Local Watershed Plan for the Yadkin River Basin: Upper Uwharrie River Watershed

Preliminary Findings and Recommendations Report

North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program

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August 2005

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1 Background

The North Carolina Division of Environment and Natural Resources Ecosystem Enhancement Program (EEP) contracted with Buck Engineering to perform a technical assessment of three 14-digit hydrologic units (HUs) in the Yadkin River Basin. Work is being performed in the HUs 03040103050020 (Little Uwharrie River), 03040103050010 (Upper Uwharrie River), and 03040103050040 (Caraway Creek), described here within as the Upper Uwharrie River watershed. This project is part of EEP's Local Watershed Planning (LWP) initiative, a systematic effort to address watershed functional issues in selected high-priority HUs across the state. This report presents a preliminary watershed characterization for the study area and is accompanied by a GIS-based data compendium on CD, which was used to produce many of the statistics for the study (populations, drainage network statistics, land use by area, etc).

The Upper Uwharrie River watershed includes portions of the cities of Archdale, High Point, Thomasville, and Trinity. Cities in the vicinity of the project area include Asheboro and Randleman. The project includes the northern portion of the Uwharrie Mountains, an ancient mountain chain that has been eroded to form rolling hills with isolated peaks greater than 1,000 feet above sea level. The project watersheds are parallel drainages to the lower Uwharrie River and are located within portions of Randolph, Davidson, and Guilford Counties (Figure 1.1). The study area covers 134.5 square miles, 80 percent of which is in Randolph County (108.1 square miles) and just 0.3 percent within Guilford County (0.4 square miles). Table 1.1 shows the land area within each of the three HUs.

Table 1.1 Major Drainage Regions of Upper Uwharrie River Watershed

Drainage Region	HU Code	Land Area (mi^2)
Little Uwharrie River	03040103050020	43.4
Upper Uwharrie River	03040103050010	41.2
Caraway Creek	03040103050040	49.9

Two of the HUs in the Upper Uwharrie River watershed drain into Lake Reese. The backwaters of Lake Reese extend to the confluence of the Little Uwharrie and Uwharrie Rivers. This man-made lake serves as a water supply reservoir for the City of Asheboro. The lake is also an important recreational area for residents of Randolph County, offering camping and fishing opportunities. Caraway Creek drains into the Uwharrie River downstream of the water supply intake.

No waterbody within the Upper Uwharrie River watershed area was listed on North Carolina's draft 2004 Clean Water Act Section 303(d) list of impaired waters. However, the Uwharrie River, from below Reese Lake to Betty McGees Creek, is listed for low dissolved oxygen levels. This segment begins above the confluence of the Uwharrie River with Caraway Creek, which is south of the study area. Thus, the project reaches may contribute to this impairment. However, it is unknown at this time if the streams in the study area are significant contributors to this problem.

N

High Point

Archdale

Thomasville

Trinity

HU 03040103050010

HU 03040103050020

HU 03040103050040

Little Uwharrie River

Brier Creek

Uwharrie River

Caraway Creek

Little Caraway Creek

Flat Swamp Creek

Little River

85B

85

62

109

311

64

47

49

LEGEND

- Upper Uwharrie Watershed
- Streams
- Unnamed Tributaries
- Counties
- Uwharrie National Forest
- Municipal Boundaries

Ecosystem Enhancement Program

Local Watershed Plan for the Yadkin River Basin: Upper Uwharrie River Watershed

Yadkin River Basin

Upper Uwharrie River Watershed

Randolph, Davidson, & Guilford Counties, NC

Figure 1.1: Project Location Map
Upper Uwharrie River Watershed

0 0.5 1 2 3 Miles

Even though there are no 303(d)-listed reaches in the study area, some streams are potentially degraded and/or threatened by development and existing uses, including urban land, agriculture, and silviculture. This project will further investigate the presence of degraded or threatened streams.

North Carolina Division of Water Quality (NCDWQ) designations for High Quality Waters or Outstanding Resource Waters are not present in the project area. The Little Uwharrie River and Uwharrie River are designated as water supply watersheds (WS-III) by NCDWQ. This is a supplemental classification designed to further protect drinking water by requiring new development density regulations and additional water quality standards.

This report presents a summary of existing watershed and land use information collected within the study area. Tasks performed include the following:

- Collection and review of existing planning information
- Collection and review of existing GIS data (Appendix A)
- Identification of critical missing GIS data (Appendix A)
- Collection and review of existing monitoring data (Appendix B)
- Presentation of summary general statistics and subwatershed conditions (Appendix C)
- Initial visual assessment (Appendix D)
- Identification of potential types of restoration projects (Appendix E)
- Development of a plan of further study based on the general condition of the watershed.

The characterization presented in this memorandum will be supplemented with additional materials collected in future phases of the local watershed plan, such as field data or modeling results. Together this information will allow the EEP to draw conclusions about the streams, riparian buffers and wetlands within the Upper Uwharrie River watershed.

The final products of this Local Watershed Planning (LWP) effort -- once additional phases of work are completed -- will include: a detailed assessment of hydrologic and ecologic watershed functions; determination of major sources of water quality impairment and aquatic habitat degradation; and the identification and prioritization of mitigation project sites and watershed management strategies to address functional deficits.

2 General Watershed Characteristics

Buck Engineering scientists conducted windshield surveys throughout the Upper Uwharrie River watershed. During these preliminary reviews, our team collected qualitative information on riparian buffer widths, channel characteristics, stream types, bank stability, land use, and invasive species. This information was used to develop subwatershed delineations (see Section 9), and assist in the evaluation of potential preservation and restoration opportunities. While the initial evaluation was not intended to provide a complete picture of the study area, general observations are included below. More detailed information about the visual assessment sites is included in Chapter 2.

2.1 Little Uwharrie River

Buck Engineering evaluated 18 sites in the Little Uwharrie River watershed. Streams in the area tended to have minimal buffer widths (four of the sites had no buffers, and those for three other sites were less than ten feet on at least one bank). Land use was mainly residential or agricultural (cropland, pastures, and fields), with some forested areas. Despite the lack of significant buffers, the channels and banks of most of the streams appeared to be relatively stable. At some of the sites, this was attributed to the fact that the stream had a bedrock bed.

2.2 Uwharrie River

Buck Engineering evaluated 21 sites in the Uwharrie River watershed. Even though the field evaluation avoided heavily developed areas, streams in this watershed showed signs of disturbance. As this watershed includes areas of High Point, Archdale, and Trinity, that is to be expected. Land use in the evaluated sites included residential areas, active and fallow agricultural sites (hay, cropland, fields and pastures), and some forested areas. Four of the sites were impacted by kudzu. Stream bank stability in nine of the sites was considered to be marginal or suboptimal. Channel erosion or incision was noted in seven of the sites.

2.3 Caraway Creek

Buck Engineering evaluated 18 sites in the Caraway Creek watershed. There were a wide variety of site conditions observed. Some of the sites were relatively undisturbed. Four of the sites were not impacted by invasive species. Land use was primarily forested or agricultural (hay or cropland), with a few residential areas. The sites that showed the greatest disturbance were associated with croplands and pastures. Buffer widths ranged from zero to over 300 feet, but were generally greater than in other areas. Channel and bank conditions also varied, but were generally less impacted than other parts of the study area. At the bottom end of the watershed where streambeds generally run at a lower slope excess sediment was not observed in the stream channels. The water was often turbid, clouded with very fine suspended sediments, but the lower stream reaches clearly had capacity to transport sediments supplied from headwater areas. Given the heavy sediment load observed in some upland areas, it is clear that the lower portion of the watershed is relying on its broad and active floodplain for sediment deposition and storage in a stable and natural manner.

2.4 Watershed Impervious Area

Impervious cover in the study area ranges from less than 1% in rural areas to more than 10% near the cities of High Point, Trinity, and Archdale. The Little Uwharrie River watershed is predominantly rural, comprised of farms and forested lands with little to no impervious cover (generally less than 2%). However, a small portion of the watershed just south of I-85 contains residential development and impervious cover exceeds 5%. The Uwharrie River watershed contains the greatest amount of impervious area in the study area due to the urban centers within its limits. The upper portion of the watershed contains both urban and suburban land uses, with impervious cover ranging from 4% to 11%. The lower portion of the watershed is predominantly rural, with impervious cover 2% or less. The Caraway Creek watershed contains the least amount of impervious area in the study area. The majority of land use is rural and impervious cover is 1% or less. However, the northernmost portion of the watershed includes part of the City of Archdale, and impervious cover in that area is greater than 5%. More detailed information on impervious area is included in the subwatershed summaries in Appendix C.

2.5 Channel Condition

Channel conditions throughout the watershed are dependent on a variety of factors, including site-specific conditions such as degree of channel modification and buffer condition. However, some general conditions can be discussed. Riparian buffer condition is an important factor in determining channel condition and lateral stability; where mature riparian buffers have been removed, channel conditions have typically deteriorated. In addition, a surprisingly large number of headwater sites have been adversely affected by poor culvert design and/or installation. In many places, culverts have been installed too high relative to the natural streambed. The results have been backwater conditions with associated excessive sediment deposition upstream of the road crossing. Below such culverts, excessive scour pools and stream incision also damage channel condition. Proper placement of culverts is a key to stable stream channels in small streams throughout the study area.

The larger channels all face challenges that are the result of past channelization. Mature stream buffers are generally sufficient to maintain stream stability even in streams that have been straightened in the past. Toward the bottom of the larger drainages, where streambed slopes are generally flatter, many streams have good access to their floodplains and vegetation is relatively robust as a result. Preservation of existing buffers on these larger streams is important to the stability of these stream channels.

2.6 Riparian Buffer Condition

Riparian buffer condition varied throughout the study area, with some urban and agricultural lands lacking buffer entirely. In other locations, buffers were narrow or sparsely vegetated. However, intact lengths of buffer exist in all three of the study watersheds. The quality of riparian buffers is dependent on site-specific land use decisions and is therefore difficult to predict.

In the absence of a study area-wide field assessment of riparian buffers, a GIS analysis was performed. Land use (USGS, 2004) within 100 feet of streams was assessed as an indicator of riparian buffer intactness. In the Little Uwharrie River watershed, 75% of the 100-foot buffer contained forested land or wetlands. In the Uwharrie River watershed, 79% of the 100-foot buffer contained forested land or wetlands. In the Caraway Creek watershed, 81% of the 100-foot buffer contained forested land or wetlands. It is important to note that the presence of a riparian buffer does not ensure it is effective at sustaining habitat, water quality, and hydrology functions. Factors such as channelization and vegetation type (e.g., high percentage of exotic species, lack of canopy complexity, young stand age) can reduce the effectiveness of a riparian buffer and are not indicated in the GIS analysis.

3 Physical Watershed Characteristics

3.1 Climate

The climate in the Upper Uwharrie River watershed is typical for the Piedmont of North Carolina. The average 24-hour temperature is approximately 59 degrees Fahrenheit, with an average maximum temperature of about 70 degrees Fahrenheit. The watershed averages about 45 inches of rain per year (WorldClimate.com, 2005).

3.2 Terrestrial Habitat Issues

The following is a qualitative discussion of terrestrial habitat, based on observations throughout the study area. In future studies, a GIS patch analysis of remote sensing data could be done to quantitatively assess habitat fragmentation.

For the most part, the study area has good, intact terrestrial habitat. Fragmentation is present in the northern sections near Trinity and Archdale, which is a result of urban expansion. Much of this area is no longer viable as wildlife terrestrial habitat. However, the size of the fragmented area is relatively small and the majority of the study area (middle and southern sections) has terrestrial habitat that is worth preserving.

The riparian buffers in the watershed are variable, though many have widths of 100 feet or more. In terms of wildlife habitat, however, wide buffers do not necessarily equate to optimal buffers. Buffers along streams that are not incised (i.e., are frequently wet and have good flooding processes) provide habitat diversity by hosting species that are suited for wetter sites. Buffers along incised streams are not as wet as they should be and thus offer less habitat diversity. In general, lower portions of Caraway Creek are not incised and have excellent riparian habitat. In contrast, lower portions of Uwharrie River and Little Uwharrie River are incised and do not provide good riparian habitat. Thus, the focus on Caraway Creek should be preservation, while restoration is more appropriate for the Uwharrie and Little Uwharrie Rivers.

Large-scale agriculture in the study area is mostly located on the ridges. In general, this is good for wildlife migration and habitat as there is much more abundant upland area and they are likely to be able to find suitable passageways and sites. There are occasional hobby farms (i.e., large gardens) on the floodplains. This might be a problem if it were more widespread.

3.3 Topography

Topography in the Upper Uwharrie River watershed is gently rolling to hilly. The interstream divides are characterized by gently rolling land, while slopes become more broken and steeper near the streams (Randolph County Soil Survey, 2002). Elevation data for the Upper Uwharrie River watershed is shown in Figure 3.1.

Shepard Mountain (1,150 feet above sea level) and Caraway Mountain (1,134 feet above sea level) are the highest elevations in the watershed. Both peaks are located on the boundary of the Caraway Creek watershed, with Shepard Mountain west of Little Caraway Creek and Caraway Mountain east of Caraway Creek. The lowest point in the

study area is found at the mouth of Caraway Creek as it enters the Uwharrie River (384 feet above sea level).

In general, slopes along the Little Uwharrie River and Uwharrie River HUs are smaller, gradually falling from north to south. Caraway Creek has greater relief, which may explain why this watershed is less developed than other HUs in the study area.

3.4 Geology

The Upper Uwharrie River watershed lies in the central Piedmont ecoregion. The Piedmont is considered to be a transitional area between the Appalachian Mountains to the northwest and the Coastal Plain to the southeast. The Piedmont is a patchwork mix of Precambrian and Paleozoic metamorphic and igneous rocks with moderately dissected plains and some hills. The soils tend to be more clay-rich than those of the Coastal Plain.

Bedrock in the study area is predominantly associated with the Carolina Slate Belt, a suite of predominantly metamorphic igneous and metamorphic rocks. These rocks were deeply buried and altered by heat and pressure over time, before being brought to the surface by erosion. The rocks of the Carolina Slate Belt were originally deposited along a series of volcanic islands about 650 to 550 million years ago. A description of the formations associated with the Upper Uwharrie River watershed is presented in Table 3.1. A geologic map of the study area geology is shown in Figure 3.2. Both are adapted from North Carolina Geological Survey (USGS) data.

Table 3.1 Geology Descriptions for the Study Watersheds

Abbr.	Name	Description
PzZg	Metamorphosed Gabbro and Diorite	Paleozoic mafic igneous rock altered by intense heat and pressure caused by deep burial. Bedrock is foliated to massive.
CZg	Metamorphosed Granitic Rock	Precambrian felsic igneous rock altered by intense heat and pressure caused by deep burial.
CZmd	Metamudstone and Meta-Argillite	Precambrian metamorphosed sedimentary rocks from the Carolina Slate Belt. The Tillery Formation (CZmd1) appears in lower Caraway Creek watershed and the Cid Formation (CZmd2) is located in the lower Brier Creek watershed.
CZmv	Mafic Metavolcanic Rock	Metamorphosed basaltic flows and tuffs, dark green to black; interbedded with felsic and intermediate metavolcanic rock and metamudstone. The Cid Formation (CZmv1), is located southwest of Asheboro.
CZv	Metavolcanic Rock	Precambrian metamorphosed mafic and felsic volcanic rock.
CZph	Phyllite and Schist	Includes phyllonite, sheared fine-grained metasediment, and metavolcanic rock.
CZfv	Felsic Metavolcanic Rock	Precambrian metamorphosed felsic flows and tuffs. The Uwharrie Formation (CZfv1) is located in the Caraway Creek watershed.

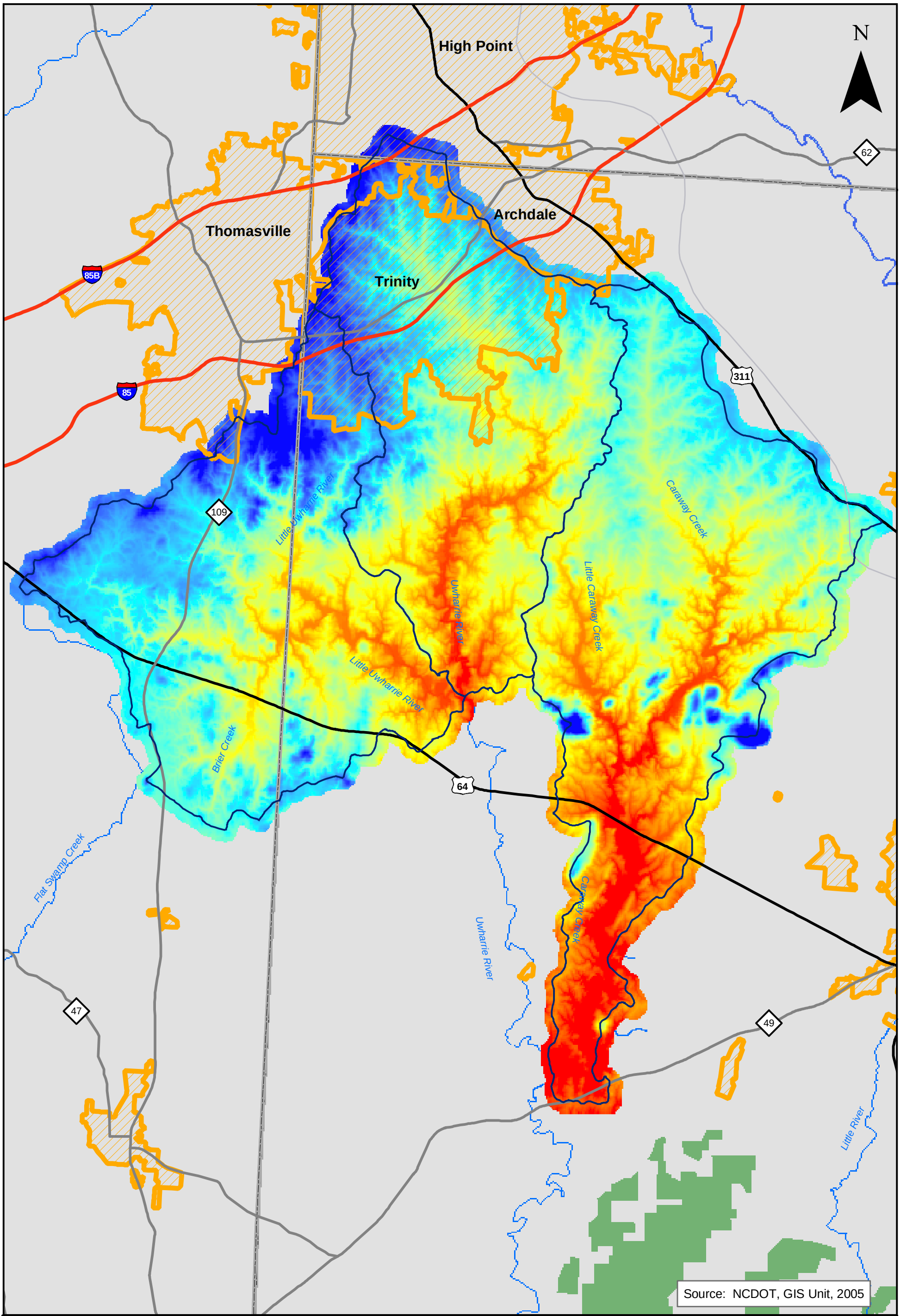
N
High Point
Archdale
Thomasville
Trinity
62
85B
85
311
109
64
47
49
Little Uwharrie River
Uwharrie River
Caraway Creek
Little Caraway Creek
Brier Creek
Flat Swamp Creek
Little River
Source: NCDOT, GIS Unit, 2005
LEGEND
Study Area HUs
Streams
Counties
Municipal Boundaries
Elevation
Value
High : 1154 feet
Mid : 769 feet
Low : 384 feet
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Figure 3.1: Elevation Map
Upper Uwharrie River Watershed
0 0.5 1 2 3 Miles

3.5 Soils

There are 24 soil series within the Upper Uwharrie River watershed; however, the majority of the soils in the study area (94 percent) are represented by eight soil series. The locations of these eight soils series are shown in Figure 3.3. Descriptions and percent of study area composition for each of the eight primary soil series in the study area are presented in Table 3.2.

Table 3.2 Soil Series Descriptions for the Study Area

Series (Percent of study area)*	**Description**
Badin-Tarrus (35 percent)	This series consists of moderately deep, well drained, moderately permeable soils that formed in material weathered from fine grained rock, such as argillite or slate of the Carolina Slate Belt. These soils are on upland ridges and side slopes. The texture is channery (more than 15 percent thin, flat rock fragments of sandstone, shale, slate, limestone, or schist) silt loam. Slopes range from 2 to 30 percent.
Enon-Wynott-Wilkes (27 percent)	This series consists of very deep, well drained, slowly permeable soils that formed in material weathered from mafic or intermediate crystalline rocks. The texture grades from fine sandy loam to gravelly loam to very stony loam. They are located on upland ridges and side slopes. Slopes range from 2 to 25 percent.
Mecklenburg (13 percent)	The Mecklenburg series consists of very deep, well drained, slowly permeable soils that formed from intermediate and mafic crystalline rocks. The texture is loam or clay loam. This series is located on upland ridges and side slopes. Slope ranges from 2 to 15 percent.
Georgeville (11 percent)	The Georgeville series consists of very deep, well drained, moderately permeable soils that formed in material weathered from fine grained rocks, such as argillate or slate of the Carolina Slate Belt. The texture is silt loam. This series is also located on upland ridges and side slopes. Slopes range from 2 to 15 percent.
Goldston (3 percent)	This series consists of shallow, well drained to excessively drained, moderately to rapidly permeable soils that formed from material weathered from fine grained rocks, such as argillite or slate of the Carolina Slate Belt. The texture is very channery silt loam. They are located on narrow ridges and side slopes, with slopes ranging from 4 to 45 percent.
Riverview (2 percent)	This series consists of very deep, moderately drained, moderately permeable soils that formed from recent alluvium. The texture is sandy loam with added clay to depth. The soils are located on floodplains, with slopes of 0 to 2 percent.
Helena (2 percent)	This series consists of very deep, moderately well drained, slowly permeable soils that formed from weathered felsic metamorphic or igneous rocks. The texture is sandy loam. The soils are located on uplands and broad ridges with slopes of 2 to 10 percent.
Chewacla (1 percent)	The Chewacla series consists of very deep, somewhat poorly drained, moderately permeable soils that formed in recent alluvium. The texture is loam. The soils are located on floodplains, with slopes of 0 to 2 percent.

Source: US Department of Agriculture, 1994 and 1995

*-Other soil series comprise 6 percent of the study area

3.6 National Wetlands Inventory

The US Fish and Wildlife Service mapped wetland units in the project watersheds as part of the National Wetlands Inventory (NWI) (Figure 3.4). Table 3.3 provides descriptions and acreages of the mapping units that appear in the study area. For the purpose of simplification, wetlands are described only by the four initial alphanumeric descriptors.

The majority of NWI wetlands in the study area are Palustrine. The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, emergents, mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 parts per thousand (ppt). Wetlands lacking such vegetation are also included if they exhibit all of the following characteristics: are less than 20 acres; do not have an active wave-formed or bedrock shoreline feature; have, at low water, a depth less than 6.6 feet in the deepest part of the basin; have salinity due to ocean-derived salts of less than 0.5 ppt.

One wetland type in the study area is mapped as Lacustrine. The Lacustrine System includes wetlands and deepwater habitats with all of the following characteristics: situated in a topographic depression or a dammed river channel; lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30 percent areal coverage; total area exceeds 20 acres.

There are 865 acres of NWI-mapped wetlands in the study watersheds, which represents about one percent of the Upper Uwharrie River watershed. The wetlands are fairly evenly distributed across the study area. However, a higher concentration of Palustrine NWI wetlands exists on the floodplains of Caraway Creek and Little Caraway Creek.

N

High Point

Thomasville

Archdale

Trinity

PzZg

CZv

CZg

CZmd

CZmv

CZfv1

CZmd2

CZmv1

CZfv

CZmd1

CZph

Caraway Creek

Brier Creek

Little Uwharrie River

Uwharrie River

Little River

85B

85

62

109

64

311

47

49

Source: North Carolina Geological Survey

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LEGEND

Study Area HUs

Counties

Municipal Boundaries

Geology

CZfv, CZfv1, CZg, CZmd, CZmd1, CZmd2, CZmv, CZmv1, CZph, CZv, PzZg

Figure 3.2: Geology Map
Upper Uwharrie River Watershed

0 0.5 1 2 3 Miles

N

High Point

Archdale

Thomasville

Trinity

62

85B

85

311

109

64

49

47

Flat Swamp Creek

Bells Creek

Little Uwharrie River

Uwharrie River

Deep Creek

Little River

Source: USDA, 1994, 1995

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LEGEND

- Study Area HUs
- Counties
- Municipal Boundaries

Major Soil Series

- Badin-Tarrus
- Chewacla
- Enon-Wynott-Wilkes
- Georgeville
- Goldston
- Helena
- Mecklenburg
- Riverview
- Other Soils

Figure 3.3: Soils Map
Upper Uwharrie River Watershed

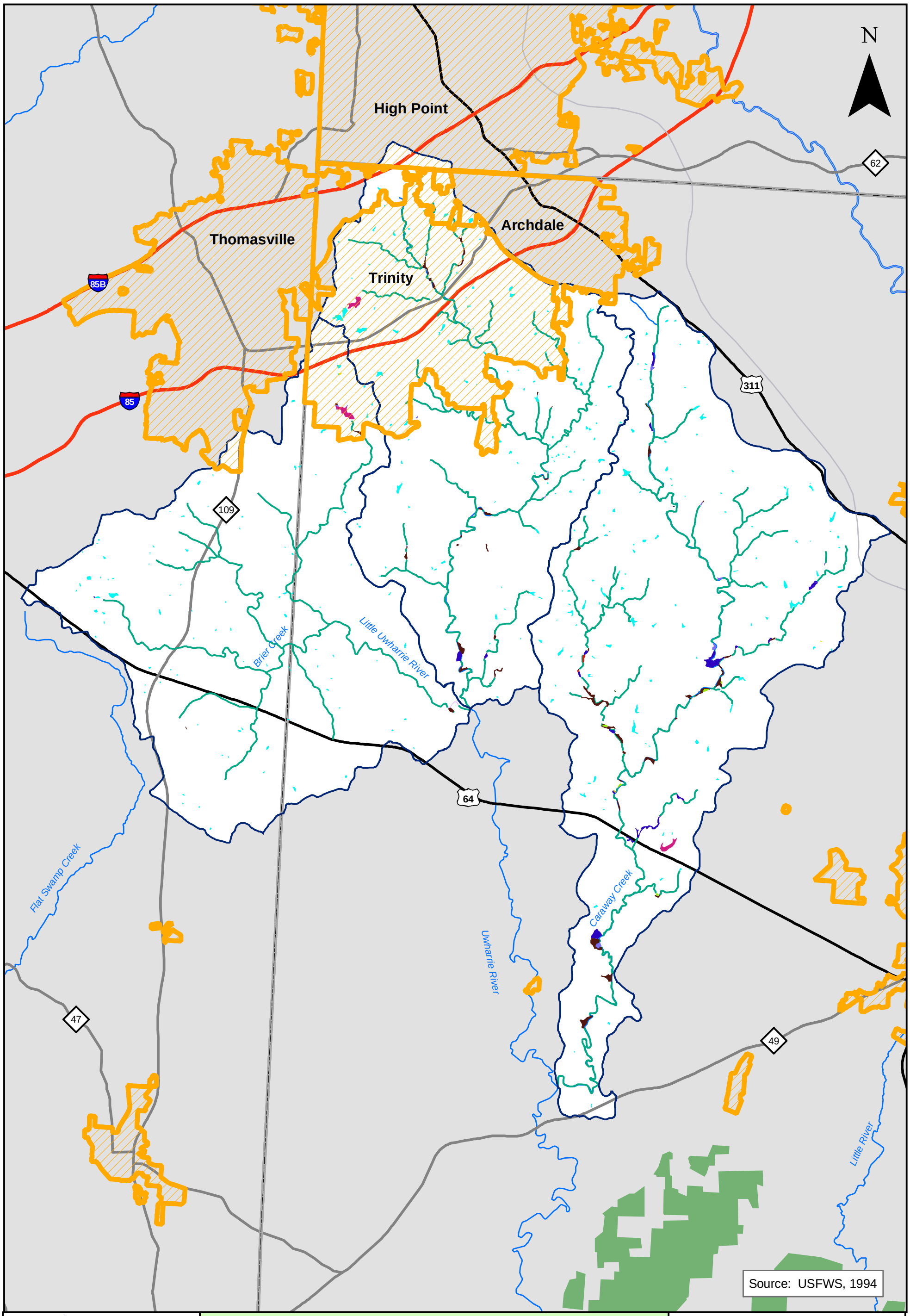
0 0.5 1 2 3 Miles

Table 3.3 National Wetlands Inventory Mapping Codes

Mapping Unit	Name	Description
L1UB (63 acres)	Lacustrine Unconsolidated Bottom	Unconsolidated bottom includes all wetlands and deepwater habitats with at least 25 percent cover of particles smaller than stones (less than 2.6 inches), and a vegetative cover of less than 30 percent.
PABH (0.5 acres)	Palustrine Aquatic Bed Permanently Flooded	Aquatic Bed includes wetlands and deepwater habitats dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Aquatic beds generally occur in water less than 6.6 feet deep. Permanently Flooded signifies that water covers the land surface throughout the year in all years.
PEM1 (22 acres)	Palustrine Emergent Persistent	Emergent is characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants. Persistent is dominated by species that normally remain standing at least until the beginning of the next growing season. This subclass is found only in the Estuarine and Palustrine systems.
PFO1 (220 acres)	Palustrine Forested Broad-Leaved Deciduous	Forested is characterized by woody vegetation that is 20 feet tall or higher. Broad-leaved Deciduous is woody angiosperms (trees or shrubs) with relatively wide, flat leaves that are shed during the cold or dry season; e.g., black ash (Fraxinus nigra).
PFO4 (10 acres)	Palustrine Forested Needle-Leaved Evergreen	Forested is characterized by woody vegetation that is 20 feet tall or higher. Needle-leaved Evergreen is woody gymnosperms with green, needle-shaped, or scale-like leaves that are retained by plants throughout the year; e.g. black spruce (Picea mariana).
PSS1 (125 acres)	Palustrine Scrub-Shrub Broad-Leaved Deciduous	Scrub-Shrub includes areas dominated by woody vegetation less than 20 feet tall. The species include true shrubs, young trees (saplings), and trees or shrubs that are small or stunted because of environmental conditions. Broad-leaved Deciduous is woody angiosperms (trees or shrubs) with relatively wide, flat leaves that are shed during the cold or dry season; e.g., black ash (Fraxinus nigra).
PSS3 (5 acres)	Palustrine Scrub-Shrub Broad-Leaved Evergreen	Scrub-Shrub includes areas dominated by woody vegetation less than 20 feet tall. The species include true shrubs, young trees (saplings), and trees or shrubs that are small or stunted because of environmental conditions. Broad-leaved Evergreen is dominated by herbaceous vegetation such as various native perennials and grasses.
PSS4 (1 acre)	Palustrine Scrub-Shrub Needle-Leaved Evergreen	Scrub-Shrub includes areas dominated by woody vegetation less than 20 feet tall. The species include true shrubs, young trees (saplings), and trees or shrubs that are small or stunted because of environmental conditions. Needle-leaved Evergreen is dominated by young or stunted trees such as black spruce or pond pine.
PUBH (414 acres)	Palustrine Unconsolidated Bottom Permanently Flooded	Unconsolidated Bottom includes all wetlands and deepwater habitats with at least 25 percent cover of particles smaller than stones (less than 2.6 inches), and a vegetative cover less than 30 percent. Permanently Flooded means that water covers the land surface throughout the year in all years.

Mapping Unit	Name	Description
PUSA (2 acres)	Palustrine Unconsolidated Shore Temporarily Flooded	Unconsolidated Shore includes unconsolidated substrates with less than 75 percent areal cover of stones, boulders, or bedrock; less than 30 percent areal cover of vegetation other than pioneering plants; and any of the following water regimes: irregularly exposed, regularly flooded; irregularly flooded, seasonally flooded; temporarily flooded, intermittently flooded; or artificially flooded. Landforms such as beaches, bars, and flats are included in the Unconsolidated Shore class. Temporarily Flooded surface water is present for brief periods during growing season, but the water table usually lies well below the soil surface. Plants that grow both in uplands and wetlands may be characteristic of this water regime.
PUSC (0.3 acres)	Palustrine Unconsolidated Shore Seasonally Flooded	Seasonally Flooded surface water is present for extended periods especially early in the growing season, but is absent by the end of the growing season in most years. The water table after flooding ceases is variable, extending from saturated to the surface to a water table well below the ground surface.
R2UB (3 acres)	Riverine Lower Perennial Unconsolidated Bottom	Lower Perennial is characterized by a low gradient and slow water velocity. There is no tidal influence, and some water flows throughout the year. The substrate consists mainly of sand and mud. The floodplain is well developed. Oxygen deficits may sometimes occur. Unconsolidated Bottom includes all wetlands and deepwater habitats with at least 25 percent cover of particles smaller than stones (less than 2.6 inches), and a vegetative cover less than 30 percent.

Source: US Fish and Wildlife Service, 1994



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LEGEND

NWI Polygons

L1UB	PFO4	PUBH	Streams
PABH	PSS1	PUSA	
PEM1	PSS3	PUSC	
PFO1	PSS4	R2UB	

Figure 3.4: National Wetlands Inventory
Upper Uwharrie River Watershed

0 0.5 1 2 3 Miles

4 Terrestrial Habitat and Species of Concern

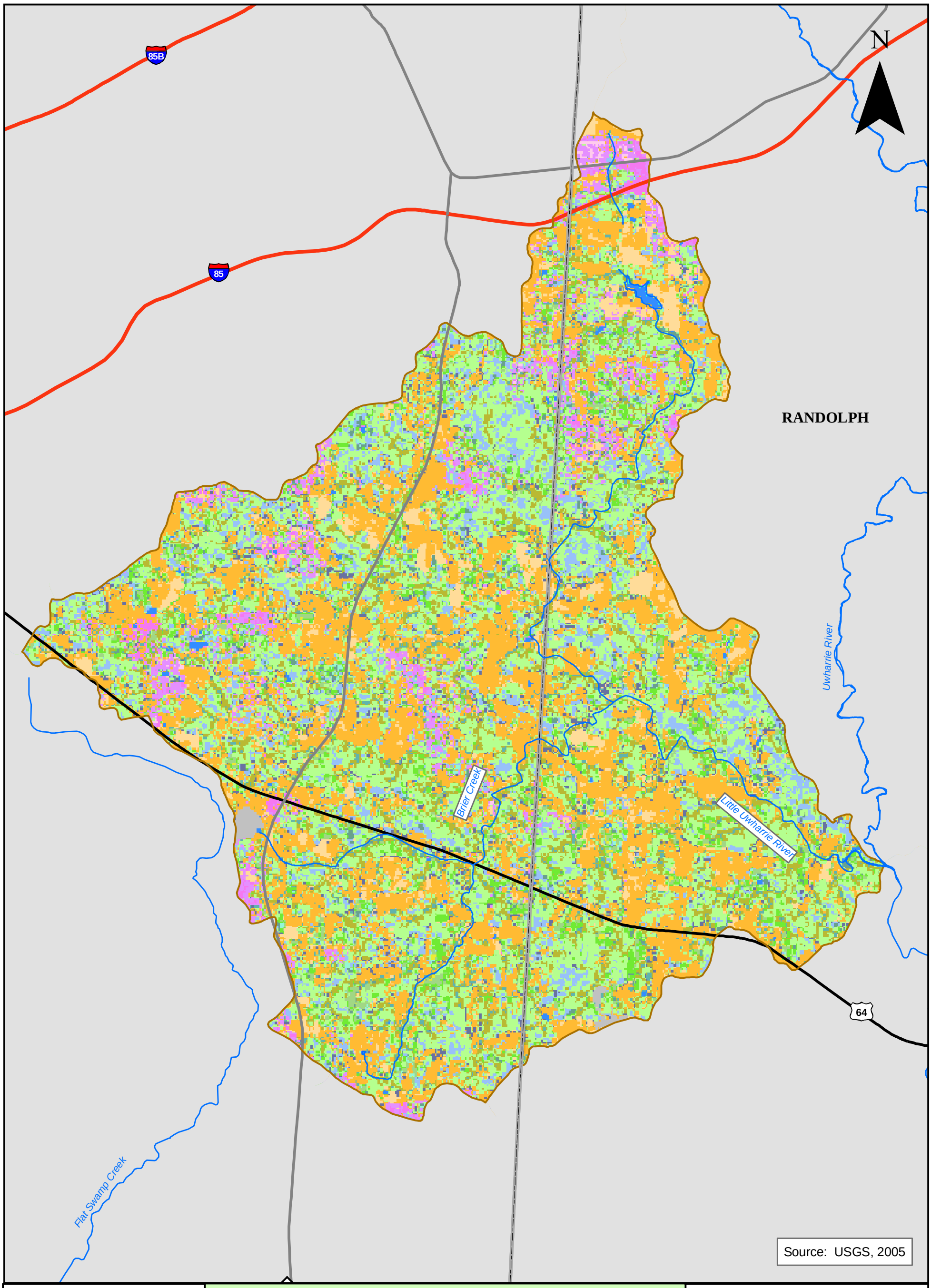
4.1 GAP Analysis Habitat

The project watersheds include unique habitat areas, as well as threatened and endangered species. Data on these resources are important in the watershed planning process as a means of assessing habitat functions. Habitat and species occurrence data address issues of habitat loss and fragmentation. Smaller and more isolated habitats limit species survival, resulting in population isolation and the loss of genetic diversity. Efforts should be made to locate appropriate watershed restoration and protection projects in areas of unique and important habitat. Vegetative habitat data for the Little Uwharrie River, Uwharrie River, and Caraway Creek from the NC GAP Analysis Project (NC GAP) are shown in figures 4.1, 4.2, and 4.3, respectively.

NC GAP is sponsored by the Biological Resources Division of the USGS and North Carolina State University (for more information, see http://www.basic.ncsu.edu/ncgap/). GAP analysis is a scientific means for assessing the extent to which native animal and plant species are being protected. The goal of GAP analysis is to assist conservation efforts by identifying those species and plant communities that are not adequately represented in existing conservation lands (US Geological Survey, 2005). Resources used in the development of GAP data for North Carolina include state-level land use, national land cover, National Wetland Inventory, National Elevation Data Set, and detailed soils information. Limited ground truthing of data was performed during the initial field surveys. NC GAP GIS data will assist in the identification of restoration and preservation opportunities within the study watershed.

4.2 Terrestrial Communities

The Upper Uwharrie River watershed is home to a wide range of habitat types. Before European settlement, the region was covered by oak-hickory-pine forest, with the primary species consisting of white oak (*Quercus alba*), southern red oak (*Quercus falcata*), post oak (*Quercus stellata*), and hickory (*Carya* spp.), as well as shortleaf pine (*Pinus echinata*) and loblolly pine (*Pinus taeda*) (Griffith et al., 2002). The following discussion summarizes the terrestrial communities within the study area. Descriptions of the terrestrial systems are presented in the context of plant community classifications. These classifications follow Schafale and Weakley (1990) and are consistent with North Carolina Natural Heritage Program (NCNHP) designations.



Ecosystem Enhancement Program

Local Watershed Plan
for the Yadkin River Basin:
Upper Uwharrie River Watershed

GAP Habitat Categories

- Open water
- Agricultural Crop Fields
- Agricultural Pasture/Hay and Natural Herbaceous
- Barren; bare rock and sand
- Barren; quarries, strip mines, and gravel pits
- Coniferous Cultivated Plantation (natural / planted)
- Dry Mesic Oak Pine Forests
- Floodplain Wet Shrublands
- Piedmont Dry-Mesic Pine Forests
- Piedmont Mesic Forest
- Piedmont Oak Bottomland Forest and Swamp Forest
- Piedmont Xeric Pine Forests
- Piedmont Xeric Woodlands
- Piedmont/ Mountains Dry-Mesic Oak and Hardwood Forests
- Piedmont/Mountain Emergent Vegetation
- Piedmont/Mountain Mixed Bottomland Hardwood Forests
- Piedmont/Mountain Submerged Aquatic Vegetation
- Riverbank Shrublands
- Successional Deciduous Forests
- Xeric Pine-Hardwood Woodlands and Forests
- Residential Urban
- Urban High-Intensity Developed and Transportation
- Urban Low-Intensity Developed

Figure 4.1: GAP Habitat Data
Little Uwharrie River HU
Upper Uwharrie River Watershed

0 0.25 0.5 1 1.5 Miles

N

610

62

85

85

Uwharrie River

Little Uwharrie River

Little Caraway Creek

Creek

Source: USGS, 2005

Ecosystem Enhancement Program

Local Watershed Plan for the Yadkin River Basin: Upper Uwharrie River Watershed

GAP Habitat Categories

- Open water
- Agricultural Crop Fields
- Agricultural Pasture/Hay and Natural Herbaceous
- Barren; bare rock and sand
- Barren; quarries, strip mines, and gravel pits
- Coniferous Cultivated Plantation (natural / planted)
- Dry Mesic Oak Pine Forests
- Floodplain Wet Shrublands
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- Piedmont Mesic Forest
- Piedmont Oak Bottomland Forest and Swamp Forest
- Piedmont Xeric Pine Forests
- Piedmont Xeric Woodlands
- Piedmont/ Mountains Dry-Mesic Oak and Hardwood Forests
- Piedmont/Mountain Emergent Vegetation
- Piedmont/Mountain Mixed Bottomland Hardwood Forests
- Piedmont/Mountain Submerged Aquatic Vegetation
- Riverbank Shrublands
- Successional Deciduous Forests
- Xeric Pine-Hardwood Woodlands and Forests
- Residential Urban
- Urban High-Intensity Developed and Transportation
- Urban Low-Intensity Developed

Figure 4.2: GAP Habitat Data
Uwharrie River HU
Upper Uwharrie River Watershed

0 0.25 0.5 1 1.5 Miles

N

85

311

220

64

49

Uwharrie River

Little Uwharrie River

Uwharrie River

Little Caraway Creek

Caraway Creek

Caraway Creek

Deep R

Source: USGS, 2005

Ecosystem Enhancement Program

Local Watershed Plan for the Yadkin River Basin: Upper Uwharrie River Watershed

GAP Habitat Categories

- Open water
- Agricultural Crop Fields
- Agricultural Pasture/Hay and Natural Herbaceous
- Barren; bare rock and sand
- Barren; quarries, strip mines, and gravel pits
- Coniferous Cultivated Plantation (natural / planted)
- Dry Mesic Oak Pine Forests
- Floodplain Wet Shrublands
- Piedmont Dry-Mesic Pine Forests
- Piedmont Mesic Forest
- Piedmont Oak Bottomland Forest and Swamp Forest
- Piedmont Xeric Pine Forests
- Piedmont Xeric Woodlands
- Piedmont/ Mountains Dry-Mesic Oak and Hardwood Forests
- Piedmont/Mountain Emergent Vegetation
- Piedmont/Mountain Mixed Bottomland Hardwood Forests
- Piedmont/Mountain Submerged Aquatic Vegetation
- Riverbank Shrublands
- Successional Deciduous Forests
- Xeric Pine-Hardwood Woodlands and Forests
- Residential Urban
- Urban High-Intensity Developed and Transportation
- Urban Low-Intensity Developed

Figure 4.3: GAP Habitat Data
Caraway Creek HU
Upper Uwharrie River Watershed

0 0.250.5 1 1.5 Miles

Basic Mesic Forest (Piedmont Subtype)

This natural community occurs along lower slopes, north-facing slopes, ravines, and occasionally well-drained small stream bottoms, with basic or circumneutral soils. Canopy is dominated by mesophytic trees, primarily tulip poplar (*Liriodendron tulipifera)*, American beech (*Fagus grandifolia*), southern sugar maple (*Acer floridanum*), and red oak (*Quercus rubra*). Other trees, typical of better-drained bottomland sites, such as Shumard oak (*Quercus shumardii*), black walnut (*Juglans nigra*), and sugarberry (*Celtis laevigata*), may be present. Understory and shrub species may include redbud (*Cercis canadensis*), flowering dogwood (*Cornus florida*), hop hornbeam (*Ostrya virginiana*), ironwood (*Carpinus caroliniana*), pawpaw (*Asimina triloba*), slippery elm (*Ulmus rubra*), arrowwoods (*Viburnum* spp.), spicebush (*Lindera benzoin*), bigleaf snowbell (*Styrax grandifolia*), wild hydrangea (*Hydrangea arborescens*), eastern burning bush (*Evonymus atropurpurea*), bladdernut (*Staphylea trifolia*), sweetshrub (*Calycanthus floridus*), and painted buckeye (*Aesculus sylvatica*).

The herb layer in the Basic Mesic Forest community is generally dense and very diverse, with species such as Christmas fern (*Polystichum acrostichoides*), wild ginger (*Asarum canadense*), doll's eyes (*Actaea pachypoda*), moonseed (*Menispermum canadense*), round-lobed hepatica (*Hepatica americana*), bloodroot (*Sanguinaria canadensis*), black cohosh (*Cimicifuga racemosa*), yellow ladyslipper (*Cypripedium pubescens*), ginseng (*Panax quinquefolius*), maidenhair fern (*Adiantum pedatum*), may-apple (*Podophyllum peltatum*), violets (*Viola* spp.), green violet (*Hybanthus concolor*), dutchman's britches (*Dicentra cucullaria*), Atlantic isopyrum (*Enemion biternatum*), little sweet betsy (*Trillium cuneatum*), smooth peavine (*Lathyrus venosus*), and yellow fumewort (*Corydalis flavula*) (Schafale and Weakley, 1990).

Mesic Mixed Hardwood Forest (Piedmont Subtype)

This natural community occupies landscapes similar to those found in the Basic Mesic Forest (Piedmont Subtype) community; however, the underlying soil is acidic. This community is also distinguished from the prior community by its sparser and less diverse herb layer, and the absence of basic-loving plants such as green violet, doll's eyes, dutchman's britches, and little sweet betsy. Additional species, such as pawpaw, spicebush, eastern burning bush, bladdernut, and yellow fumewort, may occur on upland slopes. The canopy and understory layer in the Mesic Mixed Hardwood Forest community is similar to Basic Mesic Forest community, including species such as American beech, red oak, tulip poplar, red maple (*Acer rubrum*), flowering dogwood, hop-hornbeam, and American holly (*Ilex opaca*). Typical shrub species may include deerberry (*Vaccinium stamineum*), downy arrowwood (*Viburnum rafinesquianum*), American strawberry-bush (*Evonymus americana*), and sometimes mountain laurel (*Kalmia latifolia*). Herb species may include Christmas fern, violets, round-lobed hepatica, may-apple, witchgrasses (*Dichanthelium* spp.), licorice bedstraw (*Galium circaezans*), arrowleaf heartleaf (*Hexastylis arifolia*), little heartleaf (*Hexastylis minus*), woodland tick-trefoil (*Desmodium nudiflorum*), southern trout lily (*Erythronium umbilicatum* var. *umbilicatum*), fairywand (*Chamaelirium luteum*), beechdrops (*Epifagus virginiana*), common foamflower (*Tiarella cordifolia* var. *collina*), common alumroot

(*Heuchera americana*), giant starwort (*Stellaria pubera*), rattlesnake fern (*Botrychium virginianum*), and lion's foot (*Prenanthes serpentaria*) (Schafale and Weakley, 1990).

Piedmont/Coastal Plain Acidic Cliff

This natural community occurs on stream bluffs with very steep to vertical slopes that are rocky or dry enough to prevent the formation of a closed tree or shrub community. This community generally occurs on hard rock, but may occur in areas where soils are exposed by erosion. The vegetation in this community is generally heterogeneous within and among sites. Most of the area is bare or moss- and lichen-covered rock. Typical mosses include *Grimmia laevigata*, *Aulocomnium heterostichum,* and *Bartramia pomiformis*. Herbs may include trailing arbutus (*Epigaea repens*), broomsedge (*Andropogon virginicus*), little bluestem (*Schizachrium scoparium*), northern oat grass (*Danthonia spicata*), Canada sanicle (*Sanicula canadensis*), rattlesnake hawkweed (*Hieracium venosum*), summer bluet (*Houstonia purpurea*), greater coreopsis (*Coreopsis major*), hairy lipfern (*Cheilanthes lanosa*), galax (*Galax urceolata*), early saxifrage (*Saxifraga virginiensis*), partridgeberry (*Mitchella repens*), alumroot (*Heucheria* spp.), and rockcap fern (*Polypodium virginianum*). Scattered trees and shrubs may occur in crevices or other areas of deeper soil. These species may include Virginia pine (*Pinus virginiana*), shortleaf pine, red cedar, chestnut oak (*Quercus montana*), scarlet oak (*Quercus coccinea*), southern red oak, red oak, American beech, red maple, flowering dogwood, sourwood (*Oxydendrum arboreum*), mountain laurel, blueberry (*Vaccinium* spp.), and huckleberry (*Gaylussacia* spp.) (Schafale and Weakley, 1990).

Dry Oak-Hickory Forest

This natural community occurs on ridgetops, upper slopes, steep south-facing slopes, and other relatively dry upland areas on acidic soils. This forest is dominated primarily by white oak, southern red oak, or post oak, along with various other oak and hickory species such as chestnut oak, blackjack oak (*Quercus marilandica*), scarlet oak, black oak (*Quercus velutina*), mockernut hickory (*Carya alba*), red hickory (*Carya ovalis*), and pignut hickory (*Carya glabra*). Pines (*Pinus* spp.) are also a major component of the community. Typical understory and shrub species include sourwood, red maple, black gum (*Nyssa sylvatica*), flowering dogwood, and blueberry. Vines and herbs commonly found in this community include muscadine (*Vitis rotundifolia*), poison ivy (*Toxicodendron radicans*), pipsissewa (*Chimaphila maculata*), arrowleaf heartleaf, needlegrass (*Piptochaetium avenaceum*), northern oat grass, goat's rue (*Tephrosia virginiana*), greater coreopsis, and rattlesnake hawkweed (Schafale and Weakley, 1990).

Dry-Mesic Oak-Hickory Forest

This natural community is found downslope of the Dry Oak-Hickory Forest natural community, on low ridges, upland flats, and other dry-mesic upland areas on acidic soils. The Dry-Mesic Oak-Hickory Forest is dominated by oaks and hickories, with white oak being most prevalent, along with red oak, and other oak and hickory species. Pine species, tulip poplar, and sweet gum (*Liquidambar styraciflua*) may be common. Understory and shrub species include those found in the Dry Oak-Hickory Forest community, along with American holly, strawberry bush, and downy arrowwood. Muscadine and poison ivy are often present. Herbs are fairly sparse, with heartleaf

(Hexastylis spp.), downy rattlesnake orchid (*Goodyera pubescens*), pipsissewa, woodland tick-trefoil, and rattlesnake hawkweed being common (Schafale and Weakley, 1990).

Piedmont/Coastal Plain Heath Bluff

This natural community occurs on steep slopes and bluffs, generally north-facing, on acidic substrates in the Piedmont and Coastal Plain. This community generally occurs on hard rock, but may occur in areas of eroded soils. A dense shrub community consisting of mountain laurel, purple laurel (*Rhododendron catawbiense*), and/or great laurel (*Rhododendron maximum*) dominates this community. Other shrubs may include witch-hazel (*Hamamelis virginiana*), horsesugar (*Symplocus tinctoria*), and blueberry. The tree canopy is open to very sparse, with trees such as chestnut oak, Virginia pine, loblolly pine, sourwood, red maple, and downy serviceberry (*Amelanchier arborea*) being characteristic. Herbs are generally sparse under the shrubs, with acidophilus species such as galax, trailing arbutus, wintergreen (*Gaultheria procumbens*), pipisissewa, little heartleaf, and partridgeberry being typical (Schafale and Weakley, 1990).

Low Elevation Seep

This natural community includes seepages and springs occurring at bases of slopes or edges of floodplains. This community is generally small enough to be partially shaded by canopies of trees rooted in adjacent communities. Occasional wetland trees such as red maple and willow oak (*Quercus phellos*) may be rooted in the seep. A variety of wetland herbs occur, including lizard's-tail (*Saururus cernuus*), orange jewelweed (*Impatiens capensis*), cinnamon fern (*Osmunda cinnamomea*), royal fern (*Osmunda regalis*), false nettle (*Boehmeria cylindrica*), green-head coneflower (*Rudbeckia laciniata*), hooked buttercup (*Ranunculus recurvatus*), white turtlehead (*Chelone glabra*), rush (*Juncus* spp.), and branch lettuce (*Saxifraga micranthidifolia*). These communities are important breeding as well as foraging sites for amphibians. They are used by species such as the dwarf salamander (*Eurycea quadridigitata*), red salamander (*Pseudotriton ruber*), mud salamander (*Pseudotriton montanus*), four-toed salamander (*Hemidactylium scutatum*), spring peeper (*Hyla crucifer*), and upland chorus frog (*Pseudacris triseriata*) (Schafale and Weakley, 1990).

Piedmont/Low Mountain Alluvial Forest

This natural community occurs on river and stream floodplains in which separate fluvial landforms and associated vegetation zones are too small to distinguish, in the Piedmont and lower Mountain valleys. This community contains an open to dense understory or shrub layer and dense diverse herb layer. The canopy is a mixture of bottomland and mesophytic trees, including river birch (*Betula nigra*), sycamore (*Platanus occidentalis*), sweet gum, tulip poplar, American elm (*Ulmus americana*), sugarberry, black walnut, green ash (*Fraxinus pennsylvanica*), bitternut hickory (*Carya cordiformes*), shagbark hickory (*Carya ovata*), shingle oak (*Quercus imbricaria*), and red maple. Understory trees and shrubs include boxelder (*Acer negundo*), southern sugar maple, red maple, paw-paw, American holly, ironwood, spicebush, strawberry bush, painted buckeye, mountain doghobble (*Leucothoe recurva*), beaked hazelnut (*Corylus cornuta*), and silky dogwood (*Cornus amomum*). Vines are often prominent, including poison ivy, Virginia creeper (*Parthenocissus quinquefolia*), crossvine (*Bignonia capreolata*), wild grape (*Vitis* spp.), moonseed, and greenbriers (*Smilax* spp.). The herb layer is generally lush and diverse

including species such as southern trout lily, giant starwort, Virginia spring-beauty (*Claytonia virginiana*), bluestem goldenrod (*Solidago caesia*), heartleaf aster (*Aster divaricatus*), broad loose-flower sedge (*Carex laxiflora*), Virginia wild rye (*Elymus virginicus*), common witchgrass (*Dichanthelium dichotomum*), Christmas fern, river oats (*Chasmanthium latifolium*), rattlesnake fern, sessile-leaf bellwort (*Uvularia sessilifolia*), false nettle, bottlebrush grass (*Elymus hystrix*), slender spikegrass (*Chasmanthium laxum*), woodland stonecrop (*Sedum ternatum*), Canada avens (*Geum canadense*), jumpseed (*Polygonum virginianum*), wingstem (*Verbesina alternifolia*), yellow fumewort, orange jewelweed, honewort (*Cryptotaenia canadensis*), violets, jack-in-the-pulpit (*Arisaema triphyllum*), and golden ragwort (*Senecio aureus*). In many areas, this natural community has been heavily invaded by Japanese honeysuckle (*Lonicera japonica*) and Japanese grass (*Microstegium vimineum*) at the expense of native herbs (Schafale and Weakley, 1990).

Piedmont Monadnock Forest

This natural community occurs on monadnocks and high ridges, generally on quartzite, rhyolite, pyrophyllite or other, highly resistant, rocks. Canopy is strongly dominated by chestnut oak. Other canopy trees may include white oak, scarlet oak, post oak, blackjack oak, southern red oak, pignut hickory, mockernut hickory, Virginia pine, and shortleaf pine. The understory is typically strongly dominated by sourwood and red maple, with some flowering dogwood, black gum, and other species. A patchy shrub layer consists primarily of blueberries, black huckleberry (*Gaylussacia baccata*), mountain laurel, and poison ivy. The herb layer is sparse, with pipsissewa, woodland's tick-trefoil, northern oat grass, little bluestem, goat's rue, rattlesnake hawkweed, whorled coreopsis (*Coreopsis verticillata*), and bracken fern (*Pteridium aquilinum*) being characteristic (Schafale and Weakley, 1990).

Basic Oak – Hickory Forest

This natural community is found on slopes, ridges, upland flats, and other dry to dry-mesic sites on basic or circumneutral soils. Its canopy is dominated by oaks and hickories, including white oak, post oak, black oak, chinkapin oak (Quercus *muehlenbergii*), various other oak species, Carolina shagbark hickory (*Carya carolinae-septentrionalis*), pignut hickory, mockernut hickory, and red hickory. Other trees include white ash (*Fraxinus americana*), tulip poplar, black walnut, and pine species. Understory includes species such as flowering dogwood, redbud (*Cercis canadensis*), fringetree (*Chionanthus virginicus*), chalk maple (*Acer leucoderme*), and hop-hornbeam (*Ostrya virginiana*). Shrubs may include sweetshrub (*Calycanthus floridus*), painted buckeye, fragrant sumac (*Rhus aromatica*), coralberry (*Symphoricarpos orbiculatus*), mapleleaf arrowwood (*Viburnum acerifolium*), black haw (*V. prunifolium*), and downy arrowwood. The herb layer is usually moderately diverse, with species such as drywoods sedge (*Carex artitecta*), black-edge sedge (*Carex nigromarginata*), Solomon's seal (*Polygonatum biflorum*), licorice bedstraw, perfoliate bellwort (*Uvularia perfoliata*), littlehead nutrush (*Scleria oligantha*), turpentine root (*Aristolochia serpentaria*), flowering spurge (*Euphorbia corollata*), and in the mesic part of the range of this type, as on lower slopes, many of the herbs of the Basic Mesic Forest (Schafale and Weakley, 1990).

Upland Depression Swamp Forest

This seasonally to intermittently flooded or saturated natural community occurs on poorly drained upland flats or depressions; usually on broad upland flats but occasionally on high ridge tops. The forest canopy is usually dominated by willow oak or overcup oak (*Quercus lyrata*). Other trees may be present, including swamp chestnut oak (*Quercus michauxii*), swamp white oak (*Quercus bicolor*), sweet gum, red maple, tulip poplar, swamp tupelo (*Nyssa biflora*), shagbark hickory, and occasional upland trees, particularly post oak and Carolina shagbark hickory. Shrubs are usually sparse including species such as black highbush blueberry (*Vaccinium fuscatum*), highbush blueberry (*V. corymbosum*), buttonbush (*Cephalanthus occidentalis*), possum-haw (*Ilex decidua*), and arrowwood (*Viburnum dentatum*). Herbs are usually sparse, with sedge species (*Carex* spp.) being most typical. Other species include eastern mannagrass (*Glyceria septentrionalis*), soft rush (*Juncus effusus*), meadow spikemoss (*Selaginella apoda*), white nodding ladies' tresses (*Spiranthes cernua*), slender spikerush (*Eleocharis tenuis*), and various bottomland spring ephemerals such as Virginia spring-beauty. The mosses *Climacium americanum* and *Sphagnum lescurii* are often abundant. In disturbed areas, vines, primarily Japanese honeysuckle, poison ivy, trumpet creeper (*Campsis radicans*), and muscadine, may proliferate (Schafale and Weakley, 1990).

Upland Pool

This natural community occurs in small upland depressions, in the Piedmont and Mountain regions, where water is ponded by an impermeable substrate. It is dominated by various wetland shrubs and herbs. Trees such as black gum, willow oak, red maple, and sweet gum may be present on the edge or scattered in the center. Shrub species include buttonbush, blueberries, swamp doghobble, and in some areas ti-ti (*Cyrilla racemiflora*). Herbs include royal fern, various *Carex* species, soft rush, and a variety of *Sphagnum* moss species, including *S. cuspidatum*, *S. palustre*, and *S. recurvum* (Schafale and Weakley, 1990).

Xeric Hardpan Forest

This natural community occurs on upland flats and gentle slopes with impermeable clay subsoils that do not pond water for extended periods. It is most commonly associated with mafic rocks. The somewhat stunted and open canopy is characteristically dominated by post oak and blackjack oak. Other species that may be present include Virginia pine, shortleaf pine, Carolina shagbark hickory, pignut hickory, white ash, white oak, willow oak, and various other oaks. Typical understory and shrub species include red cedar (*Juniperus virginiana*), redbud, persimmon (*Diospyros virginiana*), blueberries, winged elm, fringetree, downy arrowwood, and black haw. The most common herbs are northern oat grass and little bluestem. Other herbs include curlyheads (*Clematis ochroleuca*), asters (*Aster* spp.), rattlesnake hawkweed, queendevil (*Hieracium gronovii*), bushclovers (*Lespedeza* spp.), St. Andrew's cross (*Hypericum hypericoides*), narrowleaf evening primrose (*Oenothera fruticosa*), grassleaf blazing-star (*Liatris graminifolia*), and goldenrods (*Solidago* spp.). In some areas, where the canopy was removed or kept open by artificial disturbance, a very diverse herbaceous flora has developed with a number of species commonly associated with prairies (Schafale and Weakley, 1990).

4.3 Endangered Species

According to the state's database of Natural Heritage Element Occurrence Sites, 11 threatened and endangered species are found in the project watersheds (NCNHP, 2005a). These species are listed in Table 4.1.

Table 4.1 Threatened and Endangered Species in the Study Watersheds

Scientific Name	Common Name	State Status	Federal Status	Status/Quad Location
Mussels				
Alasmidonta varicose	Brook Floater	Endangered	Federal Species of Concern	Current - FARMER
Fusconaia masoni	Atlantic Pigtoe	Endangered	Federal Species of Concern	Current - FARMER
Lampsilis radiata conspicua	Carolina Fatmucket	Threatened	-	Current – FARMER
Strophitus undulatus	Squawfoot	Threatened	-	Current – FARMER
Villosa constricta	Notched Rainbow	Special Concern	-	Current – FARMER
Villosa delumbis	Eastern Creekshell	Significantly Rare	-	Current – FAIR GROVE, FARMER
Villosa vaughaniana	Carolina Creekshell	Endangered	Federal Species of Concern	Current – FARMER, GLENOLA
Vascular Plants				
Cardamine dissecta	Dissected Toothwort	Significantly Rare (Peripheral)	-	Current - GLENOLA
Helianthus schweinitzii	Schweinitz's Sunflower	Endangered	Endangered	Current – DENTON, FAIR GROVE, GLENOLA
Hexalectris spicata	Crested Coralroot	Significantly Rare (Peripheral)	-	Current – FARMER
Ruellia purshiana	Pursh's Wild-petunia	Significantly Rare (Other)	-	Historic - GLENOLA

Source: NCNHP, 2005a

All of the fauna listed in Table 4.1 are mussel species. According to American Rivers, over 75 percent of freshwater mussels in North Carolina are considered imperiled or in need of protection (American Rivers, 2005). Five of the seven listed species are State Threatened or Endangered. Strong, healthy mussel populations are an indicator of good water quality. Mussels in general also help to improve water quality with their natural filtering system.

4.4 Natural Heritage Inventory Corridors

The Upper Uwharrie River watershed contains a number of areas identified by the Randolph County Natural Heritage Inventory in 1999 (and updated in 2005). The inventory was a partnership between the Piedmont Land Conservancy, the City of Greensboro, and NCNHP. The North Carolina Natural Heritage Trust Fund, the North

Carolina Zoological Society, and Randolph County provided funding for the inventory (NCNHP, 2005b).

Most of the sites identified during the Natural Heritage inventory were privately owned. Designation as a significant Natural Heritage area by NCNHP conveys no protection status. Protection of a natural area comes from the landowner, and is often completed in partnership with a local land trust. The following list of Natural Heritage sites in the Upper Uwharrie River Watershed was taken from the Randolph County Natural Heritage Inventory (NCNHP, 2005b). Natural Heritage areas and Piedmont Land Conservancy (PLC) areas in the Upper Uwharrie River Watershed are shown in Figure 4.4 (NCNHP, 2005; Piedmont Land Conservancy, 2005).

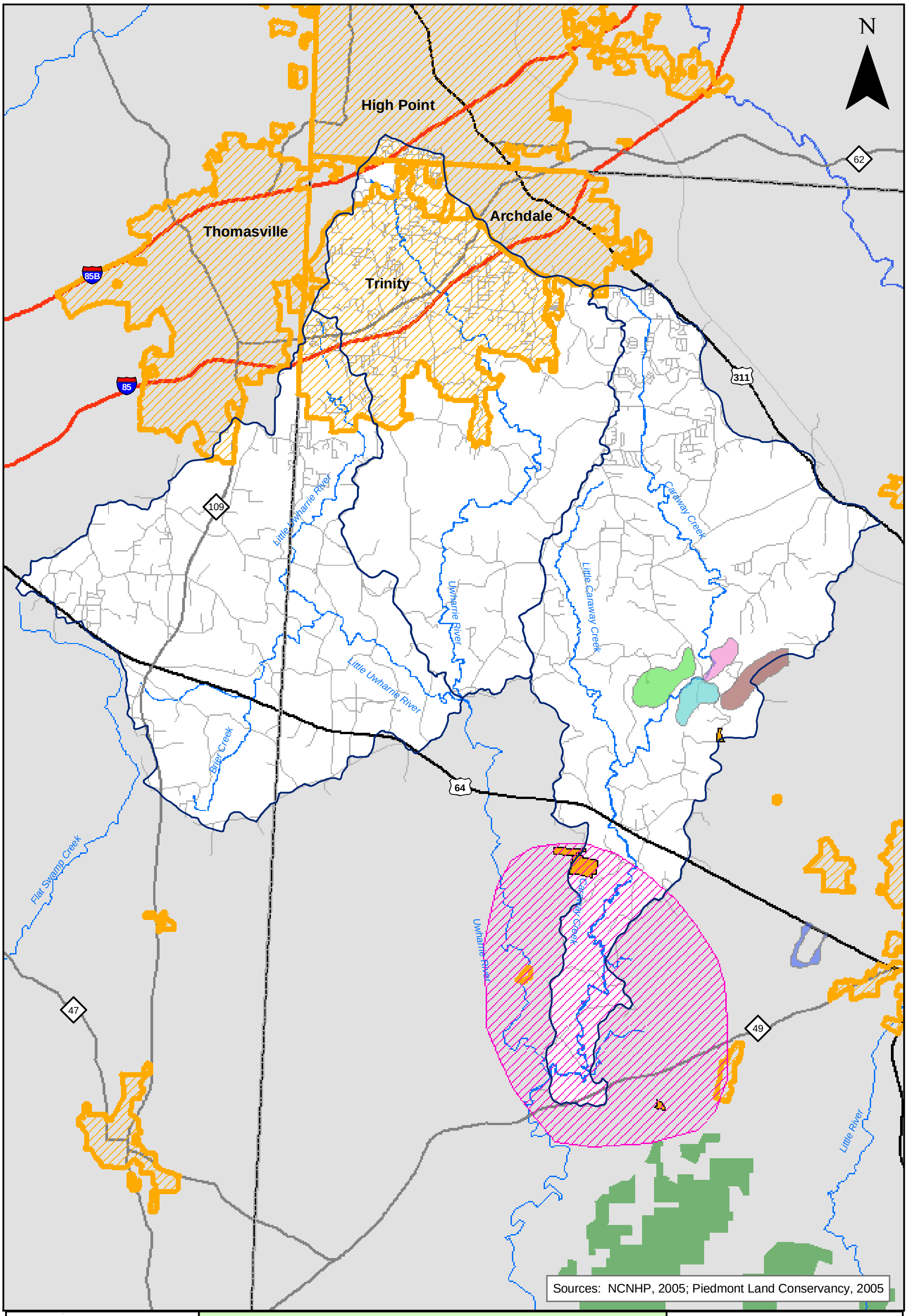
As stated previously, there are sites in the Upper Uwharrie River watershed that are protected by the PLC, or have ongoing PLC preservation initiatives. The PLC is dedicated to preserving natural and scenic lands, farms, and open spaces in Piedmont North Carolina. PLC preservation activities include accepting donations of land and easements as well as purchasing land and easements. Donated and bargain sale easements and fee simple purchases offer donors potential income tax credits, estate tax reductions, and may also reduce property taxes in certain instances.

Caraway Creek Aquatic Habitat contains a cluster of rare mussels, including: brook floater (*Alasmidonta varicosa*); Atlantic pigtoe (*Fusconaia masoni*); creeper (*Strophitus undulatus*); notched rainbow (*Villosa constricta*); Carolina creekshell (*Villosa vaughaniana*), and eastern creekshell (*Villosa delumbis*). The river is a public resource, but the adjacent land is privately owned.

Caraway Creek Forests are ecologically significant for a population of dissected toothwort (*Cardamine dissecta*) and the high quality, large, unfragmented forest found at Camp Caraway. The natural communities found here range from Piedmont Alluvial Forest along the creek, to Piedmont Heath Bluffs, Dry-Mesic Oak-Hickory Forest, and Dry Oak-Hickory Forest on the slopes. This site is privately owned.

Caraway Mountain/Mundo Vista includes a population of dissected toothwort and three occurrences of the uncommon Xeric Hardpan Forest natural community. Because the area includes two monadnocks, several rock outcrops, intermittent and perennial streams, and seepage areas, there is a diverse mosaic of natural communities present. These communities include Piedmont Alluvial Forest, Xeric Hardpan Forest, Mesic Mixed Hardwoods Forest, Low Elevation Seep, Dry Oak-Hickory Forest, and Piedmont Monadnock Forest. This site is privately owned.

Caraway Mountain Sunflower Site contains a Schweinitz's sunflower (*Helianthus schweinitzii*) population in its natural habitat. The site is described as one of the best examples in the state. The portion of the natural area in the Progress Energy power line right of way is a Registered Natural Heritage Area.



Ecosystem Enhancement Program

Local Watershed Plan
for the Yadkin River Basin:
Upper Uwharrie River Watershed

LEGEND

- Streams
- Counties
- Study Area HUs
- PLC Initiative Areas
- PLC Protected Sites
- Municipal Boundaries

Randolph Co Natural Heritage Corridors

- Camp Caraway
- Camp Caraway Ridge
- Caraway Bluffs
- Caraway Creek Corridor Cable Creek Headwaters
- Caraway Mountain - Mundo Vista

Figure 4.4: Natural Areas
Upper Uwharrie River Watershed

0 0.5 1 2 3 Miles

5 Existing Water Quality Data

The NCDWQ Surface Water Protection Section prepared a summary of existing water quality data for the study area. This discussion is included in its entirety in Appendix B. Below is a brief review of the NCDWQ report.

5.1 Monitoring Data

NCDWQ has completed benthic macroinvertebrate/aquatic habitat surveys and fish community assessments in the study area and surrounding region NCDWQ, 2005). These areas are shown in Figure 5.1. However, these data are limited. The monitoring sites are located at the most downstream portion of each HU; data do not exist for upstream mainstem sites or tributaries. In addition, physical/chemical water quality data are generally lacking for mainstem streams and tributaries within the study area.

There are three benthic macroinvertebrate survey sites located within the study area (Uwharrie River at SR 1406 (site B-1), Little Uwharrie River at SR 1405 (site B-2), and Caraway Creek at SR 1331 (site B-4)). All sites were rated Good-Fair in 1996 and 2001, and had aquatic habitat scores of approximately 50 to 60 out of 100. A regional reference site (Dutchmans Creek at SR 1150 (B-7)) and Outstanding Resource Water site (Barnes Creek at SR 1303 (B-6)) are both located downstream of the study area. These sites have received Good and Excellent benthic macroinvertebrate ratings and aquatic habitat scores of 80 or more. According to NCDWQ, the available benthic and aquatic habitat data suggest that streams within the planning area are more degraded than regional reference streams.

NCDWQ completed fish monitoring at one site within the study area as part of a special study in April, June, and October 1999 (Uwharrie River at SR 1406 (F-Sp)). The community was rated Excellent in April and June; Good-Fair in October. The decline in October was attributed to summer drought conditions and late summer hurricanes. There are two regional reference sites located downstream of the study area (Betty McGees Creek at SR 1107 (F-1) and Barnes Creek at SR 1303 (F-2 reference site)). The fish communities at these sites have received ratings from Good-Fair to Excellent.

5.2 Point Sources

There are three minor National Pollutant Discharge Elimination System (NPDES) facilities that discharge to headwater streams within the watershed (Figure 5.2). Monitoring reports were not reviewed in the NCDWQ report. However, NCDWQ regional office staff reported that the Countryside Mobile Home Park continues to experience occasional biological oxygen demand (BOD) violations; however, plant operations have improved with a new operator. No deficiencies were reported in reference to the other two facilities.

5.3 Conclusions

NCDWQ recommended additional monitoring to better characterize water quality in the study area. Chemical/physical data and recent benthic and fish community data are needed for sites in the Uwharrie and Little Uwharrie Rivers, Caraway Creek and

reference sites. Chemical, physical, and biological data are needed for Little Caraway Creek, Brier Creek, and from one or more upstream locations on the Uwharrie River and Caraway Creek. Aquatic habitat evaluations are needed at several locations on Caraway, Little Caraway, and Brier Creeks and the Uwharrie and Little Uwharrie Rivers.

Additional, more current water quality data are needed to help ascertain where problems within the watershed may exist. The data will provide a more comprehensive characterization of water quality and guide future monitoring and assessment work conducted within the watershed.

N

Thomasville

Archdale

Trinity

GUILFORD

62

85B

85

311

220B

109

Randleman

F-sp

B-1

B-2

IDSON

64

220

RANDOL

B-4

Asheboro

47

49

159

8

F-1

F-2

B-6

MONTGOMERY

B-7

Source: NCDWQ, 2005

Ecosystem Enhancement Program

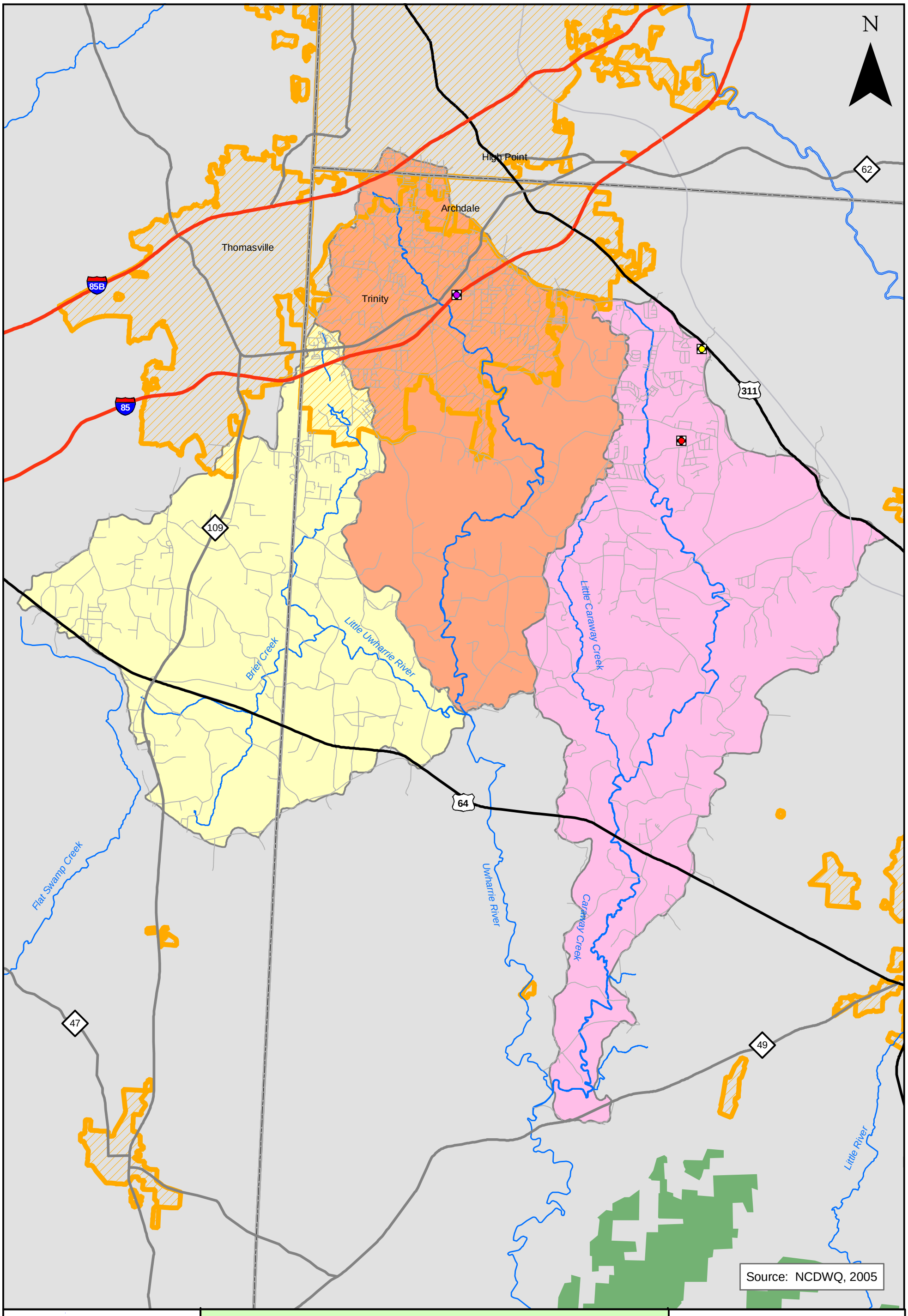
Local Watershed Plan
for the Yadkin River Basin:
Upper Uwharrie River Watershed

LEGEND

NCDWQ Monitoring Sites
- Benthic macroinvertebrate
- Fish community
- Streams
- Counties
- Little Uwharrie River HU
- Uwharrie River HU
- Caraway Creek HU
- Uwharrie National Forest
- Municipal Boundaries

Figure 5.1: NCDWQ Monitoring Sites
Upper Uwharrie River Watershed

0 1 2 4 Miles



Ecosystem Enhancement Program

Local Watershed Plan
for the Yadkin River Basin:
Upper Uwharrie River Watershed

LEGEND

NPDES Point Source Dischargers

- NC0056201, Countryside Mobile Home Park
- NC0084786, Furniture Illustrators, Inc.
- NC0086029, Trinity American Corporation

- Little Uwharrie River HU
- Uwharrie River HU
- Caraway Creek HU
- Municipal Boundaries

Figure 5.2: NPDES Dischargers
Upper Uwharrie River Watershed

0 0.5 1 2 3 Miles

6 Trends in Land Use and Development

Land use change is a primary factor in water quality and habitat degradation. Increasing population and development pressures contribute to the degradation of water resources, including changes in water flow and storage, input of nonpoint source pollutants, and increases in soil erosion. One of the most important ways land use relates to water quality is through changes in the occurrence of impervious surface. Generally, water quality degrades in direct proportion to the amount of land development inhibiting the infiltration of precipitation.

In the Upper Uwharrie River watershed, it is important to understand how land use is changing over time. A successful local watershed plan will need to address development pressures and forecast the potential impact of changing land use. The following sections review land use changes in the study watersheds, including population development, agricultural and silvicultural land uses, and transportation.

6.1 Cities in the Upper Uwharrie River Watershed

While the project area is predominantly rural, the cities of Archdale, High Point, Thomasville, and Trinity lie within the Upper Uwharrie River basin, and the cities of Randleman and Asheboro are in the vicinity. While both Archdale and Trinity were recently incorporated, both have a long history. Archdale, initially called Bush Hill, was settled by Quakers in 1866. The community was named for John Archdale, the Quaker Governor of the Colony Carolina in 1692. The town charter lapsed in 1924, but the city was re-established in 1969.

Trinity has a long background as an educational center. Brown's schoolhouse (founded 1832) was the first university in the area. The college, later known as Union Institute, and Trinity College was eventually relocated to Durham in 1892 and renamed Duke University. Trinity's small town charter lapsed in 1924, but the city was re-established in 1997.

High Point was named after the highest point on the North Carolina Railroad, and was originally settled by Quakers as well as German, Welsh, and Scotch-Irish immigrants. The city was incorporated in 1859. The city is known as a center of furniture manufacturing and sales. The cities of Greensboro, Winston-Salem, and High Point are referred to collectively as the Triad.

Thomasville was founded in 1852 and incorporated in 1857. However, the earliest settlements in this area of Davidson County were a few miles south. John Thomas moved to what is now the Fairgrove area of Davidson County in about 1820 to prospect for gold among the many mines in the area. However, when the railroad was built in the early 1850s, Thomas moved the "town" north, adjacent to the rail line. Currently, the city is known for its artisan furniture.

Randleman was named after John Banner Randleman, a local cotton mill owner. The city was originally known as Dicks Grist Mill and, later, Union Factory. At one time, the city

was a center of the state hosiery industry. Mr. Randleman was one of the driving forces in developing the city. The city of Randleman was incorporated in 1880.

Asheboro is the county seat of Randolph County. Originally called "Asheborough," the city received its original charter from the State Legislature on Christmas Day 1796. Original settlements in the area began in 1780, when citizens demanded that the county seat be relocated from Johnstonville to a more central location. The city was named for Samuel Ashe, North Carolina's governor from 1795 to 1798. Asheboro is home to the North Carolina Zoo, and is an industrial center for the area.

6.2 Population and Development, Current Trends

Based on census data, overall growth in Davidson, Guilford, and Randolph Counties was approximately the same as the state average from 1990 to 2000. However, growth in the cities within the study area met or exceeded state averages. Tables 6.1 and 6.2 summarize population data for the state of North Carolina, and area counties and cities.

Table 6.1 Population Growth for North Carolina and Randolph, Guilford, and Davidson Counties

	1990 Population	2000 Population	Population Increase	Percent Growth (%)	Land Area (miles^2)	2000 Persons per miles^2
North Carolina	6,628,937	8,049,313	1,420,376	21	48,710.88	165.2
Randolph County	106,546	130,454	23,908	22	787.36	165.7
Guilford County	347,420	421,048	73,628	21	649.42	648.3
Davidson County	126,667	147,246	20,579	16	552.15	266.7

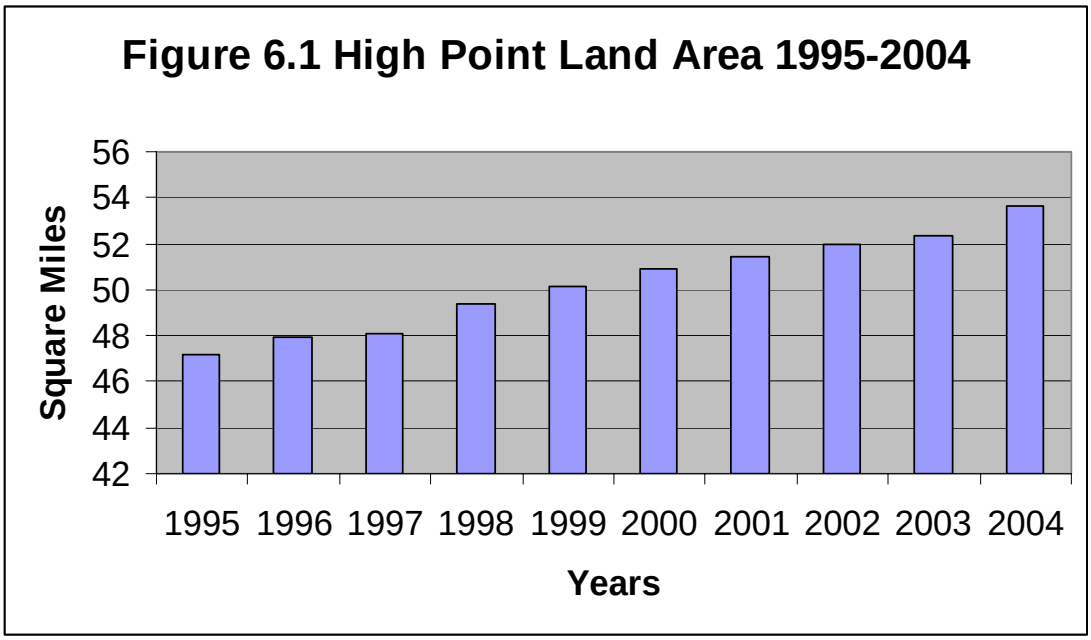
Source U.S. Census Bureau, 1990 and 2000 Census data

Table 6.2 Population Growth for Cities in the Study Area

	1990 Population	2000 Population	Population Increase	Percent Growth (%)	Land Area (miles^2)	2000 Persons per miles^2
Archdale	6,913	9,014	2,101	30	7.83	1,151.8
Asheboro	16,362	21,672	5,310	32	15.34	1,412.5
High Point	69,496	85,839	16,343	24	49.05	1,750.1
Randleman	2,612	3,557	945	36	3.57	997.4
Thomasville	15,915	19,788	3,873	24	11.15	1,775.2
Trinity	5,469	6,690	1,221	22	16.90	395.9

Source U.S. Census Bureau, 1990 Census Data

At least part of the growth in area cities was accomplished by annexing surrounding areas. For example, Figure 6.1 shows growth in the City of High Point from 1995 through 2004 (City of High Point, 2005).



Other cities in the area achieved similar increases in land area between 1990 and 2000. In the Upper Uwharrie River watershed, Archdale increased in size by 0.9 square miles. The land area of nearby Thomasville increased by 1.07 square miles, Randleman by 0.84 square miles, and Asheboro by 3.44 square miles (Piedmont Triad Council of Governments, Undated web page).

Block Group Census data from 1990 and 2000 were used to determine population densities and growth rates for the areas in the study area. This information is summarized in Table 6.3 and Figure 6.2. It should be noted that the boundaries of some block groups changed between the two census periods. As the data indicate, growth rates in the project area varied widely, ranging from a decrease of 15 percent to an increase of over 300 percent.

Table 6.3 Population Growth for Census Tracts in the Study Area by Block Groups

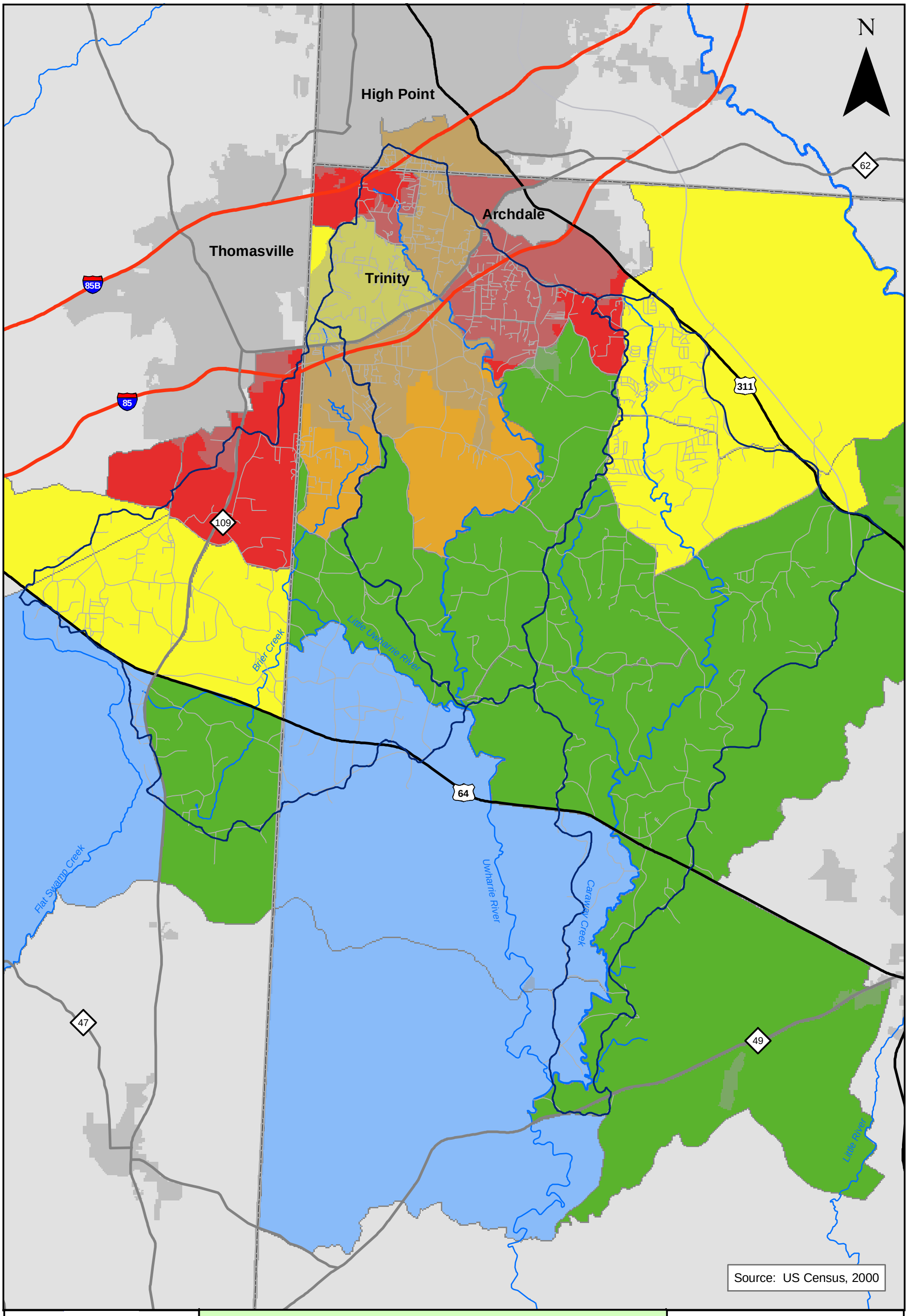
Tract (Block Group)	1990 Population	2000 Population	Population Increase	Percent Growth (%)	Land Area (miles^2)#	2000 Persons per miles^2
Randolph County						
305.01 (1)	2,144	3,185	1041	49	22.39	142.25
305.01 (2)	4,188	5,372	1184	28	42.56	126.22
305.01 (3)	1,657	2,027	370	22	31.50	64.35
306 (1)	1,731	2,609	878	51	17.07	152.84
306 (2)	1,740	2,138	398	23	12.56	170.22
307 (1)	1,196	1,746	550	46	35.45	49.25
313.01 (1)	7,112	6,978	-134	-2	26.75	260.86
313.01 (2)	2,158	2,300	142	7	8.85	259.89
315.01 (1)	4,656	5,588	932	20	15.62	357.75

Tract (Block Group)	1990 Population	2000 Population	Population Increase	Percent Growth (%)	Land Area (miles^2)#	2000 Persons per miles^2
315.02 (3)	1,678	1,848	170	10	2.34	789.74
315.02 (4)	985	859	-126	-13	1.71	502.34
315.02 (5)	1,474	1,929	455	31	3.61	534.35
315.02 (6)	900	986	86	10	6.19	159.29
316.01 (1)*	222	964	742	334	2.54	379.53
316.01 (2)	1,719	1,345	374	22	2.41	558.09
316.01 (9/3)*	1,588	1,348	-240	-15	4.63	291.14
316.02 (1)	1,463	1,383	-80	-5	0.97	1,425.77
Davidson County						
611 (2)	2,421	3,078	657	31	7.55	407.68
611 (4)	686	703	17	2	1.62	433.95
619 (1)	2,325	2,583	258	11	9.79	263.84
619 (3)	1,776	1,809	33	2	6.23	290.37
619 (4)	1,263	1,649	386	31	6.13	269.00
619 (5)	1,462	1,698	236	16	10.54	161.10
619 (6)	1,982	2,123	141	7	24.97	85.02
Guilford County						
145.01 (1)	421	759	338	80	2.25	337.33

Land area information from the 2000 Census only
* The size of the Block Group (and/or name) changed between 1990 and 2000
Source US Census Bureau, 1990 and 2000 Census

Based on the Randolph County Growth Management Plan, the predominant pattern of development in Randolph County over the past twenty-five years has been rural sprawl. Under this type of development, unlimited, large-lot or large-tract growth removed from areas currently served by public infrastructure. Most of the development was in the form of single-family residential land subdivisions. These types of developments generally consume more land and resources than is needed to create a livable and functional community (Randolph County, 2002).

While some may see rural sprawl as indicative of a healthy sign of growth, such unmanaged development can impact quality of life for residents of the county and can seriously impact water resources. This can threaten growth and the county's ability to continue providing cost-effective services to maintain a high rural quality of life (Randolph County, 2002).



Ecosystem Enhancement Program

Local Watershed Plan
for the Yadkin River Basin:
Upper Uwharrie River Watershed

LEGEND

- Study Area Hydrologic Units
- Counties
- Roads
- Municipal Boundaries

Population Density (2000 Census)

- < 100 pers/sq mi
- 100 - 200 pers/sq mi
- 200 - 300 pers/sq mi
- 300 - 400 pers/sq mi
- > 400 pers/sq mi

Figure 6.2: Population Density
by Census Blocks (2000)
Upper Uwharrie River Watershed

0 0.5 1 2 3 Miles

6.3 Population and Development, Projected Growth

Based on data from the North Carolina State Demographics Unit, the counties that comprise the Upper Uwharrie River watershed are expected to grow at a lower rate than the rest of the state. The highest rates of growth are forecast to be in Randolph County, while the lowest are in Davidson County (North Carolina State Demographics Unit, 2005). Projected growth rates for North Carolina and Davidson, Guilford, and Randolph Counties are shown in Table 6.4.

Table 6.4 Projected Populations of North Carolina and Davidson, Guilford, and Randolph Counties*

	2000 Population	Growth Rate 2000-2010 (%)	Growth Rate 2010-2020 (%)	Growth Rate 2020-2030 (%)	2030 Population
North Carolina	8,046,813	15.8	14.7	13.0	12,067,013
Davidson County	147,246	10.9	10.6	9.5	197,877
Guilford County	421,048	10.9	12.9	11.7	588,886
Randolph County	130,471	12.6	13.6	12.3	187,504

Source North Carolina State Demographics Unit, 2001

6.4 Economics within the Study Area

According to data from the 2000 Census, manufacturing is the primary source of employment in the study area. For each Census Block Group in the study area, more people reported a manufacturing job source than any other. Percentages of manufacturing jobs in block groups in the study area ranged from 21.2 to 46.8 percent. The percentage of construction jobs ranged from 2.9 to 14.5 percent. Agricultural and mining jobs accounted for no more than 2.8 percent of jobs, and 7 Census Block Groups in the study area reported no agricultural jobs in 2000 (US Census Bureau).

The Randolph County Growth Management Plan (2002) cited an economic analysis conducted by Standard & Poors that indicated the county's population would experience steady growth from 2001 to 2003. Randolph County's fastest growing employment sectors were expected to be in services (2.8 percent increase), trade (2.4 percent increase) and government and education services (2.7 percent increase). Manufacturing employment is expected to remain near the 1999 level of 40% of total jobs (Randolph County, 2002). It is likely that sections of the project area within Davidson and Guilford Counties would experience similar economic conditions.

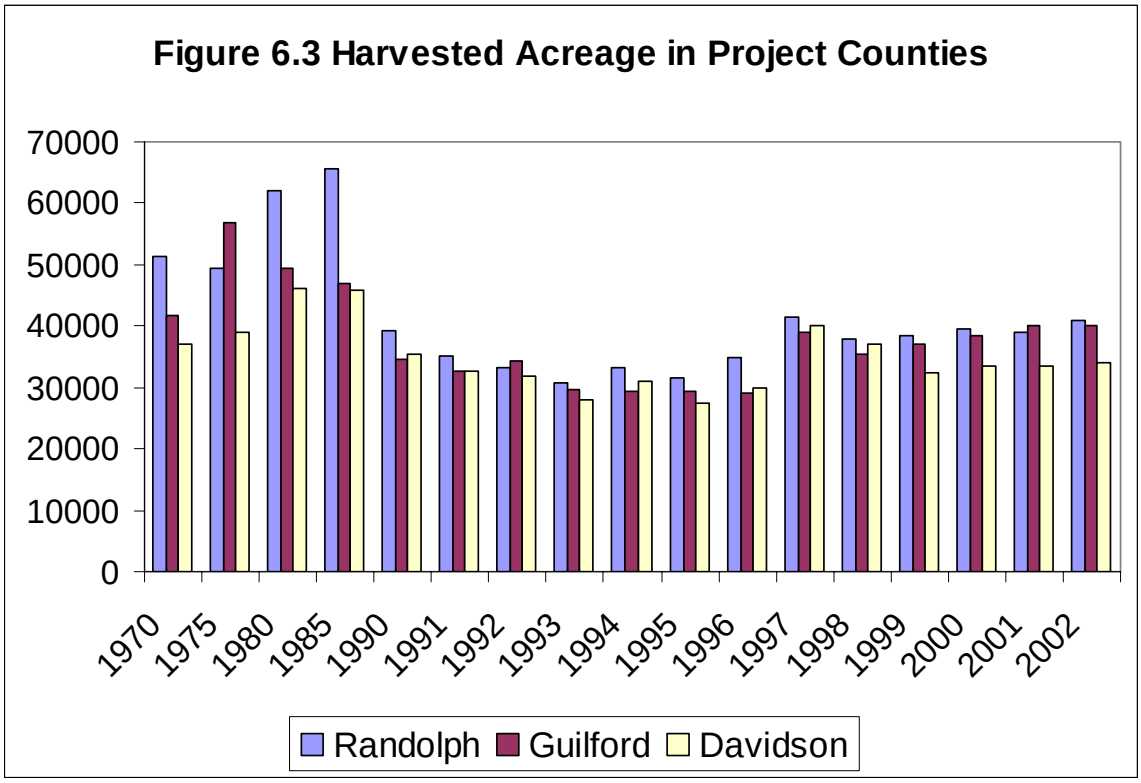
6.5 Historic Patterns of Land Development

While there are relatively few people employed in agriculture within the study area, the counties within the Upper Uwharrie River watershed have many acres involved in agricultural production. Table 6.5 shows the harvested acreage reported for Davidson, Guilford, and Randolph Counties. Note that harvested acreage peaked in the 1980s, declined in the early to mid 1990s, and has rebounded over the last few years (although the total acreage is still significantly below 1980s totals). This information is shown in Table 6.5 and Figure 6.3.

Table 6.5 Harvested Acreage for Davidson, Guilford, and Randolph County Farms

County	1970	1975	1980	1985	1990	1995	2000	2002
Davidson	37,000	38,900	46,100	45,800	35,300	27,400	33,500	34,000
Guilford	41,700	56,800	49,500	46,900	34,600	29,500	38,500	40,000
Randolph	51,300	49,500	62,100	65,600	39,200	31,500	39,500	41,000

Source: North Carolina Data Center Log into North Carolina (LINC) System, 2005



Source: North Carolina LINC System, 2005

Most residents of Davidson and Randolph Counties use septic systems for waste disposal and the majority of Guilford County residents are served by sewer systems (see Table 6.6). However, in each of the counties in the study area, the number of septic systems increased from 1970 through 1990 (no information on waste disposal systems was gathered for the 2000 Census). Septic systems that are not properly operated or that fail can impact water quality. Factors that can increase the risk of contamination include high density of septic systems (greater than 1 unit per acre), age of the system (most fail after 20 to 30 years), soil type (coarse soils), slope (slopes greater than 30 percent), and distance to groundwater, surface water, or private drinking water wells (Boulder County Water Quality Program, 2005).

Table 6.6 Waste Disposal Systems for Year-Round Housing Units in Davidson, Guilford, and Randolph Counties

	1970	1980	1990
Davidson County			
Sewer Systems	10,476	14,418	17,279
Septic Systems/Cesspools	17,986	28,344	35,612
Other Systems	2,254	978	375
Guilford County			
Sewer Systems	64,680	90,358	114,492
Septic Systems/Cesspools	22,793	28,301	31,139
Other Systems	3,567	1,619	1,181
Randolph County			
Sewer Systems	6,413	9,768	14,315
Septic Systems/Cesspools	15,429	23,946	28,509
Other Systems	3,096	1,451	810

Source: North Carolina LINC System, 2005

While many residents of the Upper Uwharrie River watershed currently use septic systems for waste disposal, many of the residents are connected to a public drinking water system. The drinking water infrastructure for the study area is shown in Figure 6.4.

6.6 Examples of Land Use Change

Development has not been uniform in the Upper Uwharrie River watershed. Buck Engineering conducted a qualitative assessment of the project area using aerial photography from 1957 and 2004. It should be noted that the streams had been traced over the existing photography from 1957.

Based on the aerial photography assessment, some parts of Caraway Creek appear to have experienced little change in land use over the last 40 years. Figure 6.5 shows a portion of Caraway Creek. Note that some areas that were cultivated in the 1950s have been allowed to return to a forest use, while some small areas of residential used were developed.

In contrast, the area surrounding the headwaters of the Uwharrie River shows significant development. Since the time of the 1957 aerial photography, I-85 was constructed and there has been significant growth and sprawl in High Point, Archdale, and Trinity. Figures 6.6 and 6.7 show the Trinity area. Figure 6.6 shows the conversion of farmland to residential areas, industrial sites, and a golf course. Figure 6.7 shows the land use changes caused by construction of I-85, the development of residential areas, and the construction of a significant industrial site.

N

High Point

Archdale

Thomasville

Trinity

85B

85

62

311

109

64

47

49

Little Uwharrie River

Uwharrie River

Caraway Creek

Little Caraway Creek

Brier Creek

Flat Swamp Creek

Little River

Sources: Davidson County, 2005; City of Thomasville, 2005; Randolph County, 2005(b)

Ecosystem Enhancement Program

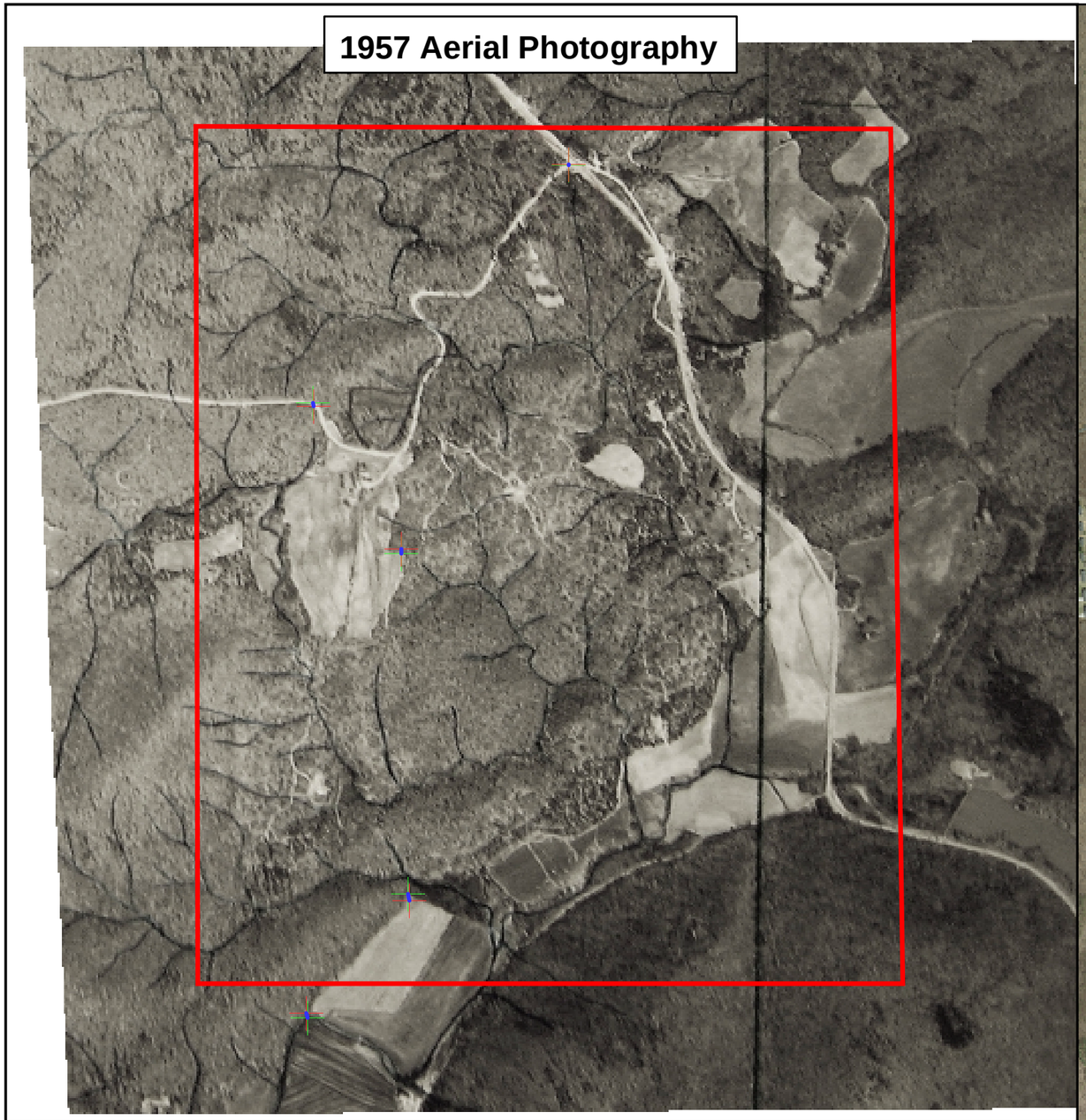
Local Watershed Plan
for the Yadkin River Basin:
Upper Uwharrie River Watershed

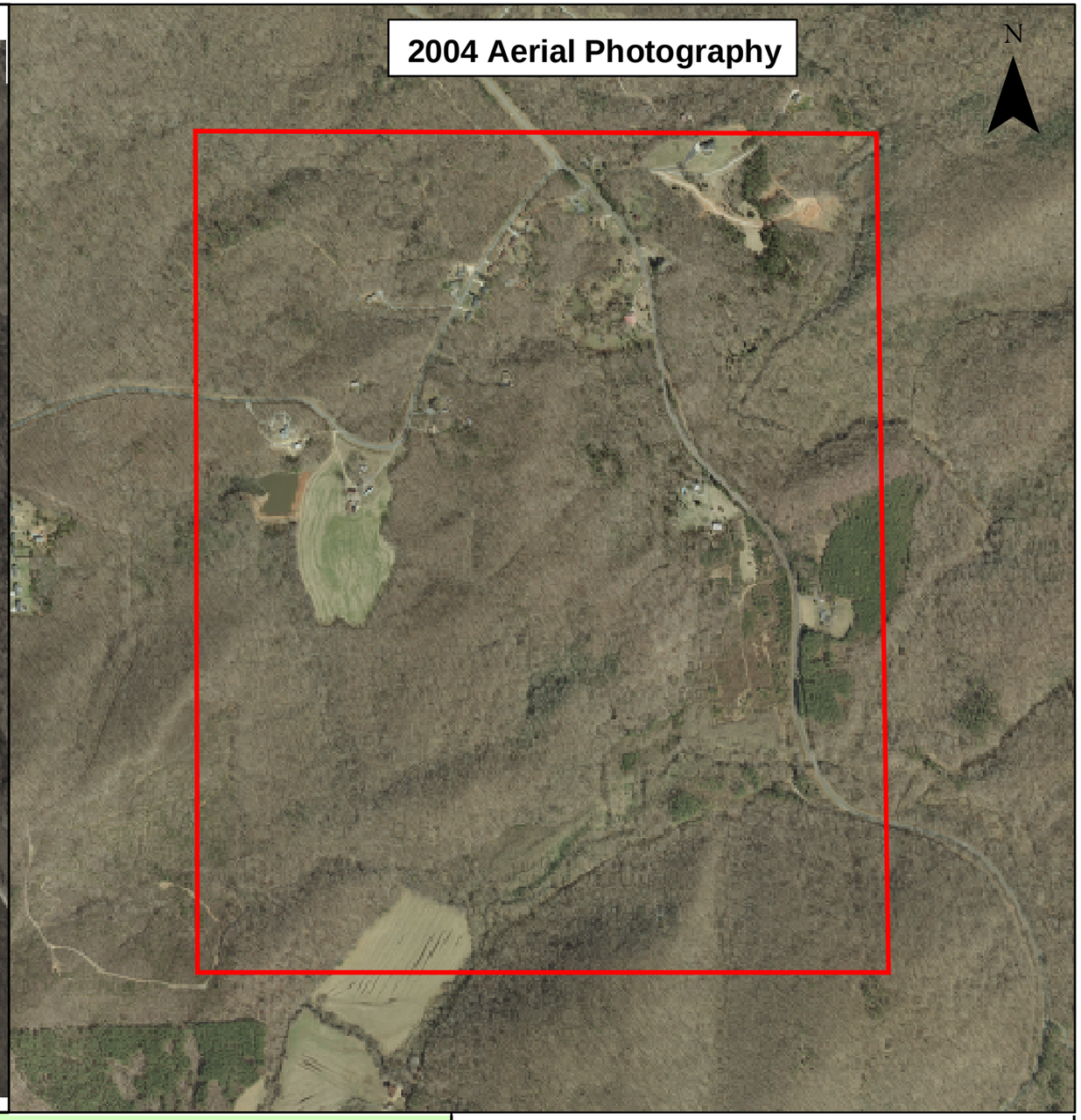
LEGEND

- Streams
- Counties
- Davidson Water, Inc., Water Lines
- Thomasville Sewer Lines
- Randolph County Sewer Lines
- Little Uwharrie River HU
- Uwharrie River HU
- Caraway Creek HU
- Municipal Boundaries

Figure 6.4: Water Infrastructure
Upper Uwharrie River Watershed

0 0.5 1 2 3 Miles





Ecosystem Enhancement Program

Local Watershed Plan for the Yadkin River Basin: Upper Uwharrie River Watershed

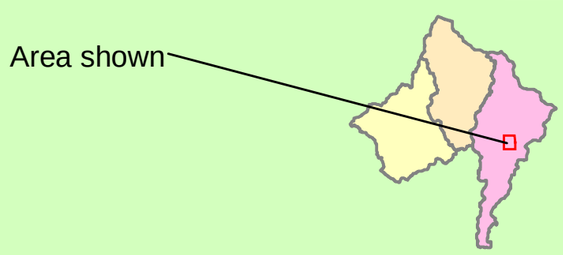
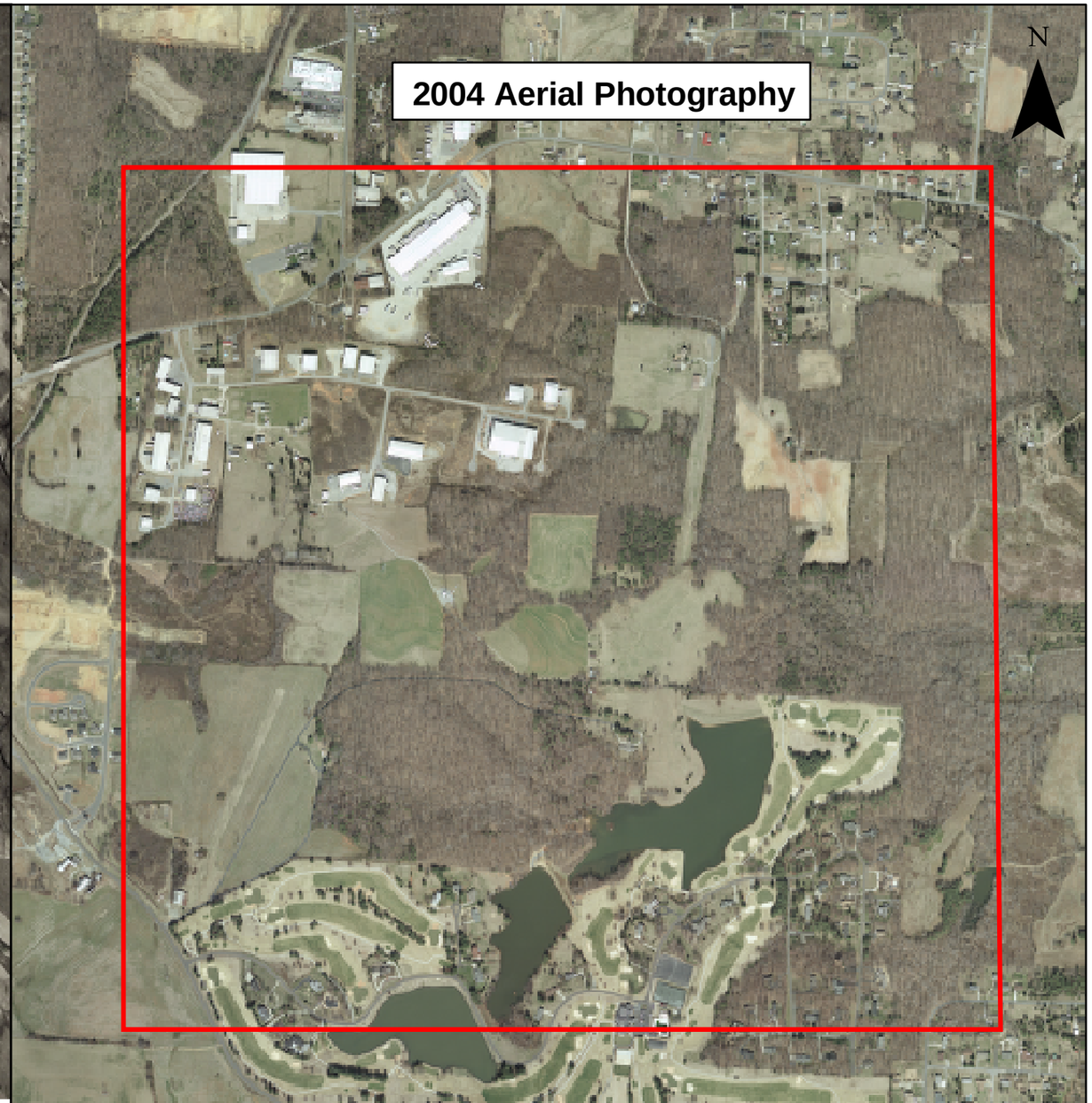


Figure 6.5: Aerial Photography
Caraway Creek Area 1957 and 2004
Upper Uwharrie River Watershed

0 500 1,000 2,000 3,000 Feet



Ecosystem Enhancement Program

Local Watershed Plan for the Yadkin River Basin: Upper Uwharrie River Watershed

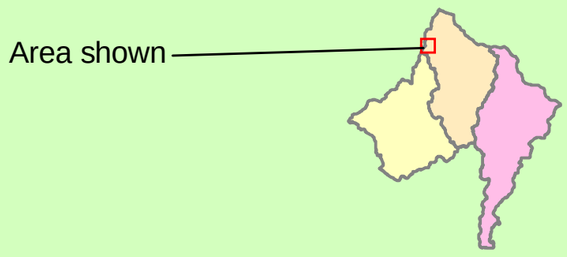
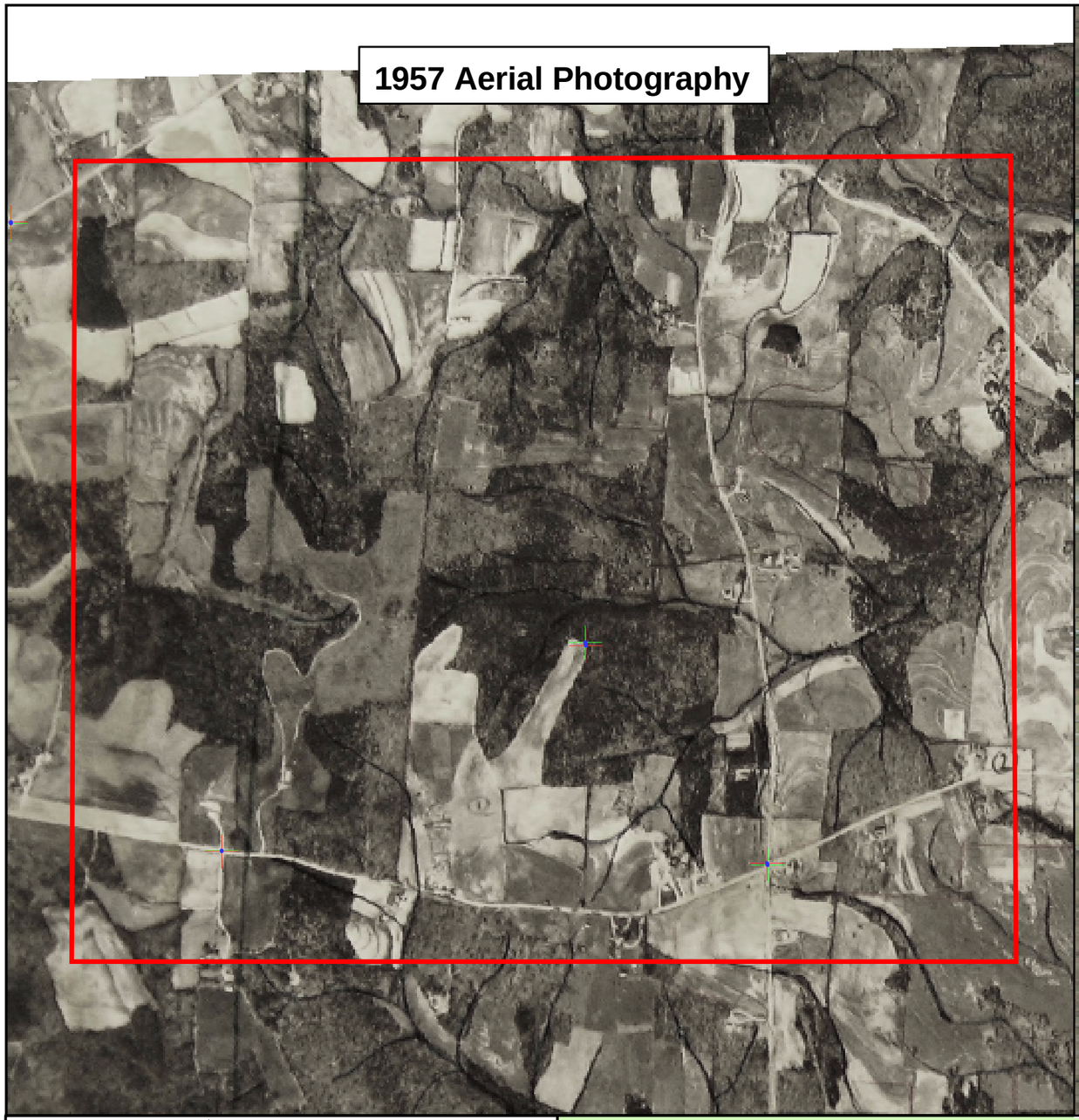
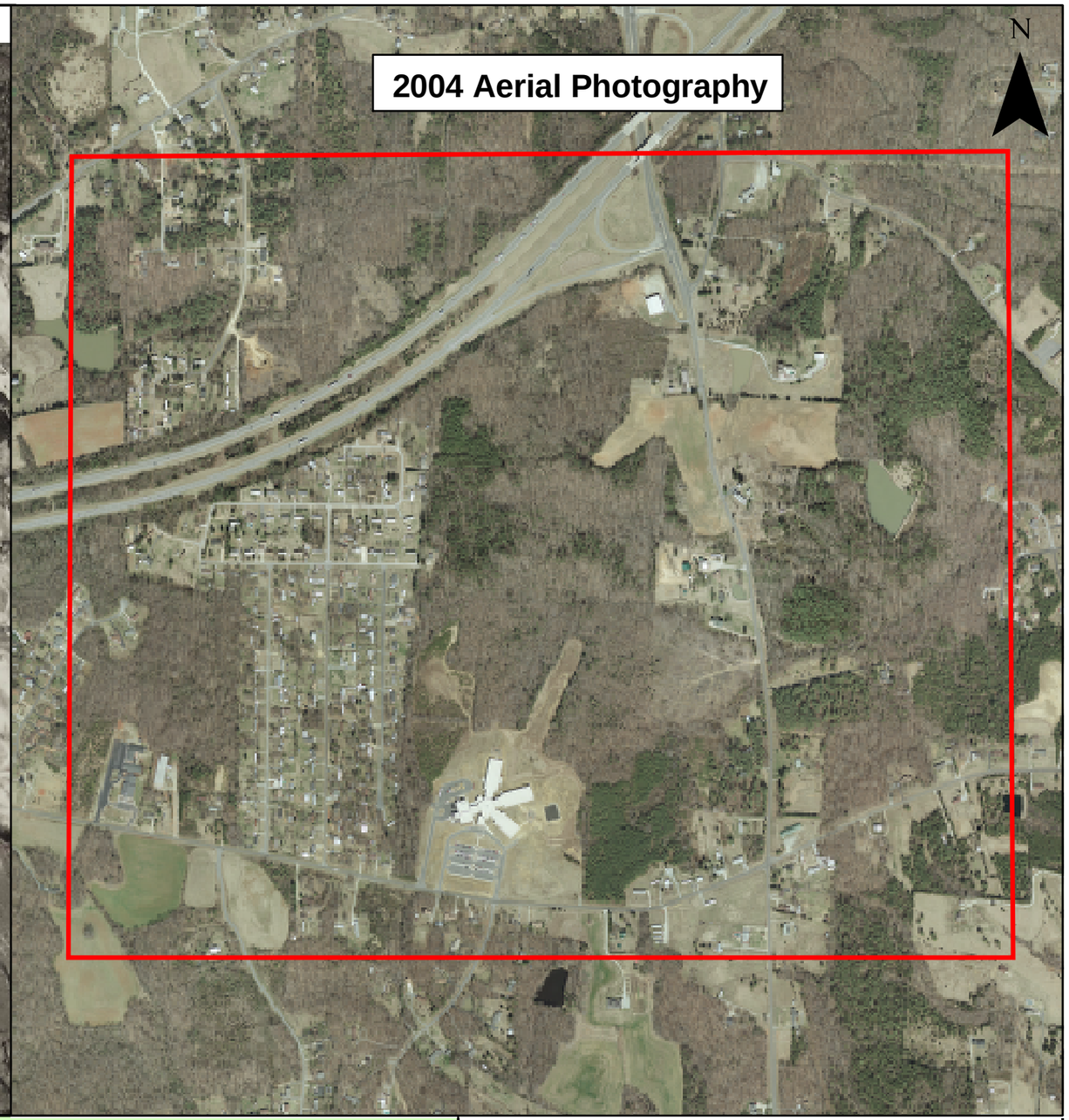


Figure 6.6: Aerial Photography
Trinity 1957 and 2004
Upper Uwharrie River Watershed

0 500 1,000 2,000 3,000 Feet





Ecosystem Enhancement Program

Local Watershed Plan for the Yadkin River Basin: Upper Uwharrie River Watershed

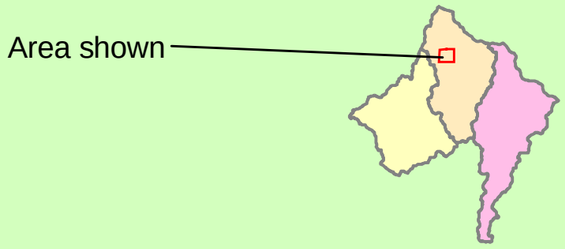


Figure 6.7: Aerial Photography
Trinity 1957 and 2004
Upper Uwharrie River Watershed

0 500 1,000 2,000 3,000 Feet

While land use within the Little Uwharrie River watershed remains predominantly agricultural, there has been an increase in residential development over time, particularly in the northwest portion of the HU. Residential growth associated with the expansion of the Cities of Thomasville and Trinity is largely responsible for the observed changes in land use.

6.7 Land Use Trends

The 1957 aerial photography described in Section 6.6 was used to estimate the conversion of forested and agricultural land to residential and urban uses within the study area. This land use change is indicative of an increase in impervious cover and associated decrease in hydrology, water quality, and habitat functions. Table 6.7 presents the percent change in land use by HU and subwatershed (see Section 9 for a description of subwatersheds). Figure 6.8 shows the areas that were converted to urban uses. It is important to note that the 1957 photography only covers a portion of the study area. Therefore, the percent of land converted to urban uses only addresses the area shown in the 1957 photography. The land use conversion is likely similar in areas not shown.

Table 6.7 Conversion of Agriculture and Forested Lands to Urban Uses between 1957 and 2004

Subwatershed	Percent Shown in 1957 Aerial Photography	Percent Conversion to Urban Land Use
Little Uwharrie River HU	34	469
Upper Little Uwharrie River - Residential	67	1,301
Upper Little Uwharrie River - Rural	52	353
Brier Creek	3	*
Upper Brier Creek/Plummers Creek	14	475
Lower Little Uwharrie River	65	107
Uwharrie River HU	78	184
Upper Uwharrie River	91	179
Middle Uwharrie River -Mixed-Use	97	282
Middle Uwharrie River -Residential	100	390
Middle Uwharrie River -Rural	100	27
Lower Uwharrie River -Rural	67	138
Lower Uwharrie River -Residential	0	*
Caraway Creek HU	83	280
Upper Caraway Creek	100	857
Middle Caraway Creek -Rural Mainstem	100	144
Middle Caraway Creek -Rural Tributaries	99	9
Little Caraway Creek	69	153
Middle Caraway Creek -Forested	82	25
Lower Caraway Creek	72	0

* Aerial photography did not sufficiently cover this area to allow calculation of land use change.

N

High Point

Thomasville

Archdale

Trinity

85B

85

62

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49

Upper Uwharrie River

Middle Uwharrie River Residential

Middle Uwharrie River Rural

Middle Uwharrie River Mixed-Use

Upper Little Uwharrie River Residential

Upper Little Uwharrie River Rural

Lower Uwharrie River Rural

Upper Caraway Creek

Middle Caraway Creek Rural Mainstem

Middle Caraway Creek Rural Tributaries

Middle Caraway Creek Forested

Little Caraway Creek

Lower Uwharrie River Residential

Lower Little Uwharrie River

Brier Creek

Brier Creek/ Plummers Creek

Lower Caraway Creek

Little Uwharrie River

Caraway Creek

Little Caraway Creek

Brier Creek

Flat Swamp Creek

Uwharrie River

Little River

LEGEND

- Subwatershed Boundary
- Area Covered by 1957 Aerial Photographs
- Agricultural/Forested Land Converted to Urban Uses

Figure 6.8: Land Converted to Urban Uses between 1957 and 2004

0 0.5 1 2 3 Miles

Ecosystem Enhancement Program

Local Watershed Plan for the Yadkin River Basin: Upper Uwharrie River Watershed

7 TIP Projects and Potential Stream and Wetland Impacts

7.1 Roads, Infrastructure, and Development

The NC Department of Transportation (NCDOT) draft 2006-2012 Transportation Improvement Program (TIP) lists five projects in the Upper Uwharrie River watershed (NCDOT, 2001, in press). These projects are listed in Table 7.1 and shown in Figure 7.1. Within the study area, all of the projects are identified as post year, which means they are not funded during 2006-2012 and their anticipated construction date is uncertain.

Table 7.1 Projects Listed in the 2002-2008 Transportation Improvement Program

TIP No.	Route	Description	Comment
R-2606	US 311	New location freeway	Section within study area is slated for post year (>2012)
U-2537	Westside Thoroughfare	New location multi-lane	Project has been moved to post year (>2012)
R-2220	US 64	Widen to four lanes	Project has been moved to post year (>2012)
R-2808	US 29-70 and I-85 Bus	Safety improvements	Project has been moved to post year (>2012)
R-2535	NC 49	Widen to four lanes	Project has been moved to post year (>2012)

Source: NCDOT, in press

7.2 Anticipated Impacts

New Location Projects

Project R-2606 will relocate US 311 east of its current location and may cross a small piece of the Caraway Creek HU. The exact location of the highway in the HU and the type of stream crossings (e.g., culverts, bridges) required, if any, will not be determined until further into NCDOT's planning process.

Project U-2537 will provide a new multi-line thoroughfare east of Trinity in the Uwharrie River HU. The exact location of the thoroughfare in the HU and the type of stream crossings (e.g., culverts, bridges) required, if any, will not be determined until further into NCDOT's planning process.

Road projects that involve new location construction generate edge effects that extend beyond the roadway construction limits by changing the physical characteristics of the site. These altered characteristics include:

- Soil density (increased by compaction during construction)
- Temperature (increased due to a loss of vegetation)
- Soil water content (reduced due to soil compaction)
- Light (increased due to loss of canopy)
- Dust (increased as soil exposed to the elements)
- Surface water flow (increased soil compaction reduces infiltration and increases runoff)
- Pattern of runoff (increased in terms of volume and velocity)
- Sedimentation (increased by higher exposed surface and greater runoff velocity)

- Microhabitat changes (both terrestrial and aquatic) (Trombulak and Frissell, 2000; NCDWQ, 2003).

New location construction can encourage the spread of exotic species by providing habitat, altering conditions, making invasion more likely by stressing native species, and allowing easier movement by wild or human vectors. Road development can also increase the sediment load of streams in the project area. This increase can destroy habitat including spawning and rearing areas for fish, leading to suppressed population levels (USFS, 2003). These habitats may improve with time as accumulated sediment is transported downstream, allowing recolonization in the disturbed areas. However, such improvement is unlikely in streams where development follows road construction (Angermeier et al., 2004). For aquatic insects, recolonization may happen through downstream drift from undisturbed locations while fish may migrate upstream or down to repopulate a formerly disturbed area.

Road Widening Projects

Project R-2220 will widen US 64 to four lanes through the lower portions Caraway Creek and Little Uwharrie River HUs. The extent of the potential impacts of this project will depend on which side (north or south) is widened and other site-specific factors.

Project R-2535 will widen NC 49 to four lanes in a small section of the Caraway Creek watershed. The extent of the potential impacts of this project will depend on which side (east or west) is widened and other site-specific factors.

Road widening projects generally have fewer impacts than those involving new locations. Since a transportation corridor is already in place, concerns over the spread of invasive species are, to an extent, minimized. The changes to the physical properties of the area listed for new locations alternatives have already been encountered at the site. Both NC 49 and US 64 have been in place for many years, so any behavioral impacts on animal species in the area have already taken place. It is possible that widening may impact streams and wetlands in the area, and relocations of businesses or residences may be required. Widening also generally involves the removal of roadside vegetation, which can increase runoff to area streams.

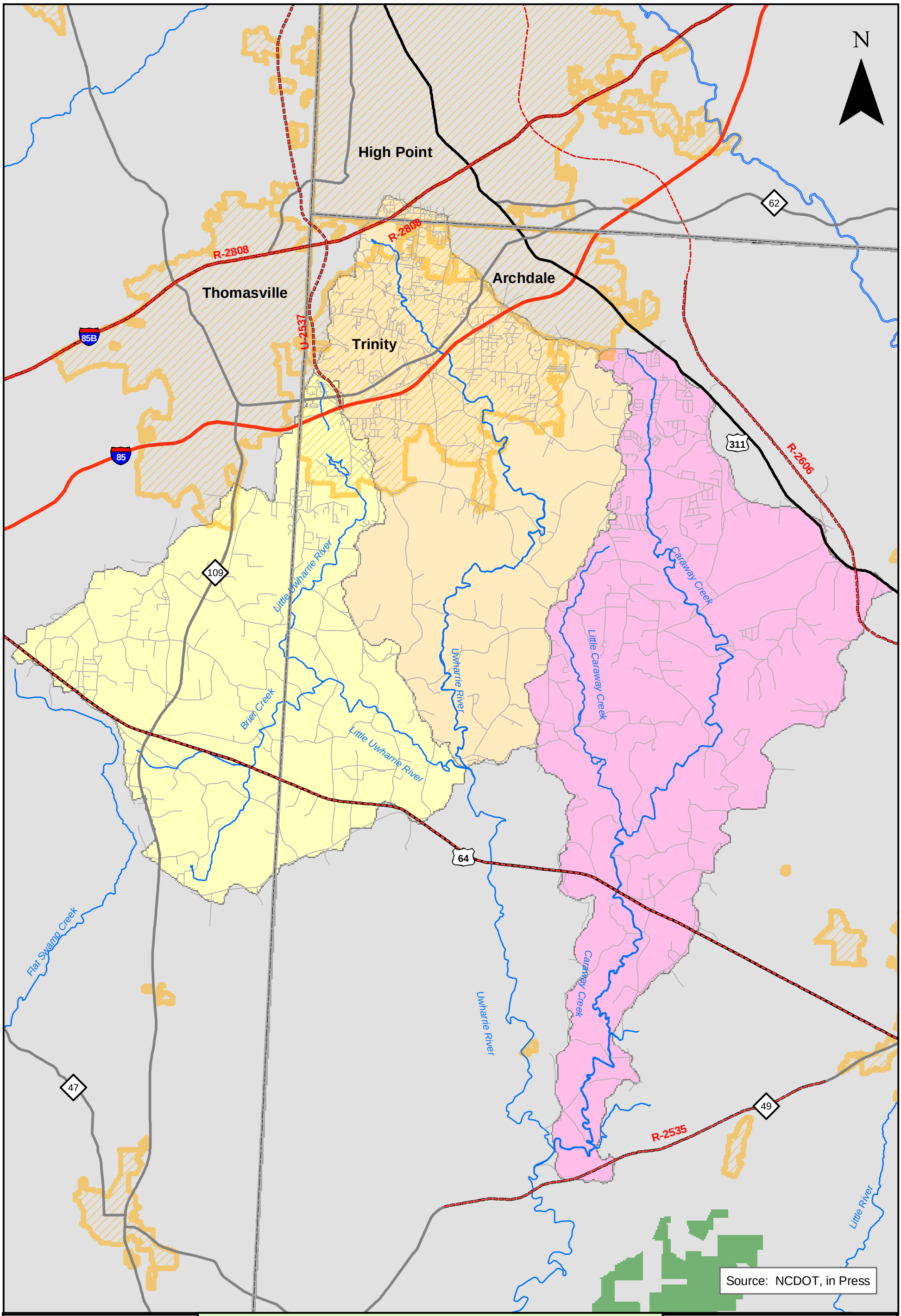
Safety Improvement Projects

Project R-2808 will involve safety improvements to US 29-70 and I-85 Business in the upper reaches of the Uwharrie River HU. These safety improvements (e.g., guard rails, signage) are unlikely to have an impact on water quality in the Uwharrie River HU. In general, safety improvement projects have limited impacts to water quality. In some cases, complete removal of vegetation is not required, minimizing potential changes in runoff.

7.3 Transportation Planning

Davidson, Guilford, and Randolph Counties, as well as the cities of Asheboro and High Point are members of the Piedmont Area Regional Transportation Authority (PART). The North Carolina General Assembly passed enabling legislation in 1997 that allowed the formation of a regional authority to assist in the development of transportation

systems for the Triad. In addition to roadways, PART evaluates bus systems, and passenger rail service. In an evaluation of commuting patterns, PART listed the area between High Point and Davidson County as a potential major transit corridor. This could impact the headwaters of the Uwharrie River.



Ecosystem Enhancement Program

Local Watershed Plan for the Yadkin River Basin: Upper Uwharrie River Watershed

LEGEND

- Draft 2006-2012 TIP Projects in Watershed
- Streams
- Counties
- Municipal Boundaries
- Little Uwharrie River HU
- Uwharrie River HU
- Caraway Creek HU

Figure 7.1: TIP Projects
Upper Uwharrie River Watershed

0 0.5 1 2 3 Miles

8 Applicable Local and State Programs

The cities of Archdale, High Point, Thomasville, and Trinity, and Davidson and Randolph Counties have jurisdiction over land use in the project watershed (see Table 8.1). These governments have zoning and land use restrictions that affect how development occurs. In some cases, these jurisdictions have specific zoning, sediment control, and/or storm water-related rules and programs that address watershed protection. These rules and programs are outlined below. This information will be helpful later in the local watershed planning process in making recommendations for new ordinances and programs to improve and protect watershed functions.

Table 8.1 Project Area Municipalities

Municipality	Acres in Project Area	Square Miles in Project Area	Percentage of Project Area
Randolph	57,726.24	90.17	67.06%
Davidson	16,462.00	25.71	19.12%
Trinity	10,679.92	16.68	12.41%
Thomasville	165.89	0.26	0.19%
High Point	378.72	0.59	0.44%
Archdale	670.95	1.05	0.78%
	86,083.72	134.46	100.00%

8.1 Randolph County

The Randolph County Department of Planning and Zoning is responsible for the administration of a comprehensive planning program designed to protect the public health, safety, and welfare by maintaining quality and sustainable growth within Randolph County. The department manages the administration and enforcement of the Unified Development Ordinance which includes zoning, watershed, and flood damage prevention regulations.

The Randolph County Unified Development Ordinance contains zoning districts and corresponding conditional use districts. The majority of the county is presently zoned Residential Agricultural. The purpose of this district is to provide a place for agricultural operations, forestry, and small amounts of non-farm residences on traditional rural lots while preserving rural open space and Natural Heritage resources. To maintain rural character, only minor conventional residential subdivisions are allowed in this district. Requests for higher intensity residential use are considered through standards established in the Unified Development Ordinance, in accordance with the Randolph County Growth Management Plan (Randolph County, 2002). The plan is not a detailed, lot by lot, site-specific land use plan as reflected by zoning maps. Instead, the plan prepares broad policy statements that form an overall growth management philosophy for Randolph County. The plan is described below.

Area 1: Primary Growth Area
This primary county growth area is located adjacent to municipal limits or regulatory areas and generally extends along major urban/transportation corridors within the county. It includes areas that are likely to have access to urban infrastructure services, such as water and sewer, within the foreseeable future. The Primary Growth Area is of predominately mixed use that will include residential, commercial and industrial development. Higher urban type density level can be anticipated in this area.

Area 2: Secondary Growth Area
Transitional residential development is predominant in this area with major subdivisions scattered between agricultural and commercial land use patterns. Both public water and sewer infrastructure access is unlikely within the immediate future. The availability of large undeveloped tracts can substantially alter the development character of established residential areas.

Area 3: Rural Growth Area
This specialized area is characterized by traditional agricultural operations, pasture land, forestry, and open space scattered non-farm residences on large tracts of land. Rural scenic vistas are a natural part of the landscape. There is normally a relative abundance of large, undeveloped tracts not experiencing significant residential development encroachment or pressures. There are natural, scenic, historic or other heritage assets that contribute to the special characteristics of the area that might require special conservation and management.

Area 4: Watershed Environmental Area
This area is of mixed density and impervious surface coverage and is regulated by North Carolina Watershed development laws. Primary development considerations are to protect public drinking water supplies. Unlike other growth areas, Watershed Environmental Areas overlay parts of all the other growth management designations.

Area 5: Zoological Park Environmental Area
This specialized growth area was established in 1973 and includes the property occupied by the NC Zoo, and a special zoning area extending from one to two miles from the zoo boundary. The purpose of this designation is to provide an area surrounding the zoo for a mixture of relatively low-density land uses emphasizing the retention of natural features and the preservation of a rural setting. Land uses in this area are intended to enhance and preserve the character of the zoo site.

Area 6: Municipal Growth Area
This growth area is contained within the corporate limits or extraterritorial planning and zoning jurisdictions of municipalities located within Randolph County. Mixed high-density urban growth is anticipated in these planning areas. Coordinated planning for land use, transportation, water and sewer infrastructure, scenic heritage asset preservation, and economic development is strongly encouraged between the county and the municipalities.

Randolph County's Watershed Ordinances define the areas lying within one-half mile of the high water mark of water supplies as Water Quality Critical Areas. Residential

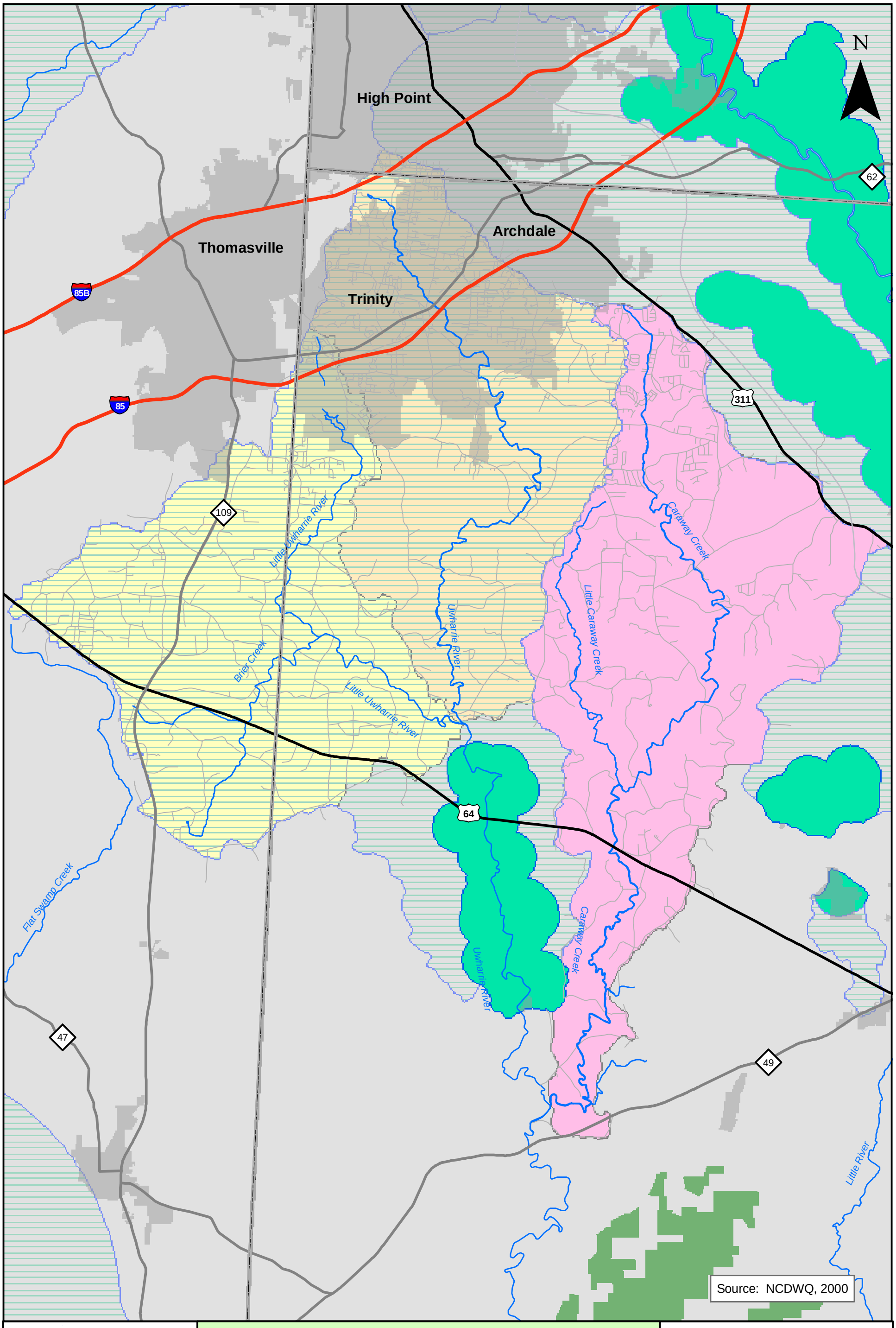
development in these critical areas is limited to one dwelling per two acres. Industrial development is not permitted, but commercial, educational, recreational and institutional uses are allowed as long as the built-upon area of each lot does not exceed six percent. In the balance of the watershed, a maximum of two dwelling units per acre is permitted if the area is supplied with city sewer or one unit per 40,000 square feet if there is no public sewer available. Impervious surface coverage in the balance of the watershed is limited to 24 percent for industrial, commercial and institutional uses. To facilitate economic development, Randolph County has adopted the 10/70 provision allowed by state Water Supply Watershed Protection Rules, where 10 percent of any balance of a watershed area that lies within any one jurisdiction may have 70 percent built-upon coverage. Water supply watersheds for the study area are shown in Figure 8.1.

Randolph County requires riparian buffer zones to be maintained in all watersheds for all development activities. A minimum distance of fifty feet of vegetative buffer is required for all perennial waters indicated on USGS topographic maps. Should the waters not be indicated on the USGS maps, but be determined as perennial waters by local government studies, then the buffer zone regulation applies. No new development is allowed inside the buffer zones except for water dependent structures and public projects such as road crossings and greenways where no practical alternative exists. Desirable artificial stream bank and shoreline stabilization are permitted.

Randolph County flood hazard areas are subject to periodic inundation which can result in loss of life, property, health, and safety hazards, disruption of commerce and governmental services, and extraordinary public expenditures of flood protection. The County's Flood Damage Prevention Ordinance restricts activities that are dangerous to health, safety, and property due to water or erosion hazards or which result in damaging increases in erosion or in flood heights. Flood hazard areas for the Upper Uwharrie River watershed, as identified by the Federal Emergency Management Agency (FEMA), are depicted in Figure 8.2.

Randolph County adopted their Land Use Plan in 1987. The plan calls for the majority of watershed areas to be zoned rural/residential to ensure low-density development. More intensive development is directed to established urban areas where public services may be more readily available. Land use plans for the Upper Uwharrie River watershed are shown in Figure 8.3.

Another method Randolph County uses to preserve the rural makeup of the county is the establishment of Voluntary Agricultural Districts (VAD) (see Figure 8.4). These specialized Agricultural Districts are allowed under North Carolina law so that development and growth will be accompanied by protection of farms from non-farm development. The VAD is a way of recognizing the importance of agriculture to the economic and cultural life of Randolph County. A VAD must consist of at least twenty contiguous areas of qualified farmland or two or more tracts of qualifying farmland that contain a minimum total of 20 acres and are located within one-half mile of each other. Within the district, non-farm use or development of the land is prohibited for ten years. The property owner may voluntarily revoke the agreement in writing to the County Agricultural Advisory Board.



Ecosystem Enhancement Program

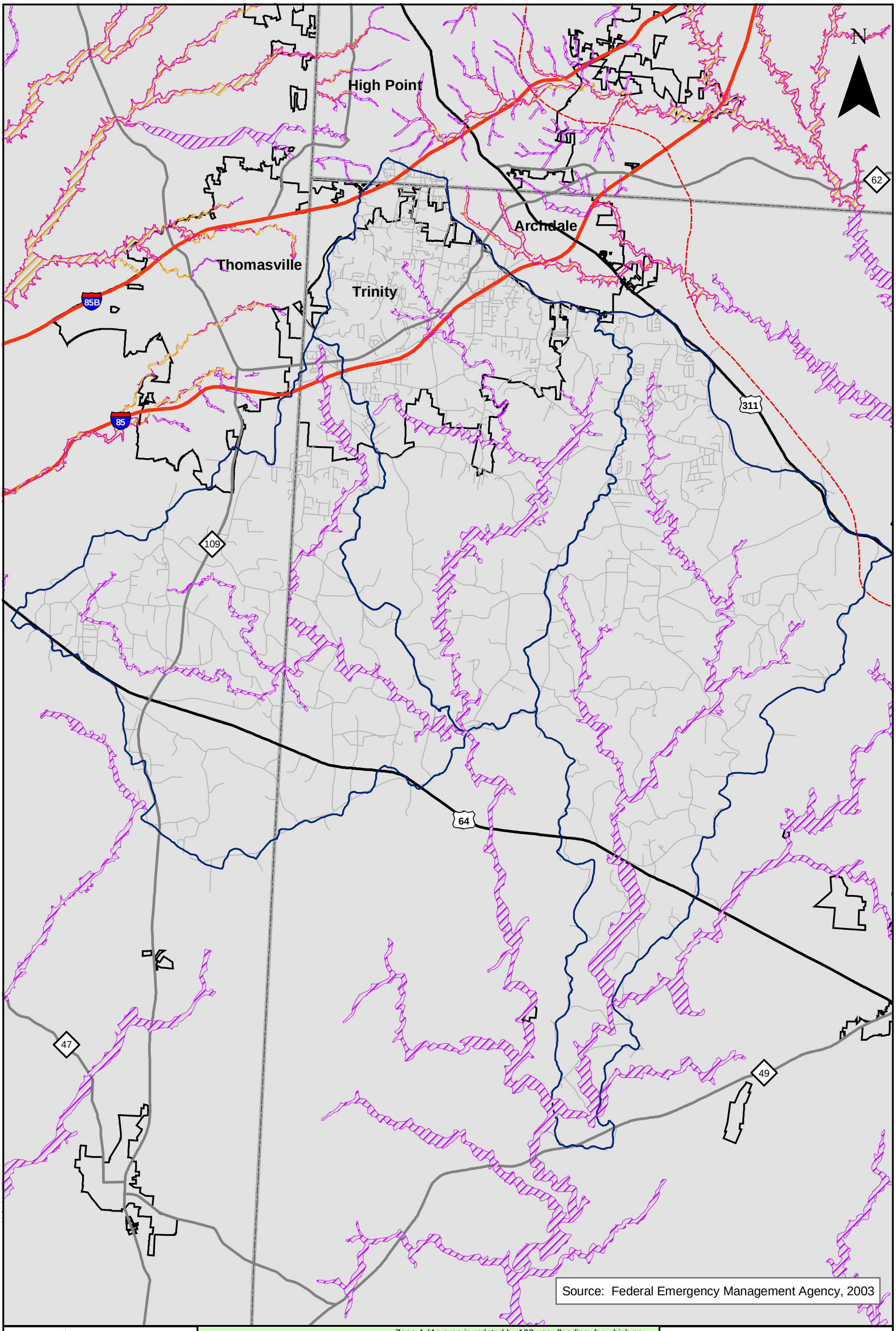
Local Watershed Plan
for the Yadkin River Basin:
Upper Uwharrie River Watershed

LEGEND

- Streams
- Counties
- WSW Critical Area
- WSW Protected Area
- Little Uwharrie River HU
- Uwharrie River HU
- Caraway Creek HU

Figure 8.1: Water Supply Watersheds
Upper Uwharrie River Watershed

0 0.5 1 2 3 Miles



Ecosystem Enhancement Program

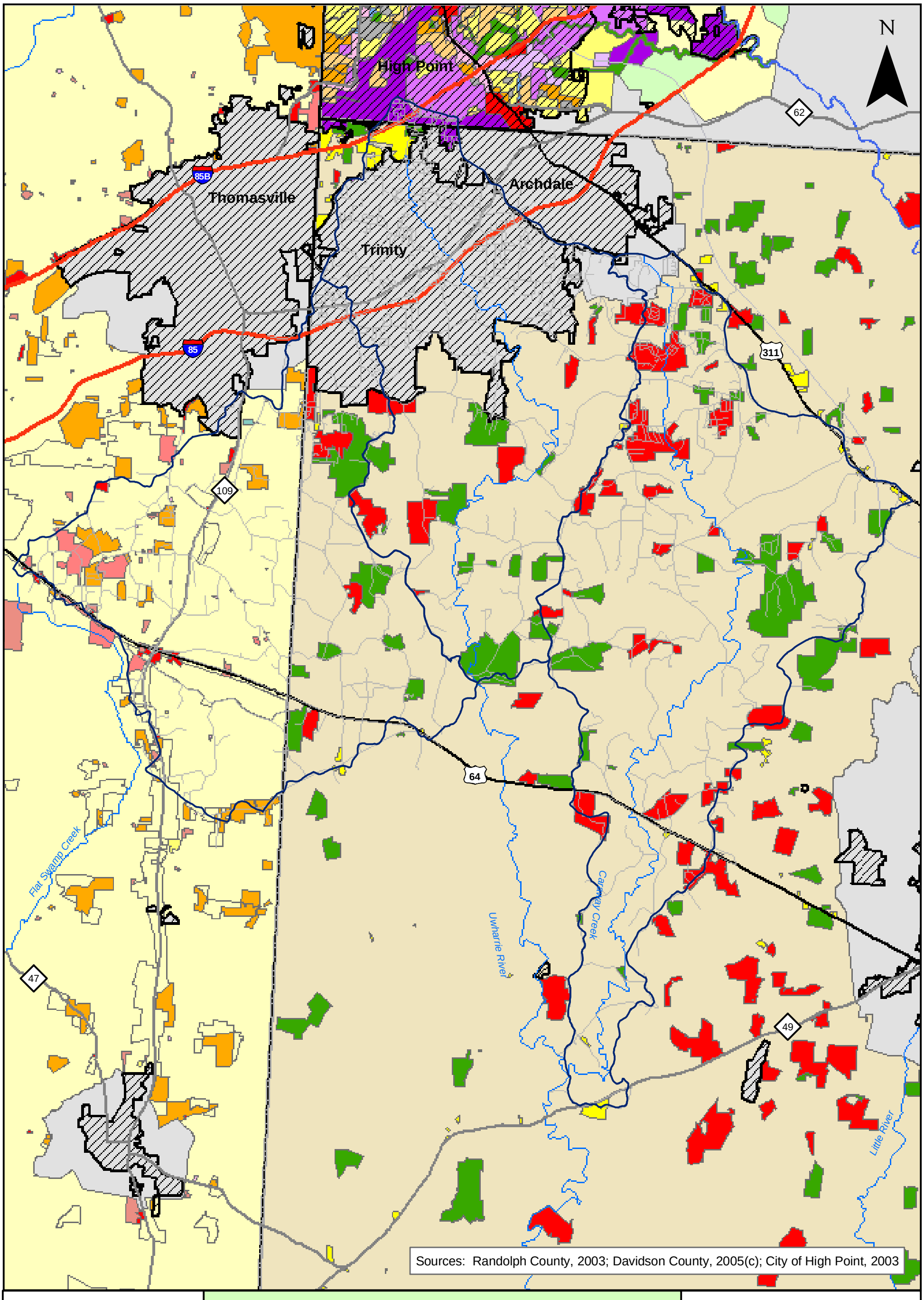
Local Watershed Plan
for the Yadkin River Basin:
Upper Uwharrie River Watershed

LEGEND

- Study Area HUs
- Counties
- Roads
- Municipal Boundaries
- Zone A (An area inundated by 100-year flooding, for which no base flood evelations (BFEs) have been determined)
- Zone AE (An area inundated by 100-year flooding, for which BFEs have been determined)
- Zone X500 (An area inundated by 500-year flooding; an area inundated by 100-year flooding with average depths of less than 1 ft or with drainage areas less than 1 sq mi; or an area protected by levees from 100-year flooding)

Figure 8.2: FEMA Map
Upper Uwharrie River Watershed

0 0.5 1 2 3 Miles



Ecosystem Enhancement Program

Local Watershed Plan
for the Yadkin River Basin:
Upper Uwharrie River Watershed

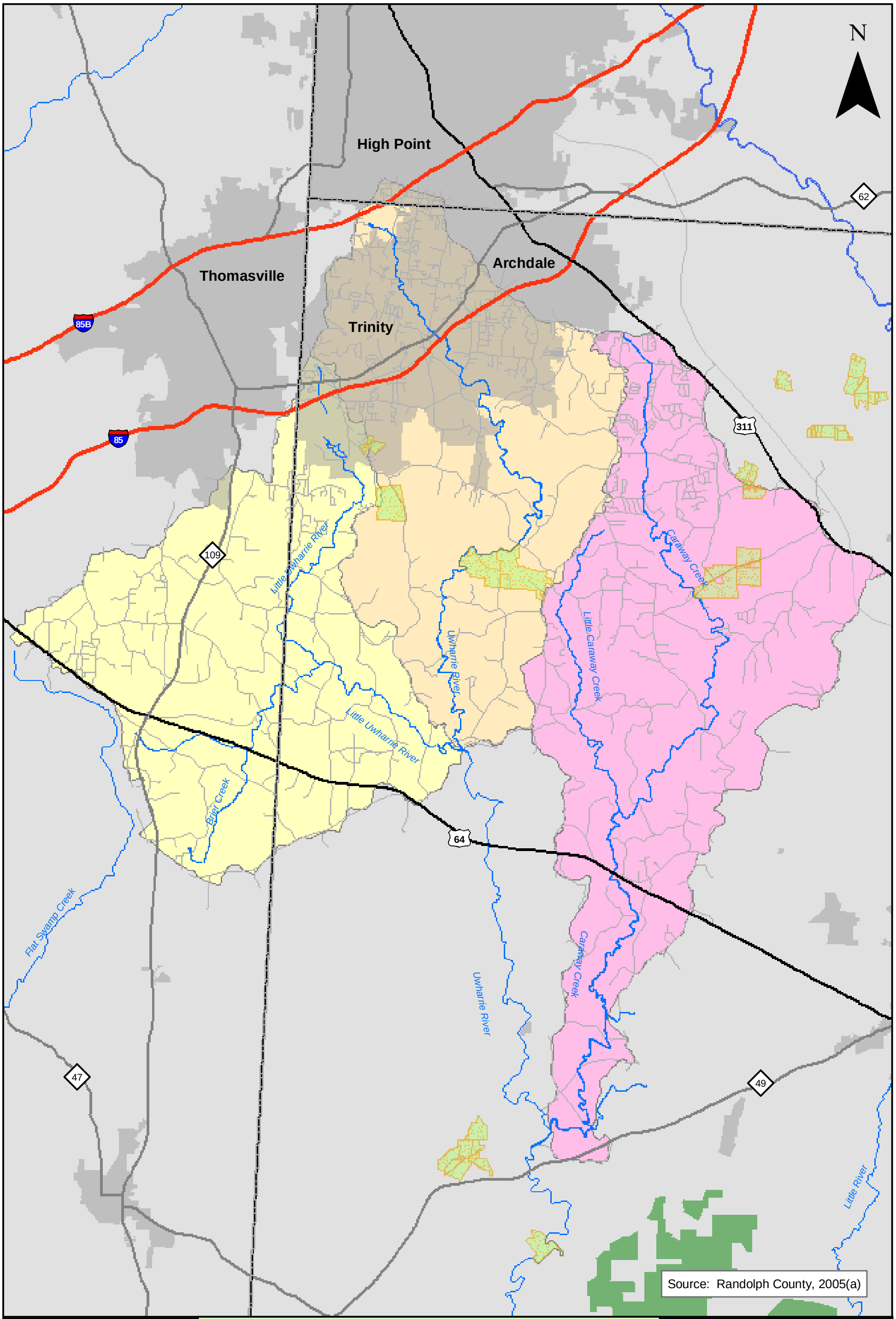
Randolph Co Growth Trends
- Commercial/Industrial
- Manufactured Housing
- Site Built Development
- Zoo Zoning District
- Undefined

Davidson Zoning
- Industrial/Commercial
- Rural Agricultural
- Residential

High Point Land Use Plan (2000)
- Rural Development
- Low-Density Residential
- Moderate-Density Residential
- Medium-Density Residential
- High-Density Residential
- Office
- Local/Convenience Commercial
- Community/Regional Commercial
- Restricted Industrial
- Light Industrial
- Heavy Industrial
- Institutional
- Recreation/Open Space
- Future Growth Area
- Municipal Boundary

Figure 8.3: Land Use Plans
Upper Uwharrie River Watershed

0 0.5 1 2 3 Miles



Ecosystem Enhancement Program

Local Watershed Plan
for the Yadkin River Basin:
Upper Uwharrie River Watershed

LEGEND

- Streams
- Counties
- Voluntary Agricultural Districts
- Little Uwharrie River HU
- Uwharrie River HU
- Caraway Creek HU

Figure 8.4: Randolph County
Voluntary Agricultural Districts
Upper Uwharrie River Watershed

0 0.5 1 2 3 Miles

Randolph County adopted a countywide stormwater management plan in 2000. Their program includes a watershed protection public education program, identification and removal of illegal discharges, and identification of suitable locations for potential storm water retrofits (Randolph County, 2000). The county has joined thirteen other local governments in the region to form the Piedmont Water Quality Partnership to implement the public education component of their plan.

8.2 Davidson County

Davidson County has jurisdiction over 25 square miles within the Little Uwharrie River HU and has adopted a zoning ordinance, land development plan, and watershed protection ordinance that are applied countywide (Davidson County, 2005(b); Davidson County, 2002, and Davidson County, undated; respectively). The study area is zoned primarily as Residential Agricultural and, based on the county's land use plan, is not currently highlighted for development. Because this section of the study area is part of the Lake Reece Watershed, the area is also regulated by the county's Watershed Ordinances. These ordinances are primarily consistent with the State of North Carolina's standards set for a WS-III water supply watershed, except that they require 40,000 square feet for one residential unit, compared to the state's standard of 20,000 square feet for one residential unit.

Table 8.2 North Carolina State Standards for a WS-III Water Supply Watershed

	Low Density Option	High Density Option	10/70 Provision	Storm water Control
Critical Area	• 1 dwelling unit/ acre or 12 percent built-upon area • Vegetated riparian buffer no less than 30 feet	• 12 – 30 percent built-upon area • Vegetated riparian buffer no less than 100 feet	Not allowed	12-30 percent built-upon area must control first one-inch of rainfall
Balance of Watershed	• 2 dwelling units/acre or 24 percent built-upon area • Vegetated riparian buffer of no less than 30 feet	• 24 – 50 percent built-upon area • Vegetated riparian buffer of no less than 100 feet	• Allowed • Vegetated riparian buffer of no less than 100 feet	24-50 percent built-upon area must control first one-inch of rainfall

Davidson County has voluntarily begun implementing the same storm water management requirements as their neighbors who are included in the federally mandated National Pollutant Discharge Elimination System (NPDES) Phase II storm water program. The county's plan includes: public education and outreach, public involvement and participation, illicit discharge detection and elimination, construction and post construction site runoff controls, and pollution prevention for municipal operations.

8.3 Guilford County

While no formal cooperative agreement exists between Guilford County and the City of High Point, development within the study area is controlled by the city. [Note: Guilford County constitutes a very small portion of the LWP study area, less than 0.5% in the headwaters region of the Upper Uwharrie River HU.]

8.4 City of Trinity

Since the City of Trinity's incorporation in 1997, they have adopted zoning, flooding, and watershed protection ordinances. The provisions of these ordinances apply within the corporate limits of the City of Trinity and within any area adjacent to the City limits within which the city may exercise extraterritorial jurisdiction.

At the time of adoption of Trinity's initial zoning ordinance, considerable land in the area was zoned Residential Agricultural. This was a carryover from its Randolph County zoning classification. This classification provides a place for agricultural operations and scattered non-farm residences on traditional rural lots. Only minor conventional residential subdivisions (three or fewer lots) are allowed in this district. Requests for higher intensity residential use or other uses in this area are handled through the rezoning process.

The city's watershed ordinance is consistent with the state standards for a WS-III water supply watershed as it permits two dwelling units per acre or twenty-four percent built-upon area. The exception is the Trin-Thom Development Zoning District where ten percent of the watershed may have a seventy percent built-upon area when approved by the city council as a Special Nonresidential Intensity Allocation (SNIA).

The City of Trinity has adopted riparian buffer standards stricter than the minimum state WS III standards of thirty feet. Trinity requires a minimum distance of fifty feet of vegetative buffer for all perennial waters indicated on USGS topographic maps. Should the waters not be indicated on the USGS maps, but be determined as perennial waters by local government studies, then the buffer zone regulation applies. No new development is allowed inside the buffer zones except for water-dependent structures and public projects such as road crossings and greenways where no practical alternative exists. Desirable artificial stream bank and shoreline stabilization are permitted.

Areas in Trinity that are subject to periodic inundation are designated as Flood Hazard Areas. Flooding of these areas could result in loss of life and property, health and safety hazards, disruption of commerce and governmental services, public expenditures for flood protection and relief, and impairment of the tax base, all of which adversely affect the public health, safety and general welfare. As a result, except for streets, bridges, and utilities, Trinity's flood damage prevention ordinance prohibits encroachments in hazard areas. Activities prevented include fill, new construction, and substantial improvements, unless certification is provided by a registered professional engineer demonstrating that such encroachments shall not result in any increase in flood levels during base flood discharge.

Trinity was designated by the US Environmental Protection Agency (EPA) for inclusion in the NPDES Phase II storm water program. The program's requirements include: public education and outreach, public involvement and participation, illicit discharge detection and elimination, construction and post construction site runoff controls, and pollution prevention for municipal operations.

The City has contracted with the Piedmont Triad Council of Governments to develop a land use plan for the city. The plan is scheduled to be completed in the spring of 2006.

8.5 City of Thomasville

The City of Thomasville annexed its extra-territorial jurisdiction (ETJ) in 2003; therefore, the city's development regulations are applicable to the current city limits only. Thomasville must go before the Davidson County Commissioners in order to acquire additional ETJ in the future.

The city's development regulations include zoning ordinances and watershed ordinances. Thomasville's jurisdiction within the project area is located completely within the Lake Reese Watershed and falls under the City's watershed ordinances (see Figure 8.1). These ordinances are consistent with the State of North Carolina's standards set for a WS-III watershed. Thomasville has adopted to use the 10/70 provision in this watershed. Storm water controls are not required under this provision.

Thomasville was designated by EPA for inclusion in the NPDES Phase II storm water program. The program's requirements include: public education and outreach, public involvement and participation, illicit discharge detection and elimination, construction and post construction site runoff controls, and pollution prevention for municipal operations.

8.6 City of High Point

The City of High Point's Planning and Development Department developed the city's land use plan. The plan establishes the future land use pattern for High Point's planning area based on the policy document adopted by High Point City Council in April 2000 (see Figure 8.3). High Point's jurisdiction within the project area is classified as a combination of light and heavy industrial. Light industrial uses include general manufacturing, wholesaling, warehousing, and research and development uses. The heavy industrial classification includes the whole range of assembling, fabricating, and heavy manufacturing activities, some of which have significant environmental impacts and require special measures to ensure compatibility with adjoining properties.

High Point's planning area includes the City's current jurisdiction and adjacent locations that are governed by annexation agreements with the neighboring cities. An annexation agreement is a legal agreement that defines territory that each participating municipality may not annex within a specific timeframe. The agreement sets limits on each municipality's future annexation into an area, thus establishing its potential future jurisdiction. The agreement, however, does not obligate a municipality to undertake annexations. High Point has an annexation agreement with Archdale, Greensboro,

Jamestown, and Thomasville; however, they do not have an annexation agreement with Trinity.

The city's development ordinance, which was first adopted in 1992, includes regulations governing: watershed protection overlay districts, greenways, soil erosion and sedimentation control, and flood damage prevention. High Point's jurisdiction within the project area is completely within the Lake Reese watershed protection overlay district. The development standards in this district are consistent with those set by the State of North Carolina for a WS-III water supply watershed (see Table 8.2). High Point has chosen to implement the 10/70 provision in the Lake Reese Watershed, where ten percent of the local jurisdiction's portion of this watershed may be developed with new nonresidential development at up to seventy percent built-upon area. Development under these provisions requires engineered storm water controls. The city also allows land donated to and accepted by the City of High Point in fee-simple for the expressed purpose of establishing a public greenway to be credited toward the donating parcel, lot, or tract area for the purpose of calculating the density of development and area coverage calculations though no longer part of the parcel.

All new development in a Watershed Critical Area (WCA) Overlay District or General Watershed Area (GWA) Overlay District, including grading, paving, gravel placement, and construction of buildings and other structures must comply with the procedural, design, and construction requirements of the ordinance (unless exempted within the ordinance). The ordinance establishes a 100-foot buffer for perennial streams, lakes, and ponds, and a 50-foot riparian buffer for intermittent streams for high-density development within the Uwharrie River watershed contributing to Lake Reese. For low-density development, a 30-foot buffer is recommended for perennial streams, lakes, and ponds, and no buffer is required for intermittent streams (City of High Point, 2004).

High Point has adopted a Soil Erosion and Sedimentation Control Ordinance to prevent water pollution from sedimentation, prevent accelerated erosion of waterbodies, and prevent damage to property from sedimentation. The ordinances requires a soil erosion and sedimentation control plan and land-disturbing permit if the land-disturbing activity: exceeds one acre, takes place in highly erodible soils, includes a pond or retention structure in a watershed critical area, or will take place in Tier 1 or Tier 2 of a watershed critical area.

The city has designated areas which are subject to periodic inundation as flood hazard areas. The flooding of these areas could result in loss of life and property, health and safety hazards, disruption of commerce and governmental services, extraordinary public expenditures for flood protection and relief, and impairment of the tax base, all of which adversely affect the public health, safety and general welfare. As a result, except for streets, bridges, and utilities, High Point's flood damage prevention ordinance prohibits encroachments in these designated areas. Activities prevented include fill, new construction, and substantial improvements, unless certification is provided by a registered professional engineer demonstrating that such encroachments shall not result in any increase in flood levels during base flood discharge.

High Point was designated by the EPA for inclusion in the NPDES Phase II storm water program. The program's requirements include: public education and outreach, public involvement and participation, illicit discharge detection and elimination, construction and post construction site runoff controls, and pollution prevention for municipal operations.

8.7 City of Archdale

The City of Archdale's Planning Department is responsible for the administration and enforcement of development regulations throughout the city limits and zoning limits. The city's development regulations include zoning ordinances and watershed ordinances. Within the project boundary, Archdale's jurisdiction falls completely within the Lake Reese watershed and, therefore, development in that area must comply with the city's watershed ordinances. These ordinances are consistent with the State of North Carolina's standards set for a WS-III water supply watershed (see Table 8.2).

Archdale was designated by the EPA for inclusion in the NPDES Phase II storm water program. The program's requirements include: public education and outreach, public involvement and participation, illicit discharge detection and elimination, construction and post construction site runoff controls, and pollution prevention for municipal operations.

9 Subwatershed Characterization

9.1 Subwatershed Delineation

After the collection of existing land use, natural resource, and water quality data and the completion of an initial visual assessment, Buck Engineering performed a preliminary delineation of subwatersheds. This involved dividing each of the three study HUs into smaller drainage areas for the purposes of summarizing data and planning future assessment work (Figure 9.1). Although the subwatershed boundaries follow topographic features, the delineation was also based on other factors such as land use/land cover, zoning ordinances, elevation, riparian buffer condition, and Natural Heritage occurrences. The delineation created as homogeneous subwatersheds as possible given the variety of conditions in the watershed and the need to have a manageable number of subwatersheds.

9.2 Subwatershed Description

An atlas of subwatersheds within the project area is included as Appendix C. The three study HUs were divided into 18 subwatersheds ranging in size from 2.2 to 14.9 square miles. The subwatershed maps in Appendix C include location information and aerial photography for each of the subwatersheds, along with a summary of land use, description of watershed morphology, and discussion of positive features or obvious problems. This information will be used to initially describe habitat, hydrology, and water quality functional losses and identify major issues and potential priority areas.

N

High Point

Thomasville

Archdale

Trinity

62

85B

85

311

109

64

47

49

Little Uwharrie River

Brier Creek

Caraway Creek

Little Caraway Creek

Flat Swamp Creek

Uwharrie River

Little River

Ecosystem Enhancement Program

Local Watershed Plan
for the Yadkin River Basin:
Upper Uwharrie River Watershed

Subwatersheds

- Up Ltl Uwharrie Riv Rural
- Up Ltl Uwharrie Riv Resid.
- Brier Creek
- Brier Creek/Plummers Ck
- Lower Ltl Uwharrie Riv
- Lower Uwharrie Riv Resid.
- Up Uwharrie Riv
- Mid Uwharrie Riv Mixed-Use
- Mid Uwharrie Riv Resid.
- Mid Uwharrie Riv Rural
- Lower Uwharrie Riv Rural
- Up Caraway Ck
- Mid Caraway Ck Forested
- Mid Caraway Ck Rural Mainstem
- Mid Carway Ck Rural Tribes
- Ltl Caraway Ck
- Lower Caraway Ck

Figure 9.1: Preliminary Delineation
of Subwatersheds
Upper Uwharrie River Watershed

0 0.5 1 2 3 Miles

Chapter 2
Data Assessment and Subwatershed Summary

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1 Data Assessment

1.1 Visual Assessment Protocol

Buck Engineering performed a windshield survey between May 2005 and July 2005 to document general watershed conditions in the study area. Thirty-one representative mainstem sites and 26 representative headwater sites were then selected from all road-crossings in the study area (Figure 1.1). Sites were selected that exhibit typical land use and stream condition for that portion of the watershed. Areas that lacked road crossings were not assessed. At one location, access to the property was denied and an assessment could not be conducted.

Mainstem sites had drainage areas of at least 2.5 square miles and typically made up a series of sites along major drainages such as the Uwharrie River, Little Uwharrie River, and Caraway Creek. Where practical, each mainstem site was paired with a smaller headwater site within its drainage area. In general, headwater sites had a drainage area of less than 2.5 square miles.

The selected mainstem and headwater sites were then visited and assessed in terms of the following variables:

- habitat function – aquatic habitat and existing riparian vegetation variables
- hydrology and geomorphic stability function – lateral (bank) stability and vertical stability variables
- water quality function – human impacts, temperature/shading, clarity, and odor variable (treated collectively).

These conditions were evaluated using a visual assessment scoring form that merged the US Army Corps of Engineer's Stream Condition Assessment form with other applicable assessment protocols (Appendix D). Watershed assets and problems were also noted at the sites. For example, the presence of sensitive species was noted as an asset, while channelization or inadequate riparian buffers were noted as problems. Photographs and GPS points were also taken at each assessment site.

1.2 Scoring

Multiple attributes were scored on a scale of one to twelve for each of the variables, with higher scores indicating greater stream function. For example, the riparian vegetation variable had metrics that addressed both the width of the buffer, the presence of trees and understory species, and impacts associated with invasive species. The attributes were averaged to generate a score for each of the five variables. A total score was then generated for each site by summing the habitat, hydrology, and water quality average scores. The data are included in a matrix in Appendix D.

Each subwatershed was evaluated based on the scoring for the assessment sites located within it. The number of assessment sites within the subwatersheds varied from one to five based on the size of the subwatershed and number of road crossings. An average of the total scores for the sites was generated to allow a comparison of the subwatersheds and prioritization of restoration and preservation opportunities (Table 1.1).

Table 1.1 Average Visual Assessment Scores for Project Subwatersheds

Subwatershed	Average Score
Little Uwharrie River HU	
Upper Little Uwharrie River - Residential	33
Upper Little Uwharrie River - Rural	35
Brier Creek	49
Upper Brier Creek/Plummers Creek	47
Lower Little Uwharrie River	37
Uwharrie River HU	
Upper Uwharrie River	43
Middle Uwharrie River -Mixed-Use	38
Middle Uwharrie River -Residential	45
Middle Uwharrie River -Rural	42
Lower Uwharrie River -Rural	40
Lower Uwharrie River -Residential	52
Caraway Creek HU	
Upper Caraway Creek	45
Middle Caraway Creek -Rural Mainstem	39
Middle Caraway Creek -Rural Tributaries	39
Little Caraway Creek	40
Middle Caraway Creek -Forested	51
Lower Caraway Creek	49

1.3 Conclusions

Based on the site assessment, overall conclusions and recommendations were prepared for each site. Factors that contributed to reduced function at the site (e.g., cattle in the streams, lack of riparian buffer, and improperly sized culverts) were listed. Recommendations were provided as to the feasibility of the site for potential restoration and preservation. These observations are included as a basis for further study only.

Data from the initial site assessment were combined with land use information, aerial photography, and available monitoring data to determine an initial functional status of the project subwatersheds. Once impacts were estimated, potential causes of the loss of function were investigated as were potential mitigation measures.

Where the site assessments or a review of aerial photography indicated potential preservation/restoration opportunities, summary sheets were prepared. These summaries are included in Appendix E and include the site location, approximate drainage area, causes of site impacts, and recommendations. Since many assessed sites were found to have inadequate riparian buffers, buffer improvement opportunities were identified for each project HU.

N

High Point

Thomasville

Archdale

Trinity

Site U5
Site U90A
Site U17
Site U35A
Site U35
Site U42
Site C2
Site U56
Site U188A
Site L24A
Site U90
Site U80
Site U79
Site U152A
Site U152
Site U54
Site C31
Site C31A
Site L12
Site L19
Site C56A
Site C52A
Site C48
Site U188
Site C72A
Site C52
Site L4
Site U242A
Site L24
Site U224A
Site U224
Site C56
Site L65A
Site L57A
Site C98
Site C101
Site U242
Site U64
Site L57
Site C51
Site L65
Site C76A
Site U69
Site C72
Site L75
Site C76
Site L70
Site L68A
Site L75A
Site L93
Site L56
Site L58
Site C86
Site L93A
Site C89A
Site C89

Little Uwharrie River
Brier Creek
Caraway Creek
Little Caraway Creek
Flat Swamp Creek
Uwharrie River
Little River

85B
85
62
311
109
64
47
49

Visual Assessment Sites

Subwatersheds

- Up Ltl Uwharrie Riv Rural
- Up Ltl Uwharrie Riv Resid.
- Brier Creek
- Brier Creek/Plummers Ck
- Lower Ltl Uwharrie Riv
- Lower Uwharrie Riv Resid.
- Up Uwharrie Riv
- Mid Uwharrie Riv Mixed-Use
- Mid Uwharrie Riv Resid.
- Mid Uwharrie Riv Rural
- Lower Uwharrie Riv Rural
- Up Caraway Ck
- Mid Caraway Ck Forested
- Mid Caraway Ck Rural Mainstem
- Mid Carway Ck Rural Tribes
- Ltl Caraway Ck
- Lower Caraway Ck

Ecosystem Enhancement Program

Local Watershed Plan for the Yadkin River Basin: Upper Uwharrie River Watershed

Figure 1.1: Visual Assessment Sites
Upper Uwharrie River Watershed

0 0.5 1 2 3 Miles

2 Identification of Functional Losses and Proposed Solutions

Generally, when functioning properly, watersheds provide aquatic and terrestrial habitat for living organisms. They also help maintain good water quality by filtering runoff and retaining sediment on land during rainfall events. Lastly, watersheds maintain a good hydrologic balance when functioning well; rainfall and flooding do not cause catastrophic changes to the general character of streams because they are well-connected to their floodplains. When parts of the watershed cease proper function, balances are disturbed and indicators of problems that are occurring need to be measured.

Functional losses, watershed goals, tasks, indicators, tools, and assessment outcomes are outlined below for each of the three HUs (Table 2.1). The proposed plan of further study (Chapter 3) addresses methods to achieve these goals and outcomes. In addition, the functional status of each of the 17 subwatersheds in the study area was generally assessed for habitat quality, water quality and hydraulic condition. For each of the three functions, subwatersheds were categorized as one of three general types: "Assumed Functioning," "Assumed Function Threatened," or "Assumed Function Deficit" (Figures 2.1 through 2.3). These assignments are labeled "assumed" due to the limited amount of data available to draw the preliminary conclusion. The levels of function are described as follows:

- Assumed Functioning - existing conditions indicated that function was achieved without immediate risk of alteration. If several sites within an assessment unit were assessed, an attempt was made to broadly characterize function by collectively considering all sites. Minor degradation at a particular site was overlooked if evidence suggested that impacts did not extend beyond its local area.
- Assumed Function Threatened - observed conditions indicated that function was minimally achieved, though immediate risk of alteration exists. Evidence of risk was considered in several forms. It may have been a local impact that extended slightly to other areas of an assessment unit, or a more widespread problem that did not hinder function significantly. Also, a function may have been rated 'at risk' if land use or channel conditions in an assessment had recently and dramatically changed, but the impacts were not yet observed. An attempt was made to avoid speculation of risk if development or other alterations were planned beyond the near future.
- Assumed Function Deficit - existing conditions indicate that function is not being achieved. Noteworthy functional failure at any site(s) that impacted other parts of the assessment unit or that indicated designated use degradation earned this rating.

Functional status was primarily determined from assessment data collected at the 57 visual assessment sites. General observations made during field evaluations; land use patterns, and percent impervious cover were also taken into account. Habitat quality assessment was based on site-specific riparian conditions and aquatic habitat scores, relative abundance of human impacts at sites, and land cover patterns. Water quality assessment was based on site-specific water quality scores, observations of sediment patterns, and upstream stormwater sources. Hydraulic condition assessment was based on site-specific vertical and lateral stability, identified infrastructure problems (e.g., poorly placed culverts), and percent impervious cover.

Table 2.1 Functional Losses, Watershed Goals, Tasks, Indicators, Tools, and Assessment Outcomes

Watershed	***Watershed Goal***	***Watershed Objectives***	***Key Functional Stressors***	***Indicators/ Metrics***	***Assessment Tools***	***Assessment Outcomes***
Caraway Creek	Preserve active floodplains	Prevent functional losses of floodplains due to incision and habitat fragmentation on mainstem reaches	- Removal of riparian buffer vegetation - Hydraulic modifications	- Riparian land use pattern - Buffer conditions - Percent contributing impervious cover - Bankfull return interval	- GIS patch analysis of remote data - Monitor riparian plots - GIS trend analysis of remote data - Monitor or model hydrographs	- Identify key intact buffer areas - Report percent change of buffered stream miles - Predicted development thresholds for stream incision
	Protect and enhance aquatic habitat	Minimize functional losses due to sediment loading and improve fish habitat	- Poorly installed culverts - Residential road runoff - Runoff from small "garden" plots in floodplain - Obstructions of fish passage	- Culvert position (downstream drop, upstream backwater) - Riffle embeddedness - Riparian land use patterns	- Cursory survey of poor culverts - GIS trend analysis of remote data in buffer areas - Mapping of stormwater drainage	- Inventory of culverts with retrofit needs - Drainage maps - Identification of likely fine sediment source areas
Uwharrie River	Enhance and restore aquatic habitat	Enhance and restore functional conditions at degraded sites	- Poorly installed culverts - Residential road runoff - Buffer damage from agricultural and forestry activities	- Culvert position (downstream drop, upstream backwater) - Riffle embeddedness - Riparian land use patterns - Buffer conditions	- Cursory survey of poor culverts - GIS patch analysis of remote data - Monitor riparian plots - Suspended sediment monitoring	- Identify culverts for retrofit - Identify key buffer restoration areas - Report percent change of buffered stream miles - Trend of sediment loads
	Preserve high quality sub-watershed drainages	Maintain functional status at high quality sites	- Residential development - Hydraulic modifications	- Percent contributing impervious cover - Bankfull return interval	- GIS trend analysis of remote data - Monitor or model hydrographs	- Predicted development thresholds for stream incision - Identify areas addition local planning
Little Uwharrie River	Enhance and restore aquatic habitat	Enhance and restore functional conditions at degraded sites	- Poorly installed culverts - Residential road runoff - Buffer damage from agricultural and forestry activities - Animal access to streams	- Culvert position (downstream drop, upstream backwater) - Riffle embeddedness - Riparian land use patterns - Buffer conditions	- Cursory survey of poor culverts - GIS patch analysis of remote data - Monitor riparian plots - Suspended sediment monitoring	- Identify culverts for retrofit - Identify key buffer restoration areas - Report percent change of buffered stream miles - Trend of sediment loads - Animal exclusion area recommendations
	Preserve high quality sub-watershed drainages	Maintain functional status at high quality sites	- Residential development - Hydraulic modifications	- Percent contributing impervious cover - Bankfull return interval	- GIS trend analysis of remote data - Monitor or model hydrographs	- Predicted development thresholds for stream incision - Identify areas addition local planning

N

High Point

Thomasville

Archdale

Trinity

62

85B

85

311

109

64

47

49

Upper Uwharrie River

Middle Uwharrie River Residential

Middle Uwharrie River Rural

Middle Uwharrie River Mixed-Use

Upper Caraway Creek

Upper Little Uwharrie River Residential

Upper Little Uwharrie River Rural

Little Uwharrie River

Lower Uwharrie River Rural

Middle Caraway Creek Rural Mainstem

Caraway Creek

Brier Creek

Lower Little Uwharrie River

Little Caraway Creek

Lower Uwharrie River Residential

Middle Carway Creek Rural Tributaries

Middle Caraway Creek Forested

Brier Creek

Brier Creek/ Plummers Creek

Lower Caraway Creek

Flat Swamp Creek

Uwharrie River

Little River

Ecosystem Enhancement Program

Local Watershed Plan for the Yadkin River Basin: Upper Uwharrie River Watershed

LEGEND

- Assumed Functioning
- Assumed Function Threatened
- Assumed Function Deficit
- Subwatershed Boundary

Figure 2.1: Preliminary Status of Habitat Function by Subwatershed

0 0.5 1 2 3 Miles

N

High Point

Thomasville

Archdale

Trinity

62

85B

85

311

109

64

47

49

Upper Uwharrie River

Middle Uwharrie River Residential

Middle Uwharrie River Rural

Upper Caraway Creek

Middle Uwharrie River Mixed-Use

Upper Little Uwharrie River Residential

Upper Little Uwharrie River Rural

Little Uwharrie River

Lower Uwharrie River Rural

Caraway Creek

Middle Caraway Creek Rural Mainstem

Middle Carway Creek Rural Tributaries

Brier Creek

Lower Little Uwharrie River

Little Caraway Creek

Little Caraway Creek

Lower Uwharrie River Residential

Middle Caraway Creek Forested

Brier Creek

Brier Creek/ Plummers Creek

Lower Caraway Creek

Caraway Creek

Flat Swamp Creek

Uwharrie River

Little River

Ecosystem Enhancement Program

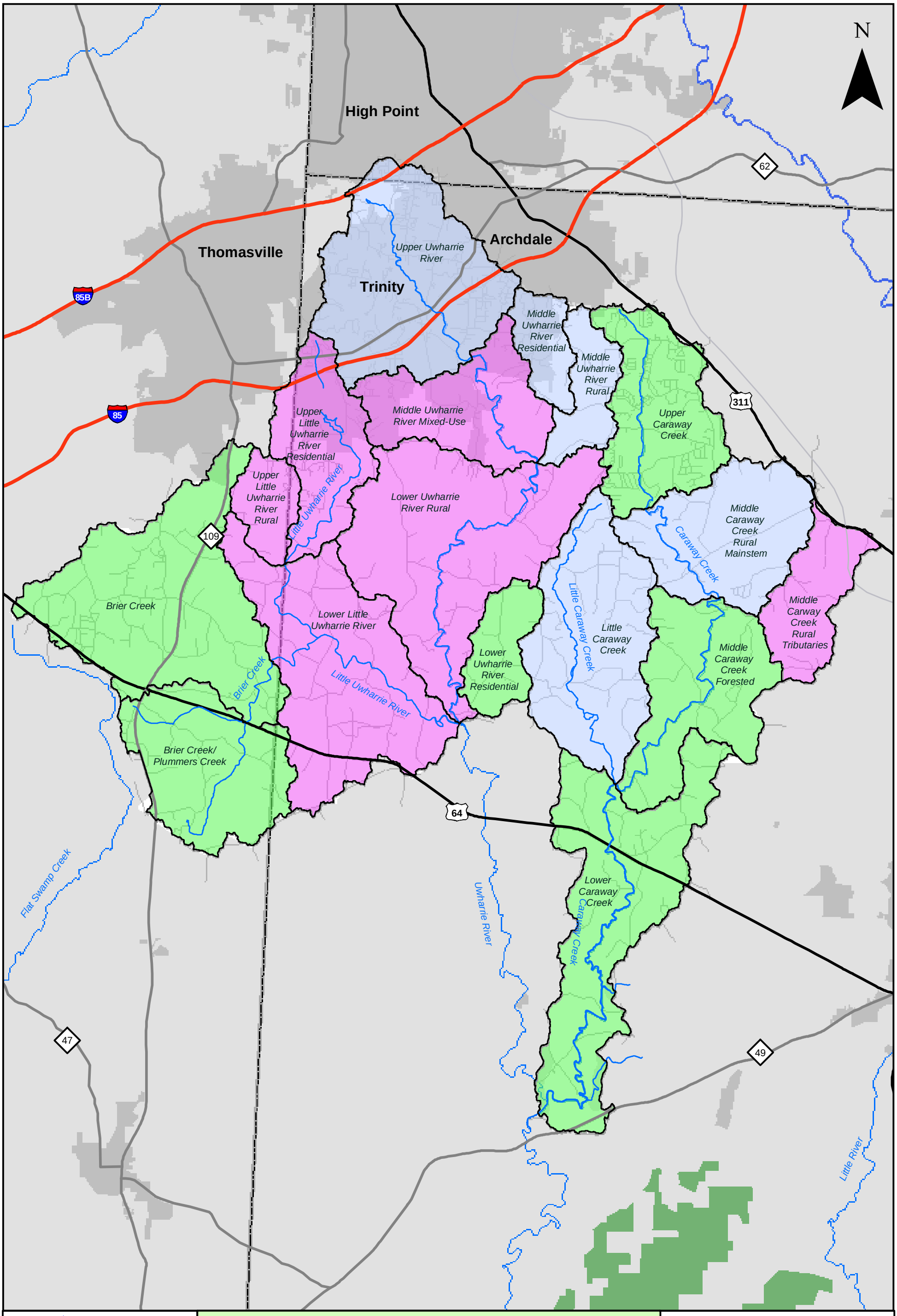
Local Watershed Plan for the Yadkin River Basin: Upper Uwharrie River Watershed

LEGEND

- Assumed Functioning
- Assumed Function Threatened
- Assumed Function Deficit
- Subwatershed Boundary

Figure 2.2: Preliminary Status of Water Quality Function by Subwatershed

0 0.5 1 2 3 Miles



Local Watershed Plan for the Yadkin River Basin: Upper Uwharrie River Watershed

LEGEND

- Assumed Functioning
- Assumed Function Threatened
- Assumed Function Deficit
- Subwatershed Boundary

Figure 2.3: Preliminary Status of Hydrology Function by Subwatershed

0 0.5 1 2 3 Miles

3 Subwatershed Summary

As detailed above, Buck Engineering conducted cursory stream and aquatic habitat evaluations of each subwatershed. The findings of these evaluations are presented below and subwatershed summary datasheets are included in Appendix C. Please refer to the summary datasheets for the location of the subwatershed and assessment sites, drainage area and drainage density, mean elevation, basin relief, and mean slope. The summary also includes estimated percentages of impervious cover and forest/wetland, agricultural, residential/industrial land uses, as well as barren land and open-water areas. Key indicators are also summarized in Table 3.1.

Table 3.1 Subwatershed Summary Information

Subwatershed	**Area (mi^2)**	**Stream Miles[1]**	**Impervious Area[2]**	**Intact 100-Foot Riparian Buffer[3]**	**No. Visual Assessment Sites**
Little Uwharrie River HU					
Upper Little Uwharrie River - Residential	5.7	16.2	5.2%	69%	4
Upper Little Uwharrie River - Rural	2.2	6.4	1.3%	87%	1[4]
Brier Creek	14.4	37.0	2.0%	71%	4
Upper Brier Creek/Plummers Creek	8.1	21.9	1.2%	77%	5
Lower Little Uwharrie River	13.0	33.0	0.6%	79%	4
Uwharrie River					
Upper Uwharrie River	12.0	38.7	10.8%	70%	6
Middle Uwharrie River - Mixed-Use	6.6	19.4	2.3%	83%	4
Middle Uwharrie River -Residential	2.2	7.4	3.9%	76%	2
Middle Uwharrie River -Rural	2.7	9.5	0.8%	88%	2
Lower Uwharrie River -Rural	14.9	45.5	0.8%	83%	5
Lower Uwharrie River -Residential	2.8	9.0	0.7%	89%	2
Caraway Creek					
Upper Caraway Creek	7.3	21.9	5.6%	56%	4
Middle Caraway Creek -Rural Mainstem	7.9	23.8	0.8%	81%	4
Middle Caraway Creek -Rural Tributaries	4.1	11.6	1.2%	89%	1
Little Caraway Creek	10.2	33.8	0.7%	84%	4
Middle Caraway Creek -Forested	8.1	22.4	0.3%	95%	3
Lower Caraway Creek	12.8	36.0	0.5%	81%	2

1 Stream miles based on USGS 1:24,000 hydrography (undated).
2 Percent impervious derived from USGS (2004).
3 Percent intact riparian buffer based on percent of forested/wetland land use within a 100-foot buffer of all streams in the subwatershed. Land use data from USGS (2005).
4 Additional visual assessment site in subwatershed was posted as no trespassing.

3.1 Little Uwharrie Watershed

The Little Uwharrie watershed has few outstanding subwatersheds but assessment in the Brier Creek drainages found extensive areas where functional status is well above average. Threats to functional status include road drainage, poorly placed culverts, ongoing residential development, clear cutting of buffers and, to a lesser extent, farm animal access to streams.

Upper Little Uwharrie River - Residential Subwatershed

The subwatershed consists of significant urban land cover (primarily areas in the City of Trinity). Agricultural and forested areas are found outside of the city. Urban and suburban development has significantly affected habitat and water quality in this watershed. Riparian buffers are generally poor and dominated by exotic plant species. This is the most impacted subwatershed in the study area. Functional status compromised in all categories at essentially all sites. Overall, the subwatershed received ratings of "Assumed Function Deficit" for habitat, water quality, and hydrology functions.

Upper Little Uwharrie River - Rural Subwatershed

Forests dominate the subwatershed, with lesser amounts of urban land use and a relatively small number of agricultural areas. GAP data suggests that streams in the subwatershed may be relatively stable. Headwater streams were impacted by residential and logging practices. The lower watershed was lacked public road crossings and could not be surveyed. Only one site in the watershed was assessed, but based on the site visit and the GAP data, it appears to be an average watershed of the Little Uwharrie in terms of functional status. Overall, the subwatershed received ratings of "Assumed Function Deficit" for habitat, water quality, and hydrology functions.

Brier Creek Subwatershed

The subwatershed is a mix of forested, agricultural, and urban land use. Aquatic habitat is generally fair to good throughout. Three of the four sites assessed had excellent functional values, so Brier Creek was considered one of the best in the study area and was the most pristine of the Little Uwharrie River subwatersheds. One site was impacted by buffer manipulation, leading to stream banks that lacked sufficient root mass to maintain stability. Overall, the subwatershed received ratings of "Assumed Functioning" for habitat, water quality function, and hydrology functions.

Upper Brier Creek/Plummers Creek Subwatershed

The subwatershed is largely undeveloped and most of the land is forested or used in agriculture. Sites in the watershed were characterized by good aquatic habitat that was occasionally compromised by fine sediments. Mature buffers were common with the exception of farm fields and residential land use adjacent to the streams. Water quality appeared to be in good condition at all sites visited. The cutting of riparian buffers (as noted at two of the five sites) was the only major threat to the functional status of the watershed. Overall, the subwatershed received ratings of "Assumed Function

Threatened" for habitat and water quality functions, and "Assumed Functioning" for hydrology function.

Lower Little Uwharrie River Subwatershed

Land cover in the subwatershed is primarily forest and agriculture. Incised stream reaches in the watershed greatly diminish the quality of habitat in the relatively coarse stream beds. The removal of large trees from stream bans and channelization has caused instability at several locations. Two sites maintained fair functional status while two sites in the subwatershed showed greatly impacted functions due to loss of riparian buffers and limited aquatic habitat. Overall, the subwatershed received ratings of "Assumed Function Deficit" for habitat, water quality, and hydrology functions.

3.2 Uwharrie River Watershed

The Uwharrie River watershed generally maintains good functional status despite the beginning of urbanization. Excellent buffers on small tributaries and streams have generally protected aquatic resources. However, as residential development increases in the area, additional stresses to stream function are likely. Threats to functional status include road drainage, poorly placed culverts and ongoing residential development.

Upper Uwharrie River Subwatershed

Parts of the City of Trinity are located in this subwatershed, which also includes areas of forested or agricultural use. The headwater areas of this sub-watershed have a higher percentage of impervious surfaces than the remainder of the subwatershed. Unstable drainage ditches were noted during the assessment; as was significant road cover, stream bank erosion, riparian buffer impacts and residential/urban land use. Water quality is most likely impaired as a result. Siltation was present in the substrate of each site visited. Generally this watershed had good riparian buffers. The site visited with poor buffers had significantly poorer scores for all assessment criteria than others in the subwatershed. Overall, the subwatershed received ratings of "Assumed Functioning" for habitat function, and "Assumed Function Threatened" for water quality and hydrology functions.

Middle Uwharrie River – Mixed Use Subwatershed

The subwatershed has mixed land use with similar amounts of forest, agricultural, and urban land. Water quality conditions were also mixed. A variety of riparian buffer, geomorphic, and aquatic habitat conditions were noted. Large farms in the subwatershed should be investigated for BMP needs such as cattle exclusion. Residential areas need riparian buffer improvements. The loss of riparian buffer has contributed to the Middle Uwharrie River- Mixed subwatershed having the lowest functional qualities of any subwatershed in the study area. Overall, the subwatershed received ratings of "Assumed Function Threatened" for habitat function, and "Assumed Function Deficit" for water quality and hydrology functions.

Middle Uwharrie River - Residential Subwatershed

The subwatershed has mixed cover of forest, agricultural, and urban land. Streams in this watershed generally appear to be in good condition with some threats to habitat from poor buffer conditions in a few locations. Bedrock has served to maintain vertical stability in the streams, preventing major stream incision in many locations. Overall, the subwatershed received ratings of "Assumed Function Deficit" for habitat function, and "Assumed Function Threatened" for water quality and hydrology functions.

Middle Uwharrie River - Rural Subwatershed

Forest land cover dominates the subwatershed, with some agricultural and residential land. The main stem site on the Uwharrie River showed signs of persistent turbidity. The tributary site had additional water quality concerns, most notably roadway drainage and isolated pockets of stream bank erosion. Cattle were observed in the streams on the lower watershed. Further investigation should be done to assess agricultural and residential BMP needs. Despite generally poor aquatic habitat scores, the watershed had generally good functional conditions due to deep buffers and stable stream channels. Overall, the subwatershed received ratings of "Assumed Function Threatened" for habitat and hydrology functions, and "Assumed Functioning" for water quality function.

Lower Uwharrie River - Rural Subwatershed

The primarily undeveloped subwatershed has significant forest land cover and moderate area in agricultural use. All sites visited in this subwatershed exhibited excessive sediment loads that impacted habitat quality and water quality. Timber clear cuts and agricultural fields adjacent to streams were the primary sources of sediment. Human impacts resulted in a loss of vertical stability at most sites with impacted aquatic habitat. However, terrestrial habitat is excellent, with wide and diverse buffers with mature vegetation. Overall, the subwatershed received ratings of "Assumed Functioning" for habitat and water quality functions, and "Assumed Function Deficit" for hydrology function.

Lower Uwharrie River - Residential Subwatershed

Predominantly forested, the subwatershed has lesser amount of agriculture and residential land use. Neighborhoods are encroaching into formerly forested areas. Well-established riparian buffers have preserved excellent aquatic habitat and protected water quality. Some stream incision has led to minor bank erosion but bedrock has served as an elevation control. Given the presence of residential development in the watershed, it is somewhat surprising that this watershed had the highest average function score of any watershed in the study area. However, it should be noted that only two sites were visited in the subwatershed. Overall, the subwatershed received ratings of "Assumed Functioning" for habitat, water quality, and hydrology functions.

3.3 Caraway Creek Watershed

The Caraway Creek watershed is primarily an upland area with regions of near-surface bedrock. Some of the tributaries are impacted, especially upstream, but main stem sites

in the lower portion of the watershed generally show good function. Large streams in the watershed have contact with their floodplains and typically have excellent riparian buffers. These features mitigate the water quality impacts found in the headwaters of some tributaries. Threats to functional status include road drainage, poorly placed culverts and ongoing residential development.

Upper Caraway Creek Subwatershed

Parts of the City of Archdale are located in the subwatershed, which is considered to be mostly urban with significant agricultural areas. The subwatershed is extremely variable, with significant differences in riparian buffer thickness and water quality reported. Specific impacts included turbidity, sunlight exposure, algae, and channelization. Overall, the subwatershed received ratings of "Assumed Function Deficit" for habitat function, "Assumed Function Threatened" for water quality function, and "Assumed Functioning" for hydrology function. Hydrologic functions in the subwatershed are maintained despite more than 5 percent impervious cover by the presence of bedrock pavement and coarse sediment loads in streambeds, which protect the vertical stability of many streams and keep them in contact with their associated floodplains. However, several sites show indications of lateral instability. As development continues, over-widening of channels can eventually lead to the loss of hydrologic functions even in vertically stable systems. Zoning and/or planning efforts that limit imperious cover to less than 10 percent by catchment could play an important role in preserving existing functions in this subwatershed. If future development pressures are not too great, improvements in habitat could also allow streams to achieve higher function.

Little Caraway Creek Subwatershed

Land use in the subwatershed is primarily forest and agriculture. Conditions are variable, and strong preservation opportunities exist in areas with intact riparian buffers. In other areas, poor forestry practices have impacted riparian buffers and contributed to severe erosion of stream banks. Overall, the subwatershed received ratings of "Assumed Function Threatened" for habitat and hydrology functions, and "Assumed Function Deficit" for water quality function.

Middle Caraway Creek – Rural Mainstem Subwatershed

The subwatershed is largely agricultural, especially along tributaries to Caraway Creek. Conditions are variable; agricultural impacts including low-flow impacts possibly caused by irrigation were noted, while the mainstem of Caraway Creek has stable reaches with excellent habitat, mature riparian buffers, and good water quality. Two sites that achieved the highest assessment scores are in this subwatershed, as is the worst site (a deep, treeless gully). Overall, the subwatershed received ratings of "Assumed Function Deficit" for habitat function, and "Assumed Function Threatened" for water quality and hydrology functions.

Middle Caraway Creek - Rural Tributaries Subwatershed

Forests dominate the watershed with significant agricultural areas and minimal residential lands. The site chosen at random for assessment was located below a large

impoundment. The stream in this area was incised and had poor habitat. However, aerial photography indicates that the portion of the subwatershed upstream of the lake has more robust riparian buffers. Therefore, the subwatershed may have a higher degree of function than is indicated by the assessed score. Overall, the subwatershed received ratings of "Assumed Function Threatened" for habitat function, and "Assumed Function Deficit" for water quality and hydrology functions.

Middle Caraway Creek – Forested Subwatershed

The subwatershed is predominantly forest lands with some agricultural and minor residential use. Sediment found in main stem substrates indicates potential upstream loss of function. Upper Caraway Creek (the upstream subwatershed) may be the source of these sediments. Stream function supported by deep, mature, riparian buffers. Overall, the subwatershed received ratings of "Assumed Functioning" for habitat, water quality, and hydrology functions.

Lower Caraway Creek Subwatershed

Forests dominate the watershed with small agricultural areas. Good riparian buffer conditions in the subwatershed help to maintain good aquatic habitat, however the stream is incised in some areas. As is the case with the Middle Caraway Creek - Forested subwatershed, upland erosion and unstable upstream watersheds cause high sediment loads and turbid water. In spite of the upstream disturbances, the watershed is considered to be well above average in terms of functional status. Overall, the subwatershed received ratings of "Assumed Functioning" for habitat, water quality, and hydrology functions.

4 Initial Protection Priorities

The study area was evaluated to establish initial protection priorities based on the presence of threatened and endangered species, land use (existing and forecasted), NCDWQ water quality designations, existing National Wetland Inventory data, and information from local land trust organizations. Based on this analysis, the following recommendations are proposed.

4.1 Threatened and Endangered Species

The Middle Caraway Creek Forested and Lower Caraway Creek subwatersheds contain Natural Heritage Element Occurrences Sites (NHEOS). These elements include both threatened and endangered species, including endangered mussels, as well as unique habitat such as dry oak hickory forest. Areas with known existing NHEOS, as well as those with potential habitat for threatened and endangered species, should be considered a priority for preservation.

In particular, there is a large, high-quality, unfragmented area of forest at Camp Caraway. This area has a rare population of dissected toothwort (*Cardamine dissecta*). Nearby, Caraway Mountain has another population of this rare plant, as well as the only endangered terrestrial species in the watershed, Schweinitz's sunflower (*Helianthus schweinitzii*). The site for the sunflower is described as one of the best in the state.

4.2 Land Use

Areas where well-managed agricultural and forested lands are under the greatest pressure for conversion to urban uses should be considered priorities for preservation. Maintenance of these areas will help protect water quality by preserving pervious cover and existing riparian buffers. High Point's planned industrial corridor extends through the Upper Uwharrie River subwatershed, which also contains the growing communities of Trinity, Thomasville, and Archdale. Therefore, this subwatershed should be considered a priority for preservation.

4.3 Water Quality Designations

The Little Uwharrie River and Uwharrie River HUs drain to Reese Lake, the water supply for Asheboro. NCDWQ has designated the HUs as water supply watersheds (WS-III), requiring new development density regulations and additional water quality standards. It is important to maintain existing riparian buffers within these watersheds in order to maintain their filtering ability. Opportunities for such preservation should be considered a priority.

4.4 National Wetland Inventory Data

The acreage of NWI wetlands within each subwatershed, excluding man-made ponds, was summed in order to prioritize preservation efforts. The Lower Caraway Creek subwatershed has the greatest acreage of NWI wetlands (107 acres), followed by the Middle Caraway Creek Forested (81 acres), Little Caraway Creek (63 acres), and Lower Uwharrie River Rural (45 acres) subwatersheds. Wetland areas within these

subwatersheds, both those appearing in NWI and others, should be prioritized for preservation.

4.5 Land Trust Recommendations

The Randolph County Natural Heritage Inventory was conducted during 1997-1998 as a partnership between the Piedmont Land Conservancy (PLC), Greensboro, NC, and the North Carolina Natural Heritage Program. The North Carolina Natural Heritage Trust Fund, the North Carolina Zoological Society, and Randolph County provided funding for the inventory. The inventory identified natural heritage corridors throughout the county with unique habitat. Four of these corridors are located within the Middle Caraway Creek Forested subwatershed (Chapter 1, Figure 4.4). These areas overlap with the NHEOS described above. They represent some of the most diverse terrestrial and aquatic habitat with the study area and should be considered a high priority for preservation efforts.

The PLC has also identified initiative areas within Randolph County. These include the majority of the Lower Caraway Creek subwatershed. Similar to the Middle Caraway Creek Forested subwatershed, this area is home to a number of NHEOS. They should also be considered a high priority for preservation.

5 Recommendations for Additional Monitoring

There have been minimal water quality observations made in the watersheds in the Upper Uwharrie River watershed. No NCDWQ ambient monitoring stations are located in the project area. Water quality field measurements (dissolved oxygen, pH, conductivity, and temperature) are limited to the data collected by NCDWQ staff as part of benthic surveys in 1996 and 2001. Those data appear to be within the normal range, except that dissolved oxygen levels in Caraway Creek were less than 6 mg/l. These levels did not violate the NCDWQ standard for dissolved oxygen (5.0 mg/l), but they approached that level during the only occasions when dissolved oxygen content was measured. This suggests that dissolved oxygen may be a potential stressor and it may that additional monitoring of this parameter would be advisable.

In the existing water quality data summary, NCDWQ concluded that chemical and physical data and recent benthic and fish community data are needed for the basin-wide monitoring sites in the Uwharrie River, Little Uwharrie River, and Caraway Creek watersheds. NCDWQ added that similar data from upstream locations, including Little Caraway Creek and Brier Creek, would be beneficial. Finally, aquatic habitat evaluations are needed at locations throughout the planning area.

5.1 Sediment

As stated previously, Buck Engineering conducted cursory aquatic habitat evaluations of the Upper Uwharrie River watershed. Generally, sediment appeared to be a problem at a number of sites throughout the planning area. Sediment is a stressor because it can bury benthic macroinvertebrate habitat and fish spawing areas, can alter stream hydraulics, and a variety of toxic pollutants can adsorb to it. Table 5.1 lists the visual assessment sites that included observations of embeddedness, high sediment loading, and/or moderate to severe streambank erosion. Visual assessment sites are shown in the subwatershed summaries in Appendix C.

Table 5.1 Visual assessment sites with sediment-related problems by HU

Subwatershed	**Total Sites**	**Number of sites with sediment problems (specific sites)**
Little Uwharrie River	18	**8** (C31A, C51, C52, C56A, C72A, C86, C89A)
Uwharrie River	18	**11** (U17, U188, U188A, U224, U35, U42, U54, U69, U79, U90, U90A)
Caraway Creek	21	**8** (C31A, C51, C52, C56A, C72A, C86, C89A)

Future investigations could be conducted to more formally characterize the sediment problems at particular sites, using assessment techniques such as those described in Reid and Dunne (1996). This may include measurements of embeddedness and assessments of bank erosion. In general, the goals would be to determine if sediment is impacting the biological communities and/or hydrologic function. Further steps may be taken to assess whether the sediment problems relate to excess supply, insufficient transport ability, or

some combination of supply and transport. This might include sampling of suspended sediment concentration, perhaps using single-stage samplers to collect samples over a range of stream flows. With corresponding measurements of stage and stream flow, sediment rating curves may be developed; these can help to determine the amount of sediment that may be effectively transported (i.e., not deposited) at various stream flows. This sets a target for the reduction of sediment loading or the need for stream restoration, which can increase stream transport capabilities.

5.2 Benthic Macroinvertebrates and Fish Surveys

As NCDWQ noted in their summary, the first step in future monitoring should be to update benthic macroinvertebrate and fish surveys. These surveys are used by NCDWQ as the primary determinant for characterizing overall stream integrity. This is appropriate because primary designated uses for most waterbodies in North Carolina are propagation of aquatic life and biological integrity, which are directly measured by the benthic and fish surveys.

The survey updates may be conducted soon as part of the basin-wide planning process. If these studies do not indicate aquatic habitat impacts (i.e., Good-Fair bioclassifications or better), the need for additional monitoring is reduced. If the surveys indicate that one or more of the sites are impaired, further monitoring will be needed to characterize the causes and sources of the impairment. The monitoring typically recommended by NCDWQ includes a baseline monitoring program of water column physical, chemical and toxicity observations, sediment chemistry and toxicity information, habitat surveys, and other stream information such as channel stability assessments or pollution sources.

With such baseline monitoring program, it is possible to evaluate potential stressors and further assess the degree to which they cause biological impairment. As mentioned above, sediment is a suspected stressor as it relates to aquatic habitat. Additionally, dissolved oxygen levels in Caraway Creek may be problematic. Dissolved oxygen is a response variable; that is, it reflects a response to stream temperature and nutrient and biological oxygen demand (BOD) loading. Thus, the cause of low dissolved oxygen must be determined. This would entail monitoring dissolved oxygen and temperature in the stream and collecting of nutrient and BOD samples.

With the limited amount of monitoring data available for the planning area, other stressors may be present. The recommended baseline monitoring recommended by NCDWQ would help to identify other potential stressors.

Suitable reference data from a nearby minimally impacted stream are available (Dutchmans Creek). These data set the standard for impaired waterbodies to achieve or maintain biological integrity. They also help to identify potential stressors.

5.3 Conclusion

In conclusion, based on the limited available data, the biological communities in the study area waterbodies were not impaired as of 2001. Additional monitoring is needed, both to improve out overall understanding of water quality in the study area and to document any changes that have occurred since 2001. If impacts to water quality are

indicated by these additional data, the establishment of a broad baseline monitoring program would be needed. Assessments from this local watershed plan will satisfy some of the program's requirements, including visual assessments and updated GIS data collection and analysis.

Chapter 3
Plan of Further Study

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1 Further Plan of Study

Based on the general characterization of the Upper Uwharrie River study area, a plan of further study is recommended in order to collect detailed data in key locations to support a final watershed plan. Further study is recommend to focus on seven representative subwatersheds where planning issues will likely be challenged by future development (Figure 1.1). These subwatersheds were chosen because additional data can most significantly assist in guiding future management, either in protecting or restoring functional assets. Subwatersheds where broad-scale impacts have resulted in widespread functional losses, such as the Upper Little Uwharrie – Residential subwatershed, were not recommended for study because watershed management can clearly proceed without further data. Likewise, watersheds where adequate functional assets are maintained by relatively stable features, such as the bedrock-supported channels of the Upper Caraway Creek subwatershed, were not recommended for further study. In these subwatersheds, general management approaches are relatively clear and less pressing than in more vulnerable subwatersheds. Therefore, the seven subwatersheds selected for further contain represent relatively good functional qualities that may be threatened by current land use management and land cover changes in the near future.

Four general data collection methods are recommended below to address sediment pollution and disturbance of riparian habitat, and to support regional planning in the face of increased residential development.

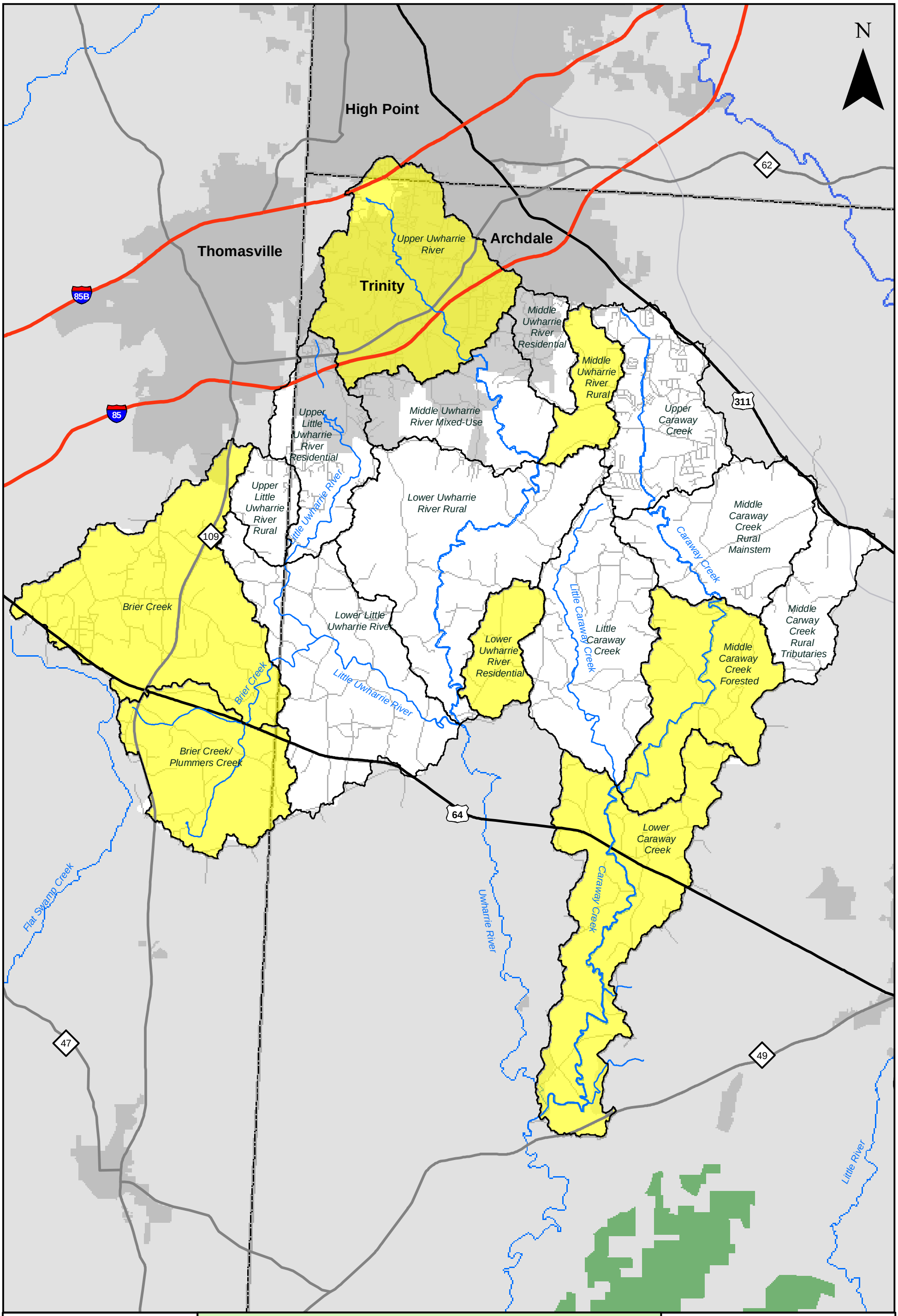
1. Longitudinal riparian corridor assessments to characterize and prioritize management strategies for individual reaches. Riparian areas should be identified where maintenance of exiting practices or straightforward buffer enhancement will result in significant benefit to functional conditions.

2. Water quality and biological monitoring to identify impacts from watershed and riparian degradation and, importantly, to establish baseline conditions on a reasonable detailed scale.

3. Inventory of culverts, road drainage, and other infrastructure that appear to impact sediment transport and adversely affect stream stability.

4. Determination of likely upland and in-channel sediment sources impacting water quality.

The objective of the additional monitoring and data analysis is to assess the ability of watershed and streams to support and sustain various water quality and aquatic habitat and floodplain functions. The data generated will assist the local planning effort by further identifying overall stream health problems, identifying sources, and outlining preservation opportunities.



Ecosystem Enhancement Program

Local Watershed Plan for the Yadkin River Basin: Upper Uwharrie River Watershed

LEGEND

- Subwatersheds Proposed for Further Study
- Subwatershed Boundary

Figure 1.1: Subwatersheds Proposed for Further Study

0 0.5 1 2 3 Miles

1.1 Longitudinal Riparian Corridor Assessments

Observations made during the watershed characterization clearly suggested that riparian corridor condition is a key element in determining the function condition of streams. The riparian corridor condition greatly influences habitat structure, sediment supply, channel stability, and water quality. As existing data is presently only available at specific points (e.g., bridge crossings) or from remote sensing data, longitudinal study of select riparian corridors should be undertaken. Quantitatively documenting the reach-wide conditions of stream habitat quality, channel form and stability, buffer vegetation quality, and localized land use impacts allows for management prioritization at the site level.

Specific methods for collecting and quantifying this data will be developed during the next phase of the study with the project team, but general data collected should include:

- Terrestrial Habitat Quality
- Bank Stability
- Geomorphic Form including Floodplain Parameters
- Buffer Effectiveness
- Land Use Impacts and Threats

These data should be collected in the field over relatively long stream segments of at least several thousand feet. GPS points should be collected to document locations of specific riparian features. Reaches targeted for longitudinal study should be either ones likely to be important to maintenance of excellent stream function or where riparian corridors appear to be threatened with significant loss of function. Reaches where riparian areas are already degraded are not recommended for further study as part of this design.

Specifically, longitudinal riparian data should be collected in the following subwatersheds:

- Lower Uwharrie River – Residential
- Upper Uwharrie River
- Middle Uwharrie River – Rural
- Brier Creek
- Upper Brier Creek/Plummers Creek
- Middle Caraway Creek – Forested
- Lower Caraway Creek – Mainstem Sections only

Remote sensing data should be used to identify study corridors from each subwatershed. Several sites should be selected from each subwatershed totaling approximately 5 miles per subwatershed or 35 - 40 linear miles for the total assessment. Results of this work will further characterize the watershed in general, provide specific examples of excellent and threatened habitat, and locate both preservation and large scale restoration opportunities.

1.2 Water Quality and Biological Monitoring

To establish baseline conditions throughout the watershed, water quality and biological monitoring sites should be established. The exact locations of sites should be coordinated

with NCDWQ, but should positioned so as to characterize the outlets of the three HUs, as well as the five upstream subwatersheds where further buffer study has been recommended (Upper Uwharrie, Middle Uwharrie – Rural, Brier Creek, Upper Brier Creek/Plummers Creek and the Middle Caraway – Forested). This will result in the establishment of seven monitoring sites and one existing NCDWQ site will serve to characterize the Little Uwharrie HU (although data types collected would need to be expanded).

Biological monitoring including benthic macroinvertebrates and fish is recommended for all sites, as is basic physical and chemical monitoring. Nutrient monitoring, while not specific to water impairment issues in the watershed, should be include if possible as they can be useful in determining typical sources of sediment or other common pollutants upstream. Monitoring should be conducted monthly for at least two years to establish a reasonable baseline dataset. After that period, rates of change and events in the watershed will dictate how frequently and intensely monitoring should continue.

1.3 Infrastructure Inventory

A unique feature of this watershed is that while development has yet to dramatically affect water quality in general, infrastructure associated with residential development has impacted many aquatic systems locally. Particularly, poorly designed road drainage and improperly located culverts have impacted stream stability and habitat quality. Incised channels, braided channels and barriers to fish passage were frequently noted. It is recommended that in five upland subwatersheds (Upper Uwharrie, Middle Uwharrie – Rural, Brier Creek, Upper Brier Creek/Plummers Creek, and Middle Caraway – Forested), roadside review be conducted to identify infrastructure issues. Where problematic culverts, pipes, ditches, and water control structures are identified, it is recommended that rudimentary survey be conducted to document relative structure elevation to stream features. This work will provide a list of small scale potential projects for retrofit as well as a large database that could be used to develop and defend appropriate planning materials to address future development pressures.

1.4 Determination of Upland Sediment Sources

While degraded stream channels and poorly maintained road ditches are likely to remain the largest source of excess sediment in the watershed, upland sediment sources may also play a role in determining the functional status of some catchments. Determination of upland sediment sources could be conducted in a tiered approach, where catchments with relatively high potential for upland erosion are identified and specific sources determined within those targeted catchments. A relatively straight-forward GIS analysis that takes into account catchment slope, general soil type, and land use could identify catchments with relatively high upland erosion potential. Depending on land use and scale, watersheds models such as SWAT, AGNAPS, and RUSLE could be used to identify potential sediment sources. Results from these models could be compared to empirical models and/or monitoring of construction impacts in each catchment to broadly estimate the relative impact of construction activities versus agricultural and forestry sources. Specific sources could then be ranked and prioritized in a management plan.

2 Stakeholder Involvement

Local stakeholders have extensive knowledge of the Upper Uwharrie River watershed; they may also be affected by the decisions made in the development of the watershed plan. Primary watershed stakeholders typically include watershed residents, farmers, developers, and local government or resource agency staff with a direct role in the planning process. Secondary stakeholders may include state or regional resource agency staff who can serve as technical resources/advisors during the local planning process.

Future phases of the LWP process should involve development of a memorandum of understanding (MOU), a signed, written agreement between EEP and stakeholders that can be used to define roles and responsibilities. Meetings with stakeholders can provide information about ongoing water quality issues and other watershed data. For example, local experts will be asked about examples of intact and non-functioning resources within the watershed. Information collected for the LWP will be shared with the stakeholder committee to build trust and support for the process and end product. Stakeholder involvement will help develop successful watershed solutions.

A number of stakeholders were identified in the initial phase of the Upper Uwharrie River LWP. These include representatives from the cities of Trinity, High Point, Archdale, and Thomasville; Randolph and Davidson Counties; Piedmont Triad Council of Governments; Natural Resource Conservation Service; Davidson Water, Inc.; Yadkin Pee Dee River Basin Association; local land trusts (Piedmont Land Conservancy and Land Trust for Central Carolina); Pilot View Resource Conservation and Development (RC&D) program; and the North Carolina Zoological Park.

Chapter 4
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