximately 0.04 percent of that period of time. At the request of the Water Quality TWC, SCE&G collected additional water quality data in the tailrace and forebay of Parr Shoals Dam from July to September 2014 in an attempt to determine whether project operations were causing these excursions, and if so, how SCE&G might prevent them from occurring. SCE&G collected temperature and DO data at seven sites along the downstream face of the Parr Shoals Dam, adjacent to the USGS station 02160991, and at a location approximately 400 feet downstream of Parr Shoals Dam. Data was collected on a weekly basis, three times per day including one hour before sunrise, at sunrise, and one hour after sunrise. To see if unit location had an effect on DO, the turbine(s) running during collections and the number of lowered crest gates was also recorded. Results from this effort can be found in Table 4-10 (Kleinschmidt 2015).

TABLE 4-10 DISSOLVED OXYGEN DATA AT USGS STATION 02160991 AND PARR SHOALS TAILRACE JULY – SEPTEMBER 2014

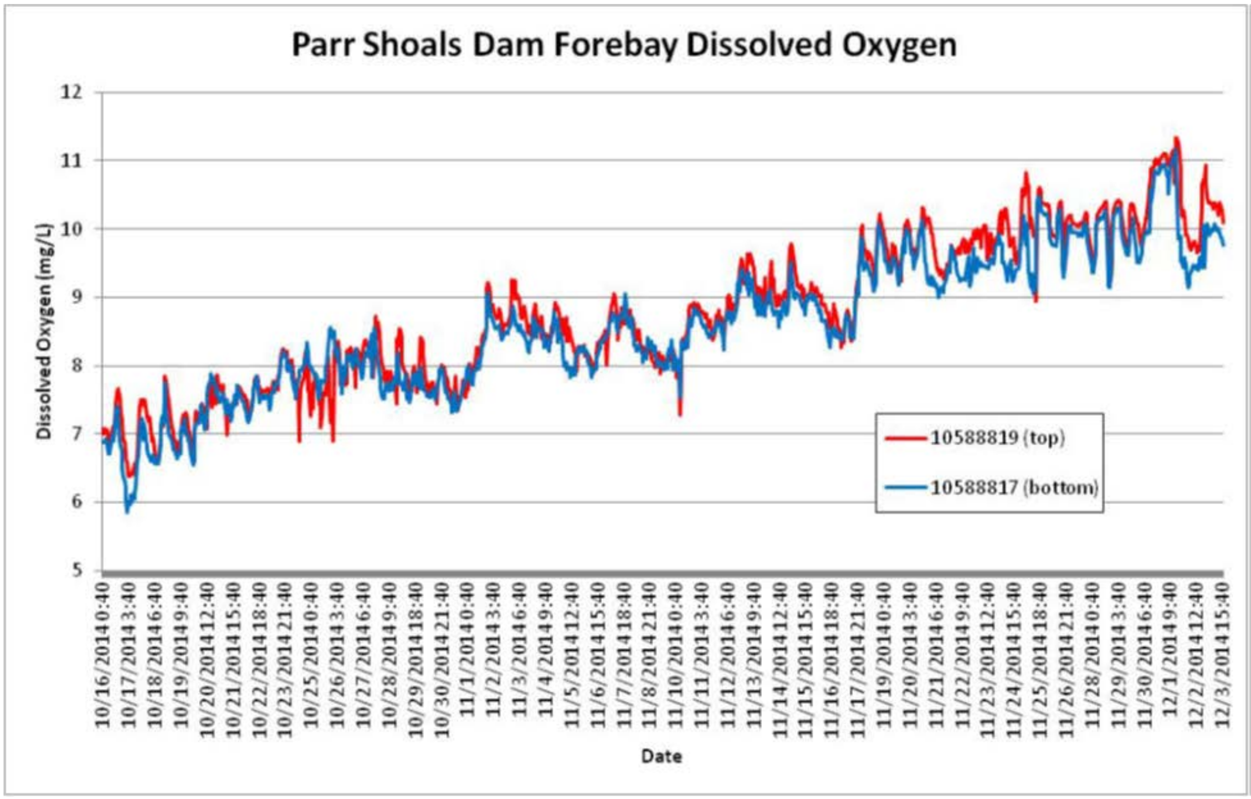
	USGS DATA		SCE&G DATA	
DATE	TIME	DO MG/L	TIME	DO MG/L
7/2/14	5:00 AM	6.2	5:35 AM	6.12
	6:00 AM	6.0	6:37 AM	5.95
	7:00 AM	6.0	7:42 AM	5.86
	8:00 AM	6.0		
7/10/14	5:00 AM	6.0	5:32 AM	6.24
	6:00 AM	5.9	6:27 AM	6.16
	7:00 AM	5.7	7:33 AM	6.08
	8:00 AM	5.5		
7/15/14	5:00 AM	5.5	5:34 AM	5.62
	6:00 AM	5.4	6:32 AM	5.32
	7:00 AM	4.9	7:42 AM	4.91
	8:00 AM	5.0		
7/24/14	5:00 AM	5.2	5:41 AM	5.15
	6:00 AM	5.2	6:51 AM	5.03
	7:00 AM	5.1	7:50 AM	5.49
	8:00 AM	5.3		
7/31/14	5:00 AM	5.8	5:43 AM	5.66
	6:00 AM	5.7	6:42 AM	5.55
	7:00 AM	5.7	7:54 AM	5.53
	8:00 AM	5.7		
8/7/14	5:00 AM	6.0	5:39 AM	5.90
	6:00 AM	6.0	6:48 AM	5.84
	7:00 AM	5.9	7:49 AM	5.74
	8:00 AM	5.9		
8/13/14	5:00 AM	5.9	5:30 AM	5.83

Date	USGS Data		SCE&G Data	
	Time	DO mg/l	Time	DO mg/l
	6:00 AM	5.9	6:33 AM	5.86
	7:00 AM	5.9	7:33 AM	5.83
	8:00 AM	5.9		
8/20/14	5:00 AM	5.8	5:48 AM	5.90
	6:00 AM	5.8	6:46 AM	5.97
	7:00 AM	5.7	7:56 AM	5.86
	8:00 AM	5.7		
8/26/14	5:00 AM	6.3	5:41 AM	6.26
	6:00 AM	6.4	6:51 AM	6.51
	7:00 AM	6.4	7:48 AM	6.35
	8:00 AM	6.3		
9/3/14	5:00 AM	5.7	5:29 AM	6.02
	6:00 AM	5.8	6:40 AM	5.73
	7:00 AM	5.4	7:53 AM	5.46
	8:00 AM	5.4		
9/10/14	6:00 AM	5.6	6:30 AM	5.62
	7:00 AM	5.7	7:46 AM	5.78
	8:00 AM	5.7	8:46 AM	5.71
	9:00 AM	5.7		
9/16/14	6:00 AM	5.0	6:22 AM	4.94
	7:00 AM	5.0	7:24 AM	4.98
	8:00 AM	5.0	8:24 AM	4.92
	9:00 AM	5.0		
9/25/14	6:00 AM	7.3	6:33 AM	7.10
	7:00 AM	7.3	7:34 AM	7.65
	8:00 AM	7.3	8:29 AM	7.62
	9:00 AM	7.3		

Source: Kleinschmidt 2015

SCE&G collected data in the tailrace for two main reasons: (1) to verify the accuracy of the USGS Jenkinsville gage and (2) to determine if DO could be correlated to an early morning DO sag or related to which turbine units were running at the time of data collection. During the sampling period, DO levels consistently stayed above 4.0 mg/l. No excursions were recorded by SCE&G or on the USGS gage. Data collected by SCE&G at the site of the USGS Jenkinsville gage were consistent with the USGS gage data. Results did not detect a clear correlation between DO readings and the units running at the time of data collection (Kleinschmidt 2015).

Water quality data, including DO and temperature, were collected in the forebay of the Parr Shoals Dam to determine if low DO water was being released through the turbines, causing the DO in the tailrace to drop. The data was collected using two HOBO data loggers, with one logger located approximately one foot above the bottom of the reservoir and the other located approximately one foot below the surface of the reservoir. Data was logged on an hourly basis from October 16, 2014 through December 3, 2014. Results showed the expected correlations between DO and temperature and natural diel fluctuations. As shown in Figure 4-10, DO levels at the bottom of the forebay were consistently slightly lower than those at the top of the forebay, and there was no evidence of stratification in the forebay area of the reservoir. There were no low DO events observed in the tailrace during the monitoring effort (Kleinschmidt 2015).



Source: Kleinschmidt 2015

FIGURE 4-10 PARR SHOALS DAM FOREBAY DISSOLVED OXYGEN

SCE&G followed up this effort by collecting another series of water quality data in the Parr forebay from May through mid-October 2015 (Kleinschmidt 2016a). Due to the fluctuations of the reservoir, periods of low inflows, and the general location of the HOBO loggers in the forebay of the dam, the loggers were highly susceptible to fouling due to debris, sediment, and algae. After approximately one week of data collection in the reservoir, the HOBO loggers became severely compromised and no longer collected accurate data. This fouling made it more difficult to see clear trends in the DO levels experienced in the forebay, but they did detect lower DO levels and a diel shift in DO levels starting at the end of June and extending through the end of September. During 2015, there were no DO levels below 4.2 mg/L detected at the USGS Jenkinsville tailrace gage. After July 31, there was only one DO reading lower than 5.0 mg/l and that was 4.9 mg/l on August 2 (Kleinschmidt 2016a).

TURBINE VENTING PLAN

SCE&G proposed to test all of the Parr turbines for their ability to self-vent and potentially increase the dissolved oxygen in the tailrace during specific periods of the year. An initial test of the turbines' capacity to vent was performed August 2014; a second test to determine which turbines had the most significant impact on increasing dissolved oxygen was performed in July 2015. The results of the testing, along with the findings published in the Baseline Water Quality Report, were used to develop a Turbine Venting Plan.

During the 2014 test, the primary objective was to determine the turbines' physical capacity to self-vent. This required both the presence of vacuum breakers (which are used during dewatering operations) (Photo 4-1), as well as the proper turbine vertical setting and sufficient gross head to draw air into the turbine during operation. With a turbine operating, the vacuum breaker valve is opened, and venting can be audibly determined. Aeration of the water can also be visually observed in the tailrace (Photo 4-2) (Kleinschmidt 2016a).

PHOTO 4-1 PARR SHOALS DAM PIPING FOR VACUUM BREAKERS IN HEADCOVER

PHOTO 4-2 PARR SHOALS DAM TURBINE DISCHARGE WITH VENTS OPEN

Several of the turbines were undergoing maintenance, and testing of all units was not possible. In addition, the tailrace dissolved oxygen and total saturation levels were high prior to opening the vents, which likely reduced the effectiveness of venting. Given these limitations, an effectiveness venting test was planned for summer 2015 when additional turbines could be evaluated. Prior to the 2015 testing date, DO levels were monitored via the downstream USGS Jenkinsville Gage (No. 02160991) to identify a test period with lower DO conditions.

During the 2015 test, all turbines were tested except unit 4, which was inoperable due to ongoing maintenance; however, unit 4 had been tested in 2014. Results of the 2015 testing indicate that unit 3 venting had the most significant increase in dissolved oxygen, followed by units 1, 5 and 2. The increases are shown in Table 4-11 (Kleinschmidt 2016a).

TABLE 4-11 PARR SHOALS DAM DISSOLVED OXYGEN MEASUREMENTS DURING TURBINE VENTING TESTING (MG/L)

UNIT NO.	VENT CLOSED	VENT OPEN	INCREASE IN DO
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.

While the 2014 test indicated a dissolved oxygen increase of 0.16 mg/L induced by venting unit 4, the increase was hindered by the starting saturation level compared to the testing in 2015. It was assumed that the lower levels in 2015 would have resulted in better uptake, but the exact level of increase is not known. Operating priority for the Turbine Venting Plan was not modified to arbitrarily place unit 4 above other turbines that have a better demonstrated uptake capacity (Kleinschmidt 2016a).

Based on testing results, SCE&G developed a turbine venting plan in consultation with SCDHEC and other stakeholders, to help increase DO levels downstream of Parr Shoals Dam during the low DO season. The plan states that turbine venting shall occur continuously during a “venting period” for each calendar year, with vents opened as turbines are started up and brought online. During the venting period, the turbines will be operated with vents opened in a first-on / last-off order as follows: 3, 1, 5, 2, 4, and 6. Exceptions to this operating order shall occur due to equipment maintenance that results in unit outages, or emergency conditions. SCE&G shall follow the venting procedures from June 15 through July 31 of each year. This period captures all of the excursions recorded by the nearby USGS Jenkinsville Gage since the newer style probe was installed in 2011 (Kleinschmidt 2016a).

SCE&G will provide documentation to SCDHEC of dissolved oxygen excursions below the standard within ten days of occurrence. Upon request from a consulting agency, SCE&G will provide hourly records to agency representatives to demonstrate adherence to the order of turbine operating during a venting period. Documentation of maintenance activities to justify deviation from the turbine operating order will also be provided, should a deviation occur (Kleinschmidt 2016a).

At the March 2016 Water Quality TWC meeting, SCE&G made a proposal to test the Turbine Venting Plan during June 15th through July 31st of 2016. In addition to testing the plan during 2016, SCE&G also conducted a re-test of Unit 4 after installation of the new “air-cooled wooden bearings” (Table 4-15). The success of turbine venting was measured at the USGS Jenkinsville Gage. Dissolved oxygen and temperatures observed in the tailrace are presented in Table 4-12. No excursions of DO levels less than 4.0 mg/L were observed during the testing period (Table 4-13 and Figure 4-12) (Kleinschmidt 2016b).

TABLE 4-12 PARR SHOALS TURBINE VENTING UNIT 4 TEST – AUGUST 2016

Test #	Time (DST)	Breaker Position Open/Closed	DO (mg/l)	Temp (°C)	TDG	% Sat	HP El	TW El	KW	Kvars Act.	Gates Act. (%)	BP
1	9:00	closed	5.08	29.42	713	67.2	257.22	220.70	1360±	150	45	759
2	9:40	open	5.3	29.48	718	70.2	257.53	220.72	1360±	151	46	759

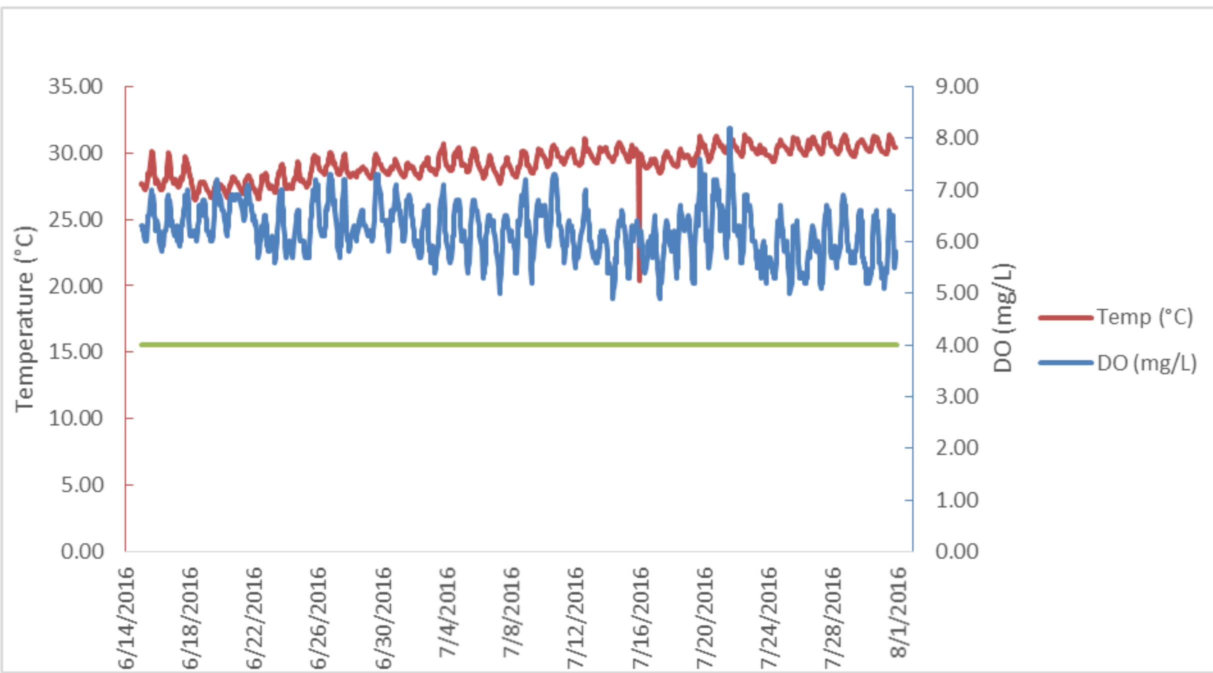
Notes:
Requested plant/system control to have all gates up and a max. of 2 units generating by 07:00 (DST).
Units 4 & 6 were operating and all gates up upon arrival at the plant. Unit 6 was shutdown at 08:20 (DST).
Breaker valve on Unit 4 was opened at approx. 09:20 (DST).

Source: Kleinschmidt 2016b

TABLE 4-13 PARR SHOALS TAILRACE MAX AND MIN DO AND TEMP JUNE 15- JULY 31, 2016

	JUNE		JULY	
	DO (MG/L)	TEMPERATURE (°C)	DO (MG/L)	TEMPERATURE (°C)
Maximum	7.30	30.10	8.20	31.50
Minimum	5.60	26.50	4.90	20.40

Source: Kleinschmidt 2016b



Source: Kleinschmidt 2016b

FIGURE 4-11 PARR SHOALS TAILRACE DO AND TEMPERATURE JUNE 15 – JULY 31, 2016

It was noted that there was a general decline in DO levels recorded at the USGS Jenkinsville gage during the first two weeks of August 2016, after venting had been stopped for the season. It is unknown if this was related to reductions associated with the cessation of turbine venting or environmental factors. Due to the success of the 2016 Turbine Venting Plan test, SCE&G proposed to perform turbine venting tests during 2017 and to extend the venting season to include June 15 through August 31. SCE&G will use the results of the 2016 and 2017 testing and the individual Unit test to update and modify the current Turbine Venting Plan. SCE&G plans to include the updated Turbine Venting Plan as one of the proposed PM&E measures to be included in the Final License Application for continued operation of the Parr Hydroelectric Project (FERC No. 1894).

2015 PARR SHOALS DAM DOWNSTREAM WEST CHANNEL WATER QUALITY STUDY

During issues scoping, the Water Quality TWC identified the west channel area of the Broad River downstream of the Parr Dam as a potential area in need of water quality study. SCDNR expressed concern regarding low DO levels in this area of the Broad River during the warmer months. SCE&G developed a study plan to assess the water quality, specifically DO levels, of the west channel of the Broad River, immediately downstream the Parr Shoals Dam (Kleinschmidt 2016c).

Water temperature and DO were continuously monitored at four sites downstream of the Parr Shoals Dam from April 1st through October 15th, 2015. Hourly data was collected using HOBO U26 Dissolved Oxygen Loggers with spot measurements collected using a YSI-85 DO meter during monthly downloads of the HOBO data. There were three monitoring sites in the west channel and one in the east channel (Figure 4-13).

FIGURE 4-12 PARR SHOALS DOWNSTREAM WATER QUALITY MONITORING SITES

The study identified that DO levels in the west channel are periodically below the SCDHEC standard of 4.0 mg/L. Dissolved oxygen levels in the upper west channel of the Broad River, downstream of Parr Shoals Dam, were consistently lower than those further down the west channel and in the east channel. This is likely due to the shallow nature of the river in this area, as well as the presence of dense algal mats. Also, during drier weather conditions, the west channel does not receive a consistent flow of water. Throughout the study, fouling of the HOBO loggers was a constant issue. DO measurements recorded by the YSI meter often displayed very different readings than those collected by the HOBO loggers in the same locations. There were also periods of missing data due to equipment malfunctions and monitors being lost during high flows.

The study data showed that DO levels in the west channel are variable. Dissolved oxygen levels are lowest in the west channel directly downstream of the dam during the summer months, however these levels increase as the distance from the dam increases. Dissolved oxygen levels at the lower west channel site, located approximately 1 mile downstream of the dam, and at the east channel site, located approximately 0.5 miles downstream of the dam, were generally above the SCDHEC instantaneous standard of 4.0 mg/L and were often similar. Figure 4-14 and Figure

4-15 illustrate results from August 2015, including the general data trends as well as instances of bad data caused by fouling (Kleinschmidt 2016c).

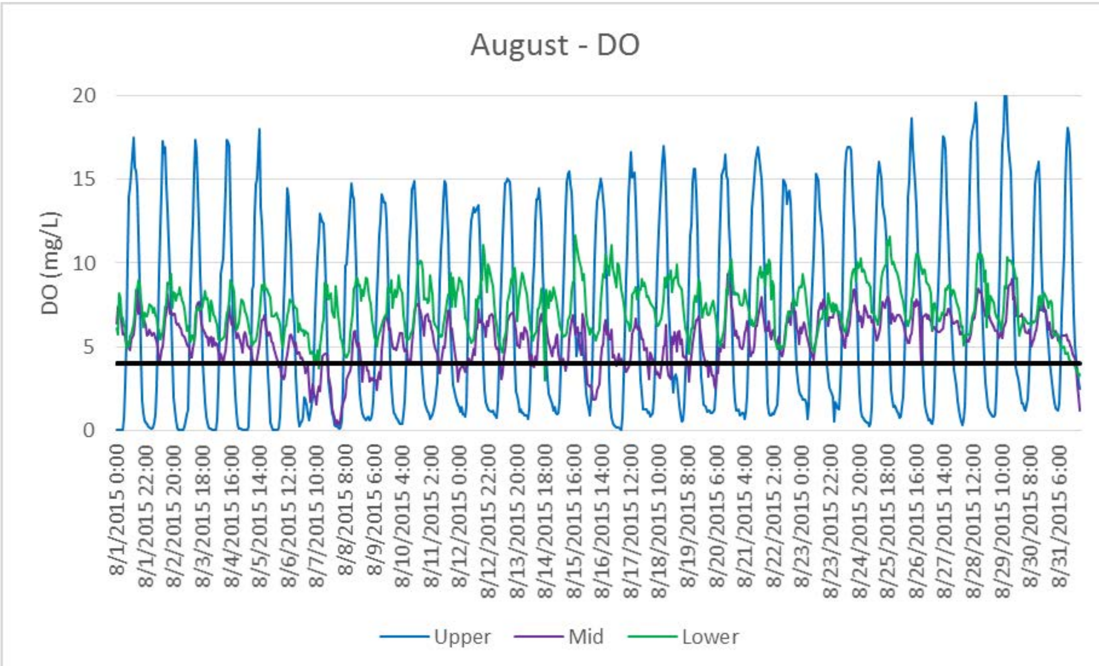


FIGURE 4-13 PARR SHOALS DOWNSTREAM WEST CHANNEL WATER QUALITY FOR AUGUST 2015

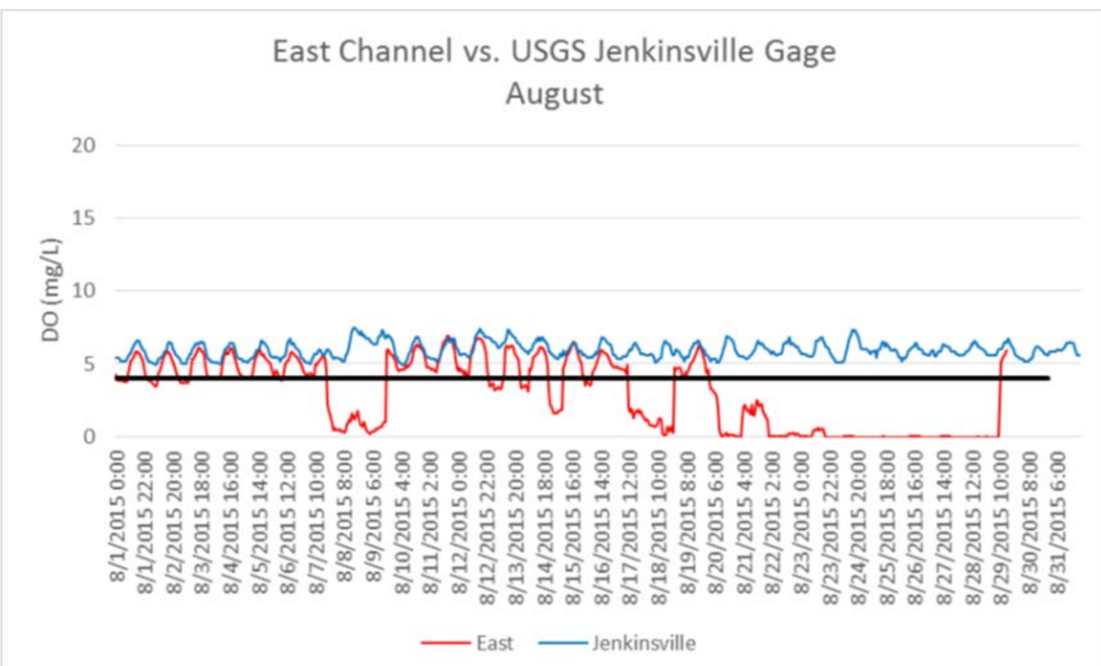


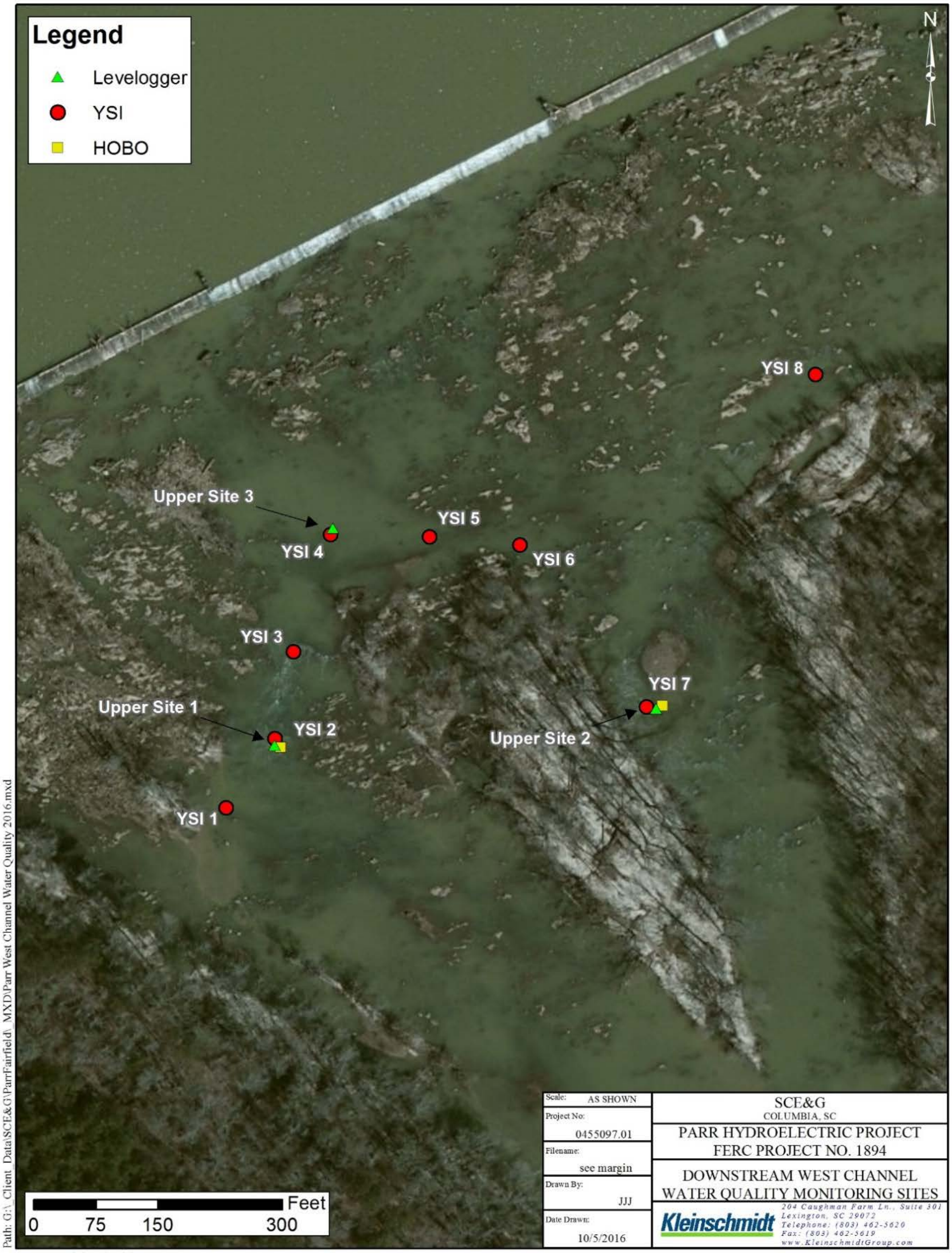
FIGURE 4-14 PARR SHOALS DOWNSTREAM EAST CHANNEL WATER QUALITY FOR AUGUST 2015

As water depths increase at the middle west channel site, the influence of diel respiration was less drastic and some re-aeration likely occurred in the shallow sections of the lower west channel. The lower west channel site DO levels may also periodically (based on turbine flows) receive some positive influence from main channel flows.

2016 Parr Shoals Dam Downstream West Channel Water Quality Study

SCE&G performed initial sampling in the west channel during 2015 and presented that data to the Water Quality TWC. The TWC recommended that SCE&G perform additional collections during 2016 to verify some of the high water temperatures and low dissolved oxygen readings recorded during late summer of 2015. SCE&G performed collections of water temperature and DO during August 2016 to verify baseline conditions and to evaluate how discrete spillway releases or pulses through the spillway gates affect water quality in the west channel. The pulse flows consisted of distinct releases through spillway gates 1 and 2 for approximately 3 hours. The spills were targeted to release 25 acre-feet of water into the west channel.

Water temperature and DO were continuously monitored at four sites along the western channel using HOBO U26 DO loggers: two locations just downstream of the Parr Dam (Upper Site 1 and Upper Site 2), one location midway down Hampton Island near the Highway 213 bridge (Middle West Channel), and one location at the lower extent of the western channel, just upstream of the confluence with the Broad River main channel (Lower West Channel). Additional water quality sites were also sampled for DO and water temperature periodically during the study using a YSI-85 DO meter (YSI-1 through YSI-8). Level logger data were collected at 3 locations in the upper west channel (Upper Site 1, Upper Site 2, and Upper Site 3), and stream flow measurements were collected at two locations in the upper west channel (Upper Site 1 and Upper Site 2). Each of the monitoring sites are shown in Figure 4-16 and Figure 4-17 (Kleinschmidt 2016d).



Path: G:_Client Data\SCE&G\ParrFairfield_MXD\Parr West Channel Water Quality 2016.mxd

Source: Kleinschmidt, ESRI

Source: Kleinschmidt 2016d

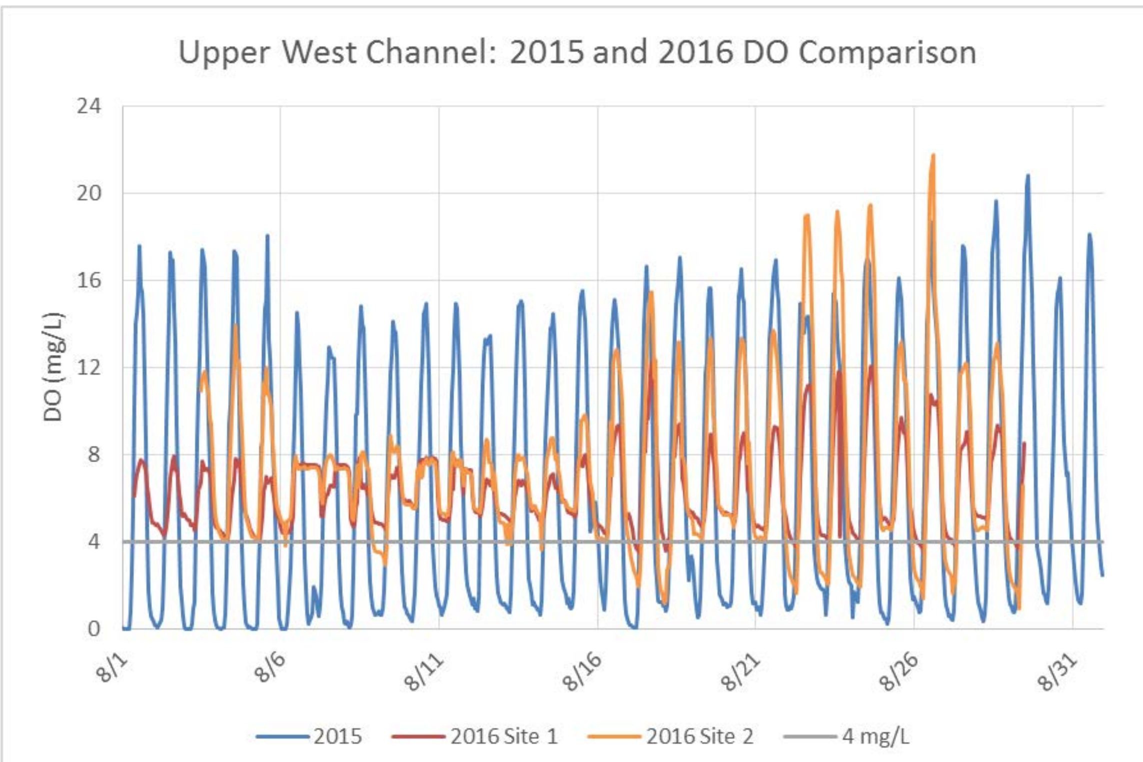
FIGURE 4-15 PARR SHOALS DOWNSTREAM UPPER WEST CHANNEL MONITORING SITES

Source: Kleinschmidt, ESRI

Source: Kleinschmidt 2016d

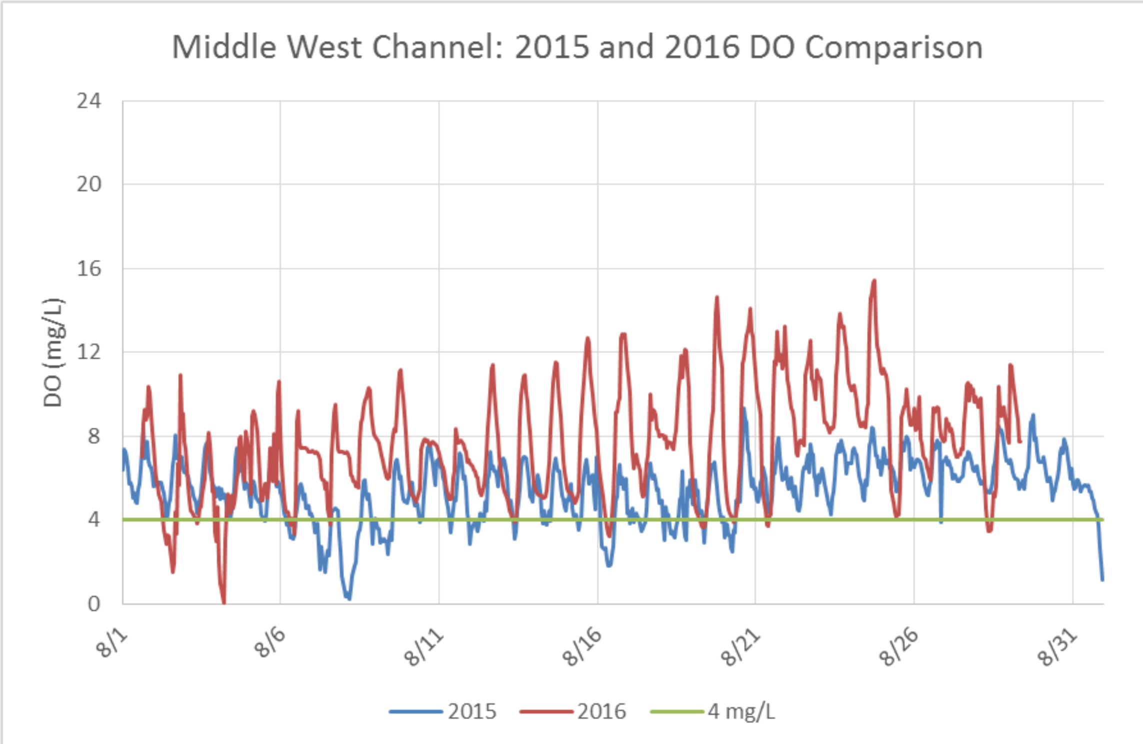
FIGURE 4-16 PARR SHOALS DOWNSTREAM LOWER WEST CHANNEL MONITORING SITES

DO levels generally remained above the SCDHEC standard of 4 mg/L (SCDHEC 2012) during 2016, with diel fluctuations in both temperature and DO occurring throughout the study, as shown in Figure 4-18, Figure 4-19 and Figure 4-20. Greater fluctuations in DO were observed later in the month as aquatic vegetation increased and spillway flows were curtailed. Unlike the original 2015 study, where equipment was continually fouled by aquatic vegetation, equipment during this 2016 study was cleaned on a weekly basis, suggesting that the results of this study offer more accurate readings for DO experienced in the west channel during the late summer period. DO levels in 2016 were generally greater than those observed during 2015, reaching higher levels, and not reaching minimum levels observed during 2015.



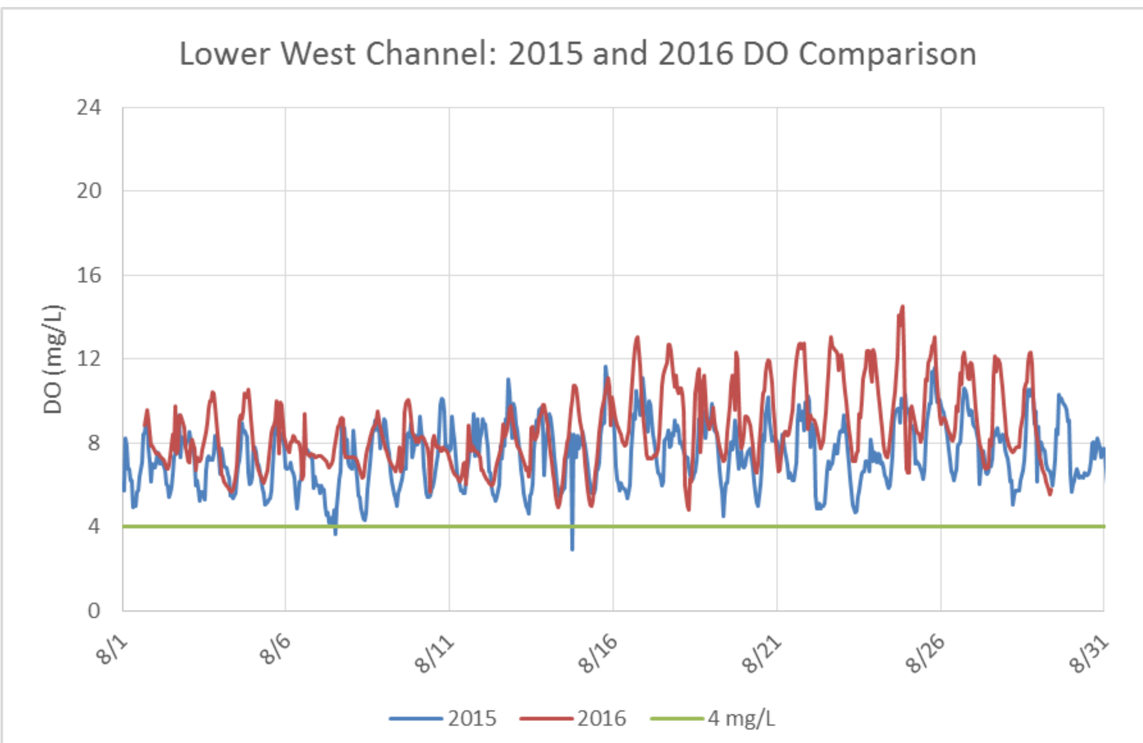
Source: Kleinschmidt 2016d

FIGURE 4-17 UPPER WEST CHANNEL DO – AUGUST 2015 AND 2016



Source: Kleinschmidt 2016d

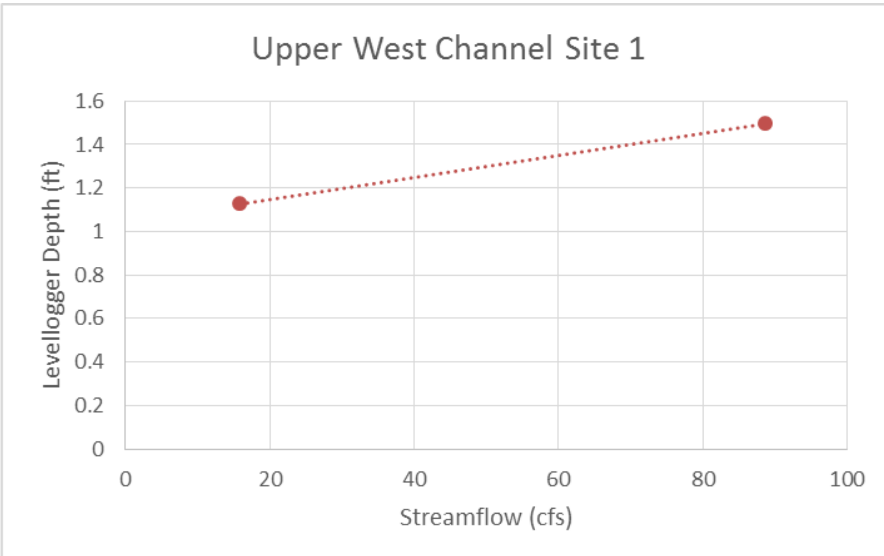
FIGURE 4-18 MIDDLE WEST CHANNEL DO – AUGUST 2015 AND 2016

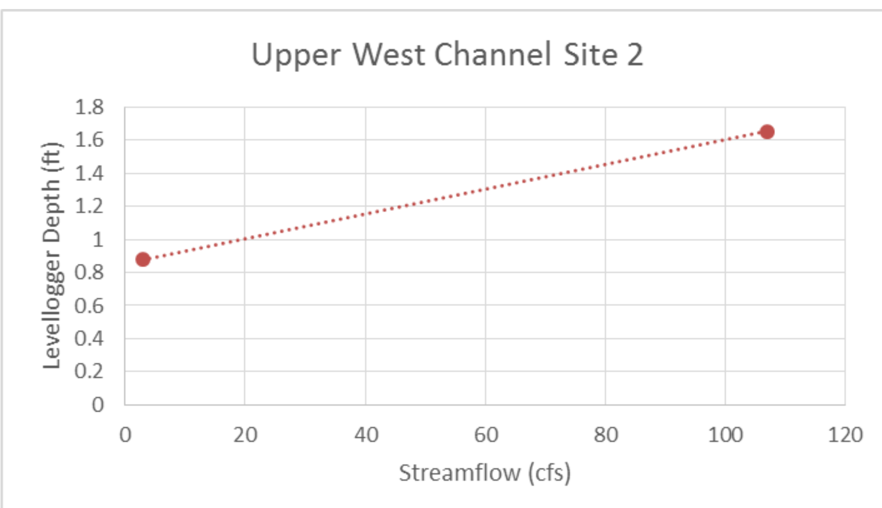


Source: Kleinschmidt 2016d

FIGURE 4-19 LOWER WEST CHANNEL DO – AUGUST 2015 AND 2016

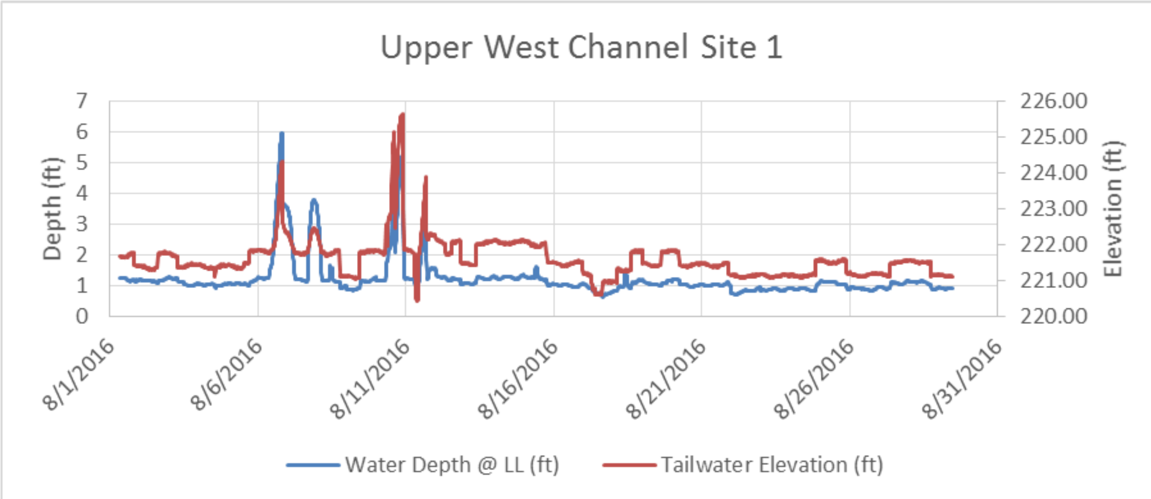
The study also determined that water levels in the west channel are strongly influenced by flows from the powerhouse and indicate that portions of the tailrace flows enter the west channel (Figure 4-21). An increase in the amount of water passing through the powerhouse will increase the amount of water in the west channel and should help to improve DO levels in the west channel (Figure 4-22). It is possible that the higher DO levels observed during 2016 were a result of both the flows to the west channel from the tailrace combined with periodic spills of approximately 25 acre-feet.

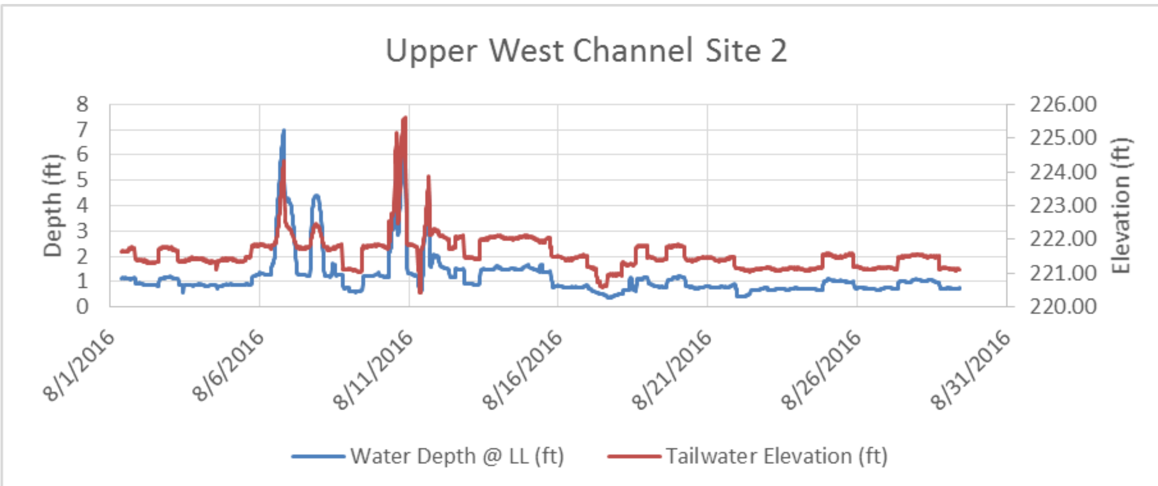


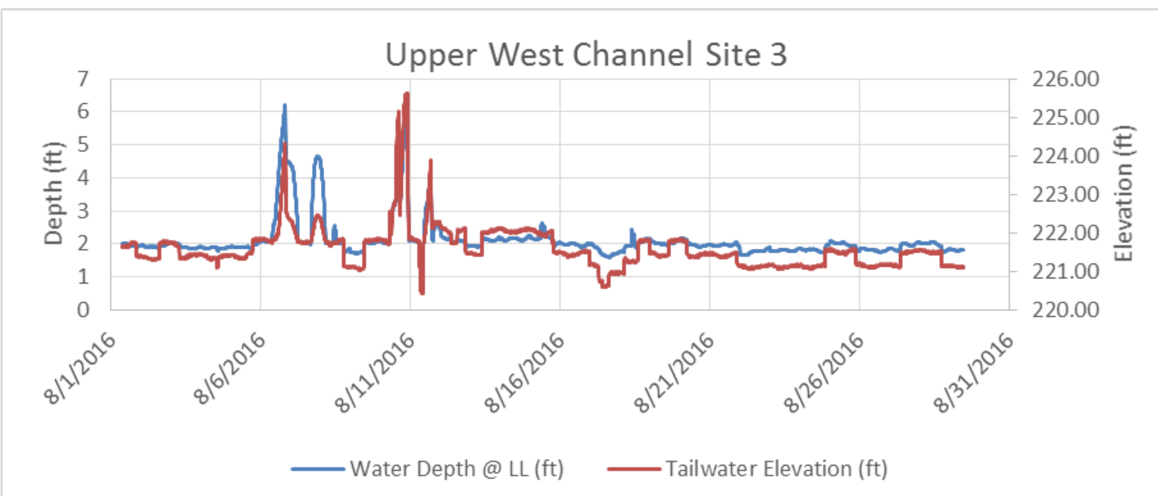


Source: Kleinschmidt 2016d

FIGURE 4-20 STREAM FLOW DATA FOR LEVEL LOGGER 1 AND 2 LOCATIONS







Source: Kleinschmidt 2016d

FIGURE 4-21 LEVEL LOGGER AND PARR SHOALS TAILWATER ELEVATION COMPARISON

Overall, water quality in the west channel seems to be most impacted during the later summer months, when stream flows are typically lower, temperatures are warmer, and vegetation growth is at a higher level. The planned smaller spillway pulses appeared to have a positive effect on DO levels in the west channel, as observed DO levels were measurably increased with each of the planned pulse events. The pulses of approximately 25 acre-feet, in combination with the unplanned spills, were able to maintain higher levels of water quality in the west channel.

4.4.2.4 WATER QUALITY – PROPOSED ACTION

SCE&G proposes to implement the Turbine Venting Plan (Appendix D) at Parr Shoals Dam during the first year after license issuance. This will improve water quality downstream of the dam, minimizing excursions from the instantaneous minimum. SCE&G also plans to implement the West Channel AMP during the first five years of the new license. The objective of the AMP is to enhance aquatic habitat in the West Channel of the Broad River by improving flows and DO levels in the West Channel specifically during the summer/fall period. SCE&G will work with stakeholders throughout the five year term of the AMP to accomplish this objective. The AMP details several methods for water quality improvement and habitat enhancement including increased minimum flows, channel modifications, and potential low inflow pulses. The AMP is still under development in consultation with stakeholders, and will be finalized as part of the FLA. However, a draft version of the West Channel AMP is included in Appendix D. SCE&G will also implement the updated SMPs for both reservoirs. This will require permittees to utilize best management practices when performing any construction or activities within the project boundary. It will mitigate introduction of new point sources of pollution for the reservoir.

4.4.3 ENVIRONMENTAL EFFECTS – NO ACTION ALTERNATIVE

Under the No Action Alternative, the existing systems would continue to operate. Periodic incidences of DO levels less than 4 mg/L in the tailrace of Parr Shoals Dam during late summer would continue to occur. Also, the downstream west channel would continue to experience low DO during periods of low inflow. These instances would occur more frequently during both generation and non-generation periods under the no action alternative than they would under the proposed action due to the lack of turbine enhancements and operational changes at the developments.

4.4.4 UNAVOIDABLE ADVERSE EFFECTS

The proposed operations and enhancements described should not lead to any unavoidable adverse effects on water resources at the Project.

4.4.5 REFERENCES

Federal Energy Regulatory Commission (FERC). 2011. Environmental Inspection Report for Parr Shoals Hydroelectric Project (FERC No. 1894). Accession No.: 20110628-4016. Filed June 28, 2011.

Federal Power Commission (FPC). 1974. Order Issuing New License (Major), Authorizing Project Redevelopment, Permitting use of Project Waters for Condenser Cooling Purposes, Vacating Hearing Order, and Permitting Withdrawal of Intervention. (Project No. 1894). Issued August 28, 1974.

Kleinschmidt 2014. *Baseline Water Quality Report*. Prepared for SCE&G by Kleinschmidt Associates, Lexington, SC. April 2014.

Kleinschmidt 2015. "Water Quality Report – Supplemental Dissolved Oxygen Data." Memo to the Water Quality TWC. Prepared for SCE&G by Kleinschmidt Associates, Lexington, SC. March 2015.

Kleinschmidt 2016a. *Parr Shoals Dam Turbine Venting Report*. Prepared for SCE&G by Kleinschmidt Associates, Lexington, SC. April 2016.

Kleinschmidt 2016b. "2016 Turbine Venting Test Results." Memo to the Water Quality TWC. Prepared for SCE&G by Kleinschmidt Associates, Lexington, SC. August 2016.

Kleinschmidt 2016c. *Water Quality in Downstream West Channel Study Report*. Prepared for SCE&G by Kleinschmidt Associates, Lexington, SC. April 2016.

Kleinschmidt 2016d. *West Channel Water Quality Second Year Study Report*. Prepared for SCE&G by Kleinschmidt Associates, Lexington, SC. October 2016.

South Carolina Department of Health and Environmental Control (SCDHEC). 2012. R.61-68, Water Classifications & Standards. [Online] URL: http://www.scdhec.gov/environment/water/reg.htm. Accessed March 21, 2014

South Carolina Department of Health and Environmental Control (SCDHEC). 2016a. Integrated Report for 2012 Part I: Section 303(d) List of Impaired Waters. [Online] URL: http://www.scdhec.gov/HomeAndEnvironment/Docs/tmdl_14-303d.pdf Accessed November 7, 2016.

South Carolina Department of Health and Environmental Control (SCDHEC). 2016b. Integrated Report for 2012 Part II: Section 305 (b) Assessment and Reporting. [Online] URL: http://www.scdhec.gov/environment/water/tmdl/docs/tmdl_14-305b.pdf. Accessed November 7, 2016.

South Carolina Electric & Gas (SCE&G). 2010. United States Nuclear Regulatory Commission-COL Application Part 3- Environmental Report. Accession No: ML101930216. Filed 2010.

South Carolina Electric & Gas (SCE&G). 2012. Thermal Mixing Zone Evaluation Virgil C. Summer Nuclear Station. [Online] URL: http://pbadupws.nrc.gov/docs/ML1204/ML12047A146.pdf. Accessed March 21, 2014.

U. S. Geological Survey (USGS). 2016. Water resources data for the United States, Water Year 2015: U.S. Geological Survey Water Data Report WDR-US-2015, site 02161000. [Online] URL: http://waterdata.usgs.gov/nwis/wys_rpt?dv_ts_ids=125354_125355_125356&wys_water_yr=2015&site_no=02161000&agency_cd=USGS&adr_water_years=2006%2C2007%2C2008%2C2009%2C2010%2C2011%2C2012%2C2013%2C2014%2C2015&referred_module= Accessed October 25, 2016.

U.S. Nuclear Regulatory Commission (NRC). 2012. Combined License Application Documents for Virgil C. Summer Nuclear Station, Units 2 and 3 Application. [Online] URL: http://www.nrc.gov/reactors/new-reactors/col/summer/documents.html Accessed September 25, 2014.

4.5 FISHERY RESOURCES

4.5.1 AFFECTED ENVIRONMENT

Parr Reservoir, Monticello Reservoir, and the Broad River downstream of Parr Shoals Dam are the three water bodies affected by the Project. Only Parr Reservoir and Monticello Reservoir are located within the Project boundary. Parr Reservoir is an impoundment on the Broad River and normally operates in a modified run-of-river mode to continuously pass Broad River flow. The 15 mile long Parr Reservoir has a surface area of 4,400 acres at full pool and serves as the lower reservoir for pumped-storage operations. The current license allows for Parr Reservoir to fluctuate up to 10 feet, which dewaters aquatic habitat on a daily basis. During February through April, when many fish species are spawning in shallow water habitat, average daily water level fluctuations range from 2.9-4.2 feet in Parr Reservoir, and the majority of substrate consists of silt, with some sand.

The Fairfield Development is located directly off of the Broad River and forms the 6,800-acre upper reservoir, Monticello Reservoir, with four earthen dams. The current license allows for Monticello Reservoir to fluctuate up to 4.5 feet, which dewaters aquatic habitat on a daily basis. During February through April, when many fish species are spawning in shallow water habitat, average daily water level fluctuations range from 1.6-2.4 feet in Monticello Reservoir.

In 2013, SCE&G assessed baseline fisheries data for Parr Reservoir, Monticello Reservoir, and the downstream reach of the Broad River in the Baseline Fisheries Report, which was filed with the PAD on January 5, 2015. A summary of the information contained in that report is included in the sections below.

4.5.1.1 PARR RESERVOIR FISHERIES

Thirty fish species have been documented in Parr Reservoir (Table 4-14). Although some seasonal variations in community structure have been documented, the fish communities are similar between the Parr and Monticello reservoirs, with gizzard shad, blue catfish, bluegill, channel catfish and white perch as the dominant species (Kleinschmidt 2013a). Large numbers of gizzard shad have been documented during the summer months; however, data suggest that these populations decline rapidly during the fall and winter, presumably due to high levels of predation, seasonal die-offs, or both (Normandeau 2007, 2008, 2009; SCANA 2013). The robust redhorse, a species of highest conservation priority in South Carolina (SCDNR 2005) has been found in Parr Reservoir and in the Broad River downstream of Parr Shoals Dam.

TABLE 4-14 FISH SPECIES DOCUMENTED AT PARR AND MONTICELLO RESERVOIRS

COMMON NAME	SCIENTIFIC NAME	PARR	MONTICELLO
black crappie	*Pomoxis nigromaculatus*	x	x
blue catfish	*Ictalurus furcatus*	x	x
bluegill	*Lepomis macrochirus*	x	x
channel catfish	*Ictalurus punctatus*	x	x
flat bullhead	*Ameiurus platycephalus*	x	x
flathead catfish	*Pylodictis olivaris*	x	
gizzard shad	*Dorosoma cepedianum*	x	x
golden shiner	*Notemigonus chrysoleucas*	x	x
highfin carpsucker	*Carpoides velifer*	x	
largemouth bass	*Micropterus salmoides*	x	x
longnose gar	*Lepisosteus osseus*	x	
northern hogsucker	*Hypentelium nigricans*	x	x
notchlip redhorse	*Moxostoma collapsum*	x	x
pumpkinseed	*Lepomis gibbosus*	x	x
quillback	*Carpoides cyprinus*	x	x
redbreast sunfish	*Lepomis auritus*	x	x
redear sunfish	*Lepomis microlophus*	x	x
robust redhorse	*Moxostoma robustum*	x	x
sandbar shiner	*Notropis scepticus*	x	
shorthead redhorse	*Moxostoma macrolepidotum*	x	x
smallmouth bass	*Micropterus dolomieu*	x	x
snail bullhead	*Ameiurus brunneus*		x
spottail shiner	*Notropis hudsonius*	x	x
threadfin shad	*Dorosoma petenense*	x	x
warmouth	*Lepomis gulosus*	x	x
white bass	*Morone chrysops*	x	
white catfish	*Ameiurus catus*	x	x
white perch	*Morone americana*	x	x
whitefin shiner	*Cyprinella nivea*	x	x
yellow bullhead	*Amierus natalis*	x	x
yellow perch	*Perca flavescens*	x	x

(Source: Normandeau 2007, 2008, 2009; SCANA 2013; Caleb Gaston, personal communication, January 17, 2017)

4.5.1.2 MONTICELLO RESERVOIR FISHERIES

Twenty-six fish species have been documented in Monticello Reservoir (Table 4-14), and fish assemblages found in Monticello Reservoir are similar to those found in Parr Reservoir, with gizzard shad, blue catfish, bluegill, channel catfish, and white perch being among the dominant species (Kleinschmidt 2013a). As in Parr Reservoir, large numbers of gizzard shad have been documented during the summer months, and these populations decline during the fall and winter, presumably due to high levels of predation, seasonal die-offs, or both (Normandeau 2007, 2008, 2009; SCANA 2013).

4.5.1.3 FISHERIES IN THE BROAD RIVER DOWNSTREAM OF PARR SHOALS DAM

An ongoing fish community study conducted by SCDNR Region 3 fisheries staff has provided significant data describing the fish community in the lower Broad River downstream of the Parr Shoals Dam. This study has sampled the lower Broad River fish community since 2009. Data compiled from 2009-2013 indicates that there is higher species diversity in the downstream reaches, as compared to the two upstream reservoirs (54 species in the Broad River downstream of Parr Shoals Dam, compared to 24-30 species in the Parr and Monticello reservoirs) (Table 4-15). The number of species increases with increased distance from the dam, although redbreast sunfish, whitefin shiner, bluegill and snail bullhead dominate boat electrofishing samples throughout the downstream reaches. The west channel area displays the lowest diversity (13 species) and is dominated by Centrarchids, with bluegill and redbreast sunfish accounting for more than 85% of the total catch in that reach. Bettinger and colleagues (2003) also sampled a site downstream of the Parr Shoals Dam (just below Bookman Island) as part of a basin-wide aquatic resource inventory. They documented 34 fish species in that reach. Boat electrofishing samples were dominated by redbreast sunfish, redear sunfish, whitefin shiner, and sandbar shiner. Redbreast sunfish, margined madtom, Piedmont darter, whitefin shiner and seagreen darter dominated backpack electrofishing samples (Table 4-16).

TABLE 4-15 FISH ABUNDANCE IN THE BROAD RIVER DOWNSTREAM OF PARR SHOALS DAM, FALL 2009 THROUGH SPRING 2013

COMMON NAME	SCIENTIFIC NAME	N	RELATIVE ABUNDANCE
redbreast sunfish	Lepomis auritus	5455	30.21%
snail bullhead	Ameiurus brunneus	2884	15.97%
whitefin shiner	Cyprinella nivea	1824	10.10%
bluegill	Lepomis macrochirus	1440	7.97%
brassy jumprock	Scartomyzon sp. (1-27-06)	774	4.29%
sandbar shiner	Notropis scepticus	585	3.24%
largemouth bass	Micropterus salmoides	446	2.47%
margined madtom	Noturus insignis	415	2.30%
spottail shiner	Notropis hudsonius	414	2.29%
longnose gar	Lepisosteus osseus	345	1.91%
notchlip redhorse	Moxostoma collapsum	315	1.74%
shorthead	Moxostoma	294	1.63%

COMMON NAME	SCIENTIFIC NAME	N	RELATIVE ABUNDANCE
piedmont darter	Percina crassa	285	1.58%
redear sunfish	Lepomis microlophus	275	1.52%
flat bullhead	Ameiurus platycephalus	212	1.17%
channel catfish	Ictalurus punctatus	188	1.04%
v-lip redhorse	Moxostoma pappillosum	161	0.89%
smallmouth bass	Micropterus dolomieu	159	0.88%
bluehead chub	Nocomis leptocephalus	145	0.80%
threadfin shad	Dorosoma petenense	140	0.78%
coastal shiner	Notropis petersoni	126	0.70%
gizzard shad	Dorosoma cepedianum	114	0.63%
american shad	Alosa sapidissima	109	0.60%
northern	Hypentelium nigricans	102	0.56%
greenfin shiner	Cyprinella chloristia	85	0.47%
blue catfish	Ictalurus furcatus	67	0.37%
seagreen darter	Etheostoma thalassinum	55	0.30%
thicklip chub	Cyprinella labrosa	51	0.28%
tessellated darter	Etheostoma olmstedi	51	0.28%
highback chub	Hybopsis hypsinotus	46	0.25%
mosquitofish	Gambusia affinis	43	0.24%
green sunfish	Lepomis cyanellus	36	0.20%
warmouth	Lepomis gulosus	32	0.18%
spotted sucker	Minytrema melanops	29	0.16%
quillback	Carpiodes cyprinus	26	0.14%
white perch	Morone americana	26	0.14%
white catfish	Ameiurus catus	19	0.11%
robust redhorse	Moxostoma robustum	18	0.10%
American eel	Anguilla rostrata	17	0.09%
striped jumprock	Moxostoma rupiscartes	17	0.09%
black crappie	Pomoxis nigromaculatus	14	0.08%
swallowtail shiner	Notropis procne	14	0.08%
carp	Cyprinus carpio	11	0.06%
flathead catfish	Pylodictis olivaris	9	0.05%
blackbanded	Percina nigrofasciata	3	0.02%
grass carp	Ctenopharyngodon idella	2	0.01%
striped bass	Morone saxatilis	2	0.01%
tadpole madtom	Noturus gyrinus	2	0.01%
creek chubsucker	Erimyzon oblongus	1	0.01%
Santee chub	Hybopsis zanema	1	0.01%
white bass	Morone chrysops	1	0.01%
yellow perch	Perca flavescens	1	0.01%

(Source: Ron Ahle, SCDNR Freshwater Fisheries Region 3, Unpublished data)

TABLE 4-16 RELATIVE ABUNDANCE OF FISH SPECIES COLLECTED BY BOAT AND BACKPACK ELECTROFISHING BELOW BOOKMAN ISLAND

SPECIES	BOAT	BACKPACK
longnose gar	0.8	
gizzard shad	0.1	
threadfin shad	0.4	
greenfin shiner	0.1	0.4
whitefin shiner	6.4	9
common carp	0.1	
eastern silvery minnow	0.1	
thicklip chub		4.3
bluehead chub		1.7
spottail shiner	0.5	0.9
yellowfin shiner	0.2	1.3
sandbar shiner	8.3	3.2
silver redhorse	4.8	
shorthead redhorse	0.1	
striped jumprock	0.2	
brassy jumprock	3.6	
snail bullhead	0.9	7.7
flat bullhead	0.6	1.0
channel catfish	0.2	0.1
margined madtom	0.2	13.6
white perch	0.3	
white bass	0.1	
flier	0.1	
redbreast sunfish	41.8	35.9
pumpkinseed	0.1	
warmouth	0.8	
bluegill	16.2	0.3
redear sunfish	7.5	
largemouth bass	4.2	0.5
black crappie	0.4	
tessellated darter	0.1	1.0
yellow perch	0.8	
seagreen darter		8.3
Piedmont darter	0.1	10.6
	100%	100%

(Source: Bettinger et al. 2003)

Smallmouth bass were first introduced to the Broad River by SCDNR in 1984 to enhance sportfishing opportunities, and they are currently found throughout the Broad River, as well as in Parr and Monticello reservoirs (Bettinger et al. 2003). Stocking has recently been curtailed due to sustainable levels of natural recruitment (Hal Beard, SCDNR, Personal Communication). Smallmouth bass growth rates in the Broad River are similar to those found in other Piedmont systems in the Southeast (Bettinger et al. 2003).

Robust redhorse are also present throughout the Project. Several areas downstream of Parr Shoals Dam offer suitable spawning habitat for robust redhorse, and may be utilized by the species during spring spawning (see Robust Redhorse Spawning Areas Memo in Appendix B). At least four potential spawning habitats for robust redhorse have been identified downstream of the Project and spawning has been observed at one of the four locations.

4.5.1.4 Diadromous Fish

Historically, many rivers in the Santee River Basin, including the lower Broad River where the Project is located, supported diadromous fish populations. Diadromous species that occurred in the Santee River Basin prior to the construction of dams include anadromous American shad, blueback herring, hickory shad, striped bass and shortnose sturgeon, as well as the catadromous American eel (Newcome and Fuller 2001). Currently, only American shad, striped bass and American eel are known to occur in the Broad River downstream of the Project. Striped bass that occur in the lower Broad River are part of the dam-locked Santee-Cooper lakes population (Rohde et al. 2009) and thus are not truly anadromous. American shad and American eel are both listed as SCDNR species of highest conservation priority (SCDNR 2005) and have been the focus of restoration efforts in the basin.

American shad have been documented downstream of Parr Shoals Dam at the Columbia Hydroelectric Project (Columbia Project) (FERC No. 1895) (Table 4-17). This anadromous species passes through the Santee-Cooper lake system via the St. Stephen Fish Lift and moves up into the Congaree River. Some individuals continue to pass upstream into the Broad River through the Columbia Fishway. The Columbia Fishway was constructed in 2006 at the Columbia Project, located on the lower Broad River approximately 23 miles downstream of the Parr Shoals Dam. The fishway was designed to provide safe, timely and effective upstream passage for anadromous American shad and blueback herring to historical spawning and maturation habitats upstream of the Columbia Diversion Dam (i.e. areas of the lower Broad River downstream of the Parr Shoals Dam). The most recent monitoring data suggests that an estimated 1,154 American shad were passed upstream during the 2016 migration season, and 3,733 shad were passed during the 2015 migration season (Kleinschmidt 2016a) (Table 4-20). Although American shad passage numbers at the Columbia Fishway have generally increased with time, telemetry research suggests that the majority of Santee Basin shad (76% of tagged fish in 2010) terminate their annual upstream migration somewhere between the Congaree/Wateree confluence and the Interstate 95 Bridge crossing on the Santee River (Post 2010). This reach is located approximately 70 miles downstream of the Project. In addition to passage through the fishway at the Columbia Project, the SCDNR has stocked American shad fry in the lower Broad River downstream of the Project annually since 2009, with more than 7 million fry having been stocked to date in the Broad River and more than 2 million in 2013 (Rose 2013). However, recent otolith analyses suggests very low hatchery contribution to the Santee Basin shad population, with only 0.08 to 2.8% percent of fish captured during 2010 through 2012 being of hatchery origin (Gibbons and Post 2013). All of these studies indicate that American shad are currently at low levels downstream of the Project.

TABLE 4-17 AMERICAN SHAD PASSAGE AT COLUMBIA PROJECT

YEAR	SHAD OBSERVED (N)	ESTIMATED TOTAL SHAD PASSAGE	ST. STEPHENS PASSAGE
2007	15	224	328,828
2008	7	102	29,000
2009	35	243	389,000
2010	45	323	348,300
2011	77	615	272,961
2012	240	1182	150,082
2013	183	1730	324,984
2014	163	843	42,535
2015	899	3733	85,417
2016	268	1154	41,375

(Source: Kleinschmidt, 2016a)

4.5.1.5 MUSSELS

In 2013, SCE&G compiled existing data on mussels and macroinvertebrates within Parr Reservoir and the Broad River downstream of the Project in the Macroinvertebrate and Mussel Report, which was filed with the PAD on January 5, 2015 (Kleinschmidt 2013b).

Dense mussel populations and suitable mussel habitat have been noted throughout the reach of the Broad River downstream of Parr Shoals Dam (Price 2010). Similarly, it has been noted that the greatest documented freshwater mussel diversity in the Broad River sub-basin in North and

South Carolina upriver from the Columbia dam occurs in the Parr tailrace (Alderman and Alderman 2012). In addition, the Parr tailrace has the most upriver occurrence of the yellow lampmussel recorded to date and the largest extant population of eastern creekshell in the Santee Basin (Alderman and Alderman 2012). Finally, Roanoke slabshell juveniles, which are thought to require an anadromous fish host, have been documented in the Parr tailrace (Table 4-18). None of the species found in the Parr Reservoir or in the downstream reach of the Broad River are listed as threatened or endangered; however, SCDNR (2006) has classified several as priority species (Table 4-18).

TABLE 4-18 FRESHWATER MUSSELS DOCUMENTED IN PARR RESERVOIR AND BROAD RIVER

COMMON NAME	SCIENTIFIC NAME	Parr Reservoir[1]	Broad River[1]	Parr Tailrace[2]	Priority Status[3]
common elliptio	*Elliptio complanata*	x	x	x	Moderate
Roanoke slabshell	*E. roanokensis*			x	High
variable spike	*E. icterina*			x	Moderate
Carolina lance	*E. angustata*			x	Moderate
northern lance	*E. fisheriana*			x	High
yellow lance	*E. lanceolata*	x	x		
Florida pondhorn	*Uniomerus carolinianus*	x	x	x	
paper pondshell	*Utterbackia imbecillis*			x	
eastern creekshell	*Villosa delumbis*	x	x	x	Moderate
yellow lampmussel	*Lampsilis cariosa*			x	Highest

[1] Source: Price 2010
[2] Source: Alderman and Alderman 2012
[3] Source: SCDNR 2006

4.5.2 ENVIRONMENTAL EFFECTS

4.5.2.1 COMPLETED STUDIES

DESKTOP FISH ENTRAINMENT STUDY

The Fisheries TWC recommended that a desktop fish entrainment and turbine mortality study be conducted as part of Project relicensing to determine the potential impacts that operation of the Parr and Monticello developments has on the fish communities at the Project. Entrainment rates were estimated via a desktop analysis, using fish entrainment data for similar projects throughout the Southeast. Since the report was completed in early 2016, stakeholders have provided additional information that may provide a more accurate estimate of entrainment mortality at the Project. SCE&G is currently in the process of reevaluating the study results using the new data. The final Entrainment Study Report will be included with the FLA.

RESERVOIR FLUCTUATION STUDY

During issues scoping meetings and in comments on the PAD, the Fisheries TWC identified the need for a reservoir fluctuation study on Parr and Monticello reservoirs (Appendix B). The operating regime for the Project currently consists of lowering and refilling the Project's two reservoirs on a daily basis. Parr Reservoir is currently permitted by the FERC license to fluctuate up to 10 feet and Monticello Reservoir is permitted to fluctuate up to 4.5 feet. However, the amount that the Project reservoirs fluctuate is dependent on load demands and system needs. GIS and photogrammetry were used to estimate total reservoir acreage exposed at different reservoir elevations in Parr Reservoir, and to characterize the types of substrate found throughout the reservoir (Kleinschmidt 2016b). On Monticello Reservoir, SCE&G collected digital imagery during a partial drawdown and used it to create a digital elevation model that could be viewed and assessed using GIS (Kleinschmidt 2016b). During this drawdown event on Monticello Reservoir, areas that could be part of habitat enhancement efforts were identified. The Fisheries TWC, specifically SCDNR representatives, requested that a Monticello Reservoir Fish Habitat Enhancement Study be conducted. This study resulted in PM&E measures which are outlined in the Proposed Action Section 4.5.2.2.

IFIM STUDY AND DOWNSTREAM FLOW FLUCTUATIONS

Stakeholders requested a study of the current downstream minimum flows requirements for the Parr Development and their potential effect on downstream aquatic habitat. SCE&G performed a Mesohabitat Assessment to characterize downstream aquatic habitats and an IFIM study downstream of Parr Shoals Dam. Part of the downstream evaluation included a qualitative assessment of spawning habitat for robust redhorse. Biologists with SCANA Corporate Environmental Services, Kleinschmidt Associates, and SCDNR evaluated reaches of the Broad River downstream of Parr Shoals Dam that could provide suitable robust redhorse spawning habitat. The group also utilized published habitat suitability criteria to identify areas along the river as part of the robust redhorse spawning site assessment. The complete IFIM Report and Mesohabitat Assessment are included in Appendix B.

In a response to comments received on the PAD, SCE&G also performed additional desktop analysis of downstream flow fluctuations from the Project associated with combined Parr and Fairfield operations and their potential impact on fish spawning habitat in the Broad River downstream of the Project (Appendix B).

AMERICAN EEL ABUNDANCE STUDY

As a part of Project relicensing efforts, SCE&G conducted American eel surveys in 2015 and 2016 to characterize the abundance and distribution of American eels immediately downstream of Parr Shoals Dam. These surveys found that American eels are present downstream of Parr Shoals Dam, however in low numbers (Kleinschmidt 2016c). The complete results of this study are outlined in Appendix B.

MONTICELLO RESERVOIR FRESHWATER MUSSEL SURVEY REPORT

Six species of freshwater mussels were found in the Monticello Reservoir during the Monticello Reservoir Freshwater Mussel Survey (Kleinschmidt 2016d) (Appendix B). Multiple size classes were found for five of the six species (i.e. multiple ages/lifestages), suggesting that daily water level fluctuations do not limit the population sustainability of the mussels found in the reservoir, and that the mussels are successfully reproducing. Three of the species found during the study (Carolina creekshell, Carolina lance, and Eastern creekshell) have some reported level of conservation concern (SCDNR 2005) (Table 4-23).

TABLE 4-19 MUSSEL SPECIES COLLECTED IN MONTICELLO RESERVOIR DURING 2015

SPECIES	SCIENTIFIC NAME	SCDNR PRIORITY STATUS
Carolina lance	*Elliptio angustata*	Moderate
Eastern floater	*Pyganadon cataracta*	n/a
Florida pondhorn	*Uniomerus carolinianus*	n/a
Paper pondshell	*Utterbackia imbecillis*	n/a

SPECIES	SCIENTIFIC NAME	SCDNR PRIORITY STATUS
Eastern creekshell	*Villosa delumbis*	Moderate
Carolina creekshell	*Villosa vaughaniana*	Highest

(Source: Kleinschmidt, 2016d)

4.5.2.2 PROPOSED ACTION

DOWNSTREAM FLOWS

SCE&G plans to reduce flow fluctuations downstream of the Parr Development that are associated with operation of the Project through the implementation of the Downstream Flow Fluctuation AMP. Through this plan, SCE&G proposes to reduce general year round fluctuations that will benefit aquatic habitat and reduce fluctuations during discrete spring fish spawning periods. Reduction of year round flow fluctuations will be accomplished by improving the operation of the Parr Shoals Dam crest gates and by increasing the hydraulic capacity of the Parr Development.

During spring spawning stabilization SCE&G will work to more closely match their outflows with inflows based on the computed sum of flows measured at the three USGS gage stations upstream of the Project. The two spawning periods are to benefit shortnose sturgeon spawning during March of each year and for American shad, robust redhorse, and striped bass during April and early May each year.

SCE&G will also pass a new set of higher minimum flows from the Project to increase wetted usable aquatic habitat year round. These flows are detailed in the Minimum Flow AMP and include a high spring spawning flow, a medium transition flow, and a summer/fall low flow. Each of these flows was selected by the Fisheries and Instream Flows TWCs based on the results of the IFIM study. The AMP includes a “Target Flow” and a “Compliance Limit.” Because the Project is not a storage project and outflows should be related to inflow to the Project, the Target Flow is a minimum flow based on habitat data from the IFIM study results and the Compliance Limit is based on inflow exceedance values. These two items will be evaluated as part of the AMP, which is anticipated to last for the first 5 years of the new license. The AMP also includes a series of low flow scenarios within each flow period that would allow for operations during low flow periods. This recommendation provides the basis for a Low Inflow Protocol. The minimum flow will also provide depths in the Broad River downstream of the Parr Shoals Dam sufficient for upstream and downstream fish passage in the river. Currently, SCE&G and the stakeholders are discussing the final Minimum Flow AMP that will be proposed for the Project, however the draft AMP is in Appendix D. Final minimum flow recommendations will be included in the FLA.

MONTICELLO FISH HABITAT ENHANCEMENTS

SCE&G worked with the stakeholders to develop a plan for the installation of aquatic habitat enhancements in Monticello Reservoir. The habitat enhancement structures could provide enhanced fish production within Monticello Reservoir and they could also concentrate fish as an enhancement for recreational fishermen (Wagner 2016). Spawning, nursery/juvenile, and deep-water habitat enhancements will be placed in selected areas of the reservoir. The areas selected are on the upper end of the reservoir away from the turbine intakes, which should help to offset fish entrainment losses. The enhancement measures will be made of man-made materials that should not deteriorate over the life of the new license. SCE&G and the stakeholders have developed an adaptive management plan approach for installation of these enhancements. Timing of installation, numbers of enhancements, enhancement evaluation process, and maps of the proposed locations within Monticello Reservoir for habitat enhancement are included in the Monticello Habitat Enhancement Plan in Appendix D.

DIADROMOUS SPECIES

Currently, the most upstream hydro development on the Broad River with fish passage is the Columbia Project, located 23 miles downstream of Parr Shoals Dam. Fish that pass above Columbia can utilize the 23 miles of habitat, and the existing tributaries, but cannot move beyond Parr Shoals Dam. Measures have been put in place with the Accord that include the construction of a fish passage facility at Parr Shoals Dam when American shad (target species) passage at the downstream Columbia Fishway reach 69,600 individuals during a season (CAP 2008). Current numbers of American shad passing at Columbia are well below this threshold, with an estimated 3,733 individuals passing in 2015 and 1,154 individuals passing in 2016 (Kleinschmidt 2016a).

American eel are another species that may require passage in the future. Currently, low densities of American eel utilize habitat downstream of Parr Shoals Dam and existing tributaries, but as with American shad, cannot pass beyond the dam. Per the request of the Fisheries TWC, SCE&G will continue American eel monitoring throughout the term of the new license. SCE&G is currently developing an American Eel Monitoring Plan. A draft of the plan is located in Appendix D and a final proposal on American eel monitoring will be included in the FLA.

4.5.3 Environmental Effects – No Action Alternative

Under a no action alternative, the Project would continue to operate under the same conditions as those described in the current license. Parr Reservoir would continue to fluctuate up to 10 feet daily and Monticello Reservoir would continue to fluctuate up to 4.5 feet daily. The minimum flow during June through February would continue to be 150 cfs with a minimum daily average flow of 800 cfs, or the daily natural inflow to the Parr Reservoir (minus evaporative losses from the Parr and Monticello reservoirs), whichever is less. The minimum flow during March, April and May would continue to be 1,000 cfs or the average daily natural inflow into the Parr Reservoir (minus evaporative losses from the Parr and Monticello reservoirs), whichever is less.

Effects on entrainment and entrainment mortality under the no action alternative would continue at the same rates as they currently do under the existing license conditions.

4.5.4 Unavoidable Adverse Effects

Reservoir Fluctuation

Currently, Parr Reservoir experiences fluctuations associated with pumped storage operations of up to 10 feet per day. These fluctuations can dewater potential spawning habitat, and may reduce spawning success or recruitment of juvenile fish to adult lifestages. It is not anticipated that habitat enhancements would greatly benefit spawning success in Parr Reservoir given these conditions. Efforts to improve spawning and recruitment success in the Project area are instead being implemented in Monticello Reservoir (See Section 4.5.2.2 Proposed Action).

Impingement and Entrainment

Fish entrainment and turbine mortality are one of the unavoidable impacts of hydropower operations. There are ways to reduce fish entrainment with the use of avoidance technology, which include smaller trashrack spacing, changing of lighting near the intakes, reducing intake velocity, and modification of the intake area. Adding these types of changes at the Parr and Monticello developments would be very expensive and likely not completely offset impacts. On Monticello Reservoir, SCE&G has identified a way to increase fish production and enhance aquatic habitats away from the development's intakes, which should help to offset fish entrainment. However, entrainment will continue at both of the developments at levels that will continue to impact the reservoir fisheries.

4.5.5 CUMULATIVE EFFECTS

The Council on Environmental Quality defines a cumulative effect as an 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 or person undertakes such actions. Proposed changes to the Project include an increased minimum flow, which could potentially benefit the aquatic community downstream of the Project. The Licensee is also a signatory to the Accord, which initiates future fish passage construction at the Project when specific triggers are met. When a significant number of diadromous fish are present downstream of the Project, the Licensee will accommodate upstream passage for these fish by constructing a fish passage facility. In addition, the Licensee is proposing to install fish habitat enhancements in Monticello Reservoir, in an effort to decrease entrainment and mortality at the Fairfield Development and encourage fish spawning and rearing in the reservoir. Due to these changes and provisions, it is unlikely that continued operation of the Project would contribute to any cumulative effects to the fishery.

4.5.6 REFERENCES

Alderman, J.M. and J.D. Alderman. 2012. Freshwater Mussel Surveys within The Broad River, East of Hampton Island. Prepared by Alderman Environmental Services, Inc. for SCANA Services, Inc. October 29, 2012. 48 pp.

Bettinger, J., J. Crane, and J. Bulak 2003. Broad River Aquatic Resources Inventory Completion Report (Draft). Prepared by SCDNR as part of the Broad River Comprehensive Entrainment Mitigation and Fisheries Resource Enhancement Program. January 28, 2003.

Cooperative Accord Partnership (CAP). 2008. Santee River Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement. Santee River Basin Accord: Final Administrative and Policy Document. April 9, 2008.

Gibbons, J., and B. Post. 2013. Juvenile American Shad Study. South Carolina Department of Natural Resources – Division of Wildlife and Freshwater Fisheries. Presented at the 2013 Meeting of the Santee River Basin Accord for Diadromous Fish Protection, Restoration and Enhancement.

Jenkins, R. C., and N. M. Burkhead. 1993. The Freshwater Fishes of Virginia. American Fisheries Society, Bethesda, Maryland.

Kleinschmidt Associates. 2013. Baseline Fisheries Resources Report. Prepared for South Carolina Electric & Gas Co. November 2013.

Kleinschmidt Associates. 2013b. Macroinvertebrate and Mussel Report. Prepared for South Carolina Electric & Gas Co. November 2013.

Kleinschmidt Associates. 2014. Mesohabitat Assessment. Memorandum to the Parr/Fairfield Hydro Relicensing Instream Flow TWC. Prepared for South Carolina Electric & Gas Co. January 2014.

Kleinschmidt Associates. 2016a. 2016 Columbia Fishway Report. Prepared for City of Columbia.

Kleinschmidt Associates. 2016b. Parr and Monticello Reservoir Fluctuation Study. Prepared for South Carolina Electric & Gas Co. April 2016.

Kleinschmidt Associates. 2016c. American Eel Abundance Study Report. Prepared for South Carolina Electric & Gas Co. June 2016.

Kleinschmidt Associates. 2016d. Monticello Reservoir Freshwater Mussel Survey Report. Prepared for South Carolina Electric & Gas Co. April 2016.

Kleinschmidt Associates. 2016e. Desktop Fish Entrainment Study Results. Prepared for South Carolina Electric & Gas Co. September 2016.

Normandeau Associates (Normandeau) 2007. Monticello and Parr Reservoirs Fisheries Surveys: Final Report. Prepared for Tetra Tech NUS, Inc., Aiken, SC, by Normandeau Associates, Bedford, NH. September 2007.

Normandeau Associates (Normandeau). 2008. Monticello and Parr Reservoir Fisheries Surveys: *Summer Report.* Prepared for Tetra Tech NUS by Normandeau Associates, Bedford, NH. August 2008.

Normandeau Associates (Normandeau). 2009. Monticello and Parr Reservoir Fisheries Surveys: Summer Report. Prepared for Tetra Tech NUS by Normandeau Associates, Bedford, NH. April 2009.

Price, J. 2010. Fish Passage on the Broad River: an assessment of the benefits to freshwater mussels. Completion Report to the Broad River Mitigation Fund. University of SC and South Carolina Department of Natural Resources. 59 pp.

SCANA Services, Inc (SCANA). 2013. Fish Community Assessment of Parr Reservoir 2012. March, 2013.

SCDNR. 2005. Comprehensive Wildlife Conservation Strategy. South Carolina Priority Species. [Online] URL: http://www.dnr.sc.gov/cwcs/ Accessed October 6, 2016.

SCDNR. 2013. American Eel Abundance and Distribution Along the Spillways of the Lake Wateree Dam on the Wateree River and the Columbia Dam on the Broad River.

Newcomb, T.J. and J.S. Fuller. 2001. Anadromous and Catadromous Fish Survey of Post, B. 2010. Adult and Juvenile American Shad Studies. South Carolina Department of Natural Resources – Division of Wildlife and Freshwater Fisheries. Presented at the 2010 Meeting of the Santee River Basin Accord for Diadromous Fish Protection, Restoration and Enhancement.

Rose, L. 2013. South Carolina Department of Natural Resources American Shad Production. South Carolina Department of Natural Resources – Division of Wildlife and Freshwater Fisheries. Presented at the 2013 Meeting of the Santee River Basin Accord for Diadromous Fish Protection, Restoration and Enhancement.

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.

Wagner, E. 2016. Review of Fish Habitat Improvement Methods for Freshwater Reservoirs. Utah Division of Wildlife Resources. N.p., n.d. Web. April 2016.

4.6 TERRESTRIAL RESOURCES

4.6.1 AFFECTED ENVIRONMENT

The Project is located in the Southern Outer Piedmont Ecoregion of South Carolina (Griffith et al. 2002). This region is characterized by gently rolling hills with broad, relatively shallow stream-cut valleys and elevations that range from 375 feet to 1,000 feet msl (SCDNR 2005a). A subtropical climate prevails in this area marked by high summer humidity, moderate winters, and relatively high rainfall, which results in a vegetative growing season in the range of 250 days annually (Messina and Conner 1998; Bailey 1995). Common vegetation communities in the ecoregion include mixed oak forest and oak-hickory-pine forest (Griffith et al. 2002). The landscape in the Piedmont 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 (SCDNR 2005a). These habitats support wildlife typical of the Piedmont including white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), wild turkey (*Meleagris gallopavo*), mourning dove (*Zenaida macroura*), box turtle (*Terrapene carolina*), copperhead (*Agkistrodon contortrix*), and American toad (*Bufo americanus*) (DeGraaf and Rudis 1986; Conant and Collins 1998). The following sections provide additional detail regarding the wildlife and botanical communities found in the Project area and vicinity.

UPLAND HABITATS

Upland habitats in the Project area and vicinity are primarily forested; some limited pasturelands and residential development occur around Monticello Reservoir. Recent surveys on the adjacent V.C. Summer Nuclear Station provide significant data describing the upland habitats and associated wildlife occurring in the Project vicinity (SCE&G 2010). Primary cover types occurring in the Project vicinity include planted pine, naturally vegetated pine, mixed pine-hardwood, and hardwood forests. Pine forests are primarily second-growth stands of either naturally propagated or planted loblolly pine (*Pinus taeda*); older stands are characterized by presence of hardwoods such as white oak (*Quercus alba*). Hardwood-dominant stands occur mainly along streams and side slopes (SCE&G 2010).

Pine Forests

Natural and planted pine forests in the Project vicinity consist mostly of naturally vegetated and cultivated loblolly pine. These forests are early successional, even-aged stands that produce a closed canopy with little to no understory of either woody or herbaceous cover (FPC 1974).

Because much of this forest type consists of planted pines, it is generally poor wildlife habitat, lacking in both food and cover needed by native wildlife (SCDNR 2005a).

Mixed Pine-Hardwood Forests

Mixed pine-hardwood forests occurring in the Project vicinity consist primarily of loblolly pine and longleaf pine (*Pinus palustris*) accompanied by a variety of other species, including tulip poplar (*Liriodendron tulipifera*), red maple (*Acer rubrum*), winged elm (*Ulmus alata*), persimmon (*Diospyros virginiana*), eastern redcedar (*Juniperus virginiana*), black gum (*Nyssa sylvatica*), American beech *(Fagus grandifolia*), American holly (*Ilex opaca*), black cherry (*Prunus serotina*), and sweetgum (*Liquidambar styraciflua*) (SCE&G 2002; Nelson 2006).

Hardwood Forests

Hardwood forests are located predominately along stream bottoms and in ravines and make up a relatively small portion of the forested communities in the Project vicinity (USNRC 2004). Typical canopy species present include white oak, southern red oak (*Quercus falcata*), black gum, and some American beech (Nelson 2007). Flowering dogwood (*Cornus florida*) is a dominant understory species, and herbaceous species such as hepatica (*Hepatica americana*), golden alexander (*Zizia trifoliata*), sanicle (*Sanicula marilandica*), Christmas fern (*Polystichum acrostichoides*), and little nut-rush (*Scleria oligantha*) are common along small streams (SCE&G 2002).

FLOODPLAINS, WETLANDS, RIPARIAN, AND LITTORAL HABITAT

Wetlands in the Project vicinity are typical of those found in the South Carolina Piedmont and include both palustrine (marshes, bogs, fens, etc.) and lacustrine (on the shores of lakes and reservoirs) wetlands. Species typical of forested wetlands in the Project vicinity include those in the mixed pine-hardwood and hardwood cover types described previously, as well as tulip poplar, sweetgum, white ash (*Fraxinus americana*), black cherry, sedge (*Carex* spp.), and red maple. Limited freshwater marsh habitat occurs in shallow backwaters along Parr Reservoir; the marsh habitat contains emergent wetland species, such as cattail (*Typha latifolia*), bulrushes (*Scirpus* spp.), rushes (*Juncus* spp.), sedges, smartweed (*Polygonum hydropiperoides*), pickerelweed (*Pontederia cordata*), lizard’s tail (*Saururus cernuus*), water primrose (*Ludwigia* spp.), and water pennywort (*Hydrocotyle* spp.) (SCE&G 2010).

The USFWS maintains the National Wetlands Inventory (NWI) that provides reconnaissance level information on the location, type, and size of wetlands and deepwater habitats (USFWS 2014). 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 4-23). Most of the mapped wetlands in the Project area are classified as L1UBHh, which is a lacustrine system. The Project area is bordered by palustrine emergent, palustrine forested and/or palustrine shrub, and palustrine unconsolidated bottom systems.

The lacustrine (i.e., freshwater lake) habitat in the Project vicinity comprises permanently flooded/impounded habitat located at the Parr and Monticello reservoirs. This classification is typical of deepwater habitats formed by dammed river channels and is defined as having less than 30 percent vegetative cover (USGS, 2013a).

Palustrine habitat is defined as all freshwater wetlands including freshwater emergent wetlands, freshwater forest and shrub wetlands, and freshwater ponds (defined as a freshwater body of water with an area of less than 20 acres). Palustrine wetlands often occur along the shores of lakes or rivers and are defined as having a water depth of less than 2 meters and salinity of less than 0.5 percent (USGS, 2013b).

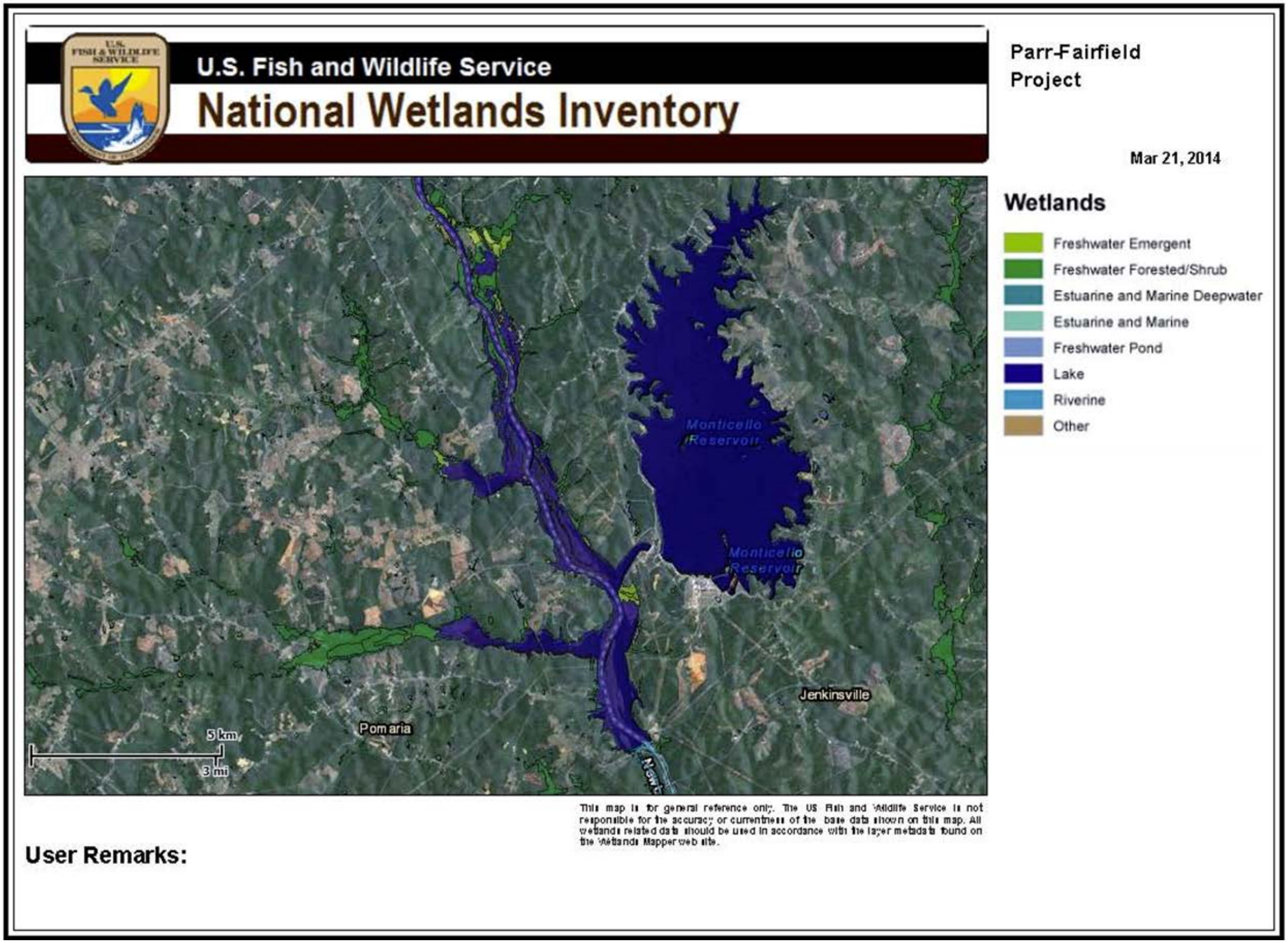


FIGURE 4-22 PROJECT VICINITY WETLAND HABITAT

Wildlife

Mammals

Mammals that occur in the Project vicinity include those typically found in the Piedmont, such as white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), gray squirrel (*Sciurus carolinensis*), eastern cottontail (*Sylvilagus floridanus*), muskrat (*Ondatra zibethica*), bobcat (*Lynx rufus*), beaver (*Castor canadensis*), opossum (*Didelphis virginiana*), hispid cotton rat (*Sigmodon hispidus*), eastern mole (*Scalopus aquaticus*), house mouse (*Mus musculus*), whitefooted mouse (*Peromyscus leucopus*), gray fox (*Urocyon cinereoargenteus*), and eastern spotted skunk (*Spilogale putorius*) (SCDNR 2005a).

Reptiles and Amphibians

The Piedmont of South Carolina is not as rich in herpetofauna as other parts of the state (SCDNR 2005b); however, several species of reptiles and amphibians are known to occur in the Project vicinity. These include the black racer snake (*Coluber constrictor*), ringneck snake (*Diadophis punctatus*), rat snake (*Elaphe obsolete*), Carolina anole (*Anolis carolinensis*), fence lizard (*Sceloporus undulates*) and various skinks and toads (FPC 1974; SCE&G 2010).

Birds

Birds that occur in the Project vicinity are typical of the Piedmont. Various species of dabbling ducks such as wood duck (*Aix sponsa*), mallard (*Anas platyrhynchos*), black duck (*Anas rubripes*), and green-winged teal (*Anas carolinensis*) use the freshwater marsh habitat in Parr Reservoir, and Monticello Reservoir supports a resident population of Canada geese (*Branta Canadensis leucopareia*). Bald eagles (*Haliaeetus leucocephalus*) nest near the site and are observed frequently, and a variety of wading birds, songbirds, birds of prey, and other migratory and non-migratory birds are expected to occur in the Project vicinity. Table 4-24 lists avian species observed during recent surveys on the adjacent V.C. Summer Nuclear Station.

TABLE 4-20 AVIAN SPECIES OBSERVED IN THE PROJECT VICINITY

WADING BIRDS, SHOREBIRDS, AND OTHER WATER BIRDS	PASSERINES AND OTHER BIRDS (CONT.)
Blue-winged teal (*Anas discors*)	Mourning dove (*Zenaida macroura*)
Mallard (Anas platyrhynchos)	Blue jay (Cyanocitta cristata)
Black duck (*Anas rubripes*)	Yellow-rumped warbler (*Dendroica coronata*)
Great egret (*Ardea alba*)	**Prairie warbler (*Dendroica discolor*)**
Great blue heron (*Ardea herodias*)	Pine warbler (*Dendroica pinus*)
Canada goose (Branta canadensis)	Pileated woodpecker (*Dryocopus pileatus*)
Green heron (Butorides virescens)	**Dark-eyed junco (*Junco hyemalis*)**
Killdeer (Charadrius vociferous)	**Loggerhead shrike (*Lanius ludovicianus*)**
Little blue heron (*Egretta caerulea*)	Belted kingfisher (*Megaceryle alcyon*)

Wading Birds, Shorebirds, and Other Water Birds	Passerines and Other Birds (Cont.)
Herring gull (Larus argentatus)	Red-bellied woodpecker (*Melanerpes carlinus*)
Double-crested cormorant (*Phalacrocorax auritus*)	Wild turkey (Meleagris gallopavo)
Birds of Prey and Soaring Birds	Song sparrow (Melospiza melodia)
Cooper's hawk (Accipiter cooperii)	Northern mockingbird (*Mimus polyglottos*)
Red-tailed hawk (*Buteo jamaicensis*)	Great crested flycatcher (*Myiarchus crinitus*)
Red-shouldered hawk (*Buteo lineatus*)	Tufted titmouse (*Parus bicolor*)
Turkey vulture (*Cathartes aura*)	Carolina chickadee (*Parus carolinensis*)
Black vulture (*Coragyps atratus*)	Indigo bunting (*Passerina cyanea*)
Bald eagle (Haliaeetus leucocephalus)	Downy woodpecker (*Picoides pubescens*)
Passerines and Other Birds	Rufous-sided towhee (Pipilo erythrophthalmus)
Red winged blackbird (*Agelaius phoeniceus*)	Summer tanager (*Piranga rubra*)
Ruby-throated hummingbird (*Archilochus colubris*)	**Golden-crowned kinglet (*Regulus satrapa*)**
Great horned owl (*Bubo virginiana*)	Eastern phoebe (*Sayornis phoebe*)
Northern cardinal (Cardinalis cardinalis)	Eastern bluebird (*Siala sialis*)
Pine siskin (Carduelis pinus)	**Brown-headed nuthatch (*Sitta pusilla*)**
Northern bobwhite (*Colinus virginianus*)	Yellow-bellied sapsucker (*Sphyrapicus varius*)
Yellow-bellied cuckoo (*Coccyzus americanus*)	Northern rough-winged swallow (*Steigidopteryx serripennis*)
Northern flicker (*Colaptes auratus*)	Barred owl (*Strix varia*)
Eastern wood pewee (*Contopus virens*)	Carolina wren (Thryothorus ludovicianus)
American crow (Corvus brachyrhynchos)	Brown thrasher (*Toxostoma rufum*)
White-throated sparrow (*Zonotrichia albicollis)*	White-eyed vireo (*Vireo griseus*)
Red-eyed vireo (*Vireo olivaceus*)	

(Sources: SCDNR 2005a; SCE&G 2010a)
Note: Taxa in bold are South Carolina Priority Species (SCDNR 2005b)

Exotic Species

Exotic upland wildlife species known to occur in the Project vicinity include feral hogs and dogs, and coyotes (SCDNR 2005a); additionally, exotic upland plants are prevalent in the Piedmont ecoregion and are likely to occur within the Project area and vicinity. Data collected by the USFS for the Forest Inventory Analysis indicate that almost three quarters of sampled plots within the Piedmont ecoregion contain at least one exotic plant (SCDNR 2005b). The South Carolina Exotic Pest Plant Council (SCEPPC) identifies several plants as severe exotic plant pest species in the Piedmont ecoregion (Table 4-25). Although no site-specific data are available, any of the species listed in Table 4-25 could 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.

TABLE 4-21 SEVERE EXOTIC PLANT PEST SPECIES OCCURRING IN THE PIEDMONT ECOREGION

COMMON NAME	SCIENTIFIC NAME
Trees	
tree of heaven	*Ailanthus altissima*
mimosa, silktree	*Albizia julibrissin*
chinaberry	*Melia azedarach*
princess tree/royal paulownia	*Paulownia tomentosa*
Chinese tallow tree	*Triadica sebifera*
Shrubs	
thorny olive	*Elaeagnus pungens*
autumn olive	*Elaeagnus umbellata*
two-color bush clover, shrub lespedeza	*Lespedeza bicolor*
Japanese privet	*Ligustrum japonicum*
Chinese privet	*Ligustrum sinense*
Japanese knotweed	*Polygonum cuspidatum*
multiflora rose	*Rosa multiflora*
Vines	
English ivy	*Hedera helix*
Japanese climbing fern	*Lygodium japonicum*
Japanese honeysuckle	*Lonicera japonica*
kudzu	*Pueraria montana*
Asian/Japanese wisteria	*Wisteria floribunda*
Chinese wisteria	*Wisteria sinensis*
bigleaf periwinkle	*Vinca major*
common periwinkle	*Vinca minor*
Grasses/Sedges	
tall fescue	*Lolium arundinaceus*
Japanese stilt grass, Nepalese browntop	*Microstegium vimineum*
Chinese silvergrass	*Miscanthus sinensis*
bahia grass	*Paspalum notatum*
golden bamboo, fishpole bamboo	*Phyllostachys aurea*
Johnson grass	*Sorghum halepense*
Herbs	
tropical spiderwort, Bengal dayflower	*Commelina bengalensis*
wart removing herb, marsh dewflower, aneilema	*Murdannia keisak*
tropical soda apple	*Solanum viarum*

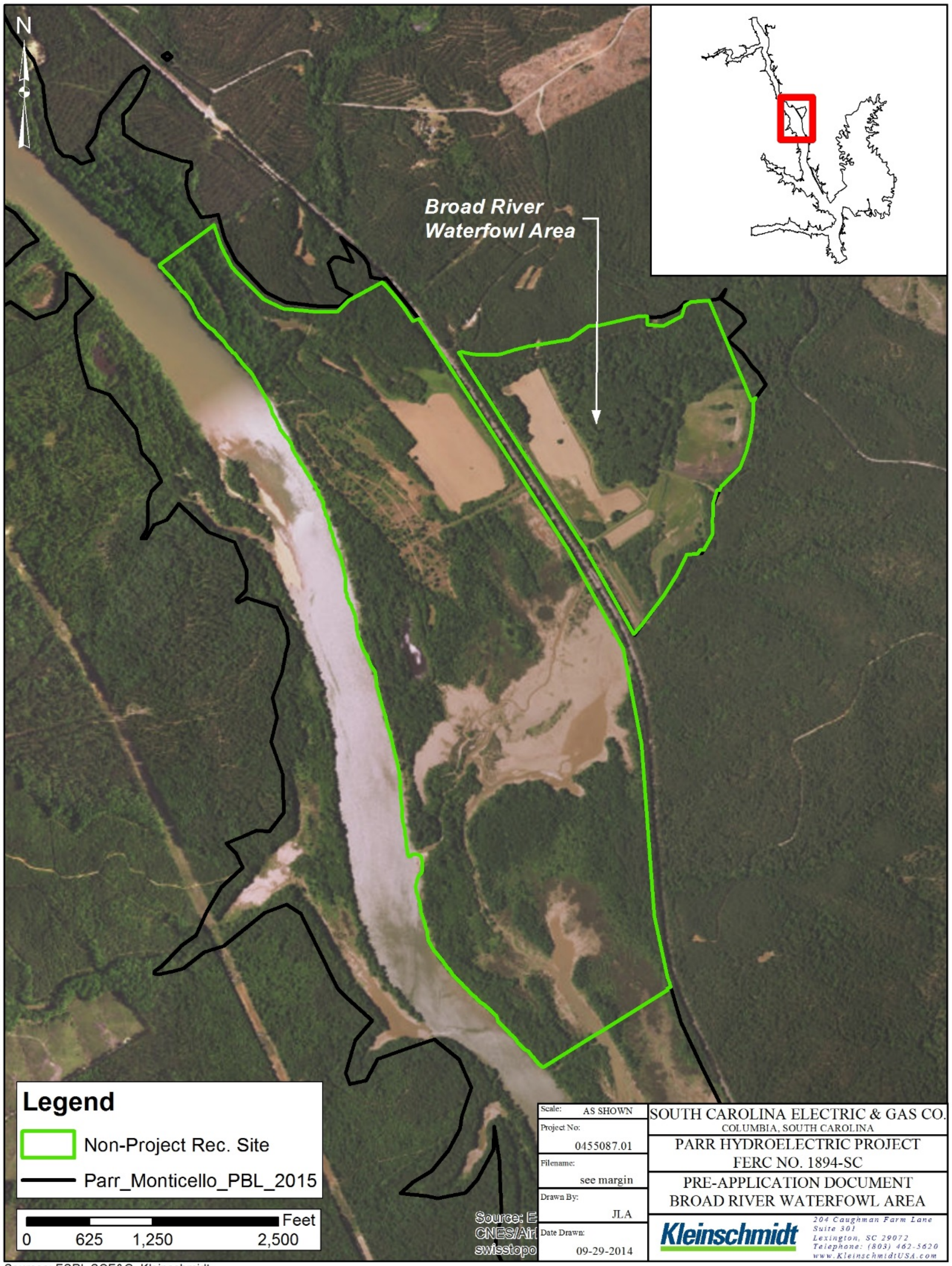
Source: SCEPPC 2008

Broad River and Enoree River Waterfowl Management Areas

The Broad River and Enoree River Waterfowl Management Areas are located in the northern portion of the Project area, and provide important habitat for overwintering waterfowl, as well as recreational waterfowl hunting opportunities that are important to the local economy. Both areas were established in the late 1970s as mitigation when Parr Reservoir was expanded during construction of the Fairfield Development and are currently managed by the SCDNR.

The Broad River Waterfowl Management Area includes five impoundments totaling approximately 130 acres of waterfowl habitat (Figure 4-24). The area includes one greentree reservoir with an oak canopy; the remaining four impoundments are planted in corn or millet and flooded seasonally. Over 500 acres of the remaining area are either upland or uncontrolled backwater. Although a wide variety of duck species may be present, the primary species harvested are ring-necked ducks (*Aythya collaris*), wood ducks, mallards and green-winged teal. Mallards were the primary species present for many years, but their numbers have decreased due to flyway migration changes (SCDNR 2007a).

The Enoree River Waterfowl Management Area includes a combination of open field agriculture (planted seasonally in corn and millet) and flooded hardwood forest (Figure 4-25). Suber Creek is used to flood the 50-acre greentree impoundment. Wood ducks, ring-necked ducks, and green-winged teal are the primary species harvested on the Enoree River Waterfowl Management Area (SCDNR 2007b).



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Sources: ESRI, SCE&G, Kleinschmidt

FIGURE 4-23 BROAD RIVER WATERFOWL MANAGEMENT AREA

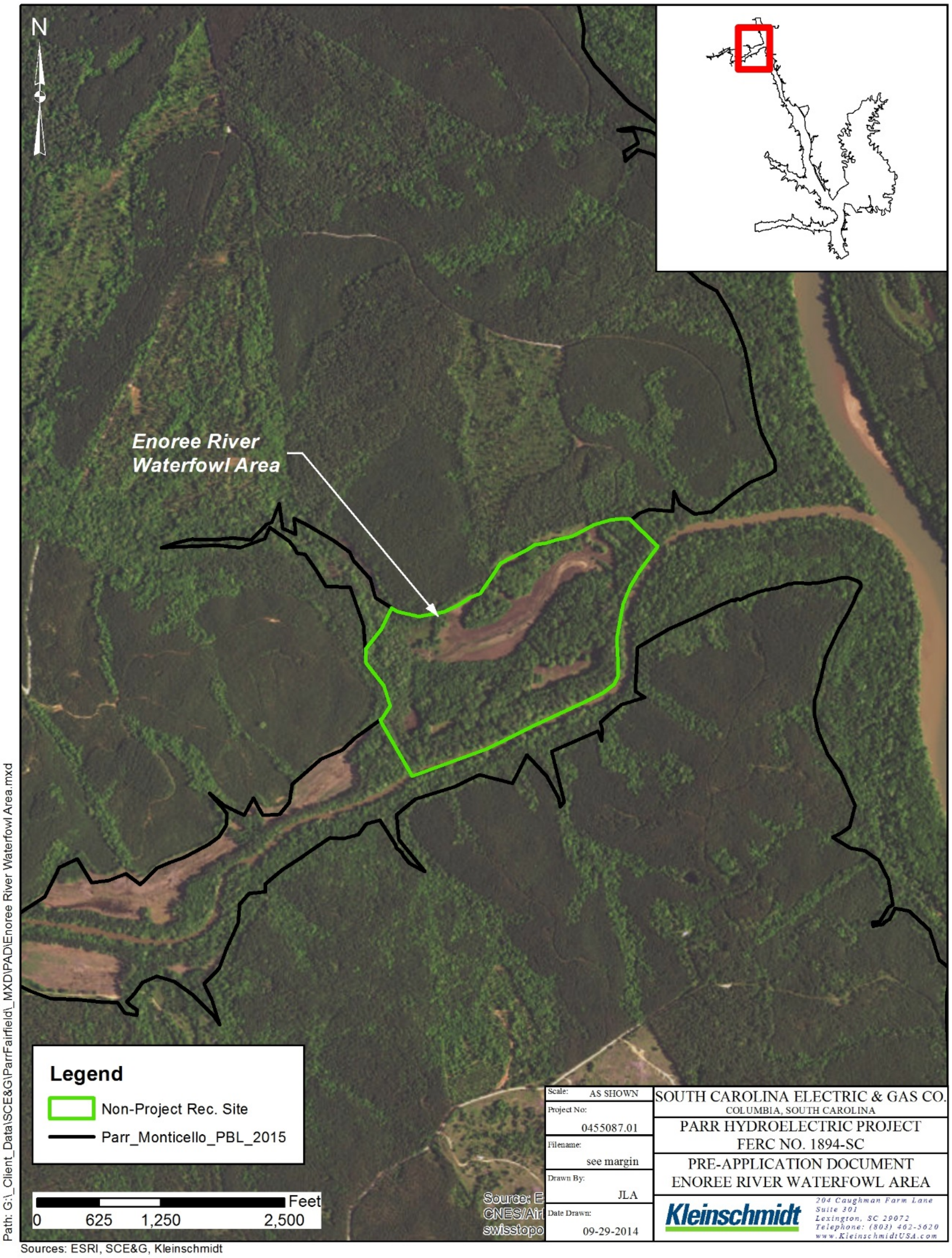


FIGURE 4-24 ENOREE RIVER WATERFOWL MANAGEMENT AREA

4.6.2 Environmental Effects

4.6.2.1 Completed Studies

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. As part of the relicensing process, the stakeholders requested aerial waterfowl surveys be performed to document the type and abundance of waterfowl in the Project area. During 2015 and early 2016, nine aerial waterfowl surveys of Monticello Reservoir, Parr Shoals Reservoir, and the downstream reach of the Broad River were conducted. Then in late 2016 and early 2017, an additional nine aerial surveys were conducted.

During 2015 and early 2016, 2,200 waterfowl (9 species) were observed on Monticello Reservoir, and 4,900 waterfowl (11 species) were recorded on Parr Reservoir (SREL and Kleinschmidt 2017). During late 2016 and early 2017, 1,250 waterfowl (10 species) were documented using the Monticello Reservoir and over 3,000 waterfowl (11 species) were documented at Parr Reservoir. The Parr Reservoir surveys include the Broad River and Enoree River WMAs, where waterfowl habitat management is conducted by the SCDNR. These areas contained the greatest number of waterfowl individuals and waterfowl species (SREL and Kleinschmidt 2017). Complete results of the 2015-2016 and 2016-2017 waterfowl surveys are included in Appendix B.

4.6.2.2 Proposed Action

Continued Project operations will expose shoreline areas during daily pumped storage activities. However, no potential impacts related to wildlife or botanical resources have been identified thus far in the relicensing process. SCE&G will implement the new Shoreline Management Plans which will provide some protection for shoreline development through the permitting process.

4.6.3 Environmental Effects – No Action Alternative

Under the no action alternative, the Project would continue to operate as it does under the existing license. The littoral and riparian areas around the reservoirs would continue to experience some effects caused by daily fluctuations of the reservoirs.

4.6.4 Unavoidable Adverse Effects

No adverse effects or issues related to terrestrial wildlife and botanical resources have been identified at this time and none are expected to occur due to continued Project operations. While no adverse impacts or issues are expected with regards to floodplains and wetlands within the Project area, there is the potential for continued Project operations to impact littoral and riparian areas within the Project boundary. Fluctuations in reservoir levels due to operation of the Project has resulted in limited erosion and potential loss of littoral habitat.

4.6.5 REFERENCES

Bailey, Roger G. 1995. Description of the ecoregions of the United States. Second edition; revised and expanded. Misc. Publication No. 1391 (Revised). Washington, DC: USDA Forest Service. 108 pp. with separate map at 1:7,500,000.

Conant, Roger, and Joseph T. Collins. A Field Guide to Reptiles & Amphibians: Eastern and Central North America. 3rd ed. Boston: Houghton Mifflin, 1998.

Degraaf, R.M. and D.D. Rudis. 1986. New England Wildlife: Habitat, Natural History, and Distribution. General Technical Report NE-108. US Department of Agriculture, US Forest Service (USFS). Northeastern Forest Experiment Station, Broomall, PA. 491 pp.

Federal Power Commission (FPC). 1974. Final Environmental Impact Statement, Parr Hydroelectric Project, No. 1894 – South Carolina. No. PPC-PWR-1894, Washington, D.C.

Griffith, G.E., J.M. Omernik, J.A. Comstock, M.P. Shafale, W.H. McNab, D.R. Lenat, J.B. Glover, and V.B. Shelburne. 2002. *Ecoregions of North Carolina and South Carolina*.

U.S. Geological Survey (USGS), Reston, Virginia.

Messina, MG. and W.H. Conner (eds). 1998. Southern Forested Wetlands: Ecology and Management. Lewis Publishers, Boca Raton, Florida. 640 pp.

Nelson, J.B. 2006. Threatened and Endangered Plant Species Survey: V.C. Summer Nuclear Station. Submitted by J.B. Nelson to Tetra Tech NUS, Inc., Columbia, South Carolina. Accession No. ML082670675.

Nelson, J.B. 2007. Survey for Three Threatened and Endangered Plants: V.C. Summer Nuclear Station. October 2007. Submitted to Tetra Tech NUS, Inc., Columbia, South Carolina.

South Carolina Department of Natural Resources (SCDNR). 2005a. Comprehensive Wildlife Conservation Strategy: Piedmont Ecoregion Terrestrial Habitats. [Online] URL: http://www.dnr.sc.gov/cwcs/pdf/habitat/PiedmontHabitat.pdf.

South Carolina Department of Natural Resources (SCDNR). 2005b. *2005 Comprehensive Wildlife Conservation Strategy*. Accessed August 30, 2009 at http://www.dnr.sc.gov/cwcs/species.html.

South Carolina Department of Natural Resources. 2007a. SCDNR Managed Lands: Broad River Waterfowl Management Area. [Online] URL: https://www.dnr.sc.gov/mlands/managedland?p_id=68. Accessed April 8, 2014.

South Carolina Department of Natural Resources. 2007b. SCDNR Managed Lands: Enoree River Waterfowl Management Area. [Online] URL: https://www.dnr.sc.gov/mlands/managedland?p_id=70 Accessed April 8, 2014.

South Carolina Electric and Gas (SCE&G). 2002. Applicant's Environmental Report, Operating License Renewal Stage Virgil C. Summer Nuclear Station. South Carolina Electric & Gas Company, Docket 50-395, License No NPF-12. Accession No. ML090641089.

South Carolina Electric and Gas (SCE&G). 2010. V.C. Summer Nuclear Station, Units 2 and 3 COL Application, Part 3, Applicant's Environmental Report – Combined License Stage. Revision 2, Jenkinsville, South Carolina.

South Carolina Exotic Pest Plant Council (SCEPPC). 2008. Invasive Species of the South East. [Online] URL: http://www.se-eppc.org/. Accessed November 7, 2006.

Savannah River Ecology Lab (SREL) and Kleinschmidt Associates. 2017. Waterfowl Aerial Surveys of Monticello and Parr Reservoirs, South Carolina: Final Report. April 2017.

U.S. Fish and Wildlife Service (USFWS). 2014. National Wetlands Inventory Mapper. [Online] URL: http://www.fws.gov/wetlands/Data/Mapper.html. Accessed March 4, 2014.

U.S. Geological Survey (USGS). 2013a. Classification of Wetlands and Deepwater Habitats of the United States- Lacustrine System. [Online] URL: http://www.npwrc.usgs.gov/resource/wetlands/classwet/lacustri.htm. Accessed March 20, 2014.

U.S. Geological Survey (USGS). 2013b. Classification of Wetlands and Deepwater Habitats of the United States- Palustrine System. [Online] URL: http://www.npwrc.usgs.gov/resource/wetlands/classwet/palustri.htm. Accessed March 20, 2014.

U.S. Nuclear Regulatory Commission (NRC). 2004. Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Regarding Virgil C. Summer Nuclear Station, Final Report. NUREG-1437, Supplement 15, Washington, D.C.

4.7 RARE, THREATENED, AND ENDANGERED SPECIES

4.7.1 AFFECTED ENVIRONMENT

During consultation, federal and state agencies and other stakeholders identified a list of rare, threatened, and endangered species and species of concern that had the potential to occur within the Project area. The Licensee conducted the Rare, Threatened, and Endangered Species Desktop Assessment to determine likelihood of occurrence for these species within Fairfield, Newberry, and Richland counties (see Appendix B for the complete assessment). Specifically, the study 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).

FEDERALLY LISTED AND CANDIDATE SPECIES

Nine species that are listed as federally threatened or endangered, or are candidates for such listing were identified by the USFWS for the three counties of interest (Table 4-26). While the Atlantic sturgeon has proposed critical habitat in the basin, including unoccupied critical habitat directly below Parr Shoals Dam, there is no other designated critical habitat in the Project boundary. Life history information and habitat requirements for these species are summarized below.

TABLE 4-22 FEDERALLY LISTED AND CANDIDATE SPECIES OCCURRING IN RICHLAND, FAIRFIELD, AND NEWBERRY COUNTIES, SOUTH CAROLINA (SOURCE: USFWS 2013A)

COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS[1]	STATE STATUS[2]	COUNTIES
Birds				
Bald eagle	*Haliaeetus leucocephal*	P	T	Newberry, Fairfield, Richland
Red-cockaded woodpecker	*Picoides borealis*	E	E	Richland
Wood stork	*Mycteria americana*	T	E	Newberry, Richland
Fish				
Atlantic sturgeon	*Acipenser oxyrinchus*	E	E	Richland
Shortnose sturgeon	*Acipenser brevirostrum*	E	E	Richland
Invertebrates				
Carolina heelsplitter	*Lasmigona decorata*	E		Newberry, Fairfield, Richland
Plants				
Canby's dropwort	*Oxypolis canbyi*	E		Richland

COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS[1]	STATE STATUS[2]	COUNTIES
Rough-leaved loosestrife	*Lysimachia asperulaefoli*	E		Richland
Smooth coneflower	*Echinacea laevigata*	E		Richland

1 Federal Status – E (listed as Endangered under ESA); T (listed as Threatened under ESA); C (Candidate for
Federal listing); SC (Federal Species of Concern); P (Federally protected).
2 State Status – E (state listed as endangered); T (state listed as threatened)

Bald eagle

The bald eagle was removed from the federal list of threatened species in 2007 (USFWS 2007a) 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 and Migratory Bird Treaty Act (16 U.S.C.668-668d) (72 FR 37345-37372). Bald eagles are found throughout North America, typically around water bodies, where they feed primarily on fish and carrion. Studies suggest that reservoirs, especially those associated with hydroelectric facilities, are particularly attractive to foraging bald eagles (Brown 1996). Eagles nest in large trees near water and typically repair and use the same nest for several years, (Degraaf and Rudis 1986). In South Carolina, the distribution of eagle nesting has expanded from the coast to encompass more inland areas. This expansion has been attributed to the construction of approximately 491,000 acres of large reservoirs in the state since the early 1900s (Wilde et al. 2003). In South Carolina, the number of estimated nesting pairs has increased from 13 in 1977 to 181 in 2003 (Wilde et al. 2003). Bald eagles are commonly observed in the Project boundary (SCE&G 2010), with Monticello and Parr reservoirs, as well as the lower Broad River, providing abundant foraging habitat and nesting.

Red-cockaded woodpecker

The red-cockaded woodpecker (RCW) is endemic to open, mature, and old growth pine ecosystems in the southeastern United States (USFWS 2003). Over 97% of the pre-colonial era RCW population has been eradicated, leaving only roughly 14,000 RCWs living in about 5,600 colonies scattered across eleven states, including South Carolina. RCW 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 (USFWS 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 RCWs preferred nesting cavities. Suitable foraging habitat consists of open-canopy, mature pine forests with low densities of small pines, little midstory vegetation, limited hardwood overstory, and abundant bunchgrass and forb groundcover (USFWS 2003). There are no known reports of RCWs in areas surrounding the Project or along the lower Broad River. Further, 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 (USFWS 1996). It was federally listed as endangered in 1984, primarily due to loss of wetland habitat throughout its range, but recently its status has been changed from endangered to threatened due to significant population recovery (USFWS 2012b). 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. 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. Shallow, open water is required for successful foraging, and depressions where fish become concentrated during periods of falling water levels are particularly attractive sites. Currently, nesting of the species in the United States is thought to be limited to the coastal plain of South Carolina, North Carolina, Georgia, and Florida (Murphy and Hand 2013), which is consistent with recent survey work that found no nesting on the adjacent Saluda Hydroelectric Project (FERC No. 516) (Kleinschmidt 2005). Periodic foraging of wood storks has been documented in the adjacent Saluda River Basin (Kleinschmidt 2005). Shallow backwaters in the Project boundary, particularly in the upper reaches of the Parr Reservoir, may provide foraging habitat for transient wood storks. Although habitat is present, wood stork use of these areas has not been documented.

Atlantic sturgeon

The Atlantic sturgeon is a large (up to 5.5m in length), long-lived (up to 60 years) anadromous species that was historically present in the Santee Basin at least as far inland as the fall line (Newcomb and Fuller 2001). The Carolina Distinct Population Segment of Atlantic sturgeon, which includes the Santee Basin population, is federally listed as endangered (77 FR 5914), primarily due to overharvesting for flesh and eggs (caviar) during the early to mid-20th Century, as well as habitat degradation and blockage of access to historical spawning grounds (NMFS1998a). The Atlantic sturgeon is considered estuarine anadromous, spending most of it life in estuarine and ocean environments and undertaking spawning migrations into riverine systems during late winter and spring months (NMFS 1998a; Marcy et al. 2005). Spawning typically occurs over hard bottoms of clay, rubble, or gravel with flowing water and temperatures of 14-24ºC. After spawning, females typically return to estuarine environments within 4 to 6 weeks, while males may remain in the river through the fall. Juveniles of this species gradually descend natal rivers for three to five years before reaching the ocean (Marcy et al. 2005).

Proposed designated critical habitat for the Atlantic sturgeon was published in the Federal Register on June 3, 2016, requesting comments by September 1, 2016. The proposed designation would include unoccupied critical habitat in the waterway immediately downstream of the Parr Shoals Dam.

Shortnose sturgeon

The shortnose sturgeon is federally listed as endangered and is thought to have occurred historically in the reach of the Broad River encompassed by the Project (Welch 2000, Newcomb and Fuller 2001). Shortnose sturgeons are amphidromous (semi-anadromous) spending portions of their life cycle in low salinity estuaries and portions in freshwater rivers (NMFS 1998b; Kynard 1997; Buckley and Kynard 1985). Shortnose sturgeon 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 9 °C (Kynard 1997, Hall et al. 1991). Shortnose sturgeon spawning has been documented in the Congaree River near the City of Columbia over substrates of sand, gravel and rock, at temperatures ranging from 9.7-15.6°C, and dissolved oxygen concentrations of 10.6-12.5 mg/L (Collins et al. 2003).

Population groups of shortnose sturgeon are known from downstream of the Santee-Cooper dams in the lower Santee and Cooper rivers (Collins et al. 2003). An additional dam-locked spawning population of shortnose sturgeon has been documented in the Santee-Cooper lakes (with Lake Marion and its tributaries harboring the most significant number of fish) and upstream in the Congaree River. Radio-telemetry studies have documented migration of shortnose sturgeon as far upstream on the Congaree as the Blossom Street Bridge adjacent to the City of Columbia (Finney et al. 2006). However, consultation with SCDNR Diadromous Fish Program staff 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. Granby Lock and Dam is located approximately one mile downstream of the Blossom Street Bridge and approximately five miles downstream of the Columbia Hydroelectric Project Fishway (fishway). 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”. Shortnose sturgeon have not been documented upstream of the Blossom Street Bridge in recent history, nor have any been documented passing into the Project boundary through the fishway since annual monitoring began in 2007.

Carolina heelsplitter

The Carolina heelsplitter is the only South Carolina freshwater mussel currently listed as federally endangered (Price 2006). Although it was once found in large rivers and streams, the Carolina heelsplitter is now restricted to cool, clean, shallow, heavily shaded streams of moderate gradient. Stable streambanks and channels, with pool, riffle and run sequences, little or no fine sediment, and periodic natural flooding, appear to be required for the Carolina heelsplitter. Carolina heelsplitter is known to occur in isolated populations distributed in the Savannah, Pee Dee, and Catawba drainages and is not known to occur in the Broad River Basin (Price 2006) or within the Project boundary.

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 (USFWS 2010). 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 and a high water table. They are also 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 affected by the Project. This assumption is consistent with result of surveys by Nelson (2006, 2007), which failed to document the species on the adjacent V.C. Summer Nuclear Plant site.

Rough-leaf Loosestrife

Rough-leaf loosestrife generally occurs in the ecotones or 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 2013). Rough-leaf loosestrife has also 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 typically found in open woods, cedar barrens, roadsides, clearcuts, dry limestone bluffs, and power line rights-of-way, usually on magnesium and calcium rich soils associated with amphibolite, dolomite or limestone (in Virginia), gabbro (in North Carolina and Virginia), diabase (in North Carolina and South Carolina), and marble (in South Carolina and Georgia) (USFWS 2012a). 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 also sun-loving species that depend on periodic disturbances to reduce the shade and competition of woody plants. The diabase 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 no site-specific surveys have been performed, surveys by Nelson (2006, 2007) failed to document smooth coneflower on the adjacent V. C. Summer Nuclear Plant area and concluded that appropriate habitat for the species does not occur on the site.

Federal At-Risk Species

The USFWS lists an additional seventeen species as At-Risk Species for the three counties of interest (Table 4-27). At-Risk Species refers to species that the USFWS has been petitioned to list and for which a positive 90-day finding has been issued (listing may be warranted), yet no federal protections currently exist. Of the seventeen species, five species have the potential of occurring in the Project area. Life history information and habitat requirements for the five species are summarized below.

TABLE 4-23 FEDERAL AT-RISK SPECIES WITH THE POTENTIAL OF OCCURRING IN THE PROJECT AREA

COMMON NAME	SCIENTIFIC NAME	COUNTIES
Crustaceans		
Broad River spiny crayfish	*Cambarus spicatus*	Fairfield, Richland
Fish		
American eel	*Anguilla rostrata*	Newberry, Fairfield, Richland
Blueback herring	*Alosa aestivalis*	Newberry, Fairfield, Richland
Robust redhorse	*Moxostoma robustum*	Richland
Mammals		
Tri-colored bat	*Perimyotis subflavus*	Newberry, Fairfield, Richland

Broad River spiny crayfish

The Broad River spiny crayfish distribution is thought to be limited to lotic environments in the Broad River drainage (Eversole 1990). Although collections are limited, Broad River spiny crayfish have been found in association with leaf litter and other organic debris located along stream banks, primarily over unstable sandy substrates that lack rooted aquatic vegetation. In the Project vicinity, this species has been collected in the Little River, a tributary to the Broad River, in Fairfield County (Eversole 1990).

American eel

The American eel is a catadromous species known to occur within river systems in South Carolina. Mature American eels spawn in the ocean and the egg and pre-larval stages mature into the leptocephalus stage, where they drift with ocean currents for approximately a year before metamorphosing into the glass eel stage. Glass eels migrate across the continental shelf, eventually entering estuaries and tidal rivers, where they mature into elvers. Elvers migrate primarily at night and are able to overcome obstacles that often times prevent passage of other aquatic species. Vertical obstacles, such as dams, can be traversed by small eels as long as the surface of the structure is textured and remains wet. As the small eels continue to mature into yellow eels, they may gradually move upstream over many years, with the greatest movement occurring during the moderate water temperatures of spring and fall (ASMFC 2000). Although the American eel currently does not have special status under state or federal regulations, it has been identified by the SCDNR as a priority species (SCDNR 2005). The federal status of this species has been further reviewed by the USFWS and NMFS several times over the past decade and the species is considered “at risk”.

Blueback herring

The blueback herring is a diadromous fish that ranges along the Atlantic Coast from Nova Scotia to Florida. It can be found in the Atlantic Ocean as well as coastal rivers and streams (SCDNR 2013). As a diadromous fish, the blueback herring spends its adult life at sea and migrates up freshwater rivers and streams to spawn. Spawning area spans the tidal zone to as far upstream as 100 miles (SCDNR 2013). During spawning the female releases as many as 250,000 eggs in shoreline areas of hard substrate (SCDNR 2013). The eggs are then fertilized by the male. After the spawning season of April and May, adult blueback herring return to the ocean. Freshly hatched blueback herring remain in the rivers for several months before moving to sea (SCDNR 2013). Blueback herring are known to occur in watersheds throughout South Carolina, including the Santee River Basin, where the Project is located. However, blueback herring have not been documented using the Columbia fishway located downstream of Parr Shoals Dam.

Robust redhorse

The robust redhorse is a large, heavy-bodied sucker, which was presumed extinct until being "rediscovered" during the initial stages of relicensing at Georgia Power's Sinclair Hydroelectric Project (FERC No. 1951). Georgia Power Company, along with state and federal resource agencies, other hydropower interests, and the Georgia Wildlife Federation, formed the Robust Redhorse Conservation Committee (RRCC) in 1995 to guide recovery efforts for the species in lieu of listing under the ESA. Subsequent research has produced valuable information about the robust redhorse and its habitat requirement. Based on recent studies, it appears that the adult robust redhorse typically inhabit areas of the river where the current is moderately swift. Preferred habitat is riffle areas or in/near outside bends, where depths are greater and accumulations of logs and other woody debris are present (Evans 1997). Spawning typically occurs at water temperatures from 18 to 24ºC, usually over gravel substrate in both deep and shallow water (Hendricks 1998).

At this time, natural populations of robust redhorse are not known to exist in the Broad River (Lamprecht and Scott 2013). Stocking of fingerlings began in 2004 at both sites above and below the Parr Shoals Dam and robust redhorse have since been documented in both Parr and Monticello reservoirs, as well as the reach of the Broad River downstream of Parr Shoals Dam. In addition, robust redhorse use of the fishway at the Columbia Hydroelectric Project has been documented, suggesting that robust redhorse from the Congaree and potentially other areas of the lower Santee Basin are utilizing habitat in the reach of the Broad River downstream of Parr Shoals Dam during the spawning season.

Tri-colored bat

The tri-colored bat is very small and exhibits delayed fertilization. In the spring, the female fertilizes an egg with stored sperm and gives birth in the fall to twins (NatureServe 2015l). The pups are able to fly within a month and remain with the mother for another week for foraging. Once young tri-colored bats learn how to forage for insects they leave their mothers and are independent (NatureServe 2015l). This bat ranges throughout most of the eastern United States, southeastern Canada, and into eastern Mexico and Central America (NatureServe 2015l). Most tri-colored bats roost in trees during the summer and hibernate in cave, mines, and rock crevices during the winter (NatureServe 2015l).

The tri-colored bat is considered common in South Carolina, and is found statewide (SCDNR 2015); however, here are no known hibernation caves located in the Project area or Project vicinity.

STATE LISTED SPECIES

Three species that are state-listed as threatened or endangered are included on the SCDNR county-level listings for the three counties of interest (Table 4-28). Life history information and habitat requirements for these species are summarized below.

TABLE 4-24 STATE-LISTED SPECIES OCCURRING IN RICHLAND, FAIRFIELD, AND NEWBERRY COUNTIES, SOUTH CAROLINA

COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS[1]	STATE STATUS[2]	COUNTIES
Amphibians				
Pine Barrens tree frog	*Hyla andersonii*		T	Richland
Mammals				
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	ARS	E	Richland
Fish				
Carolina darter	*Etheostoma collis*	SC	T	Fairfield, Richland

[1] Federal Status – E (listed as Endangered under ESA); T (listed as Threatened under ESA); C (Candidate for Federal listing); SC (Federal Species of Concern); P (Federally protected); ARS (At-risk species).
[2] State Status – E (state listed as endangered); T (state listed as threatened).

Pine Barrens tree frog

The Pine Barrens tree frog inhabits the swamps, bogs, and acidic brownwater streams of the New Jersey Pine Barrens, as well as the pocosins (shrub bogs) of the Carolinas (Conant and Collins 1991). This species is intolerant of closed-canopy conditions and is restricted to localized wetlands such as hillside seepage bogs within dry uplands, pine barrens, and headwater swamps and disperses along drainages within these areas (NatureServe 2013). Non-breeding habitat generally is in pine-oak areas adjacent to breeding habitat. Important egg-laying and larval habitats include open cedar swamps and sphagnaceous, shrubby, acidic, seepage bogs on hillsides below pine-oak ridges. For southeastern populations, typical habitats are characterized by the topography, soils, and vegetation of the Carolina Sandhills, with pocosin or evergreen shrub swamps established along seeps and small streams within the surrounding longleaf pine-oak forest. Breeding habitat in South Carolina has been described as low vegetation with dense growth of Sphagnum mosses. Cely and Sorrow (1983) found that occurrences in South Carolina appeared to be restricted to the Fall Line Sandhills at elevations ranging between 61 and 122 m.

The area surrounding the Project lacks the Carolina sandhills habitat and associated bogs and pocosins required by this species.

Rafinesque's big-eared bat

Rafinesque's big-eared bat is a colonial bat species native to the southeastern U.S. Two subspecies are recognized in South Carolina, *Corynorhinus rafinesquii rafinesquii* in the mountains and *Corynorhinus rafinesquii macrotis* along the Coastal Plain (Bunch et al. 2006). Rafinesque's big-eared bat is nocturnal, feeding primarily on moths by echolocation. Coastal plain and sandhills populations of the species utilize I-beam and T-beam bridges for roosting.

Roosting in mountainous regions of the state occurs in large hollow trees (typically large tulip poplars), abandoned buildings and mines, rock shelters, and caves. Habitat in the Blue Ridge Mountains includes rock outcrops, mesic and cove hardwood forests, forested bottomlands, bottomland agricultural fields, dry deciduous forests, pine woodlands, and forested riparian areas. Coastal zone and sandhills habitats include black gum stands, bald cypress swap forests, maritime forests, and mature hardwood and mixed forests (Bunch et al. 2006). The range of Rafinesque's big-eared bat in South Carolina includes the coastal plain and sandhills regions and the extreme northwestern Blue Ridge, with the piedmont representing a gap in the species' distribution (Bunch et al. 2006). As such, it is extremely unlikely that this species would occur in the Project area.

Carolina darter

The Carolina darter exists only in the Piedmont region from south-central Virginia through North Carolina into north-central South Carolina (Hayes and Bettinger 2006); it is state-listed as threatened and a federal species of concern. It occurs in small to moderately sized streams in areas of low current velocity, typically in backwaters among submerged tree roots or under leaves, where it feeds primarily on Chironomid larvae and micro-crustaceans. Preferred substrates are usually characterized by mud, sand, and sometimes bedrock (Rohde et al. 2009). The Carolina darter has been collected at several locations in the lower Broad River, including in a tributary to Parr Reservoir (Rohde et al. 2009). However, extensive sampling by SCE&G and SCDNR in both Parr and Monticello reservoirs and in the downstream reach have failed to document this species

(Kleinschmidt 2013a), suggesting that it may not occur in the Project area or occurs in extremely low numbers not detected by previous sampling.

SELECTED SOUTH CAROLINA CONSERVATION PRIORITY SPECIES

As previously noted, ten species that are considered state conservation priority species (SCPS) were also added to the analysis based on consultation with SCDNR and USFWS staff (Table 4-29). Life history information and habitat requirements for these species can be found within the RTE Desktop Assessment (Appendix B).

TABLE 4-25 SELECTED STATE CONSERVATION PRIORITY SPECIES

COMMON NAME	SCIENTIFIC NAME	STATE PRIORITY LEVEL[1]	FEDERAL STATUS[2]
Newberry burrowing crayfish	*Distocambarus youngineri*	Highest	ARS
Robust redhorse	*Moxostoma robustum*	Highest	ARS
Piedmont darter	*Percina crassa*	High	
Seagreen darter	*Etheostoma thalassinum*	High	
Highfin carpsucker	*Carpiodes velifer*	Highest	
Quillback	*Carpiodes cyprinus*	High	
Santee chub	*Hybopsis zanema*	High	
Striped bass	*Morone saxatilis*	Moderate	
Yellow lampmussel	*Lampsilis cariosa*	Highest	
Roakoke slabshell	*Elliptio roanokensis*	High	

[1] Refers to conservation priority level as listed in SCDNR's State Wildlife Action Plan (SCDNR 2015).
[2] ARS – At-Risk-Species. Refers to species that the USFWS has been petitioned to list and for which a positive 90- day finding has been issued (listing may be warranted), yet no Federal protections currently exist.

4.7.2 ENVIRONMENTAL EFFECTS

4.7.2.1 COMPLETED STUDIES

BROAD RIVER SPINY CRAYFISH STUDY

Based on a recommendation from the USFWS, Broad River spiny crayfish surveys were conducted in the Parr Reservoir and in the Broad River downstream of the Parr Shoals Dam from early September to late October 2015. No crayfish were collected during the Broad River spiny crayfish study (Kleinschmidt 2016b). During the American eel study performed in the Parr Shoals Dam tailrace area, approximately thirteen crayfish were collected in a large fyke net that sampled the west channel area during springtime collections (Kleinschmidt 2016c). Through consultation with USFWS the crayfish were identified as either acuminate crayfish (*Cambarus acuminatus)* or Carolina needlenose crayfish (*Cambarus aldermanorum)* and a reference sample was kept in 70% ethanol. No Broad River spiny crayfish were collected in the fyke net (Kleinschmidt 2016c). For the full report see Appendix B.

AMERICAN EEL ABUNDANCE STUDY

The Licensee conducted American eel abundance surveys during 2015 in the Broad River directly downstream of the Parr Shoals Dam. In addition, the Licensee performed one more year of backpack electrofishing during 2016 to verify the 2015 study results. The 2015 study was performed to determine the relative abundance, size and movement patterns of American eel in the Broad River immediately downstream from the Parr Shoals Dam. Only one American eel was collected (Kleinschmidt 2016c). Three backpack and three boat electrofishing efforts were conducted in the spring of 2016 to provide an additional assessment of the abundance of American eels downstream of Parr Shoals Dam. A total of two yellow eels were observed during the collections. The results of the 2016 study corroborate the findings of the previous 2015 eel sampling effort, that while American eels are present in the area downstream of Parr Shoals Dam, they do not appear to be abundant (Kleinschmidt 2016c). For the full report see Appendix B.

ROCKY SHOALS SPIDER LILY STUDY

Although the Rocky Shoals Spider Lily (RSSL) is not state or federally listed as threatened, endangered, or at risk, it is considered rare by SCDNR and is among the species tracked by the agency's Heritage Trust Program (Julie Holling, SCDNR, Pers. Comm., April 14, 2014). The RSSL occurs in significant numbers downstream of Parr Shoals Dam and stakeholders requested a study to assess the number and spatial distribution of RSSL populations in the Project area (Appendix B). In the Broad River, extending from Parr Shoals Dam through Frost Shoals, near Boatwright Island, 81 plants or clumps of plants were documented during the RSSL study (Kleinschmidt 2015).

4.7.2.2 PROPOSED ACTION

The Licensee is proposing to adjust the minimum flow to better account for aquatic species/habitat and fish passage needs through a Minimum Flow AMP. However a final downstream minimum flow has not yet been determined, as SCE&G and stakeholders are still determining which flows will be best to ensure protection of aquatic life. The Licensee will propose a new downstream minimum flow in the FLA.

Similarly, as requested by stakeholders SCE&G is proposing to adjust Project operations so that downstream flow fluctuations are lessened or stabilized during spring spawning periods and, to a lesser degree, year round. Stakeholders requested that SCE&G attempt to stabilize downstream fluctuation flows for 14 days during the last two weeks in March to minimize effects on shortnose sturgeon spawning. They also requested SCE&G stabilize downstream fluctuation flows for an additional 14 days later in the spring to minimize effects on striped bass, American shad, and robust redhorse spawning. SCE&G is still developing the Downstream Fluctuation Flow AMP and will include a final proposal on downstream fluctuation flows in the FLA.

SCE&G is also a signatory to the Accord, which requires SCE&G to implement fish passage at the Project when certain biological triggers are met. When species such as American shad and blueback herring are identified in significant numbers downstream of the Project, SCE&G will initiate construction of a fish passage facility at Parr Shoals Dam. This provision could result in significant positive effects on diadromous and anadromous fish living within the Broad River basin.

Below is discussion on how these proposed changes, along with additional PM&E measures, could affect the federal and state listed species that potentially occur within the Project area.

FEDERALLY LISTED AND CANDIDATE SPECIES

Birds

Only the bald eagle likely occurs in the Project vicinity with any regularity. Continued operation of the Project is not likely to result in negative effects on eagle foraging or nesting. The Licensee tracks bald eagle nesting in the Project area and utilizes this information to minimize potential impacts of various shoreline management activities on eagle nests. Specifically, SCE&G refrains 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. This policy is in adherence to the USFWS habitat guidelines for nesting bald eagles (USFWS 2007b). SCE&G also frequently consults with USFWS Ecological Services staff regarding proposed activities in the vicinity of known nests. The Licensee plans to continue these measures to ensure the bald eagle and its nests are protected within the Project area.

Wood storks may periodically utilize portions of Project lands and waters for seasonal foraging (primarily by post-dispersal migrants during the summer months); however, this usage tends to be sporadic and ephemeral. Project operations are expected to result in no effects on wood storks or their habitat. In fact, fluctuating water levels in Parr Reservoir could enhance foraging habitat by periodically trapping fish in shallow pool areas.

The Licensee's proposed actions should not have a negative effect on bald eagles or wood storks that may exist within the Project boundary.

Fish

Population groups of shortnose sturgeon are known to occur downstream of the Santee-Cooper dams in the lower Santee and Cooper rivers (Collins et al. 2003). Proposed actions are expected to result in no effect on this species due to a likely lack of occurrence in the Project boundary. If this species should expand its range and begin occurring within the Project area, SCE&G would likely implement fish passage at Parr Shoals Dam per the Accord. Furthermore, stabilization of downstream fluctuation flows could have a positive effect on shortnose sturgeon spawning.

Several other fish species that are not federally listed, but are classified as priority conservation species have been documented in the Project vicinity. Habitat requirements for these species were assessed as part of the IFIM study and proposed downstream minimum flows will take into account the results of this study.

FEDERAL AT-RISK SPECIES

Crustaceans

During the Broad River Spiny Crayfish Study, no Broad River spiny crayfish were collected. It can be assumed that Broad River spiny crayfish do not exist within the Project boundary, and therefore will not be effected by proposed actions.

Fish

The American Eel Abundance Study resulted in the collection of a single eel. Two additional eels were observed but not collected during additional sampling the following season. The Licensee is proposing to conduct additional monitoring during the term of the new license to determine if eel presence downstream of Parr Shoals Dam is increasing, per the request of NMFS. Frequency of monitoring and other specifics are still being determined. A draft American Eel Monitoring Plan is included in Appendix D and a final proposal on American eel monitoring will be included in the FLA. Other proposed actions are not likely to have significant effects on the species.

Currently, blueback herring do not occur in the Project vicinity, however the Columbia Fishway, allows for the possibility of this species to occur in the Project vicinity within the term of the new license. Should blueback herring triggers be met as specified in the Accord, SCE&G will initiate the construction of a fish passage facility at Parr Shoals Dam. Other proposed actions will not likely have significant impacts to blueback herring.

Robust redhorse are known to occur in Parr and Monticello reservoirs and in the Broad River downstream of Parr Shoals Dam. Robust redhorse are also documented as using the Columbia Fishway. Proposed actions, including the increased minimum flow and stabilized downstream fluctuation flows, will likely have significant positive impacts on robust redhorse. Proposed minimum flows will be determined based on the IFIM study results, which used robust redhorse as a key species for flow alterations. Similarly, downstream fluctuation flows will likely be stabilized specifically for enhancement of robust redhorse spawning, among other species, during late spring.

STATE LISTED SPECIES

Fish

The Carolina darter has been collected at several locations in the lower Broad River, including one that appears to be a tributary to Parr Reservoir (Rohde et al. 2009). However, extensive sampling by SCE&G and SCDNR in both Parr and Monticello reservoirs and in the downstream reach have failed to document this species (Kleinschmidt 2013a), suggesting that it may not occur in the Project boundary or occurs in extremely low numbers not detected by previous sampling. Proposed actions are not expected to have an impact on this species.

Plants

The Congaree Riverkeeper requested that SCE&G perform periodic monitoring of RSSL populations downstream of Parr Shoals Dam but upstream of Columbia Dam through the term of the new license. Congaree Riverkeeper also requested that SCE&G join in the ongoing efforts for restoration, public outreach and public education of the RSSL by the City of Columbia. SCE&G is considering this request, and pending further discussions with the Congaree Riverkeeper, will include a final proposal in the FLA. Other proposed actions, including an increased minimum flow and stabilized downstream fluctuation flows are not expected to have a significant impact on RSSL.

4.7.3 ENVIRONMENTAL EFFECTS – NO ACTION ALTERNATIVE

Under the no action alternative, a new license would not be issued and the Project would continue to operate as it does currently. The downstream minimum flow would not increase and downstream fluctuation flows could continue to occur at the same frequency and magnitude. Aquatic habitat enhancements would not be installed in Monticello Reservoir and American eel monitoring would not occur as requested by NMFS. In addition, the Licensee would not participate in RSSL public outreach and education efforts with the City of Columbia.

SCE&G would still plan for the construction and implementation of a fish passage facility at Parr Shoals Dam per the Accord, as this document is not tied to the current Project license. SCE&G is dedicated to this program and plans to continue participation separate from any FERC license.

SCE&G would also continue to track bald eagle nesting in the Project area 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. SCE&G would also continue to consult with USFWS Ecological Services staff regarding proposed activities in the vicinity of known nests.

4.7.4 UNAVOIDABLE ADVERSE EFFECTS

The only unavoidable adverse effect that has been identified by continued Project operation with regards to rare, threatened, and endangered resources is downstream fluctuation flows. Due to pumping and generating operations at the Fairfield Development, and when inflow is greater than hydraulic capacity of the Parr Development, water is spilled over Parr Shoals Dam, creating a fluctuation of downstream flows. This may interfere with spawning of various species including, but not limited to, shortnose sturgeon, striped bass, American shad, and robust redhorse. SCE&G is proposing to implement a variety of measures to decrease these fluctuating flows during spawning periods and year round.

4.7.5 REFERENCES

Atlantic States Marine Fisheries Commission (ASMFC). 2000. Interstate Fishery Management Plan for American Eel. [Online] URL: http://www.asmfc.org/speciesDocuments/eel/fmps/eelFMP.pdf Accessed September 5, 2013.

Bennett, S.H. and K.A. Buhlmann. 2006. Pine Barrens Treefrog (*Hyla andersoni*). South Carolina Department of Natural Resources. <http://www.dnr.sc.gov/cwcs/pdf/PineBarrensTreefrog.pdf.> Retrieved April 16, 2014.

Bettinger, J., J. Crane, and J. Bulak 2003. Broad River Aquatic Resources Inventory Completion Report (Draft). Prepared by SCDNR as part of the Broad River Comprehensive Entrainment Mitigation and Fisheries Resource Enhancement Program. January 28, 2003.

Bogan, A. E., & Alderman, J. M. 2008. *Workbook and key to the freshwater bivalves of South Carolina*. North Carolina Freshwater Bivalve Conservation Partnership.

Brown, R.D. 1996. Attraction of bald eagles to habitats just below dams in Piedmont North and South Carolina. p. 299-306 In: Raptors in Human Landscapes. Bird, D.M., D.E. Varland, J.J. Negro (eds). Academic Press. San Diego, California.

Buckley, J., and B. Kynard. 1985. Yearly movements of shortnose sturgeons in the Connecticut River. Transactions of the American Fisheries Society 114:813-820.

Bunch, M., Loeb, S., Hood, W., Clark, M.K. and Perry. T. 2006. Colonial Cavity Roosting Bats. South Carolina Department of Natural Resources. <http://www.dnr.sc.gov/cwcs/pdf/colonialbats.pdf.> Retrieved April 16, 2014.

Cely, J. E., and J. A. Sorrow, Jr. 1983. Distribution, status and habitat of the pine barrens treefrog in South Carolina. Final report, South Carolina Wildlife and Marine Resources Department, Columbia, South Carolina. 55 pp.

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.

Conant, R. and J. T. Collins. 1991. A field guide to reptiles and amphibians: eastern and central North America. Third edition. Houghton Mifflin Co., Boston, Massachusetts. 450 pp.

Degraaf, R.M. and D.D. Rudis. 1986. New England Wildlife: Habitat, Natural History, and Distribution. General Technical Report NE-108. US Department of Agriculture, US Forest Service (USFS). Northeastern Forest Experiment Station, Broomall, PA. 491 pp.

Evans, J.W. 1997. Developing stakeholder partnerships for the management of imperiled species: a case study. Waterpower '97, Proceeding of the International Conference on Hydropower. p. 490-499.

Eversole, A.G. 1990. Status Report on *Cambarus (Puncticambarus) spicatus* Hobbs, *Distocambarus (Fitzcambarus) youngineri* Hobbs, and *Procambarus (Pennides) echinatus* Hobbs. Completion Report. 21 pp.

Finney, S.T., J.J. Isely, and D.W. Cook. 2006. Upstream Migration of TwoPre-Spawning Shortnose Sturgeon Passed Upstream of the Pinopolis Dam, Cooper River, South Carolina. Southeastern Naturalist 5(2):369-37.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.

Lamprecht, S. D. and M.C. Scott. 2013. Robust Redhorse (*Moxostoma robustum*) in Draft 2015 State Wildlife Action Plan. Supplemental Volume: Species of Conservation Concern. http://www.dnr.sc.gov/swap/supplemental/freshwaterfish/robustredhorse2015.pdf. Retrieved September 16, 2014.

Hayes, G. and Bettinger, J. 2006. High Conservation Concern Priority – Piedmont Species. South Carolina Department of Natural Resources. <http://www.dnr.sc.gov/cwcs/pdfhigh/Piedmont.pdf .> Retrieved April 16, 2014.

Hendricks, A.S. 1998. The conservation and restoration of the robust redhorse (*Moxostoma robustum*) Volume 1. Georgia Power Company, Environmental Laboratory, Smyrna, Georgia. 44 pp.

Kleinschmidt. 2005. Lake Murray Wood Stork Surveys: 2005 Summary Report. Prepared for South Carolina Electric & Gas Co. December 2004. 24 pp.

Kleinschmidt. 2013. Parr Hydroelectric Project Final Baseline Fisheries Resources Report. Prepared for South Carolina Electric & Gas Co. November 2013. 39 pp.

Kleinschmidt. 2015. Rocky Shoals Spider Lily Report. Prepared for South Carolina Electric & Gas Co. November 2015.

Kleinschmidt. 2016a. Parr Hydroelectric Project Rare, Threatened and Endangered Species Desktop Assessment. Prepared for South Carolina Electric & Gas Co. March 2016.

Kleinschmidt. 2016b. Broad River Spiny Crayfish Study Report. Prepared for South Carolina Electric & Gas Co. January 2016.

Kleinschmidt. 2016c. American Eel Abundance Study Report. Prepared for South Carolina Electric & Gas Co. June 2016.

Kynard, B. 1997. Life history, latitudinal patterns, and status of the shortnose sturgeon *Acipenser brevirostrum*. Environmental Biology of Fishes 48:319-334.

Marcy, B.C., Jr., D.E. Fletcher, F.D. Martin, M.H. Paller, M.J.M. Reichert. 2005. Fishes of the Middle Saluda River Basin. University of Georgia Press, Athens, Georgia. 461 pp.

Murphy, T.M. and Hand, C.E. 2013. Wood Stork (*Mycteria Americana*). Supplemental Volume: Species of Conservation Concern, Draft – November 2013. South Carolina Department of Natural Resources. <http://www.dnr.sc.gov/cwcs/pdf/Woodstork.pdf.> Retrieved April 16, 2014.

National Marine Fisheries Service (NMFS). 1998a. Fishery Management Report No. 31 of the Atlantic States Marine Fisheries Commission. Amendment 1 to the Interstate Fishery Management Plan for Atlantic sturgeon (*Acipenser oxyrhynchus oxyrhynchus*). July 1998. 43 pp.

National Marine Fisheries Service (NMFS). 1998b. Recovery plan for the shortnose sturgeon (*Acipenser brevisrostrum*). Prepared by the Shortnose Sturgeon Recovery Team for the NMFS, Silver Spring, Maryland. 104 pp. NatureServe Explorer: An online encyclopedia of life. Version 7.1. 2013. NatureServe. Arlington, Virginia <http://www.natureserve.org/explorer/servlet/NatureServe?init=Species> Retrieved April 14, 2014.

NatureServe. 2015l. *Perimyotis subflavus*. [Online] URL: http://explorer.natureserve.org/servlet/NatureServe?searchName=Perimyotis+subflavus.

Nelson, J.B. 2006. Threatened and Endangered Plant Species Survey: V.C. Summer Nuclear Station. Submitted by J.B. Nelson to Tetra Tech NUS, Inc., Columbia, South Carolina.

Nelson, J. B. 2007. Survey for Three Threatened and Endangered Plants: V.C. Summer Nuclear Station, October 2007, Submitted to Tetra Tech NUS, Inc. Columbia, South Carolina, 2007.

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.

Price, J. 2006a. Carolina Heelsplitter (*Lasmigona decorata*). South Carolina Department of Natural Resources. http://www.dnr.sc.gov/cwcs/pdf/CarolinaHeelsplitter.pdf. Retrieved April 16, 2014.

Rohde, F.C., Arndt, R.G., Foltz, J.W., and Quattro, J.M. 2009 Freshwater Fishes of South Carolina. Columbia, South Carolina: University of South Carolina Press.

South Carolina Department of Natural Resources (SCDNR). 2005. 2005 Comprehensive Wildlife Conservation Strategy. South Carolina Priority Species. [Online] URL: http://www.dnr.sc.gov/cwcs/ Accessed September 5, 2013.

South Carolina Department of Natural Resources (SCDNR). 2013. Freshwater Fish – Species: blueback herring. [Online] URL: http://www.dnr.sc.gov/fish/species/bluebackherring.html.

South Carolina Department of Natural Resources (SCDNR). 2015. 2015 State Wildlife Action Plan, Supplemental Volume: Species of Conservation Concern. [Online] URL: http://dnr.sc.gov/swap/species2015.html.

South Carolina Electric and Gas (SCE&G). 2010. V.C. Summer Nuclear Station, Units 2 and 3 COL Application, Part 3, Applicant's Environmental Report – Combined License Stage. Revision 2, Jenkinsville, South Carolina.

United States Fish and Wildlife Service (USFWS). 1996. Revised Recovery Plan for the U.S. Breeding Population of the Wood Stork. U.S. Fish and Wildlife Service, Atlanta, Georgia. 41 pp.

United States Fish and Wildlife Service (USFWS). 2003. Recovery plan for the red-cockaded woodpecker (Picoides borealis): second revision. U.S. Fish and Wildlife Service, Atlanta, Georgia.

United States Fish and Wildlife Service (USFWS). 2007b. National Bald Eagle Management Guidelines. May 2007, 23 pp.

United States Fish and Wildlife Service (USFWS). 2013a. Endangered, Candidate, and At-Risk Species, County Listings. Charleston Ecological Services, Charleston, South Carolina. <http://www.fws.gov/charleston/EndangeredSpecies_County.html> Retrieved April 14, 2014.

USFWS. 2007a. 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.

USFWS. 2010. 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.> Retrieved April 17, 2014.

USFWS. 2012a. Species Profile: Smooth Coneflower (*Echinacea laevigata*). USFWS Raleigh Ecological Services Field Office. <http://www.fws.gov/raleigh/species/es_smooth_coneflower.html.> Retrieved April 17, 2014.

USFWS. 2012b. Endangered and Threatened Wildlife and Plants: Reclassification of the Continental U.S. Breeding Population of the Wood Stork From Endangered to Threatened, Proposed Rule, Federal Register, Volume 77, No. 242, Washington, D.C., December 26, 2012.

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.

Wilde, S.B., T.M. Murphy, and C. Hope. 2003. Lake Murray Monitoring Project: 2002-2003. Report prepared by South Carolina Department of Natural Resources and University of South Carolina, Baruch Institute. 34 pp.

4.8 Recreation Resources

4.8.1 Affected Environment

The Project is located in the Piedmont Region of South Carolina, which is home to a diversity of recreational opportunities and major tourist attractions such as Kings Mountain National Military Park, Sumter National Forest, Lake Keowee, Lake Murray, Lake Hartwell, Lake Wylie, the Catawba River, and the Saluda River (Kleinschmidt 2016a). In addition, Project lands and waters offer a variety of recreational opportunities to the residents of Newberry and Fairfield counties, as well as to recreational users traveling to the Project from greater distances. Both regional and Project recreation opportunities are discussed in greater detail in the following sections.

4.8.1.1 Regional Recreation Resources

Regionally and nationally recognized recreation opportunities within 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. These areas provide opportunities for hunting, boating, fishing, hiking, picnicking, swimming, and camping in the Project vicinity (Kleinschmidt 2016a).

Sumter National Forest is a 371,000-acre national forest providing walking, 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. Lynch's Woods Park is a 260-acre woodland area in the city of Newberry which has 7.5 miles of hiking and biking trails, 3.5 miles of equestrian trails, a primitive camp site, and picnic tables. Lake Monticello Park is a 25-acre park containing tennis courts, ball field, basketball court, picnic facilities, fishing pier, and walking trail (Kleinschmidt 2016a).

Lake Murray is a 79.5 square-mile hydropower reservoir located south of the Project in Newberry, Saluda, Lexington and Richland Counties. Lake Murray supports numerous on-water recreation opportunities through 15 public access sites situated around the reservoir. Lake Murray also hosts several national and local fishing tournaments. The lower Saluda River, which extends 10 miles downstream of the Lake Murray Dam, supports an active recreational fishery and provides a variety of paddling experiences, from flatwater to whitewater (Kleinschmidt 2016a).

Fairfield and Newberry counties encompass several municipal recreation areas. Fairfield County has 16 public parks and recreation facilities encompassing approximately 90 acres, and Newberry County has 45 public parks and recreation facilities encompassing more than 530 acres. The Enoree River Bridge Informal Access Area, primarily[5] located on U.S. Forest Service lands in Newberry County, provides paddlers and other recreators access to Project waters through a primitive boat ramp. In summary, facilities located in Fairfield and Newberry counties (Table 4-30) provides the following amenities: playgrounds, picnic areas, softball fields, horseback riding, hand-carried and trailered boat launches, basketball courts, swimming pools, birding and wildlife watching opportunities, and multi-use trails that support hiking (Kleinschmidt 2016a).

TABLE 4-26 RECREATION FACILITIES IN FAIRFIELD AND NEWBERRY COUNTIES

FAIRFIELD COUNTY	NEWBERRY COUNTY
Monticello Reservoir	Parr Reservoir
Parr Reservoir	Brick House Recreation Area
Feasterville Mini Park	Broad River Canoe Access
Mitford Mini Park	Dreher Island State Park
Sheldon Mini Park	Little Mountain Reunion Park
Eunice Shelton Trail	Lynch's Woods Park
Adger Park	Peak-to-Prosperity Rail Trail
Blair Park/Willie Lee Recreation Center	Wells Japanese Garden
Garden St. Park	Little Mountain Explorer Bicycling Route
Middle Six Mini Park	
Chappelltown Mini Park	
Centerville Mini Park	
Horeb Glenn Park	
Alton Trail	
Fortunes Spring Park	

Although the Project boundary ends at Parr Shoals Dam, the Parr Development operates in a modified run-of-river mode to continuously pass Broad River flow downstream, under normal circumstances. This segment of the Broad River extends from Parr Shoals Dam approximately 23 river miles until it meets the Columbia Diversion Dam. This reach provides valuable

[5] The Project boundary is located on the edge of the river bank at this site.

recreational opportunities to wade-anglers, paddlers, fishermen and other recreators using small watercraft.

4.8.1.2 RECREATIONAL RESOURCES WITHIN THE PROJECT BOUNDARY

The Project provides a unique recreation atmosphere, which includes riverine and lacustrine environments, waterfowl hunting areas, and areas that support a number of day-use activities such as picnicking, hiking and beach swimming. SCE&G maintains six Project Recreation Sites, well distributed within the Project Area. These sites are generally depicted on Exhibit R, entitled "Recreation Use Plan" and "Proposed Recreational Development", which was approved as part of the current license. Table 4-31 lists Project Recreation Sites at Monticello and Parr reservoirs and associated facilities provided at these sites.

TABLE 4-27 EXISTING PROJECT RECREATION SITE INVENTORY SUMMARY FOR MONTICELLO AND PARR RESERVOIRS

Recreation Site Name	$ Fee	Part 8 Signage	Barrier Free/ADA Amenities	Picnicking	# Shelters	# of Tables	# of Grills	Trail Length (Mi)	Camping	Swimming	Bank Fishing	Dock Fishing	# Ramps	# Docks	Parking Spaces	Restrooms	Playground and Sport Facilities	Owned by SCE&G	Operated by SCE&G	Leased to Other Entity
Monticello Reservoir																				
Scenic Overlook	$0	●	●	●	5	12		1	●	●	●	●		1	100	●	●	●	Partial	Partial
Highway 215	$0	●		●	1	2					●		2	1	30			●	●	
Highway 99 West	$0	●		●	2	5	1		●		●		3	1	80	●		●	●	
Recreation Lake Access Area	$0	●	●	●	2	26	7	0.3		●	●		1		105	●		●	●	
TOTALS	$0				**10**	**45**	**8**	**1.3**					**6**	**3**	**335**					
Parr Reservoir																				
Cannon's Creek	$0	●		●	2	2	1		●		●		1		30	●		●	●	
Heller's Creek	$0	●		●	2	2			●		●		1		25	●		●	●	
TOTALS	$0				**4**	**4**	**1**						**3**		**60**					

In addition to SCE&G-maintained Project Recreation Sites, there are three informal recreation sites at the Project, including the Highway 99 East Recreation Site (formerly known as the Highway 99 Informal Fishing Area), the Enoree River Bridge Recreation Site (formerly known as the Enoree River Bridge canoe put-in) and the Highway 34 Recreation Site (formerly known as the Highway 34 Primitive Ramp). The Fairfield County Recreation Commission and SCDNR also manage recreation areas within the Project boundary. The Fairfield County Recreation Commission leases property from SCE&G and manages a multiple-use recreational area at Monticello Reservoir, adjacent to the SCE&G-managed Scenic Overlook. This area includes a baseball field, tennis courts, basketball courts, a walking trail, and picnic facilities (Kleinschmidt 2016a). The SCDNR maintains two waterfowl areas within the Project boundary adjacent to Parr Reservoir, as depicted in Figure 4-24 and Figure 4-25: the Broad River Waterfowl Management Area and the Enoree River Waterfowl Management Area. These facilities provide public waterfowl hunting access under the management jurisdiction of SCDNR and its Wildlife Management Area (WMA) Program. SCE&G also permits public recreational use of the Project lands and waters[6].

The Project is not located on a designated wild and scenic river segment. In addition, no Project lands are being considered for inclusion in the National Trails System or as a Wilderness Area.

4.8.2 Environmental Effects

4.8.2.1 Completed Studies

<u>Recreation Use and Needs Study</u>

During pre-PAD consultation, it was determined that a Recreation Use and Needs (RUN) study should be performed in order to identify current and potential recreational use, opportunities, and needs at the Project. A RUN study plan was developed in consultation with the Recreation TWC and the study was conducted at the Project during the 2015 and 2016 recreation season. Study objectives were accomplished by identifying and inventorying existing Project recreation facilities, identifying patterns of recreation use and user needs and preferences at each site, and estimating future recreational use and needs at the Project over the anticipated new license term (Kleinschmidt 2016a).

Study results indicate that the Project is well used, providing an estimated 152,709 recreation days during the 2015 recreation season. Monticello Reservoir was also shown to support

[6] For safety and security reasons, public access is restricted on properties classified as Project Operation, as these properties contain critical Project works.

significant recreational use during early crappie season in 2016 (February 1 through March 31) with an estimated 26,895 recreation days. Results suggest that the sites are in “good” to “very good” condition, overall. 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 sites were primarily from the four-county area (Fairfield, Newberry, Lexington, and Richland). Respondents interviewed at Parr 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 at Parr because it provided good fishing or boating opportunities (Kleinschmidt 2016a).

Individuals using Monticello Reservoir recreation sites during the study season were found to primarily engage in water-based recreation activities. Boat fishing was the most popular activity observed, followed by bank and pier fishing. As with Monticello Reservoir, individuals recreating at Parr Reservoir recreation sites during the study season primarily engage in water-based recreation activities. Boat fishing was the most popular activity observed, followed by bank fishing (Kleinschmidt 2016a).

Study results indicate that recreation sites on Monticello Reservoir receive very similar levels of use, with most of the use occurring on the weekends. Data indicates that the Scenic Overlook Recreation Site accommodated the greatest numbers of patrons at Monticello Reservoir over the course of the 2015 study season. Density estimates for Monticello Reservoir sites indicate that some sites may be used at rates approaching or at capacity during peak periods; however, there are alternative sites in the vicinity that provide similar amenities with lower density ratings. Overall, perceptions of crowding at Monticello Reservoir sites are “low” to “moderate” and site conditions were rated very high. No Monticello Reservoir recreation site received below a 4[7] condition rating. Restrooms were indicated as being the most needed additional facility at Monticello Reservoir, which is very typical for recreation use studies. Other facility and amenity recommendations included picnic tables, shelters, lighting, and fishing piers or docks (Kleinschmidt 2016a).

Study results at Parr Reservoir indicate that Cannon’s Creek Recreation Site receives the greatest amount of use. Most of the use at Parr Reservoir occurs on weekdays. Density estimates calculated for 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

[7] On a scale of 1 to 5 where a 1 is “poor” and a 5 is “excellent.”

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 (Kleinschmidt 2016a).

A second goal of the RUN study was to characterize existing use of Waterfowl Management Areas 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. Results from surveys distributed at Parr Reservoir indicate that the majority of hunters are residents of the surrounding counties, primarily Richland and Lexington, who hunt on Saturday mornings. Waterfowl focus groups were also conducted by SCE&G and attendees noted that they prefer to hunt during weekday mornings, as there are less hunters on Parr Reservoir (Kleinschmidt 2016a).

Data regarding recreation use at the Enoree River and Broad River Waterfowl Management Areas was primarily obtained from SCDNR and waterfowl focus group attendees. Traffic counter data from the Enoree River Waterfowl Management Area indicates that it is well used. Crowding at this site was a primary concern among waterfowl focus group attendees. Crowding is not an issue for the Broad River Waterfowl Management Area, as this site is a draw-hunt site (Kleinschmidt 2016a).

4.8.2.2 PROPOSED ACTION

This section discusses the environmental effects of the Proposed Action for recreational resources.

PROPOSED MEASURES TO PROVIDE FOR FUTURE RECREATIONAL ACCESS NEEDS AT THE PROJECT

The Project serves as a significant recreation resource for the residents of Newberry and Fairfield counties, as well as those traveling from greater distances. Although a number of regional recreational opportunities are available, the Project provides a unique combination of water-based recreation activities such as waterfowl hunting, fishing, pleasure boating, and paddling. Moreover, RUN study results indicate that SCE&G recreation facilities at the Project are well-used and received “good” to “very good” condition ratings by users (Kleinschmidt 2016a).

When considering the proposed action, it is important to anticipate future recreational needs at the Project. As discussed in the RUN study, the population of the surrounding counties is projected to increase by 12.9 percent from 2015 to the year 2030. Most of this growth is projected to occur in Lexington County. However, RUN study survey respondents indicated Lexington County (11 percent of Project recreators) as their county of residence less frequently than Fairfield (12 percent of Project recreators), Richland (19 percent of Project recreators) or Newberry (33 percent of Project recreators). This indicates that Project recreational use may not grow at the 12.9 percent level. While there are many uncertainties when predicting future recreation use, fishing and boating are anticipated to remain the dominant recreation activities at Monticello Reservoir sites, and boat fishing and bank fishing are anticipated to remain the dominant recreation activities at Parr Reservoir sites (Kleinschmidt 2016a).

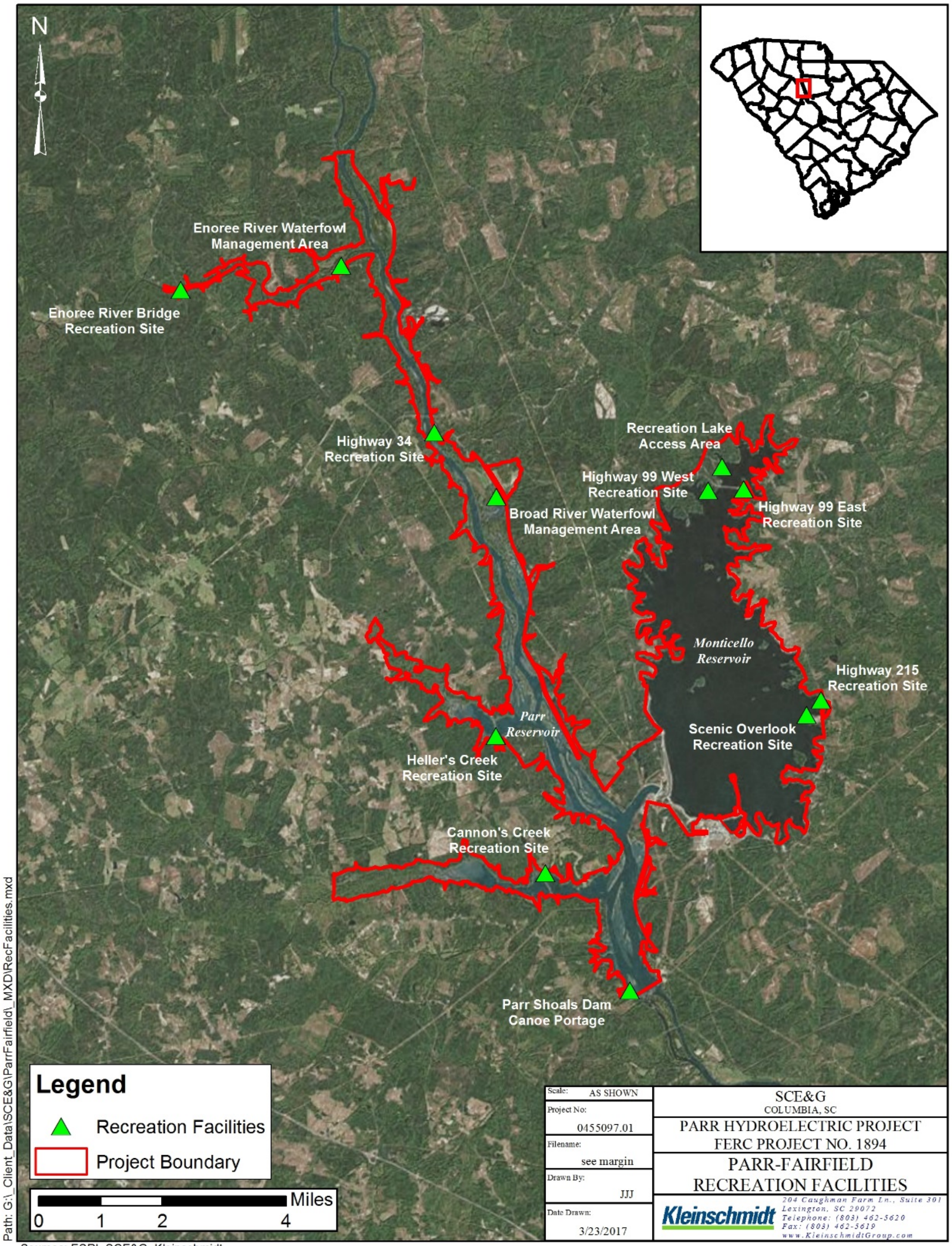
Discussions regarding appropriate measures to enhance Project recreation resources over the anticipated license term are currently taking place in the Recreation TWC. These measures are based on recreation site-user recommendations made during the RUN study. Under the proposed action, consideration has been given to site improvements at both Parr and Monticello reservoirs. Additionally, data collected at the Enoree Bridge Informal Access Area, primarily located outside of the Project boundary, indicates that it receives approximately 5 percent of the use experienced at the three SCE&G maintained access areas on Parr Reservoir (Kleinschmidt 2016a). Recreation TWC stakeholders have indicated that this site is key in providing paddlers, and individuals launching small watercraft, access to the upper portion of Project waters (Recreation TWC Meeting Notes, October 6, 2016, Appendix A). SCE&G has consulted with stakeholders to explore ways to improve access at this site. Table 4-32 presents a list of preliminary recreation site enhancement and improvement measures being proposed at the Project. Final recreational enhancements and improvements will be determined in consultation with relicensing stakeholders and included in the FLA, Settlement Agreement and proposed Project Recreation Management Plan.

TABLE 4-28 PROPOSED PROJECT RECREATION SITE ENHANCEMENTS

PROJECT RECREATION SITE	PROPOSED ENHANCEMENTS
Parr Reservoir	
Cannon's Creek Recreation Site (existing site)	Install one (1) fishing pier
	Install one (1) courtesy dock
	Install two (2) additional lights, one (1) near road and one (1) near restroom
	Pave two (2) barrier free parking spaces and access paths to picnic area, fishing pier and restrooms, upgrade restroom to barrier free standards with new handle on men's room door and install new proper height toilet seats
	Install at least one (1) interpretive display on the cultural and historic resources of the Project area.
Heller's Creek Recreation Site (existing site)	No proposed enhancements

PROJECT RECREATION SITE	PROPOSED ENHANCEMENTS
Parr Shoals Dam Canoe Portage (proposed new facility)	SCE&G built an experimental canoe portage on the Newberry side of the Parr Shoals Dam. An approximately 1,600 ft. trail was cleared and appropriate signage was installed. Depending on usage and feedback from the agencies, SCE&G plans to formalize the canoe portage by bringing it into the Project boundary and maintaining it as an additional recreation facility.
Highway 34 Recreation Site (proposed new site)	Improve boat ramp - install geogrid and stabilize bank
	Grade and gravel to improve parking area
	Remove large trees that hinder vehicle access to ramp
	Install Recreation Sign on Highway 34 per FERC regulations
	Bring into Project boundary, properties 211 parcel E (8.23 acres) and 285 parcel C (9.9 acres west of Railroad tracks) on Exhibit K-14 drawing
Enoree River Bridge Recreation Site (proposed new site)	Build canoe/kayak step down access within the PBL
	Install Recreation Sign on Maybinton Road per FERC regulations
Monticello Reservoir	
Scenic Overlook Recreation Site (existing site)	Add one (1) light at existing fishing pier
	Modify existing fishing pier for barrier free use, pave two (2) barrier free parking spaces and access path(s) to fishing pier
	Add two (2) new picnic tables
	Build one (1) barrier free shelter with one (1) barrier free picnic table, pave one (1) barrier free parking space and access path to new barrier free shelter
	Pave one (1) barrier free parking space and access path (SCE&G will need to coordinate this improvement with County)
Highway 215 Recreation Area (existing site)	Install at least one (1) interpretive display on the cultural and historic resources of the Project area.
Highway 99 West Recreation Site (existing site)	Add one (1) fishing pier
	Improve boat ramp in cove so it doesn't drop off
	Change two (2) existing lights, one (1) near boat ramp/courtesy dock and one (1) near new proposed fishing pier from standard to flood type lights
	Pave access paths or build ramps and platforms to courtesy dock, fishing pier & restrooms; and convert four (4) existing parking spaces into two (2) barrier free parking spaces
	Modify restrooms to allow year-round access - electricity exists in restrooms, so heat could be added in restroom and/or water pump room
Recreation Lake Access Area (existing site)	Install one (1) courtesy dock
Highway 99 East Recreation Site (proposed new site)	Add one (1) fishing pier
	Add two (2) benches
	Add two (2) picnic tables
	Add two (2) lights on one pole, one (1) light for fishing pier and one (1) light for parking area

In conclusion, recreational facilities surrounding the Project will be enhanced under the proposed action, thus improving recreational opportunities at the Project. Figure 4-26 depicts all existing and proposed recreation facilities included under the proposed action.



Sources: ESRI, SCE&G, Kleinschmidt

FIGURE 4-25 EXISTING & PROPOSED RECREATION FACILITIES AT THE PROJECT

PROPOSED MEASURES TO PROVIDE FOR RECREATIONAL AND NAVIGATIONAL FLOWS BELOW THE PROJECT

Pre-PAD consultation indicated that there is interest in exploring recreational flows downstream of Parr Shoals Dam. Additionally during issues scoping, relicensing stakeholders identified two areas downstream of the Parr Shoals Dam as potential areas for navigation concern. These two issues resulted in the development and implementation of the Downstream Recreational Flow Assessment, and the Downstream Navigation Flow Assessment, respectively.

The Downstream Recreational Flow Assessment was designed and implemented to assess flows downstream of the Parr Shoals Dam that provide quality recreational experiences and to identify preferred flows for recreation activities, primarily as they relate to wade angling, canoeing and kayaking. In accordance with the study plan designed to fulfill this request, a panel of stakeholders that are knowledgeable about the Project area was identified and convened as a focus group in late 2014. The focus group provided information regarding quality recreation opportunities, potential flow effects on recreation on the Broad River, downstream of the Parr Shoals Dam, and preferred flows for recreational activities. As a follow-up to the focus group meeting, an on-line survey was distributed to focus group members in 2015. The primary purpose of this survey was to gather user opinions on recreational use and preferred Broad River flows (downstream of Parr Shoals Dam) in 2015 (Kleinschmidt 2016b).

Although only a few individuals responded to this survey, it provided a starting point for Recreation TWC follow-up discussions. In 2016, TWC members reviewed survey results and further refined recommendations for inclusion in the Project Operations Model. Survey respondents and TWC members noted that higher flows (2,000 to 5,000 cfs) during the May – June timeframe support canoeing, kayaking and higher flow boat fishing; while 500-999 cfs during May - July supports lower flow boat fishing, hunting, wade-fishing and swimming. The Recreation TWC agreed that the Model should evaluate flows of 2,000 cfs and 3,500 cfs during a 6-hour window (approximately 8 AM until 2 PM) on weekends and holidays during the recreation season (May through September). The TWC determined that final IFIM recommendations will likely cover the lower ranges of flows which would be ideal for activities such as wade-fishing (Recreation TWC Meeting Notes, May 10, 2016, Appendix A).

Downstream flows to facilitate one-way navigation were addressed through the Downstream Navigational Flow Assessment, designed in consultation with TWC members. The criteria for one-way navigation was defined by the South Carolina Water Resources Commission as a "minimum depth of one foot across a channel 10 feet wide or across 10 percent of the total stream width, whichever is greater. Minimum depth does not need to occur across a continuous 10 percent of the stream width, but each point of passage must be at least 10 feet wide." One-way navigation criteria are based on the passage of a 14 foot Jon-boat without a motor in the downstream direction only (SCWRC, 1988). Navigational analyses evaluated flows within the Broad River, downstream of the Parr Shoals Dam, at two areas of navigational constriction identified by the Recreation TWC. These areas were identified as "Ledge 1" and "Ledge 2" (Figure 4-27).

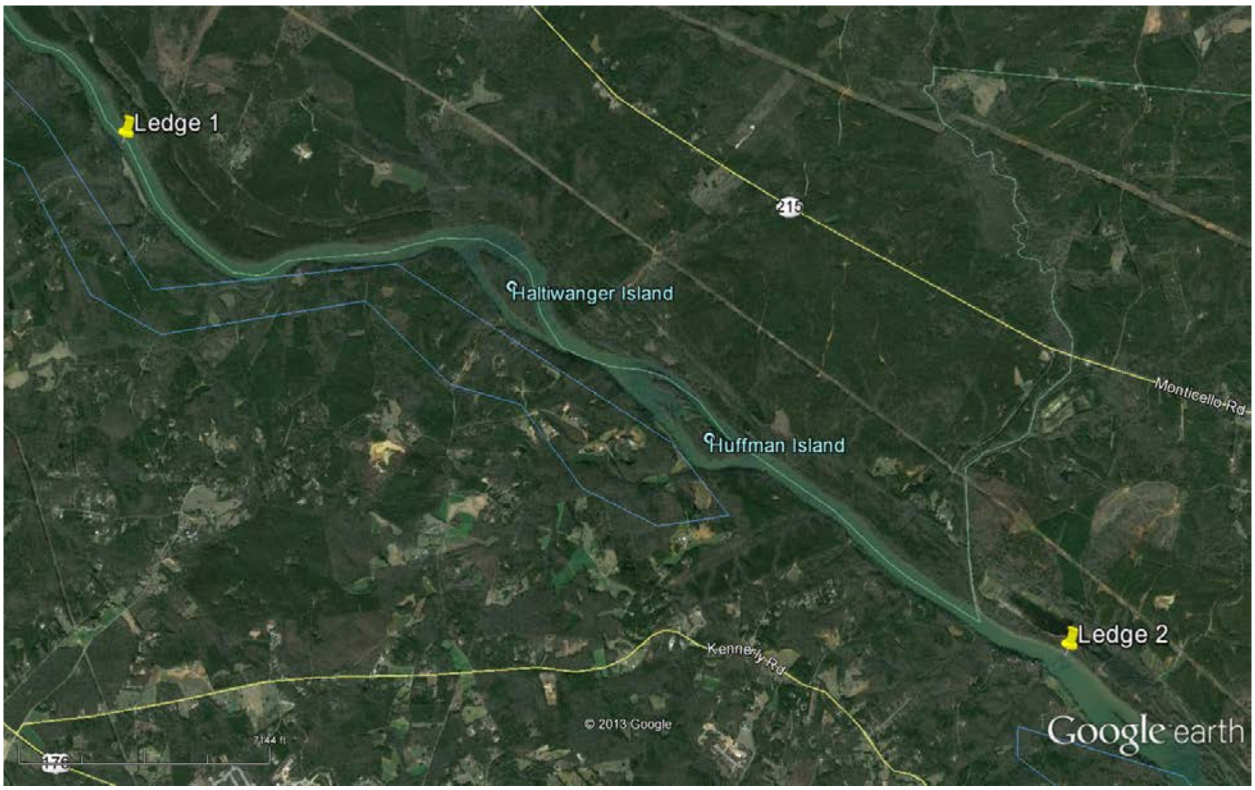


FIGURE 4-26 POTENTIAL POINTS OF NAVIGATIONAL CONSTRICTION

Points of navigational passage were determined in the field at Ledge 1 and Ledge 2 and bathymetric data within the navigational passage points were collected using an Acoustic Doppler Current Profiler (ADCP) and analyzed using appropriate software. Three-dimensional bathymetric models were created and the most limiting cross-section within each passage point was identified and compared with water stages-discharge data to determine navigational passage at various flow releases. Data suggested that navigational passage is not a limiting factor at Ledge 1 for flows as low as 500 cfs. At Ledge 2, data indicates that a flow of 1000 cfs meets both the minimum depth and width aspects of the criteria, with approximately 82 feet (10 percent) of cross-sectional passage provided collectively by the two passage points at that ledge (Kleinschmidt 2016c).

Flows for recreation and navigation are just two components of the overall downstream flow discussion currently taking place with TWC members. Flows for aquatic resources, which hinge on final determinations from the IFIM study, may also meet recreational and navigational flow requests. Moreover, as the Project is proposed to be operated in a modified run-of-river mode under the proposed action, and there is very little storage available in Parr Reservoir, the provision of scheduled high recreation flows (2,000 to 5,000 cfs) may not be feasible unless there are associated high flows in the Broad River, upstream of the Project. As flows needed for navigational passage at Ledge 1 and Ledge 2 are relatively low, it is likely that aquatic resource flows recommended in the FLA will provide ample passage at these sites. SCE&G is not evaluating recommended recreation flows as discussed in Section 3.3.4 above. Flows necessary for navigation will be discussed in the FLA and Settlement Agreement.

Nevertheless, recreational and navigational flow opportunities are anticipated to be either unaffected or improved under the proposed action.

MEASURES PROPOSED BY RESOURCE AGENCIES AND STAKEHOLDERS

Most recreation-related resource information and study requests were addressed through the implementation of the RUN study, Recreational Flow, and Navigational Flow studies, and few recreation-related comments were provided in response to the PAD. During initial recreation and shoreline management discussions, SCE&G proposed transferring a parcel of land located adjacent to the Fairfield Development tailrace from Future Recreation designation to Project Operations designation due to its proximity to Project structures. In their response to the PAD, the SCDNR and USFWS noted that it may not be necessary to reclassify the entire parcel and that any lands removed from future recreation should be replaced elsewhere within the Project boundary. In subsequent discussions with resource agencies, SCE&G determined that such a reclassification is not necessary, and the parcel will continue to remain as Future Recreation for the new license term.

4.8.3 ENVIRONMENTAL EFFECTS – NO ACTION ALTERNATIVE

Under the no action alternative, SCE&G would continue to maintain existing Project recreation facilities in their current state. Facility improvements developed in consultation with TWC members would not take place and associated recreational opportunities would not be realized.

Downstream recreation and navigation would remain as they are under current conditions. Moreover, SCE&G would continue to maintain Project recreation resources under the current terms of the Recreation Use Plan - Exhibit R sheets approved through the existing license.

4.8.4 UNAVOIDABLE ADVERSE EFFECTS

The Project serves as a positive recreation resource to the public. No unavoidable adverse effects to recreation have been identified.

4.8.5 REFERENCES

Kleinschmidt Associates. 2016a. Recreation Use and Needs Study Report – Parr Hydroelectric Project (FERC No. 1894). Prepared for South Carolina Electric & Gas Company. November 2016.

Kleinschmidt Associates. 2016b. Downstream Recreational Flow User Survey Memo – Parr Hydroelectric Project (FERC No. 1894). Prepared for South Carolina Electric & Gas Company. January 2016.

Kleinschmidt Associates. 2016c. Downstream Navigational Flow Assessment – Parr Hydroelectric Project (FERC No. 1894). Prepared for South Carolina Electric & Gas Company. September 2016.

South Carolina Water Resources Commission (SCWRC). 1988. Instream Flow Study Phase II: Determination of Minimum Flow Standards to Protect Instream Uses in Priority Stream Segments: A Report to the South Carolina General Assembly. Available Online. [URL]: http://scwaterlaw.sc.gov/Instream%20Flow%20Study%20ph2.pdf. Accessed August 2013.

4.9 CULTURAL RESOURCES

4.9.1 AFFECTED ENVIRONMENT

As discussed in previous sections, the Parr Project consists of the Parr Development, which impounds approximately 4,400 acres along the Broad River and its tributaries, from Henderson Island down to Hampton Island forming Parr Reservoir, and the Fairfield Pumped Storage Development, which impounds the approximately 6,800 acre Monticello Reservoir.

Cultural resource investigations conducted as part of the relicensing process include an Initial Historic and Archaeological Resources Study (HAR), a Phase I Cultural Resource Investigation (Phase I Study), and a Phase II study for two specific archaeological sites.

AREA OF POTENTIAL EFFECT

The Advisory Council on Historic Preservation defines an Area of Potential Effect (APE) 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. During consultation conducted as part of the HAR, it was determined that the Project APE includes all of the land and water within the FERC Project boundary (shown in Figure 4-28). Within the APE, 70 areas were determined to have a high potential for containing significant archaeological resources covering approximately 3,375 acres (S&ME 2013). The remaining 12,262 acres within the APE were determined to have a low potential for containing significant archaeological resources (S&ME 2013).

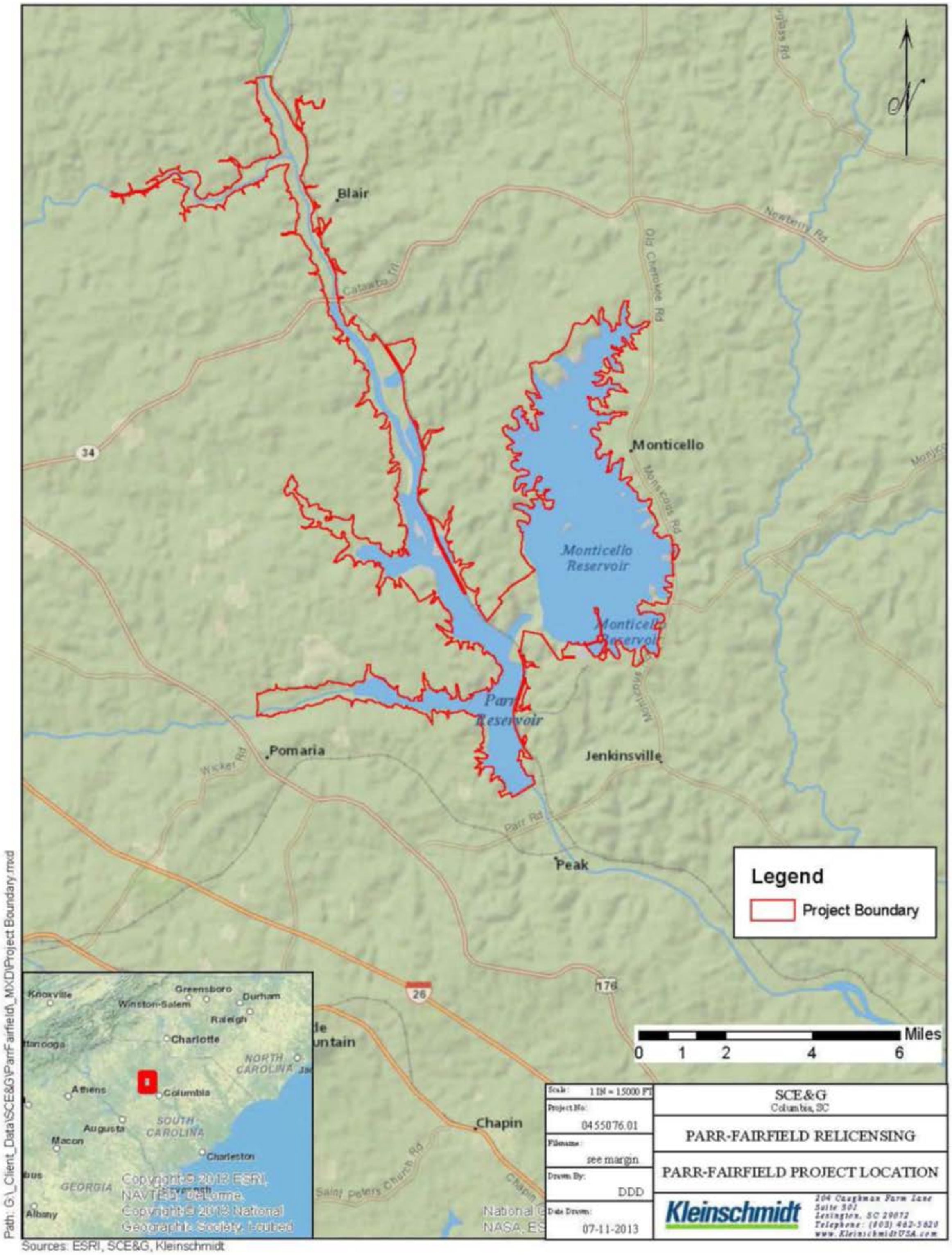


FIGURE 4-27 PARR PROJECT AREA OF POTENTIAL EFFECT

4.9.2 Environmental Effects

4.9.2.1 Completed Studies

Initial Historic and Archaeological Resources Study

The HAR was completed by S&ME in 2013 and was submitted to FERC, the South Carolina State Historic Preservation Office (SHPO), the U.S. Forest Service (USFS), the Catawba Indian Nation Tribal Historic Preservation Office (CIN-THPO), and the Eastern Band of Cherokee Indians Tribal Historic Preservation Office (EBCI-THPO). The SHPO, USFS and CIN-THPO all concurred with the recommendations in the HAR study report, which included the establishment of the APE and determination of sites requiring additional study. No comments on the HAR were received from the EBCI-THPO. The Phase I Study was completed based on the HAR recommendations.

Phase I Cultural Resource Investigation

The Phase I Study resulted in the investigation of 65 archaeological sites, 32 isolated finds, and two above ground historic resources (S&ME 2014). One site that was studied, the Blair Mound, is already listed in the National Register of Historic Places (NRHP). Two more sites, Lyles Ford and the Parr Shoals Development Facility, are recommended eligible for the NRHP (S&ME 2014). Although the Fairfield Pumped Storage Development Facility is not eligible at this time, in 2028 it will reach 50 years of age and will then be eligible for the NRHP. Additionally, 11 archaeological sites were recommended as needing more work to determine if they qualify for NRHP eligibility (S&ME 2014). These sites include seven prehistoric sites, one eighteenth/nineteenth century canal site, and three prehistoric and historic sites. Three more sites were not assessed for NRHP eligibility since the majority of the site was located outside of the APE. The remaining 49 archaeological sites and 32 isolated finds were found to be ineligible for the NRHP (S&ME 2014).

The Lyles Ford site, which is located at the northern tip of the Project boundary, was recommended as being eligible for the NRHP (S&ME 2014). However, due to its location within the Broad River, fluctuating water levels have impacted the site, thus disfiguring the site such that the center of the ford is no longer in place (S&ME 2014). Because of the importance of the site however, S&ME recommended that SCE&G consult with FERC and the SHPO on ways to mitigate for the adverse effects that have occurred at the site.

The Parr Shoals Development Facility was found to be eligible for the NRHP under Criterion A[8], due to its significance to hydroelectric development in South Carolina and the increased power demand in the Midlands in the early 1900s (NPS 2016) (S&ME 2014). Additionally, it was also found to be eligible for the NRHP under Criterion C[9], because of the powerhouse architecture and dam and hydroelectric engineering components (NPS 2016) (S&ME 2014). Although the facility is not actively impacted by Project operations, there is still a potential for adverse effects during the term of the license. S&ME recommended that SCE&G develop a Historic Properties Management Plan (HPMP) and Programmatic Agreement (PA), in consultation with FERC and the SHPO, to address potential adverse effects.

In 2028, once the Fairfield Pumped Storage Development Facility reaches 50 years of age, it will also become eligible for the NRHP under Criterion A, due to 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 2014). S&ME recommended that SCE&G address the facility and the potential for adverse effects in the HPMP and PA. They also recommend that in the case adverse effects occur after 2028, the facility should be reevaluated for NRHP eligibility and consultation with appropriate agencies should commence (S&ME 2014).

Nine of the eleven archaeological sites that were recommended as needing more work to determine NRHP eligibility, as well as the National Register listed Blair Mound, are not currently impacted by Project operations; therefore, no additional work is necessary at these sites. If future construction or Project operations specified in the new license are found to impact these sites, they will require additional consideration and testing (S&ME 2014).

Additional work was suggested at the two remaining sites (38NE8 and 38NE10) to determine their eligibility for NRHP (S&ME 2014). These sites were experiencing erosion from Project operations and S&ME recommended that the shoreline at these sites be stabilized or be subject to a Phase II archaeological testing to determine final NRHP eligibility status. The results of the Phase II study are summarized below.

[8] NRHP Criteria for Evaluation – The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and: (A) That are associated with events that have made a significant contribution to the broad patterns of our history.

[9] NRHP Criteria for Evaluation – The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and: (C) That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.

PHASE II ARCHAEOLOGICAL TESTING

The Phase II archaeological testing for the two sites referenced above (38NE8 and 38NE10) was completed by Terracon Consultants, Inc. (Terracon) in January, 2016 (included in Appendix C, filed as privileged). These sites were previously identified by the South Carolina Institute of Archaeology and Anthropology (SCIAA) in 1972, when the Fairfield Development was being constructed. Neither site was assessed for NRHP eligibility during that time (Terracon 2016).

Results of the 2016 Phase II study found that site 38NE8 is eligible for inclusion in the National Register under Criterion D[10] (NPS 2016) (Terracon 2016). The site contained a large quantity of artifacts, with good diversity and appeared to retain stratigraphic integrity. Additionally, two possible Middle Archaic features were recorded at the site (Terracon 2016). Terracon recommended that SCE&G consult with FERC and SHPO on ways to minimize or mitigate any potential adverse effects caused by Project operations at this site.

Site 38NE10 was found to be ineligible for inclusion in the National Register, as it met none of the criteria for evaluation and lacked archaeological integrity (Terracon 2016). Terracon recommended that no additional work be completed at this site.

4.9.2.2 PROPOSED ACTION

Environmental effects on historic properties within the APE may result from Project-related activities including reservoir fluctuations and Project-related ground-disturbing activities. Actions such as wind and water erosion, recreational activities and vandalism can also effect these properties. The extent of effects on cultural resources can vary widely, depending on the setting, size and visibility of the resource, and whether the location of the resource is public knowledge.

Following the recommendations from the Phase I and Phase II studies, SCE&G initiated the development of a HPMP with FERC and SHPO. SCE&G submitted a draft HPMP for comments on August 26, 2016; a final HPMP was filed with FERC on January 4, 2017. The HPMP contains policies and procedures for identifying effects of the Projects' operations on historic properties over the term of the new license. It also contains policies and procedures for the development and implementation of measures to avoid, minimize, or mitigate any adverse effects. SCE&G will

[10] NRHP Criteria for Evaluation – The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and: (D) that have yielded or may be likely to yield, information important in history or prehistory.

implement its finalized HPMP upon the issuance of a new license. On February 1, 2017, the FERC issued a draft PA for review and comment. The PA is still being developed by the FERC.

Implementation of the HPMP will ensure that adverse effects on historic properties arising from operations of the Project or Project-related activities over the term of the new license would be avoided or satisfactorily resolved.

Additionally, the Phase I study found that the Lyles Ford site has been impacted by Project operations and therefore recommended that SCE&G consult with FERC and the SHPO on ways to mitigate for this adverse effect, such as developing a brochure or booklet containing archival research of the Lyles family and documentation of the area containing the ford. SCE&G is preparing educational material/signage that will be maintained on SCE&G's website and placed in publicly accessible areas around the Parr Development and Fairfield Development. The information will include: 1) historical information about the Lyles family, Lyles Ford, and if appropriate, the ruins of a mill/store and a canal built and run by the Lyles family in the eighteenth/nineteenth century; and 2) historical information about the Parr Development and the Fairfield Development facilities. Additionally, FERC and SHPO determined that there is one archaeological site that should either be stabilized or have the adverse effects mitigated (e.g., through data recovery excavations). SCE&G will complete this stabilization or mitigation after the new license is issued.

4.9.3 Environmental Effects – No Action Alternative

Under the no-action alternative, the Parr Hydro Project would continue to operate as required by the current Project license, and therefore there would be no change to the existing environment. SCE&G would continue to manage the historic properties within the APE in accordance with Section 106 of the NHPA, but the new HPMP would not take effect and SCE&G would not enter into a PA. Accordingly, SCE&G would comply with Section 106 on a case-by-case basis.

4.9.4 Unavoidable Adverse Effects

SCE&G has proposed no changes to the operations or the facilities of the Parr Hydro Project that would result in unavoidable adverse effects. SCE&G proposes to enter into a Programmatic Agreement between FERC and the SC SHPO, and has developed a HPMP. Once implemented, this HPMP will provide SCE&G with guidance on resolving or mitigating any potential adverse effects to historic properties that may arise in the future.

4.9.5 REFERENCES

National Park Service (NPS). 2016. National Register Bulletin: How to Apply the National Register, Criteria for Evaluation.

Terracon Consultants, Inc. (Terracon). 2016. Phase II Testing of Archaeological Sites 38NE8 and 38NE10 at the Parr Hydroelectric Project; Fairfield and Newberry counties, South Carolina. June 2016.

S&ME. 2013. Initial Historic and Archaeological Resources Study (HAR); Parr Hydroelectric Project, FERC Project No. 1894, Application for New License, Fairfield and Newberry counties, South Carolina. May 2013.

S&ME. 2014. Phase I Cultural Resource Investigations for the Parr Hydroelectric Project; Fairfield and Newberry counties, South Carolina. August 2014.

4.10 LAND USE AND AESTHETICS

The Project consists of two developments, the Parr Development which forms the Parr Reservoir and the Fairfield Development which forms the Monticello Reservoir. The developments, including the hydroelectric stations and associated facilities, are located in Fairfield and Newberry counties, South Carolina. These counties are predominantly rural, consisting of forest and grassland areas. The following sections provide a general description of the land uses and aesthetic resources in the Project vicinity.

4.10.1 AFFECTED ENVIRONMENT

4.10.1.1 LAND USE AND MANAGEMENT ADJACENT TO THE PROJECT BOUNDARY

The lands adjacent to the Project boundary are dominated by forestland, deciduous forest and grassland types. Only a small percentage of the Project vicinity is developed. In Fairfield County only 0.71 % of land is classified as developed (Table 4-33). In Newberry County only 1.4% of land is classified as developed (Table 4-34).

TABLE 4-29 LAND USES IN FAIRFIELD COUNTY

LAND USE	SQUARE MILES	PERCENT
Developed	5.03	0.71%
Agriculture	0.01	0.04%
Forestland	514.13	72.41%
Wetlands	16.86	2.37%
Grasslands	108.19	15.24%
Shrub/Scrub	5.68	0.80%
Barren Land	11.9	1.68%
Open Space	22.02	3.10%
Open Water	26.2	3.69%
Total	710.02	100.00%

TABLE 4-30 LAND USES IN NEWBERRY COUNTY

LAND USE	SQUARE MILES	PERCENT
Developed	9.08	1.40%
Agriculture	0.18	0.03%
Forestland	407.19	62.90%
Wetlands	20.70	3.20%
Grasslands	142.44	22.00%
Shrub/Scrub	5.10	0.79%

LAND USE	SQUARE MILES	PERCENT
Barren Land	6.45	1.00%
Open Space	35.16	5.43%
Open Water	21.06	3.25%
Total	647.34	100.00%

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 Metro area and the Greenville-Spartanburg Metro area (City of Newberry 2010). The city has no forested land or cropland in its center; however, its eastern areas have extensive areas of forested land, cropland and pasture. The City of Newberry is surrounded by forested and agricultural land to the west and south (City of Newberry 2010). 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 (City of Newberry, 2010).

4.10.1.2 LAND USE AND MANAGEMENT WITHIN THE PROJECT BOUNDARY

Project operations, maintenance and recreation are the primary activities on Project lands. The land use types within the Project boundary consist mostly of open water, wooded wetlands and evergreen forest. Figure 4-29 is a map of land use types within the Project boundary.

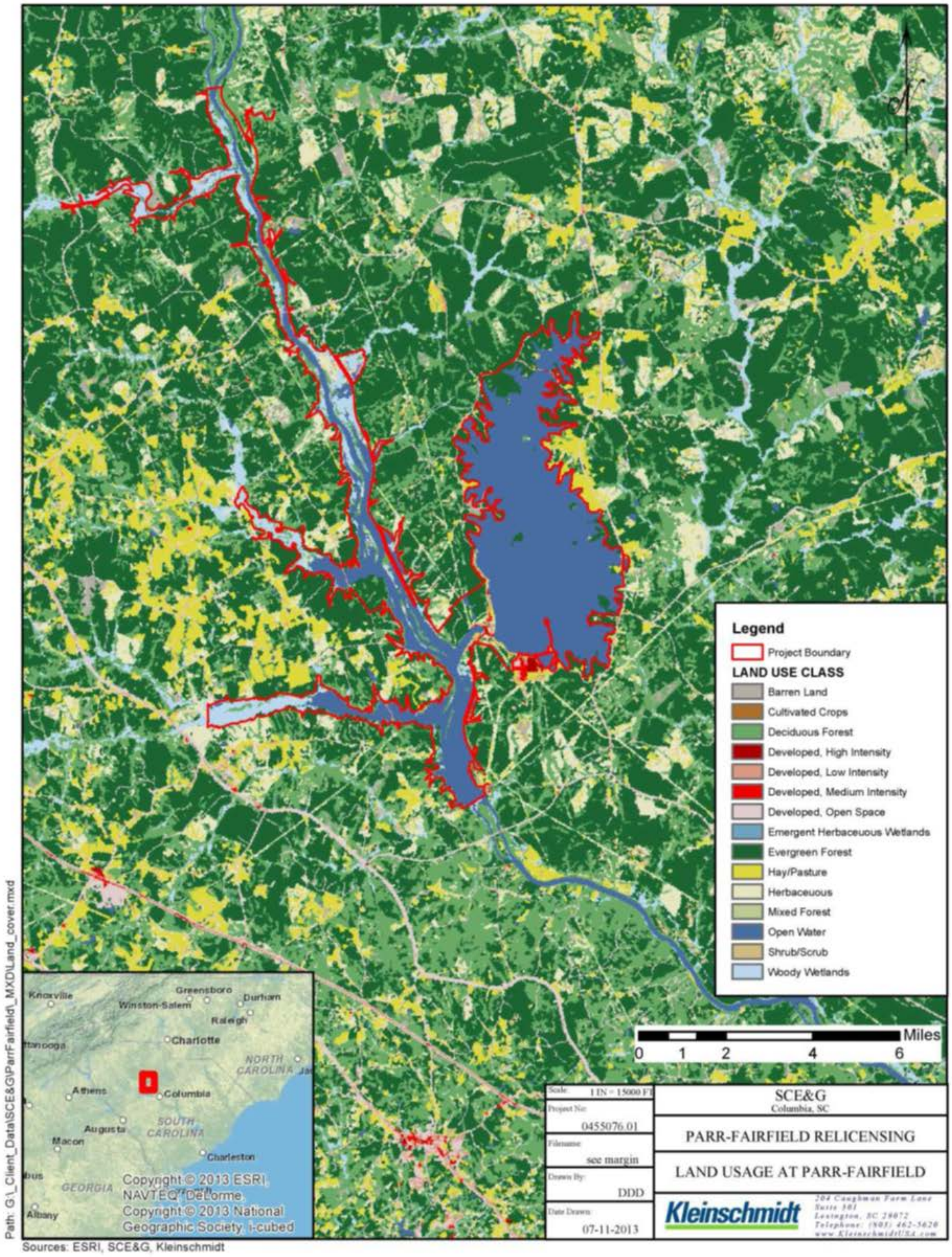


FIGURE 4-28 LAND USE MAP OF PROJECT

4.10.1.3 EXISTING SHORELINE MANAGEMENT PLAN

The Project boundary encompasses a buffer zone of land around each reservoir between the high water mark and the Project Boundary line. The 1974 FERC license required SCE&G to acquire this buffer zone for the purpose of project operations, including land for recreational use and shoreline control. License Article 20 requires that SCE&G allow public access to a reasonable extent to Project waters and adjacent Project lands (with the exception of lands necessary for the protection of life, health, and property) for navigation and outdoor recreational purposes. This Article also allows SCE&G to grant permits for public access to the reservoirs subject to FERC approval (F.P.C. 1974).

After extensive stakeholder consultation, an amended SMP was developed. It was approved by the Commission on June 4, 2001. The SMP was included as part of the Project's Exhibit R (FERC 2001). The SMP primarily covers activities associated with Monticello Reservoir. It deals with the following matters: (1) water quality; (2) forest management; (3) waterfowl management; (4) nuclear exclusion zone restrictions for the operation of SCE&G's V. C. Summer Nuclear Station; (5) fishing, boating, and hunting; (7) private boat docks and access; (8) vegetation removal; (9) water withdrawal; (10) erosion control; and (11) prohibited activities.

Currently, permits are not issued for private shoreline development activities, such as docks or erosion control measures on Parr Reservoir or on the Recreation Lake. The SMP allows adjacent property owners along 21 miles (42 percent) of the Monticello Reservoir's shoreline to have private access to the shoreline and to construct docks under certain conditions. Adjacent landowners may apply for a permit to maintain a 10-foot wide, unpaved, meandering path for access to a permitted boat dock, subject to a prohibition on removal of trees 10 inches or greater in diameter at chest height. No vegetation is allowed to be removed from the buffer zone lands except within this permitted path (FERC 2001).

4.10.1.4 AESTHETIC RESOURCES

VISUAL CHARACTER OF THE PROJECT VICINITY

The Project is located along the Broad River within a rural area of Fairfield and Newberry counties in the Piedmont physiographic region, which is characterized by rolling fills, forests, farms and orchards. The Project is located in an ecoregion of the Piedmont region called the Southern Outer Piedmont ecoregion, which has lower elevations and irregular plains rather than plains with hills (SCDNR, 2014; EOE, 2014). Approximately 72 percent of Fairfield County and 63 percent of Newberry County is forested. Most forested lands are within close vicinity of the Project.

Roadways run parallel to the waterline and structures that support recreational and Project-related activities. The shorelines surrounding the Project structures are armored with concrete embankments and rip-rap. Vegetation surrounding the Project area varies, but forested shorelines are the most predominant landscape type. The eastern shoreline of Monticello Reservoir has less forested area and more residential development than the rest of the Project vicinity.

NEARBY SCENIC ATTRACTIONS

Numerous scenic attractions of local and regional importance are located in the Project vicinity, and Fairfield and Newberry counties offer many municipal recreation areas as described in Section 4.8.1.1. Fairfield County is flanked by Lake Wateree to the east and the Monticello Reservoir to the West. These provide a combined total of 20,000 acres of pooled water in the Project vicinity.

Fairfield County's rich history is evident in its numerous homes built before the revolutionary war (Fairfield County 2014). Newberry County is situated between the Broad and Saluda rivers. It also has a rich history and was the site of several Revolutionary War battles. The City of Newberry features the Newberry Opera House, which was built in 1881 and serves as a performing arts facility with state-of-the-art technology (NewberryCounty.org 2014).

VISUAL CHARACTER OF PROJECT LANDS AND WATERS

Monticello Reservoir covers 6,800 acres and has 54 miles of shoreline. SCE&G owns and manages shoreline property extending above the 425-foot mean sea level contour as a buffer zone. This buffer zone helps to maintain the environmental, aesthetic, and recreational character of the reservoir shoreline. Approximately 7.2 miles of the Monticello Reservoir shoreline are within the nuclear exclusion zone (NEZ) of the V. C. Summer Nuclear Plant and, therefore, are not open to the public. The shoreline within the NEZ is marked with signs and buoys and is not available for public use (SCE&G 2002).

The Parr Reservoir covers about 4,400 acres and has 94 miles of shoreline. The reservoir was originally formed in 1914 as part of a conventional hydro project at Parr Shoals. The height of its dam was raised 9 feet in the 1970s during construction of the pumped storage development, nearly doubling the reservoir's surface area. The Recreation Lake, which was constructed by SCE&G solely for recreational use, is located adjacent to the Monticello Reservoir and has a surface area of 300 acres. The Recreation Lake is maintained at a stable water level and is not affected by the operation of the pumped storage facility (SCE&G 2002).

4.10.2 Environmental Effects

4.10.2.1 Completed Studies

Although no studies were completed regarding land use and aesthetics, SCE&G consulted with the Lake and Land Management TWC on the development of two new SMPs; one for Parr Reservoir and one for Monticello Reservoir. These documents are explained in greater detail in Section 4.10.2.2 Proposed Action and are included in Appendix B.

4.10.2.2 Proposed Action

The current relicensing of the Project provided an opportunity for SCE&G to review the existing SMP in cooperation with relicensing stakeholders, including federal and state regulatory agencies, interested non-governmental organizations (NGOs), and individuals. Through discussions with these parties, it was decided that the existing FERC approved SMP should be divided into two distinct SMP's, one for each reservoir. SCE&G proposes to implement two SMPs for the Project; one for the Parr Reservoir and one for the Monticello Reservoir.

The implementation of the SMPs by SCE&G will help to maintain and conserve the area's natural and man-made resources. The SMPs will comply with the terms of the License, as well as the regulations and orders of FERC, and is intended to assist in providing a balance between recreational use and development, environmental protection, and energy production.

The management guidelines set forth in these SMPs are applicable to all lands within the Project boundary. Among other things, the current document includes the following components:

- Detailed descriptions, management prescriptions and mapping of land classifications;
- Summary information on the Permitting Handbook and fee policies;
- Best management practices ("BMP"s);
- Public education and outreach;
- Reservoir monitoring; and,
- A proposed review process.

<u>Parr Reservoir SMP</u>

An SMP was developed for the Parr Reservoir to identify existing and appropriate future uses and to provide plans and programs for responsible future use and management of project lands and waters as well as the flora and fauna encompassed within them.

Three distinct land management classifications have been developed for the shorelines surrounding the Parr Reservoir. These land management classifications are as follows: (1) Project Operations; (2) Public Recreation; and (3) Non-Development Areas. Although SCE&G intends to manage its lands according to this classification system, the public generally will not be precluded from access to SCE&G land regardless of classification, with the exception of land reserved and used for Project operations or other areas specifically protected from public access and posted as such. The sections below define the land management classifications. The acreages and parcels for each of the classifications are provided in Table 4-35. Figure 4-30 depicts their distribution around the Parr Reservoir.

- **Project Operations**- Areas classified as Project Operations lands include SCE&G–owned and managed lands required for operation of the Parr Development. Public access to these lands is restricted to ensure public safety or to assure security of the infrastructure system.
- **Public Recreation**- Areas classified as Public Recreation lands serve as recreational resources for the public and include areas managed expressly for recreation as well as those with recreation as a secondary usage. Public recreation lands include the following:
    - o Public boat launches, and other areas currently being managed as public access
    - o Islands owned by SGE&G
    - o Properties owned by SCE&G that are set aside for future recreational development
    - o Wildlife Management Area Lands
- **Non-Development Areas**- Lands classified as Non-Developmental Areas are protected from private development. This is done for the protection of the environmental and aesthetic integrity of the shoreline.

TABLE 4-31 PARR RESERVOIR SHORELINE MILES AND ACREAGES BY LAND USE CLASSIFICATION [11]

CLASSIFICATION	SHORELINE MILES	ACRES
Project Operations*	2.77	90
Public Recreation*	5.78	810
Non-Development Areas*	79.11	2,217
TOTAL	**87.66**	**3,117**

*No docks allowed

[11] Preliminary information – final data will be provided in the final SMP and FLA

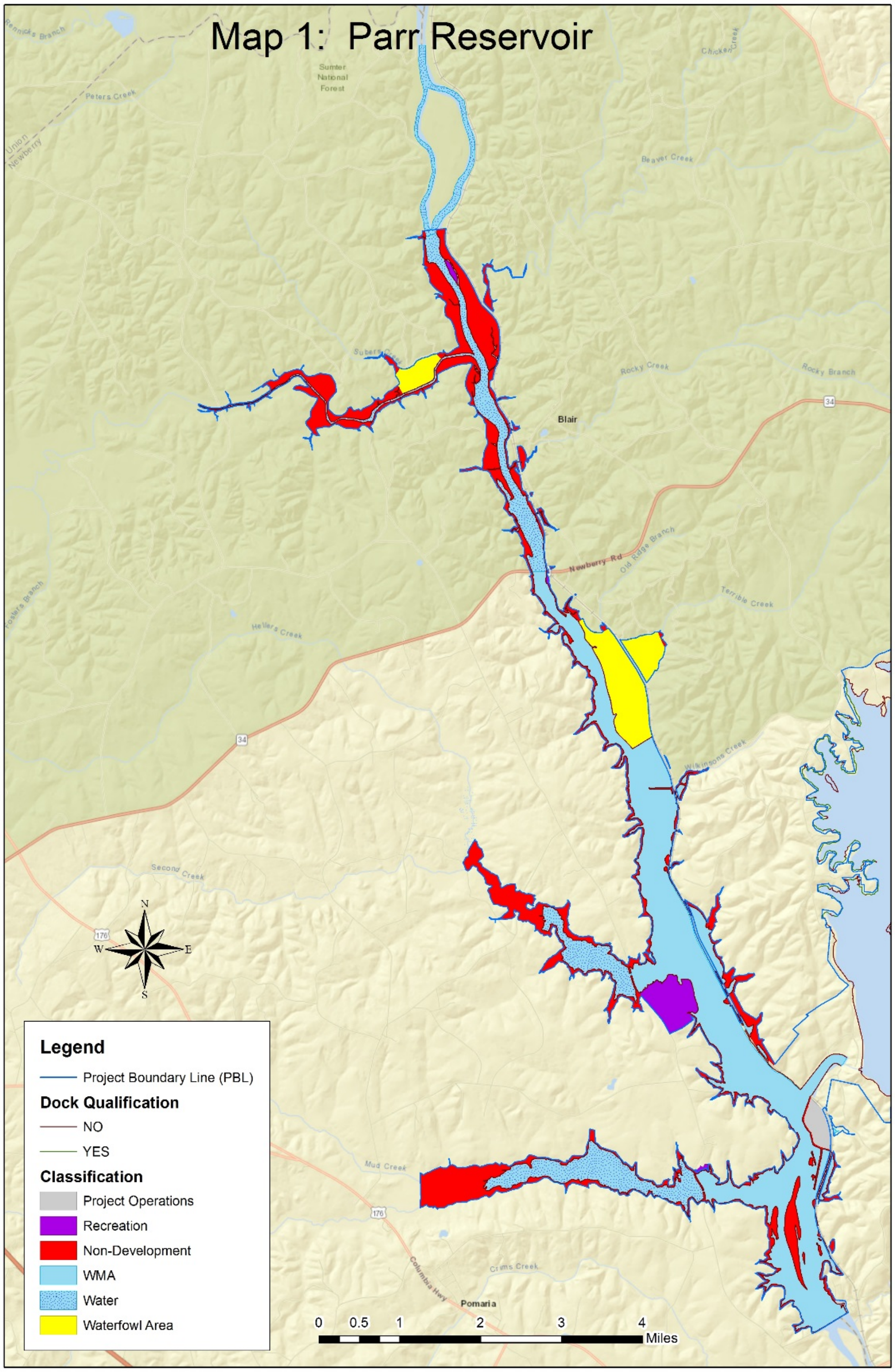


FIGURE 4-29 SHORELINE CLASSIFICATIONS MAP FOR PARR RESERVOIR

As development increases in areas surrounding the Project, so too do the development related stresses placed upon Project reservoirs and the surrounding watershed. Thus, a comprehensive SMP for the Parr Reservoir that recognizes and addresses sources of potential environmental impact is essential to managing the reservoir for the benefit of all interests and to ensure that non-Project uses remain consistent with the License.

MONTICELLO RESERVOIR SMP

An updated SMP was developed for the Monticello Reservoir to identify existing and appropriate future uses and to provide plans and programs for responsible future use and management of project lands and waters as well as the flora and fauna encompassed within them. This SMP specifically addresses shoreline uses surrounding the Monticello Reservoir.

Five distinct land management classifications have been developed for the shorelines surrounding Monticello Reservoir. These land management classifications are as follows: (1) Project Operations; (2) Nuclear Exclusion Zone; (3) Shoreline Permitting; (4) Public Recreation; and (5) Non-Development Areas. The Public Recreation classification includes designated public recreation areas, the Recreation Lake, and all islands on Monticello Reservoir. Although SCE&G intends to manage its lands according to this classification system, the public generally will not be precluded from access to SCE&G-owned lands regardless of classification, with the exception of lands reserved and used for Project operations, lands/areas within the Nuclear Exclusion Zone, or other areas specifically protected from public access and posted as such. The sections below define the land management classifications. The acreages and parcels for each of the classifications are provided in Table 4-36. Figure 4-31 depicts their distribution around Monticello Reservoir.

- **Project Operations**- Areas under this classification include SCE&G-owned and managed lands required for operations of the Fairfield Development. Public access to these lands is restricted to ensure public safety to assure the security of the infrastructure system.
- **Nuclear Exclusion Zone**- In addition to its use as part of the Fairfield Development, Monticello Reservoir provides cooling water for the V.C. Summer Nuclear Station located on its shore (authorized under 52 F.P.C. 537 [1974] and 137 FERC ¶ 62,033). The Nuclear Exclusion Zone consists of the area surrounding the V.C. Summer Nuclear Station between the Project boundary line and shoreline and a specified area within Monticello Reservoir where SCE&G as the reactor licensee has the authority to determine all activities, including exclusion or removal of personnel and property. This area is designated by warning signs on the landward side and by buoys on the lakeward side. Admittance to this area is restricted in order to comply with licensing requirements administered by the Nuclear Regulatory Commission.

- **Shoreline Permitting**- It is the policy of SCE&G to authorize certain private uses of and/or acts on Project property by permit when such uses or acts are consistent with the public interest and comply with the requirements of the Project License. Areas within the Shoreline Permitting Classification may be eligible for certain private residential uses upon approval by SCE&G. This does not include commercial activities (other than commercial water withdrawals).
- **Public Recreation**- Project lands under this classification serve as recreational resources for the public and include areas managed expressly for recreation as well as those with recreation as a secondary usage. Public recreation lands include the following:
  - Recreation Lake
  - Public boat launches and other areas currently managed as public access
  - Islands on Monticello Reservoir
  - Properties owned by SCE&G that are set aside for future recreational development.
- **Non-Development Areas**- Lands under this classification warrant special protection because they may provide important habitat, aesthetic values, or other significant Project characteristics.

TABLE 4-32 MONTICELLO RESERVOIR SHORELINE MILES AND ACREAGES BY LAND USE CLASSIFICATION [12]

CLASSIFICATION	SHORELINE MILES	ACRES
Project Operations*	4.14	156
Nuclear Exclusion Zone *	5.43	184
Shoreline Permitting	20.70	225
Public Recreation*	18.18**	1229**
Non-Development*	9.15	158
TOTAL	**57.60**	**1,952**

*No docks allowed
** Includes the shoreline surrounding the Recreation Lake and all islands

[12] Preliminary information – final data will be provided in the final SMP and FLA

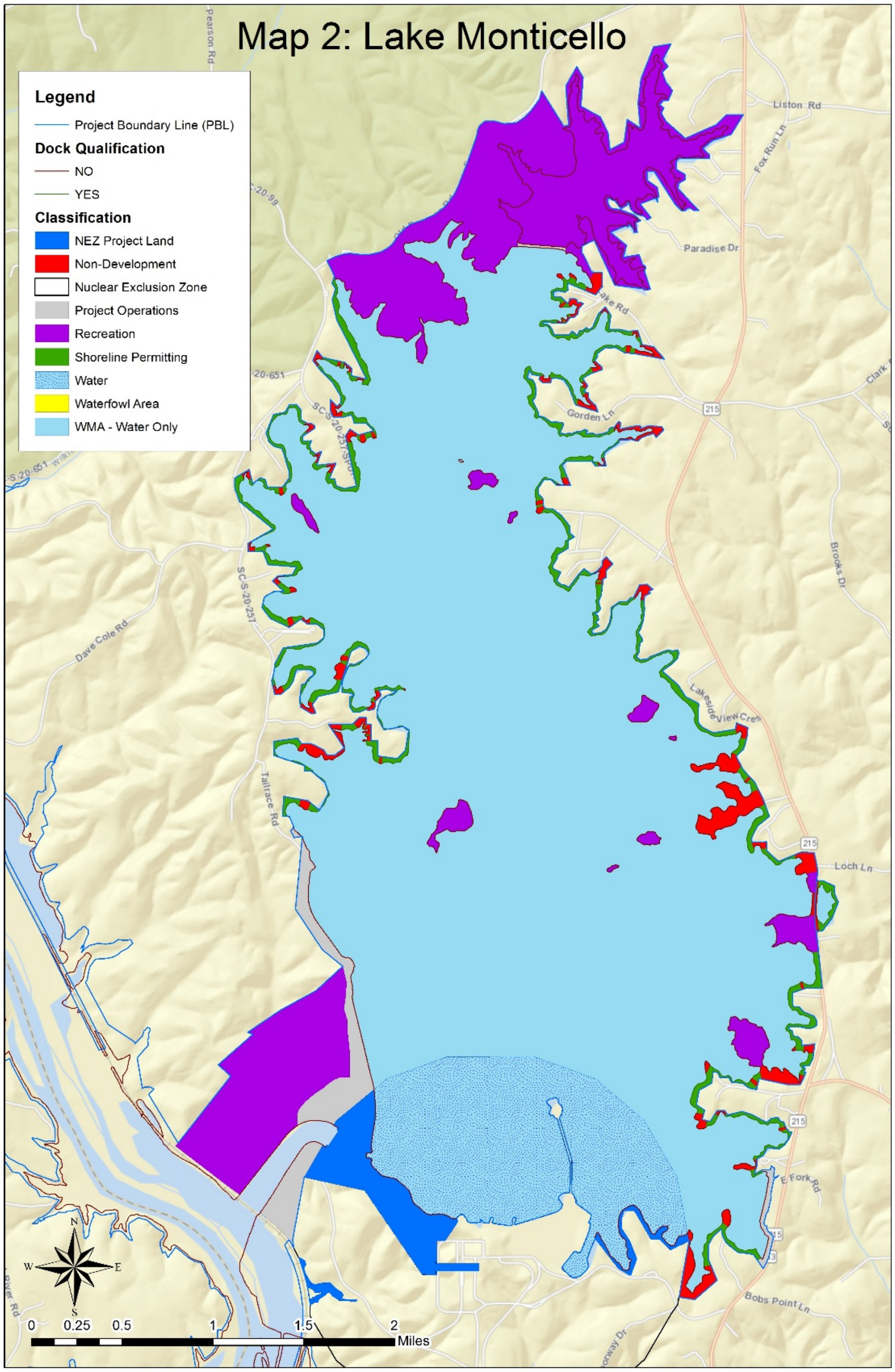


FIGURE 4-30 SHORELINE CLASSIFICATIONS MAP FOR MONTICELLO RESERVOIR

As development increases in areas surrounding the Project, so too do the development related stresses placed upon Project reservoirs and the surrounding watershed. Thus, a comprehensive SMP for the Monticello Reservoir that recognizes and addresses sources of potential environmental impact is essential to managing the reservoir for the benefit of all interests and to ensure that non-Project uses remain consistent with the License.

The implementation of the Parr Reservoir SMP, Monticello Reservoir SMP, development of a Permitting Handbook, development of shoreline BMPs, and public education associated with the SMP and BMPs by SCE&G will help to maintain and conserve the Project's shorelines. While SCE&G is not able to control land use practices on privately owned property outside the Project boundary, the revised SMPs should have a positive effect on Project shorelines by providing a balance between recreational use and development, environmental protection, and energy production.

4.10.3 ENVIRONMENTAL EFFECTS – NO ACTION ALTERNATIVE

Under the no action alternative SCE&G would continue to operate the Project in the manner it is currently operated. However without an update to existing SMP, improvements to the management of reservoir shorelines and education of adjacent owners would not occur.

4.10.4 UNAVOIDABLE ADVERSE EFFECTS

Development of private lands outside of the Project, but adjacent to Project shorelines will continue into the foreseeable future. Regardless of the implementation of SMPs for the Parr and Monticello reservoirs, private development use will continue to affect land use practices surrounding the developments.

4.10.5 REFERENCES

City of Newberry. 2010. Comprehensive Plan 2010-2020. Planning and Development Services Department. City of Newberry, South Carolina.

The Encyclopedia of Earth (EOE). 2014. Ecoregions of North Carolina and South Carolina (EPA). [Online] URL: http://www.eoearth.org/view/article/152148/ Accessed on April 2, 2014.

Federal Power Commission (F.P.C.). 1974. Order Issuing New License for the Parr Hydroelectric Project. August 28, 1974. 52 F.P.C. 537.

Federal Energy Regulatory Commission (FERC). 2001. Order Approving Land use and Shoreline Management Plan. June 4, 2001. 95 FERC ¶ 61,351.

NewberryCounty.org. 2014. Newberry County Chamber of Commerce and Visitors' Center. [Online] URL: http://www.newberrycounty.org/ Accessed March 27, 2014.

South Carolina Department of Natural Resources (SCDNR). 2014. Piedmont Ecoregion Aquatic Habitats. [Online] URL: https://www.dnr.sc.gov/cwcs/pdf/habitat/PiedmontAquatic.pdf Accessed on April 2, 2014.

South Carolina Energy & Gas Company (SCE&G). 2002. Land Use and Shoreline Management Plan – Monticello and Parr Reservoirs. Effective April 1, 2002. SCE&G Lake Management.

4.11 SOCIOECONOMIC RESOURCES

The Parr Hydroelectric Project consists of two developments, the Parr Development and the Fairfield Development. The developments, including the hydroelectric stations and associated facilities, are located in Fairfield and Newberry counties, South Carolina. The following sections provide a general description of the socioeconomic conditions in Fairfield and Newberry counties. The town of Jenkinsville is the nearest populated town to the Project.

4.11.1 AFFECTED ENVIRONMENT

4.11.1.1 POPULATION PATTERNS

In 2015, an estimated 22,747 people lived in Fairfield County, South Carolina (Table 4-37). From 2010 to 2015, the county population decreased by 5.0%. This population decline opposed the overall statewide population growth (5.9%) in South Carolina during the same period. Population densities are significantly lower in Fairfield County compared to the statewide densities. Fairfield County had 34.9 people per square mile compared to the state average of 153.9 people per square mile (U.S. Census, 2016).

In 2015, an estimated 38,012 people lived in Newberry County, South Carolina (Table 4-37). From 2010 to 2015, the county population increased by 1.3%. This population change was less than the overall statewide population growth (5.9%) in South Carolina during the same period. Population densities are significantly lower in Newberry County at 59.5 people per square mile compared to the state average of 153.9 people per square mile (U.S. Census, 2016)

TABLE 4-33 POPULATION PATTERNS

	FAIRFIELD COUNTY	NEWBERRY COUNTY	SOUTH CAROLINA
Population			
Population (2015)	22,747	38,018	4,896,146
Population (2010)	23,956	37,508	4,625,364
Population Change (2010-2015)	-5.0%	1.3%	5.9%
Geography (2010)			
Land area in square miles (sq mi)	686.28	630.04	30,060.7
Population Density (people/ sq mi)	34.9	59.5	153.9
Gender (2015)			
Female	52.3%	51.1%	51.4%
Male	47.7%	48.9%	48.6%
Age (2015)			
Persons under 5 years old	4.8%	5.8%	5.9%
Persons under 18 years old	20.4%	22.0%	22.3%

	Fairfield County	Newberry County	South Carolina
Persons over 65 years old	18.5%	18.4%	16.2%
Race (2015)			
Caucasian	39.7%	65.7%	68.4%
Black	58.1%	31.0%	27.6%
American Indian and Alaska Native	0.3%	0.8%	0.5%
Asian	0.4%	0.8%	1.4%
Native Hawaiian/Other Pacific Islander	<0.1%	0.3%	0.1%
Hispanic or Latino	1.9%	7.5%	5.5%
Two or More Races	1.6%	1.4%	1.8%

Source: U.S. Census 2016

4.11.1.2 Household/Family Distribution of Income

Between 2010 and 2014, Fairfield County had 9,402 households with 2.44 people in each household. The median household income was $36,213, which was significantly lower than the state median ($45,033). Approximately 23.1 percent of the population of Fairfield County live below the poverty level (U.S. Census 2016).

Between 2010 and 2014, Newberry County had 14,230 households with 2.56 people in each household. The median household income was $41,971, which was slightly lower than the state median ($45,033). Approximately 19.4 percent of the population of Newberry County live below the poverty level (U.S. Census 2016).

4.11.1.3 Project Vicinity Employment Sources

In 2015, the largest source of employment in Fairfield County was manufacturing. The second largest employment sector was retail trade. The third largest employment sector was health care and social assistance. The smallest source of employment was management of companies and enterprises (S. C. Department of Commerce 2016a).

In 2015, the largest source of employment in Newberry County was manufacturing. The second largest employment sector was retail trade. The third largest employment sector was administrative and waste services. The smallest source of employment was information services (S. C. Department of Commerce 2016b).

4.11.1.4 THE REGIONAL ECONOMY

As in Fairfield and Newberry counties, the primary employer within South Carolina is manufacturing. The state also relies heavily on government, real estate, retail trade and health care and social assistance to provide employment.

In 2013, South Carolina's gross domestic product was $184 billion; 16.7 percent of that came from the public sector. The main contributors to the gross domestic product were manufacturing ($31.8 billion), government ($30.6 billion), real estate ($23.6 billion), retail trade ($13.2 billion) and healthcare and social assistance ($10.9 billion). South Carolina's gross domestic product ranks 31st nationwide (S. C. Department of Commerce 2014).

4.11.1.5 REGIONAL BENEFITS OF THE PROJECT

The Project offers significant benefits to the region in terms of providing (a) low-cost renewable energy for the region; (b) economic activity related to the operation and maintenance of the Project facilities; and (c) recreational benefits in the Project vicinity.

Renewable Energy

The Project offers efficient, reliable, and cost-effective hydroelectric power. The Project has an installed capacity of 526.08 MW. The Project's average annual generation of 733,380 MWh is enough electricity to power approximately 67,085 households, assuming an average annual household use of 10,932 kWh (U.S. Energy Information Administration 2015).

Economic Activity

While continued Project operation may not significantly impact the local economy in creating jobs, SCE&G and its employees positively affect the local and regional economy by consuming goods and services and paying taxes. In addition, the Applicant pays approximately $5.4 million dollars annually in property taxes for Project property and assets, which has a significant direct impact on the surrounding communities.

Recreational Benefits

Project lands and waters provide a variety of public recreational opportunities and are served by formal and informal recreation sites. FERC-approved Project recreation facilities include a multiple-use recreation area, park areas, public boat landings, informal fishing access areas, and waterfowl management areas. Section 4.8 of Exhibit E provides an overview of the recreational resources provided by the Parr Hydroelectric Project.

4.11.2 ENVIRONMENTAL EFFECTS

4.11.2.1 COMPLETED STUDIES

SCE&G did not conduct any studies regarding socioeconomic resources.

4.11.2.2 PROPOSED ACTION

A complete description of SCE&G's proposed PM&E measures is located in Section 3.2.1. SCE&G has proposed several PM&E measures that would increase recreational opportunities in the Project area. Increased recreational opportunities may lead to an increase of tourism in the area and benefit socioeconomic resources. The following PM&E measures have been proposed that may impact socioeconomic resources:

- Parr Shoals Dam Canoe Portage and other Recreation Enhancements
- Monticello Fish Habitat Improvements
- Downstream Navigation Flows

<u>Parr Shoals Dam Canoe Portage and other Recreation Enhancements</u>

A downstream canoe portage was recommended by SCDNR at the Parr Shoals Dam. SCE&G cleared a trail along the Newberry side of the Parr Shoals Dam, approximately 1,600 feet in length, for boaters to portage around the dam. A trail evaluation is underway. Establishment of a formal canoe portage will increase recreational opportunities at the Project. The Recreation TWC also recommended several other enhancements at existing recreation sites within the Project boundary. These improvements will likely enrich recreational experiences available at the Project.

<u>Monticello Fish Habitat Improvements</u>

In response to a SCDNR request for habitat enhancements to mitigate the effects of Monticello Reservoir water fluctuations, SCE&G has proposed installing a variety of habitat enhancements at the reservoir. SCE&G is proposing to install habitat improvement structures to benefit deep-water, nursery and spawning habitat. The structures would provide enhanced fish production within the reservoir and may also concentrate fish as an enhancement for recreational fishermen, increasing fishing opportunities at the reservoir.

<u>Downstream Navigation Flows</u>

The Downstream Navigation Flow Assessment evaluated concerns regarding minimum flows in the Broad River downstream of Parr Shoals Dam. The results suggested that a flow of 700-1,000 cfs is necessary for downstream navigation. Providing the proposed minimum navigation flows will increase boating opportunities downstream of the Project.

4.11.3 Environmental Effects – No Action Alternative

Under the No Action alternative, SCE&G would continue to operate the Project in the manner it is presently operated. The Project would not likely experience the socioeconomic and recreational benefits that would possibly occur with SCE&G's proposal. Also, the PME measures described above, and their associated benefits, would not occur. However, the information provided above does show that the Project area already receives significant socioeconomic benefits from the Project.

4.11.4 Unavoidable Adverse Effects

No unavoidable adverse effects have been identified for socioeconomic resources.

4.11.5 References

South Carolina Department of Commerce. 2014. South Carolina's Gross Domestic Product. [Online] URL: http://dc.statelibrary.sc.gov/bitstream/handle/10827/15472/DOC_GDP_2014.pdf?sequence=1&isAllowed=y Accessed October 13, 2016.

South Carolina Department of Commerce. 2016a. Fairfield County Labor Profile. [Online] URL: http://maps.sccommerce.com/reports/exports/labor/Fairfield.pdf Accessed 10/13/2016.

South Carolina Department of Commerce. 2016b. Newberry County Labor Profile. [Online] URL: http://maps.sccommerce.com/reports/exports/labor/Newberry.pdf Accessed 10/13/2016.

U.S. Census, 2016. Quickfacts, South Carolina. [Online] URL: http://www.census.gov/quickfacts/table/PST045215/45039,45071,45,00 Accessed October 13, 2016.

U.S. Energy Information Administration. 2016. Frequently Asked Questions. [Online] URL http://www.eia.gov/tools/faqs/faq.cfm?id=97&t=3 Accessed October 13, 2016.

5.0 DEVELOPMENTAL ANALYSIS

The objective of a developmental analysis is to describe the electric power benefits of a project, as well as to describe the cost, power value, and net benefit for the proposed action and the no-action alternative. The developmental analysis also summarizes, and provides the estimated cost for each proposed environmental measure for the protection, mitigation and enhancement of project resources. For the purposes of this application, relevant information for the Developmental Analysis is provided in the Exhibit D, to be filed with the FLA. General information regarding the power and economic benefits of the Project is nevertheless provided in the following sections.

5.1 POWER AND ECONOMIC BENEFITS

The Parr Development has an authorized installed generation capacity of 14.88 MW. The Fairfield Development has an authorized installed generation capacity of 511.2 MW. The average annual generation of the Parr and Fairfield developments is 56,409 and 676,971 MWh, respectively. Under the proposed action, the Project would continue to operate as currently authorized under the existing license with operational adjustments for the enhancement of downstream environmental resources, as Project inflows allow. Generally, Parr Development would operate in a modified run of river mode, and the Fairfield Development operating as a peaking and reserve generation resource.

Information regarding the power and economic benefits of the Project will be included in Exhibit D of the FLA.

5.2 COMPARISON OF ALTERNATIVES

A comparison of the economics of the proposed action will be included in Exhibit D of the FLA.

5.2.1 PROPOSED ACTION

Under the proposed action, SCE&G would continue to operate the Project as currently authorized under the existing license, with the Parr Development operating in a modified run of river mode, and the Fairfield Development operating as a peaking and reserve generation resource. Licensee-implemented operational adjustments would be made for the protection of downstream environmental resources, as inflows allow. SCE&G is proposing a number of additional PM&E measures through this application. The cost of each measure will be estimated in the Exhibit D of the FLA.

5.2.2 No Action Alternative

Under the no action alternative, the Project would continue to operate as currently licensed. Average annual generation would be assumed to remain consistent with historical MWh's. Additional information regarding an average annual power value will be included in Exhibit D of the FLA.

5.3 Cost of Environmental Measures

The cost of environmental measures will be included in Exhibit D of the FLA.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 COMPARISON OF ALTERNATIVES

The purpose of this section is to compare the effects of the Proposed Action and the No Action Alternative.

RESOURCE	PROPOSED ACTION	NO ACTION ALTERNATIVE
Generation	Parr – To be determined based on final PM&E measures Fairfield - To be determined based on final PM&E measures	Parr - 56,409 MWh/year Fairfield – 676,971 MWh/year
Geology and Soils	No change. Through the Proposed Action, SCE&G would continue to monitor and implement erosion control measures at the Project.	No change.
Water Resources	Through the Proposed Action, SCE&G would implement operational measures that would likely enhance DO levels in the Parr Development tailrace according to the Turbine Venting Plan and Minimum Flow AMP and in the West Channel according to the West Channel AMP.	No change. Periodic incidences of DO levels less than 4 mg/L in the tailrace during the summer months would likely continue to occur. Moreover, the west channel would likely continue to experience low DO during periods of low inflow.
Fishery Resources	Through the Proposed Action, aquatic resources would likely be improved through the implementation of revised downstream flows through the implementation of the Minimum Flow AMP. This analysis will be available in the Final License Application. Downstream fishery enhancements would potentially occur through the reduction of downstream flow fluctuations according to the Downstream Flow Fluctuation AMP. Fish spawning habitat in Monticello Reservoir would be enhanced through habitat improvement measures.	No change.
Terrestrial Resources	No change	No change.
RT&E Species	Through the Proposed Action, aquatic resources for RT&E species would likely be improved through the implementation of revised downstream flows through the implementation of the Minimum	No change

RESOURCE	PROPOSED ACTION	NO ACTION ALTERNATIVE
	Flow AMP. This analysis will be available in the Final License Application. Potential downstream RT&E fishery enhancements would occur through the reduction of downstream flow fluctuations. Fish spawning habitat in Monticello Reservoir would be enhanced through habitat improvement measures, which may benefit RT&E species.	
Recreation	Recreation at the Project would be enhanced through the recreation site improvements, the addition of barrier free access at certain facilities, and through the formalization of the canoe portage. Higher minimum flows would improve recreation opportunities downstream of the Project through the implementation of the Minimum Flow AMP. Flows for downstream navigation would be provided through revised downstream flows through the implementation of the Minimum Flow AMP.	No change
Cultural	Cultural resources would be preserved and mitigated through implementation of the HPMP, Lyle's Ford mitigation, and other measures.	No change
Land Use and Aesthetics	Project shoreline would be preserved and public access to the Project lands would be enhanced through the implementation of the Parr and Monticello SMP's.	No change
Socioeconomic	Recreation site enhancements would likely improve socioeconomic conditions in the surrounding region.	No change

6.2 UNAVOIDABLE ADVERSE EFFECTS

The following unavoidable adverse effects have been identified at the Project, regardless of what alternative is undertaken:

Geology and Soils - Reservoir fluctuations, wave, and wind action will continue to have adverse impacts on erodible soils around the shoreline and siltation will continue to occur within the reservoirs. Continued mitigation and armoring of these areas by SCE&G would likely reduce the extent of these continuing adverse impacts.

Fishery Resources - Parr Reservoir experiences fluctuations associated with pumped storage operations. These fluctuations may dewater potential spawning habitat, and may reduce spawning success or recruitment of juvenile fish to adult lifestages. It is not anticipated that habitat enhancements would greatly benefit spawning success in Parr Reservoir given these conditions. Additionally, fish entrainment and turbine mortality would continue to occur at the Project regardless of what alternative is undertaken.

Terrestrial Resources - Fluctuations in reservoir levels due to operation of the Project may impact littoral and riparian areas within the Project boundary.

RT&E Species – Project operations, in addition to high inflows to the Project, have the potential to create downstream flow fluctuations. This may interfere with the spawning of various RT&E species.

Land Use and Aesthetics - Development of private lands outside of the Project, but adjacent to Project shorelines will continue into the foreseeable future and may affect land use practices surrounding the Project developments.

Unavoidable Adverse effects have not been identified for the following resources: Water Resources and Water Quality, Recreation, Cultural Resources, and Socioeconomic Resources.

6.3 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a) of the Federal Power Act (FPA), 16 U.S.C. § 803(a)(2)(A), requires FERC 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. On April 27, 1988, FERC issued Order No. 481—A revising Order No. 481, issued October 26, 1987, establishing that FERC will accord FPA Section 10(a)(2)(A) comprehensive plan status to any Federal or state plan that:

- Is a comprehensive study of one or more of the beneficial uses of a waterway or waterways;
- Specifies the standards, the data, and the methodology used; and
- Is filed with the Secretary of the Commission.

FERC currently lists comprehensive plans for the State of South Carolina and U.S. resources. Of the 30 plans listed, 24 are potentially relevant to the Project, as detailed below in Table 6-1.

TABLE 6-1 LIST OF QUALIFYING FEDERAL AND STATE COMPREHENSIVE WATERWAY PLANS POTENTIALLY RELEVANT TO THE PROJECT AND PROJECT CONSISTENCY

RESOURCE	COMPREHENSIVE PLAN TITLE	PROJECT CONSISTENCY (YES/NO)
Botanical Resources	Forest Service. 2001. Sumter National Forest revised land and resource management plan. Department of Agriculture, Columbia, South Carolina. January 2004.	Yes
Fisheries Resources	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.	Yes
Fisheries Resources	Atlantic States Marine Fisheries Commission. 1998. Interstate fishery management plan for Atlantic striped bass. (Report No. 34). January 1998.	Yes
Fisheries Resources	Atlantic States Marine Fisheries Commission. 1999. Amendment 1 to the Interstate Fishery Management Plan for shad and river herring. (Report No. 35). April 1999.	Yes
Fisheries Resources	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.	Yes
Fisheries Resources	Atlantic States Marine Fisheries Commission. 2009. Amendment 2 to the Interstate Fishery Management Plan for shad and river herring, Arlington, Virginia. May 2009.	Yes
Fisheries Resources	Atlantic States Marine Fisheries Commission. 2010. Amendment 3 to the Interstate Fishery Management Plan for shad and river herring, Arlington, Virginia. February 2010.	Yes
Fisheries Resources	Atlantic States Marine Fisheries Commission. 2000. Interstate Fishery Management Plan for American eel (*Anguilla rostrata*). (Report No. 36). April 2000.	Yes
Fisheries Resources	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.	Yes
Fisheries Resources	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.	Yes
Fisheries Resources	U.S. Fish and Wildlife Service, National Marine Fisheries Service, and South Carolina Department of Natural Resources. 2001. Santee-Cooper Basin diadromous fish passage restoration plan. Charleston, South Carolina. August 28, 2001.	Yes

RESOURCE	COMPREHENSIVE PLAN TITLE	PROJECT CONSISTENCY (YES/NO)
Fisheries Resources	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.	Yes
Fisheries Resources	South Carolina Wildlife and Marine Resources Department. 1989. South Carolina instream flow studies: a status report. Columbia, South Carolina. June 1989.	Yes
Fisheries Resources	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.	Yes
Water Resources	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.	Yes
Water Resources	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.	Yes
Water Resources	South Carolina Department of Natural Resources. 2004. South Carolina Water Plan-Second Edition. Columbia, South Carolina. January, 2004.	Yes
Water Resources	South Carolina Department of Health and Environmental Control. 1985. Water classifications and standards, and classified waters. Columbia, South Carolina. June 1985.	Yes
Water Resources	South Carolina Water Resources Commission. National Park Service. 1988. South Carolina Rivers Assessment. Columbia, South Carolina. September 1988.	Yes
Recreation	South Carolina Department of Parks, Recreation, & Tourism. 2008. South Carolina State Comprehensive Outdoor Recreation Plan (SCORP). Columbia, South Carolina. April 2008.	Yes
Recreation	National Park Service. The Nationwide Rivers Inventory. Department of the Interior, Washington, D.C. 1993.	Yes
Recreation	South Carolina Department of Parks, Recreation, & Tourism. 2002. The South Carolina State Trails Plan. Columbia, South Carolina. 2002.	Yes
Wildlife Resources	South Carolina Department of Natural Resources. 2005. South Carolina comprehensive wildlife conservation strategy: 2005-2010. Columbia, South Carolina. September 2005.	Yes
Wildlife Resources	U.S. Fish and Wildlife Service. Canadian Wildlife Service. 1986. North American waterfowl management plan. Department of the Interior. Environment Canada. May 1986.	Yes

6.3.1 REFERENCES

Federal Energy Regulatory Commission. 2016. List of Comprehensive Plans. October, 2016. [Online] URL: http://www.ferc.gov/industries/hydropower/gen-info/licensing/complan.pdf. Accessed November 2016.

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MC C222
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Columbia, SC 29250

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Prosperity, SC 29127

Mary Maerchlein
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Whitmire, SC 29178

Matthew Gissendanner
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Mayor Foster Senn
City of Newberry
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Federal Energy Regulatory Commission
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OEP Room 61-02
Washington, DC 20426

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Huger, SC 29450

Robert Stephenson
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Robert Stroud
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Ron Ahle
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West Columbia, SC 29172

Rusty Wenerick
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William B. Hendrix, Jr.
18662 Newberry Road
Blair, SC 29015

APPENDICES FILED SEPARATELY DUE TO FILE SIZE

EXHIBIT F

GENERAL DESIGN INFORMATION

PARR HYDROELECTRIC PROJECT
(FERC NO. 1894)

APPLICATION FOR NEW LICENSE
FOR MAJOR WATER POWER PROJECT > 5 MW

EXHIBIT F

GENERAL DESIGN INFORMATION

1.0 GENERAL DESIGN DRAWINGS

General design drawings of project structures will be included in the Final License Application as Sheets 1 through 12 of Exhibit F. As required by Section 4.51(g)(1) of the Commission's regulations, these drawings will show typical plans, sections and elevations of project structures. Unless otherwise noted, all elevation references in this Exhibit are referenced to the North American Vertical Datum of 1988 (NAVD 88); conversion to National Geodetic Vertical Datum of 1929 (NGVD29), used in numerous supporting studies for this license application and often erroneously referred to as MSL) requires the addition of 0.7 feet to elevation values referenced to NAVD88.

2.0 SUPPORTING DESIGN REPORT

Being subject to the Commission's Part 12 regulations, the Project structures are inspected every five years by a Commission-approved Independent Consultant; the most recent inspection was conducted in November 2015 and results reported to the Commission in March 2016. The 2016 Seventh Safety Inspection Report for the Fairfield Development, the 2016 Eighth Safety Inspection Report for the Parr Shoals Development, the 2016 Potential Failure Mode Analysis Reports and the 2016 Supporting Technical Information Documents include evaluation of, and information on, all project structures. The information contained in the SIRs, the STIs, and the PFMA reports fulfill the requirements for a Supporting Design Report. Copies of these documents are on file with the Commission.

EXHIBIT G

PROJECT MAPS

PARR HYDROELECTRIC PROJECT
(FERC NO. 1894)

APPLICATION FOR NEW LICENSE
FOR MAJOR WATER POWER PROJECT > 5 MW

EXHIBIT G

PROJECT MAPS

1.0 PROJECT MAPS

For this Draft License Application, the current Exhibit K maps Sheets K-1 through K-20 (20 sheets) with locations of archaeological sites removed are included as draft detail maps of the Project area. As required by Section 4.51(h) of the Commission's regulations, these maps show the location of the Project Boundary Line (PBL) and other principal features of the project. The Exhibit K maps are in the process of being converted to Exhibit G maps, which will be included with the Final License Application. A list of updates and revisions identified to date which will be incorporated in the final Exhibit G maps is included below.

2.0 EXHIBIT K/G DRAWING REVISIONS REQUIRED PRIOR TO FILING WITH LICENSE APPLICATION

SHEET NO.	REVISION REQUIRED
All Sheets	Convert all elevations to NAVD88 by subtracting 0.7 ft.
All Sheets	Delete references to archeological sites and digs and their black location marks.
All Sheets	Change notes that refer to Exhibit F.
All Sheets	Remove property lines and tract numbers EXCEPT for those listed in the Federal Lands table on K-1. Provide hatch marks along boundary with Federal lands.
K-1 and K-3	Include the Hwy. 215 Boat Ramp recreation site and hatch as a current recreation site.
K-1 and K-8	Revise PBL at Cannons Creek Park site to show the entire park site inside PBL as current recreation property.
K-5	Verify and revise if necessary PBL in vicinity of Parr Shoals Hydro and

SHEET NO.	REVISION REQUIRED
	Dam.
K-5	Modify PBL to enclose canoe portage trail at west end of Parr Dam.
K-1 and K-5	Remove Parr Steam Plant which no longer exists.
K-5	Remove reference to construction spoil area and USACE permit number.
K-5	Add project primary transmission and distribution lines from hydro plant to Parr transmission and distribution substations. Verify these are located within PBL or modify PBL to include.
K-5	Remove substation #1122 from the PBL as an "island" while keeping the lines from the plant inside the PBL.
K-6	Property adjacent to the FFPS tailrace (north side) is shown on K-1 as future recreation, but is not designated as such on K-6. Correct boundary and hatch as future recreation.
K-6	Remove reference to construction spoil area and USACE permit number (2 locations).
K-6	Verify that FF-Summer transmission lines are within PBL corridor shown on drawing and redraw them on the map to be inside the PBL.
K-10	Correct "Top of Dike" note at Broad River WMA. Also correct outline of WMA to reflect actual extents of WMA per SCDNR.
K-13	Correct outline of Broad River WMA to reflect actual extents of WMA per SCDNR.
K-14	Show tracts 211 (south of Hwy 34) and 285 (southwest of RR only) as proposed to be brought into the PBL as a proposed new recreation site.
K-15 and K-16	Correct outline of Enoree River WMA to reflect actual extents of WMA per SCDNR.
K-17	Show a narrow area inside the PBL at the Maybinton Rd. bridge (Enoree River) as a proposed recreation site for canoe launching.

3.0 LIST OF PROPERTY OWNERS ADJACENT TO THE PROJECT

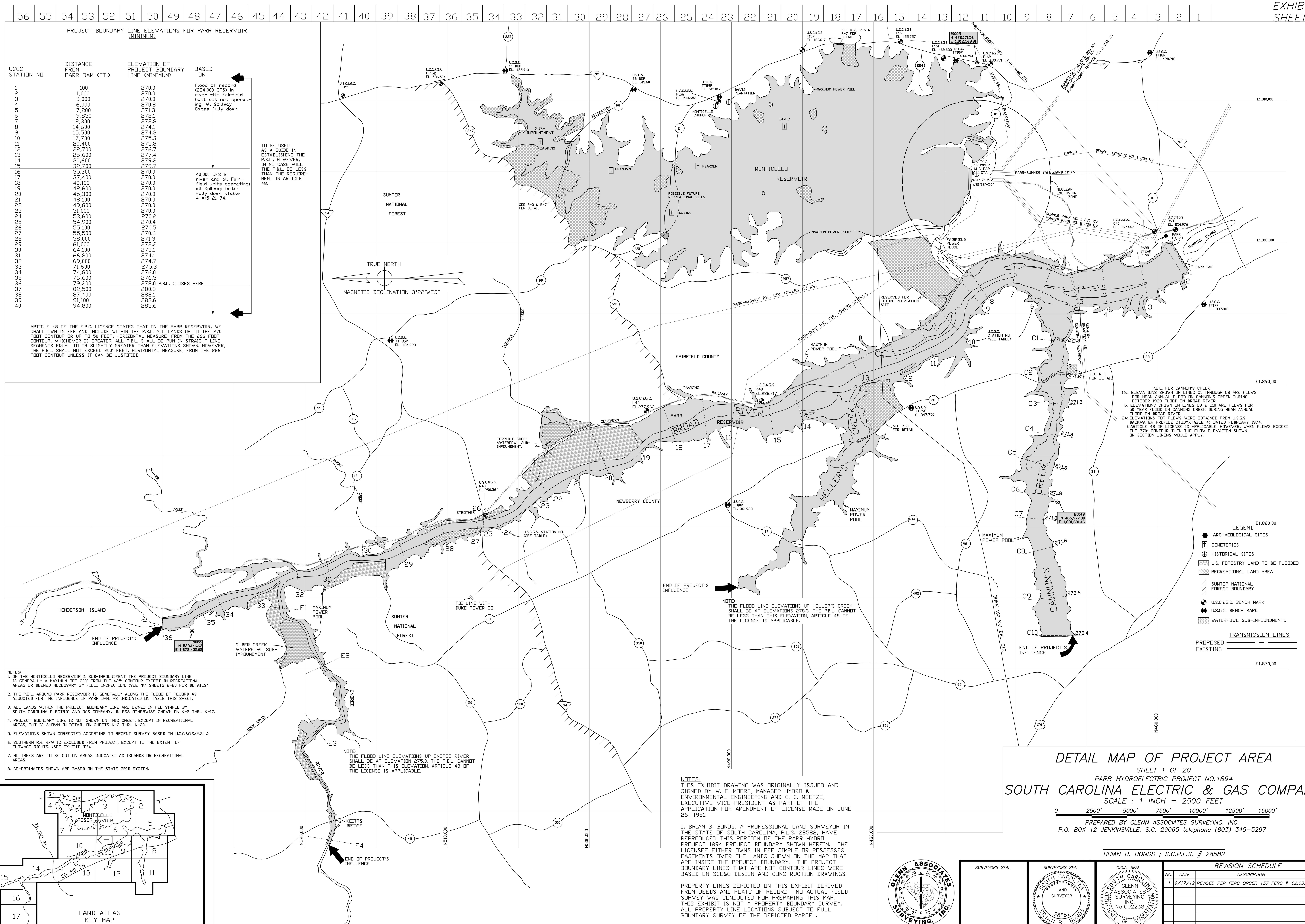
This information is currently being updated and will be provided with the final license application.

PROJECT BOUNDARY LINE ELEVATIONS FOR PARR RESERVOIR (MINIMUM)

USGS STATION NO.	DISTANCE FROM PARR DAM (FT.)	ELEVATION OF PROJECT BOUNDARY LINE (MINIMUM)	BASED ON
1	100	270.0	Flood of record (224,000 CFS) in river with Fairfield built but not operating. All Spillway Gates fully down.
2	1,000	270.0	
3	3,000	270.0	
4	6,000	270.8	
5	7,800	271.3	
6	9,850	272.1	
7	12,300	272.8	
8	14,600	274.1	
9	15,500	274.3	
10	17,700	275.3	
11	20,400	275.8	
12	22,700	276.7	
13	25,600	277.4	
14	30,600	279.2	
15	32,700	279.7	
16	35,300	270.0	40,000 CFS in river and all Fairfield units operating; all Spillway Gates fully down. (Table 4-A)5-21-74.
17	37,400	270.0	
18	40,100	270.0	
19	42,600	270.0	
20	45,300	270.0	
21	48,100	270.0	
22	49,800	270.0	
23	51,000	270.0	
24	53,600	270.2	
25	54,900	270.4	
26	55,100	270.5	
27	55,500	270.6	
28	58,000	271.3	
29	61,000	272.2	
30	64,100	273.1	
31	66,800	274.1	
32	69,000	274.7	
33	71,600	275.3	
34	74,800	276.0	
35	76,600	276.5	
36	79,200	278.0 P.B.L. CLOSES HERE	
37	82,500	280.3	
38	87,400	282.1	
39	91,100	283.6	
40	94,800	285.6	

TO BE USED AS A GUIDE IN ESTABLISHING THE P.B.L., HOWEVER, IN NO CASE WILL THE P.B.L. BE LESS THAN THE REQUIREMENT IN ARTICLE 48.

ARTICLE 48 OF THE F.P.C. LICENCE STATES THAT ON THE PARR RESERVOIR, WE SHALL OWN IN FEE AND INCLUDE WITHIN THE P.B.L. ALL LANDS UP TO THE 270 FOOT CONTOUR OR UP TO 50 FEET, HORIZONTAL MEASURE, FROM THE 266 FOOT CONTOUR, WHICHEVER IS GREATER. ALL P.B.L. SHALL BE RUN IN STRAIGHT LINE SEGMENTS EQUAL TO OR SLIGHTLY GREATER THAN ELEVATIONS SHOWN. HOWEVER, THE P.B.L. SHALL NOT EXCEED 200' FEET, HORIZONTAL MEASURE, FROM THE 266 FOOT CONTOUR UNLESS IT CAN BE JUSTIFIED.



NOTES:
1. ON THE MONTICELLO RESERVOIR & SUB-IMPOUNDMENT THE PROJECT BOUNDARY LINE IS GENERALLY A MAXIMUM OFF 200' FROM THE 425' CONTOUR EXCEPT IN RECREATIONAL AREAS OR DEEMED NECESSARY BY FIELD INSPECTION. (SEE "K" SHEETS 2-20 FOR DETAILS)
2. THE P.B.L. AROUND PARR RESERVOIR IS GENERALLY ALONG THE FLOOD OF RECORD AS ADJUSTED FOR THE INFLUENCE OF PARR DAM, AS INDICATED ON TABLE THIS SHEET.
3. ALL LANDS WITHIN THE PROJECT BOUNDARY LINE ARE OWNED IN FEE SIMPLE BY SOUTH CAROLINA ELECTRIC AND GAS COMPANY, UNLESS OTHERWISE SHOWN ON K-2 THRU K-17.
4. PROJECT BOUNDARY LINE IS NOT SHOWN ON THIS SHEET, EXCEPT IN RECREATIONAL AREAS, BUT IS SHOWN IN DETAIL ON SHEETS K-2 THRU K-20.
5. ELEVATIONS SHOWN CORRECTED ACCORDING TO RECENT SURVEY BASED ON U.S.C.&G.S.(M.S.L.)
6. SOUTHERN R.R. R/W IS EXCLUDED FROM PROJECT, EXCEPT TO THE EXTENT OF FLOWAGE RIGHTS. (SEE EXHIBIT "F").
7. NO TREES ARE TO BE CUT ON AREAS INDICATED AS ISLANDS OR RECREATIONAL AREAS.
8. CO-ORDINATES SHOWN ARE BASED ON THE STATE GRID SYSTEM.

NOTES:
THIS EXHIBIT DRAWING WAS ORIGINALLY ISSUED AND SIGNED BY W. E. MOORE, MANAGER-HYDRO & ENVIRONMENTAL ENGINEERING AND G. C. MEETZE, EXECUTIVE VICE-PRESIDENT AS PART OF THE APPLICATION FOR AMENDMENT OF LICENSE MADE ON JUNE 26, 1981.

I, BRIAN B. BONDS, A PROFESSIONAL LAND SURVEYOR IN THE STATE OF SOUTH CAROLINA, P.L.S. 28582, HAVE REPRODUCED THIS PORTION OF THE PARR HYDRO PROJECT 1894 PROJECT BOUNDARY SHOWN HEREIN. THE LICENSEE EITHER OWNS IN FEE SIMPLE OR POSSESSES EASEMENTS OVER THE LANDS SHOWN ON THE MAP THAT ARE INSIDE THE PROJECT BOUNDARY. THE PROJECT BOUNDARY LINES THAT ARE NOT CONTOUR LINES WERE BASED ON SCE&G DESIGN AND CONSTRUCTION DRAWINGS.

PROPERTY LINES DEPICTED ON THIS EXHIBIT DERIVED FROM DEEDS AND PLATS OF RECORD. NO ACTUAL FIELD SURVEY WAS CONDUCTED FOR PREPARING THIS MAP. THIS EXHIBIT IS NOT A PROPERTY BOUNDARY SURVEY. ALL PROPERTY LINE LOCATIONS SUBJECT TO FULL BOUNDARY SURVEY OF THE DEPICTED PARCEL.

DETAIL MAP OF PROJECT AREA

SHEET 1 OF 20
PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SCALE : 1 INCH = 2500 FEET

0 2500' 5000' 7500' 10000' 12500' 15000'

PREPARED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

BRIAN B. BONDS ; S.C.P.L.S. # 28582

SURVEYORS SEAL

SURVEYORS SEAL
SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR 28582 BRIAN B. BONDS

C.O.A. SEAL
SOUTH CAROLINA GLENN ASSOCIATES SURVEYING INC. No.C02238 CERTIFICATE OF AUTHORIZATION

REVISION SCHEDULE

NO.	DATE	DESCRIPTION	CHECKED
1	9/17/12	REVISED PER FERC ORDER 137 FERC ¶ 62,033	BBB

ORIGINAL NOTES:

1. ALL PROPERTY WITHIN THE PROJECT BOUNDARY LINE IS OWNED IN FEE SIMPLE BY S.C.E. & G. CO. UNLESS OTHERWISE SHOWN ON EXHIBIT "F".
2. ALL PROPERTIES & PROPERTY LINES WERE SHOWN OUTSIDE P.B.L. AS A CONVENIENCE FOR HISTORICAL PURPOSES FOR S.C.E.&G.
3. DETAILED DESCRIPTION FOR PROJECT BOUNDARY LINE IS SHOWN FOR SHEETS K-18 THRU K-20.
4. LAND PARCELS ARE KEYED FOR EXHIBIT "F" BY ENCIRCLED NUMBERS. EX 33
5. LANDS ABUTTING P.B.L. ON THE EXTERIOR ARE IN PRIVATE OWNERSHIP UNLESS SHOWN OTHERWISE ON EXHIBIT "F".
6. CO-ORDINATES SHOWN ARE BASED ON THE STATE GRID SYSTEM (NAD27)
7. ELEVATIONS SHOWN ARE BASED ON THE U.S.C.&G.S. DATA (M.S.L.)
8. P.B.L. FOR MONTICELLO RESERVOIR IS GENERALLY A MAXIMUM OF 200 FEET FROM 425 CONTOUR EXCEPT IN RECREATION AREAS OR AS DEEMED NECESSARY BY FIELD INSPECTION.
9. ALL ISLANDS ARE TO REMAIN IN THEIR NATURAL STATE.

NOTES:

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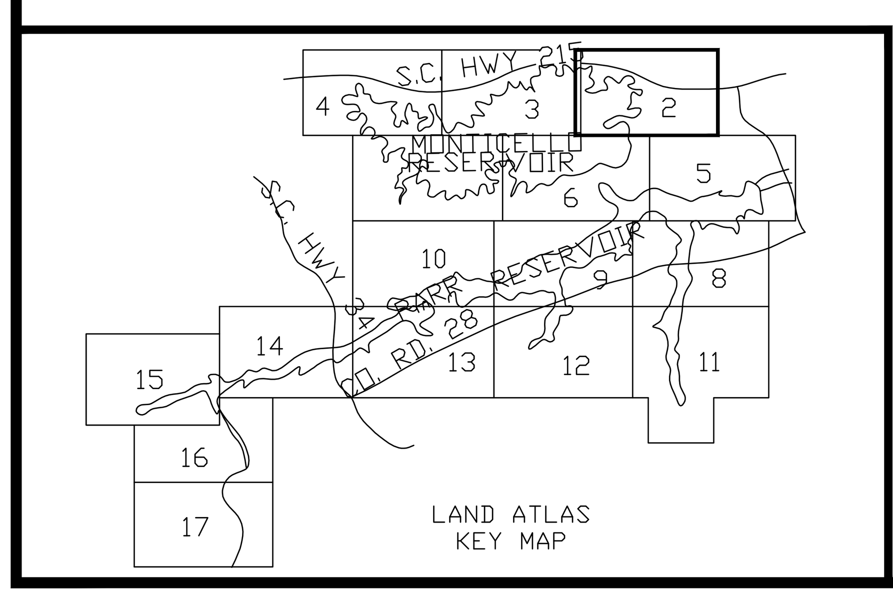

LEGEND
- ARCHAEOLOGICAL SITES
- CEMETERIES
- HISTORICAL SITES
- U.S. FORESTRY LAND TO BE FLOODED
- RECREATIONAL LAND AREA
- SUMTER NATIONAL FOREST BOUNDARY
- PROJECT BOUNDARY LINE
- U.S.C.&G.S. BENCH MARK
- U.S.G.S. BENCH MARK
- WATERFOWL SUB-IMPOUNDMENTS
- REFERENCE POINTS

TRANSMISSION LINES
PROPOSED
EXISTING

DETAIL MAP OF PROJECT AREA

SHEET 2 OF 20
PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SCALE : 1 INCH = 500 FEET
0 500' 1000' 1500' 2000' 2500' 3000'

SURVEYED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

BRIAN B. BONDS ; S.C.P.L.S. # 28582

GLENN ASSOCIATES SURVEYING, INC.

SURVEYORS SEAL
2/20/2012

SURVEYORS SEAL
SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR 28582 BRIAN B. BONDS

C.O.A. SEAL
SOUTH CAROLINA GLENN ASSOCIATES SURVEYING INC. No.C02238 CERTIFICATE OF AUTHORIZATION

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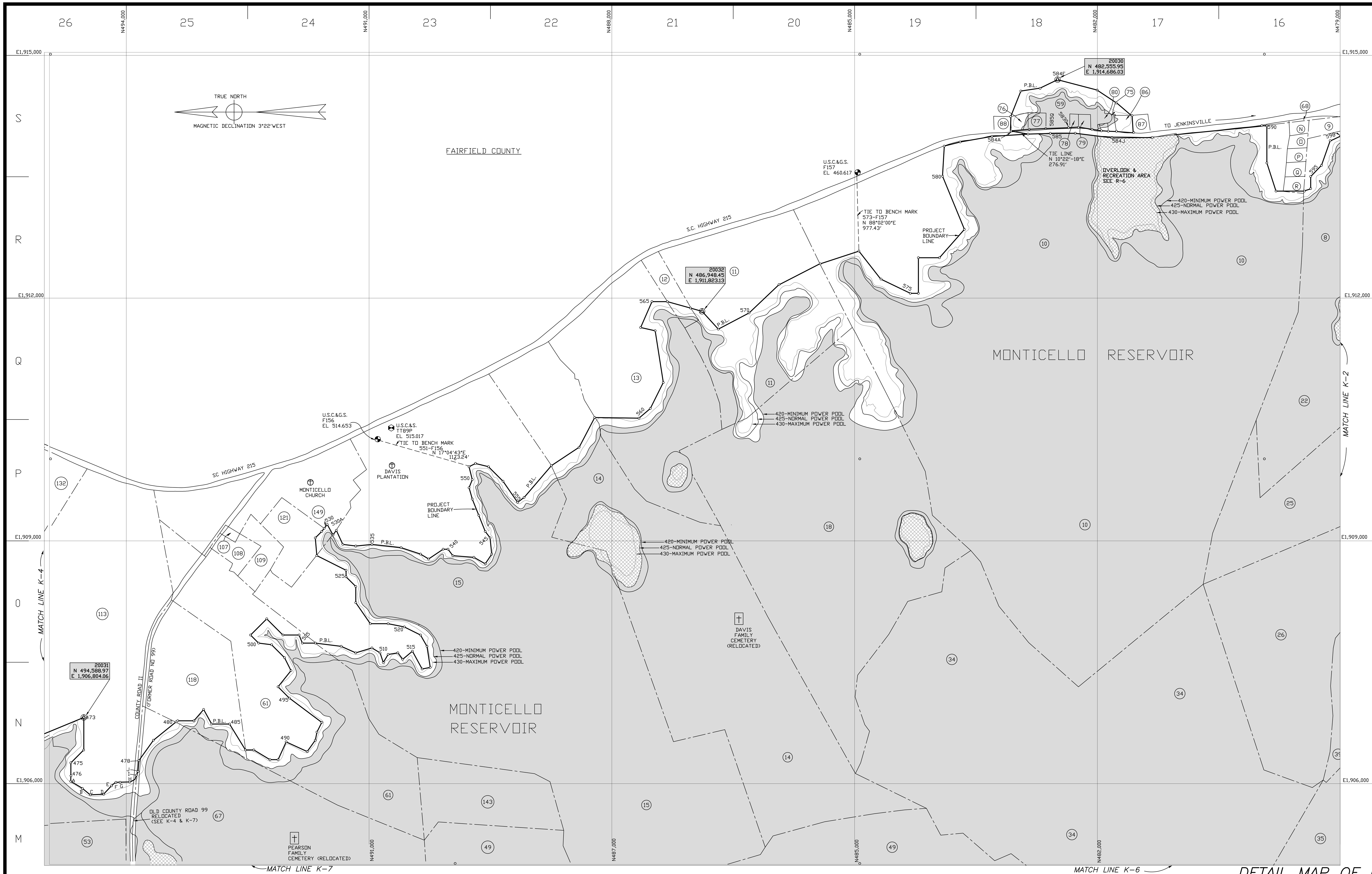

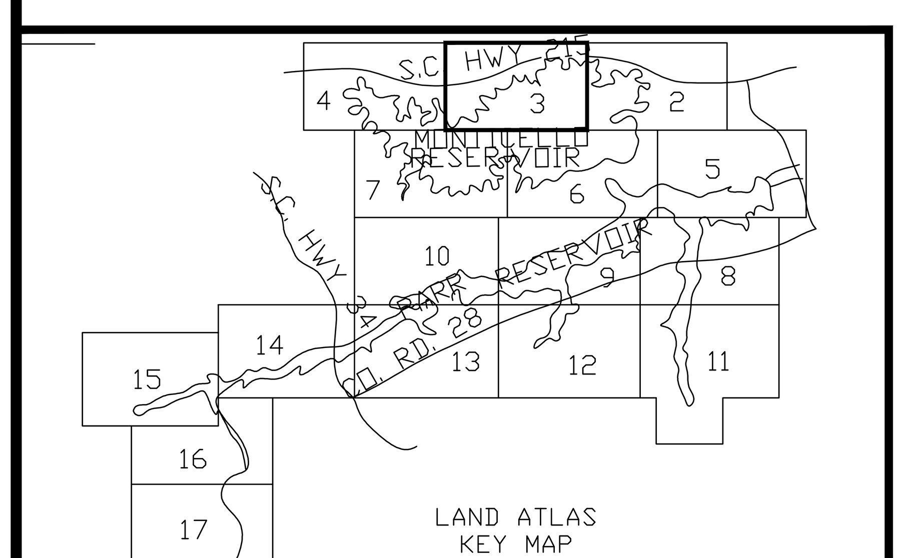

ORIGINAL NOTES:

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2. ALL PROPERTIES & PROPERTY LINES WERE SHOWN OUTSIDE P.B.L. AS A CONVENIENCE FOR HISTORICAL PURPOSES FOR S.C.E.&G. CO.
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5. LANDS ABUTTING P.B.L. ON THE EXTERIOR ARE IN PRIVATE OWNERSHIP UNLESS SHOWN OTHERWISE ON EXHIBIT "F".
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8. THE P.B.L. FOR MONTICELLO RESERVOIR IS GENERALLY A MAXIMUM OF 200 FEET FROM 425 CONTOUR EXCEPT IN RECREATION AREAS OR AS DEEMED NECESSARY BY FIELD INSPECTION.
9. ALL ISLANDS ARE TO REMAIN IN THEIR NATURAL STATE.
10. REV. 5/29/85 TO SHOW P.B.L. REVISION
11. REV. 6/12/85 TO SHOW P.B.L. REVISION AND REMOVAL OF PROPOSED PUBLIC LANDING

NOTES:

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LEGEND

- ARCHAEOLOGICAL SITES
- CEMETERIES
- HISTORICAL SITES
- U.S. FORESTRY LAND TO BE FLOODED
- RECREATIONAL LAND AREA
- SUMTER NATIONAL FOREST BOUNDARY
- PROJECT BOUNDARY LINE
- U.S.C.&G.S. BENCH MARK
- U.S.G.S. BENCH MARK
- WATERFOWL SUB-IMPOUNDMENTS

TRANSMISSION LINES

PROPOSED
EXISTING

DETAIL MAP OF PROJECT AREA

SHEET 3 OF 20

PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SCALE : 1 INCH = 500 FEET

0 500' 1000' 1500' 2000' 2500' 3000'

PREPARED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

BRIAN B. BONDS ; S.C.P.L.S. # 28582

GLENN ASSOCIATES SURVEYING, INC.

SURVEYORS SEAL

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SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR 28582 BRIAN B. BONDS

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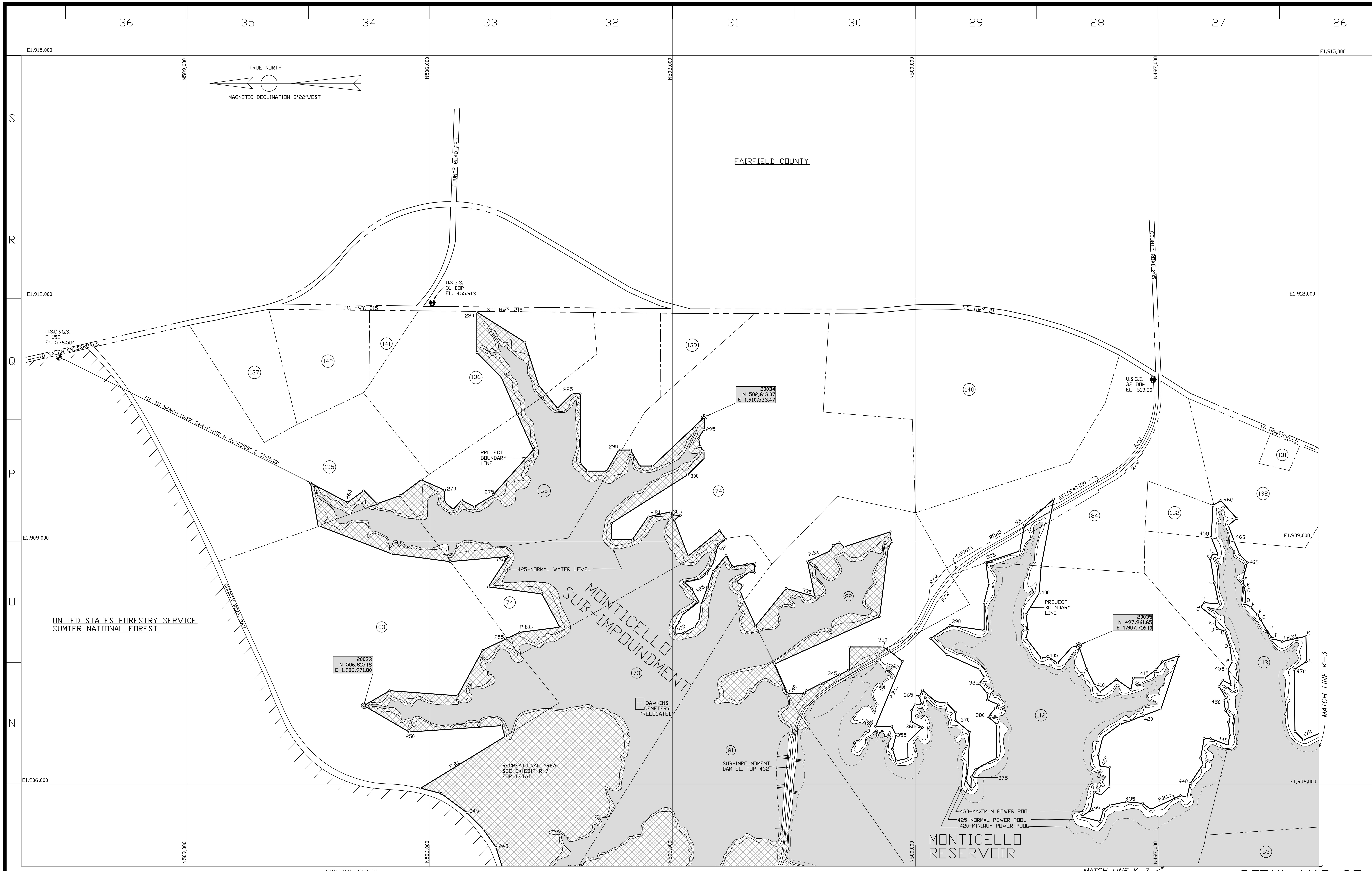

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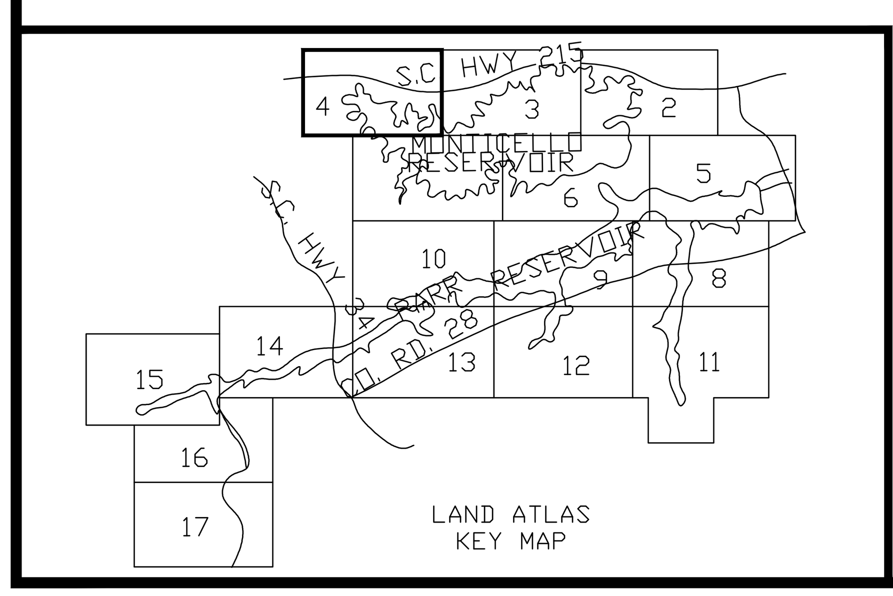

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LEGEND

- ARCHAEOLOGICAL SITES
- CEMETERIES
- HISTORICAL SITES
- U.S. FORESTRY LAND TO BE FLOODED
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- SUMTER NATIONAL FOREST BOUNDARY
- PROJECT BOUNDARY LINE
- U.S.C.&G.S. BENCH MARK
- U.S.G.S. BENCH MARK
- WATERFOWL SUB-IMPOUNDMENTS

TRANSMISSION LINES

PROPOSED
EXISTING

DETAIL MAP OF PROJECT AREA

SHEET 4 OF 20

PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SCALE : 1 INCH = 500 FEET

0 500' 1000' 1500' 2000' 2500' 3000'

PREPARED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345–5297

BRIAN B. BONDS ; S.C.P.L.S. # 28582

GLENN ASSOCIATES SURVEYING, INC.

SURVEYORS SEAL

SURVEYORS SEAL

SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR 28582 BRIAN B. BONDS

C.O.A. SEAL

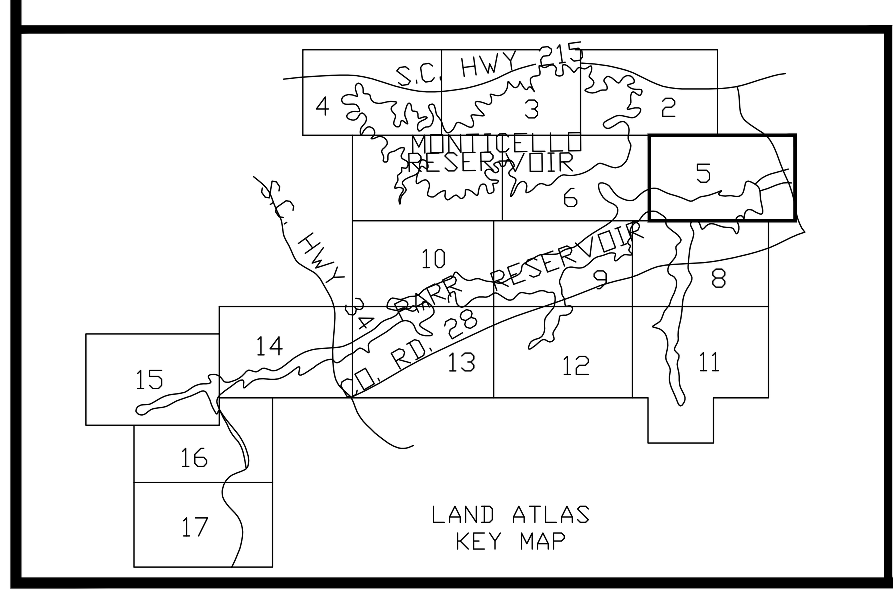
SOUTH CAROLINA GLENN ASSOCIATES SURVEYING INC. No.C02238 CERTIFICATE OF AUTHORIZATION

REVISION SCHEDULE

NO.	DATE	DESCRIPTION	CHECKED
1	5/29/85	REVISED TO SHOW P.B.L. REVISION	
2	9/17/12	REVISED PER FERC ORDER 137 FERC ¶ 62,033	BBB

1894–97

EXHIBIT K
SHEET 5



LAND ATLAS KEY MAP

ORIGINAL NOTES:

1. ALL PROPERTY WITHIN THE PROJECT BOUNDARY LINE IS OWNED IN FEE SIMPLE BY S.C.E. & G. CO. UNLESS OTHERWISE SHOWN ON EXHIBIT "F".
2. ALL PROPERTIES & PROPERTY LINES WERE SHOWN OUTSIDE P.B.L. AS A CONVENIENCE FOR HISTORICAL PURPOSES FOR S.C.E.&G.
3. DETAILED DESCRIPTION FOR PROJECT BOUNDARY LINE IS SHOWN FOR SHEETS K-18 THRU K-20.
4. LAND PARCELS ARE KEYED FOR EXHIBIT "F" BY ENCIRCLED NUMBERS. EX 33
5. LANDS ABUTTING P.B.L. ON THE EXTERIOR ARE IN PRIVATE OWNERSHIP UNLESS SHOWN OTHERWISE ON EXHIBIT "F".
6. CO-ORDINATES SHOWN ARE BASED ON THE STATE GRID SYSTEM (NAD27)
7. ELEVATIONS SHOWN ARE BASED ON THE U.S.C.&G.S. DATA (M.S.L.)
8. THE P.B.L. AROUND PARR RESERVOIR IS GENERALLY ALONG THE CONTOUR OF THE FLOOD OF RECORD AS ADJUSTED TO ACCOUNT FOR THE INFLUENCE OF PARR DAM, AS INDICATED ON EXHIBIT K-1.
9. ALL ISLANDS ARE TO REMAIN IN THEIR NATURAL STATE.
10. SOUTHERN R.R. R/W IS EXCLUDED FROM PROJECT, EXCEPT TO THE EXTENT OF FLOWAGE RIGHTS. SEE EXHIBIT "F"

NOTES:

THIS EXHIBIT DRAWING WAS ORIGINALLY ISSUED AND SIGNED BY W. E. MOORE, MANAGER-HYDRO & ENVIRONMENTAL ENGINEERING AND G. C. MEETZE, EXECUTIVE VICE-PRESIDENT AS PART OF THE APPLICATION FOR AMENDMENT OF LICENSE MADE ON JUNE 26, 1981.

I, BRIAN B. BONDS, A PROFESSIONAL LAND SURVEYOR IN THE STATE OF SOUTH CAROLINA, P.L.S. 28582, HAVE REPRODUCED THIS PORTION OF THE PARR HYDRO PROJECT 1894 PROJECT BOUNDARY SHOWN HEREIN. THE LICENSEE EITHER OWNS IN FEE SIMPLE OR POSSESSES EASEMENTS OVER THE LANDS SHOWN ON THE MAP THAT ARE INSIDE THE PROJECT BOUNDARY. THE PROJECT BOUNDARY LINES THAT ARE NOT CONTOUR LINES WERE BASED ON SCE&G DESIGN AND CONSTRUCTION DRAWINGS.

PROPERTY LINES DEPICTED ON THIS EXHIBIT DERIVED FROM DEEDS AND PLATS OF RECORD. NO ACTUAL FIELD SURVEY WAS CONDUCTED FOR PREPARING THIS MAP. THIS EXHIBIT IS NOT A PROPERTY BOUNDARY SURVEY. ALL PROPERTY LINE LOCATIONS SUBJECT TO FULL BOUNDARY SURVEY OF THE DEPICTED PARCEL.

LEGEND

- ARCHAEOLOGICAL SITES
- CEMETERIES
- HISTORICAL SITES
- U.S. FORESTRY LAND TO BE FLOODED
- RECREATIONAL LAND AREA
- SUMTER NATIONAL FOREST BOUNDARY
- PROJECT BOUNDARY LINE
- U.S.C.&G.S. BENCH MARK
- U.S.G.S. BENCH MARK
- WATERFOWL SUB-IMPOUNDMENTS
- REFERENCE POINTS

TRANSMISSION LINES
PROPOSED
EXISTING

DETAIL MAP OF PROJECT AREA

SHEET 5 OF 20
PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SCALE : 1 INCH = 500 FEET
0 500' 1000' 1500' 2000' 2500' 3000'

SURVEYED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

BRIAN B. BONDS ; S.C.P.L.S. # 28582

GLENN ASSOCIATES SURVEYING, INC.

SURVEYORS SEAL
2/20/2012

SURVEYORS SEAL
SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR 28582 BRIAN B. BONDS

C.O.A. SEAL
SOUTH CAROLINA GLENN ASSOCIATES SURVEYING INC. No.C02238 CERTIFICATE OF AUTHORIZATION

REVISION SCHEDULE

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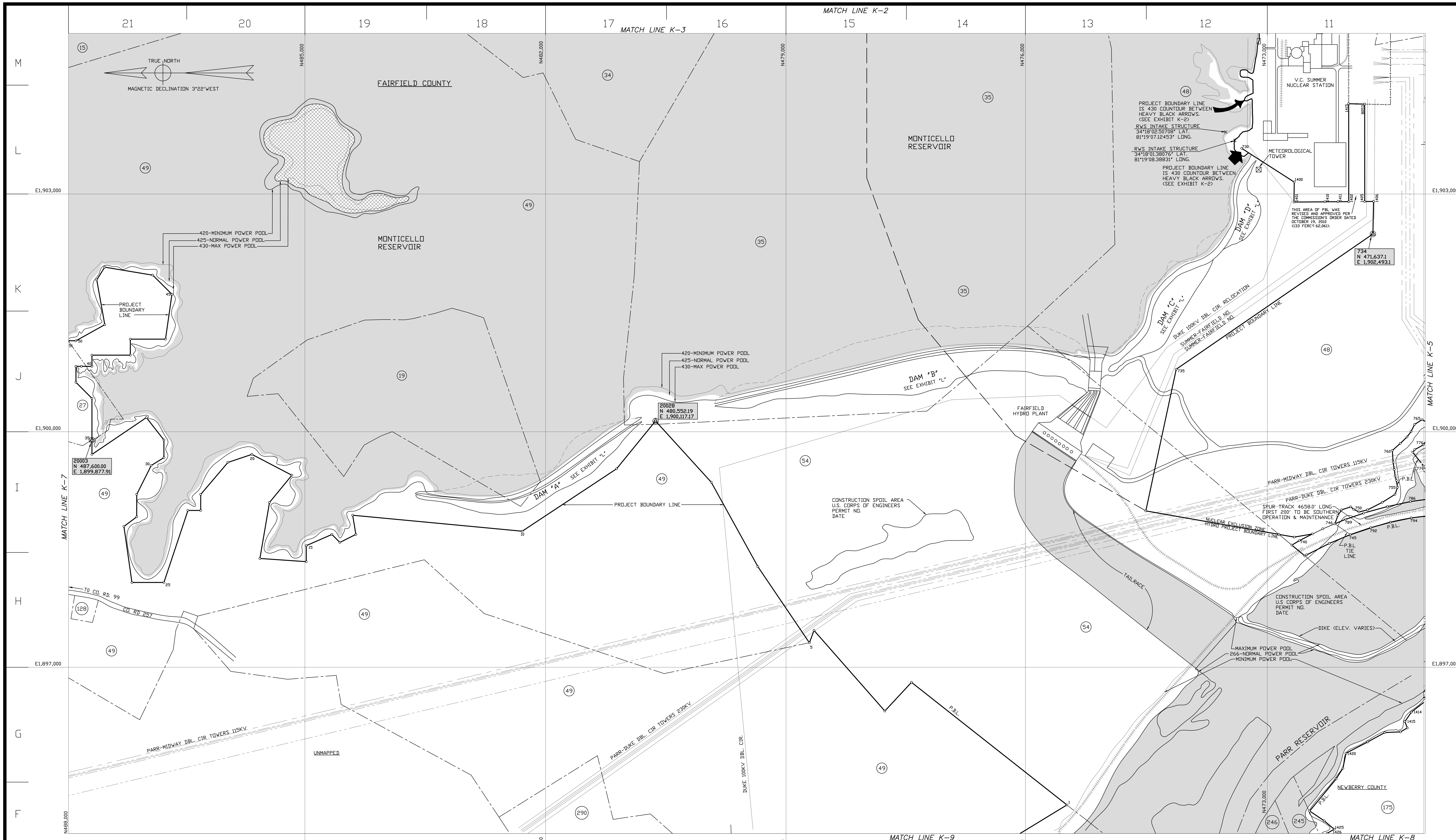
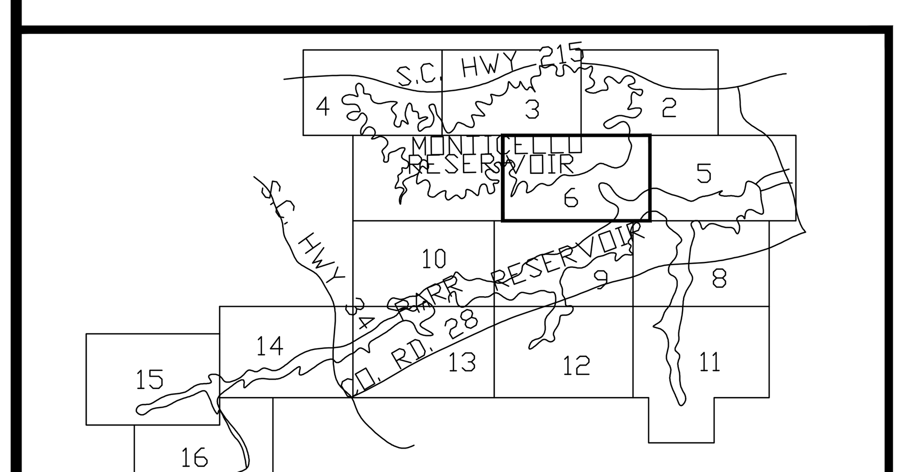
1	2/20/12	REVISED PER FERC ORDER 137 FERC ¶ 62,033	BBB

1894-110

EXHIBIT K
SHEET 6





LAND ATLAS
KEY MAP

ORIGINAL NOTES:
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4. LAND PARCELS ARE KEYED FOR EXHIBIT "F" BY ENCIRCLED NUMBERS. EX 33
5. LANDS ABUTTING P.B.L. ON THE EXTERIOR ARE IN PRIVATE OWNERSHIP UNLESS SHOWN OTHERWISE ON EXHIBIT "F".
6. CO-ORDINATES SHOWN ARE BASED ON THE STATE GRID SYSTEM (NAD27)
7. ELEVATIONS SHOWN ARE BASED ON THE U.S.C.&G.S. DATA (M.S.L.)
8. P.B.L. FOR MONTICELLO RESERVOIR IS GENERALLY A MAXIMUM OF 200 FEET FROM 425 CONTOUR EXCEPT IN RECREATION AREAS OR AS DEEMED NECESSARY BY FIELD INSPECTION. THE P.B.L. AROUND PARR RESERVOIR IS GENERALLY ALONG THE CONTOUR OF THE FLOOD OF RECORD AS ADJUSTED TO ACCOUNT FOR THE INFLUENCE OF PARR DAM, AS INDICATED ON EXHIBIT K-1
9. ALL ISLANDS ARE TO REMAIN IN THEIR NATURAL STATE.
10. SOUTHERN R.R. R/W IS EXCLUDED FROM PROJECT, EXCEPT TO THE EXTENT OF FLOWAGE RIGHTS. SEE EXHIBIT "F"

NOTES:
THIS EXHIBIT DRAWING WAS ORIGINALLY ISSUED AND SIGNED BY W. E. MOORE, MANAGER-HYDRO & ENVIRONMENTAL ENGINEERING AND G. C. MEETZE, EXECUTIVE VICE-PRESIDENT AS PART OF THE APPLICATION FOR AMENDMENT OF LICENSE MADE ON JUNE 26, 1981.

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LEGEND
- ARCHAEOLOGICAL SITES
- CEMETERIES
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- SUMTER NATIONAL FOREST BOUNDARY
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- U.S.C.&G.S. BENCH MARK
- U.S.G.S. BENCH MARK
- WATERFOWL SUB-IMPOUNDMENTS
- REFERENCE POINTS

TRANSMISSION LINES
PROPOSED
EXISTING

DETAIL MAP OF PROJECT AREA

SHEET 6 OF 20
PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SCALE : 1 INCH = 500 FEET
0 500' 1000' 1500' 2000' 2500' 3000'

SURVEYED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

BRIAN B. BONDS ; S.C.P.L.S. # 28582

GLENN ASSOCIATES SURVEYING, INC.

SURVEYORS SEAL
2/20/2012

SURVEYORS SEAL
SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR 28582 BRIAN B. BONDS

C.O.A. SEAL
SOUTH CAROLINA GLENN ASSOCIATES SURVEYING INC. No.C02238 CERTIFICATE OF AUTHORIZATION

REVISION SCHEDULE

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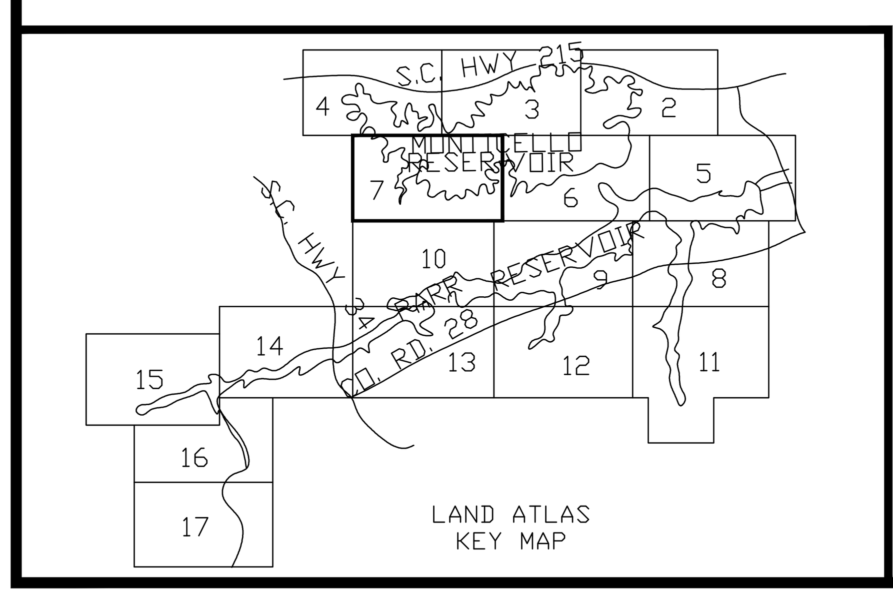
1894-111

EXHIBIT K
SHEET 7



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- WATERFOWL SUB-IMPOUNDMENTS

TRANSMISSION LINES

PROPOSED
EXISTING

DETAIL MAP OF PROJECT AREA

SHEET 7 OF 20

PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SCALE : 1 INCH = 500 FEET

0 500' 1000' 1500' 2000' 2500' 3000'

PREPARED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

BRIAN B. BONDS ; S.C.P.L.S. # 28582

GLENN ASSOCIATES SURVEYING, INC.

SURVEYORS SEAL	SURVEYORS SEAL	C.O.A. SEAL
	SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR 28582 BRIAN B. BONDS	SOUTH CAROLINA GLENN ASSOCIATES SURVEYING INC. No.C02238 CERTIFICATE OF AUTHORIZATION

REVISION SCHEDULE

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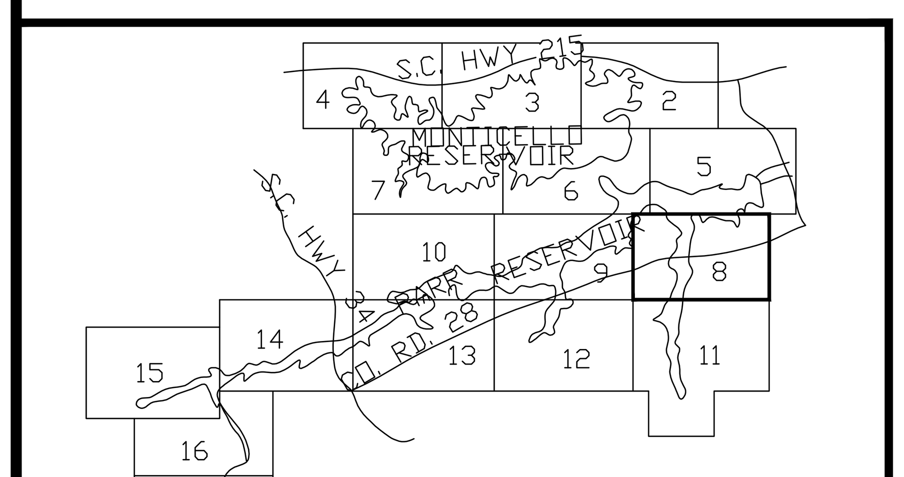
1894–82

EXHIBIT K
SHEET 8

P.B.L. FOR CANNON'S CREEK

1. ELEVATIONS SHOWN ON LINES C1 THROUGH C8 ARE FLOWS FOR MEAN ANNUAL FLOOD ON CANNON'S CREEK DURING OCTOBER 1929 FLOOD ON BROAD RIVER.
2)a. ELEVATIONS FOR FLOWS WERE OBTAINED FROM U.S.G.S BACKWATER PROFILE STUDY. (TABLE 4) DATED FEBRUARY 1974.
b. ARTICLE 48 OF LICENSE IS APPLICABLE. HOWEVER, WHEN FLOWS EXCEED THE 270' CONTOUR THEN THE FLOW ELEVATION SHOWN ON SECTION LINES WOULD APPLY.



LAND ATLAS
KEY MAP

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NOTES:

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LEGEND

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- WATERFOWL SUB-IMPOUNDMENTS

TRANSMISSION LINES

PROPOSED
EXISTING

DETAIL MAP OF PROJECT AREA

SHEET 8 OF 20
PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SCALE : 1 INCH = 500 FEET

0 500' 1000' 1500' 2000' 2500' 3000'

PREPARED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

BRIAN B. BONDS ; S.C.P.L.S. # 28582

GLENN ASSOCIATES SURVEYING, INC.

SURVEYORS SEAL

SURVEYORS SEAL
SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR 28582 BRIAN B. BONDS

C.O.A. SEAL
SOUTH CAROLINA GLENN ASSOCIATES SURVEYING INC. No.C02238 CERTIFICATE OF AUTHORIZATION

REVISION SCHEDULE

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1894-83

EXHIBIT K
SHEET 9

ORIGINAL NOTES:

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TRANSMISSION LINES

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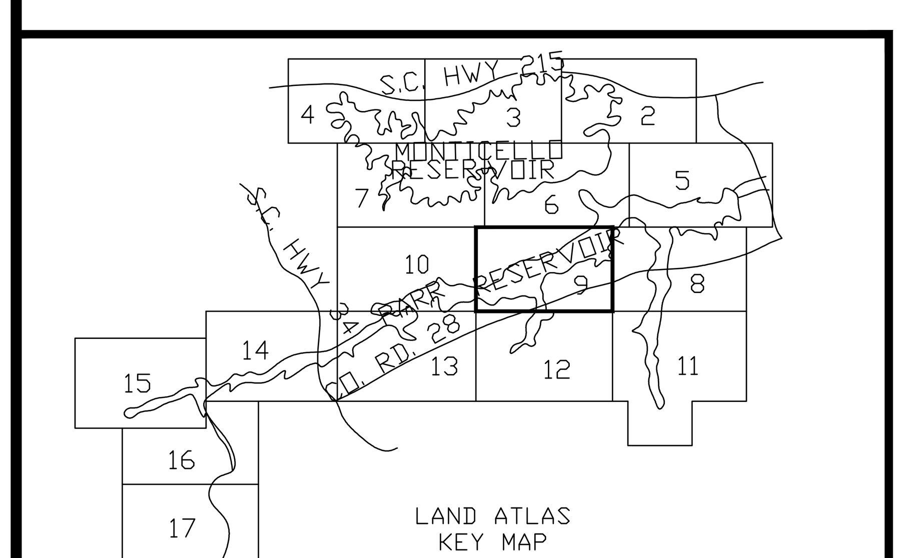

DETAIL MAP OF PROJECT AREA

SHEET 9 OF 20

PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SCALE : 1 INCH = 500 FEET

0 500' 1000' 1500' 2000' 2500' 3000'

PREPARED BY GLENN ASSOCIATES SURVEYING, INC.
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SURVEYORS SEAL

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SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR 28582 BRIAN B. BONDS

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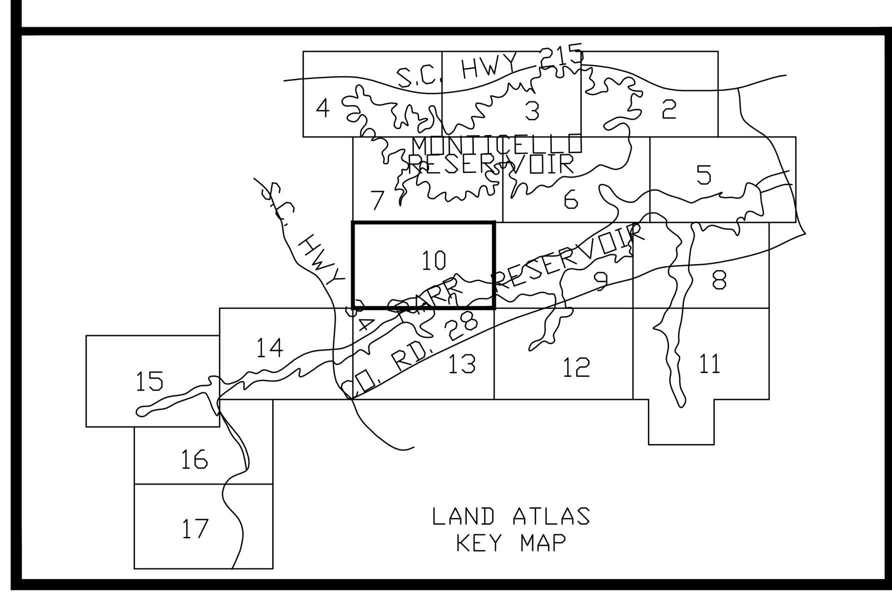

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- U.S. FORESTRY LAND TO BE FLOODED
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- SUMTER NATIONAL FOREST BOUNDARY
- PROJECT BOUNDARY LINE
- U.S.C.&G.S. BENCH MARK
- U.S.G.S. BENCH MARK
- WATERFOWL SUB-IMPOUNDMENTS
- GAME MANAGEMENT AREA PROGRAM

TRANSMISSION LINES

PROPOSED
EXISTING

DETAIL MAP OF PROJECT AREA

SHEET 10 OF 20

PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SCALE : 1 INCH = 500 FEET

0 500' 1000' 1500' 2000' 2500' 3000'

PREPARED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

BRIAN B. BONDS ; S.C.P.L.S. # 28582

GLENN ASSOCIATES SURVEYING, INC.

SURVEYORS SEAL

SURVEYORS SEAL
SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR 28582 BRIAN B. BONDS

C.O.A. SEAL
SOUTH CAROLINA GLENN ASSOCIATES SURVEYING INC. No.C02238 CERTIFICATE OF AUTHORIZATION

REVISION SCHEDULE

NO.	DATE	DESCRIPTION	CHECKED
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EXHIBIT K
SHEET 11

P.B.L. FOR CANNONS'S CREEK
(SEE EXHIBIT K-1)

1)a. ELEVATIONS SHOWN ON LINES C1 THROUGH C8 ARE FLOWS FOR MEAN ANNUAL FLOOD ON CANNON'S CREEK DURING OCTOBER 1929 FLOOD ON BROAD RIVER
b. ELEVATIONS SHOWN ON LINES C9 & C10 ARE FLOWS FOR 50 YEAR FLOOD ON CANNON'S CREEK DURING MEAN ANNUAL FLOOD ON BROAD RIVER.

2)a. ELEVATIONS FOR FLOWS WERE OBTAINED FROM U.S.G.S BACKWATER PROFILE STUDY. (TABLE 4) DATED FEBRUARY 1974
b. ARTICLE 48 OF LICENSE IS APPLICABLE. HOWEVER, WHEN FLOWS EXCEED THIS 270 CONTOUR THEN THE FLOW ELEVATIONS SHOWN ON SECTION LINES WOULD APPLY.

ORIGINAL NOTES:

1. ALL PROPERTY WITHIN THE PROJECT BOUNDARY LINE IS OWNED IN FEE SIMPLE BY S.C.E. & G. CO. UNLESS OTHERWISE SHOWN ON EXHIBIT "F".
2. ALL PROPERTIES & PROPERTY LINES WERE SHOWN OUTSIDE P.B.L. AS A CONVENIENCE FOR HISTORICAL PURPOSES FOR S.C.E.&G. CO.
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4. LAND PARCELS ARE KEYED FOR EXHIBIT "F" BY ENCIRCLED NUMBERS. EX 33
5. LANDS ABUTTING P.B.L. ON THE EXTERIOR ARE IN PRIVATE OWNERSHIP UNLESS SHOWN OTHERWISE ON EXHIBIT "F".
6. CO-ORDINATES SHOWN ARE BASED ON THE STATE GRID SYSTEM (NAD27)
7. ELEVATIONS SHOWN ARE BASED ON THE U.S.C.&G.S. DATA (M.S.L.)
8. THE P.B.L. AROUND PARR RESERVOIR IS GENERALLY ALONG THE CONTOUR OF THE FLOOD OF RECORD AS ADJUSTED TO ACCOUNT FOR THE INFLUENCE OF PARR DAM, AS INDICATED ON EXHIBIT K-1.
9. ALL ISLANDS ARE TO REMAIN IN THEIR NATURAL STATE.
10. SOUTHERN R.R. R/W IS EXCLUDED FROM PROJECT, EXCEPT TO THE EXTENT OF FLOWAGE RIGHTS. SEE EXHIBIT "F"

NOTES:

THIS EXHIBIT DRAWING WAS ORIGINALLY ISSUED AND SIGNED BY W. E. MOORE, MANAGER-HYDRO & ENVIRONMENTAL ENGINEERING AND G. C. MEETZE, EXECUTIVE VICE-PRESIDENT AS PART OF THE APPLICATION FOR AMENDMENT OF LICENSE MADE ON JUNE 26, 1981.

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DETAIL MAP OF PROJECT AREA

SHEET 11 OF 20

PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SCALE : 1 INCH = 500 FEET

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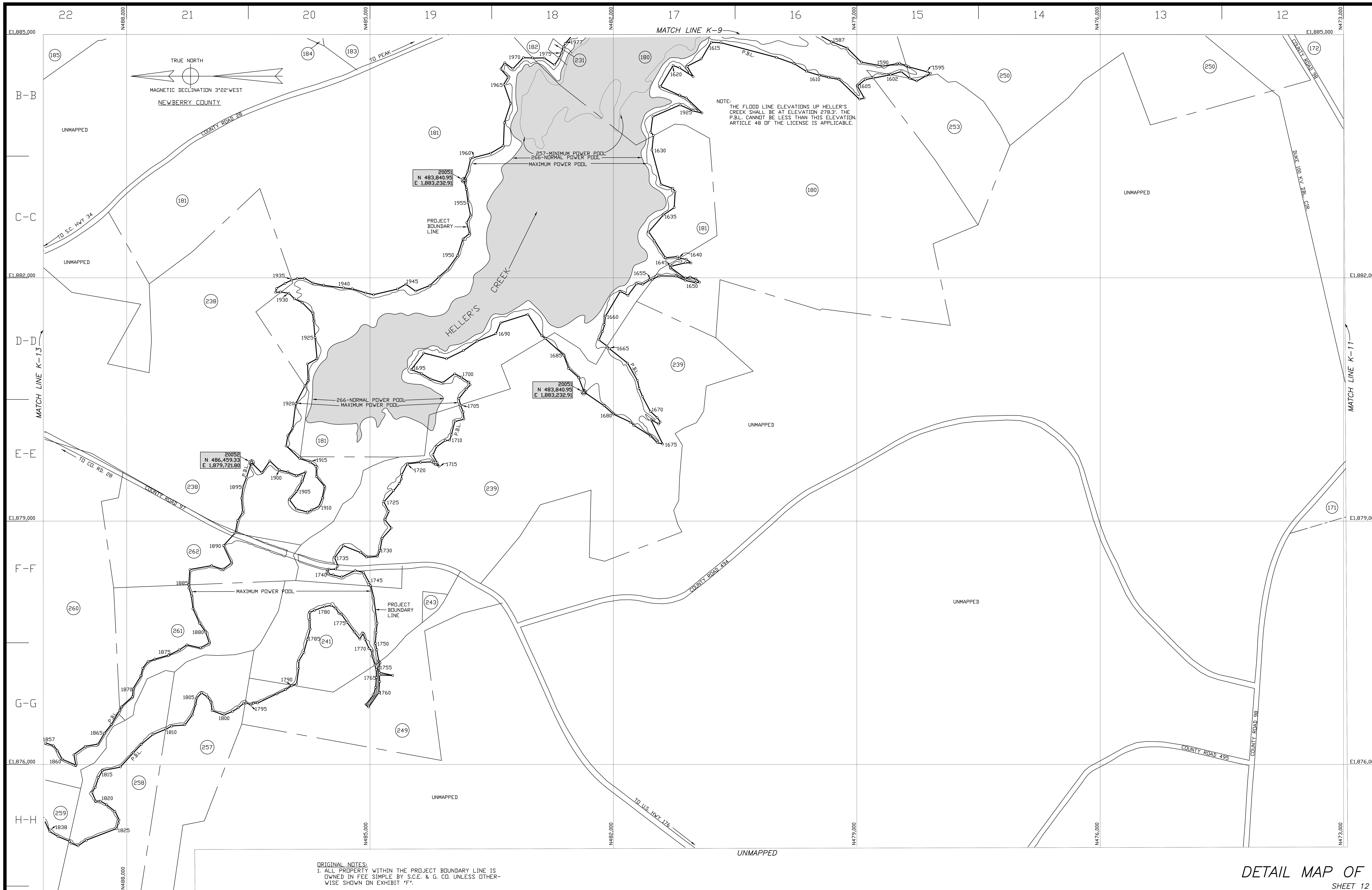
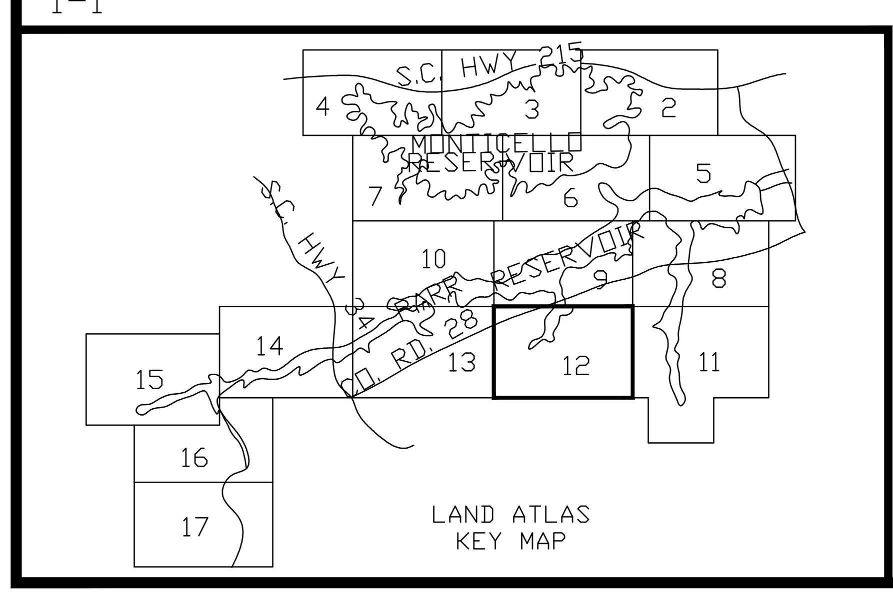
1894–86

EXHIBIT K
SHEET 12





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LEGEND

- ARCHAEOLOGICAL SITES
- CEMETERIES
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- U.S.G.S. BENCH MARK
- WATERFOWL SUB-IMPOUNDMENTS

TRANSMISSION LINES

PROPOSED
EXISTING

DETAIL MAP OF PROJECT AREA

SHEET 12 OF 20

PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SCALE : 1 INCH = 500 FEET

0 500' 1000' 1500' 2000' 2500' 3000'

PREPARED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

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BRIAN B. BONDS ; S.C.P.L.S. # 28582

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SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR 28582 BRIAN B. BONDS

C.O.A. SEAL
SOUTH CAROLINA GLENN ASSOCIATES SURVEYING INC. No.C02238 CERTIFICATE OF AUTHORIZATION

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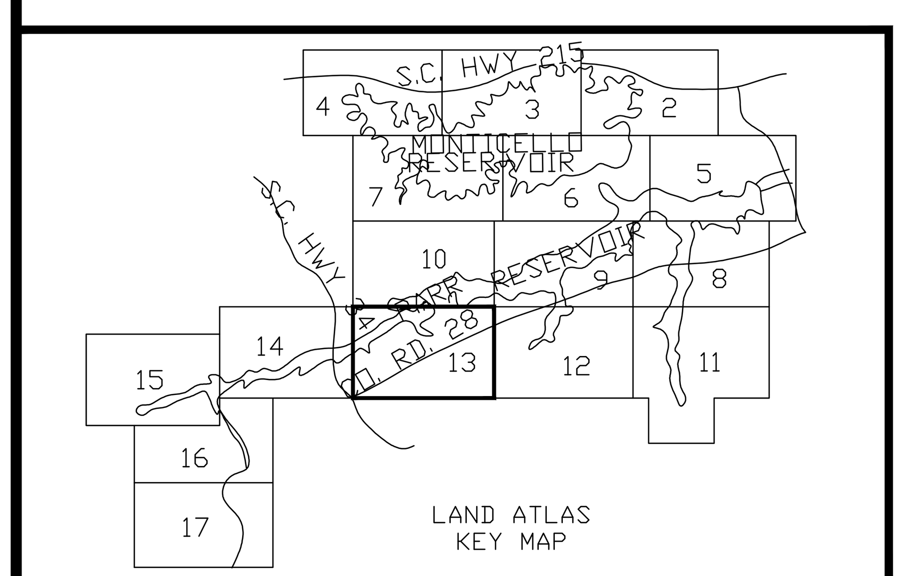
1894-87



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LEGEND

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- U.S.G.S. BENCH MARK
- WATERFOWL SUB-IMPOUNDMENTS

TRANSMISSION LINES

PROPOSED
EXISTING

GLENN ASSOCIATES SURVEYING, INC.

DETAIL MAP OF PROJECT AREA

SHEET 13 OF 20

PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SCALE : 1 INCH = 500 FEET

0 500' 1000' 1500' 2000' 2500' 3000'

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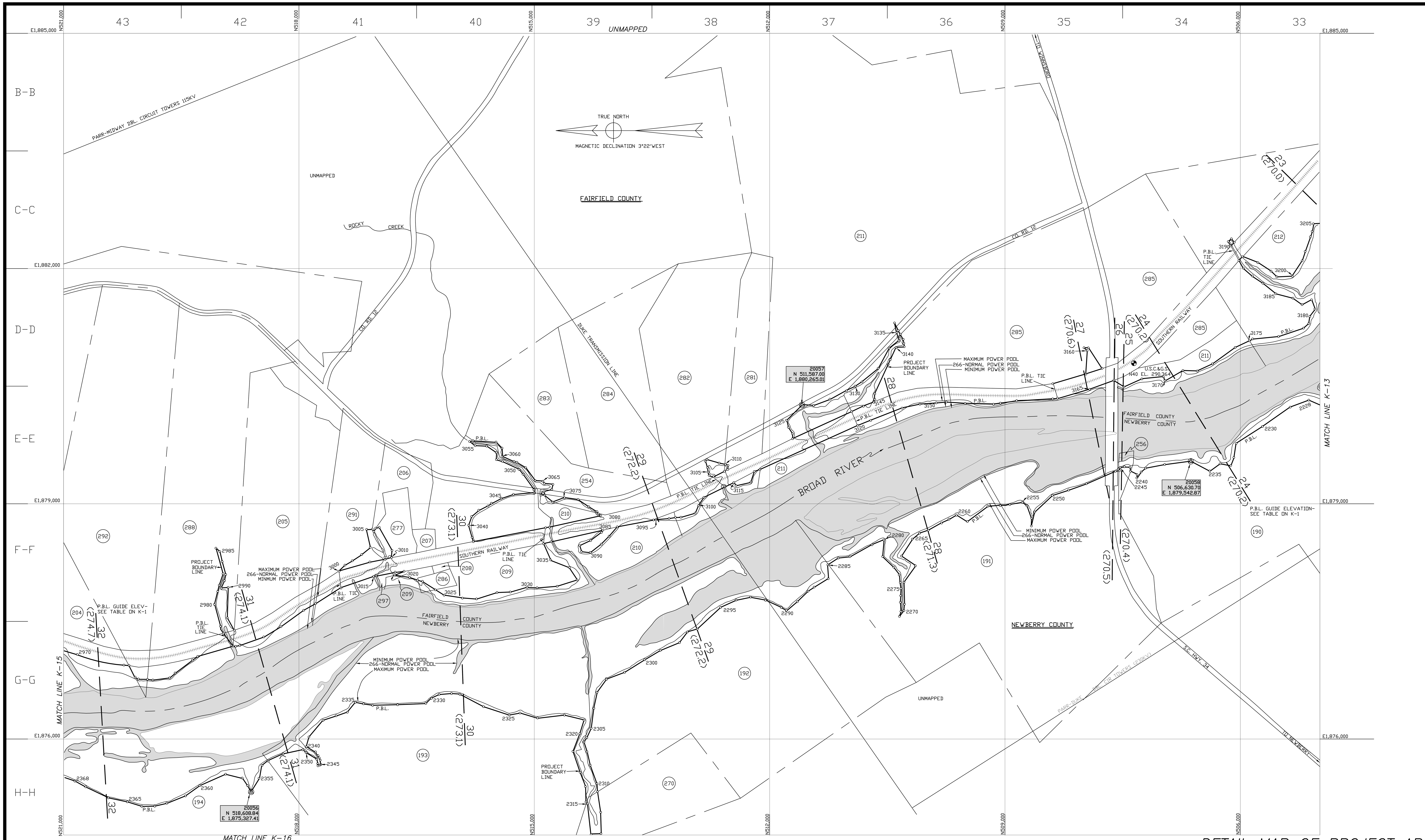
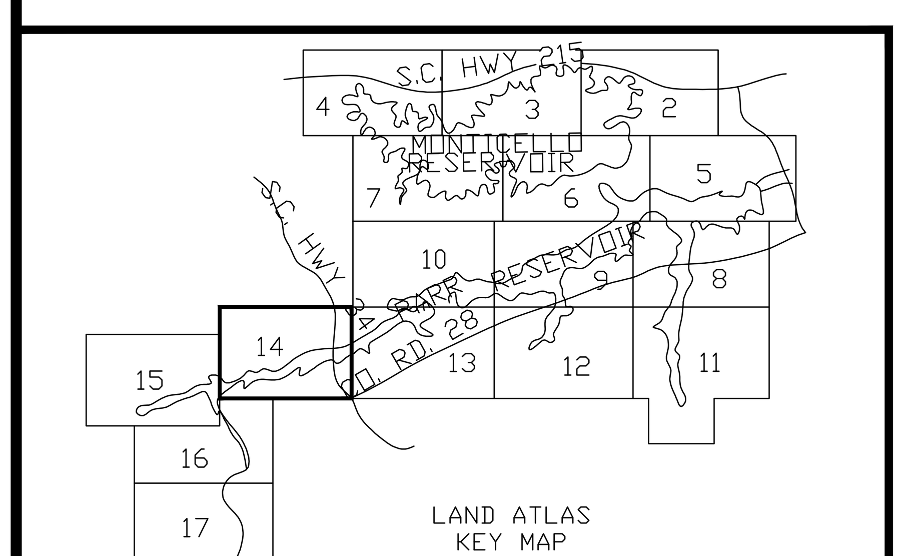
1894-88

EXHIBIT K
SHEET 14





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- U.S.G.S. BENCH MARK
- WATERFOWL SUB-IMPOUNDMENTS

TRANSMISSION LINES

PROPOSED
EXISTING

DETAIL MAP OF PROJECT AREA

SHEET 14 OF 20

PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SCALE : 1 INCH = 500 FEET

0 500' 1000' 1500' 2000' 2500' 3000'

PREPARED BY GLENN ASSOCIATES SURVEYING, INC.
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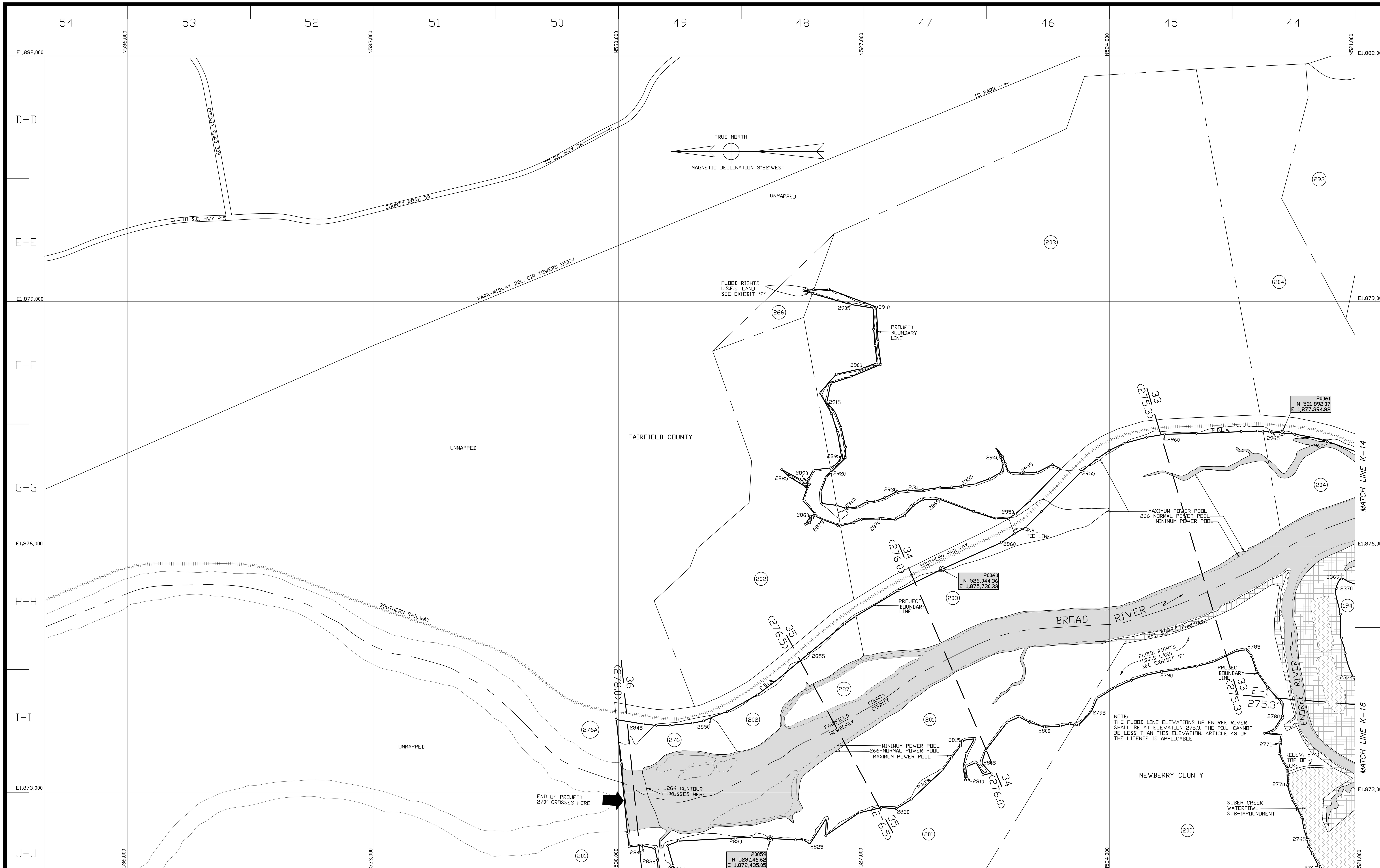
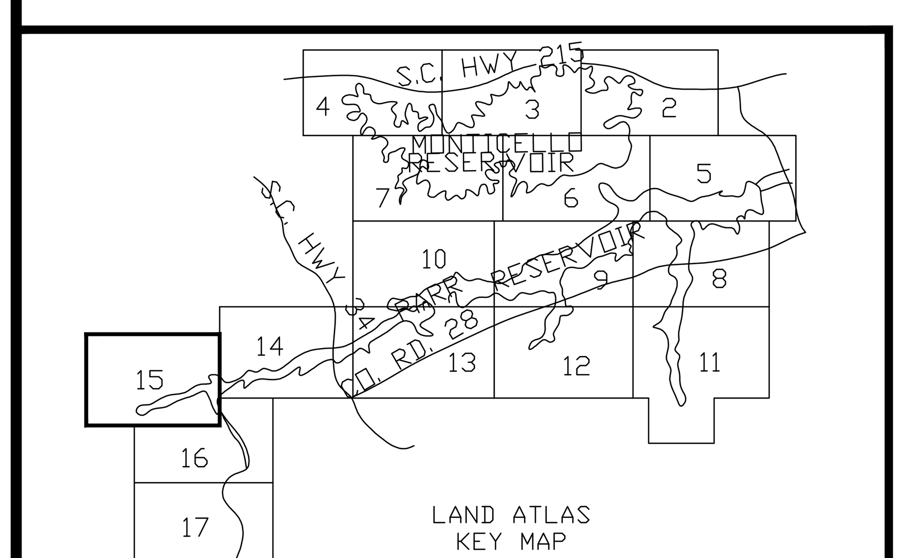
1894-89



MATCH LINE K-16



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- GAME MANAGEMENT AREA PROGRAM

TRANSMISSION LINES

PROPOSED
EXISTING

DETAIL MAP OF PROJECT AREA

SHEET 15 OF 20
PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SCALE : 1 INCH = 500 FEET

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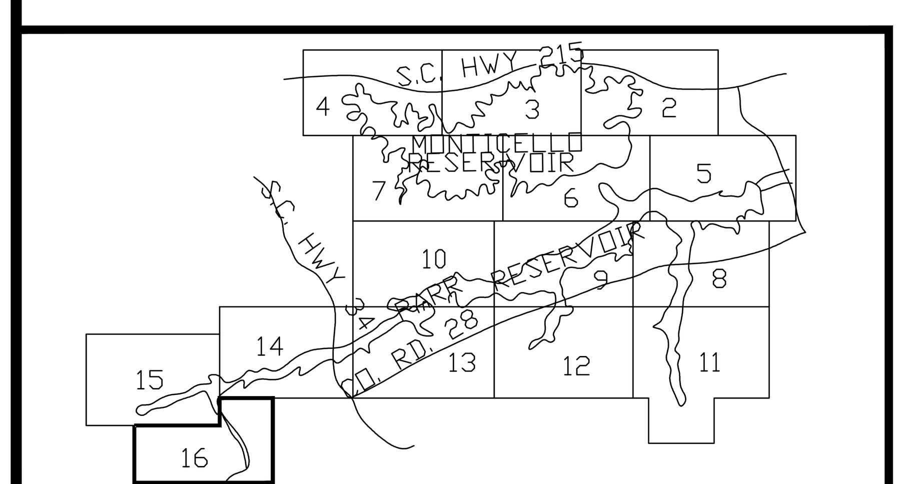

LAND ATLAS
KEY MAP

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- SUMTER NATIONAL FOREST BOUNDARY
- PROJECT BOUNDARY LINE
- U.S.C.&G.S. BENCH MARK
- U.S.G.S. BENCH MARK
- WATERFOWL SUB-IMPOUNDMENTS
- GAME MANAGEMENT AREA PROGRAM

TRANSMISSION LINES
PROPOSED
EXISTING

DETAIL MAP OF PROJECT AREA

SHEET 16 OF 20
PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SCALE : 1 INCH = 500 FEET
0 500' 1000' 1500' 2000' 2500' 3000'

PREPARED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

BRIAN B. BONDS ; S.C.P.L.S. # 28582

GLENN ASSOCIATES SURVEYING, INC.

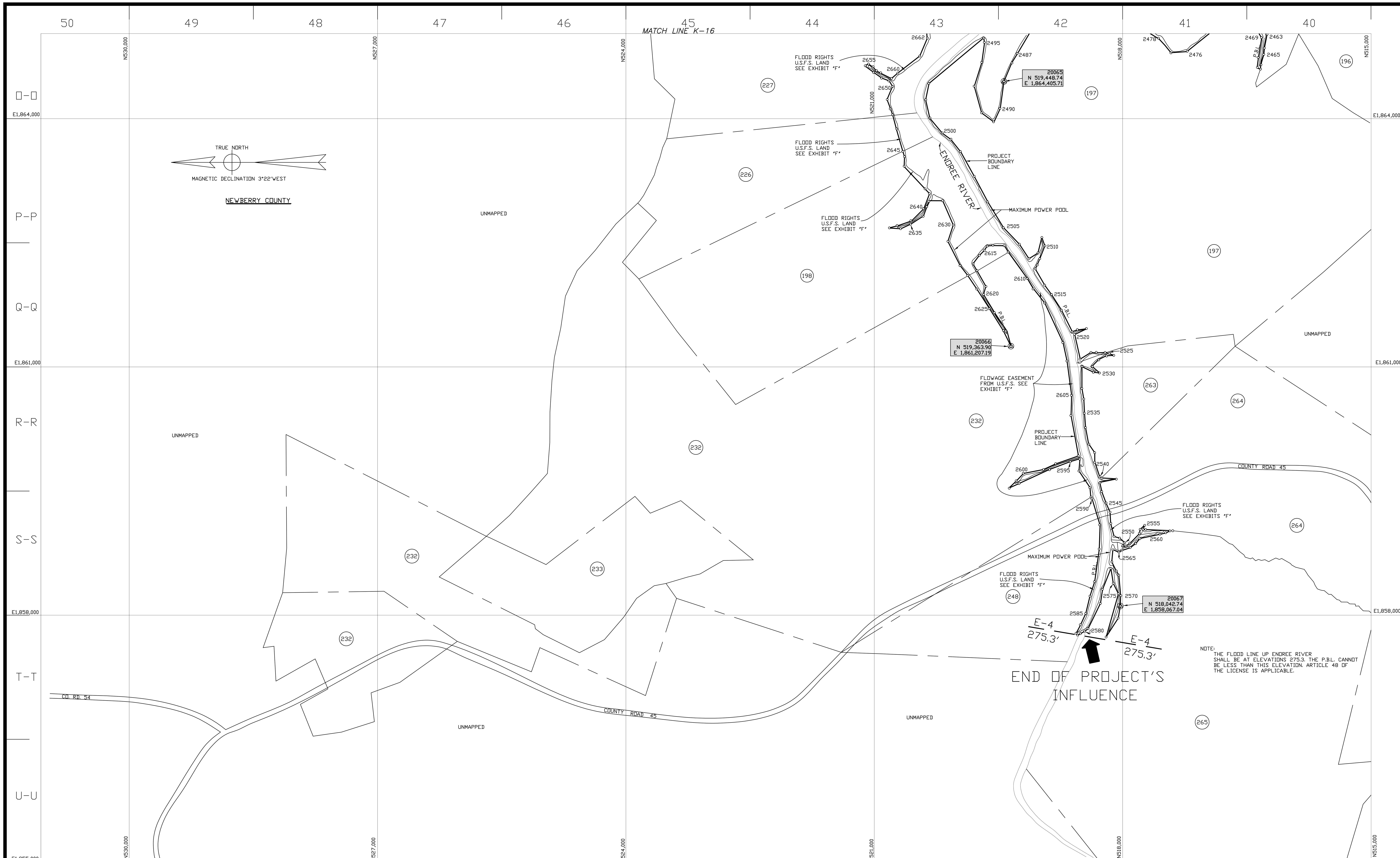
SURVEYORS SEAL

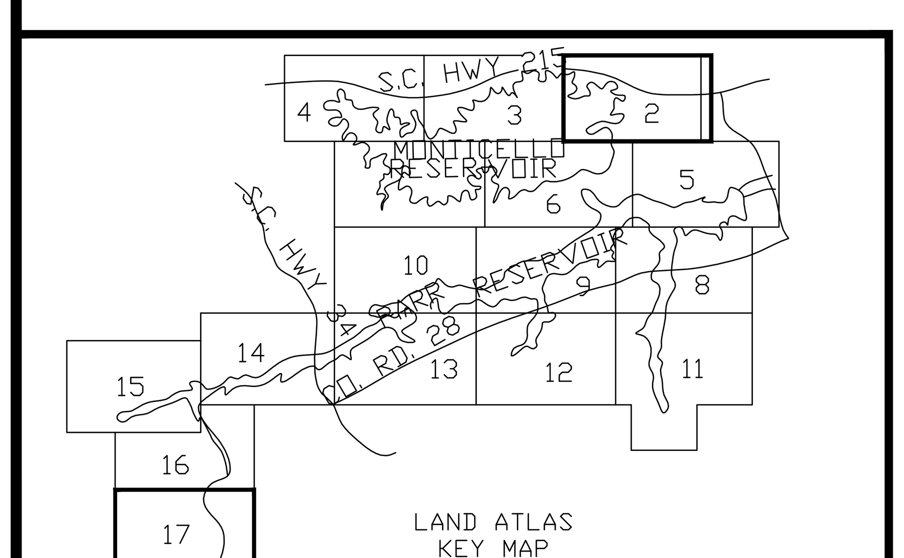
SURVEYORS SEAL
SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR 28582 BRIAN B. BONDS

C.O.A. SEAL
SOUTH CAROLINA GLENN ASSOCIATES SURVEYING INC. No.C02238 CERTIFICATE OF AUTHORIZATION

REVISION SCHEDULE

NO.	DATE	DESCRIPTION	CHECKED
1	9/17/12	REVISED PER FERC ORDER 137 FERC ¶ 62,033	BBB





ORIGINAL NOTES:

1. ALL PROPERTY WITHIN THE PROJECT BOUNDARY LINE IS OWNED IN FEE SIMPLE BY S.C.E.&G. CO. UNLESS OTHERWISE SHOWN ON EXHIBIT "F".
2. ALL PROPERTIES & PROPERTY LINES WERE SHOWN OUTSIDE P.B.L. AS A CONVENIENCE FOR HISTORICAL PURPOSES FOR S.C.E.&G. CO.
3. DETAILED DESCRIPTION FOR PROJECT BOUNDARY LINE IS SHOWN ON SHEETS K-18 THRU K-20.
4. LAND PARCELS ARE KEYED FOR EXHIBIT "F" BY ENCIRCLED NUMBERS. EX 33
5. LANDS ABUTTING P.B.L. ON THE EXTERIOR ARE IN PRIVATE OWNERSHIP UNLESS SHOWN OTHERWISE ON EXHIBIT "F".
6. CO-ORDINATES SHOWN ARE BASED ON THE STATE GRID SYSTEM (NAD27)
7. ELEVATIONS SHOWN ARE BASED ON THE U.S.C.&G.S. DATA (M.S.L.)
8. THE P.B.L. AROUND PARR RESERVOIR IS GENERALLY ALONG THE CONTOUR OF THE FLOOD OF RECORD AS ADJUSTED TO ACCOUNT FOR THE INFLUENCE OF PARR DAM, AS INDICATED ON EXHIBIT K-1.
9. ALL ISLANDS ARE TO REMAIN IN THEIR NATURAL STATE.
10. SOUTHERN R.R. R/W IS EXCLUDED FROM PROJECT, EXCEPT TO THE EXTENT OF FLOWAGE RIGHTS. SEE EXHIBIT "F"

NOTES:

THIS EXHIBIT DRAWING WAS ORIGINALLY ISSUED AND SIGNED BY W. E. MOORE, MANAGER-HYDRO & ENVIRONMENTAL ENGINEERING AND G. C. MEETZE, EXECUTIVE VICE-PRESIDENT AS PART OF THE APPLICATION FOR AMENDMENT OF LICENSE MADE ON JUNE 26, 1981.

I, BRIAN B. BONDS, A PROFESSIONAL LAND SURVEYOR IN THE STATE OF SOUTH CAROLINA, P.L.S. 28582, HAVE REPRODUCED THIS PORTION OF THE PARR HYDRO PROJECT 1894 PROJECT BOUNDARY SHOWN HEREIN. THE LICENSEE EITHER OWNS IN FEE SIMPLE OR POSSESSES EASEMENTS OVER THE LANDS SHOWN ON THE MAP THAT ARE INSIDE THE PROJECT BOUNDARY. THE PROJECT BOUNDARY LINES THAT ARE NOT CONTOUR LINES WERE BASED ON SCE&G DESIGN AND CONSTRUCTION DRAWINGS.

PROPERTY LINES DEPICTED ON THIS EXHIBIT DERIVED FROM DEEDS AND PLATS OF RECORD. NO ACTUAL FIELD SURVEY WAS CONDUCTED FOR PREPARING THIS MAP. THIS EXHIBIT IS NOT A PROPERTY BOUNDARY SURVEY. ALL PROPERTY LINE LOCATIONS SUBJECT TO FULL BOUNDARY SURVEY OF THE DEPICTED PARCEL.

LEGEND

- ARCHAEOLOGICAL SITES
- CEMETERIES
- HISTORICAL SITES
- U.S. FORESTRY LAND TO BE FLOODED
- RECREATIONAL LAND AREA
- SUMTER NATIONAL FOREST BOUNDARY
- PROJECT BOUNDARY LINE
- U.S.C.&G.S. BENCH MARK
- U.S.G.S. BENCH MARK
- WATERFOWL SUB-IMPOUNDMENTS

TRANSMISSION LINES

PROPOSED
EXISTING

DETAIL MAP OF PROJECT AREA

SHEET 17 OF 20

PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SCALE : 1 INCH = 500 FEET

0 500' 1000' 1500' 2000' 2500' 3000'

PREPARED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

GLENN ASSOCIATES SURVEYING, INC.

BRIAN B. BONDS ; S.C.P.L.S. # 28582

SURVEYORS SEAL

SURVEYORS SEAL
SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR 28582 BRIAN B. BONDS

C.O.A. SEAL
SOUTH CAROLINA GLENN ASSOCIATES SURVEYING INC. No.C02238 CERTIFICATE OF AUTHORIZATION

REVISION SCHEDULE

NO.	DATE	DESCRIPTION	CHECKED
1	9/17/12	REVISED PER FERC ORDER 137 FERC ¶ 62,033	BBB

1894-92

K-6

PT-PT	BEARING	DISTANCE
	TRACT 49	
1-2	N 38°15'23" E	2,474.54'
2-3	N 47°00'22" W	489.82'
3-4	N 48°41'14" E	1,340.34'
4-5	N 69°24'03" W	164.28'
5-6	N 55°52'21" E	1,148.93'
6-7	N 61°03'54" E	1,205.49'
7-8	N 47°41'18" E	1,033.90'
8-9	N 50°45'20" W	771.08'
9-10	N 33°27'55" W	1,414.50'
10-11	N 05°23'22" E	2,129.41'
11-12	S 80°32'16" W	243.31'
12-13	N 26°33'54" W	223.61'
13-14	N 45°00'00" E	141.42'
14-15	N 23°37'46" W	349.29'
15-16	WEST	200.00'
16-17	N 03°56'43" E	581.38'
17-18	S 80°16'21" E	710.21'
18-19	S 50°31'39" E	440.45'
19-20	N 27°28'28" E	563.56'
20-21	N 18°26'06" W	316.23'
21-22	N 49°38'08" W	524.98'
22-23	WEST	200.00'
23-24	NORTH	160.00'
24-25	N 71°33'54" W	948.68'
25-26	NORTH	400.00'
26-27	N 81°52'12" E	707.11'
27-28	S 36°52'12" E	200.00'
28-29	EAST	280.00'
29-30	S 63°26'06" E	402.49'
30-31	S 32°00'19" E	188.68'
31-32	EAST	220.00'
32-33	N 51°50'34" E	356.09'
33-34	N 34°04'38" W	820.98'
34-35	EAST	177.91'
	TRACT 27	
35-36	EAST	522.09'
36-37	N 45°00'00" E	282.84'
37-38	EAST	200.00'
38-39	SOUTH	69.30'
	TRACT 49	
39-40	SOUTH	130.70'
40-41	EAST	140.00'
41-42	SOUTH	480.00'
42-43	EAST	200.00'
43-44	SOUTH	440.00'
44-45	S 81°52'12" E	565.69'
45-46	N 45°00'00" E	339.41'
46-47	N 09°27'44" E	608.28'
47-48	N 57°59'41" W	188.68'
48-49	S 79°52'31" W	568.86'
49-50	N 29°03'17" W	411.83'
50-51	NORTH	153.09'

K-7

	TRACT 27	
51-52	NORTH	86.91'
52-53	N 14°02'11" E	164.92'
53-54	N 21°48'05" E	215.41'
54-55	N 53°07'48" E	200.00'
55-56	N 72°53'50" E	272.03'
56-57	N 26°33'54" E	89.44'
57-58	S 68°11'55" W	107.70'
58-59	N 69°26'38" W	170.88'
59-60	S 85°36'05" W	260.77'
60-61	S 29°44'42" E	161.25'
61-62	S 36°52'12" W	100.00'
62-63	S 50°11'40" W	156.20'
63-64	SOUTH	160.00'
64-65	S 36°52'12" W	100.00'
65-66	S 74°03'17" W	145.60'
66-67	N 63°26'06" W	89.44'
67-68	S 68°11'55" W	215.41'
68-69	WEST	160.00'
69-70	N 32°00'19" W	188.68'
70-71	NORTH	290.00'
71-72	N 73°18'03" E	104.40'
72-73	N 26°33'54" W	89.44'
73-74	WEST	60.00'
74-75	N 85°22'08" W	240.78'
75-76	N 00°00'06" W	340.56'
76-77	N 25°01'01" E	331.06'
77-78	N 40°36'05" E	184.39'
78-79	EAST	140.00'
79-80	N 56°18'36" E	360.56'
80-81	N 35°32'16" E	172.05'
81-82	N 32°00'19" W	188.68'
82-83	N 73°18'03" W	208.81'
83-84	S 56°18'40" W	279.19'
84-85	S 19°01'05" W	1,242.42'
	TRACT 49	
85-86	S 76°56'32" W	577.78'
86-87	S 36°52'12" W	300.00'
87-88	S 30°15'23" E	277.85'
88-89	WEST	160.00'
89-90	N 59°02'10" W	349.86'
90-91	N 11°18'36" W	203.96'
91-92	N 19°17'24" E	423.79'
92-93	N 30°15'10" E	103.95'
	TRACT 32	
93-94	N 30°15'23" E	173.89'
94-95	N 63°26'06" E	178.89'
95-96	NORTH	80.00'
96-97	N 51°20'25" W	128.06'
97-98	WEST	360.00'
98-99	S 28°18'03" W	360.01'
	TRACT 49	
99-100	S 28°18'04" W	230.58'
100-101	S 52°25'53" W	328.02'
101-102	WEST	160.00'
102-103	N 12°12'18" W	415.16'
103-104	N 13°02'12" E	108.04'

K-7

	TRACT 32	
104-105	N 13°02'12" E	91.89'
105-106	N 13°02'59" E	100.00'
106-107	N 05°44'10" E	199.61'
107-108	N 29°18'29" E	531.43'
108-109	N 83°09'26" E	1,007.17'
109-110	N 45°00'00" E	226.27'
110-111	NORTH	240.00'
111-112	N 48°21'59" W	240.83'
112-113	WEST	280.00'
113-114	N 55°00'29" W	244.13'
114-115	S 75°57'50" W	412.31'
115-116	N 69°57'03" W	607.02'
	TRACT 70	
116-117	N 28°20'12" W	399.81'
117-118	N 29°44'42" E	322.49'
118-119	N 75°04'06" E	310.48'
119-120	EAST	300.00'
120-121	N 52°07'30" W	456.07'
121-122	N 41°11'09" E	212.60'

K-7

PT-PT	BEARING	DISTANCE
122-123	N 84°33'35" E	421.90'
123-124	N 28°36'38" E	250.60'
124-125	N 85°48'54" W	822.19'
125-126	N 22°50'01" W	412.31'
126-127	WEST	440.00'
127-128	NORTH	240.00'
128-129	N 59°44'37" E	833.55'
129-130	N 50°30'44" W	1,271.74'
130-131	N 21°39'18" W	230.42'
131-132	N 17°23'19" W	122.10'
132-133	N 10°51'55" W	102.12'
133-134	N 03°55'52" W	83.29'
134-135	N 01°07'24" E	109.17'
135-136	N 06°51'19" E	43.23'
136-137	N 59°46'03" E	486.88'
137-138	S 14°02'11" E	412.31'
138-139	N 53°58'22" E	272.03'
139-140	S 69°26'38" E	170.88'
140-141	S 10°18'17" E	223.61'
141-142	EAST	440.00'
142-143	N 42°37'45" E	265.13'
	TRACT 138	
143-144	N 41°59'14" E	60.45'
144-145	NORTH	200.00'
145-146	N 17°55'42" W	629.96'
146-147	N 17°55'26" W	84.74'
147-148	N 74°44'42" W	228.04'
148-149	N 45°00'00" W	226.27'
149-150	N 18°26'06" W	252.98'
150-151	N 22°09'59" E	583.10'
151-152	N 79°59'31" E	345.25'
152-153	N 28°36'38" E	250.60'
153-154	EAST	200.00'
154-155	S 41°11'09" E	212.60'
155-156	SOUTH	280.00'
156-157	S 60°56'49" E	37.70'
157-158	S 60°56'42" E	168.21'
158-159	EAST	100.00'
159-160	S 51°20'25" E	128.06'
160-161	SOUTH	80.00'
161-162	S 50°54'22" W	412.31'
162-163	SOUTH	140.00'
163-164	EAST	260.00'
164-165	S 33°41'24" W	144.22'
165-166	S 23°11'55" E	83.11'
	TRACT 51	
166-167	S 23°11'55" E	69.20'
167-168	S 56°18'36" E	144.22'
168-169	N 66°02'15" E	196.98'
169-170	S 19°17'24" W	423.79'
170-171	N 85°54'52" E	561.43'
171-172	S 24°26'38" W	483.32'
172-173	EAST	160.00'
173-174	S 11°18'36" E	203.96'
174-175	S 71°33'54" E	252.98'
175-176	N 77°28'16" E	368.78'
176-177	N 12°21'45" W	1,494.66'
177-178	N 30°57'50" E	233.24'
178-179	S 53°07'48" E	300.00'
179-180	N 77°11'45" E	451.22'
180-181	N 42°16'25" W	297.32'
181-182	WEST	340.00'
182-183	N 17°06'10" W	172.30'
	TRACT 138	
183-184	N 17°06'10" W	99.73'
184-185	S 74°44'42" W	228.04'
185-186	WEST	300.00'
186-187	N 26°33'54" W	223.61'
187-188	NORTH	300.00'
188-189	S 45°00'00" E	282.84'
189-190	N 45°00'00" E	141.42'
190-191	NORTH	200.00'
191-192	N 30°57'50" W	466.48'
192-193	N 45°00'00" W	340.28'
193-194	N 45°00'00" W	225.40'
194-195	N 36°52'12" W	300.00'
195-196	N 23°57'45" E	313.28'
196-197	S 42°12'25" E	282.26'
	TRACT 111	
197-198	S 76°15'51" E	662.07'
198-199	S 48°21'59" E	240.83'
199-200	SOUTH	200.00'
200-201	S 77°11'45" E	451.22'
201-202	N 26°50'03" W	1,905.15'
202-203	N 14°14'37" W	608.09'
	TRACT 124	
203-204	N 19°26'24" E	329.38'
204-205	N 32°00'19" W	188.68'
205-206	N 16°23'22" E	221.11'
206-207	N 27°18'11" W	51.84'
	TRACT 123	
207-208	N 24°50'40" W	430.81'
208-209	N 60°17'15" E	193.82'
209-210	N 67°52'58" E	155.90'
210-211	N 76°47'44" E	173.97'
211-212	N 85°02'28" E	187.53'
212-213	S 87°10'47" E	175.73'
213-214	S 84°08'25" E	181.26'
214-215	S 87°21'30" E	197.80'
215-216	N 81°06'00" E	198.37'
216-217	N 71°08'32" E	179.43'
217-218	N 62°03'16" E	144.33'
218-219	N 52°10'04" E	168.79'
219-220	N 39°37'24" E	55.19'
	TRACT 120	
220-221	N 39°30'56" E	192.16'
221-222	N 35°43'03" E	208.54'
222-223	N 44°21'33" E	188.22'
223-224	N 56°09'14" E	189.92'
224-225	N 67°47'17" E	185.00'
225-226	N 72°17'49" E	224.00'
	TRACT 133	
226-227	N 67°45'06" E	176.95'
227-228	N 61°45'03" E	179.86'
228-229	N 54°57'18" E	175.80'
229-230	N 49°18'18" E	180.53'
230-231	N 43°11'00" E	162.78'
231-232	N 36°34'39" E	205.25'
232-233	N 29°55'54" E	188.72'
233-234	N 25°22'04" E	170.56'
	TRACT 81	
234-235	N 23°18'08" E	753.86'
235-236	N 18°59'06" E	837.66'
	TRACT 73	
236-237	N 08°51'49" E	153.85'
237-238	N 28°16'22" E	120.80'
238-239	N 40°28'20" E	120.38'
239-240	N 57°41'53" E	112.44'
240-241	S 88°56'47" E	291.38'
241-242	S 75°40'11" E	278.95'
242-243	N 73°05'46" E	333.61'

K-4

PT-PT	BEARING	DISTANCE
243-244	N 54°01'57" E	273.67'
244-245	N 42°58'10" E	285.70'
245-246	N 37°42'25" E	396.86'
246-247	N 14°01'20" E	261.99'
247-248	S 30°59'21" E	1,229.38'
	TRACT 83	
248-249	N 71°33'55" E	142.35'
249-250	N 04°00'51" W	1,142.80'
250-251	N 29°44'42" E	644.98'
251-252	S 29°21'28" E	367.15'
252-253	S 04°05'08" W	842.14'
253-254	S 61°49'17" E	635.30'
254-255	S 25°33'36" E	341.25'
	TRACT 74	
255-256	S 25°33'36" E	168.65'
256-257	S 06°50'34" E	503.59'
257-258	N 62°21'14" E	474.13'
258-259	N 06°54'40" E	664.83'
259-260	S 57°43'28" E	449.44'
260-261	N 05°11'46" W	722.14'
	TRACT 83	
261-262	N 06°45'24" E	725.86'
262-263	N 21°48'05" E	961.99'
	TRACT 135	
263-264	N 78°27'05" E	533.53'
264-265	S 27°33'10" W	518.84'
265-266	S 34°59'31" E	244.13'
266-267	S 45°00'00" W	230.19'
267-268	S 19°57'21" E	302.88'
268-269	S 35°47'24" E	324.31'
	TRACT 85	
269-270	S 24°13'40" W	317.43'
270-271	WEST	140.00'
271-272	S 45°00'00" W	141.42'
272-273	S 50°11'40" E	156.21'
273-274	S 26°33'54" W	178.89'
274-275	S 30°15'23" E	277.85'
275-276	S 48°14'23" E	750.73'
276-277	N 66°02'15" E	480.64'
	TRACT 136	
277-278	N 66°02'15" E	504.25'
278-279	N 45°00'00" E	424.26'
279-280	EAST	500.52'
280-281	S 31°00'00" W	699.98'
281-282	S 73°29'44" W	563.21'
282-283	S 49°23'57" W	139.02'
	TRACT 85	
283-284	S 49°23'55" W	229.77'
284-285	S 45°00'00" E	254.56'
285-286	SOUTH	100.00'
286-287	WEST	860.00'
287-288	S 51°20'25" W	128.06'
288-289	SOUTH	238.19'
289-290	S 59°30'27" E	305.91'
	TRACT 74	
290-291	SOUTH	146.58'
291-292	S 63°50'30" W	226.83'
292-293	SOUTH	160.00'
293-294	S 43°09'09" E	877.27'
294-295	WEST	150.00'
295-296	N 51°20'25" W	128.06'
296-297	S 75°57'50" W	103.08'
297-298	S 42°16'25" W	74.33'
298-299	WEST	100.00'
299-300	N 45°00'00" W	282.84'
300-301	N 32°33'00" W	1,115.17'
301-302	WEST	200.00'
302-303	SOUTH	260.00'
303-304	S 45°27'44" E	344.09'
304-305	S 12°05'41" E	286.36'
305-305A	S 69°40'37" W	43.88'
305A-305B	S 01°13'04" E	97.50'
305B-305C	N 34°12'52" W	94.91'
305C-306	S 69°40'37" W	477.27'
306-307	S 36°52'12" E	500.00'
307-308	S 56°58'01" W	128.70'
	TRACT 73	
308-309	N 28°45'03" W	127.76'
309-310	N 78°41'24" W	92.44'
310-311	N 78°41'24" W	101.98'
311-312	N 63°26'06" W	89.44'
312-313	N 53°07'48" W	100.00'
313-314	N 36°52'12" W	100.00'
314-315	N 14°44'37" W	196.47'
315-316	S 37°52'30" W	114.02'
316-317	S 62°06'10" W	192.35'
317-318	S 34°17'13" W	266.27'
318-318A	N 80°08'56" W	93.24'
318A-319	N 46°46'15" W	93.51'
319-320	S 66°48'05" W	76.16'
320-321	S 05°11'40" E	110.45'
321-322	S 28°18'03" E	147.65'
322-323	S 66°02'15" E	98.49'
323-324	S 84°17'22" E	201.00'
324-325	S 63°26'06" E	223.61'
325-326	S 73°18'03" E	208.81'
326-327	S 53°07'48" E	250.00'
327-328	S 63°26'06" W	156.53'
328-329	S 06°20'25" E	181.11'
329-329A	S 09°57'11" E	98.25'
329A-329B	N 85°12'43" W	114.39'
329B-330	N 02°32'50" W	67.29'
330-331	N 36°52'12" W	200.00'
331-331A	S 39°35'12" W	83.56'
331A-331B	N 87°39'54" W	79.11'
331B-332	S 65°11'00" W	130.53'
	TRACT 82	
332-333	S 64°26'54" W	342.75'
333-334	S 53°25'17" E	597.29'
334-335	S 12°31'44" W	368.78'
335-336	N 79°41'43" E	447.21'
336-336A	S 18°26'06" E	307.82'
336A-336B	S 73°00'00" E	77.43'
336B-336C	S 22°04'09" E	80.82'
336C-336D	S 39°16'56" W	80.68'
336D-337	S 18°26'06" E	598.71'
337-337A	N 82°20'00" W	53.20'
337A-337B	S 64°53'35" W	74.47'
337B-337C	N 53°46'29" W	84.33'
337C-338	N 82°20'00" W	859.50'
338-339	N 23°56'55" W	1,428.86'
339-340	S 64°26'54" W	399.03'
340-341	SOUTH	201.08'
341-342	S 56°29'33" E	14.78'
342-343	S 32°43'12" E	36.27'
343-344	S 25°23'20" E	198.62'
344-345	S 26°21'27" E	257.36'
345-346	S 26°55'00" E	133.77'
346-347	S 25°11'58" E	5.16'
347-348	N 89°59'59" E	285.90'
348-349	SOUTH	400.00'

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PT-PT	BEARING	DISTANCE
349-350	S 39°48'20" W	86.96'
	TRACT 112	
350-351	S 39°48'20" W	21.05'
351-352	S 39°48'20" W	204.39'
352-353	N 66°58'28" W	869.25'
353-354	SOUTH	200.00'
354-355	S 59°02'11" W	116.62'
355-356	N 77°28'16" W	184.39'
356-357	S 66°48'05" W	152.32'
357-358	S 15°56'43" E	145.60'
358-359	EAST	200.00'
359-360	S 45°00'00" E	254.56'
360-361	N 23°11'55" E	152.32'
361-362	EAST	140.00'
362-363	S 63°26'06" E	89.44'
363-364	SOUTH	80.00'
364-365	N 78°41'24" E	101.98'
365-366	S 63°26'06" E	89.44'
366-367	S 41°11'09" W	212.60'
367-368	S 08°07'48" W	141.42'
368-369	S 50°11'40" W	156.20'
369-370	WEST	100.00'
370-371	S 37°52'30" W	228.04'
371-372	N 87°23'51" W	440.45'
372-373	N 82°52'30" W	161.25'
373-374	S 68°11'55" W	107.70'
374-375	S 81°52'12" E	141.42'
375-376	S 68°11'55" E	107.70'
376-377	S 26°33'54" E	134.16'
377-378	S 29°44'42" E	161.25'
378-379	EAST	420.00'
379-380	N 45°00'00" E	141.42'
380-381	S 45°00'00" E	141.42'
381-382	S 45°00'00" E	56.57'
382-383	N 23°11'55" E	152.32'
383-384	EAST	80.00'
384-385	N 50°11'40" E	156.20'
385-386	S 53°07'48" E	100.00'
386-387	N 59°02'11" E	116.62'
387-388	N 24°13'40" E	438.63'
388-389	N 45°00'00" E	282.84'
389-390	S 33°41'24" E	288.44'
390-391	S 08°07'48" W	424.26'
391-392	EAST	340.00'
392-393	S 74°44'42" E	228.04'
393-394	S 63°26'06" E	89.44'
394-395	N 67°54'44" E	215.52'
	TRACT 84	
395-396	S 18°25'45" E	443.80'
396-397	S 79°22'49" E	325.58'
397-398	S 41°38'01" E	481.66'
398-399	N 79°27'39" W	846.37'
	TRACT 112	
399-400	N 85°36'26" W	328.88'
400-401	N 58°23'33" W	305.29'
401-402	S 84°17'22" W	201.00'
402-403	N 78°41'24" W	101.98'
403-404	S 52°25'53" W	308.02'
404-405	S 14°02'11" E	82.46'
405-406	S 33°41'24" W	144.22'
406-407	S 48°00'46" E	269.07'
407-408	S 14°02'11" E	82.46'
408-409	S 75°04'07" W	310.48'
409-410	S 63°26'06" W	223.61'
410-411	S 53°07'48" W	100.00'
411-412	S 38°39'35" E	256.12'
412-413	S 33°41'24" W	216.33'
413-414	S 74°03'17" E	145.60'
414-415	SOUTH	140.00'
415-416	S 35°32'16" E	172.05'
416-417	S 51°20'25" E	128.06'
417-418	S 21°48'05" E	215.41'
418-419	N 71°33'54" W	695.70'
419-420	N 19°58'59" W	234.09'
420-421	N 21°48'05" W	215.41'
421-422	N 14°02'11" W	82.46'
422-423	N 36°01'39" W	272.03'
423-424	N 74°44'42" W	228.04'
424-425	S 81°52'12" W	141.42'
425-426	S 09°27'44" W	121.66'
426-427	N 85°14'11" W	240.83'
427-428	N 45°00'00" W	141.42'
428-429	N 26°33'54" E	89.44'
429-430	N 74°44'42" W	228.04'
430-431	N 38°39'35" W	128.06'
431-432	S 15°15'18" W	228.04'
432-433	S 66°48'05" E	152.32'
433-434	S 36°52'12" E	100.00'
434-435	S 11°18'36" E	203.96'
435-436	S 05°42'38" W	201.00'
436-437	S 38°39'35" W	128.06'
437-438	S 26°33'54" E	402.49'
438-439	S 14°02'11" W	82.46'
439-440	S 69°26'38" E	170.88'
440-441	S 56°18'36" E	288.44'
441-442	N 75°57'50" E	82.46'
442-443	S 80°32'16" E	243.31'
443-444	SOUTH	80.00'
444-445	S 20°33'24" W	230.03'
445-446	S 75°25'31" E	128.24'
446-447	N 79°59'26" E	159.08'
447-448	S 71°33'54" E	63.25'
448-449	N 53°07'48" E	100.00'
449-450	N 80°32'16" E	121.66'
450-451	S 63°26'06" E	44.72'
451-452	N 60°15'18" E	161.25'
452-453	S 63°26'06" E	89.44'
453-454	S 30°57'50" W	116.62'
454-455	N 78°37'13" E	186.46'

NOTE:
SEE SHEET K-20 FOR P.B.L. DESCRIPTION ON THIS TRACT 455-458

	TRACT 132	
458-459	S 86°45'48" E	392.95'
459-460	S 31°30'23" E	112.82'
460-461	S 47°43'35" W	297.32'
461-462	N 26°33'54" W	134.16'
462-463	S 72°28'28" W	207.11'
	TRACT 113	

NOTE:
SEE SHEET K-20 FOR P.B.L. DESCRIPTION ON THIS TRACT 463-472

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TRACT 113

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PT-PT	BEARING	DISTANCE

NOTE:
SEE SHEET K-20 FOR P.B.L. DESCRIPTION ON THIS TRACT 472-478

	TRACT 67	
478-479	S 54°27'36" E	309.55'
479-480	S 38°39'33" E	359.56'
	TRACT 118	
480-481	S 38°40'15" E	24.63'
481-482	SOUTH	200.00'
482-483	S 49°23'55" E	184.39'
483-484	S 60°56'43" W	205.91'
484-485	SOUTH	220.00'
485-486	S 58°25'45" W	375.59'
	TRACT 61	
486-487	SOUTH	103.36'
487-488	S 30°57'50" W	233.24'
488-489	SOUTH	100.00'
489-490	S 65°33'22" E	241.66'
490-491	S 24°46'31" W	286.36'
491-492	S 54°27'44" E	172.05'
492-493	S 78°41'24" E	101.98'
493-494	S 63°26'06" E	134.16'
494-495	N 36°52'12" E	500.00'
495-496	N 45°00'00" E	197.99'
496-497	S 51°20'25" E	256.12'
497-498	N 63°26'06" E	178.89'
498-499	N 45°00'00" E	226.27'
499-500	N 07°07'30" E	161.25'
500-501	N 45°00'00" E	141.42'
501-502	S 45°00'00" E	282.84'
502-503	S 45°00'00" W	282.84'
503-504	SOUTH	200.00'
504-505	S 68°11'55" W	107.70'
505-506	SOUTH	162.08'
	TRACT 15	
506-507	S 07°10'16" W	320.43'
507-508	S 23°57'45" W	196.98'
508-509	S 16°41'57" E	208.81'
509-510	S 30°57'50" W	116.62'
510-511	S 71°33'54" W	126.49'
511-512	S 59°02'11" E	116.62'
512-513	S 09°27'44" E	121.66'
513-514	S 53°07'48" W	100.00'
514-515	S 39°48'20" E	156.20'
515-516	S 61°23'22" W	250.60'
516-517	S 11°18'36" E	101.98'
517-518	N 81°15'14" E	263.06'
518-519	N 60°15'18" E	161.25'
519-520	N 26°33'54" E	223.61'
520-521	N 11°18'36" E	203.96'
521-522	NORTH	220.00'
522-523	N 55°18'17" E	316.23'
523-524	EAST	200.00'
524-525	N 45°00'00" E	169.71'
525-526	EAST	80.00'
526-527	N 26°42'37" E	404.40'
	TRACT 121	
527-528	N 85°05'21" E	219.03'
528-529	S 45°00'00" E	113.14'
529-530	S 51°49'00" E	49.28'
	TRACT 149	
530-530A	S 51°49'02" E	59.66'
530A-531	S 60°49'50" W	147.12'
	TRACT 15	
531-532	S 53°55'29" E	69.51'
532-533	S 65°13'13" W	190.92'
533-534	S 07°07'30" W	161.25'
534-535	S 05°42'38" E	201.00'
535-536	S 06°20'25" W	362.22'
536-537	S 18°26'06" W	252.98'
537-538	S 30°57'50" W	116.62'
538-539	S 33°41'24" E	216.33'
539-540	SOUTH	60.00'
540-541	S 53°07'48" W	100.00'
541-542	S 04°23'55" W	260.77'
542-543	S 29°44'42" W	161.25'
543-544	S 56°18'36" E	144.22'
544-545	N 84°17'22" E	201.00'
545-546	N 53°07'48" E	100.00'
546-547	N 68°11'55" E	215.41'
547-548	N 68°11'55" E	215.41'
548-549	N 74°03'17" E	145.60'
549-550	S 68°11'55" E	107.70'
550-551	N 75°57'50" E	164.92'
551-552	S 26°33'54" E	89.44'
552-553	S 14°02'11" W	164.92'
553-554	S 45°00'00" W	254.56'
554-555	S 55°18'17" W	316.23'
555-556	S 36°52'12" E	100.00'
556-557	S 49°20'04" E	517.85'
	TRACT 14	
557-558	S 33°33'17" E	411.05'
558-559	S 62°18'02" E	415.04'

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PT-PT	BEARING	DISTANCE
	TRACT 13	
559-560	S 00°47'00" W	547.12'
560-561	S 40°36'05" E	184.39'
561-562	S 63°26'06" E	357.77'
562-563	N 81°07'10" E	647.77'
563-564	N 12°31'44" E	184.39'
564-565	S 66°22'14" E	349.28'
565-566	SOUTH	189.57'
	TRACT 12	
566-567	S 15°34'41" W	298.94'
	TRACT 11	
567-568	S 15°34'41" W	147.90'
568-569	S 47°43'35" W	297.32'
569-570	S 27°45'31" E	429.42'
570-571	S 43°24'32" E	509.31'
571-572	S 18°26'06" E	569.95'
	TRACT 10	
572-573	S 18°26'06" E	503.98'
573-574	S 54°09'44" W	444.07'
574-575	S 26°33'55" W	402.49'
575-576	SOUTH	100.00'
576-577	EAST	440.00'
577-578	SOUTH	260.00'
578-579	S 46°44'09" E	466.90'
579-580	N 68°29'54" E	709.37'
580-581	EAST	373.58'
581-582	S 18°37'20" E	202.88'
582-583	S 08°11'11" E	399.74'
583-584	S 03°06'09" E	533.22'
	TRACT 76	
584-584A	N 10°22'15" E	276.91'
584A-584B	S 86°37'42" E	177.00'
	TRACT 59	
584B-584C	S 65°23'59" E	340.20'
584C-584D	S 04°45'49" E	240.83'

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PT-PT	BEARING	DISTANCE
584D-584E	S 24°26'39" E	241.66'
584E-584F	S 18°26'06" W	505.96'
584F-584G	S 39°17'22" W	284.25'
584G-584H	S 35°57'25" W	177.97'
	TRACT 86	
584H-584I	S 80°26'01" W	210.00'
584I-584J	N 01°53'07" E	210.04'
	TRACT 75	
584J-584K	N 08°43'11" E	106.41'
	TRACT 80	
584K-584L	N 05°36'27" E	105.62'
	TRACT 59	
584L-584M	N 05°25'08" E	111.01'
	TRACT 79	
584M-584N	N 05°42'35" E	146.91'
	TRACT 78	
584N-584O	N 05°03'05" E	105.62'
	TRACT 59	
584O-584P	N 01°44'42" W	289.31'
	TRACT 77	
584P-584Q	N 00°39'42" W	210.00'
	TRACT 76	
584Q-584A	N 03°02'18" W	210.00'
584A-584	S 10°22'15" W	276.91'
	TRACT 10	
584-585	S 02°16'10" E	199.99'
585-586	S 02°30'53" E	299.94'
586-587	S 05°38'46" W	453.73'
587-588	S 00°14'00" E	499.02'
588-589	S 06°35'54" E	1,372.91'
589-590	S 00°12'22" E	44.80'
590-591	WEST	457.50'
591-592	S 70°52'39" W	366.31'
592-593	SOUTH	350.90'
	TRACT 8	
593-594	S 33°41'00" E	83.05'
594-595	EAST	150.00'
595-596	S 42°53'00" E	191.07'
596-597	S 68°12'00" E	323.10'
597-598	S 30°15'00" E	138.91'

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	TRACT 8	
598-599	SOUTH	160.00'
599-600	S 56°19'00" W	108.20'
600-601	S 78°42'00" W	102.00'
601-602	WEST	100.00'
602-603	N 78°07'00" W	194.20'
603-604	WEST	150.00'
604-605	N 86°11'00" W	150.34'
605-606	S 23°12'00" W	76.16'
606-607	S 68°12'00" E	107.71'
607-608	S 14°28'00" E	173.92'
	TRACT 7	
608-609	S 85°43'48" E	115.42'
609-610	S 45°00'00" E	173.56'
610-611	SOUTH	140.00'
611-612	N 83°59'28" E	382.10'
612-613	S 08°07'48" W	424.26'
613-614	S 25°20'46" W	234.04'
	TRACT 6	
614-615	N 87°59'45" W	197.75'
615-616	S 39°11'51" E	123.11'
616-617	S 20°17'30" W	114.52'
617-618	S 87°58'51" E	65.20'
	TRACT 5	
618-619	S 25°20'46" W	220.04'
	TRACT 4	
619-620	S 25°20'46" W	167.57'
620-621	WEST	360.00'
621-622	N 77°54'19" W	859.07'
622-623	S 14°19'19" W	161.50'
623-624	S 11°02'23" W	175.70'
624-625	N 78°58'18" W	214.28'
	TRACT 17	
625-626	N 52°58'02" W	245.64'
626-627	N 84°17'22" W	110.82'
	TRACT 130	
627-628	N 84°17'22" W	90.18'
628-629	WEST	120.00'
629-630	N 29°44'41" W	51.62'
	TRACT 20	
630-631	N 29°44'42" W	109.62'
631-632	WEST	250.79'
	TRACT 21	
632-633	N 26°21'48" W	175.16'
633-634	N 79°17'01" W	135.98'
634-635	S 05°22'06" W	190.15'
	TRACT 24	
635-636	S 05°22'05" W	145.84'
	TRACT 39	
636-637	S 61°06'26" W	429.89'
637-638	S 10°32'21" W	437.38'
638-639	S 58°29'51" E	288.38'
639-640	S 15°11'43" W	120.00'
640-641	S 15°11'43" W	165.35'
641-642	S 76°24'39" E	243.11'
	TRACT 96	
642-643	N 32°53'08" E	373.16'
643-644	EAST	220.00'
644-645	S 33°41'24" E	26.40'
645-646	N 77°11'45" E	412.02'
646-647	N 77°11'45" E	39.20'
647-648	S 71°51'03" E	307.36'
648-649	S 59°58'26" E	307.50'
	TRACT 101	
649-650	S 63°35'02" E	158.22'
650-651	N 50°47'48" E	186.72'
	TRACT 99	
651-652	N 79°42'18" E	179.42'
652-653	S 35°31'57" E	155.14'
653-654	S 80°47'52" E	88.63'
654-655	S 17°40'40" E	17.41'
	TRACT 106	
655-656	S 17°40'40" E	66.50'
	TRACT 103	
656-657	S 28°17'38" E	134.75'
	TRACT 125	
657-658	S 42°16'20" E	108.19'
658-659	S 80°48'40" E	68.88'
659-660	S 08°22'07" W	13.32'
660-661	S 19°30'31" W	28.71'
	TRACT 127	
661-662	S 19°30'32" W	16.19'
662-663	S 26°25'18" W	91.83'
	TRACT 115	
663-664	S 26°25'18" W	17.04'
664-665	S 07°38'28" W	27.24'
665-666	S 34°59'31" W	217.66'
	TRACT 117	
666-667	S 34°59'31" W	26.47'
667-668	S 53°07'48" W	200.00'
668-669	N 83°17'25" W	342.34'

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PT-PT	BEARING	DISTANCE
669-670	S 28°36'38" W	250.60'
670-671	S 60°56'50" W	157.94'
	TRACT 92	
671-672	S 60°56'23" W	47.97'
672-673	SOUTH	200.00'
673-674	S 18°26'06" W	252.98'
674-675	N 63°26'06" E	268.33'
675-676	EAST	220.00'
676-677	N 19°36'00" E	115.75'
677-678	S 57°08'13" E	105.81'
678-678A	S 06°03'59" W	59.86'
678A-679	S 06°03'59" W	201.73'
679-680	S 73°56'04" E	41.57'
680-681	N 65°35'38" E	136.88'
	TRACT 91	
681-682	S 52°47'55" W	192.55'
682-683	S 11°50'16" W	441.60'
	TRACT 122	
683-684	S 02°17'13" E	108.02'
684-685	S 13°15'21" W	392.24'
	TRACT 90	
685-686	S 31°58'20" W	103.98'
686-687	S 12°18'29" W	281.47'
687-688	S 27°34'15" E	54.01'
688-688A	S 77°45'42" E	56.28'
	TRACT 60	
688A-689	SOUTH	90.19'
689-690	S 33°41'24" E	90.14'
690-691	S 46°28'08" E	137.93'
691-692	S 33°27'28" E	84.14'
692-692A	S 12°30'45" W	59.28'
692A-693	S 12°30'45" W	508.19'
	TRACT 72	
693-694	S 21°07'38" W	217.73'
694-695	S 27°46'52" W	192.88'
695-696	N 34°59'29" W	490.93'
696-697	N 71°33'54" W	126.49'
697-698	N 83°17'25" W	342.34'
698-699	N 51°20'25" W	355.27'
	TRACT 60	
699-700	N 47°08'11" W	85.36'
700-701	N 29°03'18" W	205.91'
701-702	N 10°18'17" W	223.61'
702-703	S 47°29'22" W	325.58'
703-704	S 29°14'56" W	286.53'
	TRACT 72	
704-705	SOUTH	410.43'
705-706	S 22°45'03" E	672.30'
706-707	S 49°36'31" W	864.57'
	TRACT 43	
707-708	N 80°33'10" W	458.41'
	TRACT 44	
708-709	N 10°00'00" E	572.41'
	TRACT 45	
709-710	N 10°00'00" E	442.25'
	TRACT 46	
710-711	N 10°00'00" E	322.35'
	TRACT 72	
711-712	N 10°00'00" E	97.58'
	TRACT 60	
712-713	N 10°00'00" E	235.85'
713-714	S 64°15'49" W	598.76'
714-715	N 46°50'51" W	438.63'
715-716	WEST	240.00'
716-717	N 30°24'46" W	964.11'
	TRACT 68	
717-718	WEST	311.94'
718-719	S 17°38'55" W	263.87'
719-720	S 04°05'08" E	280.71'
720-721	S 32°34'26" E	427.20'
721-722	S 21°02'15" E	557.14'
722-723	S 29°36'16" W	433.42'
	TRACT 66	
723-724	S 29°36'16" W	8.42'
	TRACT 37	
724-725	S 29°35'56" W	64.30'
725-726	N 58°23'33" W	305.29'
726-727	N 37°52'30" W	1,140.18'

NOTE:
PROJECT BOUNDARY LINE BETWEEN POINT 727 AND 730 HAS NOT BEEN DETERMINED BY ACTUAL SURVEY. THE P.B.L. IS THE 430' CONTOUR IN THE VICINITY OF THE V.C. SUMMER STATION AS SHOWN BY THE HEAVY BLACK ARROWS ON K-2 & K-6

K-6

PT-PT	BEARING	DISTANCE
	TRACT 48	
730-731	S 32°41'13" W	1,425.80'
731-732	S 88°42'28" E	1,330.34'
732-733	S 01°18'07" W	440.11'
733-734	N 88°56'21" W	1,620.28'
734-735	N 34°29'19" W	2,984.58'
735-736	N 77°52'59" W	1,810.33'
	TRACT 54	
736-737	S 10°00'00" W	1,690.39'
	TRACT 48	
737-738	S 10°00'00" W	195.33'
738-739	S 10°00'00" E	229.48'
739-740	N 27°21'19" W	184.68'
740-741	N 30°49'44" W	107.76'
741-742	S 39°39'51" W	211.91'
742-743	S 30°52'48" E	26.40'
743-744	S 26°50'49" E	315.24'
744-745	S 22°46'19" E	285.57'
745-746	N 35°22'55" E	235.26'
746-747	S 70°23'15" E	109.70'
747-748	S 56°29'26" E	84.41'
748-749	S 17°42'59" E	120.01'
749-750	S 38°56'27" W	47.43'
750-751	S 26°31'00" W	74.23'
751-752	S 14°09'00" E	112.41'
752-753	S 26°55'31" E	204.09'
753-754	S 32°00'19" E	188.68'
754-755	S 70°54'19" E	92.84'
755-756	N 80°38'18" E	87.91'
756-757	N 74°17'05" E	56.45'
757-758	N 82°06'35" E	80.42'
758-759	N 81°28'37" E	94.26'
759-760	N 85°50'32" E	146.62'
760-761	S 41°31'50" E	134.02'
761-762	S 43°42'53" E	115.39'
762-763	S 53°25'46" E	86.10'
763-764	S 63°24'33" E	99.57'
764-765	S 32°08'52" E	108.72'

K-5

765-766	S 26°10'39" W	134.83'
766-767	S 88°23'10" E	131.38'
767-768	S 83°58'22" E	130.95'
768-769	N 89°55'24" E	194.11'
769-770	S 34°37'40" W	33.38'
770-771	S 83°46'17" W	24.98'
771-772	N 82°52'15" W	83.80'
772-773	N 85°17'41" W	238.56'
773-774	S 88°45'40" W	122.57'

K-5

PT-PT	BEARING	DISTANCE
774-775	N 64°21'26" W	137.79'

K-6

775-776	N 56°58'37" W	118.65'
776-777	N 28°50'51" W	123.30'
777-778	N 54°27'21" W	40.72'
778-779	S 51°36'59" W	174.35'

K-5

779-780	S 54°23'31" W	59.58'
780-781	S 60°57'25" W	126.39'
781-782	S 16°26'50" W	106.31'
782-783	N 87°15'37" W	103.35'
783-784	S 58°58'10" W	129.24'
784-785	S 37°16'16" W	43.97'

K-6

785-786	N 06°59'04" W	453.17'
786-787	N 11°44'11" W	283.44'
787-788	N 15°14'17" W	266.93'
788-789	N 18°47'46" W	283.12'
789-746	N 22°43'34" W	134.39'
746-745	S 35°22'55" W	235.26'
745-792	S 18°49'33" E	271.18'
792-793	S 15°16'23" E	253.95'
793-794	S 11°49'03" E	267.36'

K-5

794-795	S 07°02'48" E	435.08'
795-796	S 02°01'39" E	280.84'
796-797	S 01°40'26" W	270.51'
797-798	S 05°35'45" W	294.57'
798-799	S 81°22'07" E	200.00'
799-800	S 09°37'01" W	46.82'
800-801	S 03°48'12" E	75.24'
801-802	S 31°30'06" E	59.19'
802-803	S 27°52'34" E	102.43'
803-804	S 02°02'23" E	388.83'
804-805	S 25°29'02" E	372.80'
805-806	S 70°32'12" E	190.49'
806-807	S 25°24'05" E	37.86'

K-5

	TRACT 30	
807-808	S 25°24'05" E	59.91'
808-809	S 89°55'16" W	50.79'
809-810	N 78°55'57" W	64.68'
	TRACT 48	
810-811	N 78°55'57" W	132.24'
811-812	S 75°41'38" W	109.63'
812-813	S 17°46'27" W	135.61'
	TRACT 30	
813-814	S 17°46'27" W	96.68'
814-815	S 26°38'27" W	135.51'
815-816	S 21°48'05" W	215.41'
816-817	S 29°44'42" W	161.25'
817-818	S 23°11'55" W	152.32'
818-819	S 06°26'04" E	124.93'
819-820	S 41°25'59" E	60.01'
820-821	S 64°31'36" W	90.84'
821-822	S 18°42'08" W	223.61'
822-823	S 03°44'23" W	195.63'
823-824	S 05°40'40" E	55.49'
824-825	S 22°28'05" E	162.00'
825-826	S 15°01'26" E	35.88'
826-827	S 58°06'22" W	30.00'
827-828	N 74°39'22" W	77.47'
828-829	N 66°04'53" W	61.02'
829-830	S 53°22'24" W	259.15'
830-831	S 29°44'42" E	161.25'
831-832	S 76°19'24" E	190.15'
832-833	S 77°33'12" E	59.02'
833-834	S 80°48'47" E	52.36'
834-835	N 61°25'35" E	193.82'
835-836	N 51°00'26" E	69.59'
836-837	N 68°34'24" E	64.17'
837-838	N 82°56'44" E	159.02'
838-839	N 65°03'45" E	178.25'
839-840	N 53°13'59" E	40.74'
	TRACT 31	
840-840A	N 53°13'59" E	33.76'
840A-840B	N 32°25'53" E	129.64'
840B-840C	S 23°58'53" W	172.33'
840C-840D	S 36°59'41" W	157.92'
840D-841	S 49°20'37" E	62.48'
841-842	S 47°43'16" E	303.40'
842-843	N 82°12'24" W	237.17'
843-844	N 80°53'36" W	234.60'
844-845	N 74°02'00" W	37.08'
845-846	N 83°02'18" W	46.53'
846-847	S 51°33'27" W	159.75'
847-848	S 65°56'38" W	173.17'
848-849	S 61°00'21" W	92.86'
849-850	N 78°32'02" W	71.18'
850-851	N 64°41'09" W	32.37'
851-852	N 88°02'00" W	221.76'
852-853	N 85°36'05" W	260.77'
853-854	S 20°33'59" W	239.23'
854-855	N 07°23'23" E	299.13'
855-856	N 11°53'04" E	275.42'
856-857	N 65°22'08" E	11.93'
	TRACT 30	
857-858	N 13°49'44" E	237.74'
858-859	N 18°09'22" E	1,326.23'
	TRACT 48	
859-860	N 18°48'39" E	669.85'
860-861	N 16°45'27" E	313.47'
861-862	N 13°13'33" E	267.82'
862-800	N 09°37'01" E	255.11'
800-799	N 09°37'01" E	46.82'
799-798	N 81°22'07" W	200.00'
798-866	S 09°34'39" W	288.91'
866-867	S 13°11'30" W	256.42'
867-868	S 16°44'59" W	303.88'
868-869	S 18°22'27" W	855.60'
	TRACT 30	
869-870	S 18°22'27" W	1,145.41'
870-871	S 15°55'37" W	32.86'
	TRACT 31	
871-872	S 15°55'37" W	228.50'
872-873	S 11°49'16" W	288.63'
873-874	S 07°20'14" W	314.79'
874-875	S 03°05'20" W	272.57'
875-876	S 01°07'13" E	302.74'
876-877	S 05°03'33" E	242.34'
877-878	S 08°27'51" E	224.69'
878-879	S 12°02'55" E	257.10'
879-880	S 15°56'21" E	244.57'
880-881	S 19°11'14" E	242.59'
881-882	S 22°53'13" E	305.31'
882-883	S 23°57'49" E	248.05'

K-5

	TRACT 55	
883-884	S 23°57'49" E	1,029.89'
884-885	S 25°34'38" E	137.47'
885-886	S 27°42'03" E	27.20'
886-887	N 66°45'01" E	100.30'
887-888	N 66°45'01" E	43.39'

K-5

PT-PT	BEARING	DISTANCE
888-889	N 56°38'47" E	57.02'
889-890	N 27°42'03" W	32.73'
890-891	N 25°31'00" W	129.96'
891-892	N 23°57'37" W	401.78'
892-893	N 32°00'19" E	117.42'
893-894	N 07°07'30" E	161.25'
894-895	N 38°33'05" E	235.97'
895-896	N 50°37'02" E	78.46'
896-897	S 51°19'41" E	96.74'
897-898	S 30°00'34" W	44.59'
898-899	S 16°06'41" E	140.79'
899-900	SOUTH	240.00'
900-901	S 08°44'46" W	263.06'
901-890	S 26°46'06" W	273.30'
890-889	S 27°42'03" E	32.73'
889-888	S 56°38'47" W	57.02'
888-887	S 66°45'01" W	43.39'
887-886	S 66°45'01" W	100.30'
	TRACT 289	
886-907	S 28°30'17" E	156.38'
907-908	S 35°09'50" E	527.20'
908-909	S 37°50'48" E	846.76'
909-910	S 23°32'26" W	35.89'
910-911	S 82°50'46" W	161.22'
911-912	N 78°43'06" W	305.89'
912-913	N 58°25'11" W	305.24'
913-914	S 56°16'10" W	72.10'
914-915	N 68°13'56" W	107.68'
915-916	N 09°26'02" E	121.66'
916-917	N 05°40'47" E	201.00'
917-918	N 23°14'00" W	304.60'
918-919	N 56°21'05" W	144.20'
919-920	S 69°23'27" W	170.85'
920-921	S 06°16'44" W	543.32'
921-922	S 16°11'48" W	499.98'
922-923	N 89°56'43" E	80.01'
923-924	N 44°56'59" E	198.01'
924-925	N 89°56'25" E	100.02'
925-926	S 16°01'05" E	145.61'
926-927	S 12°01'09" W	286.35'
927-928	S 24°51'07" E	286.38'
928-929	S 23°36'56" W	189.55'
929-930	N 69°59'45" E	114.18'
930-931	S 71°31'30" E	63.26'
931-932	S 33°39'30" E	144.23'
932-933	S 08°06'38" E	141.41'
933-934	S 51°18'56" E	128.08'
934-935	S 19°57'52" E	234.11'
935-936	S 33°40'21" E	216.36'
936-937	S 85°55'20" E	628.15'
937-938	S 27°06'13" E	157.70'
938-939	S 11°31'48" W	236.13'
939-940	S 26°31'02" E	440.77'
940-941	S 58°21'11" W	58.19'
	POWERHOUSE & DAM	
941-942	S 58°21'11" W	376.75'
942-942A	S 58°39'30" W	2,000.89'
942A-942B	S 89°08'08" W	9.74'
	TRACT 150	
842B-943	S 66°54'10" W	318.00'
943-944	N 19°58'59" W	234.09'
944-945	N 14°02'11" E	164.92'
945-946	N 56°18'36" W	144.22'
946-947	S 64°41'30" W	307.31'
947-948	S 87°57'45" W	69.47'
	TRACT 151	
948-949	S 87°57'28" W	172.87'
949-950	S 48°22'06" W	382.83'
950-951	S 66°32'37" W	116.44'
951-952	N 10°31'46" W	366.86'
952-953	N 56°18'44" W	216.33'
953-954	N 30°57'49" E	71.19'
	TRACT 152	
954-955	N 30°57'50" E	42.42'
955-956	N 87°57'16" E	379.07'
	TRACT 150	
956-957	N 55°34'01" E	365.15'
957-958	N 34°41'43" W	221.04'

K-5

	TRACT 152	
958-959	N 10°33'04" W	405.11'
959-960	N 39°05'38" W	412.31'
960-961	N 84°48'20" W	220.91'
961-962	N 27°33'11" W	85.07'
962-963	N 00°26'25" W	84.58'
963-964	N 29°03'17" E	205.92'
964-965	N 71°33'54" W	126.49'
965-966	S 59°55'53" W	439.09'
966-967	S 48°48'51" W	212.60'
967-968	S 50°32'16" W	326.59'
968-969	N 04°36'12" E	649.67'
969-970	N 61°41'57" E	295.30'
970-971	NORTH	540.00'
971-972	N 38°39'35" W	256.13'
972-973	N 84°48'20" W	220.91'
973-974	N 86°59'14" W	380.53'
974-975	S 63°26'06" W	178.89'

K-8

975-976	S 33°41'24" W	216.33'
976-977	S 53°50'19" W	222.23'
977-978	S 22°39'58" W	509.47'
978-979	S 36°28'34" W	128.90'
979-980	N 05°39'28" E	49.60'
	TRACT 153	
980-981	N 05°39'45" E	75.91'
981-982	N 19°14'27" E	221.00'

K-8

PT-PT	BEARING	DISTANCE
982-983	N 11°27'35" E	338.08'
983-984	NORTH	220.00'
984-985	S 75°57'50" W	329.85'
985-986	S 72°53'13" W	169.58'
986-987	N 86°37'02" W	64.06'
987-988	N 43°17'14" E	475.49'
988-989	N 66°48'05" E	456.95'
989-990	N 68°57'45" W	278.57'
990-991	N 45°00'00" W	388.75'
	TRACT 154	
991-992	N 45°00'00" W	63.80'
992-993	N 63°31'49" W	233.73'
993-994	N 81°07'07" E	232.01'
994-995	S 79°41'43" E	223.61'
995-996	S 65°31'52" E	268.52'
996-997	N 78°40'07" E	260.68'

K-5

997-998	N 85°14'11" E	240.83'
998-999	N 40°51'35" E	346.11'
999-1000	N 66°32'52" W	246.82'
1000-1001	N 57°15'53" W	332.87'

K-8

1001-1002	N 66°02'15" W	393.95'
1002-1003	N 86°43'28" W	303.84'
1003-1004	S 50°54'13" W	119.69'
1004-1005	S 68°20'44" W	52.09'
1005-1006	N 85°20'40" W	95.11'
1006-1007	N 66°33'57" E	230.33'
1007-1008	N 23°59'16" E	155.04'
	TRACT 155	
1008-1009	N 23°59'06" E	61.70'
1009-1010	S 79°21'08" E	280.40'
1010-1011	N 50°30'35" E	134.70'
1011-1012	N 60°56'40" E	193.90'
1012-1013	N 59°15'21" W	259.04'
1013-1014	N 20°22'14" W	114.88'
1014-1015	N 28°40'06" E	106.62'
1015-1016	N 49°48'07" E	374.12'
1016-1017	N 01°28'34" W	253.86'
1017-1018	N 06°30'36" E	290.90'
1018-1019	N 27°26'01" W	297.43'
	TRACT 156	
1019-1020	N 27°26'35" W	65.38'
1020-1021	N 22°35'34" E	256.23'
1021-1022	N 08°45'22" W	336.87'
1022-1023	N 44°56'47" W	226.51'
1023-1024	N 13°44'14" W	134.75'
1024-1025	N 09°59'59" E	452.91'
	TRACT 157	
1025-1026	N 02°20'41" W	342.92'
1026-1027	N 11°52'32" W	228.49'
1027-1028	S 62°08'47" W	130.45'
1028-1029	WEST	240.00'
1029-1030	S 78°57'59" W	104.87'

K-8

	TRACT 158	
1030-1031	S 78°57'50" W	92.72'
1031-1032	S 21°33'10" E	41.92'
1032-1033	S 52°36'31" W	9.67'
1033-1034	N 84°53'35" W	254.79'
1034-1035	N 48°25'27" W	210.74'
1035-1036	N 77°05'12" W	269.16'
1036-1037	N 66°02'16" W	127.62'
	TRACT 159	
1037-1038	N 66°02'21" W	69.36'
1038-1039	N 41°42'04" W	177.56'
1039-1040	N 54°20'47" W	150.00'
1040-1041	N 75°57'50" W	164.92'
1041-1042	S 77°28'16" W	249.72'
	TRACT 161	
1042-1043	S 77°28'16" W	119.06'
1043-1044	S 67°22'49" W	260.00'
1044-1045	S 84°32'16" W	421.05'
1045-1046	S 81°55'57" W	84.63'
1046-1047	S 81°55'57" W	96.86'
1047-1048	N 75°53'14" W	186.81'
1048-1049	N 31°40'53" W	184.69'
1049-1050	N 77°04'32" W	124.87'
1050-1051	S 14°37'05" E	232.63'
1051-1052	S 12°59'41" E	266.83'
1052-1053	S 09°03'15" W	186.70'
1053-1054	S 13°06'39" W	107.52'
1054-1055	N 00°02'03" W	185.13'
1055-1056	N 38°03'25" W	309.27'
1056-1057	N 31°48'01" W	108.06'
1057-1058	N 31°48'01" W	229.41'
1058-1059	S 37°52'51" W	140.01'
1059-1060	N 49°58'56" W	196.25'
	TRACT 163	
1060-1061	S 85°51'04" W	234.20'
1061-1062	S 48°50'01" W	310.83'
1062-1063	N 43°36'10" W	165.01'
1063-1064	N 36°52'12" W	400.00'
1064-1065	S 48°00'46" W	269.07'
1065-1066	S 04°48'35" E	626.97'
1066-1067	S 05°14'36" W	125.82'
	TRACT 162	
1067-1068	S 05°14'34" W	90.99'
	TRACT 163A	
1068-1069	S 05°14'36" W	40.47'
1069-1070	S 23°09'56" E	129.49'
1070-1071	S 26°06'16" W	134.07'
1071-1072	S 22°32'40" E	105.59'
1072-1073	S 14°33'31" E	134.22'
1073-1074	S 47°33'14" W	51.26'
1074-1075	N 38°52'01" E	44.95'

K-8

PT-PT	BEARING	DISTANCE
1075-1076	N 27°52'16" W	53.99'
1076-1077	N 12°11'02" W	47.71'
1077-1078	N 28°34'05" W	99.77'
1078-1079	N 40°37'29" W	54.00'
1079-1080	N 36°38'29" W	180.02'
1080-1081	N 26°33'54" W	142.51'
	TRACT 163	
1081-1082	N 26°33'54" W	170.54'
1082-1083	N 68°11'55" W	107.70'
1083-1084	N 24°52'52" W	177.59'
1084-1085	N 19°38'45" W	253.66'
1085-1086	S 69°22'23" W	153.46'
1086-1087	N 76°30'22" W	224.69'
1087-1088	N 51°23'03" W	167.19'
1088-1089	N 86°36'51" W	188.96'
1089-1090	N 56°59'20" W	147.94'
1090-1091	N 46°59'26" W	184.03'
1091-1092	N 72°41'19" W	200.13'
1092-1093	N 70°18'43" W	179.43'
1093-1094	N 49°23'55" W	150.76'
1094-1095	N 73°56'36" W	151.44'
1095-1096	S 45°00'00" W	120.76'
	TRACT 164	
1096-1097	S 45°00'00" W	105.51'
1097-1098	N 36°52'12" W	200.00'
1098-1099	N 30°52'27" W	251.06'
1099-1100	S 38°02'17" W	375.16'
1100-1101	N 76°19'39" W	94.00'
1101-1102	N 44°45'15" W	131.79'
1102-1103	N 47°13'45" W	212.34'
1103-1104	N 66°02'51" W	348.84'
	TRACT 172	
1104-1105	N 66°01'24" W	242.10'
1105-1106	S 54°27'44" W	344.09'
1106-1107	S 09°41'12" E	135.99'

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	TRACT 164	
1107-1108	S 09°41'12" E	79.40'
1108-1109	S 48°23'59" W	101.95'
1109-1110	N 54°21'37" W	132.98'
	TRACT 172	
1110-1111	N 54°21'36" W	159.27'
1111-1112	N 76°21'58" W	126.04'
1112-1113	S 73°18'03" W	208.81'
1113-1114	N 39°02'29" W	68.57'
	TRACT 165	
1114-1115	N 39°02'26" W	79.77'
1115-1116	N 24°41'23" W	159.35'

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1116-1117	S 63°26'06" W	223.61'
1117-1118	N 45°00'00" W	169.71'
1118-1119	S 80°49'14" W	107.57'
1119-1120	N 32°50'57" W	157.22'
1120-1121	N 83°28'03" W	300.87'
1121-1122	N 81°17'37" W	92.46'
	TRACT 166	
1122-1123	N 81°17'38" W	150.85'
1123-1124	N 54°17'43" W	503.80'
1124-1125	S 84°47'10" W	222.39'
1125-1126	S 85°16'27" W	245.92'
1126-1127	S 08°01'59" E	285.02'
1127-1128	N 58°11'01" W	156.85'
1128-1129	N 73°04'21" W	961.67'
1129-1130	S 54°27'44" W	344.09'
1130-1131	S 18°12'31" W	211.27'
1131-1132	S 18°12'31" W	360.04'
1132-1133	N 02°54'33" W	351.75'
1133-1134	N 02°54'33" W	71.49'
1134-1135	N 21°48'05" W	215.41'
1135-1136	S 88°59'13" W	247.72'
1136-1137	N 57°28'28" W	156.94'
1137-1138	WEST	94.24'
	TRACT 167	
1138-1139	WEST	105.76'
1139-1140	N 57°04'57" W	317.21'
1140-1141	N 48°21'17" W	256.41'
1141-1142	N 87°56'36" W	257.75'
1142-1143	S 58°42'49" W	506.34'
1143-1144	S 74°57'48" W	422.37'
1144-1145	S 88°27'02" W	19.12'
	TRACT 168	
1145-1146	S 88°27'03" W	370.75'
1146-1147	S 86°11'02" W	134.48'
1147-1148	S 13°48'30" W	105.50'
1148-1149	S 46°12'30" W	216.26'
1149-1150	S 69°22'13" W	168.45'
1150-1151	S 77°27'34" W	399.16'
1151-1152	S 69°08'56" W	377.99'
1152-1153	S 81°32'22" W	321.69'
1153-1154	N 68°10'13" W	371.90'
1154-1155	S 41°18'02" W	476.92'
1155-1156	S 63°30'06" W	199.86'
1156-1157	N 54°31'47" W	225.34'
1157-1158	S 66°44'09" W	334.36'
1158-1159	S 60°39'39" W	264.36'
1159-1160	S 86°12'00" W	437.15'
	TRACT 251	
1160-1161	S 66°20'23" W	188.33'
1161-1162	S 56°57'49" W	142.98'
1162-1163	N 84°59'07" W	131.70'
1163-1164	N 87°33'33" W	182.07'
1164-1165	S 57°50'48" W	80.63'
1165-1166	N 88°05'51" W	216.55'
1166-1167	S 82°41'34" W	82.97'
	TRACT 247	
1167-1168	S 82°41'35" W	46.12'

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PT-PT	BEARING	DISTANCE
1168-1169	S 57°42'31" W	211.27'
1169-1170	S 82°59'18" W	106.55'
1170-1171	S 81°02'55" W	202.83'
1171-1172	S 52°08'51" W	177.43'
1172-1173	S 61°37'10" W	143.52'
1173-1174	S 87°19'13" W	244.47'
1174-1175	S 85°59'12" W	130.99'
1175-1176	S 35°38'55" W	114.26'
1176-1177	N 29°50'42" W	101.87'
1177-1178	N 36°06'34" W	167.39'
1178-1179	S 40°38'01" W	178.17'
1179-1180	N 28°33'05" W	128.90'
1180-1181	S 67°33'03" W	171.97'
1181-1182	N 64°37'11" W	161.49'
1182-1183	N 21°27'41" W	129.00'
1183-1184	S 66°52'23" W	161.05'
1184-1185	S 59°58'59" W	280.97'
1185-1186	S 70°42'23" W	51.52'
1186-1187	N 02°47'56" W	378.38'
1187-1188	N 07°32'30" W	12.29'
1188-1189	N 16°36'58" E	151.90'
1189-1190	N 08°30'51" E	117.58'
1190-1191	N 21°23'23" E	68.40'
	TRACT 242	
1191-1192	N 46°19'16" W	9.94'
1192-1193	N 01°23'23" W	1,577.14'
1193-1194	S 52°43'54" E	252.07'
1194-1195	N 59°13'02" E	180.82'
1195-1196	N 68°37'36" E	332.01'
	TRACT 252	
1196-1197	N 68°37'35" E	4.73'
1197-1198	N 48°58'50" E	121.47'
1198-1199	N 69°14'51" E	428.75'
1199-1200	N 62°06'54" E	167.98'
1200-1201	S 73°50'18" E	217.10'
1201-1202	S 86°35'05" E	192.15'
1202-1203	N 49°03'04" E	328.85'
1203-1204	N 26°23'05" W	89.12'
1204-1205	N 02°46'41" W	207.10'
1205-1206	N 31°54'13" W	91.89'
1206-1208	N 69°46'09" E	2.81'
1208-1209	S 38°59'43" E	86.67'
1209-1210	S 06°04'15" E	239.39'
1210-1211	S 38°11'40" E	102.14'
1211-1212	N 88°40'06" E	124.37'
1212-1213	S 70°50'39" E	134.65'
1213-1214	S 48°35'20" E	222.33'
1214-1215	N 84°42'52" E	292.32'
1215-1216	N 77°57'35" E	96.72'
1216-1217	S 17°25'35" E	58.65'
1217-1217A	N 87°48'58" E	78.91'
	TRACT 169	
1217A-1218	N 87°58'05" E	41.80'
1218-1219	N 60°22'30" E	180.87'
1219-1220	N 84°31'12" E	316.55'
1220-1221	N 46°56'19" E	78.39'
1221-1222	N 86°53'08" E	139.70'
1222-1223	S 76°55'31" E	185.17'
1223-1224	S 47°27'10" E	95.99'
1224-1225	N 81°37'15" E	271.75'
1225-1226	N 59°28'06" E	141.00'
1226-1227	N 66°31'33" E	103.43'
1227-1228	N 84°05'51" E	106.83'
	TRACT 170	
1228-1229	N 84°05'51" E	35.79'
1229-1230	S 87°30'39" E	263.64'
1230-1231	N 54°32'12" E	209.00'
1231-1232	S 56°32'19" E	164.70'
1232-1233	S 53°40'05" E	195.14'
1233-1234	N 17°14'31" E	194.40'
1234-1235	S 60°11'33" E	108.71'
1235-1236	S 42°32'35" E	103.26'
1236-1237	N 84°46'42" E	170.86'
1237-1238	S 57°27'55" E	232.20'
1238-1239	N 63°15'08" E	249.72'
1239-1240	N 41°49'08" E	113.79'
1240-1241	N 48°32'01" E	119.77'
1241-1242	N 72°32'56" E	158.22'
1242-1243	N 85°59'14" E	280.22'
1243-1244	N 75°00'06" E	249.74'
1244-1245	N 35°01'30" E	253.30'
	TRACT 171	
1245-1246	N 35°01'30" E	84.83'
1246-1247	N 50°15'24" E	96.55'
1247-1248	S 76°37'03" E	274.62'
1248-1249	S 74°02'03" E	160.91'
1249-1250	S 62°56'02" E	26.94'
	TRACT 167	
1250-1251	S 62°56'02" E	134.68'
1251-1252	N 86°25'25" E	320.62'
1252-1253	S 79°59'31" E	302.25'

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	TRACT 172	
1253-1254	S 79°59'31" E	43.00'
1254-1255	S 72°53'50" E	272.03'
1255-1256	S 83°44'10" E	442.58'
1256-1257	S 77°14'35" E	143.61'
1257-1258	S 51°49'00" E	230.86'
1258-1259	N 83°03'47" E	212.46'
1259-1260	N 17°30'58" W	148.09'
1260-1261	S 69°09'59" E	145.99'
1261-1262	N 35°47'02" E	242.69'
1262-1263	N 36°47'39" E	128.06'
1263-1264	N 63°08'19" E	136.64'
1264-1265	S 74°24'45" E	187.41'
1265-1266	N 85°05'26" E	474.06'

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PT-PT	BEARING	DISTANCE
1266-1267	N 40°17'16" E	304.87'
1267-1268	N 09°23'42" W	224.15'
1268-1269	N 09°31'44" E	152.65'
1269-1270	N 14°23'28" E	494.21'
1270-1271	N 15°36'44" E	288.31'
1271-1272	N 01°07'47" W	197.32'
1272-1273	N 11°14'22" E	148.48'
1273-1274	S 84°21'59" E	183.16'
1274-1275	S 81°56'59" E	135.82'
1275-1276	S 01°00'02" E	449.56'
1276-1277	S 05°42'20" E	345.01'
1277-1278	S 55°52'42" E	280.52'
1278-1279	S 32°00'19" E	188.68'
1279-1280	S 71°10'16" E	227.74'
1280-1281	S 71°14'09" E	828.48'

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1281-1282	S 42°28'45" E	443.08'
1282-1283	S 47°48'38" E	109.03'
1283-1284	S 28°04'21" E	340.00'
1284-1285	N 21°02'11" E	120.60'
1285-1286	S 58°09'40" E	102.08'
1286-1287	S 43°08'28" E	119.89'
1287-1288	S 48°54'07" E	382.19'
1288-1289	N 32°20'14" E	439.43'
1289-1290	S 81°50'28" E	87.30'
1290-1291	S 01°44'05" W	733.40'
1291-1292	S 44°09'58" E	304.15'
1292-1293	S 55°42'40" E	256.58'
1293-1294	S 83°54'59" E	218.06'
1294-1295	S 79°12'30" E	287.55'
1295-1296	S 80°43'08" E	139.76'
1296-1297	S 40°52'00" E	362.96'
	TRACT 173	
1297-1298	S 40°52'00" E	80.96'
1298-1299	N 64°12'37" E	193.35'
1299-1300	N 86°03'26" E	117.95'
1300-1301	N 20°44'39" E	269.60'
1301-1302	N 71°13'40" E	148.26'
1302-1303	N 66°10'09" E	180.01'
1303-1304	S 82°15'54" E	106.84'
1304-1305	S 29°47'53" W	263.99'
1305-1306	S 11°24'02" E	213.44'
1306-1307	N 79°59'31" E	345.25'
1307-1308	N 00°09'00" W	175.58'
1308-1309	N 13°35'07" W	352.80'
1309-1310	N 80°12'39" E	133.69'
1310-1311	N 08°30'48" W	178.67'
1311-1312	N 20°26'30" E	108.92'
1312-1313	N 33°41'24" W	144.22'
1313-1314	N 10°56'37" W	217.86'
1314-1315	S 56°24'20" E	169.71'
1315-1316	S 29°44'42" E	161.25'
1316-1317	N 42°33'01" E	99.60'
1317-1318	N 74°53'09" E	178.84'
1318-1319	N 24°46'31" W	286.36'
1319-1320	N 01°20'10" W	201.16'
1320-1321	N 09°14'04" W	590.44'
1321-1322	N 02°48'35" E	396.59'
1322-1323	N 36°20'02" E	53.37'
1323-1324	N 69°26'34" E	22.06'
1324-1325	N 08°22'03" E	12.90'
1325-1326	N 61°53'27" W	75.47'
1326-1327	N 27°41'13" W	71.28'
1327-1328	N 23°21'48" E	68.28'
1328-1329	N 08°48'22" W	75.38'
1329-1330	S 15°32'43" E	76.31'
1330-1331	S 20°13'48" W	76.38'
1331-1332	S 32°16'39" E	61.96'
1332-1333	S 70°53'24" E	66.55'
1333-1334	S 14°49'33" E	21.28'
1334-1335	S 31°54'52" W	34.43'
1335-1336	S 06°36'17" E	102.73'
1336-1337	S 40°22'00" E	63.21'
1337-1338	S 08°14'49" W	142.92'
1338-1339	S 41°52'41" E	327.20'
1339-1340	S 51°01'40" E	182.75'
1340-1341	S 03°48'51" E	300.67'
1341-1342	S 47°08'54" E	171.65'
1342-1343	S 18°22'30" E	235.26'
1343-1344	S 60°56'55" E	300.09'
1344-1345	S 50°56'49" E	217.78'
1345-1346	S 63°40'32" E	94.28'
1346-1347	S 63°40'28" E	19.80'
1347-1348	N 38°15'24" E	77.99'

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	TRACT 174	
1348-1349	N 38°15'24" E	7.87'
	TRACT 173	
1349-1350	N 38°15'24" E	23.14'
1350-1351	S 00°26'54" W	9.42'
	TRACT 174	
1351-1352	S 00°26'54" W	142.65'
1352-1353	EAST	120.00'
1353-1354	N 57°31'44" E	260.77'
1354-1355	N 71°33'54" E	189.74'
1355-1356	N 63°26'06" E	134.16'
1356-1357	S 45°00'00" E	226.27'
1357-1358	NORTH	420.00'
1358-1359	EAST	120.00'
1359-1360	S 23°11'55" E	456.95'
1360-1361	S 23°11'55" W	152.32'
1361-1362	S 57°59'41" E	188.68'
1362-1363	S 45°00'00" E	226.27'
1363-1364	S 60°15'18" E	161.25'
1364-1365	S 18°26'06" E	126.49'
1365-1366	S 14°02'11" W	164.92'

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PT-PT	BEARING	DISTANCE
1366-1367	S 51°20'25" W	128.06'
1367-1368	N 83°39'35" E	181.11'
1368-1369	N 74°38'35" E	251.48'
1369-1370	N 57°25'36" E	210.63'
1370-1371	N 15°56'43" E	145.60'
1371-1372	NORTH	540.00'
1372-1373	N 05°42'38" W	402.00'
1373-1374	NORTH	160.00'
1374-1375	N 66°50'19" E	82.93'
1375-1376	S 78°48'09" E	64.99'
1376-1377	S 09°59'55" E	314.48'
1377-1378	S 02°48'00" E	136.13'
1378-1379	S 21°13'12" E	272.83'
1379-1380	S 02°51'45" E	400.50'
1380-1381	S 22°04'59" E	446.66'
1381-1382	S 63°00'52" E	327.90'
1382-1383	N 57°06'45" E	427.57'
1383-1384	N 61°04'26" E	133.85'
1384-1385	S 87°13'55" E	269.18'
1385-1386	N 17°39'36" W	393.05'
1386-1387	N 74°11'14" E	101.40'
1387-1388	S 52°22'00" E	262.07'
1388-1389	N 11°11'41" E	304.06'
1389-1390	N 71°51'23" E	59.06'
1390-1391	N 81°43'15" E	506.20'
1391-1392	N 52°40'22" E	242.56'

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1392-1393	N 70°37'11" E	453.51'
1393-1394	N 40°07'03" E	191.99'
1394-1395	S 50°04'28" E	89.30'
1395-1396	S 03°21'59" E	340.59'
1396-1397	N 75°57'50" E	164.92'
1397-1398	N 18°26'06" E	126.49'
1398-1399	N 51°20'25" E	128.06'
1399-1400	N 34°41'43" E	316.23'
1400-1401	N 10°37'11" W	325.58'
1401-1402	N 07°50'15" W	618.94'
1402-1403	S 37°31'05" E	382.30'
1403-1404	S 24°52'48" E	407.73'
1404-1405	N 51°20'25" E	256.13'
1405-1406	N 34°41'43" E	316.23'
1406-1407	N 02°02'00" W	403.88'
1407-1408	N 24°56'25" E	39.27'
1408-1409	S 80°43'18" E	35.71'
	TRACT 175	
1409-1410	S 80°43'18" E	83.62'
1410-1411	N 32°28'16" E	260.77'
1411-1412	N 21°48'05" E	323.11'
1412-1413	N 20°51'16" W	449.44'

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1413-1414	N 37°52'30" W	228.04'
1414-1415	N 50°11'40" W	156.21'
1415-1416	S 66°25'54" W	95.81'
1416-1417	N 33°40'36" W	94.10'
1417-1418	NORTH	200.00'
1418-1419	N 30°15'23" W	277.85'
1419-1420	N 26°33'54" W	268.33'
1420-1421	N 77°28'16" W	184.39'
1421-1422	N 60°15'18" W	161.25'
1422-1423	N 51°00'32" ?	540.37'
1423-1424	S 33°41'24" W	216.33'
1424-1425	S 38°18'26" W	171.52'
1425-1426	N 27°04'36" W	154.22'

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1426-1427	S 54°53'07" W	74.96'
1427-1428	N 21°21'50" W	77.52'
	TRACT 245	
1428-1429	N 21°21'51" W	118.03'
1429-1430	N 04°30'56" W	138.70'
1430-1431	N 33°41'24" E	188.70'
	TRACT 246	
1431-1432	N 33°41'24" E	27.63'
1432-1433	NORTH	120.00'

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PT-PT	BEARING	DISTANCE
1433-1434	N 50°31'39" W	440.45'
1434-1435	N 52°07'30" W	228.04'
1435-1436	N 74°03'17" W	254.58'
1436-1437	S 63°24'33" W	280.09'
1437-1438	S 29°03'17" W	50.98'

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PT-PT	BEARING	DISTANCE
1438-1439	S 04°56'51" E	346.34'
1439-1440	S 21°03'55" E	242.27'
1440-1441	N 70°15'15" W	99.81'
1441-1442	N 40°05'23" W	284.18'
1442-1443	N 74°57'17" W	137.45'
1443-1444	S 78°22'52" W	126.56'
1444-1445	S 70°23'52" W	72.49'
1445-1446	S 13°58'50" W	144.91'
1446-1447	N 14°04'44" W	55.42'
1447-1448	N 12°59'37" W	95.18'
1448-1449	N 23°18'53" E	114.79'

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	TRACT 176	
1449-1450	N 02°25'49" E	223.04'
1450-1451	N 36°52'12" E	200.00'
1451-1452	N 07°07'30" W	161.25'
1452-1453	S 78°41'24" W	407.92'
1453-1454	N 60°56'43" W	205.91'
1454-1455	S 55°54'24" W	86.67'
1455-1456	S 09°13'17" E	115.82'
1456-1457	N 65°42'33" W	46.53'

NOTES:
THIS EXHIBIT DRAWING WAS ORIGINALLY ISSUED AND SIGNED BY W. E. MOORE, MANAGER-HYDRO & ENVIRONMENTAL ENGINEERING AND G. C. MEETZE, EXECUTIVE VICE-PRESIDENT AS PART OF THE APPLICATION FOR AMENDMENT OF LICENSE MADE ON JUNE 26, 1981.

I, BRIAN B. BONDS, A PROFESSIONAL LAND SURVEYOR IN THE STATE OF SOUTH CAROLINA, P.L.S. 28582, HAVE REPRODUCED THIS PORTION OF THE PARR HYDRO PROJECT 1894 PROJECT BOUNDARY SHOWN HEREIN. THE LICENSEE EITHER OWNS IN FEE SIMPLE OR POSSESSES EASEMENTS OVER THE LANDS SHOWN ON THE MAP THAT ARE INSIDE THE PROJECT BOUNDARY. THE PROJECT BOUNDARY LINES THAT ARE NOT CONTOUR LINES WERE BASED ON SCE&G DESIGN AND CONSTRUCTION DRAWINGS.

PROPERTY LINES DEPICTED ON THIS EXHIBIT DERIVED FROM DEEDS AND PLATS OF RECORD. NO ACTUAL FIELD SURVEY WAS CONDUCTED FOR PREPARING THIS MAP. THIS EXHIBIT IS NOT A PROPERTY BOUNDARY SURVEY. ALL PROPERTY LINE LOCATIONS SUBJECT TO FULL BOUNDARY SURVEY OF THE DEPICTED PARCEL.

DETAIL MAP OF PROJECT AREA

SHEET 18 OF 20
PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

PROJECT BOUNDARY LINE DESCRIPTION

PREPARED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

BRIAN B. BONDS ; S.C.P.L.S. # 28582

SURVEYORS SEAL | SURVEYORS SEAL | C.O.A. SEAL

SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR 28582 BRIAN B. BONDS

SOUTH CAROLINA GLENN ASSOCIATES SURVEYING INC. No.C02238 CERTIFICATE OF AUTHORIZATION

REVISION SCHEDULE

NO.	DATE	DESCRIPTION	CHECKED
1	9/17/12	REVISED PER FERC ORDER 137 FERC ¶ 62,033	BBB
2	5/7/13	REVISED PER FERC ORDER 143 FERC ¶ 62,095	BBB

K-6

PT-PT	BEARING	DISTANCE
1457–1458	S 07°37'28" W	597.12'
1458–1459	S 31°31'51" W	121.02'
1459–1460	N 43°45'39" W	46.46'
1460–1461	N 07°37'45" W	288.35'
1461–1462	N 69°13'51" W	52.79'

K-9

PT-PT	BEARING	DISTANCE
1462–1463	N 00°40'37" E	153.03'
1463–1463A	N 17°27'25" W	203.28'
TRACT 177		
1463A–1464	N 17°10'45" W	47.00'
1464–1465	N 24°45'44" W	238.74'
1465–1466	S 63°45'21" W	184.68'
1466–1467	S 85°06'32" W	129.14'
1467–1468	S 69°50'19" W	67.61'
1468–1469	N 85°06'39" W	190.82'
1469–1470	S 54°42'42" W	120.40'
1470–1471	S 61°22'28" W	50.90'
1471–1472	S 75°21'54" W	202.76'
1472–1473	S 64°09'08" W	110.00'
1473–1474	S 41°34'45" E	48.66'
1474–1475	N 70°38'03" W	41.01'
1475–1476	S 57°09'38" W	89.33'
1476–1477	N 69°50'15" W	29.97'
1477–1478	S 55°06'52" W	120.32'
1478–1479	S 82°03'02" W	127.85'
1479–1480	N 70°04'55" E	101.10'
1480–1481	N 47°56'50" E	142.42'
1481–1482	N 48°09'24" W	47.08'
1482–1483	N 77°12'23" E	110.53'
1483–1484	N 61°35'17" E	128.58'
1484–1485	N 53°24'35" E	94.15'
1485–1486	N 52°27'04" E	99.48'
1486–1487	N 39°05'33" E	418.76'
1487–1488	N 74°14'50" W	340.21'
1488–1489	N 89°50'40" W	242.70'
1489–1490	N 23°33'44" W	207.96'
1490–1491	N 56°18'36" W	188.44'
1491–1492	N 40°06'48" W	431.57'
1492–1493	N 80°30'47" W	169.51'
1493–1494	N 35°57'33" W	431.68'
1494–1495	N 33°51'28" W	118.56'
1495–1496	N 31°28'30" W	79.73'
1496–1497	N 05°52'18" W	69.98'
1497–1498	N 86°08'55" E	102.25'
1498–1499	S 33°26'14" E	219.48'
1499–1500	S 63°13'21" E	335.60'
1500–1501	S 65°23'15" E	129.74'
1501–1502	S 55°32'52" E	90.56'
1502–1503	S 45°32'34" E	172.99'
1503–1504	S 65°22'53" E	352.82'
1504–1505	S 70°45'16" E	458.47'
1505–1506	N 76°45'46" E	124.61'
1506–1507	N 19°58'59" W	234.09'
1507–1508	N 08°07'48" E	282.84'
1508–1509	N 39°19'29" W	296.86'
1509–1510	N 11°58'12" W	56.29'
1510–1511	N 11°58'11" W	97.42'
1511–1512	N 71°33'54" W	316.23'
1512–1513	N 47°31'48" W	301.02'
1513–1514	N 26°54'09" W	46.26'
1514–1515	N 71°52'02" E	40.55'
1515–1516	S 74°01'42" E	125.21'
1516–1517	S 71°17'11" E	246.87'
TRACT 237		
1517–1518	S 71°17'11" E	10.82'
1518–1519	N 72°53'56" E	99.09'
1519–1520	S 80°00'11" E	167.84'
1520–1521	N 03°58'18" E	181.89'
1521–1522	N 02°40'23" E	158.72'
1522–1523	N 19°39'14" W	14.47'
TRACT 234		
1523–1524	N 19°39'14" W	282.85'
1524–1525	N 29°21'28" W	164.53'
TRACT 235		
1525–1526	N 29°21'28" W	202.62'
1526–1527	N 46°48'07" W	334.34'
TRACT 236		
1527–1528	N 46°48'07" W	9.08'
1528–1529	N 75°10'09" W	175.50'
1529–1530	N 30°03'44" W	103.30'
TRACT 244		
1530–1531	N 30°19'53" W	171.50'
TRACT 178		
1531–1532	N 30°19'55" W	204.04'
1532–1533	N 28°39'13" W	622.72'
1533–1534	N 19°40'15" W	249.12'
1534–1535	S 63°00'48" W	172.00'
1535–1536	S 21°52'56" W	168.69'
1536–1537	S 45°09'56" W	360.12'
1537–1538	S 02°22'37" W	49.43'
1538–1539	S 58°05'16" W	411.61'
1539–1540	N 02°11'56" W	69.14'
1540–1541	N 31°05'17" E	434.14'
1541–1542	N 32°44'07" E	332.87'
1542–1543	N 17°21'15" E	335.26'
1543–1544	N 00°12'00" W	221.81'
1544–1545	N 53°58'07" W	298.25'

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PT-PT	BEARING	DISTANCE
TRACT 179		
1545–1546	S 00°23'30" E	49.76'
1546–1547	S 34°39'22" E	244.79'
1547–1548	S 53°35'39" W	926.92'
1548–1549	S 66°07'57" W	868.51'

K-9

PT-PT	BEARING	DISTANCE
1549–1550	N 29°20'35" W	793.69'
1550–1551	N 32°06'38" W	297.80'
1551–1552	N 39°03'25" W	277.37'
1552–1553	N 41°38'29" W	629.64'
TRACT 180		
1553–1553A	N 41°44'14" W	251.94'
1553A–1554	N 41°58'53" W	255.54'
1554–1555	N 41°22'59" W	277.09'
1555–1556	N 41°24'38" W	287.30'
1556–1557	S 59°10'42" W	131.97'
1557–1558	S 10°39'24" W	134.61'
1558–1559	S 01°28'55" E	161.43'
1559–1560	S 10°08'06" W	144.37'
1560–1561	N 89°32'37" E	80.70'
1561–1562	S 23°21'42" E	260.41'
1562–1563	S 07°15'28" W	81.64'
1563–1564	S 22°39'47" E	109.86'
1564–1565	S 42°23'11" E	109.51'
1565–1566	N 81°17'14" W	195.77'
1566–1567	N 66°41'12" W	48.33'
1567–1568	N 21°39'22" W	82.82'
1568–1569	N 27°57'34" W	98.75'
1569–1570	N 71°51'31" W	132.76'
1570–1571	S 55°58'22" W	107.73'
1571–1572	S 27°01'23" W	172.82'
1572–1573	S 46°48'22" W	61.90'
1573–1574	S 49°26'45" W	42.53'
1574–1575	N 05°15'03" E	88.03'
1575–1576	N 17°31'33" E	161.66'
1576–1577	N 68°11'02" W	146.82'
1577–1578	N 22°30'11" E	179.18'
1578–1579	N 05°32'35" E	235.65'
1579–1580	N 74°41'01" W	115.27'
1580–1581	N 40°09'43" W	188.16'
1581–1582	N 72°39'52" W	286.07'
1582–1583	N 67°22'49" W	260.00'
1583–1584	S 57°21'10" W	235.94'
1584–1585	S 12°40'29" W	279.53'
1585–1586	S 32°15'34" W	159.46'

K-12

PT-PT	BEARING	DISTANCE
1586–1587	S 31°56'28" W	140.10'
1587–1588	S 19°39'57" W	193.08'
1588–1589	S 44°32'51" W	256.32'
1589–1590	S 11°24'22" W	263.14'
1590–1591	S 10°35'37" E	171.33'
1591–1592	S 07°35'30" E	42.54'
1592–1593	S 19°24'25" W	89.86'
TRACT 250		
1593–1594	S 19°24'13" W	40.56'
1594–1595	S 17°15'06" W	212.37'
1595–1596	S 12°42'25" W	59.52'
1596–1597	N 29°58'55" W	106.26'
TRACT 253		
1597–1598	N 29°58'54" W	81.99'
1598–1599	N 14°11'41" E	88.53'
TRACT 180		
1599–1601	N 39°51'28" E	138.43'
1601–1602	N 16°38'15" W	151.64'
TRACT 253		
1602–1603	N 11°16'15" W	208.70'
TRACT 180		
1603–1604	N 11°25'34" W	97.69'
1604–1605	N 39°56'21" W	128.90'
1605–1606	S 61°27'57" W	162.26'
1606–1607	N 12°38'32" W	52.67'
1607–1608	N 42°29'13" E	341.61'
1608–1609	N 12°48'16" E	121.37'
1609–1610	N 14°41'53" E	123.32'
1610–1611	N 17°07'00" E	159.53'
1611–1612	N 32°40'09" E	183.09'
1612–1613	N 21°18'44" E	236.65'
1613–1614	N 14°59'51" E	695.26'
1614–1615	N 06°06'03" E	124.18'
1615–1616	N 59°19'47" W	245.83'
1616–1617	N 29°34'10" W	212.69'
1617–1618	S 54°53'24" W	131.54'
1618–1619	N 42°50'23" E	166.70'
1619–1620	N 08°30'36" E	129.87'
1620–1621	N 57°09'10" W	293.19'
1621–1622	S 26°26'03" W	259.31'
1622–1623	S 22°07'40" W	113.51'
1623–1624	S 44°45'59" W	264.54'
1624–1625	N 21°47'17" E	117.40'
1625–1626	N 15°55'29" E	161.75'
1626–1627	N 23°05'48" W	349.61'
1627–1628	N 87°17'48" W	171.84'
1628–1629	N 82°44'34" W	48.01'

K-12

PT-PT	BEARING	DISTANCE
TRACT 181		
1629–1630	N 82°40'02" W	202.38'
1630–1631	S 73°18'03" W	417.61'
1631–1632	S 20°40'39" W	145.91'
1632–1633	S 47°13'30" W	45.48'
1633–1634	N 88°01'49" W	215.22'
1634–1635	N 30°36'12" W	160.21'
1635–1636	N 49°04'24" W	273.20'
1636–1637	S 56°52'54" W	137.22'
1637–1638	S 57°51'27" W	241.58'
1638–1639	S 04°49'59" E	151.65'
1639–1640	S 25°00'25" W	32.40'
TRACT 180		
1640–1641	S 25°00'23" W	89.15'
1641–1642	S 31°16'46" W	65.93'
1642–1643	N 11°45'43" E	63.33'
1643–1644	N 11°16'52" W	191.90'
1644–1645	S 40°33'40" W	23.58'
1645–1646	S 46°29'53" W	216.96'
1646–1647	S 18°59'52" E	76.48'
1647–1648	S 18°37'53" W	72.84'
1648–1649	S 34°44'07" W	65.55'
1649–1650	N 09°22'40" W	67.42'
1650–1651	N 15°14'22" E	117.52'
1651–1652	N 24°52'31" E	134.37'
1652–1653	N 00°32'39" W	204.51'
1653–1654	N 28°00'17" W	98.25'
TRACT 181		
1654–1655	N 28°00'18" W	23.56'
1655–1656	N 27°02'51" W	106.57'
1656–1657	N 09°57'35" W	80.18'
1657–1658	N 53°12'21" W	182.87'
1658–1659	N 30°04'50" E	103.57'
1659–1660	N 59°44'30" W	359.22'
1660–1661	N 83°28'44" W	113.18'
1661–1662	N 69°35'33" W	73.70'
1662–1663	N 64°52'04" W	107.57'
1663–1664	S 41°49'16" W	135.32'
TRACT 239		
1664–1665	S 41°49'17" W	44.07'
1665–1666	S 38°27'10" W	283.33'
1666–1667	S 59°32'58" W	231.15'
1667–1668	S 75°54'06" W	111.63'
1668–1669	S 70°33'18" W	110.84'

K-12

PT-PT	BEARING	DISTANCE
1669–1670	S 62°25'05" W	200.12'
1670–1671	S 51°39'59" W	126.11'
1671–1672	S 57°45'43" W	67.37'
1672–1673	N 18°40'43" W	9.97'
1673–1674	N 27°18'01" E	118.08'
1674–1675	S 63°05'57" W	347.58'
1675–1676	N 25°01'29" E	78.74'
1676–1677	N 43°32'03" E	112.87'
1677–1678	N 33°30'02" E	240.26'
1678–1679	N 34°06'11" E	62.16'
1679–1680	N 26°01'56" E	230.48'
1680–1681	N 47°02'35" E	144.24'
1681–1682	N 35°02'41" E	297.95'
1682–1683	N 63°51'42" E	183.77'
1683–1684	N 45°11'23" E	179.06'
1684–1685	N 72°00'55" E	162.59'
1685–1686	N 42°57'01" E	313.34'
TRACT 181		
1686–1687	N 42°57'02" E	60.44'
1687–1688	N 57°10'47" E	305.64'
1688–1689	N 16°23'22" W	354.40'
1689–1690	N 66°48'05" W	152.32'
1690–1691	N 19°30'01" W	230.68'
1691–1692	N 33°58'14" W	220.12'
1692–1693	N 26°33'54" W	223.61'
1693–1694	N 12°05'41" E	286.36'
1694–1695	N 52°02'09" W	253.70'
1695–1696	S 18°56'18" W	139.61'
1696–1697	S 30°09'41" W	145.50'
1697–1698	S 17°22'48" W	140.55'
1698–1699	S 40°49'44" W	173.90'
1699–1700	S 25°24'49" W	107.83'
1700–1701	S 33°49'20" W	112.77'
1701–1702	S 69°12'00" W	37.78'
1702–1703	N 48°19'12" W	72.39'
1703–1704	N 53°00'26" W	145.85'
1704–1705	S 75°16'15" W	78.71'
TRACT 239		
1705–1706	S 75°16'15" W	84.96'
1706–1707	S 84°02'02" W	93.42'
1707–1708	N 09°21'03" W	110.66'
1708–1709	N 74°22'08" W	175.38'
1709–1710	N 70°20'32" W	78.78'
1710–1711	N 00°36'25" W	56.83'
1711–1712	N 34°51'24" W	113.43'
1712–1713	N 63°45'32" W	108.73'
1713–1714	S 73°34'30" W	128.58'
1714–1715	S 42°50'37" W	48.60'
1715–1716	N 36°24'55" E	47.11'
1716–1717	N 22°41'44" E	37.18'
1717–1718	N 17°41'16" E	29.80'
1718–1719	N 01°19'42" E	134.68'
1719–1720	N 08°11'52" W	157.12'
1720–1721	N 58°09'36" W	147.80'
1721–1722	N 76°29'47" W	49.99'
1722–1723	N 69°54'23" W	57.31'
1723–1724	N 50°26'52" W	109.98'
1724–1725	N 51°42'43" W	194.75'
1725–1726	S 61°32'43" W	123.29'

K-12

PT-PT	BEARING	DISTANCE
TRACT 239		
1726–1727	N 78°42'44" W	124.83'
1727–1728	S 64°16'44" W	106.05'
1728–1729	N 50°22'33" W	157.23'
1729–1730	N 81°09'05" W	148.93'
1730–1731	N 61°56'08" W	81.19'
1731–1732	N 06°03'05" W	125.24'
1732–1733	N 35°58'17" E	90.01'
1733–1734	N 23°11'00" E	221.42'
1734–1735	N 52°10'36" W	187.48'
1735–1736	S 71°18'26" W	121.01'
1736–1737	N 46°23'24" W	39.70'
1737–1738	N 01°54'17" W	78.23'
1738–1739	N 08°32'43" W	15.51'
1739–1740	S 79°22'26" W	41.00'
1740–1741	S 27°30'55" W	69.68'
1741–1742	S 07°55'48" W	105.67'
1742–1743	S 23°19'46" E	178.81'
1743–1744	S 12°42'35" W	108.89'
1744–1745	S 59°47'10" W	142.50'
1745–1746	S 74°40'07" W	52.03'
TRACT 241		
1746–1747	S 74°40'08" W	142.79'
1747–1748	S 82°40'48" W	314.07'
1748–1749	N 82°22'18" W	115.41'
1749–1750	N 89°11'12" W	138.35'
1750–1751	S 78°08'38" W	68.99'
1751–1752	S 87°04'18" W	141.29'
1752–1753	S 53°08'45" W	18.69'
TRACT 249		
1753–1754	S 53°08'45" W	0.29'
1754–1755	N 82°53'14" W	78.88'
1755–1756	S 77°27'17" W	65.89'
1756–1757	S 08°57'30" W	156.69'
1757–1758	N 05°17'28" E	162.51'
1758–1759	S 86°27'59" W	83.90'
1759–1760	N 87°06'45" W	143.02'
1760–1761	N 52°31'57" W	214.34'
1761–1762	N 54°18'03" E	43.14'
1762–1763	S 49°58'53" E	133.19'
1763–1764	S 68°33'56" E	102.15'
1764–1765	S 89°02'57" E	125.94'
1765–1766	S 86°33'58" E	99.89'
1766–1767	N 73°30'10" E	60.51'
TRACT 241		
1767–1768	N 73°30'11" E	111.38'
1768–1769	N 79°39'17" E	66.24'
1769–1770	N 42°53'19" E	46.91'
1770–1771	N 69°01'39" E	113.77'
1771–1772	N 68°20'47" E	75.23'
1772–1773	N 59°47'17" E	76.58'
1773–1774	N 54°02'31" E	114.35'
1774–1775	N 51°49'26" E	147.45'
1775–1776	N 57°43'42" E	123.97'
1776–1777	N 06°57'20" E	27.62'
1777–1778	N 56°57'07" E	81.25'
1778–1779	N 27°23'48" E	60.61'
1779–1780	N 08°09'55" W	82.79'
1780–1781	N 19°27'13" W	129.37'
1781–1782	N 21°07'42" W	67.40'
1782–1783	S 83°16'14" W	99.30'
1783–1784	N 89°47'49" W	118.17'
1784–1785	N 71°19'32" W	122.50'
1785–1786	N 76°48'15" W	165.61'
1786–1787	N 58°52'49" W	131.30'
1787–1788	S 87°23'28" W	89.00'
1788–1789	N 79°05'45" W	165.26'
1789–1790	N 34°38'47" W	71.00'
TRACT 249		
1790–1791	N 34°38'48" W	92.12'
1791–1792	N 27°13'55" W	128.23'
1792–1793	N 23°32'29" W	266.56'

K-12

PT-PT	BEARING	DISTANCE
1793–1794	N 02°14'05" W	51.62'
1794–1795	N 52°25'47" W	32.80'
1795–1796	N 20°19'34" E	70.68'
TRACT 257		
1796–1797	N 20°19'19" E	5.07'
1797–1798	N 29°20'48" W	102.48'
1798–1799	N 33°15'10" W	88.84'
1799–1800	N 22°05'57" W	115.81'
1800–1801	N 18°42'46" E	157.85'
1801–1802	N 80°39'11" E	113.54'
1802–1803	N 58°07'30" E	75.38'
1803–1804	N 37°50'36" E	82.04'
1804–1805	N 45°55'32" W	92.49'
1805–1806	N 79°57'52" W	75.55'
1806–1807	N 70°58'06" W	144.88'
1807–1808	N 45°59'55" W	159.27'
1808–1809	N 09°15'57" W	151.28'
1809–1810	N 25°42'16" W	67.54'
TRACT 258		
1810–1811	N 25°42'16" W	167.38'
1811–1812	N 40°01'39" W	190.00'
1812–1813	N 48°04'59" W	149.21'
1813–1814	N 46°07'14" W	226.21'
1814–1815	N 13°15'16" W	229.12'
1815–1816	N 59°05'35" W	96.05'
1816–1817	N 73°04'50" W	128.62'
1817–1818	N 50°45'29" W	79.90'
1818–1819	S 59°36'19" W	125.55'
1819–1820	S 07°51'14" E	47.25'
1820–1821	S 31°37'31" W	87.51'
1821–1822	S 39°43'15" W	139.35'
1822–1823	S 64°16'43" W	110.95'
1823–1824	N 76°23'05" W	51.51'
1824–1825	N 69°54'32" W	61.72'
1825–1826	N 21°09'44" W	403.70'
1826–1827	N 32°34'32" W	123.45'
1827–1828	N 19°55'26" E	83.54'
1828–1836	N 30°34'33" E	33.63'
TRACT 259		
1836–1837	N 30°34'33" E	148.08'
1837–1838	N 30°07'04" E	115.83'

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PT-PT	BEARING	DISTANCE
1838–1839	N 28°07'07" E	116.32'
1839–1840	N 17°22'00" E	116.66'
1840–1841	N 02°31'06" E	128.29'
1841–1842	N 28°37'08" W	100.35'
1842–1843	N 26°14'55" E	151.33'
TRACT 240		
1843–1844	N 26°14'52" E	13.73'
1844–1845	N 31°24'06" E	793.40'
1845–1846	S 10°30'14" E	71.09'
1846–1847	S 48°56'56" E	146.48'
1847–1848	S 12°04'41" E	90.04'
1848–1849	S 14°46'53" E	166.77'
1849–1850	S 24°12'56" E	69.94'
TRACT 260		
1850–1851	S 57°41'41" E	103.44'
1851–1852	S 54°37'24" E	162.35'
1852–1853	S 20°53'24" E	168.15'
1853–1854	S 07°57'52" E	50.39'
1854–1855	S 07°31'13" E	109.99'
1855–1856	S 16°14'06" E	153.29'

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PT-PT	BEARING	DISTANCE
1856–1857	S 04°56'20" E	117.36'
1857–1858	S 22°00'14" W	103.09'
1858–1859	S 53°21'49" W	77.52'
1859–1860	S 62°04'50" W	112.68'
1860–1861	S 24°45'51" W	187.49'
1861–1862	N 85°05'16" E	133.42'
1862–1863	S 38°35'23" E	161.93'
1863–1864	S 07°45'40" E	161.24'
1864–1865	S 60°22'58" E	155.36'
1865–1866	S 47°47'04" E	141.31'
1866–1867	S 63°00'54" E	206.37'
TRACT 261		
1867–1868	S 63°36'04" E	35.01'
1868–1869	S 42°28'34" E	191.06'
1869–1870	S 84°55'46" E	93.41'
1870–1871	S 56°08'34" E	192.11'
1871–1872	S 80°47'43" E	96.75'
1872–1873	S 53°17'33" E	108.89'
1873–1874	S 16°13'34" E	85.76'
1874–1875	S 18°06'46" E	173.79'
1875–1876	S 27°18'59" E	148.72'
1876–1877	S 30°03'57" E	115.30'
1877–1878	S 13°34'04" W	164.53'
1878–1879	S 28°29'56" E	130.83'
1879–1880	N 72°42'38" E	142.04'
1880–1881	N 54°17'31" E	134.72'
1881–1882	N 67°31'44" E	192.26'
1882–1883	N 82°54'43" E	157.44'
1883–1884	N 72°27'16" E	106.30'
1884–1885	S 86°35'32" E	39.42'
TRACT 262		
1885–1886	S 85°45'12" E	182.47'
1886–1887	S 09°47'04" E	272.22'
1887–1888	S 15°09'02" W	147.35'
1888–1889	S 35°21'52" E	135.08'
1889–1890	N 65°19'08" E	240.63'
1890–1891	S 46°01'14" E	204.33'
TRACT 238		
1891–1892	S 79°48'37" E	167.46'
1892–1893	S 58°50'50" E	122.20'
1893–1894	N 85°50'09" E	169.99'
1894–1895	S 82°44'47" E	142.31'
1895–1896	S 66°36'13" E	134.97'
1896–1897	S 73°56'32" E	179.69'
1897–1898	S 42°29'39" W	179.62'
1898–1899	S 54°46'09" E	168.99'
1899–1900	S 44°15'25" W	153.67'
1900–1901	S 13°00'49" W	112.61'
1901–1902	S 22°14'18" W	110.92'
1902–1903	S 14°34'02" E	123.90'
1903–1904	N 69°28'09" W	114.25'
1904–1905	N 57°14'36" W	143.17'
1905–1906	N 52°01'28" W	139.09'
1906–1907	S 54°50'49" W	141.09'
1907–1908	S 15°58'09" W	146.38'
1908–1909	S 23°59'10" E	49.81'
1909–1910	S 27°15'14" E	106.00'
1910–1911	S 68°22'47" E	124.06'
1911–1912	S 81°20'01" E	141.33'
1912–1913	N 49°43'48" E	154.92'
1913–1914	S 88°23'15" E	125.47'
1914–1915	N 33°56'59" E	93.63'
1915–1916	N 18°49'39" E	147.19'
1916–1917	N 43°27'42" E	228.78'
1917–1918	S 78°07'23" E	123.69'
1918–1919	S 55°11'25" E	112.92'
1919–1920	S 82°37'37" E	308.92'
1920–1921	S 61°21'23" E	243.31'

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PT-PT	BEARING	DISTANCE
TRACT 181		
1921–1922	S 61°21'21" E	79.34'
1922–1923	S 89°28'26" E	199.36'
1923–1924	S 28°28'03" E	134.21'
1924–1925	N 84°06'57" E	276.17'
1925–1926	N 85°55'32" E	202.45'
1926–1927	N 80°30'22" E	96.32'
1927–1928	N 45°33'23" E	177.55'
1928–1929	N 26°41'25" E	106.01'
1929–1930	N 43°30'37" E	98.79'
1930–1931	N 05°19'04" E	98.58'
TRACT 238		
1931–1932	N 05°19'03" E	67.54'
1932–1933	S 74°59'48" E	51.96'
1933–1934	S 28°49'22" E	114.80'
1934–1935	S 22°35'31" E	103.20'
TRACT 181		
1935–1936	S 22°35'34" E	58.95'
1936–1937	S 08°50'05" W	106.44'
1937–1938	S 23°35'58" W	102.25'
1938–1939	S 09°59'11" W	138.04'
1939–1940	S 07°13'04" W	238.07'
1940–1941	S 08°59'00" W	113.00'
1941–1942	S 17°58'33" W	170.65'
1942–1943	S 21°02'33" W	103.08'
1943–1944	S 15°09'36" E	304.59'
1944–1945	S 27°11'41" E	118.20'
1945–1946	S 35°36'16" W	144.30'
1946–1947	S 21°07'47" E	188.55'
1947–1948	S 42°12'13" E	159.74'
1948–1949	S 45°45'16" E	147.72'
1949–1950	S 50°28'02" E	196.00'
1950–1951	S 71°10'32" E	230.66'
1951–1952	S 41°21'53" E	89.11'
1952–1953	N 78°04'30" E	139.36'
1953–1954	S 62°48'20" E	119.83'
1954–1955	N 79°30'33" E	165.00'
1955–1956	N 76°23'34" E	143.80'
1956–1957	N 81°16'56" E	109.65'
1957–1958	S 69°54'33" E	110.34'
1958–1959	S 78°20'54" E	168.51'
1959–1960	S 38°43'27" E	36.51'
1960–1961	S 10°08'09" E	223.86'
1961–1962	S 32°12'46" E	190.01'
1962–1963	S 88°06'41" E	288.28'
1963–1964	S 71°24'12" E	236.81'
1964–1965	N 71°18'18" E	255.56'
1965–1966	S 59°04'03" E	91.56'
1966–1967	N 51°09'55" E	139.11'
1967–1968	S 56°26'40" E	94.31'
1968–1969	S 36°57'12" E	120.08'
1969–1970	S 47°11'07" E	197.16'
1970–1971	S 04°42'32" W	95.85'
TRACT 182		
1971–1972	S 04°48'00" W	144.98'
1972–1973	S 29°44'42" W	161.25'
1973–1974	S 55°19'52" E	90.43'
TRACT 231		
1974–1975	S 66°28'50" E	71.58'
1975–1976	S 73°30'56" E	92.41'
TRACT 182		
1976–1977	S 56°01'58" E	23.11'

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PT-PT	BEARING	DISTANCE
1977–1978	S 49°53'26" E	185.21'
1978–1979	S 43°40'17" E	194.87'
1979–1980	S 83°19'30" E	177.22'
1980–1981	S 50°25'21" E	233.83'
1981–1982	S 04°49'42" E	101.46'
1982–1983	S 76°02'27" E	184.14'
1983–1984	N 34°12'58" E	82.64'
1984–1985	N 19°07'32" E	78.06'
1985–1986	N 24°47'20" E	156.51'
1986–1987	N 18°43'34" W	122.90'
1987–1988	N 20°46'21" W	94.58'
1988–1991	N 68°26'17" E	78.20'
1991–1992	S 16°48'15" E	75.17'
1992–1993	S 73°27'58" E	314.92'
1993–1994	S 71°57'39" E	172.74'
1994–1995	N 26°53'59" E	211.69'
1995–1996	N 05°43'47" W	120.56'
1996–1997	N 35°06'03" E	93.13'
1997–1998	N 35°52'43" E	43.54'
1998–1999	S 11°20'41" E	102.20'
1999–2000	S 14°32'49" E	67.42'
2000–2001	S 03°15'47" E	170.59'
2001–2002	S 38°09'24" W	59.68'
2002–2003	S 01°06'06" W	194.10'
2003–2004	S 40°43'08" E	151.81'
2004–2005	N 53°45'27" E	73.48'
2005–2006	N 84°03'48" E	179.70'
2006–2007	N 26°46'25" E	135.99'
2007–2008	NORTH	110.00'
2008–2009	N 05°18'39" W	147.59'
2009–2010	N 41°38'38" W	200.74'
2010–2011	N 21°50'12" W	123.00'
2011–2012	N 76°33'26" E	123.18'
2012–2012A	N 39°49'53" E	44.07'
2012A–2012B	S 59°04'08" E	293.94'
2012B–2012C	S 11°55'23" W	49.15'
2012C–2012D	S 14°51'09" E	178.73'
2012D–2012E	S 51°17'26" E	164.96'
2012E–2012F	S 48°25'38" E	140.69'
2012F–2012G	S 23°05'53" E	90.32'
2012G–2012H	S 50°02'09" E	85.95'
2012H–2012I	N 33°50'32" E	47.61'
2012I–2012J	N 13°30'38" W	100.16'
2012J–2012K	N 22°12'11" W	125.61'
2012K–2012L	N 36°48'00" W	98.30'
2012L–2012M	N 43°18'55" W	83.87'
2012M–2012N	N 38°59'07" W	80.35'
2012N–2012O	N 03°52'33" E	78.73'
2012O–2012P	N 06°25'45" W	109.83'
2012P–2012Q	N 69°22'52" W	40.04'
2012Q–2012R	S 55°06'54" W	120.32'
2012R–2012S	N 57°47'49" W	153.49'
2012S–2013	N 62°14'36" W	132.88'
2013–2014	N 29°58'04" E	36.82'
2014–2015	N 32°41'40" E	374.78'
2015–2016	N 08°19'34" E	84.60'
2016–2017	N 34°24'22" W	106.19'
TRACT 183		
2017–2018	N 34°24'22" W	191.51'
2018–2019	N 09°06'05" E	47.98'
2019–2020	N 51°21'00" E	96.11'
2020–2021	N 53°09'35" E	145.11'
2021–2022	N 23°11'55" E	152.32'
2022–2023	N 19°58'59" E	234.09'
2023–2024	N 04°05'08" E	280.71'
2024–2025	N 15°56'43" E	145.60'
2025–2026	N 18°26'06" W	126.49'
2026–2027	N 06°46'33" E	169.16'

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PT-PT	BEARING	DISTANCE
2027–2028	N 24°25'35" W	145.00'
2028–2029	N 21°48'05" W	215.41'
2029–2030	N 82°29'13" W	200.18'
2030–2031	S 87°38'10" W	177.60'
2031–2032	N 88°43'39" W	109.97'
2032–2033	S 68°52'21" W	88.37'
2033–2034	S 74°40'45" W	64.40'
2034–2035	S 68°37'07" W	101.79'
2035–2036	N 31°55'20" E	74.02'
2036–2037	N 45°37'07" E	84.35'
2037–2038	N 43°33'43" E	110.88'
2038–2039	N 46°55'21" E	215.28'
2039–2040	N 01°20'35" W	260.47'
2040–2041	N 29°18'50" W	175.78'
2041–2042	N 02°04'30" W	151.03'
2042–2043	N 13°24'32" W	111.10'
TRACT 184		
2043–2044	N 07°03'47" W	79.03'
2044–2045	N 06°54'41" W	173.82'
2045–2046	N 21°58'19" W	357.81'
2046–2047	N 06°10'50" W	199.92'
2047–2048	N 08°49'01" W	181.28'
2048–2049	N 00°57'17" W	134.26'
TRACT 185		
2049–2050	N 43°44'45" W	128.85'
2050–2051	N 31°18'13" W	298.19'
2051–2052	N 56°32'12" W	308.47'
2052–2053	N 19°13'35" E	119.44'
2053–2054	N 64°39'30" E	122.20'
2054–2055	N 63°03'37" E	143.09'
2055–2056	N 33°41'29" E	134.04'
2056–2057	N 46°47'03" W	90.00'
2057–2058	N 32°50'09" E	118.37'
2058–2059	N 30°34'02" E	171.17'
2059–2060	N 18°26'06" W	189.74'
2060–2060A	N 55°40'39" W	144.54'
2060A–2061	N 55°40'39" W	8.87'
2061–2062	N 37°54'58" W	85.31'
2062–2062A	N 21°03'09" W	112.84'
2062A–2063	N 21°03'09" W	0.85'
2063–2064	N 30°57'50" E	116.62'
2064–2065	N 60°15'18" E	161.25'

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PT-PT	BEARING	DISTANCE
2065–2066	N 03°29'42" W	255.14'
2066–2067	N 30°59'31" E	265.12'
2067–2068	N 10°42'22" E	425.47'
2068–2069	N 03°21'59" W	340.59'
2069–2070	N 15°15'18" E	456.07'
2070–2071	N 10°18'17" W	223.61'
2071–2072	WEST	200.00'
2072–2073	S 40°54'52" W	396.99'
2073–2074	S 78°41'24" W	203.96'
2074–2075	S 56°18'36" W	288.44'
2075–2076	S 81°50'18" W	255.06'
2076–2077	N 69°21'13" W	18.64'
TRACT 186		
2077–2078	N 69°21'13" W	46.11'
2078–2079	N 32°04'49" W	64.74'
2079–2080	N 00°39'22" W	64.55'
2080–2081	N 80°54'32" E	142.13'
2081–2082	N 43°01'09" E	60.39'
2082–2083	N 44°51'25" E	207.90'
2083–2084	N 26°33'54" E	134.16'
2084–2085	N 59°02'11" E	233.24'
2085–2086	N 52°35'41" E	428.02'
2086–2087	N 75°57'50" E	247.39'
2087–2088	N 42°30'38" W	325.58'
2088–2089	S 79°59'31" W	345.25'
2089–2090	S 74°44'42" W	228.04'
2090–2091	N 83°00'20" W	181.69'
2091–2092	N 18°49'10" W	55.18'
2092–2093	N 36°45'13" E	431.40'
2093–2094	N 55°00'29" E	244.13'
2094–2095	N 24°46'31" W	286.36'
2095–2096	S 80°32'16" W	121.66'
2096–2097	N 08°44'46" W	263.06'
2097–2098	N 27°05'13" W	268.36'
2098–2099	N 11°26'54" W	78.59'
2099–2100	S 79°41'51" E	201.04'
2100–2101	N 11°18'36" W	509.90'
2101–2102	N 19°39'14" W	297.32'
2102–2103	N 18°26'06" E	252.98'
2103–2104	N 03°00'46" W	380.53'
2104–2105	N 26°33'54" W	178.89'
2105–2106	N 01°28'25" W	105.96'
2106–2107	N 13°44'57" W	240.98'
2107–2108	N 02°02'44" W	560.36'
2108–2109	N 10°37'11" W	325.58'
2109–2110	SOUTH	220.00'
2110–2111	S 28°04'21" W	340.00'
2111–2112	S 40°36'05" W	184.39'

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PT-PT	BEARING	DISTANCE
2112–2113	WEST	400.00'
2113–2114	N 82°38'25" W	252.58'
2114–2115	N 50°28'57" E	169.17'
2115–2116	N 56°18'36" E	216.33'

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PT-PT	BEARING	DISTANCE
2116–2117	N 45°00'00" E	254.56'
2117–2118	N 26°33'54" E	223.61'
2118–2119	N 12°05'41" E	128.26'
TRACT 187		
2119–2120	N 18°44'04" E	289.95'
2120–2121	N 23°11'55" E	304.63'
2121–2122	N 51°20'25" W	256.13'

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PT-PT	BEARING	DISTANCE
2122–2123	WEST	260.00'
2123–2124	S 71°33'54" W	379.47'
2124–2125	S 28°36'38" W	250.60'
2125–2126	S 75°57'50" W	164.92'
2126–2127	N 18°26'06" W	126.49'
2127–2128	N 17°21'15" E	335.26'
2128–2129	N 38°39'35" E	256.13'
2129–2130	N 47°45'55" W	358.95'
2130–2131	N 42°03'49" W	96.07'
2131–2132	N 26°19'47" W	833.92'
2132–2133	N 60°15'18" W	161.25'
2133–2134	S 70°01'01" W	234.09'
2134–2135	S 51°20'25" W	512.25'
2135–2136	S 70°46'23" W	219.91'
2136–2137	S 56°26'23" W	54.90'
2137–2138	S 63°35'52" W	91.97'
2138–2139	S 83°19'50" W	177.14'
TRACT 188		
2139–2140	S 83°19'50" W	58.52'
2140–2141	S 77°16'18" W	93.12'
2141–2142	N 71°26'18" W	126.75'
2142–2143	N 47°40'54" E	379.49'
2143–2144	N 49°02'17" E	177.09'
2144–2145	N 26°07'01" E	256.36'
2145–2146	N 30°15'23" E	277.85'
2146–2147	N 47°43'35" E	297.32'

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PT-PT	BEARING	DISTANCE
2147–2148	N 25°27'52" W	143.68'
2148–2149	N 45°29'17" W	142.81'
2149–2150	N 68°22'11" E	187.91'
2150–2151	N 64°43'15" E	142.59'
2151–2152	S 80°32'16" E	121.66'
2152–2153	N 34°59'31" E	244.13'
2153–2154	NORTH	380.00'
2154–2155	N 20°33'22" W	341.76'
2155–2156	N 14°58'52" E	242.35'
2156–2157	N 12°55'17" W	190.72'
2157–2158	N 20°45'37" W	283.05'
2158–2159	N 09°49'34" E	196.21'
2159–2160	N 12°34'41" E	98.85'
2160–2161	N 06°01'08" W	146.32'
2161–2162	N 26°33'54" W	223.61'
2162–2163	N 71°41'49" W	320.79'
2163–2164	S 58°29'05" W	88.78'
2164–2165	N 32°07'26" W	32.22'
2165–2166	N 46°34'36" E	133.96'
2166–2167	N 00°01'28" E	186.30'
2167–2168	N 23°11'55" W	304.63'
2168–2169	N 65°13'30" W	286.36'
2169–2170	N 49°23'55" W	184.39'
2170–2171	N 45°00'00" W	226.27'
2171–2172	S 36°52'12" W	200.00'
2172–2173	S 63°40'53" W	134.74'
2173–2174	S 33°52'48" W	123.82'
2174–2175	S 35°07'36" W	14.10'
2175–2176	S 65°30'06" W	55.53'
2176–2177	N 36°57'46" E	45.55'
2177–2178	N 25°50'21" E	68.86'
TRACT 189		
2178–2179	N 25°50'21" E	45.45'
2179–2180	N 02°18'21" W	217.99'
2180–2181	N 09°27'44" E	121.66'
2181–2182	N 50°11'40" E	156.21'
2182–2183	N 28°08'34" W	175.90'
2183–2184	N 43°08'18" W	171.16'
2184–2185	N 14°02'11" W	247.39'
2185–2186	N 38°44'19" W	445.42'
2186–2187	N 70°12'32" W	213.96'
2187–2188	N 17°06'10" W	272.03'
2188–2189	N 10°00'29" W	289.79'

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PT-PT	BEARING	DISTANCE
TRACT 190		
2189–2190	N 03°50'01" E	154.97'
2190–2191	N 45°00'00" E	254.56'
2191–2192	N 41°59'14" W	269.07'
2192–2193	N 63°26'06" W	89.44'
2193–2194	SOUTH	260.00'
2194–2195	S 45°00'00" W	141.42'
2195–2196	S 70°01'01" W	234.09'
2196–2197	N 56°18'36" W	288.44'
2197–2198	S 63°57'15" W	170.57'
2198–2199	S 21°33'47" E	62.50'
2199–2200	S 10°15'33" W	89.49'
2200–2201	S 12°05'11" W	182.36'
2201–2202	S 15°26'06" W	51.51'
2202–2203	N 33°32'04" W	68.37'
2203–2204	N 08°17'15" E	66.41'
2204–2205	N 21°34'29" E	40.24'
2205–2206	N 16°11'33" E	159.01'
2206–2207	N 49°02'29" W	142.41'
2207–2208	N 84°17'10" W	195.33'
2208–2209	N 49°40'39" W	195.34'
2209–2210	N 58°59'31" W	102.84'
2210–2211	N 44°44'49" W	108.27'
2211–2212	N 52°12'31" W	55.91'
2212–2213	S 68°28'26" E	49.11'
2213–2214	S 50°27'41" E	208.90'
2214–2215	S 58°58'39" E	46.56'
2215–2216	S 65°07'31" E	53.60'
2216–2217	S 65°33'36" E	92.90'
2217–2218	N 68°54'28" E	135.76'
2218–2219	N 23°57'45" E	196.98'
2219–2220	N 59°02'11" E	233.24'
2220–2221	N 45°00'00" E	226.27'
2221–2222	N 60°15'18" E	161.25'
2222–2223	N 40°14'11" W	340.59'
2223–2224	N 59°44'37" E	277.85'
2224–2225	N 39°48'20" W	156.21'
2225–2226	S 63°26'06" W	134.16'
2226–2227	N 52°36'49" W	200.77'

K-14

PT-PT	BEARING	DISTANCE
2227–2228	N 13°49'40" E	332.60'
2228–2229	N 23°01'59" W	255.51'
2229–2230	N 33°41'24" W	432.67'
2230–2231	N 34°30'31" W	388.33'
2231–2232	N 75°57'50" W	164.92'
2232–2233	N 73°54'15" W	142.52'
2233–2234	N 17°02'24" E	126.02'
2234–2235	N 35°32'16" W	172.05'
2235–2236	N 26°33'54" E	268.33'
2236–2237	N 06°46'35" W	342.35'
2237–2238	N 06°36'54" W	243.61'
2238–2239	N 40°22'11" W	70.42'
2239–2240	N 55°02'42" W	96.47'
2240–2241	S 77°37'33" E	51.02'
2241–2242	N 17°01'55" E	87.86'
TRACT 256		
2242–2243	S 86°01'15" E	57.30'
2243–2244	NORTH	80.00'
2244–2245	N 18°26'06" W	63.25'
2245–2246	N 73°44'08" W	40.17'
TRACT 191		
2246–2247	N 01°41'21" W	48.77'
2247–2248	N 23°57'45" W	393.95'
2248–2249	N 16°57'10" W	246.91'
2249–2250	N 19°15'18" W	206.90'
2250–2251	N 42°46'57" W	310.02'
2251–2252	N 79°41'35" W	194.20'
2252–2253	S 85°21'05" E	96.47'
2253–2254	N 68°55'01" E	190.46'
2254–2255	N 29°56'10" E	73.44'
2255–2256	N 10°00'06" W	160.26'
2256–2257	N 04°15'07" W	128.78'
2257–2258	N 05°34'08" W	147.64'
2258–2259	N 37°02'07" W	332.48'
2259–2260	N 35°45'26" E	148.56'
2260–2261	N 24°23'21" W	106.11'
2261–2262	N 28°53'05" W	105.54'
2262–2263	N 29°29'15" W	203.26'
2263–2264	N 16°00'56" W	112.85'
2264–2265	N 41°16'57" W	117.47'
2265–2266	N 57°31'44" W	260.77'
2266–2267	S 33°41'24" W	216.33'
2267–2268	N 53°35'56" W	254.62'
2268–2269	S 88°34'06" W	275.34'
2269–2270	N 79°12'36" W	91.18'
2270–2271	N 58°07'49" W	78.21'
2271–2272	S 66°43'40" E	69.79'
2272–2273	N 78°20'06" E	126.19'

K-14

PT-PT	BEARING	DISTANCE
2273–2274	S 81°14'00" E	71.84'
2274–2275	S 85°29'22" E	94.26'
2275–2276	N 75°24'37" E	75.49'
2276–2277	N 84°24'41" E	89.96'
2277–2278	N 55°13'56" E	122.86'
2278–2279	N 45°00'00" E	197.99'
2279–2280	S 85°26'34" E	213.20'
2280–2281	N 22°00'32" W	174.76'
2281–2282	N 28°06'39" W	311.75'
2282–2283	N 08°07'48" W	141.42'
2283–2285	N 29°44'42" W	161.25'
TRACT 192		
2285–2286	WEST	180.00'
2286–2287	N 29°03'17" W	205.91'
2287–2288	N 41°06'10" W	95.81'
2288–2289	N 41°20'48" W	196.60'
2289–2290	N 43°16'54" W	176.45'
2290–2291	N 42°45'37" E	75.56'
2291–2292	N 20°56'06" E	226.23'
2292–2293	N 15°28'55" E	197.45'
2293–2294	N 14°11'15" W	193.61'
2294–2295	N 22°19'16" W	222.57'
2295–2296	N 42°53'20" W	398.97'
2296–2297	N 17°30'33" W	114.06'
2297–2298	N 50°01'49" W	186.83'
2298–2299	N 20°47'27" W	250.16'
2299–2300	N 30°40'13" W	239.93'
2300–2301	N 32°26'44" W	297.66'
2301–2302	N 20°17'40" W	236.29'
2302–2303	N 54°22'40" W	217.95'
2303–2304	N 79°43'20" W	197.90'
2304–2305	N 81°28'19" W	276.96'
2305–2306	N 63°59'28" W	132.11'
2306–2307	N 62°01'23" W	57.73'
2307–2308	S 75°05'35" W	128.26'
2308–2309	S 75°05'34" W	182.23'
2309–2310	S 71°35'23" W	252.98'
2310–2311	S 85°53'07" W	94.00'
TRACT 270		
2311–2312	S 86°49'13" W	268.24'
2312–2313	S 85°54'52" W	280.71'
2313–2314	NORTH	120.00'
2314–2315	N 83°59'28" E	382.10'
2315–2316	N 82°36'03" E	34.77'
TRACT 193		
2316–2317	N 80°22'44" E	208.52'
2317–2318	N 71°23'26" E	189.81'
2318–2319	N 72°42'26" E	272.03'
2319–2320	S 70°13'08" E	234.09'
2320–2321	S 67°34'01" E	195.51'
2321–2322	N 13°57'55" E	281.79'
2322–2323	N 08°37'46" W	343.93'
2323–2324	N 20°36'31" E	228.95'
2324–2325	N 08°42'14" W	137.99'
2325–2326	N 17°46'36" E	345.55'
2326–2327	N 26°26'03" E	340.89'
2327–2328	N 09°26'54" E	99.46'
2328–2329	N 06°55'47" W	157.41'
2329–2330	N 27°29'33" W	109.01'
2330–2331	N 39°06'57" W	90.76'
2331–2332	N 03°39'22" W	365.68'
2332–2333	N 00°40'03" W	296.46'
2333–2334	N 06°45'45" E	132.18'
2334–2335	N 12°03'46" E	120.25'
2335–2336	N 53°12'31" W	153.75'
2336–2337	N 17°59'08" W	140.91'
2337–2338	N 18°49'21" W	177.10'
2338–2339	N 48°31'26" W	285.54'
2339–2340	N 79°10'46" W	140.27'
2340–2341	S 26°23'25" W	119.72'
2341–2342	S 58°03'54" W	63.88'
2342–2343	S 38°06'12" W	27.39'
2343–2344	S 83°07'34" W	42.61'
2344–2345	S 73°42'57" W	58.30'
2345–2346	N 02°30'39" W	17.03'
2346–2347	N 19°09'42" W	24.21'
2347–2348	S 88°26'04" W	19.75'
2348–2349	N 79°46'55" E	59.44'
2349–2350	N 30°30'24" E	163.95'
2350–2351	N 58°05'17" E	52.96'
2351–2352	N 10°28'56" W	262.16'
2352–2353	N 28°27'51" W	217.60'
TRACT 194		
2353–2354	N 28°27'50" W	90.10'
2354–2355	N 79°28'45" W	165.80'
2355–2356	N 59°57'55" W	217.51'
2356–2357	N 65°13'47" E	91.47'
2357–2358	N 55°19'40" E	127.98'
2358–2359	N 11°18'36" E	203.96'
2359–2360	N 22°50'23" W	363.12'
2360–2361	N 35°39'27" W	221.84'
2361–2362	N 24°36'10" W	261.13'
2362–2363	N 08°24'25" W	161.41'
2363–2364	N 02°48'50" W	152.28'
2364–2365	N 16°05'23" E	214.14'
2365–2366	N 11°53'24" E	247.00'
2366–2367	N 27°51'30" E	304.39'
2367–2368	N 28°36'13" E	163.78'

K-15

PT-PT	BEARING	DISTANCE
2368–2369	N 20°19'00" E	397.69'
2369–2370	N 54°51'43" W	123.53'
2370–2371	S 80°59'28" W	326.22'
2371–2372	S 88°34'14" W	285.89'
2372–2373	S 76°58'54" W	199.59'
2373–2374	S 66°38'40" W	320.25'

K-16

PT-PT	BEARING	DISTANCE
2374–2375	S 69°50'33" W	232.11'
2375–2376	S 62°04'14" W	244.78'
2376–2377	S 68°31'56" W	312.18'
2377–2378	S 58°46'31" W	355.17'
2378–2379	S 04°19'38" W	444.43'
2379–2380	S 47°40'34" E	112.38'
2380–2381	S 76°22'18" W	236.77'
2381–2382	S 49°34'42" W	157.39'
2382–2383	S 42°59'39" W	125.89'
2383–2384	S 18°28'45" E	68.70'
2384–2385	S 10°35'36" W	109.34'
2385–2386	N 18°54'52" W	95.06'
2386–2387	S 67°31'20" W	514.08'
2387–2388	S 13°25'42" E	525.22'
2388–2389	S 41°04'22" W	49.92'
2389–2390	N 12°20'25" W	88.37'
2390–2391	N 27°27'05" W	243.75'
2391–2392	N 45°41'41" W	294.00'
2392–2393	S 26°38'48" W	318.07'
2393–2394	N 73°50'03" W	351.16'
2394–2395	S 58°52'26" W	124.52'
2395–2396	S 66°04'33" W	152.51'
2396–2397	S 73°16'59" W	424.87'
2397–2398	S 49°33'54" W	258.37'
2398–2399	S 06°25'05" E	235.54'

K-16

PT-PT	BEARING	DISTANCE
2399–2400	S 38°54'57" E	448.86'
2400–2401	N 58°11'34" W	30.96'
TRACT 195		
2401–2402	N 58°11'34" W	156.42'
2402–2403	N 37°43'46" W	103.41'
2403–2404	N 35°41'27" W	53.70'
TRACT 194		
2404–2405	N 35°41'25" W	85.08'
TRACT 195		
2405–2406	N 35°41'25" W	209.56'
2406–2407	N 32°04'07" W	94.24'
2407–2408	S 68°16'47" W	135.20'
2408–2409	S 35°54'14" W	149.78'
2409–2410	S 85°31'18" W	149.11'
2410–2411	S 88°06'54" W	136.25'
2411–2412	S 57°31'59" W	216.96'
2412–2413	S 56°01'22" W	136.73'
2413–2414	S 55°37'55" W	231.41'
2414–2415	S 51°21'59" W	229.67'
2415–2416	S 00°39'55" W	98.98'
2416–2417	N 89°30'51" W	74.64'
TRACT 196		
2417–2418	N 89°30'49" W	75.98'
2418–2419	S 43°05'37" W	133.03'
2419–2420	S 07°49'07" W	186.86'
2420–2421	S 23°11'56" W	304.63'
2421–2422	S 21°15'01" W	193.13'
2422–2423	S 43°01'45" W	224.83'
2423–2424	S 21°44'29" E	173.75'
2424–2425	S 19°56'05" E	244.18'
2425–2426	N 33°02'05" W	79.28'
2426–2427	N 45°34'41" W	327.35'
2427–2428	N 54°21'30" W	218.74'
2428–2429	N 74°15'54" W	182.62'
2429–2430	S 68°22'22" W	152.65'
2430–2431	S 39°38'26" W	147.62'
2431–2432	S 37°05'13" W	113.03'
2432–2433	S 55°02'35" E	37.77'
2433–2434	S 55°06'25" E	97.09'
2434–2435	S 10°26'14" W	56.24'
2435–2436	N 72°10'25" W	115.35'
2436–2437	N 36°19'03" W	120.93'
2437–2438	N 86°50'01" W	183.44'
2438–2439	N 84°22'48" W	218.76'
2439–2440	N 86°01'27" W	285.16'
2440–2441	N 73°31'26" W	218.01'
2441–2442	N 61°25'15" W	433.01'
2442–2443	S 67°43'58" W	80.90'
2443–2444	N 55°19'34" W	107.07'
2444–2445	S 61°08'48" W	472.71'
2445–2446	N 79°39'58" W	243.40'
2446–2447	S 69°38'51" W	154.22'
2447–2448	S 76°34'30" W	109.52'
2448–2449	S 81°43'46" W	275.62'
2449–2450	S 58°42'03" W	99.45'
2450–2451	S 13°21'40" E	157.99'
2451–2452	S 37°14'17" E	212.98'
2452–2453	S 27°34'57" E	101.39'
2453–2454	S 84°41'24" W	217.05'
2454–2455	N 58°03'45" W	248.93'
2455–2456	S 21°07'24" W	385.45'
2456–2457	S 05°53'30" E	238.18'
2457–2458	S 28°19'19" E	110.46'
2458–2459	S 03°59'55" E	340.66'
2459–2460	N 06°44'08" W	341.82'
2460–2461	N 46°51'26" W	79.35'
2461–2462	N 00°18'00" W	40.66'

K-17

PT-PT	BEARING	DISTANCE
2462–2463	N 16°28'03" W	225.56'
2463–2464	N 77°29'53" W	177.50'
2464–2465	N 77°17'06" W	72.37'
2465–2466	N 71°48'17" W	131.39'
TRACT 197		
2466–2467	N 71°48'18" W	35.06'
2467–2468	N 87°49'37" E	129.09'
2468–2469	S 80°28'23" E	237.17'

K-16

PT-PT	BEARING	DISTANCE
2469–2470	N 69°47'38" E	95.32'
2470–2471	N 11°25'11" E	118.11'
2471–2472	N 20°44'29" E	98.02'
2472–2473	N 02°51'08" E	96.26'
2473–2474	N 31°00'02" E	143.21'
2474–2475	N 32°52'15" W	234.85'

K-17

PT-PT	BEARING	DISTANCE
2475–2476	N 46°19'43" W	353.37'
2476–2477	N 07°03'32" W	182.39'
2477–2478	N 48°20'45" E	231.49'

K-16

PT-PT	BEARING	DISTANCE
2478–2479	N 28°45'51" E	201.80'
2479–2480	N 03°02'51" W	303.61'
2480–2481	N 27°36'38" E	276.68'
2481–2482	N 35°47'08" E	225.47'
2482–2483	N 33°30'28" E	385.36'
2483–2484	N 12°32'26" E	181.24'
2484–2485	N 75°36'38" W	105.40'
2485–2486	N 75°26'51" W	385.99'

K-17

PT-PT	BEARING	DISTANCE
2486–2487	N 60°31'59" W	336.93'
2487–2488	N 60°27'03" W	138.88'
2488–2489	N 66°02'38" W	233.74'
2489–2490	N 81°23'20" W	342.49'
2490–2491	N 63°53'45" W	178.87'
2491–2492	N 35°18'52" E	186.15'
2492–2493	N 77°56'31" E	335.81'
2493–2494	S 71°44'41" E	297.42'

K-17

PT-PT	BEARING	DISTANCE
2494–2495	S 82°34'04" E	248.43'
2495–2496	N 64°21'40" E	66.38'
2496–2497	N 40°07'53" W	863.19'
2497–2498	N 80°55'11" W	188.54'
2498–2499	S 80°34'13" W	239.14'
2499–2500	S 49°22'20" W	227.15'
2500–2501	S 35°55'45" W	138.26'
2501–2502	S 51°53'53" W	188.30'
2502–2503	S 60°50'29" W	349.98'
2503–2504	S 62°59'57" W	341.00'
2504–2505	S 57°29'26" W	371.08'
2505–2506	S 48°00'46" W	269.07'
2506–2507	S 56°18'36" W	216.33'
2507–2508	S 31°37'26" E	126.14'
2508–2509	S 77°29'49" E	186.61'
2509–2510	S 68°49'18" W	102.19'
2510–2511	N 67°53'04" W	163.76'
2511–2512	N 61°10'38" W	76.28'
2512–2513	N 64°14'10" W	60.51'
2513–2514	S 59°02'11" W	233.24'
2514–2515	S 57°39'04" W	133.83'
2515–2516	S 55°31'07" W	226.78'
2516–2517	S 65°13'30" W	286.36'
2517–2518	S 08°55'27" E	92.24'
2518–2519	S 09°46'47" E	84.69'
2519–2520	N 20°19'38" W	155.80'
2520–2521	S 77°11'32" W	322.60'
2521–2522	S 31°56'26" E	164.99'
2522–2523	S 01°25'20" E	54.96'
2523–2524	S 04°44'44" W	116.75'
TRACT 263		
2524–2525	S 04°44'44" W	39.49'
2525–2526	S 20°58'27" W	73.33'
2526–2527	N 03°07'34" E	85.05'
2527–2528	N 28°06'49" W	125.21'
2528–2529	N 44°16'03" W	113.26'
2529–2530	S 41°26'04" W	124.09'
2530–2531	N 14°05'37" E	70.99'
2531–2532	N 24°52'05" E	160.54'
2532–2533	N 89°44'12" W	258.74'
2533–2534	S 81°52'12" W	141.42'
2534–2535	WEST	160.00'
2535–2536	S 84°33'04" W	178.72'
2536–2537	S 79°14'32" W	206.04'
2537–2538	S 57°03'48" W	118.76'
2538–2539	S 87°06'45" W	127.34'
2539–2540	S 69°11'36" W	196.66'
2540–2541	S 01°06'24" W	17.58'
TRACT 264		
2541–2542	S 01°06'23" W	177.24'
2542–2543	N 15°02'56" W	204.72'
2543–2544	S 75°37'59" W	111.99'
2544–2545	S 72°10'48" W	148.55'
2545–2546	S 62°24'08" W	115.28'
2546–2547	S 81°52'12" W	141.42'
2547–2548	S 82°52'30" W	161.25'
2548–2549	S 22°31'29" W	78.41'
2549–2550	S 33°00'30" W	73.52'
2550–2551	N 56°10'24" W	57.01'
2551–2552	S 18°37'48" E	94.69'
2552–2553	S 43°12'58" E	181.35'
2553–2554	S 82°50'52" E	50.88'
2554–2555	S 57°42'41" E	63.15'
2555–2556	N 65°51'52" W	59.92'
2556–2557	S 08°44'13" W	40.67'
2557–2558	S 01°50'35" W	307.94'
TRACT 265		
2558–2559	N 53°21'51" E	3.33'
2559–2560	N 10°39'27" W	140.00'
2560–2561	N 11°49'38" W	250.92'
2561–2562	N 69°08'30" W	85.62'
2562–2563	N 31°37'15" W	73.07'
2563–2564	N 19°37'00" W	119.97'
2564–2565	N 52°09'34" W	38.12'
2565–2566	N 24°52'37" E	78.16'
2566–2567	N 82°03'50" W	147.66'
2567–2568	S 59°55'41" W	121.79'
2568–2569	S 77°45'14" W	53.69'
2569–2570	S 83°35'29" W	264.38'
2570–2571	N 89°52'30" W	127.51'
2571–2572	N 80°11'57" W	143.92'
2572–2573	N 58°10'07" W	276.98'
2573–2574	S 73°28'27" E	545.84'
2574–2575	N 63°04'24" E	157.85'
2575–2576	N 84°35'05" E	193.14'
2576–2577	N 66°38'37" W	280.61'
2577–2578	N 81°35'38" W	188.86'
2578–2579	N 65°18'53" W	351.17'
2579–2580	N 62°08'32" W	61.25'
2580–2581	N 09°16'42" E	104.13'
TRACT 248		
2581–2582	S 66°19'23" E	1.00'
2582–2583	N 09°48'44" E	18.79'
2583–2584	S 63°26'06" E	125.58'
2584–2585	S 65°08'01" E	145.39'
2585–2586	S 72°52'55" E	212.99'
2586–2587	S 73°42'35" E	182.63'
2587–2588	S 81°05'14" E	404.92'
2588–2589	S 89°17'25" E	286.97'
2589–2590	N 72°32'35" E	337.82'
2590–2591	N 81°52'12" E	17.77'
TRACT 232		
2591–2592	N 81°52'12" E	123.66'
2592–2593	N 54°38'53" E	235.94'
2593–2594	S 86°10'25" E	150.64'

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PT-PT	BEARING	DISTANCE
2594–2595	N 16°16'18" W	119.94'
2595–2596	N 20°50'38" W	271.89'
2596–2597	N 23°41'23" W	401.95'
2597–2598	N 28°56'54" W	126.38'
2598–2599	S 36°40'38" E	117.65'
2599–2600	S 50°21'56" E	138.98'
2600–2601	S 05°21'15" E	234.78'
2601–2602	S 31°17'19" E	167.91'
2602–2603	S 19°04'33" E	293.75'
2603–2604	N 80°17'07" E	494.95'
2604–2605	EAST	240.00'
2605–2606	N 81°52'12" E	424.26'
2606–2607	N 79°41'43" E	223.61'
2607–2608	N 65°22'35" E	528.02'
2608–2609	N 52°07'30" E	228.04'
2609–2610	N 61°08'29" E	134.08'
2610–2611	N 55°38'06" E	393.83'
TRACT 198		
2611–2612	N 55°38'06" E	93.86'
2612–2613	N 00°31'25" E	146.82'
2613–2614	N 05°38'42" W	71.47'
2614–2615	N 56°49'02" W	60.20'
2615–2616	N 45°19'04" W	85.14'
2616–2617	N 51°15'45" W	126.25'
2617–2618	S 59°22'53" W	105.99'
TRACT 232		
2618–2619	S 57°14'24" W	216.50'
2619–2620	N 66°13'58" W	110.09'
2620–2621	S 52°12'38" W	230.00'
2621–2622	S 63°12'38" W	300.00'
2622–2623	S 68°40'38" W	182.46'
2623–2624	N 64°53'02" E	202.28'
2624–2625	N 56°51'18" E	316.45'
2625–2626	N 58°22'49" E	285.28'
2626–2627	N 53°18'05" E	189.54'
TRACT 198		
2627–2628	N 53°18'05" E	169.99'
2628–2629	N 62°04'05" E	312.20'
2629–2630	S 68°37'40" E	222.03'
2630–2631	N 65°01'48" E	320.99'
2631–2632	N 00°49'18" E	148.18'
2632–2633	N 60°56'19" W	88.16'
2633–2634	N 68°34'41" W	117.67'
2634–2635	N 28°22'47" W	181.90'
2635–2636	N 28°56'05" W	127.81'
2636–2637	N 00°54'54" E	153.43'
2637–2638	S 14°28'18" E	106.89'
2638–2639	S 17°40'52" E	182.14'
2639–2640	S 41°59'24" E	226.25'
2640–2641	S 72°03'35" E	192.31'
2641–2642	N 47°55'22" E	73.34'
2642–2643	N 48°00'10" E	372.77'
2643–2644	S 87°32'16" E	118.83'
2644–2645	N 71°32'29" E	68.38'
TRACT 226		
2645–2646	N 71°32'28" E	284.29'
2646–2647	N 73°56'14" E	178.38'
TRACT 227		
2647–2648	N 73°56'14" E	80.65'
2648–2649	N 72°53'12" E	111.66'
2649–2650	S 66°29'59" E	174.49'
2650–2651	N 59°55'07" E	94.45'
2651–2652	N 15°56'17" E	96.95'
2652–2653	N 39°09'07" E	109.38'
2653–2654	N 31°32'01" E	135.93'
2654–2655	S 23°05'53" E	48.59'
2655–2656	S 22°55'30" W	64.10'
2656–2657	S 69°45'15" W	69.26'
2657–2658	S 16°36'28" W	61.30'
2658–2659	S 31°09'46" W	148.44'
2659–2660	S 46°27'36" E	112.35'
2660–2661	S 36°00'36" E	348.95'
2661–2662	S 67°09'37" E	232.27'

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PT-PT	BEARING	DISTANCE
2662–2663	N 80°01'27" E	412.88'
2663–2664	N 67°24'54" E	375.18'
2664–2665	S 80°13'59" E	75.89'
2665–2665A	S 80°13'59" E	102.56'
TRACT 199		
2665A–2666	S 80°13'59" E	324.02'
2666–2667	S 75°05'05" E	190.36'
2667–2668	S 31°06'41" E	526.43'
2668–2669	S 14°19'15" E	233.71'
2669–2670	S 05°40'01" E	377.17'
2670–2671	S 43°27'40" W	328.62'
2671–2672	S 37°13'32" W	249.52'
2672–2673	S 32°07'10" W	257.43'
2673–2674	S 06°38'31" W	172.32'
2674–2675	SOUTH	180.00'
2675–2676	S 09°02'45" E	154.94'
2676–2677	S 45°33'17" E	282.80'
2677–2678	S 53°50'42" E	132.03'
2678–2679	S 49°38'24" E	172.69'
2679–2680	S 84°25'40" E	220.25'
2680–2681	N 84°39'23" E	185.16'
2681–2682	N 57°17'54" E	344.57'
2682–2683	N 25°01'39" E	329.08'
2683–2684	N 65°21'29" E	204.69'
2684–2685	S 32°40'08" E	283.47'
2685–2686	N 84°34'51" E	165.70'
2686–2687	N 65°52'42" E	177.45'
2687–2688	S 53°28'37" E	186.74'
2688–2689	N 47°53'54" E	243.19'
2689–2690	N 63°59'06" E	128.02'
2690–2691	N 73°10'04" E	153.11'

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PT-PT	BEARING	DISTANCE
2691–2692	N 62°17'39" E	285.08'
2692–2693	N 57°07'29" E	124.25'
2693–2694	N 31°06'17" E	142.73'
2694–2695	N 06°04'29" E	125.63'
2695–2696	N 38°09'29" W	89.57'
2696–2697	N 43°12'08" W	176.58'
2697–2698	S 46°20'08" E	180.60'
2698–2699	S 66°26'59" E	240.29'
2699–2700	N 32°52'11" E	193.95'
2700–2701	S 23°27'05" E	93.29'
2701–2702	S 35°37'06" E	84.25'
2702–2703	N 87°40'23" E	164.15'
2703–2704	N 40°58'40" E	152.59'
2704–2705	N 10°02'43" E	171.00'
2705–2706	N 48°22'17" E	236.17'
2706–2707	N 47°26'55" E	166.04'
2707–2708	N 69°16'03" E	225.83'
2708–2709	N 43°58'49" E	174.13'
2709–2710	N 49°31'00" E	340.53'
2710–2711	N 49°25'02" E	21.11'
TRACT 200		
2711–2712	N 31°31'34" E	150.91'
2712–2713	N 17°21'46" W	212.33'
2713–2714	N 38°06'18" W	173.74'
2714–2715	N 36°38'35" W	120.37'
2715–2716	N 02°56'54" E	100.65'
2716–2717	N 05°50'29" W	269.29'
2717–2718	N 18°56'32" W	127.49'
2718–2719	N 19°12'44" W	291.61'
2719–2720	N 87°43'54" W	245.82'
2720–2721	N 31°53'29" W	183.02'
2721–2722	N 34°53'05" W	200.32'
2722–2723	N 78°39'19" W	82.76'
TRACT 225		
2723–2724	N 78°39'29" W	21.85'
2724–2725	N 40°18'07" W	89.10'
2725–2726	N 52°46'29" W	248.36'
2726–2727	S 24°04'10" W	133.02'
2727–2728	S 69°47'49" W	274.86'
2728–2729	N 82°49'03" W	246.08'
2729–2730	S 87°15'49" W	135.98'
2730–2731	S 89°39'33" W	273.23'
2731–2732	S 81°58'53" W	139.33'
2732–2733	N 76°05'16" E	163.08'
2733–2734	N 69°37'12" E	151.86'
2734–2735	S 88°18'37" E	254.65'
2735–2736	N 86°26'41" E	55.89'
2736–2737	N 86°30'07" E	119.02'
2737–2738	S 81°38'33" E	176.08'
2738–2739	N 44°30'15" E	233.28'
2739–2740	N 71°52'47" E	54.08'
2740–2741	N 19°20'59" E	215.64'
2741–2742	S 10°20'28" E	268.63'
2742–2743	S 83°53'33" E	115.71'
TRACT 200		
2743–2744	S 83°53'32" E	12.22'
2744–2745	N 06°31'35" W	160.37'
2745–2746	S 65°58'01" E	118.72'
2746–2747	S 59°48'34" E	168.61'
2747–2748	S 59°28'22" E	172.61'
2748–2749	S 53°46'02" E	198.63'
2749–2750	S 23°37'17" E	91.52'
2750–2751	S 42°13'48" E	257.17'
2751–2752	S 15°49'56" E	195.02'
2752–2753	S 57°34'46" E	259.87'
2753–2754	S 76°37'38" E	224.64'
2754–2755	N 77°39'47" E	120.37'
2755–2756	N 80°18'17" E	135.66'
2756–2757	N 65°39'04" E	172.04'
2757–2758	N 56°45'07" E	141.50'
2758–2759	N 68°06'15" E	101.65'
2759–2760	N 35°01'18" E	212.74'
2760–2761	N 31°53'18" E	151.62'

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PT-PT	BEARING	DISTANCE
2761–2762	N 61°24'06" E	145.79'
2762–2763	N 64°09'14" E	159.19'
2763–2764	N 57°03'28" E	97.19'
2764–2765	N 83°55'32" E	103.59'
2765–2766	N 72°43'22" E	123.41'
2766–2767	N 77°11'18" E	154.38'
2767–2768	N 62°02'26" E	99.63'
2768–2769	N 62°01'36" E	151.56'
2769–2770	N 72°58'45" E	176.07'
2770–2771	N 85°57'01" E	140.25'
2771–2772	S 89°45'40" E	80.86'
2772–2773	N 52°37'11" E	94.55'
2773–2774	N 70°43'55" E	103.29'
2774–2775	S 87°23'01" E	132.72'
2775–2776	S 84°24'41" E	26.55'
2776–2777	S 84°24'41" E	76.51'
2777–2778	N 03°11'17" E	201.05'
2778–2779	S 25°11'24" E	142.95'
2779–2780	S 56°58'51" E	181.22'
2780–2781	N 82°54'36" E	173.18'
2781–2782	N 50°15'47" E	248.67'
2782–2783	N 53°42'29" E	234.16'
2783–2784	N 67°59'21" E	216.19'
2784–2785	N 55°37'59" E	79.61'
2785–2786	N 06°49'44" W	99.62'
2786–2787	N 25°15'47" W	323.26'
2787–2788	N 14°17'27" W	209.82'
2788–2789	N 11°09'50" W	218.85'
2789–2790	N 07°02'45" W	206.44'
2790–2791	N 11°30'02" W	223.63'
2791–2792	N 22°02'17" W	164.05'

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PT-PT	BEARING	DISTANCE
2792–2793	N 23°35'58" W	224.18'
2793–2794	N 31°11'04" W	257.57'
2794–2795	N 61°11'29" W	182.46'
2795–2796	N 47°16'00" W	219.36'
2796–2797	N 05°48'03" E	44.82'
TRACT 201		
2797–2798	N 05°48'03" E	68.59'
2798–2799	N 12°03'10" W	118.50'
2799–2800	N 03°12'33" W	195.33'
2800–2801	N 18°39'39" E	192.06'
2801–2802	N 26°20'59" E	141.67'
2802–2803	N 25°19'27" W	151.63'
2803–2804	N 52°35'26" W	431.33'
2804–2805	N 73°41'13" W	162.50'
2805–2806	S 48°43'51" W	170.88'
2806–2807	N 07°06'38" W	93.43'
2807–2808	N 57°01'33" E	171.66'
2808–2809	N 17°34'48" W	135.78'
2809–2810	S 80°24'27" W	120.09'
2810–2811	N 73°02'41" W	42.93'
2811–2812	N 79°02'28" E	41.24'
2812–2813	S 81°19'13" E	172.90'
2813–2814	S 59°43'24" E	212.90'
2814–2815	N 07°01'48" W	128.94'
2815–2816	N 62°06'46" W	80.57'
2816–2817	N 50°44'02" W	193.28'
2817–2818	N 51°21'15" W	171.83'
2818–2819	N 43°16'45" W	529.41'
2819–2820	N 32°08'46" W	212.90'
2820–2821	N 04°32'04" E	205.77'
2821–2822	N 17°12'53" W	253.97'
2822–2823	N 34°38'27" W	487.02'
2823–2824	S 86°44'59" E	216.81'
2824–2825	N 56°46'50" W	380.11'
2825–2826	N 32°09'17" E	91.99'
2826–2827	N 02°00'46" E	99.51'
2827–2828	N 02°26'12" E	316.67'
2828–2829	N 06°18'24" E	206.88'
2829–2830	N 03°49'10" W	201.13'
2830–2831	N 02°19'41" W	703.17'
2831–2832	N 32°46'10" W	146.59'
2832–2833	S 73°57'43" W	262.18'
2833–2834	N 37°43'43" W	152.16'

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PT-PT	BEARING	DISTANCE
2834–2835	S 80°31'08" W	560.37'
2835–2836	S 85°47'55" W	134.39'
2836–2837	N 74°26'03" E	563.25'

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PT-PT	BEARING	DISTANCE
2837–2838	N 87°15'49" E	135.98'
2838–2839	N 75°45'53" E	151.70'
2839–2840	N 14°54'33" E	154.74'
2840–2841	N 08°17'02" W	164.57'
2841–2842	N 81°12'24" E	170.38'
2842–2843	N 85°29'31" E	870.29'
TRACT 276		
2843–2844	N 84°47'27" E	537.90'
2844–2845	S 07°56'55" W	325.47'
2845–2846	S 06°53'28" W	156.35'
2846–2847	S 02°09'08" W	160.26'
2847–2848	S 05°43'50" E	273.36'
2848–2849	S 14°06'31" E	159.50'
2849–2850	S 21°11'20" E	74.34'
TRACT 202		
2850–2851	S 21°11'20" E	226.99'
2851–2852	S 28°20'36" E	209.31'
2852–2853	S 31°24'38" E	206.44'
2853–2854	S 35°25'12" E	309.68'
2854–2855	S 40°13'13" E	481.71'
2855–2856	S 38°56'41" E	579.58'
2856–2857	S 31°31'45" E	165.39'
TRACT 203		
2857–2858	S 31°31'44" E	613.46'
2858–2859	S 26°12'40" E	590.72'
2859–2860	S 25°26'44" E	761.30'
2860–2861	S 27°56'38" E	210.69'
2861–2862	N 68°37'53" E	205.19'
2862–2863	N 02°06'20" W	167.15'
2863–2864	N 21°33'53" E	271.85'
2864–2865	N 19°04'33" E	436.47'
2865–2866	N 01°42'06" W	201.33'
2866–2867	N 32°36'25" W	132.71'
2867–2868	N 45°35'15" W	182.19'
2868–2869	N 21°51'20" W	108.61'
2869–2870	N 00°20'18" W	178.51'
2870–2871	N 01°08'00" W	233.22'
2871–2872	N 20°03'43" W	111.08'
2872–2873	N 11°08'47" W	158.61'
TRACT 202		
2873–2874	N 11°08'47" W	7.09'
2874–2875	N 20°48'40" E	199.34'
2875–2876	N 28°10'27" E	122.74'
2876–2877	N 40°04'30" W	45.46'
2877–2878	N 53°55'47" W	67.48'
2878–2879	N 23°18'19" W	49.95'
2879–2880	S 51°11'16" E	113.10'
2880–2881	S 37°19'35" E	51.36'
2881–2882	N 51°14'14" E	223.98'
2882–2883	S 72°30'37" E	206.44'
2883–2884	N 38°14'29" W	50.00'
2884–2885	N 38°06'14" E	227.67'
2885–2886	N 31°40'49" E	132.05'
2886–2887	S 27°53'45" W	251.93'
2887–2888	S 40°51'41" W	46.40'
2888–2889	S 51°15'06" W	56.26'
2889–2890	S 37°23'42" E	43.57'

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PT-PT	BEARING	DISTANCE
2890–2891	S 77°13'58" E	53.79'
2891–2892	S 66°08'36" E	113.67'
2892–2893	S 08°07'32" E	211.49'
TRACT 203		
2893–2894	S 08°07'32" E	98.82'
2894–2895	S 66°04'19" E	126.63'
2895–2896	N 80°15'59" E	309.74'
2896–2897	N 72°21'19" E	237.53'
2897–2898	N 61°19'16" E	281.88'
2898–2899	S 50°03'20" E	295.13'
2899–2900	S 13°21'46" E	311.24'
2900–2901	S 19°16'08" E	211.77'
2901–2902	N 81°35'18" E	218.08'
2902–2903	N 85°25'19" E	200.51'
2903–2904	N 89°30'08" E	282.30'
2904–2905	N 05°03'41" E	280.59'
2905–2906	N 16°33'43" E	485.10'
TRACT 266		
2906–2907	N 16°33'54" E	109.92'
2907–2908	S 03°32'05" E	119.99'
TRACT 203		
2908–2909	S 03°32'12" E	184.84'
2909–2910	S 20°15'13" W	620.82'
2910–2911	S 86°56'28" W	425.22'
2911–2912	S 85°20'02" W	290.47'
2912–2913	N 21°42'24" W	379.46'
2913–2914	N 18°27'34" W	262.38'
2914–2915	N 77°53'10" W	243.92'
2915–2916	S 47°08'48" W	154.25'
2916–2917	S 70°36'21" W	200.86'
2917–2918	S 75°08'05" W	256.06'
2918–2919	N 88°06'19" W	175.17'
2919–2920	N 40°51'49" W	236.67'
TRACT 202		
2920–2921	N 40°51'49" W	68.81'
2921–2922	N 67°33'17" W	190.09'
2922–2923	S 86°24'11" W	137.54'
2923–2924	S 10°53'25" W	187.86'
TRACT 203		
2924–2925	S 10°53'25" W	117.26'
2925–2926	S 03°53'54" E	141.38'
2926–2927	S 29°11'26" E	126.54'
2927–2928	S 09°36'52" E	112.88'
2928–2929	S 22°33'04" E	108.18'
2929–2930	S 21°59'48" E	172.65'
2930–2931	S 07°18'45" E	119.65'
2931–2932	S 04°50'16" E	190.32'
2932–2933	S 05°19'34" E	209.21'
2933–2934	S 02°52'26" E	147.22'
2934–2935	S 03°27'16" E	135.71'
2935–2936	S 09°53'06" E	152.00'
2936–2937	S 18°29'51" E	181.80'
2937–2938	S 31°40'15" E	172.87'
2938–2939	S 71°14'14" E	104.15'
2939–2940	N 69°40'42" E	94.78'
2940–2941	N 64°39'17" E	121.27'
2941–2942	S 61°38'30" W	119.78'
2942–2943	S 69°22'01" W	98.53'
2943–2944	S 65°01'43" W	118.75'
2944–2945	S 05°33'47" W	153.43'
2945–2946	S 09°44'30" E	203.10'
2946–2947	S 24°23'23" E	184.69'
2947–2948	S 22°00'59" W	124.51'
2948–2949	N 45°19'00" W	550.43'
2949–2950	N 42°03'40" W	237.19'
2950–2862	N 34°25'41" W	101.14'
2862–2861	S 68°37'53" W	205.19'
2861–2953	S 34°37'01" E	163.64'
2953–2954	S 42°04'52" E	259.78'
2954–2955	S 45°19'08" E	706.09'
2955–2956	S 41°35'49" E	237.02'
2956–2957	S 33°05'11" E	181.95'
2957–2958	S 25°09'15" E	190.60'
2958–2959	S 15°57'27" E	282.35'
2959–2960	S 07°10'08" E	239.96'
2960–2961	S 02°21'54" E	377.20'
2961–2962	S 02°25'05" E	549.31'
2962–2963	S 00°40'57" E	193.07'
2963–2964	S 02°50'33" W	64.32'
TRACT 204		
2964–2965	S 02°50'32" W	80.73'
2965–2966	S 05°19'51" W	148.62'
2966–2967	S 06°44'30" W	157.21'
2967–2968	S 08°53'44" W	200.59'
2968–2969	S 14°03'56" W	197.78'

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PT-PT	BEARING	DISTANCE
2969–2970	S 19°28'58" W	633.30'
2970–2971	S 13°16'11" W	558.30'
2971–2971A	S 02°37'25" W	67.88'
2971A–2972	S 62°19'58" W	167.32'
TRACT 292		
2972–2973	S 20°01'46" W	50.48'
2973–2974	S 02°15'08" W	107.02'
TRACT 288		
2974–2975	S 03°05'03" W	83.85'
2975–2976	S 06°27'32" E	208.32'
2976–2976A	S 39°45'22" E	91.11'
2976A–2976B	S 37°43'22" E	277.69'
2976B–2976C	S 30°56'46" E	90.24'
2976C–2977	S 14°18'45" E	461.41'
2977–2978	N 55°45'41" E	214.24'

NOTES:
THIS EXHIBIT DRAWING WAS ORIGINALLY ISSUED AND SIGNED BY W. E. MOORE, MANAGER-HYDRO & ENVIRONMENTAL ENGINEERING AND G. C. MEETZE, EXECUTIVE VICE-PRESIDENT AS PART OF THE APPLICATION FOR AMENDMENT OF LICENSE MADE ON JUNE 26, 1981.

I, BRIAN B. BONDS, A PROFESSIONAL LAND SURVEYOR IN THE STATE OF SOUTH CAROLINA, P.L.S. 28582, HAVE REPRODUCED THIS PORTION OF THE PARR HYDRO PROJECT 1894 PROJECT BOUNDARY SHOWN HEREIN. THE LICENSEE EITHER OWNS IN FEE SIMPLE OR POSSESSES EASEMENTS OVER THE LANDS SHOWN ON THE MAP THAT ARE INSIDE THE PROJECT BOUNDARY. THE PROJECT BOUNDARY LINES THAT ARE NOT CONTOUR LINES WERE BASED ON SCE&G DESIGN AND CONSTRUCTION DRAWINGS.

PROPERTY LINES DEPICTED ON THIS EXHIBIT DERIVED FROM DEEDS AND PLATS OF RECORD. NO ACTUAL FIELD SURVEY WAS CONDUCTED FOR PREPARING THIS MAP. THIS EXHIBIT IS NOT A PROPERTY BOUNDARY SURVEY. ALL PROPERTY LINE LOCATIONS SUBJECT TO FULL BOUNDARY SURVEY OF THE DEPICTED PARCEL.

DETAIL MAP OF PROJECT AREA

SHEET 19 OF 20

PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

PROJECT BOUNDARY LINE DESCRIPTION

PREPARED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

BRIAN B. BONDS ; S.C.P.L.S. # 28582

GLENN ASSOCIATES SURVEYING, INC.

SURVEYORS SEAL	SURVEYORS SEAL	C.O.A. SEAL
	SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR 28582 BRIAN B. BONDS	SOUTH CAROLINA GLENN ASSOCIATES SURVEYING INC. No.C02238 CERTIFICATE OF AUTHORIZATION

REVISION SCHEDULE

NO.	DATE	DESCRIPTION	CHECKED
1	9/17/12	REVISED PER FERC ORDER 137 FERC ¶ 62,033	BBB
2	5/7/13	REVISED PER FERC ORDER 143 FERC ¶ 62,095	BBB

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PT–PT	BEARING	DISTANCE
2978–2979	N 82°40'29" E	81.99'
2979–2980	N 76°56'43" E	281.25'
2980–2981	S 79°28'11" E	165.26'
2981–2982	S 66°11'49" E	88.79'
2982–2983	S 69°02'36" E	156.55'
2983–2984	N 73°17'52" E	343.49'
2984–2985	S 52°45'35" W	63.54'
2985–2986	S 81°02'01" W	126.17'
2986–2987	S 71°39'01" W	170.55'
2987–2988	N 76°30'40" W	84.23'
2988–2989	N 63°19'35" W	94.44'
2989–2990	S 06°38'41" E	93.67'
2990–2991	N 88°28'57" W	405.91'
2991–2992	S 69°33'18" E	152.56'
2992–2978	N 13°44'02" W	138.63'
2978–2977	S 55°45'41" W	24.24'
TRACT 205		
2977–2994	S 14°18'42" E	30.49'
2994–2994A	S 14°18'45" E	52.75'
2994A–2995	S 20°30'22" E	316.80'
2995–2996	S 31°09'35" E	261.94'
2996–2997	S 34°44'03" E	358.64'
2997–2998	S 28°41'53" E	175.74'
TRACT 291		
2998–2999	S 28°41'54" E	409.19'
2999–3000	N 18°36'12" E	199.70'
3000–3001	S 47°43'54" E	117.21'
3001–3002	S 24°35'26" E	94.46'
3002–3003	S 32°49'47" E	156.40'
3003–3004	S 42°31'52" E	134.99'
3004–3005	N 79°17'06" E	230.93'
3005–3006	S 07°07'30" E	80.70'
3006–3006A	N 83°09'20" W	28.83'
TRACT 277		
3006A–3007	S 56°45'00" E	36.72'
3007–3008	S 07°07'30" E	54.95'
3008–3009	S 60°15'18" E	322.49'
3009–3010	S 86°29'20" W	95.15'
3010–3011	N 11°17'14" W	96.57'
TRACT 291		
3011–3012	N 11°16'45" W	184.69'
3012–3000	N 16°27'36" W	419.89'
3000–2999	S 81°36'12" W	199.70'
2999–3015	S 16°11'24" E	436.39'
3015–3016	S 11°51'52" E	12.28'
TRACT 297		
3016–3017	S 11°15'18" E	257.54'
3017–3018	S 11°17'13" E	106.88'
TRACT 209		
3018–3019	N 16°53'08" W	114.15'
3019–3020	N 70°08'39" W	7.65'
3020–3021	S 10°07'59" W	214.54'
3021–3022	S 19°19'55" W	91.28'
TRACT 286		
3022–3023	S 19°19'55" W	60.09'
3023–3024	S 33°30'36" W	197.27'
TRACT 209		
3024–3025	S 33°30'36" W	129.94'
3025–3026	S 09°27'44" W	243.31'
3026–3027	SOUTH	180.00'
3027–3028	S 16°31'00" E	268.88'
3028–3029	S 01°27'49" W	173.82'
3029–3030	S 17°52'06" E	221.04'
3030–3031	S 05°24'19" W	108.55'
3031–3032	S 06°25'28" E	271.72'
3032–3033	S 13°17'10" E	266.22'
3033–3034	N 57°17'54" E	210.94'
3034–3035	N 19°51'31" E	239.36'
3035–3036	N 65°32'15" E	235.50'
3036–3037	S 80°31'22" E	208.37'
3037–3038	N 10°49'20" W	932.13'
3038–3039	N 72°11'34" E	58.30'
3039–3040	N 72°09'12" E	167.09'
3040–3041	S 66°30'56" E	117.14'
3041–3042	S 39°50'08" E	121.88'
3042–3043	S 27°57'48" E	107.74'
3043–3044	S 29°49'11" E	94.25'
3044–3045	S 30°59'01" E	134.59'
3045–3046	S 14°16'33" E	155.71'
3046–3047	S 02°46'43" E	262.70'
3047–3048	S 87°35'13" E	39.76'
3048–3049	N 55°36'36" E	252.11'
3049–3050	N 48°43'51" E	75.84'
3050–3051	N 26°15'14" E	240.19'
3051–3052	N 20°03'22" E	76.55'
3052–3053	S 85°49'32" E	88.72'
3053–3054	N 33°12'15" E	155.94'
3054–3055	N 02°14'50" E	156.10'
3055–3056	N 39°38'44" E	84.92'
3056–3057	S 03°34'09" W	43.94'
TRACT 254		
3057–3058	S 03°34'09" W	294.60'
3058–3059	S 55°21'21" W	111.55'
3059–3060	S 86°00'23" W	89.72'
3060–3061	S 24°47'52" W	156.72'
3061–3062	S 18°25'58" W	52.03'
3062–3063	S 41°00'20" W	116.88'
3063–3064	S 47°26'26" W	182.03'
3064–3065	S 02°46'58" W	134.72'
3065–3066	S 78°41'49" W	40.49'
3066–3067	S 16°36'10" W	105.56'
3067–3068	N 73°15'17" W	76.89'
3068–3069	N 01°17'27" E	95.97'
TRACT 210		
3069–3071	N 01°17'25" E	20.92'
3071–3072	N 87°37'24" W	40.10'
3072–3073	S 34°51'07" W	51.81'
TRACT 254		
3073–3074	S 34°51'07" W	120.43'
3074–3075	S 12°30'10" E	176.69'
3075–3076	S 08°00'57" W	170.52'
3076–3077	S 33°25'07" W	145.54'
3077–3078	S 36°34'16" W	143.06'
3078–3079	S 28°36'02" W	5.02'
TRACT 210		
3079–3080	S 28°36'04" W	45.91'
3080–3081	N 12°26'39" W	668.63'
TRACT 209		
3081–3037	N 12°26'40" W	63.66'
3037–3036	N 80°31'22" W	208.37'
3036–3084	S 10°58'41" E	116.24'
TRACT 210		
3084–3085	S 12°24'42" E	637.65'
3085–3086	N 39°06'55" W	7.87'
3086–3087	N 41°17'53" W	174.62'
3087–3088	N 23°18'11" W	140.86'
3088–3089	S 81°17'12" W	97.25'
3089–3090	S 04°55'57" W	110.19'
3090–3091	S 36°49'30" E	184.30'
3091–3092	S 44°27'53" E	138.05'
3092–3093	S 49°37'53" E	156.99'

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PT–PT	BEARING	DISTANCE
3093–3094	S 12°24'42" E	475.67'
3094–3095	S 03°27'23" E	25.75'
3095–3096	S 02°24'38" E	169.40'
3096–3097	S 06°06'17" E	96.65'
TRACT 282		
3097–3098	S 06°06'17" E	51.89'
3098–3099	S 17°28'26" E	174.15'
3099–3100	S 57°59'29" E	133.01'
3100–3101	S 56°40'29" E	109.71'
3101–3102	S 24°31'09" E	288.24'
3102–3103	N 40°08'40" E	214.33'
3103–3104	N 39°12'00" E	34.48'
3104–3105	N 56°44'31" E	49.16'
3105–3106	N 88°46'17" E	55.17'
3106–3107	N 75°42'02" E	77.35'
3107–3108	S 52°52'2" E	8.88'
3108–3109	S 08°22'22" W	146.57'
3109–3110	S 16°29'24" W	97.72'
TRACT 281		
3110–3111	S 16°29'24" W	31.95'
3111–3112	N 83°55'25" W	53.52'
3112–3113	N 10°35'03" W	30.85'
TRACT 282		
3113–3103	N 26°45'31" W	184.51'
3103–3102	S 40°08'40" W	214.33'
TRACT 281		
3102–3115	S 28°06'11" W	131.17'
3115–3116	S 52°52'44" W	54.76'
3116–3117	S 12°37'45" E	194.78'
3117–3118	S 64°41'49" E	154.77'
3118–3119	S 14°31'05" E	54.55'
TRACT 211		
3119–3120	S 25°05'10" E	1,357.60'
3120–3121	N 65°16'58" E	200.00'
3121–3122	N 25°43'15" W	801.46'
3122–3123	N 83°02'26" E	62.79'
3123–3124	N 53°59'17" E	107.20'
3124–3125	N 78°35'32" E	102.71'
3125–3126	S 43°16'46" E	272.92'
3126–3127	S 02°47'26" W	128.77'
3127–3128	S 17°06'18" E	263.34'
3128–3129	S 29°35'21" E	214.82'
TRACT 285		
3129–3130	S 29°35'21" E	62.35'
3130–3131	S 29°54'23" E	164.46'
3131–3132	S 40°46'06" E	263.40'
3132–3133	S 62°33'43" E	285.38'
3133–3134	S 32°50'11" E	194.52'
3134–3134A	N 60°58'49" E	62.84'
TRACT 211		
3134A–3135	N 60°58'49" E	61.91'
3135–3135A	N 77°59'27" E	156.07'
3135A–3136	S 72°24'41" W	152.23'
3136–3136A	S 56°07'53" W	55.74'
TRACT 285		
3136A–3137	S 56°07'53" W	75.57'
3137–3138	S 76°52'54" W	69.95'
3138–3139	N 48°19'19" W	44.65'
3139–3140	N 02°10'36" W	90.52'
3140–3141	N 66°37'55" W	154.23'
3141–3142	N 58°52'17" W	68.55'
3142–3143	N 66°40'12" W	403.45'
3143–3144	S 85°32'52" W	81.53'
3144–3145	N 49°11'51" W	47.51'
3145–3146	N 20°51'01" W	134.77'
3146–3147	N 25°43'15" W	176.35'
TRACT 211		
3121–3120	S 65°16'58" W	200.00'
3120–3147	S 25°05'10" E	174.74'
3147–3148	S 20°58'59" E	430.61'
3148–3149	S 11°12'26" E	242.20'
3149–3150	S 04°13'57" E	195.47'
3150–3151	S 00°01'35" E	141.35'
3151–3152	S 01°10'54" W	231.54'
TRACT 285		
3152–3153	S 02°41'20" W	359.23'
3153–3154	S 02°05'54" W	85.30'
3154–3155	S 00°37'21" W	208.52'
3155–3156	S 09°07'22" W	460.42'
3156–3157	S 09°07'21" E	62.92'
3157–3158	N 74°17'17" E	200.00'
3158–3159	S 15°42'43" E	429.24'
3159–3160	S 86°49'54" E	320.93'
3160–3161	N 26°53'29" E	44.84'
3161–3162	S 06°46'31" W	49.92'
3162–3163	S 55°24'41" W	317.25'
3163–3159	N 19°32'58" W	220.10'
3159–3158	N 15°42'43" W	429.24'
3158–3157	S 74°17'17" W	200.00'
TRACT 211		
3157–3165	S 15°42'43" E	429.75'
3165–3166	S 20°17'59" E	314.30'
3166–3167	S 31°25'04" W	165.99'
3167–3168	S 26°37'40" E	250.49'
3168–3169	S 05°34'54" E	256.18'
3169–3170	S 62°56'55" W	59.12'
3170–3171	S 30°46'24" E	262.75'
3171–3172	S 00°43'21" E	188.08'
3172–3173	S 26°51'42" E	208.09'
3173–3174	S 36°04'06" E	365.97'
3174–3175	S 19°59'00" E	204.02'
TRACT 212		
3175–3176	S 19°59'03" E	30.07'
3176–3177	S 06°42'35" E	342.35'
3177–3178	S 17°21'15" E	335.26'
3178–3179	S 49°45'20" E	94.48'
3179–3180	S 77°49'28" E	89.91'
3180–3181	S 59°02'11" E	116.62'
3181–3182	N 71°33'54" E	126.49'
3182–3183	N 33°41'24" W	144.22'
3183–3184	N 33°41'24" W	144.22'
3184–3185	N 15°15'18" E	228.04'
3185–3186	N 41°45'57" E	153.54'
3186–3187	N 36°35'47" E	231.02'
3187–3188	N 44°59'59" E	141.42'
3188–3189	N 59°32'04" E	116.81'
3189–3190	N 59°32'03" E	209.88'
3190–3191	N 59°32'04" E	67.77'
3191–3192	S 45°00'00" E	56.57'
3192–3193	S 59°46'44" W	64.62'
3193–3190	N 48°07'23" W	57.18'
3190–3189	S 59°32'03" W	209.88'
3189–3196	S 48°07'22" E	56.24'
3196–3197	S 22°15'37" W	217.93'
3197–3198	S 32°00'19" W	188.68'
3198–3199	S 45°00'01" W	113.14'
3199–3200	S 05°03'07" E	177.83'
3200–3201	S 53°24'08" E	244.29'
3201–3202	S 70°04'37" E	123.53'
3202–3203	S 71°47'50" E	203.53'

K–14

PT–PT	BEARING	DISTANCE
3203–3204	S 73°11'53" E	75.94'
3204–3205	S 82°09'48" E	90.75'

K–13

PT–PT	BEARING	DISTANCE
3205–3206	S 38°44'16" E	107.85'
3206–3207	S 32°45'06" W	79.72'
3207–3208	S 08°07'16" W	132.50'
3208–3209	S 16°11'32" E	154.95'
3209–3210	S 28°05'09" E	217.50'
3210–3211	N 82°48'56" E	86.01'
TRACT 213		
3211–3212	N 82°48'58" E	45.11'
3212–3213	S 16°22'16" E	239.24'
3213–3214	S 25°39'26" E	247.76'
3214–3215	S 43°21'58" E	437.03'
3215–3216	S 63°26'06" E	223.61'
3216–3217	S 83°17'25" E	342.35'
3217–3218	EAST	200.00'
3218–3219	N 46°41'30" E	160.24'
3219–3220	N 61°22'31" W	171.95'
3220–3221	N 19°51'24" W	250.08'
3221–3222	N 42°05'11" E	77.97'
3222–3223	N 89°49'02" E	68.93'
3223–3224	S 63°57'03" E	36.10'
3224–3225	S 73°09'53" E	98.26'
3225–3226	N 26°50'03" W	273.93'
3226–3227	S 46°10'45" E	77.75'
3227–3228	S 54°35'19" E	99.14'
3228–3229	S 48°04'40" E	118.58'
3229–3230	S 33°41'24" E	90.38'
3230–3231	S 10°26'13" E	135.08'
3231–3232	S 80°32'47" E	126.79'
3232–3233	S 62°31'59" E	27.45'
3233–3234	S 40°55'19" E	35.75'
TRACT 214		
3234–3235	S 38°50'09" E	169.81'
3235–3236	S 38°50'09" E	320.80'
3236–3237	S 32°53'30" E	376.21'

K–10

PT–PT	BEARING	DISTANCE
3237–3238	S 78°17'41" E	280.52'
TRACT 275		
3238–3239	N 62°16'15" E	16.95'
3239–3240	N 89°26'18" E	31.83'
TRACT 274		
3240–3241	N 89°26'16" E	91.58'
3241–3242	S 87°43'26" E	51.78'
TRACT 272		
3242–3243	S 87°43'26"	186.67'
3243–3244	N 67°49'50" E	140.14'
3244–3245	N 76°35'02" E	155.38'
3245–3246	N 78°32'28" E	115.96'
3246–3247	N 83°58'55" E	294.28'
3247–3248	N 54°28'16" E	228.76'
3248–3249	N 77°03'29" E	137.01'
3249–3250	N 77°42'11" E	172.09'
3250–3251	N 75°40'55" E	211.40'
3251–3252	N 89°52'16" E	76.49'
TRACT 280		
3252–3253	N 89°52'19" E	56.38'
3253–3254	S 86°19'23" E	124.34'
3254–3255	N 65°05'57" E	154.94'
3255–3256	N 41°44'05" E	104.22'
3256–3257	N 81°19'30" E	295.72'
TRACT 271		
3257–3258	N 81°19'30" E	97.51'
3258–3259	N 38°07'17" E	109.22'
3259–3260	S 32°49'13" W	96.66'
3260–3261	S 50°16'15" E	260.25'
3261–3262	S 24°15'53" E	75.70'
3262–3263	S 44°07'23" W	259.63'
3263–3264	S 47°59'29" E	192.01'
3264–3265	S 33°28'25" E	147.13'
3265–3266	S 40°59'03" E	107.75'
3266–3267	S 27°58'43" E	138.20'
3267–3268	S 38°53'07" W	203.22'
3268–3269	S 04°03'48" W	158.23'
TRACT 280		
3269–3270	S 04°03'48" W	108.66'
3270–3271	S 14°30'45" W	69.18'
TRACT 214		
3271–3272	S 14°30'45" W	148.37'
3272–3273	S 21°48'05" W	215.41'
3273–3274	S 45°00'00" W	254.56'
3274–3275	S 23°57'45" W	196.98'
3275–3276	S 02°19'01" W	303.76'
3276–3277	S 30°17'15" W	207.52'
3277–3278	S 84°06'16" W	153.33'
3278–3279	S 26°22'32" W	217.27'
3279–3280	S 32°56'07" W	246.51'
3280–3281	S 36°01'38" W	491.00'
3281–3282	N 29°01'16" W	1,007.57'
TRACT 274		
3282–3283	N 29°01'18" W	76.20'
3283–3284	N 32°53'54" W	2,168.35'
TRACT 275		
3284–3238	N 32°54'06" W	6.91'
TRACT 214		
3238–3237	N 78°17'41" W	280.52'
3237–3287	S 32°53'30" E	2,372.21'
3287–3288	S 29°08'26" E	1,105.64'
3288–3289	S 10°51'31" E	968.12'
3289–3290	S 04°14'49" E	1,713.61'
3290–3291	S 12°06'42" E	630.33'
3291–3292	S 22°33'32" E	48.76'
TRACT 215		
3292–3293	S 22°33'32" E	416.57'
3293–3294	S 26°03'22" E	519.99'
3294–3295	S 26°17'35" E	1,260.60'
3295–3296	N 63°55'11" E	200.00'
3296–3297	N 26°17'35" W	696.93'
3297–3298	S 43°56'56" E	200.76'
3298–3299	S 25°05'11" E	415.04'
3299–3300	S 16°44'32" E	346.60'
3300–3396	N 25°04'16" W	251.18'
3396–3395	S 63°55'11" W	200.00'
3395–3303	S 21°03'22" E	661.32'
3303–3304	S 14°40'58" E	847.11'
3304–3305	N 56°56'09" E	210.62'
3305–3306	N 45°00'00" E	323.05'
3306–3307	NORTH	100.00'
3307–3308	N 26°33'54" E	178.89'
3308–3309	N 32°00'19" E	188.68'
3309–3310	N 49°23'55" E	184.39'
3310–3311	N 29°07'40" E	282.07'
3311–3312	N 80°35'43" E	314.76'
3312–3313	S 77°49'23" E	199.43'
3313–3314	N 87°09'16" E	225.82'
3314–3315	S 76°48'15" E	257.38'
3315–3316	N 46°46'31" E	154.54'
3316–3317	N 82°48'51" E	102.53'
3317–3318	N 56°52'00" E	311.12'
3318–3319	S 57°10'14" E	31.24'
3319–3320	S 31°05'35" W	187.20'

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PT–PT	BEARING	DISTANCE
3320–3321	S 56°50'52" W	119.86'
3321–3322	S 85°24'22" W	84.28'
3322–3323	S 79°18'45" W	112.71'
3323–3324	S 73°02'05" W	96.49'
3324–3325	S 61°07'02" W	214.09'
3325–3326	S 72°53'37" W	322.75'
3326–3327	N 85°54'52" W	280.71'
3327–3328	S 23°11'55" W	152.32'
3328–3329	S 09°27'44" W	364.97'
3329–3330	S 16°41'57" W	417.61'
3330–3331	S 29°44'42" W	483.73'
3331–3332	S 12°31'44" W	368.78'
3332–3333	WEST	112.99'
3333–3334	N 14°49'16" W	680.86'
3334–3305	N 14°42'44" W	241.28'
3305–3304	S 56°56'09" W	210.62'
TRACT 216		
3304–3337	S 14°40'58" E	175.64'
3337–3338	S 14°51'56" E	733.71'
3338–3339	S 13°27'45" E	182.80'
3339–3340	S 07°14'13" E	472.44'
3340–3341	S 01°22'52" W	293.01'
3341–3342	S 01°22'54" W	98.53'
3342–3343	S 10°10'59" W	448.24'
3343–3344	S 13°12'56" W	190.61'
3344–3345	S 58°11'47" E	211.01'
3345–3346	S 34°10'33" E	246.27'
3346–3347	S 33°23'00" E	121.97'
3347–3348	N 38°12'57" W	126.26'
3348–3349	N 68°23'33" W	66.26'
3349–3350	S 81°48'04" W	113.46'
3350–3345	N 13°12'57" W	203.58'
3345–3344	N 58°11'47" W	211.01'
3344–3353	S 13°12'57" W	303.97'
3353–3354	S 13°10'21" W	94.67'
3354–3355	S 13°10'21" W	133.31'
TRACT 217		
3355–3356	S 13°13'27" W	264.91'
3356–3357	S 10°04'55" W	88.69'
3357–3358	S 10°04'56" W	603.40'
3358–3359	S 06°57'06" W	419.48'

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PT–PT	BEARING	DISTANCE
3359–3360	S 06°57'07" W	157.34'
3360–3361	S 07°04'25" W	394.41'
3361–3362	N 83°15'11" E	205.96'
3362–3363	N 52°07'30" E	201.98'
3363–3364	N 81°52'12" E	141.42'
3364–3365	S 71°33'54" E	126.49'
3365–3366	S 85°24'37" E	193.84'
3366–3367	N 30°09'28" E	33.40'
3367–3368	N 74°04'41" E	98.05'
3368–3369	N 36°58'27" E	73.36'
3369–3370	S 25°48'39" E	3.64'
3370–3371	S 30°45'55" W	55.90'
3371–3372	S 61°37'05" W	134.76'
3372–3373	S 28°24'53" W	58.93'
3373–3374	S 78°02'41" W	53.47'
3374–3375	S 52°44'09" W	59.47'
3375–3376	S 38°17'44" E	22.30'
3376–3377	S 55°40'38" W	83.53'
3377–3378	WEST	200.00'
3378–3379	S 45°00'00" W	339.41'
3379–3380	S 45°00'00" W	56.85'
3380–3381	N 03°11'28" E	45.20'
3381–3382	N 06°59'54" E	264.33'
3382–3362	N 07°04'24" E	49.07'
3362–3361	S 83°15'11" W	205.96'
3361–3383C	S 07°02'09" W	28.44'
3383C–3383B	S 07°02'17" W	116.40'
3383B–3383A	S 06°54'45" W	125.56'
3383A–3383	S 03°03'20" W	196.63'
TRACT 218		
3383–3384	S 03°03'19" W	18.65'
3384–3385	S 02°28'11" E	110.39'
3385–3386	S 09°23'47" E	252.19'
3386–3387	S 19°07'26" E	278.11'
3387–3388	S 29°44'15" E	1,606.29'
TRACT 267		
3388–3389	S 29°44'15" E	585.58'
3389–3390	S 21°02'49" E	563.72'
3390–3391	S 15°50'05" E	1,077.87'
TRACT 219		
3391–3392	S 19°00'37" E	314.54'
3392–3393	S 24°38'04" E	56.88'
TRACT 222		
3393–3394	S 26°27'55" E	334.08'
3394–3395	S 27°35'45" E	1,767.22'
3395–3396	S 27°33'43" E	3,926.35'
TRACT 49		
3396–3396A	N 73°50'00" E	200.00'
3396A–3397	N 27°28'44" W	2,716.86'
TRACT 220		
3397–3397A	N 27°33'43" W	1,249.00'
3397A–3397B	N 27°35'45" W	1,767.34'
3397B–3397C	N 26°11'47" W	381.94'
3397C–3398	N 18°51'43" W	334.72'
TRACT 267		
3398–3399	N 15°40'39" W	1,025.40'
3399–3400	N 21°00'04" W	594.59'
3400–3401	N 29°44'09" W	354.43'
TRACT 218		
3401–3402	N 29°44'09" W	329.22'
3402–3403	N 29°44'09" W	832.92'
3403–3404	N 29°44'09" W	120.43'
3404–3405	S 61°09'10" E	75.24'
3405–3403	S 05°10'05" W	68.54'
3403–3402	S 29°44'09" E	832.92'
3402–3407	S 55°08'01" E	245.29'
3407–3408	S 58°55'18" E	424.16'
3408–3409	S 63°14'55" E	282.43'
3409–3410	S 44°16'18" E	133.05'
TRACT 267		
3410–3411	S 44°16'17" E	389.16'
3411–3412	S 29°28'33" E	528.39'
3412–3413	S 31°00'25" E	157.75'
TRACT 268		
3413–3414	S 31°00'25" E	48.33'
3414–3415	N 00°48'33" E	246.41'
3415–3416	N 37°48'53" E	215.14'
3416–3417	N 08°06'48" E	365.84'
3417–3418	N 28°48'38" E	219.44'
3418–3419	S 87°25'56" E	66.18'
3419–3420	S 68°16'30" E	56.07'
3420–3421	N 51°28'37" E	145.03'
3421–3422	N 04°22'54" W	261.59'
3422–3423	N 04°36'24" E	149.14'
3423–3424	N 00°47'15" W	169.41'
3424–3425	N 16°02'33" E	47.26'
3425–3426	N 35°27'17" E	225.87'
3426–3427	S 81°04'21" E	110.82'
3427–3428	N 25°18'24" E	177.99'
3428–3429	N 17°27'13" E	228.42'

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PT–PT	BEARING	DISTANCE
3429–3430	N 36°18'30" E	62.63'
3430–3431	N 50°21'39" E	88.51'
3431–3432	S 20°18'13" W	203.10'
3432–3433	S 33°29'42" W	93.42'
3433–3434	S 34°35'51" W	61.85'
3434–3435	S 18°18'56" W	141.25'
3435–3436	S 40°32'12" W	62.25'
3436–3437	S 36°44'09" W	170.03'
3437–3438	S 39°10'43" E	103.26'
3438–3439	S 02°29'10" W	117.19'
3439–3440	S 22°51'26" W	72.70'
3440–3441	S 10°21'38" E	102.62'
3441–3442	S 16°18'50" E	166.00'
3442–3443	S 18°56'55" E	157.81'
3443–3444	S 20°22'05" W	72.53'
3444–3445	S 17°14'34" W	51.36'
3445–3446	S 53°58'38" W	102.55'
3446–3447	S 38°48'32" W	192.97'
3447–3448	S 61°08'30" W	131.56'
3448–3449	S 06°32'35" E	128.63'
3449–3450	S 13°25'32" W	130.65'
3450–3451	S 21°08'15" E	67.27'

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PT–PT	BEARING	DISTANCE
TRACT 220		
3451–3452	S 21°08'13" E	286.68'
3452–3453	S 61°26'09" W	65.29'
3453–3454	S 60°12'30" W	128.32'
3454–3455	S 17°05'03" E	176.52'
3455–3456	S 39°01'56" W	136.55'
3456–3457	S 28°00'27" W	507.02'
3457–3458	S 16°22'47" E	284.91'
3458–3459	S 41°38'01" E	240.83'
3459–3460	N 72°52'49" E	430.48'
3460–3461	S 74°02'31" E	80.37'
3461–3462	S 42°48'58" W	111.46'
3462–3463	S 54°49'36" W	114.99'
3463–3464	S 56°36'25" W	139.76'
3464–3465	S 69°01'18" W	105.64'
3465–3466	S 19°16'34" W	192.69'
3466–3467	S 14°44'37" E	392.94'
3467–3468	S 27°36'21" E	274.68'
3468–3469	S 82°16'18" E	185.10'
3469–3470	S 85°20'44" E	90.97'
3470–3471	S 18°36'19" W	100.36'
3471–3472	S 31°58'15" W	99.88'
3472–3473	S 35°04'05" E	249.82'
3473–3474	S 14°55'53" E	310.48'
3474–3475	S 03°21'59" E	340.59'
3475–3476	S 68°08'55" E	120.48'
3476–3477	N 51°58'30" E	210.06'
3477–3478	N 41°16'59" E	174.74'
3478–3479	N 56°22'48" E	93.19'
3479–3480	N 40°04'33" E	71.07'
3480–3481	N 87°30'42" E	66.98'
3481–3482	S 42°16'51" E	69.52'
3482–3483	S 60°45'53" E	43.32'
TRACT 49		
3483–3484	S 60°45'52" E	24.52'
3484–3485	S 09°00'23" W	125.90'
3485–3486	S 29°58'24" W	128.11'
3486–3487	S 17°38'15" W	54.44'
TRACT 220		
3487–3488	S 14°45'27" W	150.00'
3488–3489	S 47°16'23" W	85.81'
3489–3490	S 37°50'36" W	73.48'
3490–3491	N 54°28'30" E	117.27'
TRACT 49		
3491–3492	N 16°00'02" E	178.07'
3492–3493	N 45°00'00" E	44.33'
3493–3494	N 52°06'35" E	229.73'
3494–3495	N 75°49'11" E	255.14'
3495–3496	S 86°13'58" E	224.31'
3496–3497	N 83°56'11" E	221.25'
3497–3498	N 56°30'20" E	191.67'
3498–3499	S 84°44'02" E	129.55'
TRACT 290		
3499–3500	S 84°44'03" E	116.11'
3500–3501	N 83°18'30" E	124.06'
3501–3502	S 22°50'14" W	136.28'
3502–3503	S 59°43'56" W	112.94'
TRACT 49		
3503–3504	S 59°44'00" W	24.38'
3504–3505	S 69°09'14" W	101.59'
3505–3506	S 46°41'46" W	120.07'
3506–3507	S 52°11'10" W	78.42'
3507–3508	S 60°42'34" W	142.49'
3508–3509	S 61°04'09" W	47.03'
3509–3510	S 81°18'34" W	118.00'
3510–3511	S 79°54'02" W	150.18'
3511–3512	N 77°15'28" W	101.31'
3512–3513	S 80°01'54" W	115.15'
3513–3514	S 53°18'23" W	105.79'
3514–3515	S 32°59'11" W	176.10'
3515–3516	S 18°52'26" W	224.91'
3516–3517	S 02°57'36" W	170.80'
3517–3518	S 38°52'12" W	78.66'
3518–3519	S 27°58'46" E	1,400.81'
3519–3520	S 57°10'17" E	922.29'
3520–3520A	S 09°07'49" E	49.88'
3520A–3521	N 47°36'46" E	97.08'
3521–3522	N 44°17'24" E	96.09'
3522–3523	N 17°24'16" E	178.39'
3523–3524	N 47°52'13" E	149.32'
3524–3525	S 65°13'18" E	70.11'
3525–3526	S 02°16'09" W	71.90'
3526–3527	S 23°32'01" W	91.86'
3527–3528	S 02°40'49" E	108.48'
3528–3529	S 21°29'26" W	87.05'
3529–3530	S 06°05'54" E	149.21'
3530–3531	S 41°34'50" W	179.49'
3531–3532	S 42°05'55" W	300.94'
3532–3533	S 09°07'49" E	912.03'
3533–3534	N 54°06'02" E	77.21'
3534–3535	N 83°09'38" E	150.93'
3535–3536	S 63°39'02" E	155.43'
3536–3537	S 48°02'12" W	135.26'
3537–3538	S 41°12'19" W	190.68'

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PT–PT	BEARING	DISTANCE
3538–1	S 31°21'13" E	1,636.49'

K–4

PT–PT	BEARING	DISTANCE
TRACT 113		
455–455A	S 61°55'39" E	113.98'
455A–455B	N 86°55'05" E	205.81'
455B–455C	N 76°58'37" E	219.41'
455C–455D	N 13°22'23" E	117.88'
455D–455E	N 74°15'48" E	61.89'
455E–455F	S 69°34'08" E	40.04'
455F–455G	N 34°07'24" E	244.57'
455G–455H	S 35°16'20" E	71.50'
455H–455I	S 04°38'25" W	177.33'
455I–455J	N 78°10'26" E	263.64'
455J–455K	N 80°32'16" E	303.10'
455K–455L	? 63°07'18" E	69.83'
455L–455M	S 12°13'49" W	67.12'
455M–458	N 68°22'34" E	234.66'
TRACT 113		
463–464	S 72°28'30" W	191.38'
464–465	S 39°48'20" W	156.20'
465–465A	N 73°18'03" W	208.81'
465A–465B	S 68°33'53" W	102.91'
465B–465C	N 89°01'30" W	36.33'
465C–465D	N 88°47'36" W	156.75'
465D–465E	S 40°49'08" W	102.51'
465E–465F	S 48°40'20" W	125.73'
465F–465G	S 57°24'58" W	69.85'
465G–465H	S 60°33'11" W	168.74'
465H–465I	S 45°42'23" W	94.11'
465I–465J	S 25°42'32" W	133.46'
465J–465K	S 15°56'43" E	291.20'
465K–465L	WEST	320.00'
465L–470	N 35°32'16" W	172.05'
470–471	WEST	760.00'
471–472	S 45°00'00" W	141.42'

K–3

PT–PT	BEARING	DISTANCE
TRACT 113		
472–473	S 20°33'22" E	683.52'
473–474	WEST	400.00'
474–475	N 45°00'00" W	226.27'
475–476	WEST	160.00'
476–476A	N 88°38'47" W	68.82'
476A–476B	S 30°49'20" W	164.91'
476B–476C	S 39°31'02" W	129.63'
476C–476D	S 02°33'48" E	163.69'
476D–476E	S 46°42'19" E	163.27'
476E–476F	S 37°07'45" E	46.90'
476F–476G	S 02°45'48" E	41.94'
476G–476H	S 01°20'56" E	133.67'
476H–476I	S 17°46'56" E	60.98'
476I–476J	S 68°29'47" E	118.71'
476J–478	S 85°29'01" E	134.68'

NOTES:

THIS EXHIBIT DRAWING WAS ORIGINALLY ISSUED AND SIGNED BY W. E. MOORE, MANAGER-HYDRO & ENVIRONMENTAL ENGINEERING AND G. C. MEETZE, EXECUTIVE VICE-PRESIDENT AS PART OF THE APPLICATION FOR AMENDMENT OF LICENSE MADE ON JUNE 26, 1981.

I, BRIAN B. BONDS, A PROFESSIONAL LAND SURVEYOR IN THE STATE OF SOUTH CAROLINA, P.L.S. 28582, HAVE REPRODUCED THIS PORTION OF THE PARR HYDRO PROJECT 1894 PROJECT BOUNDARY SHOWN HEREIN. THE LICENSEE EITHER OWNS IN FEE SIMPLE OR POSSESSES EASEMENTS OVER THE LANDS SHOWN ON THE MAP THAT ARE INSIDE THE PROJECT BOUNDARY. THE PROJECT BOUNDARY LINES THAT ARE NOT CONTOUR LINES WERE BASED ON SCE&G DESIGN AND CONSTRUCTION DRAWINGS.

PROPERTY LINES DEPICTED ON THIS EXHIBIT DERIVED FROM DEEDS AND PLATS OF RECORD. NO ACTUAL FIELD SURVEY WAS CONDUCTED FOR PREPARING THIS MAP. THIS EXHIBIT IS NOT A PROPERTY BOUNDARY SURVEY. ALL PROPERTY LINE LOCATIONS SUBJECT TO FULL BOUNDARY SURVEY OF THE DEPICTED PARCEL.

DETAIL MAP OF PROJECT AREA

SHEET 20 OF 20

PARR HYDROELECTRIC PROJECT NO.1894

SOUTH CAROLINA ELECTRIC & GAS COMPANY

PROJECT BOUNDARY LINE DESCRIPTION

PREPARED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345–5297

BRIAN B. BONDS ; S.C.P.L.S. # 28582

SURVEYORS SEAL

SURVEYORS SEAL

SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR 28582 BRIAN B. BONDS

C.O.A. SEAL

SOUTH CAROLINA GLENN ASSOCIATES SURVEYING INC. No.C02238 CERTIFICATE OF AUTHORIZATION

REVISION SCHEDULE

NO.	DATE	DESCRIPTION	CHECKED
1	5/29/85	REVISED TO SHOW P.B.L. REVISION	
2	9/17/12	REVISED PER FERC ORDER 137 FERC ¶ 62,033	BBB
3	5/7/13	REVISED PER FERC ORDER 143 FERC ¶ 62,095	BBB

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EXHIBIT H

ADDITIONAL INFORMATION

EXHIBIT H
ADDITIONAL INFORMATION

Information Required from All Applicants

1. The Applicant intends to continue to operate and maintain the Project to provide efficient and reliable electric service as described below.

   a. The Applicant provides for the reliability of its electric system by maintaining an adequate reserve margin of supply capacity, and by maintaining daily operating reserves to balance the risk that some of the Applicant's generation capacity may be forced offline on any given day because of mechanical failures, wet coal problems, environmental limitations, or other unforeseen events. The Applicant is a member of the Virginia-Carolinas Electric Reliability Council (VACAR), an organization which coordinates a regional reserve sharing system allowing its members to pool their reserve generation resources on a prorated basis. This VACAR Reserve Sharing Arrangement (VRSA) provides a formal mechanism for VACAR members to share reserve capacity.

   b. Fairfield Pumped Storage Development will continue to serve as a peaking and reserve generation facility in the Applicant's system, as well as serving a critical role in storing off peak energy. As a peaking power generator, up to 3,960 MWh of energy can be dispatched rapidly and flexibly to follow system load on a daily basis. During the pumping portion of the cycle, up to 5,760 MWh of off peak energy can utilized for pumping. At maximum utilization, Fairfield Pumped Storage allows the Applicant approximately 1,200 MW of "swing" in generation or load absorption on a daily basis. While generation flexibility is critical in providing on-peak generation, its energy storage capability allows baseload plants to remain on line during periods of minimum customer load, thereby avoiding additional fuel and O&M costs associated with repeated shutdown and startup of baseload units. By shifting some of the system load from peak to off peak periods, the Fairfield Development allows more efficient use of baseload plants.

c. As a reserve asset, in the event of a loss of generation elsewhere in the Applicant's system, the Fairfield Development units not being used for peaking power generation can be started and brought to full load within 15 minutes. This allows a rapid response to emergencies on SCE&G's system, and also fulfills all or part of SCE&G's reserve share obligation as a VACAR member. VACAR has set the regional reserve requirement at 150 percent of the largest unit in the region. The Applicant's prorated share of this reserve requirement is approximately 200 MW. Currently, reserve generation on the Applicant's system is provided by a mix of conventional hydro (non-run of river), pumped storage, and combustion turbine assets. The Fairfield Development usually has some reserve availability even during peak demand periods, with correspondingly greater reserve availability during off peak periods when not being utilized for pumping. Providing rapid response to emergencies on SCE&G's system and those to which SCE&G is interconnected helps to insure reliability of electrical service both locally and area-wide. The use of Fairfield Pumped Storage for both peaking and reserve generation is more efficient and reliable than other potential alternatives such as combustion turbines or diesel powered generators.

Monticello Reservoir (part of the Fairfield Development) also serves as a cooling and service water source for the Applicant's V. C. Summer Nuclear Station, and continued operation of the Parr Project is and will remain critical to continued operation of Summer Station. The Applicant and its partners are currently constructing Summer Station Units 2 and 3, which are Westinghouse AP-1000 pressurized water reactors. When these new nuclear units are completed, they will utilize water from Monticello Reservoir for makeup to their cooling towers and for process makeup water, as well as service water. The Fairfield Development will be required to make up additional evaporative and other losses due to the operation of the new units by pumping an increment of additional water into Monticello Reservoir during each pumping cycle. The operation of the Fairfield Development in both pumping and generating modes will also serve to balance the additional baseload generation of the two new nuclear units on the Applicant's system, which will continue to be critical to safe, reliable, and efficient operation of the Applicant's system.

d. The Parr Shoals Development provides low cost baseload generation as well as "black start" capability[1] for a portion of the Applicant's system, including the V. C. Summer Nuclear Station in Fairfield County. This enhances the reliability of the Applicant's system.

e. Plans for increasing capacity and generation at the Parr Hydroelectric Project are limited to replacement of generators at the Parr Shoals Development to allow use of full available project head. Potential equipment upgrades were evaluated in a Parr Hydroelectric Project Resource Utilization Study (Kleinschmidt 2015), and a Generation Capacity Increase Review (Kleinschmidt 2017). The results of this study are summarized in Exhibit B.

2. The Applicant's plans to continue to operate the Project within its own system, and in coordination with others, as described above, will help to minimize the cost of production by providing economical baseload, peaking, and reserve generation capacity. Continued operation of the Project is also critical to the Applicant's short and long term plans to transition their baseload generation fleet to an equal mix of scrubbed coal, gas (both conventional steam and combined cycle), and nuclear assets. Conventional hydro, pumped storage, and simple cycle gas turbine assets will serve peaking and reserve functions, with solar generation also being integrated into the Applicant's system as it comes on line.

3. The Applicant's need over short and long term for power generated from this project is described as follows:

a. The table below shows that total summer and winter peak electric demand on the Applicant's system is forecast to increase by approximately 1.4 percent and 0.9 percent per year, respectively, during the period 2017 – 2031. The Applicant's system generation capacity is planned to increase by 1,340 MW of new baseload generation between 2020 and 2022 due to additional nuclear units under construction on the existing V. C. Summer Station site. Based on the forecast, the continued availability of the Fairfield Development for peaking and reserve generation will be critical to maintaining the reliability of the Applicant's system.

[1] "Black start" refers to the ability to start a generating unit or plant with no external power supplied from the transmission and distribution system, using the power plant's own internal power sources such as batteries or stored compressed air or water. Black start capability may be required to restore the electric power system in the event of widespread damage to the transmission and distribution system. Hydroelectric plants need very little power to start generating, and are often utilized as black start resources.

	Summe r Peak (MW)	Winter Peak (MW)	Energ y Sales
201	4,80	4,63	22,97
201	4,91	4,75	23,28
201	4,95	4,77	23,10
202	5,07	4,82	23,33
202	5,19	4,87	23,56
202	5,30	4,92	23,99
202	5,41	4,96	24,42
202	5,48	5,00	24,83
202	5,55	5,04	25,23
202	5,61	5,08	25,64
202	5,66	5,12	26,05
202	5,71	5,15	26,48
202	5,77	5,19	26,61
203	5,82	5,23	26,74
203	5,87	5,27	27,09

Source: Integrated Resource Plan, SCE&G February 2017.

b. Parr Shoals Development's primary function will be to supply baseload power to fulfill the Applicant's own system requirements. The Parr Shoals Development is also crucial to the operation of the Fairfield Pumped Storage Development, since Parr Reservoir acts as the lower reservoir for the pumped storage system, and Parr Hydro and the spillway crest gates on Parr Shoals Dam are used to modulate discharges from the lower reservoir to balance the overall storage in the pumped storage complex.

c. Fairfield Development's primary function will be to supply peaking power and reserve generation to fulfill the Applicant's own system requirements, as well as reserve obligations under the existing VRSA. The Fairfield Development is one of the Applicant's primary peaking power generation assets, and is used nearly every day of the year to some extent in this capacity.

d. Discussion of increase in fuel, capital, and O&M costs if license is not granted: The Fairfield Development provides flexible peaking power generation and rapid-start reserve generation capacity for the Applicant's system and to meet the Applicant's reserve share obligation under the VRSA. Both peaking and reserve generation capacity is critical to maintaining the reliability of the Applicant's system as well as contributing to the reliability of the regional transmission grid. Should a new license for the Parr Project not be granted, the Project's peaking and reserve generation capacity would have to be replaced by a combination of off system power purchases and constructing new rapid-start generation facilities, most likely aero-derivative combustion turbines. The cost of financing, constructing, operating, and maintaining such facilities would increase the cost of power to the Applicant's wholesale, residential, commercial, military, and industrial customers.

The energy storage function served by the Fairfield Development due to pumping during off peak periods is also critical to the operation of the Applicant's system and would be extremely costly to replace. For example, the installed cost of storage batteries and ancillary equipment to replace the 3,960 MWh of energy stored in Monticello Reservoir would cost approximately $6 billion in 2017 dollars, based on an installed cost of $1,500 per KWh for storage batteries and ancillary equipment.

Loss of use of the Project would require that Monticello Reservoir become a dedicated cooling water source for V. C. Summer Nuclear Station. If the Fairfield Development were no longer in operation, an alternative means to pump water into the reservoir to make up for evaporative and other losses would need to be found, because the watershed draining to the reservoir is too small to rely on runoff as a makeup source. This would require modifications to the operating licenses for VCS Unit 1 as well as future Units 2 and 3.

The growth of solar generation facilities on the Applicant's system is projected to require increased use of the Fairfield Development to balance system generation on a daily basis as solar generation varies during each day. Fairfield can generate early and late in the day when solar generation is not available, and can reduce generation through the middle of the day when solar generation is at its maximum.

e. Effect of each alternative source of power on customers, operation and load characteristics, and communities: New peaking and reserve generation facilities would require a sizable site to accommodate the generating units, approximately 2,000,000 gallons of fuel, and ancillary equipment. The large quantity of fuel stored would present potential environmental and safety concerns. The site would have to be chosen with regard to permitting constraints for air, water, and noise emissions;

water availability; and the availability of interconnections with the electric transmission system. The cost of financing, constructing, operating, and maintaining such facilities would increase the cost of power to the Applicant's wholesale, residential, commercial, military, and industrial customers. The effect on operation and load characteristics would vary with the site(s) selected and their proximity to load centers on the Applicant's system.

The loss of license for the Project would result in a loss of tax revenues to the federal, state and local governments. The governmental entities affected by this loss in revenue would ultimately have to seek a reduction in expenses or an increase in other sources of revenue. For example, the Applicant currently pays approximately $5.4 million annually in property taxes on Project property and assets.

4. Data showing need, reasonable cost and availability of alternate source of power:

   a. The average annual cost of power produced by the Parr Shoals and Fairfield Developments in 2016 were $27.33 and $5.49 per net MWH respectively (2017 FERC Form 1).

   b. Projected resources required to meet short and long term capacity and energy requirements are presented in Exhibit H-1, <u>2017 Integrated Resource Plan (IRP).</u> The Applicant files a copy of its IRP with the South Carolina Public Service Commission (SCPSC) in accordance with S.C. Code Ann. § 58-37-40 (1976, as amended), § 58-33-430 (1976, as amended), and SCPSC Order No. 98-502. This Plan was filed with SCPSC on February 28, 2017.

   c. Costs associated with alternative sources of power:

      i. Generation of additional power at existing facilities: The baseload power produced by the Parr Shoals Development could be replaced by dispatching coal or gas fired units, or by purchasing the power off system. The Applicant currently has no generation units at existing facilities which could be utilized to replace the Fairfield Development's peaking power and energy storage capacity.

ii. Restarting deactivated units: SCE&G has no deactivated generation facilities capable of being restarted at this time.

iii. Purchase of power off-system: Replacing the baseload generation produced by Parr Shoals would cost approximately (to be provided later), resulting in an annual cost of (to be provided later) based on the average annual generation of 56,409 MWh given in Exhibit B-1. Replacing the peaking power produced by the Fairfield Development would cost (to be provided later), resulting in an annual cost of (to be provided later) based on the average annual generation of 676,981 MWh given in Exhibit B-1.

iv. Construction or purchase and operation of a new power plant: Replacing the baseload power generated by the Parr Shoals Development would not require the construction of a new power plant. New on-system, peaking generation to replace the Fairfield Development would be either diesel generator sets (250 to 290 units would be required), or aero-derivative combustion turbines (12 units would be required). Capital construction costs in 2017 dollars associated with each alternative are estimated to be:

1. Diesel Generator Sets:

LAND	$361,972.56
PERMITTING	$579,156.10
EQUIPMENT	$146,598,887.28
BALANCE OF PLANT	$137,549,573.25
ENGINEERING	$1,809,862.81
CONSTRUCTION	$25,338,079.28
START-UP	$904,931.40
PROJECT MGMT	$904,931.40
TOTAL	**$314,047,394**

2. Aero-Derivative Combustion Turbines:

LAND	$361,972.56
PERMITTING	$579,156.10
EQUIPMENT	$212,839,865.98
BALANCE OF PLANT	$67,978,446.99
ENGINEERING	$2,171,835.37
CONSTRUCTION	$41,264,871.98
START-UP	$723,945.12
PROJECT MGMT	$1,085,917.68
TOTAL	**$327,006,012**

The above costs are based on estimates developed by the Applicant based on typical construction costs for these types of facilities.

The U.S. Energy Information Administration[2] has estimated the installed cost of conventional combustion turbines in 2016 dollars at $1,040 per installed KW of capacity. Based on that estimate, the cost of replacing the peaking power generated at Fairfield Pumped Storage with aero-derivative combustion turbines would be approximately $600 million.

The estimated increase in annualized 30 year life cycle costs in 2017 dollars (including capital cost from the tables above, operation and maintenance costs, and fuel costs) for replacing the Fairfield Development with these two alternatives are estimated to be:

1. Diesel Generator Sets: (To be provided later).

2. Aero-Derivative Combustion Turbines: (To be provided later).

v. Discussion of the relative merits of each alternative:

1. Diesel generator sets have an overall efficiency of about 37%, and an estimated equivalent availability of about 90%. 250 to 290 individual engine-generator sets would be required to replace the peaking and reserve capacity currently provided by the Fairfield Development. This would require a sizable site to accommodate the generating units, approximately 2,000,000 gallons of fuel, and ancillary equipment. The large quantity of fuel stored would present potential safety and environmental hazards. The site would have to be chosen with regard to permitting constraints for air, water, and noise emissions; water availability; and the availability of interconnections with the electric transmission system.

2. Aero-derivative combustion turbines have an overall efficiency of about 40%, and an estimated equivalent availability of about 90%. Twelve individual turbine-generator sets would be required to replace the peaking

2 U.S. Energy Information Administration, " Cost and Performance Characteristics of New Generating Technologies, Annual Energy Outlook 2017", January 2017

and reserve capacity currently provided by the Fairfield Development. This would require a sizable site to accommodate the generating units, approximately 2,000,000 gallons of fuel, and ancillary equipment. The large quantity of fuel stored would present potential safety and environmental hazards. The site would have to be chosen with regard to permitting constraints for air, water, and noise emissions; water availability; and the availability of interconnections with the electric transmission system.

d. Load management measures such as conservation: The Applicant's Demand Side Management programs are described in Section 12 below.

5. Effect on direct providers and their customers of alternate sources: If any of the alternative sources of peaking and reserve capacity discussed above were to be constructed, the cost of financing, constructing, operating, and maintaining such facilities would increase the cost of power to the Applicant's wholesale, residential, commercial, military, and industrial customers.

6. Use of power for Applicant's own industrial facilities: The Applicant is an investor-owned utility, and has no non-utility industrial facilities to be affected by loss of electricity from the Parr Hydroelectric Project. The Parr Shoals Development provides "black start" capability for a portion of the Applicant's system as described above.

7. Need for Project to foster the purpose of an Indian Tribal Reservation: The Applicant is not an Indian Tribe, and does not use the electricity generated by the Parr Hydroelectric Project to foster the purposes of a reservation.

8. Impact on the operation and planning of transmission system of receiving or not receiving license: The Parr Hydroelectric Project is an important resource for meeting the Reliability Standards of the North American Electric Reliability Corporation (NERC) for interconnected-systems operation, in particular Standard BAL-001 - Real Power Balancing Control Performance and Standard BAL-002 – Disturbance Control Performance. These Standards provide recommended practices for maintaining steady-state frequency within defined limits and to provide for operating reserves and frequency regulation to address the resolution of inadvertent interchange between electric systems or conditions of insufficient generation resources. Over many years, NERC has developed and adopted these Standards for the planning and operation of the bulk

electric system through the cooperative efforts of its member utilities. NERC has recently begun to change from voluntary to mandatory Standards for system reliability management. NERC's Regional Entities have initiated requirements to assess and enforce compliance with NERC Reliability Standards. A Compliance Program designed to implement the Standards set forth by NERC has been adopted by the SERC Reliability Corporation (SERC). The Applicant is an active participant in the Compliance Program within SERC.

The Applicant utilizes the Parr Hydroelectric Project to comply with these NERC Standards. The Project is located near the Columbia metropolitan area, which is a major load center on the Applicant's system. The Project is also located adjacent to the V. C. Summer Nuclear Station. Interconnections with the Applicant's 115 KV and 230 KV systems are available at this location, making the current location beneficial to the Project's primary role as reserve generation in the Applicant's system. If hydroelectric operations at this facility were to be discontinued, in the short term the Applicant would be required to utilize other generation sources to maintain these and other related operational Standards specified by NERC. The effect on the Applicant's transmission system operation and planning would vary depending upon the generation sources available and their proximity to load centers on the Applicant's system. In the long term, it is likely that construction of other reserve generation facilities would be required. New peaking and reserve generation sources would best be located near one or both of the two principal load centers in the Applicant's system, namely the Columbia and Charleston metropolitan areas, and would most likely be in the form of either aero-derivative combustion turbines (at least 12 units), or diesel engine-generator sets (250 to 290 units). Depending upon siting constraints, it may not be possible to locate all of the new reserve units reasonably close to either major load center. In that case, there is the potential for negative impacts to the Applicant's transmission system in the form of inefficient redistribution of power flow in the system when reserve generation is required. It is also likely that new transmission facilities would need to be constructed to integrate the new reserve units into the Applicant's system. The potential cost impact of these system modifications would depend on the particular site(s) chosen and their proximity to load centers and system interconnection points. Transmission costs associated with new generation has been estimated by the Applicant's Generation Planning group to be $13.23 per installed KW of capacity, or approximately $7.6 million in transmission costs associated with replacing the Fairfield Development with new peaking and reserve generation on the Applicant's system.

An additional consideration in this discussion is the Parr Hydroelectric Project's role as a "black start" resource in the Applicant's system, as previously described in general terms in Section 1 of this Exhibit. The Project is a key resource, along with the Applicant's Parr Shoals Development, in providing black start capability for the V. C. Summer Nuclear Station, which is located in Fairfield County and is owned (in part) and operated by the Applicant.

A detailed map of the Applicant's transmission facilities is included as Exhibit H-2. (Note this item is CEII and will be provided with the Final License Application).

9. Need for, or usefulness of, modifications to existing Project facilities or operations: (To be provided later).

10. The Applicant's financial and personnel resources to meet its obligations under a new license are as follows:

    a. The Applicant has adequate personnel resources to continue to operate and maintain the Parr Hydroelectric Project in accordance with the provisions of the license. The permanent staff at the Parr Shoals Development consists of four operator-repairmen, who are on site eight hours per day, five days per week, and perform plant checks on weekends and holidays. The permanent staff at the Fairfield Development consists of 21 personnel who are on site eight hours per day, five days per week. The Fairfield Development control room is staffed continuously by an Operator and a Station Attendant. In addition, the Applicant can provide additional personnel from its other electric generating facilities in the event of emergencies or major maintenance outages. An organization chart for the Project is provided as Exhibit H-3. The Parr Project personnel receive on-the-job and other in-house training programs to prepare them to safely operate and maintain the plant, including training for response to environmental and other emergencies. A list of required safety training programs is included as Exhibit H-4, and a list of required Operator/Repairman Training programs is included as Exhibit H-5.

11. The Applicant proposes to extend the Project to encompass certain additional lands for existing and/or future recreation sites. All of the proposed expansion property is already owned in fee by the Applicant, therefore notification of the owners of such property for this purpose is not required. Details on these properties will be included in the Recreation Plan currently being developed in consultation with Project stakeholders as described more fully in Exhibit E.

12. Statement of energy conservation programs and measures: The Applicant is actively involved in a number of programs to improve the efficiency of electricity generation and consumption on its power system. These programs can be divided into two major categories: Energy Efficiency Programs (including Customer Education and Outreach), and Load Management Programs.

Energy Efficiency Programs

These programs include Customer Education and Outreach, Energy Conservation and Demand Side Management programs as described in the following sections.

Customer Education and Outreach

SCE&G's customer education and outreach includes a wide variety of communication vehicles to increase customer awareness and to help customers become more energy efficient. Two key components, customer insights/analysis and media/channel placement, are summarized below:

Customer Insights and Analysis: In 2015, SCE&G conducted a follow-up Voice of the Customer (VOC) panel survey to gain additional insight about energy efficiency and engagement with Demand Side Management residential programs. Over 3,200 SCE&G residential customers were solicited with a 55% completion rate.

Media/Channel Placement: SCE&G is committed to customer education about available programs and services designed to help them be more energy efficient. To reach as many customers as possible, a diverse mix of channels is used, including both paid and earned media. Direct mail, bill inserts, radio, online and community events continue to prove successful with engaging customers. Extensive outreach via social media continues to provide maximum coverage and the opportunity to inform customers. A steady increase in customer engagement with social media networks, Facebook and Twitter, has resulted in nearly 36,500 likes and about 9,100 followers respectively. Year-round news coverage is equally important and is consistently integrated into the media mix, particularly during peak winter and summer months when usage is high.

Energy Conservation Programs

The following is an overview of each SCE&G energy conservation offering:

Energy Saver / Conservation Rate: Rate 6 (Energy Saver/ Conservation) rewards homeowners and homebuilders with a reduced electric rate when they upgrade existing homes or build new homes to a high level of energy efficiency. This reduced rate, combined with a significant reduction in energy usage, provides for considerable savings to customers. Participation in the program is easy as the requirements are prescriptive which is beneficial to all customers and trade allies.

Seasonal Rates: Many SCE&G rates are designed with components that vary by season. Energy provided in the peak usage season is charged a premium to encourage conservation and efficient use.

Demand Side Management Programs: In 2016, the Demand Side Management portfolio of programs included six (6) programs targeting SCE&G's residential customer classes and two programs targeting commercial and industrial customer classes. A description of each program follows:

Residential Home Energy Reports provides customers with monthly/bi-monthly reports comparing their energy usage to a peer group and providing information to help identify, analyze and act upon potential energy efficiency measures and behaviors.

Residential Home Energy Check-up provides customers with a visual energy assessment performed by SCE&G staff at the customer's home. At the completion of the visit, customers are offered an energy efficiency kit containing simple measures, such as compact fluorescent light bulbs ("CFL"), water heater wraps and/or pipe insulation. The Home Energy Check-up is provided at no additional cost to all residential customers who elect to participate.

Residential ENERGY STAR® Lighting incentivizes residential customers to purchase and install high-efficiency ENERGY STAR® qualified lighting products by providing deep discounts directly to customers. In 2016, SCE&G continued to offer incentives via an online store, in addition to providing energy efficiency lighting kits at various business office locations.

Residential Heating & Cooling Program provides incentives to customers for purchasing and installing high efficiency HVAC equipment in existing homes. Additionally, the program provides residential customers with incentives to improve the efficiency of existing AC and heat pump systems through complete duct replacements, duct insulation and duct sealing.

Neighborhood Energy Efficiency Program (NEEP) provides income qualified customers with energy efficiency education, an in-home energy assessment and direct installation of low-cost energy saving measures as part of a neighborhood door-to-door sweep approach. In 2015 & 2016, neighborhoods in Charleston, Summerville, Columbia, West Columbia, Aiken County, Johnston, Ridgeland, Hardeeville participated in the program. Additionally, the program expanded offerings to mobile and manufactured home to include additional measures specific to this housing stock.

Appliance Recycling Program provides incentives to residential customers for allowing SCE&G to collect and recycle less-efficient, but operable, secondary refrigerators, and/or standalone freezers, permanently removing the units from service.

EnergyWise for Your Business Program provides incentives to non-residential customers to invest in high-efficiency lighting and fixtures, high efficiency motors and other equipment. To ensure simplicity, the program includes a master list of prescriptive measures and incentive levels that are easily accessible to commercial and industrial customers on SCE&G's website. Additionally, a custom path provides incentives to commercial and industrial customers based on the calculated efficiency benefits of their particular energy efficiency plans or construction proposals. This program applies to technologies and applications that are more complex and customer specific. All aspects of this program fit within the parameters of both retrofit and new construction projects.

Small Business Energy Solutions Program is a turnkey program, tailored to help owners of small businesses manage energy costs by providing incentives for energy efficiency lighting, electric water heaters and refrigeration upgrades. The program is available to SCE&G's small business and small nonprofit customers with an annual energy use of 250,000 kWh or less, and five or fewer SCE&G electric accounts.

Load Management Programs

The primary goal of SCE&G's load management programs is to reduce the need for additional generating capacity. There are four load management programs: Standby Generator Program, Interruptible Load Program, Real Time Pricing Rate and the Time of Use Rates. A description of each follows:

Standby Generator Program: The Standby Generator Program for wholesale customers provides about 25 megawatts of peaking capacity that can be called upon when reserve capacity is low on the system. This capacity is owned by our wholesale customers, and through a contractual arrangement is made available to SCE&G dispatchers. SCE&G has a retail version of its standby generator program in which SCE&G can call on participants to run their emergency generators. This retail program provides about 10 megawatts of additional capacity as needed.

Interruptible Load Program: SCE&G has over 200 megawatts of interruptible customer load under contract. Participating customers receive a discount on their demand charges for shedding load when SCE&G is short of capacity.

Real Time Pricing ("RTP") Rate: A number of customers receive power under a real time pricing rate. During peak usage periods throughout the year when capacity is low in the market, the RTP program sends a high price signal to participating customers which encourages conservation and load shifting. Of course during low usage periods, prices are lower.

Time of Use Rates: Time of use rates contain higher charges during the peak usage periods of the day and lower charges during off-peak periods. This encourages customers to conserve energy during peak periods and to shift energy consumption to off-peak periods. All SCE&G customers have the option of purchasing electricity under a time of use rate.

<u>Load Impact of Load Management Programs</u>

The Company relies on the standby generator program and the interruptible service program (both are termed Demand Response programs) to help maintain the reliability of its electrical system. There are currently 257 megawatts of capacity made available to the system through these programs. This load management capacity is expected to increase to 299 megawatts by 2030. The table below shows the peak demand on the system with and without these programs. The firm peak demand is the load level that results when the Demand Response programs are used to lower the system peak demand.

Territorial Peak Demands (MWs)

		Energy Efficiency					
Year	**Baselin e**	**SCE&G Progra**	**Federal Mandate**	**Total EE**	**System Peak Deman**	**Deman d**	**Firm Peak Deman**
201	5,07	-10	-7	-17	5,05	-	4,80
201	5,19	-19	-9	-	5,16	-	4,91
201	5,27	-40	-14	-	5,21	-	4,96
202	5,41	-58	-20	-	5,33	-	5,07
202	5,55	-69	-29	-	5,46	-	5,19
202	5,69	-79	-38	-	5,57	-	5,31
202	5,81	-90	-47	-	5,67	-	5,41
202	5,91	-	-56	-	5,75	-	5,49
202	6,00	-	-65	-	5,82	-	5,55
202	6,08	-	-75	-	5,88	-	5,61
202	6,16	-	-84	-	5,94	-	5,66
202	6,23	-	-94	-	5,99	-	5,71
202	6,31	-	-	-	6,05	-	5,77
203	6,38	-	-	-	6,10	-	5,82
203	6,45	-	-	-	6,15	-	5,87

As a corporation organized and existing under the laws of the State of South Carolina, the Applicant must comply with the policies of the SCPSC regarding energy conservation. The Applicant files a copy of its Integrated Resource Plan (IRP) with the SCPSC in accordance with S.C. Code Ann. § 58-37-40 (1976, as amended), § 58-33-430 (1976, as amended), and SCPSC Order No. 98-502. The section of the IRP titled "Demand Side Management" describes many of the Applicant's programs as well as the methodology used by the Applicant to choose cost effective programs that promote energy conservation and load management by the Applicant's customers. A copy of the most recent IRP filing (February 28, 2017) is included as Exhibit H-1.

13. Indian tribes with land on the Project or who would be affected by the Project:

a. There are no Indian tribes with land within the Parr Hydroelectric Project boundary. However, in July 2013, 17 federally-recognized Indian Tribes were contacted by mail to see if they wished to be consulting parties for the Parr Hydroelectric Project. The list of potentially interested tribes was obtained from the State Historic Preservation Office (SHPO). Contact information for the two consulting party tribes is contained in the Historic Properties Management Plan (Terracon 2016), which is included as an Appendix to Exhibit E in this Application. The responses of the tribes who were contacted are summarized below.

Indian Tribe	***Response/Status***
Absentee-Shawnee Tribe	No Response
Catawba Indian Nation	Consulting Party
Cherokee Nation	No Response
Chickasaw Nation	Not interested in being a consulting party
Choctaw Nation of Oklahoma	Not interested in being a consulting party
Eastern Band of Cherokee Indians	No Response
Eastern Shawnee Tribe of Oklahoma	No Response.
Jena Band of Choctaw Indians	No Response
Miccosukee Tribe of Indians of Florida	No Response
Mississippi Band of Choctaw	No Response
Muscogee (Creek) Nation	Not interested in being a consulting party; however, notify if human remains or cultural material are found.
Poarch Band of Creek Indians	No Response
Santee Sioux Tribe of Nebraska	No Response
Seminole Indian Tribe	Not interested in being a consulting party; however, notify if human remains or cultural material are found.
Seminole Nation of Oklahoma	No Response
Tuscarora Nation	No Response
United Keetoowah Band of Cherokee	Consulting Party

Information Required from Existing Licensees

1. The Applicant has taken measures to ensure safe management, operation, and maintenance of the Parr Hydroelectric Project, and will continue to do so in the future, as described below.

   a. Operation During Flood Conditions: Article 39 of the current Project license states, *"The Licensee shall operate the project reservoirs in such a manner that releases from the lower reservoir during flood flows shall be no greater than flows which would have occurred in the absence of the project."* During the design and construction of the Fairfield Development and the concurrent installation of the bascule crest gates on Parr Dam, the Applicant determined that a river flow in excess of 40,000 CFS downstream of Parr Dam would cause the river to begin to inundate low lying areas outside the main river channel. Since the Project Boundary does not extend downstream of Parr Dam, the Applicant operates the Project so as to never exceed 40,000 CFS downstream when the Fairfield Development is operating in generating mode. As inflow begins to increase beyond the hydraulic capacity of Parr Hydro, the operators begin to lower the Parr Dam crest gates in order to pass the excess inflow over the spillway. When the Fairfield Development is generating and the Parr crest gates are not fully raised, the discharge from Fairfield is added to the natural river flow, resulting in a higher flow downstream of Parr Dam than would occur without Fairfield's discharge. As the inflow to Parr Reservoir increases further, and the crest gates continue to be lowered to pass the flow, Fairfield generation is gradually curtailed until it completely ceases prior to the flow downstream of Parr Dam reaching 40,000 CFS, at which point all the crest gates have been lowered to the fully down position. At this point, Parr Dam is passing all inflow either through the Parr Hydro powerhouse, or over the dam crest, and the flow downstream of Parr Dam is not greater than the flow which would have occurred in the absence of the Project, i.e. the natural flow in the river. The Applicant proposes to continue operating in this manner in the future during high inflows to the Project.

   b. A second constraint imposed on the Project during high inflow periods is the need to limit the reservoir water surface elevation upstream of Parr Dam due to the backwater profile resulting from the presence of Parr Dam. A backwater study performed by the United States Geological Survey (USGS) during the design of the Fairfield Development and Parr crest gates determined that a critical cross section exists at USGS study cross section 13 ("Section 13"), located approximately 5 miles upstream of Parr Dam. At this location, the Norfolk Southern Railroad track runs on an embankment across a portion of Parr Reservoir, which can be inundated during high flow events if the Parr Dam crest gates are not lowered as inflow increases in order to reduce the maximum water surface elevation of Parr Reservoir, measured at Parr Dam. A table was developed which gives maximum Parr Reservoir water elevations (measured at Parr Shoals Dam) which are allowed at various inflow values, and is provided as Exhibit H-6. The Applicant proposes to continue to observe this restriction in the future.

c. Warning Devices Used to Ensure Public Safety: The Parr Shoals Development utilizes a warning siren to alert anyone in the river immediately downstream of the dam of when the crest gates are lowered to spill water over the dam.

d. Emergency Action Plan: The Applicant maintains up to date Emergency Action Plans (EAPs) for both the Parr Shoals and Fairfield Developments in accordance with FERC requirements. These plans define responsibilities and provide procedures designed to identify unusual and unlikely conditions that may endanger Project water retaining structures in time to take mitigating action and to notify the appropriate emergency management officials of possible, impending, or actual failure. Annual EAP training of Project personnel is performed (beginning in 2006, the annual training includes emergency response agency personnel, as required by the FERC Atlanta Regional Office.) An annual EAP drill is conducted which consists of contacting each local emergency responder by telephone to confirm that the notification procedures and contact information are valid. Prior to 2015, every five years, a tabletop and functional exercise are conducted at one of the Applicant's high hazard projects, which is intended to mimic in real time the activation of the EAP, with full participation of the emergency responders. Starting in 2015, FERC Atlanta Regional Office required Licensees to conduct a tabletop and functional exercise every five years for each high hazard dam. Therefore, a tabletop and functional exercise were conducted for Parr and Fairfield Developments in 2011 and again in 2016. The next exercise is currently scheduled for 2021.

e. Monitoring Devices: The Project structures are monitored using instrumentation (including piezometers, inclinometers, tilt meters, seepage measurement points, and survey monuments) which is read periodically by personnel familiar with the structures and instruments. The applicant maintains a Surveillance and Monitoring Program for the both developments of the Project, and files annual Dam Safety Surveillance and Monitoring Reports (DSSMRs) with the FERC Atlanta Regional Office. The Fairfield Development is staffed by operators at all times, and by maintenance and engineering personnel 5 days per week. At Parr Shoals, plant operators staff the plant five days a week, and are also present for brief surveillance periods on weekend days and holidays. This group performs routine daily visual surveillance of the Parr Shoals dam. Detailed monthly, quarterly, semi-annual, and annual surveillance and reading of instrumentation are done by SCE&G Fossil/Hydro Dam Safety personnel, and maintenance of the dams and instrumentation is performed by SCE&G parks and dams maintenance personnel. All of these groups are responsible for observation and reporting of any problems noticed during their surveillance.

f. Employee and Public Safety: During the period since the current license was issued, there have been 31 OSHA recordable work related injuries at the Project, and 24 first aid cases:

Year	Recordable	First Aid
1977	1	
1979	1	1
1980	4	
1981	3	1
1982		1
1984		1
1986		1
1988	2	
1989	1	2
1990	4	
1993	2	
1994	2	
1996	1	
1997	2	

(Continued)

Year	Recordable	First Aid
1998	1	
1999	2	
2001	1	3
2003	1	
2004	1	1
2007		2
2009		2
2011		1
2012	1	6
2013	1	
2014		1
2016		1

g. The Applicant maintains a Public Safety Plan (PSP) for the Project, which includes warning, caution, and information signs and devices of various types and at various locations at the public access facilities on the reservoirs.

In addition to the Applicant's measures to maintain and improve public safety, the S.C. Department of Natural Resources maintains navigational aids on Monticello Reservoir, and conducts law enforcement patrols by boat on both reservoirs.

There have been at least 16 incidents involving accidental or criminal death or injury to 17 members of the public within the Parr Hydroelectric Project during the period since the present license was issued through the end of 2016. The following table lists the number of incidents by year:

Year	Number of Incidents
1987	1
1989	1 (2 people died)
1992	1
1996	1
1998	2
2004	1
2008	1
2009	1
2011	2
2012	1
2013	4
2015	0
2016	0

Of the 17 people involved in incidents since 1987, 13 drowned in Monticello Reservoir, 3 drowned or were presumed drowned in Parr Reservoir, and 1 was an apparent suicide.

2. Description of Current Operation of the Project:

The Project is configured and operated as a modified run of river conventional hydro (the Parr Development) with a superimposed pumped storage system (the Fairfield Development). Prior to the Fairfield Development, the Parr Development operated in a manner more closely approximating a true run of river plant. Under the current license, during periods when the natural inflow to Parr Reservoir is within the hydraulic capacity of the Parr Hydro turbines, the Parr Dam crest gates are maintained in the fully raised position, allowing retention of the maximum active storage available in Parr Reservoir. The Fairfield Development is dispatched on a daily basis in both pumping and generating modes in order to meet the peak demands of the Applicant's interconnected system, and to a lesser extent to fulfill the reserve requirements of the Applicant's system and the aforementioned VACAR Reserve Sharing Agreement (VRSA). During Fairfield's operating cycle, some or all of the 29,000 acre-feet of active storage available within the allowable operating ranges of the Project reservoirs are exchanged, resulting in fluctuating reservoir water surface elevations in both Parr and Monticello Reservoirs on a daily basis. The operating range for Parr Reservoir is between a minimum of el. 255.3 ft. and maximum controlled elevation 265.3 ft. (which would only be exceeded as a result of a very large flood, and not by action of the Applicant). The operating range for Monticello Reservoir is between a minimum of el. 419.8 ft. and a maximum of el. 424.3 ft. In a letter dated February 22, 1979 (provided as Exhibit H-7), the Commission's Regional Engineer authorized the Applicant to draw Monticello Reservoir down to el. 417.3 during emergency situations, with a requirement that the Applicant notify the Atlanta Regional Office each time this is implemented. In a September 7, 1984 meeting with the Commission's Regional Engineer in Atlanta, the Regional Engineer agreed that the Applicant would be allowed to draw Monticello Reservoir down to el. 419.3 on an occasional basis without notifying the Commission's Atlanta Regional Office. This agreement is documented by letter dated December 19, 1984 from the Applicant to the Regional Engineer (provided as Exhibit H-8). The Applicant proposes to continue operation under these guidelines.

Other restrictions on the current operation of the Project exist for high inflows and floods, as described in part 1.a and 1.b of this section of Exhibit H.

3. Discussion of history of Project and record of programs to upgrade operation and maintenance of Project:

Parr Hydro Plant was constructed 1912-1914 by J. G. White Engineering Corporation for Parr Shoals Power Company, a subsidiary of Columbia Railway Gas and Electric Company. Initially constructed with five main turbine-generators, with a sixth installed in 1921. As of July 1, 1925, the Parr Shoals Power Company was transferred to Broad River Power Company, now South Carolina Electric and Gas Company (SCE&G). In the early 1960s, automatic control equipment was installed at Parr Hydro giving the system dispatcher operational control over the generating units through the use of remote means from the central dispatching office in then located in Columbia.

On August 28, 1974, the Federal Power Commission (later renamed Federal Energy Regulatory Commission, or “FERC”) issued a new license to SCE&G to permit continued operation of the Parr Shoals Hydroelectric Project. The new license authorized construction of the Fairfield Pumped Storage Development and modifications to the Parr Shoals Development, with both developments constituting the redeveloped Parr Shoals Hydroelectric Project. As part of the redevelopment, between 1975 and 1977 the spillway section of the Parr Shoals Dam was raised 9 feet by the addition of ten hydraulically-operated, bottom hinged bascule-type spillway crest gates. Two rows of post-tensioned rock anchors were installed during gate installation to increase dam stability under the higher reservoir load conditions. These modifications were undertaken in conjunction with the construction of the Fairfield Pumped Storage Development, to allow Parr Reservoir to serve as the pumped storage development’s lower reservoir.

Construction of Fairfield Pumped Storage Development began on September 3, 1974 and was completed on December 22, 1978. The first four units of the Development (Units 1 through 4) began commercial operation on June 15, 1978 and the last four units (Units 5 through 8) began commercial operation on December 22, 1978. Between 2000 and 2005, new stainless steel turbine runners were installed, generators were re-wedged, rotor poles were replaced, controls and governors were upgraded, and excitation were replaced on all units at Fairfield. Servo systems were replaced on units 5 and 6, and tailrace trash racks were replaced on Units 1, 2, 7 and 8.

In 2007, an automated trash rake system was installed at the Parr Shoals powerhouse, which resulted in improved operation of the units and less intake loss due to rack obstruction.

Between 2011 and 2016, the hydraulic actuating cylinders for Parr Dam crest gates 1, 2, 5, 6, 7, and 8 were replaced along with the hydraulic power unit (HPU) for the crest gates. In 2012-13, the Parr Hydro plant control system was upgraded to a PLC based system.

4. Summary of unscheduled outages over the last 5 years (to be provided later):

YEAR	DATE	UNIT	PROBLEM	DURATION

Estimate of generation lost due to forced outages: (To be provided later).

5. Discussion of record of compliance with terms and conditions of existing license, including list of all incidents of non-compliance, their disposition, and documentation relating to each incident:

   a. The Applicant has made a significant effort to comply with all articles in the existing license, as well as with the FERC's Rules and Regulations, and any directives from the Atlanta Regional Office. When necessary, the Applicant has requested additional time to complete work in progress. The Applicant has not been cited for non-compliance during the term of the current license.

6. Discussion of any actions taken that affect the public: No actions affecting the public have been taken.

7. Ownership and operating expenses that would be reduced if Project license were transferred: (To be provided later).

8. Statement of annual fees paid under Part I of the Federal Power Act for use of Federal or Indian lands within the Project boundary: There are 162.61 acres of Federal lands owned by the U.S. Forest Service which are part of the Parr Hydroelectric Project. Exhibit A-3 contains a tabulation of Federal Lands within the Project Boundary, by tract number, along with a designation as to which Exhibit G map sheet each tract is shown on. In 2016, the Applicant paid $11,729.81 in fees for Federal lands occupied by the Project. There are no Indian lands within the Project.

9. The Applicant is requesting a 50 year license term based on the proposed unit upgrade costs estimated to be as much as (to be provided later), the potential costs associated with protection, mitigation, and enhancement measures (to be provided later), lost generation (to be provided later), and estimated cost to develop the new license application of (to be provided later).