YADKIN HYDROELECTRIC PROJECT
FERC NO. 2197
DRAFT LICENSE APPLICATION

October 2005

Alcoa Power Generating Inc., Yadkin Division

Initial Statement

Before the Federal Energy Regulatory Commission
Application for License for Major Project -- Existing Dam

(1) Alcoa Power Generating Inc. (APGI), Yadkin Division, herein referred to as the "Applicant" applies to the Federal Energy Regulatory Commission (FERC) for a new license for the Yadkin Hydroelectric Project, FERC No. 2197, as described in the attached exhibits.

(2) The location of the project is:

State or territory:	North Carolina
Counties:	Davidson, Davie, Montgomery, Rowan, and Stanly
Townships or nearby towns:	Albemarle, Badin, Denton, Granite Quarry, Lexington, Mocksville, Rockwell, Salisbury, and Troy
Stream or other body of water:	Yadkin River

(3) The exact name and business address of the applicant are:

Alcoa Power Generating Inc.
Yadkin Division
P.O. Box 576
Badin, NC 28009-0576

The exact name and business address of the person authorized to act as agent for the applicant in this application is:

Mr. Walter F. Brockway
Vice President
Hydroelectric Operations
Alcoa Power Generating Inc.
Yadkin Division
300 North Hall Road
Alcoa, Tennessee 37701

(4) The applicant is a domestic corporation and is not claiming preference under section 7(a) of the Federal Power Act.

(5) (i) The statutory or regulatory requirements of North Carolina that affect the project as proposed, with respect to bed and banks and to 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 in any other business necessary to accomplish the purposes of the license under the Federal Power Act, are:

APGI is not aware of any specific laws or regulations in North Carolina with respect to the bed and banks of the Yadkin River, or to the appropriation, diversion or use of the waters therein which are applicable to the Yadkin Project.

N.C.G.S. § 55-15-01 sets forth the requirements for a "foreign corporation" to conduct business in North Carolina.

(ii) The steps which the applicant has taken or plans to take to comply with the law cited above are:

North Carolina follows the riparian system of water rights, whereby the owner of riparian land possesses the right to use the waters passing over its lands reasonably, including temporarily impounding the water through the erection of a dam. See, e.g., Dunlap v. Carolina Power & Light Co., 212 N.C. 814, 823 (N.C. 1938) APGI owns all of the lands and riparian rights necessary under North Carolina law to operate and maintain the developments of the Yadkin Project.

APGI is a Tennessee Corporation, originally incorporated as Knoxville Power Company. It was domesticated in North Carolina in 1954.

(6) The name and address of the owner of existing project facilities:

Alcoa Power Generating Inc.
Yadkin Division
P.O. Box 576
Highway 740
Badin, NC 28009-0576

(7) Person, citizen, association of citizens, domestic corporation, municipality, or state that has or intends to obtain and will maintain any proprietary right necessary to construct, operate, or maintain the project:

Alcoa Power Generating Inc.
Yadkin Division
P.O. Box 576
Highway 740
Badin, NC 28009-0576

(8) (i) Every county in which any part of the project, and any Federal facilities that would be used by the project, would be located:

Davidson County, North Carolina

Davidson County
P.O. Box 1067
Lexington, NC 27292
Mr. Robert Hyatt, County Manager

Davie County, North Carolina

Davie County
123 South Main Street
Mocksville, NC 27028
Mr. Terry Bralley, County Manager

Montgomery County, North Carolina

Montgomery County
P.O. Box 425
Troy, NC 27371
Mr. Lance Metzler, County Manager

Rowan County, North Carolina

Rowan County
202 North Main Street
Salisbury, NC 28144
County Manager

Stanly County, North Carolina

Stanly County
201 South Second Street
Albemarle, NC 28001
Mr. Jerry Myers, County Manager

(ii) Every city, town, or similar local political subdivision in which any part of the project, and any Federal facilities that would be used by the project, would be located; or that has a population of 5,000 or more people and is located within 15 miles of the project dam:

City of Albemarle, North Carolina

City of Albemarle, North Carolina
157 North 2nd Street
Albemarle, NC 28001
Mr. Raymond Allen, Manager

City of Lexington, North Carolina

City of Lexington, North Carolina
Lexington City Hall
28 W Center Street
Lexington, NC 27292
Mr. John Gray, City Manager

City of Salisbury, North Carolina

City of Salisbury, North Carolina
P.O. Box 479
Salisbury, NC 28145
Mr. David Treme, City Manager

(iii) Every irrigation district, drainage district, or similar purpose political subdivision in which any part of the project, and any Federal facilities that would be used by the project, would be located; or that owns, operates, maintains, or uses any project facilities or any Federal facilities that would be used by the project:

Not applicable

(iv) Every other political subdivision in the general area of the project that there is reason to believe would likely be interested in, or affected by, that application:

Town of Badin, North Carolina

Town of Badin, North Carolina
P.O. Box 611
Badin, NC 28009
Mr. Matt Brinkley, Town Manager

Town of Denton, North Carolina

Town of Denton, North Carolina
P.O. Box 306
Denton, NC 27239
Mr. William Pless, Town Manager

(v) All Indian tribes that may be affected by the project:

The Catawba Indian Nation of South Carolina

The Catawba Indian Nation of South Carolina
996 Avenue of the Nations
Rock Hill, SC 29730
Mr. Gilbert B. Blue, Principal Chief

This application is executed in the:

State of North Carolina

County of Stanly

By: Mr. Walter F. Brockway
Vice President
Hydroelectric Operations
Alcoa Power Generating Inc.
Yadkin Division
300 North Hall Road
Alcoa, Tennessee 37701

Being duly sworn, deposes, and says that the contents of this application are true to the best of his knowledge or belief. The undersigned Applicant has signed the application this _____ day of ________________, 2005.

Alcoa Power Generating Inc., Yadkin Division
Applicant

By:________________________________
NAME

Subscribed and sworn to before me, a Notary Public of the state of _______________ this _____ day of _____________, 2005.

____
Notary Public

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EXHIBIT E APPENDICES

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Exhibit A – Project Description

A.1 Introduction

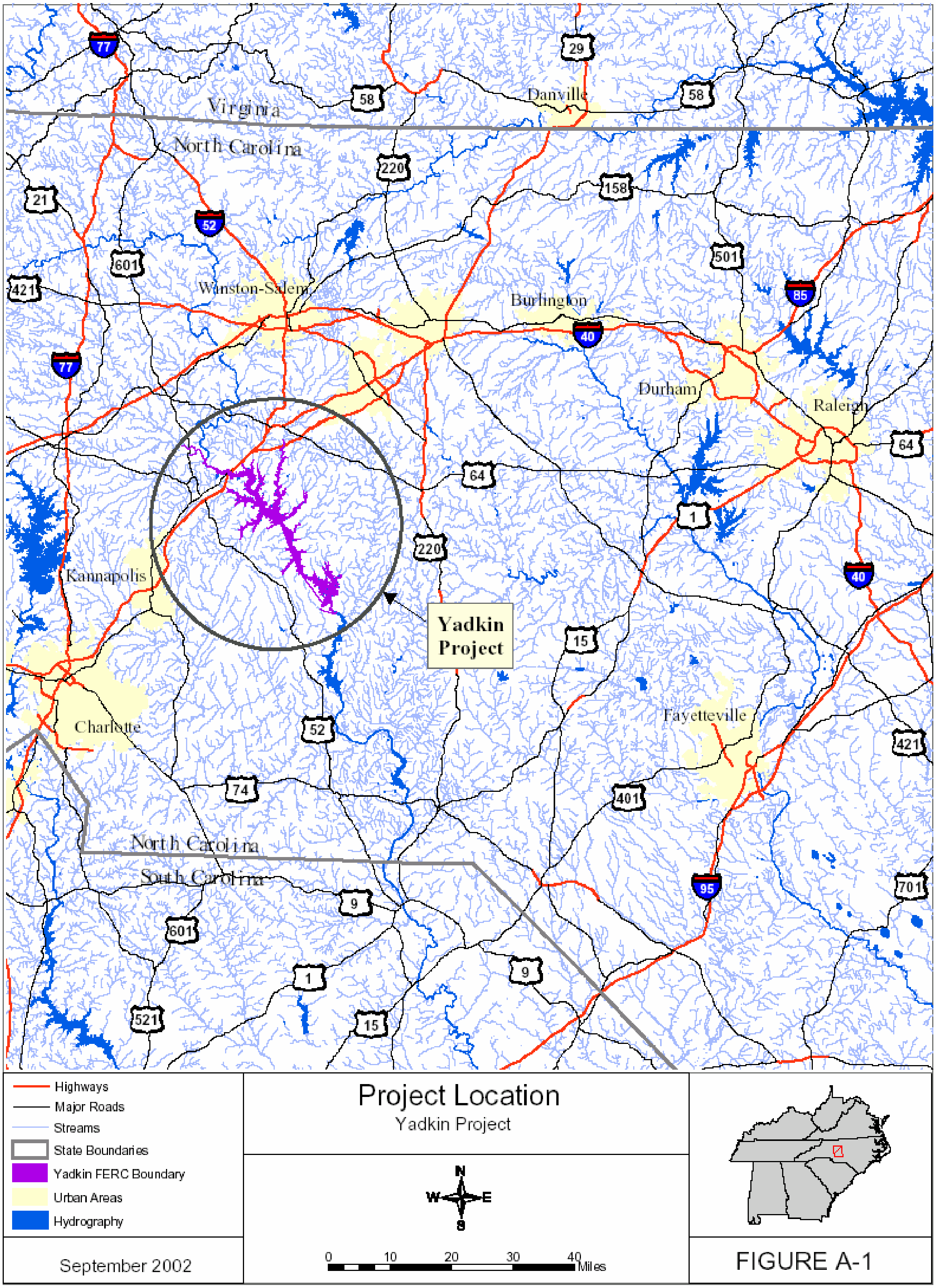
The Yadkin Project (Project) is located along the Yadkin River, approximately 60 miles northeast of Charlotte in central North Carolina, as shown on Figure A-1. The Project is located in Davidson, Davie, Montgomery, Rowan, and Stanly counties, North Carolina, as shown on Figures A-2 and A-3. The Yadkin River and its tributaries are part of the Yadkin-Pee Dee River Basin, which extends from the eastern slopes of the Blue Ridge Mountains to the Atlantic coast near Georgetown, South Carolina. The Yadkin River's name changes to the Pee Dee River at its confluence with the Uwharrie River. The Pee Dee River continues its southeastern flow to Winyah Bay, where it meets the Atlantic Ocean.

The Project is owned by Alcoa Power Generating Inc. (APGI), a wholly-owned subsidiary of Alcoa Inc. (Alcoa). APGI's Yadkin Division (Yadkin) is responsible for operation of the Project. The Project includes four hydroelectric developments, the High Rock, Tuckertown, Narrows and Falls Developments, which are located on a 38-mile stretch of the Yadkin River. High Rock, the most upstream development, is located at mile 253 on the Yadkin River and serves as the principal storage facility for the entire Yadkin-Pee Dee River. The Tuckertown, Narrows, and Falls Developments are located approximately 8.7 miles, 16.5 miles, and 19.0 miles downstream, respectively, of the High Rock Development. Progress Energy has two hydropower facilities, Tillery and Blewett Falls, the licensing of which is occurring concurrently with the Yadkin Project. Tillery and Blewett Falls are located approximately 15 and 43 miles downstream, respectively, of the Falls Development. The upper portion of the Yadkin River drainage basin, above North Wilkesboro, is regulated by the U.S. Army Corps of Engineers' (USACE) W. Kerr Scott Dam. The W. Kerr Scott Dam, which is located approximately 132 miles upstream of the High Rock Development, provides flood control for the city of Wilkesboro and maintains a conservation pool to provide a continuous minimum flow of 125 cfs in the Yadkin River.

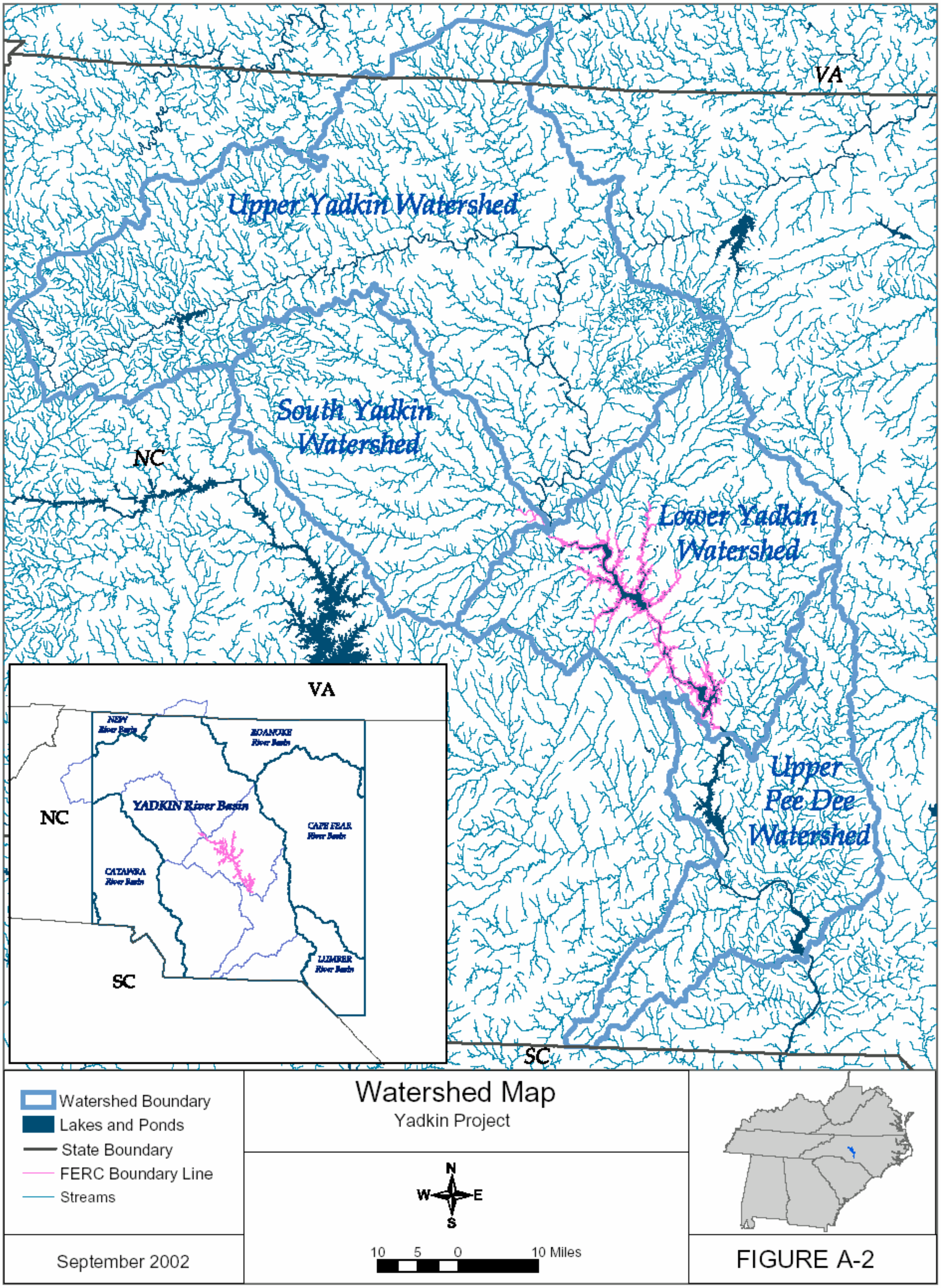
For this document, all elevations are referenced to the USGS Datum, unless otherwise noted. Table A.1-1 shows the conversion from the Yadkin Datum to the USGS Datum. To convert an elevation in the Yadkin Datum to the USGS Datum, apply the conversion shown in column, "USGS Datum Conversion". For example, the normal full pond elevation at High Rock Reservoir is 655.0 feet, Yadkin Datum, which equals 623.9 feet, USGS Datum.

Table A.1-1: USGS Datum Conversion

Development	USGS Datum Conversion
High Rock	-31.1 feet
Tuckertown	-31.3 feet
Narrows	-31.3 feet
Falls	-31.2 feet

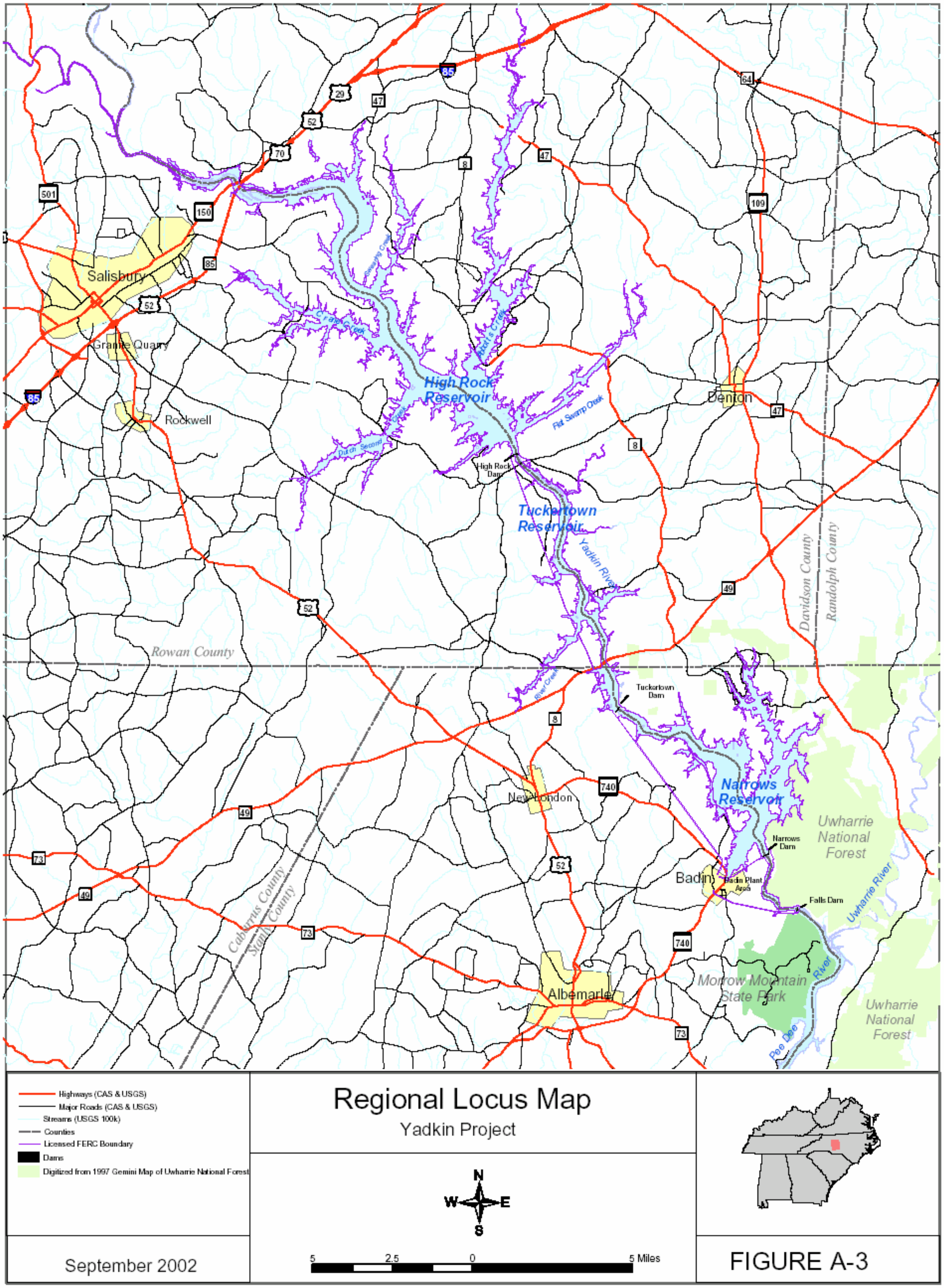


Virginia
North Carolina
Danville
Winston-Salem
Burlington
Durham
Raleigh
Kannapolis
Yadkin Project
Charlotte
Fayetteville
North Carolina
South Carolina
77
58
29
220
158
21
52
601
501
421
85
40
64
1
220
15
52
74
401
421
95
701
9
601
1
9
521
15
Highways
Major Roads
Streams
State Boundaries
Yadkin FERC Boundary
Urban Areas
Hydrography
Project Location
Yadkin Project
N
W
E
S
0
10
20
30
40
Miles
September 2002
FIGURE A-1



VA
Upper Yadkin Watershed
South Yadkin Watershed
NC
Lower Yadkin Watershed
Upper Pee Dee Watershed
SC
VA
NEW River Basin
ROANOKE River Basin
NC
YADKIN River Basin
CAPE FEAR River Basin
CATAWBA River Basin
LUMBER River Basin
SC
Watershed Boundary
Lakes and Ponds
State Boundary
FERC Boundary Line
Streams
September 2002
Watershed Map
Yadkin Project
N
W
E
S
10 5 0 10 Miles

FIGURE A-2



Regional Locus Map
Yadkin Project
Highways (CAS & USGS)
Major Roads (CAS & USGS)
Streams (USGS 100k)
Counties
Licensed FERC Boundary
Dams
Digitized from 1997 Gemini Map of Uwharrie National Forest
September 2002
N
W
E
S
5
2.5
0
5 Miles
FIGURE A-3
Salisbury
Granite Quarry
Rockwell
Denton
High Rock Reservoir
High Rock Dam
Tuckertown Reservoir
Yadkin River
Flat Swamp Creek
Rowan County
Davidson County
Randolph County
Tuckertown Dam
Narrows Reservoir
Narrows Dam
Uwharrie National Forest
New London
Badin
Badin Plant Area
Falls Dam
Uwharrie River
Cabarrus County
Stanly County
Morrow Mountain State Park
Albemarle
Pee Dee River

A.2 High Rock Development

The High Rock Development is located in Davidson, Davie, and Rowan Counties, North Carolina, approximately 16 miles from Badin, North Carolina at mile 253 on the Yadkin River. High Rock was the third of the Project developments to be built. Although land purchasing began in 1916, construction was not completed until 1927. This was due, in part, to the need to relocate numerous roads, ferries, the railroad, and other infrastructure.

A.2.1 High Rock Development Structures

High Rock Dam is a concrete gravity structure. The dam is comprised of two short non-overflow sections, a Stoney gate controlled spillway section, and an integral intake/powerhouse section.

The non-overflow sections are located at the east end of the powerhouse and at the west end of the gate controlled spillway. The gate controlled spillway section includes ten Stoney gates that release surplus water during flood events. The spillway gates are operated locally at the site by fixed individual electrically powered hoists.

The High Rock powerhouse and intake form a single structural unit integral with the dam. The structure consists of a concrete substructure containing three water passages and a brick superstructure. The intake structure includes trashracks and six headgates.

A.2.2 High Rock Reservoir

The drainage area above High Rock Dam is 3,973 square miles. The dam impounds High Rock Reservoir which has an available storage capacity of approximately 217,400 acre-feet at a full pool elevation of 623.9 feet based on a drawdown of 30 feet. High Rock Reservoir extends upstream about 19 miles to Yadkin North Fork and Hanna's Ferry, and at full pool elevation, the reservoir has a surface area of approximately 14,400 acres. The mean depth of the reservoir is 17 feet with a maximum depth of 62 feet.

A.2.3 High Rock Turbines and Generators

The High Rock powerhouse contains three 10,970 kW vertical Francis turbines, each operating under a net head of 55.0 feet, direct-connected to generators having a total capacity of 41,250 kW (Units 1, 2, and 3 @ 13,750 kW), for a total installed capacity of 32,190 kW as limited by the turbines[1]. The High Rock Development has a total hydraulic capacity of 10,050 cfs.

[1] Turbine capacity is based on the unit output in kW at the best efficiency point of turbine. Generator capacity is based on the kVA rating of the generator and the system power factor. The lower of these two values is the authorized installed capacity. If the turbine capacity is lower, the unit is turbine limited. If the generator capacity is lower, the unit is generator limited.

APGI proposes to perform the refurbishments and upgrades at High Rock Units 1, 2, and 3 under the new license. The reader is referred to Section B.2.4 for additional information on the refurbishments and upgrades proposed for the High Rock Development.

Figure A-4
High Rock Development Fact Sheet


HIGH ROCK DAM

Year Completed:
- 1927

Drainage Area:
- 3,973 square miles

Reservoir Area:
- 15,180 acres
- 57% Forested
- 34% Residential
- Public Recreation Areas

Powerhouse:
- 3 Units

Total Capacity:
- 32.19 MW
- 10,050 cfs

Dam:
- Concrete Gravity
- Gated Spillway

A.2.4 High Rock Transmission Lines

There are no transmission lines associated with the High Rock Development that are part of the licensed Project. There is a double circuit 100 kV transmission line extending from the High Rock Development southerly to the Tuckertown Development and continuing southeasterly to the Badin substation. This transmission line however, is a regional line used by various entities and is not included in the Project. Heading easterly from High Rock Development is a Duke Power Company transmission line.

A.2.5 Lands of the United States at High Rock Development

There are no federal lands within the Project boundary of the High Rock Development.

A.3 Tuckertown Development

The Tuckertown Development is located in Davidson, Montgomery, Rowan, and Stanly Counties, North Carolina, approximately 8 miles from Badin, North Carolina at mile 244.3 on the Yadkin River. Tuckertown was the last of the Project developments to be built and was completed in 1962.

A.3.1 Tuckertown Development Structures

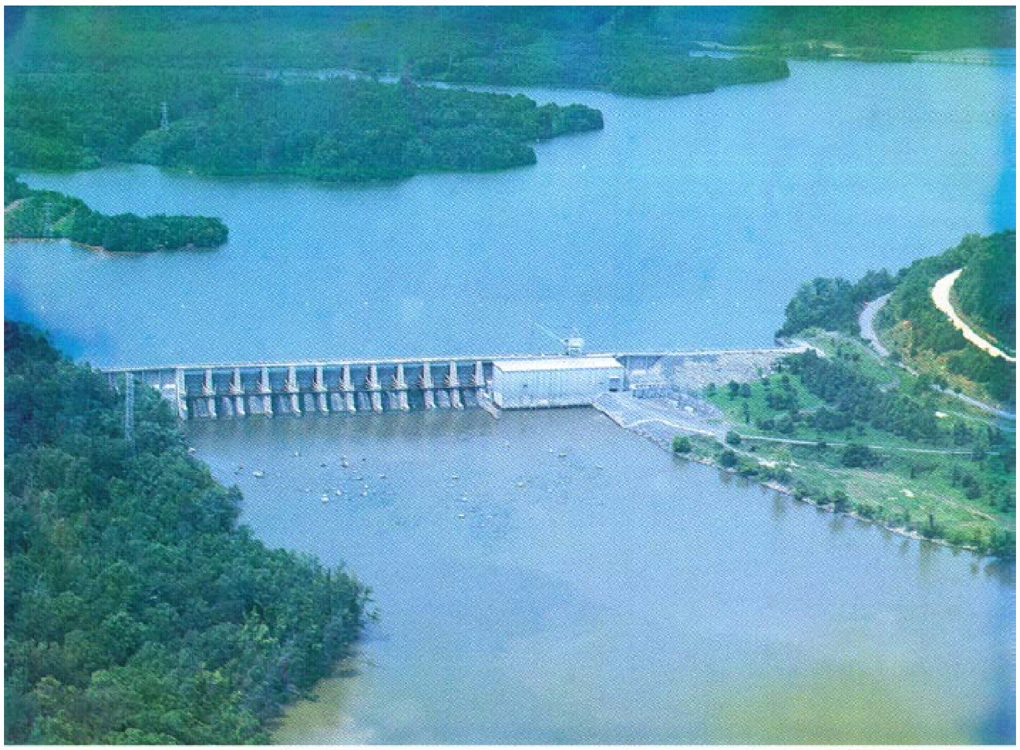
Tuckertown Dam is a concrete gravity and embankment structure and consists of a rockfill embankment section, an earthfill embankment section, three non-overflow gravity sections, a Tainter gate spillway section, and an integral intake/powerhouse section as shown in Figure A-5.

The rockfill embankment is located between the east non-overflow section and the east abutment. It was constructed of dumped rockfill with a sloping impervious core. The earthfill embankment is a homogeneous earthfill section at the west abutment. This section wraps around the adjacent right non-overflow gravity section.

The east non-overflow gravity section is located at the east end of the powerhouse. The west non-overflow gravity section is located at the west end of the gated spillway section. The middle non-overflow section is located between the east end of the gated spillway and the west end of the powerhouse. The gate controlled spillway section includes eleven Tainter gates that release surplus water during flood events.

The Tuckertown powerhouse and intake form a single structural unit integral with the dam. The powerhouse is located immediately downstream of the intake structure between the east non-overflow and middle non-overflow gravity sections. The structure consists of a concrete substructure containing three water passages and a conventional steel truss and frame structure. The intake structure includes trashracks and six motor operated fixed wheel headgates.

Figure A-5
Tuckertown Development Fact Sheet



Year Completed:
- 1962

Drainage Area:
- 4,080 square miles

Reservoir Area:
- 2,560 acres
- 81% Forested
- 10% Recreation

Powerhouse:
- 3 Units

Total Capacity:
- 38.04 MW
- 11,475 cfs

Dam:
- Concrete Gravity
- Rockfill Embankment
- Earthfill Embankment
- Gated Spillway

A.3.2 Tuckertown Reservoir

The drainage area above Tuckertown Dam is 4,080 square miles. The dam impounds Tuckertown Reservoir with an available storage capacity of approximately 6,700 acre-feet at the full pool elevation of 564.7 feet based on a drawdown of 3 feet. At full pool the surface area of the reservoir is approximately 2,560 acres. The mean depth of the reservoir is 16 feet with a maximum depth of 55 feet.

A.3.3 Tuckertown Turbines and Generators

The Tuckertown powerhouse contains three 12,680 kW Kaplan turbines, each operating under a net head of 53.5 feet, direct-connected to generators having a total capacity of 46,665 kW (Units 1, 2, and 3 @ 15,555 kW maximum capacity), for a total installed capacity of 38,040 kW as limited by the turbines. The Tuckertown Development has a total hydraulic capacity of 11,475 cfs.

APGI proposes to perform refurbishments and upgrades at Tuckertown Units 1, 2, and 3 under the new license. The reader is referred to Section B.3.4 for additional information on the refurbishments and upgrades proposed for the Tuckertown Development.

A.3.4 Tuckertown Transmission Lines

There are no transmission lines associated with the Tuckertown Development that are part of the licensed project. The Tuckertown Development has two short-taps with a 100 kV distribution voltage to the High Rock-Badin Transmission Line. These taps are regional lines used by various entities and are not included in the Project.

A.3.5 Lands of the United States at Tuckertown Development

There are no federal lands within the Project boundary of the Tuckertown Development.

A.4 Narrows Development

The Narrows Development is located in Davidson, Montgomery, and Stanly Counties, North Carolina, approximately 2 miles from Badin, North Carolina at mile 236.5 on the Yadkin River. Narrows was the first of the Project developments to be built, and was completed in 1917. Energy generation at Narrows Units 1, 2 and 3 began in 1917. Narrows Unit 4 went on line in 1924.

A.4.1 Narrows Development Structures

Narrows Dam consists of a main dam section and a bypass spillway section (see Figure A-6). The main dam section is a concrete gravity structure

A.4.1.1 Main Dam Section

The main dam consists of a non-overflow gravity section, a Tainter gate controlled spillway section, a trash gate section, an intake section, a downstream powerhouse, and four steel penstocks.

The non-overflow gravity section extends from the gated spillway section to the west river abutment. A training (wing) wall separates the non-overflow gravity section and the gate controlled spillway section. The gate controlled spillway section includes a trash gate section and twenty-two Tainter gates that release surplus water during flood events. The trash gate section is located at the west end of the intake structure.

The intake section is located adjacent to the trash gate section. The intake structure is constructed of reinforced concrete. It includes trash racks and eight headgates. Individual steel penstocks extend from the intake section to the powerhouse. The powerhouse is located approximately 280 to 360 feet downstream of the intake section. The powerhouse consists of a reinforced concrete substructure and a brick superstructure.

A.4.1.2 Bypass Spillway Section

The bypass spillway section is comprised of a non-overflow gravity section, a Stoney gate controlled spillway section, and a trash gate section.

The non-overflow gravity section extends from the bypass spillway to the east river abutment.

The gate controlled section includes ten Stoney gates and is used in conjunction with the main dam gated spillway section to control surplus waters during flooding events.

There is also a trash gate at the south end of the bypass spillway.

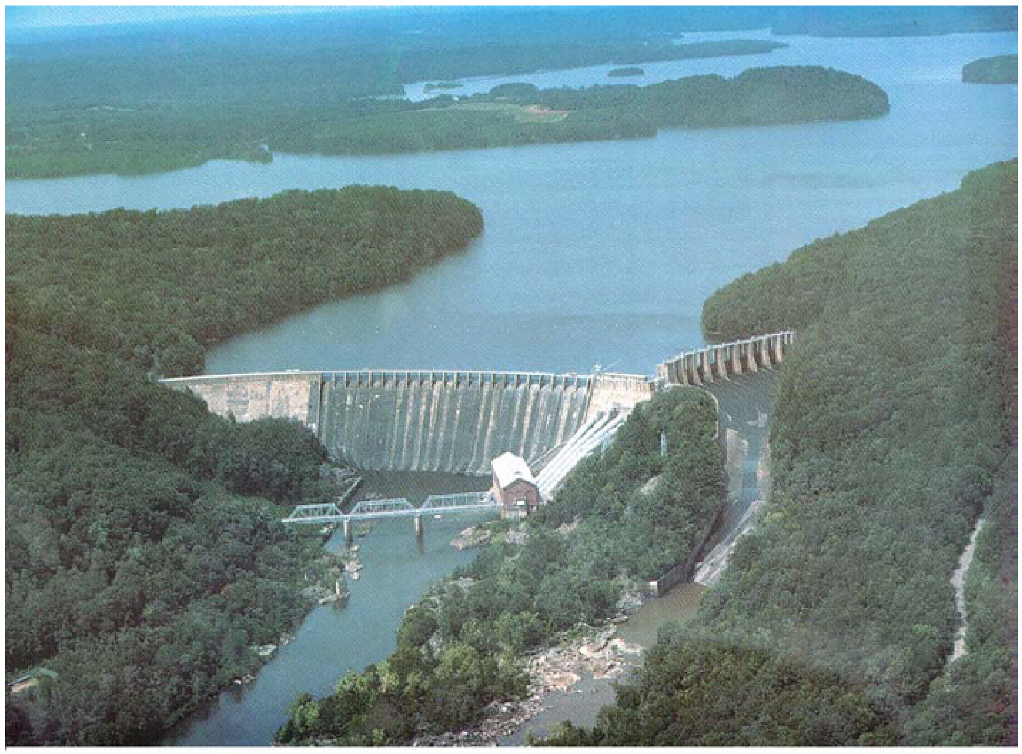
A.4.2 Narrows Reservoir

The drainage area above Narrows Dam is 4,180 square miles. The dam impounds Narrows Reservoir with an available storage capacity of approximately 129,100 acre-feet at the full pool elevation of 509.8 feet based on a drawdown of 31.1 feet. At full pool, the surface area of the reservoir is approximately 5,355 acres. The mean depth of the reservoir is 45 feet with a maximum depth of 175 feet.

A.4.3 Narrows Turbines and Generators

The Narrows powerhouse contains four vertical Francis turbines, each operating under a net head of 174.5 feet. Units 1, 2, and 3have a capacity of 26,860 kW and Unit 4 has a capacity of 27,200 kW. The turbines are direct-connected to the generators having a total capacity of 124,250 kW (Units 1 and 2 @ 27,500 kW, Unit 3 @ 31,250 kW, and Unit 4 @ 38,000 kW), for a total installed capacity of 107,780 kW, as limited by the turbines. The Narrows Development has a total hydraulic capacity of 10,000 cfs.

Figure A-6
Narrows Development Fact Sheet



NARROWS DAM

Year Completed:
- 1917

Drainage Area:
- 4,180 square miles

Reservoir Area:
- 5,355 acres
- 43% Residential Development
- 48% Forested
- Public Recreation Areas

Powerhouse:
- 4 Units

Total Capacity:
- 107.78 MW
- 10,000 cfs

Dam:
- Concrete Gravity
- Gated Main and Bypass Spillways

Penstocks:
- Units 1 – 4: 15 foot diameter
- Unit 1: 309 feet long
- Unit 2: 338 feet long
- Unit 3: 367 feet long
- Unit 4: 396 feet long

APGI proposes to perform the refurbishment and upgrade at Narrows Unit 2 under the existing license. The reader is referred to Section B.4.4 for additional information on the refurbishments and upgrades proposed for the Narrows Development (Units 1 and 3) under the new license.

A.4.4 Narrows Transmission Lines

The Narrows Development includes a four circuit 13.2 kV transmission line that connects the hydroelectric generating station at Narrows Development directly to Alcoa's Badin Works, as shown on Figure A-7. This transmission line is an APGI dedicated line and is part of the licensed Project. The approximate length of this transmission line is 8,000 feet.

A.4.5 Lands of the United States at Narrows Development

There are no federal lands within the Project boundary of the Narrows Development. The Uwharrie National Forest is adjacent to a portion of the Narrows Development.

A.5 Falls Development

The Falls Development is located in Montgomery and Stanly Counties, North Carolina, approximately 3 miles from Badin, North Carolina at mile 234 on the Yadkin River. The Falls Development was the second of the Project developments to be built, and was completed in 1919. Falls Units 2 and 3 went on line in 1919 and Falls Unit 1 went on line in 1922.

A.5.1 Falls Development Structures

Falls Dam is a concrete gravity structure. The development consists of a non-overflow gravity section, a Stoney gate controlled spillway section, a Tainter gate controlled spillway section, a trash gate section, and an integral intake/powerhouse section. The non-overflow gravity section extends from the north end of the spillway section to the river abutment.

The spillway section consists of a Stoney gate section, a Tainter gate section , and a trash gate. There are ten Stoney gates and two Tainter gates to release surplus water during the storm or flooding events. The ten Stoney gates are operated by individually fixed electrically powered screw-stem hoists from the spillway deck. Four of the Stoney gates may be remotely operated from the dispatch center in Alcoa, Tennessee and also manually at the site. The two Tainter gates are operated by a movable, electrically powered hoist from the deck. The trash gate is locally operated by a rising screw stem hoist.

The powerhouse and intake form a single structural unit integral with the dam. The powerhouse is located between the south end of the gate controlled spillway section and the river abutment. The structure consists of an integral reinforced concrete and concrete gravity substructure and a brick superstructure. The intake structure includes trashracks and six headgates

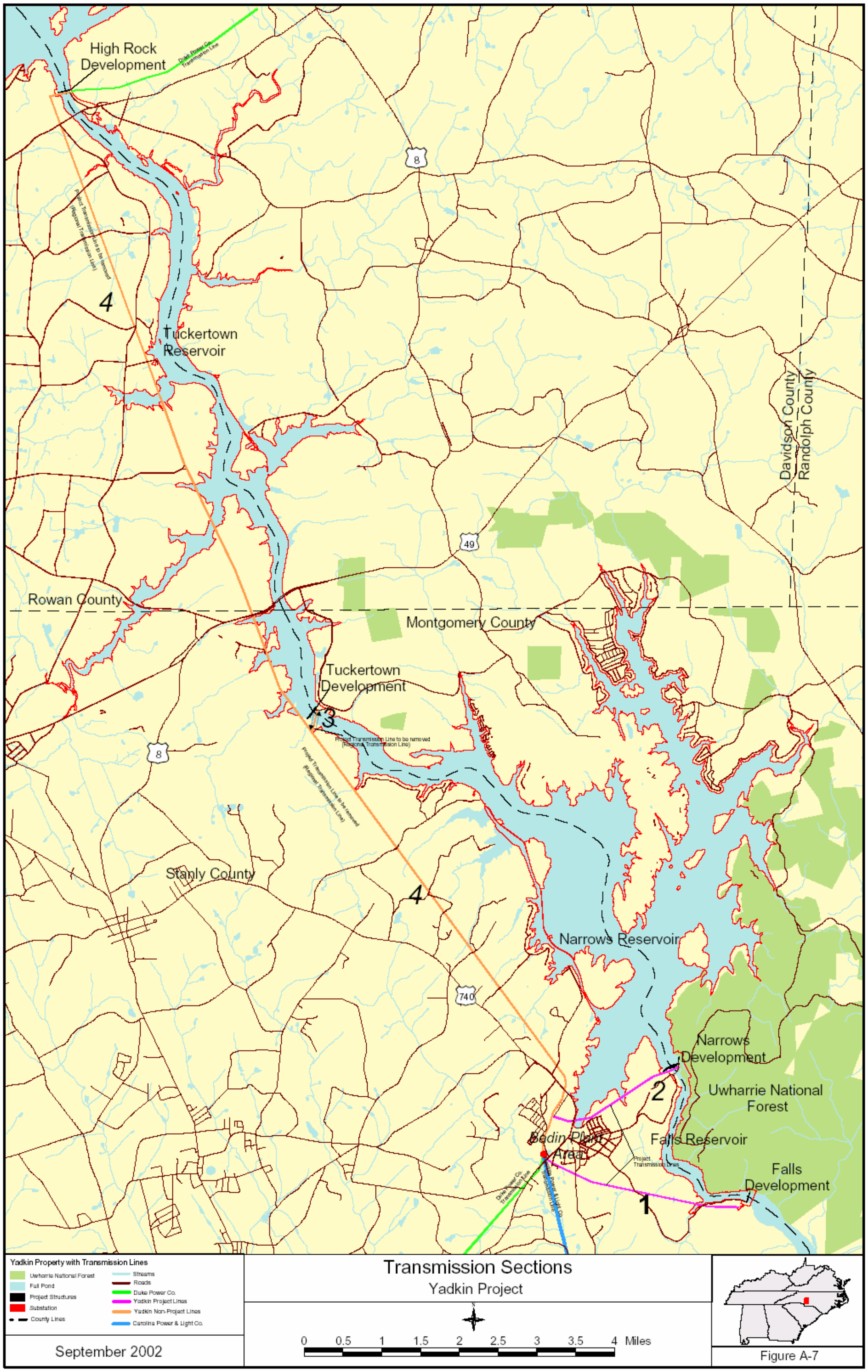

High Rock
Development
Tuckertown
Reservoir
Rowan County
Montgomery County
Tuckertown
Development
Davidson County
Randolph County
Stanly County
Narrows Reservoir
Narrows
Development
Uwharrie National
Forest
Badin Plant
Area
Falls Reservoir
Falls
Development
Yadkin Property with Transmission Lines
Transmission Sections
Yadkin Project
September 2002
0 0.5 1 1.5 2 2.5 3 3.5 4 Miles
Figure A-7

Figure A-8
Falls Development Fact Sheet

Year Completed:
- 1919

Drainage Area:
- 4,190 square miles

Reservoir Area:
- 204 acres
- 94% Forested
- Public Recreation Areas

Powerhouse:
- 3 Units

Total Licensed Capacity:
- 31.13 MW
- 8,570 cfs

Dam:
- Concrete Gravity
- Gated Spillway

A.5.2 Falls Reservoir

The drainage area above Falls Dam is 4,190 square miles. The dam impounds Falls Reservoir with an available storage capacity of approximately 760 acre-feet at the full pool elevation of 332.8 feet based on a drawdown of 4 feet. At full pool, the surface area is approximately 204 acres. The mean depth of the reservoir is 27 feet with a maximum depth of 52 feet.

A.5.3 Falls Turbines and Generators

The Falls powerhouse contains one 10,410 kW S. Morgan Smith vertical Francis turbine unit (Unit 1) and two 11,190 kW Allis Chalmers propeller type turbine units (Units 2 and 3), each operating under a net head of 54.0 feet, and direct-connected to generators having a total capacity of 33,750 kW (Unit 1 @ 8,750 kW, Units 2 and 3 @ 12,500 kW) for a total generating capacity of 31,130 kW as limited by the generator for Unit 1 and the turbines for Units 2 and 3. The Falls Development has a total hydraulic capacity of 8,570 cfs.

APGI proposes to perform refurbishments and upgrades at Falls Units 1, 2, and 3 under the new license. The reader is referred to Section B.5.4 for additional information on the refurbishments and upgrades proposed for the Falls Development.

A.5.4 Falls Transmission Lines

The Falls Development includes a single circuit 100 kV transmission line that connects the hydroelectric generating station at Falls directly to Alcoa's Badin Works, as shown on Figure A-7. This transmission line is an APGI dedicated line and is part of the licensed Project. The approximate length of this transmission line is 15,000 feet.

A.5.5 Lands of the United States at Falls Development

There are no federal lands within the Project boundary of the Falls Development. The Uwharrie National Forest is adjacent to a portion of the Falls Development.

Exhibit B – Project Operation and Resource Utilization

B.1 Introduction

This exhibit provides a detailed description of project operations and resource utilization. In accordance with FERC requirements, each development is described individually.

B.2 High Rock Development

B.2.1 Operation

High Rock Development is operated by full-time power dispatchers under the direction of the APGI Operations Manager. Project operation and generation dispatch is remotely controlled from the Dispatch Center located in Alcoa, Tennessee. During high flow conditions, maintenance personnel are sent to High Rock Dam, as required, to operate the spillway gates.

Based on gross generation records from 1972 through 2004 and the net plant capability under the most favorable operating conditions as reported on the FERC Form 1 (37 MW) the average annual plant factor at High Rock is approximately 45%.

B.2.1.1 Existing Operations

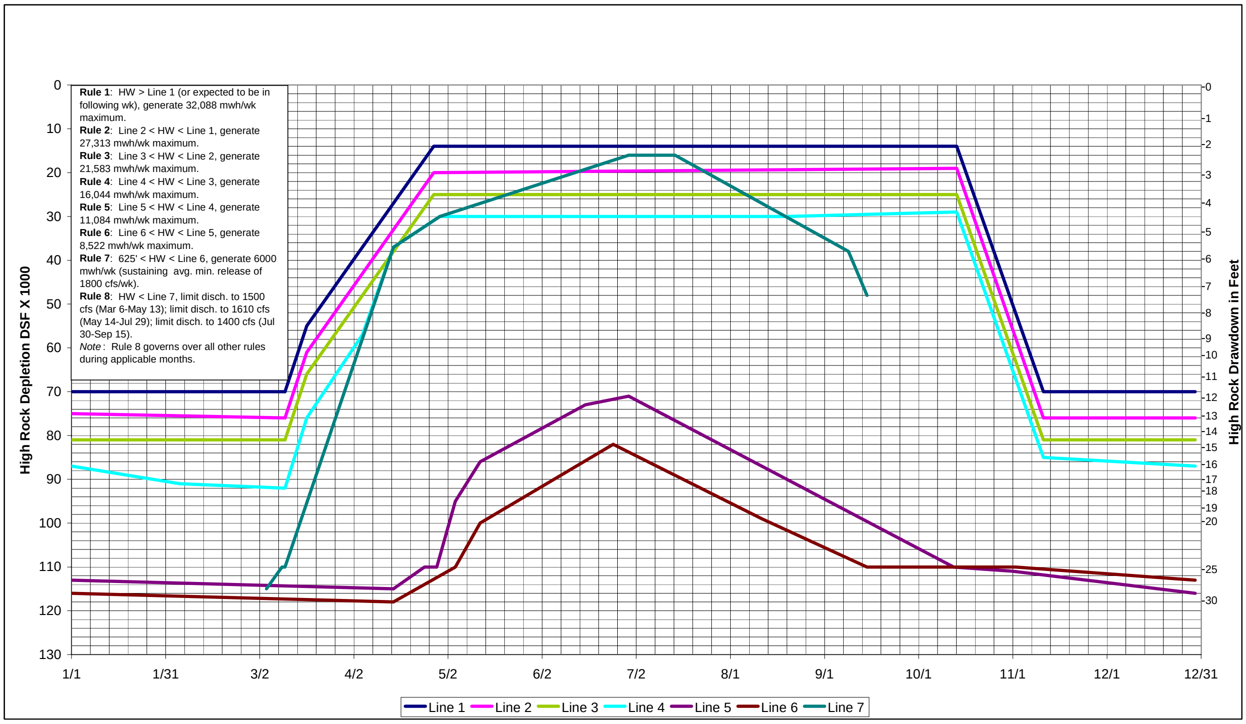
The High Rock Development is operated in a store and release mode in accordance with an operating guide. The operating guide, reviewed and approved by FERC, was established in 1968. Within the limitations of available streamflow, the operating guide is designed to maintain higher water elevations in High Rock Reservoir from mid-May to mid-September, followed by a fall-winter drawdown to allow for refill during the late winter and spring. During periods of low water levels and low streamflow at High Rock Reservoir, the operating guides have overriding requirements for APGI to discharge a minimum amount of water to satisfy downstream needs from early March to mid-September. Based on historical data, the operating guides normally limit drawdown of High Rock Reservoir to five feet or less, greater than 95% of the time between Memorial Day and Labor Day.

The operation of High Rock powerhouse and consequent releases of water through the turbines depend primarily on the current water level, streamflow into the reservoir, and time of year. The High Rock operating guide is presented in Figure B-1. It should be noted that this figure presents reservoir elevation in terms of drawdown (in feet, right vertical axis) and depletion (in day-second-feet, left vertical axis). The High Rock operating guide regulates energy generation, not headwater.

In 1928 APGI and the predecessor company of Progress Energy (PE) reached an agreement that was modified in 1968 and accepted by the Federal Power Commission (now FERC) as a headwater benefits ("HWB") settlement. HWB are defined by Section 10(f) of the Federal Power Act as the additional electric generation at a downstream Project (in this case, PE's

Project) made possible by the regulation of the river flow by the headwater, or upstream, project (in this case, the Yadkin Project). Regulation of river flow is achieved by the use of upstream storage reservoirs that retain water during high inflow periods that might otherwise be spilled rather than used for generation. (See 18 CFR 11.10). Section 10(f) of the FPA directs the Commission to condition the license of the downstream licensee upon reimbursing the owner of the upstream storage for an equitable part of the annual costs of interest, maintenance, and depreciation expenses of the headwater project. These reimbursement payments are often referred to as “headwater benefits” payments and are subject to the Commission’s approval.

Figure B-1: High Rock Development Operating Guide



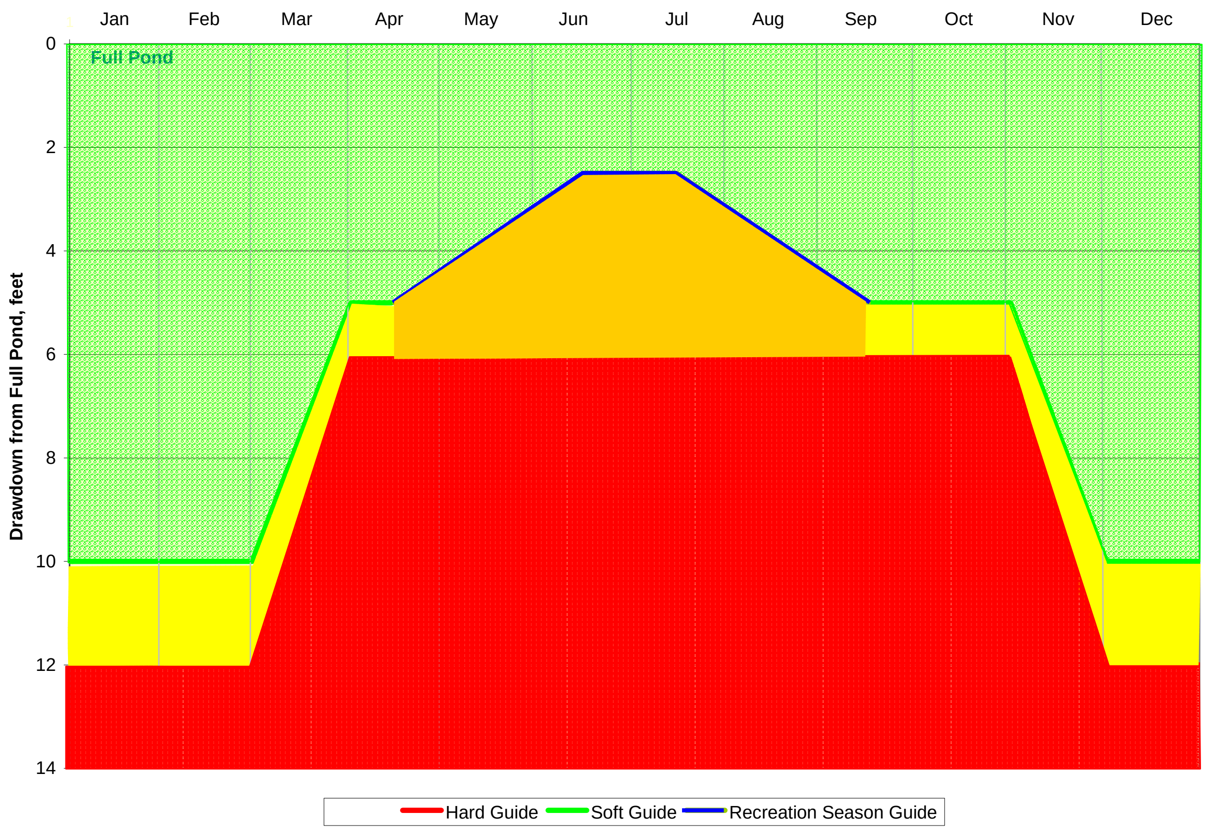
Water storage in the Yadkin Project reservoirs during periods of high streamflow allows a controlled release to enhance energy generation downstream. This regulation of flow also provides benefits to two Progress Energy plants downstream by seasonally increasing the flow available for hydropower generation at its two downstream facilities. By way of the March 1968 FERC order, Progress Energy pays APGI an annual headwater benefits fee for this benefit. The agreement with Progress Energy requires that the regulated weekly average streamflow, during the ten week period preceding the recreation period (May 15 through September 15) is not less than 1500 cfs; during the period May 15 through July 1, is not less than 1610 cfs; and during the period July 1 through September 15, is not less than 1400 cfs.

B.2.1.2 Proposed Operations

APGI proposes that under the new license, High Rock will be operated in accordance with a revised Guide Curve (Figure B-2) that features three basic guides: a Soft Guide (green line), a Hard Guide (red line), and a Recreation Season Guide (blue line and orange colored section).

During normal operations, APGI will maintain the reservoir elevation at or above the "Soft Guide" elevation (green line and green section of Figure B-2). Generation is not restricted for normal operations. If at any time the water level at High Rock falls below the Soft Guide Curve Elevation and above the Hard Guide Curve Elevation, (yellow section) APGI will reduce its generation and water releases from High Rock to the flow equivalent of no more than 1,500 cfs weekly average discharge until such time that the High Rock reservoir level returns to or above the Soft Guide Curve (green section). Operation in this range is expected to occur infrequently, and would be caused by conditions such as: actual inflows not meeting projected inflows; human error; equipment malfunction or failure; drought periods; or electrical system emergency (i.e. transmission bottlenecks, real and reactive power support, load following support, etc.).

Figure B-2: Yadkin Project High Rock Guide Curve



The reservoir would not be drawn down below the Hard Guide (within 6 feet of full April 1 through October 31 and within 12 feet of full November 1 through March 31 – red line and red section) except as needed to meet required downstream minimum flows or as outlined in the proposed Low Instream Flow Protocol, or in cases of electrical system emergency. During the period April 15 through September 15, APGI will operate High Rock in accordance with the "Recreation Season Guide Curve". If at any time during the recreation season the water level of High Rock Reservoir falls below that Recreation Season Guide Curve (orange section), APGI will reduce its generation and water releases from the Project to the flow equivalent of no more than 1500 cfs weekly average discharge, until such time that the High Rock reservoir level returns to or above the Recreation Season Guide Curve (green section).

The amended 1928 headwater benefits contract between APGI and PE, which was originally entered into before either project was license, by its terms remains in effect until 2067 and does not expire with the FERC license. However, APGI believes that the contract's status as a headwater benefits settlement does not extend beyond the term of the existing project license. To be specific, the use of project storage is inherently one of the issues to be passed upon by the Commission in the process of issuing a new license. And in its March 29, 1968 Order, FERC approved the amended contract as a HWB settlement "until further order of the Commission should be required by changes in conditions", thereby making the agreement subject to further regulatory approvals. Therefore, the Commission's decision on the new license will determine the extent to which PE's developments downstream are benefited by Yadkin Project storage, which in turn will form the basis for a new determination o headwater relicensing negotiations that relate to the use of project storage. If the terms of the new license, whether arrived at through negotiations or otherwise, frustrate the current agreement with PE, APGI will seek to renegotiate the terms of any revised HWB settlement directly with PE with the intent of submitting it to FERC for approval. Should direct negotiations with PE prove unsuccessful, APGI will seek FERC assistance in reaching a new agreement.

APGI proposes to undertake a series of Project modifications designed to increase dissolved oxygen (DO) concentrations and enhance water quality in the four Project tailwaters through installation of aeration technology at High Rock simultaneously with the unit refurbishment/upgrade, as described in Section B.2.3. Conceptually, APGI proposes installation of new aerating turbines with a "through-the-runner" aeration capability at the High Rock development. APGI proposes to operate the aerating equipment between May 1 and November 30 of each year as needed.

B.2.2 Estimate of Capacity and Generation

The dependable capacity for High Rock Development is based on the annual energy production during the critical streamflow period (2001) for the 1930 to 2003 period of record. The dependable capacity is based on the 2001 energy generation divided by the number of hours per year. The dependable capacity calculated on this basis is 5.6 MW.

The average annual gross generation of High Rock Development is 133,024 MWh based on the most recent 20-year period of 1985 to 2004.

B.2.2.1 Stream Flows

A 74-year streamflow dataset was developed for each Project development, and other areas of interest, using USGS gages located throughout the Yadkin-Pee Dee River Basin. The average daily streamflow dataset, which is referred to as the USGS flow dataset, covers the October 1, 1929 to December 31, 2003 period of record (POR) and the portion of the Yadkin-Pee Dee River extending from the U.S. Army Corps of Engineers (USACE) W. Kerr Scott Dam on the upstream end to the USGS Pee Dee gage at Pee Dee, SC on the downstream end. Details regarding the USGS flow dataset development are discussed below.

Inflows to W. Kerr Scott, the most upstream dam on the Yadkin River, were back-calculated based on USACE published outflow, change in storage, and precipitation[1] records and estimated evaporation rates[2], for the 1962 to 2003 POR. For the 1939 to 1962 POR, inflows to W. Kerr Scott were determined using the tributary flows at USGS Wilkesboro gage station minus tributary flows at the USGS Reddies River gage station, with the difference prorated for the drainage area to W. Kerr Scott. For the 1929 to 1939 POR, inflows to W. Kerr Scott were estimated using the drainage area ratios and data from the Wilkesboro gage.

Proceeding downstream, the USGS Yadkin College gage record extends back beyond 1930. The inflows to this node (gains) are the difference between the gage flows and Kerr Scott inflows, prior to W. Kerr Scott regulation, or the difference between the gage flows and the W. Kerr Scott discharges, since the construction of W. Kerr Scott.

The scarcity of gages on the main stem of the Yadkin River between Yadkin College and Rockingham complicated the development of the inflows between these two gages. At High Rock, a USGS gage was present from 1919 to 1927 and 1941 to 1962[3]. To facilitate the development of the missing flow record (1929 to 1941 and 1962 to 2003), *Fillin*[4], a program developed by the USGS, was utilized. Working on monthly data, *Fillin* was used to correlate flows at a location of interest with flows from gages in the watershed. Using regression techniques, *Fillin* uses those locations with the highest correlations (depending on the month and year) to "fill in" the missing record for the location of interest.

Fillin was used to estimate the (monthly) gains between the Yadkin College and the High Rock gages (herein referred to as "High Rock gains") and between the High Rock and Rockingham gages (herein referred to as "Rockingham gains") for the period when the gains were not known (1929 to 1941 and 1962 to 2003). The gains represent the difference between the flows at these gages. Since these gages are influenced by regulation upstream, the flows were adjusted to reflect unregulated conditions by adding back the known change in storage and estimated net evaporation from the upstream reservoirs. The monthly High Rock gain is equal to the difference between the monthly unregulated High Rock and Yadkin College flows. The monthly Rockingham gain is the difference between the monthly unregulated Rockingham and High Rock flows.

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[1] Precipitation at Kerr Scott is based on Corps of Engineers measurements and, when not available (prior to July 1, 1965), Salisbury station measurements.

[2] Evaporation is derived from monthly USGS measurements from Lake Michie in Durham, North Carolina (contained in the report entitled Evaporation from Lake Michie, North Carolina, 1961-71, USGS Water Resources Investigation 38-73).

[3] For this latter period, which coincided with the operation of High Rock Reservoir, the USGS gage measured regulated flows from the dam. Based on operating data, "total" flows into the reservoir were back calculated using mass balance (inflow = outflow + change in storage + evaporation - precipitation).

[4] "Mixed-Station Extension of Monthly Streamflow Records," *Journal of Hydraulic Engineering*, ASCE, Vol. 109, No. 10, October 1983.

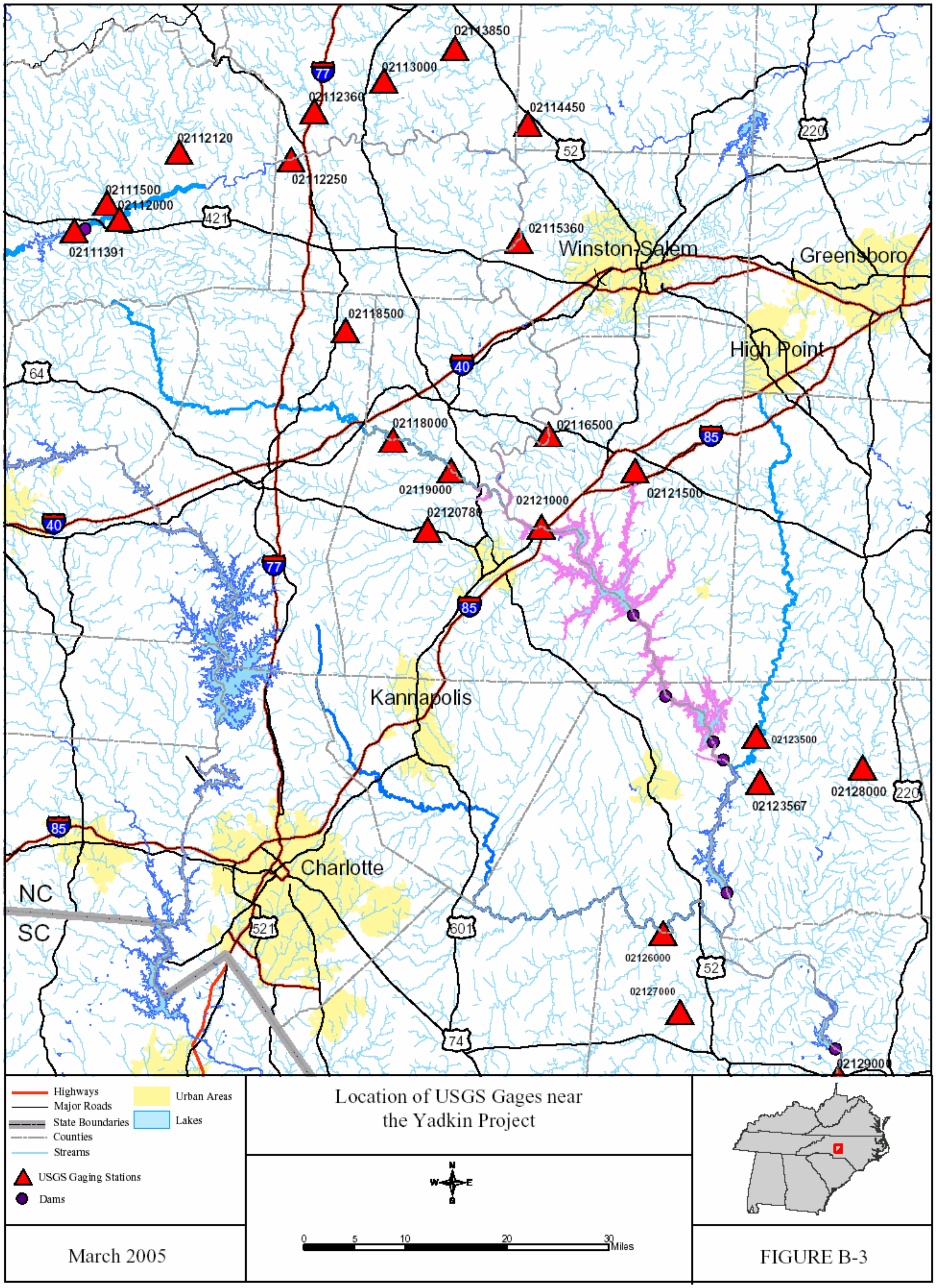
Table B.2-1 presents the USGS gages that were evaluated in the inflow development, along with their drainage areas and periods of record. Figure B-3 presents the locations of the USGS gages near the Project. Most of these gages have records that overlap in part or in full with the known gains. The only gages that cannot be correlated with High Rock are Second Creek, a tributary of the South Yadkin and Abbott's Creek, a tributary of High Rock.

Table B.2-1: USGS Gage Stations Evaluated in the Streamflow Development

USGS Gage (station number)	Drainage Area (square miles)	Period of Record
Reddies River (02111500)	89	1939 - present
Wilkesboro (02112000)	504	1903 - 1909; 1920 - present
Yadkin College (02116500)	2280	1928 - present
South Yadkin at Cooleemee (02119000)	569	1928 - 1965
South Yadkin at Mocksville (02118000)	306	1938 - present
Hunting Creek (02118500)	155	1951 - present
Second Creek (02120780)	118	1979 - present
Abbots Creek (02121500)	174	1988 - 1991; 1992 - present
Eldorado, Uwharrie River (02123500)	342	1938 – 1971
Rocky River (02126000)	1372	1929 – present
Little River (02128000)	106	1954 – present
Brown Creek (02127000)	110	1937 – 1971
Rockingham (02129000)	6863	1906 – 1911; 1927 - present
Pee Dee (02131000)	8830	1939 - present

The output from *Fillin* consists of the correlation coefficients for each of the gages in the table above and the flow estimate for each month of the filled-in record. If needed, the *Fillin*-estimated High Rock and Rockingham gains were adjusted to maintain consistency with the known gains between the USGS gages at Yadkin College and Rockingham. The monthly High Rock inflows were calculated by summing the adjusted High Rock gains to the Yadkin College flows.

The monthly High Rock inflows were disaggregated into daily flows using upstream gages. For example, if the flow at the upstream gage(s) on the fifth of the month was three percent of the monthly total, the daily High Rock flow was set at three percent of the monthly *Fillin* estimate. Multiple gages, including the Yadkin College, Cooleemee, Mocksville, Hunting Creek, South Creek, Abbott's Creek gages, were used in the daily disaggregation.



02113850
02113000
02112360
02114450
02112120
02112250
02111500
02112000
02111391
02115360
Winston-Salem
Greensboro
02118500
High Point
02118000
02116500
02119000
02121000
02121500
02120780
Kannapolis
02123500
02128000
02123567
Charlotte
NC
SC
02126000
02127000
02129000
Highways
Major Roads
State Boundaries
Counties
Streams
Urban Areas
Lakes
USGS Gaging Stations
Dams
Location of USGS Gages near the Yadkin Project
March 2005
0 5 10 20 30 Miles
FIGURE B-3

The minimum, mean, and maximum flows at High Rock during the 1930 to 2003 USGS Period of Record (POR) are 105 cfs, 4,760 cfs, and 112,050 cfs, respectively. Monthly flow duration curves of High Rock inflows for APGI's Proposed Operations are presented in Figures B-4a through B-4l.

Figure B-4a

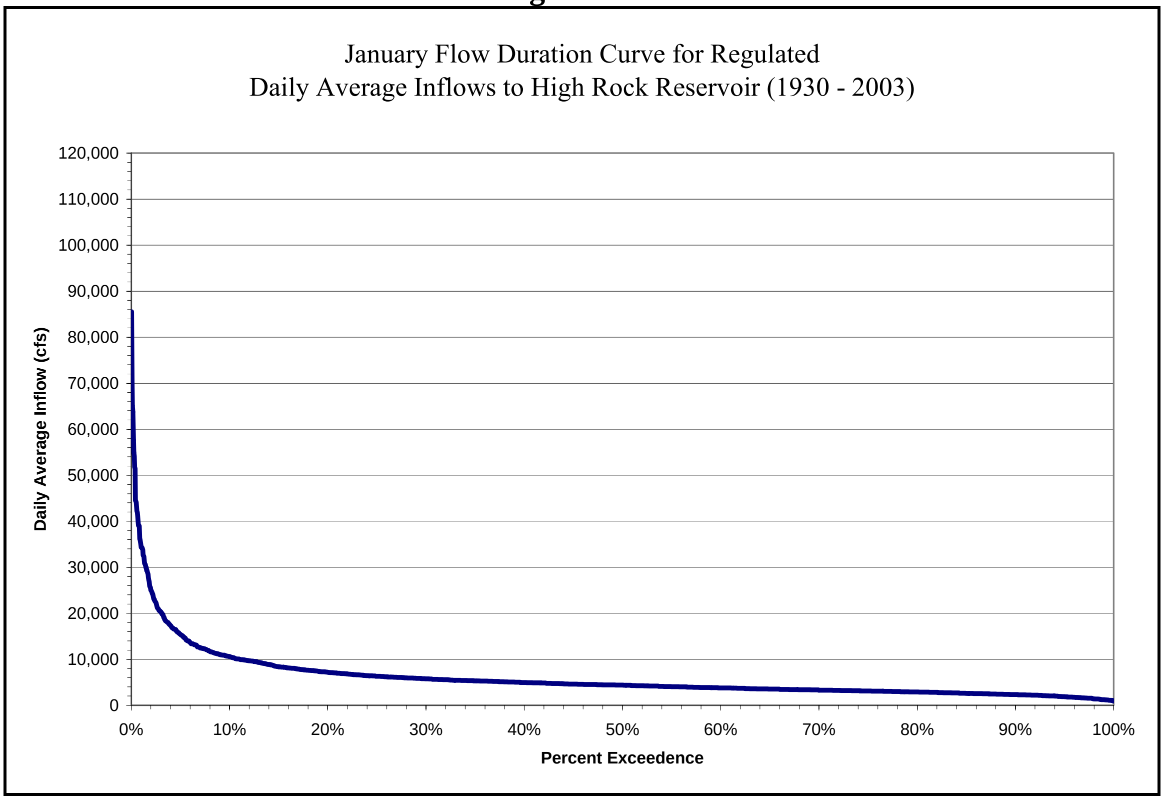


Figure B-4b

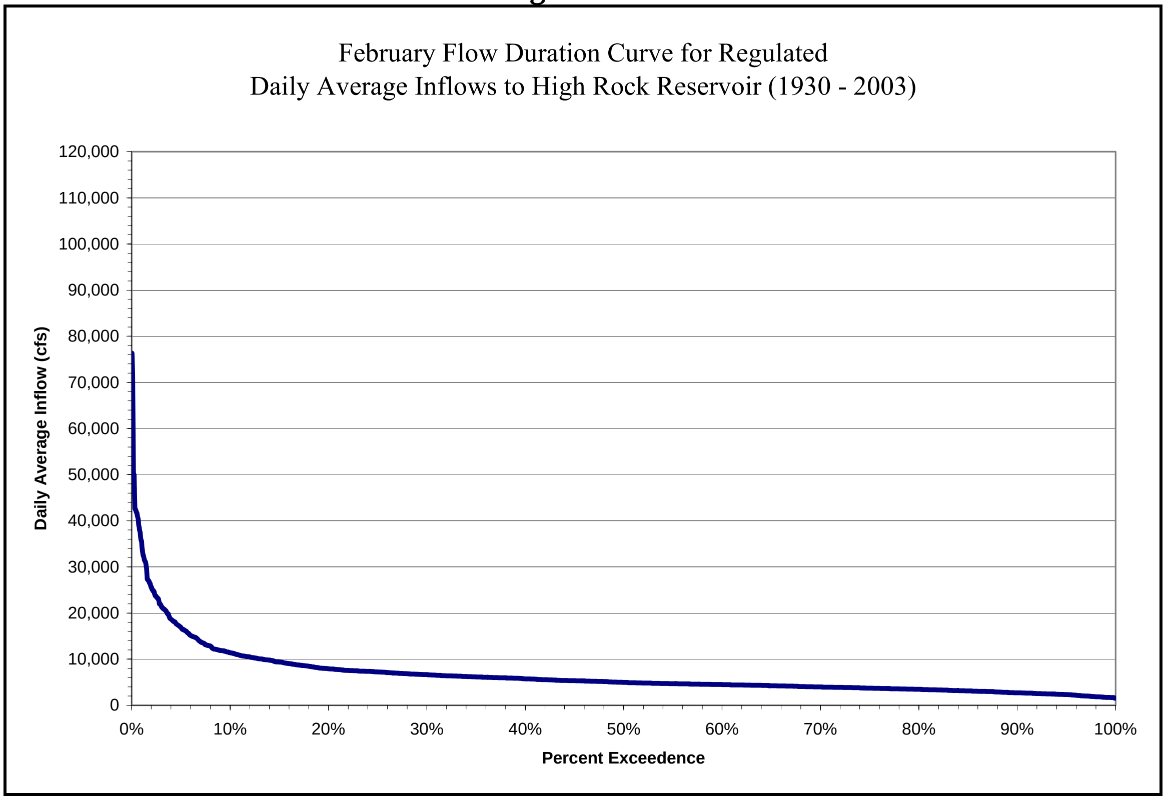


Figure B-4c

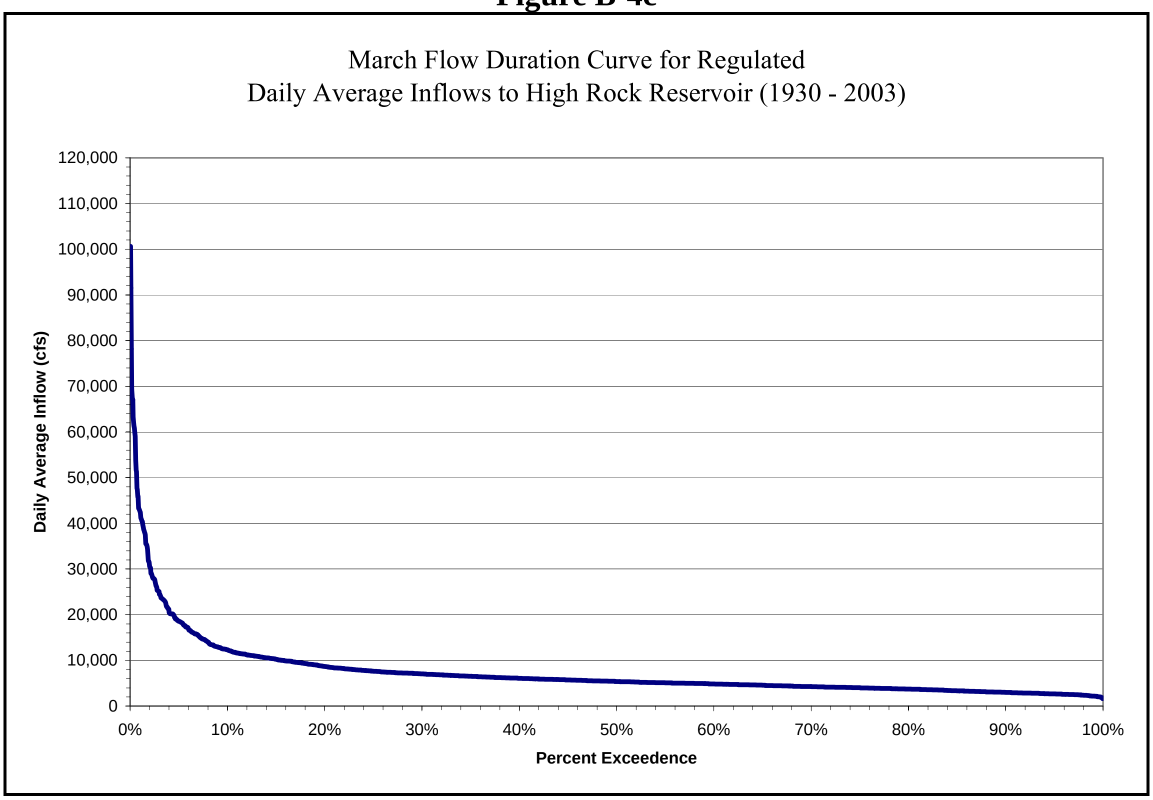


Figure B-4d

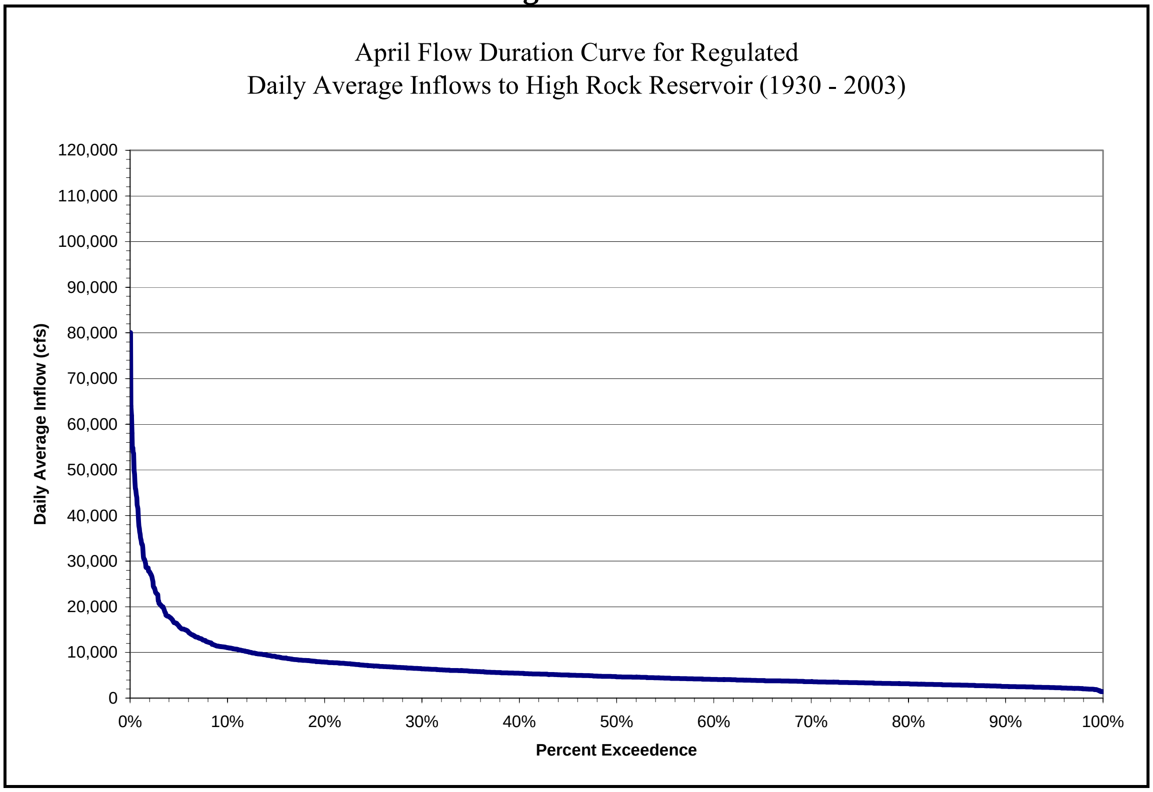


Figure B-4e

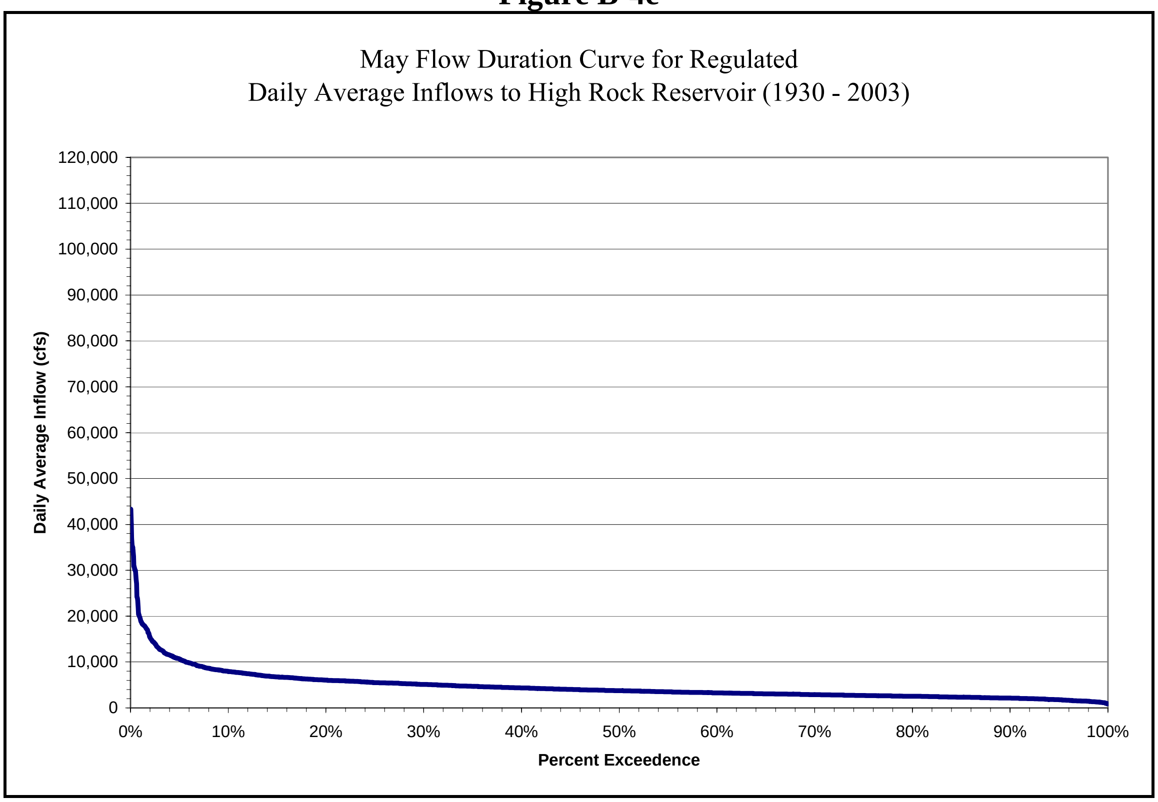


Figure B-4f

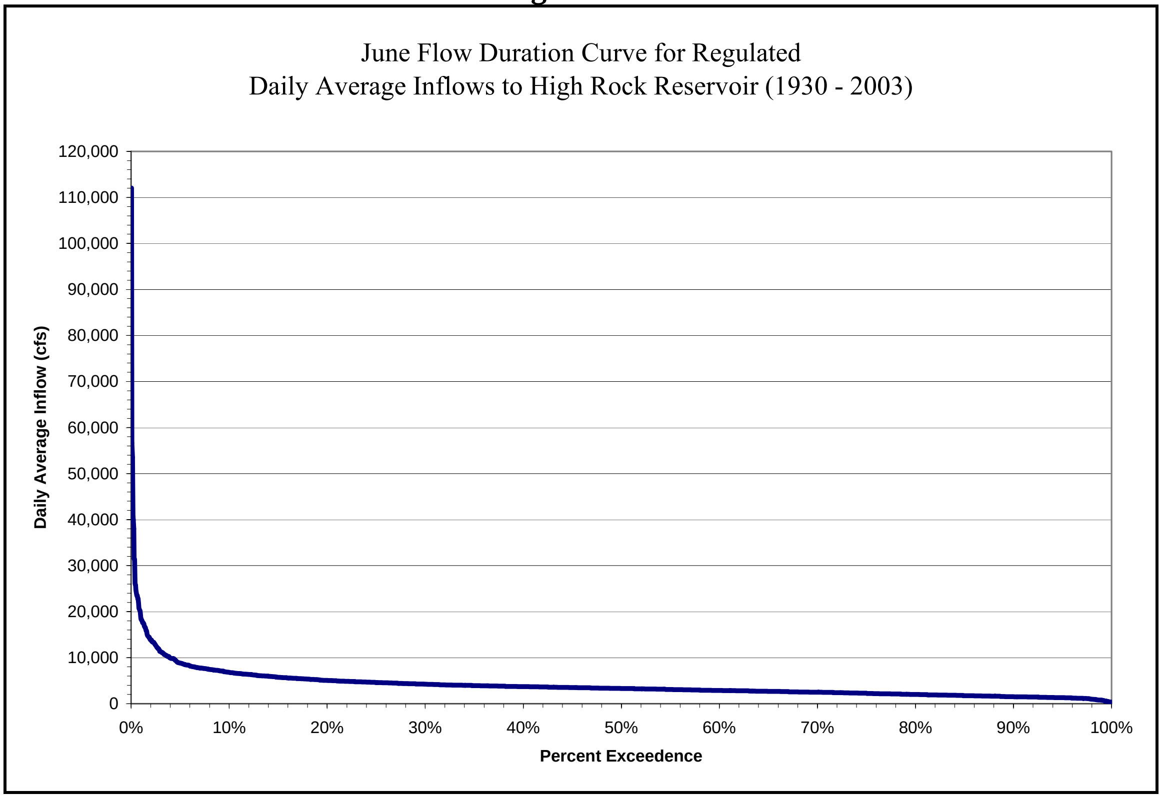


Figure B-4g

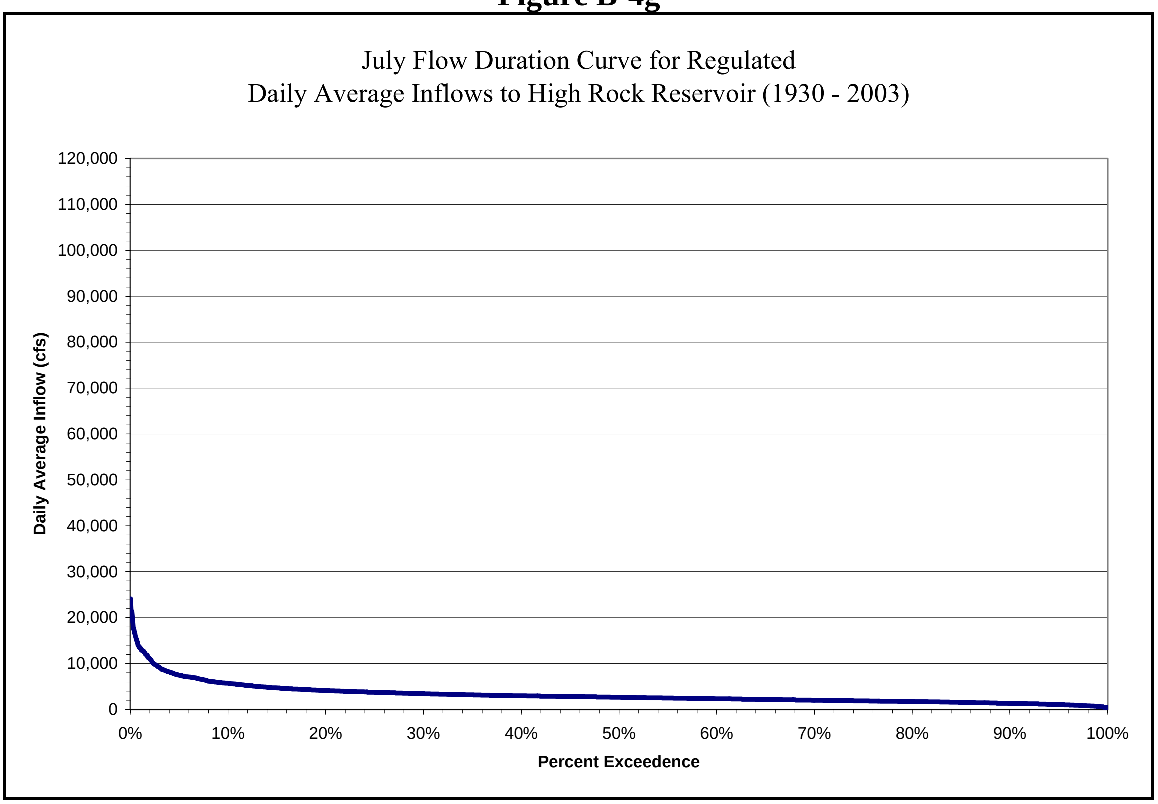


Figure B-4h

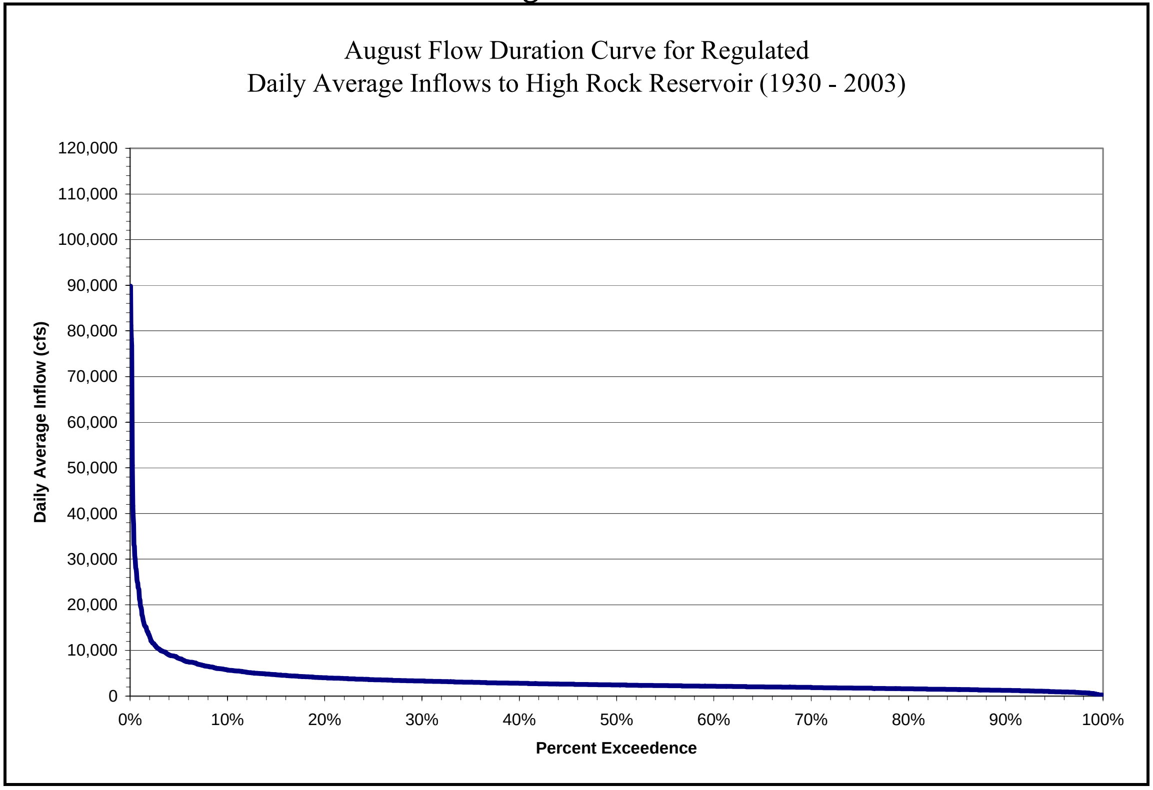


Figure B-4i

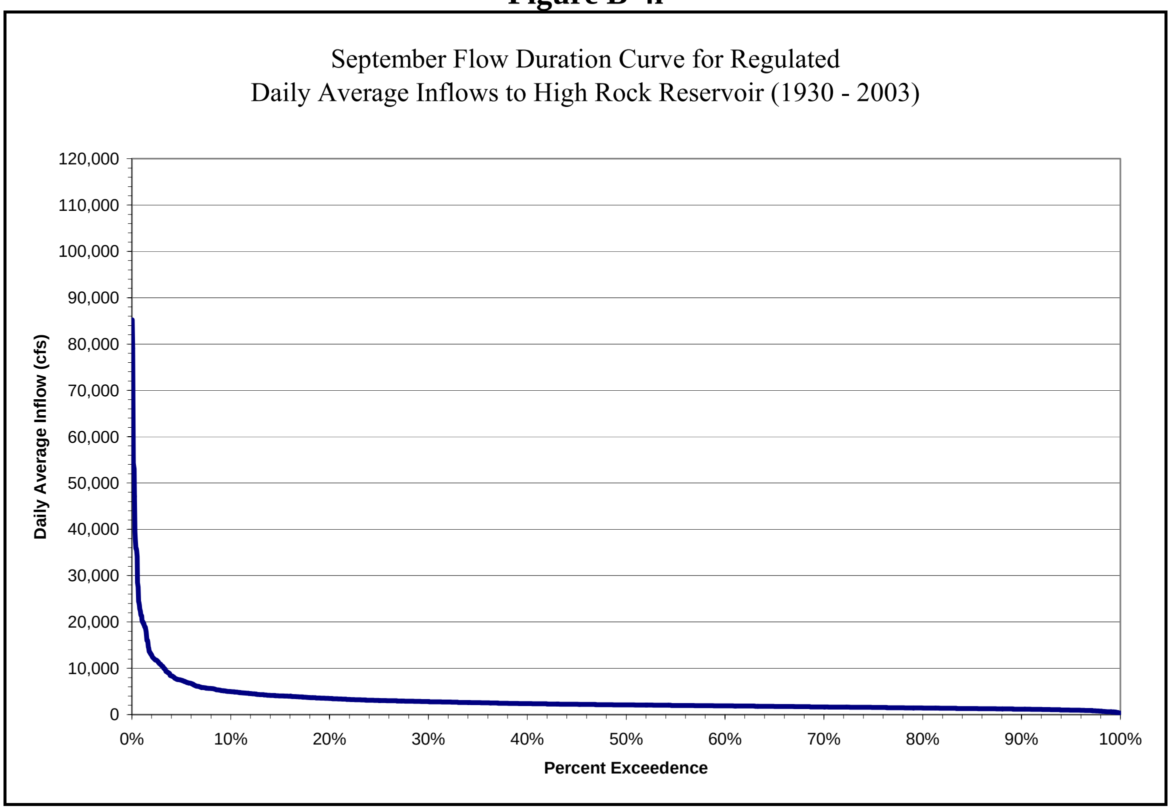


Figure B-4j

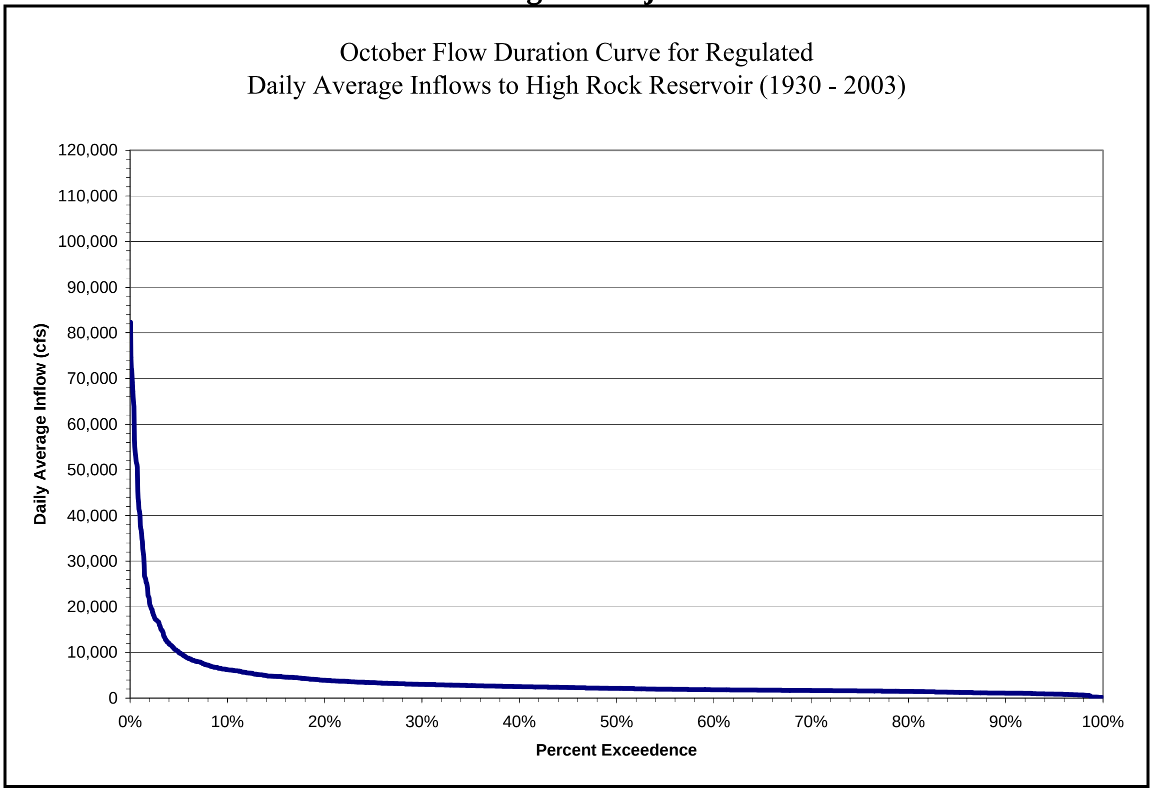


Figure B-4k

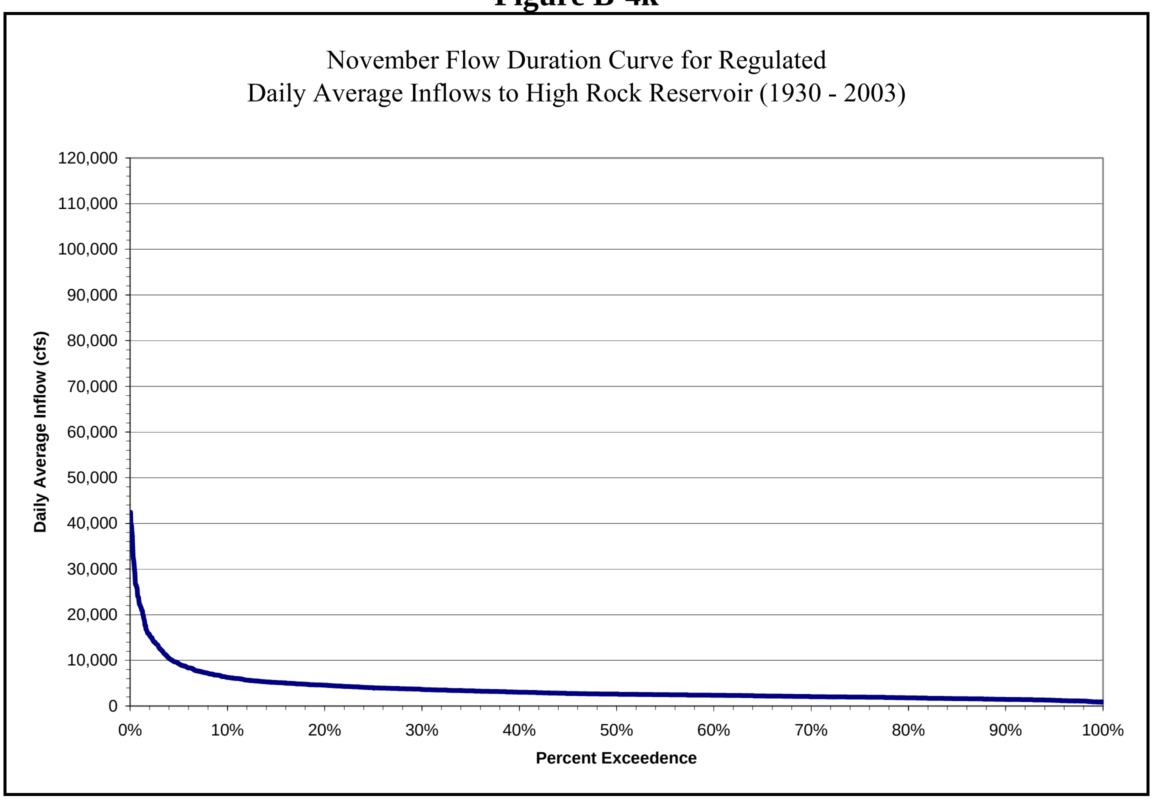
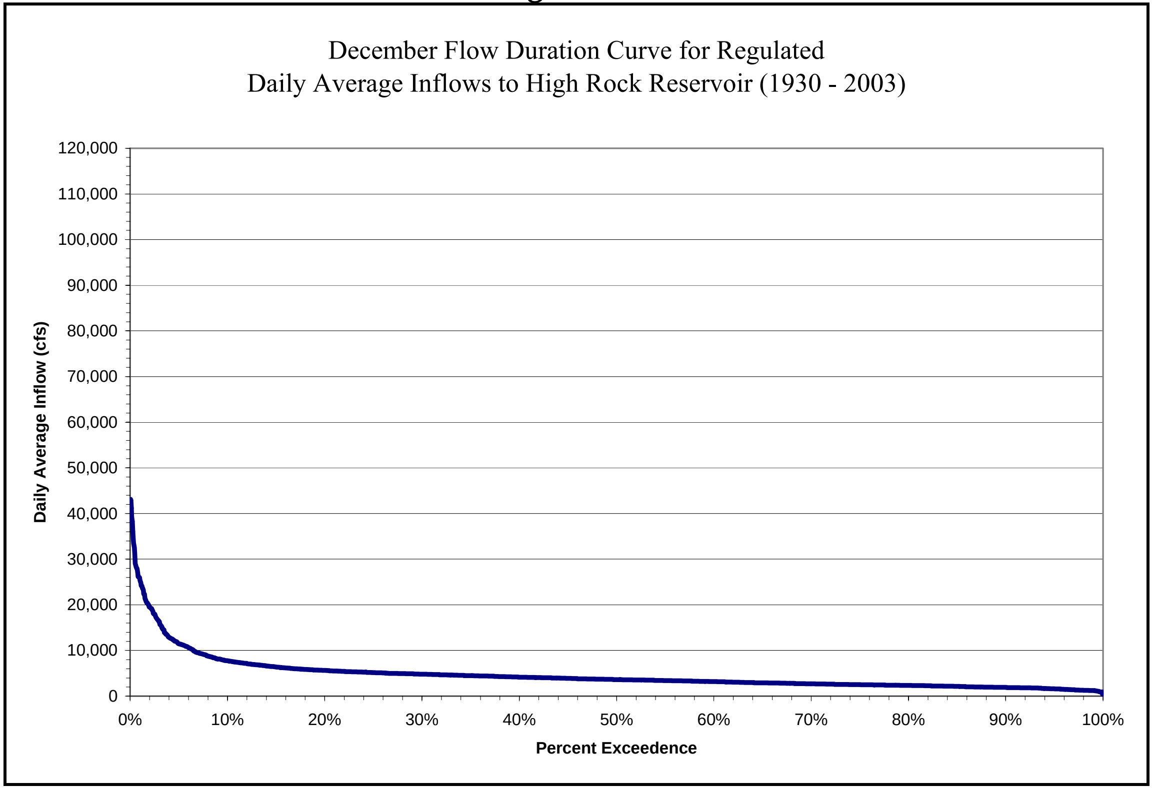


Figure B-4l



B.2.2.2 Area Capacity Relationship

A reservoir capacity curve showing the storage volume of High Rock Reservoir is provided in Figure B-5. This curve is based on recent aerial survey data in the upper elevations of the reservoir. At the normal full pond elevation of 623.9 feet, High Rock Dam impounds an available storage volume of approximately 217,400 acre-feet, which corresponds to a drawdown of approximately 30 feet. The gross storage capacity of High Rock Reservoir is 237,900 acre-feet. APGI's proposed operation of High Rock Reservoir provides a drawdown target of 10 feet for normal operation, which corresponds to a usable storage of approximately 109,500 acre-feet.

B.2.2.3 Power Plant Hydraulic Capacity

The existing estimated total hydraulic capacity of the power plant is 10,050 cfs. After the proposed refurbishments and upgrades are completed at High Rock., the estimated hydraulic capacity of the power plant will be 10,000 cfs at best efficiency and 10,650 cfs at maximum capacity.

B.2.2.4 Tailwater Curve

The tailwater rating curve for the High Rock Development is presented in Figure B-6.

Figure B-5: High Rock Reservoir Elevation vs. Available Storage

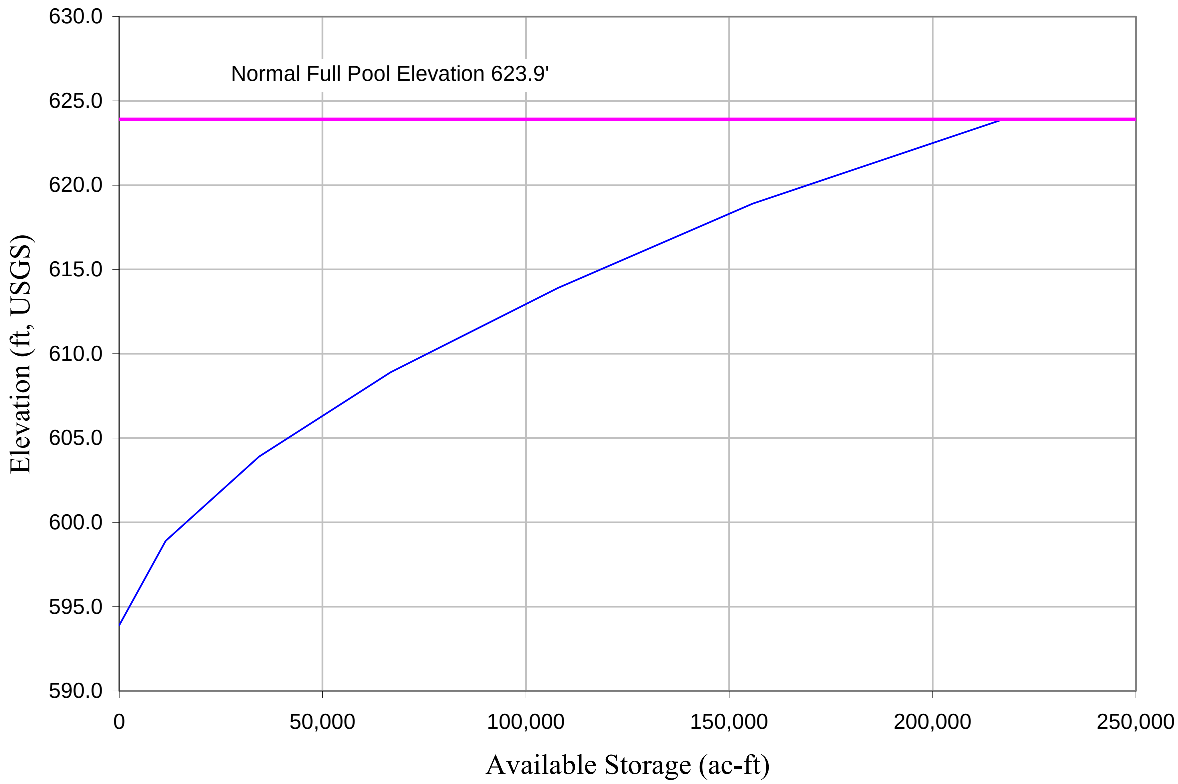
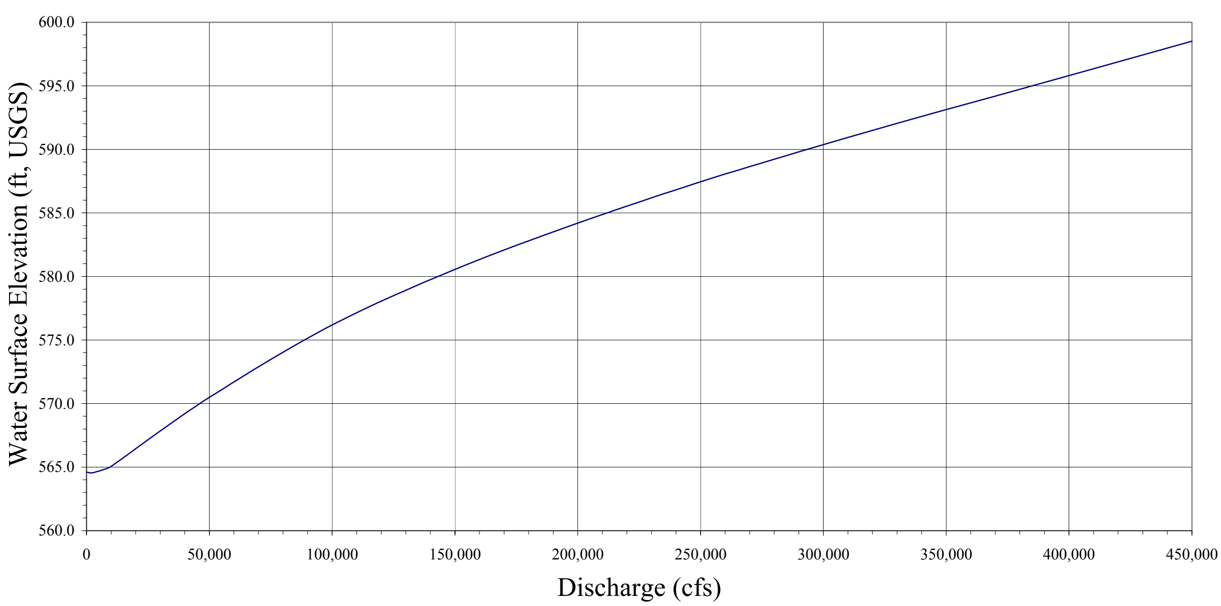


Figure B-6: High Rock Dam, Tailwater Rating Curve



B.2.2.5 Power Plant Capacity Versus Head

The maximum head occurs when High Rock Reservoir is at normal full pond elevation of 623.9 feet. Assuming High Rock is operating at maximum capacity, the tailwater would be 565 feet. This results in a gross head of 58.9 feet. At the proposed winter drawdown elevation of 613.9 feet, the gross head is 48.9 feet.

The plant capacity at maximum discharge capacity at normal full pond elevation will be approximately 40.4 MW for the proposed units. Plant capacity will be approximately 33.5 MW at the proposed winter drawdown elevation.

B.2.3 Plans for Future Development

APGI plans to refurbish/upgrade High Rock Units 1, 2, and 3 to sustain future operation and to increase generation capacity. The refurbishment activities will result in increased hydraulic efficiency. Once the refurbishments and upgrades are completed, the High Rock powerhouse will contain three 13,400 kW vertical Francis turbines, each operating under a net head of 55.0 feet, direct-connected to generators having a total capacity of 41,070 kW (Units 1, 2, and 3 @ 13,690 kW), for a total installed capacity of 40,200 kW as limited by the turbines. The High Rock Development will have a total hydraulic capacity of 10,650 cfs.

APGI also plans to install appropriate aeration technology to increase dissolved oxygen concentrations and enhance water quality in the High Rock tailwater. The installation of aeration technologies at High Rock would take part simultaneously with the unit refurbishment/upgrade work to lower the overall costs of installation. Conceptually, APGI proposes installation of new aerating turbines with a “through-the-runner” aeration capability at the High Rock Development.

B.3 Tuckertown Development

B.3.1 Operation

Tuckertown Development is operated by full-time power dispatchers under the direction of the APGI Operations Manager. Project operation and generation dispatch is remotely controlled from the Dispatch Center located in Alcoa, Tennessee. During high flow conditions, above the capacity of the remotely controlled gates, maintenance personnel are sent to Tuckertown Dam, as required, to operate the spillway gates.

Based on gross generation records from 1972 through 2004 and the net plant capability under the most favorable operating conditions as reported on the FERC Form 1 (42 MW) the average annual plant factor at Tuckertown is approximately 42%.

B.3.1.1 Existing Operations

The Tuckertown Development is operated as essentially a run-of-river facility, with a normal daily fluctuation of less than 1 foot and a maximum daily fluctuation of 1 to 3 feet. APGI’s current license requires that, except under emergency conditions or for maintenance, the drawdown of Tuckertown Reservoir is limited to 3 feet below normal full pool elevation. Historically, the maximum annual drawdown at Tuckertown Reservoir has averaged approximately 2 feet. The average daily drawdown at Tuckertown Reservoir is less than 1 foot.

B.3.1.2 Proposed Operations

Except for maintenance or under emergency conditions, APGI proposes to operate Tuckertown Reservoir as it has been operated in the past, with drawdown limited to 3 feet below normal full pond (not below elevation 561.7 feet).

B.3.2 Estimate of Capacity and Generation

The dependable capacity for Tuckertown Development is based on the annual energy production during the critical streamflow period (2001) for the 1930 to 2003 period of record. The dependable capacity is based on the 2001 energy generation divided by the number of hours per year. The dependable capacity calculated on this basis is 6.1 MW.

The average annual gross generation of Tuckertown Development is 140,213 MWh based on the most recent 20-year period of 1985 to 2004.

B.3.2.1 Stream Flows

Tuckertown inflows were estimated using the USGS flow data set discussed in Section B.2.2.1 above. Using the adjusted Rockingham gains, the inflows to Tuckertown were apportioned by subtracting out known gage flows for the portion of the basin between High Rock and Rockingham from the adjusted Rockingham gains and apportioning the remaining flow by incremental drainage area between the developments. Multiple gages, including the Rocky River, Little River, Brown Creek, and Eldorado gages, were used in disaggregating the monthly inflow data to daily inflow data.

The minimum, mean, and maximum flows at Tuckertown during the 1930 to 2003 USGS POR are 0 cfs, 4,955 cfs, and 114,695 cfs, respectively. Monthly flow duration curves of Tuckertown inflows for APGI’s Proposed Operations are presented in Figures B-7a through B-7l.

Figure B-7a

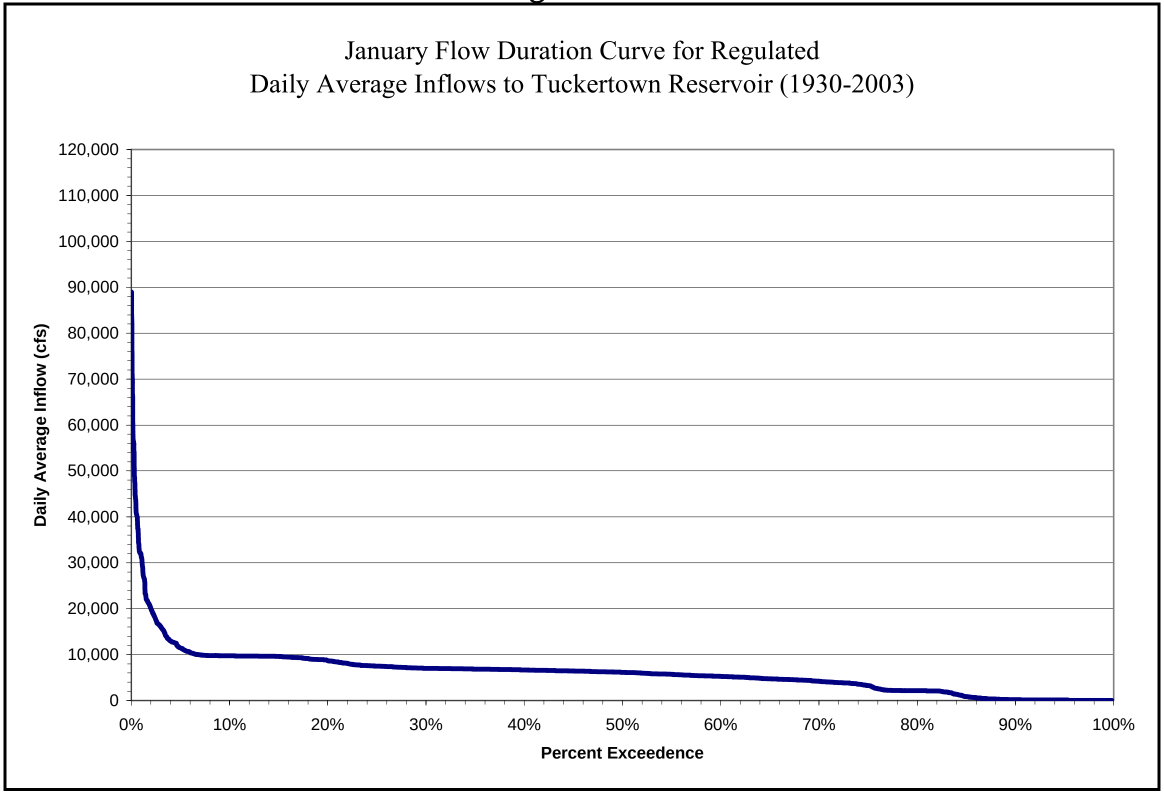


Figure B-7b

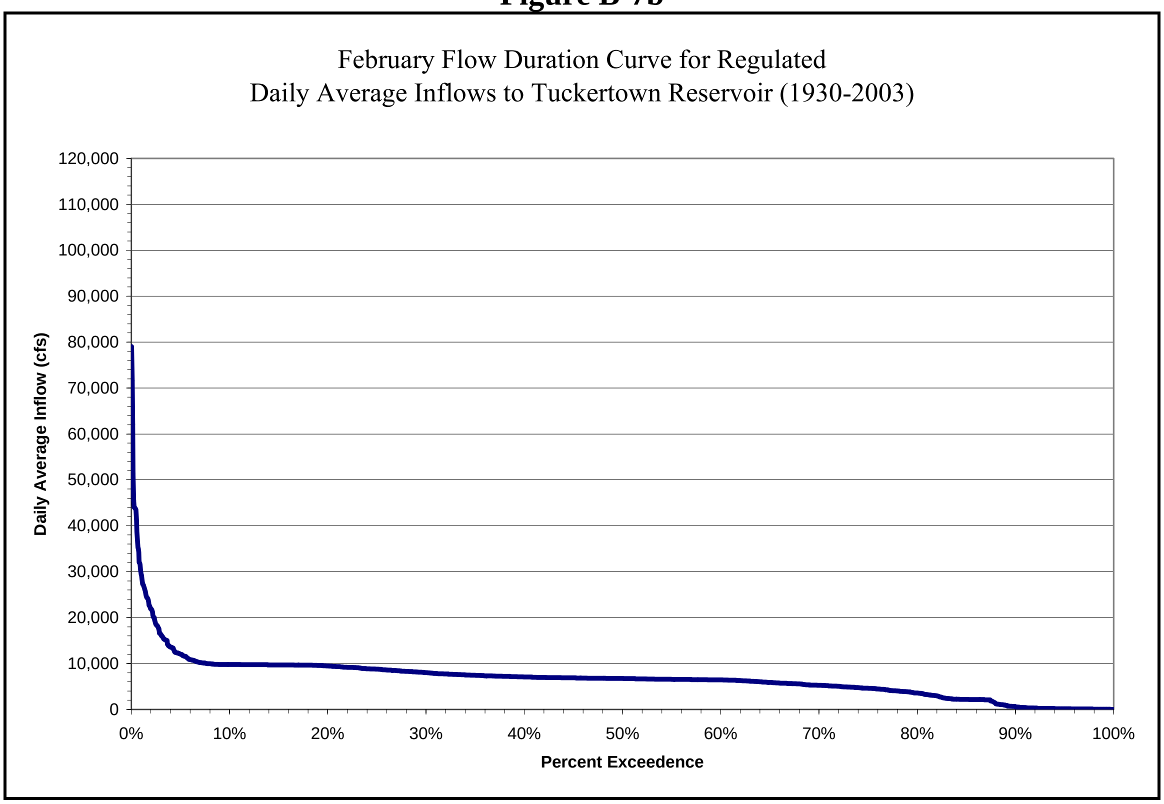


Figure B-7c

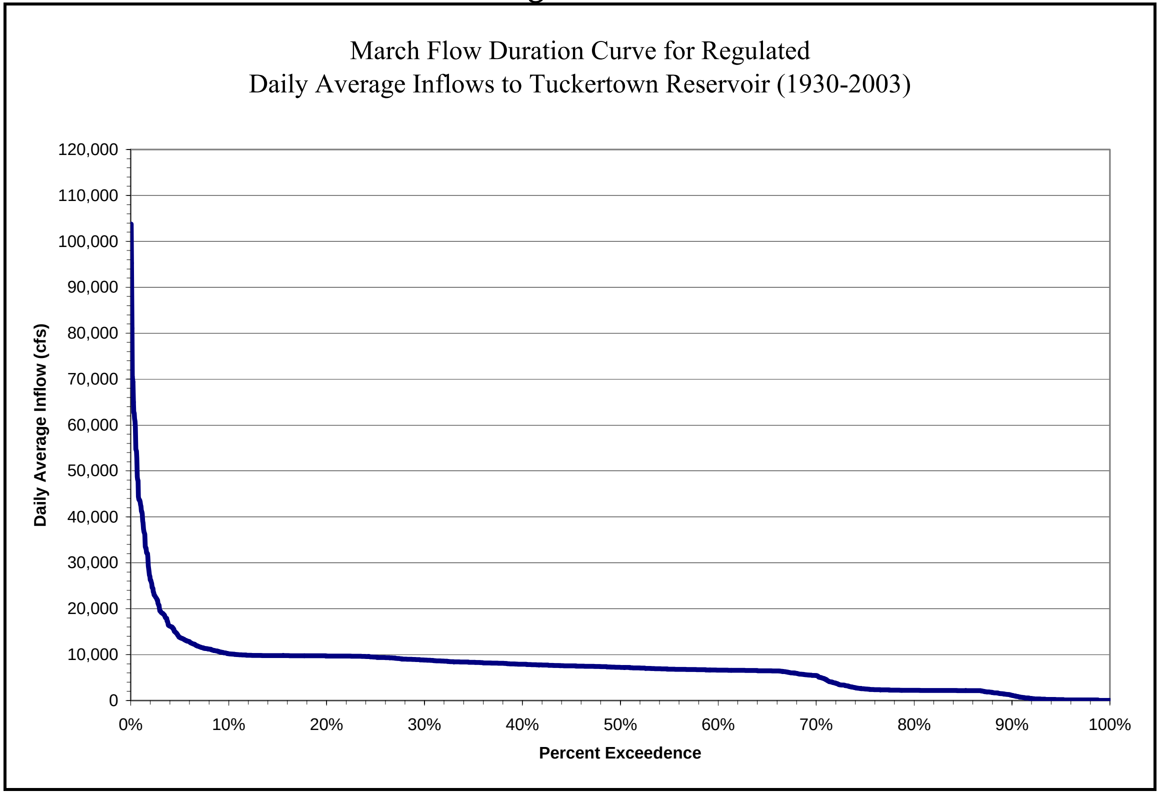


Figure B-7d

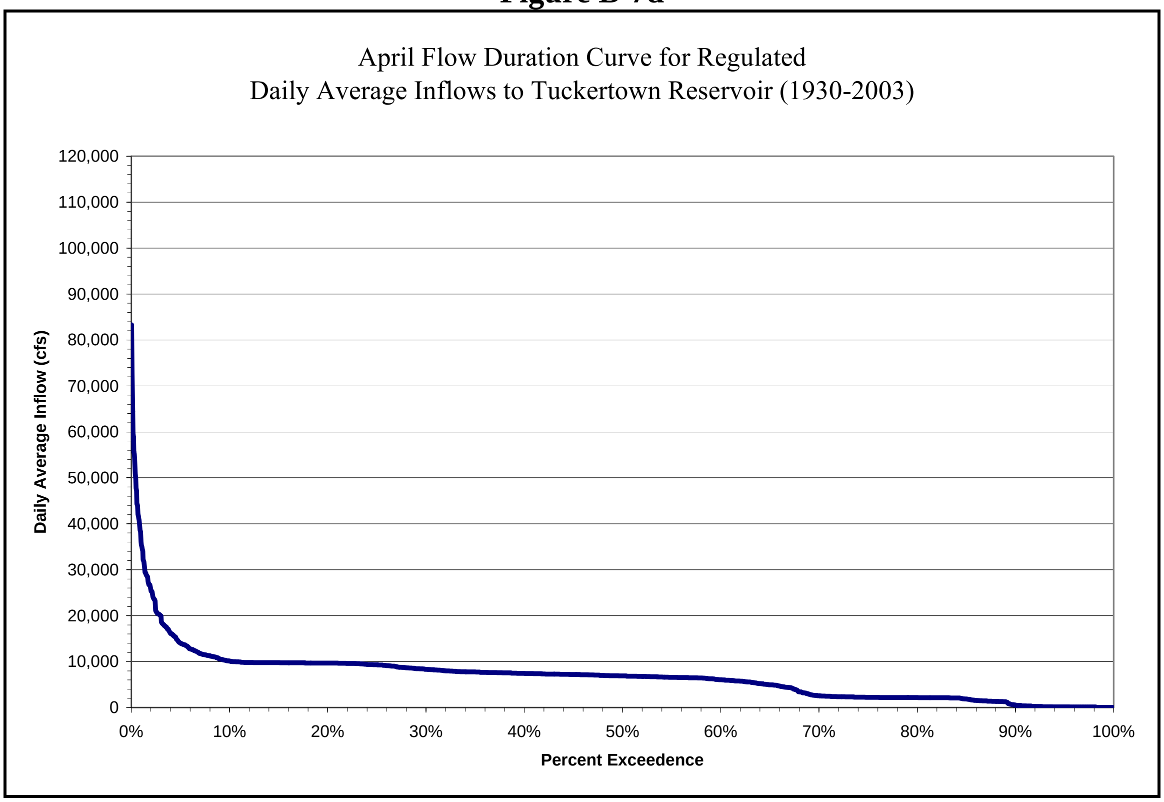


Figure B-7e

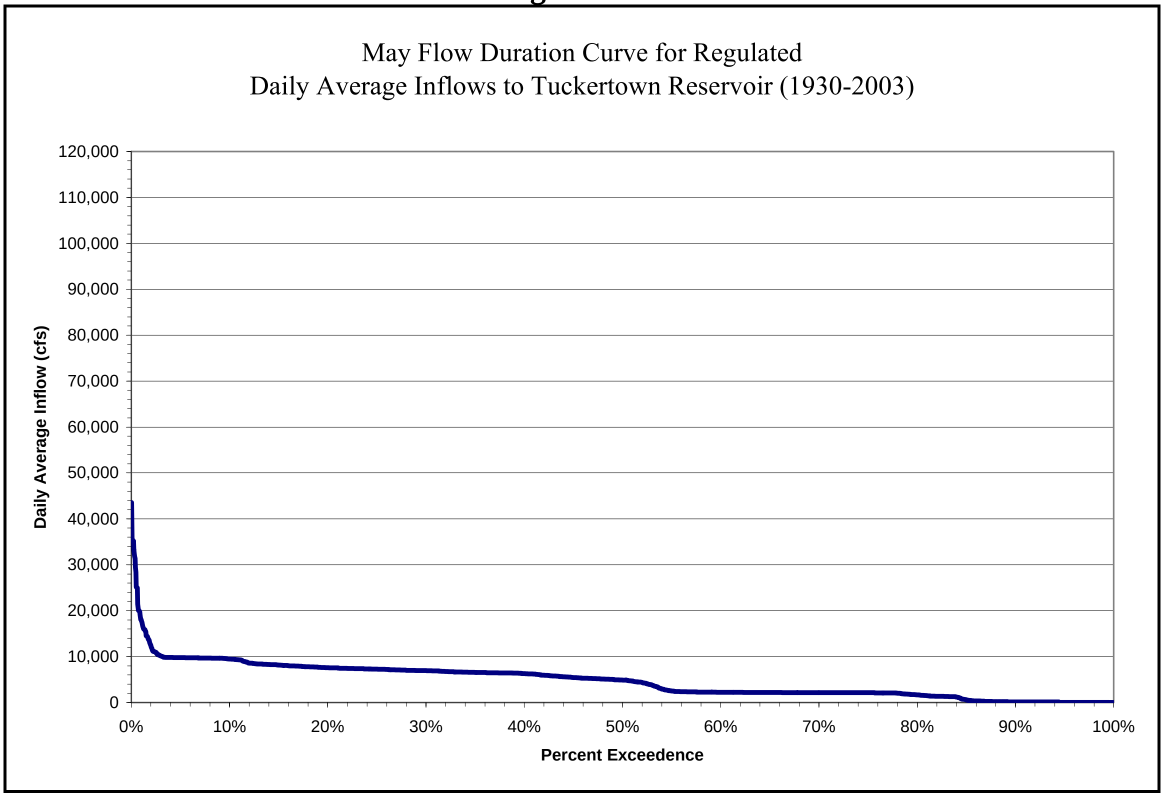


Figure B-7f

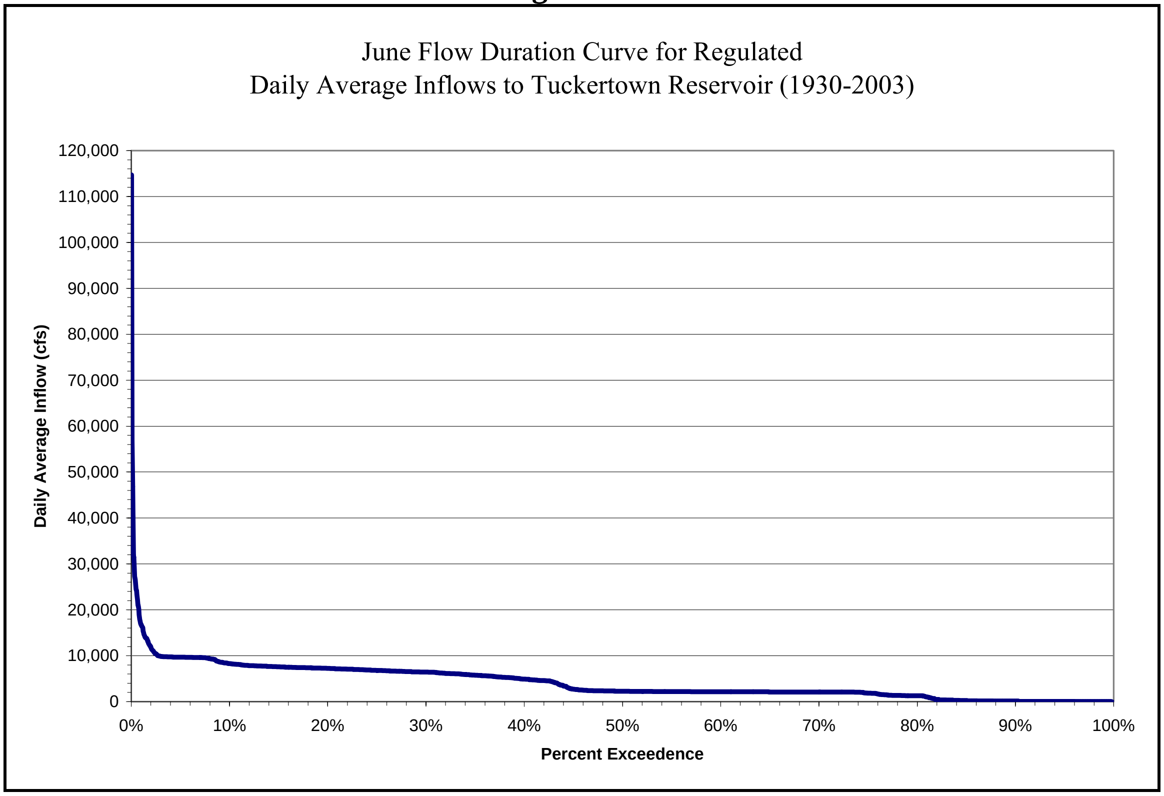


Figure B-7g

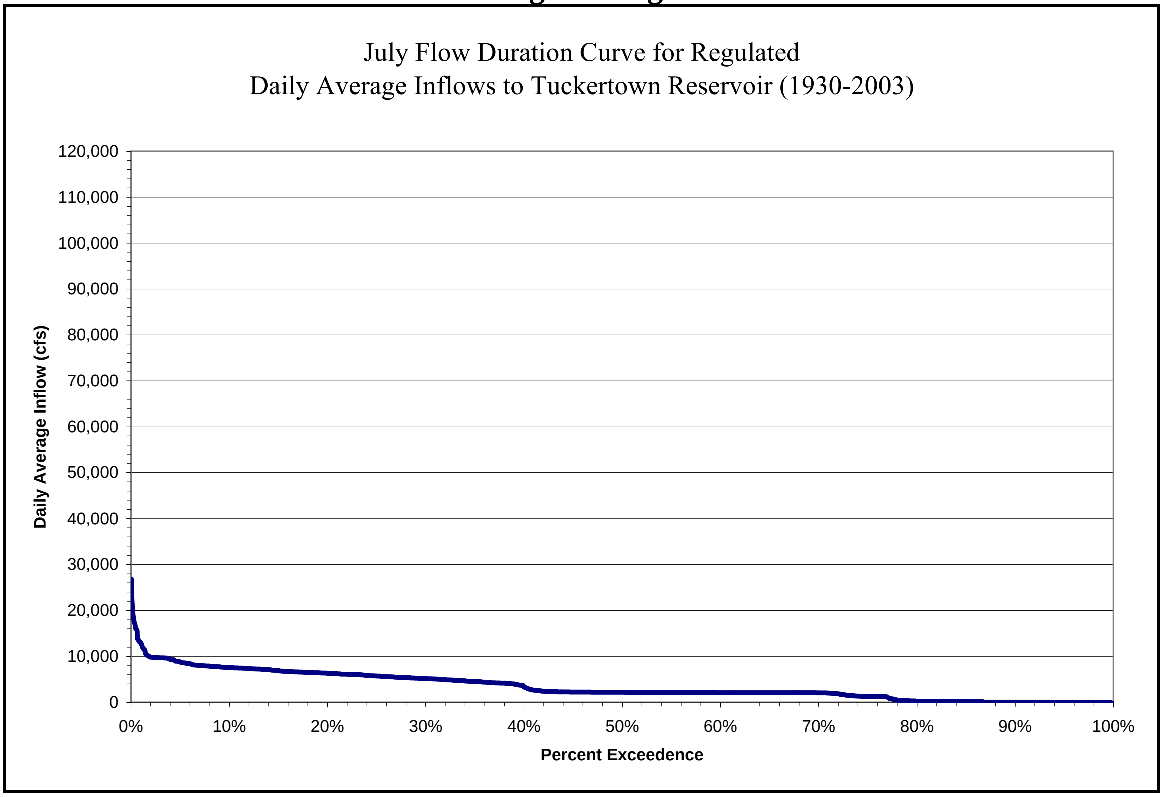


Figure B-7h

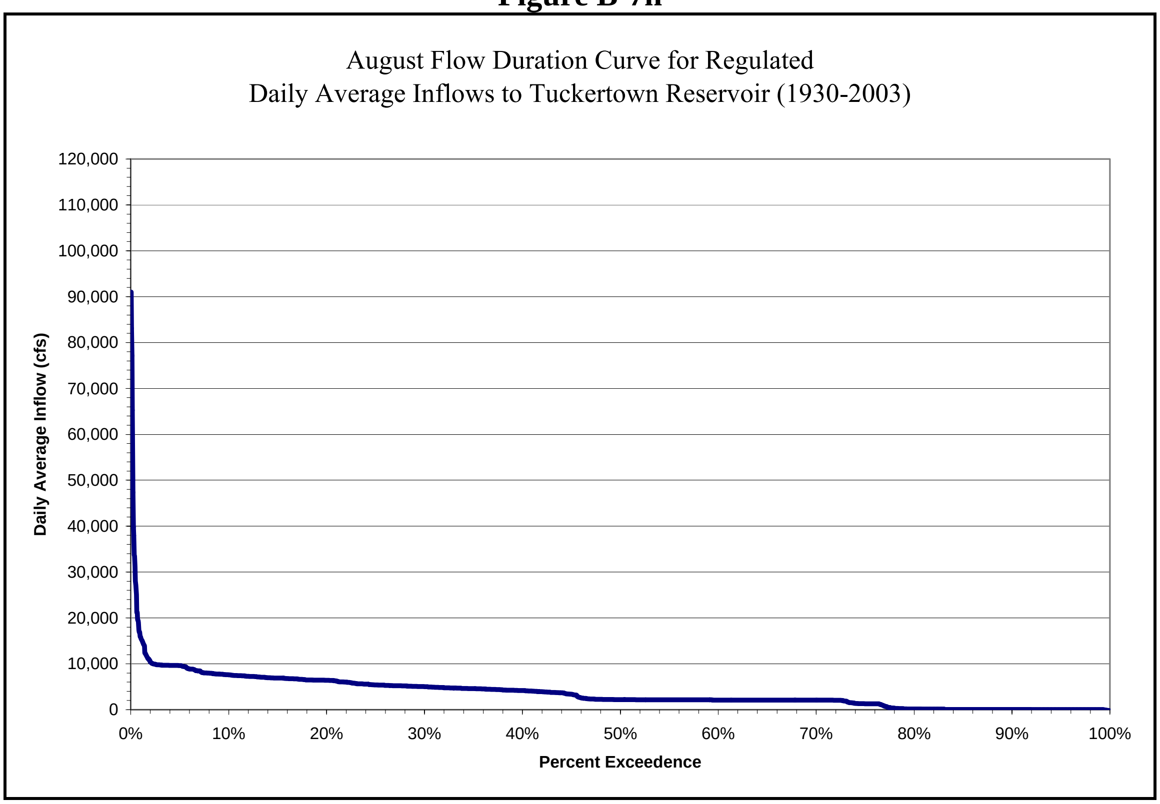


Figure B-7i

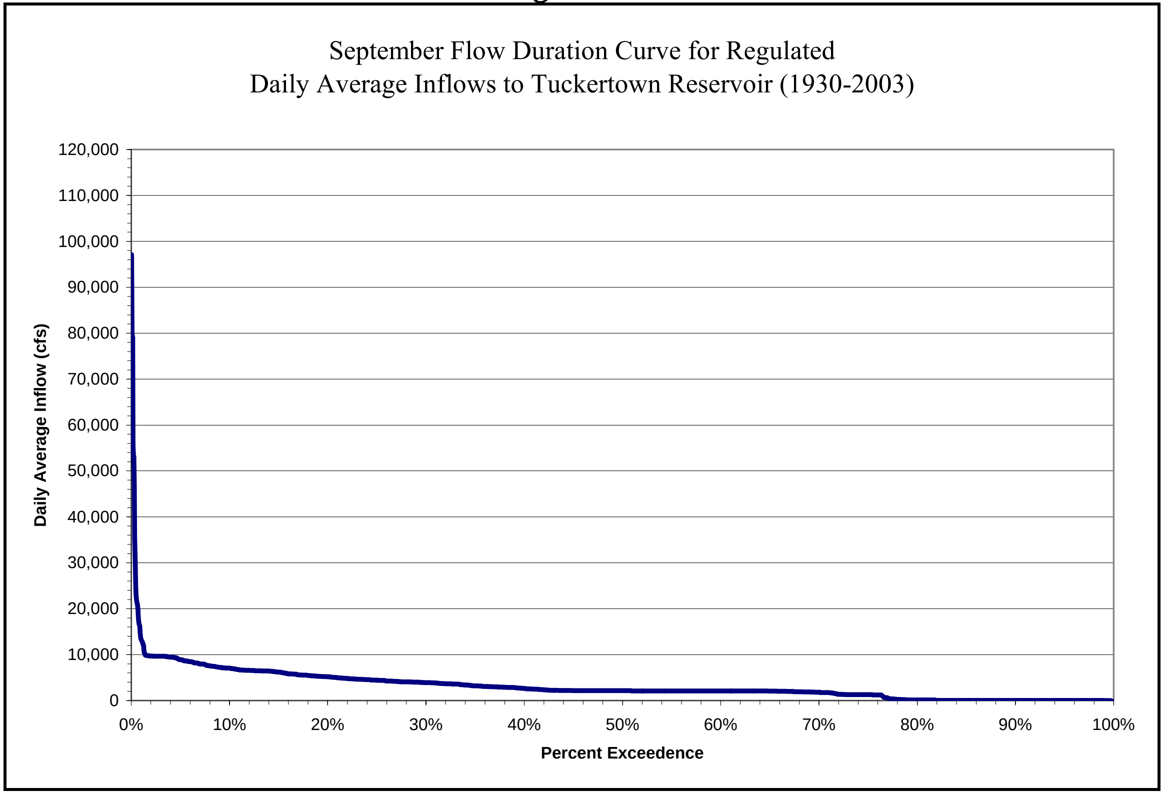


Figure B-7j

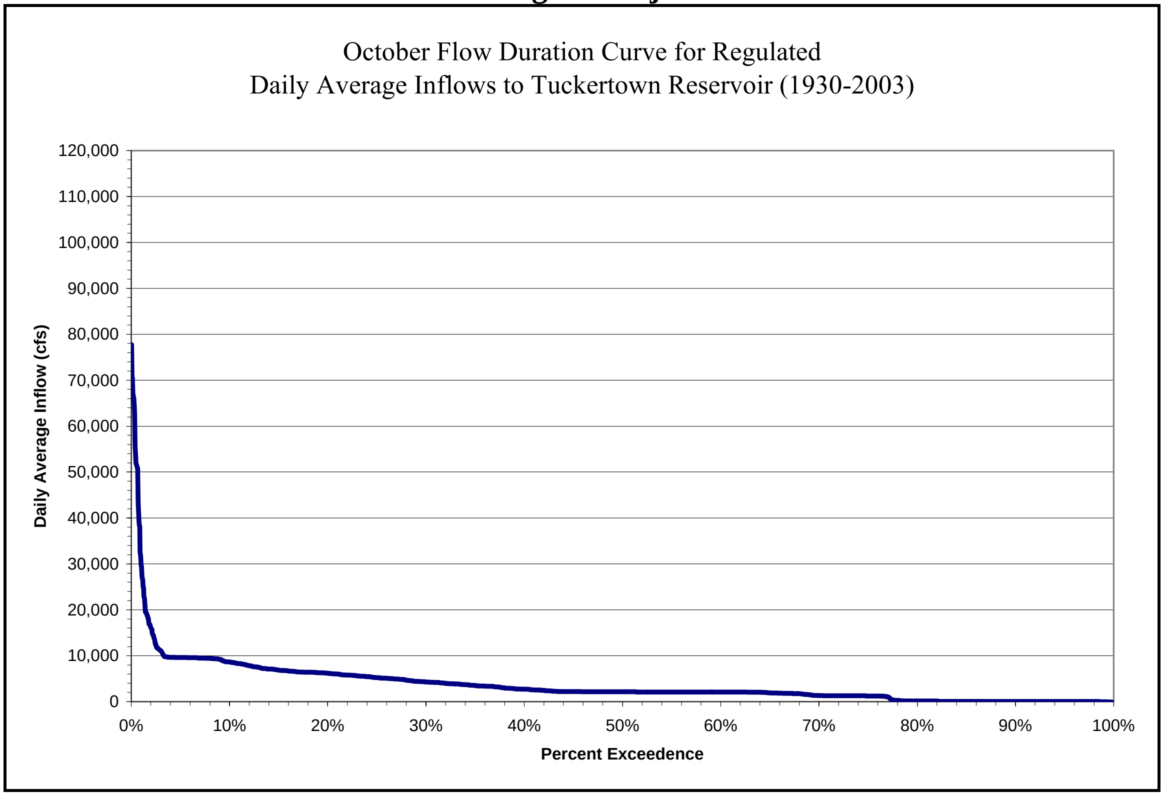


Figure B-7k

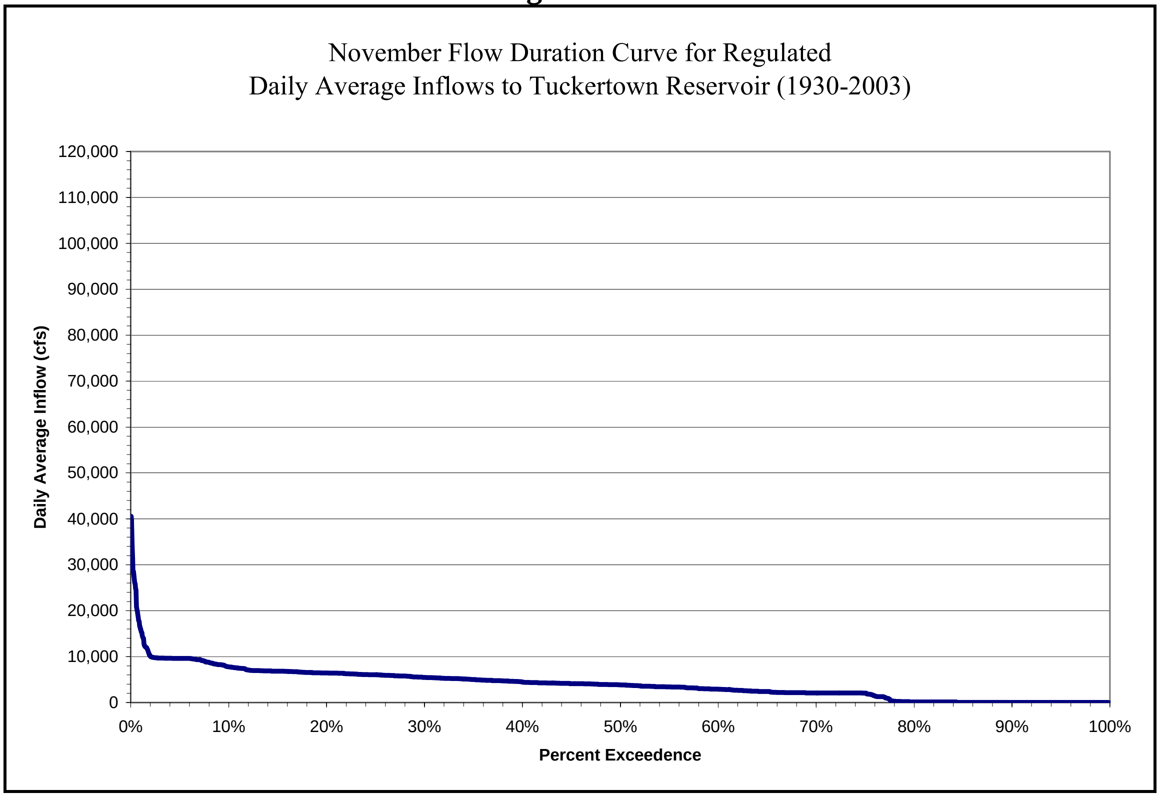
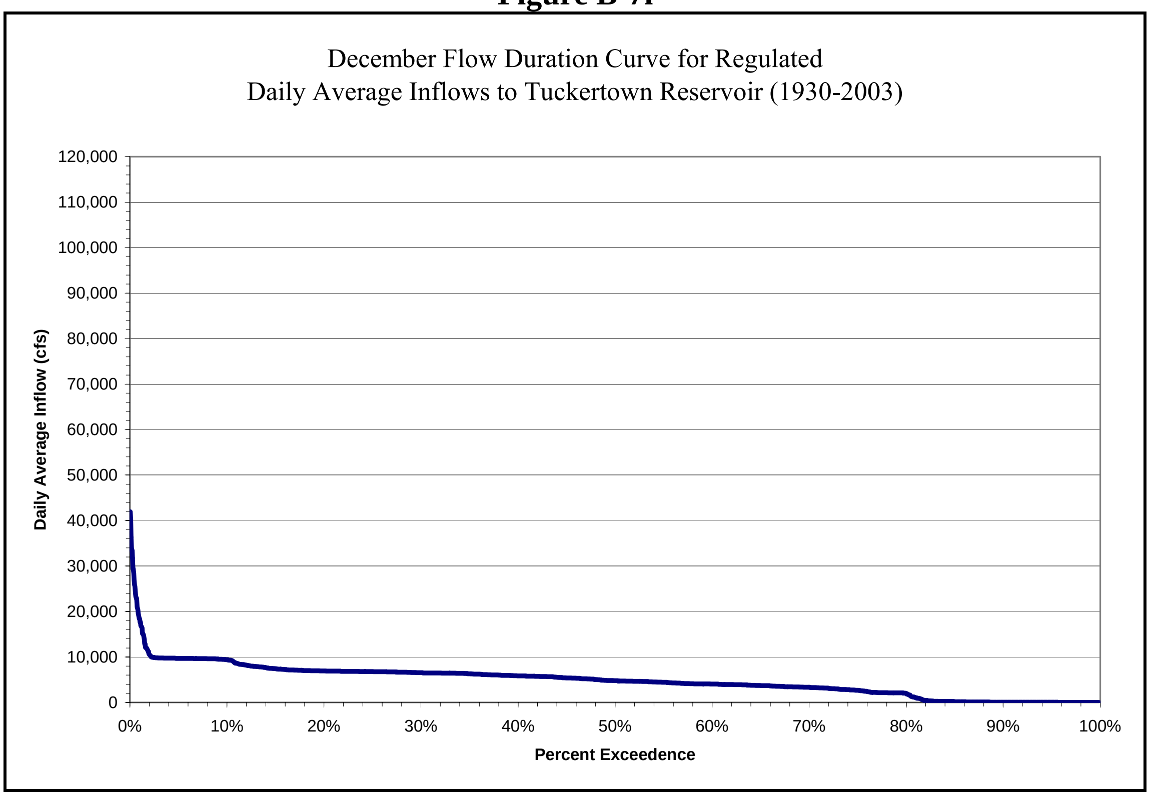


Figure B-7l



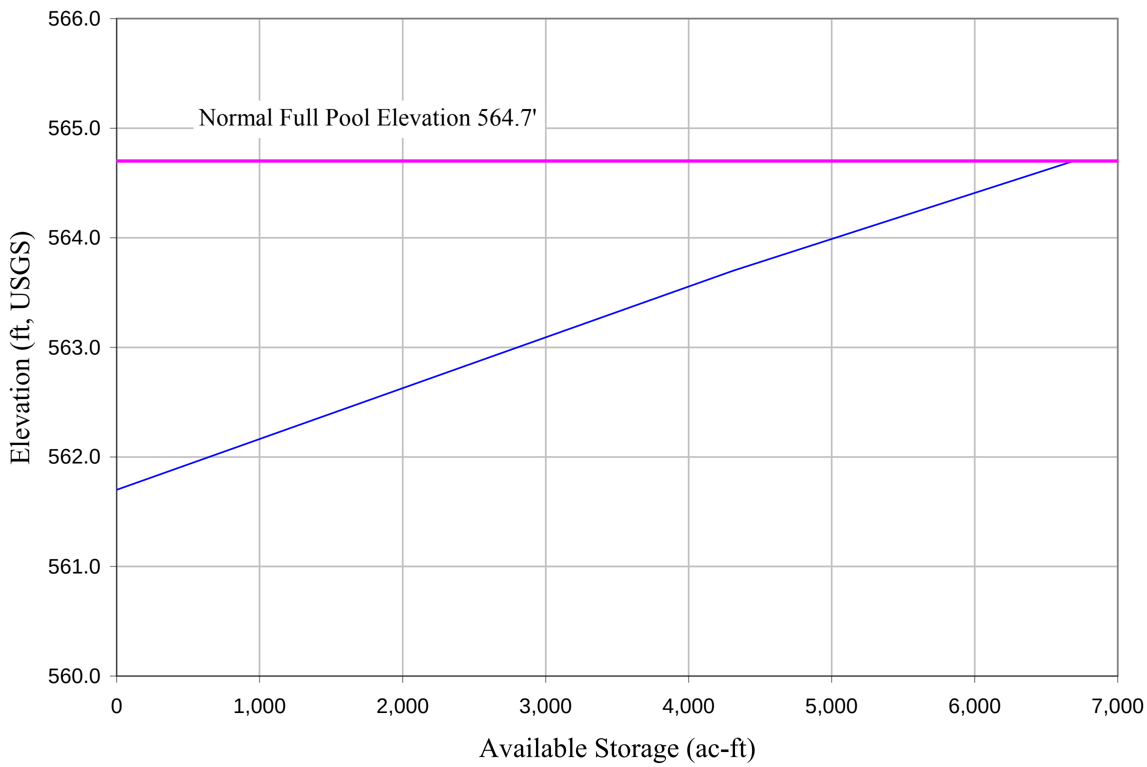
B.3.2.2 Area Capacity Relationship

A reservoir capacity curve showing the storage volume of Tuckertown Reservoir is provided in Figure B-8. At the normal full pond elevation of 564.7 feet, Tuckertown Dam impounds a usable storage volume of approximate 6,700 acre-feet, which corresponds to a drawdown of approximately 3 feet. The gross storage capacity of Tuckertown Reservoir is 42,160 acre-feet. APGI proposes to operate Tuckertown Reservoir as it has been operated in the past, with drawdown limited to 3 feet below normal full pond (not below elevation 561.7 feet), except for maintenance or under emergency conditions. As such, under the proposed operation, the usable storage at Tuckertown would remain unchanged at 6,700 acre-feet.

B.3.2.3 Power Plant Hydraulic Capacity

The existing estimated total hydraulic capacity of the power plant is 11,475 cfs. After the proposed refurbishments and upgrades are completed at Tuckertown, the estimated hydraulic capacity of the power plant will be 6,975 cfs at best efficiency and 11,130 cfs at maximum capacity.

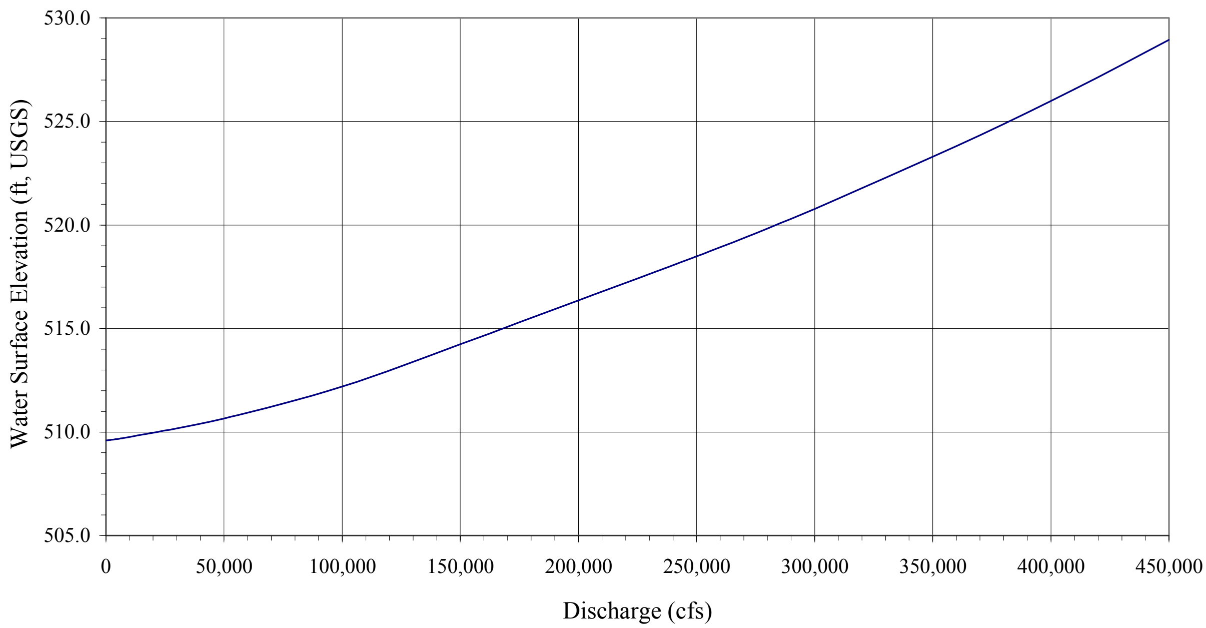
Figure B-8: Tuckertown Reservoir Elevation vs. Available Storage



B.3.2.4 Tailwater Curve

The tailwater rating curve for the Tuckertown Development is presented in Figure B-9.

Figure B-9: Tuckertown Dam, Tailwater Rating Curve



B.3.2.5 Power Plant Capacity Versus Head

The maximum head occurs when Tuckertown Reservoir is at normal full pond elevation of 564.7 feet. When Tuckertown is operating at maximum capacity, the tailwater would be 510.0 feet, resulting in a gross head of 54.7 feet. The plant capacity at normal full pond elevation will be approximately 42.7 MW.

B.3.3 Plans for Future Development

APGI plans to refurbish/upgrade the Tuckertown generating units to sustain future operation and to increase generation capacity. The refurbishment activities will result in increased hydraulic efficiency. The refurbishments will not increase the flow rate at maximum turbine discharge nor the rated generating capacity of Tuckertown. Once the refurbishments and upgrades are completed, the Tuckertown powerhouse will contain three 9,500 kW Kaplan turbines, each operating under a net head of 53.5 feet, direct-connected to generators having a total capacity of 42,720 kW (Units 1, 2, and 3 @ 14,240 kW maximum capacity), for a total installed capacity of 28,500 kW as limited by the turbines. The Tuckertown Development will have a total hydraulic capacity of 6,975 cfs at best efficiency and 11,130 cfs at maximum discharge capacity.

Under its proposed dissolved oxygen enhancement program, APGI plans to install appropriate aeration technology to increase dissolved oxygen concentrations and enhance water quality. No specific aeration equipment is proposed at the Tuckertown Development at this time pending future determination if improvements in dissolved oxygen at High Rock will extend to the Tuckertown tailrace.

B.4 Narrows Development

B.4.1 Operation

Narrows Development is operated by full-time power dispatchers under the direction of the APGI Operations Manager. Project operation and generation dispatch is remotely controlled from the Dispatch Center located in Alcoa, Tennessee. During high flow conditions, above the capacity of the remotely controlled gates, maintenance personnel are sent to Narrows Dam, as required, to operate the bypass and main dam spillway gates.

Based on gross generation records from 1972 through 2004 and the net plant capability under the most favorable operating conditions as reported on the FERC Form 1, 116 MW, the average annual plant factor at Narrows is approximately 48%.

B.4.1.1 Existing Operations

Generally, the Narrows Development is operated as a run-of-river facility. Narrows Reservoir is operated with a normal daily fluctuation of less than 1 foot and a maximum daily fluctuation of 1 to 2 feet. Historically, the normal drawdown at Narrows Reservoir has been approximately 3 feet. The average daily drawdown at Narrows is 1 to 2 feet.

However, Narrows Reservoir does have some storage available that may be used during emergencies or during periods of very low streamflow to maintain the required minimum downstream releases. Table B.4-1 lists the drawdown relationship between High Rock and Narrows Reservoirs as defined by the current Operating Guides for the Operation of Badin Works.

Table B.4-1: Drawdown Relationship Between High Rock and Narrows Reservoirs

High Rock Reservoir		Narrows Reservoir	
Elevation (feet, USGS)	**Drawdown (feet)**	**Elevation (feet, USGS)**	**Drawdown (feet)**
623.9	0	509.8 – 507.7	0 – 2.1
622.9	1.0	508.2 – 503.2	1.6 – 6.6
599.9	24.0	508.2 – 503.2	1.6 – 6.6
599.9	24.0	502.7	7.1
597.9	26.0	493.7	16.1
593.9	30.0	478.8	31.1

B.4.1.2 Proposed Operations

APGI proposes to continue to operate Narrows Reservoir as it has been operated in the past, typically maintaining reservoir water levels within 3 feet of full with the ability to go to 6.6 feet below normal full pond (not below elevation 503.2 feet), as needed in order to maintain the Project minimum flow discussed below, or as provided under a proposed "Low Instream Flow Protocol", or in cases of emergency.

APGI proposes to undertake a series of Project modifications designed to increase dissolved oxygen (DO) concentrations and enhance water quality in the Project tailwaters through installation of aeration technology at Narrows simultaneously with the unit refurbishment/upgrade, as described in Section B.4.3. Conceptually, APGI proposes installation of new aerating valves on the draft tube cones at the Narrows development. APGI proposes to operate the aerating equipment between May 1 and November 30 of each year as needed

B.4.2 Estimate of Capacity and Generation

The dependable capacity for Narrows Development is based on the annual energy production during the driest year (2001) for the 1930 to 2003 period of record. The dependable capacity is based on the 2001 energy generation divided by the number of hours per year. The dependable capacity calculated on this basis is 20.5 MW.

The average annual gross generation of Narrows Development is 447,135 MWh based on the most recent 20-year period of 1985 to 2004.

B.4.2.1 Stream Flows

Narrows inflows were estimated using the USGS flow data set discussed in Section B.2.2.1 above. Using the adjusted Rockingham gains, the inflows to Narrows were apportioned by subtracting out known gage flows for the portion of the basin between High Rock and Rockingham from the adjusted Rockingham gains and apportioning the remaining flow by incremental drainage area between the developments. Multiple gages, including the Rocky River, Little River, Brown Creek, and Eldorado gages, were used in disaggregating the monthly inflow data to daily inflow data.

The minimum, mean, and maximum Narrows flows during the 1930 to 2003 POR are 0 cfs, 5,135 cfs, and 116,570 cfs, respectively. Monthly flow duration curves of Narrows inflows for APGI's Proposed Operations are presented in Figures B-10a through B-10l.

Figure B-10a

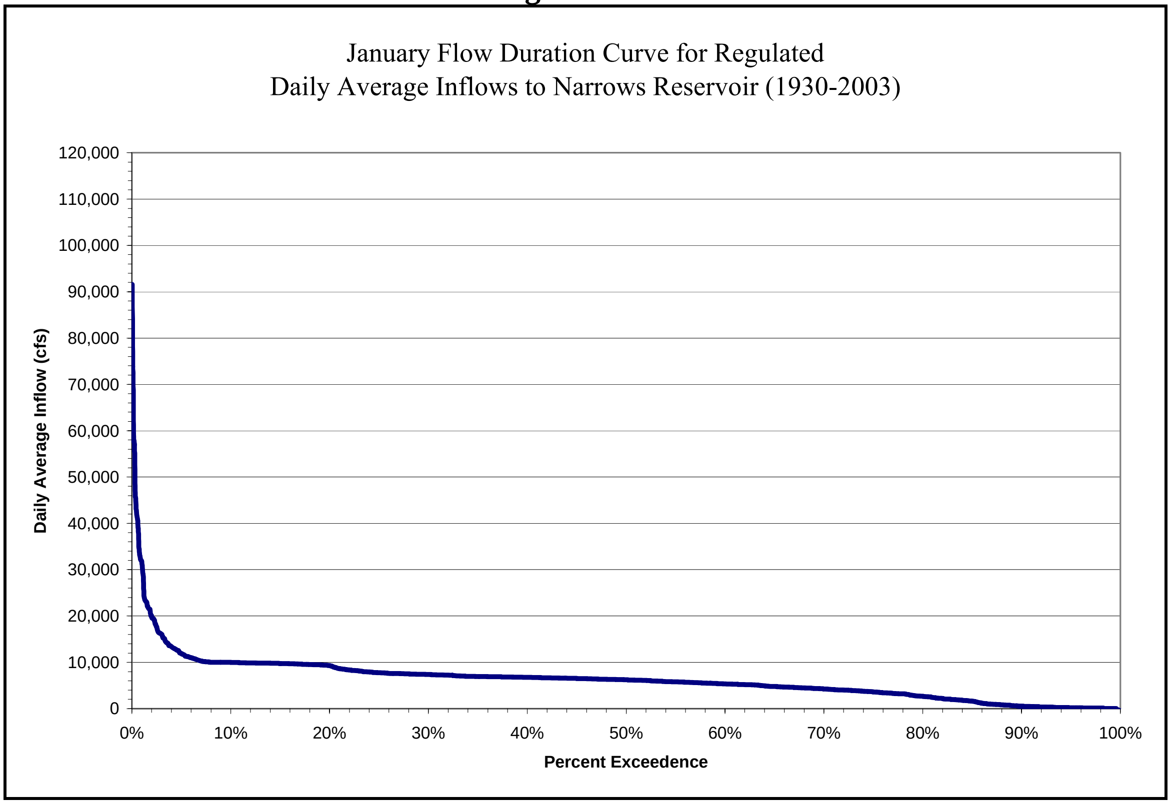


Figure B-10b

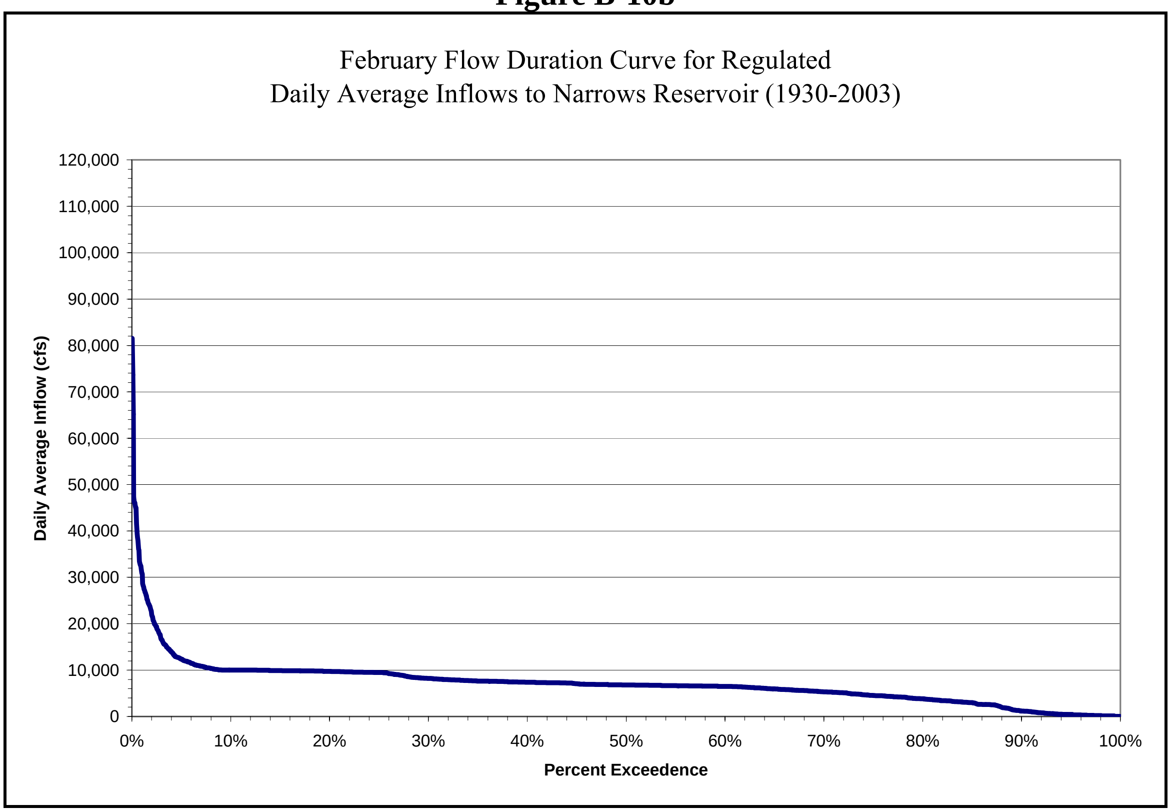


Figure B-10c

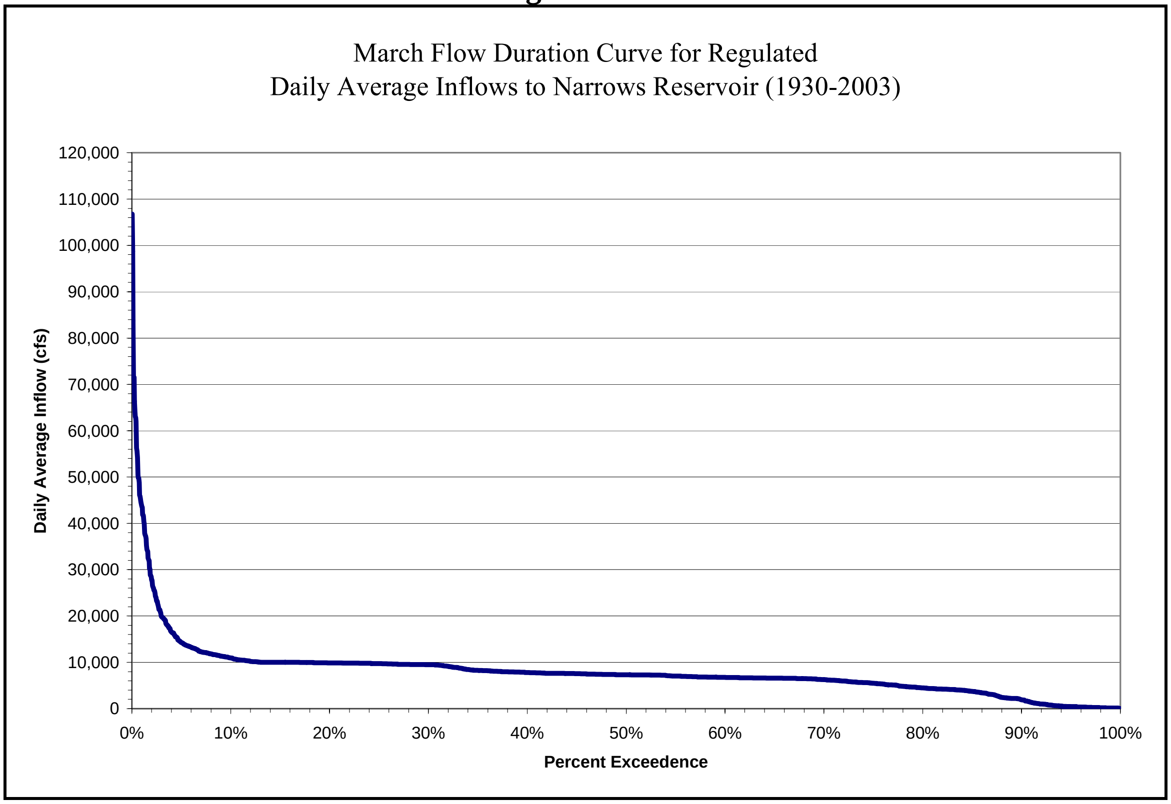


Figure B-10d

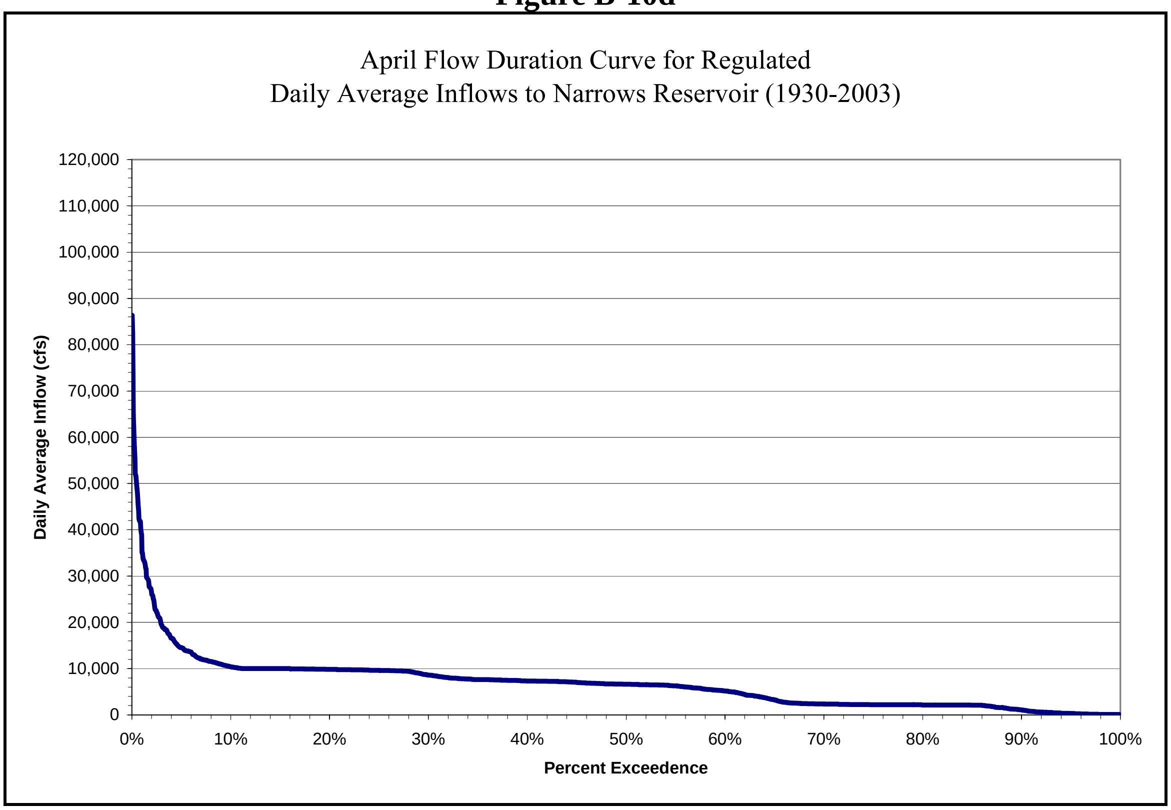


Figure B-10e

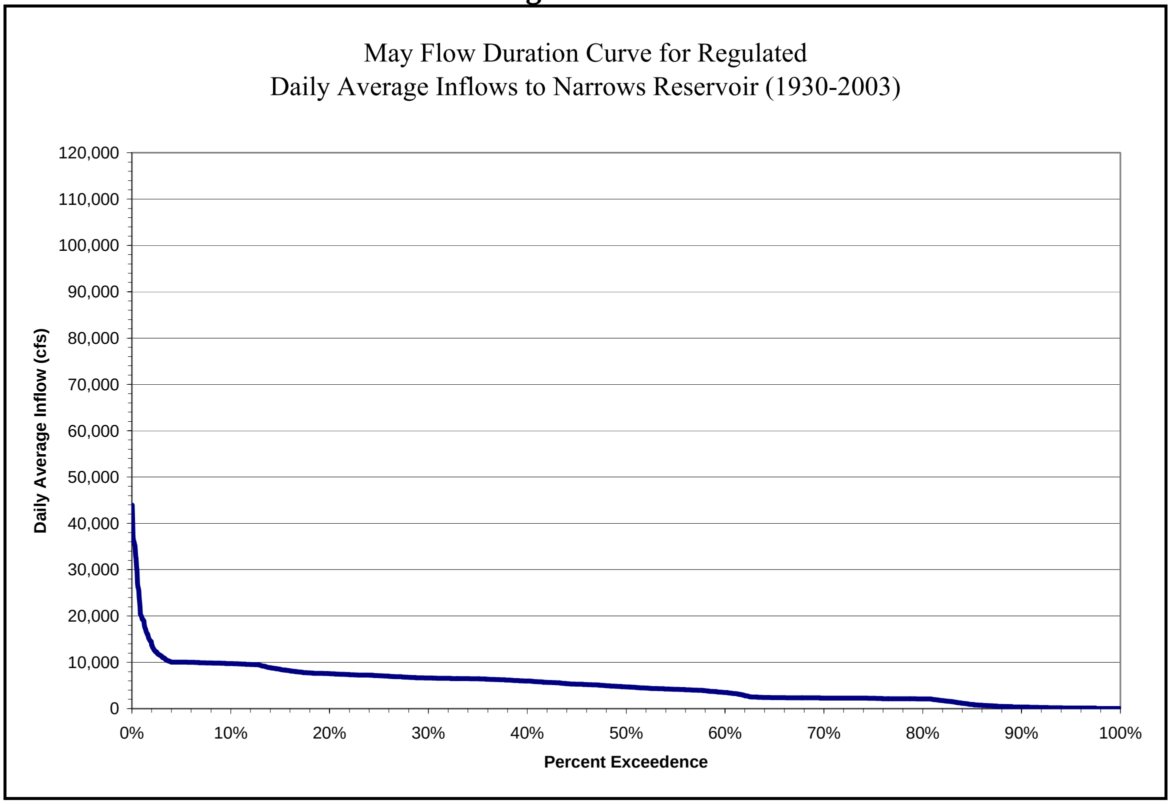


Figure B-10f

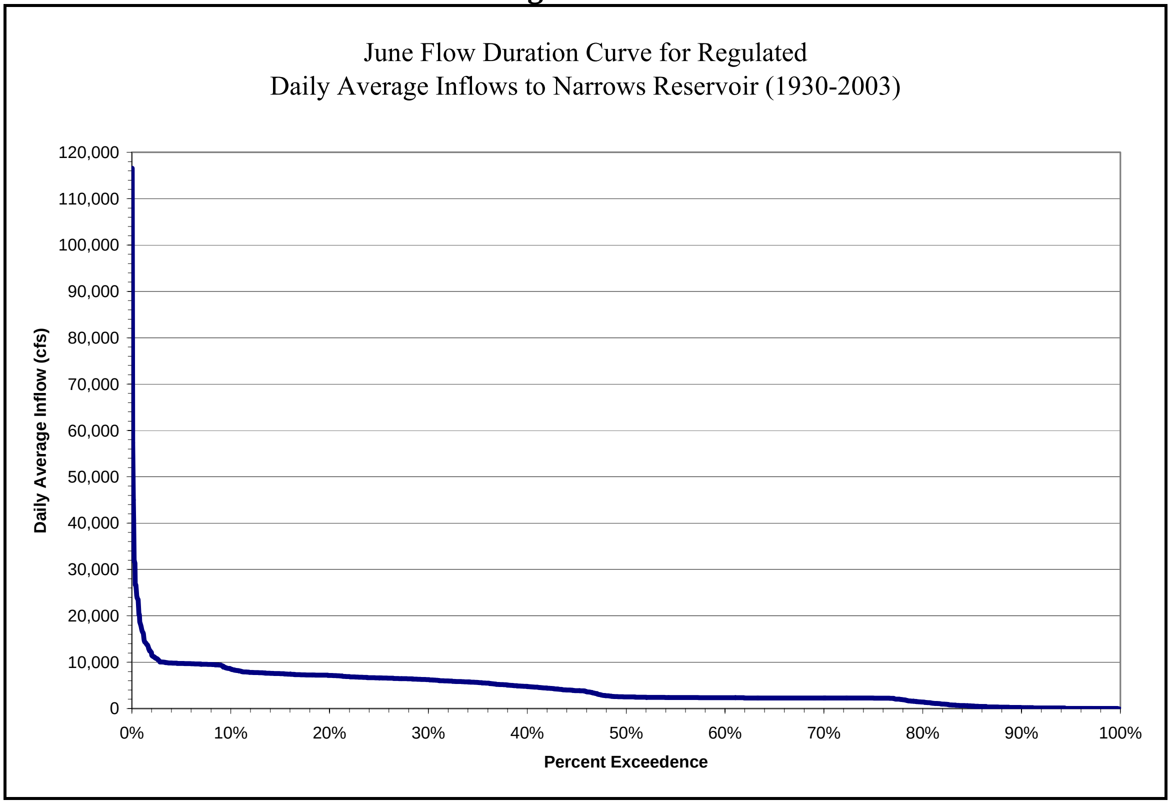


Figure B-10g

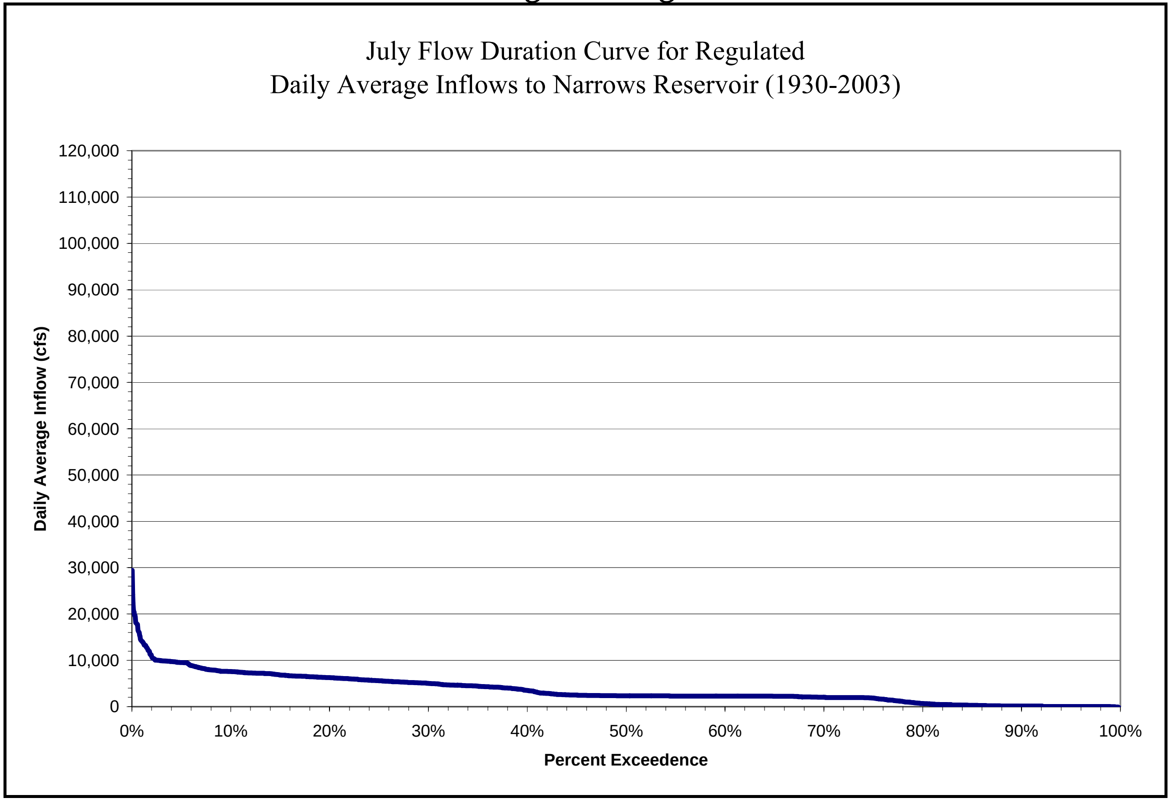


Figure B-10h

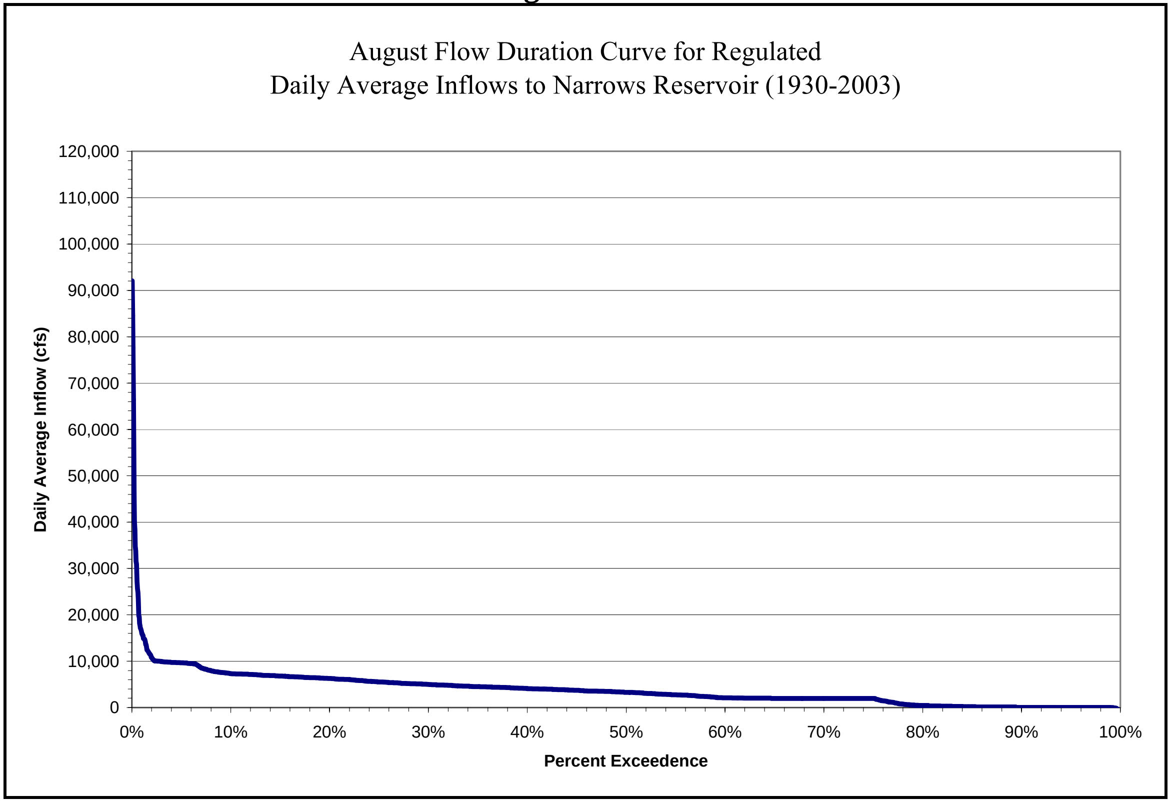


Figure B-10i

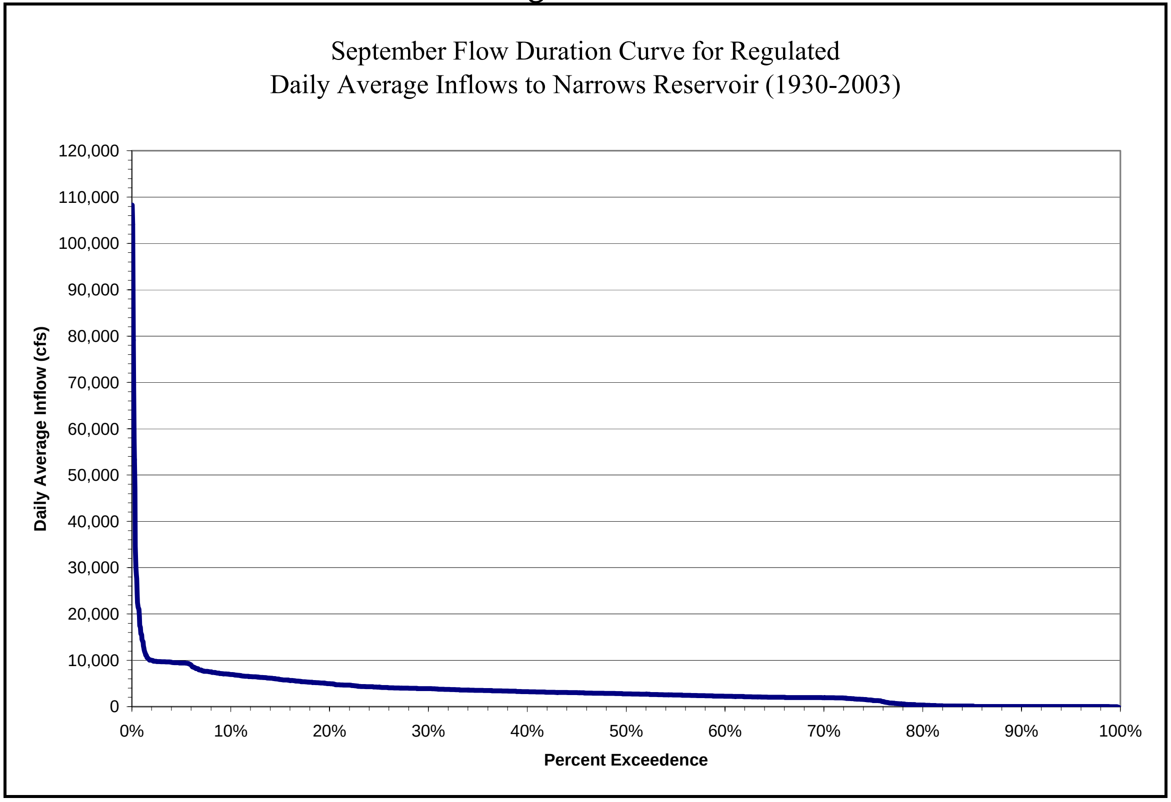


Figure B-10j

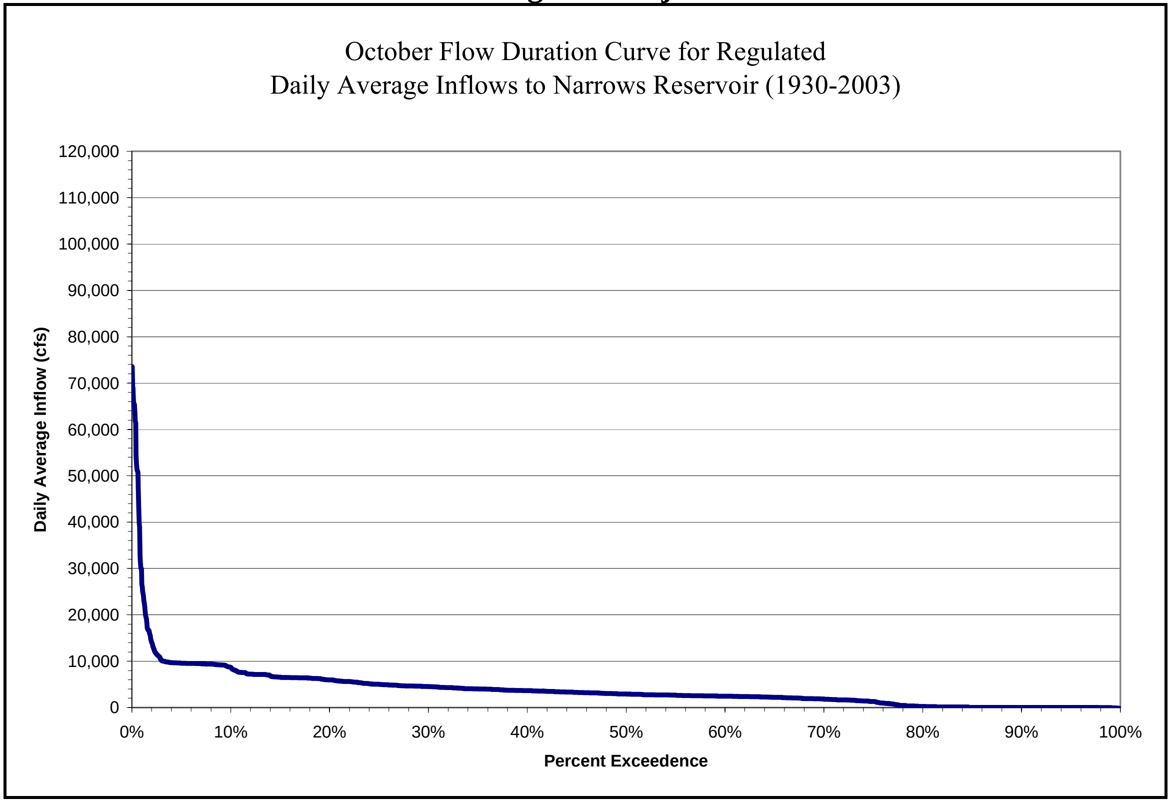


Figure B-10k

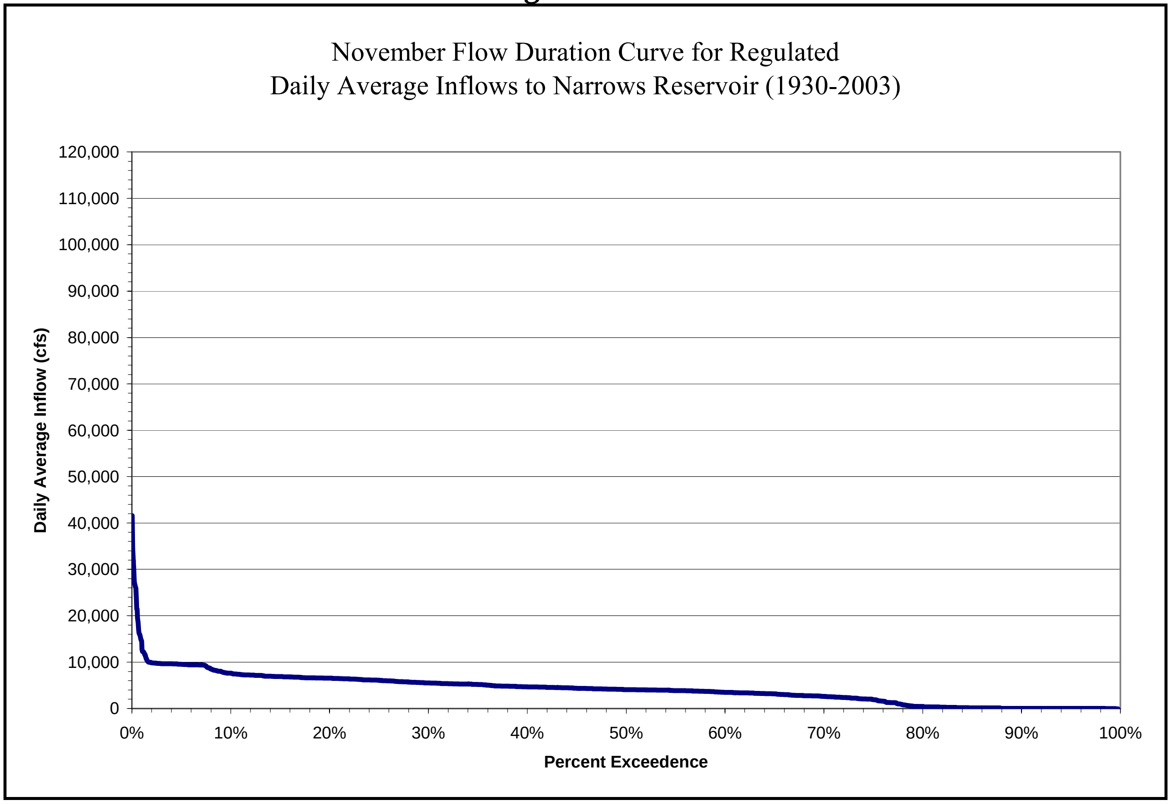
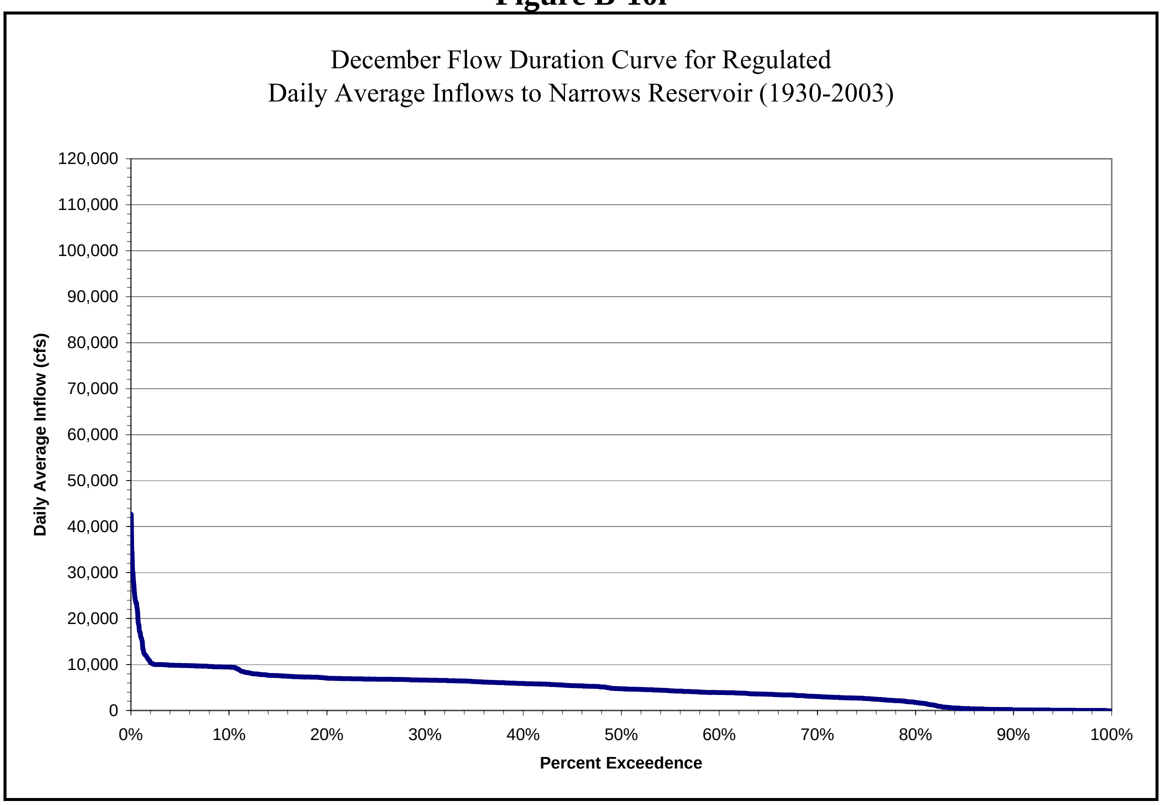


Figure B-10l



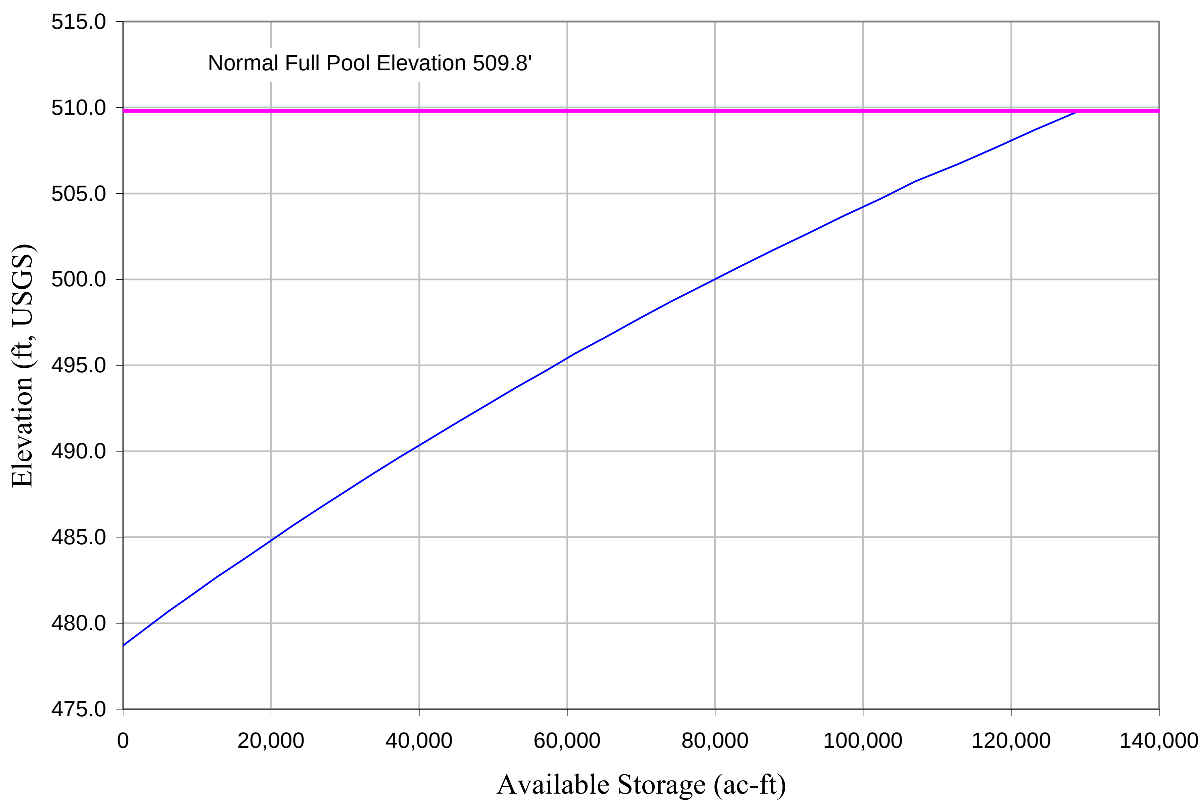
B.4.2.2 Area Capacity Relationship

A reservoir capacity curve showing the storage volume of Narrows Reservoir is provided in Figure B-11. At the normal full pond elevation of 509.8 feet, Narrows Dam impounds an available storage volume of 129,100 acre-feet, which corresponds to a drawdown of approximately 31.1 feet. The gross storage capacity of Narrows Reservoir is 142,310 acre-feet. APGI's proposed operation of Narrows Reservoir provides a drawdown target of 3 ft for normal operation which corresponds to a usable storage of 16,400 ac-ft.

B.4.2.3 Power Plant Hydraulic Capacity

The existing estimated hydraulic capacity of the power plant is 10,000 cfs at maximum discharge. After the proposed refurbishments and upgrades are completed at Narrows, the estimated hydraulic capacity of the power plant will be 7,950 cfs at best efficiency and 10,100 cfs at maximum capacity.

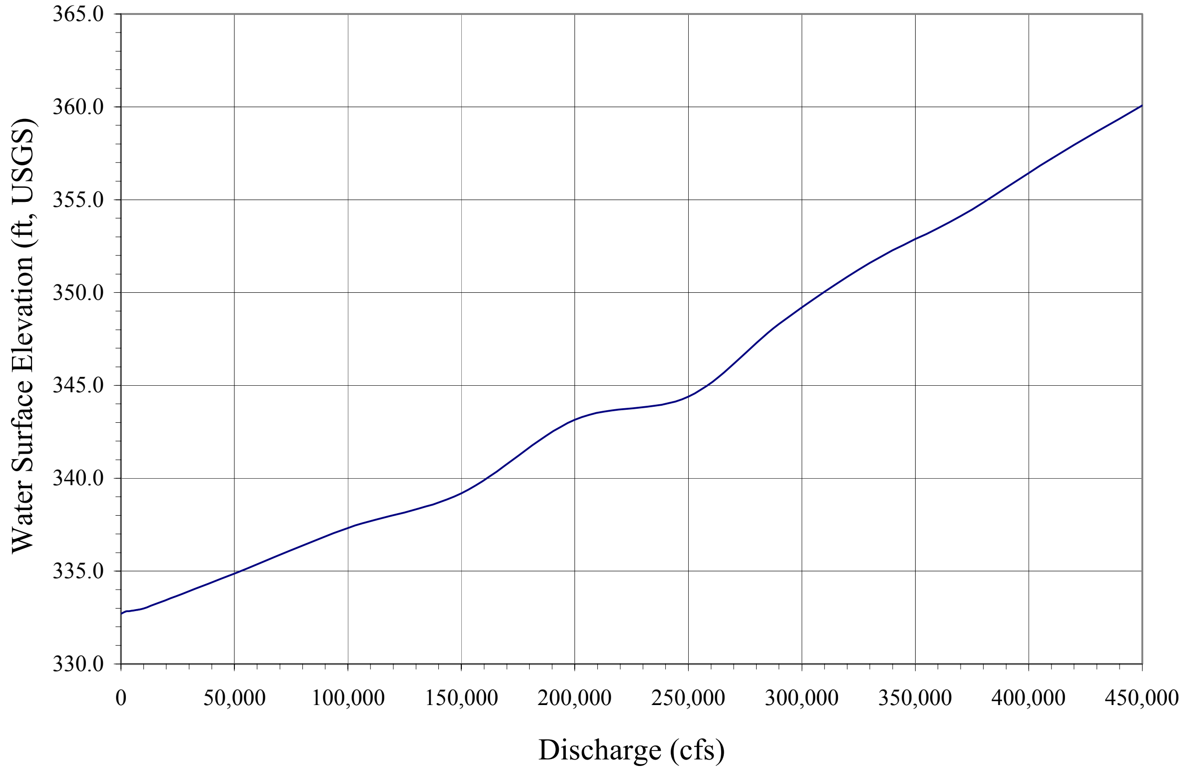
Figure B-11: Narrows Reservoir Elevation vs. Available Storage



B.4.2.4 Tailwater Curve

The tailwater rating curve for the Narrows Development is presented in Figure B-12.

Figure B-12: Narrows Dam, Tailwater Rating Curve



B.4.2.5 Power Plant Capacity Versus Head

The maximum head occurs when Narrows Reservoir is at normal full pond elevation of 509.8 feet. When Narrows is operating at maximum capacity, the tailwater would be 333.0 feet. This results in a gross head of 176.8 feet. Under a mean reservoir elevation of 508.2[1] feet, the corresponding gross head is 175.2 feet. The plant capacity at maximum discharge capacity at normal full pond elevation will be approximately 122.3 MW following completion of the proposed upgrades.

B.4.3 Plans for Future Development

APGI plans to refurbish/upgrade the Narrows generating Units 1 and 3 in order to sustain future operation and increase generation capacity. The refurbishment activities will result in increased hydraulic efficiency, as well as slightly increased flow rate at maximum turbine discharge in some cases. Once the refurbishments and upgrades are completed, the Narrows powerhouse will

[1] Average Narrows Reservoir level for 1986 – 2003 time period.

contain four vertical Francis turbines, each operating under a net head of 174.5 feet. Units 1 and 3 will each have a capacity of 27,100 kW. The turbines will be direct-connected to the generators (Units 1 and 3 @ 30,400 kW). The total installed generating capacity of the Narrows Development will be 108,400 kW, as limited by the turbines. The Narrows Development will have a total hydraulic capacity of 7,950 cfs at best efficiency and maximum discharge capacity of 10,100 cfs.

APGI also plans to install appropriate aeration technology to increase dissolved oxygen concentrations and enhance water quality in the Narrows tailwater. The installation of effective aeration technologies at Narrows would take part simultaneously with the unit refurbishment/upgrade work to lower the overall costs of installation. Conceptually, APGI proposes to install new aerating valves on the draft tube cones at the Narrows Development, similar to those already installed on Narrows Unit 4.

B.5 Falls Development

B.5.1 Operation

Falls Development is operated by full-time power dispatchers under the direction of the APGI Operations Manager. Project operation and generation dispatch is remotely controlled from the Dispatch Center located in Alcoa, Tennessee. During high flow conditions, above the capacity of the remotely controlled gates, maintenance personnel are sent to Fall Dam, as required, to operate the spillway gates.

Based on gross generation records from 1972 through 2004 and the net plant capability under the most favorable operating conditions as reported on the FERC Form 1, 32 MW, the average annual plant factor at Falls is approximately 48%.

B.5.1.1 Existing Operations

Like Tuckertown, the Falls Development is essentially operated as a run-of-river facility. Falls Reservoir is operated with a normal daily fluctuation of 0 to 2 feet and a maximum daily fluctuation of 3 to 4 feet. There is no seasonal drawdown at Falls Reservoir due to its limited ability to store water. Historically, the maximum annual drawdown at Falls Reservoir has averaged approximately 4 feet. The average daily drawdown at Falls Reservoir is approximately 1 foot.

B.5.1.2 Proposed Operations

Except for maintenance or under emergency conditions, APGI proposes to operate Falls Reservoir as it has been operated in the past, with typical reservoir fluctuations of 4 feet or less.

B.5.2 Estimate of Capacity and Generation

The dependable capacity for Falls Development is based on the annual energy production during the critical streamflow period (2001) for the 1930 to 2003 period of record. The dependable capacity is based on the 2001 energy generation divided by the number of hours per year. The dependable capacity calculated on this basis is 5.4 MW.

The average annual gross generation of Falls Development is 124,034 MWh based on the most recent 20-year period of 1985 to 2004.

B.5.2.1 Stream Flows

Falls inflows were estimated using the USGS flow data set discussed in Section B.2.2.1 above. Using the adjusted Rockingham gains, the inflows to Falls were apportioned by subtracting out known gage flows for the portion of the basin between High Rock and Rockingham from the adjusted Rockingham gains and apportioning the remaining flow by incremental drainage area between the developments. Multiple gages, including the Rocky River, Little River, Brown Creek, and Eldorado gages, were used in disaggregating the monthly inflow data to daily inflow data.

The minimum, mean, and maximum Falls flows during the 1930 to 2003 USGS POR are 0 cfs, 5,160 cfs, and 116,715 cfs, respectively. Monthly flow duration curves of Falls inflows for APGI's Proposed Operations are presented in Figures B-13a through B-13l.

Figure B-13a

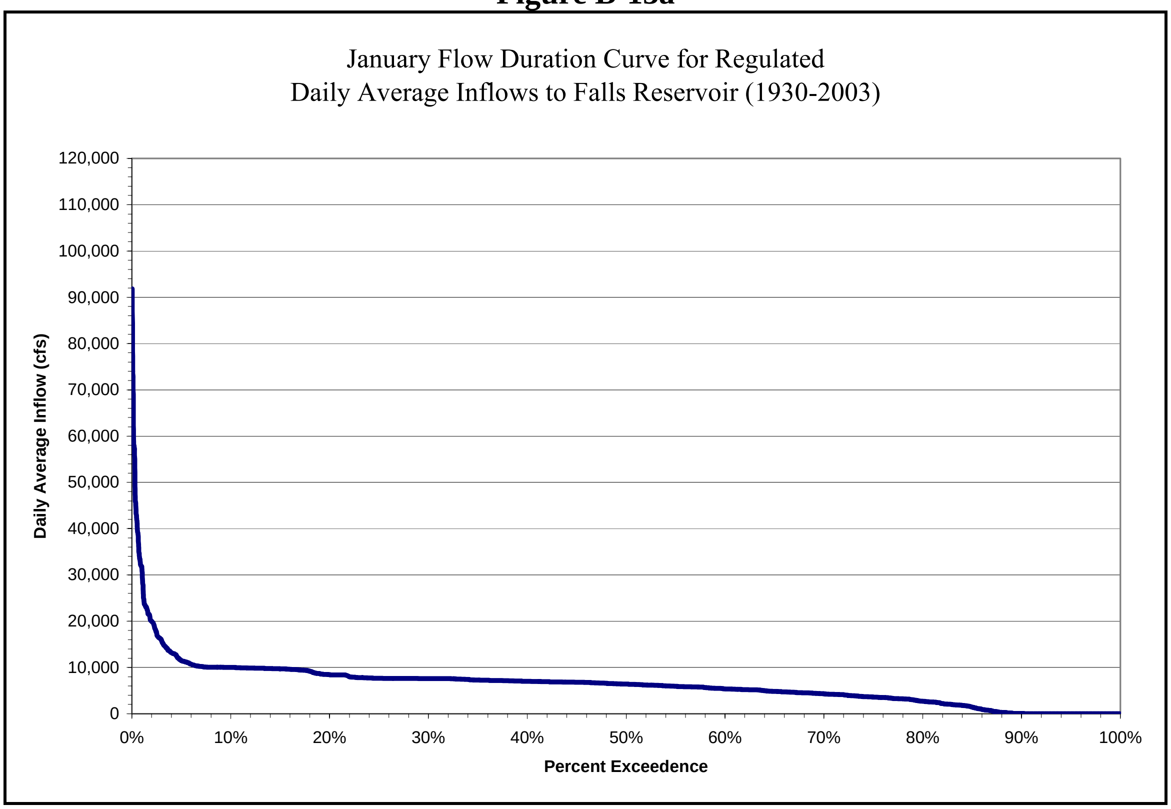


Figure B-13b

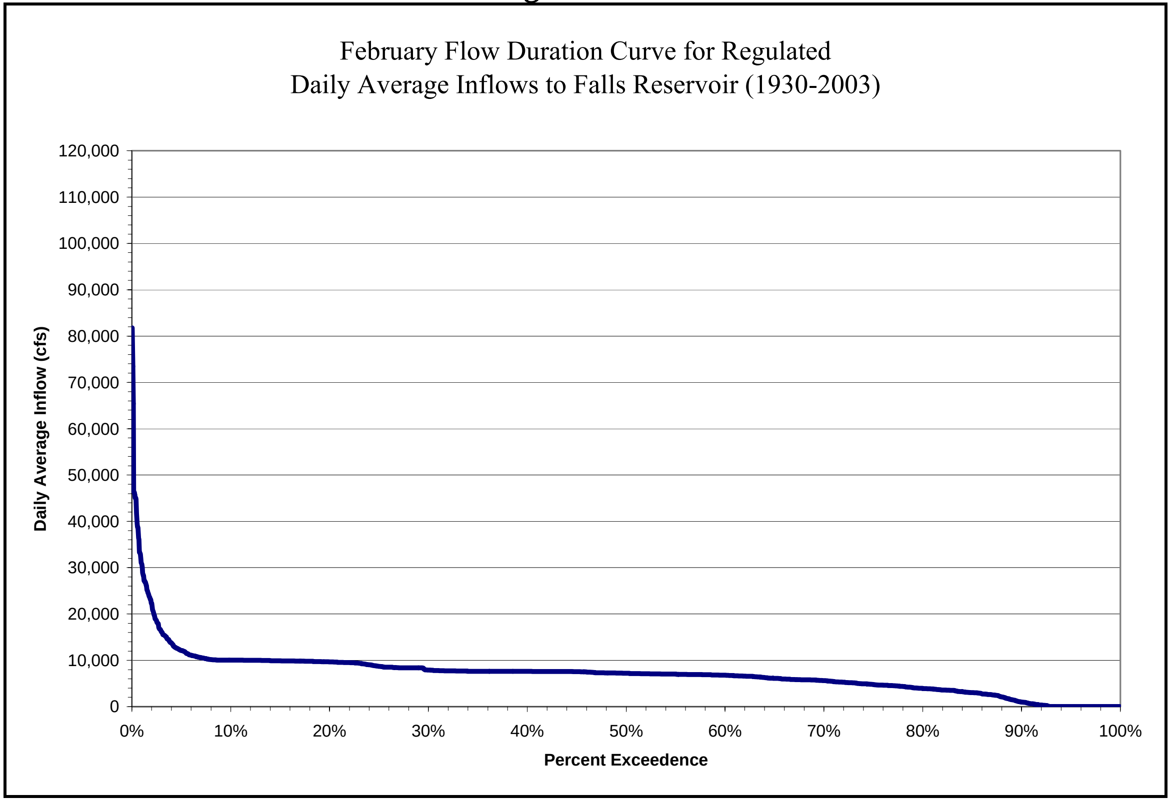


Figure B-13c

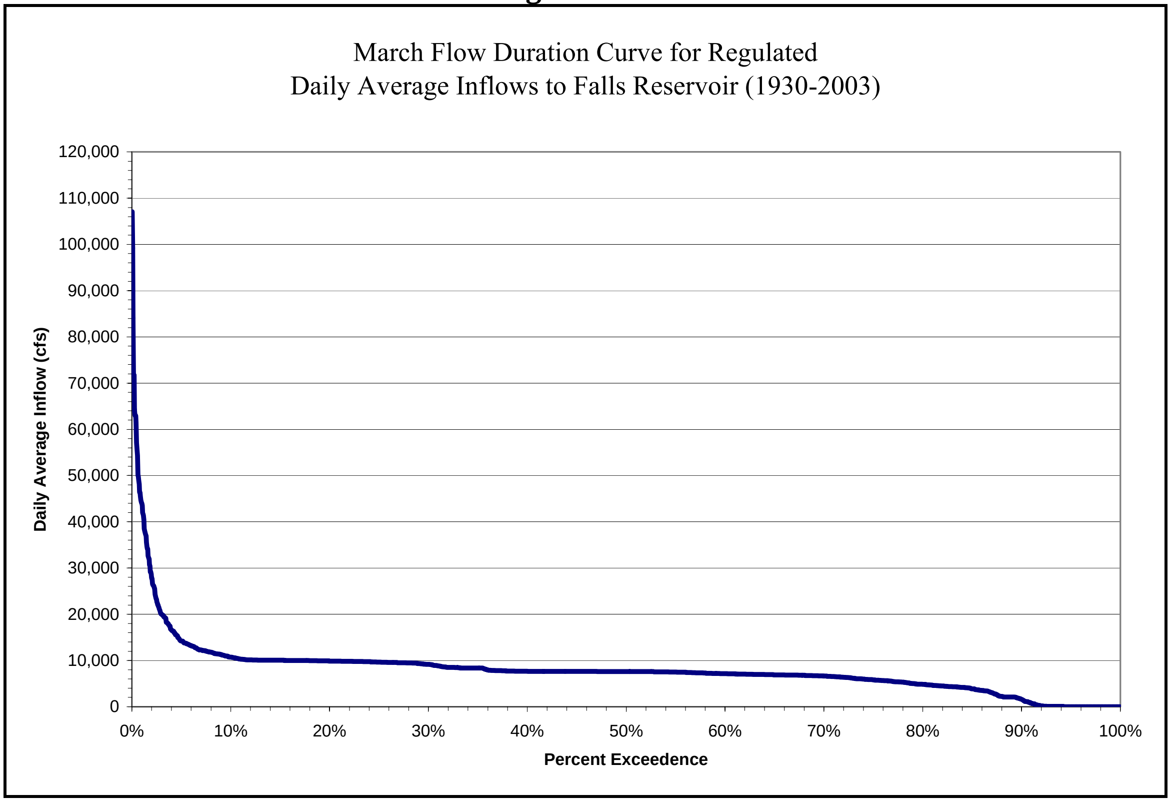


Figure B-13d

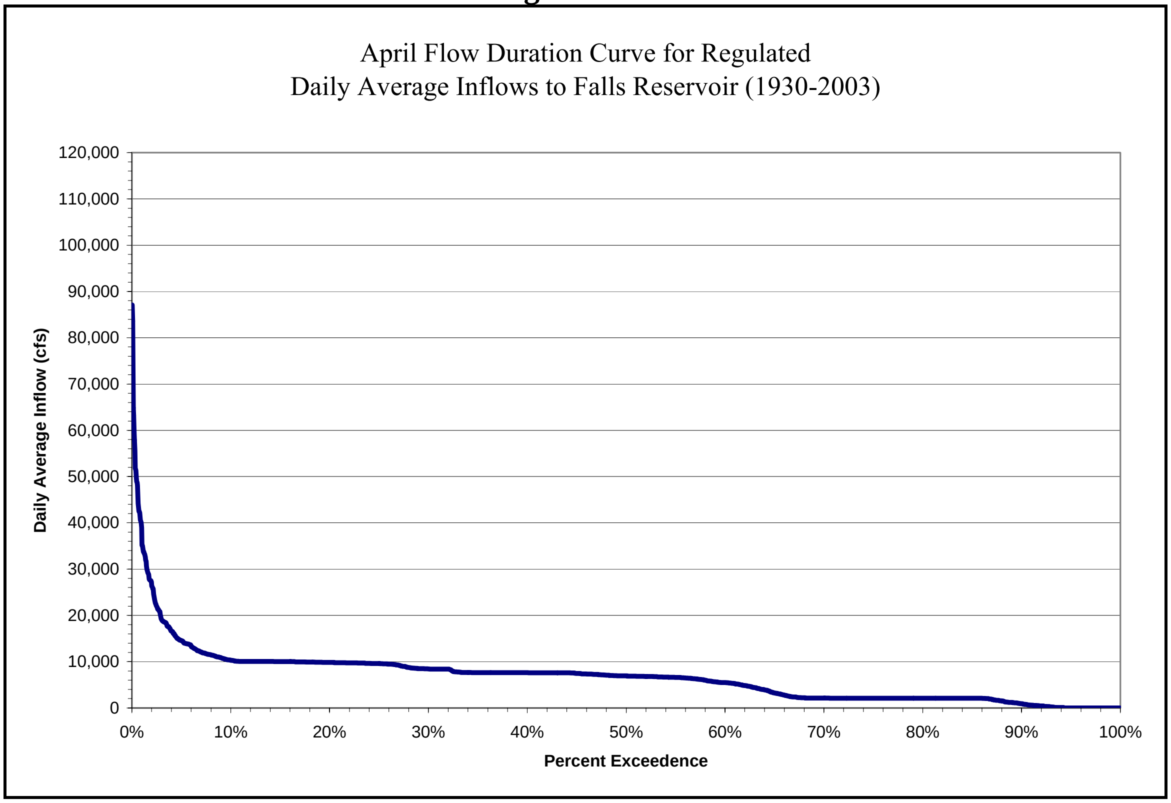


Figure B-13e

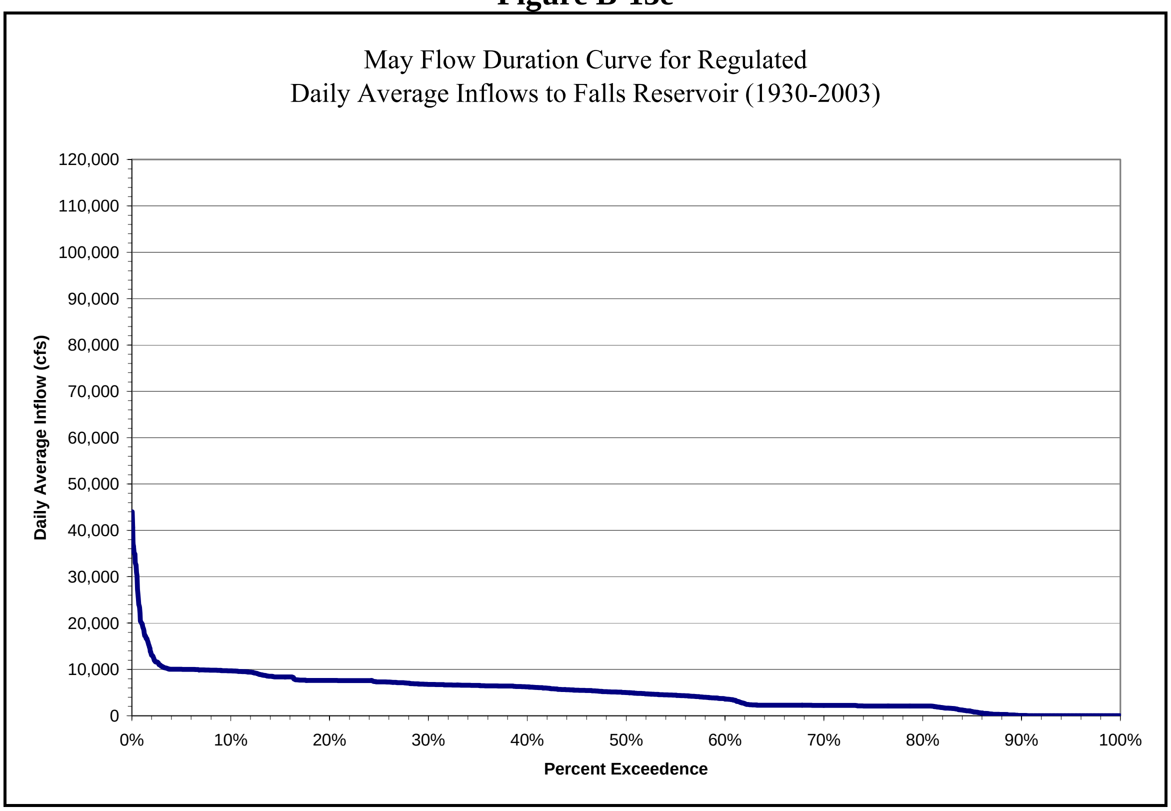


Figure B-13f

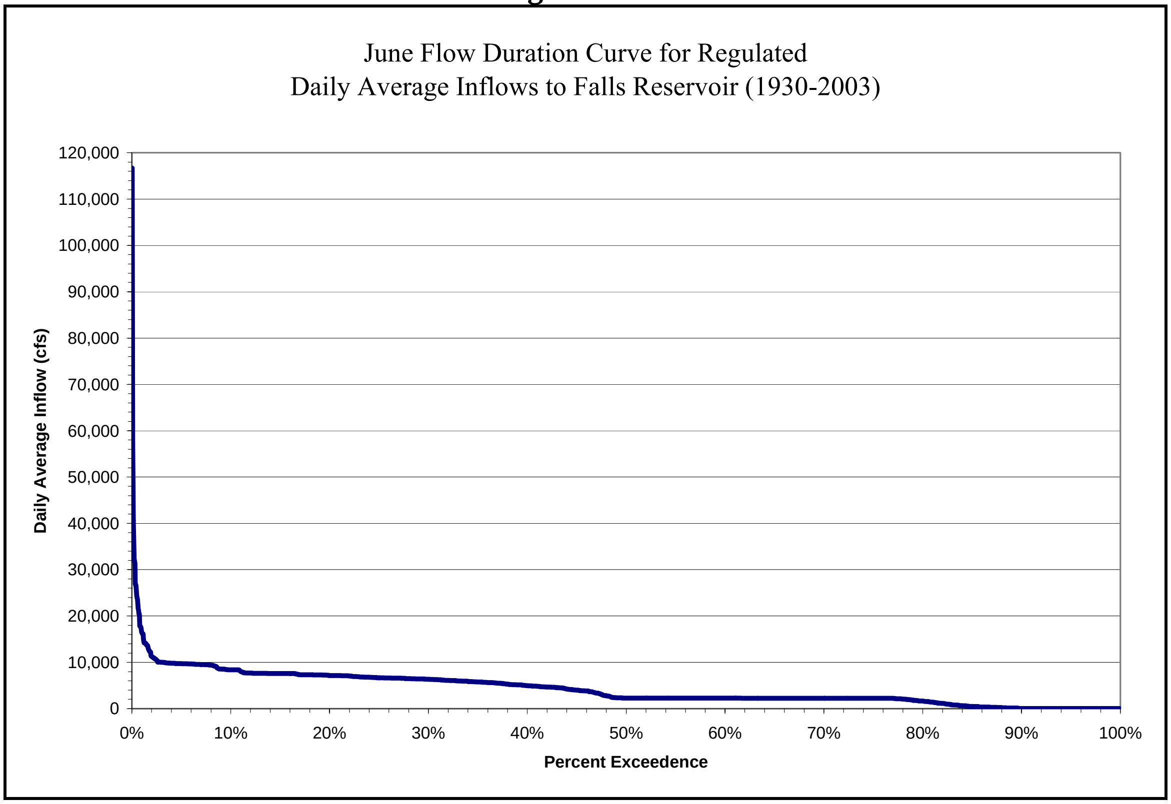


Figure B-13g

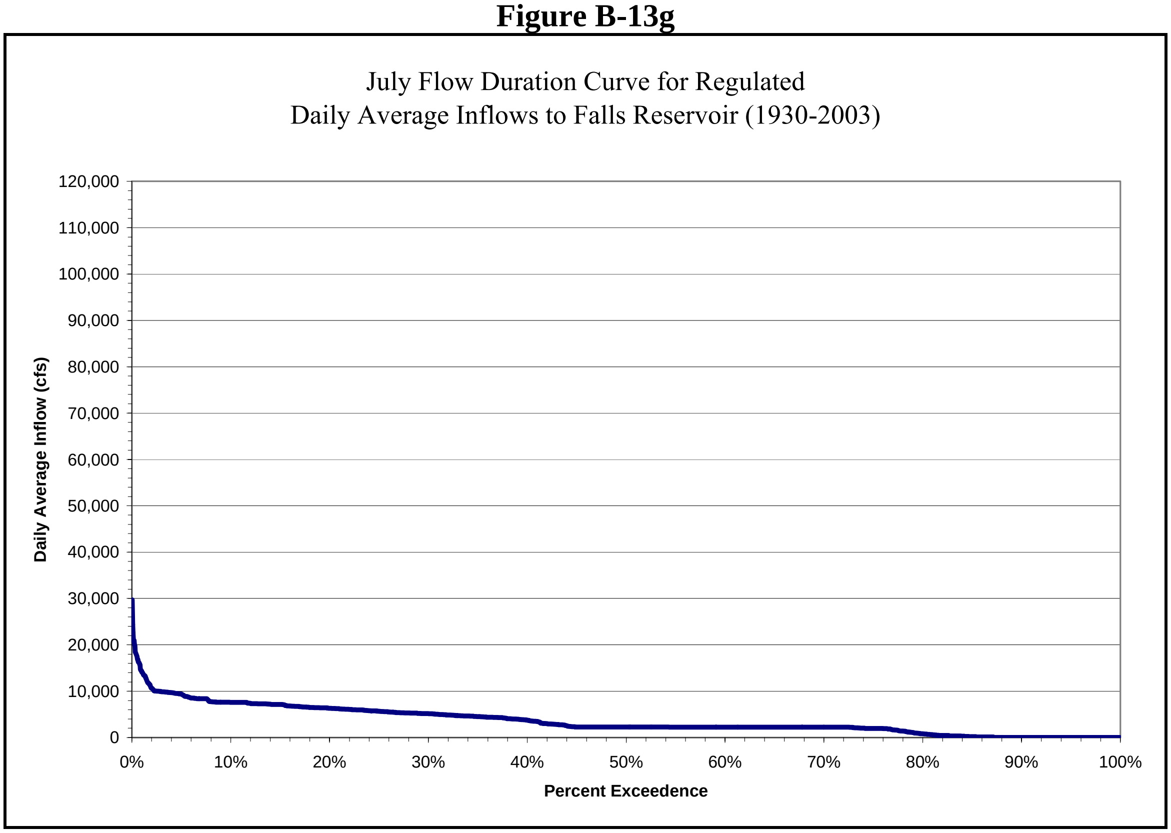


Figure B-13h

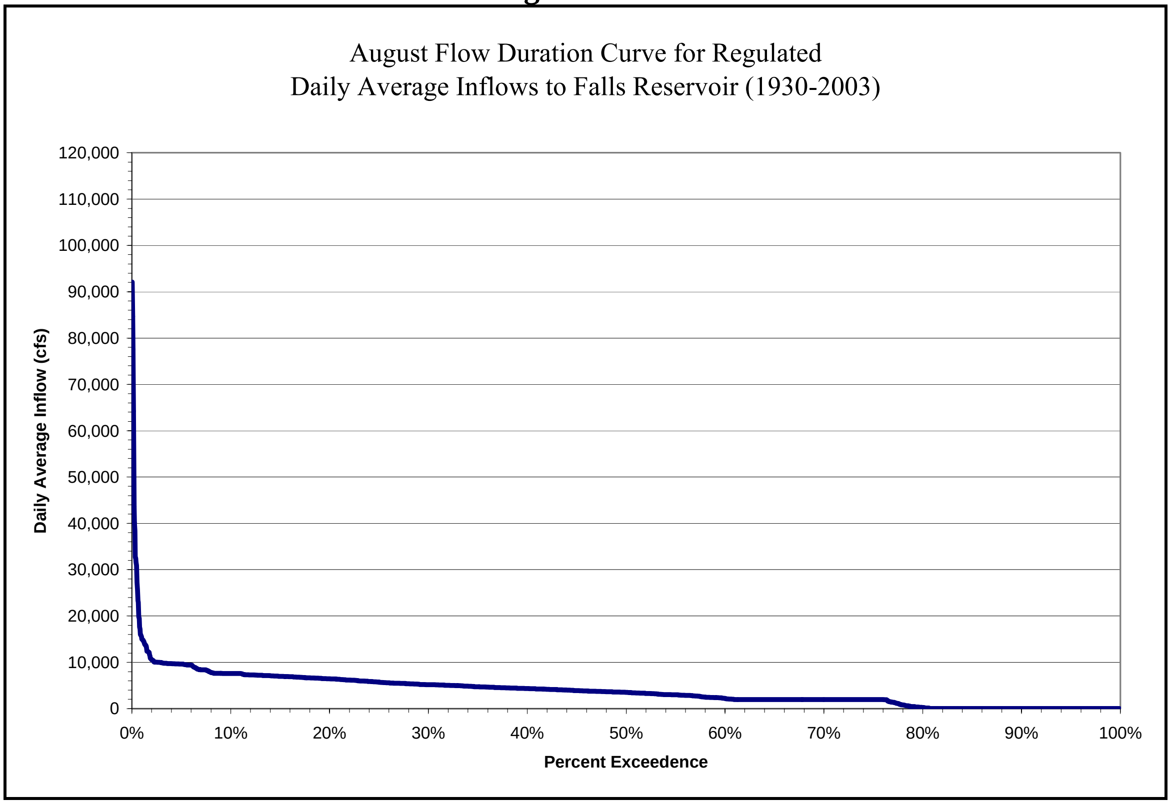


Figure B-13i

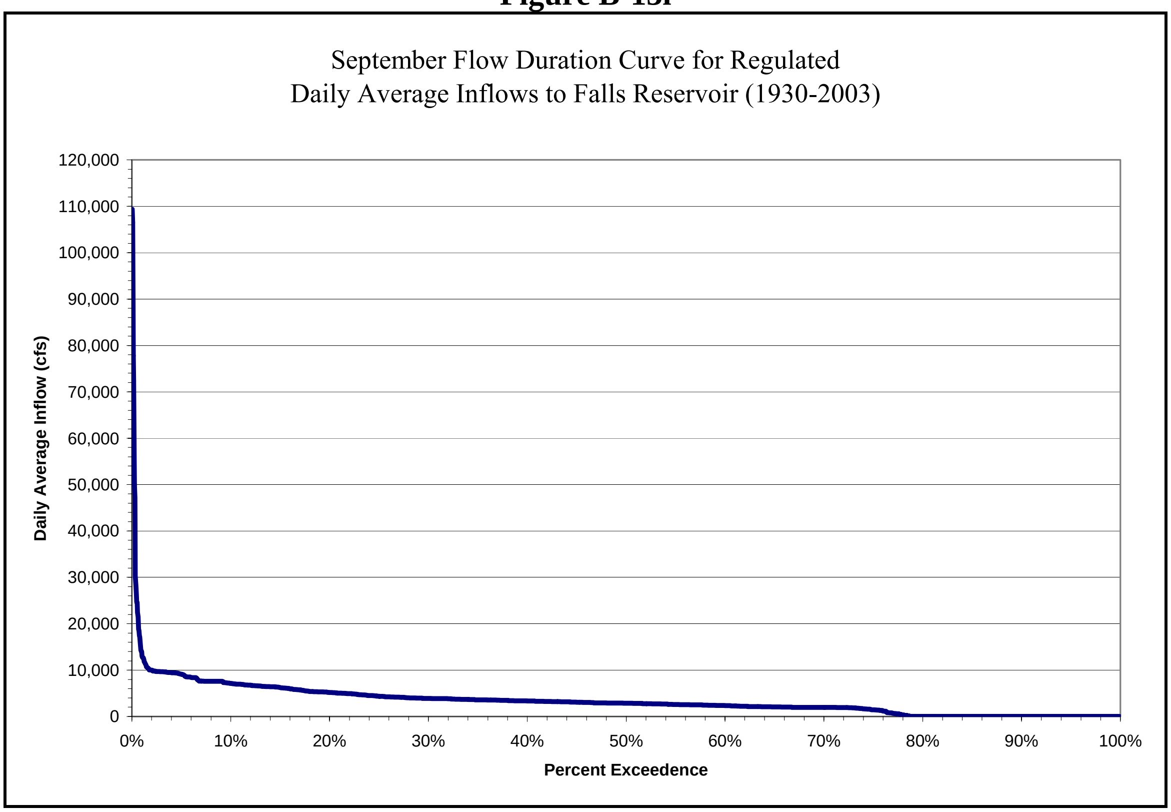


Figure B-13j

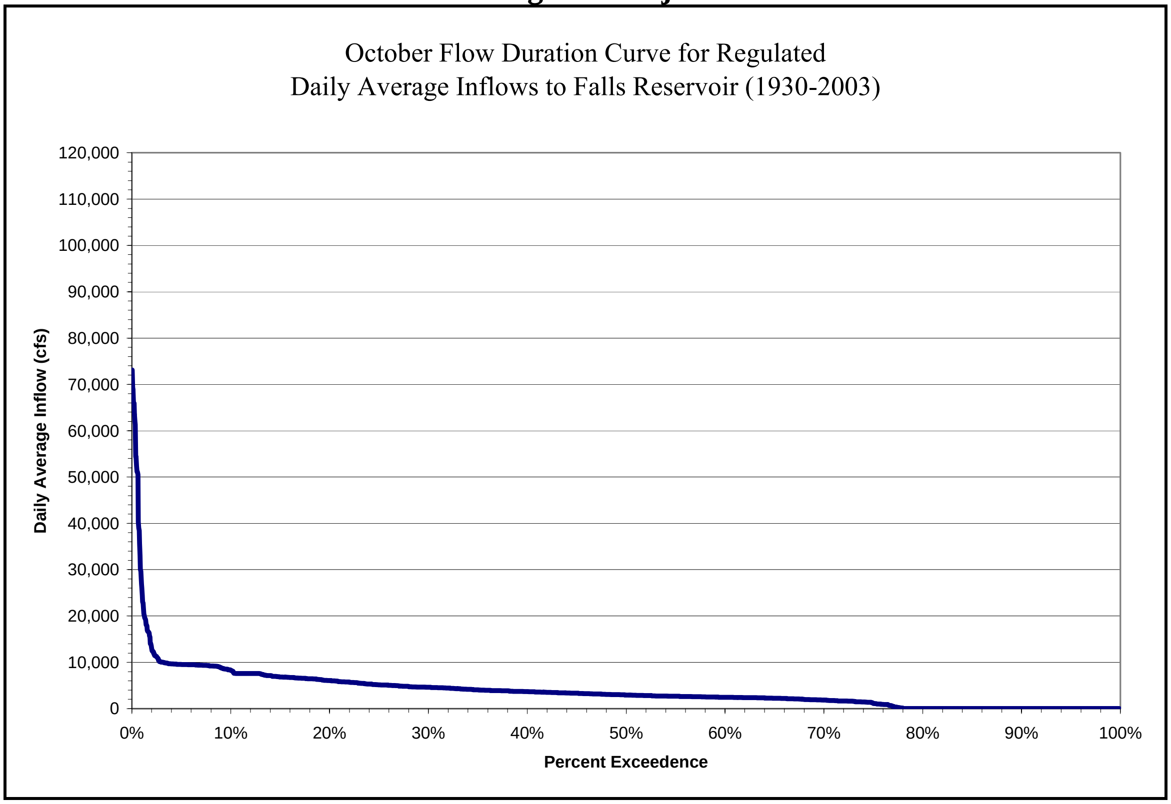


Figure B-13k

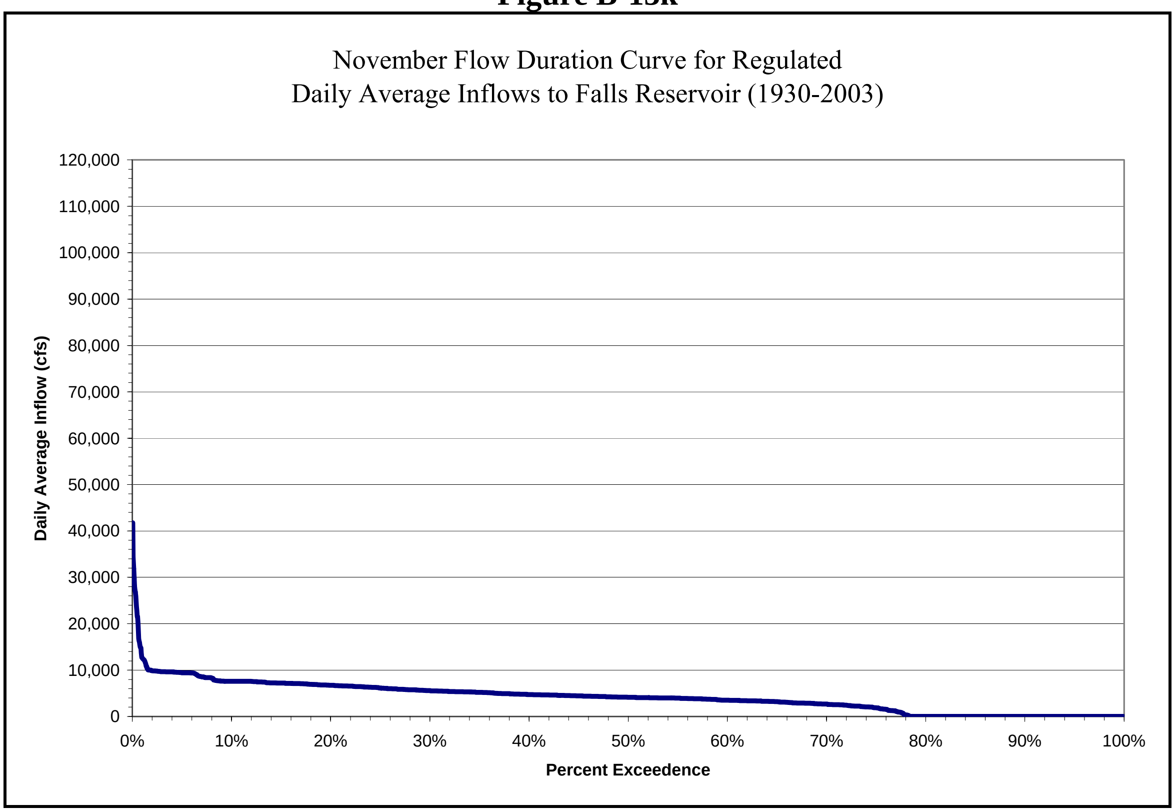
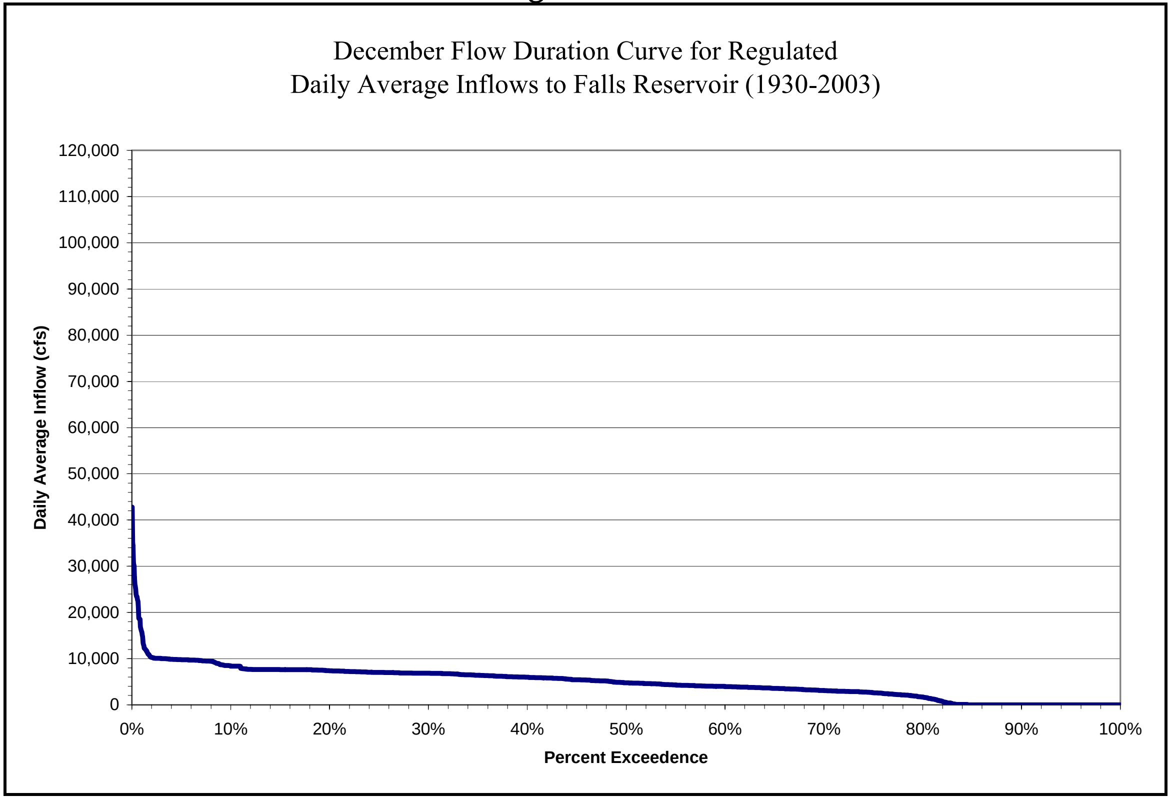


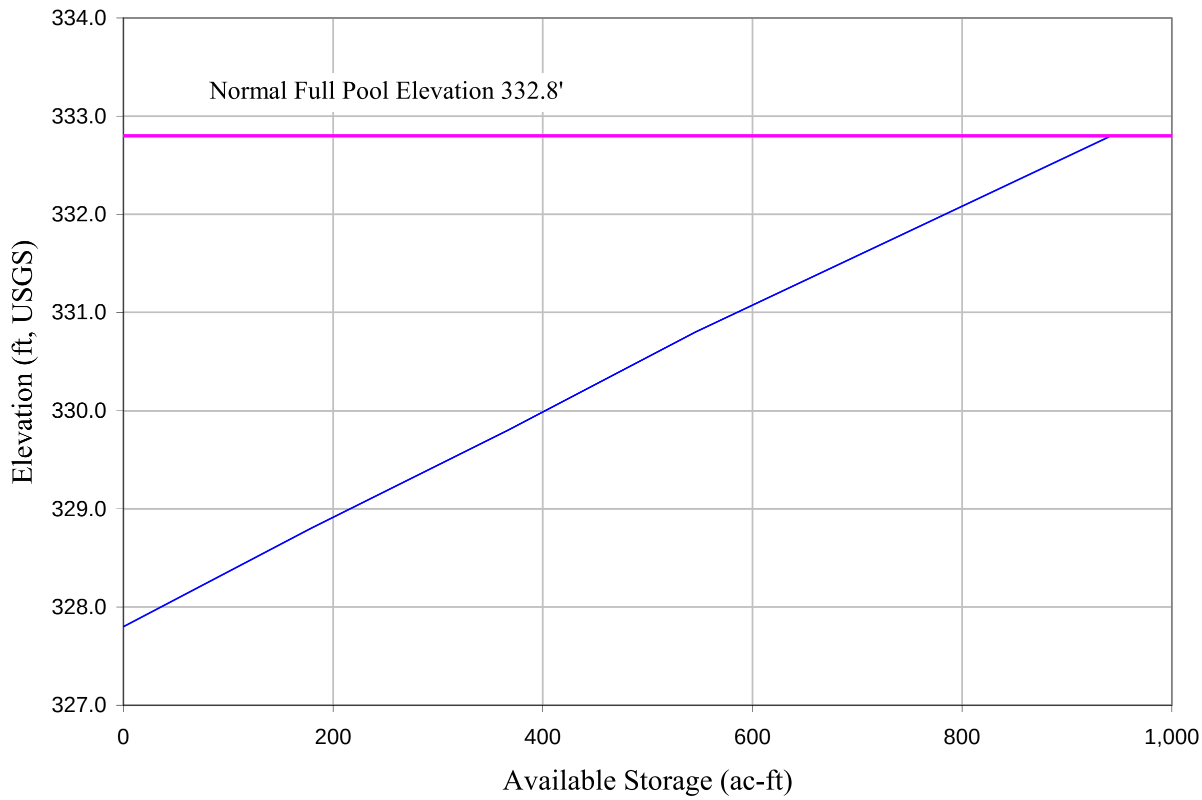
Figure B-13l



B.5.2.2 Area Capacity Relationship

A reservoir capacity curve showing the storage volume of Falls Reservoir is provided in Figure B-14. At the normal full pond elevation of 332.8 feet, Falls Dam impounds a usable storage volume of approximate 720 acre-feet, which corresponds to a drawdown of approximately 4 feet. The gross storage capacity of Falls Reservoir is 2,440 acre-feet. APGI proposes to operate Falls Reservoir as in the past, with drawdown limited to 4 feet below normal full pond (elevation 328.8 feet), except for maintenance or under emergency conditions.

Figure B-14: Falls Reservoir Elevation vs. Available Storage



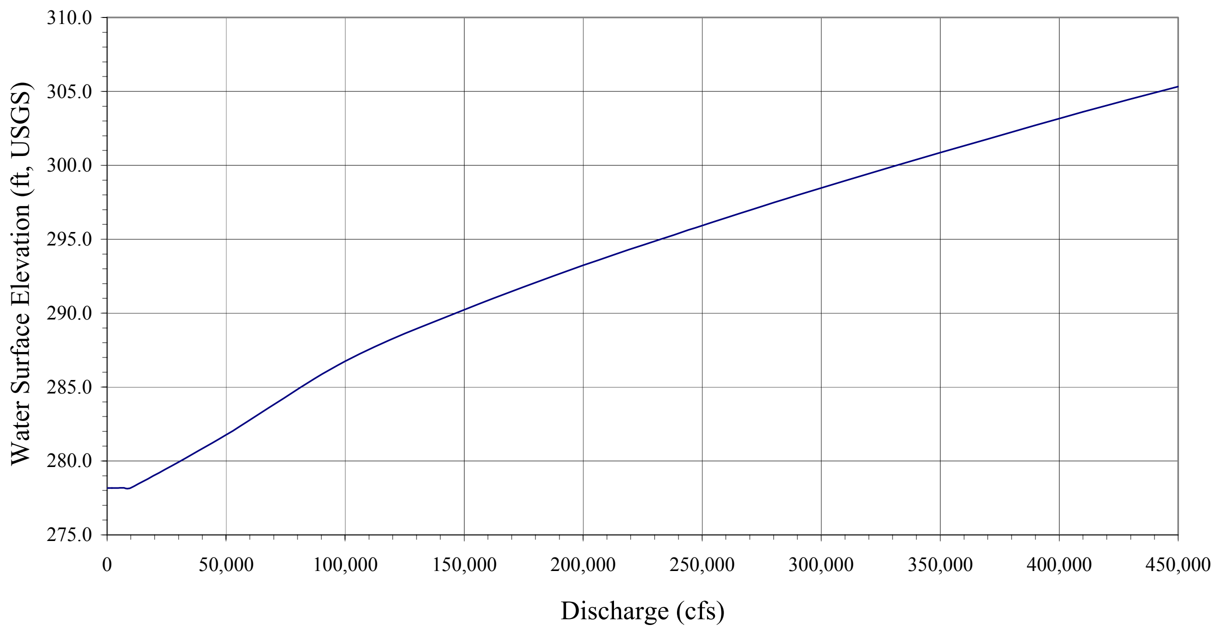
B.5.2.3 Power Plant Hydraulic Capacity

The existing estimated total hydraulic capacity of the power plant is 8,570 cfs at best efficiency. After the proposed refurbishments and upgrades are completed at Falls, the estimated total hydraulic capacity of the power plant will be 7,420 cfs at best efficiency and 8,170 cfs at maximum capacity.

B.5.2.4 Tailwater Curve

The tailwater rating curve for the Falls Development is presented in Figure B-15.

Figure B-15: Falls Dam, Tailwater Rating Curve



B.5.2.5 Power Plant Capacity Versus Head

The maximum head occurs when Falls Reservoir is at normal full pond elevation of 332.8 feet. When Falls is operating at maximum capacity, the tailwater would be 278.5 feet. This results in a gross head of 54.3 feet. Under a four foot drawdown, the reservoir elevation is 328.8 feet and the gross head is 50.3 feet. The plant capacity at normal full pond elevation will be approximately 31.9 MW.

B.5.3 Plans for Future Development

APGI plans to refurbish/upgrade the Falls generating units in order to sustain future operation and to increase generation capacity. The refurbishment activities will result in increased hydraulic efficiency. Once the refurbishments and upgrades are completed, the Falls powerhouse will contain one 10,600 kW S. Morgan Smith vertical Francis turbine unit (Unit 1) and two 10,200 kW Allis Chalmers propeller type turbine units (Units 2 and 3), each operating under a net head of 54.0 feet, and direct-connected to generators having a total capacity of 34,040 kW (Unit 1 @ 11,540 kW, Units 2 and 3 @ 11,250 kW) for a total generating capacity of 31,000 kW as limited by the generator for Unit 1 and the turbines for Units 2 and 3. The Falls Development will have a total hydraulic capacity of 7,419 cfs.

Under its proposed dissolved oxygen enhancement program, APGI plans to install appropriate aeration technology to increase dissolved oxygen concentrations and enhance water quality. No specific aeration equipment is proposed at the Falls Development at this time pending future determination if improvements in dissolved oxygen at Narrows will extend to the Falls Tailrace.

B.6.6 Yadkin Project

The following sections present matters that involve, and refer to, all four developments of the Yadkin Project.

B.6.6.1 Minimum Flows

The proposed operation of the Yadkin Project includes a year round, weekly average minimum flow of not less than 900 cfs from the Project, as measured at the Falls Development.

B.6.6.2 Headwater Benefits

The amended 1928 headwater benefits contract between APGI and PE, which was originally entered into before either project was license, by its terms remains in effect until 2067 and does not expire with the FERC license. However, APGI believes that the contract's status as a headwater benefits settlement does not extend beyond the term of the existing project license. To be specific, the use of project storage is inherently one of the issues to be passed upon by the Commission in the process of issuing a new license. And in its March 29, 1968 Order, FERC approved the amended contract as a HWB settlement "until further order of the Commission should be required by changes in conditions", thereby making the agreement subject to further regulatory approvals. Therefore, the Commission's decision on the new license will determine the extent to which PE's developments downstream are benefited by Yadkin Project storage, which in turn will form the basis for a new determination o headwater relicensing negotiations that relate to the use of project storage. If the terms of the new license, whether arrived at through negotiations or otherwise, frustrate the current agreement with PE, APGI will seek to renegotiate the terms of any revised HWB settlement directly with PE with the intent of submitting it to FERC for approval. Should direct negotiations with PE prove unsuccessful, APGI will seek FERC assistance in reaching a new agreement.

B.6.6.3 Low Instream Flow Protocol

A proposed "Low Instream Flow Protocol" will serve as a guide for operating the Project reservoirs under low inflow or drought conditions, including coordination with the Progress Energy owned and operated hydroelectric developments located downstream of the Project. The protocol would recognize different levels of downstream flow targets to be maintained under low inflow or drought conditions and guidance for managing the drawdown of High Rock, Narrows, Tillery and Blewett Falls Reservoirs in a way to balance economic, habitat, aesthetic and recreational needs. The protocol will also include procedures for communications among APGI, owners of Yadkin-Pee Dee River water intakes having a maximum instantaneous capacity greater than or equal to one million gallons per day, the members of the Yadkin-Pee Dee River Basin Drought Management Advisory Group, and the general public.

B.6.6.4 Utilization of Power

The utilization of power is discussed in Section H.2.

Exhibit C – Construction History and Proposed Schedule

C.1 Construction History

In 1912, L'Aluminum Francais, later organized as a corporation named the Southern Aluminum Company, became interested in the development of hydroelectric power on the Yadkin River. The Aluminum Company of America, now Alcoa Inc., purchased the entire holdings of the Southern Aluminum Company and L'Aluminum Francais in North Carolina in 1915 and transferred them to Tallassee Power Company, a wholly owned subsidiary. The Tallassee Power Company was later renamed Carolina Aluminum Company.

The Narrows Development was the Southern Aluminum Company's first Project development to be built on the Yadkin River. Construction of the Narrows Dam, which consists of a concrete gravity structure and a bypass spillway section, began in 1913. Dam closure occurred in June 1917. At Narrows Powerhouse, Units 1, 2, and 3 went into commercial operation in 1917 and Unit 4 went into commercial operation in 1924.

In 1917, the Tallassee Power Company initiated work on the second of the Project developments to be built, Falls Development. Construction of Falls Dam, a concrete gravity structure, and powerhouse was completed in 1919. The powerhouse includes three units; Units 2 and 3 went into commercial operation in 1919 and Unit 1 went into commercial operation in 1922.

The High Rock Development was the third development to be built. Although Tallassee Power Company began land purchasing in 1916, construction of High Rock Dam, a concrete gravity structure, was not completed until 1927. The flood gates were closed and Units 1, 2, and 3 were put in service in November 1927. The reservoir reached full capacity in April 1928.

On February 6, 1956, Carolina Aluminum Company applied to the Federal Power Commission (FPC) for a hydropower license. The application included the existing High Rock, Narrows, and Falls Developments, and the proposed Tuckertown Development. On February 11, 1958 the FPC issued a license to Carolina Aluminum Company for a period of 50 years, effective as of May 1, 1958, for the continued operation and maintenance of High Rock, Narrows, and Falls developments, and for the construction, operation, and maintenance of the proposed Tuckertown Development.

The Tuckertown Development was the last of the Project developments to be built. Construction of Tuckertown Dam, which includes concrete gravity sections, a rockfill section, and an earthfill section, and powerhouse started in January 1960 and the reservoir started filling in April 1962. At Tuckertown Powerhouse, the three generator units went into commercial operation in April 1962.

The Project is currently owned APGI and is operated by its Yadkin Division.

As APGI is applying for a new license, and not an initial license, the requirements of 18 CFR §4.51(d)(1) are not applicable and as such a tabulated chronology of construction is not presented herein.

C.2 Proposed Development

Yadkin currently plans to complete the refurbishment and upgrade on Narrows Unit 2 under the existing license.

Yadkin currently plans to refurbish and upgrade the remaining two units at Narrows [Units 1 and 3], the three units at High Rock, the three units at Tuckertown, and the three units at Falls under the new license. The proposed work includes replacement of the existing turbine runners, re-winding of the generators, and refurbishment and upgrades of the electrical controls. The work at Narrows and High Rock is anticipated to be completed by the end of 2012. The Tuckertown and Falls units would follow with scheduled completion before the end of 2020.

Exhibit D – Statement of Costs and Financing

D.1 Original Cost of the Project

The Yadkin Project (Project) was originally licensed with an effective date of May 1, 1958. Because this is not an initial license, a tabulated statement of original cost of Project land or water rights, structures, or facilities is not necessary.

D.2 Estimated Takeover Costs as per Section 14 of the Federal Power Act

Section 14 of the Federal Power Act (FPA) reserves to the United States the right to take over a non-publicly owned project upon expiration of its license. In the event that such take over is ordered by the Commission, APGI would, pursuant to Section 14, be entitled to be reimbursed for its “net investment”, not to exceed “fair value,” plus any “severance damages” suffered (see 16 U.S.C. § 807). At the time of the filing of this application, there was no indication that any federal department or agency, state or municipality has or will recommend takeover or redevelopment of the Project. Nonetheless, APGI hereby submits the basic information required by the Commission’s regulations that would be needed to quantify the compensation to be paid to APGI pursuant to Section 14.

D.2.1 Fair Value

“Fair value” as that term is used in the FPA and for the purpose of this application, is calculated as the present cost of project reproduction less estimated depreciation. “Fair value” does not mean “fair market value” but rather is a specialized calculation of a company’s unrecovered capital investment in today’s dollars. The Handy-Whitman Cost Index (Index), a standard tool used in the utility industry to estimate the reproduction costs of utility assets, such as the project works, has been used to estimate the Project reproduction costs in 2004 dollars. For the purposes of this application, plant depreciation has been estimated for each development separately by dividing the value of the accumulated depreciation (Table D.2-2) by the total plant cost (Table D.2-2). Applying these percentages to each reproduction cost (Table D.2-1) for the Yadkin developments, developed using the Index, suggests that an estimate of the fair value of the Yadkin Project in 2004 dollars is $129,877,304[1,2]. No allowance has been made for external or functional obsolescence. Adding $129,877,304 to the original cost of the land within the Project, $6,791,638 produces a total fair value estimate for the Project of $136,688,942. It must be noted that the foregoing is a rough calculation of fair value and that more precise calculations using this methodology may be possible. The estimated fair value for the Yadkin Project, excluding land, is shown in Table D.2-1.

[1] Does not include the cost of equity.
[2] Note that this is not an appraisal value, and this calculation was not performed by a licensed appraiser.

Investments of $25,000,000 are anticipated in the Project through the expiration of the existing license on April 30, 2008. These investments are not included in Table D.2-1. The investments will be incorporated, as appropriate, into the table in the Final License Application.

Table D.2-1: Estimated Fair Value of the Yadkin Project[a]
(Note: anticipated capital investments into project thru expiration of existing license not included)

Development	Reproduction Cost [b]	Estimated Physical Depreciation [c]	Estimated Fair Value
High Rock	$86,398,912	($52,813,850)	$33,585,062
Tuckertown	$53,633,687	($39,960,411)	$13,673,276
Narrows	$197,179,496	($127,310,747)	$69,868,749
Falls	$50,846,517	($38,096,300)	$12,750,217
Total	$388,058,612	($258,181,308)	$129,877,304

a. No attempt has been made to determine the current fair market value of real estate, including improvements, within the Project.
b. Based on Handy-Whitman Cost Index, all dollars are 2004. Value includes transmission equipment included within the Project as defined.
c. Does not include external or functional obsolescence.

D.2.2 Net Investment

The FPA generally defines a licensee's "net investment" in a project as the original cost of the project plus additions and betterments, minus depreciation and other amounts (See 16 U.S.C. § 796(13)). APGI's net investment in the Project, as reflected in APGI's Fixed Asset Listing as of 2004, was $25,597,512 as shown in Table D.2-2.

Table D.2-2: Estimated Net Investment in the Yadkin Project [a]

Development	Total Plant Cost [b]	Accumulated Depreciation [c]	Net Investment
High Rock	$17,764,869	($10,859,293)	$6,905,576
Tuckertown	$16,977,848	($12,649,546)	$4,328,302
Narrows	$29,351,042	($18,950,769)	$10,400,273
Falls	$15,805,464	($11,842,103)	$3,963,361
TOTAL COST	$79,899,223	($54,301,711)	$25,597,512

a. Source: 2004 Fixed Asset Listing, from email from Marion Edwards to Gene Ellis dated 4/8/05.
b. For each development, the total plant costs includes: development specific total plant costs and a prorated amount of total Project (a) substation, (b) administrative (c) property and (d) non-utility accumulated depreciation.
c. For each development, the accumulated depreciation includes: development specific accumulated depreciation and a prorated amount of total Project (a) substation, (b) administrative (c) property and (d) non-utility accumulated depreciation..

D.2.3 Severance Damages

Under FPA § 14(a), "severance damages" are those "reasonable damages" to protect property not "caused by the severance there from of property taken" (See 16 U.S.C. § 807(a)).

APGI believes that the severance damages inflicted by a takeover of the Project would be significant. Given the inherent difficulties in attempting to quantify such speculative values, APGI reserves the right to submit additional evidence quantifying such severance damages should the Commission consider ordering a takeover of the Project.

D.3 Estimated Cost of New Development Work

Per 18 CFR §4.30(b)(18), "new development costs" include any construction, installation, repair, reconstruction, or other change in the existing state of project works or appurtenant facilities, including any dredging and filling in project waters. For the purpose of this application, this includes the costs of turbine and generator upgrades and refurbishments as well as costs required to provide environmental mitigation or enhancement during the term of a new license.

APGI has conducted studies evaluating the turbine/generator refurbishment potential, as well as upgrades at the Project developments. APGI plans to refurbish and upgrade all Project units at High Rock, Tuckertown, and Falls under the new license, along with Narrows Units 1 and 3[1].

The estimated capital costs of the planned refurbishments and upgrades will be included in the Final License Application.

D.4 Estimated Average Annual Cost of the Project

The estimated annual costs of operating the Project based on existing conditions are approximately $13,000,000 including property taxes, depreciation, operation and maintenance, and FERC administrative fees. This information will be updated in the Final License Application to include anticipated changes in the future operation of the Project. The estimate does not include the cost of capital and amortization. This information will be provided in the Final License Application.

D.5 Estimated Annual Value of Project Power

APGI estimates that the annual value of Project power produced is approximately $41,000,000[2]. To develop this estimate, APGI modeled the existing Project operations in the Yadkin Project Operations Model, OASIS, for the 1930 to 2003 period of record using the average monthly on and off-peak energy values for 2004 presented below in Section D.8. APGI does not represent in this estimate any indication of the future value of wholesale electric energy or Project production levels.

[1] The upgrade of Narrows Unit 4 was completed in 2001, and Unit 2 will be completed prior to the expiration of the existing license in 2008.

[2] Note to Reviewers: This is the average energy value for the January 1, 1930 to December 31, 2003 run of H:\Yadkin\River Model Study\Yadkin_OASIS\Runs\Simulation\Yadkin-PE Runs\May 5, 2005 Yad-PE Runs\BaseCase_0305_HB (Base Case with headwater benefits).

D.6 Sources and Extent of Financing and Annual Revenues

Because the proposed refurbishment and upgrade will extend over a thirteen year period, APGI expects that the Project's capital requirements will be financed internally.

D.7 Estimate of the Cost to Develop License Application

The approximate cost to develop the License Application for the Yadkin Project will be provided in the Final License Application.

D.8 On-Peak and Off-Peak Values of Project Power

APGI calculated average monthly on-peak and off-peak energy values using a third-party developed index for southeast power sales. APGI has selected to use "Southern, Into" energy values. The "Southern, Into" energy values representing a compilation of daily values of peak and off-peak energy sold into the Southern Company Region for 2004, as reported by market participants to Platts, a McGraw-Hill company. Platts uses standard price reporting methodology, including FERC's 2003 standards. From this daily data, APGI calculated average monthly on-peak and off-peak energy values as shown in Table D.8-1. Platts, as publisher of this index, has approved the use of the data in this application.

Table D.8-1: Monthly Average Energy Values

Month	On-Peak Value of Project Power ($/MWh)	Off-Peak Value of Project Power ($/MWh)
January	$45.11	$29.31
February	$41.67	$28.89
March	$43.10	$29.41
April	$47.24	$29.51
May	$52.78	$31.00
June	$56.41	$27.35
July	$55.52	$26.28
August	$50.61	$28.26
September	$44.43	$28.02
October	$51.35	$30.82
November	$48.25	$31.84
December	$48.84	$34.39
Average	$48.78	$29.59

D.9 Estimated Average Annual Change in Project Generation and Value of Project Power Due to Changes in Project Operations

In order to estimate the average annual decrease in project generation and average annual decrease in value of project power related to the proposed PME measures, APGI modeled the existing Project operations and proposed Project operations in OASIS. Additional calculations were performed to determine the generation loses associated with dissolved oxygen improvements associated with the proposed turbines at High Rock and Narrows. Both operating scenarios were run for the 1930 to 2003 period of record using the average monthly on and off-peak energy values presented above in Section D.8. The estimated average annual decrease in project generation is 2,460 MWh[1]. The estimated average annual decrease in the value of project power is $560,000[2].

[1] Note to reviewers: This is the result of APGI's DLA Proposal OASIS model run.
[2] Note to reviewers: This is the result of APGI's initial Proposal OASIS model run ($260,000) plus the estimated annual loss due to operation of aeration technology ($300,000).

Exhibit E - Environmental Report

E.1 General Description of the Locale

E.1.1 Description of Project Environment and Immediate Vicinity

The Yadkin Project (Project) is located on the Yadkin River in central North Carolina, approximately 60 miles northeast of Charlotte (Figure E-1). The Yadkin River and its tributaries are part of the Yadkin-Pee Dee River Basin, which extends from the eastern slopes of the Blue Ridge Mountains to the Atlantic Coast near Georgetown, South Carolina. The Yadkin-Pee Dee watershed has a drainage area of 4,190 square miles above Falls Dam (the most downstream Project development). Below the Yadkin Project, the Yadkin River's name changes to the Pee Dee River at its confluence with the Uwharrie River. The Pee Dee River continues it southeastern flow to the Atlantic Ocean.

The area immediately surrounding the Project is predominantly rural and suburban, although several smaller cities, including Albemarle, Lexington, Salisbury and towns, including Badin, Mocksville and Troy, are located within 30 miles of the Project. Several of North Carolina's largest cities, including Charlotte, Winston-Salem, and Greensboro, are located within an hour drive of the Project. The predominant land use around the reservoirs was historically agricultural or forested. Farms and timberland are still common in this area, but residential development in the region, particularly along the reservoir shorelines, has increased significantly in the past 10 years.

E.1.1.1 Climate

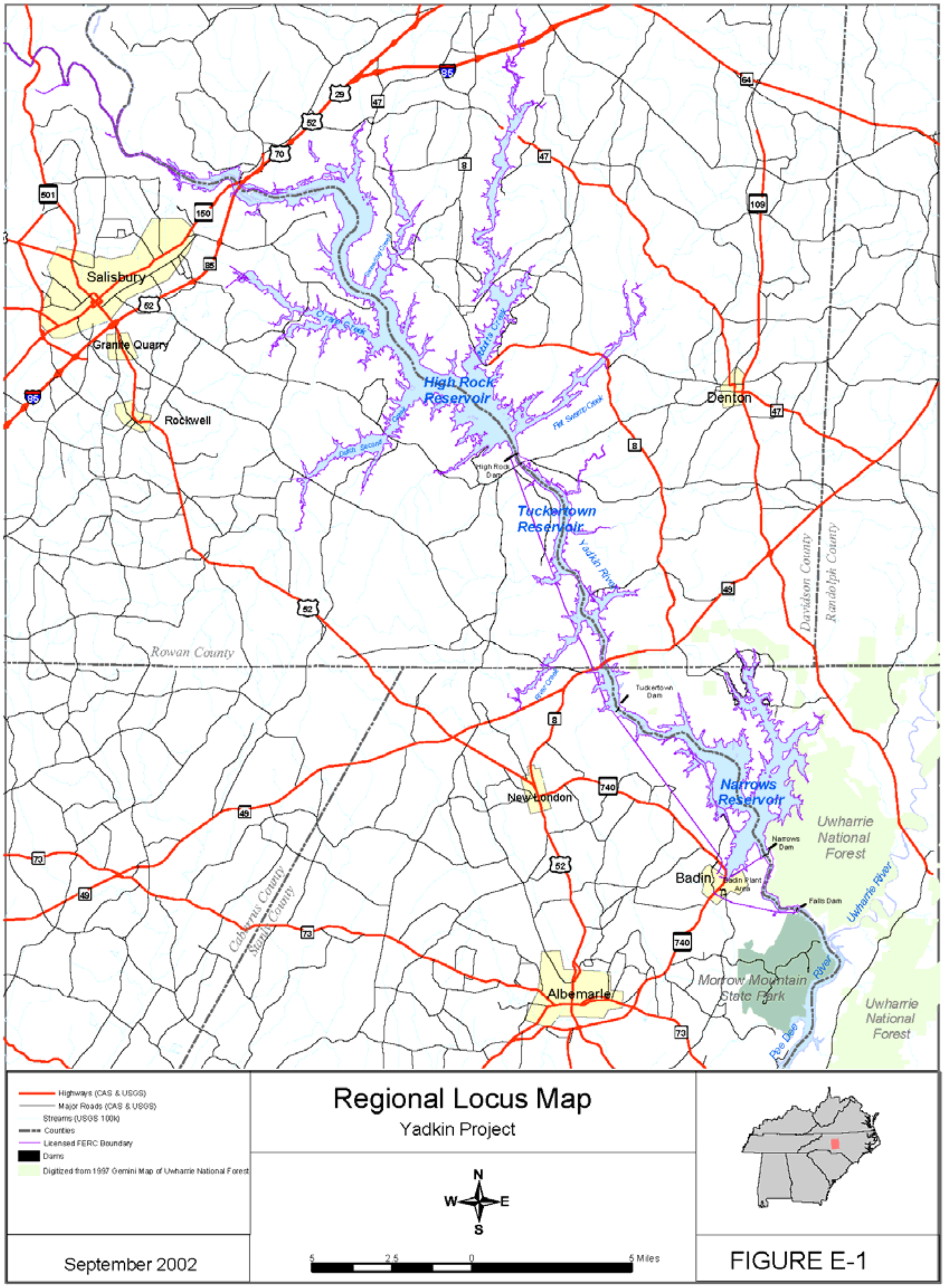
Average rainfall in the North Carolina portion of the Yadkin-Pee Dee watershed ranges between 44 to 56 inches per year, about one-third occurring during the summer. The growing season is 120 to 180 days in length. During the winter, the monthly average high temperature is generally in the 40s and low 50s with a monthly average low temperature generally in the upper 20s to low 30s with average temperatures being higher toward the south (State Climate Office of North Carolina, NC CRONOS database website). Summertime monthly average high temperatures generally are in the upper 70s to low 90s.

E.1.1.2 Topography

The Project lies in the upper part of the Piedmont physiographic region of North Carolina. The Piedmont Region is a rolling peneplain lying to the east and southeast of the Appalachian Mountains at elevations of about 1,200 to 1,500 feet above sea level and extending down to the Fall Line. The Region extends from above the Potomac River at nearly sea level to Alabama and the Coastal Plain Region in the south at elevations of 300 to 600 feet above sea level.

The Project area is characterized by a large network of generally east-flowing streams in terrain that is mostly gently rolling and hilly with narrow floodplains, low flat ridges, monadnocks, and

Figure E-1: Yadkin Project Regional Locus Map



high ridges. Topographic relief is generally greatest near the Uwharrie Mountains (Baranski, 1993).

The land around High Rock Reservoir is generally flat to rolling. Around Tuckertown Reservoir there are high steep banks along the east side, and low rolling terrain around the other areas. The land adjacent to Narrows Reservoir is a mix of gently rolling terrain with some steep sides. Around Falls Reservoir in the Uwharrie Mountains, the land is steep with a rugged terrain.

E.1.1.3 Wetlands

Vegetated wetlands are some of the most productive and important habitats found in the Yadkin Project reservoir system. Vegetated wetlands are vital habitats for many fish and wildlife species that provide fishing and hunting opportunities to area residents and visitors. Wetlands serve as nursery and spawning areas for fish and macroinvertebrates, feeding and resting areas for migratory waterfowl and shorebirds, nesting grounds for waterfowl and wading birds, feeding areas for white-tailed deer, and homes for muskrat, beaver, and river otter.

Wetland soils and vegetation also help remove impurities from water, reduce sediment and nutrient loads, and bind soil to help prevent erosion. Wetlands temporarily store flood water and slowly release it downstream, thereby reducing flood flows and peaks. The position of wetlands between uplands and the reservoirs greatly facilitates their flood protection and water quality maintenance functions.

Wetlands surrounding the Project reservoirs as well as the shoreline within 200 feet of the reservoirs were mapped and delineated using aerial photography and field surveys during 2003 and 2004 (NAI, 2005d Appendix E-12). Wetlands were categorized into six categories: forested wetland, forested floodplain wetland, scrub-shrub wetland, sparse scrub-shrub wetland, emergent wetland, and aquatic bed.

Forested wetlands support primarily deciduous forest trees (20 feet or taller). This wetland type occurs above full pond and is typically associated with small streams and the upper reaches of larger streams (often bordering the stream). The forested wetlands surrounding the Project reservoirs have fairly uniform dominant tree species, a sparse shrub layer, and a highly variable herb layer.

Forested floodplain wetlands occur in two distinct habits in the Project area. The most abundant is found along the upper portion of High Rock Reservoir where large quantities of sediment transported by the river from further up in the basin have been and continue to be deposited. In these areas, black willow is the sole dominant species in both the tree layer and the shrub layer as a young sprout with an occasional sycamore or red maple and a limited herb layer. A second type of the forested floodplain wetland occurs along low-lying lands adjacent to the Project reservoirs and is often associated with historic stream terraces which still flood during high flow events and frequent overbank flooding of larger streams which has formed levees (most pronounced along the upper Yadkin mainstem and the South Yadkin River). Plant species diversity in this type of forested floodplain wetland is higher with invasives being most abundant in this cover type and a variable herbaceous layer dependent on the level of disturbance and moisture regime.

Scrub-shrub wetlands are dominated by woody vegetation less than 20 feet tall and are dynamic due to the nature of their substrate source and type. This type of wetland occurs throughout the Project reservoir system, with the exception of Falls Reservoir. Scrub-shrub wetlands are most abundant in the delta area in the upper reaches of High Rock Reservoir, where they colonized slightly deeper sediment deposits than the forested floodplain wetlands. In these areas, young black willow formed large stands of scrub-shrub wetlands immediately downstream of the forested wetlands. Black willow, buttonbush and silky dogwood dominated the remaining smaller scrub-shrub wetlands around the reservoirs. Larger streams, such as Abbotts Creek and Cranes Creek, support more scrub-shrub wetland than the smaller tributaries.

The sparse scrub-shrub wetlands are the more tenuous of the scrub-shrub communities described above and include beds of scattered woody seedlings that occur on sediment deposits below the full pond elevation of High Rock Reservoir. With additional sediment trapping, these sparse scrub-shrub wetlands may evolve into typical scrub-shrub wetlands, and when adequate height is attained, into forested floodplain wetland. This cover type is the second most abundant wetland cover type in High Rock.

Emergent wetlands are wetlands that remain covered with water or are completely saturated nearly year round. The distribution of emergent wetlands at the Yadkin Project is generally defined by the slope and substrates of the littoral zones, and water level fluctuations of the reservoirs. In the Yadkin reservoirs, the upland extent of the emergent wetland is often generally limited by a shoreline structure (retaining wall, riprap) or a natural bluff at the full pond elevation. In areas where the slope of the shoreline was gradual, the emergent wetlands frequently grade into a scrub-shrub wetland or a forested wetland.

Aquatic bed wetlands occur in two of the Yadkin Project reservoirs, Tuckertown and Narrows. In Tuckertown, the aquatic beds typically occur adjacent to emergent wetlands in the calmer coves and tributary arms. In Narrows, aquatic beds are found in four backwater ponds created by the railroad bed on the west side of the reservoir. Gradual slopes and fine substrates provide habitat for all aquatic beds. The lowest depth to which aquatic beds occurred in both reservoirs is 5-6 feet below full pond.

The wetlands that occur in and around the Project reservoirs are discussed in further detail in Section E.3.3.

E.1.1.4 Vegetative Cover

The vegetative cover surrounding the Yadkin Project is generally a mixture of hardwood and softwood forests. According to the ecoregion classification of the USDA Forest Service (1994), the Yadkin Project area lies within the Southern Appalachian Piedmont Section of the Southeastern Mixed Forest Province, Subtropical Division of the Humid Temperate Domain. Timberland covers about 753.6 thousand acres in the five counties surrounding the Yadkin Project: Davidson, Davie, Montgomery, Rowan, and Stanly (Brown and Sheffield, 2003).

Typical forest vegetation of the Project area conforms closely with the Dry-to-Mesic Oak-Hickory Forest (Piedmont Subtype) (NAI, 2005d Appendix E-12). This forest type represents conditions midway between relatively dry and moist extremes of upland vegetation. It occupies mid-slope positions of an intermediate gradient, and seldom faces either full south or north. Oak-hickory covers about 46.5% of the timberland area in the five counties surrounding the Yadkin Project (Brown and Sheffield, 2003). Loblolly-shortleaf pine is the second most abundant forest type in the Project area (29.2% of the timberland area), followed by oak-pine (22.5%), elm-ash-cottonwood (1.47%), and oak-gum-cypress (0.42%) (Brown and Sheffield, 2003). The acidic soil in the Project area promotes dominance by heath species (blueberries and sourwood) in the shrub understory; while white oak, northern red oak, pignut hickory, and mockernut hickory generally comprise the tree canopy (NAI, 2005d Appendix E-12).

On the drier ridge tops and south-facing slopes, southern red oak replaces northern red oak, while black gum becomes more frequent among the hickories and heaths. On exceptionally dry sites, blackjack oak, post oak and short-leaf pine may predominate. In the moister areas, American beech is common and often a dominant species, along with sugar maple, tulip tree, and water oak. Steep, north-facing bluffs often promote the dense growth of heath shrubs, e.g. mountain laurel and blueberry species under chestnut oak, American beech and white oak (NAI, 2005d Appendix E-12).

When the natural upland forest succession is set back by disturbances, such as logging, pines (loblolly, short-leaf and Virginia) are among the first forest trees to emerge. Naturally occurring areas dominated by grasses and forbs (most other herbaceous species with typically broader leaves) occurs primarily due to vegetation management, wherever woody plant growth has to be routinely discouraged (often along electric power transmission lines). Grassland-Shrubland is found in the Project area only in areas where routine disturbance is maintained for long periods of time, e.g., under powerlines (NAI, 2005d Appendix E-12).

Since 1990, forest cover in the Piedmont Province of North Carolina has decreased by 7% with forests covering 5.4 million acres (52%) of the land area in 2002 (Brown and Sheffield, 2003). Oak-hickory was the predominant forest type in the Piedmont Province of North Carolina in 2002, covering about 2.7 million acres (a 3% decrease since 1990), while oak-pine increased by 31% to cover about 1.1 million acres (Brown and Sheffield, 2003). About 74% (4.0 million acres) of the timberland area is comprised of hardwoods, an increase of 2%. Softwood forest types decreased about 25% to cover about 25% of timberland area, less than 1.4 million acres, in Piedmont North Carolina. Loblolly pine is the predominant softwood type (decreasing 6% to 798,000 acres), followed by Virginia pine (decreasing 30% to 404,000 acres), and shortleaf pine (decreasing 63% to 132,000 acres).

E.1.1.5 Land Development

Within the North Carolina portion of the Yadkin-Pee Dee River watershed, approximately 50% of the land is forested, and more than 95% is privately owned (NCDENR, 2003). Approximately 30% of the land is agricultural (including cultivated and uncultivated cropland and pastureland), about 13% is developed (urban and built-up), about 6% is “other” lands (roads, railroads, rights of way), and about 1.5% is Federal lands located within the Pee Dee National Wildlife Refuge, the Uwharrie National Forest, and the Blue Ridge Parkway.

Cultivated cropland and forested land decreased significantly between 1982 and 1997 (decrease of 37% and 4.5% respectively); while there were increases in uncultivated cropland, pastureland, and the "other" categories (about 50%, 16%, and 7% respectively) (NCDENR, 2003). Within the North Carolina portion of the Yadkin-Pee Dee River watershed, the developed category exhibits the most dramatic increase (about 64%) during the 15-year period, with 43% of the increase occurring between 1992 and 1997.

Specifically, rapid growth and development is occurring in the Winston-Salem, Salisbury, and Charlotte areas of the Yadkin-Pee Dee watershed. Based on the most recent U. S. Census (2000), the most populated areas in the watershed are in and near Winston-Salem and Charlotte (NCDENR, 2003) with the largest increases projected over the next 25 years for four counties located near Charlotte (North Carolina State Data Center, State Demographics Unit website). Of the five counties surrounding the Project, Davie County, located near Winston-Salem, is expected to experience the most rapid growth over the next 25 years (64% from 2000-2030) followed by Rowan County (48.2% from 2000-2030).

In the upper portion of the Yadkin-Pee Dee watershed, the counties with the largest, densest and most urbanized populations are adjacent to the major urban centers of the Piedmont Triad (Greensboro, Winston-Salem and High Point) and Charlotte/Mecklenburg County. These two large urbanized areas are part of the Piedmont Crescent, a rapidly developing region stretching across the middle of the state from Charlotte to Raleigh and one of the most rapidly developing regions in the entire country (Northwest Piedmont Council of Governments, 1996 and NCDENR, 2003).

Overall, the shoreline of the Project reservoirs is predominantly forested (65.3%) followed by developed land use (28.5%) and a minimal amount of agricultural land (6.2%) (NAI, 2005d Appendix E-12). The most recent shoreline land use estimates are based on aerial photography of each cover type within 200 feet of the Project reservoirs (see Section E.6.1).

Along the High Rock Reservoir shoreline, the predominant land use is forested, accounting for approximately 61% of the shoreline. Forested areas occur primarily in the upper, more riverine portion of the reservoir. Development is the second largest land use category, accounting for approximately 32% of the shoreline land use. There is very little agricultural land adjacent to High Rock Reservoir.

Both the Tuckertown and Falls reservoir shorelines are largely undeveloped. Forested land accounts for 91% and 95% of the Tuckertown and Falls shorelines, respectively. Agricultural and developed land uses along the shoreline are minimal.

Narrows Reservoir has the highest percentage of residential shoreline development of any Project reservoirs, although the predominant land use around the reservoir is forested (60.7%). Development is the second largest land use category at Narrows Reservoir, accounting for 36.7% of the shoreline. Similar to the other Project reservoirs, there is very little agricultural land adjacent to Narrows.

E.1.1.6 Population Size and Density

Based on the most recent U. S. Census (2000), the population of the North Carolina portion of the Yadkin-Pee Dee watershed was close to 1.5 million people, close to a 25% increase from the 1990 U. S. Census of approximately 1.2 million people (NCDENR, 2003). The most populated areas are in and near Winston-Salem and Charlotte. The population of the five counties surrounding the Yadkin Project area, Davidson, Davie, Montgomery, Rowan, and Stanly counties, experienced growth between 1990 and 2000 ranging from an increase of 25% (Davie) to 12.2% (Stanly), as shown in Table E.1-1.

Table E.1-1: Demographic Characteristics of Counties Surrounding the Yadkin Project Area

County	Land Area (square miles)	Population (2000)	Population Density (2000)	Total Population Change (1990-2000)	Population Estimate (2003)
Davidson	552	147,246	267	16.2%	151,935
Davie	265	34,835	132	25%	37,222
Montgomery	492	26,822	55	14.8%	27,332
Rowan	511	130,340	255	17.8%	133,134
Stanly	395	58,100	147	12.2%	59,060

Source: North Carolina State Data Center, State Demographics Unit website

Population estimates for 2010, 2020, and 2030 (compared to the 2000 U. S. Census) estimate that the county-wide population for counties located wholly or partially in the North Carolina portion of the Yadkin-Pee Dee watershed will steadily increase over the next 25-year period. The largest increases are projected for Union, Mecklenburg, Cabarrus, and Iredell counties, all located near Charlotte (North Carolina State Data Center, State Demographics Unit website). The projected population growth levels for the five counties surrounding the Yadkin Project are shown in Table E.1-2. Based on the growth rate of North Carolina as a whole, modest growth levels are expected to continue in Davidson, Davie, Montgomery, Rowan, and Stanly counties through the year 2030 with Davie County expected to experience the most rapid growth (of the counties surrounding the Project).

Table E.1-2: Population Growth Projections of Counties in Yadkin Project Area

County	Population (2000)	Projected Population (2010)	Projected Population (2020)	Projected Population (2030)	Percent Growth (2000-2010)	Percent Growth (2000-2020)	Percent Growth (2000-2030)
Davidson	147,246	165,751	185,606	205,386	12.6%	26.1%	39.5%
Davie	34,835	42,235	49,564	57,124	21.2%	42.3%	64.0%
Montgomery	26,822	29,797	33,321	37,006	11.1%	24.2%	38.0%
Rowan	130,340	147,800	170,167	193,201	13.4%	30.6%	48.2%
Stanly	58,100	63,454	69,936	76,056	9.2%	20.4%	30.9%

Source: North Carolina State Data Center, State Demographics Unit website

The overall population density of the North Carolina portion of the Yadkin-Pee Dee watershed is approximately 203 persons per square mile versus a statewide average of about 165 persons per square mile (North Carolina State Data Center, State Demographics Unit website). While much of the watershed contains rural areas surrounding small towns, many of the small to large cities have high density areas. Population densities in counties located wholly or partially in the Yadkin-Pee Dee watershed range from 46 persons per square mile in Allegheny County (9% of the county is located in the watershed) to about 1,321 persons per square mile in Mecklenburg County surrounding Charlotte (26% of the county is located in the watershed) (North Carolina State Data Center, State Demographics Unit website, and NCDENR, 2003). The population densities (persons per square mile) for the five counties surrounding the Project are: 55 for Montgomery County, 132 for Davie County, 147 for Stanly County, 255 for Rowan County, and 267 for Davidson County (Table E.1-1). Of the four Project reservoirs, the area surrounding High Rock Reservoir is the most densely populated with seven towns or cities located in close proximity to the reservoir and many subdivisions adjacent to the reservoir shoreline.

In the upper portion of the basin, the counties with the largest, densest and most urbanized populations are adjacent to the major urban centers of the Piedmont Triad (Greensboro, Winston-Salem and High Point) and Charlotte/Mecklenburg County. These two large urbanized areas are part of the Piedmont Crescent, a rapidly developing region stretching across the middle of the state from Charlotte to Raleigh. This area is one of the most rapidly developing regions in the entire country, and is an extension of the Atlanta/Charlotte Corridor, which is the most rapidly developing region of the country. The development in the Crescent is reaching out from the major urban centers and basically follows Interstate 85. This growth will eventually result in a solid band of urbanized counties from Raleigh to Charlotte (Northwest Piedmont Council of Governments, 1996 and NCDENR, 2003).

As can be expected, the counties with the largest anticipated population growth are those adjacent to the major urban centers of the Piedmont Crescent. The significance of this pattern of growth is that the Piedmont Crescent (running roughly East-West) bisects the upper Yadkin River Basin, (which runs North-South). Increasing development will result in an increased demand for water, while at the same time increasing the threat to water quality (Northwest Piedmont Council of Governments, 1996 and NCDENR, 2003).

E.1.1.7 Floodplains and Flood Events

E.1.1.7.1 Floodplains

There are only limited areas of floodplain within or immediately adjacent to the Yadkin Project. Most of these are located along the upper, flowing, portions of High Rock Reservoir upstream of the I-85 Bridge. Most of the floodplains along the upper end of High Rock Reservoir are privately-owned, undeveloped properties that are currently managed as timberland. In some places, these floodplains provide significant habitat for fish and wildlife and support important biological communities (NAI, 2005d Appendix E-12).

The floodplains located along the upper end of High Rock Reservoir are mostly unaffected by the operation of High Rock Reservoir during large flood events (>20,000 cfs). Hydraulic controls located in the vicinity of the confluence of the Yadkin and South Yadkin rivers combined with high river flows can and do result in the periodic inundation of some areas of these floodplains.

E.1.1.7.2 Flood Events

The Yadkin Project is not specifically operated as a flood control project. Nonetheless, existing operation of the Project does provide some benefit in controlling downstream flooding. In particular, the operation of High Rock Reservoir as a storage facility with a seasonal drawdown allows APGI to capture a portion of large flow events that are most likely to occur during the high flow winter and early spring months (January-April), which may reduce peak flows during or following large storm events.

E.1.1.8 Other Factors Important to an Understanding of the Setting

E.1.1.8.1 Yadkin-Pee Dee Watershed

The North Carolina portion of the Yadkin-Pee Dee watershed extends from the Mountain physiographic region and includes the Piedmont, Sandhills, and Coastal Plain regions. The South Carolina portion of the watershed extends across the Piedmont, Sandhills, Upper Coastal Plain, Lower Coastal Plain, and Coastal Zone regions.

The Yadkin-Pee Dee River watershed originates on the eastern slopes of the Blue Ridge Mountains in North Carolina with a small portion of the Yadkin River headwaters originating in Virginia. The Yadkin River flows northeasterly for approximately 100 miles to near Winston-Salem, and then flows to the southeast, heading toward Salisbury, North Carolina. A major tributary is the South Yadkin River, which joins the Yadkin River mainstem north of Salisbury in Rowan County. Other major tributaries draining into the Yadkin Project reservoirs include Abbotts Creek, Swearing Creek, Dutch Second Creek, Crane Creek, Flat Swamp Creek, Cabin Creek, Flat Creek, Ellis Creek, Riles Creek, and Hunting Creek. The Yadkin River flows southeast until it is joined by the Uwharrie River, approximately 1.3 miles below Falls Dam, to form the Pee Dee River. Another major tributary, the Rocky River joins the Pee Dee River approximately five miles downstream of Progress Energy's Tillery Dam. After passing through a final reservoir, Blewett Falls, the Pee Dee River continues its southeastern flow through South Carolina where it is joined by the Lynches River, the Black River, and the Waccamaw River before it flows into Winyah Bay, where it meets the Atlantic Ocean.

The Yadkin-Pee Dee watershed is the second largest river watershed in North Carolina, covering an area of approximately 14,989 square miles in North Carolina, South Carolina, and Virginia. The North Carolina portion of the watershed contains approximately 5,862 miles of freshwater streams and rivers and includes 93 municipalities and all or part of 21 counties (NCDENR, 2003). The South Carolina portion of the watershed includes a total of 8,075 stream miles, 15,984 acres of lake waters, and 25,195 acres of estuarine areas (SCDHEC, Watershed Management website).

Six major reservoirs are located on the mainstem of the Yadkin-Pee Dee River in North Carolina: the four Yadkin Project reservoirs (High Rock, Tuckertown, Narrows, and Falls) and two reservoirs operated by Progress Energy, Tillery Reservoir and Blewett Falls Reservoir (discussed in Section E.1.1.8.2). Additionally, a flood control reservoir (W. Kerr Scott) operated by the U. S. Army Corps of Engineers (USACE) is located in the upper portion of the Yadkin River, approximately 132 river miles upstream of High Rock Dam.

A wide variety of habitat types, as well as a number of rare plants and animals, are found within the Yadkin-Pee Dee watershed. The Yadkin-Pee Dee River serves as a corridor for migration between the mountains and the Coastal Plain. The watershed contains 38 aquatic species that are rare, threatened, endangered or of special concern by the North Carolina Natural Heritage Program (NCDENR, 2003).

E.1.1.8.2 Progress Energy Developments

Progress Energy's Yadkin-Pee Dee River Project (FERC No. 2206) is located downstream of APGI's Yadkin Project on the Yadkin and Pee Dee rivers in central North Carolina and consists of the Tillery Dam and Reservoir and the Blewett Falls Dam and Reservoir.

The Tillery Hydroelectric Plant is a four-unit, 86-MW hydropower plant located near Mt. Gilead, North Carolina. The Tillery impoundment is a 5,700-acre reservoir with 118 shoreline miles at the normal maximum operating level of 277.3 feet. Tillery Reservoir is located southeast of Albemarle in Stanly and Montgomery counties, North Carolina. The reservoir extends approximately 15 miles upstream to the tailwaters of Alcoa Power Generating Inc.'s (APGI) Falls Development. Downstream is the Blewett Falls Hydroelectric Plant, a six-unit, 22-MW hydropower plant located near Lilesville, North Carolina. The Blewett Falls impoundment is a 2,900-acre reservoir at the normal maximum operating level of 177.2 feet. Blewett Falls Reservoir is located northwest of Rockingham in Richmond and Anson counties, North Carolina (Progress Energy, 2003).

The Yadkin-Pee Dee River Project's FERC license states that operation of the Yadkin Project and the Yadkin-Pee Dee River Project should be "coordinated to the greatest extent compatible with the several and distinct purposes for which the two projects are designed and operated." Operation of the Project's two power stations is also managed to comply with inflow-based reservoir level requirements. The Project's FERC license requires that continuous releases of 40 and 150 cfs be provided from the Tillery and Blewett Falls developments, respectively (Progress Energy, 2003).

The Tillery and Blewett Falls developments are operated in an integrated fashion. Tillery is operated as a "peaking" facility to provide electricity at peak times when ratepayer demand is the greatest. Tillery is also used to "adjust to rapid changes in system needs" which can result in rapid changes in discharge from the reservoir. Progress Energy operates Tillery Reservoir within a range of 4 feet during normal conditions. Much of the time, Tillery is operated within a range of two feet, except during times of maintenance. Maintenance periods require drawdowns of approximately 12 feet and the Yadkin-Pee Dee River Project's FERC license allows drawdowns of up to 22 feet below full pond. From April 15 to May 15, Tillery is operated within one foot of full pond to enhance conditions for fish spawning (Progress Energy, 2003).

Progress operates Blewett Falls as a "block loading" facility which means that the units are turned off when they are not operating at best efficiency. Blewett Falls is operated to regulate discharges from Tillery which reduces flow fluctuations downstream of the dam. The normal operation of Blewett Falls results in a daily drawdown of approximately two to three feet below the normal maximum operating level, and the reservoir is refilled overnight (Progress Energy, 2003).

Water storage in the Yadkin Project and Yadkin-Pee Dee Project reservoirs during periods of normal stream flow allows a controlled release downstream to enhance energy generation. In accordance with a March 1968 FERC order, Progress Energy pays APGI an annual headwater benefits fee for this benefit. The existing headwater benefits agreement between APGI and Progress Energy requires that the regulated weekly average streamflow, during the period March 1 through May 15 is not less than 1500 cubic feet per second (cfs), during period May 15 through July 1 is not less than 1610 cfs, and during the period July 1 through September 15 is not less than 1400 cfs.

In addition to providing downstream hydropower benefits, the historic controlled release of stored water into the lower river from the Yadkin Project reservoirs, has resulted in a somewhat higher average summer flow than would occur under unregulated conditions. As discussed further in the next section, monthly flow duration curves for the summer months at the Rockingham, NC U. S. Geological Survey (USGS) gage station, demonstrate this effect. This increase in base flow conditions provided by the operation of the Yadkin Project storage facilities (primarily High Rock Reservoir) has benefited an array of downstream water users including industrial and municipal dischargers and municipal water supply intakes.

E.2 Water Use and Water Quality

E.2.1 Use of Project Waters

The primary use of the water in the Project reservoirs is for hydropower production at APGI's hydroelectric generating facilities.

The reservoirs are also used for water withdrawals for municipal and industrial purposes. In accordance with the standard land use article of its current FERC license (Article 35) and the Yadkin Shoreline Management Plan (SMP), any new water intake from the Yadkin Project reservoirs must receive prior written permission from APGI. Any new water intakes greater than one million gallons per day (mgd) must receive prior FERC approval. In addition, any new withdrawals, excluding agriculture, from the Project reservoirs of over 100,000 gallons per day must be registered with the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Water Resources (NCDWR).

Currently, several municipalities withdraw water from the Project reservoirs for use as the local water supply, including drinking water. Water users, summarized in Table E.2-1, include the cities of Albemarle and Salisbury and the Town of Denton (NCDENR Division of Water Resources Water Supply Planning website and NCDENR, 2003). The City of Albemarle withdraws water from Tuckertown and Narrows reservoirs while the Town of Denton has an intake in Tuckertown Reservoir a short distance below the High Rock Dam (NCDENR, 2003). Salisbury's water supply on High Rock Reservoir is located at the confluence of the Yadkin and South Yadkin rivers. Additionally, there is one industrial withdrawal from the upper portion of High Rock Reservoir for process and cooling water by Duke Energy's Buck Steam Station (Table E.2-1).

Other users that withdraw minor quantities of water from the Project reservoirs include several agricultural and recreational property users, including the Uwharrie Point golf course and some adjoining property owners. In addition, occasional water users, such as local volunteer fire departments, withdraw water from the Project reservoirs for emergency purposes.

Table E.2-1: Summary of the Major Water Withdrawals from the Yadkin Project Reservoirs

Water User	Type of User	Source of Withdrawal	Total Amount Withdrawn Annually	Average Annual Daily Withdrawal (MGD)
City of Salisbury	Municipal	Headwaters of High Rock Reservoir at confluence of Yadkin and South Yadkin rivers	2,279.7 million gallons[1]	6.246 MGD[1] (total surface water supply available for regular use is 54 MGD)
City of Albemarle	Municipal	Tuckertown and Narrows	2,762.363 million gallons (total) [1]	7.568 MGD total[1] (3.524 MGD from Tuckertown and 4.040 MGD from Narrows)[2]
Town of Denton	Municipal	Tuckertown	503.492 million gallons[1]	1.379 MGD[1] (total surface water supply available for regular use is 2.300 MGD)
Duke Power's Buck Steam Station	Industrial – cooling water	Upper portion of High Rock Reservoir		233.3 MGD[3] (daily withdrawal capacity is 394.6 MGD)

[1] Data Source: 2002 Local Water Supply Plan on NCDENR Division of Water Resources Water Supply Planning website.

[2] Total contract with APGI for water withdrawal is for a total of 18 MGD from Tuckertown and Narrows reservoirs.

[3] According to the Draft 2004 Water Withdrawal and Transfer Registration Form, the average daily amount (in 2004) of this water that was returned to the river basin was 230.3 MGD (the permitted amount is 394.6 MGD). Draft 2004 Water Withdrawal and Transfer Registration Form was obtained via personal communication with Peele, 2005.

Point source dischargers in North Carolina must apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit from the NCDENR Division of Water Quality (NCDWQ). Point source dischargers include wastewater point source discharges, including municipal and industrial wastewater treatment plants and small domestic wastewater treatment systems serving schools, commercial offices, and residential subdivisions, and stormwater point source discharges, such as stormwater collection systems for municipalities serving populations greater than 100,000 and stormwater discharges associated with certain industrial activities (NCDENR, 2003). NPDES permits are distinguished between individual and general (NCDWQ, NPDES Permits website). General permits are issued for a given state-wide activity such as the discharge of wastewaters associated with sand dredging or non-contact cooling; whereas, individual permits are permits developed and issued on a case-by-case basis for activities not covered by general permits.

There are 240 permitted discharges in the North Carolina portion of the Yadkin-Pee Dee River basin (NCDENR, 2003). Although a few of these are major facilities (municipal wastewater treatment plants and some industrial facilities with flows $\geq$ one MGD), the majority of the NPDES permitted discharges in the Yadkin-Pee Dee River basin are from small wastewater treatment facilities serving communities and schools. Many of these small wastewater facilities are minor facilities with less than one MGD of flow per day. Food processing, poultry, and industrial facilities are also present in the basin. The cumulative effect of these point source discharges along with other nonpoint source discharges on the water quality of the Project impoundments is substantial (APGI, 2002).

Table E.2-2 lists the point source dischargers that are currently operated under NPDES permits issued by the State of North Carolina, that discharge wastewater directly into the Project reservoirs or to reservoir tributaries in the immediate proximity to the Project. Duke Power's Buck Steam Station discharges cooling water into the upper portion of High Rock Reservoir. In addition, Alcoa's Badin Works Plant[1] is permitted to discharge into Narrows Reservoir. Other major discharges, the City of Lexington and the Salisbury-Rowan Wastewater Treatment Plant (WWTP), are located in close proximity to High Rock Reservoir. Minor discharges into the Project waters include: discharges from Norfolk Southern Railway, PPG Industries Fiber Glass Products, American Concrete Products, Boral Bricks, Bill's Truck Stop, several Davidson County Schools, Swing Transport and Hilltop Living Center (into or in close proximity to High Rock Reservoir); discharges to Tuckertown Reservoir from the water treatment plant for the Town of Denton, and the City of Albemarle Tuckertown Water Treatment Plant (WTP). Water from APGI's High Rock Powerhouse is released into Tuckertown Reservoir; water from APGI's Tuckertown Powerhouse is released into Narrows Reservoir; water from APGI's Narrows Powerhouse is released into Falls Reservoir; and water from APGI's Falls Powerhouse is released into the upper end of Progress Energy's Tillery Reservoir.

[1] As of mid-2002, Alcoa's Badin Works smelter operations have been curtailed.

Table E.2-2: NPDES Discharges to the Yadkin Project Reservoirs or in the Immediate Proximity of the Project Reservoirs

Reservoir	Facility	NPDES Permit No.	Receiving Water	Permitted Flow (MGD)
High Rock				
	Duke Power/ Buck Steam	NC0004774	High Rock Reservoir	Not limited
	Norfolk Southern Railway Company–Linwood Yard	NC0029246	High Rock Reservoir	0.317 MGD
	PPG Industries Fiber Glass Products Inc	NC0004626	North Potts Creek Arm (Second Potts Creek)	0.6 MGD
	American Concrete Products	NCG520009	High Rock Reservoir (confluence of Yadkin and South Yadkin Rivers)	Not limited
	Boral Bricks, Inc.	NCG020241	High Rock Reservoir	Not limited
	Boral Bricks, Inc.	NCG020239	High Rock Reservoir	Not limited
	Lexington Regional WWTP	NC0055786	Upper Abbotts Creek Arm of High Rock Lake	6.5 MGD
	Bills Truck Stop Inc	NC0040045	South Potts Creek (First Potts Creek)	0.006 MGD
	Davidson County Schools-Central Middle & Senior High School WWTP	NC0041599	UT to Abbotts Creek Arm of High Rock Lake	0.014 MGD
	Davidson County Schools-Southwood Elementary School WWTP	NC0042749	UT to Swearing Creek Arm of High Rock Lake	0.01 MGD
	Salisbury-Rowan WWTP	NC0023884	Grant Creek	20.0 MGD
	Hilltop Living Center	NC0059536	UT to upper High Rock Reservoir	0.003 MGD
	Swing Transport, Inc.	NCG080279	UT to High Rock Reservoir	Not limited
Tuckertown				
	Denton WTP	NC0082949	Tuckertown Reservoir	Not limited
	APGI High Rock Powerhouse	NC0081931	Tuckertown Reservoir	Not limited
	City of Albemarle Tuckertown WTP	NC0075701	Tuckertown Reservoir	Not limited
Narrows				
	Alcoa Badin Works[1]	NC0004308	Narrows Reservoir	Not limited
	APGI Tuckertown Powerhouse	NC0081949	Narrows Reservoir	Not limited
Falls				
	APGI Narrows Powerhouse	NC0081957	Falls Reservoir	Not limited
Yadkin River				
	APGI Falls Powerhouse	NC0076775	Yadkin River	Not limited

Data Source: NCDENR, Division of Water Quality, NPDES Website and personal communication with Lau, 2004.

Notes: UT =Unnamed tributary

Individual NPDES permits have the prefix NC while general NPDES permits have the prefix NCG.

[1] As of mid-2002, Alcoa's Badin Works smelter operations have been curtailed.

E.2.2 Use of Downstream River Waters

Because High Rock Reservoir serves as a primary storage facility on the Yadkin-Pee Dee River, its operation is also important to downstream river users who rely on releases from storage to augment river flows during the low flow summer period. Several communities on the lower river (below the Falls Development) utilize the Yadkin-Pee Dee River for water withdrawals (Table E.2-3). In addition, there are wastewater discharges located in the North Carolina portion of the lower river (Table E.2-4).

Table E.2-3: Summary of the Major Water Withdrawals from the Yadkin-Pee Dee River in North Carolina Downstream of the Yadkin Project

Water User	Type of User	Source of Withdrawal	Total Amount Withdrawn Annually	Average Annual Daily Withdrawal (MGD)
Anson County, NC	Municipal	Blewett Falls Reservoir	2,397.320 million gallons[1]	6.568 MGD[1] (total surface water supply available for regular use is 16.000 MGD)
Montgomery County, NC	Municipal	Tillery Reservoir	1,132.369 million gallons[2]	3.102 MGD[2] (total surface water supply available for regular use is 6.000 MGD)
Norwood, NC	Municipal	Tillery Reservoir	108.9 million gallons[2]	0.298 MGD[2] (total surface water supply available for regular use is 2.000 MGD)
Richmond County, NC	Municipal	Blewett Falls Reservoir	1,169.60 million gallons[1]	3.4 MGD[1] (total surface water supply available for regular use is 8.000 MGD)

[1] Data Source: 2002 Local Water Supply Plan on NCDENR Division of Water Resources Water Supply Planning website.

[2] Data Source: 2002 Draft Local Water Supply Plan obtained via personal communication with Peele, 2005.

Table E.2-4: NPDES Discharges to the Mainstem Yadkin-Pee Dee River in North Carolina Downstream of the Yadkin Project

Facility	NPDES Permit No.	Receiving Water	Approximate Rivermile	Permitted Flow (MGD)
Anson County, NC Regional WWTP	NC0041408	Pee Dee River	178	3.5 MGD
Ansonville, NC WWTP	NC0081825	Pee Dee River	210	0.1200 MGD
Mount Gilead, NC WWTP	NC0021105	Pee Dee River (including Blewett Falls Reservoir below normal operating levels)	218	0.8500 MGD
Rockingham, NC WWTP	NC0020427	Pee Dee River	181	9.0 MGD
Richmond County, NC WTP	NC0081281	Pee Dee River	186	Not limited

Data Source: NCDENR, Division of Water Quality, NPDES Permits website and personal communication with Weaver, 2004.

E.2.3 Water Quality

E.2.3.1 Existing Water Quality in Project Waters and Downstream

Limited historic water quality data was collected in the 1970s on High Rock Reservoir by the U. S. Environmental Protection Agency (EPA), the North Carolina Division of Environmental Management, and the University of North Carolina. Since 1981, the State of North Carolina has collected a full suite of physical and chemical parameters for the Project reservoirs every three to four years in most instances. The sampling has been limited to the summer months and mostly to surface water. According to the most recent Yadkin River Basin Basinwide Assessment Report, symptoms of eutrophication, or high productivity (i.e., elevated pH values, chlorophyll *a*, an indicator of algal growth, and nutrient concentrations and algal blooms which can result in depleted dissolved oxygen levels), have been documented in High Rock Reservoir since 1981 and are also evident in Tuckertown Reservoir (NCDENR, 2002). Both reservoirs also exhibited decreased Secchi depths at or less than one meter. Narrows Reservoir was determined to be eutrophic from 1981 to 1987 and mesotrophic (moderately productive) in 1990 and 1994.

Portions of High Rock Reservoir are on the 2004 North Carolina list of impaired waters (the 303(d) list) and will require the development of Total Maximum Daily Loads (TMDLs) (NCDENR, 2004). The upper portion of the reservoir[1] is listed as impaired due to violation of water quality standards for chlorophyll *a*, dissolved oxygen, and turbidity, the Abbotts Creek Arm due to violations for dissolved oxygen and turbidity, and the lower portion of the reservoir is listed as impaired for turbidity (Tetra Tech, 2004). The low dissolved oxygen listing for all segments of the reservoir is planned for removal from the impaired waters list due to reanalysis of the data (Tetra Tech, 2004). Additionally, the Swearing Creek Arm of High Rock Reservoir is listed as impaired biological integrity requiring a TMDL stressor study to identify stressors to aquatic life. The tailwater below High Rock Dam to the mouth of Cabin Creek (the upper portion of Tuckertown Reservoir) is also impaired due to violations for dissolved oxygen. The section of Lick Creek draining into Tuckertown Reservoir is impaired due to dissolved oxygen violations.

E.2.3.1.1 Water Quality Monitoring Study Conducted by APGI

Monitoring

In preparation for the relicensing effort, APGI began collecting baseline water quality data in the Project reservoirs and tailwaters in 1999. In response to comments on the Yadkin Project Relicensing Initial Consultation Document (ICD) filed with FERC in 2002, APGI developed a study plan with input from the Water Quality Issue Advisory Group (IAG) and conducted water quality monitoring in the four Yadkin Project reservoirs and tailwaters for five years (NAI, 2005g Appendix E-1). The principal concerns related to water quality at the Project are the current status of water quality in the reservoirs and tailwaters and the effects of the Project operations on water quality.

[1] The upper portion of High Rock Reservoir is designated upstream of a line drawn from the downstream side of the mouth of Swearing Creek to the downstream side of the mouth of Crane Creek.

APGI conducted monthly water quality sampling at 16 reservoir locations and at each of the four tailraces below the dams from June 1999 to December 2003 (Figures E-2 and E-3) and an additional station was added in Lick Creek just above its confluence with Tuckertown Reservoir in July 2003 (Figure E-4). The tailraces of the Falls and Narrows developments were continuously monitored for dissolved oxygen and temperature for extended periods (May–November) in 2001 through 2004; while the tailraces of the High Rock and Tuckertown developments were continuously monitored for dissolved oxygen and temperature for extended periods (May–November) in 2003 and 2004 (Figures E-2 and E-3). Additional dissolved oxygen and temperature measurements were collected at two sites in the Lick Creek Arm of Tuckertown Reservoir and at seven stations below the High Rock Dam tailrace (the upper portion of Tuckertown Reservoir) beginning in July 2003 (Figure E-4).

On each sampling date, temperature, pH, dissolved oxygen and specific conductance were measured in situ using an YSI field meter at one meter intervals from the surface to the bottom. For nutrients, solids, and metals, samples were collected monthly from the surface and the bottom at each station. In February 2001, a composite sample of the photic zone, defined as twice the Secchi transparency depth, replaced the surface grab sample for all chemical parameters except for metals. Secchi transparency was measured at each station and chlorophyll *a* samples were only collected from the photic zone. All sampling and analysis was conducted in accordance with North Carolina water quality monitoring protocols and procedures (NAI, 2005g Appendix E-1). Table E.2-5 lists the chemical parameters analyzed in the laboratories and detection limits.

Table E.2-5: Selected Water Quality Parameters, the EPA Method, and Detection Limit

Parameter	EPA Method	Detection Limit	Units
Chlorophyll *a*	SM 10200H #2	0.2	µg/l
Alkalinity, Total	SM 2320B		mg/l
Biological Oxygen Demand	405.1	2	mg/l
Cadmium	200.8/6020	0.5	µg/l
Carbon, Total Organic	SM 5310C/9060		mg/l
Chemical Oxygen Demand	410.4/7196	20	mg/l
Copper	200.8/6020	10	µg/l
Cyanide, Total	335.4/9012	0.005	mg/l
Lead	200.8/6020	2	µg/l
Mercury	245.1/7470A	0.2	µg/l
Nitrogen, Ammonia	350.1	0.05	mg/l
Nitrogen, NO3+NO2(as N)	353.2/9200	0.05	mg/l
Nitrogen, Total Kjeldahl	351.2	0.5	mg/l
Phosphorus, Total	SM4500-P-E2	0.02	mg/l
Residue, Total	160.3	20	mg/l
Residue, Filterable	160.1	20	mg/l
Residue, Nonfilterable	160.2	5	mg/l

The hydrometeorologic conditions throughout APGI's monitoring period are critical to understanding the water quality dynamics in the tailraces of the Project dams. Flows during 2000 and 2001 were below average, but 2002 was an extremely dry year, particularly during the

Figure E-2: Water Quality Sampling Stations in High Rock and Tuckertown Reservoirs

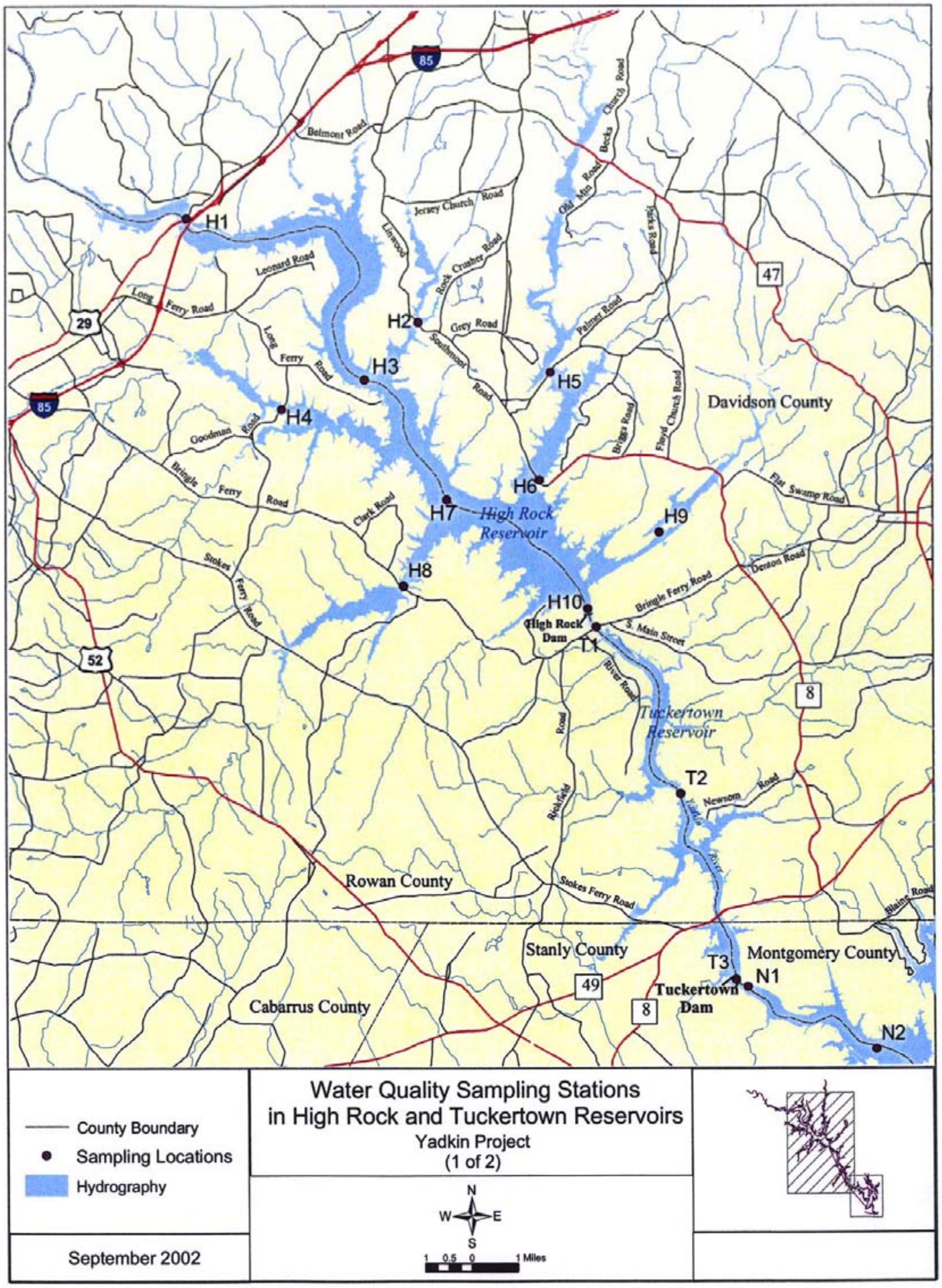


Figure E-3: Water Quality Sampling Stations in Falls and Narrows Reservoirs

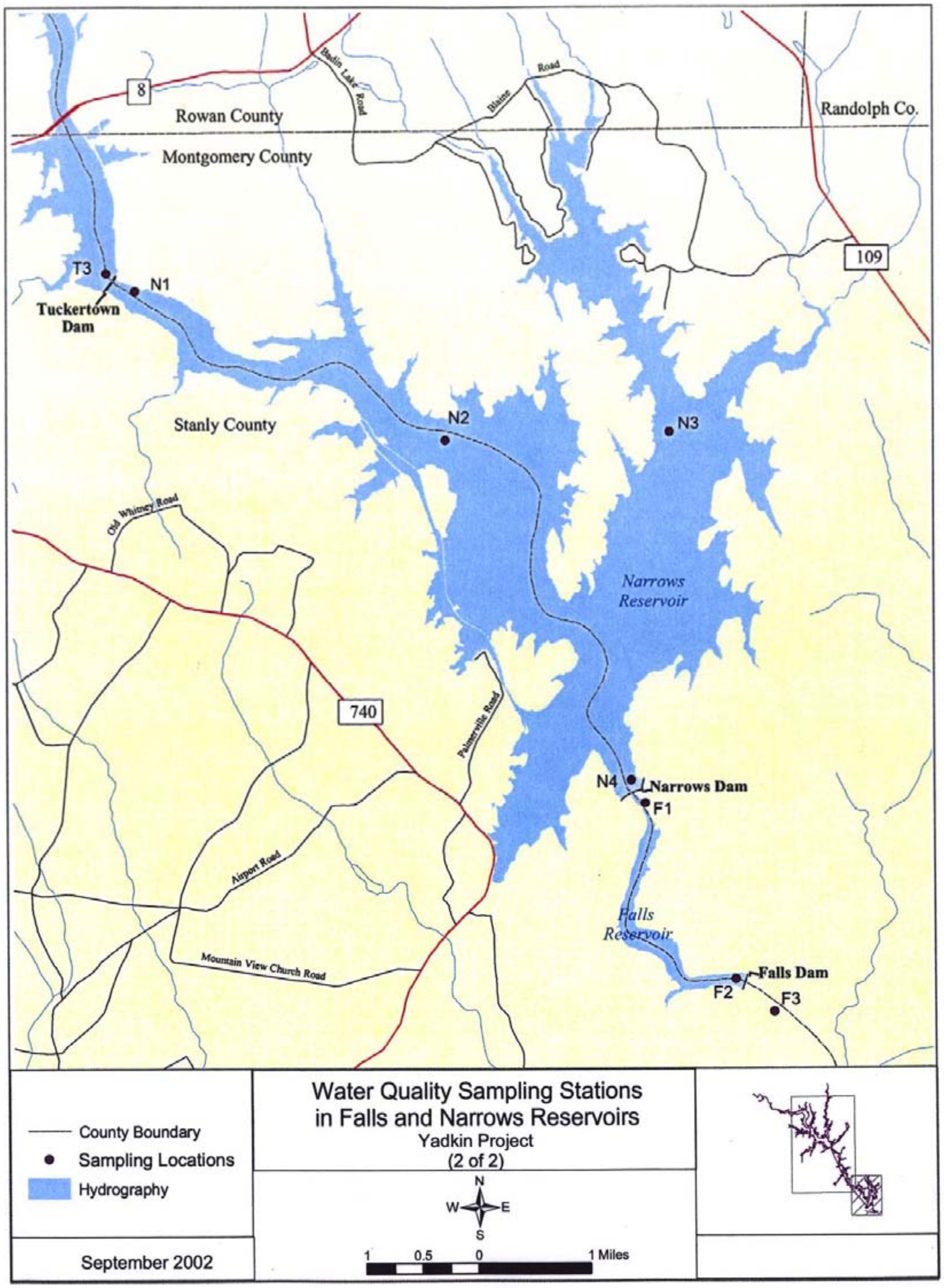
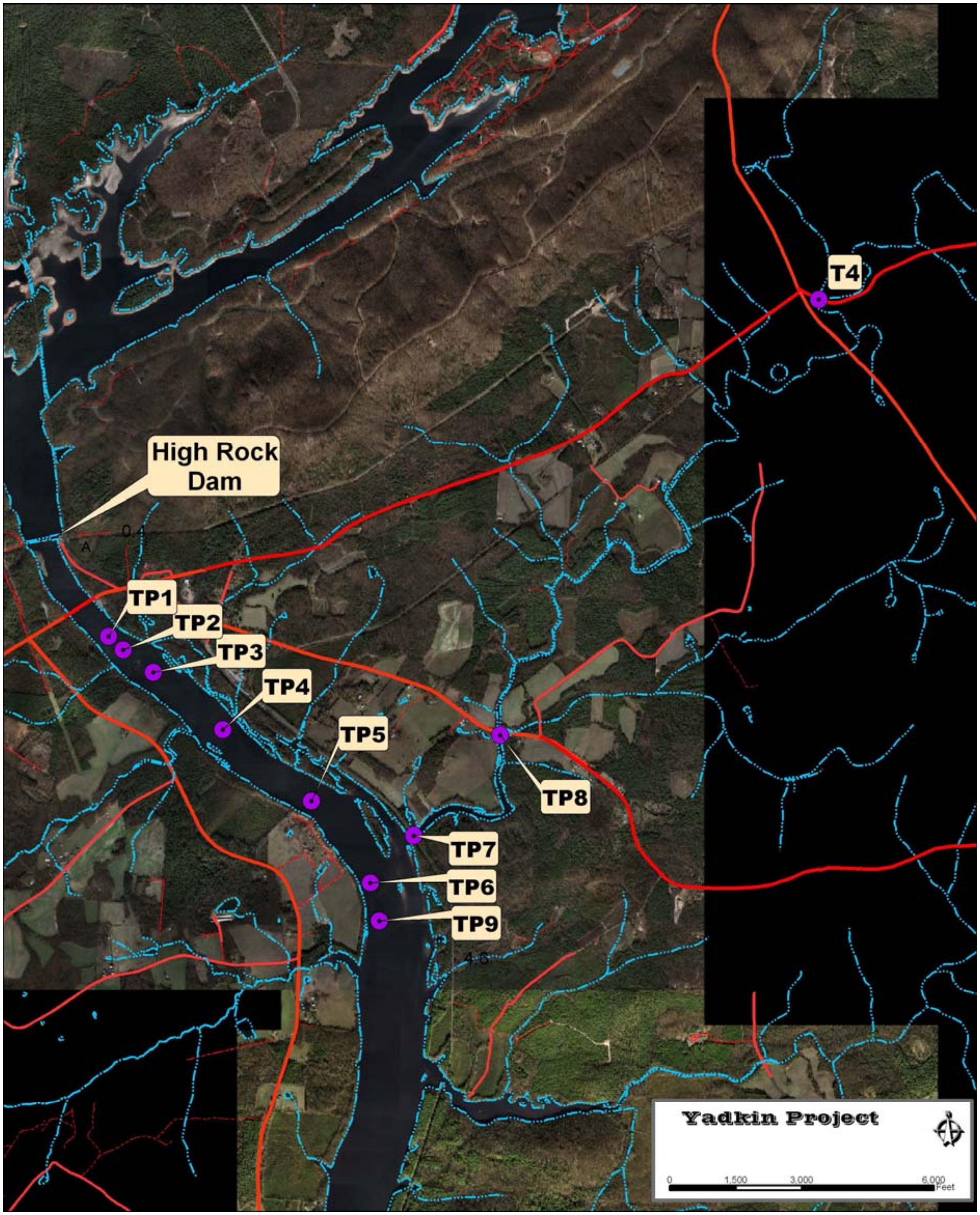


Figure E-4: Supplemental Water Quality Sampling Stations



summer. Conditions were abnormally wet in 2003 while flows returned to average in 2004 with the exception of two hurricanes in August and September that temporarily increased flows. Water levels in Tuckertown and Falls reservoirs fluctuated little throughout the monitoring period while water levels in High Rock and Narrows fluctuated significantly, particularly in the drought year of 2002.

Project-Wide Water Quality Conditions

The seasonal patterns in water quality observed in the Yadkin Project reservoirs are affected by the hydrometeorological conditions among the years of data collection. For the period of APGI's monitoring study (1999-2003), the annual minimum and maximum surface temperatures were relatively consistent among the reservoirs and the years with winter low temperatures of about 8ºC and summer highs of about 30ºC. Except for Narrows Reservoir, bottom temperatures exhibited a similar seasonal pattern. In High Rock, Tuckertown, and Falls reservoirs, weak thermal stratification of up to 4ºC occurred in the summer, generally from July to September. A hypolimnion developed in spring and persisted until December or January below a depth of 25 meters in Narrows Reservoir. Bottom dissolved oxygen concentrations in High Rock, Tuckertown, and Narrows reservoirs were relatively consistent among the years of the study; whereas, dissolved oxygen concentrations in the photic zone experienced two periods of high levels (winter and summer) in 2002, 2003 and to a lesser extent, 2000. The high concentrations in the summer were a result of algal production.

Chlorophyll *a* concentrations in the Project reservoirs follow a strong seasonal pattern in the lower mainstem and arms of High Rock, Tuckertown, and Narrows reservoirs with the lowest concentrations in early winter and the highest in mid-summer. During the monitoring period there was a fairly consistent seasonal trend in the lower mainstem and arm stations of High Rock Reservoir, where large algal populations develop, with low concentrations in late winter and early spring and high concentrations in summer. A very consistent seasonal cycle with low nitrate concentrations in summer and high concentrations in winter occurs in Tuckertown, Narrows, and the lower portion of High Rock reservoirs.

APGI's monitoring study showed that there are some differences in water quality characteristics in the bottom and surface waters of the Project reservoirs (NAI, 2005g Appendix E-1). During the summer, bottom water temperatures were generally cooler and had lower dissolved oxygen concentrations. In High Rock and Tuckertown reservoirs, summer bottom water samples are generally more turbid with greater concentrations of suspended solids, total phosphorus, and ammonia. Ammonia levels are also high in the bottom samples of Narrows Reservoir. Large differences between surface and bottom concentrations of nitrate were only observed in Narrows Reservoir.

The Yadkin Project waters experience varying degrees of eutrophication, with water quality generally poorest in High Rock Reservoir and best in Falls Reservoir (NAI, 2005g Appendix E-1). The principle flow source for High Rock Reservoir is the mainstem Yadkin River, draining a forested and agricultural region with some small towns and cities, and contributions from Swearing, Crane, Second, Abbotts, and Flat Swamp Creeks. Although Flat Swamp Creek has a relatively undeveloped watershed, the other major tributaries to High Rock Reservoir receive runoff from at least one municipality.

In general, the passage of water through the reservoirs can take weeks (the residence time of water in High Rock Reservoir ranges from 4 to 50 days, about 22 hours in Tuckertown, about 2 days in Narrows, and about 2 hours in Falls) resulting in improvement to the overall water quality due to the reduction of suspended sediments, the increase in water clarity, and the gradual reduction of algal biomass and nutrients (NAI, 2005g Appendix E-1).

Being the furthest upstream reservoir, High Rock receives a heavy load of solids with high concentrations of nutrients from the mainstem Yadkin River, the effects of which can be observed at least six miles along the mainstem in upper High Rock Reservoir. As algal populations effectively begin to utilize the nutrient source provided by the Yadkin River, there is a large increase in chlorophyll *a* and a corresponding decrease of both total phosphorus and total nitrogen, mostly nitrate, in this stretch of the impoundment. High Rock Reservoir is a very turbid reservoir with large concentrations of suspended sediments and poor water clarity. The average Secchi depth in High Rock Reservoir is about a half meter which means that light penetration and algal productivity is probably limited to the top one meter. Most of the suspended solids settle in High Rock Reservoir and turbidity and suspended solids concentrations are much lower in Tuckertown Reservoir. There is further reduction of suspended solids in Tuckertown and suspended solids are near the detection limit in Narrows and Falls reservoirs. Secchi depth increases considerably in Narrows and Falls reservoirs where the photic zone generally extends to a depth of over 3 meters.

Heavy sediment loads are likely to carry greater concentrations of nutrients and other substances. Both total phosphorus and total nitrogen concentrations are greatest in High Rock Reservoir (NAI, 2005g Appendix E-1). Phosphorus concentrations decrease in the downstream reservoirs, but concentrations remain at levels that are capable of supporting considerable algal growth. Total nitrogen concentrations decrease only slightly as water passes through the four reservoirs. The availability of nutrients in High Rock Reservoir has created a large standing crop of algae as indicated by the large chlorophyll *a* concentrations. Algal biomass decreases in the downstream reservoirs in a pattern that is similar to the reduction in phosphorus concentrations. Severe algal bloom conditions, generally >30 µg/l, are typically not observed in Narrows and Falls reservoirs. Large algal standing crop and a shallow photic zone, similar to High Rock Reservoir, tend to produce near-saturated to supersaturated oxygen levels in the photic zone, but as the micro-organisms settle into the underlying water dissolved oxygen concentrations are quickly depleted.

Although most of the sediment and nutrients are likely delivered to High Rock Reservoir from upstream sources during precipitation and runoff events, this effect is not necessarily translated downstream. Results of a correlation analysis between flows at each of the Yadkin Project dams with various water quality parameters suggest that in general water quality conditions are weakly correlated with Project flows.

APGI's monitoring also looked for the presence of metals and certain other toxins in the reservoirs. Generally, the study found cadmium, cyanide, copper, lead and mercury to occur at the Project in concentrations below the detection level of the test method (NAI, 2005g Appendix

E-1). Cyanide was detected occasionally at every sampling station in all four reservoirs; however, differences among stations were small in terms of the frequency of detectable cyanide. Detectable levels of cyanide occurred most frequently in the arms of High Rock Reservoir and in Falls Reservoir. Low, but detectable levels of metals, including lead and copper were found occasionally, particularly in the upper portions that are the most affected by runoff. Lead was the most commonly occurring toxic substance that was detected. Detectable levels of mercury occurred on almost half of the sampling dates in Narrows Reservoir near the dam, the only station with a hypolimnion which is probably a source of dissolved forms of mercury.

The question of mercury in fish tissue was also examined by APGI by collecting fish tissue samples in the upper-most portion of Narrows Reservoir, just below Tuckertown Dam (NAI, 2005g Appendix E-1). Mercury concentrations in all of the fish samples collected were below the detection limit of 0.145 mg/kg, which is well below the U. S. Environmental Protection Agency's action level of 1 mg/kg.

Concerns about levels of fecal coliform in the Project waters were also addressed in APGI's water quality monitoring study. Monitoring for fecal coliform in the Project reservoirs is handled by both the North Carolina Division of Water Quality and, as needed, by the local county health departments. APGI's study compiled fecal coliform data that had been collected in High Rock, Tuckertown and Narrows reservoirs for 1999 through 2001. For the most part fecal coliform counts were generally less than 10 per 100 ml. All of the samples had concentrations which met the state water quality standard.

High Rock Water Quality

High Rock Reservoir is an extremely diverse waterbody demonstrating large differences between the upper and lower mainstem stations and among the arms.

Relatively low chlorophyll *a* concentrations in the upper High Rock mainstem indicate that phytoplankton populations have not had sufficient time to develop and that this stretch may be more like a river than a lake (NAI, 2005g Appendix E-1). Nitrate concentrations are greater at the upper High Rock mainstem stations, before it is assimilated by phytoplankton while ammonia levels are greatest in the tailraces due to the blending of surface water (with low concentrations) and bottom water, where ammonia concentrations are seasonally greater.

APGI's monitoring study found that nutrient concentrations throughout High Rock Reservoir are at levels that can support nuisance algal blooms and algal biomass often at high levels (>30 µg/l). Thermal stratification is absent, except for a slight warming of the top few meters during the summer; while oxygen depletion below the photic zone occurs during the warmer months. In general, conditions in the upper portion of High Rock Reservoir, as measured at two mainstem stations and the arm stations of Swearing and Crane Creeks, are more turbid and have greater nutrient concentrations than the lower portion of the reservoir. The major arms of High Rock Reservoir typically have greater algal biomass than the mainstem and there are also differences among the major arms.

When compared to the mainstem, the arms of High Rock Reservoir typically have greater concentrations of alkalinity, biological oxygen demand, chlorophyll *a*, total Kjeldahl nitrogen, total organic carbon and total dissolved solids (NAI, 2005g Appendix E-1). These are all measures that are directly or indirectly affected by algal productivity and suggest that productivity in the arms is very high. The average chlorophyll *a* concentration for all arm stations is 29 µg/l, which is almost double the average concentration in the mainstem of the reservoir. Nitrate concentrations in the arms are much lower than in the mainstem, indicative of assimilation of nitrate by algae.

From the limited number of stations sampled in High Rock Reservoir's arms, some differences among the major arms were observed (NAI, 2005g Appendix E-1). The Flat Swamp Creek Arm, which has a relatively undeveloped watershed, has the best water quality observed in High Rock Reservoir and is considerably different from the other arms. The Flat Swamp Creek Arm has the greatest water clarity and the lowest concentrations of dissolved and suspended solids, chlorophyll *a* and the nutrients, total phosphorus and total nitrogen. Chlorophyll *a* concentrations are similar to concentrations seen in the lower mainstem stations, and much lower than in the other arm stations. Differences among the remaining arm stations are relatively small with the Swearing Creek and Crane Creek arms having higher concentrations of suspended solids and algae, and the photic zone averages about 0.75 meters in these two arms. The Crane Creek Arm has the greatest biological oxygen demand of all the arms. Based on a single station, the Crane Creek Arm, due to its higher nutrient, algae and sediment concentrations, probably has the worst water quality of all the arms, but Swearing Creek is only slightly better.

Thermal stratification is typically absent near the dam in High Rock Reservoir except for a slight warming of the surface few meters during the summer (NAI, 2005g Appendix E-1). The surface layer is only a few meters thick and surface temperatures are typically about 2 to 4 °C warmer than the bottom. Despite the lack of thermal stratification at this station, there is severe oxygen depletion, especially at lower depths during the warmer months. Here, oxygen depletion is independent of thermal stratification and extends from the reservoir bottom up to the lower limit of the photic zone. Reduced flows and warmer water temperature during the extreme low reservoir levels of 2002 promoted intense algal production creating supersaturated dissolved oxygen conditions in the photic zone. In 2003, high flows and a full pool during the summer reduced the effects of oxygen depletion in High Rock Reservoir resulting in dissolved oxygen concentrations greater than 5 mg/l in the top four meters and anoxic conditions only in the near bottom depths from July to September.

Dissolved oxygen characteristics vary spatially in High Rock Reservoir. The monitoring study conducted by APGI shows that low dissolved oxygen concentrations are more likely to occur in the arms rather than the mainstem of High Rock Reservoir (NAI, 2005g Appendix E-1). The upper mainstem stations generally have adequate dissolved oxygen concentrations, but low surface dissolved oxygen is a chronic problem in the Swearing Creek and Crane Creek Arms of High Rock Reservoir. The large algal standing crop and high biological oxygen demand suggests these are very productive areas and that oxygen can be consumed very quickly through microbial respiration. The shallow water will also allow more frequent mixing of the photic zone with the oxygen depleted water below resulting in an overall decrease in dissolved oxygen concentrations at the surface.

Tuckertown Water Quality

Tuckertown Reservoir has two small tributary arms and receives almost all of its flow from High Rock Reservoir. With water quality similar to that found in the lower portion of High Rock Reservoir, Tuckertown Reservoir is generally a relatively turbid reservoir with a shallow photic zone (NAI, 2005g Appendix E-1). Nutrient concentrations are at levels that can promote nuisance algae blooms and algal biomass remains at high levels. Chlorophyll *a* concentrations in the reservoir are slightly greater than those observed in the High Rock Dam tailrace indicating that some productivity is occurring in the reservoir. Although the suspended solids concentrations are generally much lower than those observed in High Rock Reservoir, they are still greater than levels typically seen in North Carolina lakes and reservoirs. As in High Rock, weak thermal stratification of the water column occurs during the summer months with the few degree difference between surface and bottom temperatures generally limited to the top five meters.

APGI's monitoring study determined that dissolved oxygen depletion in deeper water at Tuckertown Reservoir typically extends from May through October or November, but anoxic conditions are usually limited to the summer months and to depths below five meters (NAI, 2005g Appendix E-1). Dissolved oxygen in the upper five meters of the water column varies considerably among the sampling years. Low dissolved oxygen concentrations (<5 mg/l) at the surface were observed from July to September 1999, August to October 2000, July to August 2001 and briefly in October 2002.

Narrows Water Quality

Although Narrows Reservoir receives most of its flow from Tuckertown Reservoir, the Gladys Fork Arm is a major tributary to the reservoir. APGI's monitoring study found that Narrows has greater water clarity and lower concentrations of suspended solids, nutrients and algal biomass than the two upstream reservoirs, High Rock and Tuckertown, and better surface dissolved oxygen conditions than Falls Reservoir which lies downstream (NAI, 2005g Appendix E-1). Although surface waters are less turbid than the upstream reservoirs, the photic zone is still relatively shallow, with averages ranging from about 2.4 to 3.4 meters. Average suspended solids concentrations at Narrows are near the detection limit. Nutrient concentrations are lower than in High Rock and Tuckertown reservoirs; however, they are still at levels that can produce nuisance algal blooms.

Narrows, with its deeper water, is the only reservoir that truly stratifies and where a true hypolimnion develops (>4°C difference between surface and bottom temperatures). Water quality conditions across the reservoir are homogeneous and the differences among stations are very small (NAI, 2005g Appendix E-1). A strong and persistent thermocline develops near the dam in Narrows Reservoir. Thermal stratification typically begins to develop in May and persists, in some years, into December. By mid-summer, a well developed epilimnion (warm upper layer) extends from the surface to a depth of about 15 to 20 meters and a well defined metalimnion (transitional layer) separates the epilimnion from the hypolimnion (cool lower layer). Epilimnetic waters reach a maximum of about 30°C in summer. Throughout the fall, the metalimnion thins as the epilimnion cools and deepens. Turnover occurs in late summer or early fall.

Dissolved oxygen concentrations in the upper four or five meters are usually greater than 5 mg/l (NAI, 2005g Appendix E-1). Below five meters, low dissolved oxygen concentrations (<5 mg/l) persist from June through September. Oxygen depletion is independent of thermal stratification. Complete mixing of the reservoir usually occurs in December or January and dissolved oxygen concentrations are similar throughout the water column until stratification returns in late spring.

Falls Water Quality

Falls Reservoir has no tributaries of any size and receives almost all of its water from Narrows Reservoir. The monitoring study conducted by APGI found that Falls Reservoir has the lowest concentrations of solids, nutrients and algal biomass of the four Project reservoirs (NAI, 2005g Appendix E-1). The levels are generally similar to the concentrations observed in Narrows Reservoir near the dam. Nutrient concentrations are still at levels that could promote algal blooms. However, algal biomass is low because a portion of the water leaving Narrows is deep epilimnetic water that has low algal biomass and the residence time in Falls Reservoir is not sufficient for algal populations to develop. Average Secchi depth is 1.6 meters indicating a photic zone of about 3 meters.

The mid-water discharge from Narrows Reservoir includes cooler anoxic water that lowers temperature, pH and dissolved oxygen levels throughout Falls Reservoir. The monitoring conducted by APGI found no thermal stratification in Falls Reservoir, with temperatures ranging from about 8 to 28°C. Dissolved oxygen concentrations observed at the surface range from 3 to 11 mg/l. In a typical year, low dissolved oxygen concentrations extend from the bottom to within a meter or two of the surface from June to October, but anoxic conditions have not been observed. Low dissolved oxygen water (<5 mg/l) is occasionally observed at the surface.

Tailwater Water Quality

The water quality monitoring study conducted by APGI also looked at tailwater water quality (NAI, 2005g Appendix E-1). In general, monitoring results demonstrate that the quality of the water in the four development tailraces is generally similar to conditions in the reservoir immediately upstream in their nutrient and solids concentrations, but differ considerably in temperature, pH, dissolved oxygen, nitrate and ammonia.

Based on the study results, a downstream trend in median water quality values is apparent through the tailraces. Water quality of High Rock and Tuckertown tailraces is fairly similar. These two tailraces are turbid, nutrient rich and contain moderate amounts of algal biomass. Between Tuckertown and Narrows tailraces there is a moderate reduction of ammonia, chlorophyll *a*, nutrients and solids. Water clarity improves somewhat in the downstream tailraces. The water quality of Narrows and Falls tailraces is almost identical. Although median concentrations are above the state standards, all four tailraces experience low dissolved oxygen concentrations. Despite the downstream trend, overall water quality does not differ much among the four tailraces and the water clarity, turbidity and the concentrations of solids and total nutrients in each tailrace are generally similar to the surface water near the dam in the preceding reservoir.

Tailrace water quality was found to most differ from the reservoirs in temperature, pH, dissolved oxygen, algal biomass, nitrate and ammonia, which are parameters that exhibit differences in the reservoirs between surface and bottom waters. The mixing of water entrained over the wide depth range of the dam intakes alters the water quality of the water leaving each reservoir. As differences between surface and bottom water occur seasonally, the effects on released water also varied seasonally.

Tailwater temperature and dissolved oxygen were monitored continuously (every 15 minutes) during the late spring through fall below Narrows and Falls dams from 2000 through 2004 and below Tuckertown and High Rock dams in 2003 and 2004 (NAI, 2005g Appendix E-1). More limited monitoring occurred below High Rock and Tuckertown prior to 2003 (two 3-day periods).

The typical pattern at the High Rock tailrace shows reduced dissolved oxygen concentrations through the summer period, which is a direct result of low dissolved oxygen in High Rock Reservoir. When river flows are high, water in the reservoir is exchanged more rapidly translating into relatively higher dissolved oxygen concentrations in the tailrace. The Tuckertown tailrace exhibited patterns similar to High Rock. In the Narrows tailrace, the summer daily change in dissolved oxygen was usually about 3 mg/l with frequent occurrences below 4 mg/l from June to October. The study was unable to discern a clear relationship between hydrometeorologic conditions and the frequency of low dissolved oxygen levels in Narrows tailrace. Since Falls Reservoir does not stratify and the residence time is so short, the water in the Falls tailrace is generally similar to that observed in the Narrows tailrace. Temperature in both tailraces reached a summer maximum of 26-28ºC.

Dissolved oxygen concentrations in the Narrows tailrace were generally higher than conditions observed in either the High Rock or Tuckertown tailrace. These higher dissolved oxygen concentrations in the Narrows tailwater are partially the result of the operation of the Narrows Unit 4 turbine, which has two air injection valves to introduce air into the flow during generation. The aeration valves on Unit 4 began operating in early 2001. Tests of the effect of the two aeration valves on Unit 4 generally demonstrated that with both valves operating and just Unit 4 operating, about 2-4 mg/l of dissolved oxygen is added to the tailwaters.

As part of the Water Quality Monitoring Study, APGI conducted a more detailed examination of dissolved oxygen conditions in the Project tailwaters. The primary focus of this investigation was the potential for the Narrows Unit 4 air injection valves (two) to introduce air into the flow during generation. An initial study of Narrows tailwater DO was conducted by APGI in 2001 and reported to FERC (NAI, 2002).[1] A second round of operational testing was performed in 2004 to further examine the effect of Narrows Unit 4 air injection on tailwater dissolved oxygen.

The 2004 test of the effect of the two aeration valves on Unit 4 generally confirmed earlier results in 2001 that with both valves operating and just Unit 4 operating, about 2 mg/l of dissolved oxygen is added to the tailwaters. The test also led to the conclusion that operation of Unit 4 and a combination of Units 1, 2 and 3 operating at either best efficiency or at 30 percent gate will also not maintain the Narrows tailwater at or above state water quality standards, however similar air valves on all four Narrows units would likely maintain tailwater dissolved oxygen at or above 5 mg/l when the units are running. The tests also demonstrated that increases in Narrows tailwater dissolved oxygen levels are generally translated to similar increases in dissolved oxygen concentrations below Falls Dam.

Effects of Project Operations on Water Quality

Another question examined through APGI's Water Quality Monitoring Study was whether flow through the Project's developments affects reservoir or tailwater water quality. Results of the analysis demonstrated that throughout the Yadkin Project system, higher flows are associated with lower concentrations of alkalinity, pH, algal biomass (chlorophyll *a*), total dissolved solids , biological oxygen demand (BOD), and total organic carbon; all parameters that are influenced to some extent by biological processes. Greater flow reduces retention time in the reservoirs, allowing less time for microbial and phytoplankton populations to develop. The relationships between flow and BOD, chlorophyll *a*, and total organic carbon were found to be strongest in the lower mainstem and arms of High Rock Reservoir and in Tuckertown Reservoir. Strong relationships between alkalinity, pH and flow were found to exist in all locations. Algae were found to often reach high concentrations during low flow periods throughout the system, but represent a larger percentage of total suspended solids lower in the system. Nitrogen concentrations were found to be poorly correlated with flow. Nitrate concentrations tended to increase with greater flows, probably a result of reduced time for microbial populations to exploit the nutrient. Also, nitrate concentrations are lowest during the summer, when flows tend to be lower. Not surprisingly, greater turbidity was found to be associated with higher flows, especially downstream of High Rock Dam, and temperature was slightly cooler during high flow periods.

APGI's study also evaluated the effect of the reservoir water level on surface water quality in each respective reservoir using the monthly surface water quality data collected from 1999 through 2003 and reservoir water level data (NAI, 2005g Appendix E-1). Under existing operations, during periods of extreme drought, High Rock and Narrows reservoirs can experience substantial drawdown in the summer, as occurred in 2002; whereas, Tuckertown and Falls reservoirs maintain relatively stable pools most of the time.

[1] The 2001 testing focused on the Narrows tailwater recording dissolved oxygen concentrations under various operating regimes, with and without Unit 4 air valve operation. Subsequent to the 2001 testing, the normal operating policy at Narrows in 2002, 2003, and 2004 was revised to operate with both air valves open whenever Unit 4 is operated between May and November in an attempt to increase dissolved oxygen downstream (NAI, 2005g Appendix E-1).

Surface water quality in the reservoirs was found to be poorly correlated, if at all, with reservoir water level. Significant correlations were absent in Falls Reservoir and rare in Tuckertown, the two reservoirs where water levels remain constant. In general, where correlations were observed they were negative, indicating that as reservoir water levels drop concentrations of the water quality parameter tend to increase, an effect that may also be caused by seasonal changes in reservoir water quality and reservoir water levels.

In High Rock Reservoir, which experiences the greatest changes in reservoir water levels, the strongest correlations to water levels were seen in total dissolved solids and total phosphorus concentrations which were both negatively correlated with reservoir water levels; meaning that the concentrations of those parameters increased as water levels decreased.

The correlation of water quality of the tailraces with the reservoir level of the upstream reservoir was also found to be poor. In High Rock Reservoir, low reservoir levels were associated with greater levels of biological oxygen demand, chlorophyll *a* and total dissolved solids; parameters that reached high concentrations during the extreme low reservoir levels experienced during the drought year 2002. In the Narrows tailrace, some parameters were correlated with the level of Narrows Reservoir. The strongest correlations at Narrows occurred between reservoir water level and tailwater temperature, dissolved oxygen and nitrate, which are all highly seasonal parameters. Since lower reservoir levels at Narrows typically occur in the summer and fall, tailwater temperatures would be expected to be greater during periods of low reservoir level. Conversely, both dissolved oxygen and nitrate are seasonally at low levels in summer and were found to be positively correlated with reservoir water level.

Correlation coefficients in Tuckertown and Falls Reservoirs were all low indicating no effects of reservoir water level on the water quality of the downstream tailrace. Since, during normal operations, neither Falls or Tuckertown experience much change in water levels, this is as expected.

E.2.3.1.2 Sediment Study

As part of the relicensing study process, APGI conducted a literature based review of sediment fate and transport at the Yadkin Project (NAI, 2004 Appendix E-2). In general, the study used publicly available information and literature on sediment fate and transport in the Yadkin-Pee Dee River basin. The study involved two separate components; 1) a literature search performed by Normandeau Associates (NAI) to identify the body of research completed in this area, and 2) a review of historic survey data which is used to evaluate the patterns of sediment deposition within High Rock Reservoir that have occurred since High Rock Dam was constructed.

In total, the sediment fate and transport study reviewed over a dozen articles and technical papers that have examined the issue of sediment and sedimentation in parts of the Yadkin-Pee Dee River Basin. As discussed in the reports and articles reviewed, the input of sediment, its transport, and its storage are dependent upon both natural conditions such as regional geology, hydrology and soils along with man's alteration of the landscape by development. The input, output and storage of sediment within parts of the Yadkin-Pee Dee River basin has been shown to vary both spatially and temporally in response to changes in both naturally occurring and imposed conditions. An understanding of the relationship between the naturally occurring conditions along with the potential impacts associated with any imposed changes (naturally or by man's actions) within the basin is essential in order to place the sediment issue into context. The literature reviewed identified that the major inputs of sediment to the Yadkin-Pee Dee River include soil erosion, streambank and channel erosion, and urban runoff. The reviewed literature indicated that the main source of sediment in the Yadkin-Pee Dee River is soil erosion. The rates of soil erosion within the Yadkin-Pee Dee River basin vary in response to the type of soil material and land use. In general, the soils found in the Piedmont physiographic province are typically fine grained (silt) and can be readily eroded when exposed to wind and water. Other natural factors contributing to the erosion of these soils include the humid climate and topographic relief found within the Piedmont physiographic province. Although many other rivers in North Carolina also have serious sedimentation problems, the Yadkin's combination of these factors together with land use patterns within the watershed, results in some of the highest erosion rates and sediment yields in North Carolina. The majority of the authors of the publications reviewed as part of the study concluded that the decline in agricultural land use for crop production since the 18th and early 19th centuries has resulted in a substantial decline in soil erosion and sediment input to the Yadkin-Pee Dee River. They also note that for those lands remaining in agricultural use soil erosion can be further reduced by implementing agricultural best management practices (BMPs).

Several of the authors also note that increasing development and urbanization may be causing a recent increase in sediment input to the Yadkin-Pee Dee River and may in the long run exceed the reductions associated with decreased cropland. Research has shown that development can result in increased runoff, higher soil erosion and sediment transport. Utilization of urban BMPs may reduce some of these impacts, but the benefits associated with implementation of urban BMPs may not be measurable for some time due to the time lag between land use changes and the basin's response. Recognizing this trend in its Basinwide Water Quality Plan for the Yadkin-Pee Dee River (NCDENR, 2003), the NCDENR has emphasized the need for the continued implementation of appropriate urban BMPs to reduce this growing source of sediment.

Overall, the findings of the reviewed research indicate that sediment transport in the Yadkin-Pee Dee River has decreased over the last several decades. The principal reason for this decreasing trend is the decline in the land area used for crop production and possibly the implementation of BMPs to reduce soil erosion and stormwater runoff. Although this trend appears to be continuing, several of the streams and rivers within the Yadkin-Pee Dee River basin have been impaired by high sediment and turbidity levels (NCDENR, 2003). Furthermore, several of the authors warn that the production of sediment associated with land development may ultimately cause sediment transport in the Yadkin-Pee Dee River to increase. If this occurs, any gains made in reducing sediment transport in the last decade could be reduced along with the continued impairment of the basin's waters.

The study also concluded that storage of sediment in the basin naturally occurs within its streams and rivers and on their associated floodplains. The construction of dams and the operation of their associated reservoirs on the Yadkin-Pee Dee River have had an impact on the transport of sediment through the lower portion of the basin. The impoundment of water by High Rock, Tuckertown, Narrows, Falls, Tillery and Blewett Falls dams and the resulting reduction in water velocity at each reservoir have reduced the capacity of the Yadkin- Pee Dee River to transport sediment, thereby leading to deposition in each of the six impoundments.

The amount of sediment deposited in the reservoirs depends upon the amount of sediment supplied and the storage or residence time of the water in the impoundment. Several of the studies reviewed estimated the amount of sediment accumulated in the impoundments. The USDA (1979) estimated annual sediment accumulation in the Yadkin Project reservoirs ranged from 1,354,500 tons/year (903 ac. ft./yr) for High Rock Reservoir to 21,000 tons/year (14 ac. ft./yr) at Falls Reservoir, while the estimated annual loss in total storage capacity ranged from 0.36 percent in High Rock Reservoir to 0.05 percent in Narrows Reservoir. The lower capacity loss for Narrows and Falls reservoirs is due to the reduction in sediment transport by the accumulation in High Rock Reservoir. The analysis of the survey data available for High Rock Reservoir reveals that sedimentation has occurred since the construction of the dam in 1927. The bathymetry of the reservoir shows that sediment has accumulated in the upstream areas of the reservoir from Crane Creek upstream to the confluence of the Yadkin and South Yadkin rivers. The effect of 80 years of sediment accumulation has been quantified as a reduction of approximately 6 percent of the storage capacity (NAI, 2004 Appendix E-2).

Overall, changes in land use within the basin have had an effect on the input of sediment to the Yadkin-Pee Dee River and on the amount of sediment deposited in the Yadkin Project reservoirs. Although the decrease in cropland in the basin has resulted in a decline in sediment transport in the river, continued land development may represent a growing source of sediment. Only with the continued basinwide implementation and enforcement of appropriate BMPs and stormwater regulations will the input, transport and deposition of sediment in the Yadkin River basin continue to decline. Ultimately, the benefits of these actions will include the improvement of water quality and aquatic habitat in the basin's waters.

E.2.3.2 Applicable Water Quality Standards and Stream Segment Classifications

Water quality in North Carolina is regulated by the NCDWQ under the North Carolina Administrative Code Subchapter 2B (15A NAC 02B.0100, .0200, and .0300). All surface waters are assigned classifications that determine protected uses and set standards for water quality constituents to support the designated uses. The water bodies that collectively make up the Yadkin Project are reserved as water supplies and as such have been designated Water Supply (WS) classifications.

More specifically, the upper portion of High Rock Reservoir[1] is classified WS-V while the lower portion to a point 0.6 miles upstream of High Rock Dam is classified as WS-IV and B (NCDENR, BIMS website). The Abbotts Creek arm of High Rock Reservoir is classified as WS-V and B. Waters within the Project boundary classified as Class C waters include Abbotts Creek to the I-85 Bridge and the very lower portion of Grants Creek at the confluence with the Yadkin River (upper portion of High Rock Reservoir). Class C waters also abut the Project boundary on many of the tributaries feeding into the Project reservoirs, including Crane Creek, Second Creek, Abbotts Creek, and Flat Swamp Creek. The area immediately above High Rock

[1] The upper portion of High Rock Reservoir is designated upstream of a line drawn from the downstream side of the mouth of Swearing Creek to the downstream side of the mouth of Crane Creek.

Dam (from a point 0.6 miles upstream of the dam), Tuckertown Reservoir, Narrows Reservoir, and the area immediately surrounding Falls Dam (from a point 0.5 mile upstream of Falls Dam to the Uwharrie River) are classified as WS-IV Critical Area and B. Falls Reservoir to a point 0.5 mile upstream of Falls Dam is classified as WS-IV and B.

Class B waters are used for primary recreation and uses suitable for Class C waters, including secondary recreation, fishing, aquatic life propagation and survival, and wildlife (North Carolina Administrative Code, 2004). Primary recreational activities include swimming, diving, water skiing, and similar uses involving human body contact with water where such activities take place in an organized manner or on a frequent basis; whereas, secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner. There are no restrictions on watershed development or types of discharges in Class B or C waters.

The North Carolina General Assembly enacted a state law in 1989, the Water Supply Watershed Classification and Protection Act, mandating minimum statewide water protection requirements for all surface water supplies used for raw drinking water (North Carolina General Statute 143-214.5).

Class WS-IV waters are protected as water supplies which are generally in moderately to highly developed watersheds (North Carolina Administrative Code, 2004). Uses associated with the WS-IV classification include: source of water supply for drinking, culinary, or food processing purposes for those users where a more protective WS-I, WS-II, or WS-III classification is not feasible. Point source discharges of treated wastewater are permitted pursuant to specific rules and local programs to control nonpoint sources and stormwater discharges of pollution are required.

Minimum land use regulations have been established for areas within WS-IV waters. More stringent regulations have been established for the critical area which is within one-half mile upstream and draining to a water supply intake or within one-half mile and draining to the normal pool elevation of water supply reservoirs. Land use regulations affect discharge into the water source, land uses, densities, and landfills. The state's minimum requirements for WS-IV drainage basins are summarized as follows:

1. Lands within 5 miles of the full pool elevations of reservoirs are classified as WS-IV.
2. Critical areas include the following restrictions:
    a. Under the low density option, a 30-foot vegetative buffer is required from the banks of all perennial streams or other waters.
    b. In areas where new development exceeds the low density requirements, a 100-foot buffer is required.
    c. A maximum density of one dwelling unit per one-half acre and 24% built-upon area is permitted.
    d. No new landfills are allowed.
3. In the remainder of the WS-IV drainage basin:
    a. In areas where curbs and gutters are used, a maximum density of one dwelling unit per one-half acre and 24% built-upon area is permitted.

   b. In areas without a curb and gutter street system a maximum density of one dwelling unit per one-third acre and 36% built-upon area is permitted.
4. The density requirements in the WS-IV drainage basin apply only to developments requiring a Sediment Control Plan (i.e., one or more acres of land disturbing activity).

Local governments are required to adopt and administer water supply protection requirements, drainage basin management procedures, and density and built-upon area regulations using the minimum requirements established by the state described above. Four of the five counties surrounding the Yadkin Project reservoirs (Davie, Montgomery, Rowan, and Stanly) have adopted drainage basin protection ordinances that accept the state-recommended requirements for WS-IV and Critical Areas, as outlined above. The fifth county, Davidson, has adopted a more stringent drainage basin protection ordinance for WS-IV areas that requires a minimum vegetative buffer width of 50 feet along the banks of all perennial streams or other waters for low density development.

The WS-V zones in the Abbotts Creek arm and upper portion of High Rock Reservoir are so designated because they are upstream of and draining to Class WS-IV waters. Class WS-V waters have no categorical restrictions on watershed development or wastewater discharges but management requirements may be applied as deemed necessary for the protection of downstream Class WS-IV waters.

The appropriate water quality standards applicable to Class C waters also apply to Class B, WS-IV, and WS-V waters. A partial list of the numeric water quality standards that apply to these classifications is presented in Table E.2-6.

Table E.2-6: Partial List of North Carolina Water Quality Standards that Apply to the Yadkin Project Reservoirs

Parameter	Class C Waters	Class B Waters	Water Supply (WS) Waters
Chlorophyll *a*	<40 µg/l	<40 µg/l	<40 µg/l
Dissolved Oxygen	>5.0 mg/l daily average >4.0 mg/l instantaneous	>5.0 mg/l daily average >4.0 mg/l instantaneous	>5.0 mg/l daily average >4.0 mg/l instantaneous
pH	6.0 to 9.0	6.0 to 9.0	6.0 to 9.0
Temperature	<32ºC and < 2.8 ºC above natural temperature	<32ºC and < 2.8 ºC above natural temperature	<32ºC and < 2.8 ºC above natural temperature
Turbidity	<25 NTU	<25 NTU	<25 NTU
Cadmium	<2.0 µg/l	<2.0 µg/l	<2.0 µg/l
Cyanide	<5.0 µg/l	<5.0 µg/l	<5.0 µg/l
Lead	<25 µg/l	<25 µg/l	<25 µg/l
Mercury	<0.012 µg/l	<0.012 µg/l	<0.012 µg/l
Copper	7 µg/l Action Level	7 µg/l Action Level	7 µg/l Action Level
Total Dissolved Solids			<500 mg/l
Nitrate Nitrogen			<10.0 mg/l
Fecal Coliform	Geometric mean <200/100ml (MF count) based on at least five consecutive samples examined during any 30 day period or <400/100ml in more than 20 percent of the samples examined during such period; violations of the fecal coliform standard are expected during rainfall events and, in some cases, this violation is expected to be caused by uncontrollable nonpoint source pollution	Geometric mean <200/100 ml (MF count) based on at least five consecutive samples examined during any 30-day period or <exceed 400/100 ml in more than 20 percent of the samples examined during such period	Geometric mean <200/100ml (MF count) based on at least five consecutive samples examined during any 30 day period or <400/100ml in more than 20 percent of the samples examined during such period; violations of the fecal coliform standard are expected during rainfall events and, in some cases, this violation is expected to be caused by uncontrollable nonpoint source pollution

E.2.3.2.1 TMDL Process and Water Quality Data Review for High Rock Reservoir

Section 303(d) of the federal Clean Water Act (CWA) enacted in 1972 requires states, territories and authorized tribes to identify waters not in compliance with water quality standards and develop a list of impaired waters. NCDWQ has listed portions of High Rock Reservoir on its 303(d) list of impaired waters in the state of North Carolina. High Rock Reservoir appears on the 2004 North Carolina 303(d) list for turbidity, dissolved oxygen and chlorophyll *a* violations in the upper reservoir; turbidity in the lower reservoir; and turbidity and dissolved oxygen violations in the Abbotts Creek Arm.

As required under Section 303(d), NCDWQ is required to develop TMDLs for the pollutants causing impairment in those waterbodies on the 303(d) list (NCDENR, 2004). A TMDL specifies the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and allocates pollutant loadings among point and nonpoint pollutant sources. NCDWQ has initiated a TMDL process to address High Rock Reservoir, but the completion of the process by NCDWQ for High Rock Reservoir is not anticipated until around 2012. APGI expects to be an active participant in the High Rock TMDL process.

As a first step in the TMDL process, NCDWQ's contractor (Tetra Tech) reviewed existing water quality data. Tetra Tech's review of the data found water quality conditions consistent with APGI's monitoring study. In general, the Tetra Tech review found nutrient enrichment in High Rock Reservoir with elevated chlorophyll *a* in the arms and elevated turbidity in the upper portion of the reservoir. Tetra Tech's review concluded that the source of water quality problems in High Rock Reservoir is from upstream loadings of solids and nutrients, and the resulting growth of algae in the reservoir. The review further suggested that the algal response in High Rock Reservoir is controlled primarily by light availability and flushing, with a diminished response to nutrients (Tetra Tech, 2004).

E.2.4 Minimum Flow Releases

In the current FERC license, there are no minimum flow requirements for the Yadkin Project. However, there is a FERC-approved headwater benefits agreement between APGI and Progress Energy under which APGI provides a weekly average minimum flow from the Project of 1500 cfs March 1 through May 15, 1610 cfs May 15 through July 1, and 1400 cfs July 1 through September 15.

As outlined in Exhibit B, APGI is proposing to operate the Yadkin Project with a year round weekly average minimum flow of 900 cfs from the Falls Development. This flow represents 60% of a target flow at the Rockingham USGS gage of 1500 cfs and is appropriate, since the drainage area upstream of Falls Dam represents approximately 60% of the total drainage area above the USGS gage at Rockingham. The target flow of 1500 cfs at Rockingham is close to the estimated unregulated 7Q10 at Rockingham of 1716 cfs.[1]

E.2.4.1 Rate of Flow in cfs and Duration

APGI has used the OASIS model to simulate the change in flow and flow duration that would be expected to result from its proposed operation of the Project, with a 900 cfs weekly average minimum flow requirement at Falls. This simulation assumed that the reservoirs would be operated in accordance with the revised operating guides also being proposed by APGI. The

[1] The USGS (email from J. Weaver, 8/25/03) has estimated that the "natural flow" 7Q10 at Rockingham is probably in the range of 0.2 to 0.3 cfs per square mile of drainage area. Using the mean value of 0.25 cfs per square mile, the estimated 7Q10 at Rockingham is 1716 cfs.

simulated daily discharge from Falls for the period 1930-2003 is shown in annual and monthly flow duration curves provided in Figures E-5a – E-5l.

As shown, implementation of APGI's proposed minimum flow, in combination with the proposed operating guides for the four Project reservoirs (see Exhibit B) will produce little change in the average daily flow duration curve at Falls. Under APGI's proposal, weekly average flows during the summer will often exceed inflow to the Project, resulting in a higher downstream river flow than would be expected under unregulated conditions.

Figure E-5a

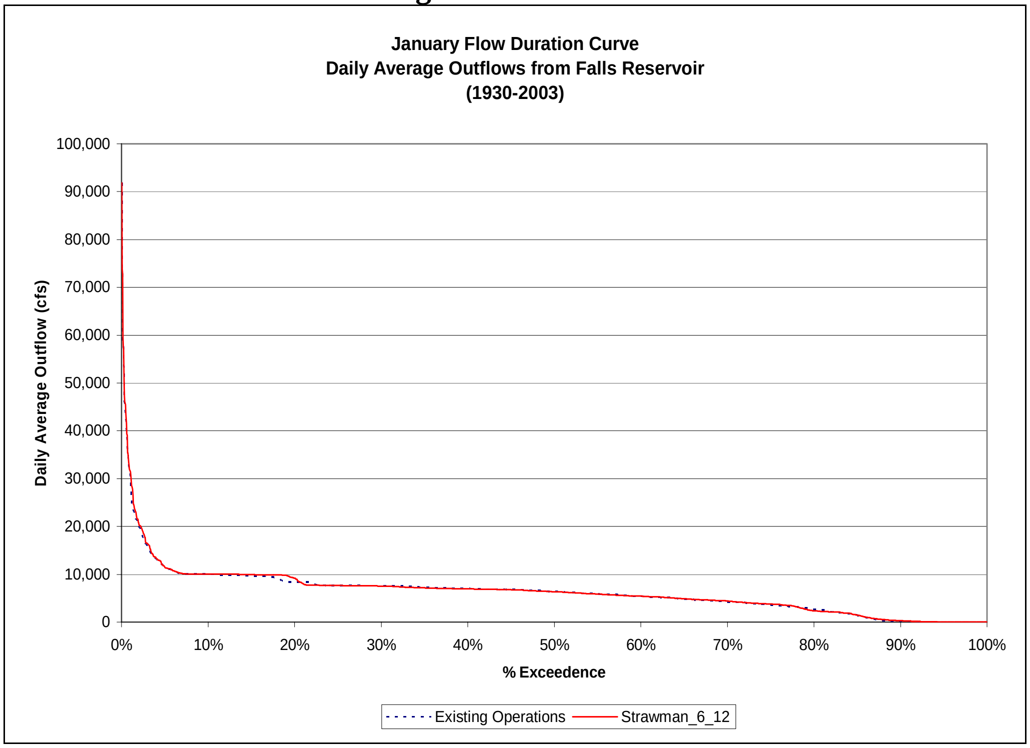


Figure E-5b

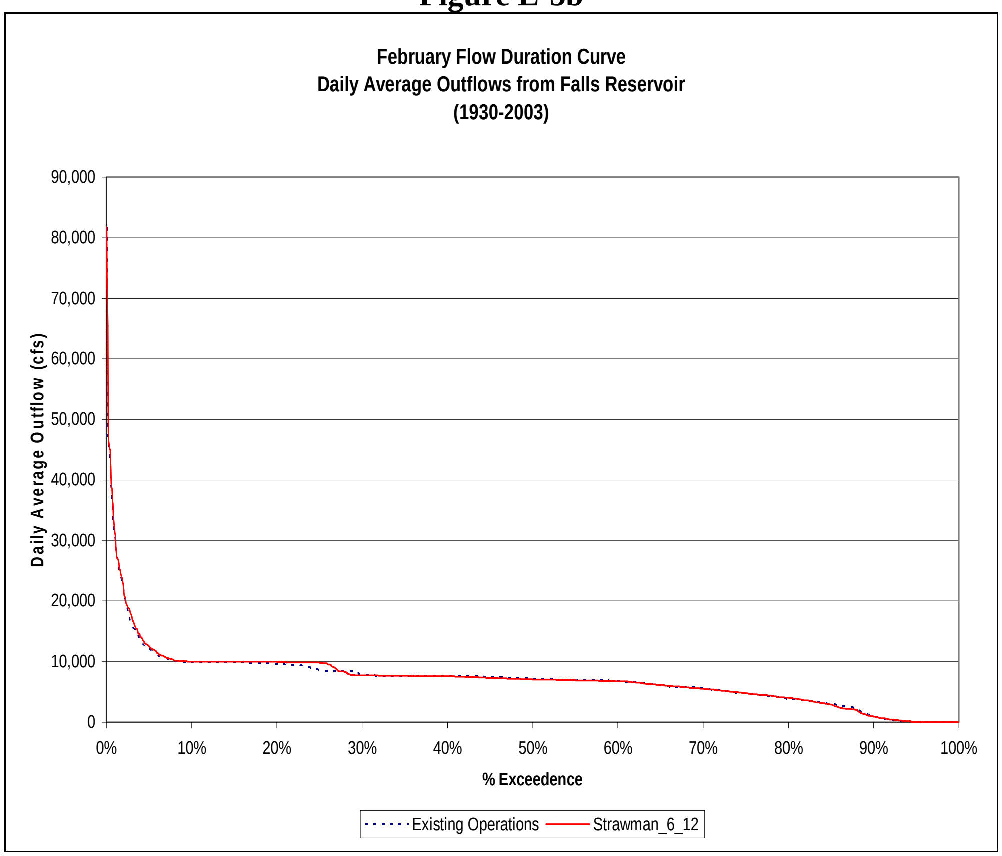


Figure E-5c

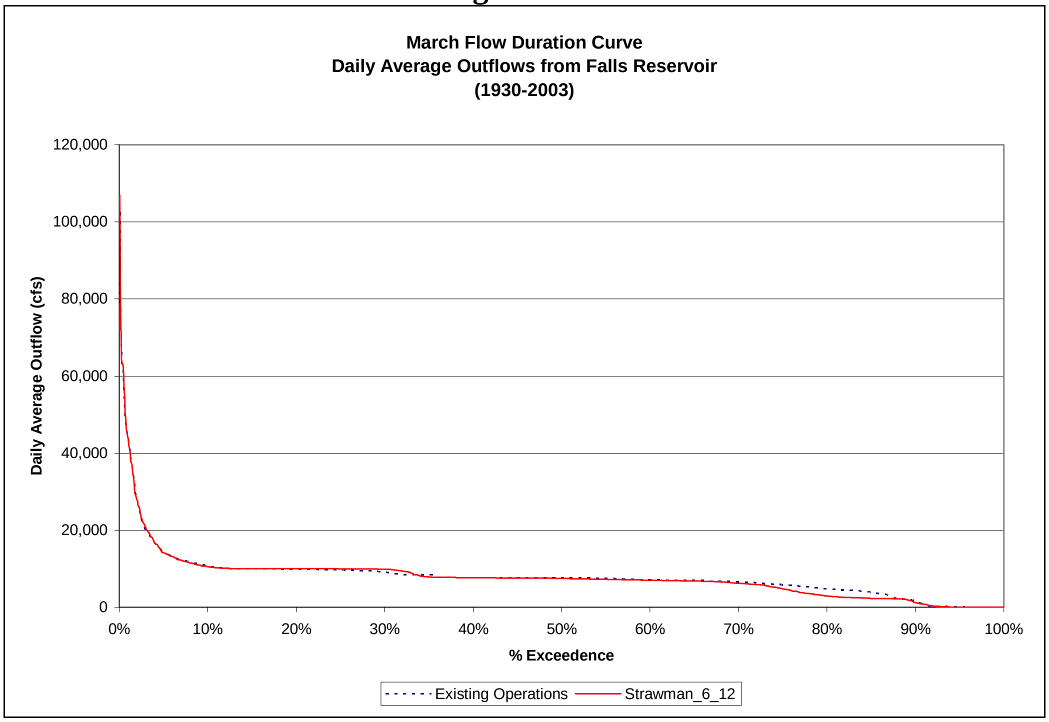


Figure E-5d

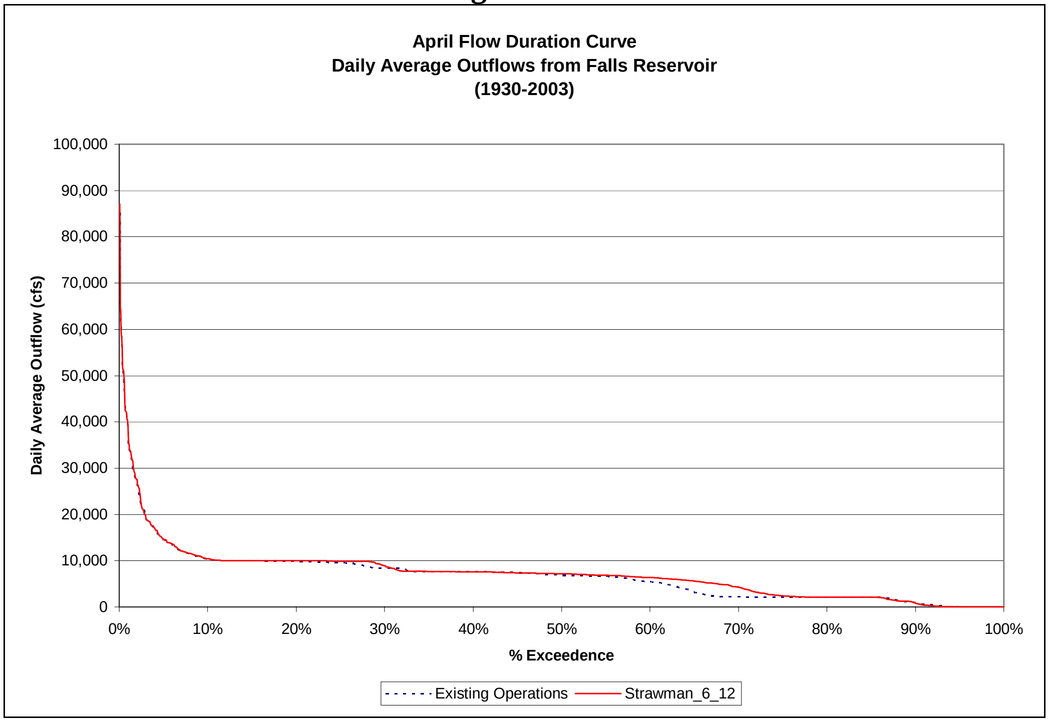


Figure E-5e

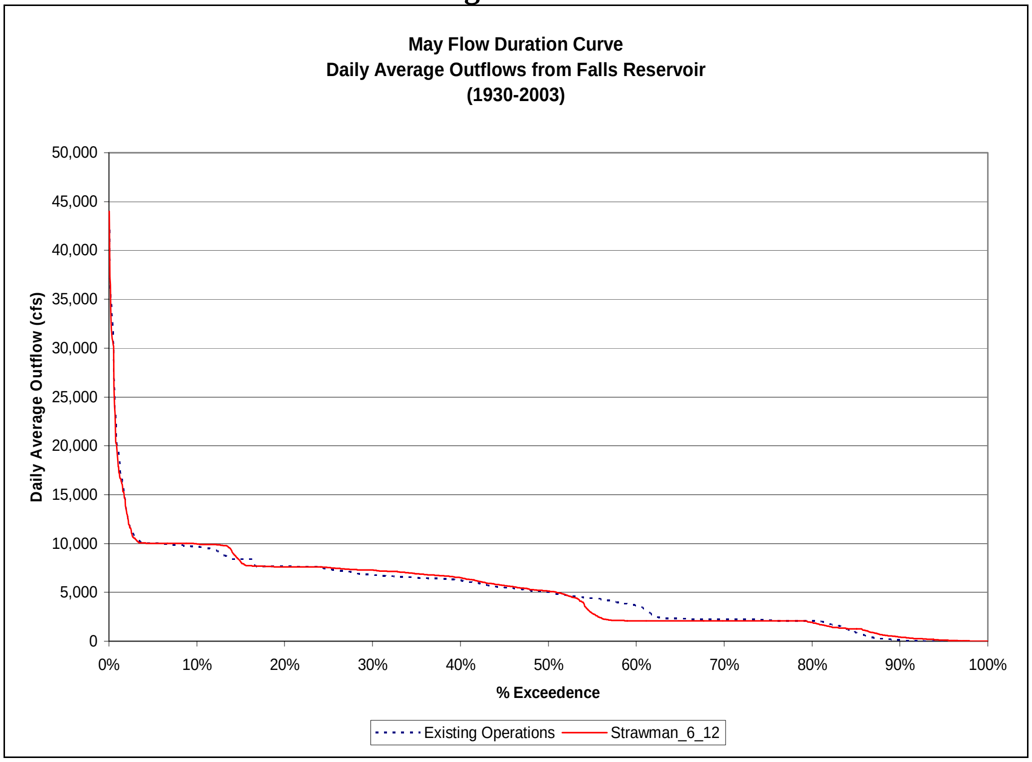


Figure E-5f

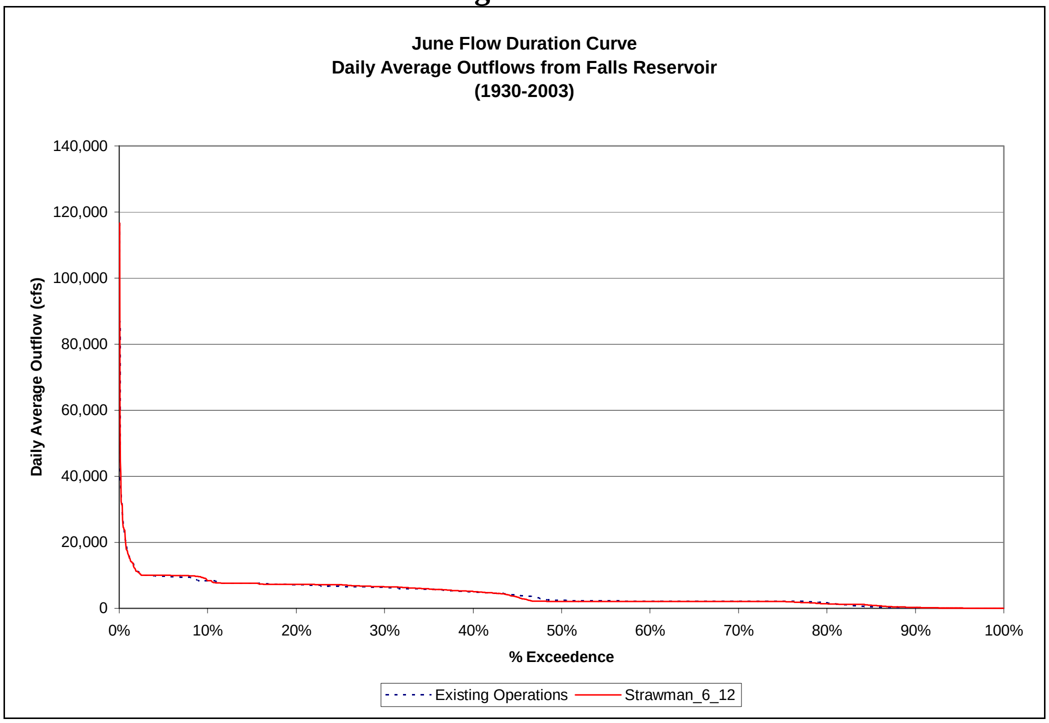


Figure E-5g

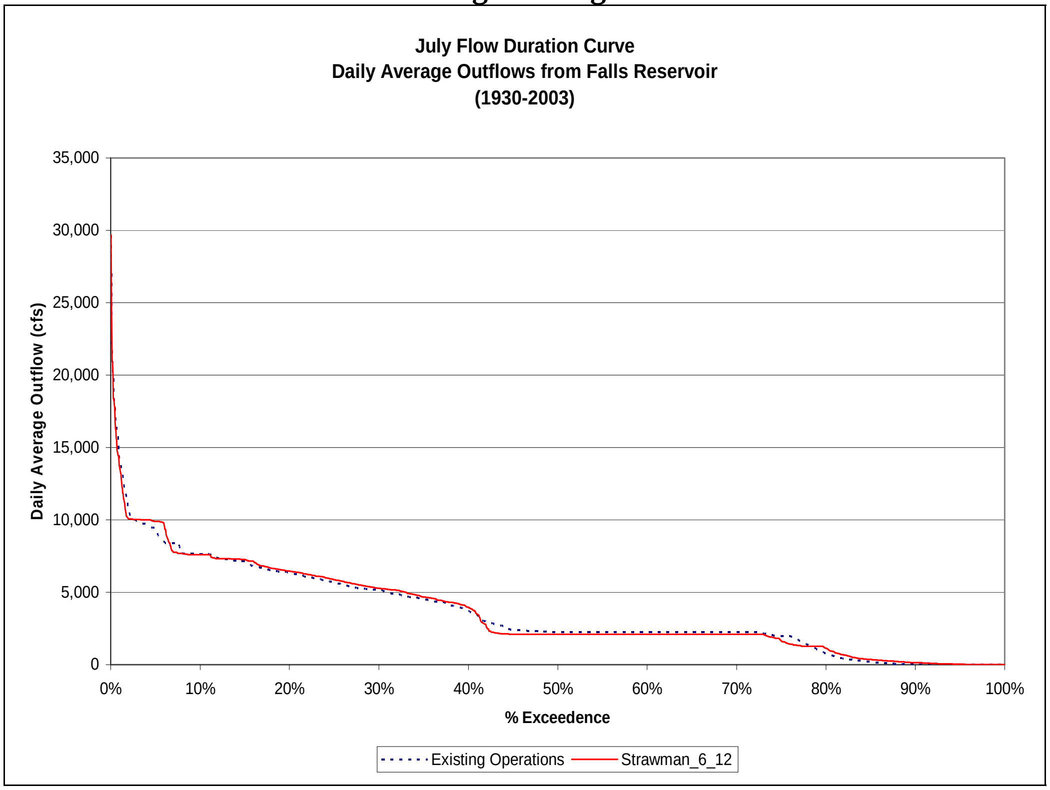


Figure E-5h

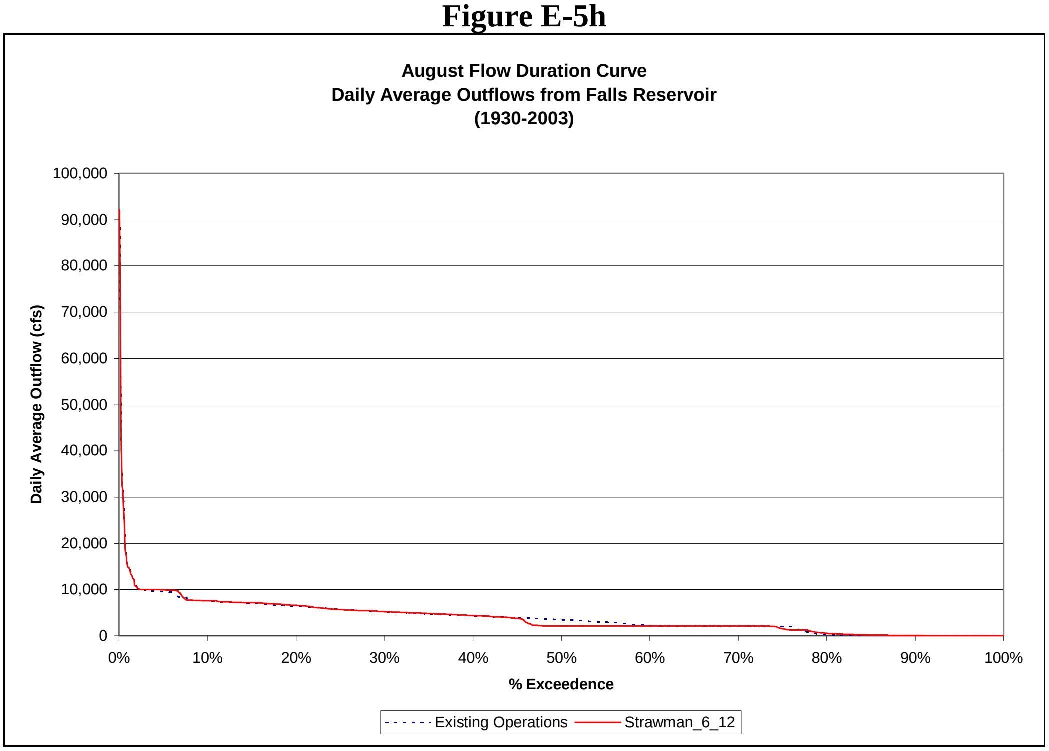


Figure E-5i

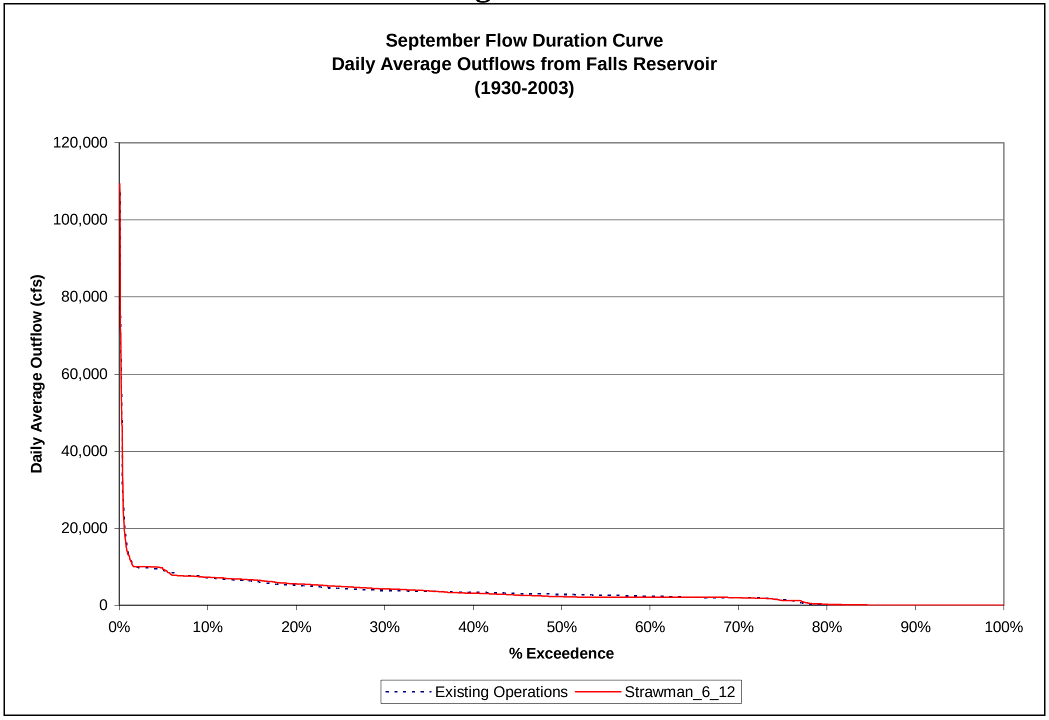


Figure E-5j

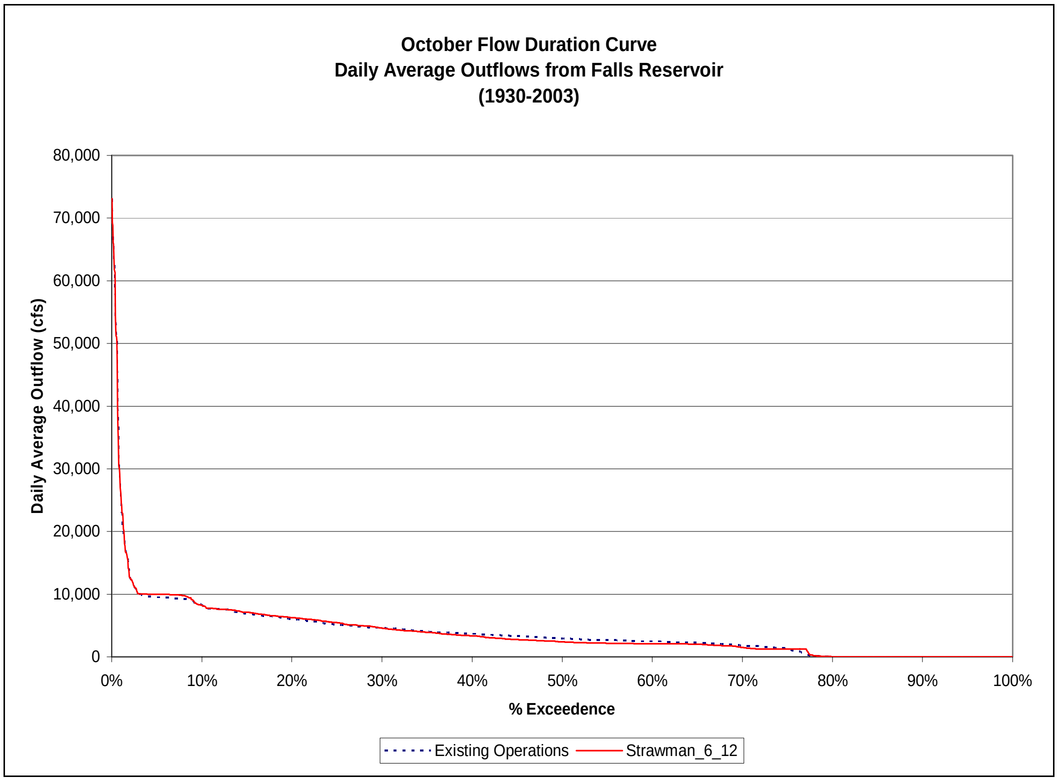


Figure E-5k

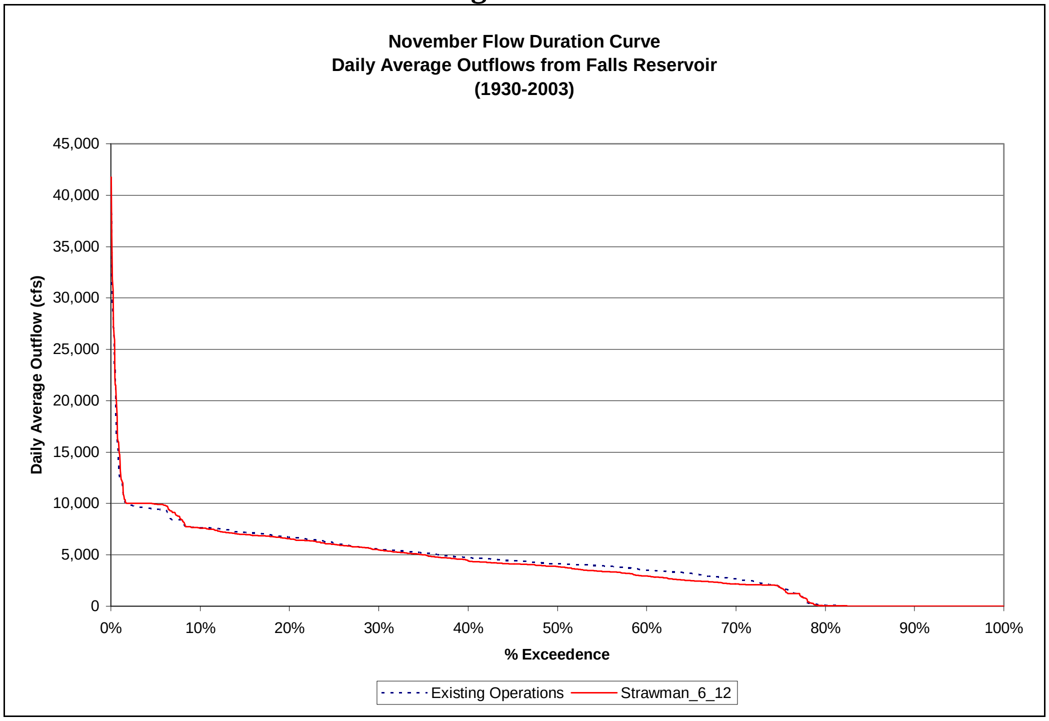
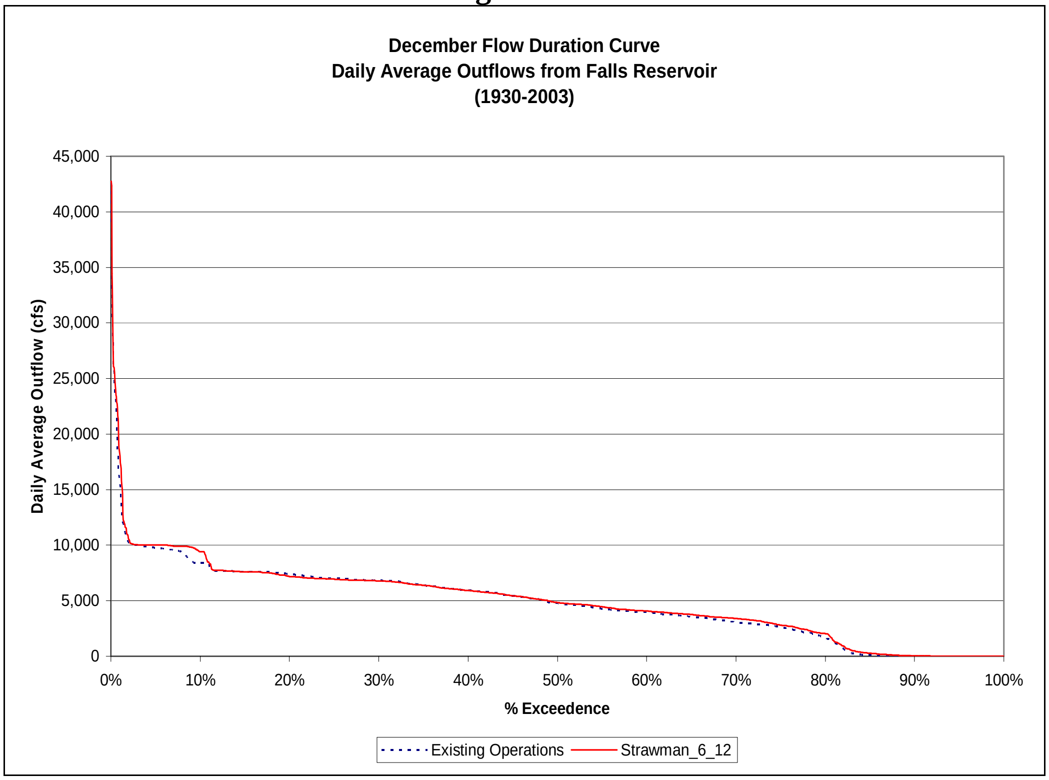


Figure E-5l



E.2.5 Changes in Project Operation or Works Recommended by the Agencies to Protect or Improve Water Quality

During initial consultation, several agencies and organizations provided comments concerning Project water quality and the effects of Project operations on water quality. At that time there were no specific recommendations made regarding Project operations or works to protect or improve water quality. However, there were several recommendations for water quality studies to be conducted by APGI. In response to those requests, APGI conducted two studies designed to address water quality issues:

1. Yadkin Project Water Quality Monitoring Study
2. Sediment Fate and Transport Study

The resulting final study reports for both of these studies are provided in Appendices E-1 and E-2 respectively and were summarized earlier in this section.

Prior to the issuance of this draft application, there were no formal recommendations from agencies regarding measures to be taken to address water quality at the Project. However, the NCDWQ has noted its concern with two aspects of Project water quality: 1) the non-compliance of High Rock Reservoir with water quality standards for turbidity and chlorophyll *a* (and its subsequent listing of portions of the reservoir under Section 303(d)), and 2) below standards dissolved oxygen concentrations that occur frequently in each of the four Project tailraces during periods of warm water temperature and low river flows.

Regarding High Rock Reservoir, portions of the reservoir appear on the 2004 North Carolina 303(d) list for turbidity, dissolved oxygen (DO) and chlorophyll *a* violations (upper reservoir); turbidity (lower reservoir); and turbidity and DO violations (Abbotts Creek Arm). Since the turbidity and eutrophication problems currently being experienced in High Rock Reservoir are a direct result of pollutant loadings from upstream sources, NCDWQ has initiated a TMDL process to address this issue. Understanding that the operation of the reservoir as a hydropower project may have some impact on reservoir water quality, NCDWQ has recommended that APGI be an active participant in the High Rock Reservoir TMDL process. Accordingly, APGI is participating in the TMDL process and expects to be an active participant throughout the multi-year process.

Regarding tailwater dissolved oxygen conditions, NCDWQ and EPA have recommended that APGI undertake a program to improve tailwater dissolved oxygen conditions. Specifically, NCDWQ has requested that APGI develop a schedule for installing and operating aeration technology at each of the Project developments designed to increase tailwater dissolved oxygen concentrations to the required standards (4.0 mg/l instantaneous, 5.0 mg/l average). NCDWQ has further recommended that APGI initiate a dissolved oxygen monitoring program, that will allow APGI and NCDWQ to assess changes to tailwater dissolved oxygen concentrations that are anticipated to occur as aeration technology is installed and brought on-line at each development.

Agencies have made no specific recommendations regarding minimum flows needed at the Yadkin Project specifically to address water quality concerns or issues. The need for minimum flows for the protection and enhancement of aquatic habitat both at the Project and in the river downstream of the Project have been discussed extensively throughout the consultation and study processes. As a result, APGI is proposing a new minimum flow regime for the Yadkin Project (outlined below). It is anticipated that the proposed minimum flow regime may provide some water quality benefits, particularly during periods of extreme low inflow and drought.

E.2.6 Existing Measures to be Continued

APGI proposes to continue to operate the Yadkin Project, with certain enhancements designed to improve Project water quality. In 2001, Narrows Unit 4 was refurbished and upgraded by APGI. At that time, aeration valves were installed on the Unit 4 draft tube cone. Opening these valves when Unit 4 is operating has been shown to significantly increase tailwater dissolved oxygen concentrations (see Section E.2.3.1.1). In a series of investigations done by APGI, it was demonstrated that the aeration valves at Unit 4 were capable of adding approximately 2 mg/l of dissolved oxygen to the water being released from Unit 4, when both valves were open (NAI, 2005g Appendix E-1). Since 2001, APGI's standard operating procedure for Narrows Unit 4 has been to operate the unit with the aeration valves open from May 1 through November 30 each year, and to generally use Unit 4 on a "first on-last off" basis, when practicable.

APGI proposes to continue to operate Narrows Unit 4 with both aeration valves open between May 1 and November 30 of each year to enhance tailwater dissolved oxygen conditions. Moreover, until such time as similar aeration valves are installed on the other generating units at Narrows, APGI will continue, as practicable, to endeavor to use Unit 4 on a "first on-last off" basis, so as to maximize the dissolved oxygen benefit in the tailwater area.

Since 2001, APGI has been operating continuous dissolved oxygen and temperature monitors in the Narrows and Falls tailrace areas from May 1 through November 30 of each year. The monitors were located so as to provide a representative sample of dissolved oxygen conditions throughout both tailwaters. To confirm the representativeness of the current monitor location, APGI conducted several field surveys designed to examine the lateral and longitudinal change in tailwater dissolved oxygen conditions, and to determine if the continuous monitor locations were indicative of overall tailwater conditions (NAI, 2005g Appendix E-1). Results of these studies demonstrated that both monitors are located in areas of the tailwater that are generally representative of overall tailwater conditions.

Beginning in 2003, continuous tailwater dissolved oxygen and temperature monitors were added to the Tuckertown and High Rock tailwaters, as well. The representativeness of these monitor locations within the tailwaters was also evaluated through field investigations carried out by APGI (NAI, 2005g Appendix E-1).

APGI proposes to continue to operate the continuous dissolved oxygen and temperature monitors in each of the four Project tailwaters between May 1 and November 30 of each year. Monitors will be installed, operated and maintained according to the manufacturer's specifications and following NCDWQ protocols. Resulting dissolved oxygen and temperature data will be recorded and periodically reported to NCDWQ.

E.2.7 New Measures Proposed by the Applicant to Protect or Improve Water Quality

APGI proposes to undertake a series of Project modifications designed to increase DO concentrations and enhance water quality in the four Project tailwaters. The fundamental concept of APGI's proposed DO enhancement program will be to first increase DO concentrations below Narrows and High Rock dams, and then to monitor to see what DO enhancement might still be needed at Tuckertown and Falls dams.

Over the term of the new license, APGI plans to undertake certain refurbishments and upgrades to the generating units at the four Yadkin Project developments (see Exhibit B for details). Unit refurbishment/upgrade provides APGI with an opportunity to install aeration technology at the dams in a cost effective manner. Therefore, APGI proposes to install appropriate aeration technology at Narrows and High Rock in accordance with its unit refurbishment/upgrade schedule to be proposed in its application for a new FERC license and companion 401 Water Quality Certification application.

Conceptually, APGI is proposing to refurbish/upgrade Narrows units 1and 3 and High Rock units 1, 2 and 3 between 2008 and 2012.[1] At the time of this work, appropriate aeration technology will be added to each unit. At Narrows, APGI anticipates the most appropriate and cost-effective technology will be the installation of aeration valves on the draft tube cones (similar to those already installed on Unit 4). At High Rock, APGI anticipates that the best aeration technology will be the installation of new aerating turbines, with "through-the-runner" aeration capability.

APGI is committed to improving tailwater water quality. Technologies to increase tailwater DO conditions are available, but such technologies are expensive to install and operate, and do result in a loss in the efficiency of the generating units, and therefore a loss in power generation. Also, to be effective, aeration technologies have to be designed and installed specific to the dam, powerhouse, penstock, turbine and tailwater conditions that are unique to each development. In other words, to be effective, each development will likely require a different type of aeration technology. The best time to do such installations is in conjunction with other facility sustainability work being planned for the various developments and units. APGI's plan to refurbish and upgrade the generating units at its four developments over several years represents a prime opportunity to most cost effectively install aeration technology, as needed, at the Project.

APGI proposes to operate the Yadkin Project with a year round, weekly average minimum flow of 900 cfs, as measured at the Falls development. This flow represents 60% of a target flow at the Rockingham USGS gage of 1500 cfs and is appropriate, since the drainage area upstream of Falls Dam represents approximately 60% of the total drainage area above the USGS gage at

[1] Refurbishment and upgrade of Narrows unit 2, including the installation of draft tube cone aeration valves, is expected to be completed under the existing Project license.

Rockingham. There may be times of extreme low instream flow (e.g., drought) when APGI will have to alter its operation of the Project in accordance with a "Low Instream Flow Protocol" in order to balance reservoir elevations and downstream flows. APGI's proposed Low Instream Flow Protocol is discussed in detail in Section B.6.6.3.

APGI is proposing to operate the four Project reservoirs in accordance with a new set of operating guides as outlined in Table E.2-7.

Table E.2-7: Summary of Proposed Operating Guides

Reservoir	Proposed Operating Guide
High Rock	High Rock will be operated in accordance with a revised Guide Curve (see Exhibit B, Figure B-2) that features three basic guides: a Soft Guide (green line), a Hard Guide (red line), and a Recreation Season Guide (blue line and orange colored section). During normal operations, APGI will maintain the reservoir elevation at or above the "Soft Guide" elevation (green line and green section of Figure B-2). Generation is not restricted for normal operations. If at any time the water level at High Rock falls below the Soft Guide Curve Elevation and above the Hard Guide Curve Elevation, (yellow section) APGI will reduce its generation and water releases from High Rock to the flow equivalent of no more than 1,500 cfs weekly average discharge until such time that the High Rock reservoir level returns to or above the Soft Guide Curve (green section). Operation in this range is expected to occur infrequently, and would be caused by conditions such as: actual inflows not meeting projected inflows, human error, equipment malfunction or failure, drought periods, or electrical system emergency (i.e. transmission bottlenecks, real and reactive power support, load following support, etc.). The reservoir would not be drawn down below the Hard Guide (within 6 feet of full April 1 through October 31 and within 12 feet of full November 1 through March 31 – red line and red section) except as needed to meet required downstream minimum flows or as outlined in the proposed Low Instream Flow Protocol, or in cases of electrical system emergency. During the period April 15 through September 15, APGI will operate High Rock in accordance with the "Recreation Season Guide Curve". If at any time during the recreation season the water level of High Rock Reservoir falls below that Recreation Season Guide Curve (orange section), APGI will reduce its generation and water releases from the Project to the flow equivalent of no more than 1500 cfs weekly average discharge, until such time that the High Rock reservoir level returns to or above the Recreation Season Guide Curve (green section).
Tuckertown	Tuckertown Reservoir will be operated as it has in the past, with drawdown limited to 3 feet below normal full pond (not below elevation 561.7 feet).
Narrows	Narrows Reservoir will be operated as it has in the past, typically maintaining reservoir water levels within 3 feet of full with the ability to go to 6.6 feet below normal full pond (not below elevation 503.2 feet), as needed in order to maintain the Project minimum flow discussed above, or as provided under a proposed "Low Instream Flow Protocol", or in cases of emergency.
Falls	Falls Reservoir will be operated as it has in the past, with typical reservoir fluctuations of 4 feet or less.

E.2.8 Explanation of Why the Applicant Has Rejected Any Measures Recommended by an Agency

APGI has not specifically rejected any measures thus far recommended by an agency.

E.2.9 Impact on Water Quality of Continued Project Operation

Continued operation of the Project as proposed by APGI will significantly enhance Project water quality. Installation of aeration technology at the Narrows and High Rock developments will provide significant improvement in High Rock and Narrows tailwater dissolved oxygen conditions over the existing conditions. As aeration technology is added to Narrows and High Rock, it is also anticipated that there will be some improvement in downstream reservoir water quality and improvements in dissolved oxygen conditions in the Tuckertown and Falls tailwaters, as well. After aeration technology has been added to all the units at High Rock and Narrows, if monitoring demonstrates that dissolved oxygen concentrations below Falls and Tuckertown are still below state water quality standards, then aeration technology may be added, as needed, at these other developments as well.

APGI is proposing to operate High Rock Reservoir in accordance with revised operating guides. The proposed operating guides will reduce the winter drawdown of the reservoir from the current average of 12-15 feet, to a maximum of 12 feet, and in general produce a somewhat narrower band of elevations within which the reservoir will fluctuate over the year. Operation of High Rock in this manner should have no impact on reservoir or Project water quality. Operation of Tuckertown, Narrows and Falls reservoirs similar to how they have been operated in the past will have no impact on Project water quality.

In addition, APGI is planning to participate in North Carolina's TMDL process for High Rock Reservoir. When completed, the TMDL process would be expected to result in changes in pollutant inputs to High Rock Reservoir and a long term improvement in reservoir water quality.

The other three reservoirs currently meet state water quality standards, and continued operation of the Project as proposed would ensure that the Tuckertown, Narrows and Falls reservoirs continue to meet water quality standards.

E.2.10 Consultation Record

The following table summarizes the consultation record related to water resources at the Yadkin Project. A complete record of all consultation regarding the relicensing of the Yadkin Project will be provided in an Appendix to the Final License Application.

Table E.2-8: Summary of Consultation Record Related to Water Resources

Agency/Party	Date	To	Description
North Carolina Division of Water Resources, Steve Reed	January 9, 2003	APGI	Letter re: first stage consultation comments
High Rock Lake Association, Larry Jones	January 9, 2003	APGI	Letter re: Yadkin Project ICD comments
North Carolina Watershed Coalition, Scott Jackson	January 9, 2003	APGI	Initial relicensing comments
U. S. Forest Service, John Ramey	January 10, 2003	APGI	Letter re: Yadkin Project ICD comments
City of Salisbury, North Carolina, David Treme	January 10, 2003	APGI	Letter re: initial relicensing comments and request for studies
U.S. Fish and Wildlife Service, Garland Pardue,	January 10, 2003	APGI	Letter re: Yadkin Project ICD comments and study requests
North Carolina Wildlife Resources Commission, Chris Goudreau	January 12, 2003	APGI	Letter re: first stage consultation comments and "Hydropower Relicensing Issues, Standards, and Mitigation"
South Carolina Coastal Conservation League and American Rivers, Gerrit Jobsis and David Sligh,	January 12, 2003	APGI	Letter re: Yadkin Project ICD comments
APGI, Jody Cason	March 13, 2003	WQ IAG	Final summary for March 13, 2003 Water Quality IAG meeting
Land Trust, Andy Abramson	March 18, 2003	APGI	Request to study utility of forested riparian buffers at the Project
SC Coastal Conservation League and American Rivers	May 20, 2003	WQ IAG	Comments on Water Quality Monitoring Draft Study Plan
APGI, Jody Cason	May 20, 2003	WQ IAG	Final summary for May 20, 2003 Water Quality IAG meeting
High Rock Lake Association, Larry Jones	June 4, 2003	WQ IAG	Comments on Water Quality Monitoring Draft Study Plan and May 20, 2003 summary
City of Salisbury, David Treme	June 17, 2003	APGI	Requests for appropriate monitoring and studies
APGI, Jody Cason	September 6, 2003	WQ IAG	Distribution of Water Quality Monitoring Final Study Plan and Sediment Fate and Transport Study
APGI, Jody Cason	October 7, 2003	WQ IAG and F&A IAG	Final summary for October 7, 2003 joint meeting between Water Quality IAG and Fish and Aquatics IAG
APGI, Jody Cason	February 3, 2004	WQ IAG and F&A IAG	Final summary for February 3, 2004 joint meeting between Water Quality IAG and Fish and Aquatics IAG
APGI, Jody Cason	April 22, 2004	WQ IAG	Agenda for May 4, 2004 Water Quality IAG meeting

Table E.2-8: Summary of Consultation Record Related to Water Resources (continued)

Agency/Party	Date	To	Description
NC Division of Water Quality, John Dorney	May 3, 2004	WQ IAG	401 Water Quality Certification Issues: A Summary
APGI, Jody Cason	July 27, 2004	WQ IAG	Draft Study Plan that outlines additional tailwater dissolved oxygen investigations
U. S. Fish and Wildlife Service, John Ellis	July 28, 2004	APGI	Request for additional information in order to comment on draft study plan for tailwater dissolved oxygen investigations
High Rock Lake Association, Larry Jones	August 3, 2004	APGI and WQ IAG	Comments on the proposed study plan for additional air injection studies at High Rock and Narrows dams
High Rock Lake Business Owners Group, Mark Oden	August 3, 2004	APGI	Comments on the proposed tailwater DO testing draft study plan
NC Wildlife Resources Commission	August 10, 2004	APGI	Comments on the proposed tailwater DO testing draft study plan
APGI, Jody Cason	September 2, 2004	WQ IAG	Final meeting summary for May 4, 2004 Water Quality IAG meeting
APGI, Jody Cason	September 2, 2004	WQ IAG	Final Tailwater Dissolved Oxygen Testing Study Plan
Jody Cason, Long View Associates	October 8, 2004	WQ IAG	Update on the status of ongoing water quality monitoring and studies at the Yadkin Project
APGI, Jody Cason	December 10, 2004	WQ IAG	Distribution of Sediment Fate and Transport Draft Study Report
APGI, Jody Cason	December 12, 2004	WQ IAG	Email informing IAG of the distribution of the Sediment Fate and Transport Draft Study Report on CD
High Rock Lake Association, Larry Jones	December 15, 2004	WQ IAG	Comments on the Sediment Fate and Transport Study Draft Report
City of Salisbury	January 6, 2005	APGI	Comments on the Sediment Fate and Transport Study Draft Report
City of Salisbury (Hazen and Sawyer), Don Cordell	March 17, 2005	City of Salisbury	Comments on the Sediment Fate and Transport Study Draft Report
APGI, Jody Cason	March 21, 2005	WQ IAG	Draft agenda for the April 6, 2005 Water Quality IAG Meeting
APGI, Gene Ellis	March 21, 2005	WQ IAG	Distribution of Water Quality Study Draft Study Report
NC Division of Water Quality	May 11, 2005	APGI	Comments on WQ IAG draft study reports
U. S. Environmental Protection Agency, Ben West	May 11, 2005	APGI	Comments on WQ IAG draft study reports

Table E.2-8: Summary of Consultation Record Related to Water Resources (continued)

Agency/Party	Date	To	Description
APGI, Jody Cason	June 20, 2005	WQ IAG	Final summary of April 6, 2005 Water Quality IAG Meeting
APGI, Gene Ellis	August 16, 2005	WQ IAG	Distribution of Water Quality Study Final Study Report

Notes: APGI - Alcoa Power Generating Inc.
IAG - Issue Advisory Group
WQ IAG - Water Quality Issue Advisory Group
F&A IAG – Fish and Aquatics Issue Advisory Group

E.3 Fish, Wildlife, and Botanical Resources

E.3.1 Fish and Aquatic Resources

E.3.1.1 Existing Fish and Aquatic Community

E.3.1.1.1 Resident Fish

The Yadkin Project reservoirs and tailwaters support a high quality warmwater resident fishery. Prior to initiating the relicensing process, APGI conducted a baseline fish assessment of the four Project reservoirs to obtain an overview of the composition of the reservoir fish community. This early sampling was supplemented during the relicensing study process by several additional studies designed to examine in more detail the tailwater aquatic communities and the location and extent of high quality aquatic habitats within the reservoirs. The results of these evaluations as they pertain to the resident fish community are summarized in the following section and are reported on in detail in the study reports found in Appendices E-3, E-4 and E-5.

As part of APGI's studies of reservoir aquatic habitat and fish, data drawn from several recent fish surveys including reservoir fisheries studies conducted by APGI in 2000, and 2003-2004, as well as recent fish sampling done by the North Carolina Wildlife Resources Commission (NCWRC) were compiled and evaluated to provide an overview of the current status of resident fish species at the Project. Table E.3-1 summarizes the species collected through the various survey efforts in each of the four Project reservoirs.

All four of the Project reservoirs are managed by the NCWRC as warmwater sport fisheries. High Rock Reservoir has a renowned sport fishery for largemouth bass, as well as black and white crappie, striped bass, and several species of catfish. Narrows Reservoir also supports a sport fishery for largemouth bass and black and white crappie, but is also known for it large catfish, especially blue catfish. Tuckertown Reservoir has size and creel limits for largemouth bass and black crappie. Fishing is very popular on the Yadkin Project reservoirs, and the reservoirs, particularly High Rock, often host bass fishing tournaments.

Table E.3-1: Fish Species Found in Each of the Four Yadkin Project Reservoirs

Scientific Name	Common Name	High Rock	Tuckertown	Narrows	Falls
Alosa aestivalis	Blueback Herring		C	B,C	B,C
Alosa pseudoharengus	Alewife		B		
Ameiurus melas	Black bullhead	A	B		
Ameiurus nebulosus	Brown bullhead	A,B	A,B	A,B	
Amia calva	Bowfin	A,B			C
Aphredoderus sayanus	Pirate perch				
Carassius auratus	Goldfish	A,B	C	B	
Carpiodes cyprinus	Quillback	A,B	A,B,C	A,C	
Catostomus commersoni	White sucker	A		A	
Cyprinus carpio	Common carp	A,B	A,B,C	A,B,C	B,C
Cyprinella analostana	Satinfin shiner		B,C	C	C
Dorosoma cepedianum	Gizzard shad	A,B	A,B,C	A,B,C	B,C
Dorosoma petenense	Threadfin shad	A,B	A,B,C	A,B,C	B,C
Erimyzon oblongus	Creek chubsucker	A,B	A,B,C	A,B,C	
Esox americanus	Redfin pickerel			A	
Esox niger	Chain pickerel			A	
Etheostoma nigrum	Johnny Darter		B		
Etheostoma olmstedi	Tesselated darter		C		
Gambusia holbrooki	Eastern mosquitofish		B	A,B	B
Hybognathus regius	Eastern Silvery Minnow		C		
Ictalurus brunneus	Snail bullhead			B	C
Ictalurus catus	White catfish	A,B	A,B,C	A,B,C	B,C
Ictalurus furcatus	Blue catfish		B,C	B,C	B,C
Ictalurus natalis	Yellow bullhead			A,B	
Ictalurus platycephalus	Flat bullhead	A	B	B	C
Ictalurus punctatus	Channel catfish	A,B	A,B,C	A,B,C	B,C
Ictiobus bubalus	Smallmouth buffalo	A	C	A	B,C
Lepisosteus osseus	Longnose gar	A,B	B,C	A,B,C	C
Lepomis auritus	Redbreast sunfish	A,B	A,B,C	A,B,C	B,C
Lepomis cyanellus	Green sunfish	A,B	A,B,C	A,B,C	B,C
Lepomis gibbosus	Pumpkinseed	A,B	B,C	A,B,C	B
Lepomis gulosus	Warmouth	A,B	A,B,C	A,B,C	B,C
Lepomis macrochirus	Bluegill	A,B	A,B,C	A,B,C	B,C
Lepomis microlophus	Redear sunfish	A,B	A,B,C	A,B,C	B,C
Micropterus salmoides	Largemouth bass	A,B	A,B,C	A,B,C	B,C
Minytrema melanops	Spotted sucker	B			
Morone americana	White perch	A,B	A,B,C	A,B,C	B,C
Morone chrysops	White bass	A,B	A,B,C	A,B,C	C
Morone saxatilis	Striped bass	A,B	A,B,C	A,B,C	B,C
Moxostoma anisurum	Silver redhorse	A	B,C	A,C	C
Moxostoma macrolepidotum	Shorthead redhorse	B	B,C	A,B,C	B,C
Moxostoma pappillosum	V-lip redhorse	A	A	A	
Nocomis leptocephalus	Bluehead chub			B	
Notemigonus crysoleucas	Golden shiner	A,B	B	A,B,C	B,C
Notropis hudsonius	Spottail shiner		C		

Table E.3-1: Fish Species Found in Each of the Four Yadkin Project Reservoirs (continued)

Scientific Name	Common Name	High Rock	Tuckertown	Narrows	Falls
Perca flavescens	Yellow perch	A,B	A,B,C	A,B,C	B,C
Pomoxis annularis	White crappie	A,B	B,C	A,B,C	B,C
Pomoxis nigromaculatus	Black crappie	A,B	A,B,C	A,B,C	B,C
Pylodictis olivaris	Flathead catfish	A,B	A,B,C	B,C	B,C
Scartomyzon spp.	Brassy jumprock	A			
	Striped bass x White bass	B	B,C	B,C	
	Carp x Goldfish	B			
	Sunfish Hybrid			B	B

Notes:
A – Source: NCWRC Surveys (taken from Fisheries and Wildlife Management Plan for the Yadkin-Pee Dee River Basin (NCWRC, 2004))
B – Source: Carolina Power and Light 2000 Survey
C – Source: Normandeau Associates Inc. 2003/2004 Tailwater Surveys (NAI, 2005f Appendix E-4)

In a separate study, NAI inventoried and assessed the resident fish community in the Project tailwaters on a seasonal basis (spring, summer, and fall). To ensure that the greatest number of species was being collected, fish sampling was done using a variety of methods and gear types including electrofishing and gill nets. Fish were sampled in many tailwater locations including both shallow and deep water habitats. The complete list of fish species found in each of the development tailwaters is provided in Table E.3-2 below. In addition, at the request of the agencies, NAI searched for rare, threatened and endangered (RTE) fish species, including the Robust and Carolina Redhorse species, in the Project tailwaters during the spring and during the summer and fall fish surveys (NAI, 2005f Appendix E-4).

Table E.3-2: Summary of Fish Species Collected in the Four Yadkin Project Tailwaters

Common Name	Scientific Name	High Rock Tailwater	Tuckertown Tailwater	Narrows Tailwater	Falls Tailwater
Blueback Herring	*Alosa aestivalis*	X	X	X	X
Gizzard Shad	*Dorosoma cepedianum*	X	X	X	X
Threadfin Shad	*Dorosoma petenense*	X	X	X	X
Goldfish	*Carassius auratus*	X			
Common Carp	*Cyprinus carpio*	X	X	X	
Golden Shiner	*Notemigonus chrysoleucas*	X	X	X	X
Spottail Shiner	*Notropis hudsonius*	X			
Satinfin Shiner	*Cyprinella analostana*	X	X	X	X
Eastern Silvery Minnow	*Hybognathus regius*	X			
Quillback	*Carpiodes cyprinus*	X	X		X
Creek Chubsucker	*Erimyzon oblongus*	X	X		X
Shorthead Redhorse	*Moxostoma macrolepidotum*	X	X	X	X
Silver Redhorse	*Moxostoma anisurum*	X	X	X	X
Flathead Catfish	*Pylodictus olivarus*	X	X	X	X
Blue Catfish	*Ictalurus furcatus*	X	X	X	X
Channel Catfish	*Ictalurus puntatus*	X	X	X	X
White Catfish	*Ameiurus catus*	X	X	X	X
Flat Bullhead	*Ameiurus platycephalus*			X	X
Yellow Bullhead	*Ameiurus natalis*				X
Snail Bullhead	*Ameiurus brunneus*				X
White Perch	*Morone americana*	X	X	X	X
Hybrid Bass (Striped x White)	*Morone saxatilis x chrysops*	X	X		
Striped Bass	*Morone saxatilis*	X	X	X	X
White Bass	*Morone chrysops*	X	X	X	X
Redbreast Sunfish	*Lepomis auritus*	X	X	X	X
Green Sunfish	*Lepomis cyanellus*	X	X	X	X
Pumpkinseed	*Lepomis gibbosus*	X	X	X	X
Bluegill	*Lepomis macrochirus*	X	X	X	X
Redear Sunfish	*Lepomis microlophus*	X	X	X	X
Warmouth	*Lepomis gulosus*	X	X	X	X
Smallmouth Bass	*Micropterus dolomieu*				X
Largemouth Bass	*Micropterus salmoides*	X	X	X	X
White Crappie	*Pomoxis annularis*	X	X	X	X
Black Crappie	*Pomoxis nigromaculatus*	X	X	X	X
Tesselated Darter	*Etheostome olmstedi*	X			X
Yellow Perch	*Perca flavescens*	X	X	X	X
Longnose Gar	*Lepisosteus osseus*	X	X	X	X
Smallmouth Buffalo	*Ictiobus bubalus*	X	X	X	
Bowfin	*Amia calva*			X	
White Sucker	*Catostomus commersoni*				X
Spotted Sucker	*Minytrema melanops*				X

Overall, the fish communities sampled in the tailwaters of High Rock, Tuckertown, Narrows and Falls developments were found to be very similar, but some differences in species captured were noted (NAI, 2005f Appendix E-4). Species diversity recorded in the tailwaters ranged from a high of 34 species in both High Rock and Falls tailwaters to a low of 29 species recorded in Narrows tailwater. Large numbers of bluegill, largemouth bass, gizzard shad and white perch dominated the catches in each tailwater. These four species are among the ten most abundant species captured within each tailwater, comprising 48% of the total catch in High Rock tailwater, 57% in Tuckertown tailwater, 64% in Narrows tailwater and 46% in Falls tailwater. These species are generally tolerant of low dissolved oxygen (DO) concentrations, a condition which can occur in the Project tailwaters during the summer. Given the numbers of these species captured it also is apparent that these species are well adapted to hydro peaking operations, and routine changes in powerhouse discharges. Another popular sport fish, black crappies, were more abundant in both Tuckertown and High Rock tailwaters than either Narrows or Falls. Channel catfish were also more abundant in High Rock and Tuckertown tailwaters than either Narrows or Falls; while redbreast sunfish were more abundant in Narrows and Falls tailwaters than either High Rock or Tuckertown. Fish species that cannot tolerate marginal water quality (especially low DO), such as some of the darter and minnow species are generally absent from the catches.

Common carp and quillback were both in the ten most abundant species sampled in the High Rock tailwater and were either not present or captured in low numbers in the other three tailwaters (NAI, 2005f Appendix E-4). The numbers of carp captured in High Rock tailwater were evenly distributed during all three seasons of sampling. Quillback were most abundant in the tailwater during the spring season and may have been using the tailwater area below High Rock Dam for spawning. In the Falls tailwater, silver and shorthead redhorse were in the top ten species collected. The shorthead redhorse was captured at all four tailwaters during the study, but its numbers were lower at the other three tailwaters. The higher catches of shorthead redhorse in the Falls tailwater compared to upstream tailwaters may be due to better habitat and water quality conditions, especially dissolved oxygen levels. The shorthead redhorse (and the black redhorse) are considered to be intolerant to poor water quality, as are some darter species (NAI, 2005f Appendix E-4).

Species abundance was highest in the High Rock and Narrows tailwaters during the spring sampling period (NAI, 2005f Appendix E-4). Species richness in the Tuckertown tailwater was highest during the November sampling period. Although the spring sampling period yielded higher species diversity than either summer or fall, species composition and catch per unit effort (CPUE) rates were similar for all three sampling periods in the Falls tailwater.

In terms of the health of the tailwater fisheries, the relative weight values for bluegill and largemouth bass were either within or near the ideal ranges for these species in each of the four tailwaters, indicating they are having no problem securing food (NAI, 2005f Appendix E-4). Average proportional stock density (PSD) and relative stock density (RSD-P) values for largemouth bass were greater than the ideal range within each of the four tailwaters. Bluegill PSD values were within (High Rock and Narrows) or close to (Tuckertown and Falls) the ideal range for the species in all four tailwaters, suggesting a balanced population. However, RSD-P values for bluegill were well below the ideal range for the species in all four tailwaters and this indicated that few large, quality sized fish were available for harvest.

Relative weights for black crappie were within or very close to the ideal range in both Narrows and Tuckertown tailwaters, indicating that the fish are in good condition (NAI, 2005f Appendix E-4). However, black crappie relative weights in High Rock tailwater (Tuckertown Reservoir) were lower than the ideal range, suggesting possible problems finding adequate food sources. The PSD and RSD-P values for black crappie were either within or greater then the ideal range for the species in High Rock, Tuckertown, and Narrows tailwaters, suggesting a balanced population with most size classes represented.

Striped bass are currently present within all of the reservoirs and tailwaters, but the numbers captured in the High Rock tailwater (n=11) and Falls tailwater (n=18), were low compared to the numbers capture in the Tuckertown (n=65) and Narrows (n=39) tailwaters (NAI, 2005f Appendix E-4). The NCWRC stocks striped bass in all the Project reservoirs except Falls (Narrows tailwater). Striped bass captured in the Narrows tailwater (upper Falls Reservoir) most likely have dropped down from Narrows Reservoir. Those collected in Falls tailwater (upper Tillery Reservoir) may have originated from stockings into Tillery Reservoir or may have dropped down from Falls Reservoir. Striped bass are known to be relatively sensitive to water temperature and DO conditions, and striped bass in Narrows Reservoir (Tuckertown tailwater) are currently the target of cooperative bioenergetic studies by NCWRC and North Carolina State University to evaluate growth in relation to available habitat, particularly the thermal environment. Dissolved oxygen levels below 2 mg/l and temperatures greater that 25.0ºC have been recorded at certain times during the summer months in the High Rock, Tuckertown, and Narrows tailwaters (Section E.2.3.1.1). While exposure to dissolved oxygen concentrations less than 2 mg/l can be detrimental to individual striped bass, short-term exposure to these conditions are tolerable and do not necessarily lead to high rates of mortality (NAI, 2005f Appendix E-4).

Blueback herring were captured in all four tailwaters during APGI's study with the highest numbers captured in the Tuckertown (n=55) and Narrows (n=61) tailwaters and lesser numbers captured in the Falls (n=11) and High Rock (n=2) tailwaters (NAI, 2005f Appendix E-4). The NCWRC stocked blueback herring into Narrows Reservoir during the 1970s and the presence of adult and juvenile sized fish suggests that this population is continuing to maintain itself. Blueback herring captured in both the Narrows (upper Falls Reservoir) and Falls (upper Tillery Reservoir) tailwaters may have passed downstream through the turbines or were flushed out of Narrows Reservoir during a spill event. The small numbers of blueback herring captured in High Rock tailwater may be the result of bait-bucket introductions. Although blueback herring occur in the lower Pee Dee River as a diadromous species, as there are currently no operational fishways at any of the Yadkin Project or Yadkin-Pee Dee Project developments, the blueback herring currently found in the Project reservoirs and tailwaters are generally considered a resident species. However, it should be noted that blueback herring and striped bass are both listed as species of interest in the Restoration Plan for the Diadromous Fishes of the Yadkin-Pee Dee River Basin: North Carolina and South Carolina (USFWS, et. al., 2005).

Two fish species listed as Federal Species of Concern, the Carolina redhorse and robust redhorse, were of particular interest to the fishery agencies during APGI's study of the Project tailwaters

(NAI, 2005f Appendix E-4). Both species have been collected previously in the Pee-Dee River below the Blewett Falls Project, and Carolina redhorse individuals have been collected below Tillery Dam and in Tillery Reservoir. For the Yadkin Project study, focused searches for these two species were made in all four tailwaters, with sampling concentrated on Falls tailwater at the upper end of Tillery Reservoir. Despite the intensive surveys, neither the Carolina redhorse nor the robust redhorse was found in any of the Yadkin Project tailwaters.[1]

Other than the likely presence of Carolina redhorse in the Falls tailwater area, no other RTE fish species are known to occur in Yadkin Project waters.

E.3.1.1.2 Diadromous Fish

Diadromous fish species known to utilize the Yadkin-Pee Dee River historically for spawning and/or rearing include American shad, blueback herring, striped bass, Atlantic sturgeon, shortnose sturgeon and American eel. Some of these species are reported to have occurred in piedmont locations, upstream of the current location of the Yadkin Project dams (USFWS, et. al., 2005). However, natural falls occurring in several locations along the river, including a significant set of falls known to have existed in the Narrows gorge, likely served as a natural migration barrier to many fish.

The river basin's diadromous fish stocks are diminished relative to historic levels (USFWS, et. al., 2005). Continued harvest of some species of diadromous fishes may still act as a limiting factor to the restoration of these species. Other factors that have contributed to the decline of diadromous fish species in the Yadkin-Pee Dee River likely include poor water quality in critical habitats, alterations to river flow, and access to suitable spawning and nursery areas.

There are no fishways operating at any of the Yadkin Project developments. At the hydropower developments located downstream of the Yadkin Project, there are no fishways at Tillery Dam. An old fishway exists at Blewett Falls Dam, but this fishway was determined to be ineffective and has not been operated for many years. As a result, there are currently no diadromous fish species that are known to occur in Yadkin Project waters. American eel have been documented upstream of Blewett Falls Dam, but have not been documented above Tillery Dam. Blueback herring and striped bass both occur in the Yadkin Project waters, but these are resident individuals that were introduced to the reservoirs via planned stockings or inadvertently via bait bucket.

The U. S. Fish and Wildlife Service (USFWS), along with the South Carolina Department of Natural Resources (SCDNR), National Marine Fisheries Service (NMFS) and NCWRC have prepared a Restoration Plan for the Diadromous Fishes of the Yadkin-Pee Dee River Basin: North Carolina and South Carolina (USFWS, et. al., 2005). This Plan discusses the agencies' objectives for the restoration of diadromous fish in the river basin in several key areas including: 1) instream flows; 2) increased fish populations; 3) water quality, 4) habitat protection and enhancement; and 5) downstream passage. Target restoration species identified by the Plan include the anadromous American shad, blueback herring, striped bass, Atlantic sturgeon, and

[1] Although NAI failed to capture any Carolina redhorse in the Falls tailwater area, this species had previously been taken from the upper end of Tillery Reservoir into which the Falls Development releases water.

shortnose sturgeon, as well as the catadromous American eel. Other migratory species such as white bass, white perch and native suckers may benefit from restoration efforts, but are not specifically targeted in the Plan.

E.3.1.1.3 Other Aquatic Organisms (Mussels and Macroinvertebrates)

In response to agency comments, during the study phase of the relicensing process, APGI inventoried macroinvertebrates and mussels in the Yadkin Project waters. The focus of the inventories was on the four development tailwaters, where it was felt that freshwater mussels were most likely to exist.

Mussels and benthic macroinvertebrates were sampled seasonally by APGI along transects established in each of the tailwaters (NAI, 2005f Appendix E-4). Two transects were set up in each tailwater, with one transect located near each powerhouse and the other located downstream in the lower tailwater. Mussel searches were conducted in each season by divers swimming along the length of each transect line. Divers searched at least one meter upstream and downstream of each transect line (a 2 meter wide band along the entire transect). Additional searches were conducted along the shoreline of each tailrace looking for mussel shells and by having divers search in areas identified by agencies as good mussel habitat that were not located along a transect line. Benthic macroinvertebrates were collected during summer (September 2003), fall (November 2003), and spring (June 2004) along each transect using an airlift in deep water and a kick net in shoal water. Benthic organisms were preserved in the field and returned to the laboratory for identification and counting. Additionally, the initial study effort included a detailed survey and description of the aquatic habitat found in each of the tailwaters. This work was accomplished by doing a detailed survey of substrate and other habitat characteristics along the transect lines.

A total of seven species of freshwater mussels were found within the four Project tailwaters (NAI, 2005f Appendix E-4). A summary of the mussel species found within each of the tailwaters is provided in Table E.3-3

Table E.3-3: Mussel Species Found in the Yadkin Project Tailwaters

Species	Falls Tailwater	Narrows Tailwater	Tuckertown Tailwater	High Rock Tailwater
Anodonta implicata (Alewife floater)	R	1		
Elliptio complanta (Eastern Elliptio)	328	16		
Elliptio cf. lanceolata (Pee Dee Lance)	113	1		
Lampsilis radiata (Eastern lamp mussel)	117	R		
Pyganodon cataracte (Eastern floater)	1	2		
Utterbackia imbecillis (Paper pond shell)	8	2	4	1
Villosa delumbis (Eastern creekshell)	8			
Total No. Of Unionidae Species	7	6	1	1
Total No. Of Individuals	575	22	4	1
Corbicula fluminea	A	A	A	A
Cipangopalucdinea chinensis (Chinese mystery snail)				231

Notes: R = represented by relics only
A = abundant

Falls tailwater had the greatest mussel diversity with seven species and 575 total individuals (NAI, 2005f Appendix E-4). In Falls tailwater, *Elliptio complanta* (Eastern Elliptio) was the most abundant (57%) mussel species, while *Elliptio cf. lanceolata* (Pee Dee Lance) (20%) and *Lampsilis radiata* (Eastern lamp mussel) (20%) were common. Narrows tailwater had six species with 22 total individuals. *Elliptio complanta* (73%) was the most abundant species within the Narrows tailwater. One specimen of *Anodonta implicata* (Alewife floater) was found within the Narrows tailwater. The only mussel species found in the Tuckertown and High Rock tailwaters was the *Utterbackia imbecillis* (Paper pond shell) with four individuals found in the Tuckertown tailwater and one in the High Rock tailwater. *Corbicula fluminea*, the Asiatic clam, is an invasive species that was abundant throughout all four tailwaters.

There were no federally endangered mussel species found within any of the four Project tailwaters (NAI, 2005f Appendix E-4). *Elliptio cf. lancolata* (Pee Dee Lance) is listed as endangered by the state of North Carolina and was found in the tailwaters of both Falls and Narrows. Two species, *Anodonta implicata* (alewife floater) and *Lampsilis radiata* (Eastern lamp mussel), are both listed as threatened by the state of North Carolina. *Anodonta implicata* was found in both Falls (relic shells only) and Narrows tailwaters. *Lampsilis radiata* was found in Falls and Narrows (relics only) tailwaters. *Villosa delumbis* (Eastern creekshell) is considered significantly rare by the North Carolina Natural Heritage Program and eight individuals were found within the Falls tailwater.

APGI's study also examined benthic macroinvertebrate communities in each of the tailwaters (NAI, 2005f Appendix E-4). Because of their limited mobility, benthic macroinvertebrates are often used as indicators of water quality and aquatic habitat quality. Generally speaking, a more diverse benthic community is indicative of better water quality. At the Yadkin Project, 6 phyla, 24 orders, and 41 families represented by 99 benthic macroinvertebrate species were found in the four Project tailwaters. Spring sampling in Falls tailwater yielded the highest number of species with 53 found and the summer sampling in High Rock yielded the lowest number of species collected with 29. The spring sampling in Narrows (12,008/12m^2) and Falls (10,172/12m^2)

yielded the highest densities of individuals. The lowest numbers of individuals per sample were recorded in Falls (1,420/12m^2) and Narrows (1,333/12m^2) during the fall sampling. Table E.3-4 summarizes the percent composition of the most abundant benthic macroinvertebrate species within each of the four tailwaters during the three seasons of sampling.

Dominant species in Falls tailwater during the three sampling periods included *Corbicula fluminea* (Asiatic clam; summer and fall) and *Caecidota* sp. (isopod sp.; spring) (NAI, 2005f Appendix E-4). The three sampling periods in Narrows were dominated by *Rheotanytarsus* sp. (midge sp.; summer), *Corbicula fluminea* (fall), and *Caecidotea* sp. (June). Tuckertown samplings were dominated by *Musculium transversum* (Fingernail clam; summer and fall) and *Caecidotea* sp. in the spring. *Musculium transversum* was the dominant species in High Rock during the summer and spring while *Caecidotea* sp. was dominant in the fall.

Table E.3-4: Percent Composition of the Dominant Benthic Macroinvertebrate Species by Sampling Season in the Yadkin Project Tailwaters

	September 2003				***November 2003***				***June 2004***			
SPECIES	**Falls Dam**	**Narrows Dam**	**Tucker-town**	**High Rock**	**Falls Dam**	**Narrows Dam**	**Tucker-town**	**High Rock**	**Falls Dam**	**Narrows Dam**	**Tucker-town**	**High Rock**
Dugesia tigrina		9.3		7.6			6.2	12.5				
Corbicula fluminea	26.7				48.0	43.5			11.0	9.3		
Musculium transversum	15.1	9.6	38.2	43.7	6.2		53.2	28.3			18.6	35.2
Physella sp.									8.2			
Menetus dilatatus			6.3									
Dero sp.											14.1	
Slavina appendiculata										14.6		9.1
Lumbriculidae										10.0		
Caecidotea sp.	11.1	17.0	10.0	12.6	6.8	17.9	13.8	28.8	17.3	16.3	29.7	6.8
Hyalella azteca					11.1				8.2	6.8		
Cyrnellus fraternus		7.3										
Cricotopus sp.										15.0		
Dicrotendipes simpsoni			24.5	22.3				11.7				
Glyptotendipes sp.							9.2					9.2
Rheotanytarsus sp.		22.5										

E.3.1.1.4 Reservoir Aquatic Habitat

In response to agency comments, APGI conducted a comprehensive survey of aquatic habitat in the four Yadkin Project reservoirs. The survey entailed mapping the existing aquatic habitats in the existing and potential drawdown zones of High Rock and Narrows reservoirs and the littoral zones of Tuckertown and Falls reservoirs. The study also examined the impacts to aquatic habitat under existing and alternative water level scenarios at High Rock and Narrows reservoirs.

Habitat surveys were conducted on the four Project reservoirs between December 2003 and August 2004 (NAI, 2005e Appendix E-3). Aquatic habitats were mapped within the existing drawdown zone of High Rock Reservoir, the littoral zone and a potential drawdown zone in Narrows Reservoir and within the littoral zones of both Tuckertown and Falls Reservoirs. The habitat surveys at High Rock and Narrows occurred during the winter months when the reservoirs were drawn down below 15 feet to assist in the habitat mapping. The habitat surveys on Tuckertown and Falls took place during the summer of 2004 while the two reservoirs were drawn down between one and two feet below full pool. During each survey, a digital video camera was used to film the entire shoreline of each reservoir, further documenting the habitat and cover present. Habitat types in the reservoir drawdown and littoral zones that were mapped during this study included: 1) aquatic vegetation (wetlands); 2) trees and woody debris (brush, fallen trees, standing trees, stumps); 3) Christmas trees added for habitat enhancement; 4) docks; 5) riprap; 6) ledge; 7) boulder; 8) cobble; 9) gravel; and 10) mud/sand/clay. The results of the habitat mapping were entered into a GIS database. This information combined with bathymetry at High Rock and Narrows in 2 foot increments, allows an easy means of determining the amount of each type of habitat that may be impacted as water levels in these reservoirs change.

Results of the habitat mapping study, in terms of the amount of each habitat type available in the drawdown or littoral zone of each of the reservoirs, are summarized in Table E.3-5 (NAI, 2005e Appendix E-3). As shown, at High Rock, mud/sand/clay substrates account for approximately 79% of the drawdown zone. This substrate type is considered to provide poor quality habitat for fish and other aquatic biota. High quality habitat types accounted for the remaining 21% of the drawdown zone. Among the high quality habitats present, four wetland cover types (palustrine emergent, floodplain forest, shrub-swamp, and sparse shrub-swamp) comprise about 19% of the habitat. Other high quality habitats including rock substrates (0.56%), woody cover (0.63%) and docks (0.50%) comprise the remaining 2% of habitat within the drawdown zone. Similarly at Narrows Reservoir, habitat within the upper 14 feet of the reservoir (elevation 508 ft. to 494 ft.) is dominated by poor quality mud/sand/clay substrates accounting for approximately 83% of the mapped habitat. Four wetland types comprised 8.4% of the habitat. Rock substrates (4.88%), woody cover (1.85%), and docks (1.01%) accounted for the remaining mapped habitats.

At the other two reservoirs, Tuckertown and Falls, only the high quality habitats found in the littoral zone were mapped (NAI, 2005e Appendix E-3). At Tuckertown, wetland habitat types accounted for the majority (85%) of the quality habitat types within the littoral zone (palustrine emergent, flood plain forest, lacustrine aquatic plant beds, shrub-swamp, sparse shrub-swamp, and aquatic vegetation), while boulders were the dominant form of rock substrate accounting for 2.52% of the total habitat mapped with lesser amounts of cobble (0.6%), rip rap (0.17%) and ledge (0.11%). At Falls, wetland habitat types (palustrine emergent, flood plain forest, and shrub-swamp, and aquatic vegetation) accounted for the highest percentage of quality habitat mapped in the littoral zone (over 60%). Rock substrate, consisting of boulders (18.21%) and cobble (3.6%), and woody cover, including medium branched trees (13.76%), stumps (0.09%) and no branched trees (0.05%) were also found in Falls Reservoir.

Table E.3-5: Habitat Types Mapped in the Drawdown and Littoral Zones of the Yadkin Project Reservoirs

Habitat Type	High Rock Habitat Mapped between Elevation 624 ft. and 612 ft.		Tuckertown Habitat Mapped in Littoral Zone[1]		Narrows Habitat Mapped between Elevation 508 ft. and 494 ft.		Falls Habitat Mapped in Littoral Zone[2]	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Mud/sand/clay	4743.62	79.09%			1098.75	83.28%		
Boulder	10.87	0.18%	4.43	2.52%	25.41	1.93%	1.05	18.21%
Brush	2.37	0.04%	0.12	0.07%	0.25	0.02%		
Christmas Trees	0.67	0.01%			0.15	0.01%		
Cobble	3.48	0.06%	1.05	0.60%	22.92	1.74%	0.21	3.60%
Docks	29.88	0.50%	0.16	0.09%	13.34	1.01%		
Gravel	0.00	0.00%			4.26	0.32%		
Heavily Branched Trees	1.44	0.02%	0.08	0.04%	8.67	0.66%		
Ledge	4.59	0.08%	0.20	0.11%	6.57	0.50%		
Medium Branched Trees	29.95	0.50%	16.39	9.32%	10.42	0.79%	0.79	13.76%
No Branched Trees	0.49	0.01%	0.23	0.13%	0.18	0.01%	0.00	0.05%
Riprap	14.49	0.24%	0.30	0.17%	5.17	0.39%		
Stumps	2.98	0.05%	2.66	1.51%	4.97	0.38%	0.01	0.09%
Tires	0.01	0.00%						
Palustrine emergent	15.09	0.25%	27.27	15.5%	54.89	4.16%	1.99	34.66%
Floodplain forest	533.10	8.89%	24.42	13.88%	3.94	0.30%	0.05	0.83%
Shrub-swamp	193.16	3.22%	12.74	7.24%	1.10	0.08%	0.17	2.87%
Sparse shrub-swamp	411.49	6.86%	3.67	2.09%				
Lacustrine aquatic bed			10.72	6.09%	50.95	3.86%		
Aquatic vegetation			71.46	40.63%			1.49	25.97%
Misc. Man-made					0.06	0.00%		

[1] The full pond elevation of Tuckertown Reservoir is 564.2 ft. (USGS). Percentages are the quality habitat types mapped within the 2-foot littoral zone. Does not include areas classified as low quality habitat (mud/sand/clay).
[2] The full pond elevation of Falls Reservoir is 334 ft. (USGS). Percentages are the quality habitat types mapped within the 2-foot littoral zone. Does not include areas classified as low quality habitat (mud/sand/clay).

E.3.1.1.5 Habitat Fragmentation Study

In response to agency comments, during the study phase of the relicensing process, APGI conducted a habitat fragmentation study of the Yadkin Project portion of the Yadkin River watershed. The focus of the study was on compiling existing information on the presence and status of populations of fish, mussels and aquatic macroinvertebrates (snails, crayfish, etc.) within the portion of the Yadkin Project watershed that drains directly to the Yadkin Project reservoirs, including some of the Yadkin River mainstem, and to examine the distribution of these populations for evidence of fragmentation. Work on this study is still ongoing, and the results of the Habitat Fragmentation Study will be included in the Final License Application.

E.3.1.2 Effects of Current Project Operation on Fish and Aquatics

E.3.1.2.1 Effects on Reservoir Habitat and Fish

APGI examined the potential impacts to aquatic habitats and fish associated with current reservoir operating regimes and the resulting water level fluctuations (NAI, 2005e Appendix E-3). Results of the study demonstrated that there is very little impact to aquatic habitat or fish populations associated with the current operation of Tuckertown and Falls reservoirs. Both reservoirs are operated as essentially run-of-river developments and therefore neither reservoir experiences any seasonal drawdowns. Short term fluctuations do occur at both reservoirs (on a daily or weekly basis), but at Tuckertown such fluctuations are typically within the 0-3 foot range, and at Falls short term fluctuations are in the 0-4 foot range. In neither case do short term fluctuations appear to be significantly impacting aquatic habitats or their use by fish (NAI, 2005e Appendix E-3). Reservoir fluctuations, even short term fluctuations, may have some impact on fish during the spring spawning season, when many species need access to high quality shallow water habitats. But, study results demonstrate that in most years, reservoir water levels in both reservoirs appear to remain relatively constant during the spring spawning season.

Like Tuckertown and Falls, Narrows Reservoir is generally operated as a run-of-river facility, resulting in short-term reservoir fluctuations of about 0-3 feet. However, there is some storage available in Narrows Reservoir and historically APGI has utilized this storage to help meet downstream flow requirements during periods of low river flow. This has resulted in a fairly typical pattern of a modest lowering of the reservoir elevation during the late summer and early fall of, on average, 2-3 feet. This modest change in reservoir water level over the course of the summer does result in some impacts to aquatic habitats and their uses (NAI, 2005e Appendix E-3). Some areas of aquatic vegetation (water willow beds) become dewatered later in the summer forcing fish and other organisms (if they are mobile) to seek cover elsewhere. However, the overall good health of the reservoir fishery suggests that these impacts are small. Moreover, voluntary efforts by APGI in recent years to maintain relatively stable water levels during the spring spawning period (mid-April to mid-May) ensure that critical shallow water habitats are available during this most important season.

As part of its study of aquatic habitat, NAI estimated the number of acres of critical habitat types which are located within 2-foot contours of the upper 16 feet of Narrows Reservoir. These estimates provide a means of considering how much critical habitat would be dewatered under various operating scenarios for Narrows Reservoir. Under existing operations, Narrows is typically operated within 3 feet of full, year round. As shown in Table E.3-6, a total of approximately 74 acres and 135 acres of high quality aquatic habitat are exposed when water levels are drawn down 2 feet and 4 feet from full, respectively. Assuming that habitat is generally linearly distributed throughout the reservoir between elevations 510 and 506, the average of these numbers (105 acres) can be used to estimate the amount of high quality habitat that is typically exposed within the upper 3 feet of Narrows Reservoir under existing operations. The remaining 203 acres of high quality found within the upper 16 feet of Narrows Reservoir is generally protected and would only be exposed during infrequent periods when APGI utilizes available storage in Narrows Reservoir down to 6.6 feet (elevation 503.4).

Table E.3-6: High Quality Habitat in the Upper 16 Feet of Narrows Reservoir in 2-foot Contour Intervals

Habitat Type	Elevation							
	510-508	508-506	506-504	504-502	502-500	500-498	498-496	496-494
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Lacustrine Aquatic Beds	6.82	10.72	12.38	10.71	8.04	5.45	2.60	1.04
Palustrine Emergent	25.46	29.72	17.98	5.41	1.28	0.33	0.12	0.05
Floodplain Forest	28.63	2.63	0.70	0.19	0.09	0.09	0.23	0.01
Shrub-swamp	1.29	0.51	0.29	0.14	0.06	0.05	0.03	0.03
Docks	2.18	3.40	4.04	3.89	1.54	0.63	0.22	0.09
Misc. Man-made	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03
Boulder	2.10	2.42	4.51	4.41	4.73	3.96	3.18	2.20
Brush	0.00	0.04	0.04	0.03	0.04	0.03	0.04	0.02
Christmas Tree	0.01	0.01	0.01	0.00	0.01	0.04	0.04	0.04
Cobble	1.93	3.26	3.88	3.88	3.59	3.43	2.91	1.97
Gravel	0.18	0.49	0.73	0.70	0.70	0.69	0.62	0.33
Heavy Branched Tree	1.58	2.76	2.35	1.43	0.94	0.61	0.36	0.21
Ledge	0.83	0.94	1.28	1.23	0.86	0.91	0.78	0.56
Medium Branched Tree	1.65	3.07	2.78	1.84	1.07	0.63	0.50	0.54
No Branched Tree	0.03	0.02	0.02	0.03	0.03	0.04	0.03	0.02
Rip rap	0.88	1.07	1.16	1.12	0.69	0.39	0.38	0.37
Stumps	0.00	0.01	0.06	0.47	0.49	0.53	1.60	1.82
TOTAL	**73.57**	**61.07**	**52.20**	**35.49**	**24.14**	**17.82**	**13.65**	**9.33**

High Rock Reservoir, which is operated as a store and release facility, produces a very different pattern of water levels which NAI's study found has more significant impacts on aquatic habitat and fish (NAI, 2005e Appendix E-3). Under current operations, High Rock Reservoir is operated with a seasonal winter drawdown of 12 feet, on average. In addition, available storage in High Rock is utilized by APGI over the course of the summer to help meet downstream flow requirements, resulting in a typical pattern of a drop in reservoir elevation of up to 5 feet over the course of the summer. Short term fluctuations (daily and weekly) at High Rock Reservoir, however, are small, generally on the order of 1 foot or less.

As part of the study of aquatic habitat in High Rock Reservoir, NAI quantified the amount of high quality habitat (acres) located in the upper 12 feet of the reservoir, in 2-foot increments (Table E.3-7). The distribution of these high quality habitats within the upper 12 feet of the reservoir drawdown zone suggests some impacts to aquatic habitat, fish, and other aquatic biota associated with the current operation of High Rock. There is a loss of about 1300 acres of quality habitat that is located in the 12-foot drawdown zone over the course of the fall and winter for use by fish and other biota. Fish are mobile and may find cover and habitat elsewhere in the reservoir as water levels recede. However, fish, especially young fish, become vulnerable to predation when they are forced to move into open water or seek cover elsewhere. The habitat mapping done as part of this study demonstrates that about 63% of the high quality habitat found in High Rock Reservoir is located in the upper 6 feet of the 12-foot reservoir drawdown zone. Thus, a slow drawdown of the reservoir by as much as 5 feet over the course of the summer results in the loss of a portion of the high quality habitat available to fish. Again, the fish that are likely most affected by this reduction in summer water levels are young fish that require the cover and protection of the high quality habitats to escape predation and mature.

Table E.3-7: High Quality Habitat in the Upper 12 Feet of High Rock Reservoir in 2-foot Contour Intervals

Habitat Type	Elevation						
	624-622	**622-620**	**620-618**	**618-616**	**616-614**	**614-612**	**<612**
	Acres	**Acres**	**Acres**	**Acres**	**Acres**	**Acres**	**Acres**
Boulder	1.23	0.92	1.42	2.19	2.67	2.52	11.46
Brush	0.33	0.36	0.51	0.27	0.37	0.60	1.39
Christmas Tree	0.01	0.05	0.16	0.11	0.16	0.19	0.50
Cobble	0.28	0.33	0.58	0.60	1.02	0.69	2.54
Heavy Branched Tree	0.25	0.29	0.93	0.21	0.34	0.03	0.02
Medium Branched Tree	6.92	8.25	9.49	4.19	2.16	0.95	1.88
No Branch Tree	0.06	0.04	0.06	0.01	0.02	0.01	0.01
Stumps	0.14	0.04	0.12	0.18	0.51	1.98	39.92
Gravel	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ledge	1.02	0.84	1.35	0.48	0.73	0.47	0.47
Misc.	0.00	0.16	0.66	0.02	0.00	0.00	0.00
Rip rap	2.54	2.29	2.64	2.49	2.09	2.50	9.06
Tires	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Palustrine Emergent	2.38	7.55	3.22	0.70	0.71	0.00	0.00
Floodplain Forest	353.64	141.07	53.11	31.23	9.74	2.43	0.03
Shrub-swamp	23.64	49.75	70.20	27.45	16.65	0.87	0.45
Sparse Shrub-swamp	15.99	15.25	77.59	170.64	106.78	28.50	3.16
Docks	5.13	5.64	7.60	6.01	3.95	1.58	1.19
TOTAL	**413.54**	**232.83**	**229.64**	**246.76**	**147.88**	**43.32**	**72.07**

The study also found that at High Rock most of the important shallow water habitats used by fish for spawning (cobble, gravel, and vegetation) are located in the upper most portion of the reservoir drawdown zone. In order to maximize the availability of these habitats to spawning fish, the study suggests that High Rock Reservoir water levels should be near full during the April – May period, when most fish species spawn. Currently, APGI operates High Rock voluntarily to try to maintain relatively stable water levels during the mid-April to mid-May period to help enhance fish spawning in the reservoir. As shown in Table E.3-8, this voluntary operation helps to ensure that water levels remain relatively stable through a significant portion of the spawning season for most species, including species of management priority such as largemouth bass, crappie and sunfish.

Changing water levels also play a role in the success of fish spawning, especially crappie. Black and white crappie use brushy cover in the littoral zone for spawning. According to researchers, successful crappie recruitment appears to be related to high inflows entering a reservoir just prior to the spring spawning season (NAI, 2005e Appendix E-3). Research suggests that crappie respond to these inflows and rising reservoir levels with increased spawning activity as it may mimic the natural flooding that would ordinarily trigger these fish to spawn (NAI, 2005e Appendix E-3). Thus, rising water levels before and during the crappie spawning season can increase crappie production along with that of other fish species spawning in the littoral zone.

Table E.3-8: Spawning Times for Fish Species Found in Falls, Narrows, Tuckertown and High Rock Reservoirs

Common Name	J	F	M	A	M	JN	JL	A	S	O	N	D	Range	Temperature	Substrate
Longnose gar													3Apr-4May		shallow, heavy vegetation
Bowfin													2Mar-4May	16-19ºC	
Gizzard shad													1May-2Jun		shallow water
Threadfin shad													Apr-Sep	21ºC	shallow shorelines, boulders, logs debris
Blueback herring													Mar		
Alewife *													Mar		
Common carp													Mar-Jun		shallow, submerged vegetation
Goldfish													Mar-May		submerged vegetation
Golden shiner													4Apr-1Aug	68-80ºF	submerged vegetation
Bluehead chub *													Apr-Jun		
Eastern silvery minnow													Mar-May		
Satinfin shiner													3Apr-1Jul		
Spottail shiner													4Apr-4May		
Spotted sucker													2Apr-3May	12.2-19.4ºC	shallow gravel shoals
White sucker													2Mar-4Apr	10ºC	gravel areas
Quillback													4Apr-3May		
Creek chubsucker													Mar-1May	17-18ºC	gravel substrate, slow water
Smallmouth buffalo													1Mar-2Jun	15-16ºC	1-6m submerged vegetation
Silver redhorse													Mar-1Apr	14-15ºC	gravel shoal areas
Shorthead redhorse													2Apr-2May	14ºC	gravel shoals (15-21cm)
Flathead catfish													Jun-2Jul		spawning shelters
Blue catfish													Apr-May		
Channel catfish													4May-1Jul	22-30ºC	spawning shelters
Yellow bullhead													Apr-2May		
Flat bullhead													Jun-Jul	21-24ºC	
Snail bullhead													4Mar-1Jun		
White catfish													3May-3Jun		
Black bullhead *													2Apr-2Jun		gravel substrate
Brown bullhead *													Apr-1May	21ºC	
Eastern mosquitofish *													Apr-Aug		
White perch													1Mar-2Apr		
Striped bass													3Mar-4Apr	15ºC	mid-water, eggs must stay suspended
White bass													Mar-4Apr		mid-water- demersal eggs
Redbreast sunfish													4Apr-Jun		nests in sandy substrate

Table E.3-8: Spawning Times for Fish Species Found in Falls, Narrows, Tuckertown and High Rock Reservoirs (continued)

Common Name	J	F	M	A	M	JN	JL	A	S	O	N	D	Range	Temperature	Substrate
Warmouth													2May-Aug		shallow, silty debris near cover
Green sunfish													1May-Aug		sunny areas near cover
Bluegill													1May-Oct		shallow gravel substrate
Pumpkinseed													1May-Oct		shallow water, less the 1m
Redear sunfish													May-Aug		shallow water
Largemouth bass													1May-Jun		firm substrate along shallow edges
Smallmouth bass													Apr-1Jun	15-18ºC	coarse gravel, less then 1m
White crappie													1Apr-1Jun		shallow protected areas near brush
Black crappie													1Apr-1Jun		shallow protected areas near brush
Yellow perch													2Feb-Mar		vegetation, brush, sand and gravel
Tesselated darter													Mar-May		
Johnny darter *													1Apr-2May		clear areas under submerged objects

Source: NAI Reservoir Fish and Aquatic Habitat Assessment, 2005 (NAI, 2005e Appendix E-3)
* Species captured by CP&L sampling in 2000.

E.3.1.2.2 Effects on Tailwater Fish and Aquatic Biota

One of the objectives of the tailwater study was to consider impacts from Project operations on aquatic biota in the Project tailwaters (NAI, 2005f Appendix E-4). Two types of impacts were considered potentially significant at the Yadkin Project: 1) the effects of low tailwater dissolved oxygen conditions; and 2) the effects of Project peaking operations on fish stranding.

Water Quality Effects

During the tailwater fish collections made in 2003 and 2004, NAI analyzed the differences in fish catches during periods of higher DO levels (5 mg/l or greater) and of low DO levels (at least a 2 mg/l drop) over two 24 hour periods (NAI, 2005f Appendix E-4). In both instances, the change in tailwater DO resulted from going from full generation down to no generation. The first test occurred during the summer collections at Narrows. During this collection period, of the 18 fish species collected, 15 had fewer individuals captured during the low DO period. In the second test that occurred during the fall sampling at Narrows, significantly fewer species were captured during the low DO period, and of the 21 fish species, 17 had fewer individuals collected during the low DO period. It is not known if the fish ceased or slowed their movements during the low DO tests making them less available for capture or moved out of the tailwater area.

Overall, the fish populations currently found in the four Yadkin tailwaters have been shaped by stocking and the current Project operations, including the routine peaking flows and low DO concentrations that occur in three of the four tailwaters (all but Falls) between 20 and 29% of the year during an average year. Many of the fish species present in the tailwaters are tolerant of marginal water quality, such as gizzard shad, white perch and largemouth bass and this is why these species dominate the catches in the Yadkin Project tailwaters. Fish species that cannot tolerate marginal water quality (especially low DO), such as some of the darter and minnow species are generally absent from the tailwaters.

Study results suggest that tailwater macroinvertebrates are also affected by water quality, particularly low dissolved oxygen levels (NAI, 2005f Appendix E-4). As discussed in detail in Section E.2.3.1.1, at each dam, both surface and bottom water from the upstream reservoir is entrained and mixed during passage through the turbines, which can cause lower dissolved oxygen concentrations in the tailwaters. The species make-up and diversity of macroinvertebrates sampled in the High Rock and Tuckertown tailwaters were generally indicative of poor water quality. In the Narrows and Falls tailwaters, the macroinvertebrate communities were generally indicative of fair water quality.

Similar water quality effects were also evident for the mussel species (NAI, 2005f Appendix E-4). Although freshwater mussels were found in all four Project tailwaters, the number of species found in each tailwater increased moving downstream, and is believed to reflect improving tailwater water quality conditions from upstream to downstream. In the High Rock and Tuckertown tailwaters, only one mussel species was collected during all three sampling periods. In the Narrows tailwater area, six mussel species were collected (22 individuals). In the Falls tailwater, which has the best water quality conditions and the highest DO levels, seven mussel species (575 individuals) were found. Although, it should be noted that in addition to having the best water quality, the Falls tailwater has the most habitat suitable for mussels.

Fish Stranding

The potential for fish stranding was also examined as part of the tailwater study. As the Yadkin Project developments are operated primarily as peaking facilities, there are rapid changes in tailwater flows as turbines are turned on and off with generation demands. Depending on the configuration of the tailwaters, these rapid flow changes can result in significant changes in water levels and wetted perimeter and can lead to the stranding of fish that are unable or reluctant to move from habitats that become dewatered. To determine if stranding is a problem in the four Yadkin Project tailwaters, as part of the overall tailwater study, NAI evaluated the stranding potential in each of the tailwaters by observing the entire tailwater area during both full and non-generation conditions. Throughout the multiple sampling events conducted by APGI, there was no stranding of fish observed at any time, in any locations, in any of four Project tailwaters (NAI, 2005f Appendix E-4). Moreover, observed drops in tailwater water levels were minor (1 foot or less) at each site after generation went from full or near full down to no generation. The lack of conditions that might produce stranding in the four tailwaters is primarily a result of the fact that all four Project developments discharges into a downstream reservoir, rather than a free flowing river reach. Thus, even after discharge from a development is reduced to zero, the downstream tailwater areas generally remain well inundated.

E.3.1.2.3 Fish Entrainment

In response to comments on the Yadkin Project Relicensing Initial Consultation Document filed with FERC in 2002, APGI conducted a study to examine the potential for impacts to fish due to entrainment at the Yadkin Project developments. The resulting Fish Entrainment study conducted by NAI evaluated the potential for entrainment of resident fishes at the four Yadkin Project powerhouses; evaluated the potential for entrainment of four diadromous fish species, alewife, Blueback herring, American shad and American eel, that are candidates for possible reintroduction to Yadkin Project waters; and evaluated fish survival rates at each development taking into account site specific data such as turbine type, turbine rotational speed (rpm), and size of entrained fish (NAI, 2005h Appendix E-6).

The fish entrainment evaluation was conducted as a desk-top evaluation utilizing existing literature and data from the Electric Power Research Institute (EPRI) on fish entrainment at other hydroelectric projects for relevant species at the Yadkin Project (NAI, 2005h Appendix E-6). The fish species considered in the evaluation were those identified by the fishery agencies and the Fish and Aquatics Issue Advisory Group (IAG) as important management species and included both resident fish such as largemouth bass, black crappie, and stocked striped bass and four diadromous fish species (alewife, Blueback herring, American shad, and American eel). For species of management interest that were not represented in the EPRI database, evaluations were made using representative surrogate species included in the EPRI database.

The study considered the potential for entrainment based on a number of physical characteristics of the Project reservoirs, dams and powerhouses. Some of the key characteristics considered included the location and depth of the powerhouse intakes, the potential abundance of fish in the littoral zone, the propensity of fish to want to migrate, reservoir water levels, the approach velocities at the intakes and the hydraulic capacity and configuration of the turbines (NAI, 2005h Appendix E-6). The study also considered the potential for fish survival in the event of entrainment into and through the Project turbines. The mortality/survival assessment was also based on an extensive review of literature and existing data and considered the important physical characteristics of the units, as well as the biological characteristics of the various fish species. Some of the important factors considered in this portion of the assessment included turbine type, turbine speed, and intake and tunnel characteristics.

Overall, the results of the entrainment study indicate that the potential for impact to fishes due to entrainment and turbine passage at the four Yadkin Project developments (High Rock, Tuckertown, Narrows and Falls) is low (NAI, 2005h Appendix E-6). Although the entrainment potential for certain fish species was found to be high to moderate-high at all four developments, the overall potential mortality rates for fish entrained at the four developments was found to be low.

Generally, the entrainment potential for small fish was higher than for medium and large fish, with alewife and gizzard shad (and by surrogate Blueback herring, American shad, and threadfin shad) having the highest potential for entrainment in reservoirs where they are abundant (NAI, 2005h Appendix E-6). Small yellow perch had a high entrainment potential while the potential for entrainment of small bluegill and other sunfish, black crappie, white perch, channel catfish, blue and white catfish (as suggested by surrogates), and largemouth bass was moderate-high. The entrainment potential of small striped bass (based on the surrogate white bass) and juvenile American eel was judged as low.

At High Rock, APGI's study concluded that the overall impact to fishes due to entrainment and turbine passage is low (NAI, 2005h Appendix E-6). High Rock Development does possess certain risk factors that suggest entrainment rates are likely to be high or moderate-high. In addition, High Rock is unique among the Yadkin developments because of the annual winter drawdown (12 foot average). The reduced reservoir volume in late fall and winter along with clupeid (primarily threadfin and gizzard shad) movements to lower reservoir areas, places these forage species and potentially their predators at somewhat higher risk of entrainment than at the other reservoirs. However, because the High Rock turbines are large and rotate slowly, survival rates of the small fish that are most likely to be entrained are expected to be high. Thus, while entrainment rates at High Rock are likely to be high due to the prevalence of shad, the overall impact to fishes due to entrainment and turbine passage at the High Rock Development is expected to be low for all species considered due to the relatively benign turbine characteristics. The fact that High Rock supports a successful and popular sport fishery supports this conclusion.

At Tuckertown, APGI concluded that the overall potential impact to fishes due to entrainment and turbine passage is low (NAI, 2005h Appendix E-6). Like High Rock, the Tuckertown Development also has abundant clupeids and other risk factors that can cause high or moderate-high entrainment rates, except there is no winter drawdown. However, the Tuckertown Development houses large slow Kaplan turbines, generally the most benign turbine type for the fishes of concern in APGI's fish entrainment study. Thus, in spite of the high to moderate-high entrainment potential, expected high survival rates during turbine passage suggest that the overall potential impact due to entrainment at Tuckertown is low.

The entrainment and survival risk factors for fishes in Narrows Reservoir are similar to those for the Tuckertown Development, with a few exceptions. Penstock pressure at Narrows is slightly more than two atmospheres (approximately 70 psi) at the turbine entrance which could affect entrained fish depending upon the depth the fish was at as it entered the intake (NAI, 2005h Appendix E-6). The fish most likely to be entrained at Narrows would be pelagic clupeids that may experience brief disorientation but no additional mortality prior to reacclimation upon reaching the tailrace. In addition, the Narrows Development utilizes Francis turbines rather than Kaplans, but the Francis units at Narrows rotate at a slow speed which minimizes their potential impacts on fish. A final difference between Narrows and the other three developments is the design head of 175 feet compared to 52-55 feet of head at the other three sites. However, high head alone does not necessarily exacerbate turbine passage mortality. The potential entrainment of fishes at Narrows Development is probably high for clupeids (shad) and moderate-high for other fishes. However, given the specific turbine configurations, fish survival during turbine passage is at least moderate to high. Thus, given the overall abundance of Narrows Reservoir fishes and the overall health of the sport fisheries for striped bass, largemouth bass, and catfishes, any impact due to entrainment mortality is probably low.

At the Falls Development, APGI's study concluded that the overall impact to fishes due to entrainment and turbine passage is low (NAI, 2005h Appendix E-6). The potential for fish entrainment at the Falls Development was judged high due to the abundance of clupeids (shad), and moderate-high for other types of abundant species, including yellow perch. In addition, the location of the Falls intakes is closer to reservoir shorelines (approximately 50 feet), than at the other Yadkin developments, a factor that could increase entrainment potential. However, due to the steep character of adjacent shorelines littoral zone habitat near the dam and powerhouse, that is likely to be inhabited by fish, is limited. Moreover, the powerhouse contains one large, slow Francis unit, and two large, slow propeller runners with few blades that operate at low design head. These features enhance the likelihood of high fish survival during turbine passage. Thus, the overall potential for impacts to fishes due to turbine entrainment at Falls Development is low.

E.3.2 Wildlife Resources

There is an abundance of wildlife that uses the Yadkin Project reservoirs and shorelines as habitat. Table E.3-9 lists species of mammals and birds that are generally known to inhabit the Project area. Bird species listed in the table are those that were recently identified during an avian inventory conducted by APGI during the relicensing study phase (CCB, 2005 Appendix E-7).

Table E.3-9: Species of Wildlife Commonly Observed or Known to Occur at the Project

Species	Habitat	Resident/ Breeding	Part-year Resident	Transitory
Mammals				
Red fox	Forest, field, shoreline	X		
Gray fox	Forest, field, shoreline	X		
White-tailed deer	Forest, field, shoreline, lands	X		
Longtail Weasel	Shoreline, wetlands, woods	X		
Mink	Shoreline, wetlands, tributaries	X		
Muskrat	Reservoir, wetlands	X		
Beaver	Reservoir, wetlands, shoreline	X		
River Otter	Reservoir, rivers, streams	X		
Gray Squirrel	Forest, shoreline	X		
Flying Squirrel	Forest	X		
Opossum	Forest, shoreline	X		
Chipmunk	Forest, field, shoreline	X		
Striped Skunk	Forest, shoreline	X		
Eastern Cottontail	Forest, field, marshes	X		
Harvest Mouse	Fields, shoreline	X		
Cotton Rat	Fields, forest, shoreline	X		
Shorttail Shrew	Forest, field, wetland, shoreline	X		
Least Shrew	Forest, wetland	X		
Southeastern Shrew	Forest, wetland, shoreline	X		
Eastern Mole	Fields, shoreline	X		
Raptors				
Bald Eagle	Open water, shoreline	X		
Osprey	Open water, shoreline			X
Red-tailed Hawk	Forest, fields, shoreline	X		
Cooper's Hawk	Forest, forested wetlands			X
Red-shouldered Hawk	Forest, forested wetlands	X		
Mississippi Kite	Forest, streams			X
Peregrine Falcon	Open areas, cliffs near rivers, cities			X
American Kestrel	Fields			X
Eastern Screech Owl	Forest, fields, farmland	X		
Great Horned Owl	Forest, forested wetlands	X		
Barred Owl	Forest, forested wetlands	X		
Turkey Vulture	Forest, field, shoreline			X
Black Vulture	Forest, field, shoreline			X
Wading/Shorebirds				
Great Blue Heron	Wetlands, shoreline	X		
Great Egret	Wetlands, shoreline			X
Snowy Egret	Wetlands, shoreline			X
Little Blue Heron	Wetlands, shoreline			X
Cattle Egret	Wetlands, farmland			X
Green Heron	Wetlands			X
Killdeer	Fields, shoreline			X
Spotted Sandpiper	Shoreline, wetlands			X
Greater Yellowlegs	Open wetlands, shoreline			X

Table E.3-9: Species of Wildlife Commonly Observed or Known to Occur at the Project (continued)

Species	Habitat	Resident/ Breeding	Part-year Resident	Transitory
American Woodcock	Wetlands, forest, field, thickets			X
Laughing Gull	Wetlands, open water			X
Common Tern	Open water, shoreline, lakes			X
Black Tern	Wetlands, lakes			X
Waterfowl				
Wood Duck	Wetlands			X
Gadwall	Wetlands, lakes			X
Mallard Duck	Wetlands, open water			X
American Black Duck	Wetlands, open water			X
Green-winged Teal	Wetlands, open water			X
Ring-necked Duck	Wetlands, open water			X
Canada Goose	Wetlands, open water	X		
Common Loon	Open water			X
Pied-billed Grebe	Wetlands, lakes			X
American Coot	Wetlands, open water			X
Double-crested cormorant	Open water			X
Song Birds				
Rock Pigeon	Cities, residential areas, farmland			
Mourning Dove	Forest, field, shoreline	X		
Yellow-billed Cuckoo	Forest, field			X
Black-billed Cuckoo	Forest, forest edges, thickets			X
Red-headed Woodpecker	Forest	X		
Pileated Woodpecker	Forest	X		
Northern Flicker	Forest			X
Downy Woodpecker	Forest	X		
Hairy Woodpecker	Forest	X		
Red-bellied Woodpecker	Forest	X		
Yellow-bellied Sapsucker	Forest			X
Eastern Kingbird	Shoreline, field, wetlands			X
Great Crested Flycatcher	Forest, shoreline			X
Eastern Wood-Pewee	Forest, shoreline			X
Eastern Phoebe	Forest, shoreline			X
Acadian Flycatcher	Forested wetlands, wetlands			X
Barn Swallow	Fields, farmland, shoreline			X
Willow Flycatcher	Thickets			X
Northern Rough-winged Swallow	Shoreline, tributaries			X
Chimney Swift	Towns, residential areas			X
American Crow	Shoreline, wetlands, fields	X		
Fish Crow	Forest, rivers, shoreline, fields	X		
Purple Martin	Towns, farmland, fields			X
Tree Swallow	Wetlands, meadows, lakes			X
Cliff Swallow	Farmland, cliffs near rivers, lakes			X
Blue Jay	Forest			X
Carolina Chickadee	Forest	X		

Table E.3-9: Species of Wildlife Commonly Observed or Known to Occur at the Project (continued)

Species	Habitat	Resident/ Breeding	Part-year Resident	Transitory
Eastern Tufted Titmouse	Forest	X		
White-breasted Nuthatch	Forest	X		
Brown-headed Nuthatch	Forest	X		
Ruby-crowned Kinglet	Forest			X
Carolina Wren	Forest, residential, shoreline	X		
Golden-crowned Kinglet	Forest			X
Blue-gray Gnatcatcher	Forest			X
Brown Thrasher	Fields, wetlands			X
Gray Catbird	Fields, residential, shoreline			X
Northern Mockingbird	Residential	X		
Eastern Bluebird	Fields, farmland			X
American Robin	Residential, fields			X
Hermit Thrush	Forest			X
Wood Thrush	Forest			X
Red-Eyed Vireo	Forest			X
Yellow-throated Vireo	Forest			X
White-eyed Vireo	Forest			X
Warbling Vireo	Forest			X
Prothonotary Warbler	Forested wetlands, shoreline			X
Northern Parula	Forested wetlands			X
Yellow-throated Warbler	Forest			X
Black-and-white Warbler	Forest			X
Yellow Warbler	Forest			X
Pine Warbler	Forest			X
Hooded Warbler	Forest, forested wetlands			X
Kentucky Warbler	Forest			X
Cape May Warbler	Forest			X
Palm Warbler	Forest, wetlands			X
Prairie Warbler	Forest edge, shrubby forest, thickets			X
Blackburnian Warbler	Forest			X
Worm-eating Warbler	Forest, forested wetlands			X
Northern Waterthrush	Wetlands, lakes			X
Common Yellowthroat	Wetlands, forested wetlands			X
Yellow-breasted Chat	Forest, shoreline			X
Ovenbird	Forest			X
Louisiana Waterthrush	Forested wetlands, tributaries			X
Red-winged Blackbird	Wetlands	X		
Common Grackel	Shoreline, fields, wetlands	X		
Eastern Meadowlark	Fields, farmland			X
Orchard Oriole	Forest			X
Scarlet Tanager	Forest			X
Summer Tanager	Forest			X
Northern Cardinal	Forest, residential	X		
Blue Grosbeak	Forested wetlands			X
Indigo Bunting	Fields, farmland			X

Table E.3-9: Species of Wildlife Commonly Observed or Known to Occur at the Project (continued)

Species	Habitat	Resident/ Breeding	Part-year Resident	Transitory
Eastern Towhee	Forest			X
Chipping Sparrow	Fields, farmland, residential			X
Song Sparrow	Fields, farmland, residential			X
White-throated Sparrow	Forest			X
American Goldfinch	Fields, residential, farmland			X
House Sparrow	Residential, farmland	X		
House Finch	Cities, residential areas, farmland	X		
Brown-headed Cowbird	Field, shoreline, forest	X		
Ruby-throated Hummingbird	Fields, farmland, residential			X
Belted Kingfisher	Shoreline, open water	X		
Gamebirds				
Wild Turkey	Forest	X		
Northern Bobwhite	Fields, farmland	X		

Source: Yadkin SMP (1999) and Avian Inventory (CCB, 2005 Appendix E-7).
Note: Many other songbirds, waterfowl, and shorebirds may use the reservoirs and surrounding buffer in migration.

During the consultation phase of the Project relicensing, agencies and stakeholders identified several issues with respect to wildlife and wildlife habitats that they requested be addressed by conducting certain studies or inventories of wildlife or habitats including an inventory of birds utilizing various habitats in and around the Project (CCB, 2005 Appendix E-7), and an assessment of wildlife habitats on Project lands, which occur primarily along two short sections of transmission line and in the immediate vicinity of the Project dams and powerhouses (NAI, 2005b Appendix E-8). The findings of both of these studies are summarized later in this section.

In addition to these two studies, the use of the Project by bald eagles and great blue herons for nesting has been the subject of ongoing monitoring for several years. Specifically, for the past four years, APGI has conducted a bald eagle and great blue heron nesting survey on all four Project reservoirs. The results of the most recent surveys are provided in Appendices E-9, E-10, and E-11 and are summarized herein.

E.3.2.1 Bald Eagle and Great Blue Heron Nesting Surveys

The Yadkin Project reservoirs have been utilized for many years by bald eagles. Bald eagles initially appeared at the Project in mid-1990s during the winter and utilized the reservoirs for fishing and areas surrounding the reservoirs for roosting. As early as 1996, the USFWS indicated its concern with the protection of bald eagle roosting and nesting habitat and the protection of those habitats in the face of increasing shoreline development around the Yadkin Project reservoirs. In response to those concerns, APGI developed a Bald Eagle Management Plan for the Yadkin Project which was submitted to and approved by FERC. Later, bald eagle habitats were inventoried and identified as critical habitat that was subsequently classified as “Conservation Zone” under the FERC-approved Yadkin Project Shoreline Management Plan.

Beginning in 2001, APGI initiated annual bald eagle nesting surveys to document nesting attempts and successes by eagles at the Project. The specific objectives of the surveys were to: document the status, distribution and productivity of nesting pairs of bald eagles in association with the Yadkin reservoirs and associated river corridors; increase the understanding of bald eagle natural history in interior regions of North Carolina; and determine the status and distribution of breeding great blue herons along the Project reservoirs.

Each spring, all four Project reservoirs and their major tributaries were surveyed for breeding bald eagles (CCB, 2004 and CCB, 2002 Appendices E-11, E-10, and E-9). Surveys were conducted from the air, and usually nesting activity was surveyed twice each spring; once early in the spring to inventory nesting attempts and again in late spring to determine fledgling success. During the early spring aerial surveys, eagle nests and bald eagles were surveyed including examination of nests to determine structural condition, the type and condition of nest trees, and the condition of the surrounding landscape. During the late spring surveys, bald eagle observations were recorded and the nests were rechecked to determine the structural condition of the nests and nest contents.

Table E.3-10 summarizes the results of the most recent surveys. Although two bald eagle territories were located in 2002 along High Rock, only one bald eagle territory was observed to be active on High Rock Reservoir in 2003 and 2004 since one nest (RO-02-01) was blown out of the tree in 2002 and has not been replaced. One nest has been active on Tuckertown Reservoir since 2002. Although two nests have been documented in the surveys at Narrows Reservoir, only the newer nest was active in 2003 and 2004. The nest located at Falls Reservoir has not been active since 2002 and appears to have been abandoned.

Table E.3-10: Summary of Activity of Bald Eagle Surveys (2002-2004)

Nest	2002	2003	2004	Comments
High Rock Reservoir				
DA-01-01	Active	Active		Active and productive since 2001; good visual buffer on all sides; limited disturbance potential.
RO-04-01			Active	Replacement nest for DA-01-01; active late in the breeding season; located directly across the reservoir from DA-01-01; limited disturbance potential.
RO-02-01				Nest was blown out of the tree in spring of 2002 and has not been rebuilt; located along the shoreline.
Tuckertown Reservoir				
RO-02-02	Active	Active	Active	Located within the upper section; fairly remote with a considerable buffer on upland side and a tree buffer on water side; limited disturbance potential.
Narrows Reservoir				
ST-01-01				An older nest; disturbance appears to be limited.
MO-03-01		Active	Active	A new nest located on Uwharrie National Forest land; protected by a visual buffer of scattered trees; may be seen and accessed from a nearby logging road.
Falls Reservoir				
ST-01-02				Located along the shoreline of Falls Reservoir; appeared to be in good condition; appeared to be abandoned; limited disturbance potential.

The Yadkin Project also provides breeding habitat for a significant number of great blue heron. For this reason, all breeding colonies of great blue herons are also inventoried during the annual bald eagle nesting surveys. Since 2002, breeding colonies of great blue heron were found on High Rock, Tuckertown and Narrows Reservoirs (Table E.3-11). No breeding colonies were detected on Falls Reservoir, but this is not surprising as appropriate nesting habitat is limited along this reservoir.

Table E.3-11: Results of Great Blue Heron Breeding Colony Surveys (2002-2004)

Reservoir	2002 Number of Breeding Colonies	2002 Estimated Breeding Pairs	2003 Number of Breeding Colonies	2003 Estimated Breeding Pairs	2004 Number of Breeding Colonies	2004 Estimated Breeding Pairs
High Rock	5	528	5	437	5	563
Tuckertown	1	19	1	60	1	75
Narrows	1	140	1	185	2	118
Falls	0	0	0	0	0	0
Total	**7**	**687**	**7**	**682**	**8**	**756**

E.3.2.2 Transmission Line and Project Facility Habitat

In response to comments on the Yadkin Project Relicensing Initial Consultation Document, APGI surveyed wildlife habitats on Project lands, including two short sections of transmission line sections that are within the Yadkin Project boundary. The specific objectives of the study were to: identify vegetation cover types and wildlife habitat quality in the vicinity of Project transmission lines, dams, and powerhouses; evaluate effects of transmission line and facility operation and maintenance on vegetation cover and wildlife habitat; and identify opportunities for wildlife habitat enhancements on Yadkin Project lands (NAI, 2005b Appendix E-8). A more detailed discussion relative to botanical species can be found in Section E.3.3.3.

The study area for this wildlife habitat assessment included the Falls and Narrows transmission corridors (approximately 4.4 miles) and Project lands in the vicinity of the four dams and powerhouses including parking lots and access roads (NAI, 2005b Appendix E-8). A preliminary delineation of vegetation cover types was made using aerial photographs taken during the summer 2003 and was verified in the field during three reconnaissance-level surveys conducted between April and October 2004. During the field surveys, vegetation cover types and wildlife habitat quality were reviewed and representative areas were also inventoried as to species, structure and composition. All of the dam-related facilities and both transmission line corridors were visited one or more times during the field surveys. An evaluation was completed of wildlife habitat quality and use by birds, mammals, reptiles and amphibians within representative areas.

Results of the surveys showed that the vegetation found on Project lands around the dams and powerhouses and in the transmission line corridors is managed by APGI to maintain visibility, appearance and facility access, resulting in a mixture of grasses and shrubs as the predominant vegetative cover type in these areas (NAI, 2005b Appendix E-8). Around the dams and powerhouses, most lands are open areas used for parking and vehicle access which offer relatively low quality habitat for wildlife. Common vertebrate wildlife using these areas include small mammals and small birds, including migratory songbirds. Species likely to be encountered include Gray Squirrel, moles, shrews, lizards, snakes, Carolina Chickadee, Blue Jay, and Cardinal.

The Falls (approximately 3 miles in length) and Narrows (approximately 2 mile in length) transmission line corridors add to the diversity of habitat within the area that otherwise is characterized by large blocks of woodland, sections of which are under silvicultural management (NAI, 2005b Appendix E-8). Both of the transmission line corridors are characterized by a mix of herbaceous and shrub habitat abutting timber stands which provides structure (vertical and horizontal complexity), an important habitat element for wildlife usage. Because of this habitat diversity, many vertebrate species were found to use the transmission line corridor environment including neotropical migratory birds, resident songbirds and game birds, birds of prey, large and small mammals, reptiles and amphibians. Reptiles find particular value in the "solar window" provided by forest openings of the kind maintained in transmission line corridors. In addition, the Falls transmission line crosses an emergent marsh, in which the water ponds for a sufficient time to support aquatic species. The "ephemeral pool" is important habitat to many amphibian species, such as Spotted and Marbled Salamanders (*Ambystoma* spp.) and Upland Chorus Frog (*Pseudacris triseriata*), which may use them for breeding (NAI, 2005b Appendix E-8).

Table E.3-12 lists the wildlife species observed along the Falls and Narrows transmission lines during this study.

Table E.3-12: Wildlife Species or Signs of Wildlife Observed in the 2004 Narrows and Falls Transmission Line Surveys

Common Name	Scientific Name	Narrows	Falls
Birds			
Blue jay	*Cyanocitta cristata*		X
Bluebird, eastern	*Sialia sialis*		X
Chickadee, Carolina	*Poecile carolinensis*		X
Crow, American	*Corax brachyrhynchos*		X
Cuckoo, yellow-billed	*Coccyzus americanus*		X
Eagle, bald	*Haliaeetus leucocephalus*	X	
Flycatcher, Acadian	*Empidonax virescens*		X
Flycatcher, great crested	*Myiarchus crinitus*		X
Goldfinch, American	*Carduelis tristis*		X
Hawk, red-tailed	*Buteo jamaicensis*	X	
Hummingbird, ruby-throated	*Archilochus colubris*		X
Indigo bunting	*Passerina cyanea*	X	X
Kingfisher, belted	*Ceryle torquata*	X	
Tanager, summer	*Piranga rubra*	X	X
Thrush, wood	*Hylocichla mustelina*	X	
Towhee	*Pipilo erythrophthalmus*	X	X
Tufted titmouse	*Baeolophus bicolor*		X
Turkey	*Meleagris gallopavo*		X
Vireo, red-eyed	*Vireo olivaceus*	X	X
Vulture, black	*Coragyps atratus*	X	X
Vulture, turkey	*Cathartes aura*	X	X
Warbler, black and white	*Mniotilta varia*		X
Warbler, magnolia	*Dendroica magnolia*		X
Warbler, parula	*Parula Americana*		X
Warbler, pine	*Dendroica pinus*		X
Warbler, prairie	*Dendroica discolor*		X
Warbler, prothonotary	*Protonotaria citrea*		X
Woodpecker, red-bellied	*Melanerpes carolinus*		X
Wren, Carolina	*Thyothorus ludovicianus*	X	X
Reptiles			
Fence lizard	*Sceloporus undulatus*		X
Racerunner, six-lined	*Cnemidophorus sexlineatus*		X
Skink, ground	*Scincella lateralis*		X
Snake, black racer	*Coluber constrictor*		X
Snake, eastern hognosed	*Heterodon platyrhinos*		X
Snake, rat	*Elaphe obsolete*		X
Snake, ringneck	*Diadophis punctatus*		X
Snake, timber rattler	*Crotalus horridus*		X
Snake, worm	*Carphophis amoenus*	X	
Turtle nest	Emydidae	X	X
Turtle, box	*Terrepene Carolina*	X	X
Amphibians			
Egg masses	*Rana clamitans*		X

Table E.3-12: Wildlife Species or Signs of Wildlife Observed in the 2004 Narrows and Falls Transmission Line Surveys (continued)

Common Name	Scientific Name	Narrows	Falls
Green frog	*Acris crepitans*		X
Northern cricket frog	*Hyla crucifer*		X
Spring peeper	*Hyla versicolor*		X
S. gray treefrog	*Acris* spp.		X
Cricket frog chorusing			X
Salamander tadpoles			X
Toad tadpoles			X
Toad, American	*Bufo americanus*		X
Mammals			
Red Squirrel	*Tamiasciurus hudsonicus*		X
Rodent	Cricetidae		X
White-tailed deer	*Odocoileus virginicus*		X

Source: Transmission Line and Project Facility Habitat Assessment Final Study Report (NAI 2005b, Appendix E-8).

E.3.2.3 Avian Inventory

In response to comments on the Yadkin Project Relicensing Initial Consultation Document, migratory and breeding birds in the Project area were surveyed. The main objective of the study was to evaluate the current status of migratory and breeding bird use of the Yadkin Project. The focus of the survey was to survey priority habitats for birds. Priority was given to documenting species of management interest or species already listed by state or federal authorities (CCB, 2005 Appendix E-7).

Habitats within the Project area were surveyed and habitat types were grouped into the following habitat categories:

- Mainland habitats located along two transmission line corridors (an approximately 2 mile long corridor from Narrows Dam, and an approximately 3 mile long corridor from Falls Dam), and small areas of land around the Project dams and powerhouses. In addition, mainland habitats located within close proximity to the Project reservoirs were also included in the survey.
- Wetlands and riparian floodplain islands located in upper High Rock Reservoir and upper parts of Tuckertown and Narrows reservoirs. Wetlands associated with Crane Creek cove were also surveyed.
- Early successional shrub-scrub habitat associated with clearcuts.
- Open water surveys were conducted on all four project reservoirs.

Each of these habitats were surveyed for birds using a variety of methods including point counts, line transects, aerial surveys, and area searches between October 2003 and July 2004 with an additional aerial survey in January 2005 to aid in analysis of waterfowl habitat use on the Project reservoirs (CCB, 2005 Appendix E-7). The survey results found that habitats within the Project area support a diverse array of species. During the survey, 124 different species (over 7,000 individuals) were recorded in the Yadkin Project area (CCB, 2005 Appendix E-7). Nine of the species detected are designated by Partners in Flight (PIF) as "watch" species or species of concern in the Southern Piedmont Region, including Brown-headed Nuthatch, Prairie Warbler, Worm-eating Warbler, Chimney Swift, Field Sparrow, Wood Thrush, Kentucky Warbler, Prothonotary Warbler, and American Black Duck. All bird species listed in Table E.3-9 in Section E.3.2 were identified during the recent surveys.

Of the Project habitats surveyed, the riparian floodplain habitats located along undeveloped portions of the reservoir shorelines, particularly in the upper end of High Rock Reservoir, were found to support the most diverse assemblages of neotropical migratory birds, including high concentrations of the Prothonotary Warbler, a PIF "watch list" species. The pine islands in the Project reservoirs were found to support most of the Great Blue Heron rookeries in the Project area. Great Egrets were also found to be nesting in these rookeries (CCB, 2005 Appendix E-7). Keeping the islands containing rookeries free of disturbance during the May through June breeding season would benefit these species.

A high species richness and density of neotropical migrants were observed in the early successional shrub-scrub habitat. At the Project, this habitat type is often bordered by a thin section of pine or hardwood, creating an edge effect between two separate habitats. The edge effect can concentrate species between two habitat types, thereby increasing species richness within the shrub-scrub habitat. The Prairie Warbler and Field Sparrow, PIF "watch" species, use shrub-scrub type habitat for breeding.

Hardwood habitats located within the Project area were found to support at least three PIF "watch" species (Wood Thrush, Worm-eating Warbler, and Kentucky Warbler). This habitat is also important for neotropical migratory birds passing through and late successional stage hardwood habitats provide the largest species richness and abundance of hardwood habitat types.

The habitat with the lowest observed bird densities was the monoculture pine plantations located near the Project reservoirs. While both young (1-5 years) and old (>100 years) pine forests support large communities of birds, intermediate aged pine forests support very few bird species. However, at least one important PIF "watch" species, the Brown-headed Nuthatch, is a southeastern pine ecosystem obligate and would be expected to utilize this habitat.

The fall and winter Narrows and Falls transmission line corridor surveys detected low diversity and numbers of migrant and wintering birds. The patchy, grassy habitat along these corridors provides poor habitat for migrant or wintering birds and much of the corridor habitat is exposed rock. Since the transmission line is too narrow to provide any substantial habitat for wintering birds, it is not currently an important migratory bird use area.

The Project area generally provides little suitable habitat for waterfowl. The aerial waterfowl survey found waterfowl congregating mainly on Duke Power's Buck Steam Station settling ponds. The Center for Conservation Biology (CCB) suggested that the apparent lack of shallow water and emergent vegetation in the Project area deters waterfowl use.

Overall, the CCB study found that the Yadkin Project area provides nesting and migratory habitat for a large number of bird species. Many of the habitats utilized by the birds are outside the Project boundary and not within the influence of Project operations (hardwood and softwood forests). Other habitat types, including primarily the riparian shrub-scrub habitats located in places around the periphery of the Project reservoirs, could be influenced by Project operations, and in particular reservoir water levels. However, the study identified no specific adverse impacts to the bird community or habitats associated with the current operation of the Yadkin Project.

E.3.3 Botanical Resources

E.3.3.1 Wetlands

Wetlands are one of the most important habitats found at the Yadkin Project. In response to comments on the Yadkin Project Relicensing Initial Consultation Document during the study phase of the relicensing process, APGI conducted a comprehensive survey of wetlands at the Yadkin Project. The primary objectives of the study were to: 1) identify and map vegetated wetlands and riparian habitats within the influence of reservoir water levels; 2) evaluate the effects of current Project operations on these wetlands and riparian habitats; 3) assess the effects of reservoir facilities (such as piers, boat ramps, beaches, bulkheads and other forms or shoreline hardening) on wetlands and riparian habitats, with a particular emphasis on the potential impact of piers on water willow at Narrows Reservoir; and 4) evaluate how significant changes in Project operations, including both increasing and decreasing short-term and long-term reservoir drawdowns would impact existing wetlands, or would allow for additional wetland development (NAI, 2005d Appendix E-12). Assessing the effects of reservoir facilities on wetlands and riparian habitats was added as a study objective to address the concern of the North Carolina Wildlife Resources Commission regarding the impact of piers on emergent and wetlands and aquatic beds, particularly on Narrows Reservoir.

As part of the study, all of the wetlands located within the study area which included all of the Project reservoirs as well as the shoreline within 200 feet of the reservoirs were mapped (NAI, 2005d Appendix E-12). Table E.3-13 below summarizes the wetland acres at the Project reservoirs. Wetland delineation and mapping was done using aerial photography conducted in July 2003 and field surveys in late 2003 and 2004. Wetlands were categorized into six categories: forested wetland, forested floodplain wetland, scrub-shrub wetland, sparse scrub-shrub wetland, emergent marsh, and aquatic bed. The remainder of the study area was categorized into eight upland cover types: forest, shrub (including areas, typically under powerlines, permanently maintained in the shrub/sapling stage), urban/recreational grasslands, agriculture-pasture, agriculture-crops, residential, commercial/industrial, and bare soil or rock.

Table E.3-13: Existing Wetland Acres at the Yadkin Project Reservoirs

Wetland Type	High Rock	Tuckertown	Narrows	Falls	Falls Tailrace	Project Total
Forested Wetland	234	64	51	<1	6	355
Forested Floodplain Wetland	2194	86	40	0	<1	2320
Scrub-Shrub Wetlands	325	40	4	<1	<1	369
Sparse Scrub-Shrub Wetlands	484	4	0	0	0	488
Emergent Marsh	28	45	179	3	2	257
Aquatic Bed	3	14	60	0	0	77
Reservoir Total	**3268**	**253**	**334**	**3**	**8**	**3866**

High Rock Wetlands

As shown in Table E.3-13, High Rock Reservoir supports the greatest total acreage of wetland habitat with a total of 3,268. The vast majority of the wetland acres found at High Rock are concentrated in the upper end of the reservoir, where extensive areas of forested floodplain wetlands exist (2,194 acres of the total) and where there are sizeable scrub-shrub wetlands, mainly composed of black willow, that have developed on deltas and islands formed by sediment deposits. Elsewhere in High Rock Reservoir, wetlands are noticeably absent, and there are almost no stands of emergent marsh or aquatic bed wetlands.

The concentration of scrub-shrub wetlands in the upper end of High Rock Reservoir is primarily the result of colonization by wetland plant species of large areas of sediment deposition which has created a complex of islands, deltas and sand bars (NAI, 2005d Appendix E-12). These wetlands provide the premier riparian habitat on High Rock Reservoir and are critical to the reservoir as fish spawning and rearing habitat. The wetlands located in the upper end of High Rock Reservoir appear to be unaffected by the current operation of the reservoir and the resulting fluctuating reservoir water levels, but are clearly affected by high river flows which cause flooding in the floodplain and can generate flow velocities that can dislodge vegetation and remobilize the deposited sediments.

The lack of wetlands elsewhere in the reservoir appears to be due to the current operation of the reservoir which is characterized by a period of reservoir drawdown of between 10-15 feet during the fall and winter (NAI, 2005d Appendix E-12). In addition, drawdowns of five feet or more late in the summer growing season impact wetland formation. Few native emergent or aquatic species can tolerate the combined effects of the conditions created in the reservoir drawdown zone: flooding for periods in the spring, followed by "drought" as the water levels drop in the late summer and fall. Exposure to freezing and desiccation in the winter further stresses any overwintering plant material. Annuals are the best strategists for taking advantage of regeneration opportunities, as was observed during the drought of 2002 when entire sections of the reservoir that were exposed by the prolonged drawdown were colonized in the late summer by a grass or sedge.

Tuckertown Wetlands

Tuckertown Reservoir supports 253 acres of wetlands (NAI, 2005d Appendix E-12). The wetlands at Tuckertown are a mix of all six wetland types. Forested floodplain wetlands and forested wetlands were the dominant wetland types at Tuckertown occurring in scattered stands at the mouths of most tributaries. Within each of the wetland types found at Tuckertown, the species composition of the wetlands is very diverse. In particular, the emergent marsh and aquatic bed wetlands found in the reservoir contain a healthy mix of species and exhibit a classic pattern of zonation that is a characteristic of a healthy wetland system. The extensive development of emergent marsh and aquatic bed wetlands at Tuckertown is attributed to its relatively stable water levels, quiet water, and fine, gently sloping substrates.

Narrows Wetlands

Narrows Reservoir supports 334 acres of wetlands (NAI, 2005d Appendix E-12). The most prevalent wetland type at Narrows was emergent marsh which accounted for 179 acres of the total, followed by aquatic beds (60 acres of the total). There were no sparse scrub shrub wetlands at Narrows. In contrast to Tuckertown, emergent marsh wetlands on Narrows are not species diverse but are instead dominated by water willow *(Justicia americana*). In some cases beds of emergent vegetation were found to be made up entirely of water willow. The existence of large stands of water willow on Narrows suggests that growing conditions are very suitable for this species which is particularly tolerant of alternating periods of inundation and exposure. Aquatic beds at Narrows Reservoir were confined to four backwater ponds created by the railroad bed on the west side of the reservoir.

Falls Wetlands

Falls Reservoir has the fewest wetlands both in acres (3 acres) and percent (NAI, 2005d Appendix E-12). This reservoir is characterized by steep, rocky slopes and substrates and a riverine nature. These natural features along with very frequent fluctuations in reservoir water levels serve to limit additional wetland development on Falls Reservoir. The dominant wetland type at Falls was emergent marsh which accounted for about 3 acres of the total. Like Narrows, emergent wetlands at Falls were dominated by water willow. Forested floodplain wetlands, aquatic beds, and sparse scrub shrub wetlands were not present in Fall Reservoir. The Falls tailrace, which extends into Tillery Reservoir, was estimated to have 8 acres of wetlands. The most prevalent type of wetland in the Falls tailrace was forested wetlands.

Effects of Structures on Water Willow

During the study phase of the relicensing process, NCWRC indicated a particular concern with the effects of man-made facilities (such as piers, boat ramps, beaches, bulkheads and other forms of shoreline hardening) on wetland and wetland vegetation. The focus of this concern is Narrows Reservoir where there are approximately 1,084 (as of September 6, 2005) private piers which have the potential to impact water willow. To address this issue, as part of the wetlands study, NAI conducted a special investigation of the effects of piers on water willow at Narrows. Specifically, NAI sampled 16 "old" piers constructed prior to 1997 and 18 "new" piers constructed after 1997 which were located in beds of water willow or in potential water willow habitat (NAI, 2005d Appendix E-12). At each new pier, key parameters collected included length, width, and water depth of the water willow bed on either side of the pier, the height and width of the pier within the water willow bed, land use features, and management of the aquatic bed (if apparent). For the old piers, the data was more qualitative and included estimates of the percent cover of water willow adjacent to and under the pier and a description of impacts to the water willow bed.

Approximately 178 acres of water willow were recorded on Narrows with almost half (86 acres) occurring in beds large enough to be delineated from the aerial photographs. The remainder (92 acres) resulted from estimates of small and/or narrow beds fringing the edge of the reservoir. In total, 30% of the shoreline of Narrows was estimated to support water willow. In general, NAI found that water willow is capable of growing close to and around piers, even piers that are situated low to the water. However, associated use of piers for boating, jet skis, swimming and other activities clearly can disturb and destroy these beds. Other human disturbance activities along the shoreline such as the addition of sand and the intentional removal of aquatic plants were also observed to have a detrimental effect on water willow located along developed portions of Narrows Reservoir.

E.3.3.2 Invasive Exotic Plant Pests

The presence of invasive exotic plant pests (IEPPs) at the Yadkin Project was another issue of concern to resource agencies. In response to comments on the Yadkin Project Relicensing Initial Consultation Document, APGI conducted a survey of the IEPPs found within the Yadkin Project area. The specific objectives of the study were to: identify potential impact areas within the Project area and inventory for the presence of IEPP species, evaluate the current status of known aquatic IEPPs, and evaluate potential impacts of IEPPs on natural communities in areas of concern (NAI, 2005a Appendix E-13).

IEPPs are non-native plants that were introduced to this country over the years, and possess characteristics or growth habits that allow them to out-compete native vegetation or occupy new habitats. IEPPs are ubiquitous to developed areas of the United States, and the Yadkin Project area is no exception (NAI, 2005a Appendix E-13). Common examples of IEPPs include Japanese honeysuckle and kudzu. IEPPs are of concern in areas where they have the potential to threaten rare plant species or native vegetation that provide important habitat for wildlife.

The focus of APGI's study was to survey the Project area for IEPPs that pose a threat to rare plant species or important wildlife habitats at the Yadkin Project (NAI, 2005a Appendix E-13). At the outset of the study, a list of IEPPs that were considered likely to occur in the Project area and would be the focus of the inventory was developed and approved by the Wetlands, Wildlife and Botanical IAG. In total, 32 IEPPs, including both aquatic and terrestrial plants, were included on the initial IEPP search list. Field searches for IEPPs were conducted during the fall of 2003 and the spring, summer and fall of 2004.

Results of the field surveys found 20 species of IEPPs occurring in the Yadkin Project area, including 3 aquatic species and 17 terrestrial species (NAI, 2005a Appendix E-13). Table E.3-14 lists the IEPP species found in the Project area during APGI's study.

Table E.3-14: IEPP Species Observed within Yadkin Project Area

Scientific Name	Common Name	Life Form	Habitat
Aquatic			
Hydrilla verticillata	Hydrilla	SAV	Aquatic bed
Ludwigia hexapetala/uruguayensis	Uruguay waterprimrose	SAV	Aquatic bed
Pistia stratiotes	Water lettuce	SAV	Aquatic bed
Terrestrial			
Ailanthus altissima	Tree of Heaven	Tree	Upland, dams
Albizia julibrissin	Mimosa	Tree	Upland, dams
Arthraxon hispidus	Small carpgrass/hairy jointgrass	Grass	Powerline
Lespedeza cuneata	Chinese lespedeza	Grass	Powerline, dams
Ligustrum japonicum	Japanese privet	Shrub	Upland
Ligustrum sinense	Chinese privet	Shrub	Upland, forested wetlands
Lonicera japonica	Japanese honeysuckle	Vine	Upland, forested wetlands
Lonicera spp (morrowii, bella, tartarica)	Bush honeysuckle	Shrub	Upland, forested wetlands
Melia azedarach	Chinaberry	Tree	Powerline
Microstegium vimineum	Nepalese browntop	Grass	Powerline, upland, forested wetlands
Miscanthus sinensis	Chinese silvergrass	Grass	Powerline
Pueraria montana	Kudzu	Vine	Dams
Rosa multiflora	Multiflora rose	Shrub	Upland, dams
Wisteria sinensis	Chinese wisteria	Vine	Dams
Glechoma hederacea	Gill-over-the-ground	Herb	Forested wetlands
Lysimachia nummularia	Moneywort	Herb	Forested wetlands
Rosa wichuraiana	Memorial rose	Vine	Dams

Of the aquatic IEPP species located by NAI at the Yadkin Project, only one, a small population of Hydrilla found in the Flat Creek arm of Tuckertown Reservoir, is of any concern (NAI, 2005a Appendix E-13). NAI concluded that this Hydrilla population "bears watching" to see if the population is expanding or stable. Another aquatic IEPP species, Uruguay Water-primrose (*Ludwigia uruguayensis* (*L. hexapetala*)), was found in a large monotypic stand only in Abbotts Creek at High Rock Reservoir, but was not considered a concern. The third aquatic IEPP found included three small specimens of floating Water Lettuce (*Pistia stratiotes*), found in Narrows Reservoir, apparently far from their point of origin. Two aquatic IEPP species that were previously reported to occur in one or more of the Project reservoirs, Variable-leaf Milfoil (*Myriophyllum heterophyllum*) and Brazilian elodea (*Egeria densa*) were not found during the study period. Overall, the NAI study concluded that aquatic IEPP species constitute no apparent threat to native species in aquatic plant communities under existing conditions. However, because aquatic IEPPs do have the potential to become more widely established, particularly in response to any change in reservoir operation, NAI recommended periodic monitoring of aquatic IEPPs.

About a dozen terrestrial IEPP species were found in the primarily upland vegetation of both the Falls Dam and Narrows Dam transmission lines as described in further detail in Section E.3.3.3 (NAI, 2005a Appendix E-13). However, many of the IEPP species appear to be irreversibly incorporated in their respective plant communities, and in most cases, attempts to eliminate or control them would be infeasible. Moreover, only one of the terrestrial IEPP species, *Lonicera X bella* (bush honeysuckle), was determined to be of immediate management concern. On the Falls Reservoir shoreline, just downstream of Narrows Dam, this species was found growing in the upland forest in close association with two RTE species, piedmont indigo-bush (*Amorpha schwerinii*) and thick-pod white wild indigo (*Baptisia alba*). At this site, an area commonly referred to as the "Yadkin River Scour Banks", the bush honeysuckle occupied most of the available space that appeared to provide suitable habitat for the two RTE species.

E.3.3.3 Transmission Line and Project Facility Habitat

In response to comments on the Yadkin Project Relicensing Initial Consultation Document filed with FERC in 2002, APGI conducted a survey of the vegetation cover types and wildlife habitat on Project lands, including two Project transmission line sections. The specific objectives of the study were to identify vegetation cover types and wildlife habitat quality in the vicinity of Project transmission lines, dams, and powerhouses, to evaluate effects of transmission line and facility operation and maintenance on vegetation cover and wildlife habitat, and to identify opportunities for wildlife habitat enhancements on Yadkin Project lands (NAI, 2005b Appendix E-8). A more detailed discussion of the survey results relative to wildlife species was provided earlier in Section E.3.2.2.

The study area for APGI's assessment included the Falls and Narrows transmission corridors (approximately 4.4 miles) and Project lands in the vicinity of the four dams and powerhouses including parking lots and access roads (NAI, 2005b Appendix E-8). A preliminary delineation of vegetation cover types was made using aerial photographs taken during the summer 2003 and was verified in the field during three reconnaissance-level surveys conducted between April and October 2004. During the field surveys, vegetation cover types and wildlife habitat quality were reviewed and representative areas were also inventoried as to species, structure and composition. All of the dam-related facilities and both transmission line corridors were visited one or more times during the field surveys.

Results of the surveys showed that the vegetation found on Project lands around the dams and powerhouses and in the transmission line corridors is managed by APGI through a combination of logging to remove tree fall risk, and mowing and herbicides to maintain visibility, appearance and facility access (NAI, 2005b Appendix E-8). As a result, the predominant vegetative cover type found in these areas is a mixture of grasses and shrubs. Around the dams and powerhouses, most lands are open areas used for parking and vehicle access that offer relatively low quality habitat for wildlife.

The Falls and Narrows transmission line corridors are predominantly rolling upland with scattered rock outcrops and boulders. The vegetation found within the cleared portion of the corridors is generally a mix of herbaceous and shrub species. Grasses, sedges, and regenerating tree species are all common including bush clovers (*Lespedeza* spp.), beard grasses (*Andropogon* spp.), sedges (*Carex* spp.), foxtail grasses (*Setaria* spp.), Meadow Fescue (*Festuca elatior*), Small White Aster (*Aster vimineus*), Ragweed (*Ambrosia artemisiifolia*), St. Johnsworts (*Hypericum* spp.), *Lobelia* spp., black-eyed susans (*Rudbeckia* spp.), goldenrods (*Solidago* spp.) panic grasses (*Panicum* spp.), Loblolly Pine (*Pinus taeda*), Water Oak (*Quercus falcata*), Shortleaf Pine (*Pinus echinata*), Black Locust (*Robinia pseudoacacia*), and vines such as greenbrier (*Smilax* spp.) and rose (*Rosa* spp.). Generally species which are adapted to direct sunlight and generally drought-like conditions are dominant over most of the managed corridors, while on either side of the transmission line corridors, where trees provide some shading, there is a narrow band supporting species that prefer partial shade and more moisture. Several small, mostly intermittent streams drain from the transmission line corridors to the Narrows, Falls or Tillery reservoirs, and both the Falls and Narrows transmission line corridors cross narrow coves of their respective reservoirs. A segment of the Narrows transmission line borders a narrow fringe of scrub-shrub habitat. In addition, the Falls transmission line crosses two narrow wetland areas, a wet meadow, in which water is at or near the surface but rarely ponds, and an emergent marsh, in which the water ponds for a sufficient time to support aquatic species (see Section E.3.2.2).

The Falls and Narrows transmission line corridors add to the diversity of habitat within the area that otherwise is characterized by large blocks of woodland, sections of which are under silvicultural management (NAI, 2005b Appendix E-8). The mix of herbaceous and shrub habitat abutting timber stands provide structure (vertical and horizontal complexity), an important habitat element for wildlife usage.

Vegetation within the transmission line corridors and Project lands associated with the dam facilities are maintained by APGI at specific height limits, depending on location, to ensure the safe and reliable operation of the Project (NAI, 2005b Appendix E-8). APGI's maintenance program utilizes herbicide treatments as the major method of control, with mowing or brush cutting used where appropriate. Herbicide applications are not made within 100 feet of the reservoirs. Along the transmission lines, the treatment objectives are to maintain vegetation height while minimizing adverse impacts on sensitive habitats and desirable species such as cedar and dogwood, which will not interfere with the line. By means of spot applications, spray drift to non-target species and soil is kept to a minimum. In sensitive areas such as wetlands, the herbicide Habitat® is used, which is approved for use in wetlands when there is no ponded water. Herbicides are generally applied with either backpack sprayers or from a truck by means of a 600-foot hose. A drift control agent is added to the mix when there is wind and applications are discontinued when wind speed exceeds approximately 10 mph. Herbicides are not applied during rainfall.

Historically, the Falls and Narrows transmission line corridors have been maintained to a cleared width of approximately 100-150 feet. In a recent initiative to improve safety and enhance transmission line reliability, APGI cleared the Falls transmission line in 2004 to an average width of 200 feet. This clearing activity resulted in some short-term impacts to vegetation. In the long-term, the widening of the transmission line corridor can be expected to add additional mixed grass and shrub habitat for wildlife use (NAI, 2005b Appendix E-8). A similar widening of the Narrows transmission line corridor is scheduled to be completed in 2005.

The current vegetation management program used by APGI for maintenance of its transmission lines and project facilities utilizes herbicides appropriate to the control of target species and sensitive environments (NAI, 2005b Appendix E-8). Continued facility maintenance using appropriately selected and applied herbicides should have no adverse impacts on the use of these areas by wildlife. However, to ensure that the desired effects are being achieved, the program should be periodically reviewed to ensure that impacts to rare and endangered species habitats and wetlands are minimized, and herbicide selection follows the approved label guidelines.

E.3.4 Rare, Threatened and Endangered Species

To determine the status of rare, threatened and endangered (RTE) species at the Yadkin Project, the resource agencies requested, and APGI conducted an RTE species survey at the Project. To streamline the effort, prior to conducting field surveys, APGI reviewed all historic records of RTE species known to exist in the Project vicinity, including recent Natural Heritage Program inventories and database. From this information, APGI worked with the Wetlands, Wildlife and Botanical IAG to develop a priority list of RTE species to be searched for as part of the Project survey. A total of 36 species were included on the final RTE species search list.

The RTE species searches were conducted at the Yadkin Project in 2004. The searches targeted habitats that were suspected to most likely support RTE species on the search list. Table E.3-15 summarizes the RTE species found at the Yadkin Project in 2004. As shown, a total of 10 RTE species were located at the Yadkin Project including nine plants and one reptile. Most of the rare plant species found occurred in lightly forested to open, primarily herbaceous communities, often associated with steep slopes overhanging the water, or overhanging road cuts (NAI, 2005c Appendix E-14).

Table E.3-15: RTE Species Recorded in the Yadkin Project Study Area, 2004

Plant Species	Common Name	RTE[1]	Location
Amorpha schwerinii	Piedmont Indigo-bush	SR-T	Falls Reservoir High Rock Reservoir Narrows Reservoir Tuckertown Reservoir
Baptisia alba	Thick-pod White Wild Indigo	SR-P	Falls Reservoir
Cirsium carolinianum	Carolina Thistle	SR-P	Falls Reservoir
Helianthus laevigatus	Smooth Sunflower	SR-P	Tuckertown Reservoir
Helianthus schweinitzii	Schweinitz's Sunflower	E	Falls Reservoir
Lotus helleri	Heller's Trefoil	SR-T, FSC	Falls Transmission Line
Porteranthus stipulatus (=*Gillenia stipulate*)	Indian Physic	SR-P	Tuckertown Reservoir
Ruellia purshiana	Pursh's Wild Petunia	SR-O	Falls Transmission Line
Solidago plumosa	Yadkin River Goldenrod	E, FSC	Falls Reservoir
Animal Species			
Crotalus horridus	Timber Rattlesnake	SC	Falls Transmission Line

[1] SR-T = Significant Rare Throughout (NC) SR-P = Significantly Rare Peripheral (NC)
SR-O = Significantly Rare Other (NC) E = Endangered in NC
SC = Special Concern (NC) FSC = Federal Special Concern

Amorpha schwerinii, the piedmont indigo-bush, was the most abundant and widespread of the nine plant species. The indigo-bush was found at all four reservoirs, mostly at forest edge locations and often on steep slopes overhanging the water. Steep bedrock slopes appear to promote favorable conditions for *Amorpha schwerinii*, *Baptisia alba*, *Cirsium carolinianum* and *Helianthus schweinitzii*. All four of these species were found along Falls Reservoir with *A. schwerinii* being recorded at all four reservoirs. Steep bedrock with periodic current scouring below the Narrows and Falls dams appears to promote favorable conditions for *Amorpha schwerinii* and *Baptisia alba.* Similarly, *Solidago plumosa* (Yadkin River goldenrod) was found in the scours below Narrows Dam and appears to be able to tolerate spill events/scouring to a greater degree than the other species found in this location. *Helianthus laevigatus*, *Lotus helleri* and *Ruellia purshiana* were recorded only in unforested locations such as the Falls transmission line (*L. helleri* and *R. purshiana*) and a mown roadway (*H. laevigatus*). *Porteranthus stipulatus* was found in only one place, a location of previous record constituting a steep, northwest-facing slope of young upland hardwoods bordering the Tuckertown Reservoir (NAI, 2005c Appendix E-14).

The only non-plant species found in these surveys was the timber rattlesnake (*Crotalus horridus*) which was observed along the Falls transmission line corridor (NAI, 2005c Appendix E-14). However, it is known that the Project also supports several breeding pairs of bald eagle (*Haliaeetus leucocephalus*) which is discussed in Section E.3.2.1 of this Exhibit. Similarly, aquatic RTE species were reviewed through a different study report and are discussed in Section E.3.1 of this Exhibit.

The RTE Study concluded that due to their upland locations, most of the RTE species found would not be impacted by the operation of the Project and the related changes in reservoir water levels. The exceptions are those species found in the tailwater areas including *Solidago plumosa*, *Amorpha schwerinii* and *Baptisia alba* which were all found on Falls Reservoir in the vicinity of the Narrows tailwater. These three species seem to benefit from periodic scouring associated with high flow releases from Narrows Dam that help to remove competing vegetation (NAI, 2005c Appendix E-14).

The effects of tailwater flows on *Solidago plumosa* (Yadkin River goldenrod) were the subject of a separate study being conducted by APGI as part of the ongoing relicensing. However, this study is still underway and results of the study are not yet available. Results of the Yadkin River goldenrod survey and the effects of Project operations on the existing populations of that species will be discussed in the Final License Application

E.3.5 Agency Recommended Protection or Mitigation Measures or Facilities

E.3.5.1 Fish and Aquatic Resources

At the outset of the consultation process, agencies, non-governmental organizations (NGOs) and other stakeholders raised a number of issues with respect to fish and aquatic resources. No specific recommendations were made at that time, but there were requests for fish and aquatic studies to be done by APGI. Ultimately, APGI conducted four different studies that fall into the category of fish and aquatics:

- Reservoir Fish and Aquatic Habitat Assessment – Appendix E-3
- Tailwater Fish and Aquatic Biota Assessment – Appendix E-4
- Fish Entrainment Study – Appendix E-6
- Habitat Fragmentation Study – Appendix E-5

Information gained from these studies was used earlier in this section to describe existing fish and aquatic resources at the Project. The studies also provided the basis for examining the continuing impacts to fish and aquatic resources under both existing conditions and APGI's proposed future operation of the Project.

In addition to these studies specific to the Yadkin Project, agencies and NGOs requested an instream flow study to be conducted for the free-flowing reaches of the river below Progress Energy's Tillery and Blewett Falls developments (collectively, the Yadkin-Pee Dee River Project, FERC No. 2206). As Progress Energy's Project was undergoing relicensing on the same time-schedule as the Yadkin Project, Progress Energy (PE) subsequently undertook the requested instream flow study.

At this time, no specific recommendations for the protection, mitigation or enhancement of fish and aquatic resources at the Yadkin Project have been made by resource agencies.

E.3.5.2 Wildlife Resources

At the outset of the consultation process, agencies, NGOs and other stakeholders raised a number of issues with respect to wildlife resources. No specific recommendations were made at that time, but there were requests for wildlife resource studies to be done by APGI. Ultimately, APGI conducted two studies that fall into the category of wildlife resources:

- Avian Inventory – Appendix E-7
- Transmission Line and Project Facility Habitat Assessment – Appendix E-8

In addition, since 2000, APGI has been conducting annual bald eagle and great blue heron nesting surveys at the Yadkin Project. At the request of agencies, those annual surveys continued during the study phase of the relicensing process (in 2004 and 2005).

Information gained from these studies was used earlier in this section to describe existing wildlife resources and their habitats at the Project. The studies also provided the basis for examining the continuing impacts to wildlife resource habitats under both existing conditions and APGI's proposed future operation of the Project (discussed below).

At this time, no specific recommendations for the protection, mitigation or enhancement of wildlife resources at the Yadkin Project have been made by resource agencies.

E.3.5.3 Botanical Resources

At the outset of the consultation process, agencies, NGOs and other stakeholders raised a number of issues with respect botanical resources. No specific recommendations were made at that time, but there were requests for certain studies of botanical resources to be done by APGI. Ultimately, APGI conducted two different studies that fall into the category of fish and aquatics:

- Wetland and Riparian Habitat Assessment – Appendix E-12
- Invasive Exotic Plant Pest Species Assessment – Appendix E-13

Information gained from these studies was used earlier in this section to describe existing botanical resources at the Project. The studies also provided the basis for examining the continuing impacts to botanical resources under both existing conditions and APGI's proposed future operation of the Project.

At this time, no specific recommendations for the protection, mitigation or enhancement of botanical resources at the Yadkin Project have been made by resource agencies.

E.3.5.4 RTE Species

At the outset of the consultation process, agencies, NGOs and other stakeholders indicated a concern about the presence and status of RTE species at the Yadkin Project. No specific recommendations were made at that time, but there were requests for studies to be done by APGI that investigated the status of RTE species. In response to those concerns, APGI conducted several studies aimed at understanding the presence and status of RTE species and their habitats at the Project:

- Rare, Threatened and Endangered Species Survey – Appendix E-14
- Yadkin River Goldenrod Survey – Appendix E-15 (report still in development)
- Bald Eagle Nesting Survey – Appendices E-9, E-10, and E-11 (also listed above)

In addition, specific objectives of the Tailwater Fish and Aquatic Biota Assessment included directed searches for rare fish species (Carolina and robust redhorse) and rare mussel species. Information gained from these studies was used earlier in this section to describe the status of RTE species and their habitats at the Project. The studies also provided the basis for examining the continuing impacts to RTE species and their habitats under both existing conditions and APGI's proposed future operation of the Project.

At this time, no specific recommendations for the protection, mitigation or enhancement of RTE species at the Yadkin Project have been made by resource agencies.

E.3.6 Existing Measures to be Continued and Applicant Proposed Measures for the Mitigation of Impacts on Fish, Wildlife, and Botanical Resources

APGI is proposing to continue to operate the Yadkin Project as it has historically, with certain changes in operations or measures undertaken to enhance non-power resources at the Project, including certain changes in Project operation and certain protection, mitigation or enhancement measures that will enhance fish, wildlife and botanical resources at the Project.

E.3.6.1 Existing Measures to be Continued

Fish Spawning Enhancement

Since 1997, APGI has worked with the NCWRC to develop a voluntary mode of reservoir operation that is designed to enhance fish spawning at the Yadkin Project reservoirs. Based on recommendations from NCWRC, during the prime fish spawning season (usually April 15 to May 15), APGI makes every effort to maintain reservoir water levels within ± 1 foot of the elevation of the reservoir on April 15. Typically, APGI has been able to maintain the reservoirs within the target elevation range throughout the period. This operation helps to maximize spawning success in the shallow water portions of the reservoirs, which provide the prime habitat for spawning. APGI proposes to continue a similar mode of operation during the fish spawning season throughout the term of a new Project license. Resulting reservoir water levels achieved at each reservoir during the fish spawning season will be reported to the NCWRC each year in a letter report.

Fish and Wildlife Habitat

APGI has worked cooperatively with the NCWRC, U. S. Forest Service (USFS), and local fishing clubs for many years to enhance fisheries and wildlife resources at the Project. APGI has provided resources to improve fish habitat along the High Rock and Narrows shorelines, such as the "cut and cable" of trees along the shoreline. In addition to providing resources, APGI has improved habitat for wildlife by planting beneficial vegetation.

Bald Eagle Nesting Surveys

Since 2001, APGI has been conducting bald eagle and great blue heron nesting surveys at the Yadkin Project. These surveys have allowed resource agencies to closely track the status of breeding populations of these two species over time. In particular, the surveys allow resource agencies to closely monitor the status of the federally threatened bald eagle and its habitats; a species that has been of concern at the Project for a number of years.

APGI is proposing to continue to monitor bald eagle and great blue heron nesting at the Project by conducting annual nesting surveys in the spring of each year. As it has in the past, APGI will provide the results of each year's nesting survey in the form of a written report to state and federal resource agencies annually. The resulting reports will not be made readily available to the public to help protect information on the location of heron colonies and eagle nesting sites.

Transmission Line and Facility Habitat Management

Historically, the Falls and Narrows transmission line corridors have been maintained to a cleared width of approximately 100-150 feet. In a recent initiative to improve safety and enhance transmission line reliability, APGI cleared the Falls transmission line in 2004 to an average width of 200 feet. A similar widening of the Narrows transmission line is scheduled to be completed in 2005. In the long-term, the widening of the transmission line corridor can be expected to add additional mixed grass and shrub habitat for wildlife use and is expected to benefit game species such as White-tailed Deer, Turkey, and Bobwhite as well as some non-game species (NAI, 2005b Appendix E-8). A widened transmission line corridor, especially one that has been recently cleared, may reduce or eliminate the crossing movements of some animals (e.g. small birds and mammals) that now may include both forested edges in one territory.

The current vegetation management program used by APGI for maintenance of its transmission lines and project facilities utilizes herbicides appropriate to the control of target species and sensitive environments (NAI, 2005b Appendix E-8). APGI proposes to continue to use similar techniques to manage vegetation along the transmission line corridors in the future. Continued facility maintenance using appropriately selected and applied herbicides should have no adverse impacts on the use of these areas by wildlife.

E.3.6.2 New Measures Proposed

E.3.6.2.1 Operational Measures

As outlined in Exhibit B and Section E.2.7, APGI is proposing to operate the Yadkin Project with certain changes in Project operations designed to enhance Project resources including fish, wildlife and botanical resources. In summary, these proposed changes include:

- Operating the Project with a year round weekly average minimum flow of 900 cfs at Falls;
- Operating the four Project reservoirs in accordance with a new set of operating guides (Table E.2-7);
- Operating the Project in accordance with a Low Instream Flow Protocol; and
- Installing and operating aeration technology designed to improve dissolved oxygen conditions in the Project tailwaters.

E.3.6.2.2 Non-Operational Measures

APGI is also proposing to undertake several non-operational measures to enhance fish, wildlife and botanical resources at the Project.

RTE Species

As there are several rare, threatened and endangered species found at the Yadkin Project, APGI is proposing to develop an RTE species management plan for the Project. The plan will be developed in consultation with state and federal resource agencies. The plan will be developed and submitted to FERC within one year of the effective date of the new license. The plan will detail any specific actions to be taken by APGI and/or resource agencies to protect RTE species and their habitats at the Yadkin Project, over the term of a new FERC license.

IEPP Management

APGI's study of IEPPs at the Yadkin Project demonstrated that there are numerous IEPP species at the Project, including a few aquatic IEPPs that resource agencies are concerned could become problematic, if they are not monitored closely. Accordingly, APGI is proposing to work in cooperation with North Carolina Division of Water Resources (NCDWR) and NCWRC to monitor IEPPs of concern and to periodically undertake IEPP control activities as needed. The primary focus of the IEPP monitoring program will be on aquatic IEPPs that may become established in the reservoirs. APGI will help fund efforts to be undertaken by NCDWR or NCWRC to survey the Yadkin Project reservoirs annually for the presence and extent of IEPP aquatic species of concern. If at any time NCDWR or NCWRC identifies the presence of IEPPs in any of the Yadkin Project reservoirs to an extent that is of concern to the agencies, APGI will work with NCDWR and NCWRC to identify and undertake appropriate control actions on a cost-share basis.

E.3.7 Design Drawings of Any Fish Passage and Collection Facilities

APGI is proposing no fish passage and collection facilities at the Yadkin Project, so no design drawings are provided.

E.3.8 Operation and Maintenance Procedures for Any Existing or Proposed Measures or Facilities

No new facilities are being specifically proposed for the protection, enhancement or mitigation of fish, wildlife or botanical resources, so there are no new operation or maintenance procedures being considered. As discussed in Section E.2.7, APGI is proposing to install and operate new aeration technologies to improve tailwater and reservoir dissolved oxygen conditions at the Project, which in turn will enhance tailwater aquatic habitat and fisheries. Details on the operation and maintenance of the proposed new aeration equipment were provided earlier in Section E.2.7.

APGI is proposing to continue to operate and maintain Project transmission line corridors. Details on procedures to be undertaken as part of the transmission line maintenance proposal were discussed earlier in Section E.3.6.1.

E.3.9 Implementation or Construction Schedule for Any Proposed Measures or Facilities

APGI is proposing no new facilities specifically for the protection, enhancement or mitigation of fish, wildlife or botanical resources. APGI is proposing facilities and measures for the improvement of tailwater and reservoir dissolved oxygen conditions and the implementation schedule for these measures was discussed previously in Section E.2.7.

E.3.10 Estimate of the Costs of Construction, Operation, and Maintenance of Implementation of Any Proposed Measures

APGI will provide an estimate of the cost of its proposed measures for the protection and enhancement of fish, wildlife and botanical resources in the Final License Application.

E.3.11 Maps and Drawings

As APGI is proposing no new facilities specifically for the protection, mitigation and enhancement of fish, wildlife and botanical resources, there are no relevant maps or drawings to present in this section.

E.3.12 Explanation of Why the Applicant Has Rejected Any Measures or Facilities Recommended by an Agency

APGI has not specifically rejected any measures thus far recommended by an agency.

All studies related to fish, wildlife and botanical resources specifically requested by agencies during initial consultation were conducted by APGI.

E.3.13 Impact of Continued Project Operation as Proposed on Fish, Wildlife, and Botanical Resources

The Yadkin Project currently provides a wide array of important fish and wildlife habitats, and supports healthy and diverse warmwater reservoir fisheries, significant areas of vegetative wetlands, diverse riparian and edge habitat for both game and non-game species of wildlife, and habitat for rare species. The continued operation of the Yadkin Project will maintain the existing reservoir ecosystem and the biological communities that have evolved around the reservoirs over the past 80 years. Moreover, APGI is proposing to continue its operation of the Yadkin Project with several measures undertaken that will provide significant enhancement to the fish, wildlife and botanical resources at the Yadkin Project and elsewhere in the Yadkin-Pee Dee River basin. The anticipated impacts to fish, wildlife and botanical resources expected to occur as a result of the continued operation of the Project, as proposed, are discussed in more detail in the following sections.

E.3.13.1 Effects of Proposed Reservoir Operations on Fish and Aquatic Habitat

APGI is proposing to operate the Yadkin Project reservoirs in accordance with a new set of operating guides (see Table E.2-7 and Exhibit B, Figure B-2). Under the proposed operation there will be no significant change to reservoir water levels anticipated at Tuckertown, Narrows or Falls reservoirs. Generally, these reservoirs will continue to be operated as they have been in the past, with no seasonal drawdowns and minimal short-term fluctuations in reservoir water levels. Accordingly, there will be no impacts to the existing fish, wildlife or botanical resources found in and around these reservoirs.

At High Rock Reservoir, the proposed new operating guides will result in some changes in reservoir water levels which, in turn, will enhance habitat conditions for fish, wildlife and botanical resources in this reservoir. The most significant changes to the water level regime that will result from the proposed High Rock operating guide will be an extended season of water levels within 5 feet of full, and a somewhat reduced winter drawdown from a current average of 12 feet, to a winter drawdown average of near 10 feet. These changes are anticipated to enhance habitat conditions for fish and wildlife.

As part of the Reservoir Fish and Aquatic Habitat Assessment conducted by APGI, NAI evaluated how significant changes in Project operations, including both increasing and decreasing short and long term reservoir drawdowns would impact reservoir fish and aquatic habitat. To do this APGI used several simplified water level regimes that were developed to encompass the range of operational alternatives for High Rock Reservoir that might be considered in the relicensing (NAI, 2005e Appendix E-3). One of the water level regimes evaluated by NAI in the reservoir aquatic habitat study (Alternative 2) is similar to APGI's proposed operating guide for High Rock. Figure E-6 illustrates the water level scenario examined by Alternative 2 in the reservoir fish and aquatic habitat study. As can be seen, like the proposed operating guide for High Rock Reservoir, Alternative 2 features an extended period of near full water levels in the spring and fall, and a reduced winter drawdown (10 feet) over what typically occurs under existing Project operations (average of 12 feet). These two features of the proposed operating guide for High Rock are expected to provide significant enhancement to High Rock fisheries.

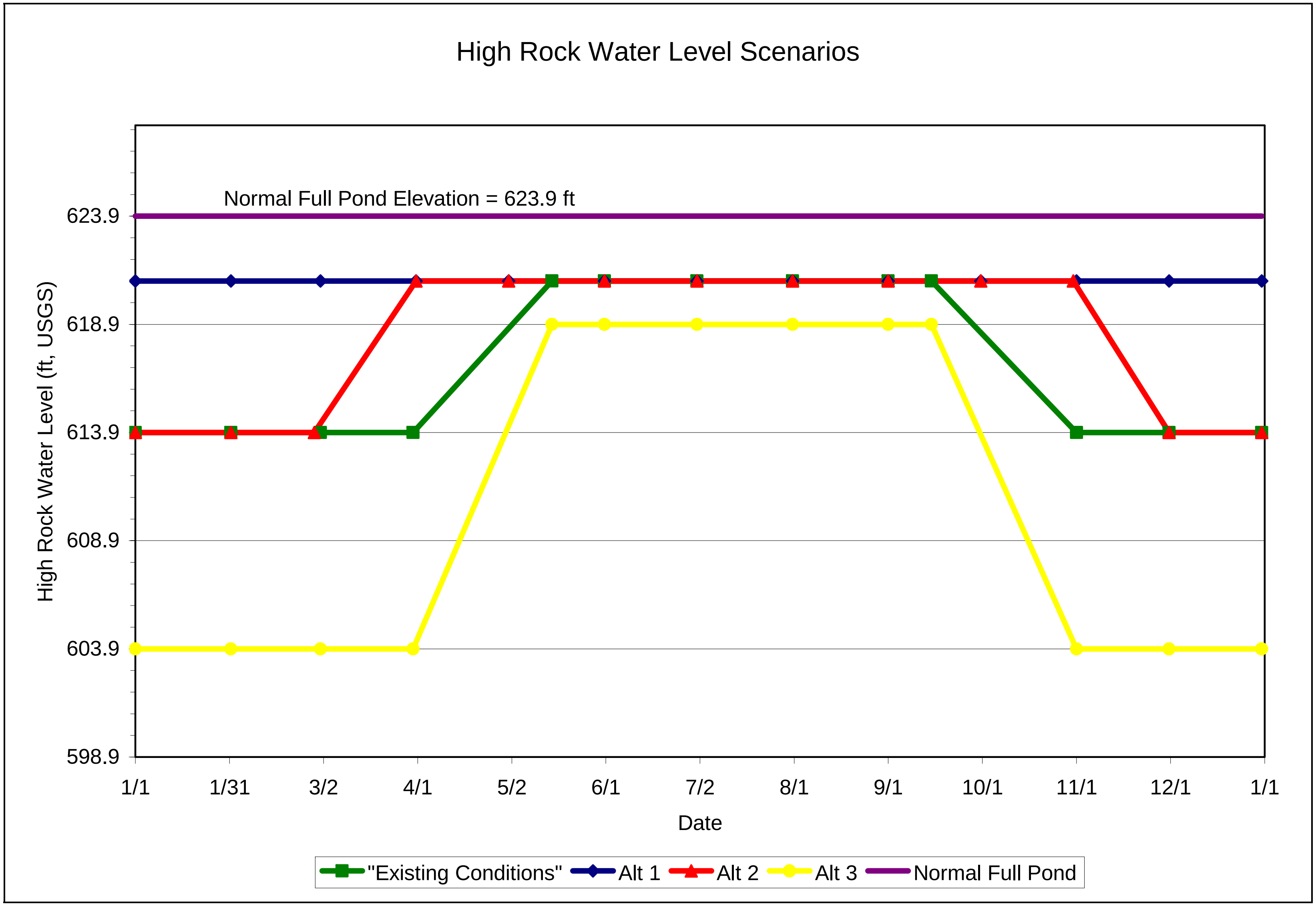
In general, NAI concluded that High Rock Reservoir operated with an extended season of near-full water levels that is refilled in March and drawn down an average of 10 feet in November would enhance fish populations in High Rock (NAI, 2005e Appendix E-3). Filling the reservoir in March will improve spawning conditions for important management species such as largemouth bass and black and white crappies and many other fish that spawn in shallow water during April and May (see Section E.3.1.2.1). Also, extending the near full season until November will help increase the survival rates of young of the year fish. In addition, NAI concluded that a water level regime like Alternative 2 would improve survival of more young of the year fish compared to the current drawdown scenario while still providing the benefit of preventing certain fish species such as sunfish and carp from becoming severely overpopulated. Also, because Alternative 2 is similar to the current drawdown regime, the percent composition of the current fish populations in the reservoir would be expected to remain the same. Important game fish such as black crappie, bluegill and largemouth bass would continue to dominate the catches, because they have done well under the current drawdown regime. Gizzard and threadfin shad, the primary forage fishes in the reservoir, would also continue to do well under the proposed High Rock operating guides, given their high abundance under the current drawdown regime.

In terms of aquatic habitat, the proposed operating guide for High Rock would be expected to make the current amount of high quality habitat (see the earlier discussion in Section E.3.1) available during the growing season for an extended period of time. In the winter, the expected average drawdown of about 10 feet under the proposed operating guide would increase the amount of high quality habitat over what is currently available under existing operations. Table E.3-16 summarizes the amount of high quality habitat expected to be available in each month under the proposed High Rock operating guide, as compared to existing operations.

Table E.3-16: The Estimated Amount of High Quality Habitat in High Rock Reservoir that Would be Available in Each Month Under Existing and Proposed Operation of the Reservoir

	Existing Operations			**Proposed Operations**		
Month	**Expected Drawdown Level (ft)**	**Acres**	**% of Total High Quality Habitat in Upper 12' of Reservoir**	**Expected Drawdown Level (ft)**	**Acres**	**% of Total High Quality Habitat in Upper 12' of Reservoir**
Jan	-12	115	8 %	-10	263	19 %
Feb	-12	115	8 %	-10	263	19 %
Mar	-10	263	19 %	-8	510	37 %
Apr	-8	510	37 %	-5	740	53 %
May	-5	740	53 %	-5	740	53 %
Jun	-5	740	53 %	-5	740	53 %
Jul	-5	740	53 %	-5	740	53 %
Aug	-5	740	53 %	-5	740	53 %
Sep	-5	740	53 %	-5	740	53 %
Oct	-8	510	37 %	-5	740	53 %
Nov	-10	263	19 %	-8	510	37 %
Dec	-12	115	8 %	-10	263	19 %

Figure E-6: Water Level Scenario Alternatives Analyzed in the Reservoir Fish and Aquatic Habitat Assessment



E.3.13.2 Effects of Proposed Reservoir Operations on Wetlands

As part of the wetlands study conducted by APGI (Appendix E-12), NAI evaluated how significant changes in Project operations, including both increasing and decreasing short-term and long-term reservoir drawdowns would impact existing wetlands, or would allow for additional wetland development. As with the reservoir fish and aquatic study, NAI used several simplified water level regimes that were developed to encompass the range of operational alternatives for High Rock Reservoir. One of the water level regimes evaluated by NAI in the wetlands study (Alternative 2) is similar to APGI's proposed future operation of High Rock Reservoir under the proposed operating guide (see Figure E-6 above).

Under the proposed operating guide for High Rock the extension of the near full season and the resulting shorter period of winter drawdown would likely enhance wetland development around the perimeter of High Rock, probably similar to Narrows with water willow dominating the emergent wetlands.

As no significant changes in reservoir operating regimes are being proposed by APGI for the Tuckertown, Narrows and Falls developments, no impacts to existing wetlands are expected to occur as a result of continued Project operations.

E.3.13.3 Effects of Minimum Flows and the Low Instream Flow Protocol

APGI is proposing to operate the Yadkin Project with a year round weekly average minimum flow at Falls of 900 cfs. As water from the Falls Development is released into Tillery Reservoir and there is no free-flowing river reach downstream of Falls, the proposed minimum flow is expected to have no effect on existing fish and aquatic resources in the Falls tailwater area. This area will continue to support a vital warmwater fishery and the aquatic habitat conditions that currently allow freshwater mussels and a wide array of macroinvertebrate species to exist there.

APGI is also proposing to operate the Yadkin Project in accordance with a Low Instream Flow Protocol (LIFP). The LIFP is anticipated to include provisions for APGI to reduce (to specified amounts) its flow releases downstream to help balance water levels in the reservoirs during periods of extreme low inflow or drought. As the details of the proposed LIFP are still being worked out, it is not possible at this time to consider the specific effects on Project resources expected to occur. However, in general, the LIFP is predicated on the idea that during periods of limited water availability, that the water be used equitably to help preserve both reservoir and tailwater resources during periods of drought. In that sense, then, the proposed LIFP would be expected to benefit fish, wildlife and botanical resources throughout the Project.

E.3.13.4 Effects of Proposed Project Operations on RTE Species

The continued operation of the Yadkin Project as proposed will have no adverse impacts to RTE species or their habitats. APGI is proposing some modifications to existing project operations (minimum flows and reservoir operating guides), but implementation of these changes is not expected to have any significant impact (positive or negative) on RTE species. As part of the RTE Species Survey (Appendix E-14), NAI evaluated the potential impact of reservoir operations on the RTE species and habitats located through the study. NAI concluded that due to their upland locations, most of the rare species found would not be impacted by the operation of the Project and the related changes in reservoir water levels. The exceptions were those species found in the tailwater areas including *Solidago plumosa*, *Amorpha schwerinii* and *Baptisia alba* which were all found on Falls Reservoir in the vicinity of the Narrows tailwater. These three species seem to benefit from periodic scouring associated with high flow releases from Narrows Dam that help to remove competing vegetation (NAI, 2005c Appendix E-14).

APGI is also proposing to prepare an RTE Species Management Plan for the Project, which will detail actions to be taken by APGI and others to help protect RTE species and their habitats over the term of a new license.

*Bald Eagl*es

Continued operation of the Project reservoirs as proposed will continue to provide habitat for both resident and transitory bald eagles. The high quality warmwater fishery found in the Project reservoirs provides eagles with an excellent forage resource. Proposed modifications to reservoir water levels, as a result of implementing new reservoir operating guides and minimum flow requirements are not expected to have any adverse impact on the fishery resource, and, in fact are expected to enhance the High Rock Reservoir fishery. Bald eagles should continue to find suitable nesting habitat on tracts of undeveloped and preserved lands (e.g., Uwharrie National Forest) that are located outside the Project boundary but in close proximity to the reservoirs.

E.3.14 Consultation Record

The following table summarizes the consultation record related to fish, wildlife and botanical resources at the Yadkin Project. A complete record of all consultation regarding the relicensing of the Yadkin Project will be provided in an Appendix to the Final License Application.

Table E.3-17: Summary of Consultation Record Related to Fish, Wildlife and Botanical Resources

Agency/Party	Date	To	Description
North Carolina Division of Water Resources, Steve Reed	January 9, 2003	Gene Ellis, APGI	Letter re: first stage consultation comments
High Rock Lake Association, Larry Jones	January 9, 2003	APGI	Letter re: Yadkin Project ICD comments
North Carolina Watershed Coalition, Scott Jackson	January 9, 2003		Initial relicensing comments
U. S. Fish and Wildlife Service, Garland Pardue	January 10, 2003	APGI	Letter re: Yadkin Project ICD comments and study requests
U. S. Forest Service, John Ramey	January 10, 2003	APGI	Letter re: Yadkin Project ICD comments
Yadkin-Pee-Dee Lakes Project, Ann Liebenstein Bass	January 10, 2003	APGI	Letter re: Yadkin Project ICD comments
North Carolina Wildlife Resources Commission, Chris Goudreau	January 12, 2003	APGI	Letter re: first stage consultation comments and "Hydropower Relicensing Issues, Standards, and Mitigation"
South Carolina Coastal Conservation League and American Rivers, Gerrit Jobsis and David Sligh	January 12, 2003	APGI	Letter re: Yadkin Project ICD comments
APGI	March 12, 2003	F&A IAG	Final summary of March 12, 2003 F&A IAG meeting
APGI	March 13, 2003	WWB IAG	Final summary of March 13, 2003 WWB IAG meeting
APGI, Jody Cason	April 4, 2003	F&A IAG	F&A IAG draft study plans out for review and comment
APGI	April 9, 2003	F&A IAG	Final summary of April 9, 2003 F&A IAG meeting
APGI, Jody Cason	April 18, 2003	WWB IAG	WWB IAG draft study plans out for review and comment
APGI	April 25, 2003	WWB IAG	Final summary of April 25, 2003 WWB IAG meeting
APGI, Jody Cason	April 29, 2003	WWB IAG	Avian Inventory draft study plan out for review and comment
APGI, Jody Cason	May 22, 2003	F&A IAG	Revised F&A IAG study plans for final review and comment
APGI, Jody Cason	June 9, 2003	WWB IAG	Revised WWB IAG study plans for final review and comment
APGI	June 23, 2003	F&A IAG	Scheduling Tailwaters Site Visit
APGI	June 2003	F&A IAG	Final study plan for the Reservoir Fish and Aquatic Habitat Assessment

Table E.3-17: Summary of Consultation Record Related to Fish, Wildlife and Botanical Resources (continued)

Agency/Party	Date	To	Description
APGI	June 2003	F&A IAG	Final study plan for the Tailwater Fish and Aquatic Biota Assessment
APGI	June 2003	F&A IAG	Final study plan for the Fish Entrainment Study
APGI	June 2003	WWB IAG	Final study plan for the Avian Inventory
APGI	June 2003	WWB IAG	Final study plans for Wetlands and Riparian Habitat Assessment, Transmission Line and Project Facility Habitat Assessment, Invasive Exotic Plant Pest (IEPP) Species Inventory, and Rare, Threatened, and Endangered (RTE) Species Survey
APGI	October 7, 2003	F&A IAG	Final summary of October 7, 2003 F&A IAG meeting
APGI	October 8, 2003	WWB IAG	Final summary of October 8, 2003 WWB IAG meeting
APGI, Wendy Bley	November 3, 2003	WWB IAG	Request for USFWS review of RTE Species List
APGI	February 3, 2004	F&A IAG WQ IAG	Final summary of February 3, 2004 Fish and Aquatics and Water Quality IAGs joint meeting
APGI	February 3, 2004	WWB IAG	Final summary of February 3, 2004 WWB IAG meeting
US Fish and Wildlife Service, Mark Cantrell	March 4, 2004	WWB IAG	Comments (e-mail) on RTE Species list for RTE Survey
APGI, Jody Cason	May 3, 2004	F&A IAG	Announcement of meeting to discuss habitat fragmentation with resource agencies for May 4, 2004
APGI, Jody Cason	May 19, 2004	F&A IAG	Draft meeting summary of May 4, 2004 Fish and Aquatics Meeting
APGI, Jody Cason	June 25, 2004	WWB IAG	Email transmitting the RTE Species Survey Final Study Plan (June 2003); a RTE Species Survey Study Plan Addendum (June 2004); and the final list of RTE species (June 2004)
APGI, Jody Cason	July 30, 2004	F&A IAG	Draft study plan for the Yadkin Project Habitat Fragmentation Study
APGI, Jody Cason	August 1, 2004	WWB IAG	Draft Study Plan for Yadkin River Goldenrod and invitation to participate in site visit
APGI, Jody Cason	August 4, 2004	WWB IAG	Details about site visit on August 5, 2004 for the Yadkin River goldenrod
APGI, Jody Cason	September 2, 2004	F&A IAG	Final meeting summary of May 4, 2004 Fish and Aquatics Meeting

Table E.3-17: Summary of Consultation Record Related to Fish, Wildlife and Botanical Resources (continued)

Agency/Party	Date	To	Description
APGI, Jody Cason	September 23, 2004	F&A IAG	Distribution of Yadkin Project Fish Entrainment Assessment Draft Report
APGI, Jody Cason	October 1, 2004	WWB IAG	Final study plan for the Yadkin River Goldenrod Survey
APGI, Jody Cason	October 1, 2004	F&A IAG	Final study plan for the Yadkin Project Habitat Fragmentation Study
APGI, Jody Cason	October 13, 2004	WWB IAG	Final study plan for the Yadkin River Goldenrod Survey revised with additional comment from USFWS
APGI, Jody Cason	December 22, 2004	WWB IAG	Distribution of Bald Eagle and Great Blue Heron Final Report
APGI, Gene Ellis	February 18, 2005	WWB IAG	Distribution of draft study reports: Wetlands and Riparian Habitat Assessment, Transmission Line and Project Facility Habitat Assessment, Invasive Exotic Plant Pest (IEPP) Species Inventory, and Rare, Threatened, and Endangered (RTE) Species Survey
APGI, Jody Cason	February 20, 2005	WWB IAG	Draft agenda for the March 2, 2005 WWB IAG meeting
WWB IAG	March 2, 2005		WWB IAG Meeting
APGI, Gene Ellis	March 18, 2005	F&A IAG	Distribution of draft study reports: Reservoir Fish and Aquatic Habitat Assessment and Tailwater Fish and Aquatic Biota Assessment
APGI, Jody Cason	March 18, 2005	F&A IAG	Draft meeting agenda for April 5, 2005 F&A IAG Meeting
Land Trust, Andy Abramson	March 24, 2005	WWB IAG	Comments (e-mail) on RTE Species Draft Report
Land Trust, Andy Abramson	March 24, 2005	WWB IAG	Comments (e-mail) on Wetlands and Riparian Habitat Assessment
F&A IAG	April 5, 2005		IAG Meeting
APGI, Jody Cason	April 12, 2005	WWB IAG	Reminder of comments due on draft study reports: Wetlands and Riparian Habitat Assessment, Transmission Line and Project Facility Habitat Assessment, Invasive Exotic Plant Pest (IEPP) Species Inventory, and Rare, Threatened, and Endangered (RTE) Species Survey
NC Wildlife Resources Commission, Todd Ewing	April 15, 2005	WWB IAG	Comments (e-mail) on WWB IAG Draft Study Reports
NC Division of Water Quality, Darlene Kucken	April 29, 2005	F&A IAG	Comment (e-mail) on Habitat Assessment Draft Report

Table E.3-17: Summary of Consultation Record Related to Fish, Wildlife and Botanical Resources (continued)

Agency/Party	Date	To	Description
APGI, Jody Cason	June 20, 2005	F&A IAG	Final summary of April 5, 2005 F&A IAG Meeting
APGI, Jody Cason	June 20, 2005	WWB IAG	Final summary of March 2, 2005 WWB IAG Meeting
APGI, Jody Cason	June 22, 2005	WWB IAG	Distribution of IEPP Species Assessment Final Report
APGI, Jody Cason	June 24, 2005	WWB IAG	Distribution of RTE Species Study Final Report
APGI, Jody Cason	June 28, 2005	WWB IAG	Distribution of Transmission Line and Project Facility Habitat Assessment Final Report
APGI, Gene Ellis	July 6, 2005	WWB IAG	Distribution of Wetlands and Riparian Habitat Assessment Final Report
APGI, Gene Ellis	July 22, 2005	F&A IAG	Distribution of final study reports: Reservoir Fish and Aquatic Habitat Assessment and Tailwater Fish and Aquatic Biota Assessment
APGI, Jody Cason	September 6, 2005	F&A IAG	Distribution of Fish Entrainment Assessment Final Report

Notes: APGI - Alcoa Power Generating Inc.
IAG - Issue Advisory Group
F&A IAG - Fish and Aquatics Issue Advisory Group
WWB IAG - Wetlands, Wildlife, and Botanical Issue Advisory Group

E.4 Historical and Archeological Resources

E.4.1 Sites Listed on or Determined Eligible for the National Register of Historic Places

E.4.1.1 Historic Resources

Section 106 of the National Historic Preservation Act (NHPA) requires that FERC take into account the effects of its relicensing decision on historic properties, and to allow the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on FERC's relicensing decision. In North Carolina, the Division of Historic Resources serves as the State Historic Preservation Office (SHPO) and is responsible for administration of the Section 106 Program of the National Historic Preservation Act (NHPA).

To meet the SHPO's requirements, a thorough review of the history and architecture of the Yadkin Project's hydroelectric developments was undertaken along with evaluations and recommendations for properties meeting the criteria of the National Register of Historic Places (NRHP). APGI developed a study plan with input from the Cultural Resources IAG and evaluated the Project's four hydroelectric developments to determine their eligibility for the NRHP (Thomason and Associates, 2005 Appendix E-16). Since one of the properties in the Yadkin Project, the Narrows Dam and Power Plant Complex, was already listed on the NRHP in 1983 as part of the Badin Multiple Resource Area nomination for its architectural and engineering significance, a reassessment of its eligibility and a reevaluation of its NRHP-listed boundaries were conducted.

The evaluation of the Project's four hydroelectric developments consisted of architectural and historical surveys, including a physical inventory, photography of properties, historical research, an evaluation of each development as a complex of facilities including powerhouses, dams, penstocks, gatehouses, and other associated properties, and recommendations for NRHP eligibility in accordance with National Register criteria. In addition to the evaluation of the four hydroelectric developments, at the request of the IAG, an assessment of the cultural landscape of the Yadkin River within the FERC boundary was also completed, extending from the Beard's Bridge ruins in the Trading Ford vicinity on the north to the Falls Hydroelectric Development on the south. The FERC boundary generally follows the normal full pool elevation of the reservoirs. For purposes of the cultural landscape assessment, properties which were fifty years old or older along the shoreline or readily visible from the shoreline were assessed for their National Register eligibility.

In addition to the Narrows Development, the dams, powerhouses, and adjacent ancillary buildings and structures of the Falls, High Rock, and Tuckertown developments were determined to meet the criteria of the National Register of Historic Places.

All four of the Project developments were found to be eligible for listing on the NRHP under criteria A and D for their historical and engineering significance. Under National Register criterion A, the properties are significant in the industrial development of North Carolina. By the mid-20th century, Alcoa emerged as one of the leading manufacturers in the state, and the development of the Alcoa facility at Badin contributed to the growth and development of this region of the state. During the mid-20th century Alcoa employed over a thousand workers in its Badin Plant, and its hydroelectric facilities made this production possible. All four developments are also significant under criterion D for the information they contain concerning the engineering and construction of 20th century hydroelectric plants.

Three of the developments were determined to meet National Register criterion C for their engineering and architectural design. The Narrows Development was listed on the National Register in 1983 in recognition of its architectural significance. Both Falls and High Rock developments also possess architectural significance as intact examples of dam and powerhouse complexes of the early 20th century. The three developments possess excellent examples of concrete dams of the period as well as Colonial Revival style influenced powerhouses. The three developments retain much of their integrity and sense of time and place from their era of construction, including dams that possess their original poured concrete exterior surface along with ancillary structures such as gatehouses and gantry cranes. The powerhouses are similar in integrity with each retaining most of their original windows, decorative detailing, and interior floor plan and layout. With the exception of replacement doors at some locations, the character of the powerhouses remains largely intact. The properties within the proposed Yadkin Hydroelectric Project Multiple Property Documentation Form (MPDF) maintain their sense of time and place as a planned and integrated early- to mid-20th century hydroelectric complex.

As part of the study of historic resources at the Yadkin Project, Thomason Associates also undertook a cultural landscape assessment of the Project. The cultural landscape assessment provides information on how this section of the Yadkin River has been transformed over time and what remains on the landscape. The cultural landscape of the Yadkin Project is representative of the 20th century effects of the dam and powerhouse construction, and reservoir impoundment. The impoundment of the four reservoirs resulted in the demolition of all of the buildings within the reservoir basins. Dwellings, outbuildings, mills, commercial buildings, and other structures were removed prior to the impoundment of the reservoirs, while the impoundment inundated historic ferry crossings and landings and fords. No comprehensive photographic documentation was undertaken to record these properties prior to their demolition.

Despite the changes to this section of the Yadkin River, in addition to the four Yadkin Project developments, a number of properties remain extant within the FERC Project boundary or in the nearby landscape that are potentially eligible for listing on the NRHP. These properties were identified as potentially eligible during the study and their eligibility was concurred with by the North Carolina Department of Cultural Resources (NCDCR).

1. The Whitney Dam and Canal on the south shoreline of Narrows Reservoir. The Whitney Dam and Canal was constructed in the early 1900s as part of the proposed industrial development of the Narrows region. The granite dam and canal were largely completed when the Whitney Company went bankrupt in 1907 and the dam and canal were inundated by the impoundment of Narrows Reservoir in 1917. During the drawdown of Narrows Reservoir in December of 2003, both the dam and canal were readily visible and remain in good condition. The workmanship of the dam is especially noteworthy and large sections of the canal along with railroad bridge abutments also remain on the

landscape from the site of Whitney to south of Palmer Mountain. This property is significant under National Register criteria A, C and D for its role in the industrial development of the Narrows and for information it may yield on hydroelectric development of the early 20th century. This property is located wholly within the FERC Project boundary. Most of the old dam site is inundated under Narrows Reservoir at the normal full pool elevation. A drawdown of approximately 18 feet (el. 492 USGS datum), undertaken for purposes of relicensing studies conducted in December 2003, exposed portions of the old dam and canal works. However, normal operation of Narrows Reservoir with water level fluctuations in the one to six-foot range has no impact on this site.

2. The L'Aluminum Francais area at Narrows Dam and Powerhouse Complex on the west shoreline of Narrows Reservoir. The Narrows Dam and Powerhouse Complex boundary was drawn to include the dam, powerhouse, and foundations of the original L'Aluminum Francais powerhouse when the property was listed on the National Register in 1983. To the west of this boundary are additional properties associated with the L'Aluminum Francais development of the early 1910s. These properties include a railroad line, the site of worker's housing, and the foundations of support buildings. The area also contains the concrete footings of a large aluminum smelter which were erected before the French abandoned the project. Primarily archaeological in character, this area is potentially eligible for the National Register under criteria A and C for its significance in industry and for the information it may yield on early 20th century industrial development. Routine operation of Narrows Development has no impact on this site. Routine maintenance activities undertaken by APGI in the vicinity of the Narrows Development including parking lot and road maintenance, mowing and vegetation removal would not be expected to impact the site. Ground disturbing activities are minimal, and APGI has no plans to undertake any major construction activities at the Narrows Development that would impact this site.

3. The Bald Mountain Quarry Conveyor Ruins on the east shoreline of Tuckertown Reservoir. Built in the early 20th century, these imposing ruins are the remains of the conveyor and loading buildings for the Bald Mountain Quarry. This quarry produced slate and gravel commercially for many decades and provided the stone used in the construction of High Rock Dam and Powerhouse. The property is significant under criteria A and D in industry for the information it may yield on early 20th century stone quarrying operations in North Carolina. The Bald Mountain Quarry site is located immediately adjacent to the Tuckertown Reservoir shoreline, but a large portion of the site is located outside the FERC Project boundary. As the important features of the site are located above the normal full pool elevation of the reservoir, the operation of Tuckertown Development and the resulting minimal fluctuation in reservoir water level have no impact on this site. In addition, since the Yadkin Shoreline Management Plan does not allow the development of private recreation facilities on Tuckertown Reservoir, the site will not be impacted by shoreline development activity.

Several additional properties that lie outside of the Project boundary, but within the cultural landscape were also determined to be eligible (Thomason and Associates, 2005 Appendix E-16). These include:

- The L'Aluminum Francais Farmhouse located in Stanly County on Old Whitney Dam Road to the west of Narrows Reservoir.
- The Frick-Starnes Farm in Rowan County on the north shore of Second Creek and High Rock Reservoir.
- The David Linn House in Rowan County on the west shoreline of High Rock Reservoir.
- The Trading Ford Road section west of the Duke Steam Plant along the south shoreline of High Rock Reservoir.

An additional area of interest discussed in the Thomason report (Appendix E-16) is the Trading Ford Historic District at the north end of High Rock Reservoir along a 1.5 mile section of the Yadkin River. Once the site of the Trading Path of Native American tribes, the Trading Ford has served as one of North Carolina's primary transportation corridors for hundreds of years and is one of the oldest documented roads in North Carolina. The Trading Ford includes at least three different ford and ferry crossings and was one of two primary ferry crossings over the Yadkin River in the 18th and 19th centuries. The Trading Ford continued to be used in the late nineteenth and early twentieth centuries. After the Trading Ford shoreline was purchased by the Tallassee Power Company in the 1920s as part of the development of the High Rock Hydroelectric Development, the use of the fords and ferries in the Trading Ford vicinity came to an end.

The Trading Ford area has been the subject of several studies over the past few years due to the proposed construction of a new bridge for Interstate 85 over the Yadkin River. These studies include assessments completed by the North Carolina Department of Transportation (NCDOT), the URS Corporation, and analysis conducted as part of the NRHP Eligibility Study conducted by APGI.

Through the NCDOT studies, two properties in the Trading Ford area have been identified as meeting National Register criteria; the Wil-Cox Bridge and Camp Yadkin (Fort York). The Wil-Cox Bridge was built in 1922 northwest of the Yadkin Ford. The Wil-Cox Bridge is a concrete arch bridge with eleven spans and the seven main spans are open spandrel arches. This type of bridge design and construction is rare in North Carolina and this bridge was deemed eligible for the National Register under criterion C in 1999 (Thomason and Associates, 2005 Appendix E-16). The partial remains of Camp Yadkin, also known as Fort York, continue to exist on the hillside directly north of the Yadkin Ford site. This Civil War fortification was partially removed in the 20th century due to the construction of US 29 and Interstate 29. Despite the removal of some sections of the fort, it retains sufficient integrity to meet the criteria of the National Register (Thomason and Associates, 2005 Appendix E-16).

On recommendation of the Cultural Resources IAG, the cultural landscape assessment conducted as part of the NRHP Eligibility Study included the Trading Ford area (Thomason and Associates, 2005 Appendix E-16). As part of this survey, accessible, above ground structures and sites such as the ford and ferry crossings, and roadbeds leading to these sites were examined. Based on the results, Thomason determined that a 1.5-mile section of the Yadkin River in the Trading Ford vicinity may meet National Register criteria A, C and D as an historic district. From the Beard's Bridge ruins on the north to the Trading Ford on the south, this section of the river contains structures and sites reflective of the evolution of transportation from the 17th century to the 1950s. Extant on the landscape are the sites of the Trading Ford, Yadkin Ford and other significant fords and ferries, the ruins of the Beard's Bridge, the 1896 Southern Railway Bridge, the National Register-eligible Wil-Cox Bridge, and a bridge from 1951 reflecting the expansion of the state's U. S. highway system. Some of these contributing elements lie within or partially within the FERC Project boundary for the Yadkin Project. In October 2004, the Keeper of the National Register of Historic Places determined that there was insufficient information to make a formal determination of eligibility of four properties in the Trading Ford area: Trading Path and Trading Ford, Yadkin Ford and Ferry, Greene's Crossing at Trading Ford, and Battle at Camp Yadkin.

With the exception of these properties, no other buildings, structures, sites or districts were identified as meeting National Register criteria within the Yadkin Project area. As noted above, continued operation of the Yadkin Project under the current reservoir water level regime would have no impact on the properties identified as eligible or potentially eligible for the National Register. Similarly, APGI has no plans for Project lands or waters which would result in effects to the eligible properties. The pool levels of the reservoirs are not anticipated to fluctuate in a way which could result in the inundation of these resources and there are no projects now underway or in the planning stages which would affect the existing condition and integrity of the properties within the Project boundary.

E.4.1.2 Archaeological Resources

E.4.1.2.1 Existing or Known Archaeological Resources

There are numerous archeological sites in the Project vicinity. Many of these sites are found adjacent to the reservoirs, since the river provided a source of food and water and was an important travel route. The NCDCR, Office of State Archaeology, maintains a listing of all known archaeological sites in the state. Its records indicate over 100 known archaeological sites along the shorelines or in the vicinity of the Project reservoirs. Some of these sites have been investigated thoroughly, but others have not been studied and little is known about them. A few of the most important sites in the immediate Project area include the Hardaway Site, Doerschuk Site, and Talbert Site. Because of the potential destruction of these sites through vandalism, the locations of these sites are kept confidential, and APGI protects and restricts access to the sites.

Hardaway Site

This site, one of only two archaeological sites in North Carolina designated a National Historic Landmark, is located in the vicinity of Narrows Dam. The site is located at sufficient height above the reservoir that it is not affected by Project waters or operations. At this site, 12,000 year old prehistoric Native American artifacts have been excavated. The Hardaway Site is considered nationally significant for its contribution in defining prehistoric cultural sequences for the Paleo-Indian and Early Archaic periods and their associated artifacts. These artifacts have been important in dating other prehistoric archaeological sites of similar age throughout the eastern United States.

The Hardaway Site has been on the National Register of Historic Places since 1984 and was designated a National Historic Landmark in 1990. In 1991, APGI granted NCDCR an exclusive license to preserve archeological remains and to mine and excavate for Native American relics at the site. The license agreement expires June 1, 2008. In 1998, Alcoa entered into a Donation Agreement with the University of North Carolina at Chapel Hill in which it donated to the University the Hardaway Archaeological Collection artifacts that were excavated at the site between 1948 and 1980.

Doerschuk Site

This significant site, located in the vicinity of Falls Dam, was occupied by Native Americans from before 7,000 BC until the 18th century. The Doerschuk Site is significant for having provided type materials and for its contribution in defining prehistoric cultural sequences for several Archaic and Woodland complexes. It has been on the National Register of Historic Places since 1985. In 1991, APGI granted NCDCR an exclusive license to preserve archeological remains and to mine and excavate for Native American relics at the site. The license agreement expires June 1, 2008.

Talbert Site

Located on the eastern shore of Narrows Reservoir, the Talbert Site totals 27 acres. This site is also considered a significant site, and prehistoric use of the site may be associated with the Hardaway Site, which is located nearby. In 1991, APGI granted NCDCR an exclusive license to preserve archeological remains and to mine and excavate for Native American relics at the site. The license agreement expires June 1, 2008.

E.4.1.2.2 Cultural Probability Zones

Hundreds of prehistoric and historic cultural sites have already been found in the Project region and archaeologists believe that many others exist. Because the locations of these archaeological sites are not known and finding them involves very intensive survey efforts, archaeologists believe the best way to determine the location of sites is to use knowledge of cultural history and patterns of human behavior to predict where prehistoric archaeological sites are most likely to exist. In this way, areas that are most likely to harbor significant archaeological sites can be identified without the cost and time required to survey large shoreline areas. During the development of the Yadkin Shoreline Management Plan (Yadkin Inc, 1999) the NCDCR assisted APGI in conducting such an assessment of the Project reservoir shorelines by developing a cultural probability model to predict the likelihood of certain reservoir shoreline areas harboring archaeological sites.

The cultural probability model developed by the NCDCR examined site characteristics such as soils, slopes, orientation, and distance from the water to classify shoreline areas into High, Medium, and Low probability zones. A fourth category, Developed, was used to describe areas that have already been developed and where cultural sites have likely already been destroyed or disturbed, and so are of limited importance. The results of the NCDCR cultural probability model have been mapped on the Cultural Resources Probability Areas Maps (see Figures E-7 through E-10). Given the archaeological richness of the surrounding area, much of the undeveloped portions of the reservoir shorelines have been determined to be High and Medium probability. Low probability areas are generally those that are on very steep terrain and/or north facing. In addition, the location of known archaeological sites has also been mapped by the NCDCR and provided to APGI. Maps of known sites are used by APGI in the management of the reservoir shorelines, but are not available to the public because of concerns by the NCDCR about revealing the location of known sites and exposing them to possible vandalism.

APGI, in consultation with the NCDCR, uses the designation of cultural resource probability zones in its evaluation of the potential impacts of proposed shoreline development on cultural resources. In general, the NCDCR does not require further cultural resource evaluation for areas designated as Low probability or Developed, but will require evaluation for areas of Medium or High probability.

As outlined in the Yadkin SMP, for private individual facilities (piers, etc.), an adjoining property owner must obtain a permit from APGI before installing any private facilities within the Project boundary or on the Yadkin-Managed Buffer[1]. Moreover, only certain types of private recreation facilities and activities are currently permitted by APGI . The NCDCR has determined that the construction of any private facility currently permitted by APGI would have minimal impact on cultural resources. Therefore, installation of private recreation facilities or undertaking activities in accordance with APGI's Shoreline Stewardship Policy and all other applicable APGI procedures and requirements (see Table E.4-1) will be permitted in any probability zone, so long as the proposed activity is not located in the immediate vicinity of a known archeological site.

APGI's Specifications for Private Recreation Facilities provide that during the mandatory on-site visit for a new pier, APGI will check the location of the planned pier with respect to known archaeological sites to determine that no known sites are located in close proximity to the proposed pier location. If there is a known archaeological site proximate to the proposed location of the pier, APGI consults with the NCDCR to determine what measures should be taken to protect the known site.

[1] The first 100' feet from the normal full pool elevation of the reservoir is managed by APGI as buffer and is referred to in the SMP as the Yadkin-Managed Buffer.

Figure E-7: Cultural Resources Probability Areas (1 of 4)

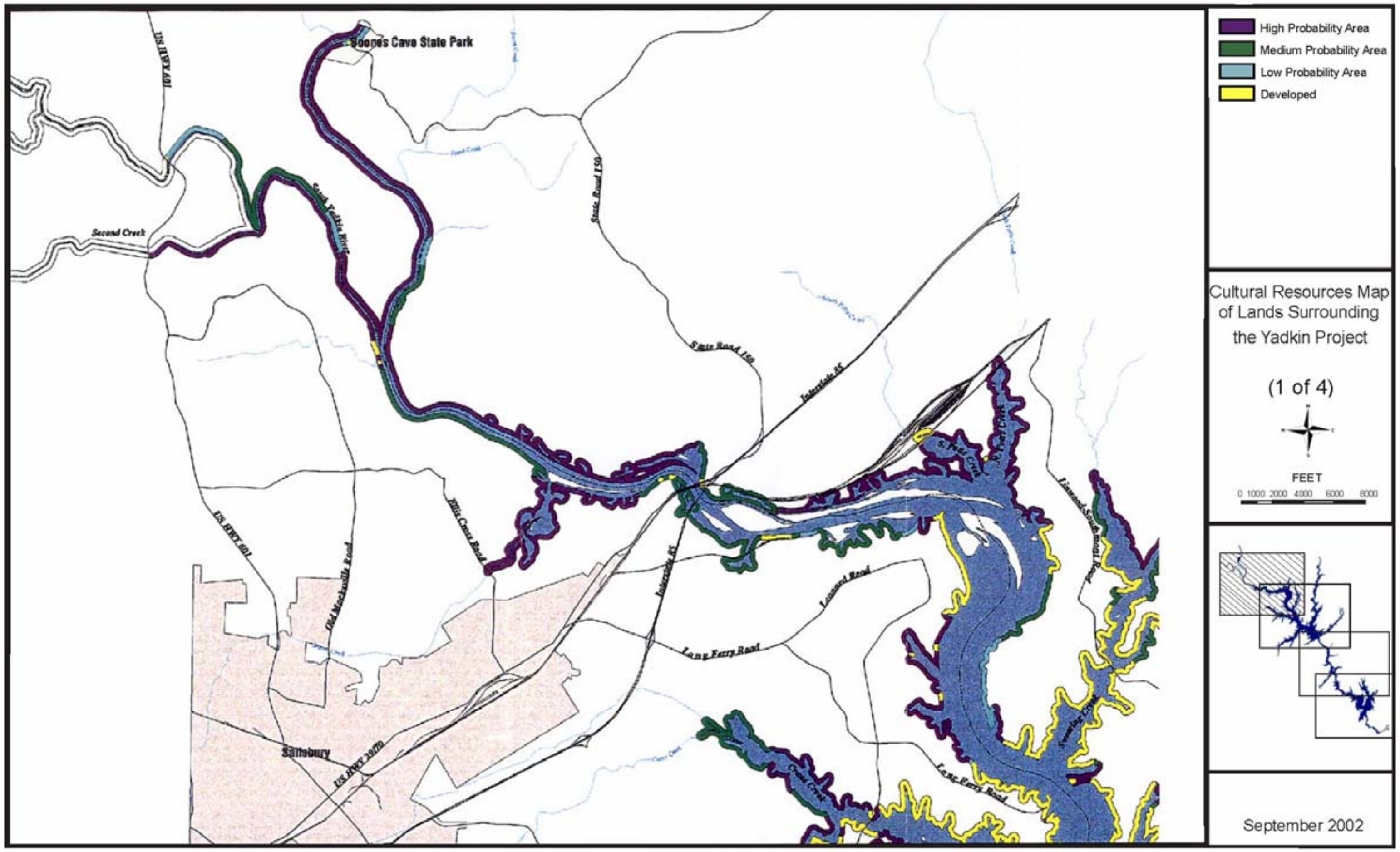


Figure E-8: Cultural Resources Probability Areas (2 of 4)

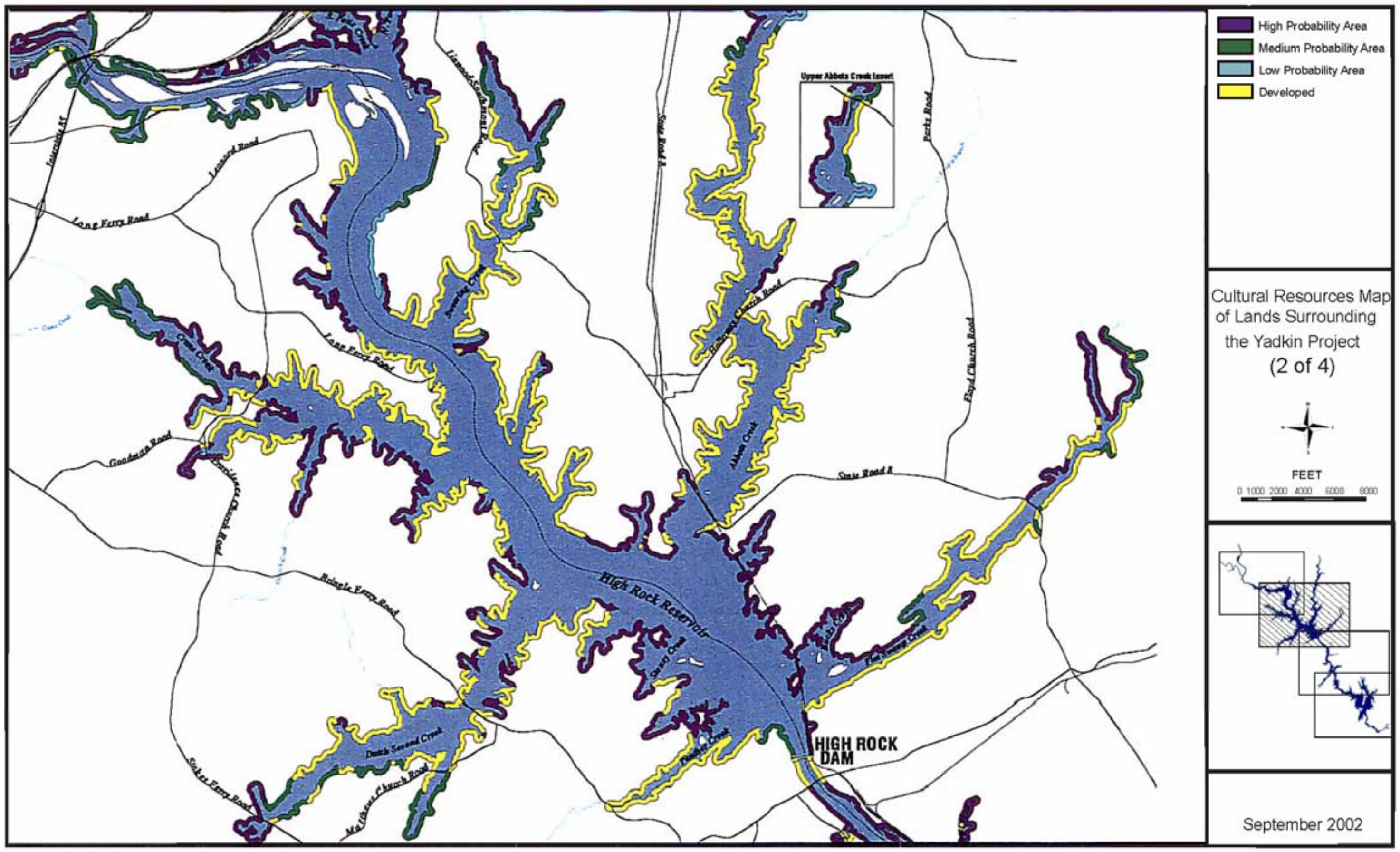


Figure E-9: Cultural Resources Probability Areas (3 of 4)

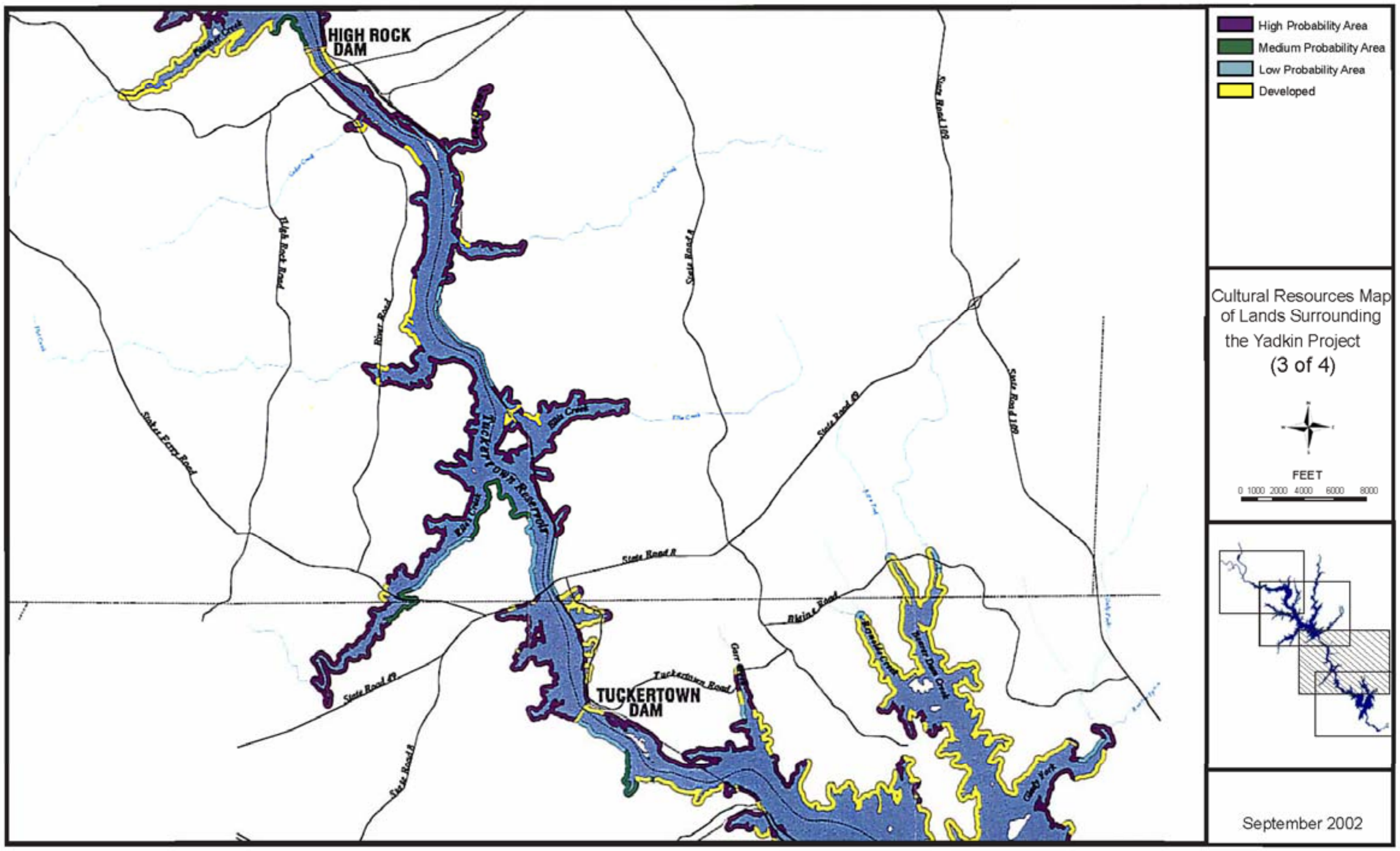


Figure E-10: Cultural Resources Probability Areas (4 of 4)

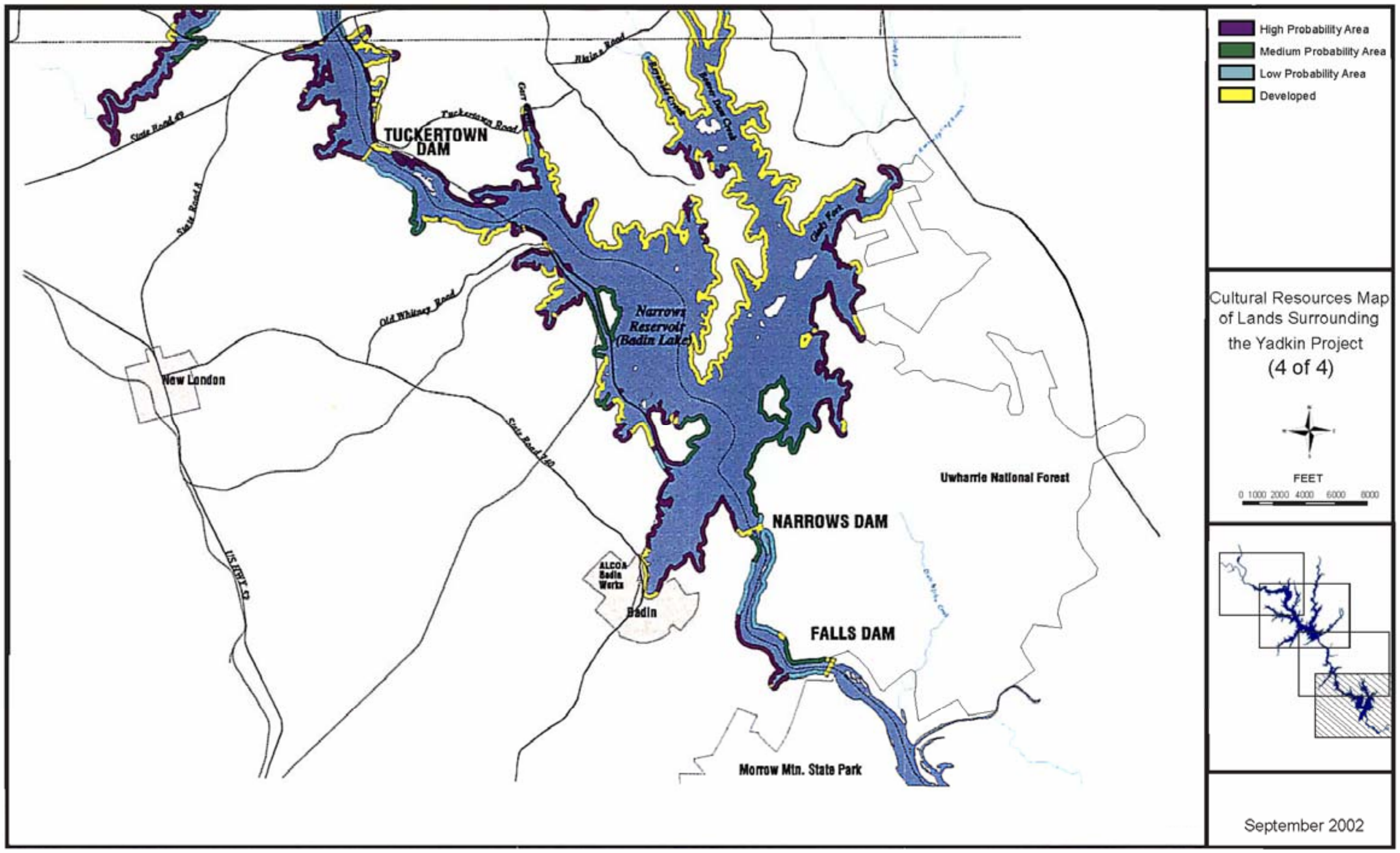


Table E.4-1: Private Recreation and Access Facilities Permitted in High, Medium, and Low Cultural Probability Zones

Private Facility/Use Type	Conditions
Pier with floating section up to 75 feet	In accordance with APGI's Specifications for Private Recreation Facilities.
Pathway	In accordance with APGI's Shoreline Stewardship Policy.
Shoreline erosion control (vegetative plantings, riprap, retaining wall)	In accordance with APGI's Shoreline Stewardship Policy AND so long as installation results in no removal of shoreline material. If removal of shoreline material is necessary, consultation with the NCDCR will be required.
Irrigation system	In accordance with APGI's Shoreline Stewardship Policy.

For multi-use recreation or industrial facilities proposed for shoreline areas designated as High or Medium probability zones, APGI requires prior evaluation of potential impacts to cultural resources located within 100 feet of the reservoir's normal full pool elevation. Typically, such an evaluation is done as part of the Environmental Assessment process or the Agency Consultation Process, as outlined in the Yadkin SMP. Similarly, developers of new subdivisions located on property adjoining the reservoirs in High or Medium probability zones are required to conduct an evaluation of potential impacts to cultural resources located within 100 feet of the normal full pool elevation of the reservoir.

E.4.1.2.3 Archaeological Studies

Although much is already known about archaeological resources in the immediate vicinity of the Yadkin Project, during initial consultation, the U. S. Forest Service (USFS) expressed concern over the potential impact of recreational use and shoreline erosion on possible archaeological sites of significance located along the Narrows Reservoir shoreline at the interface with Uwharrie National Forest. The USFS subsequently requested APGI conduct a study to examine four specific areas of the Project shoreline for several previously identified shoreline archaeological sites to determine their potential eligibility and to assess any ongoing impacts being incurred in relation to Project operation or use.

The Study Plan for this study was developed in consultation with the North Carolina State Historic Preservation Office (SHPO), the USFS, and the Cultural Resources IAG. The study objectives included: (1) conducting background research for the Project study area and (2) conducting field surveys at the four areas on Narrows Reservoir in order to locate (or relocate) and evaluate previously recorded and unrecorded archaeological sites within the study area that may be subject to direct and indirect effects from Project operations. The study was conducted by Legacy Research Associates, Inc. (Legacy) (Legacy, 2005, Appendix E-17). The four areas surveyed are located along Narrows Reservoir and extend from Narrows Reservoir, through a narrow strip of APGI-owned non-Project land (Yadkin-owned buffer) and onto adjacent USFS land.

- Area A (onshore and adjacent to Turkey Island in the Uwharrie National Forest). This area is primarily used for bank fishing and camping and can be accessed by boat and by foot from the Holt's Cabin Picnic Area.

- Area B (directly south of Area A, across Buffalo Creek or Skiers Cove and along the Badin Lake Hiking Trail). This area is used for both camping and bank fishing. It is accessible via boat but is primarily accessed by foot on the hiking trail.

- Area C (inlet adjacent to Pear Tree Island). This area is used for dispersed camping and bank fishing and is predominantly accessed by boat.

- Area D (adjacent to the Badin Lake Campground). This area is used for both camping and bank fishing. The Badin Lake Hiking Trail follows the shoreline on the eastern shore of Narrows Reservoir. From Cove Boat Landing the trail follows the shoreline north around the point and then moves inland at the Skiers Cove inlet after 5.6 km (3.5 mi). The trail is heavily used with hiking, bank fishing, and dispersed camping being the predominant activities.

Field surveys at the four selected survey areas along the Narrows Reservoir shoreline resulted in relocating three previously recorded archaeological sites and identifying one new archaeological site. Three of the four sites were determined by Legacy not to be eligible for listing on the National Register and no further work was recommended. One site was recommended by Legacy as being potentially eligible for the NRHP due to its extensive size, diversity, and density of materials and artifact types; and intact soils that suggest potentially intact subsurface artifact deposits may be present at the site. Legacy reported that this site appears to have the potential to yield significant information about the prehistory of the area, and additional work was recommended for this site because it is being affected by shoreline erosion, recreational activity, and pot-hunting activities.

E.4.2 Agency Recommended Survey and Salvage Measures

To date, no agency has made any formal recommendations regarding cultural resource protection at the Project. During initial consultation with the Cultural Resources IAG, the USFS requested that APGI conduct an investigation of possible impacts to a few potentially eligible archaeological sites located on the Narrows shoreline. As outlined above, APGI conducted the requested study. Also during initial consultation, the NCSHPO requested that APGI evaluate the potential eligibility of the Project developments (dams and powerhouses) for listing on the NRHP. This work was also completed by APGI as requested.

During initial consultation, the Cultural Resources IAG recommended that a cultural landscape evaluation of the Project, including an evaluation of the entire Trading Ford area, be conducted by APGI. Based on this recommendation, APGI did conduct a reconnaissance level cultural landscape evaluation of the area within the Yadkin Project boundary, with an emphasis on approximately 6.2 miles of river (upper end of High Rock Reservoir) located in the vicinity of the I-85 bridge crossing and the Trading Ford area. Results of this evaluation were summarized earlier in Section E.4.1.1.

E.4.3 Applicant Proposed Survey and Salvage Measures

APGI is proposing no specific survey and salvage measures at this time. Instead, APGI proposes to develop a Historic Properties Management Plan (HPMP) for the Project which will include the details of any specific survey or salvage measures recommended by the NCSHPO or other agencies.

E.4.3.1 Schedule for Activities

The schedule for any activities to be carried out under the HPMP will be detailed in the HPMP.

E.4.3.2 Estimate of Costs

As no specific activities regarding additional survey, salvage or protection of cultural resources have been identified yet, there are no costs to report.

E.4.4 Explanation of Why the Applicant Rejects Any Measures Recommended by an Agency

APGI has not specifically rejected any measures thus far recommended by an agency.

E.4.5 Consultation Record

The following table summarizes the consultation record related to cultural resources at the Yadkin Project. A complete record of all consultation regarding the relicensing of the Yadkin Project will be provided in an Appendix to the Final License Application.

Table E.4-2: Summary of Consultation Record Related to Cultural Resources

Agency/Party	Date	To	Description
North Carolina Department of Cultural Resources, State Historic Preservation Office, Renee Gledhill-Earley for David Brook	December 17, 2002	APGI	Letter re: Yadkin Project ICD comments
U. S. Forest Service, National Forests in North Carolina, John Ramey	January 10, 2003	APGI	Letter re: Yadkin Project ICD comments
Yadkin-Pee-Dee Lakes Project, Ann Liebenstein Bass	January 10, 2003	APGI	Letter re: Yadkin Project ICD comments
Catawba Indian Nation THPO	February 25, 2003	APGI	Expression of interest in the Project relicensing
APGI	August 2003	CR IAG	National Register of Historic Places Eligibility Draft Study Plan
APGI	August 27, 2003	CR IAG	Final summary of August 27, 2003 CR IAG Meeting
APGI	November 5, 2003	CR IAG	Final summary of November 5, 2003 CR IAG Meeting
APGI	November 2003	CR IAG	Final study plan for National Register of Historic Places Eligibility Study
APGI, Gene Ellis	July 30, 2004	CR IAG	Distribution of National Register of Historic Places Eligibility Study Draft Report
APGI, Jody Cason	August 2, 2004	CR IAG	Email informing the CR IAG that the National Register of Historic Places Eligibility Study Draft Report was mailed on July 30, 2004
Trading Ford Historic District Preservation Association, Ann Brownlee	August 3, 2004	CR IAG	Email expressing concern that more sites were not identified as potentially eligible for the National Register
Trading Ford Historic District Preservation Association, Ann Brownlee	August 3, 2004	APGI	Request for consulting party status
APGI, Jody Cason	September 17, 2004	CR IAG	Announcement for upcoming CR IAG Meeting on October 6, 2004
Trading Ford Historic District Preservation Association, Ann Brownlee	September 24, 2004	APGI	Request for consulting party status
APGI, Jody Cason	September 28, 2004	CR IAG	Draft meeting agenda for CR IAG Meeting on October 6, 2004
APGI, Gene Ellis	September 29, 2004	TFHDPA	APGI acknowledgement of consulting party status

Table E.4-2: Summary of Consultation Record Related to Cultural Resources (continued)

Agency/Party	Date	To	Description
APGI, Gene Ellis	October 1, 2004	Catawba Indian Nation, Wenonah Haire,	Letter suggesting a meeting to discuss relicensing and Tribe's interests
APGI, Gene Ellis	October 1, 2004	Eastern Band of Cherokee Indians, Chief Hicks	Letter suggesting a meeting to discuss relicensing and Tribe's interests
CR IAG	October 6, 2004		CR IAG Meeting
NC Department of Cultural Resources	October 12, 2004	APGI	Comments on NRHP Eligibility Draft Report
APGI, Jody Cason	October 18, 2004	CR IAG	Email with letter, dated October 13, 2004, sent to Mr. Dan Vivian in the office of the Keeper of the National Register of Historic Places
APGI, Jody Cason	October 20, 2004	CR IAG	Draft meeting summary of October 6, 2004 CR IAG Meeting
APGI, Jody Cason	November 4, 2004	CR IAG	Email extending comment deadline for the NRHP Eligibility Study Draft Report by one week
Trading Ford Historic District Preservation Association, Ann Brownlee	November 4, 2004	APGI	Comments on the NRHP Eligibility Study Draft Report
APGI, Jody Cason	November 30, 2004	CR IAG	Draft study plan for Archaeological Surveys of Four Areas along the UNF on Narrows Reservoir for review
APGI, Jody Cason	November 30, 2004	CR IAG	Final meeting summary of October 6, 2004 CR IAG Meeting
APGI, Jody Cason	January 17, 2005	CR IAG	Final study plan for Archaeological Surveys of Four Areas along the UNF on Narrows Reservoir for review
APGI, Jody Cason	April 15, 2005	CR IAG	Email informing IAG of the distribution of the NRHP Final Study Report on CD
APGI, Gene Ellis	April 15, 2005	CR IAG	Distribution of the NRHP Final Study Report
Trading Ford Historic District Preservation Association, Ann Brownlee	April 16, 2005	APGI	Response to NRHP Final Study Report
Trading Ford Historic District Preservation Association, Ann Brownlee	April 17, 2005	APGI	Additional comments on the NRHP Study

Table E.4-2: Summary of Consultation Record Related to Cultural Resources (continued)

Agency/Party	Date	To	Description
Trading Ford Historic District Preservation Association, Ann Brownlee	April 24, 2005	APGI	Additional comments on the NRHP Study
Trading Ford Historic District Preservation Association, Ann Brownlee	May 1, 2005	IAGs	Comments on NRHP Eligibility Final Report
APGI	May 24, 2005	TFHDPA	Meeting between APGI and the TFHDPA

Notes: APGI – Alcoa Power Generating Inc.
IAG – Issue Advisory Group
CR IAG – Cultural Resources
TFHDPA - Trading Ford Historic District Preservation Association
THPO – Tribal Historic Preservation Office
UNF – Uwharrie National Forest

E.5 Recreation Resources

E.5.1 Existing Recreation Facilities

There are numerous existing public and private recreation facilities at the Yadkin Project. The following sections describe both public and private recreation facilities.

E.5.1.1 Public Recreation Facilities

During the study phase of the relicensing process, APGI conducted a comprehensive inventory of the public recreation facilities at the Yadkin Project. The resulting information complemented and updated previous inventories that had been done, including inventories undertaken as part of FERC's periodic Form 80 reporting requirement.

The recreation facility inventory was carried out in accordance with a study plan that was developed in close consultation with the Recreation, Aesthetics, and Shoreline Management IAG. The objectives of the study were to:

- Inventory existing public recreation areas that provide direct access to Yadkin Project lands and/or waters.
- Describe the available recreation facilities, the condition of the recreation facilities, and identify any operational, maintenance, or safety issues at each recreation area
- Assess the present adequacies and future accessibility needs for people with disabilities to recreation facilities at public recreation areas (See Section E.5.2)

Yadkin Project recreation areas provide opportunities to the public for motorized and non-motorized boating, bank and pier fishing, swimming, camping, picnicking, and hiking. Public recreational facilities available at the recreation areas generally include boat launching ramps, boat docks, fishing piers, swimming areas, picnic areas, campgrounds, and canoe portage trails. Table E.5-1 provides a listing of the public recreation areas of the Yadkin Project (LVA, 2005a Appendix E-18).

Currently, there are 40 major public recreation areas (excluding sites considered "closed") that provide direct access to Yadkin Project lands and/or waters. These recreation areas are located in Davidson, Davie, Montgomery, Rowan, and Stanly counties. With 26 boat ramps, 15 boat docks, and 40 bank fishing areas, boating and fishing facilities are well-dispersed. Generally, the ramps and docks are distributed evenly around the Project with Davidson, Montgomery, Rowan, and Stanly having 7, 7, 5, and 6 boat ramps respectively. Similarly, picnic areas (14 total) are also well-dispersed among the four counties. Fishing piers are available in Montgomery and Stanly counties, swim areas are available in Davidson and Stanly counties, and campgrounds are available in Montgomery County (LVA, 2005a Appendix E-18).

Table E.5-1: Public and Commercial Recreation Areas on Yadkin Project Reservoirs

Recreation Area No.	Recreation Area	Reservoir
Public Access Recreation Areas		
H1	Highway 601 Access Area	High Rock
H3	Rowan County Pump Station	High Rock
H8	York Hill Boat Access	High Rock
H16	Crane Creek Fishing Access Pull-off	High Rock
H19	Little Crane Creek Fishing Access	High Rock
H28	Southmont Boat Access Area	High Rock
H36	Highway 47 Fishing Pull-off	High Rock
H39	Buddle Creek Boat Access Area	High Rock
H44	Abbotts Creek/NC 8 Bridge Pull-off	High Rock
H48	Dutch Second Creek Boat Access	High Rock
H64	Flat Swamp Boat Access	High Rock
H67	High Rock Dam Canoe Portage	High Rock
T1	High Rock Dam Tailrace Access (Rowan)	Tuckertown
T2	High Rock Dam Tailrace Access (Davidson)	Tuckertown
T3	Bringle Ferry Boat Access	Tuckertown
T4	Cedar Creek Fishing Pull-off	Tuckertown
T6	Lick Creek Fishing Pull-off	Tuckertown
T8	Flat Creek Boat Access Area	Tuckertown
T9	Flat Creek Fishing Access Area	Tuckertown
T10	Newsome Road Access	Tuckertown
T12	Riles Creek Recreation Area	Tuckertown
T14	Highway 49 Boat Access Area	Tuckertown
T15	Tuckertown Pull-off Fishing Access	Tuckertown
T16	Tuckertown Dam Canoe Portage	Tuckertown
N1	Tuckertown Dam Tailrace Access	Narrows/Badin
N2	Garr Creek Access Area	Narrows/Badin
N5	Old Whitney NCWRC Fishing Pier	Narrows/Badin
N6	Old Whitney Boat Access Area	Narrows/Badin
N13	Circle Drive Boat Access Area	Narrows/Badin
N16	Lakemont Access Area	Narrows/Badin
N24	UNF Holt's Cabin Picnic Area	Narrows/Badin
N25	UNF Walk-in Fishing Pier	Narrows/Badin
N26	UNF Badin Lake Campground	Narrows/Badin
N27	UNF Cove Boat Landing	Narrows/Badin
N28	Palmerville Access Area	Narrows/Badin
N29	Badin Lake Swim/Picnic Area	Narrows/Badin
N30	Badin Boat Access	Narrows/Badin
N31	Narrows Dam Canoe Portage	Narrows/Badin
N36	Badin Lake Group Camp	Narrows/Badin
N38	UNF Arrowhead Campground	Narrows/Badin
F1	UNF Deep Water Trail Access	Falls
F2	Falls Boat Access	Falls
F3	Falls Dam Canoe Portage	Falls
Commercial Recreation Areas		
H31	High Rock Marina and Campground	High Rock

Table E.5-1: Public and Commercial Recreation Areas on Yadkin Project Reservoirs (continued)

Recreation Area No.	Recreation Area	Reservoir
H47	Tamarac Marina	High Rock
N9/N10	Lake Forest CG/Fish Tales Marina	Narrows

In addition to the recreation areas listed in Table E.5-1, 41 dispersed recreation areas have been identified on all four reservoirs. Generally, these dispersed recreation areas are used for bank fishing and camping (see Section E.5.1.4).

Recently, APGI began discouraging use at several of the pull-off fishing areas because of the potentially unsafe vehicular/pedestrian interactions. Three of the sites listed in Table E.5-1 are sites at which use has been discouraged: Crane Creek Fishing Access Pull-off, Abbotts Creek/ NC 8 Bridge Pull-off, and Lick Creek Fishing Pull-off. These areas are considered "closed" and will no longer be considered official public recreation areas (LVA, 2005a Appendix E-18).

E.5.1.1.1 High Rock Development Recreational Facilities

There are 10 public recreation areas and four commercial recreation areas located on High Rock Reservoir that provide direct access to the reservoir. The recreation areas on High Rock Reservoir are listed in Table E.5-2 and the location of each area is shown in Figures E-11 and E-12.

There are major recreation facilities at seven of these public recreation areas (not including commercial sites) with three areas having no major facilities. Highway 47 Fishing Pull-off, Little Crane Creek Fishing Access, and the High Rock Dam Canoe Portage are the three recreation sites without major facilities. Crane Creek Fishing Pull-off, and Abbotts Creek/NC 8 Bridge Pull-off have historically been reported in FERC Form 80 Reports, but are currently considered "closed" and are not listed as "major facilities." Boat launch ramps (does not include unimproved, dirt ramps), boat docks, fishing piers, swim areas, campgrounds, and picnic areas are all considered major recreation facilities. On High Rock Reservoir, there are 9 boat ramps, 4 boat docks, 2 swim areas, and 4 picnic areas. Of these major recreation facilities on High Rock, 2 boat ramps and 1 boat dock are located in Rowan County and 1 boat ramp is located in Davie County. The remaining 6 boat ramps, 3 boat docks, 2 swim areas, and 4 picnic areas are located in Davidson County (Table E.5-2) (LVA, 2005a Appendix E-18).

Table E.5-2: Major Public Facilities on High Rock Reservoir by County and Access Area

High Rock Reservoir		**Major Facilities**					
Site Name	**County**	**Boat Ramp[1]**	**Boat Dock**	**Fishing Pier**	**Swim Area**	**Camp-ground**	**Picnic Area**
York Hill Boat Access	Davidson	2	0	0	0	0	0
Southmont Boat Access Area	Davidson	2	1	0	0	0	1
Highway 47 Fishing Pull-off	Davidson	0	0	0	0	0	0
Buddle Creek Boat Access Area	Davidson	1	1	0	1	0	2
Flat Swamp Boat Access	Davidson	1	1	0	1	0	1
Highway 601 Access Area	Davie	1	0	0	0	0	0
Rowan County Pump Station Access Area	Rowan	1	0	0	0	0	0
Little Crane Creek Fishing Access	Rowan	0	0	0	0	0	0
Dutch Second Creek Boat Access	Rowan	1	1	0	0	0	0
High Rock Dam Canoe Portage	Rowan	0	0	0	0	0	0
Davidson Co. Totals	5 areas	6	3	0	2	0	4
Davie Co. Totals	1 area	1	0	0	0	0	0
Rowan Co. Totals	4 areas	2	1	0	0	0	0
High Rock Reservoir Totals	**10 areas**	**9**	**4**	**0**	**2**	**0**	**4**

[1] "Boat ramp" is specific to ramps and does not consider individual launch lanes (e.g. one boat ramp may have two launch lanes).

Figure E-11: Yadkin Project Recreation Areas (Upper High Rock Reservoir)

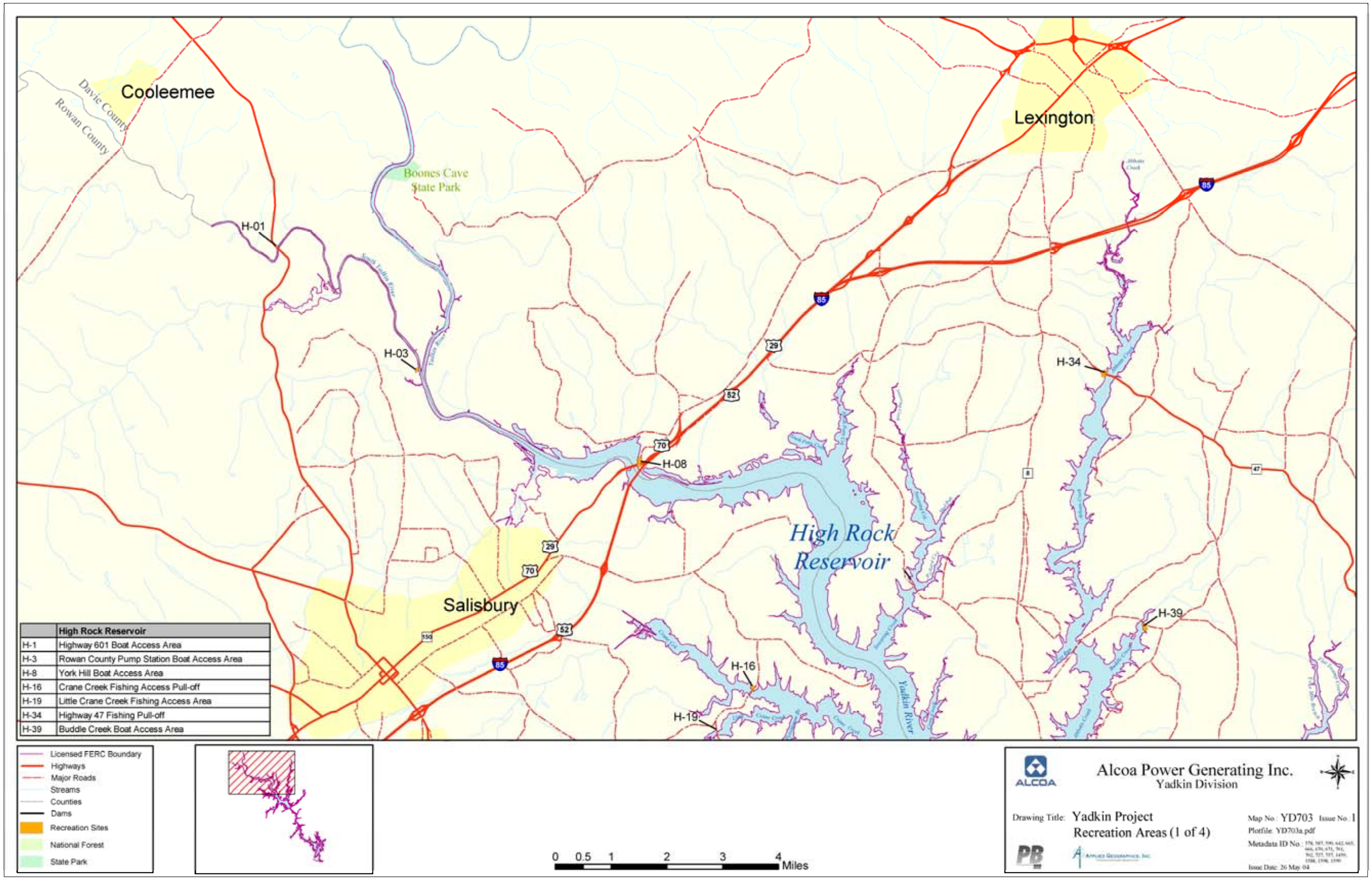
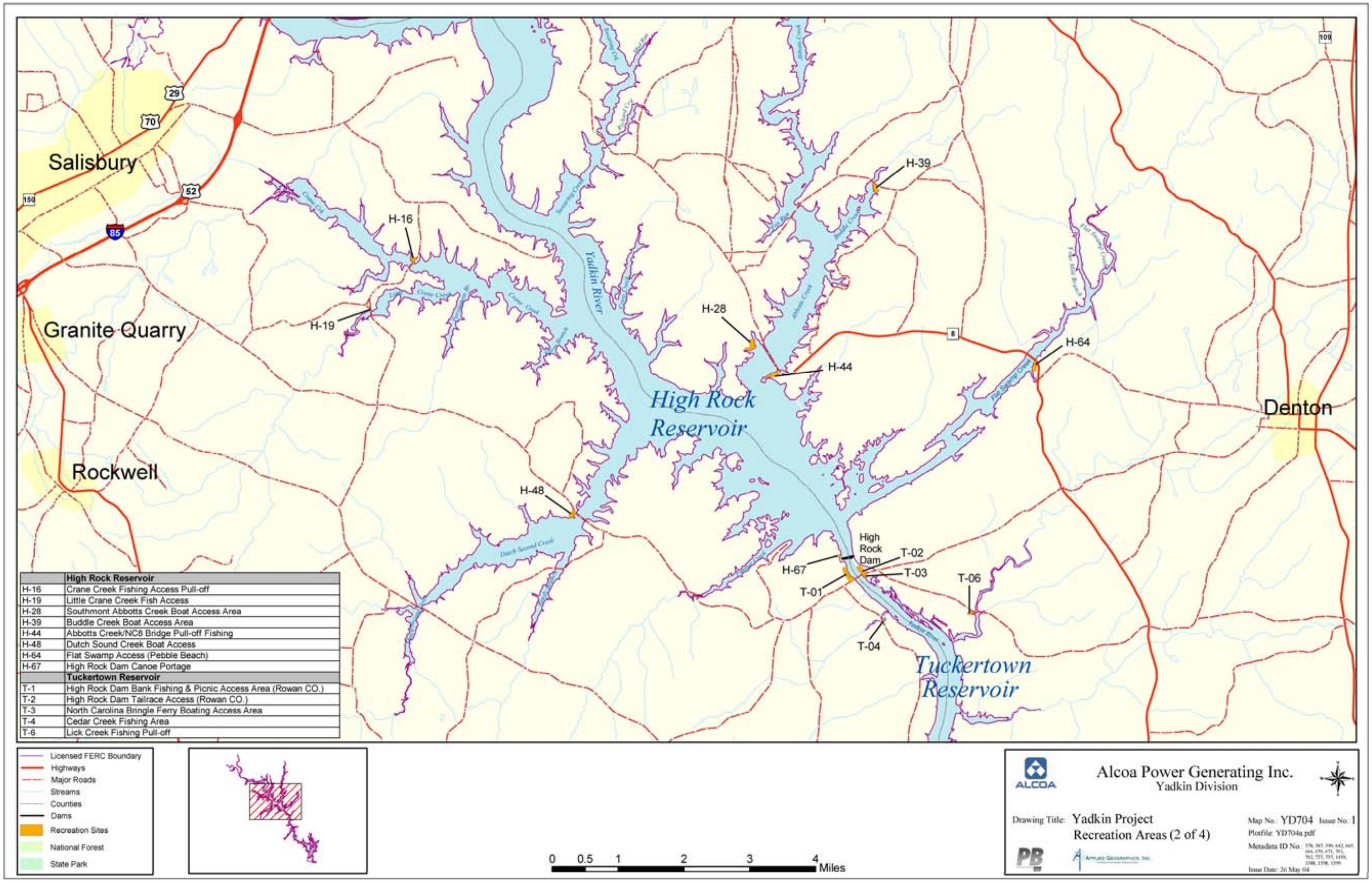


Figure E-12: Yadkin Project Recreation Areas (Lower High Rock and Upper Tuckertown Reservoirs)



Recreation facilities at the 10 public recreation areas on High Rock Reservoir are generally in good condition. The condition of each recreation area is summarized in Table E.5-3 below (LVA, 2005a Appendix E-18).

Table E.5-3: Summary of Facilities Condition at High Rock Reservoir Recreation Areas

Recreation Area	Notes on Condition
Highway 601 Access Area	Generally in good condition; ramp needs maintenance
Rowan County Pump Station	Improvements needed; site is in general disrepair
York Hill Boat Access	Generally in good condition; needs some maintenance (smaller boat ramp) and repair (access road)
Crane Creek Fishing Access Pull-off	Area is closed
Little Crane Creek Fishing Access	Improvements needed; significant erosion in vehicular access areas.
Southmont Boat Access Area	Generally in good condition; boat ramp needs significant repairs
Highway 47 Fishing Pull-off	Area is closed
Buddle Creek Boat Access Area	Generally in good condition; swimming area needs improvements; other minor repair and maintenance work needed
Abbotts Creek/NC 8 Bridge Pull-off	Area is closed
Dutch Second Creek Boat Access	Good condition
Flat Swamp Boat Access	Good condition
High Rock Dam Canoe Portage	Good condition

E.5.1.1.2 Tuckertown Development Recreational Facilities

Located in Davidson, Montgomery, Rowan, and Stanly counties, Tuckertown Reservoir has 11 major public recreation areas and no commercial recreation areas that provide direct access to the reservoir. Table E.5-4 is a summary of the major facilities on Tuckertown Reservoir and Figure E-13 shows the location of the facilities on the reservoir.

Of the 11 public recreation areas, six have major facilities and five do not. The six sites with major facilities include High Rock Dam Tailrace Access (Rowan), Bringle Ferry Boat Access, Flat Creek Boat Access Area, Newsome Road Access, Riles Creek Recreation Area, and Highway 49 Boat Access Area. Lick Creek Fishing Pull-off has historically been represented in FERC Form 80 Reports, but is currently considered “closed” and is not listed as a “major facility.” On Tuckertown Reservoir, there are a total of 7 boat ramps, 4 boat docks, and 3 picnic areas. Of the major recreation facilities on Tuckertown; 3 boat ramps, 2 boat docks, and 2 picnic areas are located in Rowan County, 2 boat ramps and 1 picnic area are located in Davidson County, and 2 boat ramps and 2 boat docks are located in Stanly County. There are no major recreation facilities on Tuckertown Reservoir in Montgomery County (LVA, 2005a Appendix E-18).

Figure E-13: Yadkin Project Recreation Areas (Tuckertown and Narrows Reservoirs)

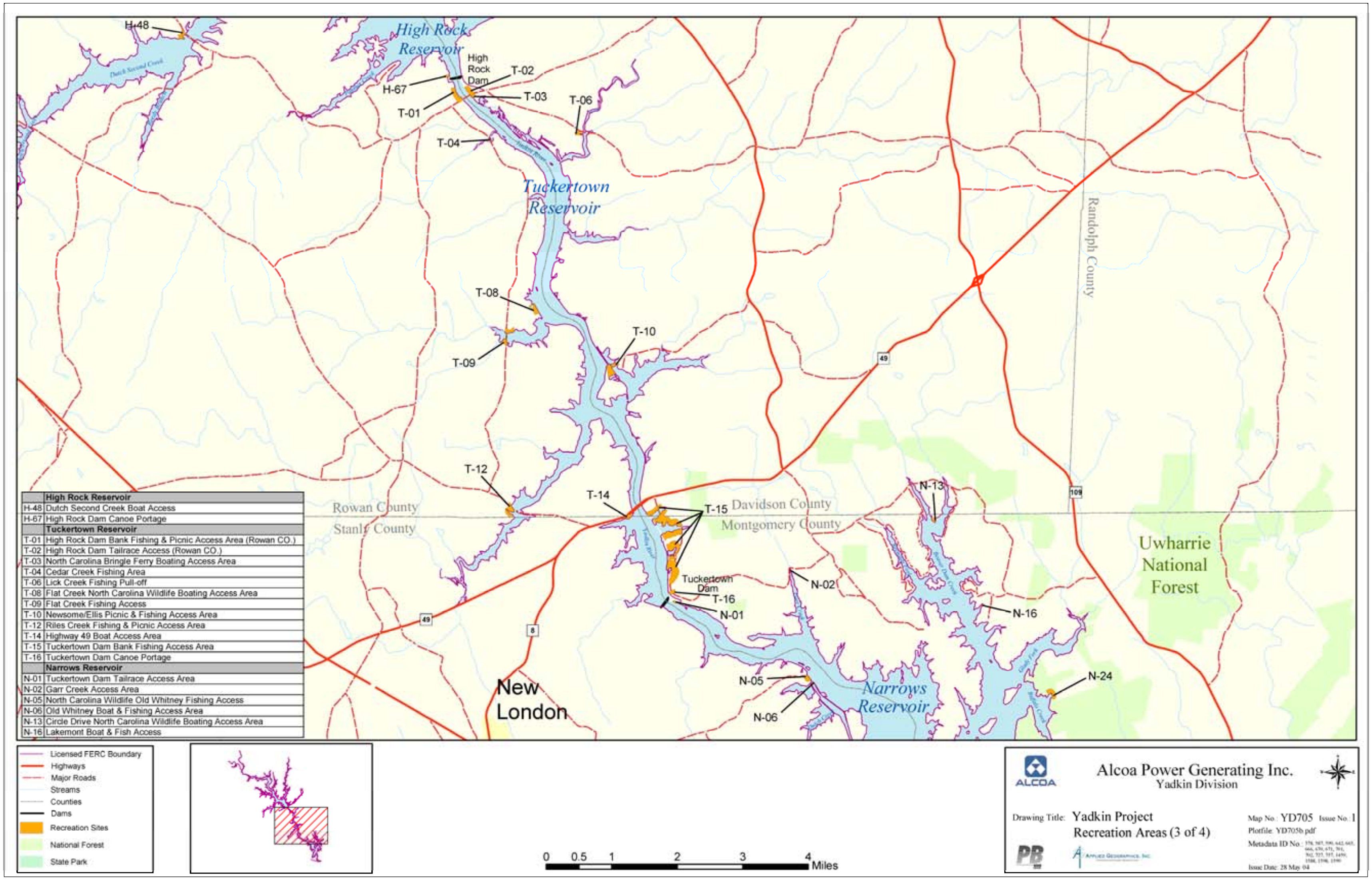


Table E.5-4: Major Public Facilities on Tuckertown Reservoir by County and Access Area

Tuckertown Reservoir		**Major Facilities**					
Site Name	**County**	**Boat Ramp**	**Boat Dock**	**Fishing Pier**	**Swim Area**	**Camp-ground**	**Picnic Area**
High Rock Dam Tailrace Access (Davidson)	Davidson	0	0	0	0	0	0
Newsome Road Access	Davidson	2	0	0	0	0	1
Tuckertown Road Pull-off Fishing Access	Davidson, Montgomery	0	0	0	0	0	0
Tuckertown Dam Canoe Portage	Montgomery	0	0	0	0	0	0
High Rock Dam Tailrace Access (Rowan)	Rowan	0	0	0	0	0	1
Bringle Ferry Boat Access Area	Rowan	1	1	0	0	0	0
Cedar Creek Fishing Pull-off	Rowan	0	0	0	0	0	0
Flat Creek Boat Access Area	Rowan	2	1	0	0	0	0
Flat Creek Fishing Access	Rowan	0	0	0	0	0	0
Riles Creek Recreation Area	Rowan	0	0	0	0	0	1
Highway 49 Boat Access Area	Stanly	2	2	0	0	0	0
Davidson Co. Totals	3 areas	2	0	0	0	0	1
Rowan Co. Totals	6 areas	3	2	0	0	0	2
Montgomery Co. Totals	2 areas	0	0	0	0	0	0
Stanly Co. Totals	1 area	2	2	0	0	0	0
Tuckertown Reservoir Totals	**11 areas**	**7**	**4**	**0**	**0**	**0**	**3**

Recreation facilities at the 11 public recreation areas on Tuckertown Reservoir are generally in good condition. The condition of each recreation area is summarized in Table E.5-5 below (LVA, 2005a Appendix E-18).

Table E.5-5: Summary of Facilities Condition at Tuckertown Reservoir Recreation Areas

Recreation Area	**Notes on Condition**
High Rock Dam Tailrace Access (Rowan)	Good condition
High Rock Dam Tailrace Access (Davidson)	Improvements needed; significant erosion, general maintenance and litter problems
Bringle Ferry Boat Access	Generally in good condition; access road needs maintenance
Cedar Creek Fishing Pull-off	Generally in good condition; some maintenance problems
Lick Creek Fishing Pull-off	Area is closed
Flat Creek Boat Access Area	Good condition
Flat Creek Fishing Access Area	Generally in good condition; parking area needs maintenance
Newsome Road Access	Improvements needed; boat ramps are of deteriorated quality
Riles Creek Recreation Area	Improvements needed; vandalism and erosion problems
Highway 49 Boat Access Area	Generally in good condition; boat ramps need resurfacing
Tuckertown Pull-off Fishing Access	Maintenance improvements needed
Tuckertown Dam Canoe Portage	Good condition

E.5.1.1.3 Narrows Development Recreational Facilities

Located in Davidson, Montgomery, and Stanly counties, Narrows Reservoir has 16 public recreation areas and one commercial recreation area[1] that provide direct access to the reservoir. The Uwharrie National Forest (UNF) also borders the reservoir on the east. The UNF maintains several recreation areas that provide access to Narrows Reservoir. A summary of the major facilities on Narrows Reservoir is included in Table E.5-6 below and the locations of the areas on reservoir are shown in Figure E-14.

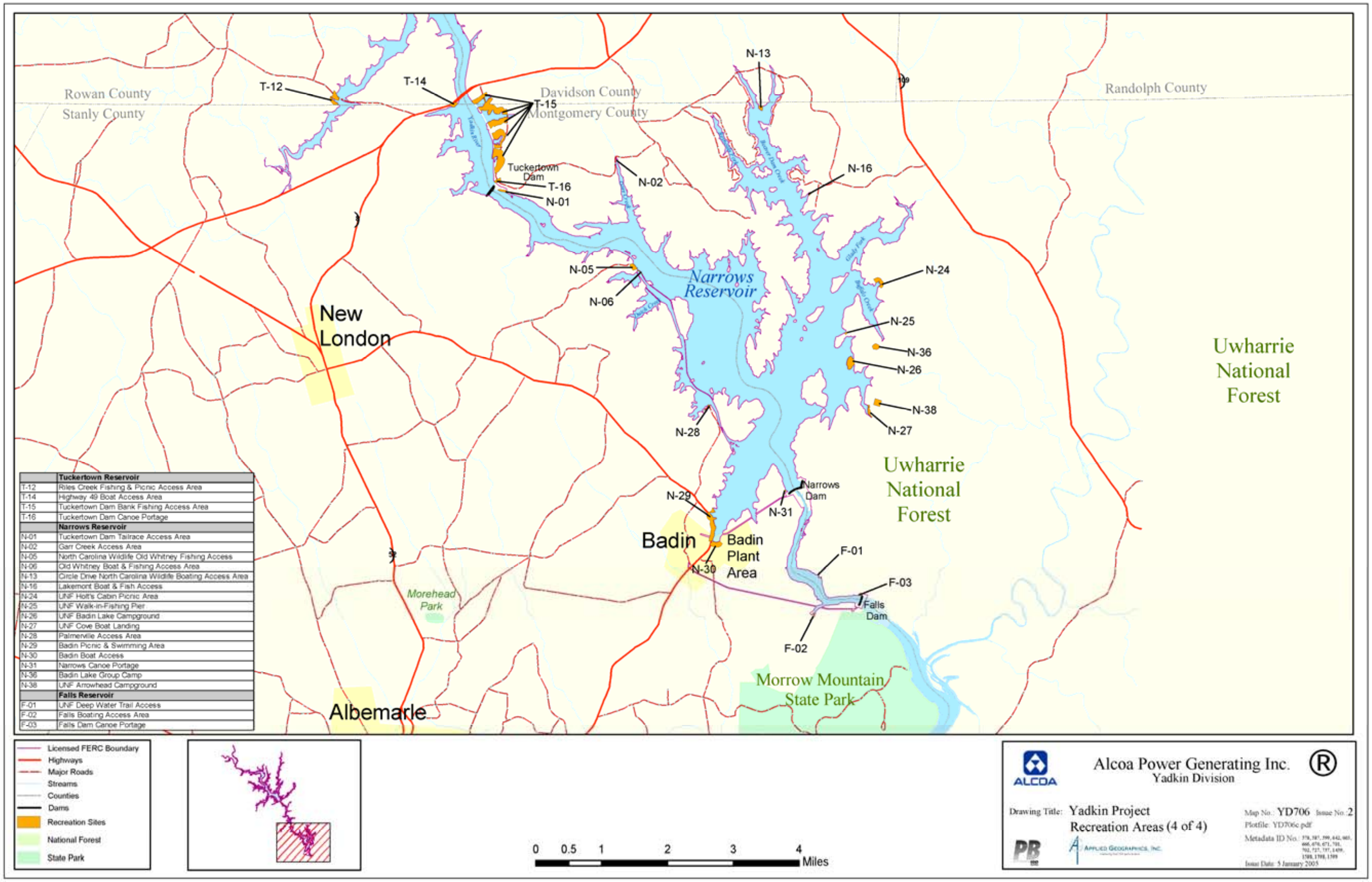
Fourteen of the 16 public recreation areas have major facilities; the only two areas without major facilities are Tuckertown Dam Tailrace Access Area and the Narrows Dam Canoe Portage. All totaled, there are 10 boat ramps, 7 boat docks, 2 fishing piers, 1 swim area, 3 campgrounds, and 7 picnic areas on Narrows Reservoir. Individually, 7 boat ramps, 4 boat docks, 1 fishing pier, 3 campgrounds, and 3 picnic areas are located in Montgomery County and 3 boat ramps, 3 boat docks, 1 fishing pier, 1 swim area, and 4 picnic areas are located in Stanly County. There are no public recreation areas on Narrows Reservoir located in Davidson County (LVA, 2005a Appendix E-18).

Table E.5-6: Major Public Facilities on Narrows Reservoir by County and Access Area

Narrows Reservoir		**Major Facilities**					
Site Name	**County**	**Boat Ramp**	**Boat Dock**	**Fishing Pier**	**Swim Area**	**Camp-ground**	**Picnic Area**
Tuckertown Dam Tailrace Access Area	Montgomery	0	0	0	0	0	1
Garr Creek Access	Montgomery	1	0	0	0	0	0
Circle Drive Boat Access	Montgomery	3	3	0	0	0	0
Lakemont Access	Montgomery	2	0	0	0	0	0
UNF Holt's Cabin Picnic Area	Montgomery	0	0	0	0	0	1
UNF King's Mountain Point Walk-in Fishing Pier	Montgomery	0	0	1	0	0	0
UNF Badin Lake Campground	Montgomery	0	0	0	0	1	0
UNF Arrowhead Campground	Montgomery	0	0	0	0	1	0
UNF Cove Boat Landing	Montgomery	1	1	0	0	0	1
Badin Lake Group Camp	Montgomery	0	0	0	0	1	0
Old Whitney Fishing Pier	Stanly	0	0	1	0	0	1
Old Whitney Boat Access	Stanly	1	1	0	0	0	1
Palmerville Access	Stanly	1	0	0	0	0	0
Badin Lake Swim and Picnic Area	Stanly	0	0	0	1	0	1
Badin Lake Boat Access	Stanly	1	2	0	0	0	1
Narrows Dam Canoe Portage	Stanly	0	0	0	0	0	0
Montgomery Co. Totals	10 areas	7	4	1	0	3	3
Stanly Co. Totals	6 areas	3	3	1	1	0	4
Narrows Reservoir Totals	**16 areas**	**10**	**7**	**2**	**1**	**3**	**7**

[1] Included in the Recreation Facility Inventory and Condition Assessment.

Figure E-14: Yadkin Project Recreation Areas (Narrows and Falls Reservoirs)



Recreation facilities at the 16 public recreation areas on Narrows Reservoir are generally in good condition. The condition of each recreation area is summarized in Table E.5-7 below (LVA, 2005a Appendix E-18).

Table E.5-7: Summary of Facilities Condition at Narrows Reservoir Recreation Areas

Recreation Area	Notes on Condition
Tuckertown Dam Tailrace Access	Good condition
Garr Creek Access Area	Improvements needed; boat ramps need significant repair
Old Whitney NCWRC Fishing Pier	Good condition
Old Whitney Boat Access Area	Good Condition
Circle Drive Boat Access Area	Generally in good condition; some minor maintenance issues
Lakemont Access Area	Improvements needed; ramps need replacement, vehicular access needs maintenance/repair, general aesthetic improvements needed
UNF Holt's Cabin Picnic Area	General reconstruction needed
UNF Walk-in Fishing Pier	Good condition
UNF Badin Lake Campground	Under reconstruction
UNF Cove Boat Landing	Under reconstruction
Palmerville Access Area	Improvements needed; maintenances issues (picnic area and boat ramp), lack of identifiable parking area
Badin Lake Swim/Picnic Area	Good condition
Badin Boat Access	Good condition
Narrows Dam Canoe Portage	Improvements needed; steep terrain and often narrow (especially along fence toward put-in)
Badin Lake Group Camp	Improvements needed; gravel and grading improvements needed
UNF Arrowhead Campground	Generally in good condition; repairs needed for many living spaces and access pathways, some grills/fire rings and ID posts also need repair

E.5.1.1.4 Falls Development Recreational Facilities

Located in Montgomery and Stanly counties, Falls Reservoir has only three public recreation areas: UNF Deep Water Trail Access, Falls Boat Access, and the Falls Dam Canoe Portage (see Table E.5-8 and Figure E-14). A single boat launch ramp at Falls Boat Access in Stanly County is the only major facility available on Falls Reservoir. There are no commercial recreation areas on Falls Reservoir.

Table E.5-8: Major Public Facilities on Falls Reservoir by County and Access Area

Narrows Reservoir		Major Facilities					
Site Name	**County**	**Boat Ramp**	**Boat Dock**	**Fishing Pier**	**Swim Area**	**Camp-ground**	**Picnic Area**
Deep Water Trail Access	Montgomery	1	0	0	0	0	0
Falls Dam Canoe Portage	Montgomery	0	0	0	0	0	0
Falls Boat Access	Stanly	1	0	0	0	0	0
Montgomery Co. Totals	2 areas	1	0	0	0	0	0
Stanly Co. Totals	1 area	1	0	0	0	0	0
Falls Reservoir Totals	**3 areas**	**2**	**0**	**0**	**0**	**0**	**0**

The condition of each recreation area is summarized in Table E.5-9 below (LVA, 2005a Appendix E-18).

Table E.5-9: Summary of Facilities Condition at Falls Reservoir Recreation Areas

Recreation Area	Notes on Condition
UNF Deep Water Trail Access	Improvements needed; steep terrain
Falls Boat Access	Generally in good condition; boat ramp needs resurfacing
Falls Dam Canoe Portage	Improvements needed; uneven terrain, extremely steep and difficult put-in

E.5.1.2 Other Public Recreation Sites

Yadkin-Pee Dee River Canoe Trail

The Yadkin-Pee Dee River Canoe Trail is a 230-mile river trail on the Yadkin and Pee-Dee Rivers from Wilkesboro, North Carolina to the South Carolina border. The 230-mile trail has numerous access points at public recreation areas on the Project reservoirs and includes the entire 38-mile stretch within the Project. Specifically, the Yadkin-Pee Dee River Trail map lists 31 of the inventoried public recreation areas on the Project reservoirs as either providing boat access or providing some other facilities (e.g., bathroom, picnic tables, camping). In addition to the public areas, the trail map also lists High Rock Campground and Marina as providing boating access, camping, bathrooms, and picnic tables.

Eagle Point Nature Preserve

The Eagle Point Nature Preserve is located on High Rock Reservoir in Rowan County. The preserve falls under the management of Rowan County Parks and Recreation. The preserve consists of approximately 100 acres of public land owned by Rowan County and over 80 acres on lease from APGI at no cost. The preserve is open to the public daily and the preserve's facilities include hiking trails, a canoe access (to High Rock Reservoir), and wildlife observation sites (LVA, 2005a Appendix E-18).

E.5.1.3 Commercial Recreation Areas

On High Rock and Narrows reservoirs, five commercial recreation areas were identified and included in the Recreation Facility Inventory and Condition Assessment (Table E.5-10). Four areas are located on High Rock Reservoir and one is located on Narrows Reservoir. Combined, the five commercial areas provide four marinas including five boat ramps and five boat docks, one fishing pier, one campground, and two picnic areas. As commercial recreation areas, these sites are generally available to the public for a fee (LVA, 2005a Appendix E-18).

Table E.5-10: Major Facilities at Commercial Recreation Areas

Site Name	Reservoir	Boat Ramp	Boat Dock	Fishing Pier	Swim Area	Camp-ground	Picnic Area
High Rock Marina and Campground	High Rock	1	0	1	0	1	1
Tamarac Marina	High Rock	1	2	0	0	0	1
High Rock Boat and Ski Club	High Rock	1	1	0	0	0	0
Boat Dock Marina	High Rock	1	1	0	0	0	0
Fish Tales Marina	Narrows	1	1	0	0	0	0
High Rock Reservoir Totals	4 areas	4	4	1	0	1	2
Narrows Reservoir Totals	1 area	1	1	0	0	0	0
Commercial Area Totals	**5 areas**	**5**	**5**	**1**	**0**	**1**	**2**

E.5.1.4 Dispersed Recreation Sites

Dispersed recreation sites are areas where recreation occurs outside the boundaries of an established public recreation area. While no survey could document all dispersed recreation sites along the reservoirs, APGI's inventory identified 41 dispersed sites of varying lengths of shoreline that were obviously receiving routine use by recreationists. These 41 sites are scattered throughout the shorelines and islands of all four reservoirs: 5 on Falls Reservoir, 12 on Narrows Reservoir, 12 on Tuckertown Reservoir, and 12 on High Rock Reservoir. At the 41 specifically identified dispersed recreation areas, bank fishing and camping (and hunting in one instance) are the only activities known to occur (LVA, 2005a Appendix E-18).

While specific dispersed areas were surveyed where recreation is known to occur routinely, it should be noted that dispersed recreation can and probably does occur (at varying use levels) along the entire shoreline of all four reservoirs. Dispersed recreation use is particularly prevalent on islands and along forested shorelines that are not directly adjacent to private property. The 41 sites identified in the Recreation Facility Inventory and Condition Assessment are considered to be sites where use is most obvious and significant. Also, although it may not always be the predominant method of access, all dispersed recreation areas can be accessed by means of boat. Likewise, although camping may be noted as the predominant activity that occurs at a site, it is assumed that bank fishing occurs at nearly every dispersed recreation site. APGI does not allow camping on APGI lands and considers "dispersed camping" as unauthorized. No camping signs have been posted but are frequently vandalized and/or removed. Additionally, many of the sites documented as dispersed recreation are recreation areas that extend beyond the bounds of established public access sites. Although not all such sites were addressed in the Recreation Facility Inventory and Condition Assessment, it should be noted that at nearly all public access areas, bank fishing extends beyond the established facilities of that recreation site (LVA, 2005a Appendix E-18).

E.5.1.5 Private Recreation Facilities

In addition to the recreation facilities available to the general public, there are numerous privately owned and operated multi-use (group) recreation facilities located around the Project reservoirs. These facilities include private boat clubs, private campgrounds, day use areas and facilities for private organizations such as the Elks Lodge or Moose Lodge, and private facilities that are maintained by homeowner associations.

There are also numerous private individual and shared recreation facilities on the High Rock and Narrows reservoirs. Most of these facilities are private individual piers. According to permit records, there are approximately 2,700 private piers on High Rock and approximately 1,084 private piers on Narrows. While private individual boat houses and boat ramps are no longer allowed (under APGI's Shoreline Management Plan), some of the older shoreline properties have these facilities as well.

E.5.2 Opportunities for the Handicapped

In the Recreation Facility Inventory and Condition Assessment, a disabled access assessment was made at each public access recreation area. A "barrier-free" facility is a facility where access is free of impediments to safe use and passage to persons with disabilities or handicaps.[1] Typical impediments at boating and fishing facilities include the absence of cuts in the curb around parking lots, improperly surfaced walks and decking, poor transitions from pathways to structures such as boat docks and fishing piers, and steeply graded access ways (LVA, 2005a Appendix E-18).

Facilities classified as barrier-free, such as a boat ramp, courtesy dock, fishing pier, or a picnic area should be designed so that it can be approached, entered, and used by people with disabilities. Factors that were considered in conducting the disabled access assessment at each recreation area included: the availability of signed handicapped parking; the surface and slope of accessible pathways; access to boat transfer facilities (courtesy docks); the design of existing fishing piers; the accessibility to side or end-approach picnic tables; and the availability of barrier-free restroom facilities at each recreation area. Tables E.5-11 through E.5-14 below summarize the barrier-free opportunities at Yadkin Project public recreation areas for each reservoir and suggests possible improvements to help meet barrier-free status at sites where they are not currently met (LVA, 2005a Appendix E-18).

E.5.2.1 High Rock Reservoir

High Rock Reservoir currently has no fully accessible recreation areas. Nevertheless, there are numerous facilities that have been designed to be barrier-free but lack important features. Boating facilities at Southmont Boat Access Area, Buddle Creek Boat Access Area, Dutch Second Creek Boat Access Area, and Flat Swamp Boat Access Area need designated parking spaces and accessible pathways in order to make them accessible. All other facilities and recreation areas are completely not accessible[2] (LVA, 2005a Appendix E-18).

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[1] Definition from "Guidelines for the Design of Barrier-Free Recreational Boating and Fishing Facilities" prepared for the States Organization for Boating Access, 1992.

[2] "Completely not accessible" is used to describe those areas without paved/accessible parking, accessible pathways to any facilities, and courtesy docks (for those areas with boating facilities). Such areas would need all of the above mentioned additions to be barrier-free.

Table E.5-11: Summary of Barrier-Free Areas and Possible Improvements to Achieve Barrier-Free Accessibility at High Rock Reservoir

Recreation Area	Accessible (yes/no)	Notes; Possibilities for Accessibility
Highway 601 Access Area	No	Completely not accessible
Rowan County Pump Station	No	Completely not accessible
York Hill Boat Access	No	Completely not accessible
Crane Creek Fishing Access Pull-off	No	Completely not accessible
Little Crane Creek Fishing Access	No	Completely not accessible
Southmont Boat Access Area	No	Designated parking space and accessible pathway would make boating facilities accessible.
Highway 47 Fishing Pull-off	No	Completely not accessible
Buddle Creek Boat Access Area	No	Designated parking space and accessible pathway would make boating facilities accessible.
Abbotts Creek/NC 8 Bridge Pull-off	No	Completely not accessible
Dutch Second Creek Boat Access	No	Designated parking space and accessible pathway would make boating facilities accessible.
Flat Swamp Boat Access	No	Designated parking space and accessible pathway would make boating facilities accessible.

E.5.2.2 Tuckertown Reservoir

Tuckertown Reservoir currently has one fully accessible recreation area: Flat Creek Boat Access Area. Additionally, there are numerous facilities that have been designed to be barrier-free but lack important features. Boating facilities at Bringle Ferry Boat Access Area and Highway 49 Boat Access Area need designated parking spaces and accessible pathways in order to make them accessible. All other facilities and recreation areas are completely not accessible (LVA, 2005a Appendix E-18).

Table E.5-12: Summary of Barrier-Free Areas and Possible Improvements to Achieve Barrier-Free Accessibility at Tuckertown Reservoir

Recreation Area	Accessible (yes/no)	Notes; Possibilities for Accessibility
High Rock Dam Tailrace Access (Rowan)	No	Completely not accessible
High Rock Dam Tailrace Access (Davidson)	No	Completely not accessible
Bringle Ferry Boat Access	No	Designated parking space, accessible pathways and barrier-free transitions would make boating facilities accessible.
Cedar Creek Fishing Pull-off	No	Completely not accessible
Lick Creek Fishing Pull-off	No	Completely not accessible
Flat Creek Boat Access Area	Yes	Accessible; transition plates are recommended
Flat Creek Fishing Access Area	No	Completely not accessible
Newsome Road Access	No	Completely not accessible
Riles Creek Recreation Area	No	Completely not accessible
Highway 49 Boat Access Area	No	Designated parking space and accessible pathway would make boating facilities accessible
Tuckertown Pull-off Fishing Access	No	Completely not accessible

E.5.2.3 Narrows Reservoir

Narrows Reservoir currently has two fully accessible recreation areas: Circle Drive Boat Access Area and UNF Cove Boat Landing. Additionally, there are numerous facilities that have been designed to be barrier-free but lack important features. Facilities at Old Whitney Boat Access Area, Badin Boat Access, and UNF Arrowhead Campground need minimal improvements in order to make them accessible. All other facilities and recreation areas are completely not accessible (LVA, 2005a Appendix E-18).

Table E.5-13: Summary of Barrier-Free Areas and Possible Improvements to Achieve Barrier-Free Accessibility at Narrows Reservoir

Recreation Area	Accessible (yes/no)	Notes; Possibilities for Accessibility
Tuckertown Dam Tailrace Access	No	Completely not accessible
Garr Creek Access Area	No	Completely not accessible
Old Whitney NCWRC Fishing Pier	No	Completely not accessible
Old Whitney Boat Access Area	No	Designated parking space, accessible pathways and gaps in courtesy dock curb would make boating facilities accessible
Circle Drive Boat Access Area	Yes	Accessible
Lakemont Access Area	No	Completely not accessible
UNF Holt's Cabin Picnic Area	No	Completely not accessible
UNF Walk-in Fishing Pier	No	Completely not accessible
UNF Badin Lake Campground	N/A	Under Construction
UNF Cove Boat Landing	Yes	It is intended that reconstruction will fully provide barrier-free facilities
Palmerville Access Area	No	Completely not accessible
Badin Lake Swim/Picnic Area	No	Completely not accessible
Badin Boat Access	No	Paved, designated parking space, accessible pathway to ramp and floating dock, and transition plates and gaps in dock curb are needed to achieve barrier free status
Badin Lake Group Camp	No	Completely not accessible
UNF Arrowhead Campground	No	Campsite parking areas must be wider to be barrier-free. Picnic tables, lantern poles, and living spaces are not barrier-free. Bathhouse currently meets barrier free guidelines

E.5.2.4 Falls Reservoir

Falls Reservoir currently has no fully accessible recreation areas. Boating facilities at Falls Boat Access need a courtesy dock, an accessible pathway, and designated parking spaces in order to make them accessible. Facilities at UNF Deep Water Trail Access are completely not accessible (LVA, 2005a Appendix E-18).

Table E.5-14: Summary of Barrier-Free Areas and Possible Improvements to Achieve Barrier-Free Accessibility at Falls Reservoir

Recreation Area	Accessible (yes/no)	Notes; Possibilities for Accessibility
UNF Deep Water Trail Access	No	Completely not accessible
Falls Boat Access	No	Addition of a courtesy dock, accessible pathway, and designated parking spaces are needed.

Although limited, barrier-free opportunities do exist at the Project. The Circle Drive Boat Access Area, managed by the NCWRC, is a good example of barrier-free boating facilities. The area has a designated and signed handicapped parking space, which is along an accessible pathway (concrete) that leads to accessible boat ramps and courtesy docks (one with a handicapped accessible handrail). The restroom facilities at this area are not barrier-free (LVA, 2005a Appendix E-18).

Several access areas, such as the Highway 49 Boat Access Area on Narrows Reservoir (Badin Lake), are designed to be barrier-free, but lack some necessary elements. The courtesy boat docks at the Highway 49 Boat Access Areas were constructed to be barrier-free, but there is currently no signed handicapped parking space or accessible pathway to the facilities. In most cases, the absence of an accessible pathway and/or a designated parking space is the only remaining improvements required to make facilities barrier-free. Because the predominant uses at the reservoirs are boating and fishing, efforts to improve barrier-free accessibility should focus on these uses (LVA, 2005a Appendix E-18).

E.5.3 Public Safety Measures

In 1968, to ensure public safety around dams, "Exclusionary Zones" were established below Tuckertown and Falls dams. These zones prohibit fishing, swimming, and boating within 100 feet upstream and downstream of the dams and are enforced by the NCWRC. In 2001, APGI petitioned the NCWRC to designate similar exclusionary zones at High Rock and Narrows dams, but the petition was denied. In 2003, APGI asked the NCWRC to reconsider its previous petition for exclusionary zones at High Rock and Narrows dams. Unsuccessful in its attempts to designate exclusionary zones at these dams, APGI posted additional safety signs at all four dams to reinforce the importance of water safety. The signs, posted in both English and Spanish, inform individuals that swimming, boating, or entry between the sign and the dam is potentially dangerous. APGI strongly encourages users to take additional caution in these areas (LVA, 2005a Appendix E-18).

In December 2003, APGI filed a revised Public Safety Plan with FERC. Generally, the Public Safety Plan outlines the safety precautions taken at the Project dams and around the Project reservoirs. Such precautions include, but are not limited to, warning signs, "no wake" and "no boat" buoy lines, and lights. FERC inspects these facilities at the Yadkin Project on a regular basis to ensure that they are maintained (LVA, 2005a Appendix E-18).

In addition to the Public Safety Plan, APGI developed a plan to promote swimming safety at all of its swimming areas in June 2001. The plan limits swimming from sunrise to sunset from May 15 through September 15 and requires children under the age of 16 to be supervised by an adult. In 2001, APGI restricted the size of the swimming areas and installed a two-line buoy system in an effort to improve public safety. APGI also installed public telephones, posted emergency procedures, and provided safety equipment (rescue throw bags) at the swimming areas. APGI provides funding to local governments to support additional law enforcement patrols at the recreation areas and local swimming safety programs. In February 2004, APGI funded the purchase of a patrol boat for the Montgomery County Sheriff's Office of Water Safety. APGI has also provided throw bags to county law enforcement departments to use in their boats (LVA, 2005a Appendix E-18).

In May 2004, APGI installed a life jacket station to promote water safety at the Buddle Creek Access Area in cooperation with SAFE KIDS in Davidson County. A similar life jacket station was installed at the Flat Swamp Access Area in 2003. The stations are designed to offer free use of life jackets for children and other inexperienced swimmers. APGI has offered to install a similar life jacket rack in Rowan County in cooperation with SAFE KIDS (LVA, 2005a Appendix E-18).

There are several areas around the Project reservoirs, especially at bridge crossings, where fishermen like to bank fish. Concerned about the potentially unsafe pedestrian and vehicular interactions along roadways, APGI is discouraging this use in some areas. In cooperation with NCDOT, APGI has posted numerous "No Parking" signs along the NC Highway 8 at Abbotts Creek to discourage fishing from the bridge. Additionally, APGI provides no facilities (e.g. trash receptacles) at this area. Other fishing pull-offs areas where use has been discouraged through "No Parking" signs and the absence of improved facilities include Crane Creek Fishing Access Pull-off, and Lick Creek Fishing Pull-off. These areas are considered "closed" and will no longer be considered official public recreation areas (LVA, 2005a Appendix E-18).

Boating safety at the bridges that pass over High Rock Reservoir has been identified by the relicensing participants as a safety issue. At higher reservoir elevations, the clearance height for boats moving underneath the bridge overpasses decrease. To help address this issue, APGI has installed strips of reflective tape on all the bridges at High Rock to make them more visible. Additionally, APGI is exploring options with the NCDOT and SaveHighRockLake.org to install lighting on six bridges at High Rock to help improve visibility of and around the bridges at night.

The relicensing participants have also identified the need for more and better navigational aids on the Project reservoirs to mark potentially dangerous areas such as exposed tree stumps and/or low water areas. The participants have also requested that flashing lights be added to existing "no wake" and "danger buoys" to make them more visible. APGI does not have the authority to install and maintain buoys and other navigational aids on the Project reservoirs. North Carolina General Statute 75A-15 governs the adoption of local water safety rules. NCWRC promulgates and enforces rules that establish safety zones and provide for the placement of buoys as informational markers in waters of the state. Such markers may indicate swimming or no wake zones, channel paths, restrictions on certain activities, and other designations. Only a unit of local government (county or city), or an agency empowered by authority of local government with jurisdiction over the area may request the NCWRC to promulgate local water safety regulations. The NCWRC may also establish no wake zones in waters of the state where an investigation by a NCWRC enforcement officer demonstrates that water safety hazards exist (NCWRC Boating and Waterways website).

E.5.4 Signage

FERC requires licensees to take the appropriate actions, including placing the appropriate signage, to safeguard the public from harm at and around hydropower projects. To this end, FERC requires that licensees develop and file a Public Safety Plan (discussed in Section E.5.3), which includes a list of safety devices and their location at the Project. APGI has posted and maintains numerous safety signs at the Project. These signs warn against rapidly rising water, overhead transmission lines, shallow water, no swimming, etc. In addition to signs aimed at improving public safety at the Project, APGI posts signs required by Part 8 of FERC's regulations at every recreation area that provides access to the Project. In many cases, signs are posted in both English and Spanish. Every sign at the Yadkin Project meets FERC's requirements.

E.5.5 Recreational Use

During the initial consultation phase of the relicensing process, APGI was requested by resource agencies and others to evaluate recreational use at the Yadkin Project. In response to this request, APGI undertook a Recreational Use Assessment which was carried out in accordance with a study plan that was developed in close consultation with the Recreation, Aesthetics, and Shoreline Management IAG. The objectives of the study were to:

- Estimate total annual recreation use at each of the four reservoirs.
- Characterize the type of recreational activities.
- Evaluate recreation issues and facility condition.
- Estimate peak recreational use and recreational carrying capacity.
- Assess the effects of Project operations on tailwater recreational use.

A variety of data collection measures were used to obtain information regarding recreational use of the Project area including spot counts and numerous use surveys. All recreational use was measured in terms of recreation days. A "recreation day" was defined as "each visit by a person to a development for recreation purposes during any portion of a 24-hour period." In other words, any and all recreation during a 24-hour period by one person would equal one recreation day.

E.5.5.1 Total Project Use

Based on the results of the Recreation Use Assessment, annual recreational use for the entire Yadkin Project is estimated at over 2.5 million recreation days for the one year study period (May 2003 through April 2004). High Rock and Narrows receive the most use (60 percent and 37 percent, respectively). Tuckertown Reservoir receives about 2 percent of total Project recreational use, and Falls Reservoir receives less than 1 percent of total project use (ERM, 2005 Appendix E-19).

Table E.5-15: Total Project Recreational Use (in recreation days)

Reservoir	Visitor Use	Waterfront Resident Use	Non-Waterfront Resident Use	Businesses and Organization Use	Portage Use	Total Use	% of Total
High Rock	82,846	1,058,585	269,448	132,982	30	1,543,891	60%
Tuckertown	51,887	0	0	2,465	0	54,352	2%
Narrows	127,561	285,993	450,009	95,570	20	959,153	37%
Falls	4,159	0	0	0	20	4,179	<1%
Total	266,453	1,344,578	719,457	231,017	70	2,561,575	100%
% of Total	10%	52%	28%	9%	<1%	100%	

Waterfront residents at High Rock and Narrows reservoirs are estimated to represent about 52 percent of the total recreation days at the Project. Non-waterfront residents (28 percent), commercial businesses and private organizations (9 percent), and visitors (10 percent) represent nearly all of the remaining use. Use data collected via the canoe registries that were established at the portage trails around the four dams indicate that the portage trails receive very light use (estimated at 70 recreation days per year) (ERM, 2005 Appendix E-19).

The four Project reservoirs are used primarily for boating and fishing (from boats and along the shoreline), with swimming, sunbathing, picnicking, waterskiing, and camping also popular. High Rock and Narrows reservoirs are used for a wide variety of recreational activities. The predominant use at Tuckertown Reservoir is fishing, while Falls Reservoir is popular for both camping and fishing. Recreational use at High Rock and Narrows reservoirs primarily occurs during May through September. These five months (May through September) represents 71 percent of the total recreation days at High Rock Reservoir and 67 percent at Narrows Reservoir. Tuckertown and Falls Reservoirs do not have any waterfront residents with pier permits, are smaller, and are primarily used for fishing and camping. Recreational use at these reservoirs picks up earlier in the year (early April) than at High Rock and Narrows reservoirs. Recreational use also drops off earlier at Tuckertown and Falls reservoirs (August) than at High Rock or Narrows reservoirs (ERM, 2005 Appendix E-19).

E.5.5.1.1 High Rock Reservoir

Eighty-three percent of total recreation use at High Rock Reservoir is conducted by waterfront residents and totals over 1,500,000 recreation days. The highest use levels are May through September and these months account for more than 70% of the total recreation use. The months of June through August receive the highest recreation use (ERM, 2005 Appendix E-19).

Table E.5-16: Estimated Annual High Rock Reservoir Recreation Use (in recreation days)

Month	Public Access Rec Use	Waterfront Resident Rec Use	Private Community Rec Use	Commercial and Club Rec Use	Canoe Portage Use	Total	% of Total Use
May	13,899	119,768	15,949	14,673	4	164,293	11
June	14,251	176,930	33,576	18,148	4	242,909	16
July	14,925	181,013	33,576	22,245	2	251,761,	16
August	11,802	185,096	33,576	21,511	2	251,987	16
September	7,557	144,266	25,555	11,060	4	188,442	12
October	5,756	103,436	25,555	10,474	4	145,225	9
November	1,023	7,077	25,555	10,020	2	43,677	3
December	2,304	7,077	14,736	2,739	2	26,858	2
January	961	7,077	14,736	2,733	0	25,507	2
February	971	7,077	14,736	2,639	0	25,423	2
March	2,103	38,108	15,949	7,809	2	63,971	4
April	7,294	81,660	15,949	8,931	4	113,838	7
Total	**82,846**	**1,058,585**	**269,448**	**132,982**	**30**	**1,543,891**	**100**

Fishing (by boat and along the shoreline) is the most popular activity at High Rock Reservoir with approximately 85% of all survey respondents participating. Fishing is more popular with visitors than residents while activities such as motor boating and swimming are more popular with residents than visitors (ERM, 2005 Appendix E-19).

Table E.5-17: High Rock Resident and Visitor Recreational Activities (% of total recreation days)

Recreational Activity	Public Access Areas	Waterfront Residents	Non-Waterfront Residents
Motor boating	15%	26%	22%
Boat fishing	33%	10%	30%
Bank fishing	22%	14%	19%
Canoeing/kayaking	0%	3%	0%
Swimming	9%	13%	11%
Personal Watercraft use	2%	9%	0%
Camping	3%	1%	0%
Windsurfing	0%	0%	0%
Waterskiing	1%	4%	1%
Picnicking	3%	5%	2%
Hiking	1%	1%	11%
Sunbathing	8%	11%	3%
Sailing	0%	1%	0%
Other	3%	2%	1%
Total	**100%**	**100%**	**100%**

Although High Rock Marina and Campground is the only public recreation area with camping facilities, some survey respondents indicated that they were camping on the reservoir. Additionally, there are numerous private organizations with camping facilities along the reservoir. The total number of overnight users at High Rock Reservoir was estimated at 69,235 recreation days (nights) or approximately 4% of total recreational use (ERM, 2005 Appendix E-19).

E.5.5.1.2 Tuckertown Reservoir

Ninety-five percent of total recreation use at Tuckertown Reservoir is conducted through public access use and totals over 50,000 recreation days. The highest use levels are April through August and these months account for approximately 81% of the total recreation use. July receives the highest recreation use of any month (ERM, 2005 Appendix E-19).

Table E.5-18: Estimated Annual Tuckertown Reservoir Recreation Use (in recreation days)

Month	Public Access Rec Use	Waterfront Resident Rec Use	Private Community Rec Use	Commercial and Club Rec Use	Canoe Portage Use	Total	% of Total Use
May	8,674	0	0	379	0	9,053	17
June	8,476	0	0	465	0	8,941	16
July	10,973	0	0	530	0	11,503	21
August	7,513	0	0	550	0	8,063	15
September	2,749	0	0	97	0	2,846	5
October	2,204	0	0	39	0	2,243	4
November	1,761	0	0	40	0	1,801	3
December	952	0	0	0	0	952	2
January	98	0	0	0	0	98	<1
February	408	0	0	0	0	408	1
March	1,637	0	0	183	0	1,820	3
April	6,442	0	0	182	0	6,624	12
Total	**51,887**	**0**	**0**	**2,465**	**0**	**54,352**	**100**

Fishing (by boat and along the shoreline) is the primary recreational activity at all public access areas along Tuckertown Reservoir. Other popular activities include picnicking, swimming, and motor boating (ERM, 2005 Appendix E-19).

Although there are no public recreation areas with camping facilities, some survey respondents indicated that they were camping on the reservoir. The total number of overnight users at Tuckertown Reservoir was estimated at 3,952 recreation days (nights) or approximately 7% of total recreational use (ERM, 2005 Appendix E-19).

E.5.5.1.3 Narrows Reservoir

Recreation use at Narrows Reservoir is conducted by a combination of public access recreation use (13%), waterfront residents (30%), private communities (47%), and commercial and club uses (10%) and totals over 950,000 recreation days. The highest use levels are June through September and these months account for approximately 59% of the total recreation use. July receives the highest recreation use of any month (ERM, 2005 Appendix E-19).

Table E.5-19: Estimated Annual Narrows Reservoir Recreation Use (in recreation days)

Total	Public Access Rec Areas	Waterfront Resident Rec Use	Private Community Rec Use	Commercial and Club Rec Use	Canoe Portage Use	Grand Total	% of Total Use
May	20,297	19,133	26,636	5,545	2	71,613	8
June	23,816	44,308	56,076	14,030	2	138,232	14
July	23,974	74,015	56,076	39,000	2	193,067	20
August	18,701	44,308	56,076	15,475	2	134,562	14
September	10,670	42,294	42,680	4,330	2	99,976	11
October	6,626	18,630	42,680	4,260	2	72,198	8
November	3,810	5,539	42,680	2,440	2	54,471	6
December	1,382	5,539	24,611	854	2	32,388	3
January	998	5,539	24,611	881	0	32,029	3
February	1,604	5,539	24,611	855	0	32,609	3
March	7,219	4,029	26,636	3,150	2	41,036	4
April	8,464	17,120	26,636	4,750	2	56,972	6
Total	**127,561**	**285,993**	**450,009**	**95,570**	**20**	**959,153**	**100**

Boat and bank fishing are the primary recreational activities (over 40 percent participation) at public access recreation areas at Narrows Reservoir. Other common recreational activities include swimming, picnicking, camping, and motor boating (ERM, 2005 Appendix E-19).

Table E.5-20: Narrows Resident and Visitor Recreational Activities (% of total recreation days)

Recreational Activity	Public Access Areas	Waterfront Residents	Non-Waterfront Residents
Motor boating	9%	26%	23%
Boat fishing	19%	9%	19%
Bank fishing	18%	12%	17%
Canoeing/kayaking	3%	1%	2%
Swimming	12%	16%	13%
Personal Watercraft use	2%	12%	6%
Camping	10%	0%	2%
Windsurfing	0%	0%	0%
Waterskiing	1%	6%	4%
Picnicking	9%	2%	3%
Hiking	4%	1%	2%
Sunbathing	8%	12%	8%
Sailing	0%	0%	1%
Other	5%	3%	0%
Total	**101%**	**100%**	**100%**

Several of the public access recreation areas and private campgrounds at Narrows Reservoir provide facilities for camping. Some survey respondents from recreation areas besides those that provide camping facilities also indicated that they were camping on the reservoir. The total number of overnight users at Narrows Reservoir was estimated at 95,072 recreation days (nights) or approximately 10% of total recreational use (ERM, 2005 Appendix E-19).

E.5.5.1.4 Falls Reservoir

One-hundred percent of recreation use at Falls Reservoir is conducted through public access use and totals over 4,000 recreation days. The highest use levels are April through August and these months account for approximately 68% of the total recreation use. June receives the highest recreation use of any month (ERM, 2005 Appendix E-19).

Table E.5-21: Estimated Annual Falls Reservoir Recreation Use (in recreation days)

Month	Public Access Recreation Areas	Canoe Portage Use	Grand Total	% of Total Use
May	606	2	608	15
June	669	2	671	16
July	612	2	614	15
August	532	2	534	13
September	342	2	344	8
October	214	2	216	5
November	350	2	352	8
December	93	2	95	2
January	17	0	17	<1
February	76	0	76	2
March	240	2	242	6
April	408	2	410	10
Total	**4,159**	**20**	**4,179**	**100**

Fishing (by boat and along the shoreline) and camping are the primary recreational activities at Falls Reservoir with over 40% of respondents indicating participation. Other popular activities include hiking, picnicking, and swimming (ERM, 2005 Appendix E-19).

Eighty-four percent of the recreation users at Deep Water Trail Access indicated that they were camping for at least one night. The total number of overnight users at Falls Reservoir was estimated at 1,284 recreation days (nights) or approximately 31% of total recreational use (ERM, 2005 Appendix E-19).

E.5.6 Capacity Issues and Future Trends

Recreational facilities at the public access recreation areas were evaluated in terms of their capacity to meet recreational demand; physical, social, and total carrying capacity; and future use trends.

Overall recreation use has increased 69% since 1991 with High Rock and Narrows use increasing by 118% and 56% respectively. Both Tuckertown and Falls reservoirs have experienced a decrease in recreational use since 1991 (ERM, 2005 Appendix E-19).

Table E.5-22: Summary of Historical Annual Recreational Use at the Yadkin Project (in recreation days)

Reservoir	1991	1997	2003	2004
High Rock	708,500	815,166	410,230	1,543,891
Tuckertown	178,000	110,856	117,476	54,352
Narrows	614,000	365,596	289,521	959,153
Falls	12,000	9,036	10,209	4,179
Total	1,512,500	1,300,654	827,436	2,561,575

The number of boat launch lanes and amount of parking were found to be generally adequate. Several relatively heavily used recreation areas lacked any trash receptacles and toilets. Given the number of survey respondents who identified lack of sanitary facilities and improper disposal of litter and trash as big or moderate problems, additional trash receptacles and toilets are warranted (ERM, 2005 Appendix E-19).

The estimated physical carrying capacities (PCC) of High Rock, Tuckertown, Narrows, and Falls reservoirs are 1355, 283, 507, and 25 respectively (ERM, 2005 Appendix E-19).

Table E.5-23: Project Physical Carrying Capacity by Reservoir

Reservoir	Motor Boats and PWC	Water skiers or Tubers	Sailboats	Canoes/ Kayaks/ Windsurfers	Estimated Physical Carrying Capacity (# of boats)
High Rock	1191	82	27	55	1355
Tuckertown	235	17	0	31	283
Narrows	446	41	0	20	507
Falls	18	2	0	5	25

Table E.5-24 summarizes the results of social carrying capacity surveys for the Project reservoirs. Generally, very few users rated Tuckertown and Falls reservoirs as “very” or “quite” crowded on summer weekends. A higher percentage of users, but less than 40%, rated High Rock and Narrows reservoirs as “very” or “quite” crowded on summer weekends (ERM, 2005 Appendix E-19).

Table E.5-24: Project Social Carrying Capacity by Reservoir

Reservoir	Percentage of Users Rating Project Reservoirs as “Quite” or “Very Crowded” on Summer Weekends
High Rock	21-36%
Tuckertown	5%
Narrows	8-38%
Falls	6%

Based on spot counts, aerial photographs on peak holiday weekends, and peak day recreational use from prior studies, the maximum number of boats at one time (BAOT) was estimated as follows:

High Rock Reservoir - 641 watercraft
Tuckertown Reservoir - 92 watercraft
Narrows Reservoir - 411 watercraft
Falls Reservoir - 8 watercraft

The estimates of future maximum BAOT approaches but does not exceed the physical carrying capacity at Tuckertown and Falls reservoirs. At High Rock and Narrows current boating use is approaching the reservoirs' carrying capacity, and significant increases in both waterfront and non-waterfront residences, combined with regional trends for increasing boating, results in use levels that may exceed carrying capacity. At the current pace, High Rock is expected to be at 119% of its PCC and Narrows is expected to be at 150% of its PCC by the year 2030 (ERM, 2005 Appendix E-19).

Table E.5-25: Comparison of Estimated Future BAOT with Reservoir Carrying Capacity

Reservoir	Current Max BAOT	Population Growth	Participation Rate Trends	Frequency Rate Trends	2030 Max BAOT	Physical Carrying Capacity (PCC)	2030 BAOT as % of PCC
High Rock							
Residents	367	1.20	1.33	1.05	615		
Visitors	274	1.44	1.33	1.05	551		
Total	641				1,166	981	119%
Tuckertown							
Total	92	1.44	1.33	1.05	185	264	70%
Narrows							
Residents	212	1.15	1.33	1.05	340		
Visitors	199	1.44	1.33	1.05	400		
Total	411				740	494	150%
Falls							
Total	8	1.44	1.33	1.05	16	18	89%

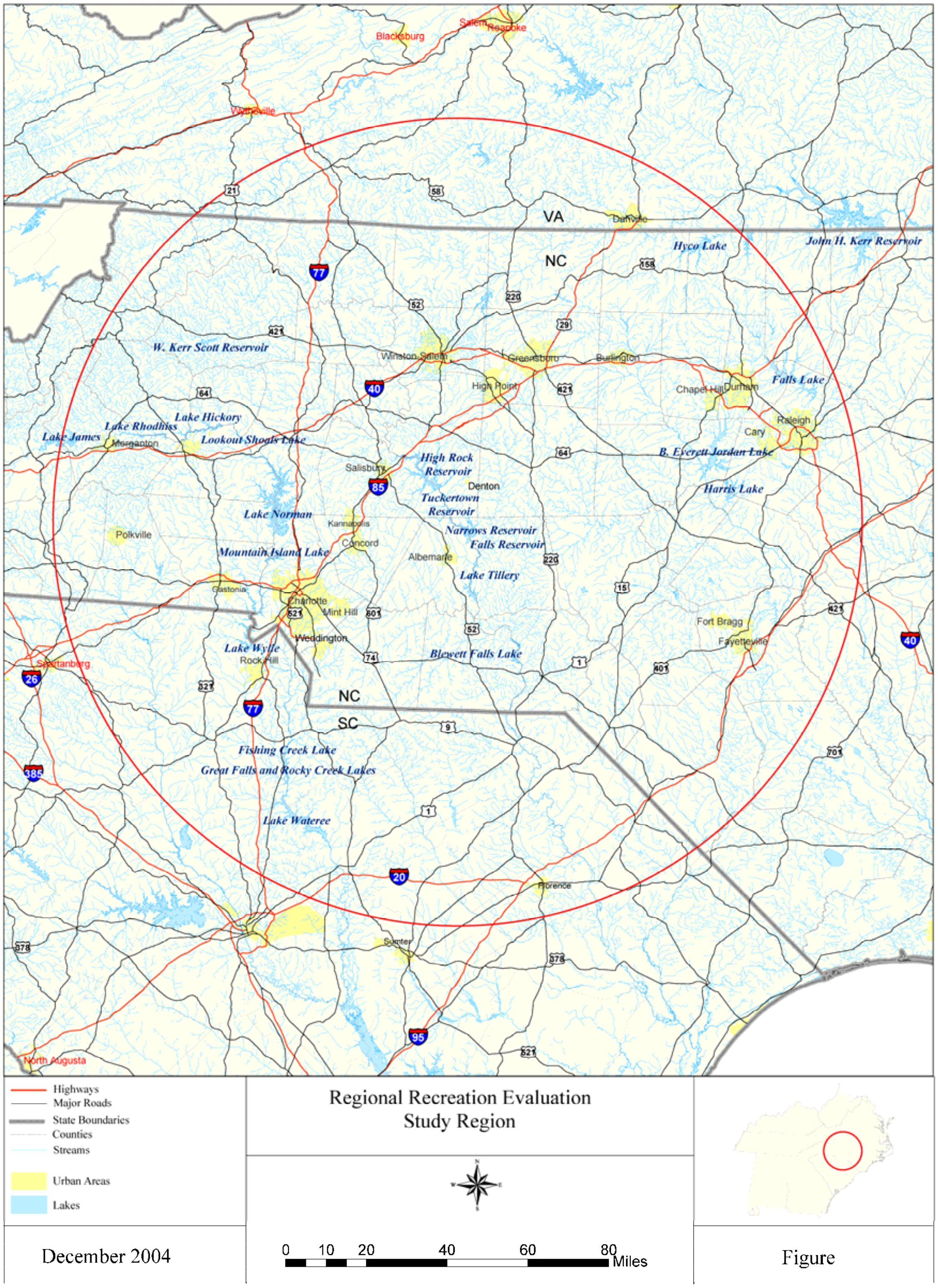
E.5.7 Regional Recreation Resources

Through the relicensing study process, APGI was asked to examine recreational facilities and opportunities at the Yadkin Project in a regional context. Accordingly, in response to comments on the Yadkin Project Relicensing Initial Consultation Document filed with FERC in 2002, APGI developed a study plan for a Regional Recreation Evaluation with input from the Recreation, Aesthetics, and Shoreline Management IAG. The objectives of the study were to:

- Identify and inventory the publicly available (governmental and private) recreation sites/facilities at other reservoirs in the study region.
- Provide a general characterization of the recreational opportunities and experiences available at these reservoirs and sites.
- Evaluate how recreation opportunities available at the Yadkin Project compare with those available elsewhere within the study region.

For the study, existing recreation information was reviewed and compiled to create a general inventory of major regional recreation sites found at the Yadkin Project and at other locations within the "study region". The evaluation defined the "study region" as the area within a 100-mile radius of the Yadkin Project (Figure E-15). The inventory focused on the major outdoor water-based recreational opportunities afforded by other reservoirs and lakes within the study region.

Figure E-15 : Regional Recreation Evaluation Study Region



Within the study region, there are 182 recreation sites along 23 different reservoirs which provide ample opportunities for reservoir and water-based recreation. Generally, reservoir recreation sites provide shoreline fishing access and boat launching facilities. A majority of these sites also provide picnicking opportunities. A few offer fishing piers, swimming beaches, and campgrounds. Beyond these five major activities, reservoir access sites not associated with large state or regional parks provide few other recreational opportunities. Generally, activities such as rock climbing, hiking, mountain biking, and whitewater boating are available within the study region, but opportunities for these activities in conjunction specifically with reservoir-based recreation are limited (LVA, 2005b Appendix E-20).

Compared to other hydroelectric or power-related projects, the Yadkin Project provides similar recreational opportunities. Specifically, the predominant type of recreation provided is boating access. The four Yadkin Project reservoirs provide a total of 40 recreation sites and 30 boat ramps. To a lesser extent, fishing piers, campgrounds, and swimming beaches are also available. A similar distribution of recreation facilities can be found among all power-related reservoirs.

Of the 23 reservoirs within the study region, nine reservoirs have been classified as “Natural,” seven as “Limited Development,” and seven as “Developed” (Table E.5-26). Generally, there is an even distribution of all three types of reservoir experiences within the study region (LVA, 2005b Appendix E-20).

Table E.5-26: Summary of Experience Classifications for Reservoirs within the Study Region

Reservoir	Shoreline Miles	Percentage of Undeveloped Shoreline	Experience Classification
High Rock Reservoir	360	57%	Developed
Tuckertown Reservoir	75	81%	Limited Development
Narrows Reservoir	115	48%	Developed
Falls Reservoir	6	94%	Natural
Tillery Reservoir	118	38%	Developed
Blewett Falls Reservoir	46.9	NA	Natural
Harris Lake	40	90-95%	Natural
Hyco Lake	160	NA	Developed
Lake James	151.1	83%	Limited Development
Lake Rhodhiss	103.9	96.5%	Natural
Lake Hickory	110.6	45.1	Developed
Lookout Shoals Lake	36.3	71%	Limited Development
Lake Norman	591.6	62%	Developed
Mountain Island Lake	86.5	74%	Limited Development
Lake Wylie	327.51	48%	Developed
Fishing Creek Lake	67.1	91.4%	Natural
Great Falls and Rocky Creek Lakes	37	77%	Natural
Lake Wateree	213.1	58%	Limited Development
W. Kerr Scott	55	NA	Limited Development
John H. Kerr Reservoir	800	31%	Limited Development
Falls Lake	175	NA	Natural
B. Everett Jordan Lake	200	NA	Natural

* NA – denotes information that was not available.

Two of the Yadkin Project reservoirs, Narrows and Falls, are adjacent to a national forest, a feature that most other reservoirs (with the exception of Tillery Reservoir classified as "Developed" and Lake James, classified as a "Limited Development") do not have. The location of the Uwharrie National Forest adjacent to Narrows and Falls reservoirs and the fully natural character of the shoreline in these areas are unique within central North Carolina. Recreation users seeking a "Natural" reservoir experience, especially in central North Carolina, have far fewer opportunities than recreation users who are unconcerned with a reservoir's overall setting.

Large reservoirs within the study region, including the Yadkin Project reservoirs, were also evaluated in terms of tourism through interviews with local tourism departments and boards. Generally, tourism at the reservoirs is promoted by localities (counties, cities, and towns) directly adjacent to the reservoir through websites, advertisements, and visitor brochures. The reservoirs in the study region receive the most use from local areas, with the exception of some of the larger reservoirs. Some of the larger reservoirs within the region attract significant numbers of tourists from outside the local area by hosting large events (fishing tournaments, holiday celebrations, etc.). Conversely, many of the smaller reservoirs within the study region are not promoted as tourist destinations at all, but receive light use predominantly by locals (LVA, 2005b Appendix E-20).

E.5.8 Area Plans and Future Opportunities

Of the five counties surrounding the Project (Davidson, Davie, Montgomery, Rowan, and Stanly), three do not have any future plans for the addition of recreational facilities: Davie, Montgomery, and Stanly. Rowan County, although it currently has no specific plans, has stated its desire to expand the Eagle Point Nature Preserve on High Rock Reservoir and possibly adding a new park/recreation area directly adjacent to the reservoir (LVA, 2005b Appendix E-20).

In June 2005, Davidson County completed a recreation and tourism “Master Plan” (Piedmont Triad Council of Governments, 2005) which made recommendations for future recreation opportunities, some of which are applicable to the Yadkin Project. Davidson County passed a resolution supporting the recommendations of the Master Plan. Applicable to the Yadkin Project, the Master Plan identified three top-priority park development projects which would require a partnership with APGI to develop public parks on its current land holdings: 1) Boone’s Cave State Park Expansion and Greenway along the Yadkin River, 2) Linwood Community Center Park Expansion and Greenway along High Rock Reservoir, and 3) Proposed Alcoa Park and Greenway along Tuckertown Reservoir (approximately 2,683 acres). The Master Plan also recommended that Davidson County ask APGI to preserve in perpetuity all of its land holdings with Davidson County along the Yadkin River and both reservoirs (13,050 acres). The Master Plan suggested that the following preservation options be explored: permanent conservation easements (sale or donation), long-term/minimum cost lease arrangements, fee simple donation or sale, and preservation partnerships.

E.5.9 Agency Recommended Measures or Facilities to Create, Preserve, or Enhance Recreational Opportunities at the Project and in its Vicinity

To date, agencies have made no specific formal recommendations for improving recreational facilities at the Yadkin Project. However, through the initial consultation process and in subsequent Recreation, Aesthetics, and Shoreline Management IAG meetings to review study findings, agencies and other stakeholders have raised several issues regarding recreation resources at the Yadkin Project.

Both the NCWRC and USFS have indicated a concern with the lack of adequate fishing access for bank fishermen. As noted previously (Section E.5.3), several of the most heavily used, traditional bank fishing areas have been effectively “closed” recently by the posting of “No Parking” signs on the busy roadways along which anglers using these areas have traditionally parked. APGI is discouraging use of these areas because of the potentially unsafe pedestrian and vehicular interactions along roadways. This has reduced the number of bank fishing areas easily available to fishermen. In addition, the NCWRC has noted that there are currently no public fishing piers located on High Rock Reservoir, which further reduces opportunities for non-boating anglers. Finally, the USFS and NCWRC have both noted that informal access created by bank fishers at many locations around the reservoir (often in the vicinity of other public recreation areas such as boat launches), can be problematic leading to problems with shoreline erosion and trash.

In a letter dated July 31, 2003, Rowan County specifically indicated its concern with the fact that there are no public swim beaches located along the Rowan County side of High Rock Reservoir. According to the County, this creates a situation where Rowan residents have to travel long distances to access designated swim beaches on the Davidson County side of High Rock or in Stanly County on Narrows Reservoir.

Several agencies and NGOs have voiced concern with the condition and facilities available at some of the existing public recreation sites. In particular, the lack of restroom/toilet facilities at several of the major access areas has been noted as an issue that should be addressed by APGI.

Finally, agencies have indicated their interest in assuring that appropriate handicapped access is considered and made available at additional public recreation sites at the Yadkin Project.

E.5.10 Existing Measures or Facilities to be Continued and New Measures or Facilities Proposed by the Applicant

E.5.10.1 Proposed Facilities and Facility Operations

APGI is proposing to continue to maintain and operate the existing public recreation facilities at the Project with a few exceptions. As noted previously, due to safety concerns associated with roadside parking, NCDOT has posted no parking signs along roadways that have traditionally served as parking areas for several informal shoreline fishing areas including the bridge on Highway 8 at Abbotts Creek (High Rock), the Crane Creek Fishing Access Pull-off (High Rock), and Lick Creek Fishing Pull-off (Tuckertown). In conjunction with the “no parking” signs, APGI has been discouraging use of these areas and considers them “closed”.

APGI intends to continue to maintain the remaining public recreation sites. Many of these sites are maintained and operated by the NCWRC and the USFS. In some cases, APGI has an existing agreement with NCWRC to jointly manage and maintain the sites. APGI plans to continue to work with NCWRC, as it has in the past, to jointly manage several of the major recreation sites.

As a result of its most recent recreation facility inventory, APGI is proposing to upgrade facilities at several of the existing recreation sites. In response to concerns by stakeholders regarding toilet facilities at some of the sites, APGI is proposing to provide and maintain new portable toilet facilities at 3-5 existing recreation sites, where such facilities are not currently available. Sites where toilets are to be added will be determined in consultation with the NCWRC, USFS, surrounding Counties, and other appropriate agencies.

Specifically to address the concern expressed by Rowan County regarding the lack of public swimming areas on the Rowan side of High Rock Reservoir, APGI is proposing to donate to

Rowan County a parcel of non-Project land located immediately adjacent to the reservoir, that will be suitable for the development of a new public recreation site with a swimming facility.

Finally, APGI is proposing to make access improvements to three of the existing public recreation sites (one site each on High Rock, Tuckertown and Narrows reservoirs). Sites to be improved will be determined in consultation with NCWRC, USFS, the surrounding Counties, and other appropriate agencies. Sites will be improved in accordance with Americans with Disabilities Act (ADA) specifications and other appropriate "accessibility" standards.

Details of all of the facility improvements proposed to be undertaken by APGI at the Yadkin Project will be outlined in a Recreation Plan for the Yadkin Project. The Recreation Plan will outline new facilities or facility improvements to be undertaken by APGI during the term of its new FERC license. The Recreation Plan will include a schedule for the improvements and will also provide information on maintenance activities to be undertaken by APGI at the public recreation sites. The Recreation Plan will be developed in consultation with resource agencies and the surrounding Counties. The final plan will be submitted to FERC for review and approval.

APGI is also proposing to continue to maintain and operate its public recreation facilities. The facilities for which APGI currently undertakes full responsibility for maintenance and operation are listed in Table E.5-27. Currently, APGI spends approximately $500,000 annually to maintain these facilities. These costs cover routine maintenance of the facilities including trash removal, mowing, portable toilet services, and minor repairs. A portion of these annual costs also goes toward more significant maintenance activities which APGI undertakes periodically on an as needed basis. Such maintenance may include, but is not limited to, parking and road repairs, repairs to boat launches and boat docks, accessibility upgrades, replacement and/or repair of signs, and replacement or repair of other facilities (swimming buoys, safety equipment, trash cans, picnic tables, etc.)

APGI also provides funding to the surrounding counties to help support safety patrols in and around the reservoirs during the recreation season. Currently, APGI provides the counties with approximately $90,000, annually for safety patrols. APGI proposes to continue its safety patrol assistance to the counties.

E.5.10.2 Proposed Project Operations

As outlined in Exhibit B and Section E.2.7, APGI is proposing to operate the Yadkin Project with certain changes in Project operations including changes in reservoir operations. The potential effects of proposed changes in reservoir operations on recreational resources are discussed in the following section.

E.5.10.2.1 Effects of Proposed Reservoir Operations on Recreation Resources

APGI is proposing to operate the four Project reservoirs in accordance with a new set of operating guides as outlined earlier in Exhibit B and Section E.2.7. Under this proposal, the only significant change in reservoir operation will occur at High Rock Reservoir where under the proposed operating guide the reservoir will not be drawn below the proposed "Hard Guide" except as needed to meet required downstream minimum flows or as outlined in the Low Instream Flow Protocol, or in cases of system emergency. Moreover, during most of the year, the reservoir will be operated in accordance with a "Soft Guide". During the period April 15 through September 15, APGI will operate High Rock in accordance with a new "Recreation Season Guide Curve" which would maintain water levels within 3 feet of full during the prime recreation season. If at any time during this period the water level of High Rock falls below that Recreation Season Guide Curve, APGI will reduce its generation to the flow equivalent of no more than 1500 cfs weekly average from the Project, until such time that the High Rock water level returns to or above the Recreation Season Guide Curve.

Operation of High Rock Reservoir under the proposed operating guides will provide significant enhancement of recreational use of the reservoir. First and foremost, the proposed operating guides will significantly extend the period of near-full (within 5 feet of full) reservoir levels over what currently occurs. In total, three additional months (six weeks in spring and six weeks in fall) of near full reservoir conditions will be provided at High Rock. This will significantly enhance the quality of the recreation experience at High Rock during both the spring and fall, and is expected to increase recreational use on the reservoir during those periods, particularly by shoreline residents.

Also, as APGI is proposing both a "soft guide" and a "hard guide" under this proposal, recreational users at High Rock will have a greater assurance of reservoir levels within 5 feet of full during the late summer and fall than they have in the past. No longer will APGI reduce the reservoir below the 649 elevation in the summer in order to meet its generation needs. Instead, APGI will maintain the reservoir within 6 feet of full throughout the period, except as needed to maintain the downstream 900 cfs minimum flow requirement at Falls, or in cases of emergency, or as specified in the Low Instream Flow Protocol.

As discussed earlier in Section E.5.5.1, since the period of greatest recreational use of all the Yadkin Project reservoirs is April through September, APGI's proposed operating guide for High Rock, will enhance recreational use of the reservoir over existing conditions, particularly during the spring and fall recreation seasons. High Rock will continue to experience a seasonal drawdown on average of about 10 feet, in the winter, but recreational use data collected at the Yadkin Reservoirs and compared to other reservoirs in the region clearly demonstrate that recreational use declines significantly during the winter months, even on reservoirs that do not experience a seasonal reduction in water levels. Moreover, while High Rock will still continue to have a seasonal drawdown, the magnitude of the drawdown will be reduced over the existing average of 12 feet. Maintaining the reservoir water level within 10 feet of full in the winter will also allow most of the public recreation facilities (particularly the boat launches) located on High Rock Reservoir to remain useable on a year round basis.

E.5.11 Identification of the Entities Responsible for Managing and Maintaining any Existing or Proposed Recreation Measures or Facilities

Public recreation facilities at the Yadkin Project are owned, operated and maintained by various entities. As outlined in Section E.5.1.3, there are a number of recreation facilities that are operated as private commercial establishments, but which are open to the general public for use. However, most public use at the Project is through one of the public access areas owned, operated, and maintained by APGI, NCWRC, the USFS, or some combination thereof. Table E.5-27 summarizes the entities that are currently responsible for operating and maintaining the non-commercial public recreation facilities at the Yadkin Project.

Table E.5-27: Major Public Recreation Sites at the Yadkin Project and Entity Currently Responsible for Managing and Maintaining the Site

Site No.	Site Name	Site Manager	Notes
High Rock			
H1	Highway 601 Access Area	Davie County Parks and Recreation Department	Site maintained with permission from APGI (site owner); agreement expires in 2008
H3	Rowan County Pump Station	Rowan County Parks and Recreation Department	Rowan County Parks and Recreation Department is the site owner
H8	York Hill Boat Access	APGI	APGI is the site owner
H16	Crane Creek Fishing Access Pull-off	APGI and NCDOT	NCDOT is the site owner; APGI discourages use of this area because of the potentially unsafe pedestrian/vehicular interactions
H19	Little Crane Creek Fishing Access	APGI	APGI is the site owner
H28	Southmont Boat Access Area	APGI	APGI is the site owner
H36	Highway 47 Fishing Pull-off	APGI	APGI is the site owner
H39	Buddle Creek Boat Access Area	APGI	APGI is the site owner
H44	Abbotts Creek/NC 8 Bridge Pull-off		APGI discourages use of this area because of the potentially unsafe pedestrian/vehicular interactions
H48	Dutch Second Creek Boat Access	NCWRC	APGI is the site owner; NCWRC manages the site under agreement with APGI
H64	Flat Swamp Boat Access	APGI	APGI is the site owner
H67	High Rock Dam Canoe Portage	APGI	APGI is the site owner
Tuckertown			
T1	High Rock Dam Tailrace Access (Rowan)	APGI	APGI is the site owner
T2	High Rock Dam Tailrace Access (Davidson)	APGI	APGI is the site owner
T3	Bringle Ferry Boat Access	NCWRC	APGI is the site owner
T4	Cedar Creek Fishing Pull-off	APGI	APGI is the site owner
T6	Lick Creek Fishing Pull-off		APGI discourages use of this area because of the potentially unsafe pedestrian/vehicular interactions
T8	Flat Creek Boat Access Area	NCWRC and APGI	APGI is the site owner; site is maintained jointly by NCWRC and APGI

Table E.5-27: Major Public Recreation Sites at the Yadkin Project and Entity Currently Responsible for Managing and Maintaining the Site (continued)

Site No.	Site Name	Site Manager	Notes
T9	Flat Creek Fishing Access Area	NCWRC and APGI	APGI is the site owner; site is maintained jointly by NCWRC and APGI
T10	Newsome Road Access	APGI	APGI is the site owner
T12	Riles Creek Recreation Area	APGI	APGI is the site owner
T14	Highway 49 Boat Access Area	APGI	APGI is the site owner
T15	Tuckertown Pull-off Fishing Access		This area consists of four separate areas. APGI discourages use of one of these areas (parking area is on the opposite side of road from access area) because of the potentially unsafe pedestrian/vehicular interactions
T16	Tuckertown Dam Canoe Portage	APGI	APGI is the site owner
Narrows			
N1	Tuckertown Dam Tailrace Access	APGI	APGI is the site owner
N2	Garr Creek Access Area	APGI	APGI is the site owner
N5	Old Whitney NCWRC Fishing Pier	NCWRC	NCWRC is the property owner (under agreement with APGI)
N6	Old Whitney Boat Access Area	APGI	APGI is the site owner
N13	Circle Drive Boat Access Area	NCWRC	APGI owns up to the 545 contour, NCWRC is the property owner above the 545 contour
N16	Lakemont Boat Access Area	NCWRC	NCWRC is the site owner
N24	UNF Holt's Cabin Picnic Area	USFS	USFS is the site owner
N25	UNF Walk-in Fishing Pier	USFS manages the recreation area; NCWRC maintains the pier	APGI and USFS are the site owners
N26	UNF Badin Lake Campground	USFS	USFS is the site owner
N27	UNF Cove Boat Landing	USFS	USFS is the site owner
N28	Palmerville Access Area	APGI	APGI is the site owner
N29	Badin Lake Swim/Picnic Area	APGI	APGI is the site owner
N30	Badin Boat Access	APGI	APGI is the site owner
N31	Narrows Dam Canoe Portage	APGI	APGI is the site owner
N36	Badin Lake Group Camp	USFS	USFS is the site owner
N38	UNF Arrowhead Campground	USFS	USFS is the site owner
Falls			
F1	UNF Deep Water Trail Access	USFS	USFS is the site owner
F2	Falls Boat Access	APGI	APGI is the site owner
F3	Falls Dam Canoe Portage	APGI	APGI is the site owner

All the measures being proposed by APGI for improving existing recreation facilities and sites at the Project will be funded by APGI. In some cases, if the improvement involves a site that is managed by the NCWRC or USFS, APGI may provide the funding to those agencies so that they can make the actual improvement to the site in accordance with their own plans and specifications.

E.5.12 Schedule of Implementation of the Measures or Construction of the Facilities

To assist APGI and the other agencies with an interest in recreation use and facilities at the Yadkin Project in planning for future improvements to Project recreational facilities, APGI is proposing to develop a Recreation Plan for the Yadkin Project. The Recreation Plan will be developed in consultation with resource agencies and the surrounding Counties, and will be submitted to FERC within 18 months of the effective date of a new license. Included in the Plan will be a detailed schedule for the implementation of all recreation site measures or facilities being proposed by APGI at the Yadkin Project.

E.5.13 Estimate of Costs of Construction, Operation, and Maintenance of Proposed Facilities

Currently, APGI spends approximately $500,000 annually to maintain these facilities. These costs cover routine maintenance of the facilities including trash removal, mowing, portable toilet services, and minor repairs. A portion of these annual costs also goes toward more significant maintenance activities which APGI undertakes periodically on an as needed basis.

E.5.14 Map of Recreation Measures or Facilities

Maps showing the location of existing public recreation facilities at the Yadkin Project were provided earlier in Figures E-11 through E-14. Conceptual drawings of recreation sites and facilities to be upgraded and improved by APGI during a new license term will be prepared and provided in the proposed Recreation Plan for the Yadkin Project.

E.5.15 Explanation of why the Applicant has Rejected any Measures or Facilities Recommended by an Agency

APGI has not specifically rejected any measures thus far recommended by an agency.

E.5.16 Specially Designated Areas

E.5.16.1 National Wild and Scenic Rivers System

No Project waters are included in the National Wild and Scenic Rivers System. No portion of the Yadkin-Pee Dee River upstream or downstream of the Project have been designated as Wild and Scenic River.

E.5.16.2 Wilderness Areas

There are no areas within the Project or in close proximity to the Yadkin Project that have been designated as Wilderness Area.

E.5.17 Consultation Record

The following table summarizes the consultation record related to recreation resources at the Yadkin Project. A complete record of all consultation regarding the relicensing of the Yadkin Project will be provided in an Appendix to the Final License Application.

Table E.5-28: Summary of Consultation Record Related to Recreation Resources

Agency/Party	Date	To	Description
North Carolina Division of Water Resources, Steve Reed	January 9, 2003	APGI	Letter re: first stage consultation comments
High Rock Lake Association, Larry Jones	January 9, 2003	APGI	Letter re: Yadkin Project ICD comments
North Carolina Watershed Coalition, Scott Jackson	January 9, 2003	APGI	Initial relicensing comments
Yadkin-Pee-Dee Lakes Project, Ann Liebenstein Bass	January 10, 2003	APGI	Letter re: Yadkin Project ICD comments
U. S. Forest Service, John Ramey	January 10, 2003	APGI	Letter re: Yadkin Project ICD comments
North Carolina Wildlife Resources Commission, Chris Goudreau	January 12, 2003	APGI	Letter re: first stage consultation comments and "Hydropower Relicensing Issues, Standards, and Mitigation"
South Carolina Coastal Conservation League and American Rivers, Gerrit Jobsis	January 12, 2003	APGI	Letter re: Yadkin Project ICD comments
APGI	March 13, 2003	RASM IAG	Final summary of March 13, 2003 RASM IAG meeting
APGI	April 10, 2003	RASM IAG	Final summary of April 10, 2003 RASM IAG meeting
APGI	May 2, 2003	RASM IAG	Distribution of Recreation Use Assessment Revised Study Plan
APGI	May 26, 2003	RASM IAG	Distribution o f revised study plan for the Recreation Economic Impact Study
APGI	July 9, 2003	RASM IAG	Final summary of July 9, 2003 RASM IAG meeting
APGI	July 23, 2003	RASM IAG	Final study plan for Recreation Economic Impact Study
APGI	July 23, 2003	RASM IAG	Final study plan for Recreation Use Assessment
APGI	July 28, 2003	RASM IAG	Distribution of Recreation Facilities Inventory and Condition Assessment Draft Study Plan
APGI	October 8, 2003	RASM IAG	Final summary of October 8, 2003 RASM IAG meeting
APGI	October 2003	RASM IAG	Final study plan for Recreation Facility Inventory and Condition Assessment
APGI	February 4, 2004	RASM IAG	Final summary of February 4, 2004 RASM IAG meeting
APGI, Jody Cason	April 22, 2004	RASM IAG	Agenda for the May 5, 2004 RASM IAG meeting
RASM IAG	May 5, 2004		RASM IAG Meeting

Table E.5-28: Summary of Consultation Record Related to Recreation Resources (continued)

Agency/Party	Date	To	Description
APGI, Jody Cason	May 7, 2004	RASM IAG	Request for additional comments on Regional Recreation Evaluation Draft Study Plan
APGI, Jody Cason	July 14, 2004	RASM IAG	Final Regional Recreation Evaluation Study Plan
APGI, Jody Cason	September 2, 2004	RASM IAG	Final summary for RASM IAG meeting on May 5, 2004
APGI, Gene Ellis	October 15, 2004	RASM IAG	Distribution of Recreation Facilities Inventory and Condition Assessment Draft Study Report
APGI, Jody Cason	October 18, 2004	RASM IAG	Email informing IAG of the distribution of the Recreation Facilities Inventory and Condition Assessment Draft Study Report on CD
APGI, Jody Cason	October 20, 2004	RASM IAG	Meeting announcement and draft agenda for the November 3, 2004 RASM IAG meeting
RASM IAG	November 3, 2004		RASM IAG Meeting
U. S. Forest Service	November 23, 2004	APGI	Comments on Recreation Facility Inventory and Condition Assessment Draft Report
High Rock Lake Association, Larry Jones	December 5, 2004	APGI	Comments on the Recreation Facilities Inventory and Condition Assessment Draft Report
Concerned Property Owners High Rock Lake, Don Seitz	December 6, 2004	APGI	Comments on Recreation Facility Inventory and Condition Assessment Draft Report
APGI, Gene Ellis	December 22, 2004	RASM IAG	Distribution of the Recreation Use Assessment Draft Study Report
APGI, Jody Cason	December 23, 2004	RASM IAG	Email informing IAG of the distribution of the Recreation Use Assessment Draft Study Report on CD
APGI, Jody Cason	January 11, 2005	RASM IAG	Final summary for the November 3, 2004 RASM IAG meeting
APGI, Jody Cason	January 13, 2005	RASM IAG	Email informing IAG of the distribution of the Regional Recreation Evaluation Draft Report on CD
APGI, Gene Ellis	January 13, 2005	RASM IAG	Distribution of the Regional Recreation Evaluation Draft Report
APGI, Jody Cason	January 14, 2005	RASM IAG	Draft agenda for the February 2, 2005 RASM IAG meeting

Table E.5-28: Summary of Consultation Record Related to Recreation Resources (continued)

Agency/Party	Date	To	Description
APGI	February 2, 2005	RASM IAG	Final summary of February 2, 2005 RASM IAG Meeting
APGI, Gene Ellis	February 28, 2005	RASM IAG	Distribution of Recreation Facilities Inventory and Condition Assessment Final Study Report
NC Wildlife Resources Commission, Todd Ewing	March 1, 2005	APGI	Comments on Recreation Use Assessment Draft Report
U. S. Forest Service, Ray Jones	March 4, 2005	APGI	Comments on Recreation Use Assessment Draft Report
APGI, Jody Cason	April 20, 2005	RASM IAG	Draft agenda for May 3, 2005 RASM IAG Meeting
APGI, Gene Ellis	April 20, 2005	RASM IAG	Distribution of Regional Recreation Evaluation Final Study Report
RASM IAG	May 3, 2005		RASM IAG Meeting
APGI, Jody Cason	June 16, 2005	RASM IAG and CE IAG	Draft agenda for June 30, 2005 Joint RASM and County Economic Impacts IAG
APGI, Jody Cason	June 28, 2005	RASM IAG and CE IAG	Distribution of County Economic Impacts of APGI's Yadkin Project Draft Report
RASM IAG and CE IAG	June 30, 2005		RASM IAG and CE IAG Joint Meeting
Salisbury-Rowan Utilities	August 4, 2005	APGI	Comments on County Economic Impacts Draft Report
APGI, Jody Cason	August 24, 2005	RASM IAG and CE IAG	Final meeting summary for June 30, 2005 joint IAG meeting
APGI, Jody Cason	August 24, 2005	RASM IAG	Final meeting summary for May 3, 2005 RASM IAG meeting

Notes: APGI – Alcoa Power Generating Inc.
IAG – Issue Advisory Group
CE IAG – County Economics Issue Advisory Group
RASM IAG – Recreation, Aesthetics, and Shoreline Management Issue Advisory Group

E.6 Land Management and Aesthetics

E.6.1 Existing Development and Land Use

The Yadkin Project reservoirs vary greatly in terms of the level of development around each, and general land use and aesthetic character each reservoir possesses. The following section provides an updated description of land use around each of the Project reservoirs. Table E.6-1 provides a breakdown of the four Project reservoir shorelines by major land use type. Maps showing cover types around each of the Project reservoirs are provided in Figures E-16 through E-20. These maps provide a good overview of the portions of the reservoir shorelines that are developed and those which are not. Other prominent land uses/cover types shown on the maps include agricultural land and various forest cover types

Table E.6-1: Reservoir Shoreline Miles in Each Land Use Category

	High Rock		**Tuckertown**		**Narrows**		**Falls**		**Project Total**	
Land Use	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**
Forest	219.2	60.9	68.3	91.0	69.8	60.7	5.7	95	363	65.3
Developed	114.8	31.9	1.3	1.8	42.2	36.7	0.1	1.7	158.4	28.5
Agricultural	26.0	7.2	5.4	7.2	3.0	2.6	0.2	3.3	34.6	6.2
Total Shoreline Miles	**360**	**100**	**75**	**100**	**115**	**100**	**6**	**100**	**556**	**100**

E.6.1.1 High Rock Development

High Rock Reservoir is the largest of the four Yadkin Project reservoirs. High Rock Reservoir has 360 miles of shoreline. It is generally shallow and is subject to sedimentation from upstream sources. The upper end of the reservoir (above I-85) is very narrow and shallow, and retains much of the character of a slow flowing river. Below I-85, the reservoir widens to an area of broad shallow waters with sediment deposits and sand bars that has created a large wetland complex that provides premier habitat for waterfowl, wading birds, fish, and other wildlife. This area is used extensively for hunting and fishing, but boat access to the area is limited by the shallow waters. While there are some large towns and cities nearby, the upper reaches of High Rock Reservoir are generally undeveloped.

The middle and lower portions of High Rock Reservoir are more developed. Beginning at Swearing Creek, the reservoir shoreline is heavily developed with seasonal and permanent residences. In most instances these shore front homes have private piers, and some of the older homes have on-pier structures, boat houses, and other recreation facilities associated with them. Many homes have lawns extending to the shoreline, where they end at a retaining wall or shoreline riprap. Boating use and other recreational uses of the middle and lower parts of High Rock Reservoir are very high. These parts of the reservoir are wider and can accommodate sizable watercraft; it is not uncommon to see motorboats and sailboats of up to 20 feet in length. There are few remaining natural areas on the middle and lower portions of High Rock Reservoir.

The larger tributary embayments on High Rock Reservoir, including Abbotts Creek, Crane Creek, Swearing Creek, Flat Swamp Creek, and Dutch Second Creek, are also heavily developed. In some areas of older development, houses and private piers are set very close together along the shoreline, while in other areas, houses and private piers are more widely spaced, and in some instances, areas of natural shoreline have been preserved. Many of the newer homes are very large and are designed to maximize the water view. Boating use on these large tributary embayments is also very high.

As shown in Figures E-16 through E-18, the predominant land use/cover type along the High Rock shoreline is forest (Forested Upland) which accounts for approximately 61% of the shoreline. Approximately 32% of the High Rock shoreline is developed land, primarily in the form of residential development. Agricultural land uses (crop land, grassland, pasture, and mineral) are also common along the reservoir shoreline (7.2%). Residential development is greatest in the lower portion of the reservoir and is the predominant cover type along many of the lower reservoir tributary arms such as the Abbotts Creek, Flat Swamp Creek, Panther Creek, Dutch Second Creek, Crane Creek and Swearing Creek arms. As a result of this development, the lower portion of High Rock Reservoir (Swearing Creek southward) is a moderately developed reservoir. The upper end of High Rock Reservoir, however, is largely undeveloped. From Swearing Creek upstream, undeveloped cover types including forest, and floodplain and forest wetlands predominate the shoreline.

There are several public access recreation sites located on High Rock Reservoir. The reservoir also supports approximately 2,700 private individual piers as well as numerous multi-use recreation facilities associated with private development and commercial establishments.

Figure E-16: Cover Types within the 200-foot Project Area on Upper High Rock Reservoir

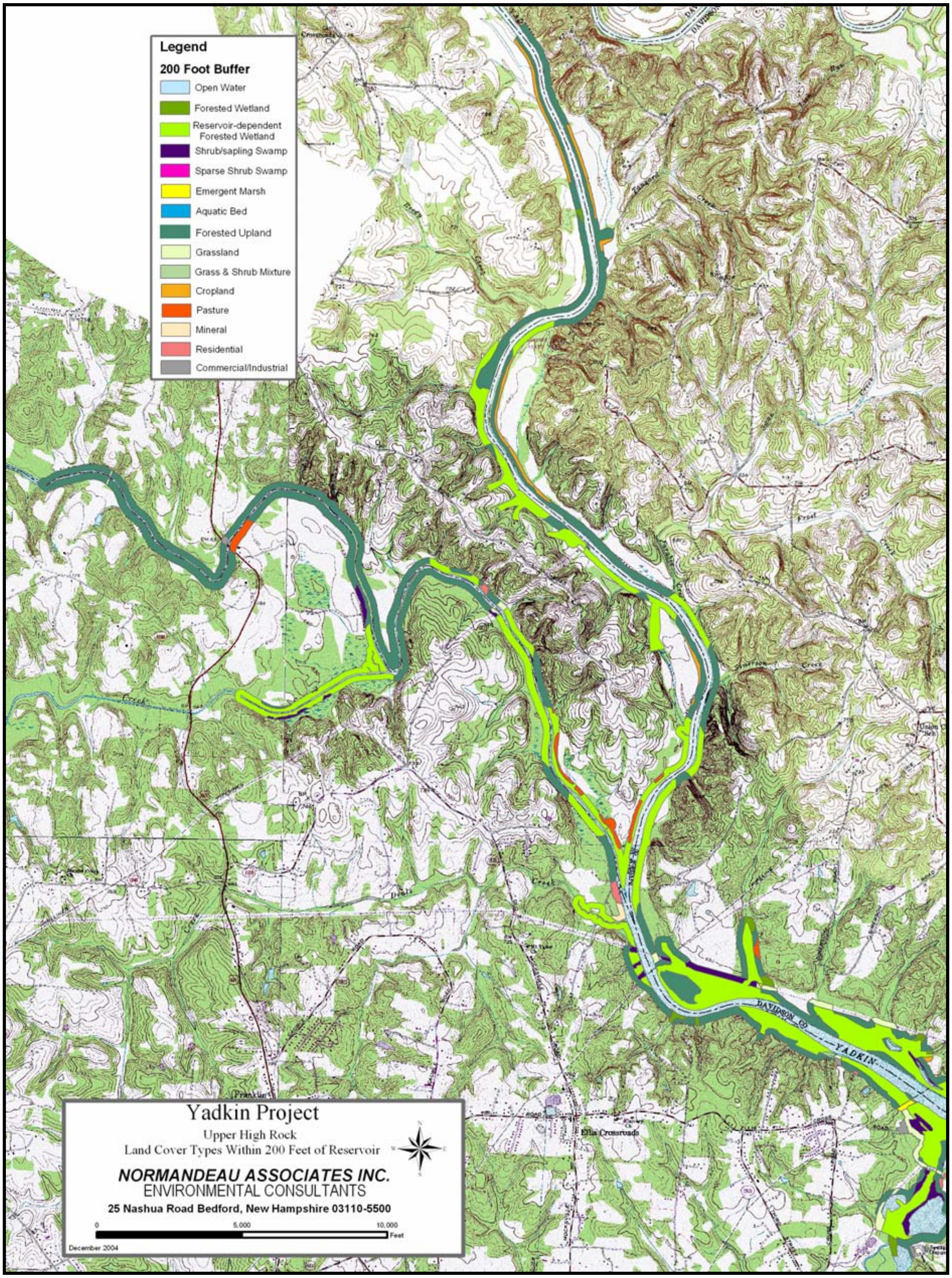


Figure E-17: Cover Types within the 200-foot Project Area on the Central Section of High Rock Reservoir

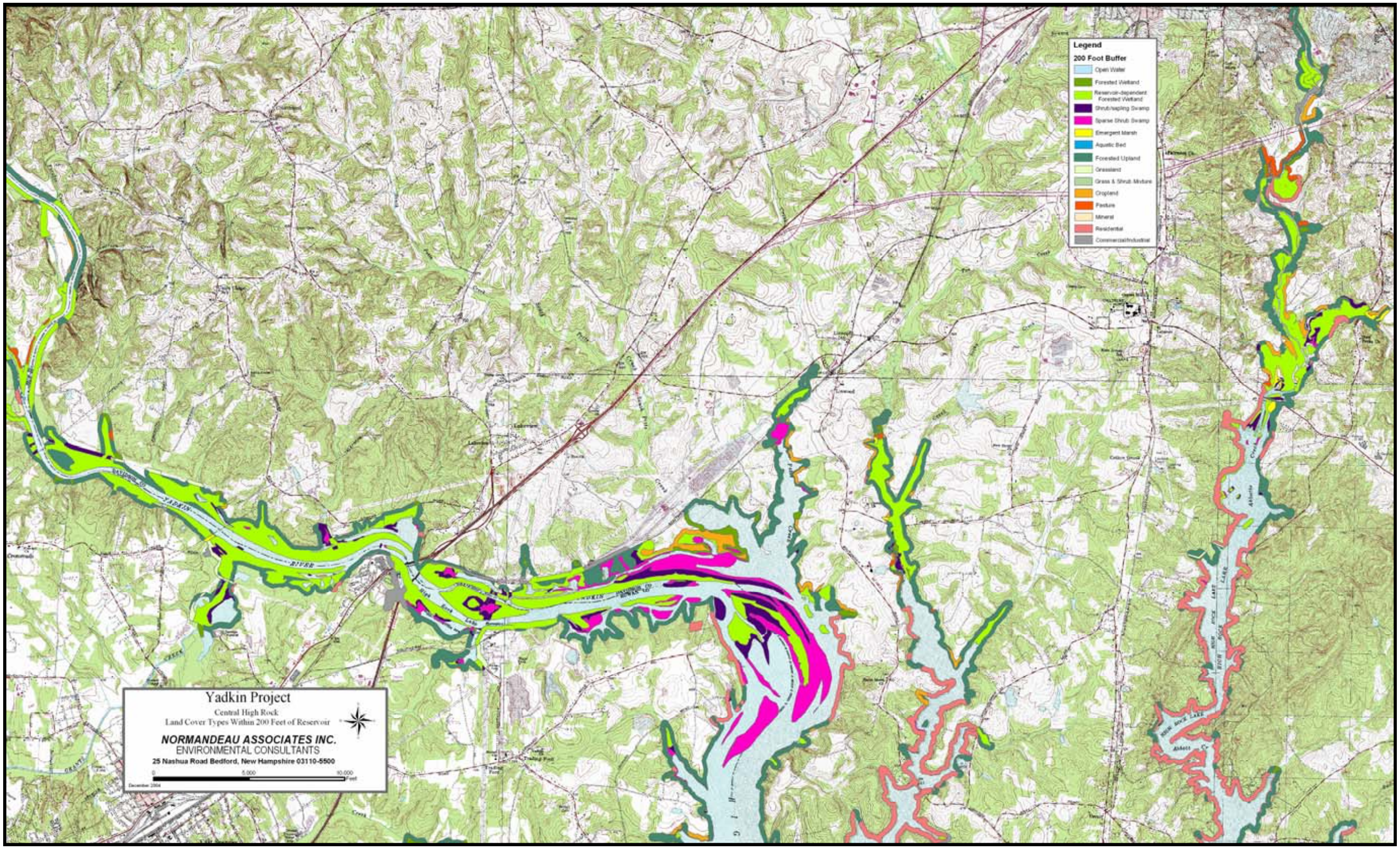
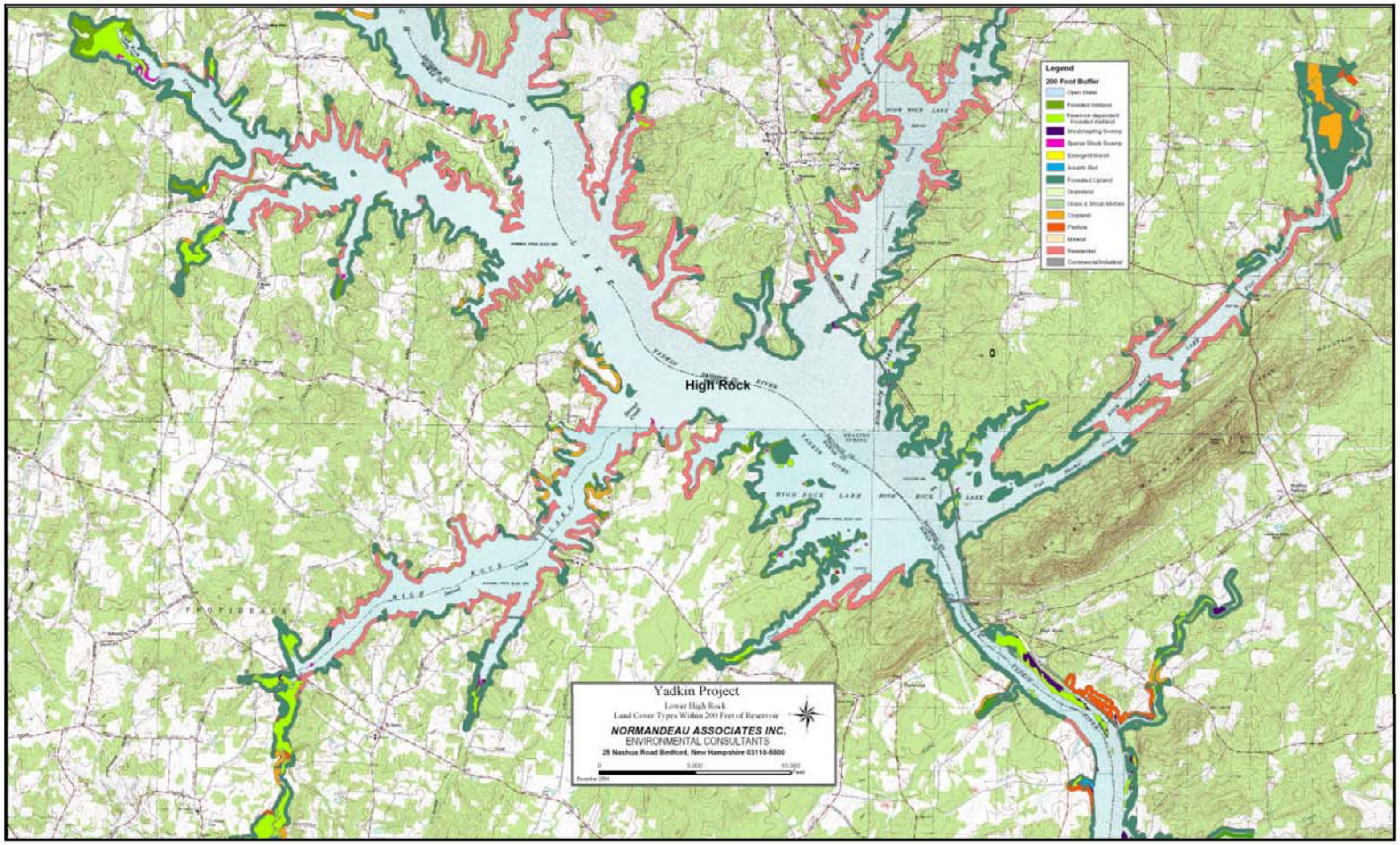


Figure E-18: Cover Types within the 200-foot Project Area on Lower High Rock Reservoir



E.6.1.2 Tuckertown Development

Tuckertown Reservoir (Figure E-19) has 75 miles of shoreline and is largely undeveloped. The shoreline around Tuckertown Reservoir is predominately forest (91%), and development accounts for only about 1.8% of the shoreline. Because of the limited development around this reservoir, the reservoir provides a relatively natural experience for those using the reservoir for recreation. There are several public access recreation sites located on Tuckertown Reservoir and a couple of multi-use facilities (piers) associated with commercial businesses.

APGI does not allow private piers or other private access facilities along Tuckertown Reservoir and, therefore, the few existing shoreline residences do not infringe upon the natural character of the reservoir. Tuckertown Reservoir is long and narrow and is generally considered a fishing reservoir. While boating use of the reservoir by non-residents can be relatively high during peak use weekends, most of the boating use is by anglers rather than for water skiing or cruising.

Tuckertown Reservoir has several unique habitat areas. There are extensive areas of complex wetlands located throughout the reservoir, particularly in the shallow coves and embayments (see Section E.3.3.1). The majority of the shoreline around Tuckertown Reservoir is non-Project land owned by APGI. Generally the first 100' feet of these non-Project lands is managed by APGI as buffer[1]. Much of the APGI owned, non-Project lands surrounding Tuckertown Reservoir have been designated as North Carolina Game Lands and are open for public recreation use, as allowed under State Game Land regulations. The railroad parallels nearly the entire eastern shore of the reservoir, which further serves to limit the opportunity for future development.

E.6.1.3 Narrows Development

Narrows Reservoir is comprised of two major basins, the east arm and west arm, which are divided down the middle by the Uwharrie Point peninsula. Narrows Reservoir is moderately developed and much of the existing development at the reservoir is older, high-density development. Thus, while there are still many areas of Narrows Reservoir that are undeveloped, use levels at the reservoir are very high. Recreational use of Narrows Reservoir by both residents and non-residents is very high, and boating and boat fishing are the principal recreation interests.

The water quality of Narrows Reservoir is generally better than that of High Rock and Tuckertown Reservoirs. The higher water quality in Narrows Reservoir is attributable in part to the presence of the two upstream Project reservoirs and to the largely undeveloped Uwharrie National Forest adjacent to Narrows Reservoir. Also, Narrows Reservoir supports much larger quantities of submergent and emergent aquatic vegetation. These aquatic vegetation beds provide excellent habitat for fish and wildlife and contribute to maintaining good water quality in the reservoir by filtering sediment and removing nutrients (see Section E.3.3.1).

Despite a moderate level of development, Narrows Reservoir still supports some large areas of natural shoreline. Narrows Reservoir has 115 miles of shoreline with about 61% of the shoreline

[1] The first 100 feet from the normal full pool elevation of the reservoir is managed by APGI as buffer and is referred to in the SMP as the Yadkin-Managed Buffer.

forested (see Figure E-20). A unique feature of the Narrows shoreline is the Uwharrie National Forest, which accounts for approximately 10 miles of undeveloped forested shoreline on the eastern side of the reservoir. In this area, the shoreline is generally characterized by large stands of relatively mature second-growth forest, interspersed with some small, vegetated wetlands in coves. There are also several undeveloped islands located in the eastern arm of the reservoir adjacent to the National Forest. Another area, Palmer Island on the western shore, north of Badin, also provides a large area of undeveloped natural shoreline. In addition, the railroad paralleling the western shoreline above and below Palmer Island has created a moderate vegetated wetland complex that is generally inaccessible, and therefore cannot be developed.

Development accounts for approximately 36.7% of the reservoir shoreline. Like High Rock, most of the development at Narrows is residential development. There are several public recreation facilities scattered around the reservoir along with numerous multi-use recreation facilities and about 1,084[1] private individual piers.

E.6.1.4 Falls Development

Falls Reservoir occupies a forested, gorge-like setting. The reservoir is narrow and deep with a steep shoreline. There is no development along the Falls Reservoir shoreline. It is bordered on the east by Uwharrie National Forest and on the west by non-Project lands owned by APGI. Recreational use of the reservoir is low, most of which is by anglers in the spring and early summer.

The natural and remote character of Falls Reservoir supports areas of very distinctive habitat. Both the Falls Dam Slope and Yadkin River Scour Banks support populations of federal and state listed Rare and Endangered plant species (see Section E.3.4). Other than the land immediately around the dam and powerhouse and two small public access areas, there is no development along the shoreline of Falls Reservoir. Forest land accounts for approximately 95% of the shoreline. The shoreline is generally rugged and steep and does not lend itself to either development or agricultural uses.

[1] This number is as of September 6, 2005.

Figure E-19: Cover Types within the 200-foot Project Area on Tuckertown Reservoir

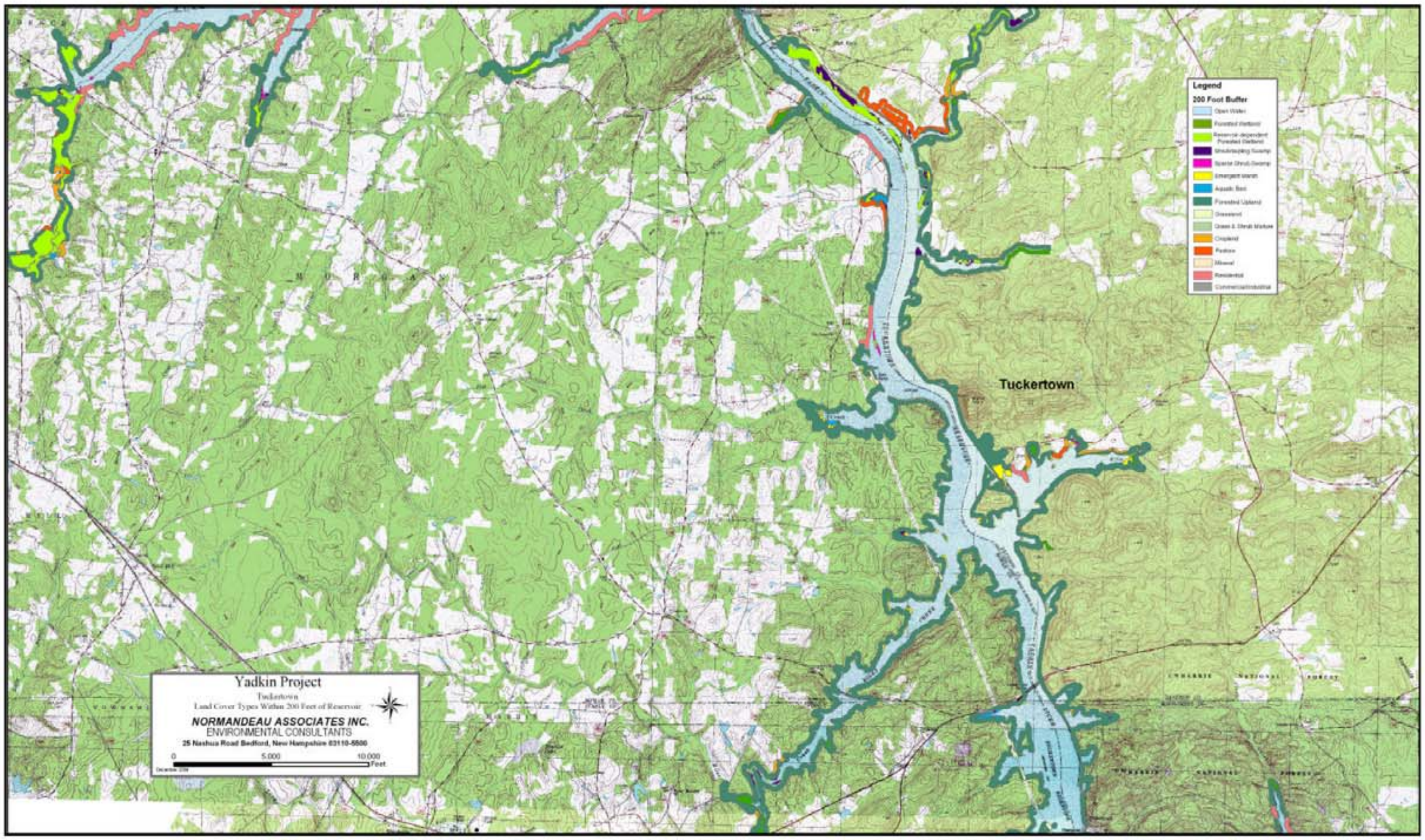
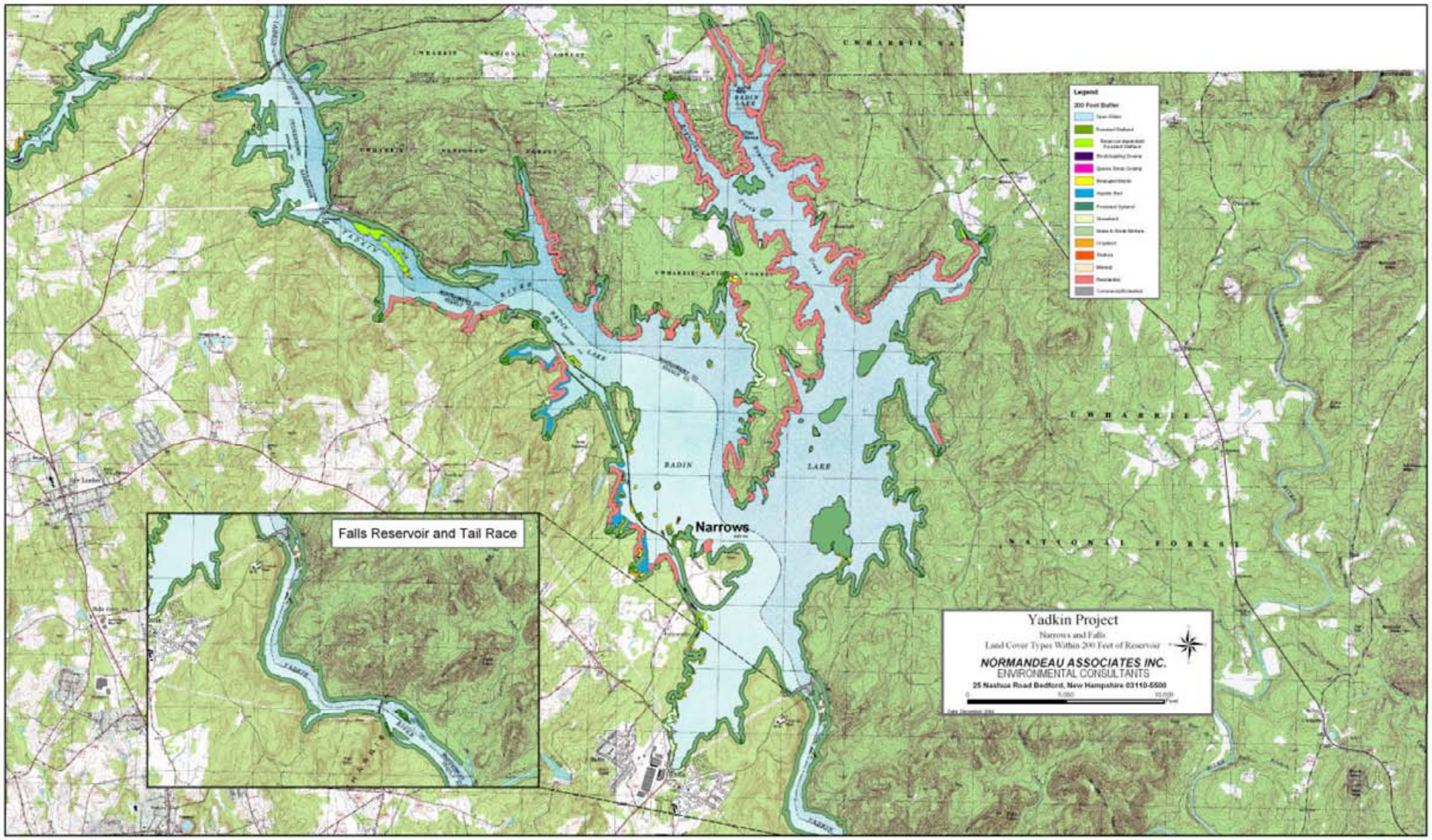


Figure E-20: Cover Types within the 200-foot Project Area on Narrows and Falls Reservoir



E.6.2 Yadkin Shoreline Management Plan

In response to increasing shoreline development pressure, in the late 1990s, APGI developed a Shoreline Management Plan (SMP) for the Yadkin Project. The Yadkin SMP was developed by APGI with considerable input from the public, local municipalities and state and federal agencies, and was submitted to FERC on July 1, 1999. FERC approved the SMP on November 9, 2000. Subsequent minor revisions were submitted to FERC on June 3, 2002 and became effective on July 1, 2002. The revisions were formally approved by FERC on February 9, 2004.

The Yadkin SMP established reservoir management priorities for each of the four Project reservoirs. The priorities were designed to reflect both the natural character of each of the reservoirs, the historical use of the reservoirs, and the level of shoreline development. The management priorities established for each of the reservoirs through the SMP were as follows:

High Rock Reservoir

- protect the High Rock Reservoir wetland complex as habitat for fish and wildlife, and manage the wetland complex in cooperation with NCWRC;
- protect bald eagle habitat on the peninsulas and islands found along the mainstem of the reservoir;
- protect the fishery resource of High Rock Reservoir by preserving wetlands and areas of aquatic vegetation and cooperating with NCWRC fishery management efforts;
- allow additional development on the reservoir only in areas that can best accommodate increased use and associated environmental impacts;
- protect remaining areas of natural shoreline in the middle and lower portions of High Rock Reservoir; and
- monitor recreational use of the reservoir.

Tuckertown Reservoir Management

- protect the natural character of Tuckertown Reservoir;
- protect the fishery resource of Tuckertown Reservoir by preserving wetlands and areas of aquatic vegetation and cooperating with NCWRC fishery management efforts;
- protect other significant natural areas along the Tuckertown Reservoir shoreline, including bald eagle habitat;
- encourage low impact recreational use of the reservoir, such as bank fishing; and
- provide adequate public access and recreation facilities, and monitor recreation use.

Narrows Reservoir Management

- protect the natural undeveloped shoreline located adjacent to the Uwharrie National Forest;
- protect submergent and emergent aquatic vegetation to retain good reservoir water quality;

- protect the fishery resource of Narrows Reservoir by preserving wetlands and areas of aquatic vegetation and cooperating with NCWRC fishery management efforts;
- allow additional reservoir development only in areas that can best accommodate increased use and associated environmental impacts;
- monitor recreation use of the reservoir; and
- protect bald eagle habitat on islands and peninsulas overlooking the main body of the reservoir.

Falls Reservoir Management

- protect the natural character of the Falls Reservoir; do not allow the installation of private access/recreation facilities on the reservoir;
- protect shoreline areas inhabited by RTE species;
- protect the fishery resource of Falls Reservoir by preserving areas of aquatic vegetation and cooperating with NCWRC fishery management efforts; and
- encourage low impact recreational use of the reservoir such as bank fishing in suitable areas.

The SMP identifies important natural resource areas along the Project reservoir shorelines. These areas are worthy of special consideration and protection and have been designated as Conservation Zone. The SMP designation of shoreline areas as Conservation Zone is used as a planning tool to identify areas that may require special consideration or protection. If potential impacts to that resource cannot be adequately avoided or mitigated, development will not be allowed. The remainder of the Project shoreline has not been designated as Conservation Zone. This does not mean that the resources in these areas do not need to be protected or mitigated, but it does suggest that impacts to those areas may be more readily avoided or mitigated. Regardless of an area's designation, the SMP requires that developmental impacts to identified resources be avoided or mitigated according to state and federal resource agency requirements.

Of the 556 Project shoreline miles, approximately 227 miles (41%) are designated as Conservation Zone, as shown in Table E.6-2. The largest areas of shoreline Conservation Zone are found on Tuckertown Reservoir, the upper reaches of High Rock Reservoir above Swearing Creek, along the Uwharrie National Forest boundary on Narrows Reservoir, and on Falls Reservoir.

Table E.6-2: Percentage of Shoreline as Conservation Zone

Reservoir	Shoreline (miles)	Conservation Zone (miles)	Conservation Zone (percent)
High Rock	360	119	33%
Tuckertown	75	49	65%
Narrows	115	54	47%
Falls	6	5	91%
Project Total	**556**	**227**	**41%**

The SMP established processes for reviewing and permitting private individual and multi-use recreational facilities and uses. The SMP also established procedures for approving subdivision access and industrial uses/facilities. These processes, combined with the designation of Conservation Zones, are the means by which shoreline recreation development and other uses of Project lands and waters are managed by APGI at the Yadkin Project.

The SMP also established a Shoreline Stewardship Policy (Policy). The Policy details APGI 's policies, procedures, and requirements for use of the reservoirs, shorelines, and Yadkin-Managed Buffer by adjoining property owners and others. It includes APGI 's goals for protecting and enhancing the shoreline, as well as guidance on how adjoining property owners can voluntarily help to protect the reservoirs. Among the issues addressed in the Shoreline Stewardship Policy are vegetation management, activity permits, aquatic vegetation protection, and volutary shoreline stewardship practices.

E.6.2.1 SMP Comparison Study

During the initial consultation phase of the relicensing process, APGI was asked to conduct a study comparing elements of the Yadkin SMP with SMPs for other southeastern United States hydropower reservoirs. As part of the study, a wide variety of issues were compared among 12 SMPs, including:

- Shoreline Classification
- Private Pier Requirements
- Private Pier Dimensions
- Private Pier Configuration
- Pier Materials
- Private Boathouses
- Private Boat Launches
- Private Boat Lifts
- Multi-Use Facilities
- Excavation and Dredging
- Shoreline Stabilization
- Shoreline Buffers
- Vegetation Management
- Other Vegetation Guidelines
- Permitting Procedures
- Fees
- Cultural Resource Issues
- Aesthetic Considerations
- Facility Classifications
- Miscellaneous
- Environmental Considerations
- Shoreline Cleanup

The 12 SMPs reviewed for the study were:

- APGI’s Yadkin Project
- American Electric Power’s Smith Mountain Project
- Duke Power Nantahala Area
- Duke Power Catawba-Wateree
- Dominion’s Lake Gaston and Roanoke Rapids Hydroelectric Project
- Georgia Power’s North Georgia Project
- Progress Energy’s Tillery Reservoir Project
- Santee Cooper Lakes Project
- South Carolina Electric & Gas’ Lake Murray Project
- The Tennessee Valley Authority system
- USACE’s Hartwell Lake
- USACE’s Lake Lanier

The SMP comparison study found that all of the SMPs reviewed for the study were generally similar in content (LVA, 2004 Appendix E-21). All of the project SMPs were found to provide specific management policies for most major shoreline issues, including facility construction procedures and specifications, vegetation management guidelines, and application processes to carry out shoreline activities. Of the shoreline development issues outlined above most were found to be addressed by almost all of the SMPs. In addition, all 12 SMPs reviewed were found to share similar objectives in attempting to maintain a balance between shoreline development and preserving environmental, cultural, and aesthetic resources and recreational opportunities. The report also found that the specific requirements and guidelines for different shoreline activities outlined in each SMP were highly variable.

Overall, the study demonstrated that the Yadkin SMP was similar to most of the other regional SMPs in terms of the issues addressed and the specifications and requirements for shoreline facilities. In the case of issues that have numeric standards associated with them, the comparison report found that the Yadkin SMP was solely at one end of the range of the standards given for three issues: the minimum lot width requirement (200 feet at Yadkin), the minimum water depth requirement (8 feet at Yadkin), and the designated shoreline buffer (100 feet at Yadkin). For the remaining SMP issues examined in the study, the Yadkin SMP is similar to, or falls within the range of, requirements at the other projects. In no case, was the Yadkin SMP found to be the only one of the twelve SMPs to address a particular issue or to set criteria or requirements for the permitting of facilities or uses.

E.6.3 Project Aesthetics

E.6.3.1 Project-Wide Aesthetic Study

In response to comments from stakeholders during the initial consultation phase of the relicensing process, APGI conducted two visual resource studies at the Yadkin Project. Both studies were done in accordance with study plans developed with input from the Recreation, Aesthetics, and Shoreline Management IAG: a Project-Wide Aesthetic Study and an Uwharrie National Forest Aesthetic Study. For the first study, the Project-Wide Aesthetic Study, APGI collected, analyzed, and provided information regarding aesthetics at the Yadkin Project (ERM, 2005a, Appendix E-22).

The objectives of the study were to:

- Generally characterize the aesthetic character of the Project area,
- Characterize the aesthetic character of Project facilities, and
- Evaluate the effect of existing and alternative Project facilities and operations on aesthetics in the Project area.

The Project-Wide Aesthetic Study included two integral analyses of project aesthetics: a technical analysis, based on evaluating the views from 42 Key Observation Points (KOPs) during different seasons and varying water levels; and a user analysis, based on the responses from surveys of visitors, waterfront residents, and non-waterfront residents of private communities regarding Project aesthetics.

For each reservoir, KOPs were identified as representative views of the Project reservoirs and facilities in order to evaluate the aesthetic character of each reservoir respectively (Table E.6-3).

Table E.6-3: Total Number of KOPs and Views for Each Reservoir

Reservoir	Number of KOPs	Number of Views
High Rock	12	18
Tuckertown	8	11
Narrows	16	16
Falls	6	6
Total	**42**	**51**

Additionally, each reservoir was characterized according to its "scenic integrity" or a measure of the degree to which the landscape is visually perceived to be whole, intact, and complete. Scenic integrity ratings were given to each of the developments and surrounding areas. The ratings are a continuum ranging over five levels of integrity: very high (unaltered), high (appears unaltered), moderate (slightly altered), low (moderately altered), and very low (heavily altered). The aesthetic analyses for each reservoir are discussed below. The study also surveyed reservoir users to evaluate how users perceive the scenic quality of each of the reservoirs. Results of the user survey are summarized in Table E.6-4 below.

Table E.6-4: Summary of User Responses on Project Reservoir Aesthetics

Reservoir	# of Respondents	Average Score	Ratings/Scores				
			1	2	3	4	5
			Very Un-attractive	Somewhat Unattractive	Average	Somewhat Attractive	Very Attractive
High Rock	1,559	3.7	4%	5%	36%	29%	26%
Tuckertown	215	4.1	1%	2%	29%	18%	49%
Narrows	915	4.3	5%	2%	15%	20%	58%
Falls	17	3.8	0%	12%	29%	29%	29%

High Rock Development

High Rock is the most developed of the four Project reservoirs with approximately 32% of the shoreline developed. The majority of the development is concentrated along the middle and lower portions of the reservoir. There are approximately 2,700 private piers and docks along the shoreline. Overall the area surrounding High Rock Reservoir is moderately altered and therefore it received a Low (moderately altered) Scenic Integrity rating (ERM, 2005a Appendix E-22). In response to a survey of reservoir users (residents and visitors), over half of the respondents rated High Rock Reservoir as "very attractive" or "somewhat attractive", with only nine percent of respondents rating it as "very unattractive" or "unattractive" (ERM, 2005a Appendix E-22).

Floating debris was indicated as the greatest detractor of scenic quality at the High Rock Development by 75 percent of the respondents. Additionally, muddy water, exposed lake bottom, and eroding shoreline were also identified by recreational users as primary detractors from scenic quality. The exposed lake bottom is at least partially attributable to Project operations. Project facilities such as High Rock Dam, electric transmission lines, and High Rock

Reservoir were identified as detractors by less than 10 percent of respondents (ERM, 2005a Appendix E-22).

Overall, existing Project facilities were found to be consistent with the moderately altered Scenic Integrity rating of the area. However, Project operations that result in significant water level drawdown adversely affect the visual quality of the Project area. The large number of viewers, the magnitude of the drawdown, and duration of drawdown collectively increase the severity of this aesthetic impact (ERM, 2005a Appendix E-22).

Tuckertown Development

The Tuckertown Development is relatively undeveloped with about 98% of the shoreline in forest or agricultural uses. There are a few waterfront homes along Tuckertown Reservoir, but there are no private piers or docks that intrude into the reservoir. Tuckertown Reservoir is operated as a run-of-river facility with relatively little water level fluctuation. The presence of overhead transmission lines alters the otherwise natural landscape and therefore, the Tuckertown Reservoir area received a Moderate (slightly altered) Scenic Integrity rating (ERM, 2005a Appendix E-22).

Two-thirds of the respondents to the user survey rated Tuckertown Reservoir as “very attractive” or “somewhat attractive”, with only three percent of respondents rating it as “very unattractive” or “unattractive” (ERM, 2005a Appendix E-22).

Floating debris was indicated as the greatest detractor of scenic quality at the Tuckertown Development by 52 percent of the respondents. Muddy water and eroding shorelines were also identified by recreational users as primary detractors from scenic quality. Project facilities and operations were identified as detractors by less than 15 percent of respondents. Overhead, electric transmission lines cross the Yadkin River immediately downstream of Tuckertown Dam and a regional transmission line runs along the west side of Tuckertown Reservoir and crosses Flat Creek and Riles Creek. Approximately 13 percent of respondents identified electric transmission lines as aesthetic detractors. Overall, Project facilities and operations at Tuckertown Reservoir were found to be consistent with the slightly altered Scenic Integrity rating of the area (ERM, 2005a Appendix E-22).

Narrows Development

The Narrows Development is moderately developed with about 37% of the shoreline classified as developed. Overhead transmission lines and a railroad trestle cross the reservoir. However, much of the eastern shoreline is within the Uwharrie National Forest and is undeveloped. The Narrows Development is generally operated as a run-of river facility with annual maximum water level fluctuations generally less than three feet. During the study period, Narrows Reservoir was drawn down over 16 feet between Thanksgiving and Christmas, 2003 in order to conduct several relicensing studies. Overall, the area surrounding the Narrows Development is slightly to moderately altered and therefore received a Low-Moderate Scenic Integrity rating (ERM, 2005a Appendix E-22).

Despite the effects of shoreline development, overhead transmission lines, and the railroad trestle, 78 percent of the constituents rated Narrows Reservoir as “very attractive” or “somewhat attractive”. Nearly 60 percent of respondents rated Narrows Reservoir as “very attractive”, while only seven percent of respondents rated the reservoir as “very unattractive” or “somewhat unattractive” (ERM, 2005a Appendix E-22).

Floating debris was indicated as the greatest detractor of scenic quality at the Narrows Development by 54 percent of the respondents to the constituent analysis. Muddy water, timber harvesting, and eroding shoreline were identified by recreational users as primary detractors from scenic quality. Project facilities were identified as detractors by less than 15 percent of respondents. The technical analysis identified the view of Narrows Dam from the tailwaters as being only somewhat compatible with the Low-Moderate Scenic Integrity rating of the surrounding area. The scale of the dam dominates the view from downstream. This impact is offset to some extent by the relatively small number of recreation users who view the dam from this perspective (ERM, 2005a Appendix E-22).

Under existing Project operations, water levels within Narrows Reservoir generally fluctuate approximately 3 feet annually. Nevertheless, exposed lake bottom was identified by 14 percent of survey respondents as a detractor from scenic quality. This result may be at least partially attributable to the significant drawdown that occurred between Thanksgiving and Christmas 2003 to allow a relicensing study to be performed. The magnitude of this drawdown resulted in significant dewatering of several coves and exposed large expanses of muddy lake bottom. A drawdown of this magnitude is not compatible with the Low to Moderate Scenic Integrity rating of this area (ERM, 2005a Appendix E-22).

Overall, Project facilities and operations at Narrows Reservoir were found to be consistent with the slightly to moderately altered Scenic Integrity rating of the area (ERM, 2005a Appendix E-22).

Falls Development

The Falls Development is the least developed of the four Yadkin developments with no waterfront residences and the Uwharrie National Forest encompassing the eastern half of the Falls Reservoir shoreline. Falls Reservoir is operated as a run-of-river facility with relatively little water level fluctuation. Although Falls Dam and Reservoir represent man-made deviations from a natural landscape, the overall effect is still quite natural and the setting appears unaltered. Therefore, the Falls Reservoir area received a High Scenic Integrity rating (ERM, 2005a Appendix E-22).

The technical analysis of the KOPs identified views of Falls Dam (from both upstream and the tailwaters) and the overhead electric transmission lines as Project features that are only somewhat compatible with the High Scenic Integrity rating of the surroundings. Approximately 60 percent of the user survey respondents rated Falls Reservoir as “very attractive” or “somewhat attractive”, although there were not sufficient responses to ensure a statistically valid response (ERM, 2005a Appendix E-22).

Floating debris was indicated as the greatest detractor of scenic quality at the Falls Development by 71 percent of the respondents. Eroding shorelines and muddy water were also identified by recreational users as the primary detractors from scenic quality. Project facilities and operations were identified as detractors by less than 15 percent of respondents (ERM, 2005a Appendix E-22).

Overall, Project facilities and operations at Falls Dam are generally compatible with the High Scenic Integrity rating of the area (ERM, 2005a Appendix E-22).

E.6.3.2 Uwharrie National Forest Aesthetic Study

The objectives of the second aesthetics study, the Uwharrie National Forest Aesthetic Study, were to:

- Evaluate the consistency of existing and proposed Project facilities and operations that are visible from Uwharrie National Forest (UNF) with the Visual Quality Objectives (VQO) of the Uwharrie National Forest Management Plan with
- A secondary objective to consider the potential auditory effects of Project use on the UNF.

The Uwharrie National Forest Aesthetic Study included two integral analyses of project aesthetics: 1) a technical analysis, based on evaluating the views from 14 KOPs during different seasons and varying water levels; and 2) a visitor preference survey to assess user opinions regarding the scenic quality of the Project area and those elements that detracted from scenic quality. Based on the KOP analysis only two aspects of the Project or its operation that are visible or potentially visible from Uwharrie National Forest received a “Low” or “Very Low” scenic integrity ratings: 1) Narrows Dam viewed from downstream, and 2) Narrows Reservoir with an extreme drawdown (approximately 12 feet).

Narrows Dam (when viewed from downstream) is a large imposing structure with a maximum height of approximately 200 feet. The visual effect of the dam is complicated with alterations (e.g. a non-integral powerhouse and transmission lines, an access road, and a bridge all crossing the tailwaters downstream of the dam) tending to dominate the landscape. Therefore, Narrows Dam received a Low Scenic Integrity rating (ERM, 2005b Appendix E-23).

Narrows Reservoir was evaluated over a range of drawdowns. At full pool, Narrows Reservoir appears “intact” and is consistent with a High Scenic Integrity rating. At the normal maximum annual drawdown of approximately 3 feet, the reservoir “appears slightly altered” and is consistent with a Moderate Scenic Integrity rating. At an extreme drawdown of approximately 16 feet, like that which occurred during the winter of 2003 for purposes of relicensing studies, the reservoir “appears heavily altered” and is consistent with a Very Low Scenic Integrity rating. Falls Reservoir is operated as a run-of- river facility with relatively little daily fluctuation (approximately one foot). Under current operations, Falls Reservoir appears “intact” and is consistent with a High Scenic Integrity rating (ERM, 2005b Appendix E-23).

The study also included a survey of Uwharrie National Forest users. The primary findings of the user survey were as follows:

- 85 percent of respondents indicated that scenic quality was either a minor consideration or not a consideration in the user's decision to go to the UNF.
- 67 percent of respondents considered the scenic quality of the UNF as better than alternative recreation areas in the region.
- 89 percent of respondents rated the scenic quality of the Project in the vicinity of UNF "somewhat attractive" or "very attractive".
- Most respondents considered the Project reservoirs (Narrows and Falls), forest, and trails as the most attractive features of the UNF.
- Campgrounds/picnic areas and the reservoirs were frequently noticed and generated primarily positive reactions.
- Most respondents considered the dirt roads and trash as the least attractive features of the UNF.
- Forest roads and timber harvests were frequently noticed and generated primarily negative reactions.
- The lowest rating of the Visual Preference photographs was given to the Narrows Dam tailrace and Falls Dam (viewed from upstream), which reflects a slightly positive visual impression. No photographs received an overall negative rating.
- Floating debris/trash, eroding shorelines, and muddy water were identified as the most common detractors of scenic quality in the UNF Project area.
- Relatively few respondents indicated that they had "special ties" to the Project area (e.g., family traditionally visited the area).

In terms of Project facilities, none were identified as a significant detractor of visual quality. In fact, the reservoirs were considered as one of the principal amenities of UNF. Narrows Dam, as viewed from downstream, and Falls Dam, as viewed from upstream, received the lowest Visual Preference ratings, but these ratings were still slightly positive (ERM, 2005b Appendix E-23).

Most existing views of the Project reservoir and facilities were found to be compatible with the VQO of the UNF Management Plan. However, Narrows Dam as viewed from downstream received a low scenic integrity rating in the technical analysis but constituents rated the view as slightly positive. From a Project operations perspective, current operations (normal maximum drawdown of approximately 3 feet at Narrows and 1 foot at Falls reservoirs) were found to be consistent with the VQO of the UNF Management Plan. More extreme drawdowns, such as the approximately 16 foot drawdown that occurred in December 2003 at Narrows Reservoir for purposes of relicensing studies, would not be compatible with the VQO of the UNF Management Plan (ERM, 2005b Appendix E-23).

The constituent surveys also questioned users about the magnitude and source of noise problems encountered at the UNF. About 81 percent of respondents indicated that noise was not a problem, with only 1 percent indicating that noise was a big problem and 4 percent indicating that noise was a moderate problem. RV generators, rather than watercraft (boats and jet skis) were cited as the major source of noise problems (ERM, 2005b Appendix E-23).

E.6.4 Measures Proposed by the Applicant to Ensure that any Proposed Project Works and Topographic Alterations Blend with the Surrounding Environment

APGI is proposing no structural additions or changes to the existing Project or Project works that would have any impact on the current visual quality of the reservoirs or Project facilities.

E.6.5 Wetlands and Floodplains Within or Adjacent to the Project Boundary

As discussed previously in Section E.3.3.1, APGI mapped all of the wetlands located in and around the Project reservoirs. Table E.3-13 summarizes the wetland acres at the Project reservoirs.

Floodplains at the Yadkin Project are found primarily along the mainstem Yadkin and South Yadkin rivers in the upper-most, riverine portion of High Rock Reservoir (upstream of the I-85 Bridge). Floodplains and the effects of Project operation on flooding were discussed earlier in Section E.1.1.7.

E.6.6 Project Buffer Zone

At the Yadkin Project, the FERC Project boundary generally follows the normal full pool elevation of each of the four Project reservoirs. Project lands are limited, and most Project land occurs in the immediate vicinity of the dams and powerhouses. Therefore, strictly speaking there is no Project buffer zone.

However, through the provisions of the Yadkin SMP, APGI has created an effective buffer around the Project reservoirs through its shoreline management policies. Under the SMP, Project shoreline buffers are managed by APGI under two separate headings: the Yadkin-Managed Buffer and the 100-foot Forested Setback. The Yadkin-Managed Buffer is defined as property adjoining the FERC Project boundary at the normal full pool elevation of the reservoir that is owned by APGI (or its parent company Alcoa), to a width of 100 feet. More specifically, in some areas around the Project reservoirs, APGI owns a narrow strip of shoreline property immediately adjacent to the FERC Project boundary. At Narrows Reservoir, APGI owns a narrow strip of shoreline property around nearly the entire reservoir, generally to an elevation of 545.0 (Yadkin datum), approximately 4 vertical feet above normal full pool elevation. APGI also owns some narrow strips of shoreline property around portions of High Rock Reservoir. Most of the High Rock shoreline strips are owned to a specified elevation. Collectively, these strips of shoreline property, to the extent they extend no more than 100 feet from the FERC Project boundary, are considered “Yadkin-Managed Buffer.” In other areas, including along large portions of Tuckertown and Falls reservoirs, APGI may own shoreline property that extends back from the water a considerable distance. In these areas, the first 100 feet of shoreline from the Project boundary is also considered “Yadkin-Managed Buffer”.

Under the Yadkin SMP, APGI strictly limits use of the Yadkin-Managed Buffer. For example, the Yadkin SMP prohibits private and industrial uses and facilities within the Yadkin-Managed Buffer without APGI's written permission. Likewise, the SMP prohibits any unauthorized uses within the Yadkin-Managed Buffer such as:

- change in the features or vegetation
- construction, installation, or placement of structures, including retaining walls
- construction of roads, sidewalks or pathways
- clearing or disturbance of land
- logging or removal of trees and vegetation
- dumping

In addition, the Yadkin SMP requires a "100-Foot Forested Setback" be maintained by adjoining property owners in new subdivisions recorded after July 1, 1999 in order to qualify for private pier construction. The SMP sets forth specific vegetation management guidelines for maintaining the 100-Foot Forested Setback:

- A 20-foot construction zone is allowed to intrude on the 100' setback but must be revegetated
- The 100-foot setback must be maintained as existed prior to development
- To improve water views: 50% of vegetation less than 5 feet may be removed (but no tree greater than 2 inches in diameter as measured 1 foot above ground may be removed
- Nothing may be removed within 30' of tributaries, ditches, swales, or reservoir drainages
- Dead limbs may be removed
- Living limbs up to 8' above ground may be removed
- Fallen limbs and trees may be removed but leaf litter must remain
- No trees overhanging or within the reservoir may be removed without permission
- Any vegetation removal requires a written permit from APGI

Together, the Yadkin-Managed Buffer and the 100-Foot Forested Setback combine to create an effective buffer zone of 100 feet along the reservoirs' shorelines totaling 5,868 acres.

E.6.6.1 Costs and Other Constraints of Applicant's Ability to Provide a Buffer Zone

The management of a 100-foot strip non-Project shoreline property by APGI as buffer results in a loss of potential timbering revenue by APGI.

E.6.7 Applicant's Policies Regarding Permitting Shoreline Facilities on Project Lands and Waters

Shoreline facilities development (including piers, docks, boat landings, and bulkheads) along Project lands and waters are strictly regulated under the Yadkin Shoreline Management Plan. The specific policies and regulations pertaining to all types of shoreline development are detailed in four sections of the SMP:

- Section 7.0: Shoreline Management

- Appendix E: Specifications for Private Recreation Facilities at High Rock and Narrows Reservoirs
- Appendix F: Subdivision Access Approval, Multi-Use Facility Permitting, and Industrial Approval Procedures
- Appendix G: Shoreline Stewardship Policy

Combined, these sections of the Project's SMP contain a comprehensive policy for the permitting of shoreline facilities on Project lands and waters (Yadkin, 1999).

E.6.8 Existing Shoreline Management Measures to be Continued and New Measures Proposed

APGI is proposing to continue to manage the reservoir shorelines through the policies and procedures in the Yadkin Shoreline Management Plan. At the time that the original Project SMP was filed with FERC, APGI recognized that the SMP would need to undergo periodic review, revision and updating in order remain current and effective. An initial revision involving some minor changes to the original SMP was filed with FERC in 2002. The relicensing process for the Yadkin Project provides APGI with another excellent opportunity to review and potentially revise the current Yadkin SMP.

Specifically, APGI is proposing to make modifications to the Yadkin Shoreline Management Plan. Modifications to the SMP will be identified through a collaborative process that includes state and federal agencies, public recreation users, non-governmental organizations and shoreline property owners. Modifications to the SMP will be undertaken within one year of the effective date of a new FERC license and the revised SMP will be filed with FERC for final approval within two years of the effective date of a new license.

The Yadkin SMP has been in effect for six years. Over that time, the SMP has proved to be highly protective of the reservoir shoreline and related environments, while at the same time allowing new private facilities to be permitted. However, such protections impose certain restrictions on shoreline property development and activities that could be modified while still maintaining the same level of resource protection. A proposal by APGI to undertake modifications to the SMP in consultation/collaboration with agencies and other stakeholders provides the opportunity of continued protection of reservoir resources while allowing some changes in certain shoreline specifications that are of interest to shoreline property owners.

E.6.9 Consultation Record

The following table summarizes the consultation record related to land management and aesthetics at the Yadkin Project. A complete record of all consultation regarding the relicensing of the Yadkin Project will be provided in an Appendix to the Final License Application.

Table E.6-5: Summary of Consultation Record Related to Land Management and Aesthetics

Agency/Party	Date	To	Description
North Carolina Division of Water Resources, Steve Reed	January 9, 2003	APGI	Letter re: first stage consultation comments
High Rock Lake Association, Larry Jones	January 9, 2003	APGI	Letter re: Yadkin Project ICD comments
North Carolina Watershed Coalition, Scott Jackson	January 9, 2003	APGI	Initial relicensing comments
Yadkin-Pee-Dee Lakes Project, Ann Liebenstein Bass	January 10, 2003	APGI	Letter re: Yadkin Project ICD comments
U. S. Forest Service, John Ramey	January 10, 2003	APGI	Letter re: Yadkin Project ICD comments
North Carolina Wildlife Resources Commission, Chris Goudreau	January 12, 2003	APGI	Letter re: first stage consultation comments and "Hydropower Relicensing Issues, Standards, and Mitigation"
The Trust for Public Land, David Brown	January 12, 2003	APGI	Email re: initial relicensing comments
South Carolina Coastal Conservation League and American Rivers, Gerrit Jobsis and David Sligh	January 12, 2003	APGI	Letter re: Yadkin Project ICD comments
Land Trust for Central North Carolina, Jason Walser	January 12, 2003	APGI	Email re: initial relicensing comments
APGI	March 13, 2003	RASM IAG	Final summary of March 13, 2003 RASM IAG meeting
APGI	April 10, 2003	RASM IAG	Final summary of April 10, 2003 RASM IAG meeting
APGI	May 26, 2003	RASM IAG	Distribution o f revised study plans for the Overall Project Aesthetic Study and Uwharrie National Forest Aesthetic Study
APGI	July 9, 2003	RASM IAG	Final summary of July 9, 2003 RASM IAG meeting
APGI	July 23, 2003	RASM IAG	Final study plan for Overall Project Aesthetic Study
APGI	July 23, 2003	RASM IAG	Final Study Plan For Uwharrie National Forest Aesthetic Study
APGI	July 28, 2003	RASM IAG	Distribution of SMP Comparison Revised Study Plan
APGI	October 8, 2003	RASM IAG	Final summary of October 8, 2003 RASM IAG meeting
APGI	October 2003	RASM IAG	Final study plan for Shoreline Management Plan Comparison
APGI	February 4, 2004	RASM IAG	Final summary of February 4, 2004 RASM IAG meeting
APGI	March 30, 2004	RASM IAG	Distribution of SMP Comparison Draft Study Report

Table E.6-5: Summary of Consultation Record Related to Land Management and Aesthetics (continued)

Agency/Party	Date	To	Description
APGI, Jody Cason	April 22, 2004	RASM IAG	Agenda for the May 5, 2004 RASM IAG meeting
RASM IAG	May 5, 2004		RASM IAG Meeting
APGI, Jody Cason	May 8, 2004	RASM IAG	Request for additional comments on SMP Comparison Draft Study Report by May 28, 2004
High Rock Lake Association, Larry Jones	May 8, 2004	APGI	Provided SMP comparison tables
High Rock Lake Association, Larry Jones	May 28, 2004	APGI	Comments on the SMP Comparison Study Draft Report
APGI, Jody Cason	June 10, 2004	RASM IAG	Update on significant changes to the SMP Comparison Draft Study Report
High Rock Lake Association, Larry Jones	June 11, 2004	APGI and RASM IAG	Request of reconsideration of some of the changes to the SMP Comparison Draft Study Report
APGI, Jody Cason	September 2, 2004	RASM IAG	Final summary for RASM IAG meeting on May 5, 2004
APGI, Jody Cason	September 27, 2004	RASM IAG	Distribution of Final SMP Comparison Study Report
Concerned Property Owners of High Rock Lake, Dean Vick	September 27, 2004	APGI	Email expressing comments on the Final SMP Comparison Study Report
APGI, Gene Ellis	September 28, 2004	CPOHRL and RASM IAG	Response from APGI, Gene Ellis, to Mr. Vick's comments on Final SMP Comparison Study Report
APGI, Jody Cason	October 20, 2004	RASM IAG	Meeting announcement and draft agenda for the November 3, 2004 RASM IAG meeting
RASM IAG	November 3, 2004		RASM IAG Meeting
APGI, Jody Cason	January 11, 2005	RASM IAG	Final summary for the November 3, 2004 RASM IAG meeting
APGI, Jody Cason	January 14, 2005	RASM IAG	Draft agenda for the February 2, 2005 RASM IAG meeting
APGI	February 2, 2005	RASM IAG	Final summary of February 2, 2005 RASM IAG Meeting
APGI, Jody Cason	April 20, 2005	RASM IAG	Draft agenda for May 3, 2005 RASM IAG Meeting

Table E.6-5: Summary of Consultation Record Related to Land Management and Aesthetics (continued)

Agency/Party	Date	To	Description
APGI, Gene Ellis	April 20, 2005	RASM IAG	Distribution of draft study reports: Project-wide Aesthetics Study Draft Report and Uwharrie National Forest Aesthetics Study Draft Report
RASM IAG	May 3, 2005		RASM IAG Meeting
APGI, Jody Cason	June 16, 2005	RASM IAG and CE IAG	Draft agenda for June 30, 2005 Joint RASM and County Economic Impacts IAG
RASM IAG and CE IAG	June 30, 2005		RASM IAG and CE IAG Joint Meeting
APGI, Jody Cason	August 24, 2005	RASM IAG and CE IAG	Final meeting summary for June 30, 2005 joint IAG meeting
APGI, Jody Cason	August 24, 2005	RASM IAG	Final meeting summary for May 3, 2005 RASM IAG meeting

Notes: APGI – Alcoa Power Generating Inc.
IAG – Issue Advisory Group
CE IAG – County Economics Issue Advisory Group
RASM IAG – Recreation, Aesthetics, and Shoreline Management Issue Advisory Group
CPOHRL - Concerned Property Owners of High Rock Lake

E.7 Consistency with Comprehensive Plans

In the Final License Application this section will discuss how and why the continued operation of the Yadkin Project, as proposed, would, would not, or should not comply with any relevant comprehensive plan (18 CFR §4.38(f)(6)). The following is a list of comprehensive plans that will be discussed in this section.

- North Carolina Department of Environment and Natural Resources Division of Water Quality – *Basinwide Assessment Report: Yadkin River*

- North Carolina Department of Environment and Natural Resources Division of Water Quality – *North Carolina Water Quality Assessment and Impaired Waters List (2004 Integrated 305(b) and 303(d) Report)*

- North Carolina Department of Environment and Natural Resources Division of Water Quality – *"Redbook" Surface Waters and Wetlands Standards NC Administrative Code 15A NCAC 02B .0100, .0200 & .0300*

- North Carolina Department of Environment and Natural Resources Division of Water Quality – *Yadkin-Pee Dee River Basinwide Water Quality Plan*

- North Carolina Department of Environment and Natural Resources Wetlands Restoration Program - *Basinwide Wetlands and Riparian Restoration Plan for the Yadkin-Pee Dee River Basin*

- North Carolina Division of Parks and Recreation - *Statewide Comprehensive Outdoor Recreation Plan: North Carolina Outdoor Recreation Plan 2003-2008*

- North Carolina Wildlife Resources Commission - *Fisheries and Wildlife Management Plan for the Yadkin-Pee Dee River Basin*

- U. S. Fish and Wildlife Service, Southeast Region - *Habitat Management Guidelines for the Bald Eagle in the Southeast Region*

- U. S. Fish and Wildlife Service, National Marine Fisheries Service, North Carolina Wildlife Resources Commission, and South Carolina Department of Natural Resources - *Restoration Plan for the Diadromous Fishes of the Yadkin-Pee Dee River Basin: North Carolina and South Carolina*

- U. S. Forest Service - *Land and Resource Management Plan: 1985-2000, Croatan and Uwharrie National Forests*

E.8 References

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Long View Associates (LVA). 2004. Shoreline Management Plan Comparison Study, Yadkin Project Relicensing (FERC No. 2197) Final Report. July 2004. [Appendix E-21]

Long View Associates (LVA). 2005a. Recreation Facility Inventory and Condition Assessment (FERC No. 2197) Final Report. February 2005. [Appendix E-18]

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Normandeau Associates Inc. (NAI). 2005a. Invasive Exotic Plant Pest Species Assessment Final Study Report. June 2005. [Appendix E-13]

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Normandeau Associates Inc. (NAI). 2005c. Rare, Threatened and Endangered Species Survey Final Study Report. June 2005. [Appendix E-14]

Normandeau Associates Inc. (NAI). 2005d. Wetland and Riparian Habitat Assessment Final Study Report. June 2005. [Appendix E-12]

Normandeau Associates Inc. (NAI). 2005e. Reservoir Fish and Aquatic Habitat Assessment Final Study Report. June 2005. [Appendix E-3]

Normandeau Associates Inc. (NAI). 2005f. Tailwater Fish and Aquatic Biota Assessment Final Study Report. June 2005. [Appendix E-4]

Normandeau Associates Inc. (NAI). 2005g. Water Quality Final Study Report. August 2005. [Appendix E-1]

Normandeau Associates Inc. (NAI). 2005h. Fish Entrainment Assessment Final Report. August 2005. [Appendix E-6]

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Yadkin Inc. 1999. Yadkin Hydroelectric Project, FERC Project No. 2197.Yadkin Project Shoreline Management Plan, July 1, 1999.

Appendices E-1 – E-23

Copies of the following final study reports will be appended to the Final License Application:

Appendix E-1: Water Quality Final Study Report

Appendix E-2: Sediment Fate and Transport Draft Study Report

Appendix E-3: Reservoir Fish and Aquatic Habitat Assessment Final Study Report

Appendix E-4: Tailwater Fish and Aquatic Biota Assessment Final Study Report

Appendix E-5: Habitat Fragmentation Study Report (to be added)

Appendix E-6: Fish Entrainment Assessment Final Report

Appendix E-7: Avian Inventory Report

Appendix E-8: Transmission Line and Project Facility Habitat Assessment Final Study Report

Appendix E-9: An Assessment of The Bald Eagle And Great Blue Heron Breeding Populations Along High Rock, Tuckertown, Narrows, And Falls Reservoirs in Central North Carolina: 2002 Breeding Season Draft Report

Appendix E-10: An Assessment of The Bald Eagle And Great Blue Heron Breeding Populations Along High Rock, Tuckertown, Narrows, And Falls Reservoirs in Central North Carolina: 2003 Breeding Season Final Report

Appendix E-11: An Assessment of The Bald Eagle And Great Blue Heron Breeding Populations Along High Rock, Tuckertown, Narrows, And Falls Reservoirs in Central North Carolina: 2004 Breeding Season Final Report

Appendix E-12: Wetland and Riparian Habitat Assessment Final Study Report

Appendix E-13: Invasive Exotic Plant Pest Species Assessment Final Study Report

Appendix E-14: Rare, Threatened and Endangered Species Survey Final Study Report

Appendix E-15: Yadkin River Goldenrod Report (to be added)

Appendix E-16: National Register of Historic Place Eligibility Study Final Report

Appendix E-17: Archaeological Survey of Four Areas Along The Narrows Reservoir and in the Uwharrie National Forest in Montgomery County, North Carolina, for the Relicensing of the Yadkin Hydroelectric Project Draft Report

Appendix E-18: Recreation Facility Inventory and Condition Assessment Final Report

Appendix E-19: Recreation Use Assessment, Yadkin Project Relicensing Draft Report

Appendix E-20: Regional Recreation Evaluation Final Study Report

Appendix E-21: Shoreline Management Plan Comparison Study, Yadkin Project Relicensing (FERC No. 2197) Final Report

Appendix E-22: Project-Wide Aesthetic Study, Yadkin Project Relicensing (FERC No. 2197) Draft Report

Appendix E-23: Uwharrie National Forest Aesthetic Study, Yadkin Project Relicensing (FERC No. 2197) Draft Report

Appendix E-24: Consultation Record Related to Miscellaneous Relicensing Issues at the Yadkin Project

The following table summarizes the consultation record related to miscellaneous relicensing issues at the Yadkin Project including issues regarding socio-economic issues, operations modeling, and relicensing process and administration. A complete record of all consultation regarding the relicensing of the Yadkin Project will be provided in an Appendix to the Final License Application.

From	Date	To	Description
City of Lexington, North Carolina, Richard Thomas,	October 28, 2002	APGI	Resolution No. 09-03 in Support of Actions to Stabilize the Water Level of High Rock Lake
APGI	September 2002		Initial Consultation Document distribution to agencies, tribes and other stakeholders
APGI	November 6-7 and 13, 2002		Public Meetings Conducted (Presentation)
Nancy Ruppert	November 7, 2002	APGI	Initial relicensing comments
Henry Booke	November 13, 2002	APGI	Email re: initial relicensing comments
Mike	November 16, 2002	APGI	Initial relicensing comments
Saveourlake.org, Karyn Musgrave	November 23, 2002	APGI	Initial relicensing comments
Rainer Muth	December 10, 2002	APGI	Initial relicensing comments
City of Georgetown, South Carolina, Lynn Wood Wilson	January 2, 2003	APGI	Letter re: initial relicensing comments and request for studies
W.R. (Randy) Dredge	January 5, 2003	APGI	Initial relicensing comments
Steve Lohr	January 6, 2003	APGI	Letter re: initial relicensing comments
Pee Dee River Coalition, Frank Willis	January 7, 2003	APGI	Letter re: initial relicensing comments and request for studies
Duke Power Buck Steam Station, Drew Garman	January 8, 2003	APGI	Letter re: first stage consultation comments
South Carolina Department of Natural Resources, Robert Duncan	January 9, 2003	APGI	Letter re: Yadkin Project ICD comments
North Carolina Division of Water Resources, Steve Reed	January 9, 2003	APGI	Letter re: first stage consultation comments
Pee Dee River Coalition, Marty Barfield	January 9, 2003	APGI	E-mail inquiring about an Issue Advisory Group dealing with Yadkin Project operations

Appendix E-24: Consultation Record Related to Miscellaneous Relicensing Issues at the Yadkin Project (continued)

From	Date	To	Description
SaveHighRockLake.org, Jean Creed	January 9, 2003	APGI	Initial relicensing comments
North Carolina Watershed Coalition, Scott Jackson	January 9, 2003	APGI	Initial relicensing comments
High Rock Lake Association, Larry Jones	January 9, 2003	APGI	Letter re: Yadkin Project ICD comments
Anchor Downs Property Owners Association, Richard Martin	January 9, 2003	APGI	Letter re: Yadkin Project ICD comments
B. Thomas Lee	January 9, 2003	APGI	Initial relicensing comments
Linda Bell	January 9, 2003	APGI	Initial relicensing comments
Ed and Beth Solseth	January 9, 2003	APGI	Initial relicensing comments
Jack Walters	January 9, 2003	APGI	Initial relicensing comments
Roy Rowe	January 10, 2003	APGI	Initial relicensing comments
Weyerhaeuser Co., W. Martin Barfield	January 10, 2003	APGI	Letter re: Yadkin Project ICD comments
Yadkin-Pee-Dee Lakes Project, Ann Liebenstein Bass	January 10, 2003	APGI	Letter re: Yadkin Project ICD comments
U.S. Forest Service, John Ramey	January 10, 2003	APGI	Letter re: Yadkin Project ICD comments
River Rats Inc, Herb Ennis	January 10, 2003	APGI	Initial relicensing comments
City of Salisbury, North Carolina, David Treme	January 10, 2003	APGI	Letter re: initial relicensing comments and request for studies
SaveHighRockLake.org, Tom and Linda Webster	January 10, 2003	APGI	Initial relicensing comments
Denny and Cheryl Cottingham,	January 11, 2003	APGI	Initial relicensing comments
John Ellington	January 11, 2003	APGI	Initial relicensing comments
Warren Godwin	January 11, 2003	APGI	Initial relicensing comments
Mark DiRienzo	January 12, 2003	APGI	Initial relicensing comments
Rebecca DiRienzo	January 12, 2003	APGI	Initial relicensing comments
North Carolina Wildlife Resources Commission, Chris Goudreau	January 12, 2003	APGI	Letter re: first stage consultation comments and "Hydropower Relicensing Issues, Standards, and Mitigation"
South Carolina Coastal Conservation League and American Rivers, Gerrit Jobsis and David Sligh	January 12, 2003	APGI	Letter re: Yadkin Project ICD comments

Appendix E-24: Consultation Record Related to Miscellaneous Relicensing Issues at the Yadkin Project (continued)

From	Date	To	Description
Land Trust for Central North Carolina, Jason Walser	January 12, 2003	APGI	Email re: initial relicensing comments
Stuart Andrews	January 12, 2003	APGI	Email re: initial relicensing comments
Henry Sobiech	January 12, 2003	APGI	Initial relicensing comments
Anne Price	January 13, 2003	APGI	Initial relicensing comments
High Rock Lake Coalition, Lou Adkins		APGI	Initial relicensing comments
SaveHighRockLake.org, William Carr		APGI	Initial relicensing comments
Robert Amos		APGI	Initial relicensing comments
Brittany Bell		APGI	Initial relicensing comments
Nick Bell		APGI	Initial relicensing comments
Roger and Annette Bell		APGI	Initial relicensing comments
Ralph Brinkley		APGI	Initial relicensing comments
William Carr		APGI	Initial relicensing comments
George Carter		APGI	Initial relicensing comments
SaveHighRockLake.org, Horris Conner		APGI	Initial relicensing comments
SaveHighRockLake.org, Rick Conner		APGI	Initial relicensing comments
Kevin Eddinger		APGI	Initial relicensing comments
Michael Gregory		APGI	Initial relicensing comments
SaveourLake.org, David Halpin		APGI	Initial relicensing comments
SaveHighRockLake.org, Reid Harvey, Jr.		APGI	Initial relicensing comments
SaveHighRockLake.org, Reid Harvey, Sr.		APGI	Initial relicensing comments
Judy Heffner		APGI	Initial relicensing comments
SaveourLake.org, Marcell Hogan		APGI	Initial relicensing comments
Mary Hotchkiss		APGI	Initial relicensing comments
Charles Jensen		APGI	Initial relicensing comments
David Kelley		APGI	Initial relicensing comments
SaveHighRockLake.org, Sandy & John Lockwood		APGI	Initial relicensing comments
Robert Loflin		APGI	Initial relicensing comments
E. Wayne Mabry		APGI	Initial relicensing comments
SaveHighRockLake.org, Annmarie & Mike Medlin		APGI	Initial relicensing comments
SaveHighRockLake.org, James Melton		APGI	Initial relicensing comments

Appendix E-24: Consultation Record Related to Miscellaneous Relicensing Issues at the Yadkin Project (continued)

From	Date	To	Description
Piedmont Boat Club, Dan Nicholson		APGI	Initial relicensing comments
Dan Patterson		APGI	Initial relicensing comments
SaveHighRockLake.org, Robert Petree		APGI	Initial relicensing comments
SaveHighRockLake.org, Carol Ray		APGI	Initial relicensing comments
James Reep		APGI	Initial relicensing comments
SaveHighRockLake.org, Jean Rushing		APGI	Initial relicensing comments
SaveHighRockLake.org, Hollye Robinson		APGI	Initial relicensing comments
SaveHighRockLake.org, Mary Segers		APGI	Initial relicensing comments
Gregg Seitz		APGI	Initial relicensing comments
Concerned Property Owners of High Rock Lake, Charles Sink		APGI	Initial relicensing comments
SaveHighRockLake.org, Rusty Sloop		APGI	Initial relicensing comments
Mike Stroud		APGI	Initial relicensing comments
Howard Swicegood		APGI	Initial relicensing comments
Evelyn Tate		APGI	Initial relicensing comments
Doug and Lisa Tomlin		APGI	Initial relicensing comments
Scott Yates		APGI	Initial relicensing comments
SaveourLake.org, Kathleen Yothers		APGI	Initial relicensing comments
SaveHighRockLake.org, Von Everhart		APGI	Initial relicensing comments
APGI	February 28, 2003	Stakeholders	Meeting summary for Issue Advisory Group Organizational Meeting held on February 28, 2003
APGI	March 2003	FERC	Notice of Intent to relicense filed with FERC
APGI		Stakeholders	IAG Meeting Guidelines
APGI	March 7, 2003	All IAGs	March 2003 IAG Meeting Schedule
APGI	March 14, 2003	CE IAG	Final summary of March 14, 2003 County Economic Impacts IAG meeting
APGI	March 25, 2003	All IAGs	April 2003 IAG Meeting Schedule
APGI	July 7, 2003	OM IAG	Presentation from the July 7, 2003 Operations Model Meeting
APGI	June 27, 2003	All IAGs	IAG Update

Appendix E-24: Consultation Record Related to Miscellaneous Relicensing Issues at the Yadkin Project (continued)

From	Date	To	Description
APGI	July 21, 2003	All IAGs	Message about Operations Model
APGI, Gene Ellis	July 23, 2003	OM IAG	Message about Operations Model
APGI	July 29-31, 2003	Stakeholders	Public Meetings Conducted (Presentation)
APGI	September 4, 2003	OM IAG	Final summary of September 4, 2003 Operations Model Meeting
APGI	November 5, 2003	CE IAG	Final summary of November 5, 2003 County Economic Impacts IAG meeting
APGI	November 6, 2003	OM IAG	Final summary of November 6, 2003 Operations Model Meeting
APGI	February 4, 2004	CE IAG	Final summary of February 4, 2004 County Economic Impacts IAG meeting
APGI, Jody Cason	March 17, 2004	All IAGs	Update on recent relicensing activity, studies and study reports, and upcoming meetings
APGI, Jody Cason	April 12, 2004	All IAGs	Email update on how to access relicensing study reports
APGI, Jody Cason	April 13, 2004	All IAGs	Request for objections to providing a list to the media of All IAGs
APGI, Jody Cason	April 22, 2004	CE IAG	Surrounding Counties Economic Impact Analysis Final Study Plan
APGI, Jody Cason	April 25, 2004	All IAGs	Agenda for joint meeting of all Yadkin Project Issue Advisory Groups on May 4, 2004
APGI, Jody Cason	May 3, 2004	OM IAG	Operations Modeling Update
APGI, Jody Cason	May 26, 2004	All IAGs	Draft meeting summary for May 4, 2004 Joint IAG Meeting
APGI, Jody Cason	June 17, 2004	All IAGs	Schedule for June/July 2004 public meetings
APGI, Jody Cason	June 22, 2004	All IAGs	Reminder for June/July 2004 public meetings
APGI	June 29-30 and July 1, 2004	Stakeholders	Public Meetings Conducted (Presentation)
High Rock Lake Association, Larry Jones	August 9, 2004	APGI and OM IAG	Request for update on status of the US Geological Survey (USGS) review of the operations modeling dataset
APGI, Jody Cason	August 10, 2004	OM IAG	Update on status of the US Geological Survey (USGS) review of the operations modeling dataset
High Rock Lake Association, Larry Jones	August 21, 2004	APGI and OM IAG	Request for schedule of any planned lowering of Project reservoir levels

Appendix E-24: Consultation Record Related to Miscellaneous Relicensing Issues at the Yadkin Project (continued)

From	Date	To	Description
APGI, Jody Cason	August 31, 2004	All IAGs	On behalf of NCWRC, Fisheries and Wildlife Management Plan for the Yadkin-Pee Dee River Basin was sent to All IAGs for comments
APGI, Jody Cason	September 2, 2004	All IAGs	Final meeting summary for May 4, 2004 Joint IAG Meeting
APGI	September 9, 2004	All IAGs	Joint meeting of all Yadkin Project Issue Advisory Groups
APGI, Jody Cason	September 17, 2004	All IAGs	Schedule of October and November 2004 IAG Meetings
APGI, Jody Cason	September 24, 2004	All IAGs	Update on recent relicensing activity
APGI, Jody Cason	October 19, 2004	OM IAG	Agenda for Operations Model IAG meeting on November 4, 2004
APGI, Jody Cason	December 6, 2004	All IAGs	Email announcing there are no December 2004 IAG meetings
APGI, Jody Cason	December 17, 2004	All IAGs	Update on recent relicensing activity, studies and study reports, and upcoming meetings
APGI, Jody Cason	January 11, 2005	OM IAGs	Final summary of November 4, 2004 Operations Model Meeting
APGI, Jody Cason	January 14, 2005	All IAGs	Email announcing February 2005 schedule for Yadkin Project meetings
APGI, Jody Cason	February 20, 2005	All IAGs	Email announcing March 2005 schedule for Yadkin Project meetings
APGI, Jody Cason	February 21, 2005	OM IAGs	Draft agenda for the March 3, 2005 Operations Model Meeting
APGI, Jody Cason	April 20, 2005	All IAGs	Transitioning from IAG Work to Settlement Negotiations
APGI, Jody Cason	June 16, 2005	CE IAG and RASM IAG	Draft agenda for June 30, 2005 Joint RASM and County Economic Impacts IAG
APGI, Jody Cason	June 28, 2005	CE IAG and RASM IAG	Distribution of draft report for County Economic Impacts of APGI's Yadkin Project Study
APGI, Jody Cason	August 24, 2005	CE IAG and RASM IAG	Final meeting summary for June 30, 2005 joint IAG meeting
APGI, Jody Cason	July 30, 2005	All IAGs	July 2005 Issue Advisory Group Update

Notes: APGI – Alcoa Power Generating Inc.
IAG – Issue Advisory Group
CE IAG – County Economic Impacts IAG
OM IAG – Operations Model IAG
RASM IAG – Recreation, Aesthetics, and Shoreline Management IAG

Exhibit F - Design Drawings and Supporting Design Report

F.1 Design Drawings of the Major Project Structures

F. 2 Supporting Design Report

Exhibit G – Project Map

Exhibit G for the Yadkin Project will include 64 sheets to define the location of the project, principal features, project boundary and nearby federal lands. Each individual sheet will meet the current specifications of 18 CFR 4.39.

The attached drawing, YD630, Issue No. 2 is included herein to illustrate the project boundary limits at the Yadkin Project. The 64 sheets which comprise Exhibit G for the Yadkin Project will be included in the Final License Application.

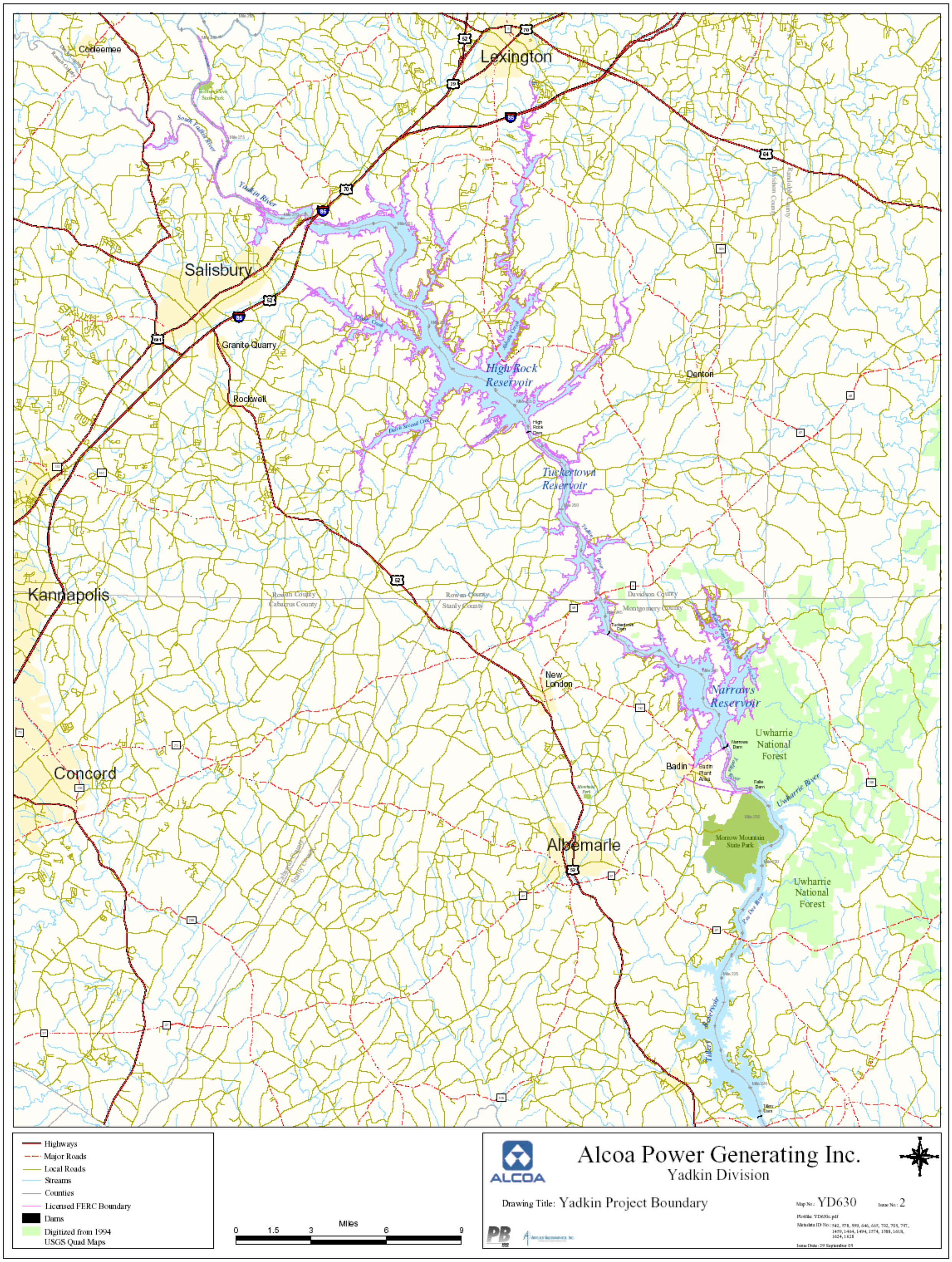
Lexington
Cooleemee
Salisbury
Granite Quarry
Rockwell
High Rock Reservoir
Tuckertown Reservoir
Denton
Kannapolis
Rowan County
Cabarrus County
Stanly County
Davidson County
Montgomery County
New London
Narrows Reservoir
Uwharrie National Forest
Badin
Concord
Albemarle
Morrow Mountain State Park
Uwharrie River
Highways
Major Roads
Local Roads
Streams
Counties
Licensed FERC Boundary
Dams
Digitized from 1994 USGS Quad Maps
Miles
0
1.5
3
6
9
ALCOA
Alcoa Power Generating Inc.
Yadkin Division
Drawing Title: Yadkin Project Boundary
YD630
2

Exhibit H – Information Required for New License

H.1 Plans and Ability of the Applicant to Operate and Maintain the Project

H.1.1 Plans to Increase Capacity or Generation

Throughout the term of the current license, APGI has maintained the Project to maximize generation value and efficiency. These efforts have included structural modifications, unit refurbishments, generator rewinds, and runner replacements. Under the new license, APGI plans to continue its refurbishment and upgrade program to ensure efficient and reliable electric service in the future. Unit refurbishments and potential upgrades at High Rock, Tuckertown, Narrows, and Falls Developments are proposed for completion under the new license.

H.1.2 Plans to Coordinate Project Operation with Other Water Resource Projects

Historically, APGI has coordinated the operation of its facilities with the Tillery and Blewett Falls developments owned by Progress Energy downstream. This coordination has taken place pursuant to a contract between the parties that dates from 1928 but which has been modified over the years, most recently in 1968. Further modifications to this contractual arrangement may be necessary depending on the terms of a new license for the Yadkin Project.

APGI schedules energy availability by Thursday noon for the coming week, allowing APGI to determine subsequent water flows downstream. Operating schedules are shared daily with the downstream project owner to communicate delivery of water. The Corps of Engineers operates and maintains a flood control project, W. Kerr Scott upstream of the Yadkin project. Discharges from the Corps project are available on the internet. APGI's operation of it's reservoirs will be within the allowable drawdown limits of the license.

H.1.3 Plans to Coordinate Project Operation with Other Electrical Systems

The APGI generation and transmission system operates as a North American Electric Reliability Council (NERC) Balancing Authority. The facilities are operated in compliance with NERC and Southeastern Electric Reliability Council (SERC) guidelines.

The Project facilities are operated from the Dispatch Center in Alcoa, Tennessee, which is staffed 24 hours per day with NERC certified operators. In addition, there is a backup Dispatch Center in Badin, North Carolina that is equipped for full functionality should the need arise.

The Project is connected to the Duke Energy transmission system and the Progress Energy transmission system via the APGI 100kV transmission facilities. The transmission line connections in Badin and at the High Rock powerhouse are sufficiently sized for the flow of energy generated by the Yadkin Project.

H.2 Need of Applicant for Electricity Generated by the Project

Alcoa Inc. (Alcoa) is the nation's largest producer of aluminum and aluminum products, and has several aluminum smelters and related operations in the United States, including extensive operations in the southeast and midwest regions, particularly in North Carolina, South Carolina, Indiana, and Tennessee. Aluminum smelting requires large amounts of low cost, reliable electricity, and energy can comprise more than thirty percent of the cost of producing aluminum. Thus, the competitiveness of Alcoa's primary aluminum business is closely tied to the availability of low-cost power rates. For this reason, Alcoa has located its smelting operations in close proximity to low-cost sources of reliable electric power such as the Yadkin Project hydropower developments, owned and operated by Alcoa's subsidiary, Alcoa Power Generating Inc. The Yadkin Project is critical to Alcoa's Primary Metals Operations in the southeast and midwest regions of the United States and helps the Company maintain its competitiveness in the domestic metals market. For many years, the power from the Yadkin Project was a source of power for Alcoa's Badin Works, an aluminum smelter and processing plant. More recently, the smelting operations at Badin were reduced and later curtailed, but the hydropower developments have continued to supply some power directly to Badin Works, with the remaining power sold to help offset the cost of electricity purchases required for Alcoa's other domestic smelting operations. Currently, the Yadkin Project provides 5 to 8 MW of electricity directly to Badin Works for aluminum refining and other operations that still occur at the plant, with the balance being sold into the wholesale market. Whether the energy from the Yadkin Project is sold into the wholesale market or used to directly supply Alcoa's smelting facilities in the southeast and midwest regions, access to that source of competitively-priced power is crucial to the ability of Alcoa's Primary Metals Business to maintain its manufacturing operations in those regions.

H.2.1 Reasonable Costs and Availability of Alternative Sources of Power

If the power and energy generated by the Yadkin were not available, Alcoa's smelting facilities in the southeast and midwest regions would require a replacement source of energy that could be either used as a direct supply or sold into the wholesale market to provide equal value to that being supplied by the Yadkin Project. The project's wholesale customers would be faced with obtaining firm or spot market power at a cost not to exceed that currently being paid for energy from the Yadkin Project. It is likely that the alternative source of on peak energy to replace on peak energy currently being obtained from the Yadkin Project hydroelectric generation would be generated from coal or natural gas combustion at a high economic and environmental cost.

H.2.2 Increase in Fuel, Capital, and Other Costs

Alcoa would incur a cost equal to the loss of the market value of the Yadkin Project hydroelectric generation. Whether the power generated by the Yadkin Project is consumed by the load at Alcoa's Badin Works or is being sold on the wholesale market, the difference between the cost of generation and the price on the wholesale market is the value that Alcoa receives from the Project.

The project's wholesale customers would incur a cost increase equal to the price of replacement power minus the price currently being paid for the Yadkin Project hydroelectric generation.

H.2.3 Effects of Alternative Source of Power

See Section H.2 above.

H.2.3.1 Effects on Applicant's Customers, Including Wholesale Customers

As, discussed in Section H.2 above, loss of the value of the Yadkin Project hydroelectric power by Alcoa will affect the cost of its primary aluminum production in its southeast and midwest regions.

In addition, customers other than Alcoa who presently purchase power would have to purchase from alternative sources if project power were to become unavailable. At present, the only alternative generation for sale in the region comes from coal-fired facilities or gas-fired combustion turbines, generally at much higher costs and prices.

H.2.3.2 Effects on Applicant's Operating and Load Characteristics

Electrical energy from any alternative source of power would be a net flow of power into the Yadkin Balancing Authority from the Duke Energy or Progress Energy transmission systems. The load at the Alcoa Inc. Badin Works would be fed by the alternative source of power instead of the Yadkin Project hydroelectric generation.

H.2.3.3 Effects on Communities Served or to be Served

The Yadkin Project does not sell power either wholesale or retail directly to communities. However, the Yadkin Project does enhance the reliability and power quality of the communities located in the area surrounding the Project. The Yadkin Project operates as a separate balancing authority within the Southeastern Reliability Council ("SERC"), responsible for the proper and reliable operation of its electric system in coordination with the electric power systems of neighboring utilities, specifically Duke Power Company and Progress Energy. This includes responsibility for assuring the power flows in and out of APGI's system are balanced, that voltage is maintained, and that frequency is held within strict limits. These actions by APGI, in concert with other utilities in North and South Carolina and Virginia, ensure that retail customers in North Carolina receive a reliable supply of electricity, with adequate reserve margins in both generation and transmission. The Yadkin Project also provides reactive power for voltage support of the transmission grid. There are instances that the Yadkin Project provides electrical energy for retail utilities during times of equipment failure, weather related outages, maintenance outages and equipment upgrades. During the summer of 2005 the Yadkin Project provided electrical energy for Duke Power to communities north of APGI's High Rock transmission line connection with Duke Power while local transmissions lines were being upgraded by Duke Power.

H.3 Need, Reasonable Cost, and Availability of Alternative Sources of Power

H.3.1 Average Annual Cost of Power Produced by the Project

Table H.3-1 presents the average annual cost of the power produced by the Yadkin Project over the last two years. The basis for this information is actual accounting records. This does not include the cost of capital and amortization. This information will be provided in the Final License Application.

Table H.3-1: Average Annual Cost of Power Produced by the Yadkin Project

Year	Cost
2004	$12,539,130
2005 Projected	$12,700,000

H.3.2 Resources Required to Meet Capacity and Energy Requirements

H.3.2.1 Energy and Capacity Resources

To be provided later.

H.3.2.2 Resource Analysis

Because of the requirement for low cost power arising out of the economics of aluminum manufacturing, there do not appear to be such alternatives to power from the Yadkin Project available in the wholesale market. Although capacity and energy could be purchased over the short and long term to replace Yadkin Project power, the purchase price for such resources almost certainly render this power uneconomic for aluminum production. However, this would not be true regarding the wholesale customers who currently purchase some of the Yadkin Project output as such sales are made at market prices.

H.3.2.3 Effects of Load Management Measures

Load management measures would not have an effect, for the reasons stated above.

H.3.3 Costs of Alternative Sources of Power

H.3.3.1 Annual Cost of Each Alternative Source of Power to Replace Project Power

To be provided later. See response H.3.2.2

H.3.3.2 Basis for Determination of Annual Cost of Each Alternative Source of Power

To be provided later. See response H.3.2.2

H.3.3.3 Relative Merits of Each Alternative

To be provided later. See response H.3.2.2

H.3.4 Effect on the Direct Providers of Alternative Sources of Power

To be provided later. See response to H.3.2.2

H.4 Effect of Obtaining or Loosing Electricity on the Applicant's Own Industrial Facilities

As discussed previously in Section H.2.

H.5 The Impact on the Operations and Planning of the Applicant's Transmission System

H.5.1 Effects of Power Flow Redistribution

The Project is connected to the Duke Energy transmission system and the Progress Energy transmission system at Badin and High Rock via the APGI 100kV transmission facilities. The transmission line connections in Badin substation and at the High Rock powerhouse are individually sufficiently sized for the flow of energy generated by the Yadkin Project.

As addressed previously in section 2.3.3, the Yadkin system is used to increase reliability of electricity in the geographic region. During periods of forced outages on generating units in adjacent utilities, and in high North-South or South-North power flows, the Yadkin generation is redirected on the interconnected transmission system to offset high line loading during abnormal conditions. Redistribution of the power flows reduces the line loading to within acceptable engineering limits. Reductions or restrictions in the amount or timing of Yadkin's power generation would prohibit Yadkin from alleviating these overloading conditions which could lead to opening of line breakers on the transmission system to redirect the flow of power in the immediate area, and thus effect reliability of electricity.

H.5.2 Advantages of the Applicant's Transmission System

The Yadkin Project transmission system was originally primarily used to connect the generating facilities of the Project, and to provide a path for additional power to increase the reliability of the electricity supply to Alcoa's Badin Works during low Project generation periods through interconnections with local utilities Duke Energy and Progress Energy. Originally these transmission facilities were all part of the Project, but as Duke Energy and Progress Energy expanded their own transmission facilities in the region, it became apparent that the bulk of the Yadkin Project 100 KV transmission facilities had become part of the larger interconnected transmission grid. Subsequently, the project license was amended to remove all but two transmission lines from the project.

The two transmission lines that remain in the project are 1) the four circuit 13.2 KV line that connects the Narrows Powerhouse to a switchyard located at Alcoa's Badin Works and 2) the single circuit 100 KV line that connects the Falls Powerhouse to the Badin substation. Thus, there is limited transmission in the Yadkin project that would materially help regional electrical reliability. Delivery of Project energy to Alcoa's Badin Works and/or to the interconnections with Duke Energy and Progress Energy at the Badin substation and High Rock powerhouse does benefit the regional distribution of the Project's power and to help provide voltage regulation in the area. These uses will remain an important function of Yadkin's transmission system if a new license is granted.

Yadkin’s non-project transmission system consists of approximately 15 miles of single circuit 100 KV transmission lines that run from the High Rock Development, through the Tuckertown Development and continues to a switchyard at Alcoa’s Badin Works.

H.5.3 Single Line Diagrams

The electrical one-line diagram is shown in Figure H-1.

H.6 Plans to Modify Existing Project Facilities

APGI plans on replacing existing turbine runners, rewinding generators, and refurbishing auxiliary equipment at all Project developments under the new license terms. The proposed facilities to be replaced are nearing the end of their useful operating lives and are in need of overhaul or replacement. Replacement of the runners will result in increased hydraulic efficiency. Similarly, rewinding the generators and completing associated refurbishments to the electric controls will increase the efficiency by which mechanical energy is converted to electric energy.

In evaluating the proposed unit upgrades, APGI considered the potential effects of the unit upgrades on environmental resources. In this regard, APGI proposes to enhance project water quality by either modifying the design of the replacement runners and draft tube cones in such a way as to increase the dissolved oxygen concentration in the Project tailraces at the High Rock and Narrows Developments.

The planned unit upgrades, refurbishments, along with the installation of technology to improve dissolved oxygen will conform with the comprehensive plan for improving the waterway and for other beneficial uses as defined in Section 10(a)(1) of the Federal Power Act.

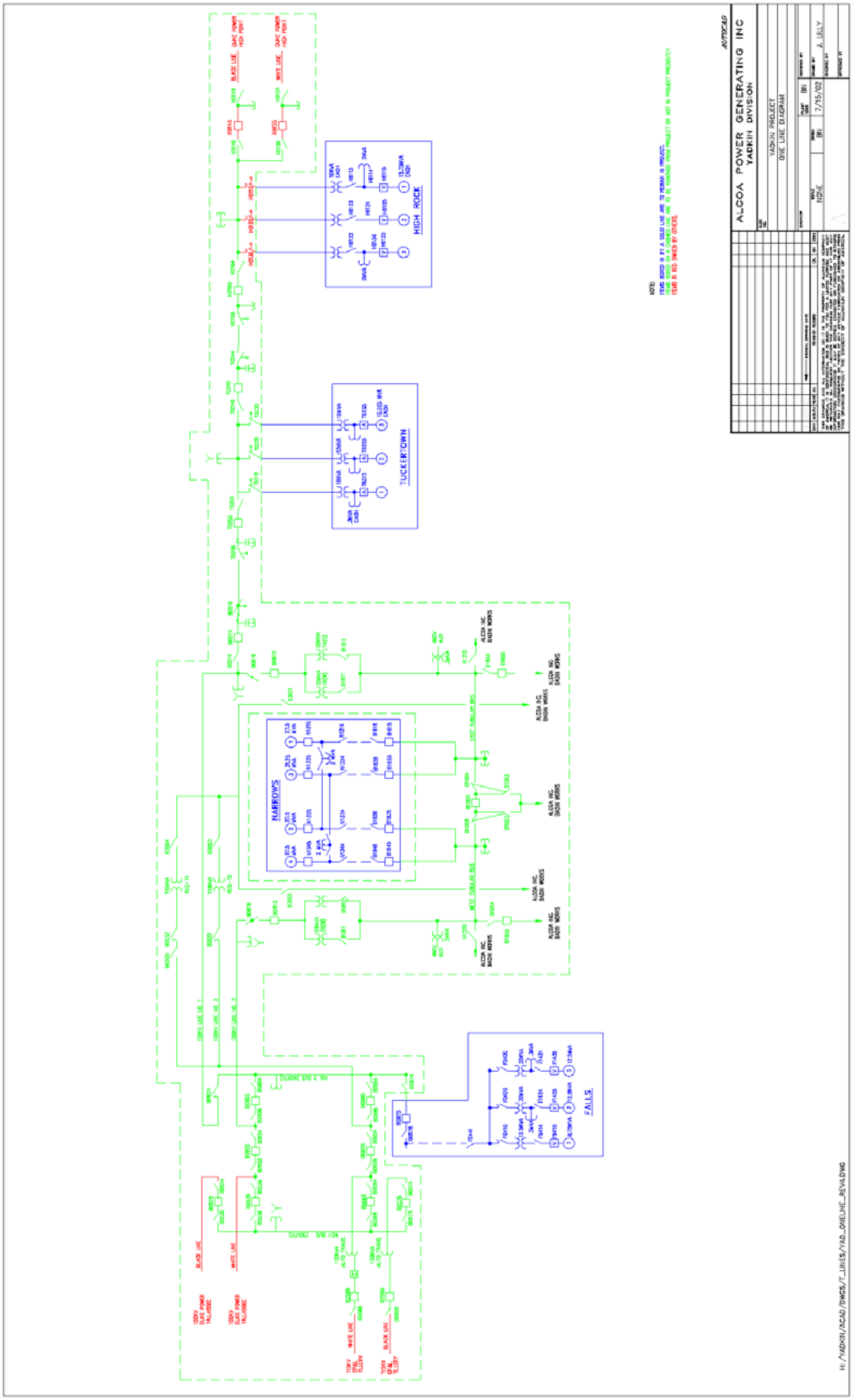

Figure H-1: One Line Diagram

H.7 Financial and Personnel Resources

As a wholly-owned subsidiary of Alcoa Inc., APGI has sufficient financial resources to continue operating and maintaining the Project, as well as perform the unit refurbishments/upgrades that are contemplated under the new license.

As previously mentioned, all four Project developments are operated by full-time Power Dispatchers under the direction of the APGI Operations Manager. Operation and generation dispatch is remotely controlled from the Dispatch Center located in Alcoa, Tennessee. The Project is staffed by a crew either located at High Rock or Narrows powerhouses, or at the plant in Badin, North Carolina. The crew consists of hydroelectric mechanics, multi-craft classification, electronics technicians, and supervisors.

The technical support staff is based in Badin, North Carolina and Alcoa, Tennessee, in the same building as the Dispatch Center. The support staff consists of electrical and mechanical engineers, and technical and office personnel. Members of the technical support staff have formal education in their field of expertise and are expected to stay abreast of developments in the hydroelectric industry through continuing education opportunities.

The entire staff receives annual safety training that goes beyond the current state and federal requirements.

Routine maintenance for all four developments, including trash removal, is performed by either contracted maintenance crews or by maintenance crews based at their facilities. Major maintenance is normally contracted under specifications by APGI's Engineering Department.

H.8 Proposed Expansion of Project Lands

APGI does not propose to expand the Project to encompass additional lands.

H.9 Applicant's Electricity Consumption Efficiency Improvement Program

To be provided later.

H.9.1 Applicant's Record of Encouraging Power Conservation and Plans for Promoting Power Conservation

All of the electricity that APGI generates at the Project is for the benefit of its ultimate customer, Alcoa, and specifically, Alcoa's smelting facilities in the southeast and midwest regions, whether the Project power is sold in the wholesale market or used directly. The nature of the aluminum smelting process makes energy efficiency a top priority for Alcoa.

Alcoa and other primary aluminum companies produce aluminum from alumina by an electrolytic reduction process that requires large amounts of electric energy as an industrial input.

Electric energy accounts for more than thirty percent of the cost of a pound of aluminum produced at an aluminum smelter, and as such, is often the largest single variable cost in the production of aluminum metal and the most significant factor in determining a company's competitive position in the market

As a result, smelters in the United States (and elsewhere in the world) have been built in proximity to low-cost electric energy sources, such as hydroelectric power. For example, the Project was constructed with the specific intent of providing a dedicated supply of electricity for Alcoa's Badin Works.

Hydroelectric power also supports Alcoa's environmental goals. Hydroelectric power is the only large scale power resource that is both renewable and commercially viable. Electricity generated by waterpower does not create waste products, and the fuel for the plants – water – is a renewable resource. Alcoa is committed to increasing its use of clean and renewable hydroelectric power as a means of achieving sustainability for its manufacturing and service operations.

Additionally, Alcoa's smelters are constantly seeking opportunities to reduce operating costs. Such cost savings are often realized through improved energy efficiency both in the industrial smelting process and in the generation of electric power. As described in Section H.6, Plans to Modify Existing Project Facilities, Yadkin has initiated phased-in refurbishments and upgrades of aging equipment in order to generate additional electric power from the same water flows on the Yadkin River. In addition, the aluminum smelting industry in general and Alcoa in particular are constantly searching for ways to improve energy efficiency in the smelting process. The Aluminum Association, Inc., estimates that optimization of aluminum smelting processes has reduced the energy demands by more than 20% (from more than 8kWh to approximately 6.5kWh per pound) over the last 20 years.

Finally, Alcoa also has implemented a long-term energy strategy for the past several decades. New policies developed in the wake of the energy crisis of the 1970's sought to increase self-sufficiency in energy generation and greater energy efficiency at every step of the manufacturing process. More recently, Alcoa has formulated an energy efficiency plan that benchmarks best practices in the industry and makes them available to Alcoa locations. The foundation of the plan is the formation of a network of energy users at Alcoa locations that will embrace and employ best practices for improving energy efficiency.

In 2003 Alcoa began participating in the World Resource Institute's Green Power Market Development Group – the largest purchaser of renewable energy in the United States. In 2004, Alcoa expanded its involvement from four to seven administrative centers and increased purchases of green power by 50%.

Achievement of benchmark energy efficiency for Alcoa smelters throughout the world will contribute significantly to energy conservation. In addition to these efforts, there are similar efforts for processing steps, from bauxite mining through fabricating and recycling. Incremental energy efficiency improvements are being made in the liquor yield and calciner efficiency of alumina refineries. In smelting, the focus has been on the optimization of new cell design and the operation of existing cells combined with the upgrading of carbon baking furnaces. The energy efficiencies of remelt furnaces are being improved and the level of remelt is being reduced by improving the recovery phase of fabricating operations. Alcoa also participates in voluntary programs such as the installation of cost-efficient lighting systems which conserve energy. Indirect energy conservation in the form of reduced waste of raw materials and operating supplies can also be significant and is frequently easier to achieve once "tolerance" or acceptance of the status quo is reduced. These wastes can be eliminated systematically through process improvements.

H.9.2 Compliance of Power Conservation Programs with Applicable Regulatory Requirements

To be provided later.

H.10 Identification of Indian Tribes Affected by the Project

Since the distribution of the Initial Consultation Document in September 2002, APGI has worked to engage the Catawba Indian Nation (CIN) and the Eastern Band of the Cherokee Indians (EBCI) in the relicensing of the Yadkin Project. In addition to the identified tribes, APGI also provided a copy of the ICD to the North Carolina Commission of Indian Affairs.

In response to the ICD, the Cherokee Indian Nation Tribal Historic Preservation Office expressed a general interest in the relicensing. Although the current Catawba Indian Nation Reservation is located in South Carolina on the Catawba River, the traditional ceded homelands of the tribe do extend through the entire Piedmont of North Carolina. The Catawba Indian Nation has not identified any specific interest in the relicensing or any potential Project impacts to lands with religious or cultural significance to the tribe.

The EBCI has not expressed an interest in the relicensing. In a meeting in July 2004, EBCI shared with APGI a map of lands to which they attach religious or cultural significance and none of the five counties immediately adjacent to the Yadkin Project were identified as significant.

The Catawba Indian Nation of South Carolina
Chief Gilbert B. Blue
996 Avenue of the Nations
Rock Hill, SC 29730

The Eastern Band of the Cherokee Indians
Chief Michell A. Hicks
88 Council House Loop
Cherokee, NC 28719

H.11 Measures Planned to Ensure Safe Management, Operation, and Maintenance of the Project

APGI strictly adheres to the FERC regulations for maintaining safety at all of its developments within the Project. As such, APGI prepares quality control programs during construction, repair, and modifications of Project works; prepares adequate provisions for installing and maintaining appropriate monitoring instrumentation wherever any physical condition has the potential to affect the safety or stability of the Project; and prepares public safety plans. In addition, APGI performs periodic inspections, every 5 years, of the Project facilities by an independent consultant, performs power and communication lines testing, and performs annual spillway gates testing.

Also in accordance with FERC guidelines, the Project has an Emergency Action Plan (EAP), which was most recently revised and updated in December 2004. The EAP serves as a tool to APGI personnel as well as public safety agencies to ensure public safety while minimizing property damage in the unlikely event of a failure or potential failure of High Rock, Tuckertown, Narrows, or Falls Dam.

The reservoir and tailrace elevations are monitored continuously by float-operated or sonic transducers. The elevations are recorded hourly at the Dispatch Center in Alcoa, Tennessee. Any significant change in the reservoir or tailrace elevations will be noted by the power dispatcher.

High Rock and Narrows powerhouses are manned by APGI shift mechanics. The Tuckertown and Falls Developments are unmanned, but are inspected each manned shift. The staff is well trained and routine surveillance of potential hazards is included in the operation of the facilities. Any abnormal condition is reported to the power dispatcher, the operations general supervisor, and/or the maintenance coordinator.

Instrumentation monitoring plans are also set up at the Project facilities to monitor conditions at the developments to alert staff to possible problems.

Weekly inspections of pertinent operating and safety features are performed by the APGI operating personnel. In addition, annual inspections of the Project structures are conducted by APGI's supervisory and engineering personnel with documentation of conditions. Routine maintenance for all four developments, including trash removal, is performed by either contracted maintenance crews or by maintenance crews based at their facilities. Major maintenance is normally contracted under specifications by APGI's Engineering Department.

The backup diesel generators are inspected on a weekly basis and tested on a monthly basis to ensure operability of the spillway gates. The spillway gates are tested annually at each development and a full open gate testing is performed on a five year basis. The data communication lines are tested daily, and voice communication lines are tested weekly.

H.11.1 Existing and Planned Operation of the Project During Flood Conditions

During unusually high flow conditions (greater than 30,000 cfs), maintenance personnel are sent to the Project dams, as required, to operate bypass and spillway gates, and monitor general conditions at the Project dam. Each Project development uses a "Standard Gate Operating Procedure" for discharging water through the spillway gates during flood conditions.

All four dams are continuously monitored at the Dispatch Center located in Alcoa, Tennessee through a Supervisory Control and Data Acquisition (SCADA) system. The SCADA system provides real time monitoring, reporting, and alarming of key elements associated with the normal operation of the dams, including, but not limited to, power generation, unit operation, and reservoir and tailrace elevations. APGI's operation of all four hydro developments as an integral system allows for advance notice of impending flood flows, including localized storm events. Any significant change in the reservoir elevation due to inoperability of the gates or other conditions will be noted by the Dispatcher who will alert the necessary personnel at Alcoa's plant in Badin, North Carolina. These remote monitoring devices provide for a timely response to an adverse condition if it were to occur.

The principal means of communication during an emergency, including flood events consist of the Yadkin PBX system, the public telephone, cell phones, and two-way radios carried by APGI maintenance crew while working on the dams. There are two base stations for the two-way radio system, one at High Rock Powerhouse and one at Building 105 (Badin Plant) - a backup station, in case the High Rock Powerhouse station system is inoperable. Communication is possible between the base station and the mobile units, between the independent mobile units, as well as the Dispatch Center in Alcoa, Tennessee

H.11.2 Warning Devices Used to Ensure Downstream Public Safety

APGI maintains a comprehensive public safety program to ensure the structural adequacy of the Project dams and the safety of the public within the Project area. All four of the Project dams are inspected annually by a team of APGI's supervisory and engineering personnel. Independent consultants, approved in advance by FERC and engaged by APGI, thoroughly examine the development structures once every five years and publish a comprehensive Safety Inspection Report. The most recent Independent Safety Inspection Reports for the Project developments were prepared in 2001 by PB Power, Inc.

APGI maintains a current EAP for the Project in the event of high flows, or the unlikely event of a failure or potential failure of the Project dams. This plan is designed to minimize danger to people and property downstream of the High Rock, Tuckertown, Narrows, and Falls Dams. The EAP provides guidelines for notification and early warning of local, state, and federal agencies, emergency services staff, and the public in the event of an actual or potential failure. Developed in accordance with FERC guidelines, the plan is tested and updated annually. This plan includes a flood warning notification to the National Weather Service and other agencies during periods of high release (high flows) from the Project developments.

Some of the specific safety measures employed at the Project include fencing, lighting, signs at the dam fore bays and tailraces, and turbulent water and spillway warning signs.

At all four Project Dams, a warning/sounding alarm is present at the spillway gates and tailwater of generating units. Sounding the alarm prior to starting a unit or opening a spillway gate is a separate control action from opening of the spillway gate.

H.11.3 Proposed Changes Affecting the Existing Emergency Action Plan

APGI does not propose any changes to the operation of the Project that might affect the existing EAP. The EAP was most recently updated in December 2004.

H.11.4 Existing and Planned Structural Monitoring Devices

Instrumentation monitoring plans have been set up at each of Project facilities to monitor conditions at the developments and to alert staff to possible problems. The following sections discuss monitoring at the Project Developments. No changes are proposed at this time.

H.11.4.1 High Rock Dam and Powerhouse Monitoring Devices

The instrumentation program consists of deformation monitoring (inclinometers, extensometers, crackmeters, and survey points), piezometers, thermistor readings, seepage measurements, precipitation measurements, and reservoir and tailwater level monitoring devices.

H.11.4.2 Tuckertown Dam and Powerhouse Monitoring Devices

The instrumentation program consists of deformation monitoring (inclinometers), piezometers, seepage, and reservoir and tailwater level monitoring devices.

H.11.4.3 Narrows Dam and Powerhouse Monitoring Devices

The instrumentation program consists of deformation monitoring (extensometer and inclinometers), seepage, and reservoir and tailwater level monitoring devices.

H.11.4.4 Falls Dam and Powerhouse Monitoring Devices

The instrumentation program consists of deformation monitoring (survey) and reservoir and tailwater level monitoring devices.

H.11.5 Project's Employee and Public Safety Record

As previously mentioned, the entire APGI staff receives annual safety training that goes beyond the state and federal requirements. The safety process consists of a highly developed combination of protective equipment, procedures, inspections, observations, and audits. The success of the process is evident in the fact that APGI has not had a lost workday due to injury since September 23, 1986.

The Project is a popular destination for boating, camping, fishing, swimming, and various other recreation activities. The high use and popularity of the Project's large reservoirs, currently with 40 recreation facilities and access areas available to the public use, contributes to the high number of public safety incidents. Table H.11-1 presents a brief description (with dates) of reported deaths and injuries that have occurred within the Project boundary from the beginning of 2004 through May 31, 2005.

Table H.11-1: Summary of Injuries and Deaths at the Yadkin Project

Date	Reported Injury/Fatality
3/21/2004	Drowning of a 35 year old male on High Rock Reservoir. Boat overturned in rough waters. Victim was not wearing a life jacket.
6/2/2004	Overturning of a boat in the Tuckertown Powerhouse tailrace on Narrows Reservoir.
10/29/2004	Apparent suicide (shooting). A 22 year old male found in picnic table at the Southmont Public Access Area on High Rock Reservoir, Davidson County.
11/18/2004	Drowning of an 81 year old male on High Rock Reservoir, near a commercial lake access area off Bringle Ferry Road, Rowan County. Victim had a history of heart problems and his boat was found tied to a pier.
6/3/2005	Drowning of a 43 year old male on High Rock Reservoir. Victim was hit by a propeller when he fell off from a boat that took on water.

H.12 Current Operation of the Project

The High Rock and Narrows Developments are storage facilities that that may be operated in a store and release mode. The Narrows Development, however, is generally operated as essentially a run-of-river[1] facility on a daily basis. Based on the limited available storage capacity, the Tuckertown and Falls Developments are essentially operated as essentially run-of-river facilities on a daily basis. Generally, the plants operate during peak hours to maximize the economic value of the power produced. During periods of high stream flow, the system is operated continuously.

As part of its current license with the FERC, APGI operates the Project under operating guides developed with consideration given to many diverse interests including energy generation, recreation, environmental stewardship, downstream municipal and industrial needs, and others. Specifically, the water releases from the Project developments are governed by two FERC orders, one order governs the Project operation under an operating guide for the High Rock Reservoir and the second order governs the headwater benefits settlement between APGI and Progress Energy.

The High Rock Development is operated in accordance with an approved operating guide curve which regulates generation, not headwater elevation. Within the limitations of available streamflow, the operating guide curve is designed to maintain higher water elevations from mid-May to mid-September, followed by a fall-winter drawdown to allow for refill during the late winter and spring runoff. The operating guide curve, reviewed and approved by FERC, was established ten years after issuance of the existing license in 1968. During periods of low High Rock water levels and low streamflows, the operating guide has an overriding reservoir elevation requirement for APGI to limit discharge to a maximum amount of water on a weekly basis from early March to mid-September to help maintain High Rock water levels.

1 Run-of-river means that the average daily discharge is approximately equal to the average daily inflow, with daily fluctuations occurring to meet system operating demands.

In addition to the operating guide curve, APGI operates in accordance with a March 1968 FERC order related to headwater benefits. Water storage in the APGI reservoirs during periods of high streamflow allows a controlled release to enhance power generation. This regulation of flow provides benefits to APGI and to Progress Energy, by seasonally increasing the flow available for hydropower generation at the downstream facilities. By way of the March 1968 FERC order, Progress Energy pays APGI an annual headwater benefits fee for this benefit. The agreement with Progress Energy requires that that the regulated weekly average streamflow, during the ten week period preceding the recreation period (May 15 through September 15) is not less than 1500 cfs; during the period May 15 through July 1, is not less than 1610 cfs; and during the period July 1 through September 15, is not less than 1400 cfs.

Available storage at Narrows Reservoir may be used during periods of low streamflow to maintain the required minimum downstream releases. Table H.12-1 lists the drawdown relationship between High Rock and Narrows Reservoirs as defined by the current Project License.

Current Project operation is discussed in more detail in Exhibit B.

Table H.12-1: Drawdown Relationship Between High Rock and Narrows Reservoirs

High Rock Reservoir		Narrows Reservoir	
Elevation (feet)	**Drawdown (feet)**	**Elevation (feet)**	**Drawdown (feet)**
623.9	0.0	509.8 – 507.7	0.0 – 2.1
622.9	1.0	508.2 – 503.2	1.6 – 6.6
599.9	24.0	508.2 – 503.2	1.6 – 6.6
599.9	24.0	502.7	7.1
597.9	26.0	493.7	16.1
593.9	30.0	478.8	31.1

H.13 History of the Project and Record of Programs to Upgrade the Operation and Maintenance of the Project

H.13.1 High Rock Development

High Rock Development was the third of the Project developments to be built. The turbines for Units 1, 2 and 3 were put in service in 1927. There have been no upgrades to the original Units under the existing license. The Unit 1 generator was rewound in 1988. Other available structural/maintenance records are summarized below:

- At the time of the original construction, the embankments were not riprapped at locations adjacent to the shallow bodies of reservoir water. However, after the reservoir was filled, it was found that sufficient wave action existed to erode the embankments. These locations were repaired with riprap to prevent further damage.
- In 1954, the elevation of the top intake deck and non-overflow gravity sections was raised to elevation of 638.9 feet. This 1954 concrete was extensively dowelled to the original 1927 concrete. Along with increasing the height, the thickness of the no-

overflow sections as well as portions of the intake/powerhouse (service and unloading bay) was also increased.

- Based on a review of underwater diving inspections and tailrace investigations, there is evidence of scour of the spillway and powerhouse. Repairs have been made multiple times [1961, 1993, and 1996] in the past to maintain the powerhouse and spillway in good condition.

- During a dive inspection in 1983, an area of undermining was located at the southwest corner of the powerhouse and repaired using grout bags as formwork, and then grouting behind the grout bags to simply fill the remaining voids. The area was repaired again in 1996/1997 by first removing the grout bags and then installing reinforcing bars, dowels and grout.

- The stability analysis of the High Rock Dam was subsequently updated to meet the FERC requirements, including stability under PMF loading. The results of the analyses indicated that spillway bays 1-10 required remediation. Remediation of the spillway bays at High Rock consisted of installing 20 multi-strand, epoxy coated and filled post-tension anchors. Construction activities began in September 1999 and work was completed in 2001.

- The hoist cables for all ten Stoney gates were replaced between September and November 2003. The replacements were made to maintain the gate lifting devices in good condition

H.13.2 Tuckertown Development

Tuckertown Development was the fourth of the Project developments to be built. The turbines for Units 1, 2 and 3 were put in service in 1962. There have been no upgrades or modifications to the original Units under the existing license. There were no major structural or maintenance activities performed at the Tuckertown Development under the current license term.

H.13.3 Narrows Development

Narrows Development was the first of the Project developments to be built. The turbines for Units 1, 2 and 3 were put in service in 1917, and Unit 4 went on line in 1924. The present runners were installed in Unit 1 in 1988, Unit 2 in 1964, Unit 3 in 1996 and Unit 4 in 2001. The original generators for Units 1 and 2 were installed in 1917. The original generators for Units 3 and 4 were installed in 1923 and 1924, respectively, and rebuilt in 1947 and 1946, respectively. A new generator was installed in Units 1 and 2 in 1964. Units 1 and 2 were rewound and rotor poles reinsulated in 1997. An upgrade of Unit 3 was completed in 1996, and an upgrade of Narrows Unit 4 was completed in 2001. Other available structural/maintenance records are summarized below:

- The bypass spillway was originally constructed as an open excavation cut through the rock, approximately 115 feet wide, 1,100 feet long, the depth varying with the contour of the hillside. For a distance of approximately 130 feet downstream of the flood gates the bottom and sides of the bypass channel were lined with concrete. During July 1919 high flood waters were discharged through the dam. The flood waters were discharged through the bypass spillway depositing rock and other debris in the main channel below the powerhouse, which affected the operation of the turbines. As a result, a channel was constructed and a crib built so that the discharge from the bypass spillway would be carried further downstream before it merged with the main river stream below the powerhouse. The chute was further extended and extensive repairs were made in 1923 to prevent further erosion and the washing of materials into the river downstream of the powerhouse.

- A rock reef located about 1,200 feet below the powerhouse was removed during 1922. This rock reef also hindered the free flow of water from the tailrace and was thought to affect the turbine efficiency. During subsequent flood events, it was found that the rock crib erected in 1919 was not of sufficient length to provide the necessary protection for keeping wash material and debris from entering the tailrace area. In addition, it was noted that the bottom and sides of the channel excavated in the rock were severally damaged and extensive repairs would be necessary to prevent further erosion. Before this work had begun a model of the bypass spillway, true to scale, was constructed so that the action of the water could be observed on the proposed repairs. The repair work consisted of excavating the rock so that a solid foundation of concrete could be placed on the bottom and sides, which had not been originally concreted. Also, floods passing over the east end of the main dam spillway washed out areas of the protecting rock ledge in the river between the toe of the dam and the powerhouse. To prevent further damage in this area an armor coating of concrete was installed. Hardaway Contracting Company was given the contract for this work in July 1923 and the work was completed in 1925.

- During 1925, flood water passing over the main dam spillway washed loose rock into the tailrace area to such an extent that the debris interfered with the efficiency of the turbines. This material was removed from the river by the Hardaway Contracting Company.

- A two foot steel extension was installed on the gates in 1918, thereby increasing the height of the gates approximately 2 ft.

- As a result of seepage observed flowing from the bottom of the inter-gallery drains A-1, A-2 and A-3 in gallery "A" within the intake section, an exploratory drilling and grouting program was performed in 1986 to identify and control the seepage. A total of eight holes were drilled from the piers into the concrete to seek out and identify seepage paths, and to permit grout injection for sealing purposes. In addition, surface repairs were carried out within Penstock Nos. 3 and 4, which included the removal of spalled and cracked concrete, the installation of new concrete and the patching of voids at the steel liner transition area. Inter-gallery Drains A-1, A-2, and A-3 were drilled and cleared of obstructions to restore them to useful function.

- The main spillway deck consists of an integral concrete slab and beam support system spanning between spillway piers. The deck over the trash gate section that is adjacent to the intake is 6 inches thick with no support steel. No expansion joints were included in the original design of the spillway deck. Visual inspections showed abrasion of the concrete in an arc on the right pier side of each gate (viewed looking in the downstream direction) along a path which the gates travel when opened. Normal thermal conditions combined with the lack of expansion joints caused the trash gate deck slab, adjacent to the intake, to buckle in the early 1990s. The first four pier caps adjacent to the trash gate deck slab separated from the piers and translated approximately 1 inch towards the intake structure. Full open gate testing performed in 2001 showed gate binding prior to the full opening at nine of the Tainter gates. A two-phase remediation program was established to allow the Tainter gates to be fully opened. The initial phase of remediation activities included the cutting of one slot in the spillway deck at the right non-overflow section and Pier No. 1, and six sets of slots, one set each in Pier Nos. 5, 7, 11, 15, 19 and 21 in 2002. The initial phase of the work was completed in October 2002. The second phase of the remediation effort involved the remediation of the gates themselves, and was initiated in August 2003 and was completed in early 2004.

H.13.4 Falls Development

Falls Development was the second of the Project developments to be built. The turbines for Units 1 and 2 were put in service in 1919, and Unit 3 went on line in 1922. Since that time, both Units 2 and 3 have required realignment to correct runner clearance problems (runner began to rub against its discharge ring resulting in the need to realign the unit) on about a 10 year cycle. Unit 1 has experienced similar though somewhat less severe runner clearance problems with the initial runner clearance problems surfacing in the mid 1930s. The difficulties associated with the vertical alignment of the units led to extensive rehabilitation efforts. Alignment adjustment was no longer possible for Units 2 and 3 in 1961, and the turbine-generators were removed and upgraded in 1962. A similar replacement/upgrade was performed on Unit 1 in 1981. The rehabilitation of all three units included the removal and replacement of mass concrete from the powerhouse floor down to just below the stay ring for each of the three units. The concrete piers between the units, and the east (downstream) and north (river side) walls remained in place. Following the rehabilitation efforts there has been no significant trends in the runner clearance measurements since the Unit 1 replacement in 1981 and small progressive movement towards the downstream-river corner of the powerhouse at Units 2 and 3 since their replacement in 1961. Subsequent to the major upgrade, the turbine-generator alignments have been less frequent.

Additionally, a two foot extension consisting of wooden boards was installed on the gates in 1923, thereby increasing the height of the gates approximately 2 ft. In 1929, the 2 ft wooden extensions were replaced by 2 ft steel extensions. In 1946, the 2 ft steel extensions were increased to 4 ft.

H.14 Summary of Unscheduled Outages Over the Last Five Years

Table H.14-1 presents a summary of unscheduled outages over the last five years, including the cause of the outage, the duration of the outage, and the corrective action taken.

Table H.14-1: Summary of Unscheduled Outages Over the Last Five Years

Generating Unit	Date	Cause	Duration (hours)	Corrective Action
Tuckertown #3	3/2000	Field ground	19.2	Cleaned slip rings
High Rock #1	8/2001	Low governor air pressure	16.0	Replaced leaking air valve
Tuckertown #3	8/2001	Turbine lube flow switch	78.4	Replaced flow switch
Falls #3	8/10/2001	Governor trouble	20.6	Replaced LVDT
Falls #3	9/2/2001	Intake gate operating hoist	315.5	Rebuilt gear boxes
Tuckertown #3	1/16/2003	86E Stator ground	11.1	Tested windings no ground
Narrows #1	1/6/2003	86N Governor trouble	10.6	Repaired governor
Falls #1	2/23/2003	Tree in transmission line	9.5	Removed tree and repaired line
Falls #2	2/23/2003	Tree in transmission line	9.5	Removed tree and repaired line
Falls #3	2/23/2003	Tree in transmission line	10.9	Removed tree and repaired line
Tuckertown #2	5/9/2003	86N governor controller	13.7	Repaired controller processor
Narrows #2	8/28/2003	86E & 86N Breaker bushing field	89.1	Replaced bushing
Falls #2	8/27/2003	86N governor trouble	32.2	Repaired governor
Falls #1	10/28/2003	Governor trouble	23.5	Repaired governor
Tuckertown #3	12/30/2004	Turbine pit sump level high	17.5	Repaired sump pump float
Narrows #3	12/30/2004	DC ground, turbine bearing oil flow	39	Repaired DC lube pump

H.15 Licensee's Record of Compliance

APGI has an excellent record of compliance with the terms of the existing license. Complaints to the Commission alleging non-compliance have all be resolved in APGI's favor.

H.16 Project Actions Affecting the Public

APGI's operation of the Yadkin Project affects the public in a number of ways. One is that a significant portion of the electricity currently generated by the project is being sold to utilities that serve the public. Second, the project reservoirs provide many recreational benefits to surrounding landowners as well as the public generally (operating guides that allow higher water levels during the summer recreation season, a private access permitting program, etc.), including numerous, well-maintained public recreation facilities on Project waters, which allow hunting, picnicking, boating access, fishing, swimming, and other water-based recreation. In addition, other similar facilities are owned or managed by surrounding counties, the State of North Carolina, or the USFS. Third, the Project is operated in a manner consistent with APGI's environmental stewardship ethic, and the public benefits from the improved environmental conditions that result from that mode of operation. For many years, APGI has worked with agencies and others to enhance fisheries and wildlife resources. Finally, for its relicensing of the Yadkin Project, APGI chose to use a Communications-enhanced Process that provides for issue identification and open communication with interested parties, including the general public.

H.17 Reduced Ownership and Operating Expenses if the Project License were Transferred

If APGI did not receive the new license for the Project, its annual operating costs would be reduced by the amount shown in Exhibit D. In this case, APGI would no longer be responsible for Project operation or paying taxes and administrative fees associated with the Project.

H.18 Annual Fees Paid Under Part I of the Federal Power Act

Since the initial licensing of the Project, APGI has paid annual FERC administrative charges as presented in Table H.18-1.

APGI does not pay fees for the use of federal lands within the Project boundary because there are no federal lands within the Project boundary. There are no Indian lands included within the Project boundary.

Table H.18-1: FERC Annual Administrative Charges[a]

Fiscal Year	FERC Administrative Charge	Other Federal Agencies Administrative Charge[b]	Total Administrative Charge
1994	$161,279	$0	$161,279
1995	$369,566	$0	$369,566
1996	$657,244	$0	$657,244
1997	$440,118	$0	$440,118
1998	$377,516	$0	$377,516
1999	$447,027	$0	$447,027
2000	$403,890	$0	$403,890
2001	$369,878	$0	$369,878
2002	$451,053	$0	$451,053
2003	$345,152	$0	$345,152
2004	$1,015,280	$0	$1,015,280

a. All dollars are actual, as of the year identified.
b. There were no known administrative charges paid to other federal agencies.