Franklin to Fontana
Local Watershed Plan
Phase III

Upper Little Tennessee River Basin
Swain and Macon Counties, N.C.

Watershed Management Plan

July 2011

A Project of
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With Assistance from
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Executive Summary

The purpose of this *Watershed Management Plan* is to (1) summarize the results of the watershed characterization tasks (Phases I and II) and (2) present the final recommendations developed during the Phase III process for the Franklin to Fontana Local Watershed Planning (LWP) area within the upper Little Tennessee River basin (Cataloging Unit 06010202) in North Carolina. The stakeholder-driven LWP process for the Franklin to Fontana study area, comprised of five 14-digit hydrologic units covering 154 square miles in Macon and Swain counties, was initiated in early 2008 and included a total of nine meetings with the Local Advisory Committee (LAC). The LAC consisted of representatives from a range of local watershed groups and state programs, including the Little Tennessee Watershed Association, Land Trust for the Little Tennessee, Macon County government, the Town of Franklin, the US Forest Service, the US Fish & Wildlife Service, county Soil & Water Conservation Districts, the NC Wildlife Resources Commission, the NC Natural Heritage Program, the NC Cooperative Extension Service and others.

The recommendations contained within this Plan represent what are believed to be the most effective solutions to address the major watershed stressors and to conserve and protect the major watershed assets across the LWP study area. These stressors are particularly important within the focus area of the LWP. The 56 square mile LWP focus area consists of 14 of the 29 subwatersheds delineated within the study area, which are the subwatersheds considered to have the lowest (or most at risk) level of ecological function. The primary stressors to local watershed functions within the Franklin to Fontana LWP are summarized in Table ES-1 and include the following:

1. Lack of woody riparian vegetation
2. Channel modification
3. Excess sediment inputs
4. Excess nutrient inputs
5. Bacterial contamination
6. Stormwater runoff
7. Tomato pesticides
8. Barriers to fish passage

The table includes information on the sources of the various stressors, their primary functional impacts pertaining to water quality, habitat, and hydrology, and a summary of the recommendations developed to address the various categories of stressors and sources. Links to sections of the Plan providing additional details and discussion of the recommendations are provided.

Table ES-2 below presents the major assets (natural and cultural resources) identified within the Franklin to Fontana LWP area and summarizes the specific recommendations developed to achieve protection and conservation of these local watershed resources. As with Table ES-1, links are provided that allow the reader to jump to later sections of the Plan where the protection and conservation recommendations are described in greater depth.

The watershed management recommendations contained within Section 4 of the Plan include specific conservation projects cataloged within the final *Project Atlas*. In particular, stream and wetland restoration projects and agricultural best management practices (BMPs) were

identified and prioritized for rural subwatersheds within the focus area. Buffer restoration projects were identified along the Little Tennessee River. Forty retrofit stormwater BMPs were identified for specific sites in Franklin. In order to conserve the natural and cultural heritage of the Franklin to Fontana watershed, both wildland and farmland preservation projects were identified for the entire planning area.

A number of policy and institutional measures related to state and local government programs are needed to address both existing and future threats to stream health. Two new ordinances would be particularly effective at protecting resources, including a county steep slope ordinance and a stormwater management ordinance. Existing sedimentation and erosion control programs and ordinances can be modified to increase their efficacy in riparian vegetation protection and provide consistent training and rules across Western North Carolina. Numerous other government programs should be applied to address specific challenges identified by the Plan.

Education is a key element in achieving many of the strategies named above and is fundamental to increasing public awareness of the value of streams and rivers. A local environmental education program is essential to encourage environmental stewardship, and a number of specific elements of that program are spelled out in this document.

Continued research and assessment are needed to better understand watershed stressors, protect and restore aquatic resources, and to target conservation activities. In particular, continued investment into understanding the ecology of mussels in general and the cause of the Appalachian elktoe decline in the Little Tennessee River in particular are important to mussel and aquatic habitat conservation both in the Little Tennessee River and in Western North Carolina at large. The Little Tennessee Watershed Association's highly successful stream biomonitoring program not only provides an on-going picture of stream and river health, but it also serves to educate area citizens through volunteer opportunities; this program is essential to community-based conservation of watershed resources.

In order to improve and protect streams and rivers in the watershed, a coordinated effort to implement the management recommendations described in Tables ES-1 and ES-2 and in Section 4 is needed. A specific strategy has been developed in Section 5 to guide this effort, which recommends the establishment of an Implementation Team with a clear mission, established roles, and consensus goals and objectives to be achieved over the next several years. Implementation of plan recommendations can be achieved with the aid of technical resources and possible funding sources; these are compiled within Section 6 of the Plan.

The Franklin to Fontana watershed is an ecologically and culturally rich area. Everything that we do can impact stream and river health both in the Franklin to Fontana watershed and in downstream waters; this plan identifies a number of ways to live and work and play in the watershed that will conserve and improve the health of the Little Tennessee River and its tributaries.

Table ES-1 Proposed Management Strategies to Address Stressors in the Franklin to Fontana Watershed (Sheet 1 of 2)

Stressors	Sources	Functional Impacts	Recommendations (plan section links)
Lack of Woody Riparian Vegetation	Removal of vegetation	Stream bank instability; poor shading; increased temperature; habitat degradation--insufficient woody and leaf material in streams; limited pollutant removal	-Plant native woody vegetation in riparian areas (4.2.1, 4.2.3) -Implement key buffer restoration projects (4.2.1, 4.2.3, 4.2.5) -Adopt revisions to Macon County Sediment & Erosion Control (S&EC) Ordinance (4.3.1) -Develop buffer awareness program (4.4.1) -Implement agricultural BMPs (4.2.1, 4.2.3)
Channel Modification	Channel straightening, dredging, and berming	Stream channel and bank instability; habitat degradation--loss of riffle and pool habitat	-Implement stream restoration projects (4.2.1)
Excess Sediment Inputs	Stream bank erosion, unpaved roads and eroding road banks, disturbed areas and landslides, poorly managed pastures and fields, livestock access to streams	Habitat degradation--filling of pools, embedded riffles; increased turbidity during storms	-Stabilize eroding stream banks (stream and buffer restoration) (4.2.1, 4.2.3) -Implement agricultural BMPs (4.2.1, 4.2.3) -Implement stormwater BMPs (4.2.4) -Ensure consistent enforcement of S&EC programs (4.3.1) -Adopt county steep slope ordinance (4.3.1) -Improve sediment retention capacity in Lake Emory (4.2.6) -Develop S&EC educational program, including consistent S&EC training contractor program for seven western counties (4.3.1, 4.4.2) -Provide input to Nantahala National Forest management plan update to reduce sediment from US Forest Service roads (4.3.2) -Perform unpaved roads survey (4.5) -Stabilize eroding road banks via hydroseeding or other methods (4.3.1)
Excess Nutrient Inputs	Livestock access to streams, poorly managed livestock operations, residential and agricultural fertilizers, trout farms, faulty septic systems, leaking and overflowing sewer lines	Over-enrichment of streams, resulting in increased algal growth and altered aquatic communities	-Implement stream and buffer restoration projects (4.2.1, 4.2.3) -Implement agricultural BMPs (4.2.1, 4.2.3) -Develop nutrient/waste management plans for livestock operations (4.2.3) -Adopt county stormwater ordinance (4.3.1) -Develop more effective waste management plan for Tellico Trout Farm (4.3.2)
Bacterial Contamination	Livestock access to streams, poorly managed livestock operations, faulty septic systems, leaking and overflowing sewer lines	Human health risk	-Implement agricultural BMPs - fence livestock out of streams (4.2.1, 4.2.3) -Develop nutrient/waste management plans for livestock operations (4.2.3) -Franklin: investigate sewer collection system integrity (4.5)

Table ES-1 Proposed Management Recommendations to Address Stressors in the Franklin to Fontana Watershed (Sheet 2 of 2)

Stressors	Sources	Functional Impacts	Recommendations (plan section)
Stormwater Runoff	Impervious areas, especially in Franklin	Channel erosion and degradation of in-stream habitats due to increased stormwater discharge; aquatic life impacts from nutrients, toxic pollutants, and high flows	-Implement stormwater BMP retrofits (4.2.4) -Encourage Low Impact Development (4.3.1) -Adopt county stormwater ordinance (4.3.1) -Develop educational program to control stormwater, reduce pollutants (4.4.1)
Tomato Pesticides	Runoff from fields; possible poor pesticide handling	Impaired aquatic community	-Develop a set of BMPs for tomato farming operations (4.3.2)
Barriers to Aquatic Organism Passage	Culverts, dams, other human-made structures	Isolation of fish communities, lack of access to habitat	-Replace/retrofit identified barriers on public and private roads (4.2.6) -Develop education program on culvert installation (4.4.2) -Continue inventories of barriers (4.5)

Table ES-2 Proposed Management Recommendations to Protect Assets in the Franklin to Fontana Watershed

Asset	Protection/Conservation Recommendations
Natural Resources	
Rich Aquatic Fauna of Little Tennessee River and its Tributaries Nantahala-Cowee Corridor Terrestrial Significant Natural Heritage Areas (SNHAs)and Natural Heritage Element Occurrences (NHEOs) Large Tracts of Privately-owned Forest Little Tennessee River Floodplain Public Lands: Nantahala National Forest and Needmore Gamelands	-Implement stressor-related on-the-ground projects (4.2.1, 4.2.3, 4.2.4, 4.2.5) -Protect the floodplain of the Little Tennessee River, plant riparian buffers along the river, restore floodplain wetland communities (4.2.1, 4.2.2, 4.2.3) -Protect large tracts of privately-owned forest (4.2.2) -Protect lands with SNHAs and NHEOs through conservation easements and acquisition (4.2.2) -Acquire funding through Land and Water Conservation Fund to conserve key lands in the Nantahala-Cowee Corridor (4.3.2) -Ensure that water quality-oriented management decisions are made in the updated Nantahala National Forest Management Plan (4.3.2) -Implement a watershed literacy program and landowner action guide (4.4.1) -Establish a watershed stewardship recognition program (4.4.1) -Educate public on present-use value and wildlife tax incentive programs (4.4.2) -Continue investigations on sediment in the Little Tennessee River (4.5) -Support research of mussel stress diagnostics and nutritional dynamics (4.5) -Continue biomonitoring program for the Little Tennessee River and its tributaries (4.5)
Cultural Resources	
Rural Character Agricultural Lands Cultural History	-Protect large farms through conservation easements (4.2.2) -Protect existing wildlands (4.2.2) -Broaden homestead exemption in state and county tax structure (4.3.2) -Educate landowners on forest, farm, and wildlife management tax incentive programs (4.4.2)

List of Acronyms and Abbreviations

ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
BI	Biotic Index
BMPs	Best Management Practices
cfu/mL	Colony Forming Units/100 milliliters
NCCGIA	North Carolina Center for Geographic Information and Analysis
DSWC	Division of Soil and Water Conservation
EPA	US Environmental Protection Agency
GIS	Geographic Information System
IBI	Index of Biological integrity
IT	Implementation Team
LAC	Local Advisory Committee
LIDAR	Light Detection and Ranging
LTWA	Little Tennessee Watershed Association
LWP	Local Watershed Plan
NCDENR	North Carolina Department of Environment and Natural Resources
NCDOT	North Carolina Department of Transportation
NCDWQ	North Carolina Division of Water Quality
NCEEP	North Carolina Ecosystem Enhancement Program
NCNHP	North Carolina Natural Heritage Program
NCWRC	North Carolina Wildlife Resources Commission
NHEO	Natural Heritage Element Occurrence
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
PFRR	Preliminary Findings and Recommendations Report
PLT	Partners for the Little Tennessee
S&EC	Sediment and Erosion Control
SNHA	Significant Natural Heritage Area
SR	Secondary Road
SWCD	Soil and Water Conservation District
UDO	Unified Development Ordinance
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USACE	United States Army Corps of Engineers
USFS	United States Forest Service
USGS	United States Geological Survey
WMP	Watershed Management Plan

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Section 1 Introduction

This section provides an overview of the North Carolina Ecosystem Enhancement Program (NCEEP) and its approach to **local watershed planning** (LWP). It describes the Franklin to Fontana **watershed** planning area and includes a timeline of the major phases for the planning effort. A synopsis of watershed-specific goals and objectives developed by the Local Advisory Committee (LAC), NCEEP, and Equinox Environmental Consultation & Design, Inc. (Equinox) is included, as is a description of the ***Watershed Management Plan*'s** (WMP) contents and organization.

Words highlighted in **Bold** when first encountered are defined in the glossary (Appendix A).

1.1 NCEEP Background and Mission

The NCEEP was created in 2003 to provide ecologically effective **compensatory mitigation** for permitted impacts to streams, **wetlands**, and **riparian buffers** under the Clean Water Act. The cornerstone of NCEEP's approach to compensatory mitigation is the identification of high priority watersheds within which a detailed assessment of watershed conditions is completed through a **stakeholder**-driven LWP process. **Mitigation** projects are designed to address the major **stressors** occurring at a **subwatershed** scale within the local watersheds. The primary purpose of NCEEP mitigation projects is to restore, **enhance**, or protect key **watershed functions**, including water quality, hydrology, and habitat.

For additional information about the NCEEP program, missions, and operations, including watershed planning and project implementation, go to the following web site: http://portal.ncdenr.org/web/eep/watershed-planning-home .

1.2 NCEEP Local Watershed Planning Approach

Local watershed planning is a comprehensive effort initiated by NCEEP to assess watershed conditions, identify natural resource **assets**, determine deficiencies in current and future watershed functions, and recommend appropriate management actions. Although NCEEP's responsibility is to identify those stream and wetland **restoration** and **preservation** projects that can satisfy compensatory mitigation needs, a holistic set of recommendations is developed to address watershed stressors (problems) and protect watershed assets. Local stakeholders, often referred to as "Partners" in this document, advise NCEEP throughout the process to ensure that recommendations are both ecologically effective and locally relevant. Recommendations may include activities such as land use planning, application of agricultural **best management practices (BMPs)**, and construction of BMPs to reduce impacts of **stormwater** runoff. In addition to serving the needs of NCEEP, the planning effort is also intended to provide stakeholders with information necessary to support their local watershed protection and improvement initiatives.

Local watershed planning is performed on the US Geological Survey (USGS) 14-digit **hydrologic unit** scale, usually incorporating one to four hydrologic units that cover a total of 40-150 mi^2. The LWP process used by NCEEP typically requires 24 to 30 months to complete and includes three phases:

Phase I is the preliminary characterization of watershed conditions, based primarily on existing **Geographic Information System (GIS),** water quality, and **aquatic habitat**

information. Some preliminary field assessments such as windshield surveys are performed in Phase I, as well. Phase I culminates in a *Preliminary Finding and Recommendations Report* (PFRR; Equinox 2009a), which summarizes general findings regarding the planning area, identifies data gaps, and recommends additional data collection and analysis activities. For the Franklin to Fontana effort, the *Preliminary Finding and Recommendations Report* was supplemented by a *Phase I Preliminary Project Atlas* (Equinox 2009b), which identified potential restoration and preservation projects based on GIS analysis.

Phase II is the detailed watershed assessment phase, when data gaps identified in Phase I are addressed, key stressors impacting stream integrity and function are identified, and sources of these stressors documented. This work is summarized in a *Watershed Assessment Report* (Equinox 2010a).

Phase III integrates watershed assessment data and stakeholder recommendations into the development of two final LWP products. The *Phase III Project Atlas* (Equinox 2010b) is composed of ranked **conservation projects** that encompass the broad array of stream and wetland restoration projects, stream, wetland, and **wildland** protection projects, and stormwater BMP projects. A *Watershed Management Plan* [this document], consisting of recommendations for consideration by local governments, resource agencies, and watershed citizens or groups seeking to restore and protect watershed resources and functions, is then developed.

All documents for the Franklin to Fontana LWP are available through the fact sheet located at http://www.nceep.net/services/lwps/Little_Tennessee/Franklin2Fontana_LWP_fact_sheet.pdf .

1.3 Planning Area Description

The 154 mi^2 Franklin to Fontana planning area, located in Macon and Swain Counties, consists of the area draining to the Little Tennessee River between the mouth of the Cullasaja River and the headwaters of Fontana Lake (Figure 1.1). The project area is located in **Cataloging Unit** 06010202 and consists of five 14-digit hydrologic units (040010, 040021, 040030, 040040, and 060010). The area includes Lake Emory and the 23-mile **reach** of the Little Tennessee River below Porters Bend Dam, a reach that supports the greatest diversity and abundance of native aquatic species in the region (NCWRC 2005). The planning area was divided into 29 subwatersheds, most of which range in size from two to eight square miles (Figure 1.2).

This portion of the Little Tennessee River **Basin** was selected by NCEEP in large part due to its ecological significance, as well as the potential for collaborating with a diverse group of active local organizations and building upon existing planning efforts to implement conservation projects. While Phase I encompassed the entire planning area, the Phase II assessment centered on a subset of the original group of subwatersheds comprising 56 mi^2, described as the "**focus area**" in this report. The *Project Atlas* created in Phase III centers on priority conservation projects within this focus area, but wildland and farmland preservation projects outside the focus area also are included.

The main urban center in the project area is the Town of Franklin, located at the southern end of the planning area. The area is otherwise largely rural, containing substantial forested areas as well as significant agricultural activity, consisting primarily of **livestock operations** and hay production. About 40 mi^2 of the planning area are part of the Nantahala National Forest, managed by the US Forest Service (USFS). Nantahala National Forest land is located

primarily at higher elevations along the eastern and western boundaries of the area. In the northern portion of the area, much of the property along the mainstem of the Little Tennessee River lies within the approximately seven square mile Needmore Tract, managed by the North Carolina Wildlife Resources Commission (NCWRC) as public gamelands.

1.4 Franklin to Fontana LWP Timeline

The Franklin to Fontana LWP effort began in summer 2008, when a Local Advisory Committee (LAC) was assembled and work began on Phase I of the project (Table 1.1). Phase I ended in February 2009 when the *Preliminary Findings and Recommendations Report* and a supporting *Preliminary Project Atlas* were completed (Equinox 2009a, 2009b). Phase II assessment work was carried out from January 2009 to January 2010 and culminated with the completion of the *Watershed Assessment Report* in October 2010 (Equinox 2010a). Conservation project identification (*Project Atlas*; Equinox 2010b), development of management recommendations included in this *Watershed Management Plan*, and other Phase III activities were performed in late 2010 and early 2011.

Table 1.1 Major Milestones for the Franklin to Fontana Local Watershed Planning Project

Date	Major Project Milestones
June 2008	Phase I Tasks Begin; Local Advisory Committee established
January 2009	*Preliminary Findings Recommendations Report* Completed
January 2009	Phase II Tasks Begin
February 2009	*Preliminary Project Atlas* Completed
January 2010	Phase III Tasks Begin
October 2010	*Watershed Assessment Report* Completed (Phase II)
January 2011	Final *Project Atlas* Completed (Phase III)
June 2011	*Watershed Management Plan* Completed (Phase III)

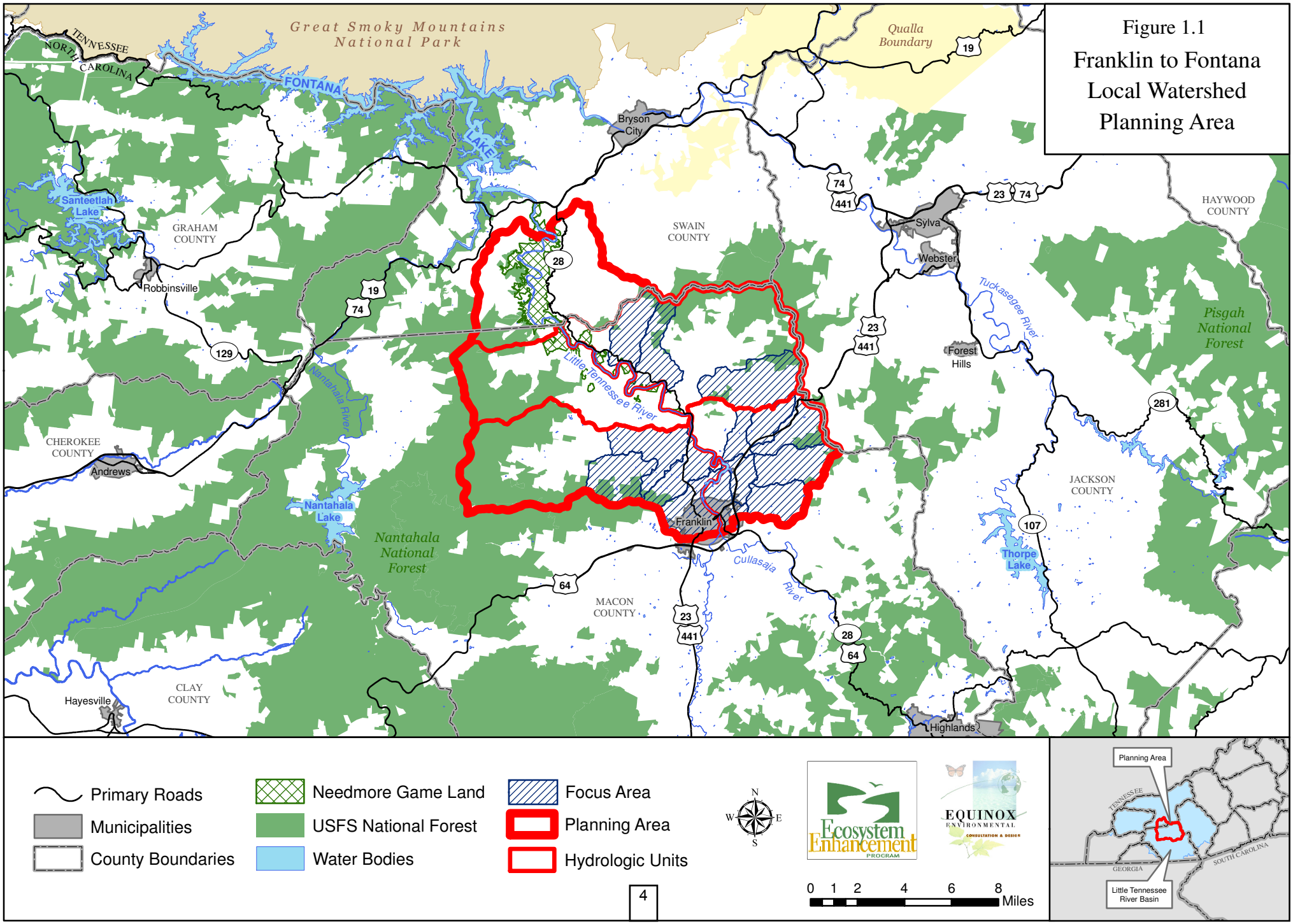
Figure 1.1
Franklin to Fontana
Local Watershed
Planning Area
Great Smoky Mountains
National Park
Qualla
Boundary
TENNESSEE
NORTH CAROLINA
FONTANA
LAKE
Bryson
City
Santeetlah
Lake
GRAHAM
COUNTY
Robbinsville
SWAIN
COUNTY
Sylva
Webster
HAYWOOD
COUNTY
Tuckasegee River
Pisgah
National
Forest
Forest
Hills
Little Tennessee River
Nantahala River
CHEROKEE
COUNTY
Andrews
Nantahala
Lake
Nantahala
National
Forest
Franklin
Cullasaja
River
JACKSON
COUNTY
Thorpe
Lake
MACON
COUNTY
CLAY
COUNTY
Hayesville
Highlands
Primary Roads
Municipalities
County Boundaries
Needmore Game Land
USFS National Forest
Water Bodies
Focus Area
Planning Area
Hydrologic Units
N
W
E
S
Ecosystem
Enhancement
PROGRAM
EQUINOX
ENVIRONMENTAL
CONSULTATION & DESIGN
0 1 2 4 6 8
Miles
Planning Area
TENNESSEE
GEORGIA
SOUTH CAROLINA
Little Tennessee
River Basin

Figure 1.2

Franklin to Fontana Watershed

Subwatersheds and Focus Area

- Fish Barriers
- USGS Stream Gage
- Streams
- Roads
- Nantahala-Cowee Corridor

Focus Area Subwatersheds
- Highly Impacted
- Moderately Impacted
- Urban

- Subwatersheds
- Local Watershed Planning Area
- Needmore Game Land
- National Forest
- Municipalities
- County Boundary

N W E S

0 0.75 1.5 2.25 3 Miles

Note: This map is not a survey and is not to be construed as such.

Ecosystem Enhancement Program

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1.5 Franklin to Fontana LWP Goals and Objectives

The goals of the Franklin to Fontana planning effort are to (1) conduct a reasonably comprehensive assessment of watershed conditions within the study area, (2) identify the major ecological stressors and important watershed assets to be addressed by watershed management plan recommendations, (3) produce an atlas of conservation projects at locations where the greatest benefit to local watershed functions can be achieved, and (4) produce a watershed management plan containing recommendations for the restoration and protection of local watershed resources. These goals have been achieved through a collaborative working process with the LAC.

Goals are defined as broader aims of the planning effort; specific planning and assessment objectives, which are more detailed tasks, were developed by the LAC and are described below.

1. Assess conditions of tributaries of the Little Tennessee River, identifying major stressors and their sources, and focusing on the following problems:
   a. Nutrients;
   b. Sediment;
   c. Fecal coliform bacteria;
   d. Riparian buffers;
   e. Channel modification; and
   f. Habitat deficiencies.

   Tributary assessment objectives were addressed through GIS and field activities performed during Phases I and II by NCEEP, the North Carolina Division of Water Quality (NCDWQ), and Equinox and are summarized in Section 3.

2. Develop a set of conservation projects, including stream and wetland restoration, farmland and wildland protection, buffer restoration, agricultural BMPs, and stormwater BMPs that are likely to provide the greatest improvement in watershed functions and are geared towards the priorities of conservation partner organizations.

   These objectives are addressed in the Project Atlas (Equinox 2010b), a companion document to this watershed management plan, and are summarized in Section 4.2.

3. Present a set of recommendations that addresses policy and institutional issues as follows:
   a. Changes to local ordinances and policies; and
   b. Use of existing environmental rules and programs.

   These objectives are described in Section 4.3.

4. Develop a watershed outreach and education program that leads to increased public awareness and involvement by targeting the following:
    a. Increased environmental literacy of the general public;
    b. Promotion of specific actions individuals can take to improve watershed health; and
    c. Landowner involvement in conservation projects.

    These objectives and associated recommendations are addressed in Section 4.4.

5. Support research and assessment needs, including:
    a. Increase understanding of sediment dynamics in the Little Tennessee River and how they may impact the aquatic community, including turbidity, contaminants in sediments, and sediment source areas and activities;
    b. Assess aquatic organism communities regularly through LTWA's stream monitoring program; and
    c. Identify barriers to fish passage in tributaries to the Little Tennessee River.

    These objectives are being addressed through ongoing studies by the following implementation Partners – Little Tennessee Watershed Association (LTWA), Western Carolina University (WCU), US Geological Survey, and US Fish and Wildlife Service (USFWS). They are summarized in Sections 3.4.1 and 4.5.

1.6 Organization of the Report

The remainder of this report is organized as follows:

- **Section 2** summarizes the stakeholder process and key inputs from the Franklin to Fontana Local Advisory Committee;
- **Section 3** summarizes current watershed conditions and the watershed assessment findings, naming key stressors and their sources;
- **Section 4** describes management recommendations addressing watershed stressors and assets;
- **Section 5** presents a coordinated strategy for integrating and implementing the management plan recommendations named in Section 4;
- **Section 6** provides a set of technical and funding resources;
- **Section 7** lists documents, personal communications, and web sites referenced in the report; and
- **Appendices** provide supporting information.

Section 2 Stakeholder Involvement

Local stakeholders are a critical component of NCEEP LWP initiatives. They include any individual, agency, institution, organization, or other group having a vested interest in the outcomes and products of the LWP process. Stakeholders can both influence and be affected by the decisions, recommendations, and solutions that come out of the planning process. Local stakeholders provide input into the planning process in the following important ways:

1. Establishing goals and objectives for the LWP work;
2. Identifying key areas within the LWP study area where watershed assessment and project implementation should be focused;
3. Providing data used in assessing watershed conditions;
4. Providing periodic review and feedback on technical findings and documents produced during the planning process;
5. Developing recommendations regarding watershed management activities and measures that should be adopted in order to meet the LWP goals; and
6. Providing initial contact or assisting in the recruitment of landowners whose properties contain potential watershed conservation projects.

The Local Advisory Committee (LAC) for the Franklin to Fontana local watershed planning initiative was established in June 2008. The LAC consists of representatives from local governments, conservation organizations, and resource agencies (Table 2.1) working in the project area who agreed to provide input regarding local issues of concern and appropriate goals for the plan.

Jenny Sanders, Stacy Guffey, and Lewis Penland participating in a LAC meeting.

Members of the LAC collaborated with a technical team comprised of NCEEP planning staff (Andrea Leslie and Hal Bryson), NCDWQ technical staff (Cathy Tyndall), and a technical consultant (Equinox Environmental Consultation & Design, Inc. [Equinox]) throughout all three phases of the watershed planning process. The LAC met eight times to provide input to and receive updates from NCEEP on the LWP effort. A summary of the issues addressed at those meetings is provided in Table 2.2. Committee members participated in the following activities:

- Identification of watershed stressors and their sources;
- Provision of data, local knowledge, and landowner contact information;
- Development of conservation project search screening and prioritization criteria;
- Review and input on project documents that enhanced their quality and usefulness;
- Identification of watershed goals, objectives, strategies, and actions for inclusion in the watershed management plan;
- Formulation of an education strategy; and
- Consensus on an organizational structure from which LAC members can implement the *Watershed Management Plan*.

Table 2.1 Franklin to Fontana LWP Local Advisory Committee[1]

Member Name	Organization
Jenny Sanders	Little Tennessee Watershed Association
Bill McLarney	Little Tennessee Watershed Association
Angie Rodgers	North Carolina Natural Heritage Program
Steve Fraley	North Carolina Wildlife Resources Commission
Sharon Taylor	Land Trust for the Little Tennessee
Anita Goetz	US Fish and Wildlife Service
Stacy Guffey	Citizen of Macon County, Land Trust for the Little Tennessee
Doug Johnson	Macon County Soil and Water Conservation District
Tim Garrett	Southwestern Resource Conservation and Development
Jerry Miller	Western Carolina University
Barry Clinton	Coweeta Hydrologic Laboratory
Darron Collins	World Wildlife Fund
Mike Grubermann	Town of Franklin
Erica Wadl	Tennessee Valley Authority
Sue Waldroop	Local landowner
Harvey Fouts	North Carolina Cooperative Extension Service, Fletcher
Alan Durden	Macon County Cooperative Extension Service
Brent Martin	The Wilderness Society
Brady Dodd	US Forest Service
Adrian Holt	Macon County Public Schools
Lewis Penland	Macon County Planning Board
Steve Johnson	Duke Energy Corporation
Matt Mason	Macon County Environmental Services
Owen Anderson	North Carolina Department of Transportation
Christy Bredenkamp	Swain County Cooperative Extension Service
Jason Love	Coweeta Hydrologic Laboratory – Long Term Ecological Research Program

[1]Note: these individuals agreed to be a part of the Local Advisory Committee and were involved in one or more meetings. Others were invited to participate but were not involved, including staff from the Natural Resources Conservation Service, Clean Water Management Trust Fund, Swain County Soil and Water Conservation District, and NC Division of Water Quality Planning Branch.

Table 2.2 Local Advisory Committee Meeting Summary

Meeting Date	Meeting Activities
July 16, 2008	Initial meeting of the LAC; NCEEP reviewed the LWP process; datasets to be used were presented by various partners (NCWRC, NCDWQ, USFS-Coweeta, LTWA); group discussions of project goals and issues were presented.
October 15,2008	A summary of data to be used in the *Preliminary Findings and Recommendations Report* was presented; breakout groups discussed two topics – (1) watershed assessment objectives and methods, (2) marketing and public relations aspects of the planning process.
December 11, 2008	Preliminary results of the PFRR document were presented; LAC members provided feedback on the proposed recommendations for consideration in designing the watershed assessment study.
November 5, 2009	The timeline for the LWP process was reviewed; water quality sampling results were presented by NCDWQ; an update on the status of freshwater mussels in the Little Tennessee River was presented by the NCWRC; NCEEP updated the LAC on related watershed work being completed by WCU and USGS as well as the status of the Cat Creek stream restoration project; a description of the Phase III *Project Atlas* was presented by Equinox; NCEEP described the final outputs of the watershed planning process (final *Project Atlas* and *Watershed Management Plan*); Equinox continued its effort to develop the education and outreach strategy by engaging the LAC in an "Outcome – Audience – Message – Method – Who" process using stormwater BMPs as an example.
April 13, 2010	LAC members presented updates on watershed associated activities taking place within their organizations; LAC members continued development of an outreach and education strategy for the watershed management plan; Equinox presented a summary of the watershed assessment results for the Rabbit, Iotla, and Watauga Creek watersheds; the screening criteria for the Phase III *Project Atlas* were reviewed, LAC members made suggestions that would improve the results for non-NCEEP projects.
July 9, 2010	This was a special meeting called for the expressed purpose of obtaining selected LAC member input on the screening and prioritization criteria to be used in the Phase III *Project Atlas*; more than 25 specific suggestions were made; all types of partner projects were addressed; one type, recreation, was dropped from the analysis.
September 7, 2010	Findings of the watershed assessment were presented along with how they related to the Phase I PFRR; information was presented on the Little Tennessee River/Lake Emory turbidity/sediment studies, Crawford Branch, and Tellico Creek trout farm water quality data; a status report on the Phase III *Project Atlas* was made, including how LAC input was incorporated into the process and preliminary maps of potential projects; Equinox presented an organization model for implementing the watershed management plan, LAC members were asked to provide input on the goals, objectives, and strategies to be considered for inclusion in the watershed management plan.
November 16, 2010	This meeting was held specifically for the purpose of brainstorming a list of recommendations the LAC felt were important to include in the watershed management plan. Recommendations addressing both stressors and assets were solicited.
April 20, 2011	The draft Watershed Management Plan was presented to the LAC; LAC members reviewed recommendations in Section 4 and the implementation strategy in Section 5.
Stakeholder Interviews on Stressors, 2009 & 2010	During the Phase II watershed assessment, individual LAC members were interviewed to capture their knowledge of specific stressors and sources in the focus area subwatersheds. This information was incorporated into the field assessments.
Stakeholder Interviews on Management Strategies, 2010 & 2011	Individual LAC members were contacted to provide input into the development of the outreach and education program and implementation model to be used in implementing the *Watershed Management Plan*. Others were interviewed to develop policy and institutional measures and conservation project recommendations included in the plan.

Section 3 Watershed Characterization

This section provides a brief overview of assessment methods, watershed characteristics, and current stream conditions and stressors. This information was derived mainly from the *Preliminary Findings and Recommendations Report* (Equinox 2009a), the *Watershed Assessment Report* (Equinox 2010a), and the NCDWQ water quality assessment summary report (NCDWQ 2010a). Other references are cited as necessary.

3.1 Assessment Methodology

Subwatershed conditions in the planning area were characterized in two phases. Phase I consisted of analyses of existing data and low intensity field assessments for all subwatersheds in the planning area. In Phase II, more detailed GIS data analyses and field assessments were completed in order to address assessment objectives developed by the Local Advisory Team (see Section 1.5). The following sections summarize the methods used in the Franklin to Fontana LWP assessment process.

3.1.1 Phase I – Preliminary Watershed Characterization

The assessment of watershed condition on a functional basis is an important component of the NCEEP's approach to local watershed planning (WNAT 2003). Such a **functional assessment** typically seeks to evaluate watersheds on three factors:

1. Hydrology;
2. Aquatic and terrestrial habitat (including physical habitat as well as plant and animal distributions and abundance); and
3. Water quality (including chemical and thermal processes).

The Franklin to Fontana local watershed planning area was divided into 29 subwatersheds (Figure 1.2, Table 3.1) to facilitate interpretation of existing data and to rate ecological conditions among the subwatersheds. Some streams drain more than one subwatershed, and in these cases, the entire stream's watershed is referred to as a drainage, such as the Iotla Creek drainage, which includes the Upper and Lower Iotla Creek and Iotla Branch subwatersheds. General watershed characteristics (Equinox 2009a) for the entire planning area were determined based on the following activities:

- Analysis of spatial data – GIS datasets, aerial photographs, and topographic maps;
- Review of existing fish community, benthic macroinvertebrate community, and water chemistry monitoring data from NCDWQ, LTWA, and TVA;
- Windshield surveys, additional water chemistry sampling, and assessment stream and riparian conditions of selected stream reaches; and
- Information gleaned from other technical reports and plans of government and private sector sources.

Table 3.1 Characteristics of Subwatersheds in the Franklin to Fontana Planning Area

	Subwatershed Name and Code[1]		Drainage Area (sq mi)	Developed (%)	Agriculture (%)	Forest (%)	Other (%)	Ecological Function Rating
Focus Area Subwatersheds	Lakey Creek (Caler Cove Branch, UTs)	Lak	4.3	5.3%	11.3%	82.9%	0.5%	Moderate
	Bradley Creek (misc. tribs.)	Brad	4.6	6.8%	12.3%	79.5%	1.4%	Moderate
	Caler Fork	CFrk	7.4	5.1%	3.5%	91.0%	0.5%	High
	Lower Watauga Creek	LWat	1.8	12.3%	17.0%	70.3%	0.5%	Moderate
	Upper Watauga Creek	UWat	3.9	11.7%	4.1%	84.1%	0.1%	Moderate
	Coon Creek	Coon	2.4	16.4%	1.4%	81.7%	0.5%	Moderate
	Lower Rabbit Creek, UTs	LRab	1.9	21.1%	4.4%	72.7%	1.8%	Moderate
	Upper Rabbit Creek	URab	4.8	6.9%	15.4%	77.5%	0.2%	Low
	Cat Creek	Cat	3.7	12.2%	20.7%	66.9%	0.3%	Low
	Rocky Branch, UTs	Rock	3.8	10.8%	18.2%	70.2%	0.9%	Moderate
	Lower Iotla Creek	LIot	5.1	12.7%	23.5%	63.1%	0.8%	Low
	Upper Iotla Creek	UIot	4.8	5.4%	7.7%	86.7%	0.1%	Moderate
	Lake Emory, UTs	LEm	2.5	31.6%	5.6%	56.2%	6.5%	Low
	Crawford Branch, UTs	Craw	4.5	34.2%	3.4%	60.3%	2.1%	Low
Other Subwatersheds	Sawmill Creek, Dehart Creek	Saw	6.8	4.0%	0.9%	93.0%	2.1%	High
	Brush Creek	Bru	8.6	3.4%	2.1%	93.4%	1.0%	High
	Queen Branch, Simon Branch, UTs	Que	2.6	7.1%	1.1%	88.2%	3.7%	High
	Matlock Creek	Matl	5.1	4.2%	4.0%	91.8%	0.0%	High
	Lower Cowee Creek, UTs	UCow	2.1	4.7%	4.6%	90.5%	0.2%	High
	Upper Cowee Creek	UCow	3.1	4.7%	4.6%	90.5%	0.2%	High
	Beasley Creek	Beas	6.2	2.1%	0.7%	97.2%	0.0%	High
	Mica City Creek	Mica	2.4	2.4%	2.9%	94.6%	0.0%	High
	Tippet Branch, Mason Branch	Tip	3.7	8.4%	12.3%	77.5%	1.7%	Moderate
	Rose Creek, misc. tribs	Rose	6.0	7.1%	10.0%	81.0%	1.9%	Moderate
	Upper Burningtown Creek	UBur	12.6	1.2%	0.9%	97.8%	0.1%	High
	Middle Burningtown Creek	MBur	8.8	3.6%	6.0%	90.2%	0.2%	High
	Lower Burningtown Creek	LBur	5.3	4.3%	4.7%	90.9%	0.1%	High
	Tellico Creek, misc tribs	Tell	12.8	1.9%	0.8%	97.1%	0.2%	High
	Needmore	Need	12.0	5.0%	1.3%	92.6%	1.2%	High

[1] Some tributaries do not drain directly into the named stream. They were included due to the method by which subwatersheds were delineated.

Spatial Data Analyses – Land cover was analyzed using a 13-class database created by the NC Center for Geographic Information and Analysis (NCCGIA) based on ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) satellite imagery with a resolution of 59 feet (NCCGIA 2008). Land cover classes were based on the 2001 National Land Cover Database definitions (USEPA 2007).

Riparian zone condition was determined based on visual interpretation of 2006 aerial photographs and stream data provided by NCCGIA via the NC Stream Mapping Program (NCCGIA 2007). Widths of riparian forest vegetation were classified for three zones - <30 feet, 30-100 feet, and >100 feet. Less than 30 feet of forested width was considered minimal.

Water Quality Monitoring – Water quality conditions were evaluated using existing data on fish and benthic macroinvertebrate communities, aquatic habitat, and water chemistry.

Fish community data from 37 sites were available for analysis. Most fish community data were collected by LTWA between 1990 and 2008 (LTWA 2007, 2008), but NCDWQ and TVA also monitored fish at some locations. All data were assessed using an **Index of Biotic Integrity Approach (IBI)** and results were standardized to the five NCDWQ bioclassifications: Excellent, Good, Good-Fair, Fair, Poor. Benthic macroinvertebrate community data from 27 sites were available from NCDWQ, most collected since 1999; sites were rated as Excellent, Good, Good-Fair, Fair, Poor, Not Impaired, or Not Rated. Aquatic habitat assessments were conducted by NCDWQ at the same 28 locations where fish and benthic macroinvertebrate community samples also were taken. The standard NCDWQ habitat assessment protocol was used, which scores a site on a 100 point scale (NCDWQ 2006a); habitat quality ratings were developed for the Franklin to Fontana LWP, including Reference, Good-Moderate, Degraded, and Highly Degraded.

NCDWQ also collected water samples from 19 tributary streams to assess fecal coliform bacteria, nutrient (nitrite/nitrate, phosphorus, ammonia, and total Kjeldahl nitrogen), turbidity, total suspended solids, and specific conductance levels within the planning area. The NCDWQ laboratory's detection limit of 0.04 mg/L was used as a background level of nitrite/nitrate for comparison purposes. Most sites were sampled on three occasions during July-September 2008 (NCDWQ 2010a). The purpose of this monitoring was to provide an initial picture of water chemistry in the tributaries of the Little Tennessee River and to identify areas that warranted investigation in Phase II.

Additional field assessments were made at 64 locations, primarily bridge crossings, throughout the planning area. These assessments included the following:

- Measurement of specific conductance and temperature;
- Observations regarding the nature of riparian area disturbances, bank stability, channel substrate, and channel alteration (straightening, berming, ditching, etc.); and
- Taking photographs to document observed conditions.

Subwatershed Ecological Condition - A two-stage process was used to prioritize subwatersheds for additional study (Equinox 2009a). Subwatersheds were initially rated by their degree of ecological degradation using the following four attributes:

- Percent forest cover;
- Percent of subwatershed stream length with wooded riparian areas <30 feet wide on both sides of the stream;
- Median subwatershed specific conductance ; and
- Subwatershed bioclassification based on a combination of fish and benthic macroinvertebrate community bioclassifications.

Using these data, land cover data, and professional judgment, the project team initially rated each subwatershed as having High, Moderate, or Low ecological condition. They then used their general knowledge of each subwatershed and aquatic habitat scores, substrate ratings, percent developed land, and percent protected land to derive a final ecological condition rating for each subwatershed (Table 3.1 and Figure 3.1). The ecological condition ratings were used in part to determine the focus areas of further assessment in Phase II.

3.1.2 Phase II – Watershed Assessment

Generally, the methods used in Phase I were applied in Phase II; only those new or altered methods and sample locations are described here. All Phase II data were collected between September 2009 and mid-2010. Phase II sampling was designed to obtain more detailed information on 14 focus subwatersheds that were chosen based on (1) assessment priorities of the Local Advisory Committee and (2) Phase I determination of ecological condition. All of the subwatersheds with Low or Moderate ecological condition were prioritized as focus areas, with the exception of the Tippet Branch and Rose Creek subwatersheds (Figure 3.1 and Table 3.1). Caler Fork, which had an ecological rating of High, was also identified as a focus area due to sediment impacts related to the Wildflower development. Phase II assessment efforts focused on determining the extent of known stressors on the aquatic community and identifying sources of those stressors. These 14 subwatersheds, comprising 56 mi^2, constituted the focus area of the watershed assessment and were grouped into three assessment categories—urban subwatersheds and highly impacted and moderately impacted rural subwatersheds (Figure 1.2)—that were subjected to different levels and types of assessment according to stressor types and levels of degradation.

Sampling schemes were designed to identify specific locations and sources of sediment, nutrients, fecal coliform bacteria, degraded aquatic habitat conditions, and pesticides (Equinox 2010a). While data prior to 2006 were not used in the Phase II analyses, some earlier data were referenced where warranted. The Phase II assessment also included a subjective examination of the following secondary issues: the reasons for riparian area impacts, the extent of channel and floodplain modification, factors impacting first and second order streams, and the extent of stream bank erosion.

Spatial Data Analyses – Using more specific screening criteria, focus area subwatersheds were examined using GIS analyses to identify highly disturbed buffers, areas where livestock have access to streams, ditched, bermed, or otherwise modified channels, unpaved roads, residences with potentially faulty septic systems, and an inventory of other general land disturbances. In urban subwatersheds the extent of **impervious cover** was determined using the land cover dataset developed by NCCGIA in Phase I and assumptions of impervious cover for specific land cover classes.

Windshield surveys of the focus area subwatersheds were conducted to ground-truth the present conditions of selected problem sites, to identify problem sites not evident in the aerial photo analysis, and to identify stream reaches with highly eroding banks. Site specific information regarding stressors and their sources also were obtained from interviews with selected LAC members.

Crawford Branch and Lake Emory, both urban subwatersheds, were analyzed using GIS to support a search for stormwater BMP **retrofit** sites. These analyses included stormwater drainage patterns, variations in land cover, land use distribution, riparian condition, and extent of impervious cover. Stormwater BMP sites were identified using a combination of GIS analyses and on-site assessments to determine the feasibility for installing stormwater treatment features.

Water Quality and Habitat Monitoring – The LTWA continued its fish community monitoring program at established sites throughout the planning area, and seven additional samples were taken within focus area subwatersheds. An additional fish sample was taken on Tellico Creek downstream of the Tellico Trout Farm to assess the impact from the trout farm discharge to the fish community.

Nine additional benthic invertebrate community samples were taken during Phase II in order to assess potential impacts of a tomato farm in the Rabbit-Cat Creek drainage, the Tellico Trout Farm on Tellico Creek, and the highly developed part of Franklin on Crawford Branch.

Aquatic habitat was characterized at 37 locations, 30 of them within focus area subwatersheds. Current habitat condition ratings were used in conjunction with fish and benthic invertebrate community data to assess local ecological conditions and to identify subwatershed locations in need of restoration. A separate assessment of stream sediment impacts also was conducted at all sites where aquatic habitat data had been collected, determining an overall reach sediment rating based on the percentage of the substrate composed of silt and sand and a riffle embeddedness rating; ratings used were Low, Moderate, and High.

Where Phase I fecal coliform and nutrient sampling indicated problematic levels, follow-up monitoring was performed during Phase II in order to pinpoint pollution sources and/or to determine whether or not the NC State standard for fecal coliform bacteria (200 cfu/100 mL, calculated as the geometric mean of five samples collected within 30 days) was exceeded. This assessment was performed in the Rabbit Creek, Cat Creek, Crawford Branch, Watauga Creek, Rocky Branch, Iotla Branch, Iotla Creek and Bradley Creek subwatersheds.

Some key field datasets collected and/or used in Phases I and II are summarized by subwatershed in Table 3.2.

Table 3.2 Key Field Datasets Used[1] in Phases I and II, 2006-2010

	Subwatershed Name and Code	Fish IBI	Benthic macro-invertebrates	Habitat	Substrate, embedded-ness	Fecal coliform bacteria	Nutrients	Urban pollutants	AOP barrier survey
Focus Area Subwatersheds	Lakey Creek (Caler Cove Branch, UTs)		x	x	x	x	x		x
	Bradley Creek (misc. tribs.)		x	x	x	x	x		x
	Caler Fork	x	x	x	x	x	x		x
	Lower Watauga Creek	x	x	x	x	x	x		x
	Upper Watauga Creek	x		x	x	x	x		x
	Coon Creek		x	x	x	x	x		x
	Lower Rabbit Creek, UTs	x	x	x	x				
	Upper Rabbit Creek		x	x	x	x	x		
	Cat Creek	x	x	x	x	x	x		
	Rocky Branch, UTs	x		x	x	x	x		
	Lower Iotla Creek	x	x	x	x	x	x		x
	Upper Iotla Creek		x	x	x	x	x		x
	Lake Emory, UTs								
	Crawford Branch, UTs	x	x	x	x	x	x	x	
Other Subwatersheds	Sawmill Creek, Dehart Creek	x		x	x				x
	Brush Creek	x		x	x				x
	Queen Branch, Simon Branch, UTs			x	x				x
	Matlock Creek	x	x	x	x	x	x		x
	Lower Cowee Creek, UTs	x	x	x	x	x	x		x
	Upper Cowee Creek	x	x	x	x	x	x		x
	Beasley Creek								x
	Mica City Creek								x
	Tippet Branch, Mason Branch	x		x	x	x	x		
	Rose Creek, misc. tribs			x	x	x	x		x
	Upper Burningtown Creek	x		x	x				x
	Middle Burningtown Creek	x	x	x	x	x	x		x
	Lower Burningtown Creek	x	x	x	x	x	x		x
	Tellico Creek, misc tribs	x	x	x	x	x	x		x
	Needmore	x	x	x	x				x

[1]All data were collected in 2008-2010 as part of the Franklin to Fontana watershed planning effort. Additional benthic and fish data collected 2006-2007 also considered are noted here as well.

3.2 General Watershed Characteristics

The 154 mi^2 Franklin to Fontana local watershed planning area was divided into 29 subwatersheds, 27 of which are primarily rural and two of which are urban and located in the vicinity of Franklin (Figure 1.2); they range in size from 1.8 to 12.8 mi^2 (Table 3.1). The southernmost 11% of the watershed, including Cat and Rabbit Creeks and Crawford Branch, drain into Lake Emory, but the remaining watershed drains into the free-flowing section of the Little Tennessee River between Lake Emory and Lake Fontana.

Land use in the watershed shifts from more developed and agricultural uses in the south to more forested lands in the north. The most developed subwatersheds are those associated with Franklin (Lake Emory and Crawford Branch), where more than 30% of the land is developed. Within these subwatersheds, impervious surfaces make up 5.5% to 35.8% of the area within eight smaller catchments delineated. Stormwater runoff in these subwatersheds drives stream condition, causing stream bank erosion and scour of stream channels and transporting pollutants from upland areas.

The most highly agricultural subwatersheds are those in the Cat-Rabbit, Iotla, and Watauga drainages, where agricultural land use ranges from 4.1% to 23.5% of the subwatershed area. Forested land consists of 56-60% of the land in the southern urban subwatersheds but increases to 98% in some northern subwatersheds. Most of the forest land occurs in headwater and more steeply sloped areas.

The majority of disturbances impacting watershed conditions occur along the mainstem streams and lower portions of tributaries. Impacts from agricultural activities are most severe in the rural focus area subwatersheds, driving biological community degradation and higher nutrient and fecal coliform bacteria levels. Streams in agricultural areas are often straightened, bermed, or ditched, have a high proportion of poorly vegetated riparian areas, and are severely impacted where livestock have access to creek channels. Development in the rural subwatersheds consists mainly of low density residential areas and small commercial sites. Unpaved roads are common throughout the watershed and are often in steeper forested areas; many unpaved roads examined are eroding and likely contributing sediment to streams.

3.3 Subwatershed Prioritization

Subwatersheds were prioritized for detailed assessment based on their degree of ecological degradation as measured by physical, biological, and water quality indicators. As mentioned in previous sections, with the exception of the Rose Creek and Tippet Branch subwatersheds, all those subwatersheds with an ecological rating of Moderate or Low (Table 3.1 and Figure 3.1) were identified as focus area subwatersheds and subjected to more detailed assessment in Phase II. These subwatersheds were grouped as highly impacted, moderately impacted, or urban (Figure 1.2) according to both the general level of degradation and stressor types.

In Phase III, the rural focus subwatersheds were also prioritized for NCEEP stream and wetland restoration projects and agricultural BMPs in order to maximize the probability of achieving measurable ecological uplift at the subwatershed scale (Figure 4.1). The two urban subwatersheds were prioritized only for stormwater BMPs. Other Partner projects, including wildland preservation, farmland preservation, and Little Tennessee River mainstem restoration projects, were identified throughout the Franklin to Fontana watershed.

Figure 3.1

Franklin to Fontana Watershed

Subwatershed Ecological Condition

Ecological Condition

- Low
- Moderate
- High
- USGS Stream Gage
- Streams
- Roads
- Local Watershed Planning Area
- National Forest
- Municipalities
- County Boundary

N W E S

0 0.75 1.5 2.25 3 Miles

Note: This map is not a survey and is not to be construed as such.

Ecosystem Enhancement Program

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3.4 Stream Conditions

This section summarizes results from Phase I and II assessment findings by drainage or subwatershed. It briefly describes two supplemental studies performed by Partner organizations. It also provides a summary of the most significant stressors examined and describes their sources and impacts.

3.4.1 Assessment Findings

Rabbit-Cat Creek Drainage – The Rabbit-Cat Creek drainage is one of the most degraded drainages in the planning area. Approximately 15% of the drainage is in agriculture and 11% in developed land. Within the drainage, almost 38% of streams contain no or minimal woody vegetation in the riparian areas and almost 22% show evidence of having been straightened, bermed, or ditched. Farming consists mainly of livestock grazing and is concentrated in the lower elevation portions of the Cat Creek and Upper Rabbit Creek subwatersheds. Many livestock operations have poorly managed pastures. Eighty-four percent of pasture land lacks adequate fencing to keep livestock out of stream channels. Most of the developed land is concentrated in the Lower Rabbit Creek subwatershed.

Fish and benthic communities are impacted by degraded habitat, high nutrient concentrations and toxicity. Fish communities in the drainage have been rated as Poor or Fair in recent samples. Fish IBI scores are declining, accompanied by a decline in the number of native species between 2006 and 2009 and an increase in the percentage of omnivores/herbivores from 10% in 2006 to 25% in 2009.

In 2008, benthic macroinvertebrate communities were severely impacted by toxicity associated with pesticides from a large tomato farm at the confluence of Cat and Rabbit Creeks. These benthic data were used to place both Cat and Rabbit Creeks on the 2010 303(d) list (NCDWQ 2010b). However, this farm has now been replanted in blackberries, and it is likely that the benthic community has recovered to some degree. With the exception of the 2008 sampling, benthic macroinvertebrate communities have been rated as Good or Good-Fair or Not Impaired.

Sedimentation and poor stream and riparian habitat are dominant stressors throughout these subwatersheds. Aquatic habitat conditions rated as Degraded throughout the drainage with Cat Creek and Lower Rabbit Creek having the most degraded conditions, receiving scores of <50 out of 100. Sediment impact ratings were Moderate or High at all sites sampled. Over 36,000 feet of channel are severely eroding and almost 100,000 feet of stream channel lacks woody riparian vegetation. In addition, the estimated 58 miles of unpaved roads are undoubtedly contributing a significant amount of sediment to streams in the drainage.

Elevated nutrient and fecal coliform bacteria levels have been documented in the drainage. Nitrite/nitrate concentration medians are high at 0.30-0.32 mg/L and well above background levels. Geometric means of fecal coliform bacteria in both upper Rabbit Creek (510 cfu/100 mL) and Cat Creek (443 cfu/100 mL) exceeded the State standard. High nutrient and fecal coliform bacteria levels found in conjunction with active livestock operations implicate them as being the major source of these pollutants. Faulty septic systems may be a secondary source of nutrients and fecal coliform bacteria as 66 residences were found to be in close proximity of streams and have a potential for malfunction.

Iotla Creek Drainage – The Iotla Creek drainage also is severely impacted by agricultural activities, particularly livestock operations. With the exception of pesticides, impacts are similar to those described for the Rabbit-Cat Creek drainage. The Lower Iotla Creek subwatershed has more agricultural land (consisting of 24% of land use) than does the Upper Iotla Creek subwatershed, which is predominately forested (87% of land use). Most livestock operations are located along the mainstem of Iotla Creek and the lower portions of tributary streams. While residential development is common here as well, it is dispersed and is not affecting stream conditions to the extent as are agricultural activities.

Twenty-eight percent of the stream channel in the Iotla Creek drainage has little or no woody vegetation in the riparian area, and 18% of streams show evidence of being channelized, bermed, or ditched. However, most headwater streams in the Upper Iotla Creek subwatershed are in the Nantahala National Forest and have undisturbed riparian vegetation.

The fish community was rated Good-Fair and Fair at various sites on Iotla Creek; however community make-up was driven in part by proximity and access to the Little Tennessee River. The benthic macroinvertebrate community has been rated as Good or Good-Fair at most sites, despite poor habitat observed. The benthic macroinvertebrate community at Iotla Branch was rated Fair in 2008, and this stream was included on the NCDWQ 2010 303(d) list (NCDWQ 2010b); poor habitat was noted at the sampling location. Habitat conditions are generally poorest in low elevation, low gradient portions of the drainage, where riffles are highly embedded and the stream substrate is dominated by high levels of sand and silt. Aquatic habitat conditions at these sites were considered Degraded or Highly Degraded, having received scores of <59 out of 100. Higher gradient sites had habitat considered Good-Moderate (scoring 75-77 out of 100).

Sediment impact ratings were Moderate or High at all sites sampled. Sedimentation and poor stream and riparian habitat are the dominant stressors in this drainage. Over 24,000 feet of stream channel is severely eroding and 65,000 feet of channel has been channelized, bermed, or ditched. Most of this degradation occurs in the lower elevation, lower slope portions of the drainage. The Iotla Creek drainage also contains at least 58 miles of unpaved roads, contributing an unknown amount of sediment.

Nitrite/nitrate concentrations are higher than background levels, with medians ranging from 0.13 to 0.21 mg/L, but they are not as high as those in the Rabbit-Cat Creek drainage. These elevated levels are likely associated with livestock operations. Fecal coliform levels in the Iotla Creek drainage exceed the State standard, and geometric means ranged from 917 to 1,306 cfu/100 mL. Bacteria levels of one-time grab samples of up to 3,500 cfu/100 mL have been documented in the drainage. These samples were almost always directly associated with livestock grazing activities in or adjacent to riparian areas. While possible, it is less likely that the elevated nutrient and fecal coliform bacteria levels are associated with faulty septic systems. Only 45 residences were found to be within close proximity of stream channels, and they are widely dispersed throughout the drainage.

Watauga Creek Drainage - Ecological conditions within the Watauga Creek drainage are not as degraded as are those in the Rabbit-Cat and Iotla Creek drainages, but biological communities are still impacted by poor habitat conditions. Streams are impacted by extensive low-density residential development in the higher elevation areas and livestock operations concentrated at lower elevations along the mainstem Watauga Creek and its tributaries.

Much of the residential development in the Watauga Creek drainage is set within forested land that covers 80% of the drainage. Approximately 5% of the drainage is in agricultural uses, mostly in livestock pasture. Twenty-four percent of stream channels have minimal or no woody riparian vegetation, and 12% of channels show evidence of having been channelized, bermed, or ditched. While severely eroding stream banks are relatively less common in this drainage, sediment is still of concern.

Biological data indicate less degraded conditions than found in the Rabbit-Cat and Iotla Creek drainages. Fish communities have been rated as Good-Fair in recent years, while benthic macroinvertebrate communities have been rated as Good or Not Impaired. Pollution tolerant and intolerant species of both types of organisms have been collected. Aquatic habitat conditions in Watauga Creek were Good-Moderate, scoring >65 out of 100, whereas in Coon Creek, habitat conditions were poorer and were rated as Degraded.

As with the previous drainages, sedimentation and poor stream and riparian habitat conditions are dominant stressors in the drainage. In addition to the lack of riparian vegetation, the Watauga Creek drainage has 67 miles of unpaved roads, with the highest density of any drainage examined. While the amount of sediment originating from these roads is unknown, habitat assessment locations on streams draining forested areas with unpaved roads received Moderate sediment impact ratings, suggesting that significant amounts of sediment are originating from these unpaved roads.

The most recent measurements found nitrite/nitrate median levels of approximately 0.20 mg/L. These are moderately elevated over normal background levels. The fecal coliform bacteria geometric mean was 417 cfu/100 mL, exceeding the State standard. Subsequent one-day grab sampling implicated a livestock operation as the source of high levels. The likelihood of faulty septic systems being the source of nutrients appears low even though 85 residences are located in close proximity to streams in this drainage.

Rocky Branch – Rocky Branch is impacted by sediment, nutrients, and fecal coliform bacteria primarily associated with agricultural activities. Nutrients (nitrite/nitrate levels ranged from 0.03 to 0.56 mg/L) and fecal coliform bacteria levels of one-time grab samples (44-380 cfu/100 mL) were highly variable throughout the subwatershed; however, at a downstream location, the geometric mean of five fecal coliform bacteria samples exceeded the State standard at 370 cfu/100 mL. Like the Rabbit-Cat, Iotla, and Watauga drainages, the Rocky Branch subwatershed is characterized by a high percentage of stream channel with minimal or no woody riparian vegetation (31%) and a considerable proportion of channels with evidence of having been channelized, bermed, or ditched (15%). There are 9,200 feet of severely eroding stream channel, as well. Aquatic habitat conditions were similarly variable with habitat ratings ranging from Good-Moderate (scoring 69 out of 100) to Highly Degraded (scoring 49 out of 100). Sediment impact ratings for this subwatershed were almost uniformly High. Livestock operations are the likely source of nutrients and fecal coliform bacteria, as high densities of cattle operations are sited along subwatershed streams and high levels of nutrients and fecal coliform bacteria sampling were associated with these locations. Unpaved roads also are a likely source of sediment, particularly in Jacobs Branch. Only 26 residences are in close proximity to streams, making faulty septic systems an unlikely source of nutrients and fecal coliform bacteria.

Bradley Creek and Lakey Creek – The Bradley Creek and Lakey Creek subwatersheds have similar ecological characteristics and impacts. Both subwatersheds are approximately 80%

forested, much of it in the Nantahala National Forest. Most ecological impacts occur in the lower portions of both subwatersheds where much of the stream channel has minimal or no woody riparian vegetation. Only about 7% of the Bradley Creek and 4% of the Lakey Creek subwatersheds show evidence of having been channelized, bermed, or ditched.

Fecal coliform levels were higher in Bradley Creek, and they exceeded the State standard with 314 cfu/100 mL. Follow-up sampling demonstrated that these levels were associated with cattle access to streams.

Caler Fork – The Caler Fork subwatershed is in moderately good ecological condition, but because concerns regarding sediment impacts from the Wildflower Development remain, substrate conditions were examined more intensively. The Wildflower development broke ground in 2005 but is now bankrupt, and construction and development activities are at a halt. The site is characterized by unstable roads and landslides; a NC Geological Survey examination of the site in 2009 revealed a large eroding landslide and several other scarps and smaller landslides on the development's roads (NCGS, 2009).

Although the benthic community was rated as Good by NCDWQ in 2008, the fish community bounced from Good in 2001 and 2005 to Fair in 2006 to Good in 2008 to Good-Fair in 2010. The LTWA linked the drop in 2006 to large inputs of sediment from initial land clearing and road construction in the Wildflower development, and the LTWA believes the drop in 2010 may be due to continued sedimentation from unpaved roads in the Wildflower Development. Aquatic habitat ratings reveal some degradation (scores of 63 and 74 out of 100), and the subwatershed has a Moderate sediment impact rating; however, the substrate metric does not reveal serious impacts from sediment. Furthermore, an analysis of substrate particle size based on riffle pebble counts reveals that particle size distributions do not vary much in Caler Fork itself above and below tributaries impacted by Wildflower; however, somewhat smaller particle sizes are present between Tippet Branch and Dalton Creek, two tributaries that drain the development. The substrate particle sizes of runs and pools were not examined, and these may show differences up and downstream of Wildflower. In addition, most tributaries that drain Wildflower were not investigated, and these may reveal more obvious sediment impacts.

The subwatershed does contain almost 57 miles of unpaved roads, which are likely an ongoing source of sediment. Many of these unpaved roads are within the recently bankrupt Wildflower Development, characterized by eroding roads and slope failures. A more detailed investigation of the tributaries draining Wildflower and Caler Fork itself is needed in order to determine the extent of sediment impacts from this development.

Crawford Branch and Lake Emory Tributaries - Approximately one-third of the seven square miles of land in these subwatersheds is developed. Thirty-eight percent of the stream length has little or no woody riparian vegetation and over 7,500 feet of stream channel is piped underground. In Crawford Branch below the Franklin business district, the fish community was rated Poor and the benthic community was rated Fair, characterized by an extremely low number of sensitive taxa (NCDWQ 2010c). Above the business district at the Franklin Memorial Park, the benthic community was considerably healthier, rated as Good. Crawford Branch will likely be included on the State's 303(d) list in 2012 due to the benthic community findings (Cathy Tyndall, NCDWQ, personal communication).

Nutrient levels (nitrite/nitrate) as high as 1.0 mg/L have been documented in Crawford Branch, significantly above background levels of 0.04 mg/L. Fecal coliform bacteria levels exceeded the State standard with a geometric mean of 5 samples of >1,300 cfu/100 mL. Efforts to isolate the source of fecal coliform bacteria were unsuccessful.

Tellico Creek – Impacts of the Tellico Trout Farm were examined due to concerns about nutrients on the biological community (NCDWQ 2010d). A one-time set of grab samples taken in 2008 showed elevated levels of ammonia (3.0 mg/L) and total phosphorus (0.53 mg/L) downstream of the farm compared to upstream levels (0.02 mg/L and 0.02 mg/L, respectively). The fish community in 2010 showed a decline in biotic integrity compared to previous years; this decline may be linked to nutrient enrichment. The benthic macroinvertebrate community was rated Fair below the farm and Good above, and that below the farm had only half the sensitive (mayfly, caddisfly, and stonefly) taxa of that above. Tellico Creek will likely be included on the State's 303(d) list in 2012 due to the benthic community findings (Cathy Tyndall, NCDWQ, personal communication). Impacts observed during benthic sampling included discharge of farm waste from its raceways into Tellico Creek, diversion of almost the entire flow of Tellico Creek through the farm, and silty deposits below the farm onto stream substrate.

3.4.2 Supplemental Studies

In 2007 and 2008, a collaborative team of federal, state, and local partners assessed 121 crossings for aquatic organism passage on tributaries to the Little Tennessee River draining more than two square miles (Leslie 2008). Crossings suspected as barriers underwent detailed assessment using modified USFS protocols, which apply physical dimensions of the structures to models of fish swimming ability. Those crossings determined impassable or possibly impassable were tested by monitoring of fish communities up and downstream of each crossing during fall migrations of spotfin chub (*Erimonax monachus)*, whitetail shiner (*Cyprinella galactura)*, and telescope shiner (*Notropis telescopus)* from the Little Tennessee River (McLarney 2009).

Eight structures were determined to be impassable to at least some small fish species, including members of the following families: darters (*Percidae*), sculpin (*Cottidae)*, and minnows (*Cyprinidae)* such as the spotfin chub and shiners (Figure 1.2 and Table 3.3). Of the 121 crossings evaluated, two-thirds were bridges, and none of these were deemed impassable. However, of the 23 pipe culverts evaluated, four were determined impassable. Of the seven box culverts evaluated, three were determined impassable. An I-beam placed in the stream bed downstream of a private bridge was also impassable for some fish species.

In 2010, USGS and WCU researchers instigated numerous studies to examine pollutants in bed sediments, interstitial water within the bed sediments, and the water column in the Little Tennessee River. WCU collected one sediment core in Lake Emory and surficial grab samples of bed sediments at numerous sites in the free-flowing river downstream of the lake; these samples were analyzed for total metals. USGS analyzed interstitial and overlying water at eight sites in the free-flowing river on five occasions from August 2010 to January 2011 in addition to once at several sites where WCU found high copper concentrations in the bed sediment. Interstitial and overlying water samples were analyzed for dissolved copper and ammonia, and overlying water was also analyzed for 63 wastewater indicator compounds.

Table 3.3 Culverts and Other Road-related Structures Determined to be Fish Barriers

Subwatershed	Stream	Locality
Needmore	Wiggins Creek	Private road at crossroads of SR 1110 and Flint Rock Road
Needmore	Rattlesnake Creek	Along SR 1113 at crossroads of Needmore Road and Big Dog Road
Sawmill Creek	Sawmill Creek	Private driveway on SR 1128 at 520 Sawmill Creek Road
Tellico Creek	Tellico Creek	I-beam in placed in stream at private driveway along SR 1367
Queen Branch	Queen Branch	Along NC 28 and SR 1362 (Queen Branch)
Lakey Creek	UT to Lakey Creek	along SR 28 and Glass Shanty Circle
Watauga Creek[1]	Watauga Creek	Along US 441/23 (under) at crossroads of SR 1500 (Watauga Creek Rd)
Needmore[1]	Licklog Creek	Along SR 1113 (Needmore Road)

[1]Barrier identified as impassable via model, but fish data demonstrate passability at some flows (McLarney 2009).

High levels of metals (including copper, cadmium, zinc, nickel, chromium, and lead) were found in legacy sediments likely dating from before 1963 in Lake Emory (Miller 2010). Despite this, interstitial waters in sediments sampled in the river itself contained low levels of dissolved copper, well below established toxicity levels for various mussel species and life stages, even at sites with very high total copper concentrations in bed sediments. Thus the solid phase copper appears to exist in extremely stable, highly insoluble minerals such as sulfides. These sediments do not appear to be a likely source of dissolved copper to the system, at least at these sites. The vast majority of ammonia concentrations measured in interstitial waters were below established toxicity levels for various mussels species at life stages. However, a few concentrations measured at two downstream sites during summer were putatively toxic. For overlying water, copper, ammonia, and 63 wastewater compounds were generally very low. All data associated with interstitial and overlying water collected by the USGS will appear in the 2010 and 2011 Annual Data Reports of the North Carolina Water Science Center (Holly Weyers, USGS, personal communication). Nutrients and sediments in the river itself are being monitored in order to determine how these pollutants are expressed through changes in flows.

3.4.3 Stressor Summary

The assessment effort targeted eight of the most significant stressors impacting streams in the Franklin to Fontana local watershed planning area:

1. Excess sediment
2. Excess nutrients
3. Fecal coliform bacteria
4. Channel modifications
5. Lack of woody riparian vegetation
6. Stormwater runoff
7. Barriers to aquatic organism passage
8. Toxic pollutants associated with a tomato farming operation

The following is a brief description of the impacts of the major stressors, their sources, and the subwatersheds most affected (Equinox 2010a).

Sediment – Soil originating from upland areas and stream banks is deposited in stream channels as sediment, which upon settling, contributes to aquatic **habitat degradation** by clogging the space among gravels in riffles and filling pools. Suspended sediments associated with these eroded soils increases **turbidity**, reducing visibility and interfering with fishes' ability to feed. As soil settles to stream bottoms, riffles are less suitable for occupation by benthic macroinvertebrates, which leads to a decline in food availability for fish. Pools, which provide habitat for larger fish and fish species requiring low velocity waters, are greatly reduced or eliminated as they become filled with sand and silt.

During Phase I, over 15% of sites in the planning area were found to have channels dominated by sand and silt; only about 3% were found to have coarse substrate material and limited embeddedness. Sedimentation was found to be greatest in lower gradient stream reaches.

Sediment is known to be originating from four main sources in the watershed planning area (Equinox 2010a):

- Unstable stream banks associated with livestock operations;
- Riparian area disturbances not associated with agricultural activities;
- Channelized, bermed, ditched, or otherwise modified stream channels; and
- Unpaved roads, eroding road banks, and slope failures associated with roads.

Many livestock operations have poorly managed pastures and no fencing to keep livestock out of stream channels. Livestock often graze the riparian area clear of vegetation, disturb the underlying soil with their hooves, and destabilize the stream banks as they enter and exit the stream channel. With streambank vegetation eliminated or greatly reduced, soil is eroded from the stream banks or washed from upland areas during heavy rain events. Livestock access to streams is highest in the Upper Rabbit Creek, Cat Creek, Upper and Lower Iotla Creek, Rocky Branch, and Lakey Creek subwatersheds.

Row crop production, residential lawn maintenance, and new development cause additional riparian area disturbances and are an additional source of stream sediment. Within the focus area, row crop production is greatest in the Lower Iotla Creek, Upper Rabbit Creek, and Cat Creek subwatersheds. Residential areas are widely dispersed throughout all the subwatersheds in the planning area. Land disturbances associated with new development, while a potential source of sediment, are usually temporary in nature.

Many of the unpaved roads observed are dirt or poorly graveled; the cuts, fills, and adjacent ditches are often poorly vegetated, and almost all drain to streams. During storm events, eroded soil can be transported directly to streams. Catastrophic inputs of sediment also are of concern where roads constructed on steep slopes are at higher risk of causing landslides as was documented by the NCGS (2009) in the Wildflower Development.

Significant miles of unpaved roads are present in all focus area subwatersheds, but their condition and sediment contributions are unknown because most are on private lands that were not accessed during the watershed assessment (Equinox 2010a). Among subwatersheds where road densities were estimated, they were highest in the Lower and Upper Watauga Creek, Coon Creek, Lower Rabbit Creek, Rocky Branch, and Caler Fork subwatersheds.

Nutrients – Elevated nutrient (nitrite/nitrate and phosphorus) levels can change both habitat quality and food sources for the biological community. Increased nutrients can result in greater algae growth on the stream bottom and in the water column. This change can be reflected in shifts in both the fish and benthic macroinvertebrate communities. Sources of nutrients identified in the planning area (Equinox 2010a) include the following:

- Livestock with access to streams or grazed in pastures with narrow riparian areas;
- Fertilizer from crop land and residential lawns;
- Faulty residential septic systems;
- Leaking sewer lines in urban subwatersheds, and
- Trout farms.

The Cat Creek, Upper Rabbit Creek, Upper and Lower Iotla Creek, Rocky Branch, and Lakey Creek subwatersheds have significant concentrations of livestock operations where access to creeks is not restricted. Of the rural focus area subwatersheds, the highest nitrite/nitrate levels were measured in the Cat Creek (0.60-0.65 mg/L) and Rocky Branch (0.56 mg/L) subwatersheds. The highest levels were often found in association with livestock operations.

Of particular concern are the nutrient impacts from the Tellico Trout Farm operation and their impact on water quality in Tellico Creek. Levels of total phosphorus, ammonia, and nitrate/nitrite below the farm were the highest recorded during the Franklin to Fontana assessment.

While fertilizers used on crop land can be a source of nutrients, their contributions are likely much less than those from other agricultural operations simply due to the low percentage of land (2% in rural subwatersheds) in crop production.

While many residences are located near streams, they are widely distributed and, individually, not likely a large source of nutrients. However, they do warrant further investigation to determine the magnitude of their impact due to fertilizer on lawns and faulty septic systems. The Watauga Creek and Rabbit-Cat Creek drainages have the largest number of residences near streams.

Leaky sewer lines are a potential problem in urban subwatersheds. While no significant problems are known to exist in the Crawford Branch and Lake Emory subwatershed, nitrite/nitrate levels as high as 1.0 mg/L have been recorded in Crawford Branch. While such high levels of nitrite/nitrate are of concern, these levels are likely to decline as the Town of Franklin is currently replacing the sewer main and lateral connections.

Fecal Coliform Bacteria – While fecal coliform bacteria themselves do not cause ecological impacts, they are a human health concern and often occur in association with elevated nutrient levels. The main sources of fecal coliform bacteria in the Franklin to Fontana watershed planning area are livestock operations, possible faulty septic systems, possible straight pipes, and possible leaking sewer lines in urban areas. While livestock operations are easily quantifiable, the extent of leakage from domestic sewers and faulty septic systems is unknown and will require further investigation.

Fecal coliform bacteria levels exceeded the State standard in eight streams sampled—Crawford Branch, Lakey Creek, Cat Creek, Rabbit Creek, Watauga Creek, Rocky Branch, Iotla Creek, and Iotla Branch—all of which may be included on the 2012 303(d) list.

Pesticides – Pesticides used in agriculture can severely impact aquatic communities, as seen in tomato growing operations in the Rabbit-Cat Creek drainage. In fall 2008, severe impacts to benthic macroinvertebrate communities were attributed to tomato pesticides, resulting in inclusion of Cat and Rabbit Creeks on the 2010 303(d) list. While such impacts may be periodic and acute in nature, they are a serious ecological threat over the long-term.

Channel Modifications – Straightening, ditching, and berming stream channels not only impact aquatic habitat conditions by releasing sediment when the stream banks are disturbed, but also directly impact the type and quality of aquatic habitat, reducing the quality and complexity of pool, riffle, and undercut root habitats. Straightened channels also are less rough, offering less resistance to stream flow. Consequently, stream velocities increase. The increased stream velocities have more erosive power and can result in catastrophic collapse of stream banks. This not only impacts the aquatic community, but may result in severe property damage due to stream bank failure and erosion. Where such conditions exist, stream restoration projects utilizing natural channel design techniques would restore channel stability and improve aquatic habitat.

The extent of modified channels is extensive in the focus area subwatersheds, with over 156,000 feet of stream channel showing evidence of having been modified. Regardless of subwatershed, modified stream channels are generally unstable and have lower quality aquatic habitat. Most of the documented areas of severe bank erosion in the focus area subwatersheds were found in conjunction with modified stream channels.

Lack of Woody Riparian Vegetation – The removal of woody vegetation from the riparian area of streams in the Franklin to Fontana watershed planning area has both direct and indirect impacts to stream conditions. Stream banks lacking trees and shrubs are generally unstable and more likely to erode, resulting in increased sedimentation of stream channels. They also are less effective in filtering pollutants being transported from upland areas during storm events. Woody vegetation on stream banks is a source of organic material (both wood and leaves) that serves as a food source for benthic macroinvertebrates and once lodged in the stream channel provides habitat for all types of aquatic organisms. Temperatures of streams with riparian areas lacking woody vegetation also are more variable. Temperature sensitive species may not be able to withstand the increased temperature variability and will be replaced by more temperature tolerant species. Restoration of riparian area woody vegetation is one of the most effective strategies to improve stream stability and aquatic habitat conditions.

Riparian conditions are most degraded in the Cat Creek, Lower Iotla Creek, and Crawford Branch subwatersheds, where >40% of the stream length are estimated to have wooded riparian widths of <30 feet. In the Upper Rabbit Creek, Lake Emory, Rocky Branch, Lower Watauga Creek, and Lower Cowee subwatersheds, 30-40% of stream length have <30 feet of wooded riparian vegetation. Generally, the worst conditions occur along the mainstem streams and their tributaries in lower gradient areas. In many cases, poor riparian vegetation conditions are associated with livestock operations and streams that have been channelized, bermed, ditched, or otherwise altered.

Barriers to Aquatic Organism Passage – Human-made structures placed in-stream can have significant impacts to mobile aquatic organisms such as fish. A structure that does not allow the free movement of fish can result in isolated populations, fragmented habitat, and prevent recolonization of a watershed by previously occurring species. The following types of human-made barriers have been documented in the LWP area:

- Corrugated metal pipe and concrete box culverts;
- Water intake structures; and
- Structures placed across the stream bed to create pools or provide bridge stability.

Stormwater Runoff – Runoff from impervious surfaces in urban areas often causes an increase in runoff volume and velocity during rain events, resulting in destabilization of stream channels and increased stream bank erosion. These disturbances degrade aquatic habitat conditions and can lead to altered benthic macroinvertebrate and fish communities. Runoff also transports toxic materials (metals, pesticides, and organic contaminants) and nutrients originating from streets, roofs, lawns, and parking lots. Aquatic organisms intolerant of the toxic materials are reduced or eliminated from the aquatic community.

Both Crawford Branch and Lake Emory are urban subwatersheds subject to impacts from stormwater runoff. This is particularly evident in the lower portion of Crawford Branch where aquatic habitat is severely degraded and the macroinvertebrate community was rated Fair.

Section 4 Plan Recommendations

4.1 Management Strategies

This section describes the final management recommendations for the protection and improvement of aquatic resources in the Franklin to Fontana watershed. These recommendations were developed in concert with the Franklin to Fontana Local Advisory Committee, address both stressors and assets, and are summarized in Tables 4.1 and 4.2. Detailed descriptions of each recommendation are found in Sections 4.2-4.5. Many of the recommendations in this section expand on the strategies named by the *Conservation Action Plan for the Upper Little Tennessee Basin* (2008), developed by a consortium of conservation professionals working in the basin.

The management plan recommendations are organized as follows:

- **Section 4.2, Conservation Projects** - describes the recommendations for on-the-ground projects such as stream and wetland restoration, stream and wetland preservation, wildland protection, farmland protection, agricultural best management practices (BMPs), stormwater BMPs, fish barrier removal, and Lake Emory dredging. It describes both general recommendations for these activities and identifies subwatersheds with the greatest potential for ecological uplift, the most feasible projects, and highest local priorities based on project ratings.
- **Section 4.3, Policy and Institutional Measures** - describes those recommendations concerning ordinances, rules, and governmental and non-governmental programs.
- **Section 4.4, Education** - summarizes the educational initiatives geared towards local landowners, contractors, decision-makers, and others that will improve understanding of stream and river health and related issues, and encourage actions that they can take to protect and restore watershed functions and improve the resources within them.
- **Section 4.5, Research and Assessment** - names those research and assessment priorities that should be undertaken to improve our understanding of the Little Tennessee River and its tributaries so that resources can be allocated towards implementing those actions most needed to further conserve and enhance aquatic resources.

In the following sections, each recommendation is numbered according to its type: conservation project recommendations are numbered as CP-1, CP-2, etc.; policy and institutional measure recommendations are numbered as PIM-1, PIM-2, etc.; education recommendations are numbered as E-1, E-2, etc.; and research and assessment recommendations are numbered as RA-1, RA-2, etc. A summary of these recommendations is provided in Figure 4.1 at the end of Section 4.

Table 4.1 Recommendations to Address Stressors in the Franklin to Fontana Watershed (Sheet 1 of 2)

Stressors	Sources	Functional Impacts	Recommendations (plan section links)
Lack of Woody Riparian Vegetation	Removal of vegetation	Stream bank instability; poor shading; increased temperature; habitat degradation--insufficient woody and leaf material in streams; limited pollutant removal	-Plant native woody vegetation in riparian areas (4.2.1, 4.2.3) -Implement key buffer restoration projects (4.2.1, 4.2.3, 4.2.5) -Adopt revisions to Macon County Sediment & Erosion Control (S&EC) Ordinance (4.3.1) -Develop buffer awareness program (4.4.1) -Implement agricultural BMPs (4.2.1, 4.2.3)
Channel Modification	Channel straightening, dredging, and berming	Stream channel and bank instability; habitat degradation--loss of riffle and pool habitat	-Implement stream restoration projects (4.2.1)
Excess Sediment Inputs	Stream bank erosion, unpaved roads and eroding road banks, disturbed areas and landslides, poorly managed pastures and fields, livestock access to streams	Habitat degradation--filling of pools, embedded riffles; increased turbidity during storms	-Stabilize eroding stream banks (stream and buffer restoration) (4.2.1, 4.2.3) -Implement agricultural BMPs (4.2.1, 4.2.3) -Implement stormwater BMPs (4.2.4) -Ensure consistent enforcement of S&EC programs (4.3.1) -Adopt county steep slope ordinance (4.3.1) -Improve sediment retention capacity in Lake Emory (4.2.6) -Develop S&EC educational program, including consistent S&EC training contractor program for seven western counties (4.3.1, 4.4.2) -Provide input to Nantahala National Forest management plan update to reduce sediment from US Forest Service roads (4.3.2) -Perform unpaved roads survey (4.5) -Stabilize eroding road banks via hydroseeding or other methods (4.3.1)
Excess Nutrient Inputs	Livestock access to streams, poorly managed livestock operations, residential and agricultural fertilizers, trout farms, faulty septic systems, leaking and overflowing sewer lines	Over-enrichment of streams, resulting in increased algal growth and altered aquatic communities	-Implement stream and buffer restoration projects (4.2.1, 4.2.3) -Implement agricultural BMPs (4.2.1, 4.2.3) -Develop nutrient/waste management plans for livestock operations (4.2.3) -Adopt county stormwater ordinance (4.3.1) -Develop more effective waste management plan for Tellico Trout Farm (4.3.2)
Bacterial Contamination	Livestock access to streams, poorly managed livestock operations, faulty septic systems, leaking and overflowing sewer lines	Human health risk	-Implement agricultural BMPs - fence livestock out of streams (4.2.1, 4.2.3) -Develop nutrient/waste management plans for livestock operations (4.2.3) -Franklin: investigate sewer collection system integrity (4.5)

Table 4.1 Recommendations to Address Stressors in the Franklin to Fontana Watershed (Sheet 2 of 2)

Stressors	Sources	Functional Impacts	Recommendations (plan section)
Stormwater Runoff	Impervious areas, especially in Franklin	Channel erosion and degradation of in-stream habitats due to increased stormwater discharge; aquatic life impacts from nutrients, toxic pollutants, and high flows	-Implement stormwater BMP retrofits (4.2.4) -Encourage Low Impact Development (4.3.1) -Adopt county stormwater ordinance (4.3.1) -Develop educational program to control stormwater, reduce pollutants (4.4.1)
Tomato Pesticides	Runoff from fields; possible poor pesticide handling	Impaired aquatic community	-Develop a set of BMPs for tomato farming operations (4.3.2)
Barriers to Aquatic Organism Passage	Culverts, dams, other human-made structures	Isolation of fish communities, lack of access to habitat	-Replace/retrofit identified barriers on public and private roads (4.2.6) -Develop education program on culvert installation (4.4.2) -Continue inventories of barriers (4.5)

Table 4.2 Recommendations to Protect Assets in the Franklin to Fontana Watershed

Asset	Protection/Conservation Recommendations
Natural Resources	
Rich Aquatic Fauna of Little Tennessee River and its Tributaries	-Implement stressor-related on-the-ground projects (4.2.1, 4.2.3, 4.2.4, 4.2.5) -Protect the floodplain of the Little Tennessee River, plant riparian buffers along the river, restore floodplain wetland communities (4.2.1, 4.2.2, 4.2.3) -Protect large tracts of privately-owned forest (4.2.2) -Protect lands with SNHAs and NHEOs through conservation easements and acquisition (4.2.2) -Acquire funding through Land and Water Conservation Fund to conserve key lands in the Nantahala-Cowee Corridor (4.3.2) -Ensure that water quality-oriented management decisions are made in the updated Nantahala National Forest Management Plan (4.3.2) -Implement a watershed literacy program and landowner action guide (4.4.1) -Establish a watershed stewardship recognition program (4.4.1) -Educate public on present-use value and wildlife tax incentive programs (4.4.2) -Continue investigations on sediment in the Little Tennessee River (4.5) -Support research of mussel stress diagnostics and nutritional dynamics (4.5) -Continue biomonitoring program for the Little Tennessee River and its tributaries (4.5)
Nantahala-Cowee Corridor	
Terrestrial Significant Natural Heritage Areas (SNHAs)and Natural Heritage Element Occurrences (NHEOs)	
Large Tracts of Privately-owned Forest	
Little Tennessee River Floodplain	
Public Lands: Nantahala National Forest and Needmore Gamelands	
Cultural Resources	
Rural Character	-Protect large farms through conservation easements (4.2.2) -Protect existing wildlands (4.2.2) -Broaden homestead exemption in state and county tax structure (4.3.2) -Educate landowners on forest, farm, and wildlife management tax incentive programs (4.4.2)
Agricultural Lands	
Cultural History	

4.2 Conservation Projects

Conservation projects are on-the-ground projects that are designed to alleviate or remove stressors or protect assets. This plan makes recommendations for three kinds of projects: large, high priority projects; smaller projects not identified in the atlas, but warranting some type of conservation action; and special projects that address unique circumstances or issues in the watershed.

The group of larger, high priority projects identified in the *Phase III Project Atlas* (Equinox 2010b) is delineated into the following types:

- stream and wetland restoration and **enhancement**;
- stream and wetland preservation;
- wildland preservation;
- farmland preservation;
- agricultural BMPs; and
- stormwater BMPs.

While the *Phase III Project Atlas* identifies some of the greatest conservation priorities in the watershed, it is not an exhaustive list of all conservation needs.

The following section summarizes the *Phases III Project Atlas* search results. Projects were divided into those meeting NCEEP criteria (Table 4.3) and those meeting criteria developed by the LAC (Table 4.4). In general, NCEEP projects are restricted to stream and wetland restoration and enhancement or preservation types and are larger in size. Partner projects include all types and sizes. Stream and wetland restoration and enhancement projects and agricultural BMP projects are limited to focus area subwatersheds and the Little Tennessee River corridor (Figure 4.1). Preservation opportunities are found in all subwatersheds in the planning area. Only the two urban subwatersheds contain stormwater BMP project opportunities and no other project types.

Projects identified for each project type were prioritized based on criteria tailored for the project type. NCEEP restoration and preservation projects and Partner Little Tennessee River restoration projects were ranked by priority level based on a combination of the potential for ecological impact and feasibility factors, such as project size, number of landowners, watershed location, and livestock access. Partner wildland preservation projects were prioritized based on size and proximity to protected land, Significant Natural Heritage Areas, or Natural Heritage Element Occurrences. Partner farmland preservation projects were prioritized based on size, whether or not the farm is a Century Farm, and existence of a potential stream restoration site on the farm. Agricultural BMPs were prioritized based on cropland/pasture size and characteristics indicating BMP need, such as livestock access to streams. Stormwater BMPs were prioritized based on local knowledge of land ownership, likelihood of implementation, proximity to other projects, and educational impact.

For maps showing the location of these projects and tables summarizing project attributes, refer to the *Phase III Project Atlas* (Equinox 2010b). Project descriptions presented here do not include funding mechanisms. That information can be found in Section 6, Technical Resources and Funding Sources.

4.2.1 Stream and Wetland Restoration and Enhancement

Conservation Project (CP)-1: Implement Stream and Wetland Restoration and Enhancement Projects

Stressors addressed: lack of woody vegetation, channel modification, excess sediment, and nutrient inputs, bacterial contamination

Eighty restoration projects were identified in focus area subwatersheds (Figure 4.1); 35 of which are rated as High or Very High priority (Table 4.3). Restoration projects are broadly defined to include those considered enhancement. Almost 50% of opportunities for stream restoration exist in the Upper and Lower Iotla Creek, Upper Rabbit Creek, and Cat Creek subwatersheds. Because concentrating implementation in these subwatersheds would provide the greatest potential for ecological uplift, it is recommended that restoration activities center on these subwatersheds. An additional 47 stream restoration and enhancement projects and two wetland restoration sites were identified in the Little Tennessee River corridor (Table 4.4); 17 of these projects rated as High or Very High priority.

One of the simplest and most effective restoration activities recommended to improve both water quality and habitat for fish and benthic macroinvertebrates is to fence livestock out of streams and riparian areas. Fencing in combination with the planting of native plant species in riparian areas along the Little Tennessee River and its tributaries will improve the riparian area's ability to keep sediment and nutrients from reaching streams. A mixed age-class riparian forest can be jump-started by planting trees and shrubs of varying sizes, using a mix of species that are native to riparian areas in the region. Mature trees not only ensure a sustainable supply of coarse woody debris, a key to good aquatic habitat, but also provide shade that reduces stream temperature fluctuations and stabilize eroding stream banks with their dense roots. In areas where site conditions are suitable, incorporating native river cane (*Arundinaria gigantea)* should be considered in the revegetation plan. In addition, removing invasive non-native species such as Japanese knotweed and multiflora rose is important in order to maintain a healthy riparian community.

Streams with unstable banks and poor in-stream habitat also can be restored by reconstructing or modifying the channel to recreate a natural functioning stream that is reconnected to its **floodplain**. Stream restoration designs should incorporate features that recreate natural stream channel pattern, cross section dimensions, and longitudinal profile. This can be accomplished by integrating meanders into the stream pattern, creating a connection to the floodplain, installing in-stream structures that create scour pools, and incorporating coarse woody debris to provide aquatic habitat and to redistribute stream energy during high flow events.

In streams impacted by contaminants such as oil, metals, and pesticides running off the landscape, plants known to **bioaccumulate** the pollutants can be used (McIntyre 2003; Hutchinson et al. 2003). Such **phytoremediation** would be appropriate for use in the Crawford Branch, Lake Emory, and Rabbit-Cat Creek subwatersheds.

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Figure 4.1

Franklin to Fontana Local Watershed Site Atlas

Project Concentration

Projects

Streams

Roads

Number of Projects per Subwatershed

3-14

15-28

29-42

Local Watershed Planning Area

Needmore Game Land

National Forest

Municipalities

County Boundary

N

W E

S

0 0.5 1 2 Miles

Note: This map is not a survey and is not to be construed as such.

Ecosystem Enhancement Program

EQUINOX ENVIRONMENTAL CONSULTATION & DESIGN

Table 4.3 Stream and Wetland Restoration and Preservation Projects Meeting NCEEP Criteria by Subwatershed, Type, and Priority

Subwatershed		Projects Meeting NCEEP Criteria							Total Projects (Projects with Wetland Opportunities)
		Stream Restoration				Stream Preservation			
		VH[1]	H[1]	M[1]	L[1]	H	M	L	
Focus Area Subwatersheds[2]	Lakey Creek	2		2	3	1	3	3	14
	Caler Fork Creek								
	Bradley Creek	1	1	6	2	1	3		14
	Lower Rabbit Creek		1	2					3(1)
	Lower Watauga Creek		1		4			3	8
	Upper Watauga Creek	1	2	1	2				6(2)
	Coon Creek						2	1	3
	Upper Rabbit Creek	4	7	5		1	3	2	22(2)
	Cat Creek	3	2	3	2		1	1	12(1)
	Rocky Branch								
	Lower Iotla Creek	2	4	2	8		1	4	21(2)
	Upper Iotla Creek	2	2	2	1		3	1	11(1)
	Crawford Branch								
	Lake Emory								
	Totals	15	20	23	22	3	16	15	114(9)
Other Subwatersheds[3]	Beasley Creek		1						1(1)
	Mica City Creek		1	1					2
	Upper Cowee Creek			2		1			3
	Matlock Creek		1	1		3			5
	Queen Branch								
	Upper Burningtown Creek								
	Middle Burningtown Creek			3					3(2)
	Lower Burningtown Creek				1	1	1		3
	Tellico Creek								
	Needmore				2	1	2	1	6
	Brush Creek			1			2	1	4
	Sawmill Creek					1	1		2
	Tippet Branch								
	Lower Cowee Creek				1				1
	Rose Creek				2				2
	Totals		3	8	6	7	6	2	32(3)

[1]Priority classes: VH = Very High, H = High, M = Medium, L = Low.
[2]Includes projects from both phase I and III searches.
[3]Phase I projects only.

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Table 4.4 Preservation and Restoration Projects and Agricultural and Stormwater BMPs Meeting Partner Criteria by Subwatershed, Type, and Priority[1]

	Subwatershed	Projects Meeting Partner Criteria																					
		Wildland Preservation			Farmland Preservation >50 acres				Agricultural BMPs									Little Tennessee River Corridor Projects					Stormwater BMPs
									Crop Land			Large Farms (>10 acres) Livestock BMPs			Small Farms (≤10 acres) Livestock BMPs			Livestock Exclusion	Stream and Wetland Restoration				
		H	M	L	VH	H	M	L	H	M	L	H	M	L	H	M	L		VH	H	M	L	
Focus Area Subwatersheds	Lakey Creek		2	3	4						1	2	2			2	8						
	Caler Fork Creek	1	1	2		2				1		2	1			1	5						
	Bradley Creek		2	2	2					1	1	1	4	3			5						
	Lower Rabbit Creek		1		2						1		1				1						
	Lower Watauga Creek												3				4						
	Upper Watauga Creek			1	1							1	2				4						
	Coon Creek															1	4						
	Upper Rabbit Creek	2	14	2	4				1		2	2	7			2	12						
	Cat Creek				4				1		1	2	7	2		1	7						
	Rocky Branch										1	1	4		1	3	5						
	Lower Iotla Creek		2	1	6				2	1	3	3	6	1	1	5	6						
	Upper Iotla Creek			1	1					1	1	4		1	1	1	8						
	Crawford Branch			1																			22
	Lake Emory		1	1																			18
Other Subwatersheds	Beasley Creek	1	2	2																			
	Mica City Creek	2		2																			
	Upper Cowee Creek	1	2	1		1																	
	Matlock Creek	5	0	1			1																
	Queen Branch		12	3																			
	Upper Burningtown Creek		2	2																			
	Middle Burningtown Creek			1		2																	
	Lower Burningtown Creek		12	5		1	1																
	Tellico Creek	1	8	6																			
	Needmore	2	9	2																			
	Brush Creek		2	2		1																	
	Sawmill Creek	1	1																				
	Tippet Branch			3	1																		
	Lower Cowee Creek																						
	Rose Creek		2	10	2	2	1																
	Little Tennessee River																	9	3	14	17	13	
	Totals	16	75	54	27	9	3	0	4	4	11	18	37	7	3	16	69	9	3	14	17	13	40

[1]Priority categories are as follows: VH = Very High, H = High, M = Medium, L = Low. For details see Equinox (2010b).

4.2.2 Preservation

CP-2: Implement Stream and Wetland Preservation Projects

Assets addressed: rural character, multiple natural resources assets

Focus area subwatersheds are generally more degraded and contain fewer streams or wetlands in good ecological condition than do other subwatersheds. Those streams in good ecological condition are mainly 1st and 2nd order streams located at higher elevations. Preservation of these stream reaches is important to maintaining good water quality and aquatic habitat conditions in downstream areas. Protection of these areas, combined with stream restoration and enhancement projects, will lead to entire subwatersheds having intact riparian buffers, stable stream channels, and improved ecological conditions.

A total of 34 potential stream and wetland preservation projects were identified in focus area subwatersheds (Table 4.3). The three High priority projects located in the Bradley Creek, Lakey Creek, and Upper Rabbit Creek subwatersheds should be pursued first. To achieve maximum ecological improvement in combination with restoration projects, the Medium priority projects in the Upper and Lower Iotla Creek, Upper Rabbit Creek, and Cat Creek subwatersheds should also be given implementation preference. Preservation of intact stream reaches and wetland areas can be accomplished by purchase of lands in **fee simple** or by obtaining legal protection via **conservation easements** or other agreements that protect natural resource values and limit development activities.

CP-3: Wildland Preservation

Assets addressed: Nantahala-Cowee Corridor, significant natural heritage areas, rural character

The LAC recognizes wildland preservation as an important component of protecting the rural character of the Franklin to Fontana watershed planning area. Preservation can be accomplished through either conservation easements or land purchase. Wildlands are those that not only have intact stream corridors, but also have upland areas that contain little, if any, disturbances. Of particular concern to the LAC are wildlands that occur within the Nantahala-Cowee Corridor (Figure 1.2). Protection of wildlands in this area is seen as an important link to lands already in State and Federal ownership.

The Wildlife Action Plan (NCWRC, 2005) identified broad conservation priorities for North Carolina, which include the protection of floodplain forest, early successional habitats, small wetland communities, rock outcrops, high elevation forest, and streams and riparian zones, all habitats which are found in the Franklin to Fontana watershed. The Natural Areas Inventory for Macon County was completed in 2010 and identifies specific Significant Natural Heritage Areas (SNHAs), which are relatively undisturbed landscapes that support populations of ecologically significant plants and animals and important natural communities (Schwartzman, 2010). The Inventory for Swain County will be developed in the next several years. In the Macon County portion of the Franklin to Fontana watershed, SNHAs were identified in the Cowee Mountains Macrosite on the eastern edge of the watershed, Nantahala Mountains Macrosite in the west, and the Little Tennessee River and its related floodplain communities. Many of these lands are already protected as Nantahala National Forest or Needmore Gamelands; however, significant areas of private lands are in the Cowee Mountains area, which should be prioritized for preservation.

A total of 145 wildland preservation projects were identified (Table 4.4), 16 of which are considered High priority by the LAC. The projects were prioritized based on size and proximity to protected land, Significant Natural Heritage Areas, or Natural Heritage Element Occurrences. Of the 145 potential projects, 96 of them are within the Nantahala-Cowee Corridor and should be given preference for protection when opportunities arise.

CP-4: Farmland Preservation

Stressors and assets addressed: excess sediment inputs, excess nutrient inputs, bacterial contamination, rural character, agricultural lands

As with wildlands, farmlands are considered an important part of the cultural heritage of the Franklin to Fontana watershed planning area. They also are an important component of the local economy. As such, protection of farmlands is important to protecting the area's rural character and is seen as being important to the general quality of life enjoyed by its residents. Protecting farmland from future development also ensures a more permeable landscape, which protects hydrological function of streams, unlike the impervious landscapes associated with development.

While all 176 farmland preservation parcels identified in the Phase III *Project Atlas* (Equinox 2010b) are worthy of protection, this plan focuses on the 39 farm projects >50 acres in size (Table 4.4). Thirty-three of those farms are located in focus area subwatersheds and all but three of them are considered Very High or High priority by the LAC. Sixteen of the sites have agricultural BMP needs that should be addressed in the preservation plans of those projects. Emphasis should be put on those projects located in the Upper and Lower Iotla Creek, Upper Rabbit Creek, and Cat Creek subwatersheds as these are the areas in greatest need of restoration. The coordinated implementation of all types of projects in these subwatersheds will result in the greatest ecological uplift.

Farmland can be protected through conservation easements, Farm Bill programs (e.g. WHIP – Wildlife Habitat Incentives Program; EQIP – Environmental Quality Incentives Program), or other agreements that protect natural resource values. Regardless of the protective mechanism, these lands will need active management to maintain their farmland status.

4.2.3 Agricultural BMPs

CP-5: Implementation of Agricultural BMPs

Stressors addressed: excess sediment inputs, excess nutrient inputs, bacterial contamination

Agricultural activities, particularly crop land and pasture with livestock operations, were identified as major sources of pollutants contributing to stream degradation in focus area subwatersheds (Equinox 2010a) and in the Little Tennessee River corridor. Of particular concern are the inputs of sediment, nutrients, and bacterial contamination caused by livestock access to stream channels. In addition, sediment and nutrient inputs also can originate from crop lands with inadequate riparian buffers.

Nineteen potential cropland BMP projects were identified, four of which are considered High priority (Table 4.4). The High priority sites were located in the Upper Rabbit Creek, Cat Creek, and Lower Iotla Creek subwatersheds. Cropland BMP projects should focus on decreasing runoff from cultivated areas to reduce the amount of sediment, nutrients, and pesticides reaching stream channels. Recommended activities include increasing the woody vegetated buffer width along stream channels, creating vegetated drainage swales, and providing areas for sediment to settle out from overland runoff.

A total of 150 livestock BMP projects were identified in focus area subwatersheds (Table 4.4 and Figure 4.1). Eighteen large farm (>10 acres) and three small farm (≤10 acres) projects were identified as being High priority. Thirteen of these High priority sites are in the Lower and Upper Iotla Creek, Upper Rabbit Creek, and Cat Creek subwatersheds. An additional nine projects specifically targeting livestock exclusion were identified in the Little Tennessee River corridor and are considered High priority by the LAC.

Recommendations to reduce the impacts of livestock operations include fencing livestock out of stream channels, increasing the woody vegetated buffer widths, moving concentrated feeding areas to locations away from streams, implementing pasture rotation plans, and providing alternative watering sources.

Technical and funding assistance is available to farmers to implement these recommendations. See Section 6 for details.

4.2.4 Stormwater BMPs

CP-6: Installation of Stormwater BMPs

Stressors addressed: stormwater runoff, excess sediment inputs, and excess nutrient inputs

In the Crawford Branch and Lake Emory subwatersheds, pollutant runoff from impervious surfaces and increased volumes of runoff have degraded stream channels and altered aquatic communities. In the case of Crawford Branch, biological communities are severely impacted, and it is likely that the stream will be added to the State's 303(d) list in 2012 (Cathy Tyndall, NCDWQ, personal communication).

A total of 40 potential stormwater BMPs at 22 sites were identified for retrofitting (Table 4.4 and Figure 4.1; Equinox 2010b). Sixteen of these retrofits were rated High priority and are located at eight sites, all of which were partly or entirely on public lands. Public land ownership raises the likelihood that these projects can be implemented more quickly and maintained over the long run.

Recommended stormwater BMP types include, but are not limited to, bioretention cells, constructed wetlands, and extended detention structures. These recommendations are based upon GIS aerial photo analysis and limited site reconnaissance (Equinox 2010b). Further field evaluation and analysis will be required to confirm the appropriate type of BMP to be installed as well at the BMP size, drainage area, constraints, or other factors affecting the design.

A variety of technical resources and funding sources are available for implementation of the stormwater BMP recommendations. See Section 6 for additional details.

4.2.5 Other Stream and Riparian Restoration Projects

CP-7: Develop a Resource Assistance Program for Non-Agricultural Projects

Many properties, such as those in residential and commercial ownership, have stream and riparian areas in need of restoration and enhancement, but the landowners do not have access to programs or funding available to those owning larger tracts such as farmers. While many of these landowners want to implement enhancement projects, they may not have the technical or economic resources to do so. Therefore, it is recommended that a resource program specifically targeting small landowners be developed by the LTWA. This program could be modeled after the National Committee for the New River (NCNR) River Builder program, which relies heavily on Clean Water Management Trust Fund (CWMTF) grant funding.

In many cases, all that landowners may need is assistance in developing a riparian area planting plan or information on how vegetation maintenance plans can be modified to enhance existing riparian vegetation. Assistance with the purchase of native plants would

be a low cost but effective means of enhancing riparian areas on these small properties. This type of assistance also would provide individual landowners an incentive to improve riparian conditions on their property. In other cases, it may be necessary to assist a group of adjoining landowners to participate in a project covering larger stream reaches.

Funding for these types of projects may be available from the Community Conservation Assistance Program of the North Carolina Department of Agriculture as well as the CWMTF program. See Section 6 for additional details.

4.2.6 Special Projects

CP-8: Improve Sediment Retention Capacity of Lake Emory

Stressors and assets addressed: excess sediment input, rich aquatic fauna of the Little Tennessee River watershed

Since its creation in the 1920s, Lake Emory has served as a catch basin for sediment coming in from the approximately 300 mi^2 upper Little Tennessee River watershed. However, Lake Emory has no more sediment retention capacity and the incoming sediment load is effectively passed through the impoundment and downstream into the Little Tennessee River (Duke Energy 2003). Excess sediment has impacted fish and mussel habitats in the river and tributaries upstream of Lake Emory (LTWA 2011); in addition, researchers with the US Geological Survey and Western Carolina University have documented that metal and organic contaminants are attached to sediments in Lake Emory (Miller 2010; Ed Williams, NCDWQ, personal communication). These contaminants may negatively impact aquatic biota, especially those associated with bottom substrates, such as mussels.

One of the most important actions to protect the rich fauna of the Little Tennessee River may be to dredge Lake Emory to restore sediment storage capacity. However, the possible negative impacts of dredging on downstream habitats and biota should be fully evaluated and weighed against other options. Further study of sediment-borne contaminants should be pursued, and sediment removal methods evaluated to ensure that sediment release during removal is minimized. Potential partners for this effort include the US Army Corps of Engineers, Duke Energy, NC Wildlife Resources Commission, and US Fish and Wildlife Service.

The possibility of removing the Lake Emory (Porter's Bend) dam has also been discussed in the past. Dam removal would effectively accomplish the opposite of this recommendation's intention; it would eliminate the sediment retention capacity of Lake Emory. Most importantly, many resource biologists believe that Lake Emory plays an important role in the protection of rare, threatened, and endangered species in the downstream stretch of the Little Tennessee River. Removing the dam would require extensive sediment removal and site stabilization. The possible negative impacts of dam removal on the Little Tennessee River—e.g., sediment and sediment-borne contaminant release, lack of sediment retention, and consequences of reconnecting two stretches of river that have been disconnected for almost 90 years—would need to be carefully considered.

CP-9: Eliminate Aquatic Organism Passage Barriers

Assets addressed: rich aquatic fauna of the Little Tennessee River tributaries

Barriers to fishes migrating from the Little Tennessee River into its larger tributaries between Lake Emory and Lake Fontana have been identified (see Section 3.1.2 and Figure 1.2). The LTWA and US Fish and Wildlife Service are working to replace failing and impassable culverts and other structures on private lands, and this work should continue so that all problematic privately owned barriers are eliminated. The NC Department of Transportation should replace impassable culverts on public roads as funds and programs allow. If barrier elimination work is continued into headwater streams, care should be taken not to remove barriers that have prevented non-native trout species from invading area populated by brook trout (*Salvelinus fontinalis),* North Carolina's only native trout species.

4.3 Policy and Institutional Measures

Policy and institutional measures to address watershed stressors include both regulatory programs like rules and ordinances and non-regulatory options, such as incentives or educational initiatives. This section is organized into a section on local ordinances and policies and a section on existing government programs and regulations.

4.3.1 Local Ordinances and Policies

Ordinances and policies driven by county or municipal governments are essential in providing environmental protection to local natural and cultural resources. Most of the recommendations in this section were developed within the context of Macon County programs, but they are applicable to watershed stressors and sources within Swain County as well.

Policy and Institutional Measure (PIM)-1: Modify buffer specifications in the existing sediment and erosion control ordinance

Stressors addressed: lack of woody riparian vegetation, excess sediment inputs, stormwater runoff

Amendments to the current Macon County Sedimentation and Erosion Control (S&EC) ordinance have been developed by the Macon County Watershed Council. These include clearer stream buffer restoration requirements that specify a mix of native forbs, grasses, shrubs, and trees can be required on any disturbed site that is greater than one half acre. They also provide a clear definition of a buffer. These should be adopted by the County Commissioners once the revisions have undergone legal review.

PIM-2: Develop consistent S&EC rules, enforcement, and training across western North Carolina

Stressor addressed: excess sediment inputs

Current sediment and erosion control policies, rules, enforcement, and training requirements among counties in western North Carolina are quite variable, creating compliance problems for contractors and developers. Counties and the Eastern Band of the Cherokee Indians should work collaboratively towards developing uniform and consistent local S&EC rules, enforcement, and associated training programs. Program consistency will

be less confusing for contractors and can increase the efficiency and effectiveness of local programs. The Partners for the Little Tennessee, a regional conservation organization that includes some LAC members, have already begun working with local governments to facilitate this collaboration; see Section 4.4.2 for more information.

PIM-3: Adopt a steep slope ordinance with road building and maintenance provisions

Stressor and asset addressed: excess sediment inputs, rural character

Macon County should adopt a steep slope ordinance, including the minimum provisions recommended by the draft Slope Development Strategies Subcommittee of the Macon County Planning Board in 2010 (MCPB 2010). These provisions include the following:

- For development on slopes between 30 and 40%, site development must adhere to guidelines to be developed by the county, which include cut and fill specifications, a 30-ft setback from streams, and an approved project/site plan;
- For development on slopes over 40% and sites falling within designated areas of the Stability Index Map or Downslope Hazard Map (NCGS 2006), guidelines in the above bullet must be followed. In addition, plans and specifications must be prepared by a design professional.

Road building and maintenance provisions should incorporate the recommendations described in *The Layman's Guide to Private Access Road Construction in the Southern Appalachian Mountains* (NRCS 2005). Special attention should be given to developing a policy that requires the stabilization of eroding roads and road banks. During roadway construction and widening, exposed surfaces should be hydroseeded or otherwise stabilized immediately upon completion.

Pending adoption of a county steep slope ordinance, incentives like a stream-lined permitting process should be provided to contractors and landowners who voluntarily conduct pre-construction soils and slope hazard assessments in areas with slopes exceeding 30%. More stringent bonding requirements also should be required for developers working on steep slopes.

PIM-4: Adopt a stormwater management ordinance

Stressors addressed: stormwater runoff, excess sediment inputs, excess nutrient inputs

A county-wide stormwater management ordinance should be adopted. Draft recommendations for such an ordinance were developed in 2010 for inclusion in the Macon County Comprehensive Plan that is currently being prepared. The recommendations address the following issues:

- Culvert design and placement should be such that soil erosion and concentrated flows are minimized;
- Minimum lot sizes for new development should be larger as slope increases;
- Maximum percent of disturbed area allowed on lots should be specified;
- Maximum percent impervious area on a site should be specified; and
- Requirements for vegetative retention and type of vegetation should be established.

Currently, the only local stormwater regulations that exist in the Franklin to Fontana planning area are those in Article 12 of the Unified Development Ordinance for the Town of Franklin, which specify that for new development, post-construction runoff rates must mimic

pre-development rates, 85% of total suspended solids must be removed from the first inch of rainfall, and stormwater BMPs must have a drawdown time of 48-120 hours (Town of Franklin 2007). A "parking lot rule" (S.L. 2008-198 [S 845]) was established in 2008 by the State of North Carolina, which requires that parking areas that have land-disturbing areas of one acre or more must (i) contain no more than 80% impervious surface; or (ii) have an appropriately sized/designed bioretention area for capturing runoff generated by the first two inches of rainfall on at least 20% of the parking area. See Chapter 12 of NCDWQ's *Stormwater Best Management Practices Manual* (NCDWQ 2007a), which describes minimum design criteria for bioretention structures.

An effective stormwater management ordinance limits stormwater runoff volumes and reduces stormwater pollutant loadings from development sites. Site-specific stormwater BMPs should be designed and managed so as to mimic pre-development runoff rates and volume, and to remove pollutants such as nutrients, sediment, and metals. The US Environmental Protection Agency (2010) recommends the following six minimum elements for a stormwater management program:

1. Post-construction stormwater management;
2. Pollution prevention;
3. Construction site pollution control;
4. Illicit discharge detection and elimination;
5. Public involvement and participation; and
6. Public education and outreach.

Most stormwater regulations only control sediment as a pollutant. Since aquatic communities in the Little Tennessee River and its tributaries are sensitive to excess nutrients and temperatures, it is recommended that these also be considered in stormwater treatment. Stormwater management plan requirements for NCDWQ's 401 permits provide some good specifications for stormwater treatment (NCDWQ 2010e). One of the most important and effective ways to protect stream temperatures and treat pollutants flowing overland is to maintain riparian buffers in native vegetation.

The local stormwater program also should encourage the use of **Low Impact Development (LID)** techniques to minimize stormwater impacts and runoff. The primary goal of LID techniques is to mimic the pre-development hydrology of the site by using design techniques that store, infiltrate, evaporate, and detain runoff. Techniques include reducing the amount impervious surface, maintaining natural drainage courses, minimizing the use of drainage pipes, minimizing clearing and grading, and incorporating rain gardens and natural areas to trap and filter rain water. For more information, see the NCSU's LID Policy Fact Sheet and the *LID Guidebook for North Carolina* (NCSU 2009). The Southwestern Commission's Region A Toolbox (see pages 70 and 72 in SPEDC 2008) includes additional recommendations and alternatives for stormwater treatment.

There also are numerous model stormwater ordinances that can be used to develop a local ordinance. Two of the most pertinent models are:

- Universal Stormwater Model Ordinance, developed by the University of North Carolina's School of Government (UNCCH 2007); and
- Post-construction Runoff Model Ordinance developed by the Center for Watershed Protection and located at the Stormwater Manager's Resource Center.

4.3.2 Existing Government Programs and Regulations

PIM-5: Implement better management practices on Tellico Trout Farm

Stressors addressed: excess nutrients, aquatic habitat

The NCDWQ and the NC Department of Agriculture work with trout farm operators on management of trout farm waste across western North Carolina. The impacts of the Tellico Trout Farm on Tellico Creek could be minimized through a number of operational changes. The current intake structure could be modified so that it does not pass the majority or entirety of Tellico Creek through the farm raceways, resulting in a dewatered portion of Tellico Creek between the intake structure and the discharge pipe. Stricter controls on trout farm discharges could be considered via National Pollutant Discharge Elimination System (**NPDES)** permit provisions, including specifications on in-stream flow maintenance, specific nutrient discharge and suspended solids limits, stricter monitoring and reporting requirements, and the recycling of trout waste.

PIM-6: Provide input focused on sediment and erosion control to the upcoming revision of the Nantahala National Forest Management Plan

Stressor addressed: excess sediment inputs

The US Forest Service's *Land and Resource Management Plan for the Nantahala National Forest* (USFS 1995) was last revised in 1995, but the Forest Service will begin to update the plan as early as 2012. Since a considerable amount of the Franklin to Fontana watershed is in the Nantahala National Forest, conservation partners such as the LTWA, Land Trust for the Little Tennessee, and The Wilderness Society should provide input to the plan revision. In order to protect aquatic habitats in the Little Tennessee River and its tributaries, management activities should be geared towards the reduction of sediment from the Forest, including the following:

- Roadless areas should remain roadless;
- Eroding roads should be prioritized for restoration and decommissioning;
- Where timber management is active, increased consideration should be given to sedimentation and erosion control from roads and other sources of sediment to streams; and
- Unpaved, gravel roads should be properly managed to minimize sediment inputs to adjacent waterways.

PIM-7: Compile and deliver technical information regarding pesticide management for tomato farm operations

Stressor addressed: tomato pesticides

Portions of Cat and Rabbit Creeks are on the 2010 303(d) (NCDWQ 2010b) list due to toxic impacts to the aquatic community, likely from pesticides originating from a large tomato farm. In 2009 and 2010, this farm was replanted in blackberries, and it is anticipated that the aquatic community will recover to some degree. Tomatoes are grown across western North Carolina, including locations in the Franklin to Fontana watershed. Pesticide use associated with tomato farm operations have been implicated in fish and benthic macroinvertebrate kills in a number of streams in western North Carolina (e.g., NCDWQ 2003, 2007b). In a recent study on pesticides applied to tomatoes in the Mills River

watershed, NCDWQ found high concentrations of pesticides during storm events; they concluded that these pesticides were attached to sediments coming off the fields (Brett Laverty, NCDWQ, personal communication). In order to reduce pesticide inputs to streams, it is recommended that the NC Cooperative Extension Service compile technical information and work with tomato farmers to implement better pesticide management practices. The information should describe pesticide handling and application BMPs and BMPs suitable to control the loss of sediments from their fields such as grassed waterways, vegetated riparian buffers, maintenance of sheet flow from fields through vegetated riparian buffers, vegetated buffers between rows, and planting crops in rows parallel to waterways.

PIM-8: Broaden homestead tax exemption allowance to incentivize preservation of family lands in Macon and Swain Counties

Assets addressed: rural character, agricultural lands

Efforts to preserve family forest and farmlands and the rural character of the planning area can be enhanced by providing landowners with an additional tax exemption in undeveloped areas. Reducing their tax burden would reduce the risk that such landowners would be forced to sell and that such lands would be developed. Current state tax code allows a Homestead Property Tax Exemption of 50% of the property value or $25,000, whichever is greater, for low income elderly and disabled homeowners. Expanding this tax exemption to allow more landowners to qualify would make it a more effective tool for the protection of generational rural lands. Changes in both state and county tax code are needed to broaden this exemption.

PIM-9: Secure protection of lands in the Nantahala-Cowee Corridor

Multiple assets and stressors addressed

The Nantahala-Cowee Corridor (Figure 1.2) stretches from Cowee Bald at approximately 5,000 ft in elevation on the eastern boundary of the Franklin to Fontana watershed, down to 1,700 ft at the Little Tennessee River, and back up to approximately 4,650 ft at Wesser Bald in the Nantahala National Forest on the western boundary of the watershed. This corridor passes through every major forest type found in the southern Blue Ridge Mountains from red spruce to montane alluvial forests and may be the most intact forested elevation gradient in the southern Blue Ridge Mountains (Paul Carlson, LTLT, personal communication). As a consequence, conservation organizations in the Franklin to Fontana planning area have identified private lands in the corridor as being in need of additional protection. The Land Trust for the Little Tennessee (LTLT) and the US Forest Service are working together to develop a proposal to fund land protection in the corridor through the federal Land and Water Conservation Fund. It is recommended that this effort be expanded to include other major funding sources such as the North Carolina Clean Water Management Trust Fund and the North Carolina Natural Heritage Trust Fund as well as other federal, state, and private funding sources (see Table 6.5 for additional information).

4.4 Education

Education is a key element in achieving many of the institutional measures and on-the-ground projects. In addition, watershed education efforts are fundamental to increasing awareness of local watershed resources and the importance of healthy streams, riparian areas, and wetlands. This awareness can lead to widespread changes in attitudes and behaviors needed for the restoration and conservation of aquatic resources in the watershed. A set of

recommendations for an outreach and education plan was developed by the Franklin to Fontana Local Advisory Committee, NCEEP staff, and Equinox staff and is intended to produce three key outcomes within the larger community:

1. Community goodwill;
2. Landowners as willing, collaborative partners in conservation projects; and
3. Long-term stewards of resources.

4.4.1 Environmental Education Program

A local program should be developed to increase awareness of the value of streams and rivers and encourage environmental stewardship. This program should have an environmental education coordinator, ideally housed with the Little Tennessee Watershed Association. The coordinator would facilitate education and outreach efforts involving other collaborators. Key elements of this program include the following:

Education (E)-1: Establish a riparian buffer awareness program
Stressor addressed: lack of woody riparian vegetation

This program would educate the public about the importance of riparian buffers and provide resources for landowners to plant or enhance buffers on their land. It would include three key elements:

- Youth-focused education - Target youth in schools, building on the efforts of the Coweeta Long Term Ecological Research Schoolyard Program at Mountain View Intermediate School and Southwestern Community College. Revegetate buffers on school properties and use them as outdoor classrooms. Take field trips to local stream and buffer restoration sites (e.g. Mountain View Intermediate School or NCEEP's Cat Creek restoration project).
- Riparian buffer guide - A detailed technical guidance document on the importance of riparian buffers and the steps needed to restore or enhance a riparian buffer should be developed for the general public. It should include a recommended native plant species list, planting guidelines, permit and compliance information, and a list of funding resources available through state and federal programs.
- Technical assistance - Staff should be available to give on-site advice to landowners on buffer planting. Grant funds should be pursued to provide cost-share assistance to those with limited financial means.

E-2: Establish a watershed literacy program

Multiple assets and stressors addressed

A program geared to increase the public awareness of general aquatic health and biodiversity issues should be developed.

- Kids in the Creek - Enable all 8th grade students in the watershed to attend a "Kids in the Creek" style field day, where students learn about water quality, stream habitat, and stream biota. Develop take-home materials that include information on Kids in the Creek for parents and a list of simple stream-friendly actions that students and their families can take at home. Model this effort after the highly successful Haywood Waterways Association program.
- Use newspapers, radio, Facebook, Twitter, and other media to broadcast messages to increase the literacy of the general public on watershed issues such as endangered species, biodiversity, riparian buffers, and aquatic habitat. Use these media to name

specific actions that citizens can perform to increase their positive impact on land and water.

- A Water Resource Stewardship Curriculum developed by Macon County School's teacher Adrian Holt is currently used in some county schools. This curriculum should be implemented in appropriate grade levels throughout Macon County.
- Support development of Coweeta Hydrologic Laboratory's children's book on stream diversity and human impacts.

E-3: Develop a landowner action guide

Multiple stressors and assets addressed

Develop an attractive, easy-to-read booklet with visual examples and written explanations of water-friendly management guidelines for homeowners. Include general information about nutrient management, riparian buffer management, stream straightening, removal of dead wood from streams, culvert installation, stormwater management, driveway maintenance, and pollution prevention. Describe the rules and programs that protect stream and riparian areas, and provide contact information for various environmental programs. Include a resource section to help people locate technical assistance, obtain more information, and contact local cost share program administrators.

E-4: Establish an environmental steward recognition program

Multiple stressors and assets addressed

Develop a program to identify and publicly acknowledge projects, businesses, and individuals in the watershed that are using sustainable practices or appropriate BMPs to protect or restore aquatic resources. Specific recognitions should include construction sites with excellent sediment and erosion control measures in place, farms with good riparian buffers and exemplary nutrient management programs, landowners who have revegetated riparian buffers, and homeowners with rain gardens. Identify marketing benefits of such awards to developers. Signs and public announcements via newspapers and radio could be used. Examples include the NC Wildlife Resources Commission Wildlife-Friendly Development Program (NCWRC 2010a), the NC Division of Forest Resources Sustainable Forestry Initiative, and the Eastern Band of Cherokee Indians and Western Carolina University river cane restoration projects.

E-5: Develop a stormwater awareness program

Stressor addressed: stormwater runoff

Develop a stormwater education program in Franklin. Promote creative stormwater management strategies such as Low Impact Development and localized stormwater BMP retrofits. Many stormwater management tools and ideas have been compiled in Chapter 4 of the Mountain Landscape Initiatives Region A Toolbox (SPEDC 2008).

Promote pollution reduction efforts and on-site stormwater retention through the use of rain barrels, cisterns, and rain gardens. Design and construct a set of stormwater BMPs at a Franklin-based school with the input of educators and students to provide a showcase of practical, affordable measures that address stormwater issues. See stormwater BMPs at the NC Arboretum in Asheville (NCSU 2008).

E-6: Tailor education and outreach to local context

Multiple assets and stressors addressed

Researchers with the Coweeta Hydrologic Laboratory and the Coweeta Long Term Ecological Research program through the "Coweeta Listening Project" are investing in community surveys to understand motivations behind land management decisions that affect aquatic integrity, such as riparian vegetation removal. Results of these studies should be used to tailor watershed education programs.

4.4.2 Other Education Initiatives

E-7: Establish and implement sediment and erosion control training courses

Stressor addressed: excess sediment inputs

Continue efforts by Partners for the Little Tennessee to develop sediment and erosion control (S&EC) training courses for all seven southwestern North Carolina counties. This program will include the identification of prospective audiences to receive the training, funding and grant sources to pay for the development of the courses, resolution of issues regarding curriculum ownership, and development of delivery methods. This is a multi-phase effort, as follows:

- Phase I (2010-11) – Research existing programs and delivery systems and mountain-specific BMPs; secure funding for development of training program.
- Phase II (2012) – Develop basic and enrichment training courses for contractors with assistance from a private consulting firm and an advisory committee of grading contractors and local E&SC staff members. Establish a low cost, local delivery and certification/tracking system for the training program that includes a marketing component. Determine annual program budget needs and develop funding strategy.
- Phase III (2013) – Deliver suite of new mountain-specific contractor training courses.

Along with developers and road builders, include agricultural and forestry operations as an audience for local S&EC training courses and outreach. Develop courses and materials for private road building and maintenance by contractors and landowners.

In 2010, LTWA received a Next Steps grant award through the Community Foundation of Western North Carolina's (2008) Mountain Landscapes Initiative to host a round table with the seven western counties to discuss possibilities for consistency in S&EC requirements and training. Through this project, consistency and strengthening of county programs should be facilitated.

In addition, a broad instructional and certification program could be designed to build a base of 'River-Friendly' contractors. This could include:

- Emphasis on the proper practices for steep slope development;
- Education of road builders, contractors/developers, private landowners and lenders/banks on the risks and liabilities associated with steep slope construction, including road projects;
- Recommending pre-construction soils and slope failure analyses for all projects on slopes exceeding 30%;
- Promotion of adherence to minimum road building guidelines contained within *The Layman's Guide to Private Access Road Construction in the Southern Appalachian Mountains* (NRCS 2005);

- Recommendations on constructing proper stream crossings that do not impede fish passage, including recommendations for culvert placement and stream simulation design (Etowah 2007; USFS 2008).

E-8: Provide training on ecological restoration to local contractors

Multiple stressors addressed

Investments into ecosystem enhancement represent a niche market of opportunities for local construction contractors who want to diversify their skills and for other eco-minded entrepreneurs. When a stream or wetland project is undertaken, numerous supplies and services are provided that may include fencing, well-drilling, channel and in-stream habitat enhancement, temporary pool creation, riparian and wetland planting, exotic species removal, and surveying and assessment of pre- and post-construction conditions. For example, in the Muddy Creek watershed in McDowell and Burke counties, such ecological investments for stream restoration have totaled over $16 million in the last 10 years (Andy Brown, Equinox, personal communication). The vast majority of that money has been earned by contractors from the Piedmont region of the State. If just five projects per year are implemented through this plan, such investments could amount to a $10 million influx to the local economy at minimum over the next 10 years. Capturing a small portion of that investment could comprise a significant percentage of local contractors' project portfolios. This could generate community goodwill and will undoubtedly lead to word of mouth advertising about conservation project opportunities available from this plan. An education program of this type could be included in the S&EC training programs as well as through local economic development organizations.

E-9: Educate the public on present-use value and wildlife tax incentive programs

Multiple natural resource assets addressed

Working agricultural and forest lands qualify for a lower property tax rate than developed land. Landowners must show receipts of income that demonstrate sufficient agricultural use or they must have a forest management plan that specifies periodic timber harvesting to qualify for these tax reductions. Recently, the State approved land managed as wildlife habitat as a land use qualifying for tax reductions. This was done, at least in part, to allow landowners who have kept their land in forest to maintain those forested conditions. An NC Wildlife Resources Commission-approved wildlife habitat plan is required to justify this local property tax incentive (NCWRC 2010b). These tools incentivize conservation from private landowners and can be a valuable tool in securing broad watershed conservation.

E-10: Regularly communicate the intent and goals of the plan to the broader community

Multiple stressors and assets addressed

People who live and work in the Franklin to Fontana project area should be made aware of this plan and its intentions. Raising awareness will create friends and allies of the project, which will ultimately help in achieving the goals of this plan. While various media can be employed in pursuit of this goal, face-to-face interactions create the opportunities to build positive relationships. Social events such as fish fries and barbeque dinners as well as tours of conservation projects are encouraged because these will give the public and those implementing project recommendations an opportunity to meet one-on-one in an informal setting and to build healthy relationships so vital to the success of this plan.

4.5 Research and Assessment

The Franklin to Fontana watershed planning effort identified a number of research and assessment needs that should be addressed in order to better understand watershed stressors, address pollutant sources, and continue to gauge aquatic community integrity. Continued research and monitoring should address the following issues:

Research and Assessment (RA)-1: Continue investigations of the role of sediment in the decline of the Appalachian elktoe (*Alasmidonta raveneliana)*

In 2009, the USGS, Western Carolina University (WCU), and NC State University (NCSU) developed a proposal to investigate the role of sediment in the decline of the Appalachian elktoe and other mussel species and to provide information on sediment load and sources to support watershed restoration. Only part of this study was funded in 2010 through US Fish and Wildlife Service Recovery Funding, which enabled USGS and WCU researchers to analyze contaminants in Lake Emory and the Little Tennessee River (Miller 2010). In addition, USGS and WCU researchers have monitored nutrients and suspended sediment levels in the river and analyzed metal levels in Appalachian elktoe shells.

The results of these studies suggest that further investigation of sediment toxicity in the free-flowing river is not warranted. Instead, resource management partners have identified a paired watershed study as a high priority for further investigation. This study will compare sediment load, turbidity, productivity, and seston (suspended particles) quantity and quality in Little Tennessee River and Tuckasegee River, where mussels are doing well. Installation of turbidity and chlorophyll *a* sensors on USGS stream gauges in the Little Tennessee and Tuckasegee would produce data useful in this study.

RA-2: Support research of mussel stress diagnostics and nutritional dynamics, and impacts of the Asian clam (*Corbicula flumminea*)

Researchers at NCSU are performing basic research in mussel ecology, including nutritional requirements and the role of bacteria and other aspects of diet in mussel health. They are also performing basic work to understand how to assess stress in mussels. Health of mussels from the Little Tennessee and Tuckasegee are being compared using a variety of potential diagnostic techniques. Laboratory studies are focusing on potential feeding competition between the recently invaded Asian clam and native mussels. State and Federal agencies should continue to prioritize funding of this research, which is fundamental to understanding and ultimately recovering mussel populations such as the Appalachian elktoe in the Little Tennessee River.

RA-3: Better understand sediment loading dynamics in the Little Tennessee River

Stressor addressed: excess sediment inputs

A sediment loading and source identification model should be developed. This is necessary to identify the most important source areas and activities generating sediment and target sediment control activities toward them.

In order to understand sediment dynamics in the River, the USGS should continue to monitor suspended sediment at the Needmore and Prentiss gauges for the next several years.

RA-4: Sustain funding for the LTWA stream monitoring program

Multiple stressors and assets addressed

The LTWA has an on-going stream monitoring program with more than 20 years of fish community data. This program has served to raise community awareness about stream health, educate youth and adults about fish communities and stream health, foster watershed protection ordinances, prompt environmental agency action, and support organizational fundraising. Currently, LTWA is developing a habitat assessment tool it hopes to use in a citizen scientist monitoring program. The program also can be utilized to help document site-specific and cumulative benefits to the watershed from the installation of conservation projects. The stream monitoring program should be continued as an effective watershed education and advocacy tool.

RA-5: Complete inventories of potential barriers to aquatic organism passage

Stressor addressed: barriers to fish passage

While barriers to aquatic organism passage have been identified for many Little Tennessee River tributaries with drainages greater than two square miles, many have not been surveyed. The remaining tributaries likely contain additional human-made barriers that limit fish diversity. It is recommended that human-made barriers in the remaining drainages be inventoried. Those drainages containing habitat for at-risk fish species such as brook trout (*Salvelinus fontinalis)* should be given highest priority. This work should involve the US Forest Service, NC Wildlife Resources Commission, and the LTWA.

RA-6: Identify sources of fecal coliform bacteria in Crawford Branch

Stressor addressed: fecal coliform bacteria

Franklin is upgrading its wastewater treatment plant and collection system through the construction of a new waste storage basin, the replacement of a sewer line along Crawford Branch, and work with landowners with problematic lateral lines from their houses. This work should reduce problems with inflow and infiltration during storms, which can overwhelm the collection system and result in sewer overflows.

The high fecal coliform bacteria levels found in Crawford Branch during baseflows are likely not due to storm events, however. Franklin and NCDWQ's Asheville Regional Office are working together to improve the Town's waste management operations. An illicit discharge detection and elimination study is recommended to identify the source of high fecal coliform bacteria levels in the downtown area of Crawford Branch; this study could include dye testing to determine if leaky sewer lines are the source of the bacteria.

Crawford Branch is not Franklin's only urban stream, although it is its largest urban stream. Since other streams in Franklin could suffer from the same impacts as Crawford Branch, assessments of both water quality and biological community health should be performed.

RA-7: Conduct an unpaved road condition survey

Stressor addressed: excess sediment inputs

Over 250 miles of unpaved roads were identified in focus area subwatersheds, but their condition is not known. Because unpaved roads can be a significant source of sediment to streams, an assessment of their condition is needed to determine where effort should be put to stabilize eroding roads, road banks, and ditches. Priority should be given to areas where developments have failed (e.g., Wildflower); here, road conditions and their impact on streams should be inventoried so that problem areas can be stabilized.

RA-8: Monitor site-specific and cumulative impacts of conservation projects

As conservation projects are installed in subwatersheds throughout the planning area, ecosystem uplift should be determined at the site-specific and cumulative subwatershed scales. Specific criteria and indicators, along with protocols to be used, will need to be developed. Five years of post-construction monitoring is a standard part of NCEEP-implemented atlas projects, but this will likely only address a portion of the projects installed annually. A well coordinated monitoring program that tracks NCEEP and other Partner projects is recommended.

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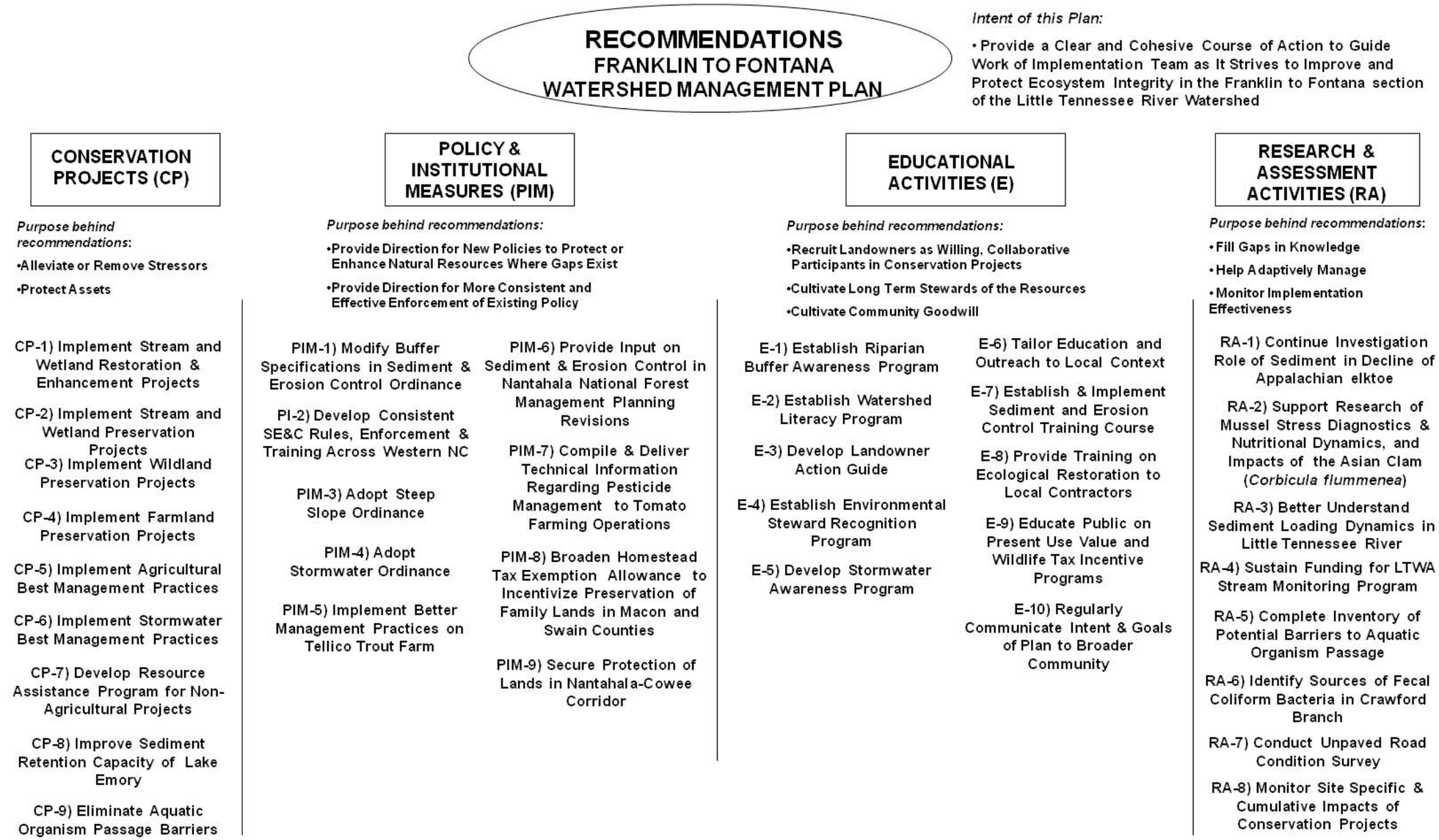
Figure 4.2 Summary of Management Recommendations for the Franklin to Fontana Watershed



Section 5 Watershed Plan Implementation

Previous sections of the management plan discuss existing ecological problems, assets, and actions needed to alleviate the problems and protect the assets. This section discusses how the plan will be implemented. Broad organizational structure and processes are described that should help guide successful plan implementation over the long-term. This section focuses on the big picture of teamwork, organizational leadership and management, and community relations, which are foundational elements upon which long-term implementation successes depend. An Implementation Team (IT) will work together to develop detailed goals, timelines related to the recommendations, and suggestions on which LAC member will be responsible for a particular recommendation. In doing so, this team will take ownership of the plan, solidify the partnership, and get projects on the ground.

5.1 The Implementation Team

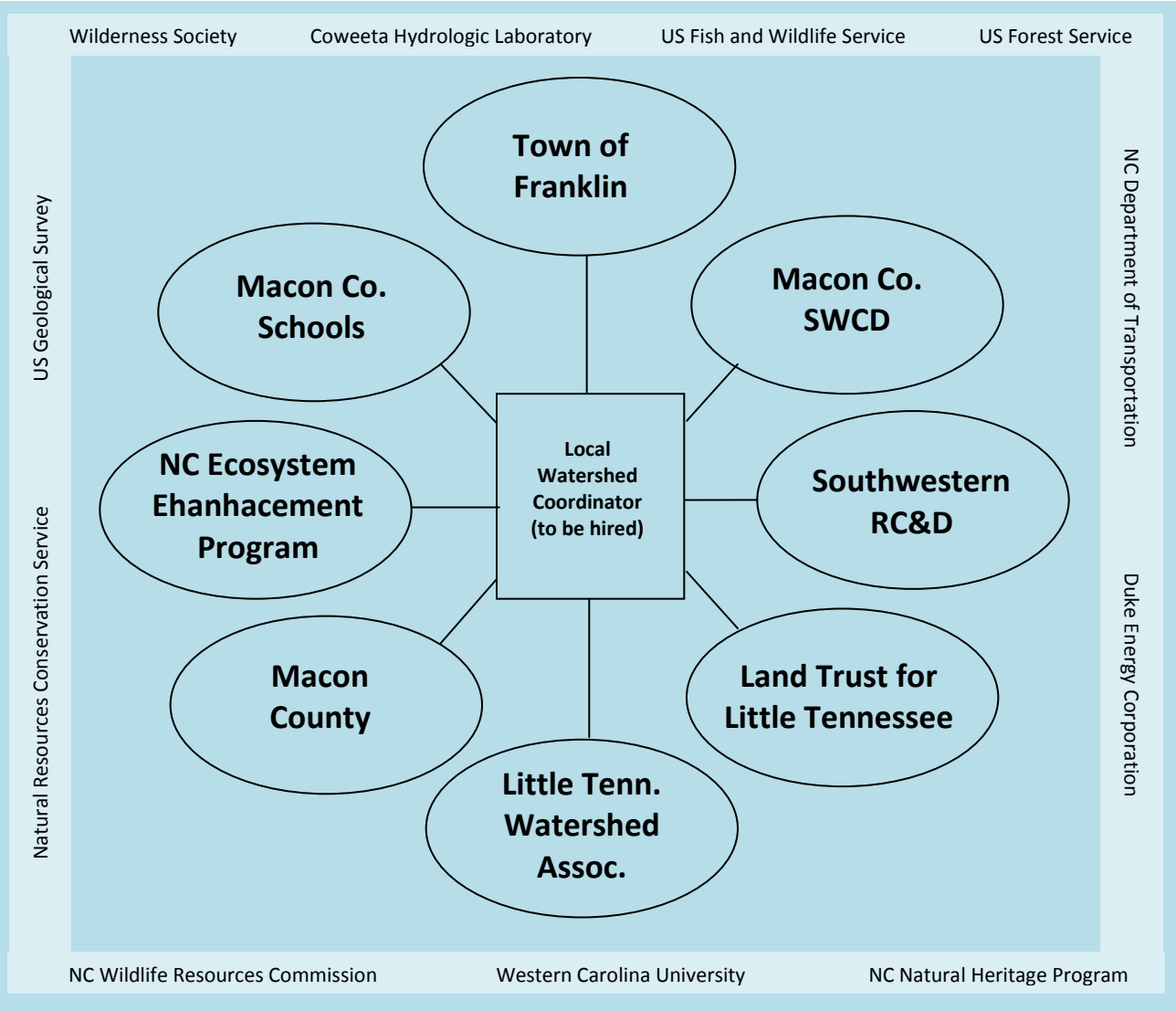
For the purpose of implementing the *Watershed Management Plan,* the Franklin to Fontana LAC has been re-configured to serve as the Implementation Team (IT) (Figure 5.1). The IT consists of two parts, each having distinct responsibilities. At the core are **Local Implementation Partners**, including a Watershed Coordinator, who have the primary responsibility of executing plan recommendations. Surrounding the Local Partners are **Supporting Partners** who help execute plan strategies by representing their respective organizations, pulling from their financial, political, academic, and technical resources.

Local Implementation Partners include local governments and non-profit organizations having close connections with the people and the land within the Franklin to Fontana project area. These organizations utilize technical, political, and public relations expertise to administer conservation programs or policies, regulations, and educational activities that both directly affect the community and afford routine direct interface with the citizenry and landowners. NCEEP has been included as a Local Partner because of its expected heavy involvement in funding conservation projects and its routine, direct interface with landowners on those conservation projects. NCEEP also was requested by members of the Local Advisory Committee to serve as the temporary, interim coordinator of the Implementation Team.

Supporting Partners include state and federal agencies and private corporations, both for-profit and non-profit that may not have the routine, direct interface with the community that Local Implementation Partners have. Furthermore, their responsibilities outside of the Franklin to Fontana project area may prevent the same intensity and frequency of involvement within this project area as Local Partners. Regardless, they are critically important members of the team that have clout and experience at getting projects on the ground. Supporting Partners provide connections to certain resources and expertise vital to implementing this plan.

The Implementation Team also has been organized into these two groupings for the purpose of facilitating effective communication, task performance, and project management. Coordination and communication between the IT and the Partnership for the Little Tennessee will need to occur in order to avoid duplication of efforts.

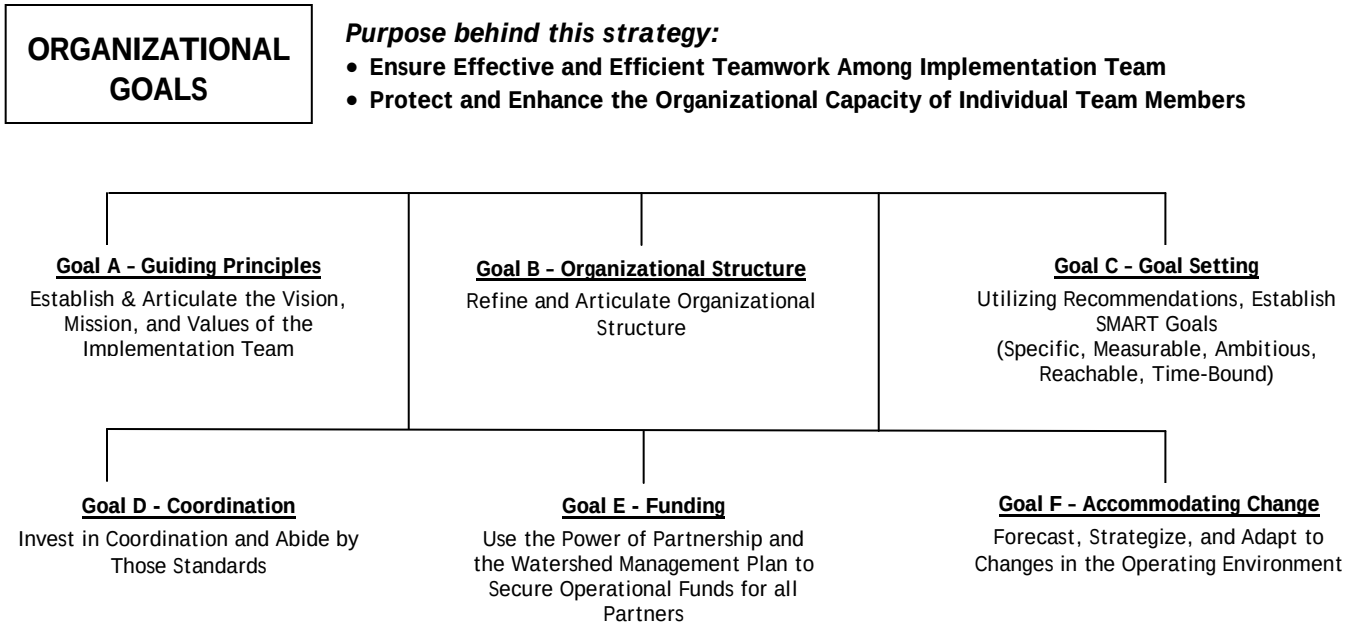
Figure 5.1 The Franklin to Fontana WMP Implementation Team



5.2 Team Function and Organizational Goals

The organization of the Implementation Team is important to the success of implementing the management plan. The IT may function as a loose affiliation of interested parties operating under non-binding agreements, as is the case now, or as an incorporated entity such as a 501(c)(3) non-profit operating under a governing charter and by-laws. Regardless of how the IT chooses to operate, organizational goals that are developed collectively help to ensure teamwork. Six key organizational goals are outlined below that, once achieved, will provide a solid foundation that can support *Watershed Management Plan* implementation over the long-term (Figure 5.2). While some project recommendations discussed in Section 4 may be implemented before these organizational goals are fully developed, the capacity of the IT and the long-term success of plan implementation will be greatly enhanced once organization goals are set.

Figure 5.2 Six Key Organizational Goals as a Foundation for Long-Term Plan Implementation



Goal A) Establish and Articulate Guiding Principles

This *Watershed Management Plan* is a central document around which Partners are to organize and collaborate. It is a starting point to galvanize Partner interest. To strengthen the partnership and maintain interest, the IT should develop and articulate a shared vision, mission statement, and values. These will establish the Partners' collective purpose, what they want to achieve, and how they will pursue goals. Developed intentionally and with all members' involvement, these statements will strengthen group identity and cohesiveness. These statements may also be an effective marketing and public relations tool that can help enhance the stature of the IT within the community and increase the odds of recruiting landowners into conservation projects.

Goal B) Refine and Articulate Organizational Structure and Roles

The organizational structure depicted in Figure 5.1 has been endorsed by the LAC. This structure emphasizes the importance of having locally based partners serving as the primary public interface and implementers of the management plan recommendations. It also recognizes the importance of supporting partners whose involvement will help ensure the long-term success of plan implementation. At the IT's discretion, sub-groupings or sub-committees may be formed to implement or manage specific activities associated with a particular recommendation. Sub-committees may also oversee organizational issues, should the need arise.

Each member of the IT should express their anticipated level of commitment to the plan, what they can contribute, and what expectations they might have of other Partners. This will help clarify roles and responsibilities of individual Partners. Clearly defined roles and

responsibilities, established through the up-front involvement of all, will help minimize miscommunications and contribute to effective teamwork and collaboration.

A Local Watershed Coordinator also is an essential element central to the organizational structure. The Coordinator will serve to bring the team together, facilitate communications, and provide reminders.

Goal C) Establish SMART Goals from List of Recommendations

Although recommendations were presented in Section 4, they have not been prioritized. Because the list of recommendations is large, prioritizing the goals will give the IT focus. Using the SMART approach to goal setting will allow the IT to prioritize how, when, and by whom the recommendations are pursued. SMART goals should be created with the following in mind:

- *Specific* - Goals are clear with well defined desires or achievement objectives. Ambiguous or vague language should be avoided in goal statements.
- *Measurable* - Goals are quantifiable in some manner. Action words should be used in goal statements that can be assessed for whether or not the action has been achieved.
- *Ambitious* - Goals should stretch the capacity of the team. The team should dream big.
- *Reachable* - Goals should be realistic. Setting goals that are too lofty can lead to frustration and disappointment. A balance is needed between ambitious and reachable.
- *Time-Bound* - Goals should be stated with timelines to hold the team accountable for achievement.

Goal D) Invest in Coordination

Effective coordination of the Implementation Team is essential to the success of this plan. At the request of the Local Advisory Committee, the NCEEP has agreed to serve temporarily in that role. At some point in the near future, the group will need to seek funding to hire a Local Watershed Coordinator (Coordinator). The Coordinator will be the *de facto* manager and leader of the group, which does not preclude other members of the IT from exercising leadership and management depending upon circumstances.

The Coordinator will play a leadership role in keeping the Implementation Team on track to achieving its vision, maintaining trust among members, and managing day-to-day activities. The Coordinator's primary responsibility will be to help guide implementation activities and to document the ecosystem enhancement achievements that this management plan is intended to generate. In this capacity, the Coordinator will play a role in balancing project demands among the IT members. Such balance must take into account each member's capacity and capability to complete projects.

The Coordinator will need to ensure that achievements are tracked and communicated to the team and externally to the community. For the team, this gives members the sense of achievement that helps maintain interested involvement. For the community, it helps assure that this group is making a difference to their environment and that people are benefiting from their work. The Coordinator will need to provide avenues for feedback and recognition among team members as well.

In the implementation of the Franklin to Fontana *Watershed Management Plan* the Coordinator has no formal authority with regard to leadership and management. This reality underscores the importance of ensuring that the team works together early in the implementation process to clarify and articulate its vision, mission, and values and refine its structure. These elements, in the absence of formal authority, will provide some glue to help hold the team together over time and ensure the accountability from each partner that a successful team needs.

Goal E) Acquire Funding

Current economic circumstances are a real threat to employment for some of the people involved in the Franklin to Fontana planning effort. Government and non-profits may not have the financial capacity to support conservation work as they have had over the last decade. These people, particularly staff from non-profit organizations and government agencies, are facing difficult budget challenges. Considering that these organizations have a central role to play as Local Partners, unfavorable financial circumstances could jeopardize the implementation of this plan. A function of Supporting Partners will be to ensure that Local Partners have the funding and capacity to serve their roles in the implementation of this plan.

The Implementation Team should also explore and pursue non-traditional funding sources such as private corporations with a vested interest in the Franklin to Fontana community and the Little Tennessee River. A sub-committee focused on fundraising that requires some creative, out-of-the-box approaches would be helpful. See Section 6.2 for more on possible funding sources.

Goal F) Accommodate Change

As the Implementation Team refines its structure as discussed in Goal B, they should assess the internal and external working environment in terms of strengths, weaknesses, opportunities, and threats. This will keep the team proactive and poised to respond well to changes that occur. Figure 5.3 illustrates an incomplete Strength-Weaknesses-Opportunities-Threat (SWOT) analysis developed from awareness of today's internal and external landscape.

Internal changes within the team and external changes in the project area and outside environment are likely to occur. For example, IT membership may grow or shrink, the economic climate may become less or more secure, and the political climate may become less or more favorable to environmental initiatives. In addition, social attitudes of the people who live in the Franklin to Fontana watershed may become less or more hospitable to outreach efforts, and landowners who are not yet interested in hosting a conservation project may change their mind as they see others participate and benefit. The IT should pay attention to changes within the internal and external environment and adapt in order for this management plan to have long-term relevance.

Figure 5.3 Partial SWOT Analysis of Current Conditions for Implementation Team

Internal Environment	STRENGTHS • Size and diversity of implementation team • Experience and savvy of implementation team members • Local team members well respected in community • Influential supporting agency and corporate organizations with political and economic connections • Technical expertise • Educational expertise • Political expertise • Management expertise • Track record of conservation successes by individual team members • A well researched, thoughtful, and stakeholder driven watershed management plan • Several team members who are non-profits and could serve as fiscal agent	WEAKNESSES • Size and diversity of implementation team • Currently have only temporary coordination from NCEEP • Limited or non-existent unrestricted funds or funds earmarked for coordinator • Roles and responsibilities of team members not yet defined for implementation purposes • Implementation Team is not a 'catchy' or well defined name for the group implementing this plan
External Environment	OPPORTUNITIES • Existing models of environmentally responsible development (Southwestern Regional Commission Toolbox) • Impaired streams get State and Federal attention • Some attitudes and behaviors in the community that run counter to the intent of the management plan • State mitigation forecast • Positive public perception of individual team members' programs - Kids in the Creek, Macon Middle School, etc.	THREATS • Difficult fundraising climate • Partner's existing responsibilities that compete for their time and resources • Potential overlap and redundancy of Partnership for the Little Tennessee and Implementation Team • Some attitudes and behaviors in the community that run counter to the intent of the management plan • Variable state mitigation forecast

5.3 The Human Element in the Conservation Equation

This *Watershed Management Plan* represents a significant investment in time and thought from more than three dozen people over the course of the last three years. A large amount of technical and scientific details have been developed and are presented in this document with the ultimate purpose to improve and protect environmental quality and habitat for plants and animals in the Franklin to Fontana watershed planning area. This is an intrinsically valuable and worthwhile endeavor. It will be of interest to many people, and not just those responsible for developing this plan.

As this plan is implemented, however, success will be largely dependent upon how well the Implementation Team connects with a broad range of people. Most importantly, this includes the community at large and individual landowners who own property where the team wants to initiate or expand conservation practices. Community and landowner connections will grow as the Implementation Team executes activities associated with all of the recommendations in this plan, not just the educational recommendations.

Connections will happen more readily with more kinds of people when communications resonate with its audiences' intellect as well as their emotions. Data available in this document provide plenty of reference material when needed for the intellectual approach,

but it will be an appeal to peoples' core values and "what's in it for them" that will more effectively achieve participation by landowners and the community in general. Rational facts may influence behavior, but it often takes a very long time before people move from being presented with facts to making changes in their behaviors such as deciding to participate in a project.

Local Partners are best equipped to know the communities' core values. For example, independence, farming, local pride, knowing and caring about your neighbor, taking care of our own, the economic vitality of the area, rural character, and cultural heritage are all values the local community embraces. Another core value of most people is economic self-interest, or a 'what's in it for me?' attitude. The Implementation Team will have more rapid and far-reaching success when it can implement recommendations that benefit not only the ecology of the watershed but integrate the broader interests of the people who live and work in the planning area.

Appealing to individual's core values can be achieved by using the audience-message-method of delivery-messenger education and outreach approach as shown in Table 5.1. In this example, the LAC explored messages that might appeal to business owners and homeowners as they try to encourage better management of stormwater runoff. Once the audience and messages were identified, they brainstormed how the message was to be delivered and the person or people best equipped to deliver the message to the audience. Implementation would benefit from the team using this model to develop its approach to marketing all of its conservation projects, and perhaps even the recommended policy and institutional measures .

Table 5.1 A Prospective Education and Outreach Strategy to Implement Stormwater BMPs

Connecting with Business and Home Owners to Help Implement Stormwater BMP Retrofit Projects			
AUDIENCE	**MESSAGE TO BE DELIVERED**	**METHOD OF DELIVERY**	**MESSENGER**
Business Owners	• Save money on property maintenance and repairs • This is an opportunity for green business public relations • This is an opportunity for community involvement • The costs of participation might be covered, at least in part, by other sources • A healthier stream = a healthier town = more visitation = ultimately more money spent in Macon and Swain counties.	• Link the impacts of flooding to direct costs in terms of property damage and cleanup costs borne by taxpayers • Show pictures of flooding and storm drain overflows • Show visuals of stormwater Best Management Practices • Show graphics that illustrate cost savings versus treatment costs • Show visualizations that connect the stormflow problem to the source of the problem • One-on-one face-to-face conversations	• Franklin Main Street • Macon County Economic Development Board • Macon County Chamber of Commerce • Macon County and Town of Franklin Planning Boards • Lewis Penland • Stacey Guffey • Mike Grubermann
Homeowners and Residents	• Use rain barrels and 1) Keep water out of your basement and from damaging your foundation; and 2) Get free water for use in your garden and landscape • Manage stormwater now and avoid a possible 'rain-tax' later • Stormwater is a safety hazard for kids who play in the creeks • Stormwater treatments can be attractive and can help beautify your lawn and the town • Better stormwater management will keep the basketball courts from flooding	• Same as above • Door-to-door canvass to deliver brochure and be available to inform and answer questions	• Macon County Watershed Council • Macon County Board of Health • Macon County Board of Realtors • Jenny Sanders • Doug Johnson • Allen Durden

At its essence, keeping people at the focus of conservation should produce the following three major benefits that are key to successful implementation of the management plan recommendations:

1) community goodwill;
2) involved landowners; and
3) advocates and stewards of the streams

These three outcomes are interrelated and mutually reinforcing. In an ideal world, the most effective implementation will create momentum among these three forces such that the plan assumes a life of its own and almost implements itself. With guidance from the IT, this can be achieved.

Section 6 Technical Resources and Funding Sources

Technical resources and funding sources are often difficult to identify and tap into when implementing watershed management plans. This section is designed to complement the plan strategies by making those resources easier to find. This section is divided into three subsections. The first two subsections contain technical resources and funding sources. The technical resource subsection is comprised of several tables that present the available resources by category. Each table contains the name of the resource, a description of what they can provide and a web link at which additional details and contact information can be obtained. The funding source subsection contains similar information for funding sources. The third subsection contains a list of additional publications that may be of use to those implementing watershed management plans. All web links were current as of July 2011.

6.1 Technical Resources

Table 6.1 Local and Regional Watershed Resources (Sheet 1 of2)

Resource/Group	Description	Website / Contact Info
Macon County Division of Soil and Water Conservation (DSWC)	Administers DSWC funding programs (e.g., agricultural cost share) in Macon County and works to promote conservation of natural resources.	http://www.maconnc.org/soil-water.html
Swain County DSWC	Administers DSWC funding programs (e.g., agricultural-cost share) in Swain County and works to promote conservation of natural resources.	http://www.swaincountync.gov/SWCD.html
Town of Franklin Planning	Responsible for short and long range Town planning, including administering development ordinances, code enforcement, community development, and the Town's GIS mapping system.	http://www.franklinnc.com/planner.html
Town of Franklin – Unified Development Ordinance	Document provides details of ordinance in place for guiding development within the Town of Franklin.	http://www.franklinnc.com/pdf/UDO_final.pdf
Surface Water Protection, NCDWQ Asheville Regional Office, NCDENR	Administers State rules and permitting related to stream and wetland protection.	http://portal.ncdenr.org/web/wq/home/ro/aro
Little Tennessee Watershed Association	Non-profit working to protect and restore the Little Tennessee River watershed.	http://www.ltwa.org/

Table 6.1 Local and Regional Watershed Resources (Sheet 2 of 2)

Resource/Group	Description	Website / Contact Info
Land Trust for the Little Tennessee	Non-profit land trust that permanently protects land, water, and wildlife habitat within the upper Little Tennessee and Hiwassee River valleys.	http://www.ltlt.org/
Partners for the Little Tennessee	A non-profit organization working to conserve the water resources of the Little Tennessee River Basin.	http://littletbasin.org/
Mountain Landscapes Initiative ["Toolbox"]	A long-range program by The Community Foundation of Western North Carolina. The "Toolbox" initiative – whose purpose is to work towards community-determined standards for planning and development in North Carolina's mountain region - was launched in partnership with the Southwestern Commission, the regional Council of Governments organization serving county and town governments in the seven westernmost counties.	http://www.mountainlandscapesnc.org/index.html
Coweeta Schoolyard Program	Coweeta Long-Term Ecological Research (LTER) scientists and staff provide middle school, high school, and community college students with "hands on" field and laboratory research experience.	http://coweeta.uga.edu/lterschoolyard
Haywood Waterways Association	Provides a model for the "Kids in the Creek" program.	http://www.haywoodwaterways.org/
Macon County Planning, Permitting, and Development	Administers floodplain program, S&EC program, watershed protection program, and other planning programs.	http://www.maconnc.org/planning-development-home.html
Macon County Planning Board	Memo from the Slope Development Strategies Committee to the Planning Board regarding recommendations for construction on steep slopes.	http://maconnc.org/images/planning/Safe-Slope-Development-Final-Recommendation-Draft.pdf
National Committee for the New River	River Builder program, which implements stream bank stabilization projects	http://www.ncnr.org/restoration.php
Rivercane Studies	WCU site that provides information about rivercane restoration	http://www.wcu.edu/24629.asp

Table 6.2 Agricultural Watershed Resources

Resource/Group	Description	Website / Contact Info
Agriculture Cost Share Program - DSWC	Provides cost-share funding to protect water quality by installing BMPs on agricultural lands.	http://www.enr.state.nc.us/dswc/pages/agcostshareprogram.html
Conservation Reserve Program - USDA	Convert highly erodible crop land or other environmentally sensitive acreage to vegetative cover.	http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=crp
Conservation Reserve Enhancement Program - Division of Soil and Water Conservation (DSWC)	Funds long-term protection of environmentally sensitive agricultural lands through implementation of grassed filter strips, forested riparian buffers, tree planting, and wetlands restoration.	http://www.enr.state.nc.us/dswc/pages/crep.html
Environmental Quality Incentives Program - NRCS, USDA	Technical and financial assistance to implement conservation practices on eligible agricultural land.	http://www.nrcs.usda.gov/programs/eqip/
Wildlife Habitat Incentive Program - NRCS, USDA.	Cost-share funding to promote the restoration of declining or important wildlife habitat.	http://www.nrcs.usda.gov/programs/whip/
Farm and Ranch Land Protection Program - NRCS, USDA	Offers matching funds to help purchase development rights to keep productive farm and ranchland in agricultural uses.	http://www.nrcs.usda.gov/programs/frpp/
Other USDA Programs	Offers information on a number a different USDA grants and technical assistance programs including those mentioned here.	http://www.nrcs.usda.gov/programs/
Virginia Soil & Water Conservation – NPS BMPs	Useful summary of information on NPS pollution and best management practices (BMPs) for controlling NPS pollutants -- including urban, agricultural, and forestry BMPs.	http://www.dcr.virginia.gov/stormwater_management/index.shtml
Wildlife Conservation Lands Program – NCWRC Division of Wildlife Management	Program that allows landowners to receive tax benefits for managing lands for wildlife benefits.	http://www.ncwildlife.org/Wildlife_Species_Con/documents/Introduction_WCLP.pdf

Table 6.3 Urban Watershed Resources

Resource/Group	Description	Website / Contact Info
Green Growth Toolbox - NCWRC, NCDENR	Technical resources, handbooks, GIS data, and other information to support conservation minded development.	http://www.ncwildlife.org/GreenGrowth/
Community Conservation Assistance Program - DSWC	Provides financial and technical assistance to improve water quality through the installation BMPs on urban, suburban, and rural lands, not directly involved in agricultural production.	http://www.enr.state.nc.us/DSWC/pages/ccap_program.html
Center for Watershed Protection	Non-profit foundation providing a wealth of technical resources (e.g., reports, model ordinances, and training materials) to support healthy land and water management.	http://www.cwp.org/
NC State University Dept. of Biological & Agricultural Engineering; Stormwater Engineering Group and Cooperative Extension Service	Their mission is to "learn and teach" stormwater management, including bioretention areas, green roofs, stormwater wetlands, permeable pavements, water harvesting systems, LID, and other innovative treatment practices.	http://www.bae.ncsu.edu/stormwater/ http://www.bae.ncsu.edu/programs/extension/wqg/frenchbroad/project-lid.html
Stormwater Manager's Resource Center	Provides resources on stormwater ordinances, post-construction runoff model ordinance, BMP design, and other tools. Maintained by the Center for Watershed Protection.	http://www.stormwatercenter.net/
UNC School of Government	Provides a Universal Stormwater Model Ordinance.	http://www.efc.unc.edu/publications/2007/UniversalStormwaterModelOrdinanceNC.pdf

Table 6.4 Other Watershed Resources

Resource/Group	Description	Website / Contact Info
Use Restoration Watershed Funding Resources - NCDWQ NCDENR	Provides technical assistance to restore the beneficial uses of impaired waters.	http://portal.ncdenr.org/web/wq/ps/bpu/urw/funding
Environmental Finance Center Network	A university-based organization at UNC–Chapel Hill along with other universities nationwide that is dedicated to creating innovative financing solutions for environmental protection. The Network includes public and private sector watershed resources.	http://www.efc.unc.edu/
NC Cooperative Extension	Provides technical resources, education, and outreach on forestry and environmental management.	http://www.ces.ncsu.edu/
NCDENR Office of Environmental Education	Serves as North Carolina's clearinghouse (central source) for all of the environmental education resources in the state. The office serves Pre-K-12 schools, colleges and universities, government agencies, non-profit organizations, environmental education centers, citizen groups, business and industry, libraries, and the general public.	http://www.eenorthcarolina.org/
NCDENR – Public Water Supply Section – SWP Program	The Source Water Protection (SWP) Program provides guidance and funding opportunities related to source water assessment and pollution prevention for public water supplies.	http://swap.deh.enr.state.nc.us/swap/pages/swplinks.htm
NC State University Water Quality Group	A multidisciplinary team that analyzes and evaluates nonpoint source (NPS) pollution control technologies and water quality programs in North Carolina.	http://www.bae.ncsu.edu/programs/extension/wqg/
NC State University WATERSHEDDS Program	WATERSHEDSS (**WATER**, **S**oil, and **H**ydro- **E**nvironmental **D**ecision **S**upport **S**ystem) was designed to help watershed managers and land treatment personnel identify their water quality problems and select appropriate best management practices.	http://www.water.ncsu.edu/watershedss/
EPA Watersheds	Portal to resources on watershed planning, assessment, total maximum daily loads (TMDLs), and water quality information.	http://www.epa.gov/owow/watershed/
NCDFR Sustainable Forestry Initiative	Provides information on sustainable forestry.	http://www.dfr.state.nc.us/Managing_your_forest/managing_sfi.htm

6.2 Funding Resources

The tables below represent an up-to-date compilation of potential funding sources and websites available to aid in the implementation of recommended management strategies within the Franklin to Fontana watershed.

Table 6.5 General Watershed Funding Resources (Sheet 1 of 2)

Resource/Group	Description	Website / Contact Info
NC Ecosystem Enhancement Program - NCDENR	Provides watershed planning and implementation of compensatory mitigation projects (e.g., stream and wetland restoration).	http://portal.ncdenr.org/web/eep/welcome
Clean Water Management Trust Fund	Offers grants to local governments, state agencies, and conservation non-profits to help finance projects that specifically address water pollution problems.	http://www.cwmtf.net/
NC Natural Heritage Trust Fund	Funds the protection of land with outstanding natural or cultural heritage values.	http://www.ncnhtf.org/
N.C. Parks and Recreation Trust Fund, NCDENR	Provides matching grants to local governments for parks and recreational projects to serve the public.	http://www.ncparks.gov/About/grants/partf_main.php
NC Agricultural Development and Farmland Preservation Trust Fund	Funds to support the farming, forestry, and horticultural industries through purchase of agricultural conservation easements and development of agricultural enterprise programs.	http://www.ncadfp.org/index.htm
Non-point Source Section 319 Grants - NCDWQ, NCDENR	Funding grants for efforts to reduce non-point source (NPS) pollution including demonstration BMPs, education and outreach, and establishing Total Maximum Daily Load (TMDL).	http://portal.ncdenr.org/web/wq/ps/nps/319program
Planning Grant 205j – NCDWQ, NCDENR	Funding available to regional Councils of Government (COGs) for water quality management planning efforts.	http://h2o.enr.state.nc.us/pb/205jPlanningGrantHomePage.htm
Z. Smith Reynolds Foundation	Private Foundation providing grants dedicated to clean water, clean air, and environmental justice.	http://www.zsr.org/
Clean Water State Revolving Fund - Construction Grants and Loans, NCDENR	Funds grants to assist in improvements to wastewater treatment facilities and projects benefitting estuary and non-point source programs.	http://portal.ncdenr.org/web/wq/cgls/fap/cwsrf
The Cooperative Water Program - USGS	Provides cost-share funds to support water resource information gathering to wisely manage the Nation's water resources.	http://water.usgs.gov/coop/
Water Resources Development Project Grant Program - Division of Water Resources, NCDENR	Provides cost-share funding and technical assistance to local governments in subject areas including navigation, water management, stream restoration, land acquisition, and aquatic weed control.	http://www.ncwater.org/Financial_Assistance/

Table 6.5 General Watershed Funding Resources (Sheet 2 of 2)

Resource/Group	Description	Website / Contact Info
Planning Assistance To States Program (Section 22) US Army Corps of Engineers	Provides technical expertise in management of water and land resources to help States deal with water resource problems including floodplain management, watershed restoration, and water supply assessment.	http://www.saw.usace.army.mil/Floodplain/Section%2022.htm
Partners for Fish and Wildlife - USFWS	Offers technical and financial assistance to landowners who want to restore and enhance fish and wildlife habitats.	http://www.fws.gov/raleigh/pfw.html
EPA List of Watershed Funding Opportunities	List of links to a number of different watershed funding resources.	http://www.epa.gov/owow/funding.html
Southeast Aquatic Resource Partnership	Provides grant funds for habitat restoration, including aquatic barrier removal.	http://southeastaquatics.net/
Land and Water Conservation Fund	Provides funding to State and Federal agencies to conserve natural resources, including land acquisition.	http://www.nps.gov/lwcf/

6.3 Reference Publications

In addition to the technical and funding information listed in the previous subsections, several reference publications were found to contain information that may be useful in implementing the Franklin to Fontana Watershed Management Plan. These references and web links to them are provided below. All web links were accessed in July 2011.

Conservation Action Plan for the Upper Little Tennessee Basin. 2008. http://littletbasin.org/documents/ULTNCAPFinalReport_Oct_2008.pdf

CWP (Center for Watershed Protection). 1998. Better Site Design: A handbook for changing development rules in your community. Center for Watershed Protection, Ellicott City Maryland. http://www.cwp.org/documents/cat_view/77-better-site-design-publications.html

NRCS (Natural Resources Conservation Service). 2005. The Layman's Guide to Private Access Road Construction in the Southern Appalachian Mountains. US Department of Agriculture Natural Resources Conservation Service, US Forest Service Southern Research Station Coweeta Hydrologic Laboratory, and North Carolina Division of Forest Resources. http://www.dfr.state.nc.us/publications/laymans_guide_to_access_road.pdf

NCDWQ (North Carolina Division of Water Quality). 2007. Stormwater Best Management Practices Manual. Raleigh. http://portal.ncdenr.org/web/wq/ws/su/bmp-manual

NCDWQ (North Carolina Division of Water Quality). 2010. Example of good stormwater treatment specification - Section 12 of Water Quality Certification No. 3821. http://portal.ncdenr.org/c/document_library/get_file?uuid=f58d0253-a423-4911-ae5a-7c6ea41b9c75&groupId=38364

NCEEP. (North Carolina Ecosystem Enhancement Program). 2006. Lower Creek Watershed Management Plan (Catawba River Basin, Caldwell and Burke Counties). Raleigh. http://www.nceep.net/services/lwps/Lower_Creek/Lower_Creek_Watershed_Management_Plan.pdf

NCEEP. (North Carolina Ecosystem Enhancement Program). Franklin to Fontana Local Watershed Planning Phase I, II, III documents: http://portal.ncdenr.org/web/eep/rbrps/little-tennessee

NCEEP. (North Carolina Ecosystem Enhancement Program). Franklin to Fontana LWP fact sheet: http://www.nceep.net/services/lwps/Little_Tennessee/Franklin2Fontana_LWP_fact_sheet.pdf

NCSU-CES (North Carolina State University Cooperative Extension Service). 2009. Low Impact Development: a guidebook for North Carolina. Raleigh. http://www.ces.ncsu.edu/depts/agecon/WECO/lidguidebook/

NCSU-CES (North Carolina State University Cooperative Extension Service). Watershed Education for Communities and Officials Program LID fact sheet: http://www.ces.ncsu.edu/depts/agecon/WECO/nemo/documents/WECO_LID_policy_fact sheet.pdf

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USEPA (Environmental Protection Agency). 2009. Managing Wet Weather and Green Infrastructure. Municipal Handbook. Water Quality Scorecard. EPA-833-B-09-004. Washington, D.C. http://www.epa.gov/npdes/pubs/gi_municipal_scorecard.pdf

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Appendix A – Glossary of Technical Terms

- **Aquatic habitat** – the wetlands, streams, lakes, ponds, estuaries, and streamside (riparian) environments where aquatic organisms (e.g., fish, benthic macroinvertebrates) live and reproduce; includes the water, soils, vegetation, and other physical substrate (rocks, sediment) upon and within which the organisms occur; also includes micro-habitats such as undercut stream banks and woody debris found within healthy streams and wetlands.
- **Assets** – Natural resources that are in a condition worthy of protection.
- **Basin** – the largest watershed management unit for planning, consisting of a group of sub-basins; typically range in size from 500 to 10,000 square miles; there are 17 major river basins in NC, the largest being the Cape Fear and the Yadkin-Pee Dee, and the smallest the Savannah and the Watauga.
- **Benthic macroinvertebrates** – organisms living in or on the bottom substrate of aquatic habitats; include insect larvae, worms, snails, crayfish and mussels; can be used as indicators of stream water quality and stream habitat condition.
- **Bioaccumulate** – the process by which an organism absorbs a substance at a rate faster than at which the substance is lost.
- **BMPs (best management practices)** – any land or stormwater management practice or structure used to mitigate flooding, reduce erosion & sedimentation, or otherwise control water pollution from runoff; includes urban stormwater management BMPs and agriculture/forestry BMPs.
- **Buffer** – an area adjacent to a stream, wetland, or shoreline where development activities (e.g., buildings, logging) are typically restricted or prohibited; may be managed as streamside (riparian) zones where undisturbed vegetation and soils act as filters of pollutants in stormwater runoff. Buffer zone widths vary depending on state and local rules, but are typically a minimum of 25 to 50 feet on each side of perennial streams. In NC, buffer rules have been established for all, or portions of, the upper Cape Fear, lower Catawba, Neuse and Tar-Pamlico river basins.
- **Cataloging Unit (CU)** – US Geological Survey-designated 8-digit Hydrologic Units (HUC), typically comprised of multiple smaller 14-digit HUs; total area of CUs ranges from about 300 to 2,000 square miles. There are 54 individual CUs in NC; they can be considered regional sub-basins within the larger river basins. They represent the watershed unit within which permitted impacts to waters and wetlands occur and where compensatory mitigation credits must be obtained.
- **Catchment** – a single or small set of connected headwater streams that make up a portion of a subwatershed; for purposes of this report it refers to portions of the Crawford Branch and Lake Emory urban subwatersheds, which are less than 1.5 square miles.
- **Channel modification** – Activities conducted to change the flow characteristics of a channel to increase its capacity including straightening, widening, deepening, berming, or relocating existing stream channels and clearing or snagging operations. Usually undertaken for the purpose of decreasing property damage (flood control), navigation, drainage improvement, and channel stabilization. The resulting channel typically has more uniform channel cross sections, steeper stream gradients, and reduced average pool depths.

- **Conservation easement** – a voluntary legal agreement between a landowner and a conservation organization (e.g., Land Trust) or public agency (e.g., NC EEP) that limits some portion of the land's uses; conservation easements are intended to preserve certain parcels/tracts in an undeveloped condition so as to provide a local or regional environmental benefit, such as water quality and habitat protection; landowners voluntarily agree to give up certain development rights on the land area in question while still retaining ownership of the land; certain tax benefits may accrue to landowners who sign conservation easements with qualified conservation organizations/agencies.
- **Conservation Projects** – a broad term that is used to define all types of project that lead to ecological enhancement or protection of natural resources. In this plan it includes restoration, enhancement, preservation and implementation of BMPs of all types.
- **Compensatory Mitigation** – an action taken to offset stream and/or wetland impacts associated with a 401/404-permitted project; includes Restoration, Enhancement, Creation and Preservation, with varying degrees of mitigation credit granted by the US Army Corps of Engineers (USACE) and the NCDWQ. It is the basic regulatory tool by which "unavoidable" impacts to streams, riparian buffers and wetlands are intended to be minimized (or compensated for).
- **Enhancement** (Enhance)– actions taken to increase or improve stream or wetland functions through the manipulation of vegetation, channel characteristics, or hydrology, but not to the extent of full stream restoration or wetland creation. An example would be the filling in of ditches in a previously drained wetland area or reshaping and revegetating banks of a stream. This type of compensatory mitigation does not receive as much mitigation credit as does Restoration; thus more enhancement is needed to mitigate for impacts than restoration.
- **Fecal coliform bacteria** – type of bacteria used as indicator of contamination by human or animal waste (and possible disease-causing pathogens).
- **Fee simple purchase** –private ownership of real estate (land) in which the owner has the right to use it for any legal purpose.
- **Floodplain** – area of land on each side of a stream channel that is inundated periodically by flood waters; important zone for dissipating the energy of peak storm flow discharges and for storing waters that otherwise might damage in-stream habitat and/or cause downstream flood damage; typically includes high-quality riparian habitat (if undisturbed). Waters flowing in incised (down-cut) streams may not be able to access the adjacent floodplain area to dissipate the volume and energy of higher storm flow events.
- **Focus area** – a subset of subwatersheds in the Franklin to Fontana watershed planning area that were examined more closely to identify the sources of stressors affecting aquatic habitat and for which a more intense search for potential projects was undertaken.
- **Functional assessment** (see **Watershed function**) – a determination of the integrity or health of a watershed. Important mega-components considered are hydrology, habitat, and water quality, which are measured by multiple indicators such as the extent of forested riparian buffers, fish and benthic community integrity, extent of stream channelization, and extent of impervious cover.
- **Geographic Information Systems (GIS)** - consisting of computer hardware, software and data designed for capturing, storing, updating, manipulating, analyzing and displaying all forms of spatial information. In EEP, desktop GIS is an important tool used in the assessment of various sets of watershed-related information (specific themes or coverages, e.g., land cover, property parcels, roads, municipal boundaries, streams, designated natural heritage areas, wetlands, soils, etc.) used in identifying the best locations for watershed project sites and management strategies.

- **Habitat degradation** – physical destruction or deterioration of in-stream and streamside aquatic habitat due to erosion & sedimentation, pollutant inputs, unstable stream banks, channel scour due to excessive storm flows, breaks in the riparian buffer zone, lack of woody debris in/along streams, loss of pools & riffles, etc.
- **Hydrologic Unit (HU)** – refers to the 14-digit Hydrologic Unit Codes used by the US Geological Survey (USGS) to identify local watersheds typically ranging from 10 to 100 square miles in total drainage area; used by NC EEP as synonymous with "local watershed".
- **Impervious cover** – a human-created or –modified surface (e.g., concrete, asphalt) that does not allow water to percolate (or infiltrate) through it; examples include parking lots, rooftops, roadways, driveways, sidewalks, compacted soils. Urbanization and development are typically associated with significant increases in the impervious cover of a given area, which result in increased rates of stormwater runoff and inputs of non-point source pollutants into local streams.
- **Implementation partners** – core members of the Franklin to Fontana watershed planning area implementation team who have the primary responsibility for executing the watershed management plan recommendations.
- **Index of Biotic (**or ***Biological*****) Integrity** – calculated parameter for assessing the biological health of a given stream (or stream reach) by comparing the condition/status of multiple groups of organisms (e.g., benthic macroinvertebrates, fishes) against the conditions expected to be found in a healthy stream; used to assess the effects of stormwater runoff (or other sources of water quality impairment and habitat degradation) on local stream health, and to help prioritize areas/sites for stream, buffer or wetlands restoration projects.
- **Livestock operations** – an agricultural activity in which concentrations of animals such as beef cattle, milk cows, goats, and pigs are maintained, usually in fenced pastures or enclosures.
- **Local implementation partners** – all potential individuals and organizations that have resources or knowledge that are willing to provide for implementation of the Franklin to Fontana watershed management plan.
- **Local Watershed Planning (LWP)** – process whereby local stakeholders (and/or a specific group of local resource agency professionals) are brought together to help EEP assess local watershed conditions, identify causes/sources of watershed impairment, identify high-priority sub-watersheds and mitigation project sites, develop solutions to watershed problems, and implement watershed management strategies for the long term protection of important watershed functions/components (streams, wetlands, riparian buffers); developed by EEP for specific Targeted Local Watersheds within 8-digit CUs where significant impacts are projected to occur.
- **Low Impact Development (LID)** - a land planning and engineering design approach to minimize impervious surfaces and manage stormwater runoff so the development maintains pre-development hydrology. LID emphasizes conservation and use of on-site natural features to protect water quality.
- **Mitigation** – see ***Compensatory Mitigation.***
- **Natural Heritage Element Occurrences** - occurrences of rare plants and animals, exemplary or unique natural communities, and important animal assemblages (e.g., heronries and colonial waterbird nesting sites). Collectively, these plants, animals, natural communities, and animal assemblages are referred to as "elements of natural diversity" or simply as "elements". Specific occurrences of these elements are referred to as "element occurrences" or simply "EOs".

- **National Pollutant Discharge Elimination System (NPDES)** – a permit issued for point source (end of pipe) dischargers under the "National Pollutant Discharge Elimination System" [per Section 402 of the Clean Water Act]; also used to regulate stormwater discharges from certain urban areas and developing counties.
- **Phase I** (of a Local Watershed Plan) – the portion of the local watershed planning process whereby a preliminary characterization of watershed conditions is completed, based primarily on existing Geographic Information System (GIS), water quality, and aquatic habitat information. It culminates in a *Preliminary Finding and Recommendations Report and* is may be supplemented by a *Phase I Preliminary Project Atlas,* which identified potential restoration and preservation projects based on GIS analysis.
- **Phase II** (of a Local Watershed Plan) - the portion of the local watershed planning process when a detailed watershed assessment is completed. Data gaps identified in Phase I are addressed, key stressors impacting stream integrity and function are identified, and sources of these stressors documented. This work is summarized in a *Watershed Assessment Report*.
- **Phase III** (of a Local Watershed Plan) – portion of the local watershed planning process where watershed assessment data and stakeholder recommendations are integrated into two final LWP products, a *Project Atlas* and a *Watershed Management Plan* [this document].
- **Phytoremediation** – the use of plants to remove nutrients and toxic substances from water and soil.
- **Preservation** – the long-term protection of an area with high habitat and/or water quality protection value (e.g., wetland, riparian buffer), generally effected through the purchase or donation of a conservation easement by/to a government agency or non-profit group (e.g., Land Trust); such areas are generally left in their natural state, with minimal human disturbance or land management activities.
- **Reach** - an individual segment of a stream that has beginning and ending points defined by identifiable features.
- **Restoration –** the re-establishment of wetlands or stream hydrology and wetlands vegetation into an area where wetland conditions (or stable stream bank and stream channel conditions) have been lost; examples include: stream restoration using natural channel design methods coupled with re-vegetation of the riparian buffer; riparian wetlands restoration through the plugging of ditches, re-connection of adjacent stream channel to the floodplain, and planting of native wetland species; this type of compensatory mitigation project receives the greatest mitigation credit under the 401/404 regulatory framework **(See also Stream Restoration and Stream Enhancement).**
- **Retrofit** (stormwater) – a redesign of a site that is the source of stormwater to receiving waters. In order to reduce impacts to the receiving waterbody, a site is modified to control and treat stormwater through the installation of management structures.
- **Riparian (buffers) –** relating to the strip of land adjacent to streams and rivers, including stream banks and adjoining floodplain area; see also *Buffer*; important streamside zones of natural vegetation that, when disturbed or removed, can have serious negative consequences for water quality in streams and rivers.

- **Sediment (Sedimentation) –** process whereby eroded soils (silt, clay, and sand) are deposited in streams, rivers, lakes; accelerated by any activity that disturbs the land surface or removes vegetation (e.g., road construction, agriculture/forestry, urban development); sediment source areas include upland sites, intermediate slopes, riparian zones, and stream banks and channel scour areas.
- **Significant Natural Heritage Areas (SNHA)** - Natural sites or precisely delineated natural areas of outstanding value from the point of view of science, conservation, or natural beauty as designated by the North Carolina Natural Heritage Program.
- **Stakeholder –** as pertaining to watershed planning efforts, a stakeholder is any agency, organization, or individual involved in or affected by the decisions made in the development of a watershed plan; typically includes: *primary stakeholders* such as watershed residents, farmers, developers, local government or resource agency staff with a direct say in the planning process; and *secondary stakeholders* such as state or regional resource agency staff who can serve as technical resources/advisors to the local planning process.
- **Stormwater –** water that flows overland as a result of precipitation onto saturated or impermeable surfaces; can flow as diffuse sheet flow over impervious surfaces (e.g., parking lots) and/or can be concentrated into ditches, gullies & swales or manmade conveyances such as storm pipes, culverts, or lined channels; in urban areas or other disturbed landscapes, stormwater can convey sediment, nutrients, fecal coliform and other pollutants directly into receiving waters.
- **Stream enhancement** - Stream rehabilitation activities undertaken to improve water quality or ecological function of a fluvial system. Enhancement activities generally will include some activities that would be required for restoration. These activities may include in-stream or stream-bank activities, but in total fall short of restoring one or more of the geomorphic variables: dimension, pattern and profile. Examples of enhancement activities include stabilization of stream banks through sloping to restore the appropriate dimension and vegetating a riparian zone that is protected from livestock by fencing, construction of structures for the primary purpose of stream bank stabilization and, when appropriate, reattaching a channel to an adjacent floodplain.
- **Stream restoration** - The process of converting an unstable, altered, or degraded stream corridor, including adjacent riparian zone (buffers) and flood-prone areas, to its natural stable condition considering recent and future watershed conditions. This process should be based on a reference condition/reach for the valley type and includes restoring the appropriate geomorphic dimension (cross-section), pattern (sinuosity), and profile (channel slopes), as well as reestablishing the biological and chemical integrity, including transport of the water and sediment produced by the stream's watershed in order to achieve dynamic equilibrium.
- **Stressors** – Physical, chemical, and biological factors that adversely affect aquatic organisms.
- **Subwatershed** - a component drainage area within a local watershed (14-digit USGS hydrologic unit); typically about one to five square miles in area, these areas are considered the most appropriate and effective geographic scale for local watershed assessment, planning, and management.
- **Supporting Partners** – members of the Franklin to Fontana watershed management plan implementation team who serve to convey information to and from their respective organizations' financial, political, academic, and technical resources. They are often in a position of to pursue initiatives outside of the capabilities of the Implementation Partners.
- **Turbidity** – a measure of water cloudiness caused by suspended solids such as fine soil particles.

- **Watershed (Drainage) –** all the land area which contributes runoff to a particular point along a stream or river; also known as a "drainage basin", although the term *Basin* usually implies a very large drainage system, as of an entire river and its tributary streams. Watersheds are generally greater than five square miles in size.
- **Watershed function** – output of the interaction of the physical, biological, and chemical components of a watershed. The integrity or health of a watershed. The three major functions that a watershed assessment targets are habitat, hydrology, and water quality.
- **Watershed Management Plan** –a document that provides assessment and management information for a geographically defined watershed, including analyses, actions, stakeholders, and resources related to development and implementation of the plan.
- **Wetlands –** by definition, these are areas characterized by three key features: hydrophytic (water-adapted) plants, hydric soils, and specific indicators of periodic saturation/inundation by water (*hydrology indicators,* e.g., water marks or water-carried debris on trees); in NC, several different types of wetlands are recognized, including tidal marshes, estuarine fringe forests, wet flats, pocosins, freshwater marshes, bottomland hardwood forests, headwater forests, bogs, and seeps.
- **Wildland** - Private, forested parcels ≥50 acres and owned by one landowner and adjacent to existing protected lands or containing known NHEO. Parcels occurring within a SNHA are included regardless of acreage.

Appendix B - GIS Data Sets

This appendix lists the spatial data sets (GIS, or Geographic Information System data) and their sources used in the Franklin to Fontana Local Watershed Planning project. during the development of the Phase III Project Atlas.

Feature	Data Set	Source
Hydrography	2007 LIDAR	NCDENR Stream Mapping Program
Roads	NC Primary and Secondary Roads for Swain and Macon Counties Roads	NCDOT
Protected Lands	Nantahala National Forest	NCGIA (BasinPro 3.1)
Protected Lands	Needmore Tract	NCGIA (BasinPro 3.1)
Protected Lands	LTLT Protected Lands	LTLT
Wetlands	National Wetlands Inventory	US FWS, via NCDENR
Municipal Boundaries	Municipal Boundaries	NCCGIA (BasinPro 3.1)
Significant Natural Heritage Areas	Significant Natural Heritage Areas	Ed Schwartzman, NCNHP, 2010 (obtained via A. Leslie, NCEEP)
Natural Heritage Element Occurrences	Natural Heritage Element Occurrences	Ed Schwartzman, NCNHP, 2010 (obtained via A. Leslie, NCEEP)
County Boundaries	County Boundaries	NCCGIA (BasinPro 3.1)
Land Cover	Land Cover	NCCGIA, selected features adjusted by Equinox (Phase II)
Parcel Data	Parcel Data Macon Counties	Macon County, August 2010 (obtained via Macon County GIS Mapping website, www.maconnc.org)
Corrected LIDAR Streams within the Planning Area	Corrected Streams	Equinox (Phase I)
Riparian Zone Width and Condition	Stream Buffer Classification	Equinox (Phase I)
Project Area Boundary	Project Area Boundary	Equinox (Phase I)
Subwatershed Boundary	Subwatershed Boundary	Equinox (Phase I)
Catchment Boundaries (Franklin only)	Catchment Boundaries	Equinox (Phase II)
2006 Color Aerial Photography	2006 Color Aerial Photography	Swain and Macon Counties
Soils	Macon County Soils	NRCS
Channel Modification	Stream Impacts	Equinox (Phase II)
Stream Bank Erosion	Stream Impacts	Equinox (Phase II)
Livestock Stream Access	Impact Polygons	Equinox (Phase II)
Pasture Condition	Impact Polygons	Equinox (Phase II)
Phase I Restoration Reaches	Phase I Restoration Reaches	Equinox (Phase I Atlas)
Phase I Preservation Reaches	Phase I Preservation Reaches	Equinox (Phase I Atlas)

See following page for table notes.

Table Notes:

LIDAR = Light Detection and Ranging
NCDENR = NC Department of Environment and Natural Resources
NCDOT = NC Department of Transportation
NCCGIA = NC Center for Geographic Information and Analysis
NCNHP = NC Natural Heritage Program
NRCS = Natural Resources Conservation Service
LTLT=Land Trust for the Little Tennessee
BasinPro 3.1 is a set of custom data layers and ArcView tools developed by NCCGIA for the NC Clean Water Management Trust Fund.
US FWS = US Fish and Wildlife Service
Equinox = data set created by Equinox Environmental Consultation and Design, Inc.
NCEEP = NC Ecosystem Enhancement Program
Phase I = see Equinox 2009a
Phase I Project Atlas = see Equinox 2009b
Phase II = see Equinox 2010a

References Cited

Equinox. 2009a. Franklin to Fontana Local Watershed Plan. Preliminary Findings and Recommendations Report. Report Developed for the NC Ecosystem Enhancement Program. January, 2009.

Equinox. 2009b. Phase I Preliminary Project Atlas. Report Developed for the NC Ecosystem Enhancement Program. January, 2009.

Equinox 2010. Franklin to Fontana Local Watershed Plan. Phase II Watershed Assessment Report. Report Developed for the NC Ecosystem Enhancement Program. June, 2010.