Yadkin Project (FERC No. 2197)
Habitat Fragmentation Assessment

Final Study Plan
September 2004

Background

Alcoa Power Generating Inc. (APGI) is the licensee for the Yadkin Hydroelectric Project. The
Yadkin Project is currently licensed by the Federal Energy Regulatory Commission (FERC) as
Project No. 2197. This license expires in 2008 and APGI must file a new license application
with FERC on or before April 30, 2006 to continue operation of the Project.

The Yadkin Project consists of four reservoirs, dams, and powerhouses (High Rock, Tuckertown,
Narrows, and Falls) located on a 38-mile stretch of the Yadkin River in central North Carolina.
The Project generates electricity to support the power needs of Alcoa's Badin Works, to support
its other aluminum operations, or is sold on the open market.

As part of the relicensing process, APGI prepared and distributed, in September 2002, an Initial
Consultation Document (ICD), which provides a general overview of the Project. Agencies,
municipalities, non-governmental organizations and members of the public were given an
opportunity to review the ICD and identify information and studies that are needed to address
relicensing issues.   To further assist in the identification of issues and data/study needs, APGI
has formed several Issue Advisory Groups (IAGs) to advise APGI on resource issues throughout
the relicensing process. IAGs have the opportunity to review and comment on Study Plans. A
Draft Study Plan was developed in response to comments on the ICD and through discussions
with the Fish and Aquatics IAG, to provide additional necessary information for consideration in
the relicensing process. This Final Study Plan reflects comments received from IAG members
on the Draft.

Issues

The following issues were raised during initial consultation and through discussions with the
Fish and Aquatics IAG regarding Habitat Fragmentation at the Yadkin Project:

- Effects of Yadkin Project dams, reservoirs and operations on habitat fragmentation
  and population isolation of aquatic biota.

At the April 9, 2003 Fish and Aquatics IAG meeting, Yadkin and participants discussed the
potential scope for the Habitat Fragmentation study. It was agreed that the participants should
review the Habitat Fragmentation report written for the Tapoco Project relicensing and use this
study to help focus efforts at the Yadkin Project. It was also agreed that in the interim, NAI
would begin completing some Phase 1 fragmentation work and this included mapping the
locations of rare, threatened and endangered (RTE) fish, crayfish and mussel species in the
Yadkin River basin using existing data. At the February 3, 2004 IAG meeting, NAI distributed a
report entitled Yadkin River RTE Species Maps. This report mapped the occurrence of RTE
mussel, fish and crayfish species within the Yadkin-Pee Dee River Basin using a large data base

provided by NCWRC. This data base included observation data collected by NCWRC, NCDOT, contractors and other state agencies between 1987 and 2002. After a brief discussion about the report, agency IAG participants agreed that they would review the RTE species maps in the report and then meet amongst themselves to discuss the next steps needed to refine the fragmentation study. Agency IAG members from NCWRC and USFWS met on 29 March 2004 to discuss how they wanted the Habitat Fragmentation study to proceed. Following the meeting, they drafted a memorandum dated 12 April 2004 that described the information they felt was needed to complete the fragmentation study (Attachment 1). The memorandum outlined four tasks, which are summarized below;

1. List of fish, mussel, crayfish and snail species (RTE & common species) in the basin using existing data bases and recently collected data from surveys conducted by APGI and Progress Energy; use local experts for opinions on historic ranges and to review existing data. Summarize the data in GIS layers.

2. A review of the causes of habitat fragmentation and what species or types of species are usually affected by each cause. Typical causes include dams, reservoirs, water quality (temperature, dissolved oxygen, sediment, NPDES discharges, natural barriers, level III ecoregion breaks, flow regime alterations and other changes to the watershed (changes in woody debris cycling). Summarize the data in GIS layers.

3. A comparison of species distributions and possible causes of fragmentation. This should include life history information on affected species to determine if they can benefit from various mitigation measures. This would include general habitat use requirements such as mainstem vs. tributary, distance of spawning, other migration movements (diadromous, anadromous) and habitat requirements (benthic, floodplain, etc.).

4. An assessment of possible mitigation measures within the watershed, including dam removal, fishways (ladders, natural channels, lower reservoir levels), stream restoration, assistance with waste water upgrades, land and river protection (buffers, land acquisition), gravel enhancement, translocation of genetic material, future monitoring, altered flow regime and public education.

The agencies' 12 April 2004 habitat fragmentation memorandum was discussed in detail at the May, 2004 Fish and Aquatics IAG meeting. It was agreed by the IAG members that Normandeau would prepare a study plan that focused on tasks 1 and 2 of memorandum (see above) and once this data was summarized in a GIS format, the IAG would reconvene to discuss the results and the next steps outlined in tasks 3 and 4 above.

A draft study plan was distributed to the IAG for review and comment in August, 2004. Comments on the draft were received from the North Carolina Wildlife Resources Commission (Todd Ewing, email dated 9/1/04) and the High Rock Lake Association (Larry Jones, email dated 8/9/04). In their comments, NCWRC requested that the study plan be modified to utilize ecoregion level IV instead of level III. This change has been made in the final study plan. HRLA expressed concern about the "reason and/or intent" of the study. More specifically, HRLA indicated that it was concerned with any suggestion that "six major hydro-electric project….be abandoned in an effort to re-create the landscape, fisheries and wildlife patterns as they existed 100 years ago". To address this comment, modifications have been made to

"Objectives" section of the final study plan to clarify the purpose of the study. Consideration of abandonment (or major alteration) to the Yadkin Project dams for purposes of recreating habitat conditions in the watershed that existed 100 years ago is not one of the objectives of the study. Moreover, FERC has made it clear that in the relicensing process, "existing conditions" is the baseline that is to be used for evaluating the ongoing affects of the Yadkin Project or its operations.

Objectives

The purpose of the study is to identify differences in the historic and current distributions of certain aquatic species in tributaries to the Yadkin Project reservoirs and to identify possible causes for any observed changes in species distribution. Over the course of discussions at the 04 May, 2004 IAG meeting the following specific objectives were identified for the habitat fragmentation study.

- Map in GIS layers the existing databases for fish, mussel, crayfish and snail species found in the Yadkin Project watershed that may be fragmented – include recent data collected by APGI at the Project
- Enlist the assistance (voluntary or paid) of local experts with experience on fish, mussel, crayfish and snail populations in the region to get information on historic ranges (if such data exists), provide data on current species ranges if not found in existing data bases, and to review/edit the GIS maps once compiled.
- Review the potential causes of any observed habitat fragmentation and the species or type of species that are usually affected by each cause.
- Map in GIS format the causes of habitat fragmentation, such as locations of dams, reservoirs, water quality (temperature, dissolved oxygen, sediment, NPDES discharges, natural barriers, level IV ecoregion breaks, flow regime alterations and other changes to the watershed (e.g., changes to large woody debris cycling.

It was also agreed at the 04 May, 2004 IAG meeting that this investigation would focus on portions of the watershed that are potentially affected by the Yadkin Project dams and reservoirs (primarily tributaries to the Yadkin Project reservoirs). Portions of the watershed that lie downstream of the Yadkin Project would not be included in the study or the evaluation of fragmentation effects. Others would be responsible for collecting similar information and conducting similar analysis on the portion of the watershed that lies downstream of Falls Dam.

Methods

Normandeau will compile existing data on locations of fish, mussel, crayfish and snail species collected in the Yadkin River basin that are potentially affected by habitat fragmentation. This data will be combined with the Yadkin River rare, threatened and endangered (RTE) data set that was previously mapped and distributed to the Fish and Aquatics IAG in February, 2004. Data for this effort will be compiled using existing data, such as NCWRC's large data set that has records primarily for fish and mussel species collected in the Yadkin basin. Other sources for data will include (but not be limited to) aquatic biota collected by APGI and Progress Energy on the Yadkin River during the recent relicensing efforts, agency files, historical records provided

by experts (if such records exist) and from published sources. Once the data has been compiled, a list of species featured in this spatial analysis will be reviewed by taxon experts. The following taxon experts have agreed to assist with this study:

Fish   Mr. Wayne C. Starnes, Ph.D., Research Curator of Fishes
             North Carolina State Museum of Natural Resources, Raleigh, NC

Mussels   Mr. Arthur Bogan, Ph.D., Curator of Aquatic Invertebrates
             North Carolina State Museum of Natural Resources, Raleigh, NC

Crayfish   Mr. John E. Cooper, Ph.D., Curator of Crustaceans
             North Carolina State Museum of Natural Resources, Raleigh, NC

Snails   Mr. Robert Dillon, Ph.D.
             Department of Biology, College of Charleston
             Charleston, SC

A large data set of aquatic biota collected in the Yadkin basin and compiled by NCWRC exists, but it primarily has data on fish and mussel species captured in the Yadkin basin since 1987. Data on snails and crayfish in the Yadkin basin are less extensive and therefore the taxon experts for these species will assist in compiling data sources from their files, research studies and other published sources. Recent data collected by APGI during the relicensing studies will also be included in each taxon's data set. Once data has been compiled and reviewed/edited by the taxon experts, GIS data layers (in Arc View format) will be created with the data and maps will be made and presented in three formats for the IAG – color hard copies, electronic map image files and an interactive GIS map project to allow user-defined selection of map features.

Potential causes of habitat fragmentation will be summarized in the report and those species susceptible to their effects will be identified. Data will include areas affected by natural, general anthropogenic and APGI project related causes, such as dams, reservoirs, water quality, NPDES discharges, Level IV ecoregion breaks, flow regime alterations and agricultural land use. Compiled data will be integrated into species and fragmentation source GIS layers with defined symbology for easy interpretation. Information summarized into GIS layers will be plotted on a map covering the Yadkin-Pee Dee River basin for all those species susceptible to habitat fragmentation caused by previously identified sources. Species distribution will be presented by species or species group, based on their life histories, on a map of all relevant sources of habitat fragmentation. Data can be displayed for comparison of the spatial distribution of aquatic species and their potential causes of fragmentation. Individual species or species group distribution maps will be created as color hard copies and electronic image files. In addition, a simple GIS application will be included for the user to install and view the GIS product interactively.

Reporting

Results of this evaluation will be reported in draft and final study reports. A draft study report that includes the maps on CD will be prepared and distributed to the Fish and Aquatics IAG for review and comment in the 1st quarter of 2005. IAG comments will be addressed in a final study report.

Attachment 1

To: Wendy Bley, Longview Associates

From: Todd Ewing, North Carolina Wildlife Resources Commission

Re: Habitat Fragmentation Study

4/12/2004

On March 29, 2004 staff from the North Carolina Wildlife Resources Commission and the United States Fish and Wildlife Service met to discuss how we thought the Habitat Fragmentation study to proceed. The following summarizes the information we feel is needed.

1) Lists of species in the basin that may be fragmented. Start with recent databases of fish, mussels, crayfish and snails. Add expert opinion on historic ranges of each taxa.   Possible experts include Wayne Starnes (fish), Art Bogan (mussels), John Cooper (crayfish), and Rob Dillon (freshwater snails). Also, add any data collected from the 2004 field surveys being conducted by APGI and Progress Energy as listed in Table 1 of the Yadkin River RTE Species Maps document. Summarize in GIS data layers.

2) A review of causes of habitat fragmentation and what species or types of species are usually affected by each cause. Typical causes include dams, reservoirs, water quality (temperature, dissolved oxygen, sediment, NPDES discharges (particularly chlorine and ammonia), etc.), natural barriers, level III ecoregion breaks, flow regime alterations, other changes to the watershed (e.g., changes to large woody debris cycling). Summarize in GIS data layers.

The above information should be compiled in a GIS data layers to facilitate the comparison of this information with the RTE species distribution data layers.

3) A comparison of the species distributions and possible causes. This step also should include information on the life history of each species to determine if they are liable to benefit from various mitigation measures. This would include such things as general habitat use (mainstem vs tributary), distance of spawning or other migration movements (e.g., diadromous, long, short), habitat requirements (benthic, floodplain, etc.)

4) An assessment of possible mitigation measures within the watershed including dam removal, fishways (ladders, natural channels, lower reservoir levels, etc.), stream restoration, assistance with waste water upgrades, land and river protection (buffers, land acquisition), gravel enhancement, translocation of genetic material, future monitoring, altered flow regime, and public education.