

## **EXHIBIT A**

### **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 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.

#### **1.0 PARR SHOALS DEVELOPMENT**

The Parr Shoals Development (“Parr”) 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 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.

#### **1.1 PROJECT STRUCTURES**

An integrated non-overflow concrete gravity section, intake, and powerhouse are located between the east (left<sup>1</sup>) 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

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<sup>1</sup> Unless otherwise noted, all references to left and right in this Exhibit are assumed to be looking downstream.

elevation of 270.4<sup>2</sup> 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.

### **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.

### **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 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.

### **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

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<sup>2</sup> 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.

gates being replaced with reinforced concrete arch walls. The two exciter turbines are no longer used, and have been abandoned in place.

### **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.

### **RESERVOIR**

The Parr Reservoir, created by the Parr Dam, is the lower reservoir for the Fairfield Pumped Storage Development (“Fairfield Development” of “Fairfield”) intake, which is located approximately three miles upstream of the Parr Dam on Frees Creek, a tributary to the Broad River. The approximately 15-mile-long reservoir covers approximately 4,250 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.

### **BYPASS REACH**

There is no bypass reach associated with this Development.

## **1.2 GENERATING EQUIPMENT**

The Parr 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:

### **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.

## **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.

## **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.

## **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.

## **GOVERNORS**

All six turbines have dedicated hydraulically controlled gate positioning systems.

## **MISCELLANEOUS EQUIPMENT**

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

## **2.0 FAIRFIELD PUMPED STORAGE DEVELOPMENT**

The Fairfield Pumped Storage Development 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.

### **2.1 PROJECT STRUCTURES**

#### **2.2 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.

##### **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.

##### **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.

### **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.

### **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.

## **2.3 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.

## **2.4 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.

## **2.5 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.

## **2.6 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 the total station capacity of 511.2 MW (at 60°C temperature rise). At 80°C temperature rise, the generator nameplate ratings total 586.8 MW. There are 16 draft tube gates on the downstream side of the powerhouse to facilitate dewatering.

## **2.7 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 VCSNS facility. The lower pool for the development is the Parr Reservoir, impounded by Parr Dam.

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 on a daily basis by the pumped storage operations. The reservoir's gross storage at full pond is approximately 400,000 acre-feet with a surface area of approximately 6,600 acres. An approximately 300-acre recreation sub-impoundment, included in the approximately 6,600 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.

## **2.8 GENERATING EQUIPMENT**

### **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.



## **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 (511.2 MW Station Cap.) 81.5 MVA, 0.9 PF, 13.8kV at 80°C rise (586.8 MW Station Cap.)
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 60°C rise

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

### **2.9 EXCITERS**

Static exciters are provided for all 8 units.

### **2.10 GOVERNORS**

Each unit is equipped with a Woodward cabinet actuator governor.

### **2.11 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.

### **2.12 SWITCHYARD**

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

### **2.13 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.

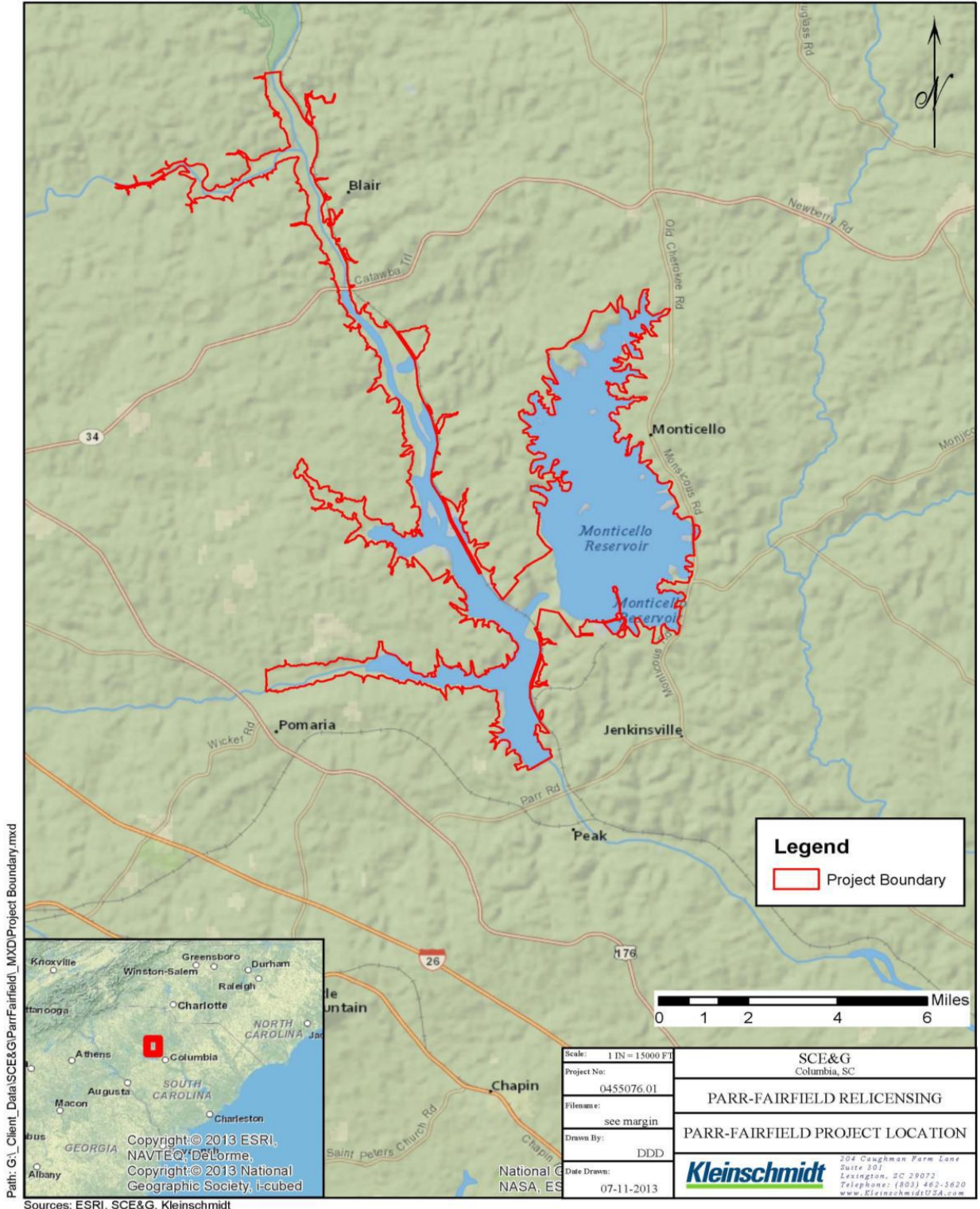
### **3.0 PROJECT TRANSMISSION LINES**

At the Parr Shoals Development, three 13.8-kV conductors from the hydro station connect to the non-project Parr 115 kV substation, which is the point of connection with the Applicant's transmission system. Each conductor has a total line length of approximately 950 feet to the point of system interconnection

At the Fairfield Development, two three-conductor 230-kV 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.

### **4.0 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 sheet each tract is shown on.



**EXHIBIT A-1 PROJECT LOCATION MAP**

Revision 0 - MAY 1, 2018

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
<b>GENERAL</b>		
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)
<b>DAM &amp; RESERVOIR</b>		
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
Normal Max. Res. Oper. Level (Full Pool) & Area	Approx. El. 266.0 ft. NGVD29; 4,248 ac. <sup>1</sup> (identified as 4,250 ac. within this application)	Approx. El. 425.0 ft. NGVD29; 6,632 ac. (identified as 6,600 ac. within this application) Sub-impoundment (recreation lake), 284 ac. (identified as 300 ac. within this application)
Min. Res. Oper. Level	Approx. El. 256.0 ft. NGVD29	Approx. 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
<b>SPILLWAY</b>		
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
<b>POWERHOUSE</b>		
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)

<sup>1</sup> The 4,248 acres reported for Parr Reservoir does not include the acreage contained within the Broad River Waterfowl Management Area.

Table of Standard Project Numbers

DESCRIPTION	NUMBER OR FACT (PARR SHOALS DEVELOPMENT)	NUMBER OR FACT (FAIRFIELD PUMPED STORAGE DEVELOPMENT)
<b>INTAKE STRUCTURE</b>		
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
<b>PENSTOCKS</b>		
Number, Type and Dimensions	(6) Concrete, integral with powerhouse	(4) Steel, 800 ft. long, 26 ft. diameter (each serves 2 units)
<b>TURBINES</b>		
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
<b>GENERATORS</b>		
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
<b>TRANSFORMERS</b>		
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

PARR HYDROELECTRIC PROJECT P-1894

FEDERAL ACREAGE WITHIN THE PROJECT BOUNDARY

<b>Exhibit G Sheet No.</b>	<b>Tract No.</b>	<b>Federal Acreage</b>
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-13	271	4.12
		<b>Total 162.61</b>