

**A BIOLOGICAL SURVEY FOR  
PLANT COMMUNITIES, WETLANDS, AND RARE PLANTS  
ASSOCIATED WITH THE  
DUKE POWER – NANTAHALA AREA  
RELICENSING PROJECT AREA**

**MACON, JACKSON, AND SWAIN COUNTIES  
NORTH CAROLINA**

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**Prepared For:  
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## EXECUTIVE SUMMARY

Duke Power-Nantahala Area is in the process of relicensing several hydroelectric power projects with the Federal Energy Regulatory Commission (FERC). These power projects are associated with the Duke Power facilities in western North Carolina. Duke Power is a division of the Duke Energy Corporation.

Due to the FERC requirements for relicensing hydroelectric generation projects, the compliance of environmental protection requirements, agency recommendations, and requirements associated with Section 7 of the Endangered Species Act (16 U.S.C. 1531 *et seq.*), Duke Power- Nantahala Area contracted with the firm *terra incognita* represented by Dr. L.L. Gaddy to conduct surveys for plant PETS (Proposed Endangered Threatened Sensitive) species. All plant PETS species determined to be within or immediately adjacent to the FERC project boundaries in Jackson, Macon, and Swain Counties were to be surveyed.

The objective of this botanical study is to characterize suitable habitat within project boundaries for use by PETS plant species noted by the pertinent agencies [U.S. Fish and Wildlife Service (USFWS), the North Carolina Department of Parks and Recreation (Natural Heritage Program) and the U.S. Forest Service (USFS)], determine actual occurrence of the species in the project area, document the natural communities and wetlands found in the project area, and evaluate the extent of any potential project-related impacts on these resources.

Duke Power-Nantahala Area plans to relicense eight hydroelectric sites that include 12 project areas. The 12 project areas are found in the Blue Ridge province of North Carolina in Macon, Jackson, and Swain counties. All projects are included within the drainage of the Tennessee River system and include sites on the Hiwassee, Nantahala, Tuckasegee, Little Tennessee, and Oconaluftee rivers. All projects are found in mountainous terrain, project elevations ranging from just over 1,650 feet to just under 3,500 feet. The study areas include: 1) Nantahala Lake (FERC No. 2692) (including all surrounding areas); 2) Glenville Lake (FERC No. 2686); 3) Bear Creek Lake (FERC No. 2698); 4) Cedar Cliff Lake (FERC No. 2698); 5) Wolf Creek Lake (FERC No. 2698); 6) Tennessee Lake (FERC No. 2698); 7) Tuckasegee Lake (Little Glenville Lake) (FERC No. 2686); 8) Dillsboro Lake (FERC No. 2602); 9) Bryson (Ela) Lake (FERC No. 2601); 10) Franklin (Lake Emory) (FERC No. 2603); 11) Mission Lake (FERC No. 2619); and 12) Bonas Defeat/Wolf Creek Gorge (FERC No. 2698).

Thirteen major plant community types were documented within Duke Power-Nantahala Area hydroelectric project areas. The Bonas Defeat/Wolf Creek Gorge area and the greater Nantahala Lake area harbored the most plant community types. As one would expect, these two areas have the greatest floristic diversity and the greatest number of state- and federally-listed plant species. The Pine-Oak/Heath, the Acidic Cove Forest, the Canada Hemlock Forest, the Sand and Mud Bar, and the Southern Appalachian Bog communities were the most commonly-encountered types within the study areas. The Spray Cliff type was common in gorges and in riverine areas. The Penstock Right-of-

Way type, a managed grassland type, was associated with the Nantahala Lake and upslope from the Wolf Creek/Bonas Defeat project areas.

Most of the total acreage of the eight project areas was the open water of reservoirs and the littoral wetlands associated with the open water. Wetlands associated with streams, rivers, and lake margins (Montane Alluvial Forest, Sand and Mud Bar, and Rocky Bar and Shore) can be classified as palustrine, intermittently flooded. Wetlands such as the Southern Appalachian Bog type and the Spray Cliff are palustrine, saturated (see Cowardin et al., 1979 and Schafale and Weakley, 1990). Some lakes such as Wolf Creek Lake have steep shores and dramatic fluctuations in water levels and, therefore, harbor no significant emergent wetlands. On the shores of Nantahala Lake and Glenville Lake where significant fluctuations in water level also occur, an unusual wetland community dominated by stiff dogwood (*Cornus amomum*) is found. Here, pure stands of the dogwood attach themselves to the banks, their stems drooping over during low water and floating upright during high water.

Data from previous studies of Duke Power-Nantahala Area wetlands, along with the fieldwork in 2001, indicate that over 135 species of vascular plants are found in the wetlands of the 11 major Duke Power Nantahala Area study areas. Lake Emory had the greatest wetland species richness with 84 species due to its extensive marshes. Nantahala Lake and its associated wetlands had 79 species of plants. Three uncommon species—rose milkweed (*Asclepias purpurascens*), rough sedge (*Carex scabrata*), and creeping spikerush (*Eleocharis palustris*)—and one federally-listed species—Virginia spiraea (*Spiraea virginiana*)—occurred within the wetlands of the Duke Power-Nantahala areas.

One hundred and twenty species of endangered, threatened, or otherwise noteworthy plant species potentially-occur within the 12 Duke Power-Nantahala Area. Of the 120 potentially-occurring species, 70 species are ferns, mosses, lichens, liverworts, or hornworts and the other 50 were vascular plants. Thirty eight species are known to occur or have historically occurred within the 12 project areas. Thirteen of these species were observed in the project areas in 2001 during this investigation (see Tables 2 and 3).

## 1.0 INTRODUCTION

Duke Power-Nantahala Area is currently in the process of relicensing several hydroelectric power projects with the Federal Energy Regulatory Commission (FERC). These power projects are associated with the Duke Power facilities in western North Carolina. Duke Power is a division of the Duke Energy Corporation.

Due to the FERC requirements for relicensing hydroelectric generation projects, the compliance of environmental protection requirements, agency recommendations, and requirements associated with Section 7 of the Endangered Species Act (16 U.S.C. 1531 *et seq.*), Duke Power-Nantahala Area contracted with the firm *terra incognita* represented by Dr. L.L. Gaddy to conduct surveys for plant PETS (Proposed Endangered Threatened Sensitive) species. All plant PETS species determined to be within or immediately adjacent to the FERC project boundaries in Jackson, Macon, and Swain Counties were to be surveyed. Surveys were associated with: 1) Nantahala Lake (FERC No. 2692) (including all surrounding areas); 2) Glenville Lake (FERC No. 2686); 3) Bear Creek Lake (FERC No. 2698); 4) Cedar Cliff Lake (FERC No. 2698); 5) Wolf Creek Lake (FERC No. 2698); 6) Tennessee Lake (FERC No. 2698); 7) Tuckasegee Lake (Little Glenville Lake) (FERC No. 2686); 8) Dillsboro Lake (FERC No. 2602); 9) Bryson (Ela) Lake (FERC No. 2601); 10) Franklin (Lake Emory) (FERC No. 2603); 11) Mission Lake (FERC No. 2619); and 12) Bonas Defeat/Wolf Creek Gorge (FERC No. 2698).

The objective of this botanical study, is to characterize suitable habitat within project boundaries for use by PETS plant species noted by the U.S. Fish and Wildlife Service (USFWS), U.S. Forest Service (USFS), and the NC Department of Parks and Recreation (Natural Heritage Program), determine actual occurrence of the species in the project area, document the natural communities and wetlands found in the project area, and evaluate the extent of any potential project-related impacts on these resources.

This report includes the results of botanical inventories of 12 Duke Power-Nantahala Area projects in the process of being relicensed. The inventories, conducted in 2001 and 2002, concentrated on plant communities, wetlands, and rare plants that occurred or potentially-occurred within the 12 project areas and their immediate environments.

## 2.0 STUDY AREA

Duke Power-Nantahala Area plans to relicense eight hydroelectric sites that include 12 project areas in the next few years. The 12 project areas are found in the Blue Ridge province of North Carolina in Macon, Jackson, and Swain counties. All projects are included within the drainage of the Tennessee River system and include sites on the Hiwassee, Nantahala, Tuckasegee, Little Tennessee, and Oconaluftee rivers. All projects are found in mountainous terrain, project elevations ranging from just over 1,650 feet to just under 3,500 feet. Because the 12 projects are hydroelectric projects, the majority of the project study areas were lakes, riverbeds, river floodplains, or gorges. Below, the projects are briefly described.

- 1) **Dillsboro Project (FERC No. 2602).** The Dillsboro project is found on the Tuckasegee River in Jackson County. It includes Dillsboro Dam and Reservoir.
- 2) **Bryson Project (FERC No. 2601).** The Bryson project is located on the Oconaluftee River in Swain County. It includes Ela Dam and Reservoir.
- 3) **Franklin Project (FERC No. 2603).** The Franklin project is found on the Little Tennessee River in Macon County. This project includes Emory Dam and Reservoir.
- 4) **Mission Project (FERC No. 2619).** The Mission project is located in Clay County on the Hiwassee River. It includes Mission Dam and Reservoir.
- 5) **East Fork Project (FERC No. 2698).** The East Fork project is found on the East Fork of the Tuckasegee River. It includes four sites—
  - a) Tennessee Dam and Reservoir,
  - b) Wolf Creek Dam and Reservoir,
  - c) Bear Creek Dam and Reservoir, and
  - d) Cedar Cliff Dam and Reservoir.In addition to these four sites, an extensive area bordering Wolf Creek and the Tuckasegee River between Tennessee Dam, Wolf Creek Dam, and the headwaters of Bear Creek Reservoir—referred to here as Bonas Defeat/Wolf Creek Gorge—is included in the East Fork project area.
- 6) **West Fork Project (FERC 2686).** The West Fork project is found on the West Fork of the Tuckasegee River. It includes two sites—
  - a) Glenville Lake and
  - b) Tuckasegee Dam and Reservoir (“Little Glenville Reservoir”).
- 7) **Nantahala Project (FERC No. 2692).** The Nantahala project is found in Macon County on the Nantahala River and its tributaries. It consists of four sites—
  - a) Nantahala Dam and Reservoir,
  - b) Dicks Creek Dam and Diversion Pond,
  - c) Whiteoak Dam and Diversion Pond, and
  - d) Diamond Valley Dam and Diversion Pond.
- 8) This project includes a considerable amount of land up the Nantahala River from the Nantahala Reservoir and land below the Nantahala Dam, in addition to several above-ground pipes (penstocks) associated with the Dicks Creek, Diamond Valley, and Whiteoak sites.

In summary, there are twelve study areas where detailed botanical field investigations were carried out. These study areas include:

- Nantahala Lake (including all surrounding areas);
- Glenville Lake;
- Bear Creek Lake;
- Cedar Cliff Lake;
- Wolf Creek Lake;
- Tennessee Lake;
- Tuckasegee Lake (Little Glenville Lake);
- Dillsboro Lake;
- Bryson (Ela) Lake;
- Franklin (Lake Emory);
- Mission Lake; and
- Bonas Defeat/Wolf Creek Gorge

### 3.0 SURVEY METHODS

In the winter of 2000, a request was made to the North Carolina Natural Heritage Program for all element occurrence data (field records) for state- and federally-listed vascular and non-vascular (mosses, lichens, and liverworts) plants and plant communities from the project areas. From the Heritage data, infrared photographs of the project areas, and general knowledge of southern Appalachian ecology, a table of community types [using community terminology from Schafale and Weakley (1990)] occurring within project boundaries of the eight projects was compiled (Table 1).

From the Heritage Program data, U.S. Fish and Wildlife Service county lists, and the principal investigator's knowledge of species/community relationships, a list of potentially-occurring endangered, threatened, and otherwise noteworthy plant species was compiled in the spring of 2001 (Table 2). During the endangered species fieldwork, habitat/community data from Table 2 was used to determine the potential for species to occur in a given plant community or habitat type.

Fieldwork began in early April 2001 and continued into October for all the vascular plants. The bryophyte and liverwort survey within the Bonas Defeat/Wolf Creek Gorge area is to be conducted in the spring of 2002. A Virginia spiraea survey will also be conducted in the spring of 2002. All habitats in each project area were searched for the listed species mentioned in Table 3. Penstock areas, gorges, and coves were inventoried on foot; lake margins, dams, and river channels were surveyed by canoe and motorboat. Special intensive botanical inventories of Bonas Defeat/Wolf Creek Gorge are to be carried out because of the known richness of rare plants at these sites. A bryophyte survey of the Bonas Defeat/Wolf Creek Gorge area is to be conducted by Dr. Paul Davison of the University of North Alabama and Dr. David Smith of the University of Tennessee. The results of the bryophyte and spiraea surveys will be presented in the summer of 2002. An inventory of penstock rights-of-way within the Duke Power-Nantahala area was conducted to determine the abundance of exotic species. Finally, a master species list was compiled for all the relicensing project areas (Table 3).

**Table 1. Plant communities and their occurrence associated with the Duke Power - Nantahala Area Hydroelectric Relicensing Project.**

Community	Nantahala Lake	Lake Glenville	Bear Creek Lk.	Cedar Cliff Lk.	Wolf Creek Lk.	Tennessee Lake	Tuckasegee Lk.	Dillsboro Lake	Bryson (Ela) Lk,	Franklin (Emory) Lk.	Mission Lake	Wolf Creek/ Bonas Defeat
<b>Montane Acidic Cliff</b>			X	X	X							X
<b>Montane Mafic Cliff</b>				X								
<b>Pine-Oak/Heath Forest</b>	X	X	X	X	X	X						X
<b>Acidic Cove Forest</b>		X	X	X	X	X						X
<b>Rich Cove Forest</b>			X	X	X							X
<b>Canada Hemlock Forest</b>	X	X	X	X	X							X
<b>Carolina Hemlock Bluff</b>												X
<b>Montane Alluvial Forest</b>	X							X	X	X	X	
<b>Sand and Mud Bar</b>	X					X	X	X	X	X	X	X
<b>Rocky Bar and Shore</b>	X					X		X	X			X
<b>Southern Appalachian Bog (Southern Subtype)</b>	X					X	X	X	X	X	X	
<b>Spray Cliff</b>	X	X	X			X						X
<b>Penstock ROW (Managed Grassland)</b>	X											X

Community names taken from Schafale and Weakley (1990)

**Table 2. Known Federal and State Listed Plant Associated with the Duke Power - Nantahala Area Hydroelectric Relicensing Project.**

Scientific and Common Name	Status	Documented Location	Natural Community
<i>Acrobolbus ciliatus</i> (a liverwort)	SR	Tanassee Lake (H)	Spray Cliff?
<i>Adlumia fungosa</i> (climbing fumitory)	SR	--	Montane Acidic Cliff
<i>Amelanchier sanguinea</i> (round-leaved serviceberry)	C	--	Montane Acidic Cliff
<i>Aneura sharpii</i> (a liverwort)	C	--	Spray Cliff, Montane Acidic Cliff
<b><i>Asclepias purpurascens</i> (rose milkweed)</b>	U	<b>Lake Emory</b>	<b>Southern App. Bog</b>
<i>Asplenium pinnatifidum</i> (lobed spleenwort)	SR	--	Montane Acidic Cliff
<i>Asplenium resiliens</i> (black-stemmed spleenwort)	W1	Wolf Creek/Bonas Defeat (H)	Spray Cliff, Montane Acidic Cliff
<i>Aster shortii</i> (Short's aster)	SR	--	Montane Acidic Cliff
<i>Bartramidula wilsonii</i> (dwarfed apple moss)	SR	--	Spray Cliff
<i>Botrychium jenmanii</i> (Alabama grapefern)	SR	--	Rich Cove Forest
<i>Botrychium lanceolatum</i> var. <i>angustisegmentum</i> (lance-leaved moonwort)	SR	--	Rich Cove Forest
<i>Botrychium matricariifolium</i> (daisy-leaved grapefern)	SR	--	Rich Cove Forest
<i>Botrychium oneidense</i> (blunt-lobed grapefern)	C	--	Rich Cove Forest
<i>Brachymerium systylum</i> (Mexican melon-moss)	C	--	Rich Cove Forest
<i>Brachythecium roteanum</i> (Rota's feather moss)	SR	--	Rich Cove Forest
<i>Bryocrumia vivicolor</i> (Anderson's gorge moss)	E	--	Spray Cliff, Montane Acidic Cliff
<i>Bryoxiphium norvegicum</i> (sword moss)	SR	Wolf Creek; Bonas Defeat (H)	Spray Cliff, Montane Acidic Cliff
<i>Bryum riparium</i> (riverside bryum)	C	--	Spray Cliff
<i>Calamagrostis porteri</i> (Porter's reedgrass)	SR	--	Pine-Oak/Heath
<i>Calystegia catesbiana</i> ssp. <i>sericata</i> (Blue Ridge bindweed)	C	Thorpe (Glenville) Lake (H)	Open woodlands, Rich Cove Forest?
<i>Campanula aparinoides</i> (marsh bellflower)	SR	--	Southern App. Bog
<b><i>Cardamine flagellifera</i> (Blue Ridge bittercress)</b>	U	<b>Queens Creek Cove</b>	<b>Rich Cove Forest</b>
<b><i>Carex biltmoreana</i> (biltmore sedge)</b>	SR	<b>Bear Creek Lake</b>	<b>Montane Acidic Cliff</b>
<i>Carex cherokeeensis</i> (Cherokee sedge)	SR	--	Rich Cove Forest
<b><i>Carex leptonevia</i> (few-nerved sedge)</b>	C	<b>Queens Creek Cove</b>	<b>Rich Cove Forest</b>
<b><i>Carex manhartii</i> (manhart's sedge)</b>	U	<b>Queens Creek Cove</b>	<b>Rich Cove Forest</b>
<i>Carex projecta</i> (necklace sedge)	C	--	Southern App. Bog
<i>Carex ruthii</i> (Ruth's sedge)	W1	--	Southern App. Bog
<b><i>Carex scabrata</i> (rough sedge)</b>	U	<b>Nantahala Lake; Bonas Defeat</b>	<b>Southern App. Bog</b>
<b><i>Carex woodii</i> (pretty sedge)</b>	SR	<b>Nantahala Lake</b>	<b>Acidic Cove Forest</b>
<i>Cephalozia pleniceps</i> var. <i>caroliniana</i> (a liverwort)	C	--	Streambanks
<i>Cheilolejeunea evansii</i> (a liverwort)	PE	--	Tree bark; gorges
<i>Cheilolejeunea myriantha</i> (a liverwort)	SR	--	Tree bark; Pine-Oak/Heath

Duke Power-Nantahala Area Relicensing Plant Communities, Wetlands, and Rare Plants

Scientific and Common Name	Status	Documented Location	Natural Community
<i>Chelone cuthbertii</i> (Cuthbert's turtlehead)	SR	--	Southern App. Bog
<i>Chenopodium simplex</i> (giant seeded goosefoot)	SR	Bear Creek Lake (H)	Montane Acidic Cliff
<i>Chiloscyphus appalachianus</i> (a liverwort)	C	--	Spray Cliff
<i>Chiloscyphus muricatus</i> (a liverwort)	C	--	On rock and bark in gorges
<i>Cirriphyllum piliferum</i> (a moss)	SR	--	Spray Cliff
<i>Diarrhena americana</i> (eastern beakgrass)	SR	--	Rich Cove Forest
<i>Dichodontium pellucidum</i> (a moss)	SR	--	Spray Cliff
<i>Ditrichum ambiguum</i> (ambiguous ditrichum)	C	--	Montane Acidic Cliff
<i>Drepanolejeunea appalachiana</i> (a liverwort)	C	Bear Creek Lake	Spray Cliff?
<b><i>Eleocharis palustris</i> (creeping spikerush)</b>	U	<b>Lake Emory</b>	<b>Southern App. Bog</b>
<i>Entodon sullivantii</i> (Sullivant's entodon)	SR	--	Gorges; Rich Cove Forest
<i>Ephebe lanata</i> (a fruticose lichen)	SR	--	Spray Cliff; rocky streams
<i>Ephebe solida</i> (fruticose lichen)	SR	--	Spray Cliff; rocky streams
<i>Filipendula rubra</i> (Queen-of-the-prairie)	E	--	Southern App. Bog
<i>Frasera carolinensis</i> (columbo)	SR	--	Montane Mafic Cliff; Rich Cove Forest
<i>Glyceria laxa</i> (lax mannagrass)	SR	--	Southern App. Bog
<i>Gymnoderma lineare</i> (rock gnome lichen)	FE	Wolf Creek/Bonas Defeat (H)	Montane Acidic Cliff
<i>Helianthemum bicknellii</i> (plains sunrose)	C	--	Montane Acidic Cliff; Montane Mafic Cliff
<i>Helianthemum propinquum</i> (creeping sunrose)	C	--	Montane Acidic Cliff; Montane Mafic Cliff
<i>Helianthus glaucophyllus</i> (white-leaved sunflower)	W1	--	Rich Cove Forest
<i>Heterodermia appalachensis</i> (a foliose lichen)	SR	--	Rocks, bark in gorges; Rich Cove Forest
<b><i>Heuchera parviflora</i> (grotto alumroot)</b>	W1	<b>Bear Creek Lake; Wolf Creek; Bonas Defeat</b>	<b>Shaded grottoes; Montane Acidic Cliff</b>
<i>Hexalectris spicata</i> (crested coral-root)	SR	--	Rich Cove Forest
<i>Homalia trichomanoides</i> (lime homalia)	C	Tanassee Lake (H)	Montane Acidic Cliff; Spray Cliff
<i>Homaliadelphus sharpii</i> (Sharpe's homaliadelphus)	C	Bonas Defeat (H)	Montane Acidic Cliff
<i>Houstonia longifolia</i> var. <i>glabra</i> (granite dome bluet)	C	Bear Creek Lake (H)	Low Elevation Rocky Summit
<b><i>Huperzia porophila</i> (rock clubmoss)</b>	C	<b>Wolf Creek/Bonas Defeat</b>	<b>Spray Cliff</b>
<i>Hydrothyria venosa</i> (an aquatic lichen)	C	Wolf Creek (H)	Spray Cliff
<b><i>Hydrocotyle americana</i> (american pennywort)</b>	W7	<b>Wolf Creek/Bonas Defeat</b>	<b>Spray Cliff</b>
<i>Hygrohypnum closteri</i> (Closter's brook-hypnum)	SR	--	Rocks submerged in streams
<i>Hymenophyllum tayloriae</i> (gorge filmy fern)	PE	Wolf Creek (H)	Montane Acidic Cliff
<i>Isotria medeoloides</i> (small whorled pogonia)	T	--	Various Upland Communities
<i>Juglans cinerea</i> (white walnut)	W5	--	Rich Cove Forest
<i>Krigia montana</i> (mountain cynthia)	W1	Wolf Creek/Bonas Defeat (H)	Montane Acidic Cliff

Duke Power-Nantahala Area Relicensing Plant Communities, Wetlands, and Rare Plants

Scientific and Common Name	Status	Documented Location	Natural Community
<i>Lejeunea blomquistii</i> (a liverwort)	C	--	Spray Cliff
<i>Macrocoma sullivantii</i> (Sullivant's maned-moss)	SR	--	Tree bark
<i>Marsupella emarginata</i> var. <i>latiloba</i> (a liverwort)	C	--	Spray Cliff, Montane Acidic Cliff
<i>Megaceros aenigmaticus</i> (a hornwort)	C	--	On rocks in streams
<i>Monotropsis odorata</i> (pygmy-pipes)	C	--	Pine-Oak/Heath
<i>Mylia taylorii</i> (a liverwort)	SR	--	Spray Cliff, Montane Acidic Cliff
<i>Oenothera perennis</i> (sundrops)	C	--	Southern App. Bog
<i>Orbexilum pedunculatum</i> (snakeroot)	W3	--	Open woodlands
<i>Orthodontium pellucens</i> (translucent orthodontium)	C	--	Calcareous rocks
<i>Palamocladium leskeoides</i> (palamocladium)	C	Bonas Defeat (H)	Montane Acidic Cliff
<i>Pedicularis lanceolata</i> (swamp lousewort)	C	--	Southern App. Bog
<i>Phegopteris connectilis</i> (northern broad beech fern)	C	--	Spray Cliff
<i>Plagiochila austinii</i> (austin's plagiochila)	SR	Tanassee Lake (H)	Spray Cliff
<i>Plagiochila echinata</i> (spiny plagiochila)	C	Wolf Creek/Bonas Defeat (H)	Spray Cliff
<i>Plagiochila ludoviciana</i> (southern plagiochila)	SR	--	Spray Cliff
<i>Plagiochila sharpii</i> (sharpe's plagiochila)	C	Wolf Creek/Bonas Defeat (H)	Spray Cliff
<i>Plagiochila sullivantii</i> var. <i>sullivantii</i> (Sullivant's plagiochila)	C	Tanassee Lake (H)	Spray Cliff, Montane Acidic Cliff
<i>Plagiochila sullivantii</i> var. <i>spinigera</i> (a liverwort)	C	--	Spray Cliff
<i>Plagiochila virginica</i> var. <i>caroliniana</i> (a liverwort)	C	--	Spray Cliff
<i>Plagiomnium carolinianum</i> (Carolina gorge-moss)	C	--	Spray Cliff, Montane Acidic Cliff
<i>Platanthera flava</i> var. <i>herbiola</i> (northern rein orchid)	SR	--	Southern App. Bog
<i>Platanthera integrilabia</i> (white fringeless orchid)	FOC	--	Southern App. Bog
<i>Platyhypnidium pringlei</i> (Pringle's eurynehchium)	C	--	Spray Cliff
<i>Porella appalchiana</i> (a liverwort)	C	--	Spray Cliff
<i>Porella wataugensis</i> (a liverwort)	C	--	Montane Acidic Cliff
<i>Radula sullivantii</i> (a liverwort)	C	--	Spray Cliff
<i>Radula voluta</i> (a liverwort)	C	--	Spray Cliff
<i>Rhabdoweisia creulata</i> (Himalayan ribbed-weissia)	C	--	Montane Acidic Cliff
<i>Riccardia jugata</i> (a liverwort)	C	--	Fallen logs in gorges
<i>Sanguisorba canadensis</i> (canada burnet)	SR	Bear Creek Lake (H)	Spray Cliff
<i>Schlotheimia lancifolia</i> (Highlands' moss)	T	--	Rich Cove Forest
<i>Sedum glaucophyllum</i> (cliff stonecrop)	SR	Bear Creek Lake (H)	Low Elevation Rocky Summit
<i>Senecio millefolium</i> (divided-leaf groundsel)	T	Bear Creek Lake (H)	Low Elevation Rocky Summit
<i>Solidago uliginosa</i> (bog goldenrod)	SR	--	Southern App. Bog
<i>Sphagnum angustifolium</i> (narrow-leaved peatmoss)	SR	--	Southern App. Bog

Duke Power-Nantahala Area Relicensing Plant Communities, Wetlands, and Rare Plants

Scientific and Common Name	Status	Documented Location	Natural Community
<i>Sphagnum fallax</i> (pretty peatmoss)	SR	--	Southern App. Bog
<i>Sphagnum pylaesii</i> (simple peatmoss)	C	--	Montane Acidic Cliff
<i>Spiraea virginiana</i> (Virginia spiraea)	FE	Nantahala Lake; Lake Emory	Rocky Bar and Shore
<i>Thaspium pinnatifidum</i> (mountain thaspium)	C	--	Rich Cove Forest
<i>Themopsis fraxinifolia</i> (ash-leaved golden banner)	C	--	Pine-Oak/Heath
<i>Tortula ammonsii</i> (Ammon's tortula)	E	--	Montane Acidic Cliff
<i>Tortula fragilis</i> (fragile tortula)	SR	--	Montane Acidic Cliff
<b><i>Tradescantia hirsuticaulis</i> (spiderwort)</b>	<b>U</b>	<b>Cedar Cliff Lake</b>	<b>Montane Mafic Cliff</b>
<i>Trichomanes boschianum</i> (Appalachian filmy-fern)	T	Wolf Creek/Bonas Defeat (H)	Spray Cliff, Montane Acidic Cliff
<i>Trichomanes intricatum</i> (grotto-felt)	W7	Wolf Creek/Bonas Defeat (H)	Spray Cliff
<i>Trichomanes petersii</i> (dwarfed filmy-fern)	T	Wolf Creek/Bonas Defeat (H)	Spray Cliff
<i>Trillium flexipes</i> (southern bent trillium)	C	--	Rich Cove Forest
<i>Trillium pusillum</i> var. <i>alabamicum</i> ? (Alabama least trillium)	E	--	Pine-Oak/Heath
<i>Trillium rugelii</i> (Southern nodding trillium)	W7	--	Rich Cove Forest
<b><i>Trillium simile</i> (Gleason's white trillium)</b>	<b>SR</b>	<b>Queens Creek Cove</b>	<b>Rich Cove Forest</b>
<i>Viola appalachiensis</i> (Appalachian violet)	C	Nantahala Lake (H)	Rich Cove Forest
<i>Vittaria appalachiana</i> (grotto shoestring fern)	W7	Wolf Creek/Bonas Defeat (H)	Spray Cliff
<i>Wernsdorfia fluitans</i> (floating sickle-moss)	SR	--	Spray Cliff

**Project Area Location: (H) historic record—not found within any project area.**

**Bold letters-observed in study area in 2001.**

**STATUS:** **Federal:**FE-listed as endangered; FT-listed as threatened; FOC-listed as of concern. **State:** C-Candidate for listing as E (Endangered) or T (Threatened); PE-proposed as endangered; E-endangered; T-threatened; SR-significantly rare; W1-watch list (rare but relatively secure); W3-watch list (rare but uncertain documentation); W5-watch list (rare because of severe decline); W7-watch list (rare and poorly known); U-listed as rare in Radford et al., 1968 but not listed in Amorosa (1999).

**Table 3. Vascular Plant Species Known from the Duke Power-Nantahala Area Hydroelectric Relicensing Project.**

Scientific Name (Common Name)	Nantahala Lake	Lake Glenville	Bear Creek Lk.	Cedar Cliff Lk.	Wolf Creek Lk.	Tennessee Lk.	Tuckasegee Lk.	Dillsboro Lake	Bryson (Ela) Lk.	Franklin (Emory) Lk.	Mission Lake	Wolf Creek / Bonas Defeat
<i>Acer rubrum</i> (red maple)	x	x	x	x	x	x	x	x	x	x	x	
<i>Acer pennsylvanica</i> (striped maple)												x
<i>Acer saccharinum</i> (silver maple)								x		x		
<i>Actaea pachypoda</i> (doll's-eye)												
<i>Adiantum pedatum</i> (maidenhair fern)												
<i>Aesculus flava</i> (yellow buckeye)												
<i>Alnus serrulata</i> (tag alder)	x	x	x	x	x	x	x	x	x	x	x	x
<i>Amelanchier arborea</i> (sarvis)												x
<i>Amelanchier laevis</i> (smooth sarvis)												#
<i>Amphicarpa bracteata</i> (hog peanut)												#
* <i>Analeima keisak</i> (Asiatic dayflower)							x			x	x	
<i>Apios americana</i> (ground nut)	x						x			x		x
<i>Aralia racemosa</i> (Hercules' club)												x
<i>Arisaema triphyllum</i> (Jack-in-the-pulpit)	x	x										x
<i>Aristolochia macrophylla</i> (Dutchman's pipe)												x
<i>Aronia melanocarpa</i> (black chokeberry)												#
<i>Aruncus dioicus</i> (goatsbeard)											x	
<i>Arundinaria gigantea</i> (giant cane)	x	x					x			x	x	
<i>Aronia arbutifolia</i> (chokeberry)		x										
<b><i>Asclepias purpurascens</i> (rose milkweed)</b>										x		
<i>Asclepias quadrifolia</i> (four-leaved milkweed)												#
<i>Asplenium montanum</i> (mountain spleenwort)												#
<i>Asplenium platyneuron</i> (ebony spleenwort)	x											x
<b><i>Asplenium resiliens</i> (black-stemmed spleenwort)</b>												#
<i>Asplenium trichomanes</i> (maidenhair spleenwort)												x
<i>Aster cordifolius</i> (heart-leaved aster)												x
<i>Aster divaricatus</i> (white-topped aster)												x
<i>Aster laterifolius</i> (calico aster)												#
<i>Aster patens</i> (Piedmont aster)												#
<i>Aster puniceus</i> (swamp aster)												#
<i>Athyrium felix-femina</i> (southern ladyfern)	x					x				x	x	x

Duke Power-Nantahala Area Relicensing Plant Communities, Wetlands, and Rare Plants

Scientific Name (Common Name)	Nantahala Lake	Lake Glenville	Bear Creek Lk.	Cedar Cliff Lk.	Wolf Creek Lk.	Tennessee Lk.	Tuckasegee Lk.	Dillsboro Lake	Bryson (Eta) Lk.	Franklin (Emory) Lk.	Mission Lake	Wolf Creek / Bonas Defeat
<i>Betula alleghaniensis</i> (yellow birch)												x
<i>Betula lenta</i> (sweet birch)	x	x	x	x							x	
<i>Betula nigra</i> (river birch)	x	x	x	x	x	x	x	x	x	x	x	
<i>Bidens bipinnatifida</i> (Spanish needles)						x	x	x	x	x		
<i>Bidens frondosa</i> (beggar ticks)							x				x	x
<i>Boehmeria cylindrica</i> (false nettle)			x	x		x	x		x	x	x	x
<i>Boykinia acontifolia</i> (streambank saxifrage)												x
<i>Cacalia atriplicifolia</i> (Indian plantain)												#
<i>Calamagrostis cinnoides</i> (Nuttall's small reedgrass)												#
<i>Campanula divaricata</i> (spreading bellflower)												#
<i>Cardamine diphylla</i> (twin-leaved bittercress)												
<b><i>Cardamine flagellifera</i> (Blue Ridge bittercress)</b>												
<i>Carex aestivalis</i> (summer sedge)												#
<i>Carex appalachia</i> (Appalachian sedge)												
<i>Carex atlantica</i> (prickly bog sedge)			x									
<i>Carex crinita</i> (fringed sedge)	x	x				x				x		x
<i>Carex debilis</i> (white-edged sedge)	x	x										
<b><i>Carex folliculata</i> (bog sedge)</b>												#
<i>Carex hystericina</i> (porcupine sedge)		@										
<i>Carex laxiculmis</i> (loose-culmed sedge)	x	x	x									
<b><i>Carex leptoneuria</i> (nerveless sedge)</b>												
<i>Carex lurida</i> (shallow sedge)	x	x	x	x	x	x	x	x	x	x		
<b><i>Carex manhartii</i> (Manhart's sedge)</b>												
<i>Carex cf. Muricata</i> (sedge)												#
<i>Carex pensylvanica</i> (Pennsylvania sedge)												x
<i>Carex plantaginea</i> (plantain-leaved sedge)												
<i>Carex retroflexa</i> (reflexed sedge)												
<b><i>Carex scabrata</i> (rough sedge)</b>	x										x	
<i>Carex scoparia</i> (broom sedge)	x	x	x	x	x	x	x	x	x	x	x	
<i>Carex torta</i> (twisted sedge)	x	x	x	x								x
<i>Carex cf. Venusta</i> (dark green sedge)												#
<i>Carex virescens</i> (silvery sedge)												#
<i>Carex vulpinoidea</i> (fox sedge)									x			

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Scientific Name (Common Name)	Nantahala Lake	Lake Glenville	Bear Creek Lk.	Cedar Cliff Lk.	Wolf Creek Lk.	Tennessee Lk.	Tuckasegee Lk.	Dillsboro Lake	Bryson (Ela) Lk.	Franklin (Emory) Lk.	Mission Lake	Wolf Creek / Bonas Defeat
<i>Carex woodii</i> (pretty sedge)	x											
<i>Carya alba</i> (sweet pignut hickory)												#
<i>Carya glabra</i> (pignut hickory)												x
<i>Castanea dentata</i> (American chestnut)												x
<i>Catalpa bignonioides</i> (catalpa)										x		
<i>Caulophyllum thalictroides</i> (blue cohosh)												
<i>Cephalanthus occidentalis</i> (buttonbush)							x		x	x	x	
<i>Chelone cf. glabra</i> (white turtlehead)												#
<i>Chelone lyonii</i> (Lyon's turtlehead)												#
<i>Chimaphila maculata</i> (spotted wintergreen)												x
<i>Chrysplenium americanum</i> (golden saxifrage)												#
<i>Cicuta maculata</i> (water hemlock)		x	x							x	x	
<i>Circea alpina</i> (northern enchanter's nightshade)												#
<i>Circea lutetiana</i> ssp. <i>canadensis</i> (southern enchanter's nightshade)												#
<i>Clematis virginiana</i> (Virgin's-bower)		x	x	x						x	x	x
<i>Clethra acuminata</i> (cinnamon clethra)												x
<i>Clintonia umbellata</i> (wood lily)												
<i>Commelina communis</i> (dayflower)	@											#
<i>Collinsonia canadensis</i> (Canada horsebalm)												#
<i>Conium maculatum</i> (poison hemlock)			@									#
<i>Cornus amomum</i> (stiff dogwood)	x	x	x	x	x	x	x	x	x	x	x	
<i>Cornus florida</i> (dogwood)												x
<i>Corydalis sempervirens</i> (rock pimpernel)												#
<i>Crataegus macrosperma</i> (large-seeded hawthorn)												#
<i>Crataegus phaenopyrum</i> (Washington hawthorn)			x	x								
<i>Cyperus strigosus</i> (straw-colored flat-sedge)										x		
<i>Cypripedium acaule</i> (pink lady's-slipper)												#
<i>Cystopteris protrusa</i> (bladder fern)												
<i>Danthonia compressa</i> (oat grass)												#
<i>Danthonia sericea</i> (silky oat grass)												#

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Scientific Name (Common Name)	Nantahala Lake	Lake Glenville	Bear Creek Lk.	Cedar Cliff Lk.	Wolf Creek Lk.	Tennessee Lk.	Tuckasegee Lk.	Dillsboro Lake	Bryson (Ela) Lk.	Franklin (Emory) Lk.	Mission Lake	Wolf Creek / Bonas Defeat
<i>Danthonia cf. spicata</i> (oat grass)												#
<i>Dennstadtia puntilobula</i> (hay-scented fern)												#
<i>Diervilla sessilifolia</i> (bush honeysuckle)	x	x	x	x								x
<i>Diodia virginiana</i> (Virginia button-weed)										x		
<i>Diospyros virginiana</i> (persimmon)	x	x			x					x	x	
<i>Diphylleia cymosa</i> (umbrella-leaf)												#
<i>Disporum lanuginosum</i> (yellow mandarin)												
<i>Dracocephalum virginianum</i> (Virginia dragonhead)		x										
<i>Dryopteris intermedia</i> (fancy fern)												#
<i>Dryopteris marginalis</i> (marginal woodfern)												#
<i>Dulichium arundinaceum</i> (three-way sedge)										x		
<i>Echinochloa sp.</i> (barnyard grass)										x	x	
<i>Eleocharis obtusa</i> (blunt spikerush)	x				x					x	x	#
<b><i>Eleocharis palustris</i> (creeping spikerush)</b>										x		
<i>Eleocharis quadrangulata</i> (square-stemmed spikerush)					x							
<i>Eupatorium fistulosum</i> (hollow Joepyeweed)	x	x	x	x	x	x	x	x	x	x	x	#
<i>Eupatorium maculatum</i> (Joepyeweed)					x	x	x	x	x	x	x	#
<i>Eupatorium perfoliatum</i> (boneset)	x	x					x			x	x	#
<i>Fagus grandifolia</i> (American beech)												x
<i>Festuca elatior</i> (fescue)												#
<i>Fraxinus americana</i> (white ash)			x	x								x
<i>Fraxinus pennsylvanica</i> (green ash)							x	x	x	x	x	
<i>Galax urceolata</i> (galax)												x
<i>Galinsoga ciliata</i> (Peruvian daisy)												#
<i>Galium obtusum</i> (blunt-leaved bedstraw)	x	x	x							x	x	
<i>Galium triflorum</i> (trifloral bedstraw)												#
<i>Gaylussacia ursine</i> (buckberry)												x
* <i>Glecoma hederacea</i> (ground ivy)									x			
<i>Gleditsia triacanthos</i> (honeylocust)										x		
<i>Glyceria melicaria</i> (melic manna grass)	x											
<i>Glyceria striata</i> (fowl manna grass)	x			x			x			x		#

Duke Power-Nantahala Area Relicensing Plant Communities, Wetlands, and Rare Plants

Scientific Name (Common Name)	Nantahala Lake	Lake Glenville	Bear Creek Lk.	Cedar Cliff Lk.	Wolf Creek Lk.	Tennessee Lk.	Tuckasegee Lk.	Dillsboro Lake	Bryson (Ela) Lk.	Franklin (Emory) Lk.	Mission Lake	Wolf Creek / Bonas Defeat
<i>Habenaria clavellata</i> (green wood orchid)				x								
<i>Goodyera pubsecens</i> (rattlesnake plantain)												#
<i>Halesia carolina</i> (silverbell)												x
<i>Hamamelis virginiana</i> (witchhazel)												x
<i>Helenium autumnale</i> (autumn sneezeweed)												#
<i>Helenium flexuosum</i> (soft sneezeweed)	x	x			x	x				x		
<b><i>Heuchera parviflora</i> (grotto alumroot)</b>												x
<i>Heuchera villosa</i> (hairy alumroot)												#
<i>Hexastylis shuttleworthii</i> (large-flowered heartleaf)												x
<i>Hibiscus moscheutos</i> (rose mallow)										x		
<i>Hieracium florentinum</i> (hawkweed)												#
<i>Holcus lanatus</i> (velvet grass)												#
<i>Houstonia longifolia</i> (long-leaved star-violet)												#
<i>Houstonia purpurea</i> (purple star-violet)												#
<i>Houstonia serpyllifolia</i> (Michaux' star-violet)												#
<i>Huperzia porophila</i> (rock clubmoss)												x
<i>Hydrangea arborescens</i> (wild hydrangea)												x
<i>Hydrocotyle ameriana</i> (American pennywort)												#
<i>Hydrophyllum canadense</i> (Canada waterleaf)												
<b><i>Hymenophyllum tayloriae</i> (Taylor's filmy fern)</b>												#
<i>Hypericum densiflorum</i> (bushy St. Johnswort)	x	x	x									
<i>Hypericum mutilum</i> (slender St. Johnswort)	x							x		x		#
<i>Ilex montana</i> (mountain holly)												#
<i>Ilex verticillata</i> (winterberry)	@	@										#
<i>Impatiens capensis</i> (jewelweed)	x	x	x	x	x	x	x	x	x	x	x	x
<i>Impatiens pallida</i> (pale jewelweed)	x						x		x			#
* <i>Iris pseudoacorus</i> (yellow iris)							x					
<i>Itea virginica</i> (Virginia willow)	x	x									x	
<i>Juglans nigra</i> (black walnut)							x	x	x	x	x	

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<i>Juncus acuminatus</i> (taper-tipped needlerush)			X	X			X			X		#
<i>Juncus effusus</i> (soft rush)	X	X	X	X	X	X	X	X	X	X	X	X
<i>Juncus tenuis</i> (path rush)												#
<i>Kalmia latifolia</i> (mountain laurel)	X	X	X	X							X	X
<b><i>Krigia montana</i> (mountain dwarf-dandelion)</b>												#
<i>Laportea canadensis</i> (wood nettle)		X	X	X								X
<i>Leersia oryzoides</i> (rice cutgrass)										X	X	
<i>Leersia virginica</i> (Virginia cutgrass)	X	X								X		
<i>Lespedeza cuneata</i> (sericea)												#
<i>Leucothoe fontesiana</i> (doghobble)											X	X
<i>Leucothoe racemosa</i> (tall hobblebush)		X	X							X		X
<b><i>Leucothoe recurva</i> (red-twigged hobblebush)</b>												#
<i>Ligusticum canadensis</i> (American lovage)											X	
<b>*<i>Ligustrum sinensis</i> (Chinese privet)</b>	X			X			X			X		
<i>Liquidambar styraciflua</i> (sweet gum)					X	X	X	X	X	X	X	X
<i>Lilium superbum</i> (Turk's cap lily)	X											
<i>Linum virginianum</i> (wild flax)	X											
<i>Liriodendron tulipifera</i> (tulip tree, yellow poplar)	X	X	X	X	X	X	X	X	X	X	X	X
<i>Lobelia cf. amoena</i> (southern lobelia)												#
<i>Lobelia cardinalis</i> (cardinal flower)							X			X		
<i>Lobelia inflata</i> (Indian tobacco)												#
<i>Lobelia puberula</i> (puberulent lobelia)	X		X	X						X		
<i>Lobelia siphilitica</i> (great blue lobelia)												#
<b>*<i>Lonicera japonica</i> (Japanese honeysuckle)</b>							X	X	X	X		
<i>Ludwigia alternifolia</i> (bushy seedbox)	X	X				X				X		
<i>Ludwigia palustris</i> (swamp seedbox)	X									X		
<i>Luzula multiflora</i> (wood rush)												#
<i>Lycopus americanus</i> (American bugleweed)	X	X	X	X						X	X	
<b><i>Lycopus cf. virginicus</i> (Virginia bugleweed)</b>												#
<b><i>Lyonia ligustrina</i> (maleberry)</b>												#
<i>Lysimachia lanceolata</i> (lance-leaved loosestrife)												#

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<i>Lysimachia quadrifolia</i> (whorled loosestrife)												#
<i>Magnolia acuminata</i> (cucumber tree)												#
<i>Magnolia fraseri</i> (Fraser's magnolia)												x
<i>Medeola virginiana</i> (Indian cucumber root)												#
* <i>Microstegium vimineum</i> (Vietnam grass, Japanese shade grass)			x				x		x		x	x
<i>Mimulus ringens</i> (allegany monkey-flower)	x	x	x	x	x	x	x	x	x	x	x	#
<i>Mitchella repens</i> (partridgeberry)												#
<i>Mitella diphylla</i> (miterwort)												
<i>Nyssa biflora</i> (swamp tupelo)	x											
<i>Nyssa sylvatica</i> (black gum)												x
<i>Onoclea sensibilis</i> (sensitive fern)	x	x	x	x	x					x		
<i>Osmunda cinnamomea</i> (cinnamon fern)	x	x	x	x								x
<i>Osmunda regalis</i> var. <i>spectabilis</i> (royal fern)	x											
<i>Oxalis acetocella</i> (wood sorrel)												#
<i>Oxalis</i> cf. <i>striata</i> (striate sorrel)												#
<i>Oxydendrum arboreum</i> (sourwood)												x
<i>Oxypolis rigidior</i> (rigid cowbane)	x	x										x
<i>Panicum</i> sp. (panic grass)	x					x		x		x	x	
<i>Panicum acuminatum</i> (acuminate panic grass)												#
<i>Panicum boscii</i> (Bosc's panic grass)												#
<i>Panicum commutatum</i> (panic grass)												#
<i>Panicum dichotomum</i> (fall panic grass)						x				x		
<i>Panicum laxiflorum</i> (loose-flowered panic grass)												#
<i>Parthenocissus quinquefolia</i> (Virginia creeper)												x
* <i>Paulownia tomentosa</i> (princess tree)												#
<i>Peltandra virginica</i> (arrow-arum)							x		x	x		
<i>Phalaris arundinacea</i> (reed canary grass)	x	x								x		
<i>Phytolacca americana</i> (pokeweed)												#
<i>Pilea pumila</i> (clearweed)												#
<i>Pinus rigida</i> (pitch pine)												x

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<i>Pinus strobus</i> (white pine)	x	x	x	x		x					x	x
<i>Pinus virginiana</i> (Virginia pine)												#
* <i>Plantago rugelii</i> (common plantain)												#
<i>Platanus occidentalis</i> (sycamore)	x	x				x	x	x	x	x	x	
<i>Poa palustris</i> (woodland bluegrass)												x
<i>Podostemum ceratophyllum</i> (riverweed)												#
<i>Polygonatum biflorum</i> (Solomon's-seal)												#
<i>Polygonum hydropiper</i> (marsh pepper)			@									
<i>Polygonum longisetum</i> (long-bristled smartweed)												#
<i>Polygonum sagittatum</i> (tearthumb)					x	x	x	x	x	x	x	#
<i>Polygonum scandens</i> (climbing buckwheat)											x	
<i>Polygonum virginianum</i> (Virginia smartweed)									@			#
<i>Polystichum acrostichoides</i> (Christmas fern)	x	x	x	x	x	x					x	x
<i>Potamogeton epihydrus</i> (ribbon-leaved pondweed)			x	x								
<i>Potamogeton pusillus</i> (weak pondweed)	x											
<i>Potentilla canadensis</i> (five-fingers)												#
<b><i>Potentilla simplex</i> (cinquefoil)</b>												#
* <i>Prunella vulgaris</i> (heal-all)	x	x	x	x	x	x	x	x	x	x	x	
<i>Quercus alba</i> (white oak)												x
<i>Quercus coccinea</i> (scarlet oak)												
<i>Quercus prinus</i> (chestnut oak)												x
<i>Quercus rubra</i> (red oak)												x
<i>Quercus velutina</i> (black oak)												x
* <i>Ranunculus acris</i> (common buttercup)												#
<i>Rhododendron arborescens</i> (streambank azalea)												x
<i>Rhododendron maximum</i> (great laurel)												x
<i>Rhododendron minus</i> (deer-tongue laurel)												x
<i>Rhus copallina</i> (winged sumac)											x	x
<i>Rhus radicans</i> (poison ivy)	x						x	x	x	x	x	
<i>Rhynchospora capitella</i> (brownish beakrush)	x			x								
<i>Robinia pseudoacacia</i> (black locust)												x

Duke Power-Nantahala Area Relicensing Plant Communities, Wetlands, and Rare Plants

Scientific Name (Common Name)	Nantahala Lake	Lake Glenville	Bear Creek Lk.	Cedar Cliff Lk.	Wolf Creek Lk.	Tennessee Lk.	Tuckasegee Lk.	Dillsboro Lake	Bryson (Ela) Lk.	Franklin (Emory) Lk.	Mission Lake	Wolf Creek / Bonas Defeat
<i>*Rosa multiflora</i> (multiflora rose)								X	X	X	X	X
<i>Rosa palustris</i> (swamp rose)	X	X	X	X						X	X	X
<i>Rubus allegheniensis</i> (Allegheny blackberry)												#
<i>Rubus argutus</i> (serrate-leaved blackberry)	X	X	X	X	X	X	X	X	X	X	X	
<i>Rubus canadensis</i> (Canada blackberry)												#
<i>Rubus cuneifolius</i> (sand blackberry)										@		
<i>Rubus flagellaris</i> (blackberry)												#
<i>Rubus hispidus</i> (hispid blackberry)	X	X									X	X
<b><i>Rubus odoratus</i></b>												#
<i>Rudbeckia laciniata</i> (lace-leaved coneflower)	X	X	X	X	X	X	X	X	X	X	X	#
<i>Rumex obtusifolius</i> (blunt-leaved dock)												#
<i>Sagittaria latifolia</i> (common arrowhead)	X						X			X	X	
<i>Sanguinaria canadensis</i> (bloodroot)												X
<i>Sanicula trifoliata</i> (trifoliate snakeroot)												X
<i>Salix nigra</i> (black willow)	X	X	X	X	X	X	X	X	X	X	X	X
<i>Salix sericea</i> (silky willow)	X	X										X
<i>Sambucus canadensis</i> (elderberry)	X	X	X	X	X	X	X	X	X	X	X	X
<i>Saxifraga careyana</i> (Carey's saxifrage)												X
<i>Saxifraga michauxii</i> (Michaux' saxifrage)												#
<i>Saxifraga micranthidiifolia</i> (mountain lettuce)												#
<i>Scirpus cyperinus</i> (woolgrass bulrush)	X				X	X	X			X	X	
<i>Scirpus expansus</i> (woodland bulrush)	X	X	X		X	X				X		
<i>Scirpus polyphyllus</i> (many-leaved bulrush)	X									X		
<i>Scirpus purshianus</i> (Pursh's bulrush)						X						
<i>Scirpus validus</i> (soft-stemmed bulrush)										X		
<i>Sium suave</i> (hemlock water-parsnip)		X										
<i>Smilacina racemosa</i> (false Solomon's-seal)												#
<i>Smilax glauca</i> (glaucus greenbrier)												
<i>Smilax rotundifolia</i> (round-leaved greenbrier)												X

Duke Power-Nantahala Area Relicensing Plant Communities, Wetlands, and Rare Plants

Scientific Name (Common Name)	Nantahala Lake	Lake Glenville	Bear Creek Lk.	Cedar Cliff Lk.	Wolf Creek Lk.	Tennessee Lk.	Tuckasegee Lk.	Dillsboro Lake	Bryson (Ela) Lk.	Franklin (Emory) Lk.	Mission Lake	Wolf Creek / Bonas Defeat
<i>Solidago rugosa</i> (wrinkled goldenrod)	x	x								x		#
<i>Sparganium americanum</i> (bur-reed)	x	x			x				x	x	x	x
<i>Spiraea alba</i> (white spiraea)			x									
<i>Spiraea tomentosa</i> (hardhack)	x	x									x	
<b><i>Spiraea virginiana</i> (Virginia spiraea)</b>										@		
<i>Symplocos tinctoria</i> (horsesugar)	x										x	x
<i>Thalictrum clavatum</i> (mountain meadow-rue)	x											#
<i>Thalictrum dioicum</i> (dioecious meadow-rue)												#
<i>Thalictrum thalictroides</i> (rue anemone)												x
<i>Thelypteris noveboracensis</i> (New York fern)												#
<i>Tilia heterophylla</i> (basswood)												x
<b><i>Trichomanes intricatum</i> (grotto felt)</b>												#
<i>Trillium erectum</i> (erect trillium)												
<i>Trillium grandiflorum</i> (large-flowered trillium)												#
<b><i>Trillium simile</i> (Gleason's white trillium)</b>												
<i>Trillium undulatum</i> (painted trillium)												#
<i>Trillium vaseyi</i> (Vasey's trillium)												
<i>Tsuga canadensis</i> (eastern hemlock)	x	x	x	x	x						x	x
<i>Tsuga caroliniana</i> (Carolina hemlock)												x
<i>Typha latifolia</i> (common cattail)							x			x		
<i>Ulmus rubra</i> (slippery elm)												#
<i>Urtica dioica</i> (stinging nettle)									@	@		
<i>Vaccinium corymbosum</i> (highbush blueberry)	x	x									x	x
<i>Vaccinium vacillans</i> (lowbush blueberry)	x										x	x
<i>Verbesina officinalis</i> (chaffseed)	x		x				x			x	x	
<i>Vernonia noveboracensis</i> (ironweed)	x	x	x	x	x	x	x	x	x	x	x	#
<i>Vernonia peregrina</i> (crownbeard)												#
<i>Viburnum cassinoides</i> (withe rod)	x	x								x		x
<i>Viburnum dentatum</i> (arrow-wood)							x					
<i>Viola blanda</i> (sweet white violet)												#
<i>Viola canadensis</i> (Canada violet)												
<i>Viola lanceolata</i> (lance-leaved violet)												#
<i>Viola primulifolia</i> (primrose-leaved violet)	x	x	x	x	x	x	x	x	x	x		#

Duke Power-Nantahala Area Relicensing Plant Communities, Wetlands, and Rare Plants

Scientific Name (Common Name)	Nantahala Lake	Lake Glenville	Bear Creek Lk.	Cedar Cliff Lk.	Wolf Creek Lk.	Tennessee Lk.	Tuckasegee Lk.	Dillsboro Lake	Bryson (Ela) Lk.	Franklin (Emory) Lk.	Mission Lake	Wolf Creek / Bonas Defeat
<i>Viola rotundifolia</i> (round-leaved violet)												#
<i>Viola sororia</i> (wooly blue violet)												#
<i>Vitis aestivalis</i> (summer grape)												x
<i>Vitis labrusca</i> (foxgrape)	x	x	x	x						x		x
<b><i>Vittaria appalachiana</i></b> (shoestring fern)												#
<i>Woodwardia areolata</i> (netted chain fern)							x					
<i>Xanthoriza simplicissima</i> (yellowroot)	x	x	x	x	x					x	x	x

**Other symbols:** \* denotes exotic species; **bold type denotes listed species**; x-observed by author during the survey; @-previously observed by Nantahala employees or subcontractors; #-reported by J. Dan Pittillo (1994) for Bonas Defeat/Wolf Creek Gorge.

## 4.0 RESULTS AND DISCUSSION

### 4.1 Plant Communities

Thirteen major plant community types were documented within the Duke Power-Nantahala Area project area. Table 1 lists the communities found in each study area. Note that the Bonas Defeat/Wolf Creek Gorge area and the greater Nantahala Lake area harbored the most plant community types. As expected, these two areas also have the greatest floristic diversity and the greatest number of state- and federally-listed plant species (Table 2 and 3). The community types and their occurrence within the project areas are discussed in detail below.

**Montane Acidic Cliff.** The montane acidic cliff type is known from the Blue Ridge and “foothills region” of North Carolina, according to Schafale and Weakley (1990). It is found on “very steep to vertical slopes on acidic rock or saprolite...[slopes] steep, rocky, or dry enough to prevent formation of a closed tree canopy.” Synonyms for this type are given as “bluffs” or “rock outcrops.” Bonas Defeat Gorge is given in Schafale and Weakley as a representative of this type. This type is also found in Wolf Creek Gorge, on Bear Creek Lake, and on Cedar Cliff Lake.

**Montane Mafic Cliff.** The montane mafic cliff type is known from the “mountain” region of North Carolina and is very similar to the montane acidic cliff. It, however, is found over rocks of “mafic” (magnesium and iron) or “basic” composition, such as hornblende gneiss or amphibolite. From a distance, eastern red cedar (*Juniperus virginiana*) (in abundance) is the best indicator of this type. Cedar Cliff Lake is the only project area in which this community type was found and, furthermore, the best examples of the montane mafic cliff type are found considerably upslope from the project area on Cedar Cliff Lake.

**Pine-Oak/Heath Forest.** This is community type found on ridges and steep xeric (i.e., dry) slopes, often on shallow soils over acidic rocks. Its canopy is dominated by pines (*Pinus rigida*, *P. virginiana*, and *P. pungens*), xeric oak species (*Quercus coccinea*, *Q. prinus*), and the understory is dominated by sourwood (*Oxydendrum arboreum*) and heaths (*Kalmia latifolia* and *Rhododendron* spp.). This type is found in numerous project areas. The area surrounding Little Glenville Reservoir is representative of this natural community.

**Rich Cove Forest.** This community type occurs in “sheltered, mesic,...broad coves and lower slopes (Schafale and Weakley, 1990). It harbors deep, rich, usually circumneutral soils, generally with pHs near or above 6.0. This type is known for its mixture of canopy trees with no clear dominance by one species. White ash (*Fraxinus meridiana*), tulip poplar (*Liriodendron tulipifera*), and basswood (*Tilia heterophylla*) are usually among the dominants in North Carolina southern Appalachian rich cove forests. This type is

known for its rich spring wildflower displays and it harbors numerous state- and federally-listed plant species (see Table 2). It was observed in five of 12 project areas. Several of the north facing coves along Nantahala Lake are representative of this natural community.

**Acidic Cove Forest.** The acidic cove forest is similar to the rich cove forest, but the former type is usually found on more acidic soils. Basswood and white ash are replaced in the canopy by red oak (*Quercus rubra*), birches (*Betula alleghaniensis* and *B. lenta*), and red maple (*Acer rubrum*) and Fraser's magnolia (*Magnolia fraseri*) are often present. Soil pHs are generally below 6.0. The type was found in six of the 12 project areas. Several of the steep coves adjacent to Glenville Lake are representative of this community.

**Canada Hemlock Forest.** The Canada hemlock type is dominated by Canada or eastern hemlock (*Tsuga canadensis*). It occurs in coves and on broad stream terraces, but almost always is found over acidic rock. Red maple, Fraser magnolia, and heaths are co-dominants in this type. It was found in six of the 12 project areas. This community can be found in the Bonas Defeat area.

**Carolina Hemlock Bluff.** The Carolina hemlock type is dominated by the southern Appalachian endemic Carolina hemlock (*Tsuga caroliniana*). It is a rare type in North Carolina, occurring on acidic bluffs, cliffs, and boulders. In the Duke Power-Nantahala Area projects, it was seen only in Bonas Defeat Gorge.

**Montane Alluvial Forest.** "Stream and river floodplains at moderate to high elevations" are called montane alluvial forest by Schafale and Weakley (1990). The canopy in this type is highly variable with numerous upland species. Sycamore (*Platanus occidentalis*), river birch (*Betula nigra*), and black willow (*Salix nigra*) are signature species, but hemlock, red maple, and tulip poplar are typically present with these species. This type was found to be well-developed on the backwaters of the Nantahala Lake, along the river itself. It was also found in four other project areas where streams or rivers enter a lake.

**Sand and Mud Bar.** This community consists of sand and mud deposits in active river and streams systems. Associated with the Montane Alluvial Forest and Rocky Bar and Shore communities, this type was found in eight of the 12 project areas. This riverine community can be found downstream of the Dillsboro and Franklin dams.

**Rocky Bar and Shore.** This community type is also associated with rivers and streams. It consists of gravelly shores and rock-bottomed streams or rivers and often has scattered boulders and outcrops within its boundaries. It was found in five of the 12 project areas. Downstream of the Dillsboro Dam provides a good representation of this natural community.

**Southern Appalachian Bog (Southern Subtype).** The southern Appalachian bog community type is another catch-all wetland plant community type. Schafale and

Weakley (1990) described this type from flat valley bottoms and depressions that are not affected by floodwaters but are fed by some type of seepage. Saturated organic or mineral soils with acidic pHs are usually present. Alder (*Alnus serrulata*), willow (*Salix nigra*), white pine (*Pinus strobus*), hemlock, red maple, sweet birch (*Betula lenta*), and various wetland shrubs are generally present. Seven of the 12 project areas harbored this community type. Good examples of this community can be found in the Nantahala Lake area.

**Spray Cliff.** This community type, as its name indicates, is “vertically to gently-sloping rock faces, constantly wet from the spray of waterfalls” (Schafale and Weakley, 1990). The spray cliff type is best developed in gorges such as Bonas Defeat and Wolf Creek but it is found within other project areas. It is dominated by wet rock faces, small herbaceous plants, bryophytes, ferns, and grasses. Most of the endangered and threatened species of Bonas Defeat/Wolf Creek Gorge are found within this community type.

**Penstock Rights-of-Way (Managed Grassland).** In several portions of the Duke Power-Nantahala Area projects and just above Bonas Defeat Gorge, several penstock rights-of-way are present. These corridors, which are maintained and kept nonforested by the utility, are managed grasslands dominated by disturbed site grasses, sedges, and other herbaceous species.

The Pine-Oak/Heath, the Acidic Cove Forest, the Canada Hemlock Forest, the Sand and Mud Bar, and the Southern Appalachian Bog communities were the most commonly-encountered types. In gorges and in riverine areas, the Spray Cliff type was common. The Penstock Right-of-Way type, a managed grassland type, was associated with the Nantahala Lake and upslope from the Wolf Creek/Bonas Defeat project areas. This community was found along the penstock from Dicks Creek Dam to the Nantahala River and from the Nantahala River toward Whiteoak Dam. It is also found along a penstock extending from Tennessee Lake to the backwaters of Bear Creek Lake.

In the penstock rights-of-way areas, disturbed site species such as grasses [*Andropogon* spp. (broomsedges), *Sorghastrum nutans* (Indian grass), *Festuca pratensis* (fescue)], nonwoody species [*Solidago* spp. (goldenrods), *Aster* spp. (asters)], shrubby species [*Rubus* spp. (blackberries), *Salix sericea* (silky willow), *Alnus serrulata* (tag alder)], and woody sprouts (*Robinia pseudoacacia* (black locust), *Kalmia latifolia* (mountain laurel), *Quercus* spp. (oaks)] dominate. No invasions of exotic species were noted on these rights-of-way. The only exotics seen were fescue (*Festuca pratensis*) and yarrow (*Achillea millefolium*).

## 4.2 Wetlands

Most of the total acreage of the eight project areas was the open water of reservoirs and the littoral wetlands associated with the open water. Wetlands associated with streams, rivers, and lake margins (Montane Alluvial Forest, Sand and Mud Bar, and Rocky Bar and Shore) can be classified as palustrine, intermittently flooded. Wetlands such as the Southern Appalachian Bog type and the Spray Cliff are palustrine, saturated

(see Cowardin et al., 1979 and Schafale and Weakley, 1990). Some lakes such as Wolf Creek Lake have steep shores and dramatic fluctuations in water levels and, therefore, harbor no significant emergent wetlands. On the shores of Nantahala Lake and Glenville Lake where significant fluctuations in water level also occur, an unusual wetland community dominated by stiff dogwood (*Cornus amomum*) is found. Here, pure stands of the dogwood attach themselves to the banks, their stems drooping over during low water and floating upright during high water.

Data from previous studies of project wetlands, along with the fieldwork in 2001, indicate that over 135 species of vascular plants are found in the wetlands of the 12 major Nantahala Lake and river study areas. Table 3 lists these wetland species and the project areas in which they were found. Several plant species occurred in every study area inventoried (Table 3): red maple (*Acer rubrum*), tag alder (*Alnus serrulata*), river birch (*Betula nigra*), broom sedge (*Carex scoparia*), stiff dogwood (*Cornus amomum*), hollow Joepyeweed (*Eupatorium maculatum*), jewelweed (*Impatiens capensis*), soft rush (*Juncus effusus*), tulip poplar (*Liriodendron tulipifera*), winged monkey-flower (*Mimulus alatus*), heal-all (*Prunella vulgaris*), serrate-leaved blackberry (*Rubus argutus*), black willow (*Salix nigra*), elderberry (*Sambucus canadensis*), and ironweed (*Vernonia noveboracensis*). Lake Emory had the greatest wetland species richness with 84 species due to its extensive marshes, followed closely by Nantahala Lake and its associated wetlands had 79 species. Three uncommon species—rose milkweed (*Asclepias purpurascens*), rough sedge (*Carex scabrata*), and creeping spikerush (*Eleocharis palustris*)—and one federally-listed species—Virginia spiraea (*Spiraea virginiana*)—occurred within the wetlands of the study areas.

### 4.3 Endangered, Threatened, and Otherwise Noteworthy Plant Species

Table 3 provides a list of 120 species of endangered, threatened, or otherwise noteworthy plant species potentially-occurring within the 12 Duke Power-Nantahala Area relicensing projects. This table was compiled primarily from file data from the North Carolina Natural Heritage Program. Of the 120 potentially-occurring species, 70 species are ferns, mosses, lichens, liverworts, or hornworts and the other 50 were vascular plants. Below is a list of 38 species that are known to occur or have historically occurred within the 12 project areas. Thirteen of these species were observed in the project areas in 2001 during this investigation (species names printed in bold letters in Table 3 and below). Each species and the potential impact of hydroelectric activities on that species are discussed below. Results of the rare Bonas Defeat/Wolf Creek gorge bryophyte/liverwort survey and the Virginia spiraea survey will be presented under a separate cover in the summer of 2002.

***Asclepias purpurascens* (rose milkweed).** Several plants of this uncommon and strikingly beautiful milkweed were observed in the marshes of Lake Emory in 2001. Near the southern limit of its range, this plant probably benefits from the existence of the extensive marshes around Lake Emory.

*Asplenium resiliens* (black-stemmed spleenwort). Reported by J. D. Pittillo (1994) from the Wolf Creek/Bonas Defeat area in the 1990's, this plant is usually found on dry to slightly humid calcareous rocks. It does not appear that decreased or increased water flow through Wolf Creek or Tuckasegee Gorge could have a negative impact on this plant.

*Calystegia catesbiana* ssp. *sericata* (Blue Ridge bindweed). This calciophile was found in open woods near Tuckasegee Falls (below Glenville Lake dam) in 1939 and has not been seen since then. Because this plant is usually found in dry woods, project operations should have no impact on it.

*Cardamine flagellifera* (**Blue Ridge bittercress**). A few plants of the uncommon, formerly state-listed Blue Ridge bittercress were found in rich, calcareous woods in Queens Creek Cove. The area in which the plants were found has not been affected by the activities of the project in any way.

*Carex biltmoreana* (**Biltmore sedge**). The Biltmore sedge has been reported from Onion Falls below Lake Thorpe dam (by J. D. Pittillo in 1992) and on cliffs above Robinson Creek south of Bear Creek Lake, both areas just outside of the project areas. In 2001, a small population of the plant was found on a montane acidic cliff overlooking Bear Creek Lake. Because the population is considerably upslope from the lake, hydroelectric operations in the area should have no impact on the plant.

*Carex leptoneuria* (**few-nerved sedge**). This state-listed sedge was commonly found in rich woods in Queens Creek cove. Five populations with over 10 plants each were discovered. Operations in the area have had no negative impact on this plant.

*Carex manhartii* (**Manhart's sedge**). Manhart's sedge is quite common on rich slopes above Queens Creek cove and on an adjacent rich ridge. This state-listed species appears not to have been negatively impacted by the project.

*Carex scabrata* (**rough sedge**). Rough sedge, also state-listed, was found in a rocky seepage on the margins of Nantahala Lake and in a seepage spring in Bonas Defeat Gorge. Both populations are healthy and are upslope from any hydroelectric operations in the two project areas.

*Carex woodii* (**pretty sedge**). Pretty sedge or Wood's sedge is a grass-like, clonal sedge that is also state-listed. A large clone of the sedge is found on Nantahala property along the Nantahala River upstream from Nantahala Lake. As the clone is above the flood level of the river and backwaters of the lake, an increase or decrease in water flow along the river should have no impact on the population.

*Chenopodium simplex* (giant-seeded goosefoot). This state-listed plant was found in dry woods at the base of Sols Creek Falls above Bear Creek Lake in 1951. The plant could not be relocated during the 2001 fieldwork. As this is an upland species, there should be no impact to the species from the activities of the project.

***Eleocharis palustris* (creeping spikerush).** Several large colonies of this uncommon spikerush were seen in the marshes of Lake Emory. This plant reaches the southern limits of its range in North Carolina. Like the rose milkweed, this plant probably has benefited by the siltation and marsh formation on Lake Emory.

***Heuchera parviflora* (grotto alumroot).** Reported by J. D. Pittillo (1994) from Bonas Defeat/Wolf Creek Gorge and verified as occurring in Bonas Defeat during the 2001 fieldwork. This plant grows in humid grottoes out of the reach of rain or seepage. The ambient moisture in the gorge, as influenced by the flow of the Tuckasegee River, does have an impact on the existence of this species. Increased water flow in the gorges would probably be beneficial to this plant.

*Houstonia longifolia* var. *glabra* (granite dome bluets). Reported from acidic cliff faces above Bear Creek Lake, this granite dome plant occurs in habitats considerably upslope and probably does not occur within the project boundaries. It is too far upslope to be impacted by hydroelectric operations.

***Hydrocotyle americana* (American pennywort).** In spray and on seepage zones at Wolf Creek Falls, low water flow could have negative impact on this plant.

*Hymenophyllum tayloriae* (gorge filmy fern). Found with other rare plants on wet cliffs below Wolf Creek Falls in Wolf Creek Gorge. Altered water flow could be detrimental to this small plant.

*Krigia montana* (mountain cynthia). Reported from Bonas Defeat/Wolf Creek Gorge by Pittillo (1994), this plant grows on acidic cliffs in seepage and in spray zones. Increased or decreased water flow could have negative impact on its abundance.

*Sanguisorba canadensis* (Canada burnet). North Carolina Natural Heritage records indicate that J. D. Pittillo reported this burnet from a “ledge seep” in Bonas Defeat in 1977. It was not observed during the 2001 inventory of the Tuckasegee Gorge. Low water flow should not have a negative impact on this species, which is more associated with seeps and boggy areas than with spray zones.

*Sedum glaucophyllum* (cliff stonecrop). Records from the area indicate that this species has been found on upper River Cliffs near Sols Creek Falls. Known from mafic cliffs considerably upslope from water, this species probably does not occur within the project boundaries.

*Senecio millefolium* (divided-leaf groundsel). Known from dry cliffs at upper River Cliffs above Bear Creek Lake, habitat for this species appears to be absent within the project boundaries.

\**Spiraea virginiana* (Virginia spiraea). According to previous studies on Duke Power-Nantahala Area properties, Virginia spiraea is known to have occurred above and below

the Lake Emory Dam. In 1999, two plants were seen above the dam. In 2000, these plants were not present. One individual plant known to have occurred below the Lake Emory Dam on an island in the Little Tennessee River has not been seen in several years. No *Virginia spiraea* was seen in 2001 during the field inventories. (See additional comments in 28 November 2001 letter to Mr. Gene Vaughan, Appendix.)

***Tradescantia hirsuticaulis* (spiderwort).** Several plants of this uncommon spiderwort were found on the lower slopes of rock outcrops and in rocky woods overlooking Bear Creek Lake. Current and future operations should have no impact on these plants.

*Trillium pusillum* var. *alabamicum* (Alabama least trillium). This variety of the least trillium is considered by most botanists as distinct from the other four or five varieties and may be a new species of *Trillium*. It was known from western North Carolina only from a 1897 record until the early 1980's when Mr. Charles Sill pointed out a population of the plant (which he thought to be *Trillium persistens*) to L.L. Gaddy. This population, which is just outside of the Nantahala Lake study area on the upper Nantahala River, was revisited in early April of 2001. The population, though now smaller than in the 1980's, still exists. Searches along the Nantahala downstream within the project area, however, turned up no new populations of the plant. Vacation home development in the area is a much greater threat to the plant than are any of hydroelectric activities.

***Trillium simile* (Gleason's white trillium).** This rare trillium is common in Queens Creek Cove and in Nantahala Gorge. The sites where it grows have not been affected by the project.

*Vittaria appalachiana* (grotto shoestring fern). This fern is a native, tropical disjunct reported from Bonas Defeat/Wolf Creek Gorge (Pittillo, 1994). Because it is at the northern limit of its range, it is extremely sensitive to drought and cold conditions. Reduced water levels in these gorges may be detrimental to its existence; increased moisture levels would probably has less impact on the species.

## 5.0 REFERENCES

- Amoroso, J. L., editor. 1999. Natural Heritage Program list of rare plant species of North Carolina. North Carolina Heritage Program. North Carolina Dept. of Environment, Health, and Natural Resources. Raleigh. 85 p
- Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of the wetlands and deepwater habitats of the United States. U. S. Fish and Wildlife Service. FWS/OBS-79/31. 103 p.
- Pittillo, J. D. 1994. Natural areas inventory of Jackson County, North Carolina. Conservation Trust for North Carolina and North Carolina Natural Heritage Program. Raleigh.
- Radford, A. E., H. E. Ahles, and C. R. Bell. 1968. Manual of the vascular flora of the Carolinas. University of North Carolina Press. Chapel Hill. 1184 p.
- Schafale, M. P. and A. S. Weakley. 1990. Classification of the natural communities of North Carolina: third approximation. North Carolina Natural Heritage Program. N. C. Dept. of Environment, Health, and Natural Resources. Raleigh. 325 p.
- Schuster, R. M. 1980. The Hepaticae and Antherotae of North America east of the 100<sup>th</sup> Meridian. Columbia University Press, New York. 1134 p.

## **ATTACHMENTS**

**PLANT SAMPLING LOCATIONS**

