Study Plan

Study Plan Name: Macrobenthic Survey Study **Plan Designation:** Aquatics 07

Study Description: Describe the aquatic macroinvertebrate assemblages associated with the Catawba-Wateree hydro projects and evaluate any potential project-related impacts

Applicable Hydro projects/Developments: portions of all developments

Prerequisite Study Designation: none

The purpose of this document is to describe the study scope, methodology and uses for the results. Previous versions of the study scope document have been reviewed and discussed by the resource agencies and other members of the Aquatics Resource Committee or Study Team and based on these discussions appropriate methodologies have been added. This document is intended to be the final Study Plan for Aquatics 07.

I. Study Objective

The study objective is to provide basic information about hydro-related macrobenthic communities and evaluate any potential project-related effects on macrobenthic resources.

II. Basis

The bases for this study are contained in 18CFR4.51 and 18CFR4.61 under basic information requirements for the identification of project-related fish and wildlife resources relative to the identification of macrobenthic resources.

III. Geographic and Temporal Scope

Surveys will be conducted in the following areas (listed from North to South):

North Carolina	South Carolina
Lake James Headwaters-Cat. R., North Fork, Linville R.	Lake Wylie tailwater*
Lake James-Paddy Creek bypass	Fishing Creek tailwater
Lake James-old Catawba River channel	Fishing Creek bypass
Lake James- Bridgewater Hydro tailwater*	Great Falls/Dearborn tailwater
Johns River	Rocky Creek/Cedar Creek tailwater
Lake Rhodhiss tailwater	Lake Wateree tailwater*
Middle Little River	
Oxford Hydro tailwater*	
Lower Little River	
Lookout Shoals tailwater	
Cowan's Ford tailwater	
Mt. Island tailwater	
South Fork Catawba River	

* Will be sampled using both Methodology 1 and 2 as described in Section V. below.

IV. Summary of Existing Data

Two studies of the Lake Wylie and the Lake Wateree tailrace macroinvertebrate communities (Duke Power; 1989, 1990) indicate a water classification of 'poor' near the dam and 'fair' downstream.

V. Methodology

Two methods of assessing macroinvertebrate communities will be deployed:

1. Macroinvertebrate Bioassessment Sampling

Aquatic macroinvertebrate bioassessment sampling will be conducted during the period of greatest stress to the organisms (July/August) in 2004 at selected locations. One sample will be collected as close to the dam as practicable (within approximately one to two kilometers [km]), and another sample will be taken approximately three to five kilometers downstream of the dam. Actual sampling locations will be determined on the basis of water depth, habitat, accessibility, and safety of field crews.

The protocol detailed in Standard Operating Procedures for Benthic Macroinvertebrates developed by the North Carolina Division of Water Quality (NCDENR, 2003) will be used in the collection of bioassessment samples. This protocol involves the following sampling methods:

Kick Net (Two collections)

A kick net consists of a double layer of flexible netting held in place between two wooden poles. The net is positioned upright on the stream bed, while the area upstream is physically disrupted using feet and/or hands. Two kick net samples will be taken from riffle areas of differing current speed. In sandy areas lacking riffles, kicks will be taken from root masses, snags, or bank areas. The debris and organisms collected in the kick net will be washed down into a sieve bucket with a U.S. Standard No. 30 mesh (0.600 micron opening) bottom, and larger leaves and debris will be removed. All types of benthic macroinvertebrates are collected by this sampling device, but emphasis is placed on Ephemeroptera, Plecoptera and Trichoptera.

Sweep Net (Three collections)

A long-handled triangular sweep net will be used to collect three samples by physically disrupting an area and then vigorously sweeping through the disturbed area. Sweep net samples are usually taken from streambank areas, including mud banks and root masses, and macrophyte beds. Streambank samples are particularly important for the collection of "edge" species which prefer low current environments. Chironomini (red chironomids), Oligochaeta, Odonata, mobile cased Trichoptera, Sialis, Crustacea, and certain Ephemeroptera are typically collected in these samples. A sweep net also may be used to sample gravel riffle areas where stone-cased Trichoptera may be abundant.

Fine-Mesh Sampler (Two collections)

A fine-mesh sampler will be used to collect smaller invertebrates (especially Chironomidae). The sampler is constructed of fine nitex mesh (300 microns) placed between four inch PVC pipe fittings that are designed to screw together. Rocks or logs will be washed down in a large plastic tub partially filled with water. Rocks which have visible growths of periphyton, Podostemum, or moss will be selected when possible. Any large particulate material (leaves, etc.) will be washed

down and discarded. A single composite sample can be made from several (usually 10-15) rocks and/or logs. The material remaining in the tub will be poured through the fine mesh sampler, the water allowed to drain out, and the residue will be preserved in 95% ethanol. The samplers will be rinsed between sites. This technique may also be used to collect fast-moving organisms (such as baetid mayflies or amphipods) or small grazing taxa (such as hydroptilid caddisflies). The "pour-and-preserve" technique may also used in conjunction with sand samples (see below).

Sand Sample (One collection)
Sandy substrates (in areas with definite flow, if possible) will be sampled with a large bag constructed of fine mesh (300 microns) nitex netting. This bag is employed in similar fashion to a Surber sampler, with the bag held open near the substrate with a foot holding the bag on the sand, and the sand immediately upstream of the net vigorously disturbed by the collector. The material collected (typically sand and a few organisms) will be emptied into a large plastic container half-filled with water. The "stir and pour" elutriation technique described above will be used in conjunction with the fine mesh sampler. Organisms typically found in sand samples may include small Chironomidae (Cryptochironomus, Robackia, Rheosmittia, Harnischia group, Polypedilum), oligochaetes, and Baetidae. The sand remaining in the large container may be picked quickly for large or heavy organisms such as Gomphidae or Corbicula.

Leaf Pack Sample (One collection)
Leaf-packs, sticks, and small logs will be washed down in a sieve bucket with a U.S. Standard No. 30 sieve (0.600 mm openings) bottom, and then discarded. When practicable three to four leaf packs will be collected from rocks or snags in fast current areas. The best leaf packs consist of older leaves (not freshly fallen) that have begun to decay. "Shredder" organisms (such as Tipulidae, Plecoptera, and Trichoptera) are usually collected in leaf pack samples.

Visual Search (One collection)
Visual inspection of large rocks and logs will be conducted at each sampling location. Large rocks and logs are often preferred macroinvertebrate microhabitats, because of their stability during floods. Rocks and logs in pools often yield additional species, as this habitat is not well sampled by either kicks or sweeps. Rock surfaces may also provide specialized microhabitats for a variety of characteristic caddisfly taxa. During sampling efforts, decaying logs will be picked apart to look for chironomids (anticipating the presence of many taxa beneath loose bark). Rocks near the shore (in negligible current areas) may harbor taxa such as Stenacron and Pycnopsyche, and leaves near the shore may be the primary habitat for some Gastropoda. The sides of rocks are the best place to look for the caddisflies Neophylax, Psilotreta and Agarodes. Polycentropodid caddisflies build funnel-shaped silken retreats (up to six inches in length) in areas of relatively slow current.

Samples will be sorted in the field when possible and preserved with 95% ethanol and returned to the laboratory for identification. If weather, hydro operations, or other factors make it unfeasible to sort in the field then the samples will be preserved with 95% ethanol and returned to the laboratory where organisms will be sorted from the debris and identified. Organisms will be picked roughly in proportion to their abundance, but no attempt will be made to remove all organisms. Some organisms will not be picked, even if found in the samples. These include colonial species (Bryozoa, Porifera), Nematoda, Collembola, semiaquatic Coleoptera, and all Hemiptera (except Naucoridae, Belostomatidae, Corixidae, and Nepidae). These are not picked

either because abundance is difficult to quantify or because they are most often found on the water surface (or on the streambanks) or are not truly benthic. The Hemipteran families that are included can spend long periods below the water surface. Approximately ten minutes will be allocated for visual searches.

Following collection and identification efforts, bioclassifications will be assigned to the samples. A water quality bioclassification is assigned based on two metrics. One score is assigned based on the total number of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) (EPT) taxa in a sample. The second metric is based on relative tolerance and abundance of each species to water pollution. The most sensitive species are those of the EPT taxa. In terms of species tolerance, the classification system uses a rating called the Biotic Index (BI). The Biotic Index is derived by assigning tolerance values to aquatic insect species and then summing the individual species tolerance values, multiplying by that species abundance, and then dividing the overall sum by the sum of the abundance values. Species with a low tolerance to pollution have a low score and conversely more tolerant species have a higher score; therefore the lower the Biotic Index number the better the water quality. The two metrics (EPT taxa and the Biotic Index) are used to derive the bioclassification for each particular stream reach. Sampling will take place in July/August 2004 because summer generally represents a high-stress period (i.e., high temperatures and low flow) for aquatic insects, and thus a time that any project-related effects would have the highest probability of occurring.
Temperature and dissolved oxygen measurements will be made at all sampling locations. In addition, qualitative sampling for crayfish, snails, and mussels will be conducted in the same general areas as the EPT surveys. This occurrence data will be combined with similar type information collected while conducting the mussel surveys as outlined in Aquatics 06.

2. Quantitative macroinvertebrate sampling

Variations in hydro releases can result in variations in the depth of the water downstream of a hydroelectric dam potentially impacting macroinvertebrate communities. Although several scientific papers have previously reported this observation, a second goal of Aquatics 07 is to quantify abundance and biomass, including addressing any downstream population gradients, in the invertebrate communities below Bridgewater, Oxford, and Lake Wylie dams (The Wateree hydro was initially consider as another possible quantitative sample site, but due to the mandatory ~mid-March thru May continual water releases required for diadromous fish migration, the water release regime did not lend itself to this sampling). A site on the Dan River near Danbury, NC, suggested by NCDWR, was selected as a sample site on a relatively unregulated stream in which to compare the hydro tailwater data.
Aquatic invertebrates will be sampled at three riffles downstream of each hydroelectric dam whenever practicable. If three riffles are not available (e.g., the next downstream reservoir has inundated riffle areas) then available riffles will be sampled. Sampling will be conducted once in the April/May timeframe and once in the July/August timeperiod of 2004, to obtain estimates of abundance at the two times of the year where densities might be expected to be at the maximum (spring) and the minimum (summer). When possible, riffles will be sampled at distances downstream of each dam that will facilitate observation of effects and/or recovery patterns associated with the hydroelectric operations. At each riffle, transects will be established across the upstream, middle, and downstream segment of the riffle. Two sample locations will be randomly selected along each transect, resulting in six samples at each riffle. A Surber sampler

(0.1 m^2; 1000 micron mesh) will be placed on the substrate of each location and the substrate disturbed to ~7 cm; all rocks will then be scrubbed. Samples will be preserved in 70% ethanol and will be returned to the laboratory for sorting and identification to family level (oligochaetes will be pooled as oligochaetes). Data from the six riffle samples will be pooled in order to calculate a richness index using Margalef's Index of Richness: D = (S-1)/ln N

where D = richness,
S = the number of families represented,
and N = the total number of individuals collected (Browner and Zar, 1977).

Mean abundance and standard errors for all invertebrates will be calculated for each site. The total abundance of EPT taxa will also analyzed, as an indicator of insects that are sensitive to water quality and habitat conditions (Barbour et al. 1999).

All applicable QA/QC procedures and standards will be used for both field and laboratory procedures per the North Carolina and South Carolina Laboratory Certification requirements and Duke Power Company internal procedures. Sub-sampling may be deployed in instances where Surber samples are replete invertebrates and numbers exceed a pre-determined number. Any work performed by personnel outside of Duke Power will be conducted by a certified laboratory.

The field work will be overseen by a Duke Power scientist. The Duke person will actively participate in the field collections and will provide direct oversight and guidance to the consultant field personnel. The logistics, field equipment, sampling protocol, labeling of samples, and chain of custody of samples will all be approved by the Duke Power scientist. Regulatory agencies will be informed of the field-sampling dates and invited to attend.

VI. Schedules and Required Conditions

The bioassessment samples will be collected during July/August of 2004 and the quantitative sampling will be conducted in both the April/May and July/August timeperiods. The field work will be completed by late August 2004. The identification of collections will be completed in early December 2004, and the final report will be completed by mid-February 2005.

VII. Use of Study Results

The results of this study will be used to describe the aquatic insect assemblages associated with the respective hydro projects and to evaluate any potential project-related impacts to those resources.

VIII. Study Participants

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IX. List of Attachments

None

X. List of References

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