2009 UPDATE

Town of
Wake Forest
North Carolina



Open Space & Greenway Plan

Wake Forest Open Space & Greenway Plan

2002 | Update 2009

Prepared for:
The Town of Wake Forest

Prepared by:
Greenways Incorporated

Original 2002 Plan Funded by:
Wake County and the Town of Wake Forest

Smith Creek Greenway Corridor

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Smith Creek Greenway Corridor

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ACKNOWLEDGMENTS

This Open Space and Greenways Plan was made possible by the joint efforts of the Wake Forest Planning, Engineering, and the Parks and Recreation Departments, and the efforts of local citizens. This public-private partnership represents the broad commitment by individual members of the Wake Forest Community to work together to improve the quality of life for area citizens.

A special thank you is given to the persons listed below for their time, support and participation in the completion of this Plan.

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Chapter 1: Introduction

Sanford Creek Greenway

Chapter Outline:

The 2009 Open Space & Greenway Plan Update

Plan Purpose & Goals

Benefits of Open Space and Greenways

This plan makes reference to many other documents, most of which are available online. To view planning documents related to the Town of Wake Forest, please visit www.wakeforestnc.gov and click 'Our Government' followed by 'Plans and Ordinances.'

THE 2009 OPEN SPACE & GREENWAY PLAN UPDATE

The Town of Wake Forest adopted its first Open Space and Greenway Plan in January 2002. In the years since that plan's adoption, much has changed in Wake Forest and in Wake County as a whole. Aside from continued population growth and development in and around Wake Forest, there have been numerous other changes in both local and regional land use and transportation patterns. The NC 98 Bypass, which was still in the planning phase at the time of the last plan, has been partially completed, creating new opportunities and constraints for the completion of a comprehensive greenway network. No less significantly, the Town of Wake Forest has adopted three new plans of particular relevance: the Pedestrian Plan (2006), the Bicycle Plan (2008), and the Parks and Recreation Master Plan Update (2005). Each of these plans is the result of extensive data collection and public input gathering, and reflects equally important aspects of Wake Forest's transportation and sustainability goals. Similarly, the North Carolina Department of Transportation (NCDOT), the Capital Area Metropolitan Planning Organization (CAMPO), Wake County, and the City of Raleigh have all produced new comprehensive plans of various types that include goals and visions for Wake Forest as it relates to regional transportation and land use objectives. Given these numerous changes, it is necessary to update the 2002 Open Space and Greenway Plan to reflect the current conditions, and update the original recommendations. While Wake Forest changes as the result of internal and external development pressures, it is critical to continually reevaluate and update planning efforts to keep up with new opportunities and to stay ahead of potential constraints.

In short, the Open Space and Greenway Plan Update expands upon key recommendations from the 2002 Plan and provides the Town of Wake Forest with new ideas and tools to effectively create and maintain a comprehensive open space and greenway network. The Plan Update also incorporates new design standards for trails and trail amenities, trail operations and management guidelines, and current trail construction cost estimates.

INTRODUCTION

At a base level, the purpose of this updated plan is the same as that of its predecessor. The three principal goals of the 2002 Open Space and Greenway Plan were: 1) to identify parcels and corridors of land that were in need of protection and conservation measures; 2) to establish a comprehensive approach that would link greenspace lands and corridors to residential, commercial, institutional and central business areas of the community, and 3) to define a concise set of strategies for protecting and conserving these corridors and at the same time developing public use facilities that would provide residents with access to these lands and corridors.

In retrospect, the 2002 Plan was largely successful in achieving these goals. However, there are still certain aspects of these goals that need to be addressed, as well as factors influencing the means by which the goals may be achieved. Due to a number of elements such as continued development pressures, the priority parcels and corridors identified by the 2002 Plan have changed. Similarly, as new residential and commercial development has occurred, new issues involving connectivity and open space conservation have emerged that were not addressed in the initial approach outlined by the Plan. Also, as development has continued at varying intensities in each of the corridors, and both the local and regional landscapes have changed, new strategies are needed for protecting and conserving land within these corridors. Finally, as the population of Wake Forest has grown and new planning efforts have been undertaken, new goals have emerged. The new goals of the Open Space and Greenway Plan Update, to be considered in conjunction with the goals of the 2002 plan, are as follows: ***1) provide specific recommendations for developing new priority greenway segments and facilities; 2) explore potential connections that can be derived from linking the old greenway plan to the adopted pedestrian, bicycle, and parks and recreation plans; and 3) expand on recent planning efforts for the Smith, Richland, and Sanford Creek corridors by identifying trail locations within their more broadly defined greenway corridors.***

Below: A portion of the Smith Creek corridor.

The goals for this plan, stated above, are in concert with the goals of other Wake Forest planning initiatives. Statements from the Wake Forest Land Use Management Plan, the Land Development Plan, the Parks and Recreation Plan Update, the Pedestrian Plan and the Bicycle Plan were consolidated into the following statements and goals. They demonstrate the continued importance and concerted effort to protect open space and preserve greenways in Wake Forest, as well as new priorities and functions afforded to greenway and open space planning by recent plans.

STATEMENTS AND GOALS RELATED TO OPEN SPACE & GREENWAYS

(Consolidated from other Wake Forest planning initiatives)

Parks and Open Space

- Provide a variety of land and water areas for recreation and environmental conservation through the acquisition of new park and open space land in accordance with the Parks and Recreation Master Plan.
- Provide equitably distributed recreation areas, facilities, and programs, conveniently located throughout the Town; improve accessibility to meet the basic needs of children, teenagers and adults, while also recognizing the special needs of the elderly, the disadvantaged, and the handicapped.
- Optimize the appreciation, use and stewardship of Wake Forest's historic, cultural and natural resource heritage.

Greenway, Bicycle, and Pedestrian Facilities

- Acquire, develop and maintain a system of greenways and bikeways to protect natural features, enhance the aesthetic character of the Town, create value and generate economic activity, provide viable alternative transportation options, and to improve health through active living.
- Provide safe, family-friendly bikeways and walkways that connect to various places in Wake Forest, including the library, schools, parks, shopping destinations, and regional destinations, such as Raleigh and other parts of the Triangle.
- Provide maps, signage, and events to facilitate and encourage the safe use of on- and off-road bicycle and pedestrian facilities.
- Improve connectivity and fill gaps in existing greenway, bicycle, and pedestrian facilities.

Land Development

- Encourage conservation of remaining open spaces through higher density development close to the Central Business District and in the appropriate districts.
- Development should be compatible with the natural environment, including steep slopes, soils, flood plains, and wooded areas, especially within water supply watersheds.
- Development should be regulated to limit land clearing to the minimum necessary for development.
- Prevent development in areas subject to damage due to flooding or unstable soils.

Implementation

- Promote better coordination among implementing agencies.
- Develop environmentally sensitive design principles.
- Enhance sustainability goals.
- Provide opportunities for community involvement.
- Encourage private recreation initiatives to supplement public facilities.
- Work in partnership with Wake County and adjacent municipalities to identify lands that can provide open space linkages to connect open space systems and to contribute to the overall Wake County Open Space Plan.

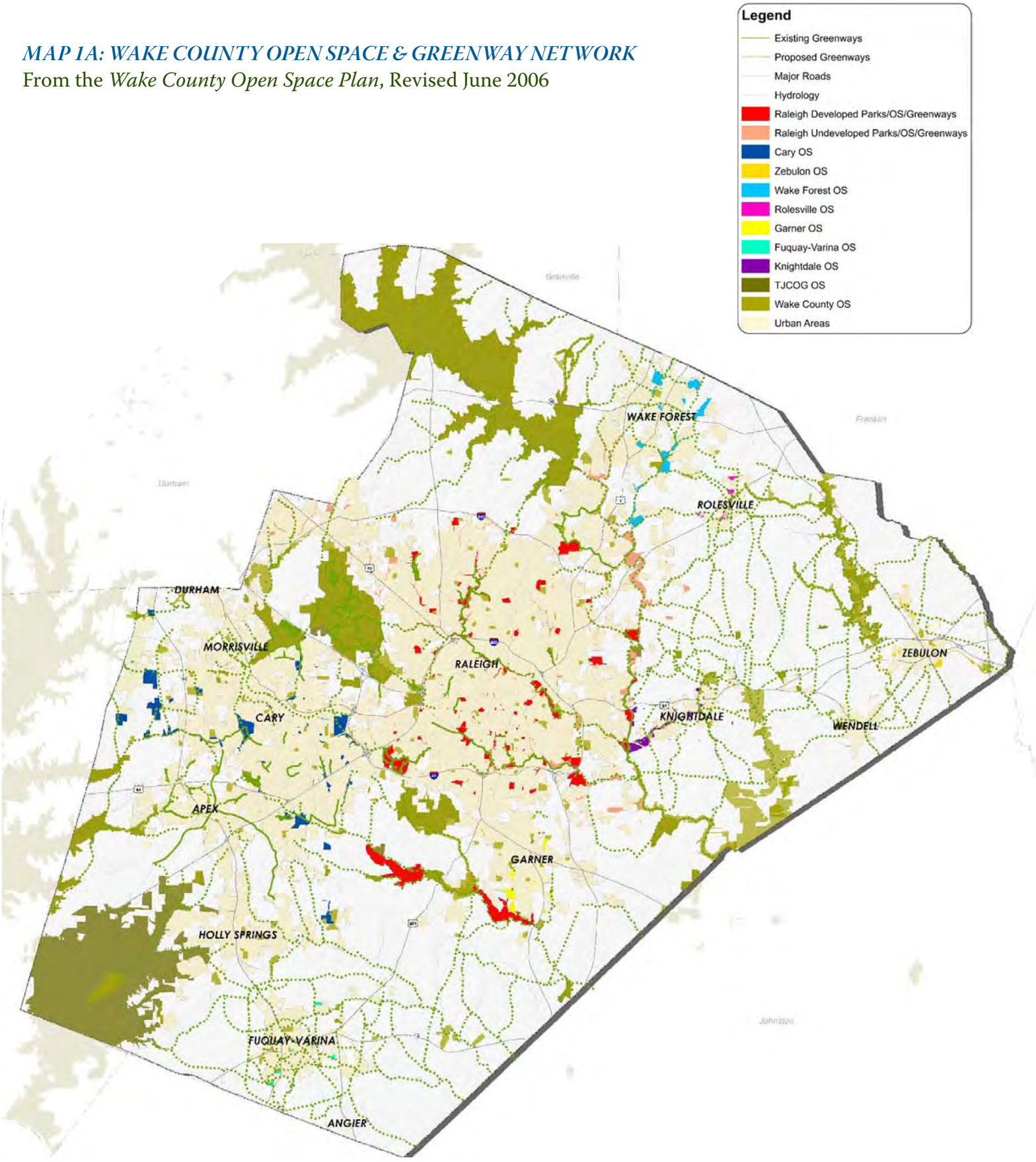
In addition to the aforementioned local plans, this Plan Update is also consistent with open space planning in Wake County. Starting in 2002, the County worked with it's twelve municipalities to support open space planning in order to preserve natural and cultural landscapes. In order to comprehensively evaluate the County's land area, and to eventually protect 30 percent of it, each municipal government was awarded a monetary grant and asked to prepare its own open space plan. The 2002 Wake Forest Open Space and Greenway Plan was one such plan, and the recommendations contained therein were combined with the recommendations of the other 11 municipalities' open space plans to collectively form the 2003 Wake County Consolidated Open Space Plan. The 2003 Plan was the first effort at developing uniform open space plans and programs throughout Wake County, and identified over 90 targeted open space areas as future priority open space acquisitions. Additionally, the Plan recommended numerous programs and policies meant to achieve balanced and sustainable growth in conjunction with an interconnected system of open spaces.

In 2006, Wake County evaluated and revised their 2003 Consolidated Open Space Plan (see map 1A, page 1-5). The 2006 Revision evaluates successes and challenges, both on a county-wide and on a municipal level, and makes recommendations on how to improve planning efforts in order to better achieve the open space conservation goals set forth in the original plan. The 2006 revised plan reveals that many of the programs and goals set forth by the 12 municipal open space plans have not been implemented, and as a result many of the overall County goals have not been met. The 2006 revised plan recommends that Wake County and its 12 municipalities modify certain aspects of their open space plans to be more creative, collaborative, aggressive, and ultimately more effective. This Wake Forest Open Space and Greenway Plan Update considers these recommendations, and incorporates them into new goals and objectives.

As Wake County continues to grow in the 21st Century, it is hoped that these current efforts of planning for the protection and conservation of open space will ensure that future generations will have access to the special landscapes and waterways that are unique to the region. Preserving and protecting these resources will also enhance the quality of life for future residents and ensure that this is one of the great places to live, work and raise a family.

MAP 1A: WAKE COUNTY OPEN SPACE & GREENWAY NETWORK

From the *Wake County Open Space Plan*, Revised June 2006



BENEFITS OF OPEN SPACE AND GREENWAYS

Open space and greenways provide a variety of benefits that ultimately affect the sustainability of economic, environmental, and social health. A summary of these benefits can also be found in the Town of Wake Forest brochure, *The Benefits of Open Space and Greenways*. These benefits include:

- creating value and generating economic activity;
- transportation benefits;
- improving health through active living;
- clear skies, clean rivers, and protected wildlife;
- protecting people and property from flood damage; and,
- enhancing cultural awareness and community identity.

CREATING VALUE & GENERATING ECONOMIC ACTIVITY

There are many examples, both nationally and locally, that affirm the positive connection between greenspace and property values[1]. Residential properties will realize a greater gain in value the closer they are located to trails and greenspace. According to a 2002 survey of recent homebuyers by the National Association of Home Realtors and the National Association of Home Builders, trails ranked as the second most important community amenity out of a list of 18 choices[2]. Additionally, the study found that 'trail availability' outranked 16 other options including security, ball fields, golf courses, parks, and access to shopping or business centers. Findings from the Trust for Public Land's Economic Benefits of Parks and Open Space, and the Rails-to-Trails Conservancy's Economic Benefits of Trails and Greenways (listed below) illustrate how this value is realized in property value across the country.

Trails & Greenways Increase Real Property Values:

- Apex, NC: The Shepherd's Vineyard housing development added $5,000 to the price of each of the 40 homes adjacent to the regional greenway, and those homes were still the first to sell[3].

- Front Royal, VA: A developer who donated a 50-foot-wide, seven-mile-long easement along a popular trail sold all 50 parcels bordering the trail in only four months.

- Salem, OR: land adjacent to a greenbelt was found to be worth about $1,200 an acre more than land only 1000 feet away.

- Oakland, CA: A three-mile greenbelt around Lake Merritt, near the city center, was found to add $41 million to surrounding property values.

Apex, NC: The Shepherd's Vineyard housing development added $5,000 to the price of each of the 40 homes adjacent to the regional greenway – and those homes were still the first to sell. (Rails to Trails Conservancy, 2005)

- Seattle, WA: Homes bordering the 12-mile Burke-Gilman trail sold for 6 percent more than other houses of comparable size.

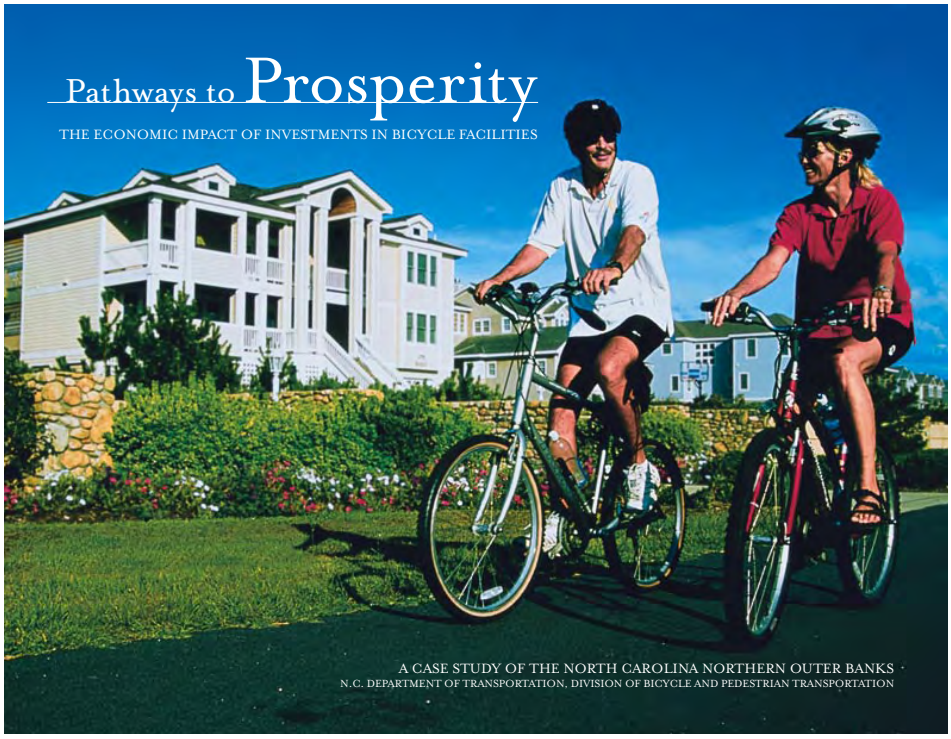
- Brown County, WI: Lots adjacent to the Mountain Bay Trail sold faster and for an average of nine percent more than similar property not located next to the trail.

- Dayton, OH: Five percent of the selling price of homes near the Cox Arboretum and park was attributable to the proximity of that openspace.

Trail Tourism Creates Economic Impacts:
Tourism and recreation-related revenues from trails and greenways come in several forms. Trails and greenways create opportunities in construction and maintenance, recreation rentals (such as bicycles, kayaks, and canoes), recreation services (such as shuttle buses and guided tours), historic preservation, restaurants and lodging.

- The Outer Banks, NC: Bicycling is estimated to have an annual economic impact of $60 million and 1,407 jobs supported from the 40,800 visitors for whom bicycling was an important reason for choosing to vacation in the area. The annual return on bicycle facility development in the Outer Banks is approximately nine times higher than the initial investment[4].

Download the full report, "Pathways to Prosperity", from: http://ncdot.org/transit/bicycle/safety/safety_economicimpact.html



- Damascus, VA: At the Virginia Creeper Trail, a 34-mile trail in southwestern Virginia, locals and non-locals spend approximately $2.5 million annually related to their recreation visits. Of this amount, non-local visitors spend about $1.2 million directly in the Washington and Grayson County economies[5].

- Morgantown, WV: The 45-mile Mon River trail system is credited by the Convention and Visitors Bureau for revitalizing an entire district of the city, with a reported $200 million in private investment as a direct result of the trail[6].

- San Antonio, TX: Riverwalk Park, created for $425,000, has surpassed the Alamo as the most popular attraction for the city's $3.5-billion tourism industry[7].

- Tallahassee, FL: The Florida Department of Environmental Protection Office of Greenways & Trails estimate an economic benefit of $2.2 million annually from the 16-mile St. Marks Trail[8].

- Allegheny Passage, PA: The direct economic impact of the trail exceeded $14 million a year, encouraging the development of several new businesses and a rise in property values in the first trailhead town.

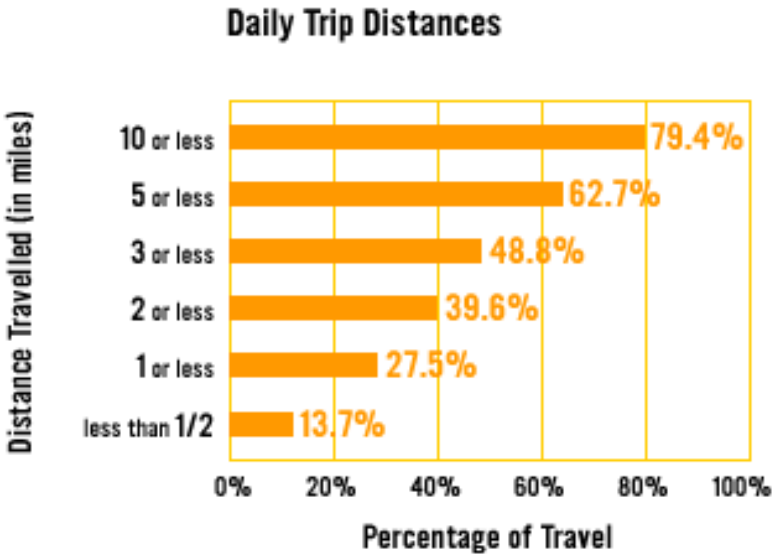
- Leadville , CO: In the months following the opening of the Mineral Belt Trail, the city reported a 19 percent increase in sales tax revenues.

- Dallas, TX: The 20-mile Mineral Wells to Weatherford Trail attracts 300,000 people annually and generates local revenues of $2 million.

Damascus, VA is able to market itself to trail users, and it reaps the rewards for doing so.

TRANSPORTATION BENEFITS

The sprawling nature of many land development patterns often leaves residents and visitors with no choice but to drive, even for short trips. In fact, nearly two-thirds (62.7%) of all trips we make are for a distance of five miles or less (see chart on page 1-9). Surveys by the Federal Highway Administration show that Americans are willing to walk as far as two miles to a destination and bicycle as far as five miles. A complete trail network, as part of the local transportation system, will offer effective transportation alternatives by connecting homes, workplaces, schools, parks, downtown, and cultural attractions.



Right: 'Daily Trip Distances' chart from the Bicycle and Pedestrian Information Center website, www.pedbikeinfo.org

Trail networks can provide alternative transportation links that are currently unavailable. Residents who live in subdivisions outside of downtown areas are able to walk or bike downtown for work, or simply for recreation. Residents are able to circulate through urban areas in a safe, efficient, and fun way: walking or biking. Residents are able to move freely along trail corridors without paying increasingly high gas prices and sitting in ever-growing automobile traffic. Last but not least, regional connectivity through alternative transportation could be achieved once adjacent trail networks are completed and combined.

IMPROVING HEALTH THROUGH ACTIVE LIVING

Greenway trails in Wake Forest will contribute to the overall health of residents by offering people attractive, safe, accessible places to bike, walk, hike, jog, skate, and possibly places to enjoy water-based trails. In short, the greenway network will create better opportunities for active lifestyles. The design of our communities—including towns, subdivisions, transportation systems, parks, trails and other public recreational facilities—affects people's ability to reach the recommended 30 minutes each day of moderately intense physical activity (60 minutes for youth). According to the Centers for Disease Control and Prevention (CDC), "Physical inactivity causes numerous physical and mental health problems, is responsible for an estimated 200,000 deaths per year, and contributes to the obesity epidemic." [9]

In identifying a solution, the CDC determined that by creating and improving places in our communities to be physically active, there could be a 25 percent increase in the percentage of people who exercise at least three times a week[10]. This is significant considering that for people who are inactive, even small increases in physical activity can bring measur-

able health benefits. [11] Additionally, as people become more physically active outdoors, they make connections with their neighbors that contribute to the health of their community.

Many public agencies are teaming up with foundations, universities, and private companies to launch a new kind of health campaign that focuses on improving people's options instead of reforming their behavior. A 2005 Newsweek Magazine feature, Designing Heart-Healthy Communities, cites the goals of such programs (italics added): "The goals range from updating restaurant menus to restoring mass transit, but the most visible efforts focus on making the built environment more conducive to *walking and cycling*."[12] Clearly, the connection between health and greenways is becoming common knowledge. The Rails-to-Trails Conservancy puts it simply: "Individuals must choose to exercise, but communities can make that choice easier."

CLEAR SKIES, CLEAN RIVERS, AND PROTECTED WILDLIFE

There are a multitude of environmental benefits from trails, greenways, and open spaces that help to protect the essential functions performed by natural ecosystems. Greenways protect and link fragmented habitat and provide opportunities for protecting plant and animal species. Trails and greenways reduce air pollution by two significant means: first, they provide enjoyable and safe alternatives to the automobile, which reduces the burning of fossil fuels; second, they protect large areas of plants that create oxygen and filter air pollutants such as ozone, sulfur dioxide, carbon monoxide and airborne particles of heavy metal. Greenways improve water quality by creating a natural buffer zone that protects streams, rivers and lakes, preventing soil erosion and filtering pollution caused by agricultural and road runoff.

As an educational tool, trail signage can be designed to inform trail-users about water quality issues particular to each watershed. Such signs could also include tips on how to improve water quality. Similarly, a greenway can serve as a hands-on environmental classroom for people of all ages to experience natural landscapes, furthering environmental awareness.

PROTECTING PEOPLE AND PROPERTY FROM FLOOD DAMAGE

The protection of open spaces associated with greenway development often also protects natural floodplains along rivers and streams. According to the Federal Emergency Management Agency (FEMA), the implementation of floodplain ordinances is estimated to prevent $1.1 billion in flood damages annually. By restoring developed floodplains to their natural state and protecting them as greenways, many riverside communities are preventing potential flood damages and related costs. [13]

ENHANCING CULTURAL AWARENESS & COMMUNITY IDENTITY

Trails, greenways, and open space can serve as connections to local heritage by preserving historic places and by providing access to them. They provide a sense of place and an understanding of past events by drawing greater public attention to historic and cultural locations and events. Trails often provide access to historic sites such as battlegrounds, bridges, buildings, and canals that otherwise would be difficult to access or interpret. Each community and region has its own unique history, its own features and destinations, and its own landscapes. By recognizing, honoring, and connecting these features, the combined results serve to enhance cultural awareness and community identity, potentially attracting tourism. Being aware of the historical and cultural context when naming parks and trails and designing features will further enhance the overall trail- and park-user experience.

Chapter 1 Footnotes

1 American Planning Association. (2002). How Cities Use Parks for Economic Development.

2 National Association of Realtors and National Association of Home Builders. (2002). Consumer's Survey on Smart Choices for Home Buyers.

3 Rails to Trails Conservancy. (2005). Economic Benefits of Trails and Greenways.

4 NCDOT and ITRE. (2006). Bikeways to Prosperity: Assessing the Economic Impact of Bicycle Facilities.

5 Virginia Department of Conservation. (2004). The Virginia Creeper Trail: An Assessment of User Demographics, Preferences, and Economics.

6 Rails to Trails. (Danzer, 2006). Trails and Tourism.

7 American Planning Association. (2002). How Cities Use Parks for Economic Development.

8 Rails to Trails. (Danzer, 2006). Trails and Tourism.

9 U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. (1996). Physical Activity and Health: A Report of the Surgeon General.

10 U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. (2002). Guide to Community Preventive Services.

11 Rails-to-Trails Conservancy. (2006) Health and Wellness Benefits.

12 Newsweek Magazine. (10/3/2005). Designing Heart-Healthy Communities.

13 Federal Emergency Management Agency. (2005) Building Stronger: State and Local Mitigation Planning.

Chapter 2: Existing Conditions

Sanford Creek

Chapter Outline:

History of Wake Forest

The Study Area

Open Space & Greenway Resources

HISTORY OF WAKE FOREST

The roots of Wake Forest stretch back to the early 1800s and the purchase of 615 acres by Dr. Calvin Jones. In 1823, the site was home to the "Wake Forest Academy for Boys." In 1834, it was sold to the North Carolina Baptist Convention and became the "Manual Labor Institute." The school grew rapidly and, in 1838, was renamed "Wake Forest College."

The growing school had an increasing need for space and money and decided to divide the property into lots and sell them for $100 each. Eighty one-acre lots north of the campus and west of the railroad were put on the market in 1839. This area was later known as Faculty Avenue and today constitutes the greater portion of the Wake Forest Historic District. The College was temporarily closed from 1862 to 1866 because of the Civil War.

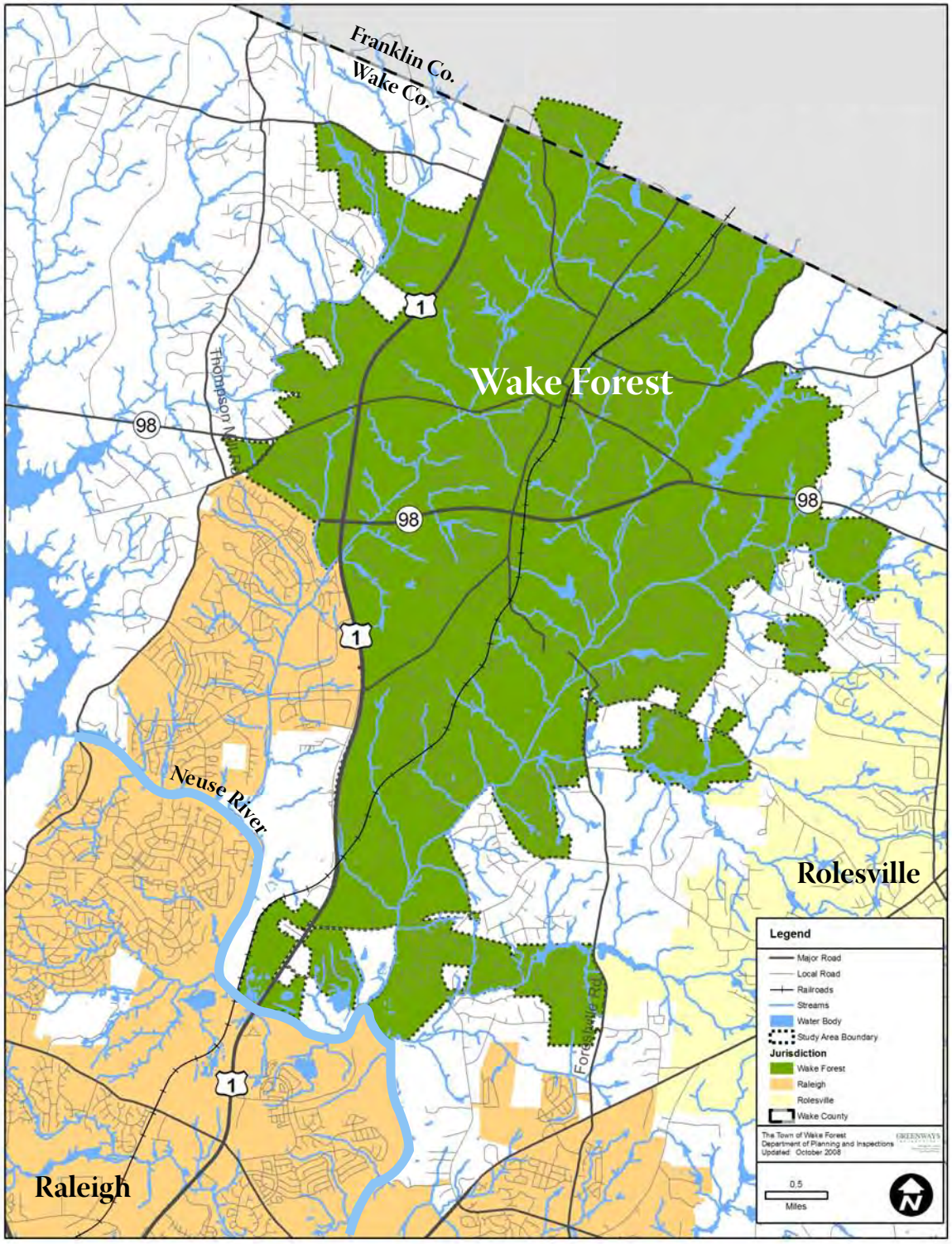
When the Raleigh and Gaston Railroad station moved from Forestville to Wake Forest College, a substantial increase in the commercial development of Wake Forest was underway. And in 1909, the community drafted its first charter to become the Town of Wake Forest. Steady growth continued into the 1950s, when Wake Forest College was transferred to Winston-Salem, North Carolina, and the existing site was sold to its current occupant, the Southeastern Baptist Theological Seminary.

Wake Forest has continued to attract families and businesses. In recent years, the nearby Research Triangle Park (RTP) has experienced explosive growth. While the region sustains success with the arrival and advances of medical and high technology firms, the accessibility and livability of Wake Forest assures it of maintaining a highly desirable quality of life.

THE STUDY AREA

The study area for this Open Space Plan is defined principally by the Neuse River (to the south) and the Wake County / Franklin County Line (to the north). The western boundary runs south from the County line along Thomson Mill Road to Capital Blvd. (US-1) and down to the Neuse River. The eastern edge of the study area generally follows Forestville Road from the southern end, north to Sanford Creek, and then north-northwest to the County line.

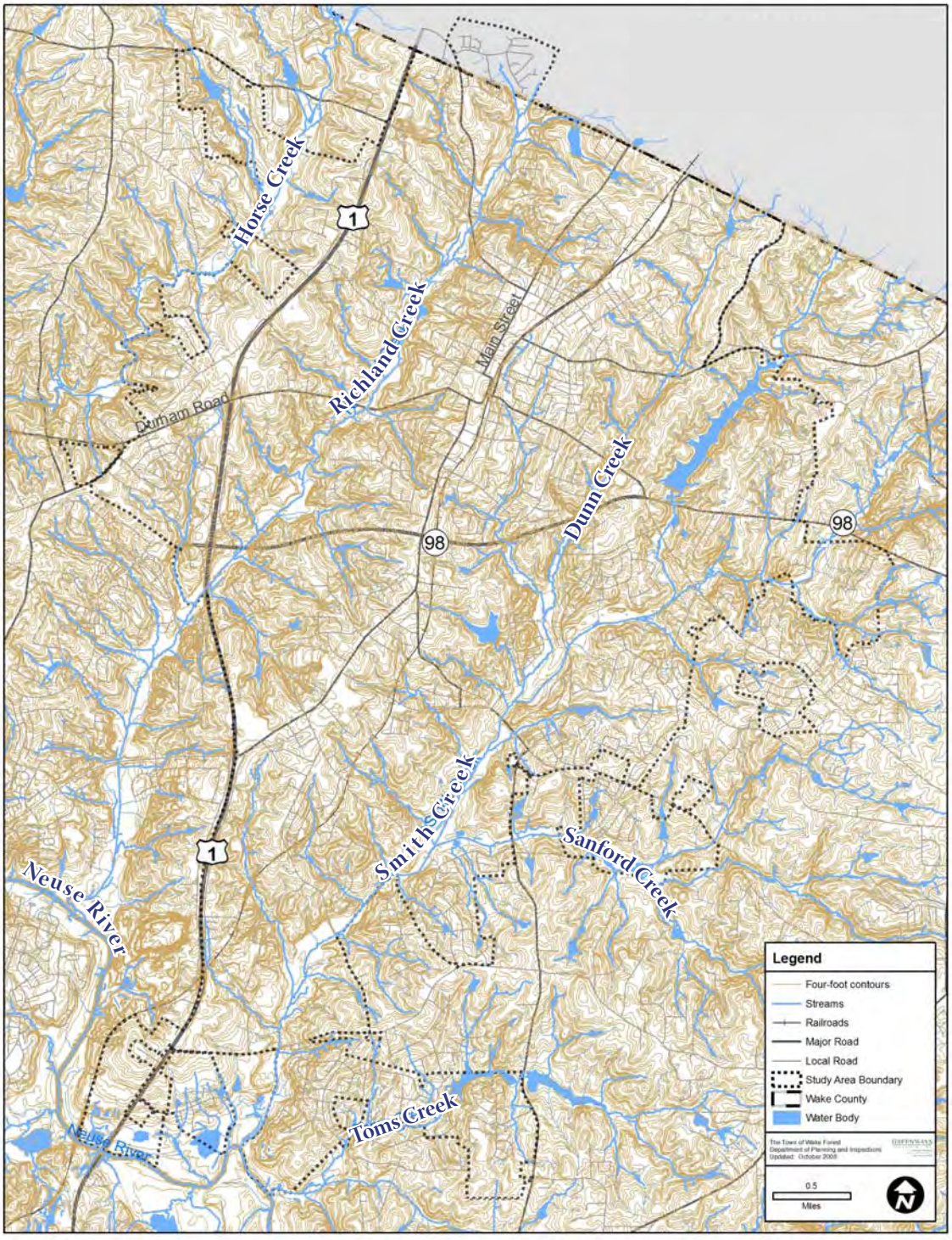
MAP 2A: STUDY AREA



TOPOGRAPHY

The topography of the study area can be characterized as rolling to hilly terrain. Major drainageways are bordered by steep slopes. The largest corridors in the study area (see Richland Creek and Smith Creek in Map 2B below) lie in north to south running valleys. The Richland and Smith creeks flow south to the Neuse River. Horse Creek, in northwest Wake Forest flows south to Falls Lake. Other creeks, such as Tom's Creek and Sanford Creek, follow east/west corridors. Downtown Wake Forest is situated atop the ridge that divides the Richland Creek watershed from the Smith Creek watershed. Elevations within the study area range from approximately 220 to 440 feet above sea level. Rounded ridgetops give way to moderate slopes and level out to relatively broad floodplains.

MAP 2B: LAND FORM



SOILS

The soil types within the study area are characteristic of soils found on ridges and the sides of ridges. The study area primarily consists of Cecil association soils. Soils around Wake Forest tend to be deep and well drained. Typically, they have a subsoil of firm, red clay, and surface layers tend to be sandy loam or gravelly sandy loam to clay loam.

In the lowlands, near stream courses, the soils are primarily of the Chewacla or Wehadkee associations. This area contains hydric and semi-hydric soils (waterlogged soils) typical of floodplains. The properties of these soils make development difficult due to greater engineering requirements and higher construction costs.

VEGETATION

Vegetation, composed principally of overstory trees, understory trees, shrubs and groundcovers, is a critically important feature of the natural landscape. Vegetation filters pollutants from the air, surface and subsurface waters; moderates local climates; offers relief from exposure to sun, wind and rain; and provides habitat for numerous species of wildlife. Wake Forest is predominantly forest-covered, featuring shagbark hickory (Carya ovata), white oak (Quercus alba), and river birch (Betula nigra). Understory vegetation is comprised primarily of greenbriar (Smilax spp.), sedge grass (Carex spp.), bull rush (Juncus spp.), native bamboo, and wool grass (Scirpus cyperinus). Along stream corridors, density is controlled by seasonal flooding, allowing for a relatively clear understory. The edge community is dominated by sweet gum (Liquidambar styraciflua) saplings, small cedars (Cedrus spp.), and sweet bay magnolia (Magnolia virginiana). Vacant farmlands are dominated by andropogon (Johnson's grass) and sumac (Rhus spp.).

Wetlands are typically defined by the presence of three unique, interrelated natural features: hydrology, hydric soils, and vegetation species. Wetlands are critical ecological systems because of their ability to filter pollutants from surface water, recharge underground aquifers, absorb floodwaters, and serve as habitat for a diverse variety of plant and animal life. Most wetlands are protected by Section 404 of the Federal Clean Water Act, which authorizes the U.S. Army Corps of Engineers to regulate the discharge of dredged and fill materials into waters of the United States, including wetlands (called "Jurisdictional Wetlands").

The primary canopy wetland species are red maple (Acer rubrum), willow (Salix spp.), ironwood (Carpinus caroliniana) and river birch. The understory is principally composed of reeds, greenbriar, and small grasses. Due to the shade cast by canopy trees, there is very little groundcover. However, along cleared corridors, such as sewer line easements, enough sunlight penetrates the canopy to support a carpet of rye grass, planted to stabilize the soil and permit access along the corridor.

WILDLIFE

There are two broad categories of wildlife that are of concern to this planning effort: "interior" forest species wildlife and "edge" species wildlife. Most species of wildlife that inhabit urban areas are known as "edge" species. These mammals, birds, amphibians and insects have adapted to urbanized landscapes and have developed harmonious relationships with urban residents. However, "interior" species require undisturbed forest environments to survive and, because of the human population growth and resulting land development, have experienced significant habitat loss and population declines.

Habitats for rare and common "interior" and "edge" species exist in various forms throughout the Wake Forest area. Diverse habitats are typically connected by migration corridors that allow plant and animal species to move through the landscape. The migration corridors most important to the study area are along streams. The Wake Forest Open Space and Greenway Plan is concerned with both the remnants of "interior" forest species and the "edge" environments that exist within the floodplains of the study area. These resource areas are the most valuable for wildlife in that they provide a food source, water and shelter. Approximately, eighty percent of all wildlife depends on riparian corridors for survival. Therefore, the protection of floodplains is crucial to sustaining a diverse wildlife population in Wake Forest.

The presence of wetlands and Brown's Lake create the potential for a wildlife refuge and/or park attraction; however, there is limited support from the surrounding neighborhoods for a greenway facility.

During site visits, evidence was found of beaver, squirrel and deer populations. Even a tiger salamander was discovered. Opossum and raccoons are expected to be in abundance. Bird species that one can expect to find within the study area include: black-capped chickadee, red-bellied woodpecker, northern cardinal, and barred owl.

POPULATION

Within the municipal boundaries of Wake Forest, the population grew from 5,581 in 1990 to 13,175 in 1999. The Town's population has increased even more dramatically since 2000, with an estimated 2008 population of **27,217.** Population density in 2008 (persons per acre) was estimated at at 2.81. As the population continues to grow, the need for conservation of undeveloped lands, such as greenway corridors, will also continue to increase.

INFRASTRUCTURE

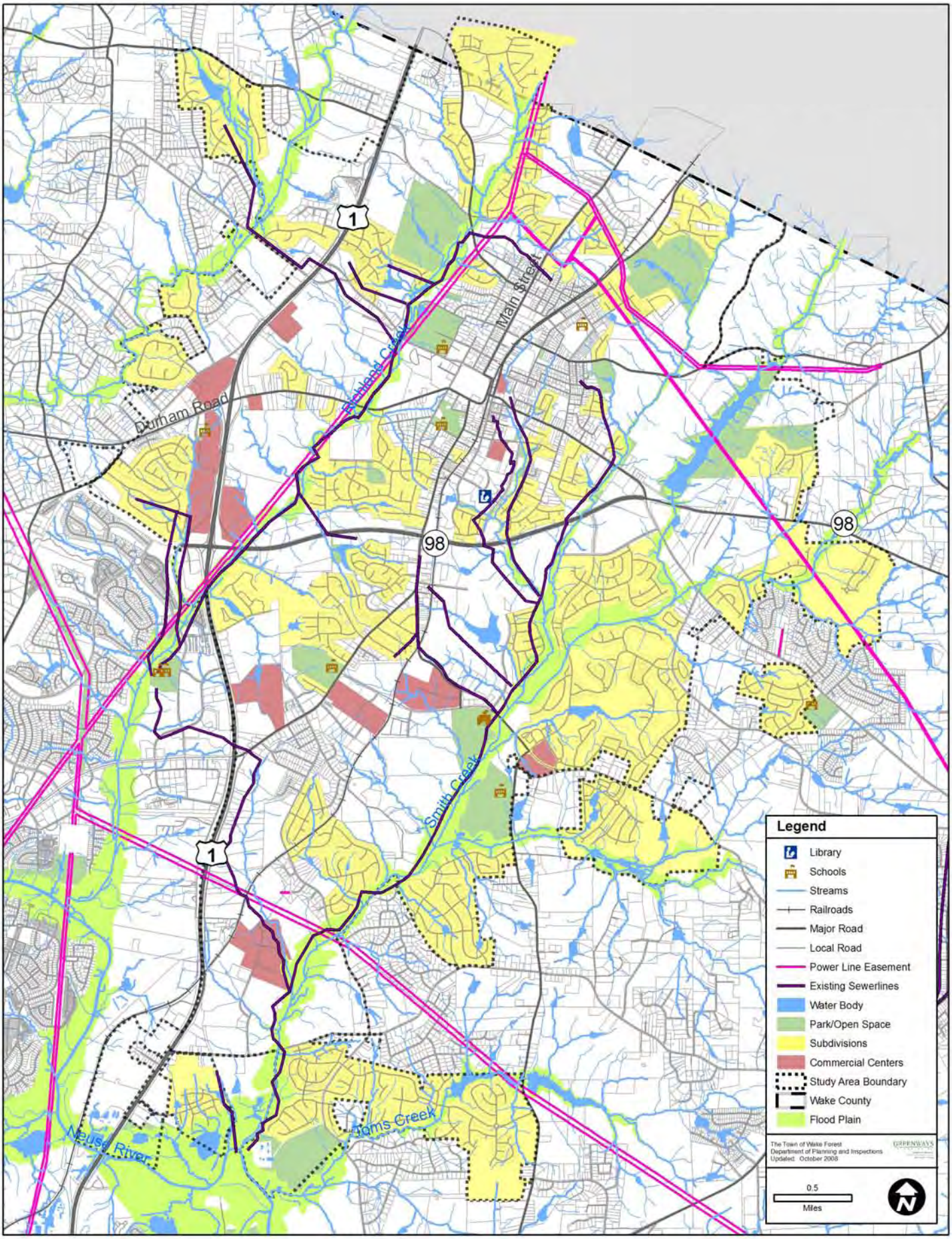
Infrastructure is the skeleton of a community and a critical determinant of future development. Infrastructure easements can play a significant role in the alignment of greenway facilities. Oftentimes, utility companies can be persuaded to grant surface easements for the construction of trails that can be used by the public as well as utility vehicles for easement maintenance.

In Wake Forest the available infrastructure data displays water and sewer lines (see map 2C. page 2-7). Most notable are the lengthy stretches of sewer lines in the floodplains of Richland Creek and Smith Creek. These facilities should remain the focus of greenway planners because of their potential to link the community from north to south. Easements that are currently for sewer only (as opposed to sewer and greenway easements) should be targeted for revision to allow for greenways. Also, sewer easements managed by the City of Raleigh within the Town of Wake Forest are still owned by the Town, so greenway planners from both municipalities will coordinate their planning efforts for trail development.

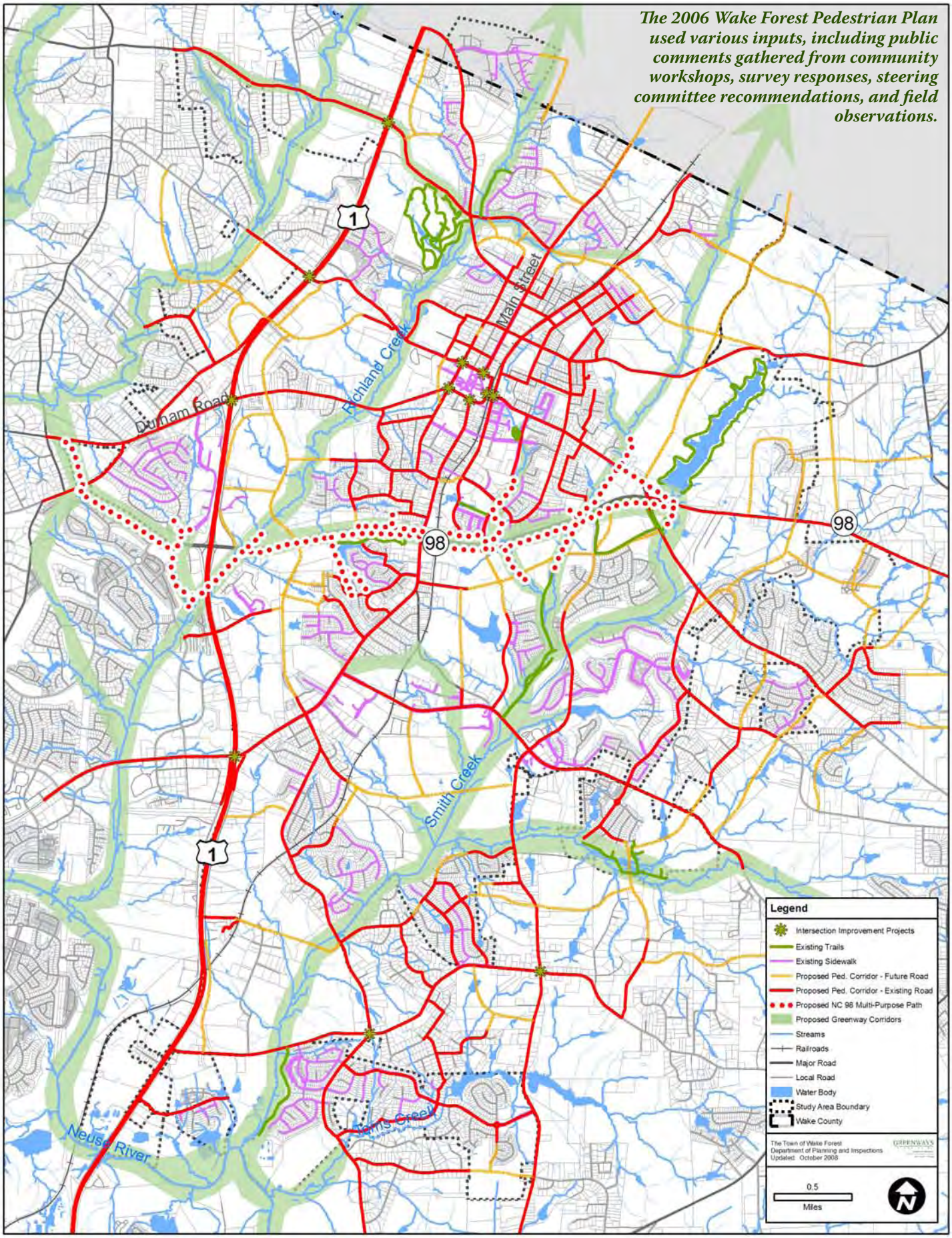
The Richland Creek corridor flanks downtown to the west. At the time of the 2002 Open Space and Greenways Plan, it was considered the most suitable for immediate greenway construction; however, development pressure along Smith Creek made it the second highest priority, resulting in greenway acquisition and trail construction along parts of Smith Creek. Also, Heritage High School is being developed nearby along the Sanford Creek Greenway, with easements dedicated for connections between the Smith Creek Greenway, downtown, and students residing in Heritage Wake Forest.

Similar to water-related infrastructure, the existing transportation infrastructure also has the potential to be incorporated into the greenway network. Bicycle facilities and sidewalks within roadway corridors should be added or improved where possible to act as interim connections during long-term greenway projects. Both the Pedestrian Plan and the Bicycle Plan contain lists of recommended on and off road facilities that may be critical in linking existing and proposed greenway segments (see maps 2D and 2E on pages 2-7 and 2-8 for the Pedestrian Plan and the Bicycle Plan recommendations; refer to the full plans for more details).

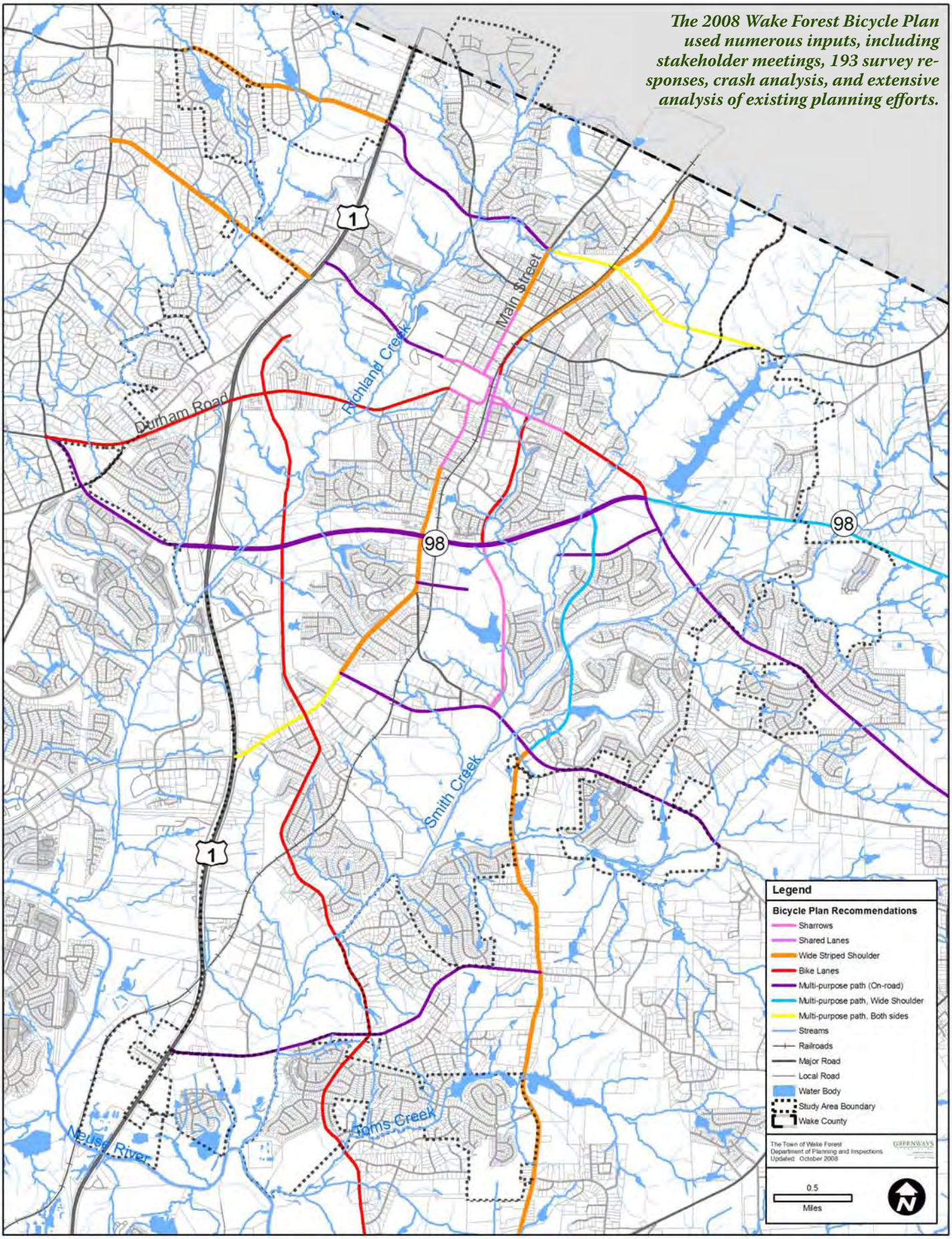
MAP 2C: INFRASTRUCTURE



MAP 2D: THE WAKE FOREST PEDESTRIAN PLAN



MAP 2E: THE WAKE FOREST BICYCLE PLAN



LAND USE

Wake Forest is located in northern Wake County, the fastest growing county in North Carolina throughout the 1990s. This extraordinary growth has continued into the 21st Century, with the population growing an incredible 4.9 percent from 2006 to 2007, making Wake County the 60th most populous county in the nation. Wake Forest's development pattern can be divided into three distinctive regions, defined by the ridgelines and streams. In general, residential development is occurring both along the ridgelines and in lower elevations.

Farmland to the west is primarily utilized for tree farming and as pastureland. Likewise, the land around the Wake Forest Reservoir is zoned for forestry. Eastern agricultural activities primarily involve raising field crops and pastureland. Development in the eastern portion of Wake Forest, centered around Sanford and Smith Creeks, is shifting towards medium-density residential neighborhoods.

Capital Blvd. (US-1) is a north/south corridor along which large scale automobile oriented commercial development is occurring. There is significant residential development pressures in Wake Forest, particularly in the southeastern sections as people continue to turn to Wake Forest for its small town and historic charm

PARKS AND RECREATION LANDS

In 2005, The Town of Wake Forest completed its Parks and Recreation Master Plan Update, which gives a summary of existing park and recreation conditions. The plan includes results from the 2003 Recreation Participation and Preference Survey and input gathered from multiple public meetings. Overall, the plan indicates a desire on the part of Wake Forest residents to have increased access to recreational opportunities of all types.

The Town of Wake Forest maintains five mini parks of less than two acres in size, six neighborhood parks between five and 20 acres in size, and three metro parks of over 100 acres in size. Also, the western portion of the study area borders on the Falls Lake recreational area, a notable recreation area that provides outdoor activities such as fishing, canoeing and kayaking, and hiking.

There are several new opportunities for public recreation within Wake Forest that have been developed since the 2002 Open Space and Greenway Plan (see map 2F, page 2-13). The Town added a community center, a two-acre dog park, and four lighted tennis courts to J.B. Flaherty Park; developed the Smith Creek Soccer Center (southeast of Downtown); added new greenway trails and nature preserves along Sanford Creek; added 45 acres of parkland adjacent to Heritage High School; and the 117-acre Joyner Park northwest of Downtown Wake Forest.

The Town has indicated that while it would continue to maintain these parks, it would not develop additional mini parks. This is due in part to the fact that private recreation areas (play areas, etc.) are frequently developed as part of new subdivisions that often serve the same role as a mini park.

The Parks and Recreation Plan also outlines some regional and national recreation trends to be taken into consideration when planning for recreation facilities. Some noted trends of interest include:

- Passive recreational activities such as Walking Facilities and Multi-Use Pathways are topping the lists of desired amenities.
- Creating interconnected systems both within the community and regionally is a key goal of most communities.
- These facilities also provide vital links to residential areas, commercial zones and workplaces to encourage walkable community initiatives and safe alternatives to automobile commuting.
- Parks and recreation facilities that highlight environmental or ecological processes and have a focus on education are being developed throughout the nation.

Below: Flaherty Park and Smith Creek Soccer Center

OPEN SPACE & GREENWAY RESOURCES

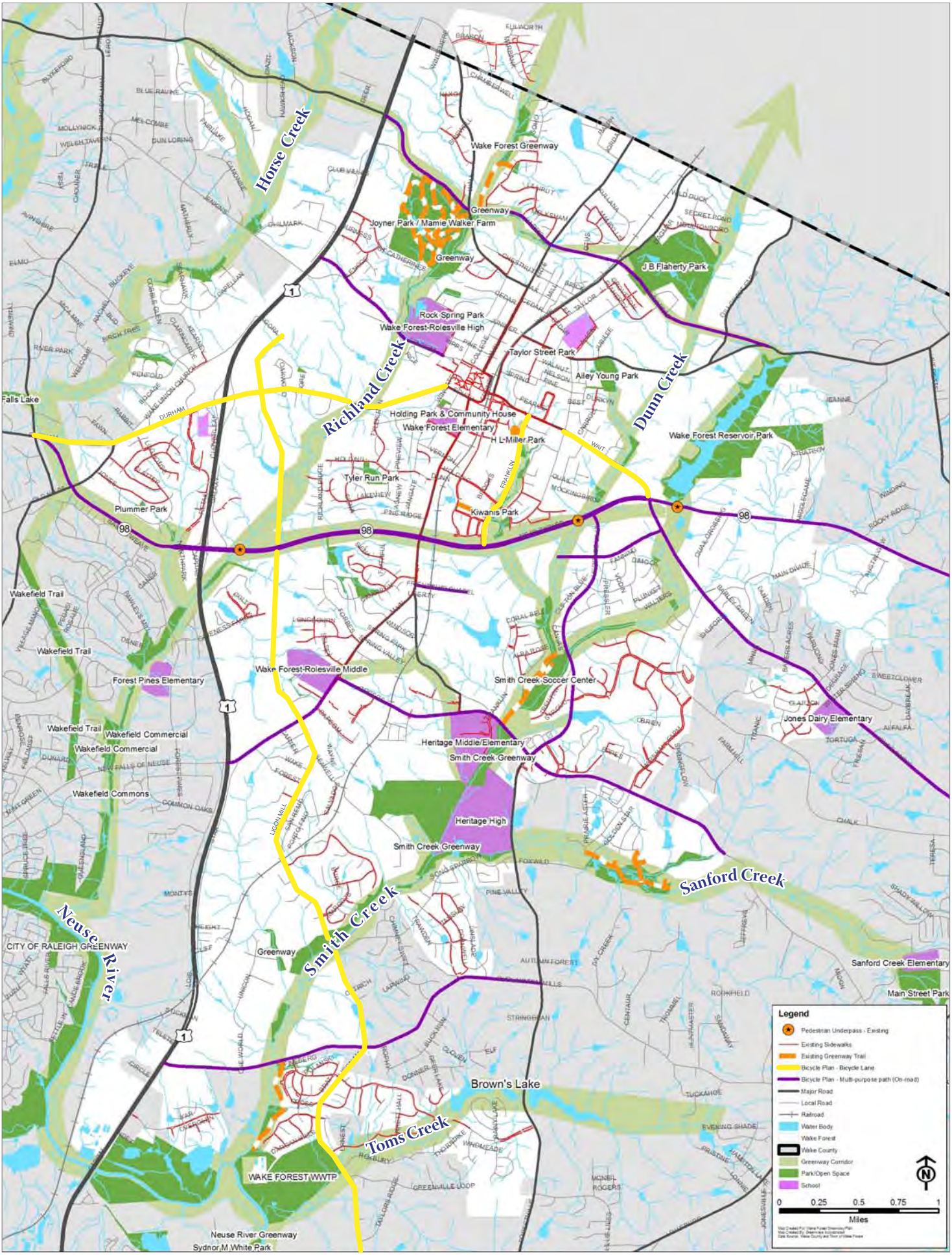
The Town of Wake Forest has significant holdings in public land, totaling approximately 500 acres (see map 2F, page 2-13). These land holdings are diverse in size and location. The majority of publicly owned open spaces in Wake Forest are small and located in more densely populated areas. Larger public open spaces are found mainly south and east of downtown, on school, park, and water/wastewater properties. Connectivity of open space throughout the Town will be a challenge, particularly through residential neighborhoods where greenway easements are not in place. However, the locations and types of parcels already in public ownership provide a starting point for building a connected open space and greenway network, even with continued development.

While the greatest development pressures are in the southern portions of the Town's ETJ, the western portion of the study area is also being identified as an attractive place to live. Residents west of Capital Blvd. (US-1) enjoy a close proximity to the recreational amenities offered by Falls Lake, while maintaining reasonable connections to downtown Durham, via Highway 98, and Raleigh, via Capital Blvd. (US-1).

Property does not have to be publicly owned or completely separated from development for the public to enjoy the landscape. Wake Forest is considered a beautiful town not only because of the small town charm in its downtown building stock, but also due to the character of the surrounding landscape. The gently rolling terrain that separates the four primary watersheds of Wake Forest is a critical resource for the town. Residents enjoy the undeveloped open spaces composed of woodland, agricultural land, and stream corridors in a part of the county that was once considered rural, but is now becoming suburbanized as residential neighborhoods and commercial facilities continue to develop. While development and economic activity will certainly continue to shape the community, Wake Forest is still rich in visually appealing open space throughout the study area.

Currently, the Town of Wake Forest requires developers to reserve land, sometimes in the form of easements, for greenways based on the planned future greenway locations indicated in the Town's Open Space and Greenway Plan; however, developers are not required to construct the greenways or to pay fees-in-lieu for construction. The Town does require developers to pay a recreation facility fee, which contributes to a fund for the construction of future Parks and Recreation facilities in the Town, including greenway trail construction.

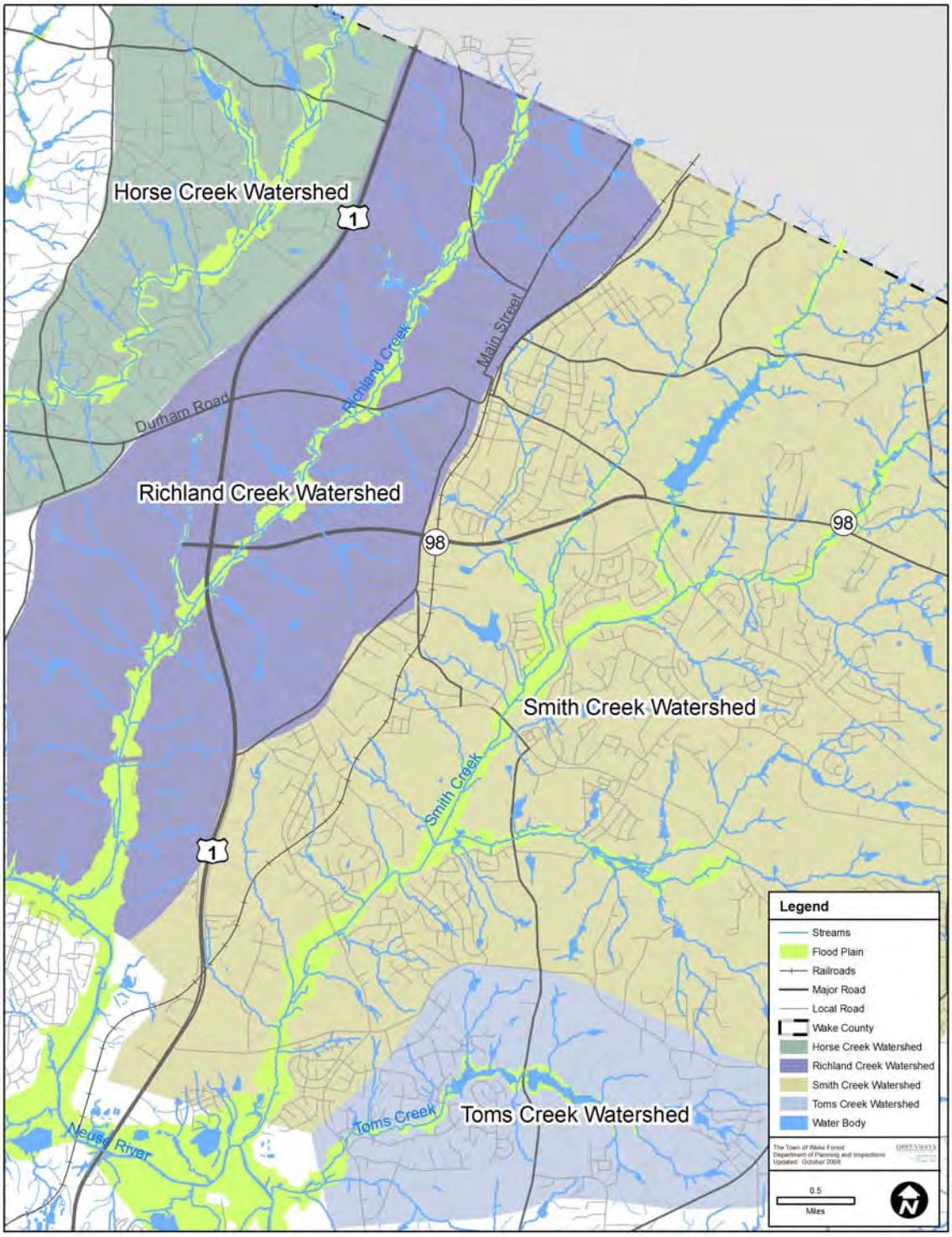
MAP 2F: OPEN SPACE & GREENWAYS



WATERSHED AREAS

The study area has been divided into sub-areas of focus based upon watershed boundaries. These areas are the Smith Creek watershed, the Richland Creek watershed, the Horse Creek watershed, and Tom's Creek watershed (see map 2G below). Determining ecological health and the suitability for greenway facilities and improvements are the primary objectives when investigating the study area's open space resources. Site inspections focused upon stream corridors, flood plains, and public utility easements, as well as upland areas and ridgelines.

MAP 2G: WATERSHEDS



SMITH CREEK WATERSHED

There has been a significant amount of development in the Smith Creek watershed since the Open Space and Greenway Plan was adopted. A 2,000-acre golf course community, known as Heritage Wake Forest, continues to develop from the eastern part of the town (between Rogers Rd. and the NC 98 Bypass Corridor) and is expanding to the north, south and east towards the Rolesville jurisdiction. There are also new subdivisions in the southern portion of the Smith Creek watershed to the south of the Heritage Schools and in the area adjacent to the wastewater treatment plant. The Smith Creek Soccer Complex has been completed and is located within the Heritage subdivision. Additionally, the new Heritage High School is near completion (located on Forestville Rd) and will have two baseball fields, two soccer fields and six lighted tennis courts.

While the large amount of development occurring in the Smith Creek watershed presents certain challenges to greenway planning efforts, it also represents an increasing need for greenways in the area, as increased population translates to increased need for recreational facilities and enhanced connectivity. Also, with two schools already in use and a third on the way, providing safe routes to school, an objective given high priority in both the Bicycle and Pedestrian Plans, becomes all the more critical.

Currently, the Smith Creek Greenway has just over one mile of paved trails located in two sections: between the Neuse River and Burlington Mills Road, and along the Smith Creek Soccer Complex in the Heritage Wake Forest Subdivision. Both sections take advantage of existing sewer corridors. Power lines also run along portions of Smith Creek and could be explored for trail opportunities.

Red oaks and pines were noted along the ridges while tulip poplars, red maples, and sycamores were identified in the lower, wetter areas. In many areas it was obvious that a boardwalk would be necessary in order to address the wet conditions. Greenway easements and/or fee simple ownership are advisable as the best method for preserving the creek flood zones and low areas.

Greenway Development in the Smith Creek Watershed

There is currently a half-mile long, 10-foot-wide paved asphalt trail located on the west side of the Smith Creek Soccer Complex. The Town has recently targeted a one mile section of the Smith Creek corridor, extending north from the soccer center to the NC-98 Bypass. The Town and DOT have already installed a pedestrian culvert underneath NC-98 for the future continuation of the trail. The new addition would extend the amount of paved trail along Smith Creek to more than two miles, and would be a significant step in connecting the southern and northern areas of the Smith Creek Watershed to downtown. In recent years, area voters approved $500,000 in bond proceeds for trail construction and the Town secured a $50,000 Recreation Trails Grant.

There are also numerous small, isolated segments of trails at various places throughout the Smith Creek Watershed:

- The Heritage South Section of the Sanford Creek Greenway is a 1.1 mile section of paved and boardwalk trail. This greenway segment is a positive step toward connecting with the future Rolesville greenway system, which will extend along Sanford Creek from the east. The developer constructed the Heritage South Section in lieu of payment of recreation facility fees, in what is an excellent partnership resulting in trails constructed for immediate use along with the new homes.

- There is a 10 foot wide, quarter-mile segment of paved asphalt trail behind Kiwanis Park running between White and Franklin Streets immediately north of the NC 98 Bypass.

- There is also a quarter-mile segment of paved trail located within Flaherty Park.

- Finally, H.L. Miller Park contains approximately a half-mile of five foot wide paved trails.

While these disconnected segments of trail are not practical in terms of transportation facilities, they are valuable on their own as recreation facilities, and increase the attractiveness of the parks as destinations.

In 2002, an inspection of the reservoir trail system showed it to be small, poorly defined, and sporadically maintained. As of this 2008 Plan update, there is no longer a reservoir trail system. Minimal trails are planned for interim access to the Reservoir with volunteers working to establish two to three foot wide soft trails. Extensive trails along Dunn Creek, just west of the reservoir, are planned with the development of the proposed 'Traditions' subdivision. The trails are planned as standard 10 foot wide paved trails, connecting to Flaherty Park. Also, the 'Reserve' subdivision is making a dedication to the Town of Wake Forest, providing for a much easier crossing on the northeast side of the Reservoir.

Smith Creek flows south from the Reservoir, along the east side of Heritage North and through the Heritage Wake Forest Golf Course. While promising for trail development and connectivity to the Reservoir, greenway easements were not obtained in the section along the golf course.

The NC 98 Bypass Corridor Plan proposes a trail along the bypass corridor (between Durham Rd. and the reservoir) providing a much needed east to west trail connection to link Wake Forest's other trails that primarily run north to south. The trail will connect to both Smith Creek and Richland Creek Greenways.

RICHLAND CREEK WATERSHED

The corridor survey began at the intersection of Richland Creek and Harris Road, just south of the half-mile Olde Mill Stream Greenway. Here a sewer easement runs through fenced pastureland along the east side of the creek. At the upper portion of the study area, the dense vegetation—primarily cedar and pine—provides an adequate visual buffer from nearby residences. Sandy, soft soils indicate a regular flood regimen. Evidence of stream health includes vegetated stream banks and very little suspended sediment. Bedload sediment primarily consists of coarse grained sands. This is sporadically (but not excessively) deposited as sandbars throughout the stream corridor. There are periodic points of stream bank degradation where the creek appears to be widening. Preserving the floodplain area will allow the stream to manage water velocity by providing room for the creek to increase its sinuosity, as necessary, to dissipate stream energy.

Richland Creek has also undergone some development since the original plan in 2002, but not to the extent observed in the Smith Creek watershed. Joyner Park, which was previously mentioned, represents the latest open space acquisition achievement by the Town. Over three miles of trails scheduled to open in 2009. An amphitheater, restoration of the existing farm buildings, and addition of a log cabin, garden, rest room and infrastructure are also planned. The Board of Commissioners approved a bid on the construction contract in early 2008 and construction has begun.

Greenway Development in the Richland Creek Watershed:
No further work has been done to connect the Olde Mill Stream Greenway to areas north or south of the existing, quarter-mile segment along Richland Creek. The only other section of existing trail in the watershed is at Tyler Run Park, located east of Richland Creek. The trail at Tyler Run is a quarter-mile long and is only five feet wide.

The sewer easement corridor along Richland Creek is approximately 15 to 20 feet wide and covered with a soft, dense layer of dormant rye grass where daylight more easily penetrates the easement's thinner canopy. Near West Stadium Drive, the grade tapers, leaving standing water in many places. Additionally, beaver dams are in place, further limiting drainage and saturating the land. Just north of Wake Forest-Rolesville High School, at the west end of West Juniper Avenue, lies an access road to the power and sewer utility corridors. This access road could be used as a trail connector to the high school while still serving as an access road for utility maintenance vehicles. Shortly past the access road, Richland Creek passes under Stadium Drive, where there appears to be room for a trail underpass.

The Paschal Golf Course lies at the approximate midpoint of the Richland Creek corridor. The nine-hole golf course facility provides greenway opportunities and constraints. The primary constraints are private property issues (the course is owned by the Southeastern Baptist Theological Seminary) and safety considerations. Most of a greenway/golf course conflict would be confined to negotiating the entry drive, parking lot, club house area, the #5 tee box and the #1 fairway. A power line corridor bisects the golf course, thus presenting a trail placement opportunity. However, after crossing the golf course, the power line continues across the very busy Durham Road (Highway 98).

One possible greenway alignment through the golf course involves running the trail between Richland Creek and the golf course driveway, behind the fifth hole tee box, and over the creek (a ford exists at this point, but it would require significant improvements to serve as a greenway crossing). After crossing the creek, a trail could continue along the west side of Richland Creek (through the woods) paralleling the first fairway. Richland Creek serves as a water hazard down the right side of the fairway, thus discouraging play along this side of the hole. Additionally, the woods along the west side of the creek are dense enough to provide some protection from wayward tee shots (though a net may ultimately be required to ensure safety).

Potential benefits to running the trail through the golf course include an opportunity to improve the vegetative buffer between the entry drive and Richland Creek and the possible economic impact of greenway users frequenting the clubhouse as a resting place. If the clubhouse catered to the needs of trail users, through services such as refreshments, bicycle rentals, and/or carrying running/cycling merchandise, the greenway trail could serve as a new source of revenue.

At the south end of the golf course, an at-grade crossing along the creek will be required at the intersection of Richland Creek and Durham Road. The area just south of Durham Road appears to have the space (a cleared area approximately an acre in size) to host a trailhead facility. There are also several cleared corridors just south of Durham Road, along the creek, that connect to adjacent neighborhoods.

After crossing Durham Road, it appears to be advantageous to follow the power line corridor or the sewer line corridor south to NC 98, with minimal need for boardwalk in wet areas. The NC 98 bridge over Richland Creek provides plenty of clearance for the trail to continue on to Capital Blvd. (US-1). It is possible to continue the Richland Creek Trail from Capital Blvd. (US-1) through Raleigh's jurisdiction to the Neuse River Trail via the 10 foot wide multipurpose path along New Falls of Neuse

Road. This would require construction of a passable culvert in place of the existing three 36 inch drainage pipes. A trailhead should be created until such an underpass is possible, though it may present some challenges for automobile access (a suitable location could be near the tennis courts off of Pasture Walk Way). Ultimately, establishing a safe trail connection across or underneath Capital Blvd. (US-1) should be the goal, providing a critical link between the greenways networks of the Town of Wake Forest and the City of Raleigh.

HORSE CREEK WATERSHED:

From the intersection of Horse Creek and Purnell Road, few residential units are along the corridor down to Jenkins Road. Trees and thickets shade the entire floodplain. River Birch and Tulip Poplar are the dominant species in the lower, wetter areas. The floodplain is very wide (approximately 300 feet) in some places. Pines are more prolific along the toe of slopes. Despite the rolling topography and thick vegetation, in some places traffic from Capital Blvd. (US-1) can be heard from the stream's edge.

Wildlife habitat along the stream looks good, however, the only evidence of aquatic life comes from beaver dams and tree cuts. The soft, sandy soils are not favorable for hosting a paved trail. In many areas a boardwalk would be needed in order to traverse the wet areas. Horse Creek also passes through the old Wake Forest Country Club (which is now closed) bisecting a couple of fairways. Redevelopment of the golf course could present an opportunity for acquisition of greenway easements for trail construction. The stream is in a degraded condition with undercutting observed and the golf course extends to the creek.

At Kearney Road, an enormous corrugated steel culvert allows the road to span Horse Creek. Slopes are covered with briars and riprap. The ridge slopes, above and below Kearney Road, appear to be steeper and the floodplain much narrower.

At Thomson Mill Road, three concrete culverts (approximately 15' high and 10' wide) allow the road to span Horse Creek. Before the stream enters the culverts, the flood plain is wide and healthy on the south side. Below the culverts the stream narrows and turns sharply north.

Greenways along Horse Creek would need to be constructed close to the toe of slopes. Soggy soils and dense vegetation make it apparent that the floodplain is effectively storing water. Greenway easements or fee simple ownership are advisable for the creek flood zones and low lying areas. Where slopes are steeper and floodplains narrower, it will be substantially more difficult to construct trails and obtain access due to more complicated land ownership issues.

TOM'S CREEK WATERSHED

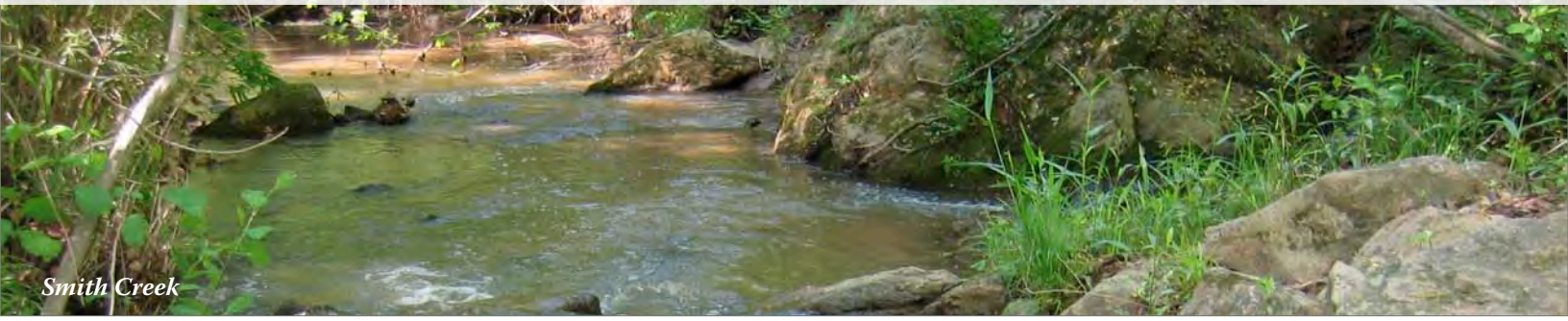
Tom's Creek is the smallest of the four watersheds in the study area. However, at the junction of the study area boundary and Tom's Creek lies Brown's Lake, one the most significant water and scenic resources in the study area. The creek flows in a southwest direction before terminating at the Neuse River. On both sides of Forestville Road are areas of marsh. Undoubtedly, the low turbidity and plant life are filtering pollutants and sediments from the upper reaches of the stream. However, in 2006, Tom's Creek was a registered 303(d) stream, indicating that considerable ecological degradation has occurred in this corridor (no other waters were identified in Wake Forest through the 2006 North Carolina Water Quality Assessment and Impaired Waters List).

Brown's Lake is approximately 13 acres, and is located south of Burlington Mills Road (directly below the marsh area), just west of Forestville Road. The lake is oblong, generally running east to west and sits beautifully between the wooded knolls on the north and south sides. A few single-family residences are on the north side of the lake and a subdivision is on the southeastern side of the lake. The degree to which the lake is buffered from human impacts is debatable. The mature vegetation reduces the amount of sediments that would otherwise wash into the lake during storm events. However, there are ATV trails that have been carved through the woods, thus reducing the effectiveness of the existing vegetation.

Below Brown's Lake, Tom's Creek passes between the Saint Andrews Plantation subdivision to the north and the Saint Andrews subdivision to the south. Larger lots are situated on the south side of the stream with homes sited well away from the banks of Tom's Creek. Impacts from both Hurricane Fran and developers caused a significant reduction in the number of mature trees that lined the stream banks. There should be increased efforts to replant where mature trees once existed. It is apparent by the maintained lawns that stretch to the edge of the stream, and the lack of vegetative buffering, that the current residents along the stream enjoy the unobstructed view of the creek. It is here, between the subdivisions, that the sedimentation is most evident.

Below Ligon Mill Road is an emergent wetland that stretches down to the Neuse River. Here the soils are waterlogged and much of the standing timber is dead. The wetland is part of a 31-acre plot (with approximately 17 acres are above the floodplain) bought by the Town of Wake Forest through the Clean Water Management Trust Fund. A future park and education center is intended for the site, and an access road would provide an excellent opportunity for an interpretive trail. Walking the road south to watch beavers, just above the point where Tom's Creek feeds into the Neuse River, is already an occasional practice for residents aware of the wildlife population along the Neuse.

Chapter 3: Recommendations



Smith Creek

Chapter Outline:

Methodology

Linkages & Regional Planning

Targeted Open Space Acquisition

Scenic Corridors

Greenway System Recommendations

METHODOLOGY

In light of the changes discussed in Chapter 2, it is necessary to revise some of the recommendations made in the 2002 Open Space and Greenway Plan to reflect current conditions. While many of the recommendations still hold true, some have become outdated or are unsuitable, and new ideas are needed to ensure that continued progress is made toward the completion of an interconnected open space and greenway network.

All three of the plans relating most closely to this plan update, including the Bicycle Plan, Pedestrian Plan, and Parks and Recreation Plan, involved extensive gathering of public input as well as inventories of existing conditions. This plan will draw from the findings and recommendations of each of these plans in order to explore possible connections between them as well as areas where shared interests and objectives exist. However, this plan will not simply recycle the efforts of prior plans, but will use them as a framework on which to build current recommendations and expand upon past observations and ideas.

The 2006 Wake Forest Pedestrian Plan and the 2008 Wake Forest Bicycle Plan both provide detailed recommendations based on high levels of public input (both plans as discussed in Chapter 2, pages 2-6 to 2-9). Similarly, the Parks and Recreation Plan Update relied on public input, including written public comments, survey data, discussions with Town Staff and the Greenway Advisory Board, and analysis of national trends in the preparation of its recommendations. When taken as a whole, these three plans represent a substantial amount of information to guide this update of the Open Space and Greenway Plan.

The intent of this chapter is to disseminate overlapping and related information from the aforementioned plans to increase efficiency in the planning process. Recommendations are also provided that may simultaneously advance the goals of this plan and serve the needs of various interests throughout the Wake Forest community. Overlapping recom-

mendations that have been discovered in the three plans are discussed below, some of which are already being implemented by Town departments.

Developer Responsibility: Nearly all of the plans reviewed cite the need for strengthening policies that require or encourage developers to increase connectivity between new development and surrounding destinations:

- "It is recommended that the Town establish a program to work with developers and homeowners to ensure that greenways are built, and that a suitable agreement for both parties is reached which guarantees long-term maintenance and security responsibilities." (Town of Wake Forest Bicycle Plan, 2008, 3-11)

- "Local ordinances should be amended to require pedestrian facilities be built as part of a subdivision project to be extended beyond the limits of the subdivision boundaries to connect to nearby trip attractors and developments" (Town of Wake Forest Pedestrian Plan, Nov. 2006, 6.3.1)

Encouragement and Education Programs: Encouragement, Education and Awareness programs increase public support for greenway trail development. While residents of Wake Forest have expressed a strong desire for more open spaces and greenways, there are additional strategies to increase awareness and support of greenways and their many benefits. Some commonly cited programs and policies include:

- Safe Routes to School programs.

- Regularly scheduled events with promotions, contests, education programs.

- Publish and distribute brochures with maps of bicycle and pedestrian routes, safety tips, event schedules, etc.

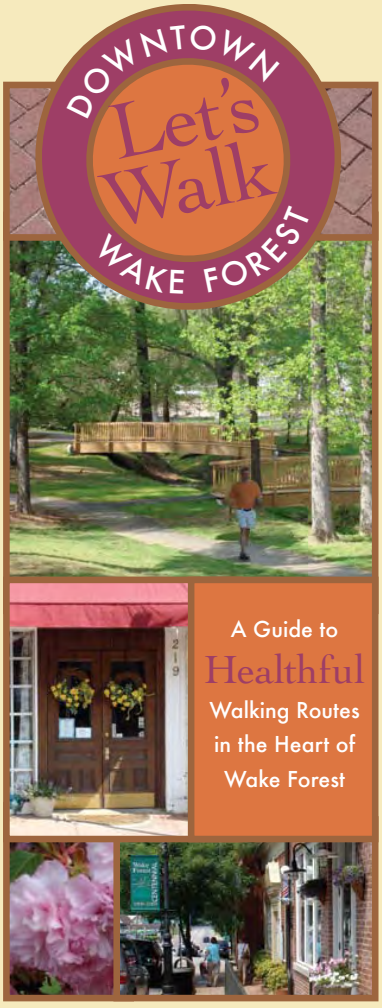
- Environmental education and interpretive facilities.

Increased Connectivity: Between neighborhoods and better access to open spaces and other destinations.

- According to the Bicycle Plan Survey, all of the respondents indicated that they would like to see more greenways in town, specifically:

  ✔ Between neighborhoods for connections from one neighborhood to another;

Below: The Downtown Wake Forest "Let's Walk" Brochure is one example of an encouragement and education tool in Wake Forest.



- ✔ From neighborhoods to downtown, parks, and schools; and
- ✔ As connections to the Raleigh greenway system and the Falls Lake Greenways.

- According to the Pedestrian Plan, some of the main concepts derived from the interests of the Town, the steering committee, and the public include:

  - ✔ Pedestrians should be able to access Downtown Wake Forest from all parts of the community; and
  - ✔ There should be increased connectivity between subdivisions and trip attractors.

Additional studies and reports reviewed in preparation for this plan include the Land Development Plan (1985), the US 1 Corridor Plan (1999), the Inventory of the Natural Areas of Wake County (1987), the Capital Area Greenway Master Plan Update (1989), North Carolina's 303(d) List (1998 and 2008 draft) of streams deficient in water quality by Clean Water Act standards, the Wake Forest Transportation Plan (2003), Master Plan for NC 98 Bypass Corridor (2003), Renaissance Plan for the Heart of Wake Forest (2004), Wake County Consolidated and Open Space Plan (2003), and the CAMPO Bicycle and Pedestrian Plan (2003, 2005). Also, the 2008 Market Study by Buxton Co. indicates, among other findings, that over half of the people living within a 15-minute drive of Wake Forest are likely trail users.

Data were also gathered from websites maintained by the U.S. Census Bureau, the Neuse River Foundation, and other sites offering environmental and cultural information specific to Wake Forest. Finally, thematic maps were produced from Wake County Geographic Information Systems (GIS) data to graphically illustrate important conditions relative to geographic position. GIS applications are tools used to analyze spatial data and allow detailed geographic analysis. The strength of GIS applications is their ability to overlay separate layers of data and reveal patterns of interrelated landscape components.

LINKAGES & REGIONAL PLANNING

Central to the Wake County Open Space Program is the concept of connectivity. For each of the municipal plans to function together successfully they must be completed with neighboring landscapes and municipalities in mind. Wake Forest has cultural opportunities to connect to the City of Raleigh, Rolesville and Franklin County. Natural opportunities exist to connect two premier water features in Wake County: the Neuse River and Falls Lake.

Regarding connectivity, Chapter Two of the 2006 Wake Forest Pedestrian Plan lists Cimarron, Crenshaw Hall Plantation, and the area between the Flaherty Park and Joyner Park as being in need of small sections of greenway to enhance connectivity (see proposed greenway corridors and multi-use paths on Map 2-D, page 2-8). Additionally, the 2008 Wake Forest Bicycle Plan lists some short trail segments as high priority projects, including S. Main Street from Rogers Road to Capital Blvd. (US-1), Stadium Drive from Capital Blvd. (US-1) to Rock Springs, and Rogers Road from Main Street to Heritage (see multi-purpose paths on Map 2-E, page 2-9). These trail segments would serve as good linkages within the proposed greenway system.

Since the adoption of the 2002 Open Space and Greenway Plan, there has been progress made toward increasing connectivity on both a local and regional scale. However, as was pointed out in the revised Wake County Open Space Plan, municipalities, including Wake Forest, need to improve coordination with both the County and neighboring municipalities if the goals of the County Plan are to be met. For its part, Wake Forest has done well on a number of fronts. It ranked third out of the twelve municipalities in terms of amount of open space protected (240 acres as of 2006), lagging behind only Raleigh and Cary, both of which are much larger in size. Still, Wake Forest Planning Staff, City Officials, and Parks and Recreation Staff must increase efforts to work with Wake County and neighboring municipal agencies on mutually beneficial projects and land acquisition. Efforts must also be increased on an intra-community level to raise support for land acquisition and greenway development. The Wake County Open Space Plan Update cites NIMBYism as one of the main obstacles to the implementation of the Wake Forest Open Space and Greenway Plan. In light of this, the recommendations of the Bike, Pedestrian, and Parks and Recreation plans to develop better education and encouragement programs become even more relevant. By stimulating community involvement and tying greenway and open space planning into other community concerns, organizations such as the Wake Forest Greenway Advisory Board (GAB) are working to educate local residents about the importance of greenways and open space.

"Since the adoption of the 2002 Open Space and Greenway Plan, there has been progress made toward increasing connectivity on both a local and regional scale."

Wake Forest has a primary consideration of preserving its small town charm and quality of life enjoyed by its residents. Providing greenway linkages to the community will preserve and accentuate that character. Greenways and open space will provide buffers from adjacent land uses, preserve the character of the landscape and allow people to access Wake Forest via alternative, slower-paced modes of transportation.

TARGETED OPEN SPACE ACQUISITION

As a result of community meetings, Town staff, and stakeholders' comments, it is recommended that the Town of Wake Forest supplement existing park systems with the following parks and open space acquisitions. These acquisition recommendations are broadly defined within this plan to cover geographical areas of the community which were agreed upon throughout the participatory planning process.

Note: The Parks Plan has further expanded on these recommendations: Goal 1, Objective 1 of the Parks Plan: Provide adequate land for future development by placing a priority on land acquisition- gives top priority to Acquiring at least one community park- or metro park-size site in the area south of NC 98 Bypass.

- *First* - We envision future development of a "central park" between the downtown area and the new bypass.

- *Second* - There is a need to establish a community park in the east-central area of the community, and there is a possibility that this park could be jointly developed in partnership with Rolesville.

- *Third* - There was a desire on the part of local residents to have a future community park in the northwestern quadrant of the community (which will be met by Joyner Park).

- *Fourth* - The Town has been provided with an opportunity to develop a future park along the Neuse River at the intersection with Capital Blvd. (US-1).

It is envisioned that these future parks will serve multiple purposes; including active and passive recreation, protection of water quality, flood plain management, and environmental education. The Wake Forest Parks Plan recommends a clear delineation of intended uses for such parks (see Chapter 8 of the Parks Plan for more information).

The third acquisition recommendation outlined above pointed to a desire on the part of residents for a community park in the northwest quadrant of the Town. This desire will undoubtedly be satisfied by the acquisition and development of Joyner Park. The designation of the land around the Town Reservoir as a natural area is also a strong step in the right direction. Less progress has been made on the vision for a "central park", or on the development of a joint Rolesville-Wake Forest community park in the east-central area of the community. These may no longer be realistic objectives due to development pressures in that area. Still, the Parks and Recreation Plan gives top priority to acquiring at least one community park or metro park-sized site in the area south of the NC 98 Bypass. Acquiring land for a park adjacent to this greenway would allow the park to have immediate access, and would also act as a significant trip attractor.

Wake Forest has two primary vehicular 'gateways' into the community (Highway 98 and Capital Blvd. (US-1)) and a significant thoroughfare to be extended (Highway 98 Bypass). Each of these corridors is significant for the first impression that visitors receive as they enter Wake Forest. Many participants in the Open Space and Greenways Workshops have said that they place a high priority on the scenic value present along these roadways. Preserving open space and establishing buffers alongside these corridors will convey the small town charm that is one of Wake Forest's greatest assets.

"Preserving open space and establishing buffers alongside these corridors will convey the small town charm that is one of Wake Forest's greatest assets."

EXISTING AND POTENTIAL SCENIC CORRIDORS

HIGHWAY 98 BUSINESS CORRIDOR

The Highway 98 Business Corridor (or Durham Highway) is the oldest of the three major connectors. It is a significant access road for Falls Lake and a convenient western entry into Wake Forest. The roadway is starting to show the effects of Research Triangle growth as new housing developments radiate from Durham, Raleigh and Wake Forest. Protecting the scenic quality of Highway 98 Business is important to Wake Forest residents. While Wake Forest is certainly experiencing its share of growth the vegetated edges of Highway 98 are a reminder of Wake Forest's more rural days.

CAPITAL BLVD. (US-1) CORRIDOR

The Capital Blvd. (US-1) corridor is one that has already received some attention to its visual quality. In 1999, the US-1 Corridor Plan was adopted. This plan focuses on the visual resources along the corridor that include the built and unbuilt environment. Preserving open space and establishing buffers along the corridor is required according to the US-1 Corridor Plan and the NC 98 Bypass Corridor Plan. The highway is a major thoroughfare (to be converted to freeway status) for commuters to and from Raleigh. Businesses will continue to target this corridor for the visual exposure to travelers and to serve commuters that require convenient shopping destinations. Despite the difficulty of preserving the scenic resources of US 1, it is a worthy effort because of the high volume of traffic that generates perceptions of Wake Forest from the windshield.

Perhaps most importantly, Capital Blvd. (US-1) represents a major barrier to connecting the Wake Forest Greenway system to the Raleigh Greenway system, particularly along the Richland Creek Corridor. A pedestrian underpass will provide a critical bicycle and pedestrian connection to the City of Raleigh especially with the proposed highway to freeway conversion status as outlined in the US-1 Corridor Study. In addition, the Pedestrian Plan lists four Capital Blvd. (US-1) intersections as priority improvement projects, and recommends taking potential greenway corridor junctions into consideration. The stakeholder input contained in the Bicycle Plan identifies Capital Blvd. (US-1) as a real and perceived

barrier to bicycling, as it "cuts" the Town from north to south. According to survey results presented in the plan, Capital Blvd. (US-1) "should provide for parallel greenway facilities or accommodations on "backage" roads that parallel the main line facility."

HIGHWAY 98 BYPASS CORRIDOR

In August 2003, shortly after the adoption of the Open Space and Greenway Plan (which made recommendations for the NC 98 Bypass corridor), the Town adopted the NC 98 Bypass Corridor Master Plan. The Plan contains detailed design guidelines, as well as recommendations for enhancing bicycle and pedestrian circulation in and around the corridor. The major goals of the plan are to preserve and enhance the visual quality of the corridor as gateways to Wake Forest and to create an east-west pedestrian and bike route on each side of the corridor (though steep slopes in some areas will require careful planning and design). Other major goals include facilitating the vehicular transportation function of the corridor, and encouraging development that is compatible with the first three goals.

The Plan states "a 10-foot wide paved trail should be provided along each side of Bypass, between the Richland Creek greenway corridor and the eastern end of the Bypass. There should be frequent connections to the sidewalk systems in the adjacent neighborhoods, to the Town's Richland Creek greenway system as a whole and to the Neuse River greenway." The Plan recognizes that the corridor presents both opportunities for connectivity as well as constraints for north-south bicycle and pedestrian travel. Some of the key recommendations are:

- Grade-separated crossings should be considered at major road intersections and/or main greenway trail connections.
- At-grade pedestrian crossings should be incorporated into all the signalized intersections, with provisions for stopping safely in the median.
- Commercial and business uses…should be clustered at signalized intersections.
- Pedestrian and bicycle connections should extend from front doors of each business to nearby public sidewalks and greenways.

In terms of specific greenway recommendations, the Plan proposes a trail along "NC 98 west of Falls of Neuse Road/NC 98 Business to connect to the Falls Lake area and neighborhoods to the west." It also proposes a multi-use trail along "NC 98 Business, starting at its western end at the Falls of Neuse Intersection, continuing past Crenshaw Manor and

transitioning to sidewalks in the shopping center area." Finally, the Plan recommends "a trail connection to Richland Creek greenway…from the southeastern corner of Crenshaw Manor and the adjacent commercial area, via a pedestrian underpass under the Bypass just west of US 1." The Plan also recommends that Wake Forest work with Raleigh to develop a trail along the south side of the Bypass between Falls of Neuse Road and the western Richland Creek trail connection. All of these recommendations are meant to increase connectivity and work in harmony with the Open Space and Greenway Plan.

GREENWAY SYSTEM RECOMMENDATIONS

The future of open space and greenways in Wake Forest is envisioned as a system of outdoor spaces that function as healthy, protected ecosystems. Contiguity is critical to the concept of preserving open space in Wake Forest. The benefits of open space and greenways are maximized when they are linked together. Contiguous natural areas are better equipped to function as healthy, interrelated ecological systems. As such, they are more stable, provide more "edge" habitat for wildlife, and allow a place to retain its natural character.

"While each plan stresses different benefits of having an interconnected greenway system, all of them recognize that there are numerous positive spillovers, and that maintaining a system of open spaces and greenways is crucial for improving the overall quality of life in Wake Forest. "

This plan views these open space and greenways as more than passive recreation areas. These natural resources fulfill multiple objectives, such as progressive floodplain management, wildlife habitat, and improved water quality. Areas that are well-suited to host trails can provide passive recreation facilities, environmental education, and alternative transportation routes. As is shown by the Bicycle, Pedestrian, and Parks and Recreation Plans, greenways serve a variety of functions that are applicable to numerous aspects of community life. All of the plans just mentioned give high priority to greenway development. While each plan stresses different benefits of having an interconnected greenway system, all of them recognize that there are numerous positive spillovers, and that maintaining a system of open spaces and greenways is crucial for improving the overall quality of life in Wake Forest.

Recommendations for a system of open space and greenways in Wake Forest are based largely on community input from civic organizations, public agencies, and the general public. Corridors and open space locations were identified and presented in map form at meetings with Wake Forest staff, as well as meetings with interested parties, civic clubs, and public workshops. Most public comments received from these meetings and workshops were incorporated into the recommendations for the open space and greenways system.

Proposed greenways are located along natural and human-made linear corridors that generally follow streams and roadways within the study limits (see map 3A, page 3-10). In this manner, greenways will fulfill ob-

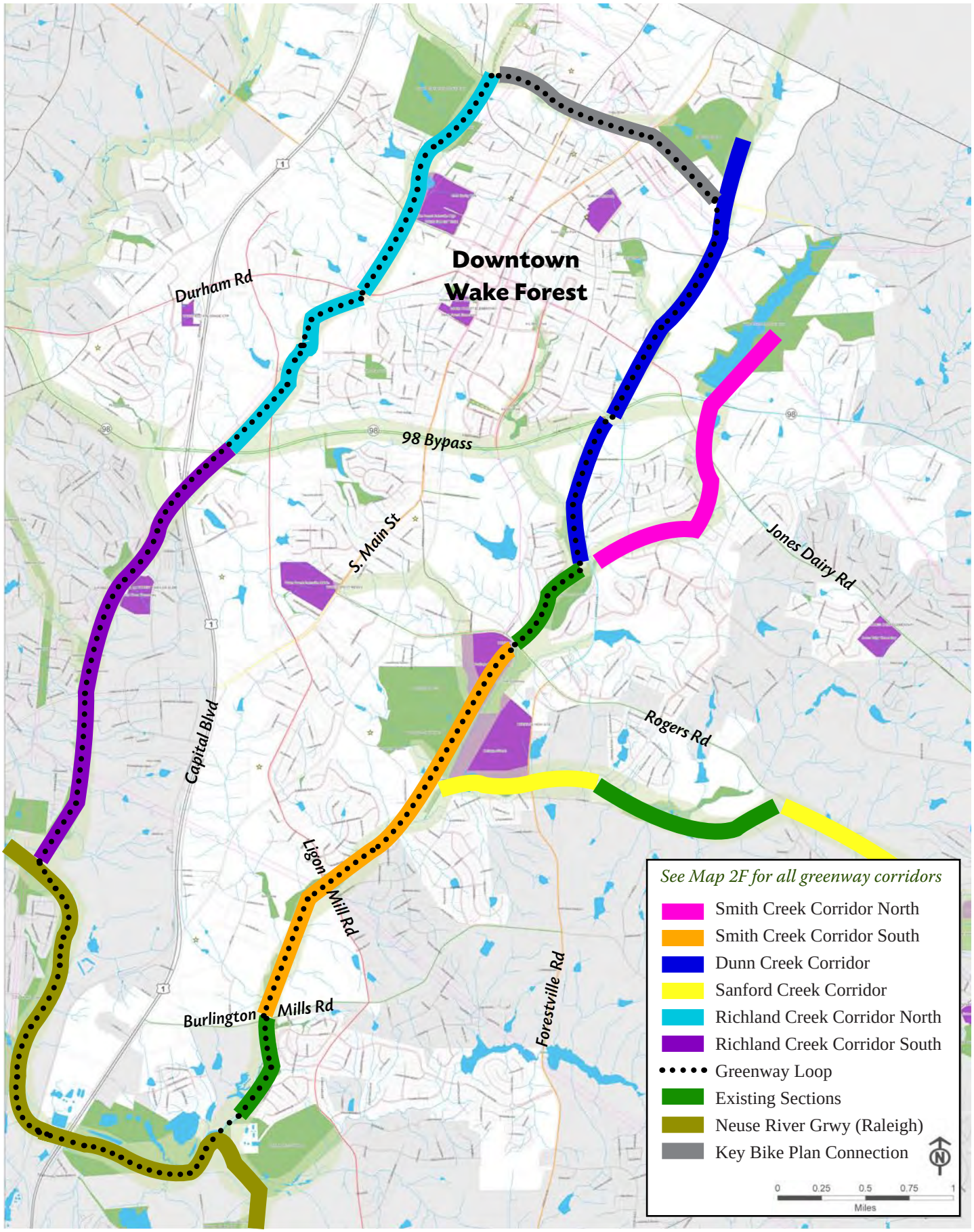
jectives related to alternative transportation, natural resource conservation, water quality, and floodplain management, in addition to their function as recreational resources. Corridors were also selected to ensure development of a continuous system of greenways located throughout Wake Forest and extending to neighboring jurisdictions.

As was discussed in the 2002 Open Space and Greenway Plan, it is expected that many Wake Forest neighborhoods will want to connect their greenway systems to the larger, municipal system. This is encouraged. As the Bicycle and Pedestrian Plans make clear, there is a desire on the part of Wake Forest residents to increase the overall level of connectivity and accessibility and to create linkages between subdivisions, parks, and downtown. Private trail connection to public greenway systems can be accomplished in coordination with the Town of Wake Forest. It is recommended that the Town establish a program to work with developers and homeowners to ensure that greenways are built, and that a suitable agreement for both parties is reached which guarantees long-term maintenance and security responsibilities. It is further recommended that the Town continue their maintenance system for greenways in order to clear debris and foliage from the path to ensure safe passage by bicyclists and pedestrians, as well as enhance aesthetic appeal of the facilities.

Proposed open space areas (as opposed to greenways) are not necessarily linear corridors. Open spaces identified in this plan are larger properties that contribute to the preservation of Wake Forest's natural character and its scenic beauty as well as perform ecological functions. In fact, open space preservation does not require public access or ownership in order to meet the desired objectives. Open space protection serves as a cultural resource and/or as an environmental resource. Opportunities to educate park and trail users about the cultural and environmental resources in Wake Forest can be achieved through the creation of a central park feature. Such a facility could serve as a destination point and an organizing feature for the community and the greenway system.

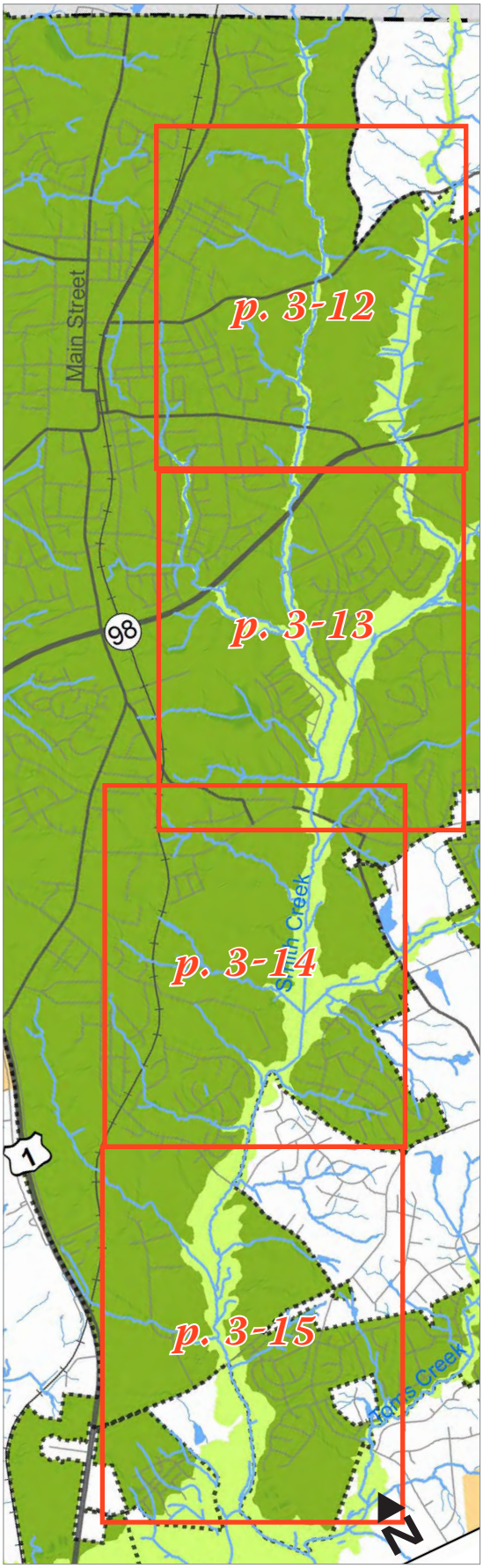
The strength of executing the open space and greenways system recommendations will be in the contiguity of natural resources. However, it is not practical to consider the acquisition of properties and easements and the development of facilities as a single unit. The following pages highlight individual segments for phased development of a contiguous system. The segments are described and the objectives for incorporation are discussed.

MAP 3A: REFERENCE MAP FOR PRIORITY GREENWAY CORRIDORS



SMITH CREEK CORRIDOR (INCLUDING DUNN CREEK)

Locator Key for Smith/Dunn Creek Corridor Maps on pages 3-12 to 3-15



Smith Creek Corridor Description:
Smith Creek is one of two major north-south greenway corridors proposed for Wake Forest, with some portions of trail already built (0.65 miles at Burlington Mills, 0.6 miles at the Soccer Complex, and just over one mile at Dunn Creek by spring 2009). The corridor's endpoints are the Neuse River to the south and the Franklin County Line to the north. The Smith Creek Greenway corridor follows Smith Creek from the Neuse River to the Reservoir, follows Dunn Creek from the Soccer Center to Franklin County to the north, and follows Spring Branch from Heritage North Subdivision to downtown Wake Forest. The Smith Creek corridor is the longest feature within the study boundaries and under considerable development pressures. The primary land use along the proposed corridor is single-family residential and agricultural.

Smith Creek/Dunn Creek Corridor Objectives:
This corridor can serve multiple objectives: First, due to the increasing number of residential dwellings, new schools, and planned bicycle and pedestrian connections to downtown, this corridor has the greatest potential to be used as an alternate transportation route. Second, a greenway along Smith Creek and Dunn Creek will also serve as a buffer to protect water quality and reduce flood damage that accompanies the increased impervious surfaces of suburbanization. Third, a complete greenway project in this increasingly populated segment of Wake Forest may stimulate interest for greenways in other areas of the Wake Forest community. Finally, this corridor could also serve as part of the East Coast Greenway, a partially built interstate trail system that will eventually connect cities from Florida to Maine.

The trail facilities in this corridor will be 10 feet wide Type 4 (Multi-Use Paved Trail), to accommodate high capacity usage. Construction of the trails must be consistent with the principles of Neuse River Riparian Buffer Rules while accommodating the expected traffic safely. Sufficient and consistent width along the corridor will be necessary to decrease pedestrian to cyclist conflicts and to discourage off path trailblazing that would result in compaction and erosion. Wake Forest should consider wider trails along substantial sections. The American Association of State Highway and Transportation Officials (AASHTO) standards and Federal Highway Administration standards recommend 10 foot wide trails, but 12 to 14 feet widths are preferred where heavy traffic is expected.

Both the Bicycle and Pedestrian Plans stress the importance of linking nearby subdivisions to the proposed Smith Creek greenway via sidewalks, bike lanes, and spur trails. The Bicycle Plan recommends a multi-use path extending from Main St. to Heritage Lake Rd. along Rogers Rd. as a short-term project. Similarly, the Pedestrian Plan lists Heritage, Smith Creek, Margots Pond, Thornrose, and Dansforth subdivisions as being in need of connections to the Smith Creek greenway.

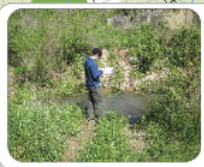
MAP 3B (PART 1): DUNN CREEK CORRIDOR OPPORTUNITIES & CONSTRAINTS

MAP 3B (PART 2): DUNN/SMITH CREEK CORRIDOR OPPORTUNITIES & CONSTRAINTS

Constraint: At southern tip of greenspace just north of NC 98 Bypass, a small pedestrian bridge is needed to cross Dunn Creek (best location to cross in order to get to the underpass); creek is about 10 feet wide here (after significant rainfall)

Constraint: Small boardwalk or culvert needed at creek crossing immediately north of NC 98 Bypass

Opportunity: NC 98 Bypass Underpass: Approximately 9 feet wide, 8 feet high; lighting is recommended, drainage needs to be established.

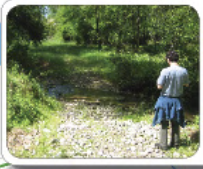


Constraint: Small pedestrian bridge is needed just south of NC 98 Bypass to route through cleared open space; creek is about 8 feet wide after significant rainfall.

Constraint: Wetland areas south of NC 98 Bypass will require significant lengths of boardwalk.

Constraint: Small pedestrian bridge needed at creek crossing just west of Heritage subdivision.

Opportunity: Potential spur trail could connect to Heritage subdivision from Dunn Creek along stream



Constraint: A small pedestrian bridge or boardwalk is needed immediately north of Coral Bell Dr to continue along the cleared and graded corridor.

Constraint: A small pedestrian bridge is planned at northern terminus of Soccer Complex, connecting the Dunn Creek corridor to the Smith Creek corridor.

Constraint: There are some homes with no vegetative buffer between them and the sewer corridor; neighborhood needs pedestrian access to soccer center.

Constraint: Crossing Rogers Rd will likely require diverting trail to controlled signal on west side of intersection with Franklin, with a pedestrian bridge over Smith Creek. The future replacement of the Rogers Rd bridge over Smith Creek should accommodate a trail underpass, per Town policy.

Opportunity: Existing trail and pedestrian bridge at Soccer complex.

Kiwanis Park

Smith Creek Soccer Center

Heritage School

Smith Creek Greenway

Legend

- Historic Sites
- Pedestrian Underpass
- Existing Sidewalks (08)
- Existing Trails
- Major Easement
- Major Road
- Local Road
- School
- Water Body
- Wake Forest
- Park/Open Space

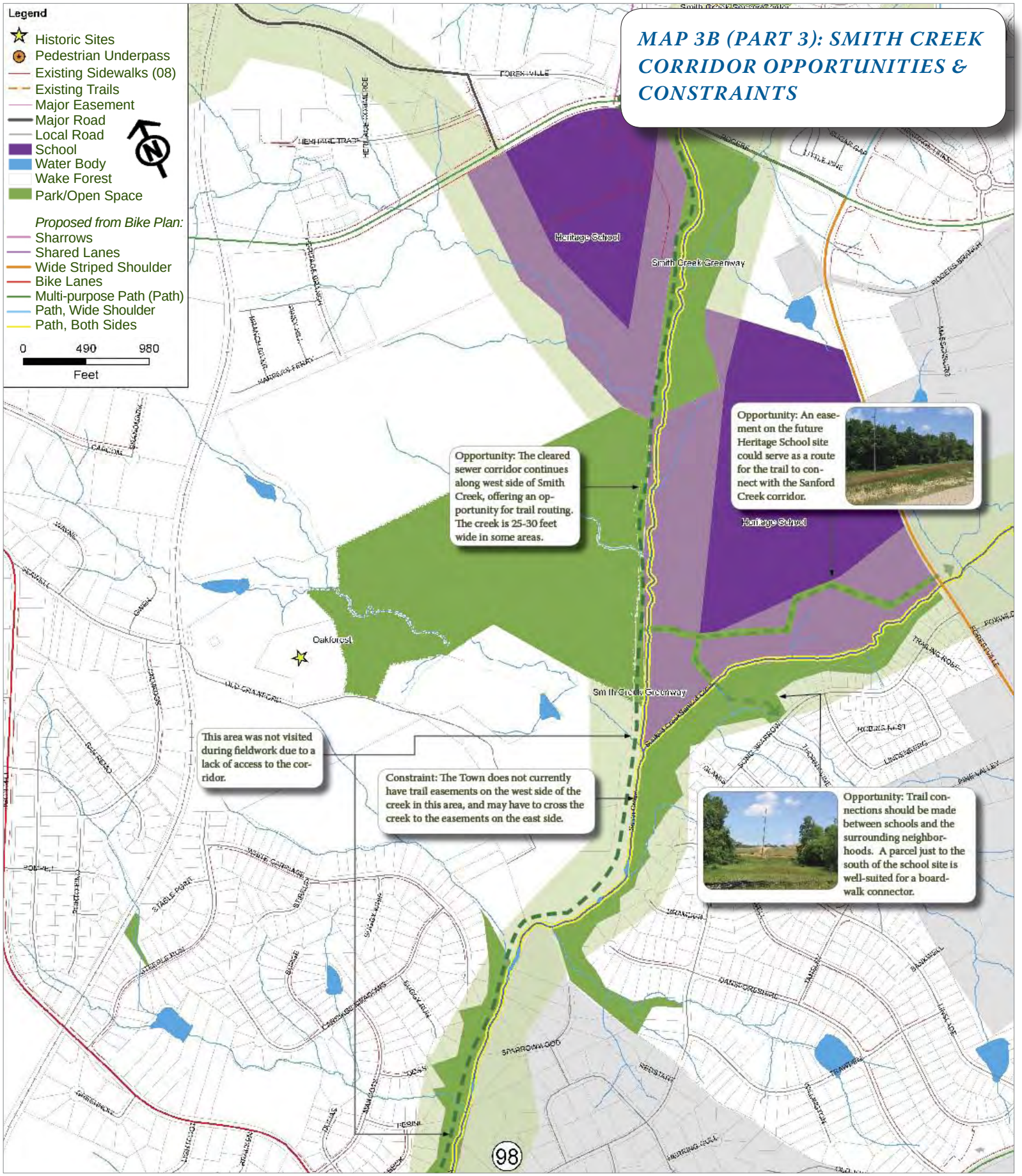
Proposed from Bike Plan:

- Sharrows
- Shared Lanes
- Wide Striped Shoulder
- Bike Lanes
- Multi-purpose Path (Path)
- Path, Wide Shoulder
- Path, Both Sides

0 490 980

Feet

MAP 3B (PART 3): SMITH CREEK CORRIDOR OPPORTUNITIES & CONSTRAINTS



MAP 3B (PART 4): SMITH CREEK CORRIDOR OPPORTUNITIES & CONSTRAINTS

Constraint: Wetland area north of Ligon Mill would require boardwalk.

Opportunity: The sewer corridor near Ligon Mill is wide and flat enough to drive on. Trail construction would be fairly simple once easements are secured.

Constraint: Crossing Ligon Mill Rd will require a reduction in speed. Crossing is at the bottom of a hill; 2 foot shoulders; high speeds observed. Vegetation on north side of crossing would need to be trimmed back. A trail underpass should be provided when the roadway/bridge is reconstructed, per Town policy.

Opportunity: Corridor remains open and graded all the way to existing greenway trail at Burlington Mills Rd.

Constraint: The Town does not have a trail easement for this parcel.

Constraint: Small bridge or major culvert needed to cross creek at crossing north of Burlington Mills Rd.

Opportunity/Constraint: Crossing at Burlington Mills Rd. 2 lanes; 45 MPH, good visibility; downhill towards crossing; plenty of room for pedestrian refuge island. Recommendation: bring crossing uphill, to wider part of the road (east of the trail corridor) and use extra width for the pedestrian refuge island. *Note: The bridge over Smith Creek was under reconstruction during the course of this plan update; some conditions may have changed.*

Opportunity: Connect to existing trail and existing neighborhood sidewalks near Burlington Mill Rd.

Opportunity: Connect Burlington Mills section of greenway to the City of Raleigh (via bridge across and greenway along Neuse River) and to Tom's Creek corridor and the future park at Tom's Creek wetlands..

Legend

- Historic Sites
- Pedestrian Underpass
- Existing Sidewalks (08)
- Existing Trails
- Major Easement
- Major Road
- Local Road
- School
- Water Body
- Wake Forest
- Park/Open Space

Proposed from Bike Plan:

- Sharrows
- Shared Lanes
- Wide Striped Shoulder
- Bike Lanes
- Multi-purpose Path (Path)
- Path, Wide Shoulder
- Path, Both Sides

0 490 980
Feet

RICHLAND CREEK CORRIDOR

Richland Creek Corridor Description:
Richland Creek is the second longest stream in the study area. It shapes downtown by flanking it to the west. Downtown Wake Forest is situated atop the ridge that separates the Richland Creek and Smith Creek watersheds. Richland Creek flows from north to south, starting above the Wake County line and flowing south into the Neuse River. Land use along Richland Creek is primarily single-family residential and agricultural. One existing portion of trail in this corridor is the Olde Mill Stream Greenway (0.35 miles). This corridor was identified as the 3rd highest priority greenway project in the Pedestrian Plan, Chapter 7-7.

Richland Creek Corridor Objectives:
The Richland Creek Corridor is well suited to serve as a greenway corridor based on current conditions. However, along the Smith Creek Greenway Corridor, more immediate action is required to acquire greenway easements and construct trails due to development pressures in that area. Richland Creek can function as a second north-south corridor that serves much of western Wake Forest. Securing the floodplain and conservation easements along the stream will protect water quality and wildlife habitat, and once funding is available, trails will be constructed along the Richland Creek Corridor. The proximity of the Richland Creek Corridor to Wake Forest/Rolesville High School provides access for students to get to and from school. Also, the Richland Creek Corridor crosses the US-1 Corridor and connects to the Neuse River Trail just below Falls Lake making it a viable alternate bicycle and pedestrian transportation corridor as well as a popular recreational amenity. Trails developed within the Richland Creek corridor should be Type 4 (Multi-Use Paved Trails) to accommodate the anticipated users. Increasing numbers of residents along this corridor will warrant a durable facility that serves the western side of Wake Forest.

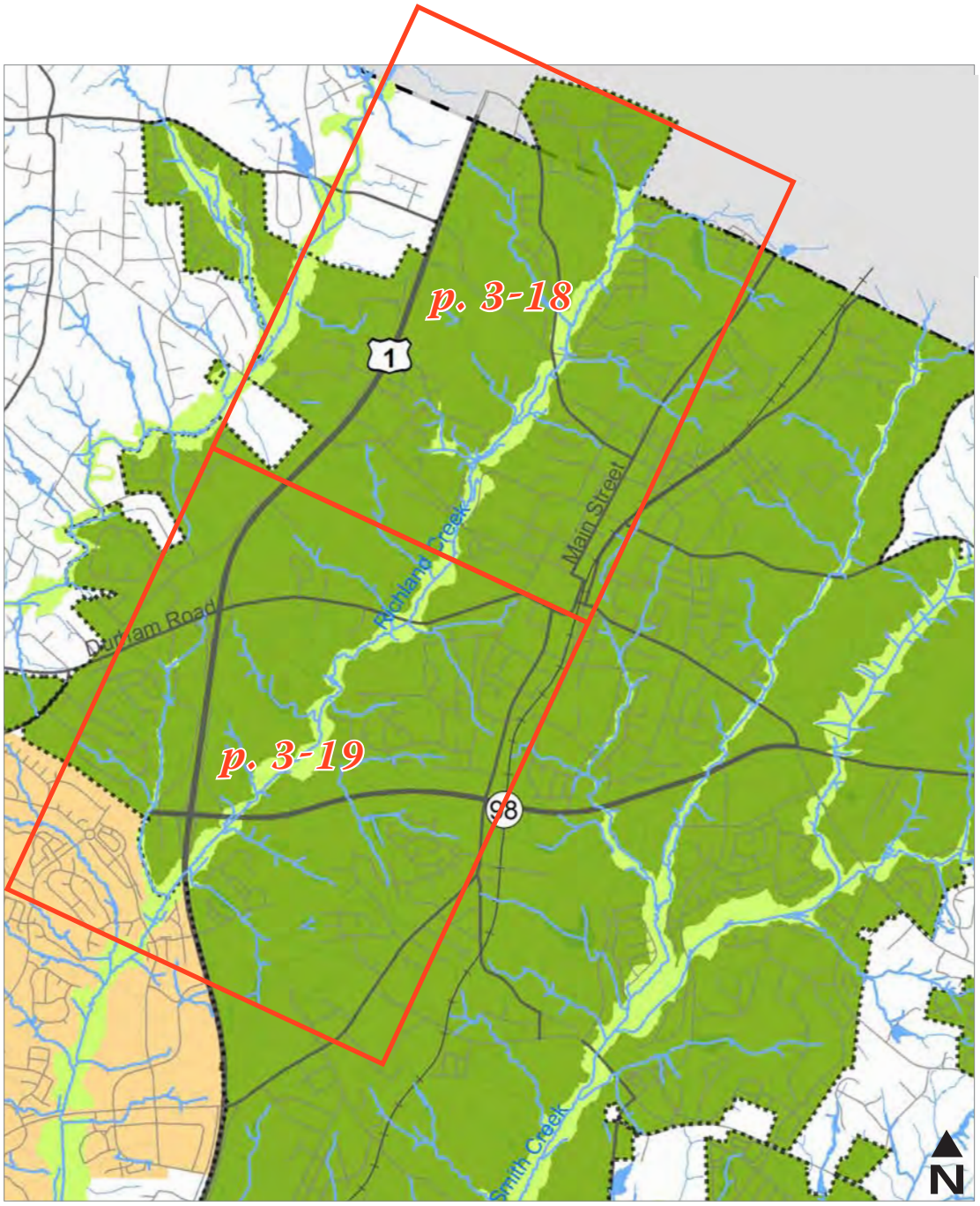
Within and adjacent to the Richland Creek corridor, there are new opportunities for trail development that were not addressed in the previous plan. The Pedestrian Plan identifies the Cimarron subdivision as an excellent starting point for a connecting trail that would link residents from S. Main Street to Richland Creek via the NC 98 Bypass Trail. According to the Pedestrian Plan, "public land, homeowner association land, and public easements, as well as a storm sewer easement in the area all make this a very attainable greenway segment that should be pursued." The Pedestrian Plan also identifies the Richland Creek Greenway as a critical long-term project that offers opportunities to "connect numerous subdivisions to the downtown pedestrian environment," as well as provide a connection to the greenway network proposed by the City of Raleigh.

Some key facility recommendations of the Bicycle Plan that relate to this corridor include:

- A multi-use path along Stadium Dr. connecting Capital Blvd. (US-1) to Wake Forest/Rolesville High School. Continuing east along Stadium Dr. with sidewalks and sharrows would complete a connection between the Richland Creek corridor and Main Street.
- A multi-use path along Harris St. connecting Capital Blvd. (US-1) to N. Main St.

Following is a list of opportunities and constraints identified by the Consultant after inspection of the Richland Creek corridor (pages 3-18 and 3-19).

Locator Key for Richland Creek Corridor Maps on pages 3-18 to 3-19



MAP 3C (PART 1): RICHLAND CREEK CORRIDOR OPPORTUNITIES & CONSTRAINTS

MAP 3C (PART 2): RICHLAND CREEK CORRIDOR OPPORTUNITIES & CONSTRAINTS

Constraint: Power easement extending north from Durham Rd is cleared and open, however steep topography will require grading or a bridge for safe crossing.

Opportunity: South of Durham Rd., Power and sewer easements are ideal trail conditions as they provide open flat area along the creek.

Opportunity: South of Durham Rd, there is potential to develop trail spur to link adjacent neighborhoods to greenway.

Opportunity: New development around Tyler Run Park is potential for trailhead and neighborhood greenway tie-in.

Constraint: Sections of the easement north of the NC 98 Bypass will require boardwalk in wet areas.

Opportunity: Sewer corridor behind residential neighborhoods north of NC 98 Bypass is dry and cleared.

Opportunity: Just north of NC 98 Bypass, banks of Richland Creek are flat and well suited for a trail.

Opportunity: Overpass at NC 98 Bypass provides overhead clearance for trail to pass beneath along the creek.

Opportunity: The cleared and level openspace along the Richland creek corridor provides an excellent approach to Capital Blvd.

Constraint: Large-scale engineering and design efforts will be needed to accommodate trail conditions at US-1/Capital Blvd overpass or underpass.

Opportunity: Trail tie-ins just south of US-1/Capital Blvd will provide access to surrounding neighborhoods.

Legend

- Historic Sites
- Pedestrian Underpass
- Existing Sidewalks (08)
- Existing Trails
- Major Easement
- Major Road
- Local Road
- School
- Water Body
- Wake Forest
- Park/Open Space

Proposed from Bike Plan:

- Sharrows
- Shared Lanes
- Wide Striped Shoulder
- Bike Lanes
- Multi-purpose Path (Path)
- Path, Wide Shoulder
- Path, Both Sides

0 490 980

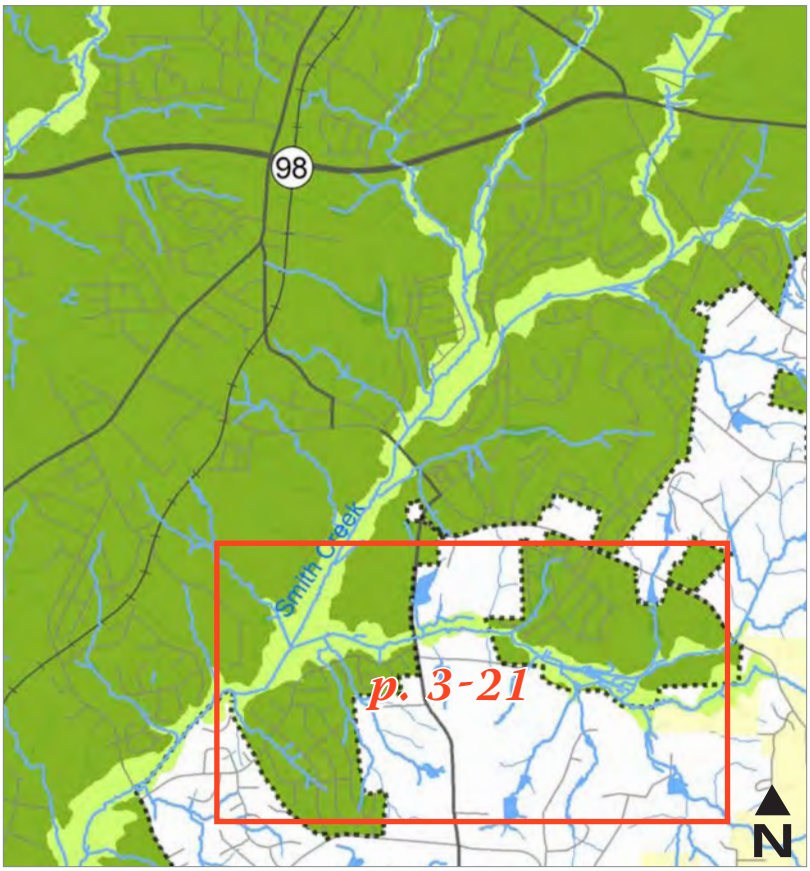
Feet

SANFORD CREEK

Sanford Creek Corridor Corridor Description:
Sanford Creek is the easternmost stream corridor in the study area. The corridor's endpoints are Smith Creek and the Town of Rolesville. Sanford Creek provides an opportunity to connect Wake Forest with planned trails in Rolesville's planning jurisdiction. Like the Smith Creek Corridor, Sanford Creek Corridor is experiencing significant changes due to residential development, particularly at its western end. The primary land use along the corridor is single-family residential and agricultural.

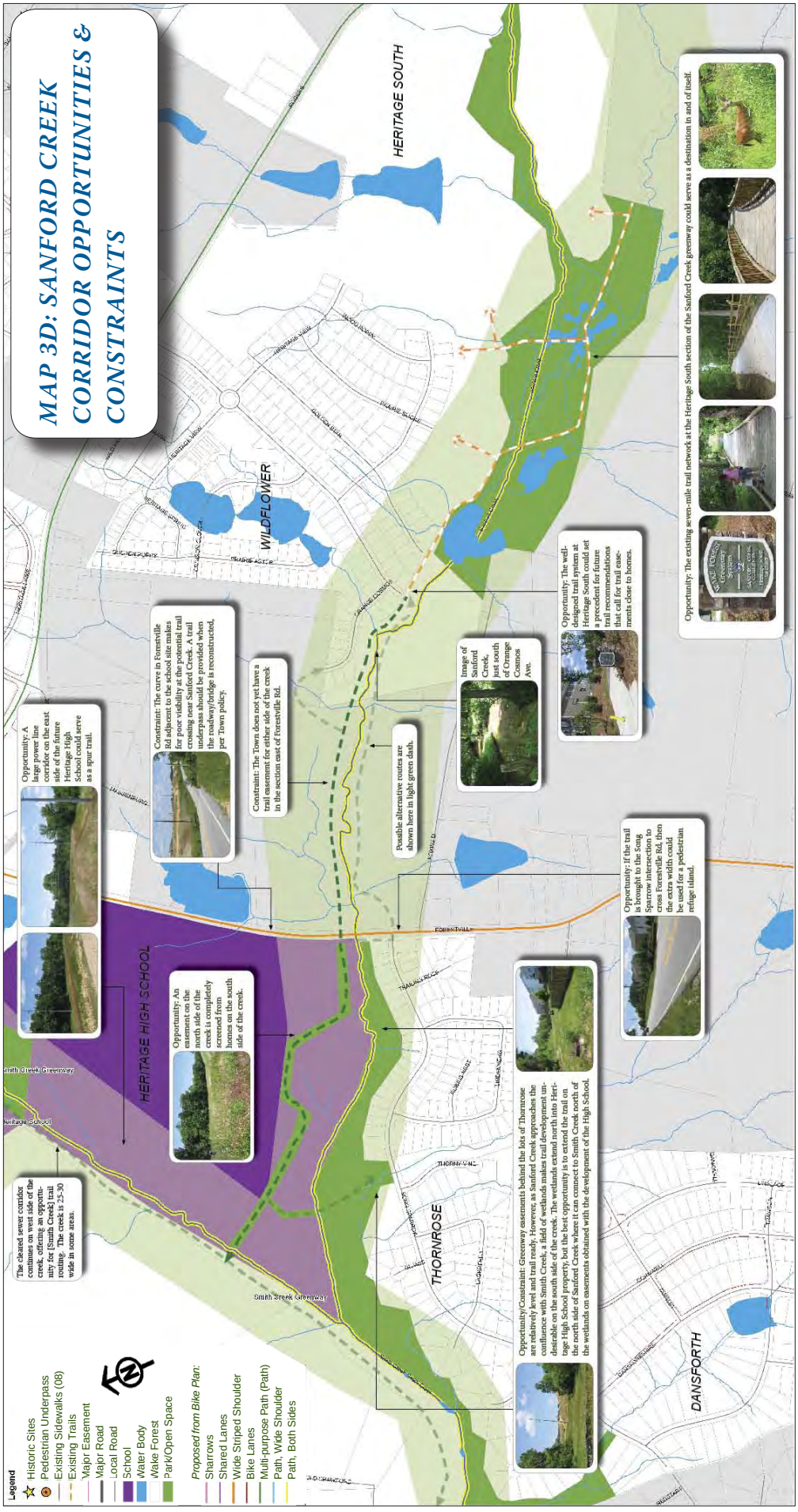
Sanford Creek Corridor Objectives:
The Sanford Creek Corridor is poised to serve as a pedestrian and bicycle route to school in addition to serving as a preserve for wildlife habitat, water quality, and stormwater containment. The existing trails connect just over one mile of public paved trails and boardwalk to private trails in the Heritage South subdivision. Trails under construction in Rolesville will connect to the eastern end in spring of 2009. The current end of trail is approximately one half mile east of Forestville Road and the southern boundary of Heritage High School, and one mile from the Smith Creek Corridor.

The Heritage South Section of the Sanford Creek Greenway was constructed under a public-private partnership with the developer constructing the trail in lieu of paying the recreation facility fees. The trail was constructed concurrently with the development, prior to occupation of the houses which served to increase the desirability of the lots near the trail and reduced opposition to the trail so often voiced when the trail comes long after the homes are built and occupied. A Type 4 (Multi-Use Paved Trail) greenway will serve the users well.



Locator Key for Sanford Creek Corridor Map on page 3-21

[INSERT 11X17 FOLD-OUT MAP]



HORSE CREEK

Horse Creek Corridor Description:
Horse Creek is the western-most stream corridor in the study area. The water in Horse Creek is clear and stream banks appear stable. The floodplain is wide and well-vegetated. Evidence suggests that the corridor supports a healthy wildlife population. The stream flows in a northeast to southwest direction before emptying into Falls Lake. Increasingly, Wake Forest is expanding westward, therefore maintaining the health of the stream should be a priority.

Horse Creek Corridor Objectives:
The Horse Creek corridor is not well suited to support a trail facility, at least not in a contiguous manner. Greenway in this corridor need to be Type 1 (No Facility Development) or Type 2 (Limited Development Low Impact Uses) to ensure that surfaces are porous and do not adversely effect the water absorbing functions of the floodplain soil. If facilities in this corridor are to be constructed, special care should be taken to ensure that Neuse River rules are strictly followed. Type 2 trails have been approved for the St. Ives Subdivision. The trail dimensions will be 6' wide and the material will be 3-5" of compacted crush.

A major obstacle along the corridor is the Wake Forest Golf Club, though the future of the golf course is unknown. Passage through or around this facility for a contiguous trail is desirable, though it would be difficult to design with the necessary safety considerations addressed. Additionally, soil conditions along the upper portion of the stream would make trail construction difficult. The lower stretches of Horse Creek, within the study area and beyond, could someday provide a popular connection to Falls Lake. However, it is important to stress that the ecological health of the stream is its greatest strength and its contribution to the drinking water supply is its greatest service. All constraints considered, it is important to leave open the opportunity of a future trail, especially considering the closer of the golf course.

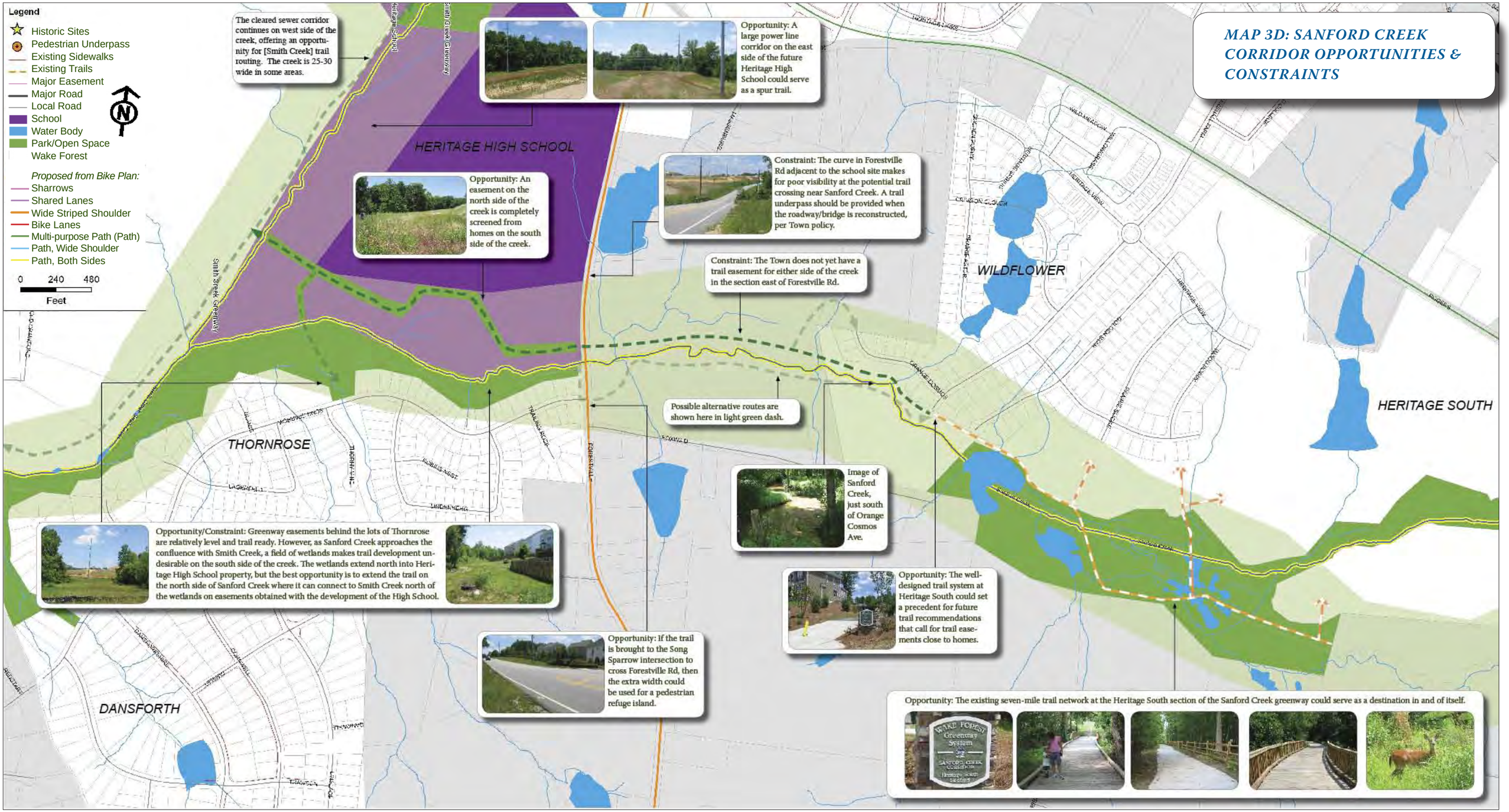
TOM'S CREEK

Corridor Description:
Tom's Creek is the shortest stream corridor within the study area. The stream flows east to southwest from the Rolesville area to the Neuse River. The stream passes through residential neighborhoods and a large wetland before emptying into the Neuse River.

Tom's Creek Corridor Objectives:
The greatest potential for this stream is its ability to connect Wake Forest to Rolesville, contributing to a countywide effort to link Wake County communities. There are sizeable wetlands associated with Brown's Lake

at the eastern edge of the study boundary. The ecological functions of the wetlands, the cultural significance of the lake and granite dam, and the overall beauty of the corridor make it significant. However, Tom's Creek flows between residential communities that have expressed mixed feelings regarding the development of trail facilities. At the lower end of Tom's Creek there is a substantial wetland adjacent to property already owned by Wake Forest. A trail here would be of benefit to the Wake Forest community, eventually connecting to the Smith Creek Greenway and to Raleigh's greenway network via the planned bridge over the Neuse River. It could also serve as an attractive destination to view wildlife. Trails being developed in this area should be Type 2 (Limited Development Low-Impact Uses) or Type 3 (Multi-Use Unpaved).

MAP 3D: SANFORD CREEK CORRIDOR OPPORTUNITIES & CONSTRAINTS



HORSE CREEK

Horse Creek Corridor Description:
Horse Creek is the western-most stream corridor in the study area.. The water in Horse Creek is clear and stream banks appear stable. The floodplain is wide and well-vegetated. Evidence suggests that the corridor supports a healthy wildlife population. The stream flows in a northeast to southwest direction before emptying into Falls Lake. Increasingly, Wake Forest is expanding westward, therefore maintaining the health of the stream should be a priority.

Horse Creek Corridor Objectives:
The Horse Creek corridor is not well suited to support a trail facility, at least not in a contiguous manner. Greenway in this corridor need to be Type 1 (No Facility Development) or Type 2 (Limited Development Low Impact Uses) to ensure that surfaces are porous and do not adversely effect the water absorbing functions of the floodplain soil. If facilities in this corridor are to be constructed, special care should be taken to ensure that Neuse River rules are strictly followed.

A major obstacle along the corridor is the Wake Forest Golf Club, though the future of the golf course is unknown. Passage through or around this facility for a contiguous trail is desirable, though it would be difficult to design with the necessary safety considerations addressed. Additionally, soil conditions along the upper portion of the stream would make trail construction difficult. The lower stretches of Horse Creek, within the study area and beyond, could someday provide a popular connection to Falls Lake. However, it is important to stress that the ecological health of the stream is its greatest strength and its contribution to the drinking water supply is its greatest service.

TOM'S CREEK

Corridor Description:
Tom's Creek is the shortest stream corridor within the study area. The stream flows east to southwest from the Rolesville area to the Neuse River. The stream passes through residential neighborhoods and a large wetland before emptying into the Neuse River. The stream is listed as a 303(d) stream due to point source pollution, land development nonpoint source pollution, and urban runoff.

Tom's Creek Corridor Objectives:
The greatest potential for this stream is its ability to connect Wake Forest to Rolesville, contributing to a countywide effort to link Wake County communities. There are sizeable wetlands associated with Brown's Lake at the eastern edge of the study boundary. The ecological functions of the wetlands, the cultural significance of the lake and granite dam, and

Chapter 4: Implementation

Dunn Creek

Chapter Outline:

Overview

Phase One

Phase Two

Phase Three

Action Steps & Trail Cut-Sheets

OVERVIEW

The recommendations of the Wake Forest Open Space and Greenway Plan are broken down into two primary phases for future development. The content of this chapter differs from the 2002 Plan, reflecting changes over the past six years in development pressure, land acquisition, easements, and other factors that are influencing greenway development in the Town of Wake Forest and neighboring jurisdictions.

This chapter contains a basic description of each phase, followed by a table of action steps for implementation and project cut-sheets that feature a detailed cost estimate and map for 11 of the individual trail segments in the Phase One and Phase Two greenway corridors (the table below lists these greenway corridors, broken down by segment).

SUMMARY TABLE FOR PRIORITY GREENWAY CORRIDORS

Priority Greenway Corridors (2.35 miles of 12 miles complete = 17% complete)

Cut Sheet #	Greenway Corridor	From	To	Miles	Feet	Development Stage
Dunn Creek Corridor (0.0 miles of 3.05 miles complete)						
1	Dunn Creek	Flaherty Park	Oak Grove Church Road	0.91	4,800	Planning
2	Dunn Creek	Oak Grove Church Road	NC 98 Bypass	1.14	6,000	Planning
3	Dunn Creek	NC 98 Bypass	Smith Creek Soccer Complex	0.92	4,850	Design
			Total	*2.96*	*15,650*	
			Percentage Complete	*0%*		
Smith Creek Corridor (1.15 miles of 2.85 miles complete)						
-	Smith Creek	Reservoir	Smith Creek Soccer Complex	1.50	7,920	Planning
-	Smith Creek	Smith Creek Soccer Complex	Rogers Road	0.63	3,326	Completed
4	Smith Creek	Rogers Road	Sanford Creek	1.00	5,280	Planning
5	Smith Creek	Sanford Creek	Ligon Mill	0.91	4,820	Planning
6	Smith Creek	Ligon Mill	Burlington Mill	0.94	4,950	Planning
-	Smith Creek	Burlington Mill	Neuse River	0.65	3,432	Completed
			Total	*5.63*	*21,808*	
			Percentage Complete	*29%*		
Richland Creek Corridor (0.35 miles of 3.91 miles complete)						
7	Richland Creek	Wake Forest Town Limits	N. End of Olde Mill Stream Gwy	0.87	4,600	Planning
-	Richland Creek	N. End of Olde Mill Stream Gwy	Harris Road	0.35	1,848	Completed
8	Richland Creek	Harris Road	Stadium Drive	0.98	5,200	Planning
9	Richland Creek	Stadium Drive	Bennet Park Neighborhood	1.17	6,175	Planning
10	Richland Creek	Bennet Park Neighborhood	Villas at Caveness Farms	1.10	5,800	Planning
			Total	*4.47*	*23,623*	
			Percentage Complete	*8%*		
Sanford Creek Corridor (0.85 miles of 1.5 miles complete)						
11	Sanford Creek	Smith Creek Greenway	Marshall Farm Road	1.16	6,100	Planning
-	Sanford Creek	Marshall Farm Road	W. End of Sanford Creek Gwy	0.85	4,488	Completed
-	Sanford Creek	W. End of Sanford Creek Gwy	Rogers Road	0.50	2,640	Construction
			Total	*2.51*	*13,228*	
			Percentage Complete	*33%*		

PHASE ONE

SMITH CREEK/DUNN CREEK CORRIDOR

Smith Creek and Dunn Creek are key north/south corridors that connect Wake Forest with the Neuse River. Within only four years, the Smith Creek Corridor will connect to the Neuse River Trail (NRT), which will host a key section of the North Carolina Mountains-to-Sea Trail (MST). It will be beneficial for Wake Forest to tie into this trail for recreation, transportation and economic benefits.

See Smith Creek Corridor Project Cut-Sheets and Cost Estimates, pages 4-8 to 4-19

Since the 2002 Plan was adopted, the Town has made progress in developing trail in the Smith Creek Corridor. The Town has developed over a mile of trail in two sections along Smith Creek: south of Burlington Mills Road and at the Smith Creek Soccer Center. Additionally, the Town acquired land and funding for approximately one mile of the Dunn Creek Greenway Trail, from the Smith Creek Soccer Center to the NC 98 Bypass pedestrian underpass (see Chapter 2). As noted in the 2008 Wake Forest Bicycle Plan, the Smith Creek corridor remains a top priority for greenway development.

Residential subdivisions have been developing quickly along both Dunn Creek and Smith Creek, and are expected to continue developing. The benefits that a greenway can bring to this area include: stormwater capacity that can balance increased impervious surfaces, recreation opportunities, buffers, and a route for pedestrian and bicycle transportation. The Smith Creek Corridor, the longest of the corridors in Wake Forest, is capable of linking a great number of residents to businesses in downtown Wake Forest, recreation facilities at Flaherty and Ailey Young Parks, Heritage Elementary, Middle and High Schools, and other greenway systems at the Reservoir and along Sanford Creek. Finally, Wake Forest already owns considerable properties and easements along Dunn Creek and Smith Creek, and despite their length, there are relatively few property owners that must be approached to close remaining gaps.

An important feature of the Smith Creek/Dunn Creek Corridor will be the ways in which it connects to Downtown Wake Forest. The aforementioned connections to the MST and NRT will mean a great deal more in terms of both economic development and overall connectivity, if users of those trail systems and the Smith Creek Greenway can easily access Downtown Wake Forest. Below are a few recommendations for such a connection, none of which are perfect, but all of which should be pursued:

- First, the Spring Branch spur trail connects the Dunn Creek Corridor at the Heritage North subdivision to Miller Park in Downtown Wake Forest. This spur trail is planned to cross the NC 98 Bypass at the future Franklin Street intersection, continuing north towards Downtown along a patchwork of publicly owned open space between Deacon Ridge Street and S. Franklin Street. To accommodate trail users, the following should be provided at a minimum for the future Franklin Street/NC 98 Bypass intersection: a pedestrian refuge island, countdown crossing signals, advance warning signs, and high visibility crosswalks. Also, refer to the Holding Village plan for trails along Spring Branch

- Second, starting from the Dunn Creek underpass at the NC 98 Bypass, a spur trail could go west to the Spring Branch corridor via a short section (less than 2000 feet) of sidewalks along Ledgerock Rd and S. Allen Road in the Decaons Ridge Subdivision. This sidewalk connection would change back to a multi-use trail at the intersection of S. Allen Rd and E. Holding Avenue, then continue north to Miller Park in Downtown Wake Forest. While the sidewalk portion is less than ideal, it would provide an alternative for trail users who prefer not to cross at an NC 98 Bypass intersection, as noted in the previous option.

- Third, sidewalks, bicycle lanes, and shared lane markings (sharrows) are planned along Wait Avenue (see the adopted 2008 Bicycle Plan and 2006 Pedestrian Plan for descriptions of these facilities). The section of Wait Avenue between Dunn Creek and Downtown Wake Forest should be a top priority for these facilities, which should be built to connect seamlessly with the trail system.

PHASE TWO

RICHLAND CREEK CORRIDOR

Both the Bicycle and Pedestrian Plans place the Richland Creek corridor immediately after the Smith Creek corridor in terms of project priority. Following the Richland Creek corridor, the plans diverge, but the general idea is the same: residential neighborhoods throughout Wake Forest need greater accessibility to downtown, parks, and other destinations. There have been numerous new subdivisions built since the Open Space and Greenway Plan was adopted, and many of them have sidewalks or short sections of greenway easements or trails, yet there is a sense of isolation on the part of many residents. Comments received in surveys and public meetings summarized in the two plans, residents express a desire to have isolated peripheral areas and subdivisions connected to the main greenway trail system via both on and off-road facilities. The greenway trails to be constructed along the Richland Creek Corridor should aim to enhance connectivity by providing access to the parks, schools, and neighborhoods along the corridor.

See Richland Creek Corridor Project Cut-Sheets and Cost Estimates, pages 4-20 to 4-27

There are no planned greenway corridors connecting the Richland Creek Corridor to Downtown Wake Forest (besides the NC 98 Bypass Corridor, which is discussed separately below). However, the best possible future connection would be along the sidewalks and bicycle facilities planned for Stadium Drive and North Avenue. The reasoning behind this connection (rather than along Durham Road or along residential streets), is that it connects Downtown to not only to Wake Forest-Rolesville High School, but also to a portion of the Richland Creek Corridor that could use publicly owned open space to connect to Joyner Park and the Old Mill Stream Greenway.

SANFORD CREEK CORRIDOR

Phase Two will also help establish a trail connection to Rolesville along Sanford Creek. This would require cooperation and coordination with the Town of Rolesville, and, undoubtedly, each town would benefit. Wake Forest has working relationships with Wake County and neighboring municipalities, and is currently an active member of the Partners for Open Space and the Environment (POSE). However, according to the 2006 Wake County Open Space Plan, it is necessary to strengthen POSE by regularly attending POSE meetings, sharing information with other POSE members, and coordinating on projects such as the Sanford Creek. Wake Forest should take a lead role in mobilizing the County and other municipalities to make POSE a more effective forum for achieving regional connectivity. Finally, this corridor offers an incredible opportunity to build a trail that connects hundreds of students to Heritage High School, Middle School and Elementary School with a relatively small amount of trail.

See Sanford Creek Corridor Project Cut-Sheets and Cost Estimates, pages 4-28 to 4-29

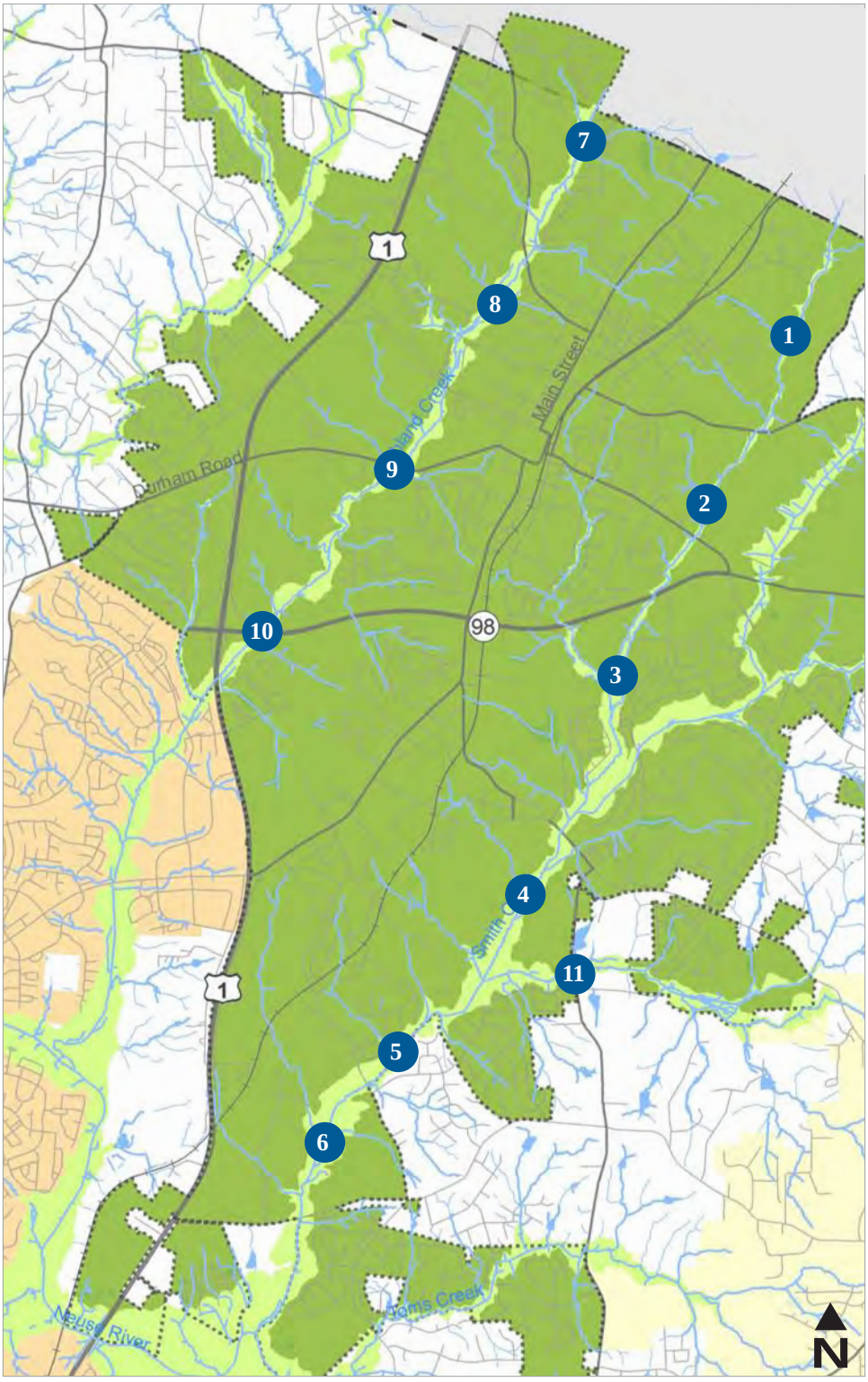
NC 98 BYPASS CORRIDOR

The Town of Wake Forest Pedestrian Plan lists the NC 98 Bypass Corridor as the top priority greenway corridor. Though slightly different, this recommendation is supported by the 2002 Open Space and Greenway Plan, which stresses the importance of creating an east/west connection for economic and transportation objectives. The NC 98 Bypass, as a limited access facility with steep cut and fill slopes in many areas, has its challenges and choke points where care is needed to provide for convenient trail passage. Still, the completion of the NC 98 Bypass has created a new opportunity for the development of an east/west trail corridor, and trail projects within this corridor have a high priority. Though the potential exists for an alternative east-west corridor along Wait Ave/Durham Rd, the NC 98 Bypass corridor would provide a better connection for transportation and recreation purposes, and would provide an off-road facility with less intersections. As such, the detailed bicycle and pedestrian recommendations contained in the NC 98 Bypass Corridor Master Plan (page 3-7) should be incorporated into the Phase Two recommendations of this plan to facilitate the planning process and ensure efficiency in the development of an east/west trail.

ACTION STEPS & TRAIL CUT-SHEETS

The action steps on page 4-7 are integral to achieving the goals and vision of this Plan. As guiding recommendations and the clearest representation of specific items to accomplish, they should be referred to often. The priority ranking is intended to provide general direction only, as many actions can be pursued simultaneously.

Locator Key for Project Cut-Sheets on pages 4-8 to 4-29



The cut-sheets on pages 4-8 to 4-29 are provided for anyone who wishes to better understand the phase one and phase two priority projects that are recommended in this plan. The cut sheets are particularly useful for Town staff as they begin developing more detailed design work for these projects. They will also help in describing these projects to various parties, such as elected officials, potential funding agencies, and interested citizens. The map at left shows the locations of these key projects (note that the cut-sheet numbers are for identification purposes and do not necessarily correspond with project priorities).

IMPLEMENTATION ACTION STEPS *for the* WAKE FOREST OPEN SPACE AND GREENWAY PLAN

#	Task	Lead Department	Support Department	Details	Phase	Reference
1	Complete design and construction of the Dunn Creek Greenway trail, from the NC98 Bypass to the Smith Creek Soccer Complex	Parks & Recreation	Planning Department + Engineering	The Town has targeted this section along the Dunn Creek tributary of Smith Creek for the construction of its next trail. The segment extends north from the Smith Creek Soccer Center to the NC 98 by-pass, where the Town and DOT have already installed a pedestrian culvert.	Phase One (2010)	Cut-sheet # 3
2	Extend the Smith Creek Greenway trail south to connect to Thornrose, Dansforth, Sanford Creek trail and Heritage elementary, middle, and high schools.	Planning Department	Parks & Recreation and Engineering	With Safe Routes to School (SRTS) funds, and an equivalent Town match in funds, this trail could produce a safe transportation route for hundreds of students living in Dansforth, Thornrose, Heritage South, and Heritage Wake Forest. Safe access needs to be provided along, across, and underneath Rogers Road. An at-grade crossing is located at the signalized intersection of Rogers Road and Franklin Street. An underpass needs to be provided when the Rogers Road bridge over Smith Creek is reconstructed. The future bridge must also accommodate bicyclists and pedestrians over the bridge.	Phase One (2011)	Cut-sheet # 4
3	Propose a bond fund to complete the Wake Forest's portions of the Greenway Loop.	Planning Department	Parks & Recreation and Engineering	Eighty-five percent of people who filled out comment forms related to this Plan Update said they would support such a measure. Calculate cost-estimates from this plan and the 2008 Bicycle Plan to determine total required funding. Also consider funding *all* phase one and phase two projects in a single bond measure.	Phase One (Begin 2009)	Map 3A, page 3-10
4	Complete design and construction of the Dunn Creek Greenway trail, from the NC 98 Bypass to Oak Grove Church Road.	Planning Department	Parks & Recreation and Engineering	This section is the logical next step, continuing the trail from the NC 98 Bypass, and connecting to the proposed Wait Avenue bicycle lanes and sidewalks to downtown. If continued trail construction to Flaherty Park is not expected to be immediate, then provide a trailhead at Oak Grove Church Road to 'anchor' the end of the trail in the short term.	Phase One (2012)	Cut-sheet # 2
5	Complete design and construction of the Dunn Creek Greenway trail, from Oak Grove Church Road to Flaherty Park.	Planning Department	Parks & Recreation and Engineering	This section connects from Oak Grove Church Road to Flaherty Park, completing a trail all the way to the Smith Creek Soccer Complex, and (depending on the status of the Rogers Road bridge improvements) to Heritage High School.	Phase One (2013)	Cut-sheet # 1
6	Develop bicycle and trail signage and wayfinding system.	Planning Department	Parks & Recreation and Engineering	A wayfinding system is recommended only after completing several key bicycle and pedestrian projects, otherwise the system would need an immediate update. After completion of the above trail segments (along with progress from the implementation of the 2008 Bicycle Plan), a wayfinding system should be designed that is flexible enough to make updates as new projects are completed.	Phase One (2013)	Appendix B
7	Complete design and construction of the Smith Creek Greenway trail, from Sanford Creek to Ligon Mill Road.	Planning Department	Parks & Recreation and Engineering	By completing the northern portions of the Smith Creek and Dunn Creek Greenway trails, this remaining portion will be 'book-ended' with Raleigh's Neuse River Trail, creating popular demand and political pressure to complete this section. Work with Wake County and landowners to acquire greenway easements on the two remaining parcels necessary for corridor connectivity (near the Margaret's pond and Dansforth subdivisions).	Phase One (2014)	Cut-sheet # 5
8	Complete design and construction of the Smith Creek Greenway trail, from Ligon Mill Road to Burlington Mill Road.	Planning Department	Parks & Recreation and Engineering	This would be the final link connecting Downtown Wake Forest to the Neuse River Trail (which doubles as the North Carolina Mountains-to-Sea Trail and connects to the entire City of Raleigh greenway system). Work with Wake County to acquire a greenway easement from the owner/developer of the one remaining parcel necessary for corridor connectivity.	Phase One (2015)	Cut-sheet # 6
9	Complete design and construction of the Richland Creek Greenway trail, from Harris Road to Stadium Drive.	Planning Department	Parks & Recreation and Engineering	This portion of the Richland Creek Greenway is a top priority for the corridor because it would use existing public open space to connect the Olde Mill Stream Greenway to the proposed trails of Joyner Park and Wake Forest-Rolesville High School. Proposed bicycle lanes and sidewalks (from the 2006 Pedestrian Plan and the 2008 Bicycle Plan) would connect the southernmost portion of this trail segment to Downtown Wake Forest.	Phase Two (2016)	Cut-sheet # 8
10	Complete design and construction of the Sanford Creek Greenway trail, from the Smith Creek Greenway to Marshall Farm Road.	Planning Department	Parks & Recreation and Engineering	This portion of the Sanford Creek Greenway would connect the Smith and Dunn Creek Greenways to the existing portions of the Sanford Creek Greenway. The redesign and reconstruction of Forestville Road should monitored closely for inclusion of bicycle and pedestrian accommodations to connect the trail across the roadway. An underpass is recommended, per Town policy.	Phase Two (2017)	Cut-sheet # 11
11	Complete construction of the Sanford Creek Greenway trail, from the west end of the existing boardwalk on Sanford Creek Greenway to Rogers Road.	Planning Department	Parks & Recreation and Engineering	This portion of the Sanford Creek Greenway would eventually connect the Wake Forest Greenway system to the Rolesville Greenway system. The redesign and reconstruction of Rogers Road should monitored closely for inclusion of bicycle and pedestrian accommodations to connect the trail across the roadway. An underpass is recommended, per Town policy.	(under construction)	Page 4-4
12	Complete design and construction of the Richland Creek Greenway trail, from Stadium Drive to the Bennett Park Neighborhood.	Planning Department	Parks & Recreation and Engineering	This is the next logical step for the Richland Creek Greenway, as it would build off of the above recommendation, extending the trail to a network of subdivisions just southwest of Downtown Wake Forest.	Phase Two (2018)	Cut-sheet # 9
13	Complete design and construction of the Richland Creek Greenway trail, from the Bennett Park Neighborhood to the Villas at Caveness Farms (US-1/Capital Blvd)	Planning Department	Parks & Recreation and Engineering	This section of the Richland Creek Greenway would be completed towards the end of phase one to allow more time for coordination with the City of Raleigh and NCDOT in either providing an underpass for the trail at US-1/Capital Blvd (as recommended) or at a minimum, providing pedestrian accommodations at the intersection of US-1/Capital Blvd and the NC 98 Bypass.	Phase Two (2019)	Cut-sheet # 10
14	Complete design and construction of the Richland Creek Greenway trail, from the north end of the Olde Mill Stream Greenway to the Wake Forest Town Limits.	Planning Department	Parks & Recreation and Engineering	Although this portion of the Richland Creek Greenway is recommended last, it should be moved up in priority if any other sections are held up for any reason. The public open space along the sewer corridor in this section would connect to the existing Olde Mill Stream Greenway.	Phase Two (2020)	Cut-sheet # 7
15	Update the 2009 Plan	Planning Department	Parks & Recreation and Engineering	After ten years (2010-2020), this plan should be thoroughly evaluated and updated according to progress made on implementation. A key step would be developing thorough recommendations for Phase Three projects.	Phase Three (2020)	-

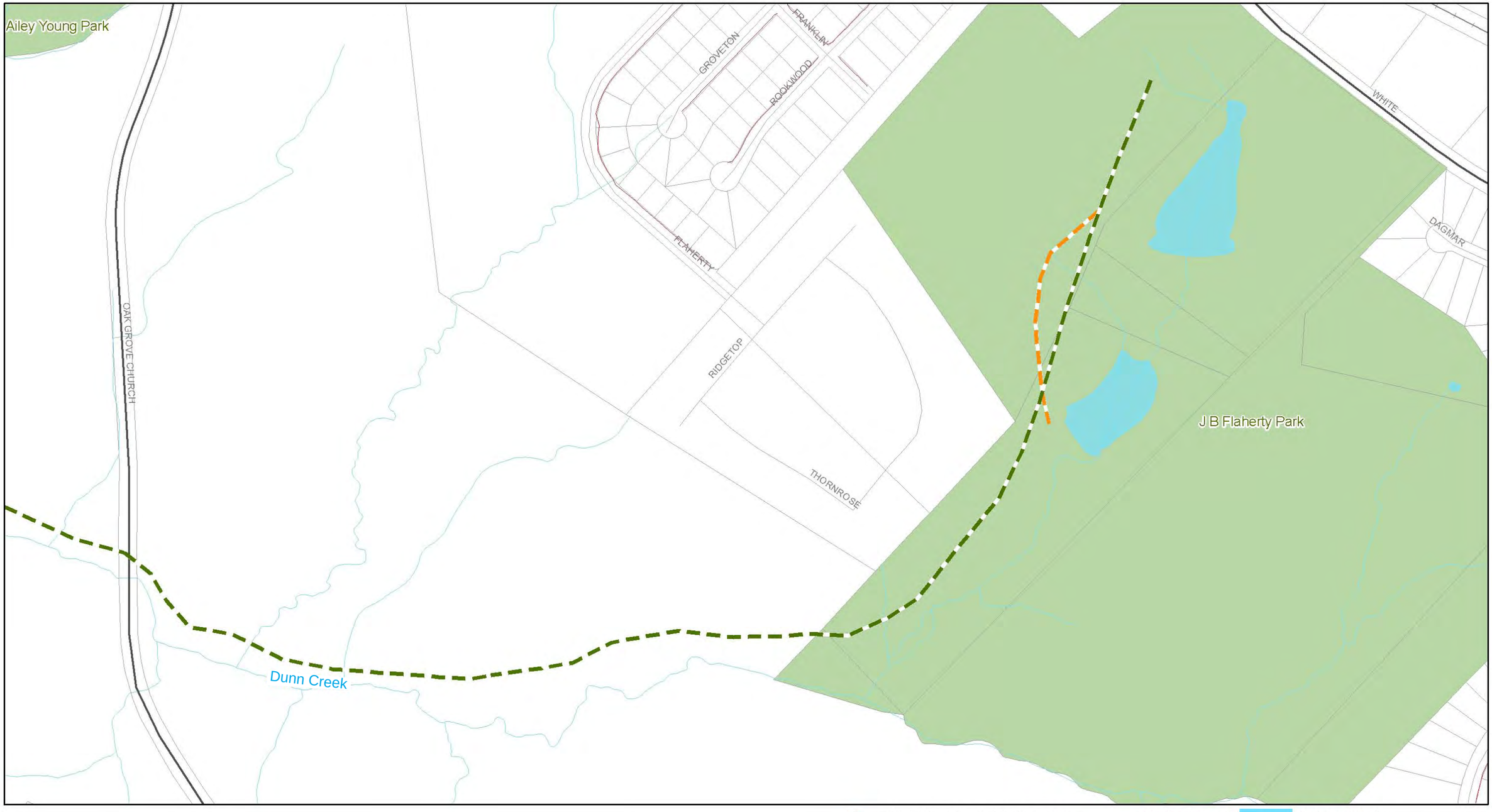
COST ESTIMATE FOR CUT SHEET 1 DUNN CREEK CORRIDOR

(From Flaherty Park to Oak Grove Church Road)

Map Key A	Demolition	Quantity	Cost	Unit	Subtotal
A1	Clearing and grubbing understory (20' wide)	0	$0.25	sf	$0.00
A2	Dumping Fees @ 6% of Demolition total			6%	$0.00
				Subtotal	$0.00
	Site Development	Quantity	Cost	Unit	Subtotal
B	Off-Road Facility *(6,335 lf)*				
B1	Temporary tree protection/silt fence (both sides)	9,600	$2.00	lf	$19,200.00
B2	Trail grading (0-5 cu ft/lf)	4,800	$3.30	lf	$15,840.00
B3	10' wide multi-use asphalt trail	4,800	$50.00	lf	$240,000.00
B4	2' wide gravel shoulder (both sides)	9,600	$6.60	lf	$63,360.00
B5	Wooden or recycled synthetic material boardwalk	0	$250.00	lf	$0.00
B6	Small Bike/Ped Bridge	0	$1,350.00	lf	$0.00
B7	Drainage culvert (36" reinforced concrete pipe)	0	$44.00	lf	$0.00
B8	Seeding or mulching trail edges (5' both sides)	48,000	$0.13	sf	$6,240.00
B9	Geotextile fabric	4,800	$1.50	lf	$7,200.00
C	On-Road Facility				
C1	Crosswalk: Striping (High Visibility Paint)	0	$1.60	lf	$0.00
C2	Crosswalk: Striping (High Visibility Thermo)	0	$4.80	lf	$0.00
C3	Ped-activated overhead warning lights	0	Unknown	ea	$0.00
C4	Median pedestrian refuge island	0	Unknown	ea	$0.00
D	Utilities				
D1	Solar powered light	0	$5,900.00	ea	$0.00
D2	Solar powered light pole	0	$1,420.00	ea	$0.00
D3	Emergency phones	0	$2,730.00	ea	$0.00
E	Signage				
E1	Mile Markers	1	$220.00	ea	$220.00
E2	Trail and street regulatory/warning signs	0	$220.00	ea	$0.00
E3	Directional signs	1	$220.00	ea	$220.00
E4	Educational signs	0	$330.00	ea	$0.00
F	Site Amenities				
F1	Benches (2 per mile recommended)	2	$900.00	ea	$1,800.00
F2	Bicycle rack (at trailheads)	1	$225.00	ea	$225.00
F3	Drinking fountains, with pet fountain (1/mile)	1	$2,000.00	ea	$2,000.00
F4	Picnic tables/ tables (at trailheads)	1	$550.00	ea	$550.00
F5	Trash receptacles (32-gallon, steel)(at trailheads)	1	$300.00	ea	$300.00
F6	Bollards (2 per trail/road intersection)	2	$600.00	ea	$1,200.00
F7	Parking (10-car lot)(at trailheads)	1	$22,000.00	ea	$22,000.00
F8	Parking (20-car lot)(at trailheads)	0	$55,000.00	ea	$0.00
				Subtotal	$380,355.00
G	Design	Quantity	Cost	Unit	Subtotal
G1	Wetlands Deliniation	4,800	$1.00	lf	$4,800.00
G2	Geotechnical Testing	4,800	$3.00	lf	$14,400.00
G3	Construction Documents @ 12 % of Dev. Cost			12%	$45,642.60
				Subtotal	$64,842.60
	Subtotals				
A	Demolition				$0.00
B	Off-Road Facility				$351,840.00
C	On-Road Facility				$0.00
D	Utilities				$0.00
E	Signage				$440.00
F	Site Amenities				$28,075.00
G	Design				$64,842.60
	SUBTOTAL				$445,197.60
	Contingency (15% of total)			15%	$66,779.64
	TOTAL				$511,977.24

Note: Does not include the following: land acquisition, potential rock and unsuitable soils excavation, permitting fees, mobilization, and taxes.

CUT SHEET 1 *DUNN CREEK CORRIDOR (From Flaherty Park to Oak Grove Church Road)*



Site Development Item (*See map key column in cost estimate table*)

COST ESTIMATE FOR CUT SHEET 2 DUNN CREEK CORRIDOR

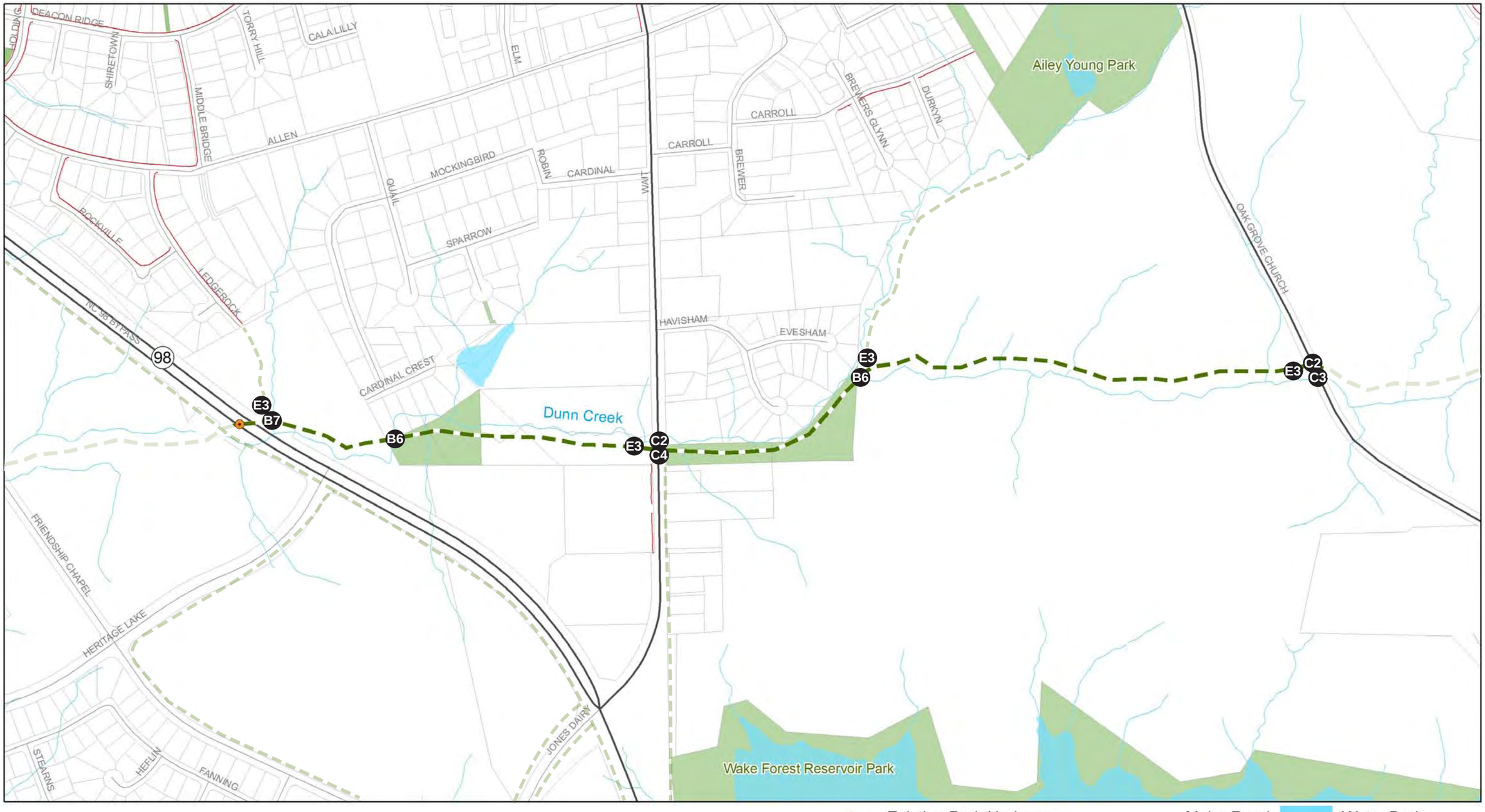
(From Oak Grove Church Road to NC 98 Bypass)

Map Key

A	Demolition	Quantity	Cost	Unit	Subtotal
A1	Clearing and grubbing understory (20' wide)	0	$0.25	sf	$0.00
A2	Dumping Fees @ 6% of Demolition total			6%	$0.00
				Subtotal	$0.00
	Site Development	Quantity	Cost	Unit	Subtotal
B	Off-Road Facility *(6,335 lf)*				
B1	Temporary tree protection/silt fence (both sides)	12,000	$2.00	lf	$24,000.00
B2	Trail grading (0-5 cu ft/lf)	6,000	$3.30	lf	$19,800.00
B3	10' wide multi-use asphalt trail	6,000	$50.00	lf	$300,000.00
B4	2' wide gravel shoulder (both sides)	12,000	$6.60	lf	$79,200.00
B5	Wooden or recycled synthetic material boardwalk	0	$250.00	lf	$0.00
B6	Small Bike/Ped Bridge (2)	40	$1,350.00	lf	$54,000.00
B7	Drainage culvert (36" reinforced concrete pipe)	15	$44.00	lf	$660.00
B8	Seeding or mulching trail edges (5' both sides)	60,000	$0.13	sf	$7,800.00
B9	Geotextile fabric	6,000	$1.50	lf	$9,000.00
C	On-Road Facility				
C1	Crosswalk: Striping (High Visibility Paint)	0	$1.60	lf	$0.00
C2	Crosswalk: Striping (High Visibility Thermo)	48	$4.80	lf	$230.40
C3	Ped-activated overhead warning lights	1	Unknown	ea	$0.00
C4	Median pedestrian refuge island	1	Unknown	ea	$0.00
D	Utilities				
D1	Solar powered light	0	$5,900.00	ea	$0.00
D2	Solar powered light pole	0	$1,420.00	ea	$0.00
D3	Emergency phones	0	$2,730.00	ea	$0.00
E	Signage				
E1	Mile Markers	2	$220.00	ea	$440.00
E2	Trail and street regulatory/warning signs	7	$220.00	ea	$1,540.00
E3	Directional signs	4	$220.00	ea	$880.00
E4	Educational signs	0	$330.00	ea	$0.00
F	Site Amenities				
F1	Benches (2 per mile recommended)	2	$900.00	ea	$1,800.00
F2	Bicycle rack (at trailheads)	0	$225.00	ea	$0.00
F3	Drinking fountains, with pet fountain (1/mile)	1	$2,000.00	ea	$2,000.00
F4	Picnic tables/ tables (at trailheads)	0	$550.00	ea	$0.00
F5	Trash receptacles (32-gallon, steel)(at trailheads)	0	$300.00	ea	$0.00
F6	Bollards (2 per trail/road intersection)	4	$600.00	ea	$2,400.00
F7	Parking (10-car lot)(at trailheads)	0	$22,000.00	ea	$0.00
F8	Parking (20-car lot)(at trailheads)	0	$55,000.00	ea	$0.00
				Subtotal	$503,750.40
G	Design	Quantity	Cost	Unit	Subtotal
G1	Wetlands Deliniation	6,000	$1.00	lf	$6,000.00
G2	Geotechnical Testing	6,000	$3.00	lf	$18,000.00
G3	Construction Documents @ 12 % of Dev. Cost			12%	$60,450.05
				Subtotal	$84,450.05
	Subtotals				
A	Demolition				$0.00
B	Off-Road Facility				$494,460.00
C	On-Road Facility				$230.40
D	Utilities				$0.00
E	Signage				$2,860.00
F	Site Amenities				$6,200.00
G	Design				$84,450.05
	SUBTOTAL				$588,200.45
	Contingency (15% of total)			15%	$88,230.07
	TOTAL				$676,430.52

Note: Total does not include land acquisition, potential rock and unsuitable soils excavation, permitting fees, mobilization, taxes, or any other item not listed above.

CUT SHEET 2 *DUNN CREEK CORRIDOR (From Oak Grove Church Road to NC 98 Bypass)*



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

A1 Site Development Item *(See map key column in cost estimate table)*

- Existing Ped. Underpass
- Cut-Sheet Trail Segment
- Existing Greenway Trail
- Existing Sidewalks
- Other Proposed Trails
- Major Road
- Local Road
- Railroad
- Hydrology
- Water Body
- Park/Open Space
- School
- Parcels

COST ESTIMATE FOR CUT SHEET 3 DUNN CREEK CORRIDOR

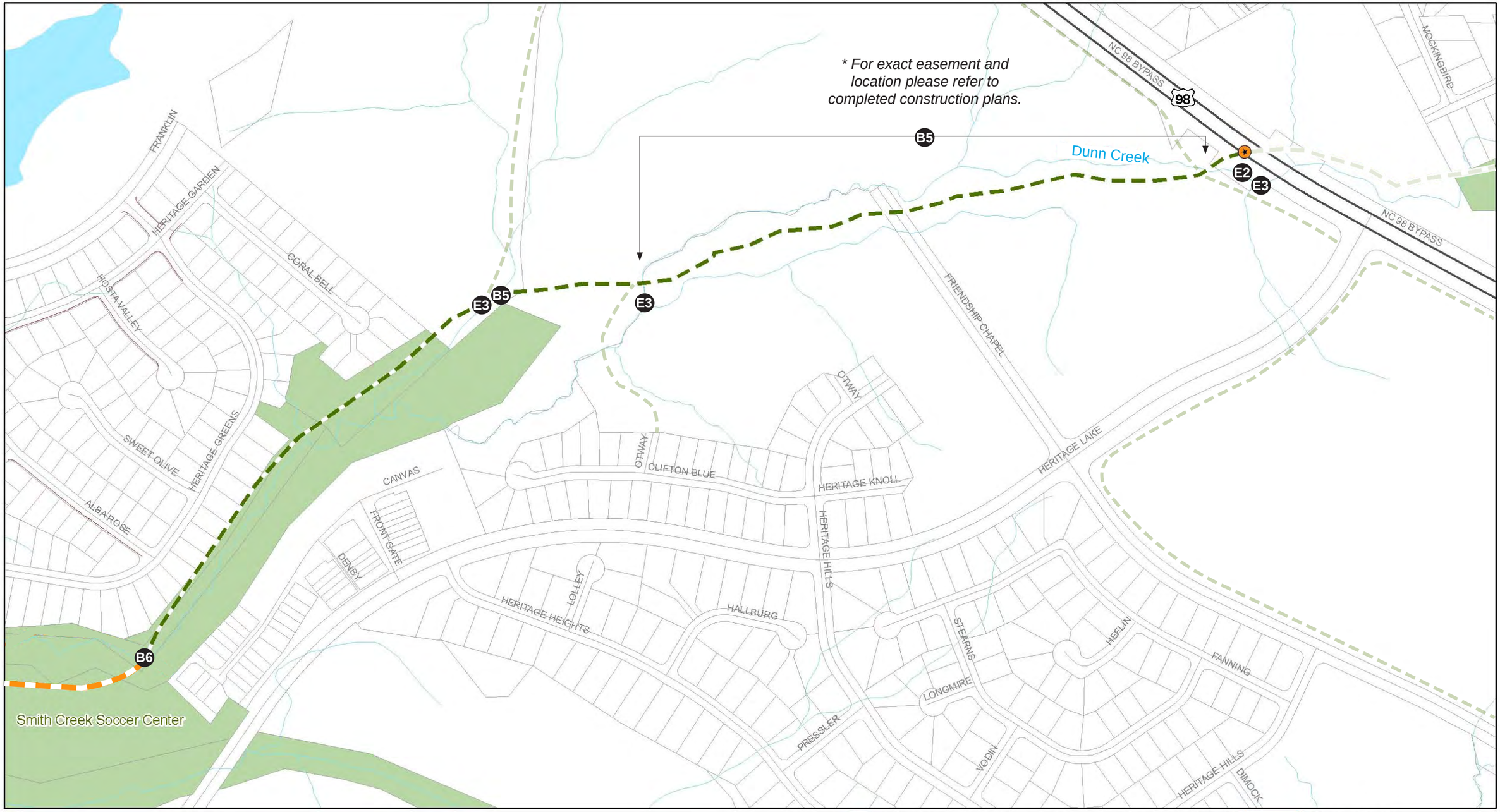
(From NC 98 Bypass to the Smith Creek Soccer Complex)

Map Key

A	Demolition	Quantity	Cost	Unit	Subtotal
A1	Clearing and grubbing understory (20' wide)	0	$0.25	sf	$0.00
A2	Dumping Fees @ 6% of Demolition total			6%	$0.00
				Subtotal	$0.00
	Site Development	Quantity	Cost	Unit	Subtotal
B	Off-Road Facility *(6,335 lf)*				
B1	Temporary tree protection/silt fence (both sides)	4,850	$2.00	lf	$9,700.00
B2	Trail grading (0-5 cu ft/lf)	2,425	$3.30	lf	$8,002.50
B3	10' wide multi-use asphalt trail	2,425	$50.00	lf	$121,250.00
B4	2' wide gravel shoulder (both sides)	4,850	$6.60	lf	$32,010.00
B5	Wooden or recycled synthetic material boardwalk	2,425	$250.00	lf	$606,250.00
B6	Small Bike/Ped Bridge (1)	30	$1,350.00	lf	$40,500.00
B7	Drainage culvert (36" reinforced concrete pipe)	0	$44.00	lf	$0.00
B8	Seeding or mulching trail edges (5' both sides)	24,250	$0.13	sf	$3,152.50
B9	Geotextile fabric	2,425	$1.50	lf	$3,637.50
C	On-Road Facility				
C1	Crosswalk: Striping (High Visibility Paint)	0	$1.60	lf	$0.00
C2	Crosswalk: Striping (High Visibility Thermo)	0	$4.80	lf	$0.00
C3	Ped-activated overhead warning lights	0	Unknown	ea	$0.00
C4	Median pedestrian refuge island	0	Unknown	ea	$0.00
D	Utilities				
D1	Solar powered light	0	$5,900.00	ea	$0.00
D2	Solar powered light pole	0	$1,420.00	ea	$0.00
D3	Emergency phones	0	$2,730.00	ea	$0.00
E	Signage				
E1	Mile Markers	1	$220.00	ea	$220.00
E2	Trail and street regulatory/warning signs	1	$220.00	ea	$220.00
E3	Directional signs	3	$220.00	ea	$660.00
E4	Educational signs	1	$330.00	ea	$330.00
F	Site Amenities				
F1	Benches (2 per mile recommended)	2	$900.00	ea	$1,800.00
F2	Bicycle rack (at trailheads)	0	$225.00	ea	$0.00
F3	Drinking fountains, with pet fountain (1/mile)	1	$2,000.00	ea	$2,000.00
F4	Picnic tables/ tables (at trailheads)	0	$550.00	ea	$0.00
F5	Trash receptacles (32-gallon, steel)(at trailheads)	0	$300.00	ea	$0.00
F6	Bollards (2 per trail/road intersection)	0	$600.00	ea	$0.00
F7	Parking (10-car lot)(at trailheads)	0	$22,000.00	ea	$0.00
F8	Parking (20-car lot)(at trailheads)	0	$55,000.00	ea	$0.00
				Subtotal	$829,732.50
G	Design	Quantity	Cost	Unit	Subtotal
G1	Wetlands Deliniation	2,425	$1.00	lf	$2,425.00
G2	Geotechnical Testing	2,425	$3.00	lf	$7,275.00
G3	Construction Documents @ 12 % of Dev. Cost			12%	$99,567.90
				Subtotal	$109,267.90
	Subtotals				
A	Demolition				$0.00
B	Off-Road Facility				$824,502.50
C	On-Road Facility				$0.00
D	Utilities				$0.00
E	Signage				$1,430.00
F	Site Amenities				$3,800.00
G	Design				$109,267.90
	SUBTOTAL				$939,000.40
	Contingency (15% of total)			15%	$140,850.06
	TOTAL				$1,079,850.46

Note: Does not include the following: land acquisition, potential rock and unsuitable soils excavation, permitting fees, mobilization, and taxes.

CUT SHEET 3 DUNN CREEK CORRIDOR (From NC 98 Bypass to the Smith Creek Soccer Complex)*



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

A1 Site Development Item *(See map key column in cost estimate table)*

- Existing Ped. Underpass
- Cut-sheet Trail Segment
- Existing Greenway Trail
- Existing Sidewalks
- Other Proposed Trails
- Major Road
- Local Road
- Railroad
- Hydrology
- Water Body
- Park/Open Space
- School
- Parcels

COST ESTIMATE FOR CUT SHEET 4 SMITH CREEK CORRIDOR

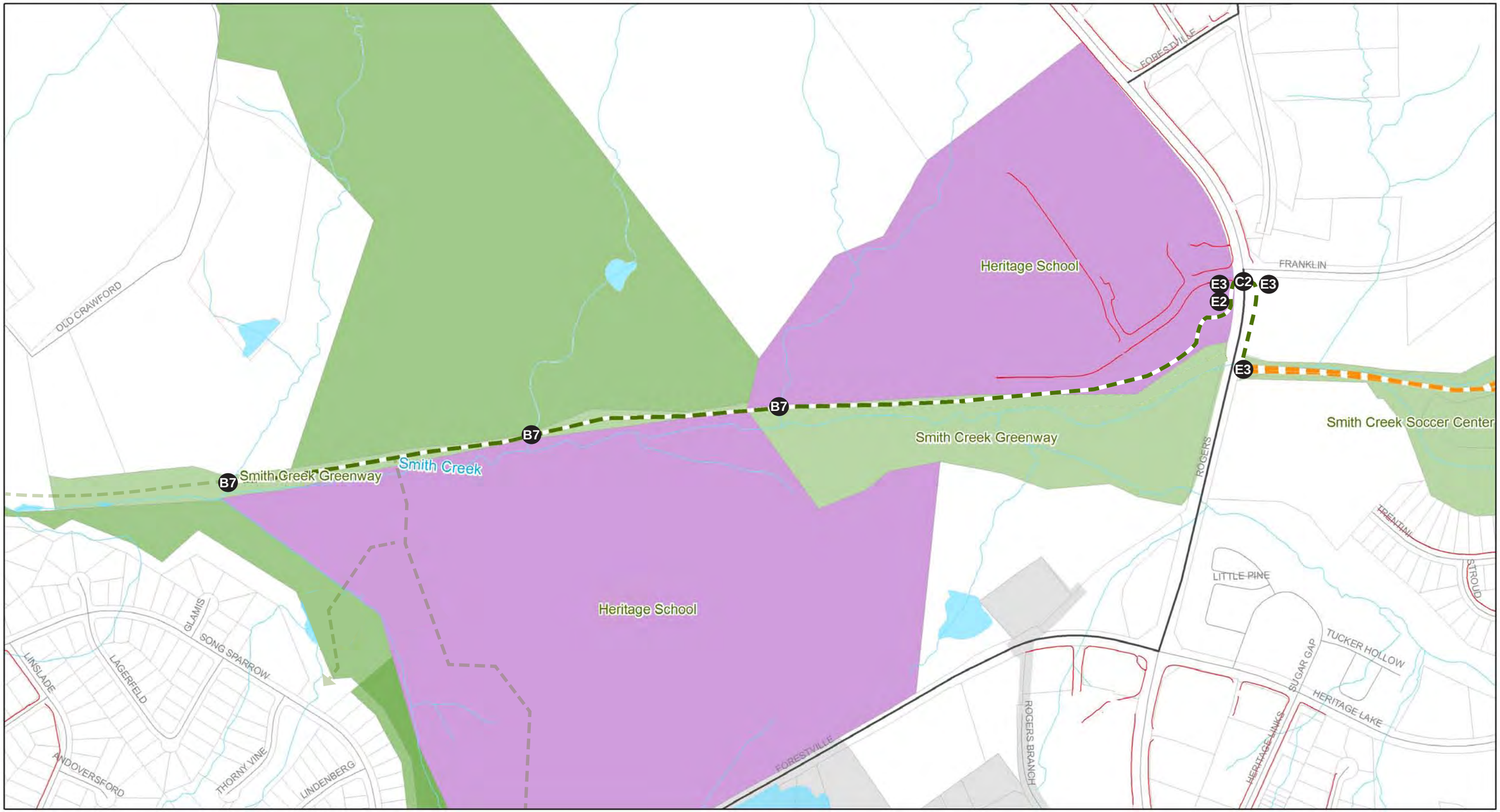
(From (From Rogers Road to Sanford Creek)

Map Key

A	Demolition	Quantity	Cost	Unit	Subtotal
A1	Clearing and grubbing understory (20' wide)	0	$0.25	sf	$0.00
A2	Dumping Fees @ 6% of Demolition total			6%	$0.00
				Subtotal	$0.00
	Site Development	Quantity	Cost	Unit	Subtotal
B	Off-Road Facility *(6,335 lf)*				
B1	Temporary tree protection/silt fence (both sides)	10,560	$2.00	lf	$21,120.00
B2	Trail grading (0-5 cu ft/lf)	5,280	$3.30	lf	$17,424.00
B3	10' wide multi-use asphalt trail	5,280	$50.00	lf	$264,000.00
B4	2' wide gravel shoulder (both sides)	10,560	$6.60	lf	$69,696.00
B5	Wooden or recycled synthetic material boardwalk	0	$250.00	lf	$0.00
B6	Small Bike/Ped Bridge	0	$1,350.00	lf	$0.00
B7	Drainage culvert (36" reinforced concrete pipe)	60	$44.00	lf	$2,640.00
B8	Seeding or mulching trail edges (5' both sides)	52,800	$0.13	sf	$6,864.00
B9	Geotextile fabric	5,280	$1.50	lf	$7,920.00
C	On-Road Facility				
C1	Crosswalk: Striping (High Visibility Paint)	0	$1.60	lf	$0.00
C2	Crosswalk: Striping (High Visibility Thermo)(4)	340	$4.80	lf	$1,632.00
C3	Ped-activated overhead warning lights	0	Unknown	ea	$0.00
C4	Median pedestrian refuge island	0	Unknown	ea	$0.00
D	Utilities				
D1	Solar powered light	0	$5,900.00	ea	$0.00
D2	Solar powered light pole	0	$1,420.00	ea	$0.00
D3	Emergency phones	0	$2,730.00	ea	$0.00
E	Signage				
E1	Mile Markers	2	$220.00	ea	$440.00
E2	Trail and street regulatory/warning signs	1	$220.00	ea	$220.00
E3	Directional signs	3	$220.00	ea	$660.00
E4	Educational signs	1	$330.00	ea	$330.00
F	Site Amenities				
F1	Benches (2 per mile recommended)	2	$900.00	ea	$1,800.00
F2	Bicycle rack (at trailheads)	0	$225.00	ea	$0.00
F3	Drinking fountains, with pet fountain (1/mile)	1	$2,000.00	ea	$2,000.00
F4	Picnic tables/ tables (at trailheads)	0	$550.00	ea	$0.00
F5	Trash receptacles (32-gallon, steel)(at trailheads)	0	$300.00	ea	$0.00
F6	Bollards (2 per trail/road intersection)	4	$600.00	ea	$2,400.00
F7	Parking (10-car lot)(at trailheads)	0	$22,000.00	ea	$0.00
F8	Parking (20-car lot)(at trailheads)	0	$55,000.00	ea	$0.00
				Subtotal	$399,146.00
G	Design	Quantity	Cost	Unit	Subtotal
G1	Wetlands Deliniation	5,280	$1.00	lf	$5,280.00
G2	Geotechnical Testing	5,280	$3.00	lf	$15,840.00
G3	Construction Documents @ 12 % of Dev. Cost			12%	$47,897.52
				Subtotal	$69,017.52
	Subtotals				
A	Demolition				$0.00
B	Off-Road Facility				$389,664.00
C	On-Road Facility				$1,632.00
D	Utilities				$0.00
E	Signage				$1,650.00
F	Site Amenities				$6,200.00
G	Design				$69,017.52
	SUBTOTAL				$468,163.52
	Contingency (15% of total)			15%	$70,224.53
	TOTAL				$538,388.05

Note: Does not include the following: land acquisition, potential rock and unsuitable soils excavation, permitting fees, mobilization, and taxes.

CUT SHEET 4 *SMITH CREEK CORRIDOR (From Rogers Road to Sanford Creek)*



A1 Site Development Item *(See map key column in cost estimate table)*

COST ESTIMATE FOR CUT SHEET 5 SMITH CREEK CORRIDOR

(From Sanford Creek to Ligon Mill)

Map Key

A	Demolition	Quantity	Cost	Unit	Subtotal
A1	Clearing and grubbing understory (20' wide)	0	$0.25	sf	$0.00
A2	Dumping Fees @ 6% of Demolition total			6%	$0.00
				Subtotal	$0.00
	Site Development	Quantity	Cost	Unit	Subtotal
B	Off-Road Facility *(6,335 lf)*				
B1	Temporary tree protection/silt fence (both sides)	6,640	$2.00	lf	$13,280.00
B2	Trail grading (0-5 cu ft/lf)	3,320	$3.30	lf	$10,956.00
B3	10' wide multi-use asphalt trail	3,320	$50.00	lf	$166,000.00
B4	2' wide gravel shoulder (both sides)	6,640	$6.60	lf	$43,824.00
B5	Wooden or recycled synthetic material boardwalk	1,500	$250.00	lf	$375,000.00
B6	Small Bike/Ped Bridge (possibly 2 needed)	0	$1,350.00	lf	$0.00
B7	Drainage culvert (36" reinforced concrete pipe)	0	$44.00	lf	$0.00
B8	Seeding or mulching trail edges (5' both sides)	33,200	$0.13	sf	$4,316.00
B9	Geotextile fabric	3,320	$1.50	lf	$4,980.00
C	On-Road Facility				
C1	Crosswalk: Striping (High Visibility Paint)	0	$1.60	lf	$0.00
C2	Crosswalk: Striping (High Visibility Thermo)	28	$4.80	lf	$134.40
C3	Ped-activated overhead warning lights	1	Unknown	ea	$0.00
C4	Median pedestrian refuge island	0	Unknown	ea	$0.00
D	Utilities				
D1	Solar powered light	0	$5,900.00	ea	$0.00
D2	Solar powered light pole	0	$1,420.00	ea	$0.00
D3	Emergency phones	0	$2,730.00	ea	$0.00
E	Signage				
E1	Mile Markers	1	$220.00	ea	$220.00
E2	Trail and street regulatory/warning signs	1	$220.00	ea	$220.00
E3	Directional signs	2	$220.00	ea	$440.00
E4	Educational signs	0	$330.00	ea	$0.00
F	Site Amenities				
F1	Benches (2 per mile recommended)	2	$900.00	ea	$1,800.00
F2	Bicycle rack (at trailheads)	0	$225.00	ea	$0.00
F3	Drinking fountains, with pet fountain (1/mile)	1	$2,000.00	ea	$2,000.00
F4	Picnic tables/ tables (at trailheads)	0	$550.00	ea	$0.00
F5	Trash receptacles (32-gallon, steel)(at trailheads)	0	$300.00	ea	$0.00
F6	Bollards (2 per trail/road intersection)	2	$600.00	ea	$1,200.00
F7	Parking (10-car lot)(at trailheads)	0	$22,000.00	ea	$0.00
F8	Parking (20-car lot)(at trailheads)	0	$55,000.00	ea	$0.00
				Subtotal	$624,370.40
G	Design	Quantity	Cost	Unit	Subtotal
G1	Wetlands Deliniation	3,320	$1.00	lf	$3,320.00
G2	Geotechnical Testing	3,320	$3.00	lf	$9,960.00
G3	Construction Documents @ 12 % of Dev. Cost			12%	$74,924.45
				Subtotal	$88,204.45
	Subtotals				
A	Demolition				$0.00
B	Off-Road Facility				$618,356.00
C	On-Road Facility				$134.40
D	Utilities				$0.00
E	Signage				$880.00
F	Site Amenities				$5,000.00
G	Design				$88,204.45
	SUBTOTAL				$712,574.85
	Contingency (15% of total)			15%	$106,886.23
	TOTAL				$819,461.08

Note: Does not include the following: land acquisition, potential rock and unsuitable soils excavation, permitting fees, mobilization, and taxes.

CUT SHEET 5 *SMITH CREEK CORRIDOR (From Sanford Creek to Ligon Mill)*

A1 Site Development Item *(See map key column in cost estimate table)*

COST ESTIMATE FOR CUT SHEET 6 SMITH CREEK CORRIDOR

(From From Ligon Mill to Burlington Mill)

Map Key

A	Demolition	Quantity	Cost	Unit	Subtotal
A1	Clearing and grubbing understory (20' wide)	0	$0.25	sf	$0.00
A2	Dumping Fees @ 6% of Demolition total			6%	$0.00
				Subtotal	$0.00
	Site Development	Quantity	Cost	Unit	Subtotal
B	Off-Road Facility *(6,335 lf)*				
B1	Temporary tree protection/silt fence (both sides)	9,900	$2.00	lf	$19,800.00
B2	Trail grading (0-5 cu ft/lf)	4,950	$3.30	lf	$16,335.00
B3	10' wide multi-use asphalt trail	4,950	$50.00	lf	$247,500.00
B4	2' wide gravel shoulder (both sides)	9,900	$6.60	lf	$65,340.00
B5	Wooden or recycled synthetic material boardwalk	0	$250.00	lf	$0.00
B6	Small Bike/Ped Bridge	0	$1,350.00	lf	$0.00
B7	Drainage culvert (36" reinforced concrete pipe)	0	$44.00	lf	$0.00
B8	Seeding or mulching trail edges (5' both sides)	49,500	$0.13	sf	$6,435.00
B9	Geotextile fabric	4,950	$1.50	lf	$7,425.00
C	On-Road Facility				
C1	Crosswalk: Striping (High Visibility Paint)	0	$1.60	lf	$0.00
C2	Crosswalk: Striping (High Visibility Thermo)	24	$4.80	lf	$115.20
C3	Ped-activated overhead warning lights	1	Unknown	ea	$0.00
C4	Median pedestrian refuge island	1	Unknown	ea	$0.00
D	Utilities				
D1	Solar powered light	0	$5,900.00	ea	$0.00
D2	Solar powered light pole	0	$1,420.00	ea	$0.00
D3	Emergency phones	0	$2,730.00	ea	$0.00
E	Signage				
E1	Mile Markers	1	$220.00	ea	$220.00
E2	Trail and street regulatory/warning signs	2	$220.00	ea	$440.00
E3	Directional signs	1	$220.00	ea	$220.00
E4	Educational signs	0	$330.00	ea	$0.00
F	Site Amenities				
F1	Benches (2 per mile recommended)	2	$900.00	ea	$1,800.00
F2	Bicycle rack (at trailheads)	0	$225.00	ea	$0.00
F3	Drinking fountains, with pet fountain (1/mile)	1	$2,000.00	ea	$2,000.00
F4	Picnic tables/ tables (at trailheads)	0	$550.00	ea	$0.00
F5	Trash receptacles (32-gallon, steel)(at trailheads)	0	$300.00	ea	$0.00
F6	Bollards (2 per trail/road intersection)	4	$600.00	ea	$2,400.00
F7	Parking (10-car lot)(at trailheads)	0	$22,000.00	ea	$0.00
F8	Parking (20-car lot)(at trailheads)	0	$55,000.00	ea	$0.00
				Subtotal	$370,030.20
G	Design	Quantity	Cost	Unit	Subtotal
G1	Wetlands Deliniation	4,950	$1.00	lf	$4,950.00
G2	Geotechnical Testing	4,950	$3.00	lf	$14,850.00
G3	Construction Documents @ 12 % of Dev. Cost			12%	$44,403.62
				Subtotal	$64,203.62
	Subtotals				
A	Demolition				$0.00
B	Off-Road Facility				$362,835.00
C	On-Road Facility				$115.20
D	Utilities				$0.00
E	Signage				$880.00
F	Site Amenities				$6,200.00
G	Design				$64,203.62
	SUBTOTAL				$434,233.82
	Contingency (15% of total)			15%	$65,135.07
	TOTAL				$499,368.90

Note: Does not include the following: land acquisition, potential rock and unsuitable soils excavation, permitting fees, mobilization, and taxes.

CUT SHEET 6 *SMITH CREEK CORRIDOR (From Ligon Mill to Burlington Mill)*

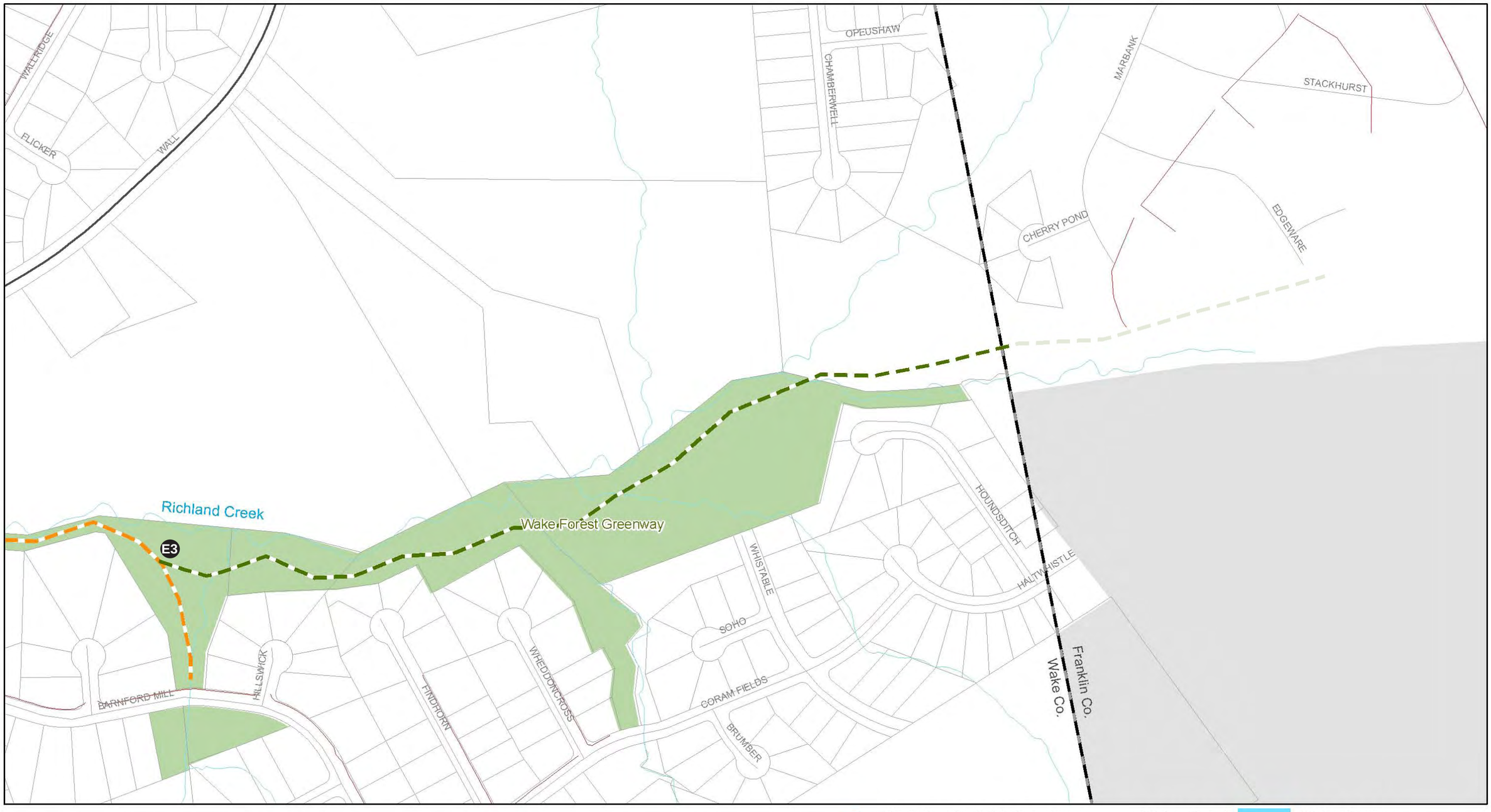
COST ESTIMATE FOR CUT SHEET 7 RICHLAND CREEK CORRIDOR

(From Wake Forest Town Limits to N. End of Olde Mill Stream Greenway)

Map Key					
A	Demolition	Quantity	Cost	Unit	Subtotal
A1	Clearing and grubbing understory (20' wide)	0	$0.25	sf	$0.00
A2	Dumping Fees @ 6% of Demolition total			6%	$0.00
				Subtotal	$0.00
	Site Development	Quantity	Cost	Unit	Subtotal
B	Off-Road Facility *(6,335 lf)*				
B1	Temporary tree protection/silt fence (both sides)	9,200	$2.00	lf	$18,400.00
B2	Trail grading (0-5 cu ft/lf)	4,600	$3.30	lf	$15,180.00
B3	10' wide multi-use asphalt trail	4,600	$50.00	lf	$230,000.00
B4	2' wide gravel shoulder (both sides)	9,200	$6.60	lf	$60,720.00
B5	Wooden or recycled synthetic material boardwalk	0	$250.00	lf	$0.00
B6	Small Bike/Ped Bridge	0	$1,350.00	lf	$0.00
B7	Drainage culvert (36" reinforced concrete pipe)	0	$44.00	lf	$0.00
B8	Seeding or mulching trail edges (5' both sides)	46,000	$0.13	sf	$5,980.00
B9	Geotextile fabric	4,600	$1.50	lf	$6,900.00
C	On-Road Facility				
C1	Crosswalk: Striping (High Visibility Paint)	0	$1.60	lf	$0.00
C2	Crosswalk: Striping (High Visibility Thermo)	0	$4.80	lf	$0.00
C3	Ped-activated overhead warning lights	0	Unknown	ea	$0.00
C4	Median pedestrian refuge island	0	Unknown	ea	$0.00
D	Utilities				
D1	Solar powered light	0	$5,900.00	ea	$0.00
D2	Solar powered light pole	0	$1,420.00	ea	$0.00
D3	Emergency phones	0	$2,730.00	ea	$0.00
E	Signage				
E1	Mile Markers	1	$220.00	ea	$220.00
E2	Trail and street regulatory/warning signs	0	$220.00	ea	$0.00
E3	Directional signs	1	$220.00	ea	$220.00
E4	Educational signs	0	$330.00	ea	$0.00
F	Site Amenities				
F1	Benches (2 per mile recommended)	2	$900.00	ea	$1,800.00
F2	Bicycle rack (at trailheads)	0	$225.00	ea	$0.00
F3	Drinking fountains, with pet fountain (1/mile)	1	$2,000.00	ea	$2,000.00
F4	Picnic tables/ tables (at trailheads)	0	$550.00	ea	$0.00
F5	Trash receptacles (32-gallon, steel)(at trailheads)	0	$300.00	ea	$0.00
F6	Bollards (2 per trail/road intersection)	0	$600.00	ea	$0.00
F7	Parking (10-car lot)(at trailheads)	0	$22,000.00	ea	$0.00
F8	Parking (20-car lot)(at trailheads)	0	$55,000.00	ea	$0.00
				Subtotal	$341,420.00
G	Design	Quantity	Cost	Unit	Subtotal
G1	Wetlands Deliniation	4,600	$1.00	lf	$4,600.00
G2	Geotechnical Testing	4,600	$3.00	lf	$13,800.00
G3	Construction Documents @ 12 % of Dev. Cost			12%	$40,970.40
				Subtotal	$59,370.40
	Subtotals				
A	Demolition				$0.00
B	Off-Road Facility				$337,180.00
C	On-Road Facility				$0.00
D	Utilities				$0.00
E	Signage				$440.00
F	Site Amenities				$3,800.00
G	Design				$59,370.40
	SUBTOTAL				$400,790.40
	Contingency (15% of total)			15%	$60,118.56
	TOTAL				$460,908.96

Note: Does not include the following: land acquisition, potential rock and unsuitable soils excavation, permitting fees, mobilization, and taxes.

CUT SHEET 7 *RICHLAND CREEK CORRIDOR (From Wake Forest Town Limits to N. End of Olde Mill Stream Greenway)*



COST ESTIMATE FOR CUT SHEET 8 RICHLAND CREEK CORRIDOR

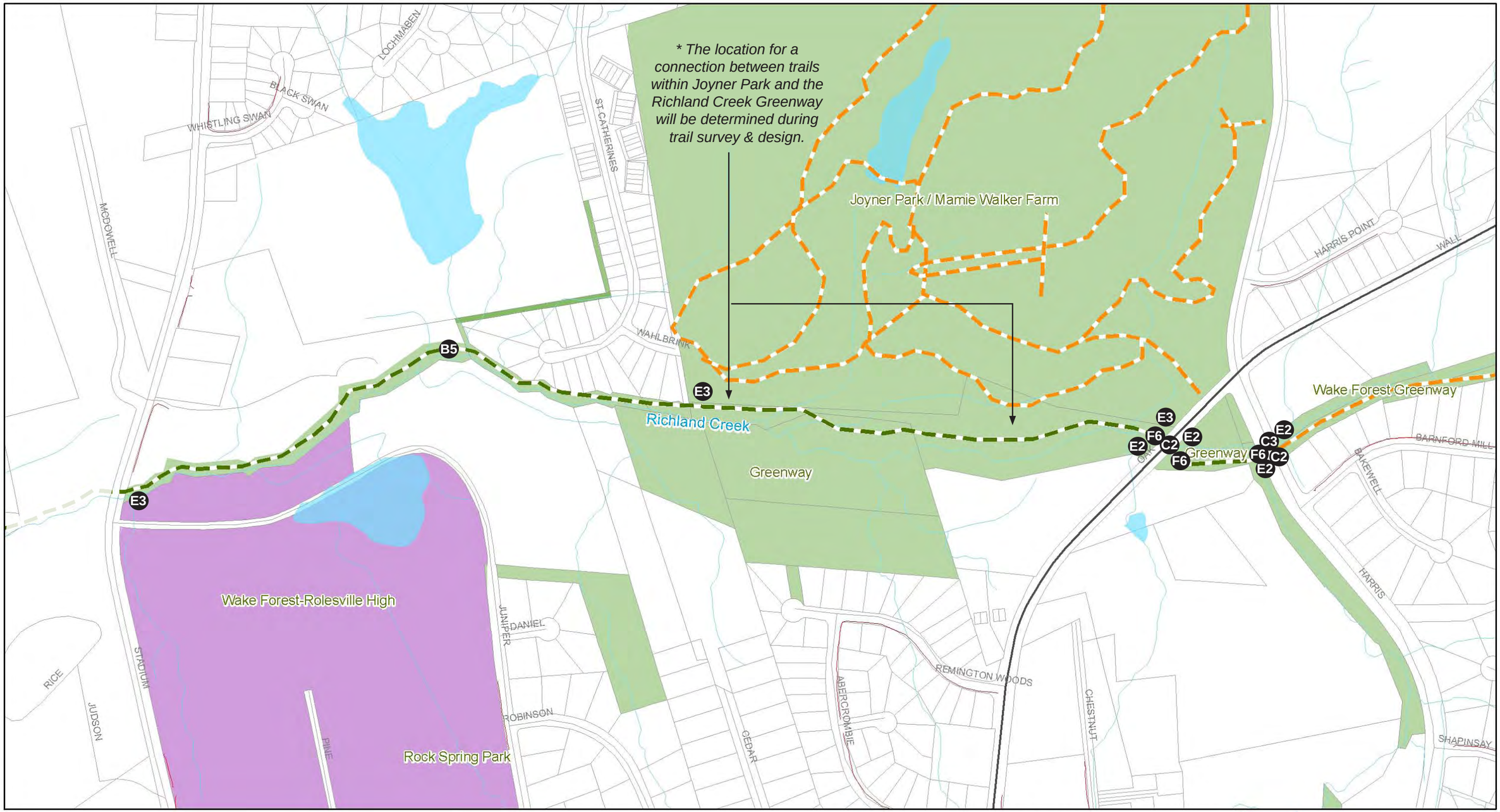
(From Harris Road to Stadium Drive)

Map Key

A	Demolition	Quantity	Cost	Unit	Subtotal
A1	Clearing and grubbing understory (20' wide)	0	$0.25	sf	$0.00
A2	Dumping Fees @ 6% of Demolition total			6%	$0.00
				Subtotal	$0.00
	Site Development	Quantity	Cost	Unit	Subtotal
B	Off-Road Facility *(6,335 lf)*				
B1	Temporary tree protection/silt fence (both sides)	8,400	$2.00	lf	$16,800.00
B2	Trail grading (0-5 cu ft/lf)	4,200	$3.30	lf	$13,860.00
B3	10' wide multi-use asphalt trail	4,200	$50.00	lf	$210,000.00
B4	2' wide gravel shoulder (both sides)	8,400	$6.60	lf	$55,440.00
B5	Wooden or recycled synthetic material boardwalk	1,000	$250.00	lf	$250,000.00
B6	Small Bike/Ped Bridge	0	$1,350.00	lf	$0.00
B7	Drainage culvert (36" reinforced concrete pipe)	0	$44.00	lf	$0.00
B8	Seeding or mulching trail edges (5' both sides)	42,000	$0.13	sf	$5,460.00
B9	Geotextile fabric	4,200	$1.50	lf	$6,300.00
C	On-Road Facility				
C1	Crosswalk: Striping (High Visibility Paint)	0	$1.60	lf	$0.00
C2	Crosswalk: Striping (High Visibility Thermo) (2)	48	$4.80	lf	$230.40
C3	Ped-activated overhead warning lights	1	Unknown	ea	$0.00
C4	Median pedestrian refuge island	0	Unknown	ea	$0.00
D	Utilities				
D1	Solar powered light	0	$5,900.00	ea	$0.00
D2	Solar powered light pole	0	$1,420.00	ea	$0.00
D3	Emergency phones	0	$2,730.00	ea	$0.00
E	Signage				
E1	Mile Markers	1	$220.00	ea	$220.00
E2	Trail and street regulatory/warning signs	4	$220.00	ea	$880.00
E3	Directional signs	2	$220.00	ea	$440.00
E4	Educational signs	1	$330.00	ea	$330.00
F	Site Amenities				
F1	Benches (2 per mile recommended)	2	$900.00	ea	$1,800.00
F2	Bicycle rack (at trailheads)	0	$225.00	ea	$0.00
F3	Drinking fountains, with pet fountain (1/mile)	1	$2,000.00	ea	$2,000.00
F4	Picnic tables/ tables (at trailheads)	0	$550.00	ea	$0.00
F5	Trash receptacles (32-gallon, steel)(at trailheads)	0	$300.00	ea	$0.00
F6	Bollards (2 per trail/road intersection)	4	$600.00	ea	$2,400.00
F7	Parking (10-car lot)(at trailheads)	0	$22,000.00	ea	$0.00
F8	Parking (20-car lot)(at trailheads)	0	$55,000.00	ea	$0.00
				Subtotal	$566,160.40
G	Design	Quantity	Cost	Unit	Subtotal
G1	Wetlands Deliniation	4,200	$1.00	lf	$4,200.00
G2	Geotechnical Testing	4,200	$3.00	lf	$12,600.00
G3	Construction Documents @ 12 % of Dev. Cost			12%	$67,939.25
				Subtotal	$84,739.25
	Subtotals				
A	Demolition				$0.00
B	Off-Road Facility				$557,860.00
C	On-Road Facility				$230.40
D	Utilities				$0.00
E	Signage				$1,870.00
F	Site Amenities				$6,200.00
G	Design				$84,739.25
	SUBTOTAL				$650,899.65
	Contingency (15% of total)			15%	$97,634.95
	TOTAL				$748,534.60

Note: Does not include the following: land acquisition, potential rock and unsuitable soils excavation, permitting fees, mobilization, and taxes. Cost estimate for routing trail underneath Staduim Drive also not included.

CUT SHEET 8 RICHLAND CREEK CORRIDOR (From Harris Road to Stadium Drive)*



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

A1 Site Development Item *(See map key column in cost estimate table)*

- Existing Ped. Underpass
- Cut-sheet Trail Segment
- Existing Greenway Trail
- Existing Sidewalks
- Other Proposed Trails
- Major Road
- Local Road
- Railroad
- Hydrology
- Water Body
- Park/Open Space
- School
- Parcels

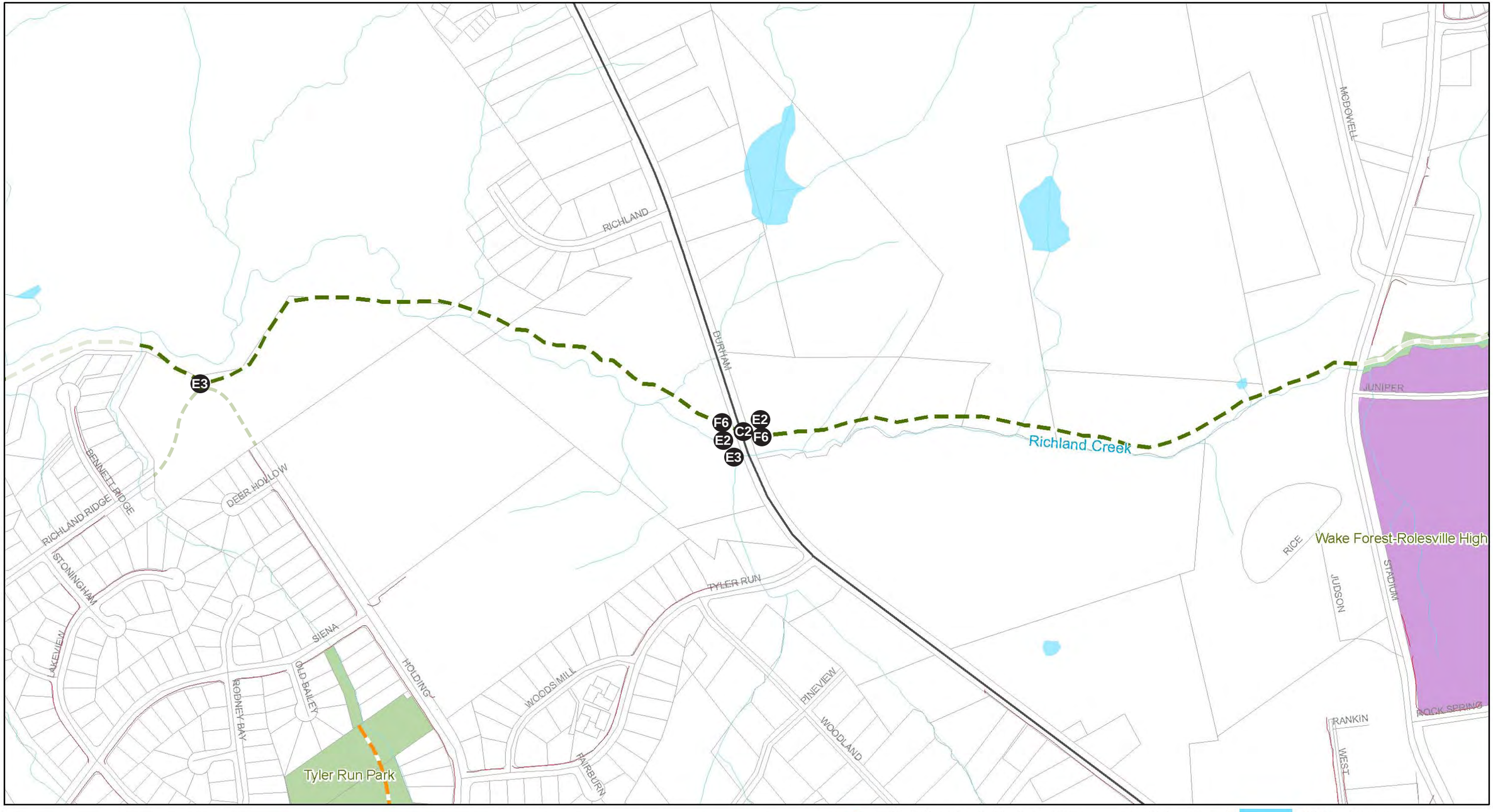
COST ESTIMATE FOR CUT SHEET 9 RICHLAND CREEK CORRIDOR

(From Stadium Drive to Bennet Park Neighborhood)

Map Key					
A	Demolition	Quantity	Cost	Unit	Subtotal
A1	Clearing and grubbing understory (20' wide)	0	$0.25	sf	$0.00
A2	Dumping Fees @ 6% of Demolition total			6%	$0.00
				Subtotal	$0.00
	Site Development	Quantity	Cost	Unit	Subtotal
B	Off-Road Facility *(6,335 lf)*				
B1	Temporary tree protection/silt fence (both sides)	12,350	$2.00	lf	$24,700.00
B2	Trail grading (0-5 cu ft/lf)	6,175	$3.30	lf	$20,377.50
B3	10' wide multi-use asphalt trail	6,175	$50.00	lf	$308,750.00
B4	2' wide gravel shoulder (both sides)	12,350	$6.60	lf	$81,510.00
B5	Wooden or recycled synthetic material boardwalk	0	$250.00	lf	$0.00
B6	Small Bike/Ped Bridge	0	$1,350.00	lf	$0.00
B7	Drainage culvert (36" reinforced concrete pipe)	0	$44.00	lf	$0.00
B8	Seeding or mulching trail edges (5' both sides)	61,750	$0.13	sf	$8,027.50
B9	Geotextile fabric	6,175	$1.50	lf	$9,262.50
C	On-Road Facility				
C1	Crosswalk: Striping (High Visibility Paint)	0	$1.60	lf	$0.00
C2	Crosswalk: Striping (High Visibility Thermo)	24	$4.80	lf	$115.20
C3	Ped-activated overhead warning lights	0	Unknown	ea	$0.00
C4	Median pedestrian refuge island	0	Unknown	ea	$0.00
D	Utilities				
D1	Solar powered light	0	$5,900.00	ea	$0.00
D2	Solar powered light pole	0	$1,420.00	ea	$0.00
D3	Emergency phones	0	$2,730.00	ea	$0.00
E	Signage				
E1	Mile Markers	1	$220.00	ea	$220.00
E2	Trail and street regulatory/warning signs	2	$220.00	ea	$440.00
E3	Directional signs	2	$220.00	ea	$440.00
E4	Educational signs	0	$330.00	ea	$0.00
F	Site Amenities				
F1	Benches (2 per mile recommended)	2	$900.00	ea	$1,800.00
F2	Bicycle rack (at trailheads)	0	$225.00	ea	$0.00
F3	Drinking fountains, with pet fountain (1/mile)	1	$2,000.00	ea	$2,000.00
F4	Picnic tables/ tables (at trailheads)	0	$550.00	ea	$0.00
F5	Trash receptacles (32-gallon, steel)(at trailheads)	0	$300.00	ea	$0.00
F6	Bollards (2 per trail/road intersection)	2	$600.00	ea	$1,200.00
F7	Parking (10-car lot)(at trailheads)	0	$22,000.00	ea	$0.00
F8	Parking (20-car lot)(at trailheads)	0	$55,000.00	ea	$0.00
				Subtotal	$458,842.70
G	Design	Quantity	Cost	Unit	Subtotal
G1	Wetlands Deliniation	6,175	$1.00	lf	$6,175.00
G2	Geotechnical Testing	6,175	$3.00	lf	$18,525.00
G3	Construction Documents @ 12 % of Dev. Cost			12%	$55,061.12
				Subtotal	$79,761.12
	Subtotals				
A	Demolition				$0.00
B	Off-Road Facility				$452,627.50
C	On-Road Facility				$115.20
D	Utilities				$0.00
E	Signage				$1,100.00
F	Site Amenities				$5,000.00
G	Design				$79,761.12
	SUBTOTAL				$538,603.82
	Contingency (15% of total)			15%	$80,790.57
	TOTAL				$619,394.40

Note: Does not include the following: land acquisition, potential rock and unsuitable soils excavation, permitting fees, mobilization, and taxes.

CUT SHEET 9 *RICHLAND CREEK CORRIDOR (From Stadium Drive to Bennet Park Neighborhood)*



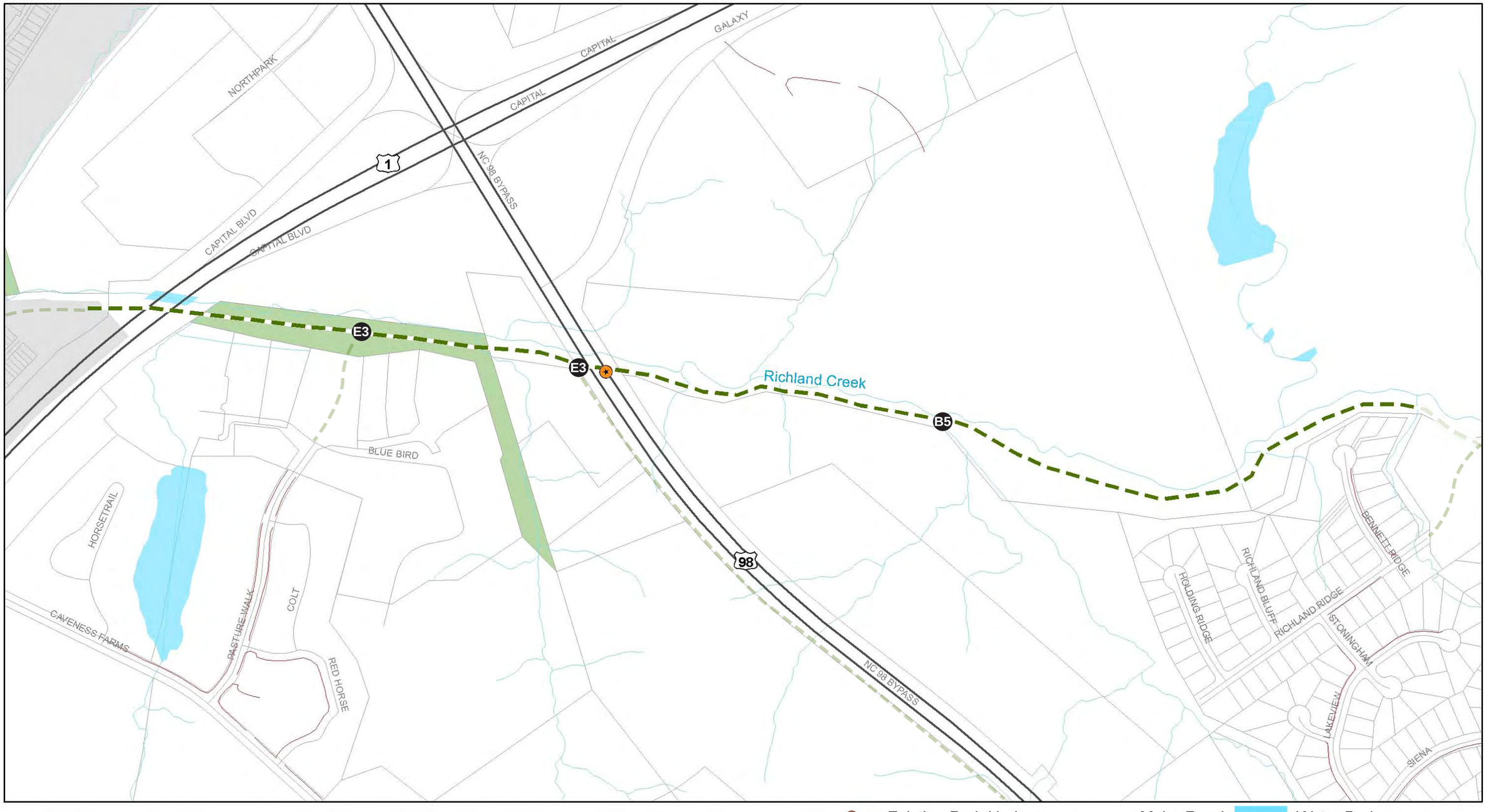
COST ESTIMATE FOR CUT SHEET 10 RICHLAND CREEK CORRIDOR

(From Bennet Park Neighborhood to Villas at Caveness Farms)

Map Key					
A	Demolition	Quantity	Cost	Unit	Subtotal
A1	Clearing and grubbing understory (20' wide)	0	$0.25	sf	$0.00
A2	Dumping Fees @ 6% of Demolition total			6%	$0.00
				Subtotal	$0.00
	Site Development	Quantity	Cost	Unit	Subtotal
B	Off-Road Facility *(6,335 lf)*				
B1	Temporary tree protection/silt fence (both sides)	9,600	$2.00	lf	$19,200.00
B2	Trail grading (0-5 cu ft/lf)	4,800	$3.30	lf	$15,840.00
B3	10' wide multi-use asphalt trail	4,800	$50.00	lf	$240,000.00
B4	2' wide gravel shoulder (both sides)	9,600	$6.60	lf	$63,360.00
B5	Wooden or recycled synthetic material boardwalk	1,000	$250.00	lf	$250,000.00
B6	Small Bike/Ped Bridge	0	$1,350.00	lf	$0.00
B7	Drainage culvert (36" reinforced concrete pipe)	0	$44.00	lf	$0.00
B8	Seeding or mulching trail edges (5' both sides)	48,000	$0.13	sf	$6,240.00
B9	Geotextile fabric	4,800	$1.50	lf	$7,200.00
C	On-Road Facility				
C1	Crosswalk: Striping (High Visibility Paint)	0	$1.60	lf	$0.00
C2	Crosswalk: Striping (High Visibility Thermo)	0	$4.80	lf	$0.00
C3	Ped-activated overhead warning lights	0	Unknown	ea	$0.00
C4	Median pedestrian refuge island	0	Unknown	ea	$0.00
D	Utilities				
D1	Solar powered light	0	$5,900.00	ea	$0.00
D2	Solar powered light pole	0	$1,420.00	ea	$0.00
D3	Emergency phones	0	$2,730.00	ea	$0.00
E	Signage				
E1	Mile Markers	1	$220.00	ea	$220.00
E2	Trail and street regulatory/warning signs	0	$220.00	ea	$0.00
E3	Directional signs	2	$220.00	ea	$440.00
E4	Educational signs	0	$330.00	ea	$0.00
F	Site Amenities				
F1	Benches (2 per mile recommended)	2	$900.00	ea	$1,800.00
F2	Bicycle rack (at trailheads)	0	$225.00	ea	$0.00
F3	Drinking fountains, with pet fountain (1/mile)	1	$2,000.00	ea	$2,000.00
F4	Picnic tables/ tables (at trailheads)	0	$550.00	ea	$0.00
F5	Trash receptacles (32-gallon, steel)(at trailheads)	0	$300.00	ea	$0.00
F6	Bollards (2 per trail/road intersection)	0	$600.00	ea	$0.00
F7	Parking (10-car lot)(at trailheads)	0	$22,000.00	ea	$0.00
F8	Parking (20-car lot)(at trailheads)	0	$55,000.00	ea	$0.00
				Subtotal	$606,300.00
G	Design	Quantity	Cost	Unit	Subtotal
G1	Wetlands Deliniation	4,800	$1.00	lf	$4,800.00
G2	Geotechnical Testing	4,800	$3.00	lf	$14,400.00
G3	Construction Documents @ 12 % of Dev. Cost			12%	$72,756.00
				Subtotal	$91,956.00
	Subtotals				
A	Demolition				$0.00
B	Off-Road Facility				$601,840.00
C	On-Road Facility				$0.00
D	Utilities				$0.00
E	Signage				$660.00
F	Site Amenities				$3,800.00
G	Design				$91,956.00
	SUBTOTAL				$698,256.00
	Contingency (15% of total)			15%	$104,738.40
	TOTAL				$802,994.40

Note: Does not include the following: land acquisition, potential rock and unsuitable soils excavation, permitting fees, mobilization, and taxes. Cost estimate for Capital Blvd (US-1) underpass also not included.

CUT SHEET 10 *RICHLAND CREEK CORRIDOR (From Bennet Park Neighborhood to Villas at Caveness Farms)*



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

A1 Site Development Item *(See map key column in cost estimate table)*

- Existing Ped. Underpass
- Cut-sheet Trail Segment
- Existing Greenway Trail
- Existing Sidewalks
- Other Proposed Trails
- Major Road
- Local Road
- Railroad
- Hydrology
- Water Body
- Park/Open Space
- School
- Parcels

COST ESTIMATE FOR CUT SHEET 11 SANFORD CREEK CORRIDOR

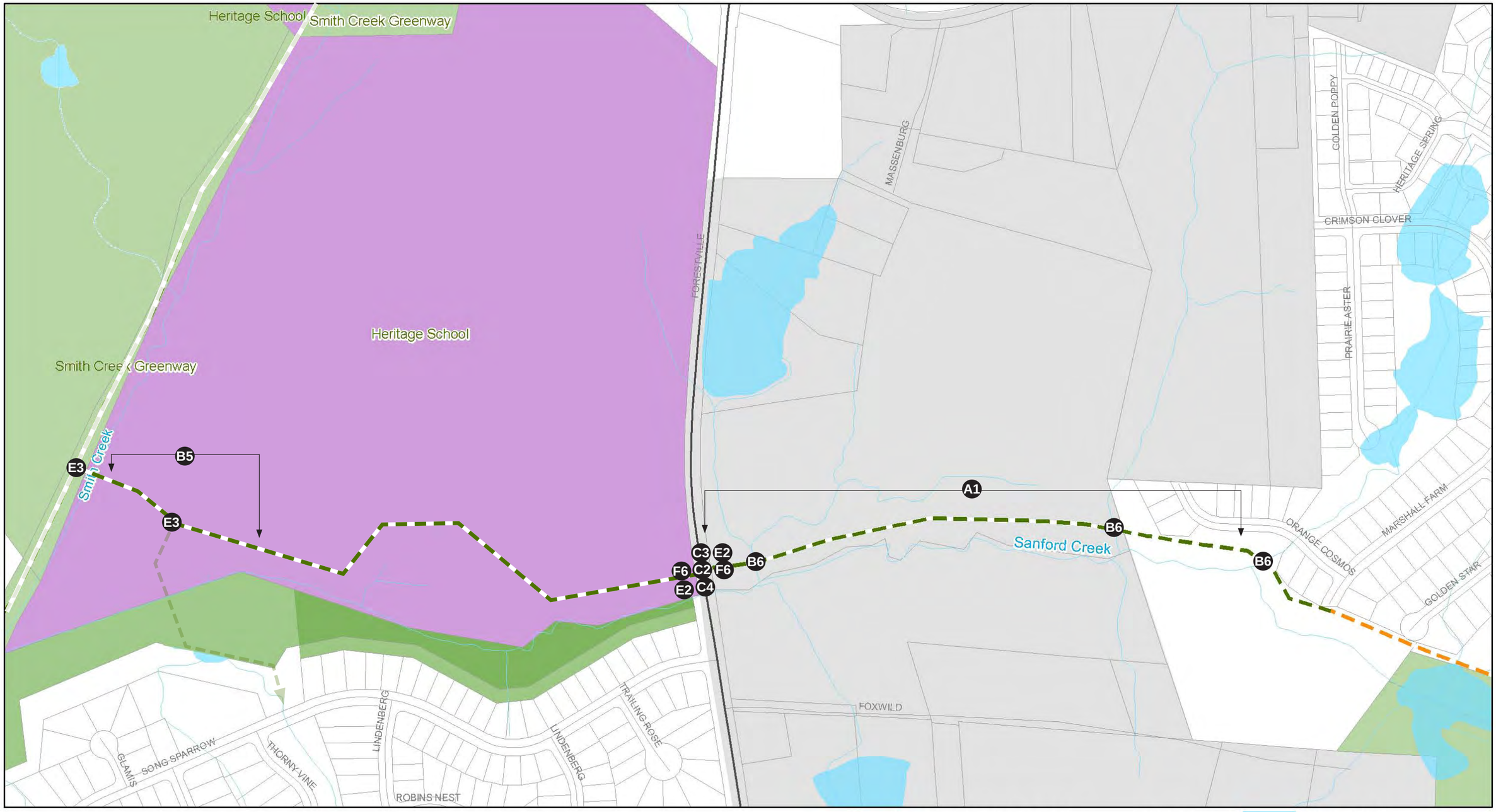
(From Smith Creek Greenway to Marshall Farm Road)

Map Key

A	Demolition	Quantity	Cost	Unit	Subtotal
A1	Clearing and grubbing understory (20' wide)	40,000	$0.25	sf	$10,000.00
A2	Dumping Fees @ 6% of Demolition total			6%	$600.00
				Subtotal	$10,600.00
	Site Development	Quantity	Cost	Unit	Subtotal
B	Off-Road Facility *(5,240 lf)*				
B1	Temporary tree protection/silt fence (both sides)	9,480	$2.00	lf	$18,960.00
B2	Trail grading (0-5 cu ft/lf)	4,740	$3.30	lf	$15,642.00
B3	10' wide multi-use asphalt trail	4,740	$50.00	lf	$237,000.00
B4	2' wide gravel shoulder (both sides)	9,480	$6.60	lf	$62,568.00
B5	Wooden or recycled synthetic material boardwalk	500	$250.00	lf	$125,000.00
B6	Small Bike/Ped Bridge (3)	30	$1,350.00	lf	$40,500.00
B7	Drainage culvert (36" reinforced concrete pipe)	0	$44.00	lf	$0.00
B8	Seeding or mulching trail edges (5' both sides)	47,400	$0.13	sf	$6,162.00
B9	Geotextile fabric	4,740	$1.50	lf	$7,110.00
C	On-Road Facility				
C1	Crosswalk: Striping (High Visibility Paint)	0	$1.60	lf	$0.00
C2	Crosswalk: Striping (High Visibility Thermo)	24	$4.80	lf	$115.20
C3	Ped-activated overhead warning lights	1	Unknown	ea	$0.00
C4	Median pedestrian refuge island	1	Unknown	ea	$0.00
D	Utilities				
D1	Solar powered light	0	$5,900.00	ea	$0.00
D2	Solar powered light pole	0	$1,420.00	ea	$0.00
D3	Emergency phones	0	$2,730.00	ea	$0.00
E	Signage				
E1	Mile Markers	1	$220.00	ea	$220.00
E2	Trail and street regulatory/warning signs	2	$220.00	ea	$440.00
E3	Directional signs	2	$220.00	ea	$440.00
E4	Educational signs	3	$330.00	ea	$990.00
F	Site Amenities				
F1	Benches (2 per mile recommended)	2	$900.00	ea	$1,800.00
F2	Bicycle rack (at trailheads)	0	$225.00	ea	$0.00
F3	Drinking fountains, with pet fountain (1/mile)	1	$2,000.00	ea	$2,000.00
F4	Picnic tables/ tables (at trailheads)	0	$550.00	ea	$0.00
F5	Trash receptacles (32-gallon, steel)(at trailheads)	0	$300.00	ea	$0.00
F6	Bollards (2 per trail/road intersection)	2	$600.00	ea	$1,200.00
F7	Parking (10-car lot)(at trailheads)	0	$22,000.00	ea	$0.00
F8	Parking (20-car lot)(at trailheads)	0	$55,000.00	ea	$0.00
				Subtotal	$520,147.20
G	Design	Quantity	Cost	Unit	Subtotal
G1	Wetlands Deliniation	4,740	$1.00	lf	$4,740.00
G2	Geotechnical Testing	4,740	$3.00	lf	$14,220.00
G3	Construction Documents @ 12 % of Dev. Cost			12%	$62,417.66
				Subtotal	$81,377.66
	Subtotals				
A	Demolition				$10,600.00
B	Off-Road Facility				$512,942.00
C	On-Road Facility				$115.20
D	Utilities				$0.00
E	Signage				$2,090.00
F	Site Amenities				$5,000.00
G	Design				$81,377.66
	SUBTOTAL				$612,124.86
	Contingency (15% of total)			15%	$91,818.73
	TOTAL				$703,943.59

Note: Does not include the following: land acquisition, potential rock and unsuitable soils excavation, permitting fees, mobilization, and taxes.

CUT SHEET 11 *SANFORD CREEK CORRIDOR (From Smith Creek Greenway to Marshall Farm Road)*



A1 Site Development Item *(See map key column in cost estimate table)*

A: SUMMARY OF PUBLIC INPUT

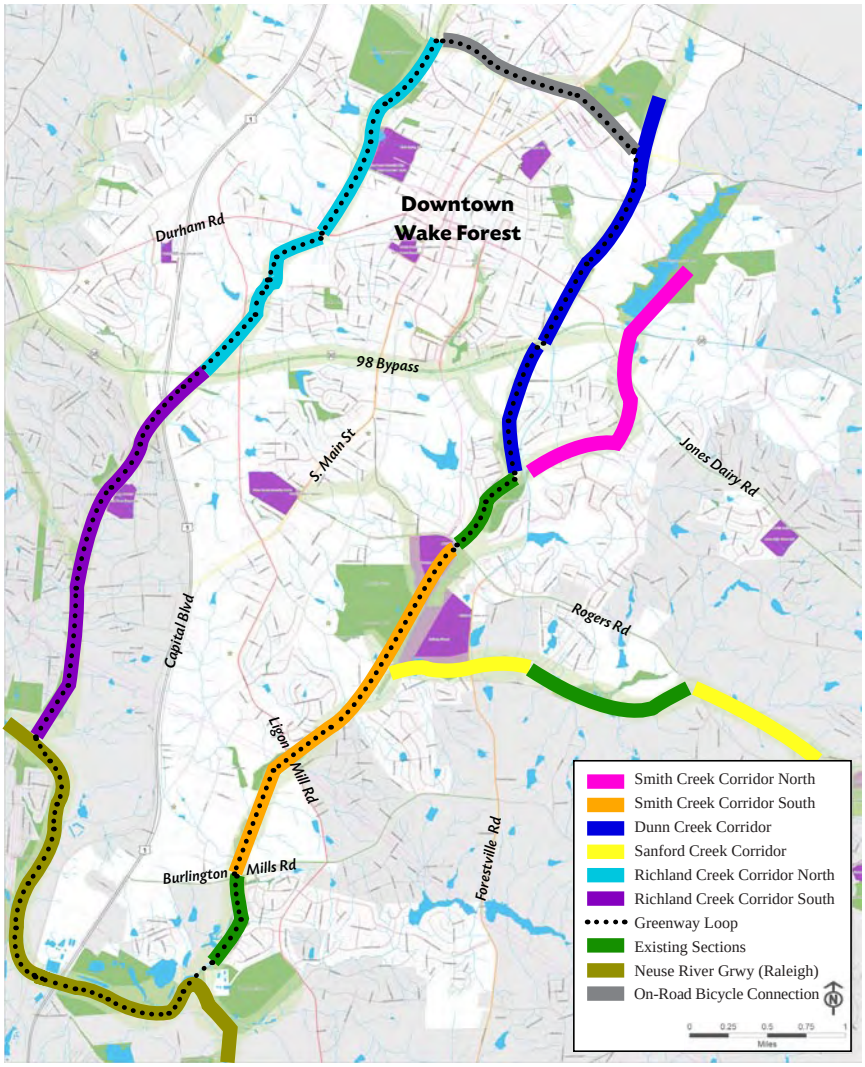
2008 Public Meeting

Chapter Outline:

2009 Plan Update Comment Forms

2009 PLAN UPDATE COMMENT FORMS

More than 150 people filled out comment forms for this 2009 Plan Update, which helped project planners identify where people most often use trails in Wake Forest, their preferences related to the trail system, and their priorities for future trail projects. The answers have been tabulated and are shown in the tables the following pages. The responses to the open-ended question have been listed verbatim. Below is the map that was used for certain questions on the comment form.



1. Do you know where greenway trails are located in Wake Forest (such as Sanford Creek at Heritage South or the Olde Mill Stream/Richland Creek Greenway)?

	Response Percent	Response Count
Yes	**54.2%**	84
No	45.8%	71
answered question		**155**
skipped question		**1**

2. If so, which trails do you use most often?

	Response Percent	Response Count
Sanford Creek at Heritage South	31.5%	28
Smith Creek at Smith Creek Soccer Center	**32.6%**	29
Smith Creek at Burlington Mills Road	21.3%	19
Miller Park Greenway	9.0%	8
Flaherty Park section	14.6%	13
Tyler Run Park section	18.0%	16
Kiwanis Park section	16.9%	15
Olde Mill Stream/Richland Creek Greenway	21.3%	19
answered question		**89**
skipped question		**67**

3. Which benefit of greenways and open space is most appealing to you? (please select top three)

	Response Percent	Response Count
Creating Value and Generating Economic Activity	28.8%	44
Bicycle and Pedestrian Transportation	75.2%	115
Improving Health through Active Living	**81.0%**	124
Clear Skies, Clean Rivers, and Protected Wildlife	58.8%	90
Protecting People and Property from Flood Damage	7.2%	11
Enhancing Cultural Awareness and Community Identity	20.9%	32
answered question		**153**
skipped question		**3**

4. What related improvements/programs do you consider priorities? (please select up to three options)

	Response Percent	Response Count
More organized events for walking and biking	30.5%	46
Safer routes to school for pedestrians and cyclists	56.3%	85
Town-wide bicycle and greenway wayfinding signs	**74.2%**	112
Interpretive trail signs for local natural environments	27.2%	41
Interpretive trail signs for local culture/history	19.9%	30
Trail maintenance	62.3%	94
answered question		**151**
skipped question		**5**

5. Other related improvements/programs you consider priorities?

#	Response Text
1	Access to greenways; Linking trails and sidewalks to commercial and educations centers to residences
2	Open up more trails on future greenways now, even if only dirt / relatively unimproved, so we can get longer sections open to the public
3	Open space around trails. Fitness training structures, such as chin-up bars, along path.
4	Singletrack mountain biking trails; Connection to Raleigh Greenways for bicycle commuting into Raleigh
5	Sidewalks and bicycle lanes to and from main downtown corridors to meet up with greenway connections. Example: Wait Ave between Jones Dairy (reservoir/Smith Creek Corridor North) and downtown. Hwy 98 between Richland Creek North Greenway and downtown. Main Street from 98 Bypass to downtown and north of downtown to meet with the greenway loop and on road bicycle connection. ; Some of this sidewalk work is already done and just needs extensions, repairs.
6	Need links from Heritage Greens/Meadows to Dunn Creek Greenway.
7	Doing a great job. Maybe seek to incorporate more water features/hardscapes, i.e. stone bridges. Seek a natural environment that will maintain and even increase its charm decades from now.
8	Building sidewalks to connect communities to the greenways.
9	Connections for distance!!!
10	SIDEWALKS!!! It is mind-boggling to me how difficult it is for children who live across the street from their school cannot walk safely because they have to navigate a tiny shoulder with 35-45 mi/hr traffic whizzing past. (In Heritage).
11	Protect open space, use school grounds for recreational as possible.
12	Neuse River Trail connection
13	Please allow horseback riding on the greenways.
14	My interest in primarily practical -- I would love to never use a car for day-to-day activities. I live up off North Main and bike to work on South Allen every day. I would love to be able to walk or bike to the store, restaurants, church, etc. with my family. "Walkability" is one of my greatest desires for Wake Forest. (I know "walkability" must be addressed from a number of angles, not just greenways, but that is my primary interest in greenways.) To that end, wider paths and quicker access to desired locations is most important to me.
15	Benchs for the elderly so that they can walk but rest when needed.
16	All new roads being built in Wake Forest that are heavily trafficked should have bike lanes to make general transportation around the town by bike possible. For example, I took my daughter for a bike ride and we were going to check out the Smith Creek trail at the Smith Creek soccer center. We headed down Rogers Rd and came to the railroad crossing there where it's just two lanes with no shoulder at all. We waited there for several minutes for a break in traffic to cross the tracks and finally just took our chances. There's no sidewalk there either. Point is because of things like this I don't feel safe biking with my kids in this town and shouldn't have to load up my car to drive to greenways to do some biking with them. I barely feel safe enough to bike by myself without my kids on some of the roads around here to be honest and I've ridden across Iowa on a bike several times. I hope you are able to make this town more biker friendly.... good luck!
17	Connectivity is Key. Whoever said these trails have to be 10+ feet wide and paved asphalt? Can't we have something intermediary in cost? Not everything has to be funded through the government. I bet a lot of companies would love to sponsor sections of the trail to enhance their community image. Don't forget abuot all the civic groups too.
18	Mileage signs for runners
19	wider lanes for cyclists on major roads
20	Blockage and signage on the greenways to keep motorized vehicles off in order to protect the safety of pedestrians, animals, wildlife, etc.
21	Get the business increase in Downtown Town WF...more restaurants....places for families to go and eat.
22	A map of the greenways currently open. Could also include proposed trails.
23	I've not used the trails because I'm uncertain of their safety. It is my impression they're in the wooded areas and not monitored.
24	Need more information about where the trails are located. This is the first time I've ever seen the full map of all the greenways.

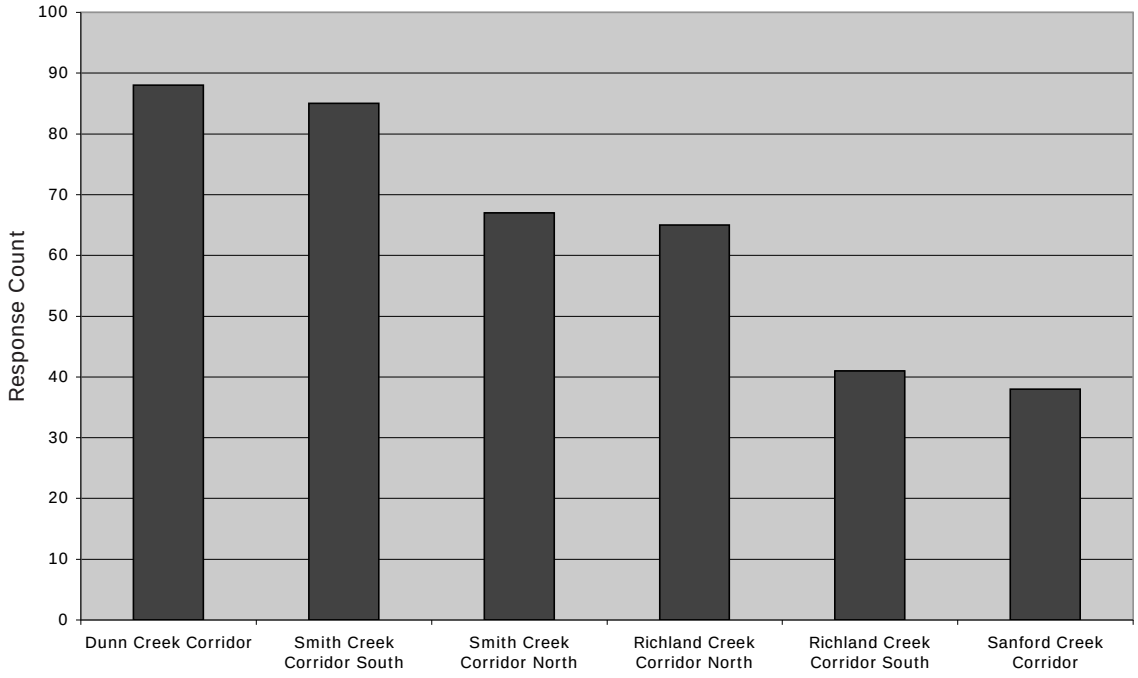
5. Other related improvements/programs you consider priorities? (continued)

25	I would greatly appreciate trails that allow equestrian access. As the town encroaches on previous farmland, open space to ride my horse has dwindled.
26	trail/greenway clean-ups, educational tours/hikes, adopt a trail/greenway financial donation programs
27	Enforce pedestrian safety with motorists. The majority of motorists in Wake Forest will run you over if they think you're in their way, whether you're in a cross-walk or have a walk signal.
28	Improved Walkability around town.
29	Connection to Raleigh Greenways and other greenways to promote cycling from town to town across the state.
30	Some of the trails seem washed out... need to make sure they are clean for walkers as run off makes it difficult to 'jump across' to continue on the path.
31	playgrounds; kid's water/sprinkler park; more dog parks; improving and updating the town pool
32	I moved to Wake Forest over two years ago and I don't know anything about the greenways. Consider a connection to users through home sales ...
33	We need safe bike routes for families and cyclist. Now Wake Forest has 0.5 mile trails with rocks at the bottom of the hills. The trails are not big enought for bikes and walkers. The trails are not safe for children also. Wake Forest needs long bike trails at least a 10 mile loop for people who would like to exercise and for famlies. Right now the trails have to many curves. They need to be straight with out big bolders at the bottom of the hills. Please take a 5 year old child to all the trails on a bike and see the danger of the current trails. Please build staight, wide, without big rocks at the bottom of the hills. I am also looking for the trails to be built as soon as possible. My oldest child is 8 years old and I don't want to wait until she is in high school before I take her on a safe biking trail. The American Tobacco Trail by Jordan Lake is a good reference for what is needed in Wake Forest. The ATT is too far away to go often with high gas prices so something in Wake forest would be great.
34	I'm interested in knowing the timeline for completion of these various trails. Please email me at bhaines@nc.rr.com
35	side walks connecting neighboorhoods to greenways
36	how about we try to improve the traffic conditions in wake forest first! Main street, especially the intersection with Capital Blvd. When the Rex Center is completed it will even be worse. Wake Forest, has high taxes and it seems that the town is taking our hard earned money and focusing it projects that don't benefit the majority of it's residents. EVERYONE complains about the traffic, very few in comparison would use a bike trail. Also, the bus service is utilized by very few. I am out and about all day everyday, and I see these buses driving around EMPTY or with one person on it. Sometimes I will see the buses just parked at a bus stop. Maybe it's ahead of schedule b/c it hasn't had ridership and it's just idling it's engine wasting time. In these economic times, our town needs to be fiscally conservative, we don't know what lies ahead. How about focusing on the needs of out town, not the extras that benefit a few. By the way I would love to know what this bus service is costing us a year and I hope WF realizes that you are not benefiting many. How about education? I will stop there, but I'm
37	Finish the Smith Creek/Burlington Mills trail already.... I used to ride it 5 years a go when I first moved here, ans now you can't ride it. Plus keep the ATV's off the trail!
38	Work on getting the loop open. Work on hooking up with the Neuse River Trails.
39	A sidewalk should be built on stadium drive to connect the all the houses on the capital blvd. side of the bridge to downtown wake forest. Running / walking on the side of the road with no sidewalks is unsafe, but people do it all the time. Especially those walking to/from the seminary.
40	Complete a unified long trail off of roadways for safe passage of bikes and pedestrians.
41	Create more greenways
42	I use the Kiwanis trail to walk to school, on hot days it is nice and cool on that trail. I am disappointed in how much of wooded area was cleared near the library, now there is too much sunshine coming in to keep it as cool as it once was.
43	More connections between the trails are needed ...the trail we take our children to, by the public library, is great but a five minute walk. We would like Wake Forest to be a place that is easy and fun to get around on foot or bicycle. Also, the sidewalks in Wake Forest are awful...try walking around Wake Forest with a double stroller. If you want more activity in the town of Wake Forest try to consider all of the families in the area. Thank you for putting out this survey...Wake Forest is a great place to live.

5. Other related improvements/programs you consider priorities? (continued)

44	Completing and linking sidewalks. It seems Wake Forest has many sidewalks that do not logically fit together (Heritage Lake Road, for example). How can a child (or adult resident) walk or ride a bike on such sidewalks, if the pavement ends in random places with no logical continuation? In short, sidewalks should not just be visually appealing; they should be functional as well.
45	Connectivity to community facilities, i.e, parks, library, businesses
46	Expansion of trail system
47	There are no greenways for the West side of Capital Boulevard. These would absolutely be a priority for me. The existing and proposed areas are fine, but limited to the population reach. Additionally if a resident from the West side of town wished to reach these greenways, there are no SAFE ways to do so either on foot or by bicycle due to the nature of the existing roadways (ie. very busy with vehicular traffic, no sidewalks, bikelanes provided. thinking of Purnell, Jenkins, Thompson Mill etc)
48	Cleanup the streams and rivers days to coincide with national "clean sweeps" and river cleanup days. Public education about the importance of keeping streams and creeks healthy.
49	parking at trailhead, extend existing trails
50	Security and Safety- pathways using solar at night; Location- construct in a way that these areas are public and don't become dangerous hang outs; Community Use...Make them a VITAL part of the community...a selling factor....ease of use.... easy to find....Our children, old folks and people my age, would enjoy walking to work, school or riding a bike. This type of access is so integral to our health, the community's value....people want to buy into neighborhoods like this...
51	Atheletic fields, specifacally baseball fields for all ages.
52	wide, safe, designated bike lanes.
53	If any of these Greenway are completed anytime soon in would be imperative to me that an connector and access greenway be place in two areas. 1. A connector to the Raleigh greenway system. 2. An access greenway to the North western side of Wake Forest specifically at or near the Purnell road and Bud Smith road Intersection. The sooner these are built the sooner people will start to ride or walk to downtown Wake Forest for dinner and other activities.
54	Sidewalks and greenway trails that connect downtown and surrounding areas is my absolute priority!
55	Bike path to downtown Raleigh

6. Which proposed section of greenway should be considered the #1, #2, and #3 priority for completion? (please refer to the Comment Form Map and select only three)



7. If grants or development do not become available in the next 5 years to build additional greenways, should the Town of Wake Forest look for ways to fund greenways?

	Response Percent	Response Count
Yes	**94.1%**	143
No	5.9%	9
answered question		**152**
skipped question		**4**

8. Specifically, would you support a bond fund to complete the Wake Forest Greenway Loop, if one were proposed? (please refer to the Comment Form Map)

	Response Percent	Response Count
Yes	**85.3%**	128
No	14.7%	22
answered question		**150**
skipped question		**6**

SUMMARY OF RESULTS

• About half of the respondents knew where trails were located in Wake Forest and the number one program recommended by the public was a wayfinding system; hence, a wayfinding system is recommended as a Phase One Action Step.

• Responses from questions three and five indicate that a good program focus for the Town of Wake Forest should be on health and active living through bicycle and pedestrian transportation.

• Priority preferences for Dunn Creek Corridor and Smith Creek Corridor are reflected in the implementation chapter, which outlines these corridors as Phase One priorities.

• Responses from questions seven and eight indicate support for local funding of trails. Even though this was not a statistically valid survey, the strong show of support among those responding to this question warrants consideration of a bond fund.

B: Design Guidelines


Sanford Creek Greenway

Chapter Outline:

Introduction

Wayfinding and Signage

Greenway Trail Types

Ancillary Trail Facilities and Amenities

INTRODUCTION

This chapter provides guidelines to both public and private entities for the future development of the Wake Forest Open Space & Greenway Plan. The guidelines noted herein are based on the best practices in use throughout the United States, as well as accepted national standards for greenway facilities.

The guidelines should be used with the understanding that each greenway is unique and that design adjustments will be necessary in certain situations in order to achieve the best results. Each segment should be evaluated on a case-by-case basis, in consultation with local or state bicycle and pedestrian coordinators, a qualified engineer and a landscape architect.

Facility design is a broad topic that covers many issues. This section provides guidelines for typical greenway facilities and is not a substitute for more thorough design and engineering work. For more in-depth information and design development standards, the following publications should be consulted:

Greenways: A Guide to Planning, Design and Development; Published by Island Press, 1993; Authors: Charles A. Flink and Robert Searns

Trails for the Twenty-First Century; Published by Island Press, 2nd ed. 2001. Authors: Charles A. Flink, Robert Searns, Kristine Olka

Guide to the Development of Bicycle Facilities; Updated in 1999 by the American Association of State Highway Transportation Officials (AASHTO).

Manual on Uniform Traffic Control Devices (MUTCD); Updated in 2003. Published by the U. S. Department of Transportation, Washington, DC

Universal Access to Outdoor Recreation: A Design Guide; Published by PLAE, Inc., Berkeley, CA, 1993

In all cases, the recommended guidelines in this report meet or exceed national standards. Should these national standards be revised in the future and result in discrepancies with this chapter, the national standards should prevail for all design decisions.

ADA REQUIREMENTS

The Americans with Disabilities Act requires that portions of the greenway be accessible to persons with varying motor skills and abilities. Perhaps the best way to comprehend the importance of ADA is to understand that most of us, at some time in our life, will experience a temporary disability which will affect the way in which we make use of outdoor resources. ADA benefits all Americans by making the outdoor environment more accessible.

RECYCLED MATERIALS

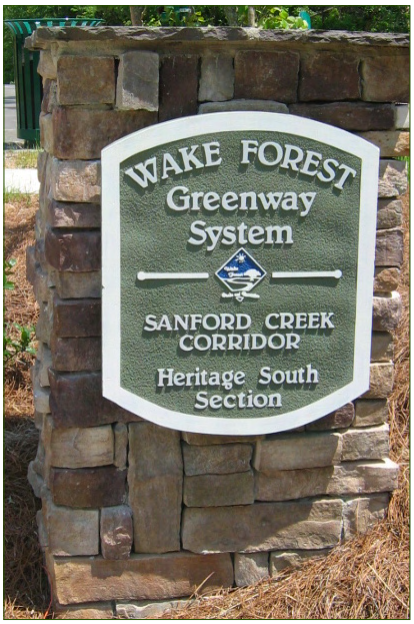
The consultant recommends the use of recycled waste materials and products in the construction of all signage for the project. Recycled waste materials offer design versatility, often have a long life span, and require less long-term maintenance than similar products constructed from natural materials. Recycled plastic lumber and or concrete can be used for the construction of posts and poles, and recycled aluminum can be used for signs.

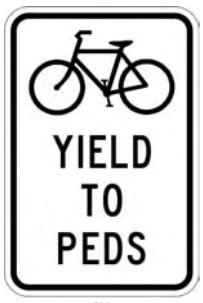
WAYFINDING AND SIGNAGE

A comprehensive system of signage is recommended throughout the Town of Wake Forest to ensure that information is provided to trail users regarding the safe and appropriate use of all facilities, both on-road & off-road. It is essential that the future trail network be signed seamlessly with other alternative transportation routes, such as designated bicycle routes, historic and/or cultural walking tours, and wherever possible, bus routes including the Wake Forest Loop and the Wake Forest-Raleigh Express.

Signage includes post- or pole-mounted signs and pavement striping. Signage is also divided into orientation and interpretive signs, regulatory signs and directional signs. Example language for trail user rules and regulations is provided in Appendix D: Operations and Management (pages D-4 to D-5), and should be provided at trail heads (see signage example image on page B-3, 'Orientation and Interpretive Information).

Below: An examples of signage from the Wake Forest Greenway System



	Description	Recommendations
Trail Identity Logo 	A Wake Forest Greenway logo should be developed and used to aid in reinforcing the trail's identity. Signage should be simple, direct, and easy to identify. Trail logo examples are shown at left.	Logos should be used as a consistent element throughout the length of the trail, and in printed trail information, such as brochures and maps.
Orientation and Interpretive Information  	This type of signage includes easy to read and comprehend information about the trail. As part of the trailhead, the overall design of this type of sign is the first experience most visitors will have with the trail. The design and information this sign communicates will establish the trail identity and help to create a more unified, pleasurable experience.	Orientation maps should clearly indicate landmarks and distances of trails. Maps should also identify the area they are placed. Interpretive information includes but is not limited to: history of the area, environmental information (plant, wildlife, river ecology), river restoration processes, and/or other important trail related or educational information.
Regulatory Information   	Regulatory signage states the rules of the trail. Regulatory information should be located at every trailhead, access parking lot, and in areas where users need to pay attention to environmental conditions.	Regulatory signage should be developed to conform to the (2001) Manual on Uniform Traffic Control Devices and the American Association of State Highway Transportation Official Guide for the Development of Bicycle Facilities.
Directional  	Directional signage consists of arrows that direct users to or from a trailhead or to amenities along the greenway.	These should be used in conjunction with the Wayfinding Logo. They are a crucial part of the off-trail signage system.

GREENWAY TRAIL TYPES

The Town should consider trail surface and width during design, two variables that will greatly affect the cost of installing and maintaining this system. When determining the width of greenways the Town should consider the safety of the user groups for which the trail will be built. A minimum trail width of 10' is standard in North Carolina for trails intended for bicycle use (not including mountain biking trails, which can be much narrower). This allows enough room for bicyclists traveling in opposite directions to pass each other comfortably. Other recommended trail widths vary, depending on the intended uses.

The following typology of greenway trails assist in defining and designing future greenway projects for the Wake Forest system. The selection of the appropriate type depends on anticipated use, topography, hydrology, existing road access and a host of other factors. Construction methods for specific trail types may vary between areas in the region depending on local environmental conditions and user requirements.

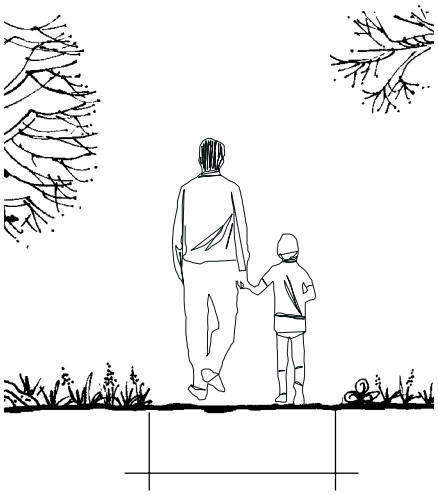
TYPE 1: NO FACILITY DEVELOPMENT

This designation applies to corridors containing significantly environmentally sensitive areas, such as steep slopes, wetlands, or other environmental constraints that make trail facilities undesirable or impractical. Where no facility is to be developed, the area will remain in a natural state and human access will be extremely limited. No support facilities or amenities are recommended in environmentally sensitive areas, and hikers should be encouraged to stay on designated footpaths, if they are allowed at all. Other functions for these corridors include floodplain management, water quality protection and conservation of important habitat for wildlife and plants.

TYPE 2: LOW-IMPACT USES, LIMITED DEVELOPMENT

Type 2 Trails have a great deal in common with Type 1. Both emphasize harmony with the natural environment, preserve natural resources, and mediate between larger habitat areas, open space, and corridors for wildlife. Type 2 trails differ in that they allow for more access for trail users, providing a valuable link to tie park components together, forming a cohesive trail system.

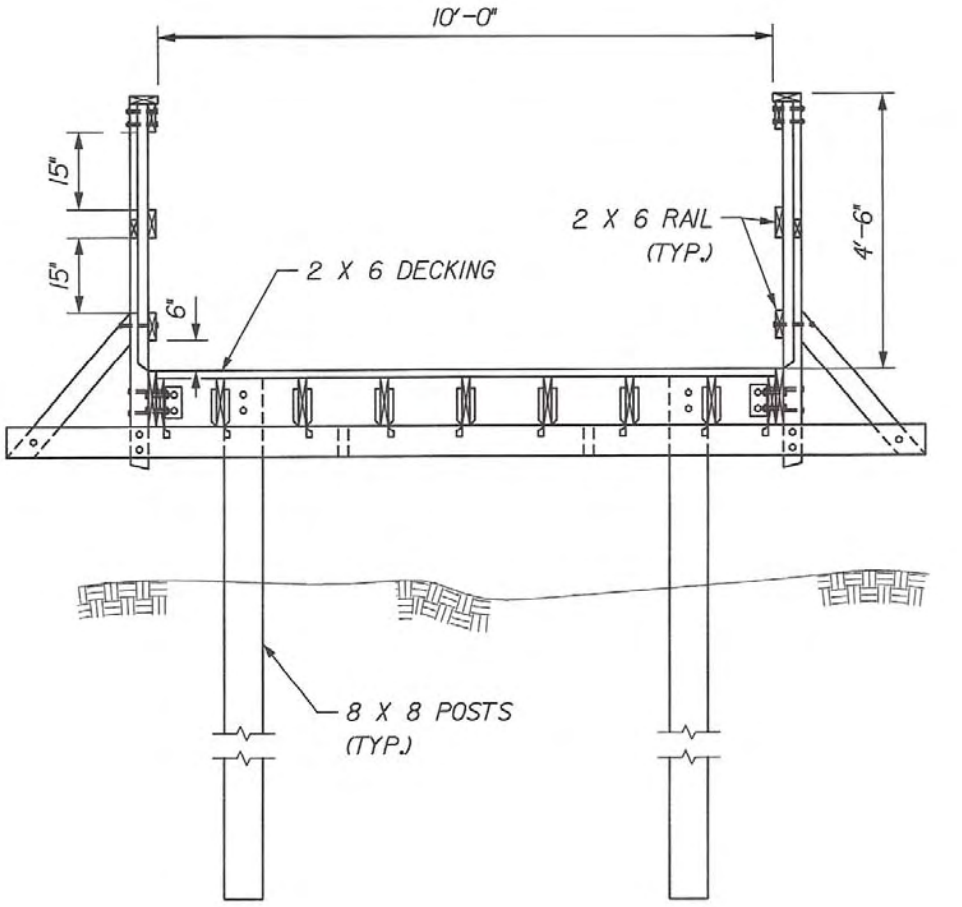
Type 2 corridors contain environmentally sensitive features that limit the extent of greenway facility development. These corridors remain primarily in a natural state, with gravel, or dirt trails (two-feet to six-feet wide) for use by low impact user groups such as hikers or joggers, and are not intended for bicyclists or other wheeled users. These paths sometimes follow strenuous routes and may limit access to all but the most mobile users. Construction of these trails consists of providing positive drain-



Above: A diagram and picture of a typical dirt trail; and a picture of boardwalk trail along the Sanford Creek Greenway

age for the trail tread and should not involve extensive removal of existing vegetation. Corridor widths totaling 200 feet are considered optimal with 50 feet usually considered the minimum. Trailhead facilities and other amenities will be limited, though some features such as signage and boardwalks may be necessary.

Boardwalk or wood surface trails are typically required when crossing wetlands or other poorly drained areas. While boardwalks can be considered multi-use trails, the surface tends to be slippery when wet. They are constructed of wooden planks or recycled material planks that form the top layer of the boardwalk. The recycled material has gained popularity in recent years since it lasts much longer than wood, especially in wet conditions. A number of low-impact support systems are also available that reduce the disturbance within wetland areas to the greatest extent possible.

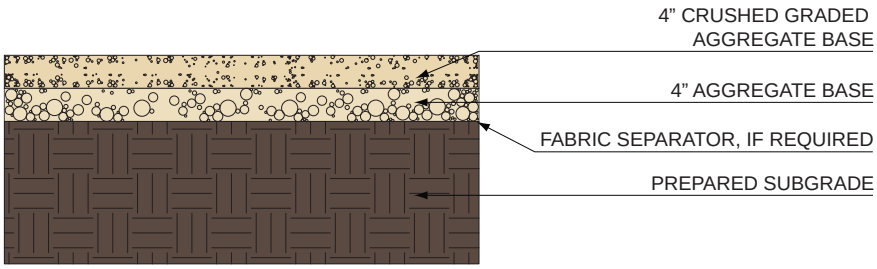


1. When the height of a boardwalk exceeds 30", railings are required
2. The thickness of the decking should be a minimum of 2"
3. Decking should be either non-toxic treated wood or recycled plastic.
3. The foundation normally consists of wooden posts or auger piers (screw anchors). Screw anchors provide greater support and last much longer.
4. Opportunities exist to build seating and signage into boardwalks.
5. In general, building in wetlands should be avoided.

TYPE 3: MULTI-USE, UNPAVED TRAIL DEVELOPMENT

Aggregate surface trails (10 feet minimum width) are appropriate for corridors outside the floodplain where anticipated use or the adjacent landscape dictates a more natural trail. Unpaved trails are not recommended in areas that experience frequent flooding because the aggregate surfaces wash away, degrading water quality and requiring reapplication of the surface material.

Regardless of their location, unpaved trails typically require more frequent repairs. Even when located outside of the floodplain, the aggregate trails should be designed to provide for proper drainage (it is best if water is channeled beside the trail rather than allowing it to cross the surface). Materials that can be used to surface a Type 3 Trail include, soil cement, compacted limestone screenings (crusher run), and crushed stone.



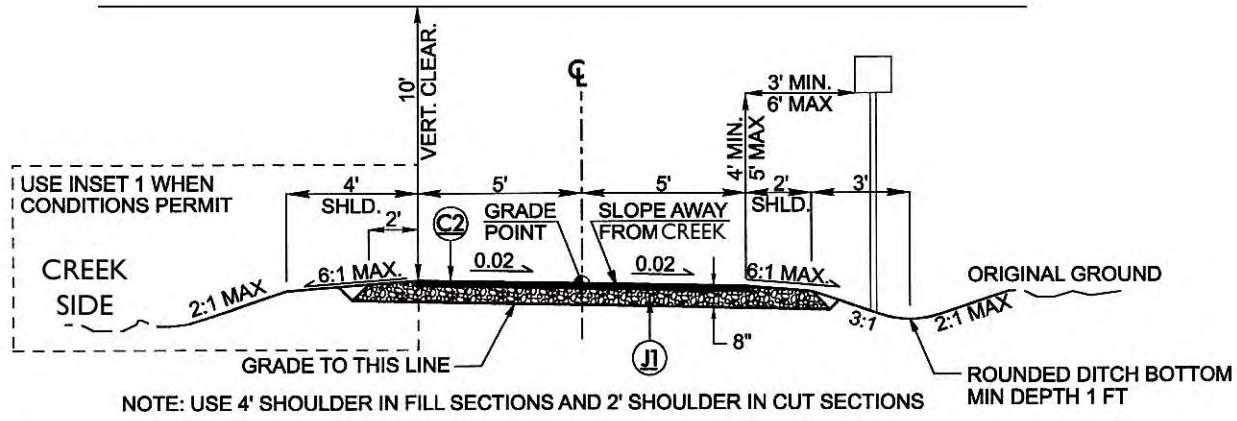
GRAVEL PAVING ON AGGREGATE

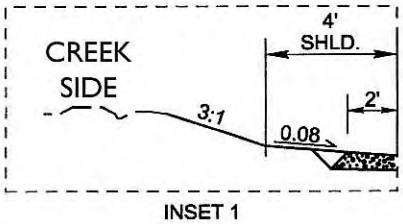
Careful consideration should also be given to the amount of traffic the specific segment will generate, since these surfaces tend to deteriorate with excessive use. The type of traffic on these trails is limited to pedestrian and bicycle activity. Wheelchair users and persons with strollers can use unpaved trails if they are designed to ADA standards and surfaced with compacted limestone screenings or other hard, permeable surface, crushed stone. Trailhead facilities and other amenities (such as benches, signage and picnic tables) are appropriate with this type trail and will be developed as needed and where desirable.

TYPE 4: MULTI-USE, PAVED TRAIL DEVELOPMENT

This designation applies to high capacity corridors, that do not contain environmentally sensitive areas, will most likely be used as transportation routes, and/or are located within frequently flooded areas. The paved trails can be surfaced with asphalt or concrete (minimum 10-feet wide) for use by several user groups, including bicyclists, joggers, wheelchair users and rollerbladers. Although asphalt is the most common paved surface used for greenway trails, concrete is best for areas experiencing frequent flooding because of its durability. Trailhead facilities and other amenities will be developed as needed and where appropriate.

Typical pavement design for paved, off-road, multi-use trails should be based on specific loading and soil conditions found on site. They should be designed to accommodate access by maintenance and emergency vehicles in both width and loading.





INSET 1

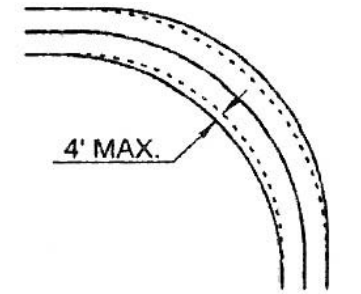
PROVIDE A SAFETY RAIL FOR THE FOLLOWING CIRCUMSTANCES:

SLOPE ≥ 3:1 AND DROP OF 6'
SLOPE ≥ 2:1 AND DROP OF 4'
SLOPE ≥ 1:1 AND DROP OF 1'

Asphalt is a popular trail surface in the region. It is highly flexible, relatively inexpensive to lay and holds-up well over time. One concern with asphalt is the deterioration of trail edges. This condition can be reduced through the installation of geotextile fabric under an aggregate base and the provision of two-foot shoulders. There are many cases in the metropolitan area, however, where asphalt is installed directly on compacted subgrade and performance is acceptable. It is important when omitting the aggregate base to pay close attention to subsurface conditions and drainage to insure a stable subgrade prior to paving.

The minimum width for a two-directional trail is 10 feet. Centerline stripes should be considered for paths that generate substantial amounts of traffic. Possible conflicts between user groups must also be considered during the design phase since cyclists often travel at higher speeds than other modes.

TYPE 4: MULTI-USE, PAVED TRAIL DEVELOPMENT (CONTINUED)



CURVE WIDENING DETAIL

General Characteristics:

Designed for:	Two-way, multi-purpose travel.
Recommended minimum width:	10 ft.
Recommended minimum design speed:	20 mph.

Horizontal Alignment:

Cross Slope:	2%
Minimum Radius:	95 ft. *

* Where a sharper curve radius is needed, curve widening will be provided to either the outside or the inside of the curve, per the detail shown. Curve warning signs and pavement markings shall also be used in accordance with MUTCD Standards.

Sight Distance:

See AASHTO Guidelines, Table 3 (page 44) and Table 4 (page 46) for stopping sight distances.

HYDRAULIC DESIGN CRITERIA

Typical C Values

SURFACE	C VALUE
Woods	0.200
Grass	0.350
Single Family Residential Dev.	0.450
Multi-Family Development	0.600
Business Development	0.600-0.800
Pavement/Building	0.900

Typical n Values

SURFACE	n VALUE
Pavement/Roofs Surface Flow	0.011
Concrete Pipes	0.013
Curb & Gutter	0.013
Grass Ditch > 0.7'	0.050
Grass Ditch < 0.7'	0.070
Existing Ditches	0.080
Grass Surface Flow	0.240
Woods Surface Flow	0.400
Rip Rap Class A	0.350
Rip Rap Class B	0.380
Rip Rap Class I	0.400
Rip Rap Class II	0.420

TYPICAL DIMENSIONS AND VALUES

Sheet (Overland) Flow

Maximum Flow Length:	300 ft.
Travel Time:	10 minute minimum
P (2 year/24 hour)	3.6 in.

Storm Channel Design

Minimum Ditch Slope:	0.50%
Ditch Protection Design Flow:	2 year
Storm Ditch Depth:	1 ft. minimum (designed for overtopping in undeveloped areas)
Storm Ditch Depth	10 year (designed for developed areas)

Ditch Liner Types

Class C Vegetation PSS:	1 lb./ft3
PSRM PSS	2+ lb./ ft3
Rip Rap	Variable

Storm System & Culvert Design

Minimum HDPE Culvert Size:	12 in.
Maximum HDPE Culvert Size:	60 in. (size required above 60 in. will default to bridge standards)
Minimum RCP Culvert Size:	18 in.
Minimum Culvert Slope:	0.25%
Minimum Pipe Cover (trail):	2 ft.
Minimum Pipe Cover (natural):	1.5 ft.
Culvert Design Flow:	10 year
Culvert Overtopping Flow:	25 year
Perennial Stream Design Flow:	25 year
Perennial Stream Overtopping Flow:	25+ year
Outlet Protection Design Flow:	10 year

Provide 0.5 ft. minimum from hydraulic grade line to top of inlet grate or junction box.

Trial Size Culvert

A trial size culvert can be determined using the design discharge and an assumed HW/D = 1.2

Head walls on inlet end only.

48 in.	Cost/ft.
54 in.	Cost/ft.
60 in.	Cost/ft.
Stream Impacts	Cost/ft.

Storm Drain Pipes

Storm drain pipes should be concrete, unless a site limitation (such as grade or corrosive conditions) dictates the use of an alternative material. The minimum pipe size to serve a single inlet is 12 in. For more than one inlet, or a length of more than 100 ft. a 15 in. pipe is the minimum size. Stream crossing culverts will utilize HDPE piping.

Bridge Length & Height

Bridge minimum length will be based on a 10 ft. setback from the Top of Bank. Bridge minimum height to low cord will be 2 ft. above Design Flow. Overtopping of bridge structure will be acceptable. No bridge piers in the Channel.

Cost Analysis & Stream Impacts

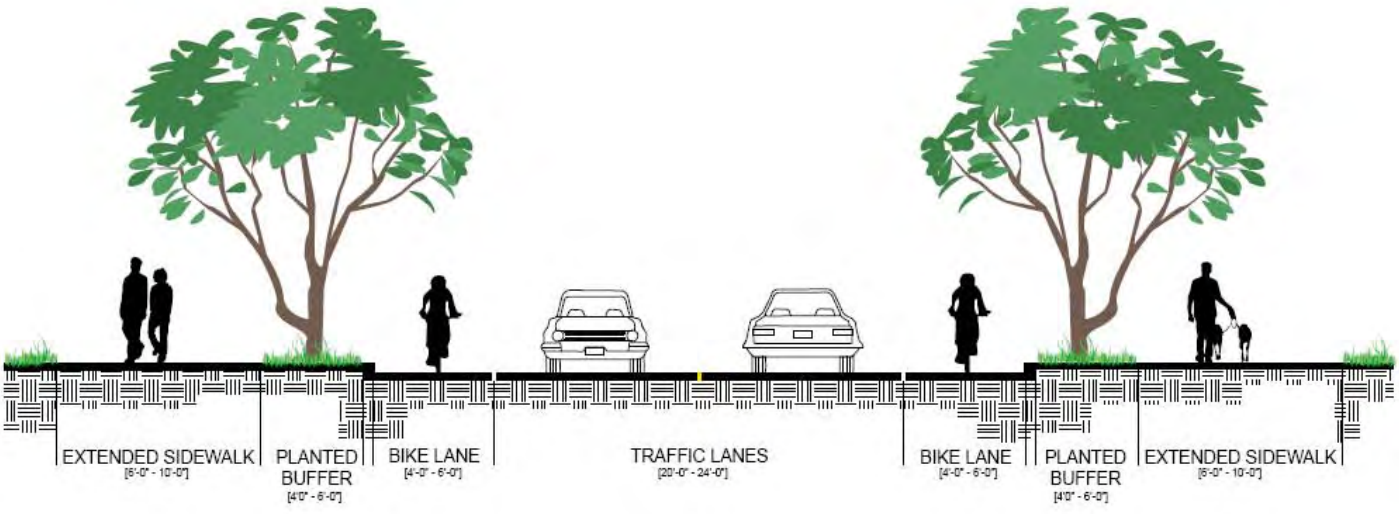
A cost analysis and stream impacts comparison will be done at all Perennial Stream crossings to determine the crossing structure type. Hydraulic opening will govern over all else. Cost analysis will be the second highest parameter. Preferred alternatives will be based on 1) bridge, 2) culvert, and 3) trail relocation. When multiple alternatives satisfy all control factors, an analysis shall be performed to ensure the alternative selected is the least costly in terms of construction, maintenance, and operations. Boardwalk will be used in low flow situations where scour is not a concern, such as in wetlands and sheet flow situations. Where culvert crossings result in an unacceptable back water condition, bridge crossings shall be utilized. Back water conditions will be studied on a case by case basis to determine what is and what is not acceptable based on geographic parameters.

Natural Channel

To the greatest extent practicable, bridge crossings will be designed to accommodate the natural channel.

TYPE 5: ROADWAY CORRIDOR (SIDEWALKS AND BICYCLE FACILITIES)

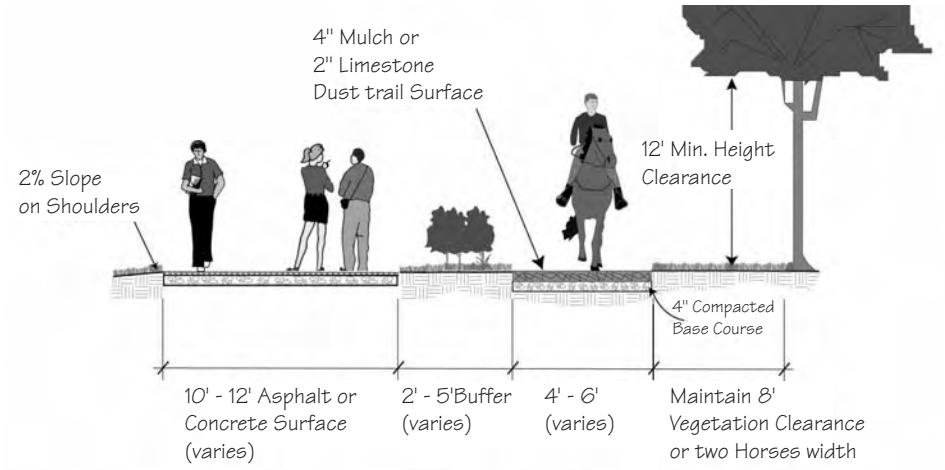
This trail type has perhaps the most variation of use and construction. This designation applies to corridors in urbanized or urbanizing areas where an off-road option is not possible. Such corridors function as connections between off-road trails and major origins and destinations. This category includes both sidewalks for pedestrian use and bicycle facilities for cyclists. Bicycle facilities can vary from bicycle lanes to paved shoulders to wide curb lanes (see the Town of Wake Forest Bicycle Plan for design guidelines on bicycle facilities). Pedestrian scale lighting, street trees, benches and other amenities should be developed to encourage sidewalk use (See the Town of Wake Forest Pedestrian Plan for design guidelines on pedestrian facilities).



EQUESTRIAN TRAILS

There is an active equestrian community in Wake Forest, particularly in the area east of the reservoir, which has expressed an interest in developing equine trails. Equestrian trails need to be separated from facilities that are used by pedestrians and cyclists. Equestrians tend to prefer longer segments of trails to ride. Wake Forest may wish to explore the possibilities of a shared facility with the towns of Rolesville, Wendell, and Zebulon. This would enable the trail to span a greater distance, connect the different towns, and create an opportunity for the towns to share in the investment of a stand-alone equestrian trail or one that parallels a pedestrian and bicyclist trail.

Signs indicating that equestrians have the right-of-way should be posted on the trail, as seen in these examples.



• Dirt or stabilized dirt is a preferred surface. Crushed granite screenings are also acceptable. Hard surfaces like asphalt and concrete are undesirable for equestrians because they can injure horses' hooves. Granular stone may also present problems because loose aggregate can get stuck in hooves.

• Within the tread, large rocks, stumps, and other debris should be cleared.

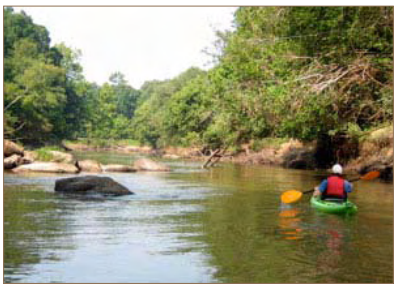
• Sight distances for equestrians, who usually travel between 4 and 6 miles per hour, should be at least 100 feet.

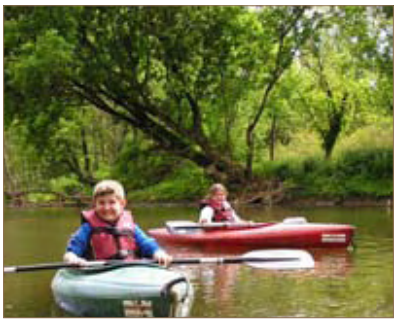
• Hitching posts should be installed at rest stops, picnic areas, and rest rooms.

• For horseback riders, a water crossing is preferred to a high and narrow bridge. If erosion is a concern, or if water crossing is for some reason undesirable, then provide mounting blocks at the bridge, so riders can dismount and lead their horses.

• Equestrians should be expected to remove their horse's manure from trail surfaces. Many riders are not comfortable dismounting and taking care of this as it occurs. Therefore, equestrians should be strongly encouraged (or possibly required in exchange for use of the trail) to join fellow riders on manure clean-up days.

WATER BASED TRAILS





This designation applies to those rivers and streams that can successfully accommodate and/or which are designated to support canoeing, kayking and boating. Water based trails can be designated with features and facilities that make this activity more enjoyable for residents, including signage systems, improved rapids, safety systems, and access points. Rental outfits could be established at put in/take out points.

• Clearly marked access points and/or trailheads should be provided.

• Educational signs, directional signs, and regulatory signs should inform users of their surroundings and how to navigate the watercourse safely.

• The provision of designated picnic areas and camp sites along water trails can reduce the problem of trespassing private property along the watercourse.

• If a pathway from parking area to water access exceeds 1500 feet, a permanently affixed canoe or kayak stand should be positioned every 1000 feet.

• Informational signs containing emergency contact numbers, as well as contact numbers for the managing partner, must be displayed at the parking space area
and/or within 150 feet of the access site.

• Access to waterway must be firm, compacted, and permanently delineated

• Minimum construction for facilities

• Lights in parking and picnic areas are recommended

• Maps should be provided to guide users along the watercourse and to access sites for drop-in and take-out.

• Natural but well maintained pathway
from parking to water access:

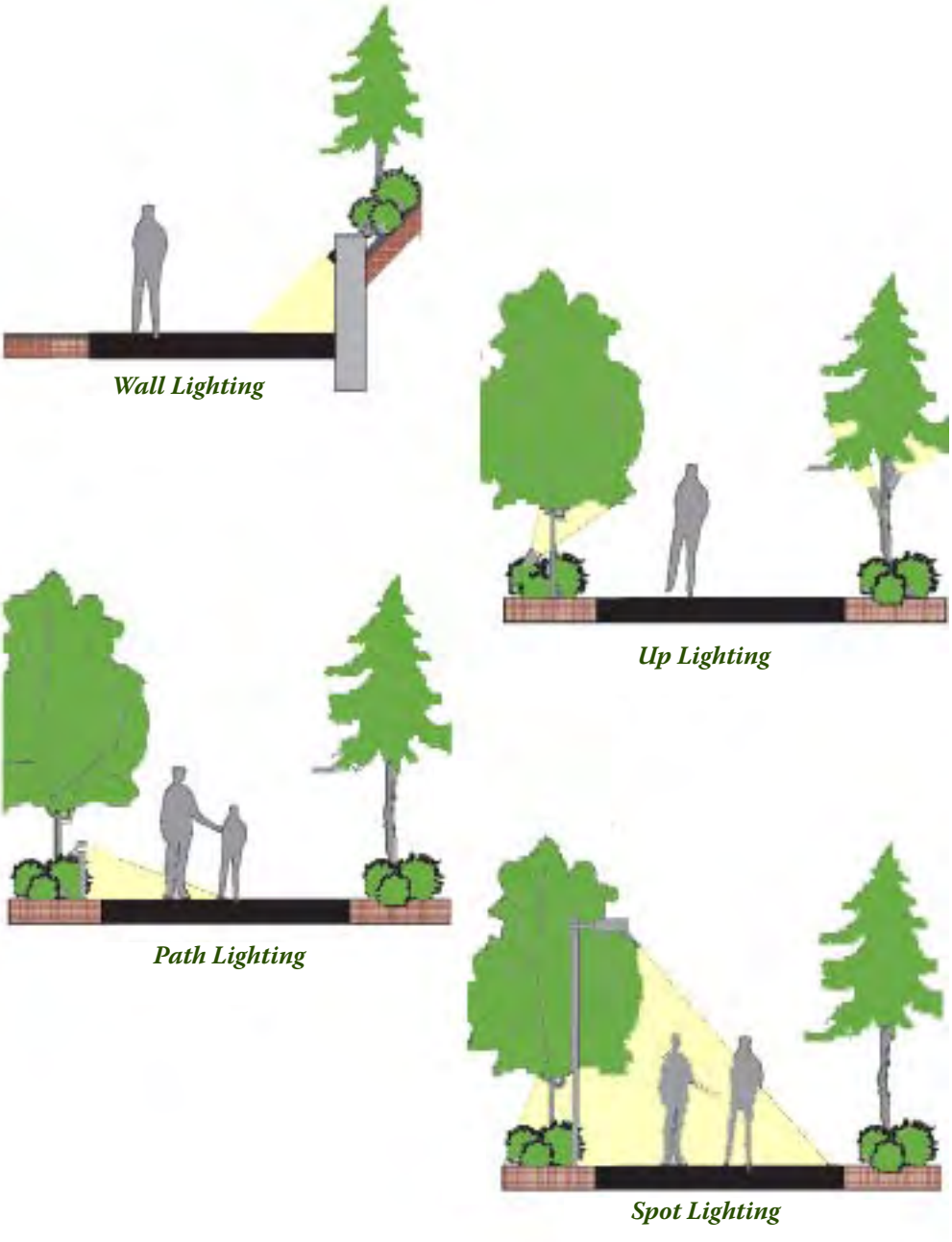
- Pathway at least 6‘ wide
- Grass not higher that 5”
- Tree overhang not lower than 14’
- Grade must not exceed 20%

MAJOR AND MINOR TRAILHEADS

Trailheads should be installed throughout the greenway system to give the public access. A "trailhead" is a point of formal public entry into the greenway system that may provide certain related public facilities such as parking, restrooms, drinking fountains, trail signage, etc. Major trailheads and minor trail heads are suggested. Major trailheads should be located in significant areas. An exhibition building or an interpretive exhibit may be incorporated, along with restrooms, water fountains, picnic tables, parking, signage, etc. Minor trailheads can be used to connect a smaller number of people to surrounding trails, open space, parks, etc.

TRAIL LIGHTING

Particularly during winter months when trips to and from work are made in the dark, adequate lighting can make the difference in a person's choice to bicycle or walk. Still, due to liability and security concerns, many off-road bicycle paths are closed at night, and therefore unlit. However, main trial corridors should be considered for later evening use, even if unlit (for example the American Tobacco Trail in Durham, NC is unlit and remains open until 10 PM for use by commuters.) Lighting for multi-use trails should be considered on a case-by-case basis in areas where 24-hour activity is expected (such as college campuses or down- town areas), with full consideration of the maintenance commitment lighting requires. A licensed and qualified lighting expert should be consulted before making any lighting design decisions. Doing so should reduce up-front fixed costs as well as long-term energy costs.



Wall Lighting

Up Lighting

Path Lighting

Spot Lighting

Left: Spot lighting is typically employed in high use areas such as an esplanade or where a trail meets a parking lot or other urbanized area. Path lighting can be used to guide individuals along a trail to a specific location.

FOOTBRIDGES

Footbridges are used where the span of a waterway is too large for culverting, where there is a wetland type area, or to cross the river. The type and size of bridges can vary widely depending on the trail type and specific site requirements. Some bridges often used for multi-use trails include suspension bridges, prefabricated span bridges and simple log bridges. When determining a bridge design for multi-use trails, it is important to consider emergency and maintenance vehicle access.

The function of a bridge in an off-road, multi-use trail situation is to provided access to the user over certain natural (i.e. streams) or man-made (i.e., roadways) features.

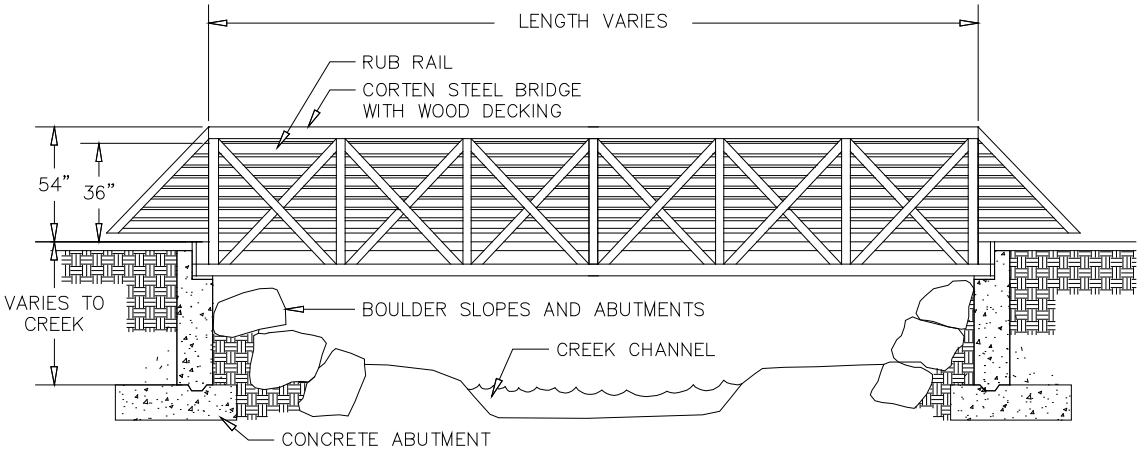
1. If a corridor already contains a bridge such as an abandoned rail bridge, an engineer should be consulted to assess the structural integrity before deciding to remove or reuse it.

2. A trail bridge should support 6.25 tons.

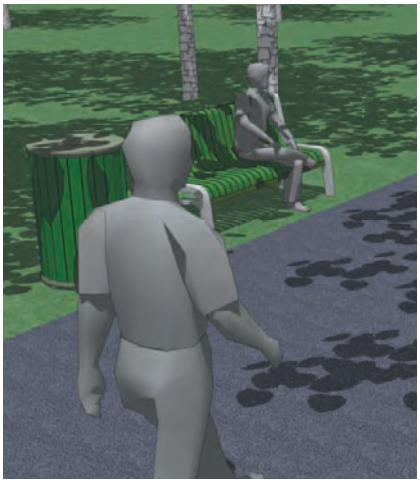
3. Information about the load- bearing capacity of bridges can be found in the American Association of State Highways and Transportation Officials (AASHTO) Standard Specifications for Highway Bridges.

4. There are many options in terms of high quality, prefabricated pedestrian bridges available. Prefabricated bridges are recommended because of their relative low cost, minimal disturbance to the project site, and usually, simple installation.

5. All abutment design should be sealed by a qualified structural engineer and all relevant permits should be filed.



ANCILLARY TRAIL FACILITIES AND AMENITIES

		Description	*Recommendations*
BENCHES		There are a wide variety of benches to choose from in terms of style and materials. Benches provide respite for trail users. The benches are to be placed on either side of the trail facing each other to help frame the trail and encourage social interaction.	Due to a wide range of users, all benches should have a back rest. A bench should normally be 16 - 20" above ground with sturdy handrails on either side. The seating depth should be 18-20" and the length should vary between 60 - 90". Benches should be placed at all trailheads and should normally appear in pairs wherever feasible. They shall be set 2' from the edge of the 2' shoulder, facing the greenway.
OTHER SEATING		Other more informal seating opportunities may exist along a trail or near a parking area where other furniture like a picnic table may be appropriate.	This type of furniture can be triangulated with cooking facilities, and a trash receptacle.
TRASH RECEPTACLES		Trash receptacles should be constructed of a suitable material to withstand the harsh elements of the outdoor environment. Additionally trash receptacles should ensure that litter is contained securely preventing contamination or spillage into the surrounding environment.	Trash receptacles should be placed along the trail and at all trailheads. Adequate trash receptacles will combat littering and preserve the natural environment for all trail users.

		Description	*Recommendations*
WEIGHTED GATES		Weighted gates increase trail safety by providing separation between motorized vehicles and trail users. Installing weighted gates allows for pedestrians and bicyclists to pass through while restricting motorized vehicular access to emergency and maintenance traffic.	Gates are typically constructed of painted steel or aluminum. These should all be painted the same and reflect the overall style of the other greenway site furnishings.
VEHICULAR LOCKABLE GATES		These types of gates control and prevent vehicular access to parking lots when the parks or trailheads are closed.	Gates are typically constructed of painted steel or aluminum, with halogen or metal halide lights in weather tight casings. These should all be painted the same and reflect the overall style of the other greenway site furnishings.
FENCING		Fencing is used to protect users from potential hazards such as steep slopes or restrict access to and from the trail. The style of fence is very important. Chain-link and poorly maintained fencing promotes a negative image and should be avoided.	Use only when necessary and take care to select a style of fencing that does not promote a negative identity. Also consider landscaping to soften the appearance of fences throughout the greenway and parks.
BICYCLE RACKS		There are many types of bike racks available however the two recommended methods are to secure a bike in an enclosed storage, or to lock it to a rack as illustrated here.	A bike rack is recommended as the most inexpensive way to secure a bicycle. An enclosed structure with rented keys is appropriate only in very high bicycle use situations. As illustrated, bike racks can be designed to reinforce a particular design theme. (See the 2008 Wake Forest Bicycle Plan for more on bicycle parking).
TRAIL BOLLARDS		Trail bollards are distance markers placed at set intervals. These let folks know where they are on the trail as well as provide important information to those who may be vigorously tracking their exercising. Bollards can also be installed on paved greenways to prevent access by unauthorized vehicles.	Typically these are constructed of either weather treated or stained wood although other materials may be selected. The Wake Forest Greenway logo may be included on these bollards.

TRAIL UNDERPASS

• Typically utilize existing overhead roadway bridges adjacent to steams or culverts under the roadway that are large enough to accommodate trail users

• Vertical clearance of the underpass should be at least 10'; NCDOT only requires 8' minimum vertical clearance.

• Width of the underpass must be at least 12'

• Proper drainage must be established to avoid pooling of stormwater.

• Lighting is recommended for safety.

TRAIL OVERPASS

• Safety should be the primary consideration in bridge/overpass design.

• Specific design and construction specifications will vary for each bridge and can be determined only after all site-specific criteria are known.

• Always consult a structural engineer before completing bridge design plans, before making alterations or additions to an existing bridge, and prior to installing a new bridge.

• A 'signature' bridge should be considered in areas of high visibility, such as over major roadways. While often more expensive, a more artistic overpass will draw more attention to the trail system in general, and could serve as a regional landmark.

• For shared-use facilities, a minimum width of 14' is recommended.

• Trail overpasses are prohibitively expensive and should only be placed in areas of substantial need.

TRAIL/ROADWAY INTERSECTIONS

• Site the crossing area at a logical and visible location; the crossing should be a safe enough distance from neighboring intersections to not interfere (or be interfered) with traffic flow; crossing at a roadway with flat topography is desirable to increase motorist visibility of the path crossing; the crossing should occur as close to perpendicular (90 degrees) to the roadway as possible.

• Warn motorists of the upcoming trail crossing and trail users of the upcoming intersections; motorists and trail users can be warned with signage (including trail stop signs), changes in pavement texture, flashing beacons, raised crossings, striping, etc.

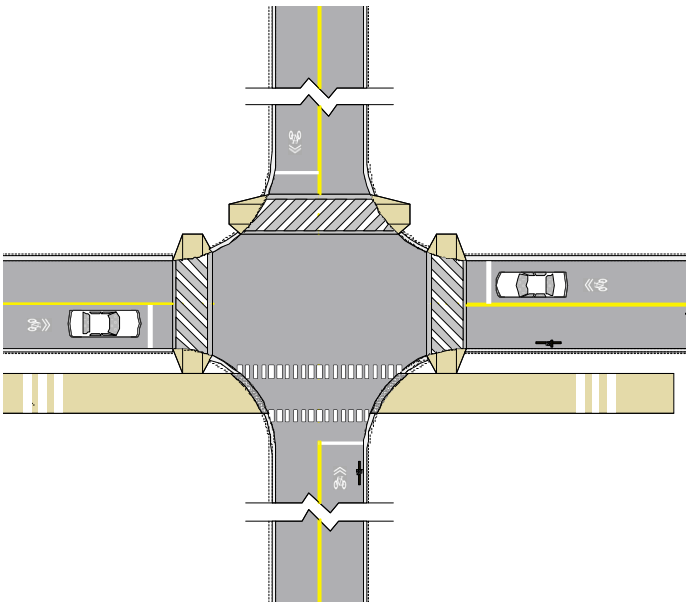
• Maintain visibility between trail users and motorists by clearing or trimming any vegetation that obstructs the view between them.

•Intersection approaches should be made at relatively flat grades so that cyclists are not riding down hill into intersections.

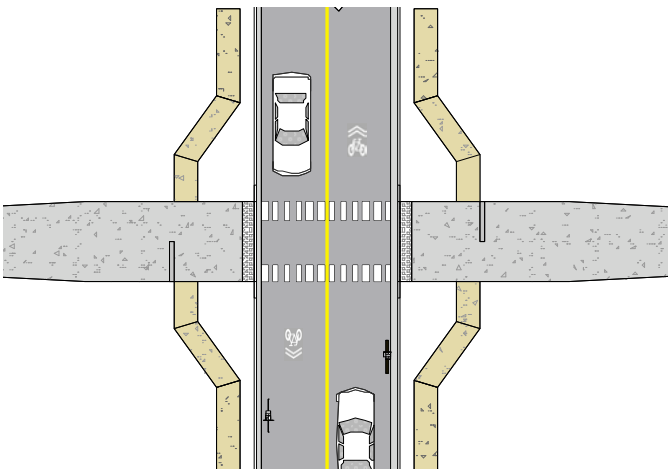
• If the intersection is more than 75 feet from curb to curb, it is preferable to provide a center median refuge area; a refuge is needed in conditions exhibiting high volumes/speeds and where the primary user group crossing the roadway requires additional time, such as school children and the elderly.

• If possible, it may be desirable to bring the path crossing up to a nearby signalized crossing in situations with high speeds/ADT and design and/or physical constraints.

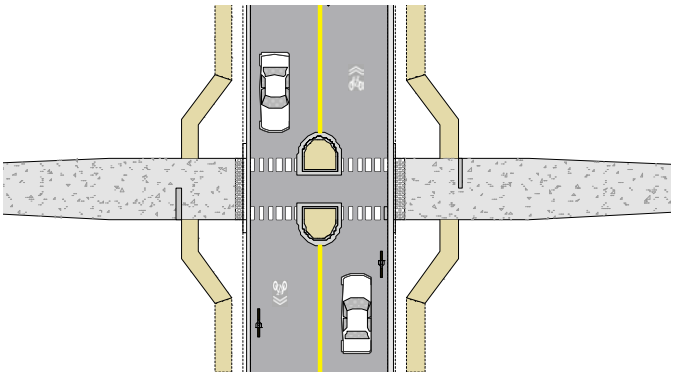
• In 4-Way Intersection Crossing with Share Use Path (diagram below) – This is also a depiction of a 'sidepath' intersecting a roadway. Trail users would navigate this crossing like a common pedestrian.



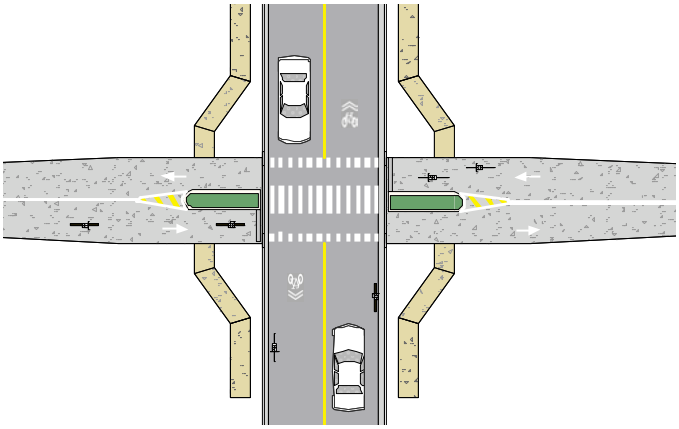
4-WAY INTERSECTION CROSSING
Shared Use Path



MID-BLOCK INTERSECTION
Shared Use Path with Sidewalks



MEDIAN REFUGE
Shared Use Path with Sidewalks



MIDBLOCK CROSSING
Shared Use Path with Sidewalks and Medians

TRAIL-ROADWAY INTERSECTIONS (SIGNALIZED)

• Signalized crossings may be necessary on trails with significant usage when intersecting with demanding roadways, but MUTCD warrants must be met for the installation of a signalized crossing. Consult the MUTCD or NCDOT Division of Bicycle and Pedestrian Transportation for signal, sign and light placement.

• FHWA issued an interim approval for the optional use of rectangular rapid flashing beacons (RRFBs, shown at left) as warning beacons supplementing pedestrian crossing or school crossing warning signs at crossings across uncontrolled approaches. An analysis by the Center for Education and Research in Safety found them to have much higher levels of effectiveness in making drivers yield at crosswalks than the standard over-head and side-mount round flashing beacons.

PUBLIC ART

Explore opportunities to include public art within the overall design of the trail system. These are examples of public art along trails. According to American Trails, "Art is one of the best ways to strengthen the connection between people and trails. Across America and elsewhere, artists are employing a remarkably wide range of creative strategies to support all phases of trail activities, from design and development to stewardship and interpretation. In particular, art can be an effective tool for telling a trail's story compellingly and memorably."

Example art programs for trails can be found at:
www.americantrails.org/resources/art/ArtfulWays.html

C: Sources of Funding

Olde Mill Stream Greenway

Chapter Outline:

Overview

High Priority Funding Options

State Funding Sources

Funding Allocated by Federal Agencies

Local Funding Sources

Other Local Options

Private Foundations and Organizations

OVERVIEW

The purpose of this appendix is to define and describe possible funding sources that could be used to support the planning, design and development of greenway improvements.

Implementing the recommendations of this plan will require a strong level of local support and commitment through a variety of local funding mechanisms. Perhaps most important is the addition of bicycle and greenway recommendations from this Plan into the Town's annual budget. These improvements should become a high priority and be supported through portions of the funding currently used for public safety, streets, parks and recreation, planning, Powell Bill funds, community development, travel and tourism, downtown, and local bonds.

The Town should also seek a combination of funding sources that include local, state, federal, and private money. Fortunately, the benefits of protected greenways are many and varied. This allows programs in Wake Forest to access money earmarked for a variety of purposes including water quality, hazard mitigation, recreation, air quality, alternate transportation, wildlife protection, community health, and economic development. Competition is almost always stiff for state and federal funds, so it becomes imperative that local governments work together to create multi-jurisdictional partnerships and to develop their own local sources of funding. These sources can then be used to leverage outside assistance.

For the past two decades, a variety of funding has been used throughout North Carolina to support the planning, design and construction of urban and rural bicycle and greenway projects. The largest single source of funding for these projects has come from the Surface Transportation Act, first the Intermodal Surface Transportation Efficiency Act (ISTEA)

in the early to mid 1990's; then its successor, Transportation Equity Act for the Twenty-First Century (TEA-21) through the early part of 2002; and now the Safe, Accountable, Flexible and Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). The North Carolina Department of Transportation manages and distributes the majority of federal funds that are derived from the Act to support the development of bicycle/trail development.

The majority of federal funding is distributed to states in the form of block grants and is then distributed throughout a given state for specific projects. State funding programs in North Carolina also support the creation of greenways. North Carolina has developed a broad array of funding sources that address land acquisition, green infrastructure development, and trail facility development.

Additionally, there are many things that the Town of Wake Forest can do to establish their own funding for greenway initiatives. For the most part, it takes money to get money. For Wake Forest, it will be necessary to create a local funding program through one of the methods that is defined within this report. Financing will be needed to administer the continued planning and implementation process, acquire parcels or easements, and manage and maintain facilities.

This appendix is organized by first addressing the state sources of funding, then addresses separate federal and local government funding sources. It is by no means an exhaustive list as there are many other funding sources available that should be researched and pursued as well. Creative planning and consistent monitoring of funding options will likely turn up new opportunities not listed here.

HIGH PRIORITY FUNDING OPTIONS

While there are a number of funding sources provided in the following pages, these sources should be the highest priority in order to achieve successful implementation. It is critical for local government to step up given the competitiveness and finite availability associated with most funding sources. Details about the following sources are found later in this appendix.

- Local Capital Improvements Program (CIP)
- Local Bond
- Local Fees
- State Transportation Improvements Program (STIP)
- Program (TIP)

- State Powell Bill Funds
- State Safe Routes to School Program
- State Parks and Recreation Trust Fund (PARTF)
- State Health and Wellness Trust Fund (HWTF)
- Private Sources

STATE FUNDING SOURCES

The most direct source of public-sector funding for the Town of Wake Forest will come from state agencies in North Carolina. Generally, these funds are made available to local governments based on grant-in-aid formulas. The single most important key to obtaining state grant funding is for local governments to have adopted plans for greenway, open space, bicycle, pedestrian or trail systems in place prior to making an application for funding. Unfortunately, there is no direct correlation between any of the programs listed and a constant stream of funding for greenway or trail projects and all projects are funded on the basis of grant applications. There is no specific set aside amount that is allocated for greenway and trail development within a given program. Funding is based solely on need and the need has to be expressed and submitted in the form of a grant application. Finally, all of these programs are geared to address needs across the entire state, so all of the programs are competitive and must allocate funding with the needs of the entire state in mind.

The Powell Bill Program is an annual state allocation to municipalities for use in street system maintenance and construction activities. There is considerable local control over Powell Bill Funds (it is not a grant application process). In the past, the State allocated a considerable portion of these revenues for construction purposes. However, budgetary constraints since 2001 have led to a shift of new Powell Bill funds to cover maintenance and operations activities. Both the Powell Bill reserves and the 2000 Transportation Bond funds are limited funding sources that will eventually be depleted.

In North Carolina, the Department of Transportation, Division of Bicycle and Pedestrian Transportation (DBPT) has been the single largest source of funding for bicycle and greenway projects, including non-construction projects such as brochures, maps, and public safety information for more than a decade. DBPT offers several programs in support of bicycle facility development.

The following information is from NCDOT's interactive web site (www.ncdot.org). Contact the NCDOT, Division of Bicycle and Pedestrian Transportation at (919) 807-2804 for more information.

North Carolina programs are listed below. A good starting website with links to many of the following programs is www.enr.state.nc.us/html/tax_credits.html.

FUNDING OPPORTUNITIES THROUGH NCDOT

Bicycle and Pedestrian Independent Projects Funded Through the Transportation ImprovementProgram (TIP):

In North Carolina, the Department of Transportation, Division of Bicycle and Pedestrian Transportation (DBPT) manages the Transportation Improvement Program (TIP) selection process for bicycle projects. Projects programmed into the TIP by the DBPT are independent projects – those which are not related to a scheduled highway project. Incidental projects – those related to a scheduled highway project – are handled through other funding sources described in this section.

DBPT has an annual budget of $6 million. Eighty percent of these funds are from STP-Enhancement funds, while the State Highway Trust provides the remaining 20 percent of the funding.

A total of $5.3 million dollars of TIP funding is available for funding various bicycle-independent projects, including the construction of multi-use trails, the striping of bicycle lanes, and the construction of paved shoulders, among other facilities. Prospective applicants are encouraged to contact the DBPT regarding funding assistance for bicycle projects. For a detailed description of the TIP project selection process, visit www.ncdot.org/transit/bicycle/funding/funding_TIP.html. Another $500,000 of the division's funding is available for miscellaneous projects.

Incidental Projects

Bicycle accommodations such as bike lanes, widened paved shoulders, and bicycle-safe bridge design are frequently included as incidental features of highway projects. In addition, bicycle-safe drainage grates are a standard feature of all highway construction. Most bicycle safety accommodations built by NCDOT are included as part of scheduled highway improvement projects funded with a combination of National Highway System funds and State Highway Trust Funds.

Governor's Highway Safety Program (GHSP)

The mission of the GHSP is to promote highway safety awareness and reduce the number of traffic crashes in the state of North Carolina through the planning and execution of safety programs. GHSP funding is provided through an annual program, upon approval of specific project requests. Amounts of GHSP funds vary from year to year, according to the specific amounts requested. Communities may apply for a GHSP grant to be used as seed money to start a program to enhance highway safety. Once a grant is awarded, funding is provided on a reimbursement basis. Evidence of reductions in crashes, injuries, and fatalities is required. For information on applying for GHSP funding, visit www.ncdot.org/programs/ghsp/.

FUNDING AVAILABLE THROUGH NORTH CAROLINA METROPOLITAN PLANNING ORGANIZATIONS (MPOS)

MPOs in North Carolina which are located in air quality nonattainment or maintenance areas have the authority to program Congestion Mitigation Air Quality (CMAQ) funds. CMAQ funding is intended for projects that reduce transportation related emissions. Some NC MPOs have chosen to use the CMAQ funding for bicycle projects. Local governments in air quality nonattainment or maintenance area should contact their MPO for information on CMAQ funding opportunities for bicycle facilities.

TRANSPORTATION ENHANCEMENT CALL FOR PROJECTS, EU, NCDOT

The Enhancement Unit administers a portion of the enhancement funding set-aside through the Call for Projects process. In North Carolina the Enhancement Program is a federally funded cost reimbursement program with a focus upon improving the transportation experience in and through local North Carolina communities either culturally, aesthetically, or environmentally. The program seeks to encourage diverse modes of travel, increase benefits to communities and to encourage citizen involvement. This is accomplished through the following twelve qualifying activities:

1. Bicycle and Pedestrian Facilities
2. Bicycle and Pedestrian Safety
3. Acquisition of Scenic Easements, Scenic or Historic Sites
4. Scenic or Historic Highway Programs (including tourist or welcome centers)
5. Landscaping and other Scenic Beautification

6. Historic Preservation
7. Rehabilitation of Historic Transportation Facilities
8. Preservation of Abandoned Rail Corridors
9. Control of Outdoor Advertising
10. Archaeological Planning and Research
11. Environmental Mitigation
12. Transportation Museums

Funds are allocated based on an equity formula approved by the Board of Transportation. The formula is applied at the county level and aggregated to the regional level. Available fund amount varies. In previous Calls, the funds available ranged from $10 million to $22 million.

The Call process takes place on even numbered years or as specified by the Secretary of Transportation. The next Call is anticipated to take place in 2008, barring financial constraints related to federal recisions resulting from the war on terror and Hurricane Katrina. For more information, visit www.ncdot.org/financial/fiscal/Enhancement/

BICYCLE AND PEDESTRIAN PLANNING GRANT INITIATIVE, MANAGED BY NCDOT, DBPT

To encourage the development of comprehensive local bicycle plans and pedestrian plans, the NCDOT Division of Bicycle and Pedestrian Transportation (DBPT) and the Transportation Planning Branch (TPB) have created a matching grant program to fund plan development. This program was initiated through a special allocation of funding approved by the North Carolina General Assembly in 2003 along with federal funds earmarked specifically for bicycle and pedestrian planning by the TPB. The planning grant program was launched in January 2004, and it is currently administered through NCDOT-DBPT and the Institute for Transportation Research and Education (ITRE) at NC State University. Over the past three grant cycles, 48 municipal plans have been selected and funded from 123 applicants. A total of $ 1,175,718 has been allocated. Funding is secured for 2007 at $400,000. Additional annual allocations will be sought for subsequent years. For more information, visit www.itre.ncsu.edu/ptg/bikeped/ncdot/index.html

SAFE ROUTES TO SCHOOL PROGRAM, MANAGED BY NCDOT, DBPT

The NCDOT Safe Routes to School Program is a federally funded program that was initiated by the passing of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) in 2005, which establishes a national SRTS program to distribute fund-

ing and institutional support to implement SRTS programs in states and communities across the country. SRTS programs facilitate the planning, development, and implementation of projects and activities that will improve safety and reduce traffic, fuel consumption, and air pollution in the vicinity of schools. The Division of Bicycle and Pedestrian Transportation at NCDOT is charged with disseminating SRTS funding.

The state of North Carolina has been allocated $15 million in Safe Routes to School funding for fiscal years 2005 through 2009 for infrastructure or non-infrastructure projects. All proposed projects must relate to increasing walking or biking to and from an elementary or middle school. An example of a non-infrastructure project is an education or encouragement program to improve rates of walking and biking to school. An example of an infrastructure project is construction of sidewalks around a school. Infrastructure improvements under this program must be made within 2 miles of an elementary or middle school. The state requires the completion of a competitive application to apply for funding. For more information, visit www.ncdot.org/programs/safeRoutes/ or contact NCDOT's Division of Bicycle and Pedestrian Transportation at (919) 807-0774.

THE NORTH CAROLINA CONSERVATION TAX CREDIT, MANAGED BY NCDENR

This program, managed by the North Carolina Department of Environment and Natural Resources, provides an incentive (in the form of an income tax credit) for landowners that donate interests in real property for conservation purposes. Property donations can be fee simple or in the form of conservation easements or bargain sale. The goal of this program is to manage stormwater, protect water supply watersheds, retain working farms and forests, and set-aside greenways for ecological communities, public trails, and wildlife corridors. For more information, visit www.enr.state.nc.us/conservationtaxcredit/.

LAND AND WATER CONSERVATION FUND (LWCF)

The Land and Water Conservation Fund (LWCF) program is a reimbursable, 50/50 matching grants program to states for conservation and recreation purposes, and through the states to local governments to address "close to home" outdoor recreation needs. LWCF grants can be used by communities to build a trail within one park site, if the local government has fee-simple title to the park site. Grants for a maximum of $250,000 in LWCF assistance are awarded yearly to county governments, incorporated municipalities, public authorities and federally recognized Indian tribes. The local match may be provided with in-kind services or cash. The program's funding comes primarily from offshore oil and gas drilling receipts, with an authorized expenditure of $900 million each year.

However, Congress generally appropriates only a small fraction of this amount. The allotted money for the year 2007 is $632,846.

The Land and Water Conservation Fund (LWCF) has historically been a primary funding source of the US Department of the Interior for outdoor recreation development and land acquisition by local governments and state agencies. In North Carolina, the program is administered by the Department of Environment and Natural Resources. Since 1965, the LWCF program has built a permanent park legacy for present and future generations. In North Carolina alone, the LWCF program has provided more than $63 million in matching grants to protect land and support more than 800 state and local park projects. More than 37,000 acres have been acquired with LWCF assistance to establish a park legacy in our state. For more information, visit http://ils.unc.edu/parkproject/lwcf/home1.html

NC ADOPT-A-TRAIL GRANT PROGRAM

This program, operated by the Trails Section of the NC Division of State Parks, offers annual grants to local governments to build, renovate, maintain, sign and map and create brochures for pedestrian trails. Grants are generally capped at about $5,000 per project and do not require a match. A total of $108,000 in Adopt-A-Trail money is awarded annually to government agencies. Applications are due during the month of February. For more information, visit http://ils.unc.edu/parkproject/trails/grant.html.

RECREATIONAL TRAILS PROGRAM

The Recreational Trails Program (RTP) is a grant program funded by Congress with money from the federal gas taxes paid on fuel used by off-highway vehicles. This program's intent is to meet the trail and trail-related recreational needs identified by the Statewide Comprehensive Outdoor Recreation Plan. Grant applicants must be able contribute 20% of the project cost with cash or in-kind contributions. The program is managed by the State Trails Program, which is a section of the N.C. Division of Parks and Recreation.

The grant application is available and instruction handbook is available through the State Trails Program website at http://ils.unc.edu/parkproject/trails/home.html. Applications are due during the month of February. For more information, call (919) 715-8699.

NORTH CAROLINA PARKS AND RECREATION TRUST FUND (PARTF)

The fund was established in 1994 by the North Carolina General Assembly and is administered by the Parks and Recreation Authority. Through this program, several million dollars each year are available to local governments to fund the acquisition, development and renovation of recreational areas. Applicable projects require a 50/50 match from the local government. Grants for a maximum of $500,000 are awarded yearly to county governments or incorporated municipalities. The fund is fueled by money from the state's portion of the real estate deed transfer tax for property sold in North Carolina.
The trust fund is allocated three ways:

- 65 percent to the state parks through the N.C. Division of Parks and Recreation.
- 30 percent as dollar-for dollar matching grants to local governments for park and recreation purposes.
- 5 percent for the Coastal and Estuarine Water Access Program.

For information on how to apply, visit www.partf.net/learn.html

POWELL BILL PROGRAM

Annually, State street-aid (Powell Bill) allocations are made to incorporated municipalities which establish their eligibility and qualify as provided by statute. This program is a state grant to municipalities for the purposes of maintaining, repairing, constructing, reconstructing or widening of local streets that are the responsibility of the municipalities or for planning, construction, and maintenance of bikeways or sidewalks along public streets and highways. Funding for this program is collected from fuel taxes. Amount of funds are based on population and mileage of town-maintained streets. For more information, visit www.ncdot.org/financial/fiscal/ExtAditBranch/Powell_Bill/powellbill.html.

CLEAN WATER MANAGEMENT TRUST FUND

This fund was established in 1996 and has become one of the largest sources of money in North Carolina for land and water protection. At the end of each fiscal year, 6.5 percent of the unreserved credit balance in North Carolina's General Fund, or a minimum of $30 million, is placed in the CWMTF. The revenue of this fund is allocated as grants to local governments, state agencies andconservation non-profits to help finance projects that specifically address water pollution problems. CWMTF

funds may be used to establish a network of riparian buffers and greenways for environmental, educational, and recreational benefits. The fund has provided funding for land acquisition of numerous greenway projects featuring trails, both paved and unpaved. For a history of awarded grants in North Carolina and more information about this fund and applications, visit www.cwmtf.net/.

NATURAL HERITAGE TRUST FUND

This trust fund, managed by the NC Natural Heritage Program, has contributed millions of dollars to support the conservation of North Carolina's most significant natural areas and cultural heritage sites. The NHTF is used to acquire and protect land that has significant habitat value. Some large wetland areas may also qualify, depending on their biological integrity and characteristics. Only certain state agencies are eligible to apply for this fund, including the Department of Environment and Natural Resources, the Wildlife Resources Commission, the Department of Cultural Resources and the Department of Agriculture and Consumer Services. As such, municipalities must work with State level partners to access this fund. Additional information is available from the NC Natural Heritage Program. For more information and grant application information, visit www.ncnhtf.org/.

NORTH CAROLINA CONSERVATION TAX CREDIT PROGRAM

North Carolina has a unique incentive program to assist land-owners to protect the environment and the quality of life. A credit is allowed against individual and corporate income taxes when real property is donated for conservation purposes. Interests in property that promote specific public benefits may be donated to a qualified recipient. Such conservation donations qualify for a substantial tax credit. For more information, visit www.enr.state.nc.us/conservationtaxcredit/.

URBAN AND COMMUNITY FORESTRY ASSISTANCE PROGRAM

This program offers small grants that can be used to plant urban trees, establish a community arboretum, or other programs that promote tree canopy in urban areas. The program operates as a cooperative partnership between the NC Division of Forest Resources and the USDA Forest Service, Southern Region. To qualify for this program, a community must pledge to develop a street-tree inventory, a municipal tree ordinance, a tree commission, and an urban forestry-management plan. All of these can be funded through the program. For more information, contact the

NC Division of Forest Resources. For more information and a grant application, contact the NC Division of Forest Resources and/or visit www.dfr.state.nc.us/urban/urban_grantprogram.htm.

ECOSYSTEM ENHANCEMENT PROGRAM

Developed in 2003 as a new mechanism to facilitate improved mitigation projects for NC highways, this program offers funding for restoration projects and for protection projects that serve to enhance water quality and wildlife habitat in NC. Information on the program is available by contacting the Natural Heritage Program in the NC Department of Environment and Natural Resources (NCDENR). For more information, visit www.nceep.net/pages/partners.html or call 919-715-0476.

CONSERVATION RESERVE ENHANCEMENT PROGRAM (CREP)

This program is a joint effort of the North Carolina Division of Soil and Water Conservation, the NC Clean Water Management Trust Fund, the Ecosystem Enhancement Program (EEP), and the Farm Service Agency - United States Department of Agriculture (USDA) to address water quality problems of the Neuse, Tar-Pamlico and Chowan river basins as well as the Jordan Lake watershed area.

CREP is a voluntary program that seeks to protect land along watercourses that is currently in agricultural production. The objectives of the program include: installing 100,000 acres of forested riparian buffers, grassed filter strips and wetlands; reducing the impacts of sediment and nutrients within the targeted area; and providing substantial ecological benefits for many wildlife species that are declining in part as a result of habitat loss. Program funding will combine the Federal Conservation Reserve Program (CRP) funding with State funding from the Clean Water Management Trust Fund, Agriculture Cost Share Program, and North Carolina Wetlands Restoration Program.

The program is managed by the NC Division of Soil and Water Conservation. For more information, visit www.enr.state.nc.us/dswc/pages/crep.html

AGRICULTURE COST SHARE PROGRAM

Established in 1984, this program assists farmers with the cost of installing best management practices (BMPs) that benefit water quality. The program covers as much as 75 percent of the costs to implement BMPs. The NC Division of Soil and Water Conservation within the NC Depart-

ment of Environment and Natural Resources administers this program through local Soil and Water Conservation Districts (SWCD). For more information, visit www.enr.state.nc.us/DSWC/pages/agcostshareprogram.html or call 919-733-2302.

WATER RESOURCES DEVELOPMENT GRANT PROGRAM

The NC Division of Water Resources offers cost-sharing grants to local governments on projects related to water resources. Of the seven project application categories available, the category which relates to the establishment of greenways is "Land Acquisition and Facility Development for Water-Based Recreation Projects." Applicants may apply for funding for a greenway as long as the greenway is in close proximity to a water body. For more information, see www.ncwater.org/Financial_Assistance or call 919-733-4064.

SMALL CITIES COMMUNITY DEVELOPMENT BLOCK GRANTS

State level funds are allocated through the NC Department of Commerce, Division of Community Assistance to be used to promote economic development and to serve low-income and moderate-income neighborhoods. Greenways that are part of a community's economic development plans may qualify for assistance under this program. Recreational areas that serve to improve the quality of life in lower income areas may also qualify. Approximately $50 million is available statewide to fund a variety of projects. For more information, visit www.hud.gov/offices/cpd/communitydevelopment/programs/stateadmin/ or call 919-733-2853.

NORTH CAROLINA HEALTH AND WELLNESS TRUST FUND

The NC Health and Wellness Trust Fund was created by the General Assembly as one of 3 entities to invest North Carolina's portion of the Tobacco Master Settlement Agreement. HWTF receives one-fourth of the state's tobacco settlement funds, which are paid in annual installments over a 25-year period.

Fit Together, a partnership of the NC Health and Wellness Trust Fund (HWTF) and Blue Cross and Blue Shield of North Carolina (BCBSNC) announces the establishment of Fit Community, a designation and grant program that recognizes and rewards North Carolina communities' efforts to support physical activity and healthy eating initiatives, as well as tobacco-free school environments. Fit Community is one component of the jointly sponsoredFit Together initiative, a statewide prevention

campaign designed to raise awareness about obesity and to equip individuals, families and communities with the tools they need to address this important issue.

All North Carolina municipalities and counties are eligible to apply for a Fit Community designation, which will be awarded to those that have excelled in supporting the following:

- physical activity in the community, schools, and workplaces
- healthy eating in the community, schools, workplaces
- tobacco use prevention efforts in schools

Designations will be valid for two years, and designated communities may have the opportunity to reapply for subsequent two-year extensions. The benefits of being a Fit Community include:

- Heightened statewide attention that can help bolster local community development and/or economic investment initiatives (highway signage and a plaque for the Mayor's or County Commission Chair's office will be provided)
- Reinvigoration of a community's sense of civic pride (each Fit Community will serve as a model for other communities that are trying to achieve similar goals)
- Use of the Fit Community designation logo for promotional and communication purposes. The application for Fit Community designation is available on the Fit Together Web site: www.FitTogetherNC.org/FitCommunity.aspx.

Fit Community grants are designed to support innovative strategies that help a community meet its goal to becoming a Fit Community. Eight to nine, two-year grants of up to $30,000 annually will be awarded to applicants that have a demonstrated need, proven capacity, and opportunity for positive change in addressing physical activity and/or healthy eating. For more information, visit www.healthwellnc.com/

EAT SMART, MOVE MORE NC COMMUNITY GRANTS

The Eat Smart, Move More (ESMM) NC Community Grants program provides funding to local communities to implement strategies that advance the goals and objectives of the ESMM NC Plan. These goals include increasing physical activity opportunities and increasing the number of citizens who get the recommended amount of physical activity. Administered by the Physical Activity and Nutrition branch of the Divi-

sion of Public Health, the program awards $10,000 - 20,000 to local communities each year. Interested applicants must submit a letter of intent in late June and an application in mid-July. For more information, visit www.eatsmartmovemorenc.com/funding/index.html.

THE NORTH CAROLINA DIVISION OF FOREST RESOURCES

Urban and Community Forestry Grant can provide funding for a variety of projects that will help toward planning and establishing street trees as well as trees for urban open space. See www.dfr.state.nc.us/urban/urban_ideas.htm

FUNDING ALLOCATED BY FEDERAL AGENCIES

WETLANDS RESERVE PROGRAM

This federal funding source is a voluntary program offering technical and financial assistance to landowners who want to restore and protect wetland areas for water quality and wildlife habitat. The US Department of Agriculture's Natural Resource Conservation Service (USDA-NRCS) administers the program and provides direct payments to private landowners who agree to place sensitive wetlands under permanent easements. This program can be used to fund the protection of open space and greenways within riparian corridors. For more information, visit http://www.nrcs.usda.gov/PROGRAMS/wrp/.

THE COMMUNITY DEVELOPMENT BLOCK GRANT (HUD-CDBG)

The U.S. Department of Housing and Urban Development (HUD) offers financial grants to communities for neighborhood revitalization, economic development, and improvements to community facilities and services, especially in low and moderate income areas. Several communities have used HUD funds to develop greenways, including the Boulding Branch Greenway in High Point, North Carolina. Grants from this program range from $50,000 to $200,000 and are either made to municipalities or non-profits. There is no formal application process. For more information, visit www.hud.gov/offices/cpd/communitydevelopment/programs/.

USDA RURAL BUSINESS ENTERPRISE GRANTS

Public and private nonprofit groups in communities with populations under 50,000 are eligible to apply for grant assistance to help their local small business environment. $1 million is available for North Carolina on an annual basis and may be used for sidewalk and other community

facilities. For more information from the local USDA Service Center, visit www.rurdev.usda.gov/rbs/busp/rbeg.htm

RIVERS TRAILS AND CONSERVATION ASSISTANCE PROGRAM (RTCA)

The Rivers, Trails, and Conservation Assistance Program, also known as the Rivers & Trails Program or RTCA, is the community assistance arm of the National Park Service. RTCA staff provide technical assistance to community groups and local, State, and federal government agencies so they can conserve rivers, preserve open space, and develop trails and greenways. The RTCA program implements the natural resource conservation and outdoor recreation mission of the National Park Service in communities across America.

PUBLIC LANDS HIGHWAYS DISCRETIONARY FUND

The Federal Highway Administration administers discretionary funding for projects that will reduce congestion and improve air quality. The FHWA issues a call for projects to disseminate this funding. The FHWA estimates that the PLHD funding for the 2007 call will be $85 million. In the past, Congress has earmarked a portion of the total available funding for projects. For information on how to apply, visit http://www.fhwa.dot.gov/discretionary/

LOCAL FUNDING SOURCES

Municipalities often plan for the funding of pedestrian facilities or improvements through development of Capital Improvement Programs (CIP). In Raleigh, for example, the greenways system has been developed over many years through a dedicated source of annual funding that has ranged from $100,000 to $500,000, administered through the Recreation and Parks Department. CIPs should include all types of capital improvements (water, sewer, buildings, streets, etc.) versus programs for single purposes. This allows municipal decision-makers to balance all capital needs. Typical capital funding mechanisms include the following: capital reserve fund, capital protection ordinances, municipal service district, tax increment financing, taxes, fees, and bonds. Each of these categories are described below.

CAPITAL RESERVE FUND

Municipalities have statutory authority to create capital reserve funds for any capital purpose, including pedestrian facilities. The reserve fund must be created through ordinance or resolution that states the purpose of the fund, the duration of the fund, the approximate amount of the

fund, and the source of revenue for the fund. Sources of revenue can include general fund allocations, fund balance allocations, grants and donations for the specified use.

CAPITAL PROJECT ORDINANCES

Municipalities can pass Capital Project Ordinances that are project specific. The ordinance identifies and makes appropriations for the project.

MUNICIPAL SERVICE DISTRICT

Municipalities have statutory authority to establish municipal service districts, to levy a property tax in the district additional to the citywide property tax, and to use the proceeds to provide services in the district. Downtown revitalization projects are one of the eligible uses of service districts.

TAX INCREMENT FINANCING

Tax increment financing is a tool to use future gains in taxes to finance the current improvements that will create those gains. When a public project, such as the construction of a greenway, is carried out, there is an increase in the value of surrounding real estate. Oftentimes, new investment in the area follows such a project. This increase sit value and investment creates more taxable property, which increases tax revenues. These increased revenues can be referred to as the "tax increment." Tax Increment Financing dedicates that increased revenue to finance debt issued to pay for the project. TIF is designed to channel funding toward improvements in distressed or underdeveloped areas where development would not otherwise occur. TIF creates funding for public projects that may otherwise be unaffordable to localities. The large majority of states have enabling legislation for tax increment financing.

INSTALLMENT PURCHASE FINANCING

As an alternative to debt financing of capital improvements, communities can execute installment/ lease purchase contracts for improvements. This type of financing is typically used for relatively small projects that the seller or a financial institution is willing to finance or when up-front funds are unavailable. In a lease purchase contract the community leases the property or improvement from the seller or financial institution. The lease is paid in installments that include principal, interest, and associated costs. Upon completion of the lease period, the community owns the property or improvement. While lease purchase contracts are similar to a bond, this arrangement allows the community to acquire the property or improvement without issuing debt. These instruments, however, are more costly than issuing debt.

TAXES

Many communities have raised money through self-imposed increases in taxes and bonds. For example, Pinellas County residents in Florida voted to adopt a one-cent sales tax increase, which provided an additional $5 million for the development of the overwhelmingly popular Pinellas Trail. Sales taxes have also been used in Allegheny County, Pennsylvania, and in Boulder, Colorado to fund open space projects. A gas tax is another method used by some municipalities to fund public improvements. A number of taxes provide direct or indirect funding for the operations of local governments. Some of them are:

Sales Tax

In North Carolina, the state has authorized a sales tax at the state and county levels. Local governments that choose to exercise the local option sales tax (all counties currently do), use the tax revenues to provide funding for a wide variety of projects and activities. Any increase in the sales tax, even if applying to a single county, must gain approval of the state legislature.

Property Tax

Property taxes generally support a significant portion of a municipality's activities. However, the revenues from property taxes can also be used to pay debt service on general obligation bonds issued to finance greenway system acquisitions. Because of limits imposed on tax rates, use of property taxes to fund greenways could limit the municipality's ability to raise funds for other activities. Property taxes can provide a steady stream of financing while broadly distributing the tax burden. In other parts of the country, this mechanism has been popular with voters as long as the increase is restricted to parks and open space. Note, other public agencies compete vigorously for these funds, and taxpayers are generally concerned about high property tax rates.

Excise Taxes

Excise taxes are taxes on specific goods and services. These taxes require special legislation and the use of the funds generated through the tax are limited to specific uses. Examples include lodging, food, and beverage taxes that generate funds for promotion of tourism, and the gas tax that generates revenues
for transportation related activities.

Occupancy Tax

The NC General Assembly may grant towns the authority to levy occupancy tax on hotel and motel rooms. The act granting the taxing authority limits the use of the proceeds, usually for tourism-promotion purposes.

FEES

Three fee options that have been used by local governments to assist in funding pedestrian and bicycle facilities are listed here:

Stormwater Utility Fees

Greenway sections may be purchased with stormwater fees, if the property in question is used to mitigate floodwater or filter pollutants.

Stormwater charges are typically based on an estimate of the amount of impervious surface on a user's property. Impervious surfaces (such as rooftops and paved areas) increase both the amount and rate of stormwater runoff compared to natural conditions. Such surfaces cause runoff that directly or indirectly discharge into public storm drainage facilities and creates a need for stormwater management services. Thus, users with more impervious surface are charged more for stormwater service than users with less impervious surface. The rates, fees, and charges collected for stormwater management services may not exceed the costs incurred to provide these services. The costs that may be recovered through the stormwater rates, fees, and charges includes any costs necessary to assure that all aspects of stormwater quality and quantity are managed in accordance with federal and state laws, regulations, and rules.

Streetscape Utility Fees

Streetscape Utility Fees could help support streetscape maintenance of the area between the curb and the property line through a flat monthly fee per residential dwelling unit. Discounts would be available for senior and disabled citizens. Non-residential customers would be charged a per foot fee based on the length of frontage on streetscape improvements. This amount could be capped for non-residential customers with extremely large amounts of street frontage. The revenues raised from Streetscape Utility fees would be limited by ordinance to maintenance (or construction and maintenance) activities in support of the streetscape.

Impact Fees

Developers can be required to provide greenway impact fees through local enabling legislation. Impact fees, which are also known as capital contributions, facilities fees, or system development charges, are typically collected from developers or property owners at the time of building permit issuance to pay for capital improvements that provide capacity to serve new growth. The intent of these fees is to avoid burdening existing customers with the costs of providing capacity to serve new growth ("growth pays its own way"). Greenway impact fees are designed to reflect

the costs incurred to provide sufficient capacity in the system to meet the additional needs of a growing community. These charges are set in a fee schedule applied uniformly to all new development. Communities that institute impact fees must develop a sound financial model that enables policy makers to justify fee levels for different user groups, and to ensure that revenues generated meet (but do not exceed) the needs of development. Factors used to determine an appropriate impact fee amount can include: lot size, number of occupants, and types of subdivision improvements. If Wake Forest is interested in pursuing open space impact fees, it will require enabling legislation to authorize the collection of the fees.

Exactions

Exactions are similar to impact fees in that they provide facilities to growing communities. The difference is that through exactions it can be established that it is the responsibility of the developer to build the greenway or pedestrian facility that crosses through the property, or adjacent to the property being developed.

In-Lieu-Of Fees

As an alternative to requiring developers to dedicate on-site greenway sections that would serve their development, some communities provide a choice of paying a front-end charge for off-site protection of pieces of the larger system. Payment is generally a condition of development approval and recovers the cost of the off-site land acquisition or the development's proportionate share of the cost of a regional facility serving a larger area. Some communities prefer in-lieu-of fees. This alternative allows community staff to purchase land worthy of protection rather than accept marginal land that meets the quantitative requirements of a developer dedication but falls a bit short of qualitative interests.

BONDS AND LOANS

Bonds have been a very popular way for communities across the country to finance their pedestrian and greenway projects. A number of bond options are listed below. Contracting with a private consultant to assist with this program may be advisable. Since bonds rely on the support of the voting population, an education and awareness program should be implemented prior to any vote. Billings, Montana used the issuance of a bond in the amount of $599,000 to provide the matching funds for several of their TEA-21 enhancement dollars. Austin, Texas has also used bond issues to fund a portion of their bicycle and trail system.

Revenue Bonds

Revenue bonds are bonds that are secured by a pledge of the revenues from a certain local government activity. The entity issuing bonds, pledges to generate sufficient revenue annually to cover the program's operating costs, plus meet the annual debt service requirements (principal and interest payment). Revenue bonds are not constrained by the debt ceilings of general obligation bonds, but they are generally more expensive than general obligation bonds.

General Obligation Bonds

Cities, counties, and service districts generally are able to issue general obligation (G.O.) bonds that are secured by the full faith and credit of the entity. In this case, the local government issuing the bonds pledges to raise its property taxes, or use any other sources of revenue, to generate sufficient revenues to make the debt service payments on the bonds. A general obligation pledge is stronger than a revenue pledge, and thus may carry a lower interest rate than a revenue bond. Frequently, when local governments issue G.O. bonds for public enterprise improvements, the public enterprise will make the debt service payments on the G.O. bonds with revenues generated through the public entity's rates and charges. However, if those rate revenues are insufficient to make the debt payment, the local government is obligated to raise taxes or use other sources of revenue to make the payments. G.O. bonds distribute the costs of land acquisition and greenway development and make funds available for immediate purchases and projects. Voter approval is required.

Special Assessment Bonds

Special assessment bonds are secured by a lien on the property that benefits by the improvements funded with the special assessment bond proceeds. Debt service payments on these bonds are funded through annual assessments to the property owners in the assessment area.

State Revolving Fund (SRF) Loans

Initially funded with federal and state money, and continued by funds generated by repayment of earlier loans, State Revolving Funds (SRFs) provide low interest loans for local governments to fund water pollution control and water supply related projects including many watershed management activities. These loans typically require a revenue pledge, like a revenue bond, but carry a below market interest rate and limited term for debt repayment (20 years).

OTHER LOCAL OPTIONS

FACILITY MAINTENANCE DISTRICTS

Facility Maintenance Districts (FMDs) can be created to pay for the costs of on-going maintenance of public facilities and landscaping within the areas of the Town where improvements have been concentrated and where their benefits most directly benefit business and institutional property owners. An FMD is needed in order to assure a sustainable maintenance program. Fees may be based upon the length of lot frontage along streets where improvements have been installed, or upon other factors such as the size of the parcel. The program supported by the FMD should include regular maintenance of streetscape of off road trail improvements. The municipality can initiate public outreach efforts to merchants, the Chamber of Commerce, and property owners. In these meetings, Town staff will discuss the proposed apportionment and allocation methodology and will explore implementation strategies.

The municipality can manage maintenance responsibilities either through its own staff or through private contractors.

PARTNERSHIPS

Another method of funding facilities is to partner with public agencies and private companies and organizations. Partnerships engender a spirit of cooperation, civic pride and community participation. The key to the involvement of private partners is to make a compelling argument for their participation. Very specific routes that make critical connections to place of business would be targeted for private partners' monetary support following a successful master planning effort. Potential partners include major employers which are located along or accessible to pedestrian facilities such as multi-use paths or greenways. Name recognition for corporate partnerships would be accomplished through signage trail heads or interpretive signage along greenway systems. Utilities often make good partners and many trails now share corridors with them. Money raised from providing an easement to utilities can help defray the costs of maintenance. It is important to have a lawyer review the legal agreement and verify ownership of the subsurface, surface or air rights in order to enter into an agreement.

LOCAL TRAIL SPONSORS

A sponsorship program for trail amenities allows smaller donations to be received from both individuals and businesses. Cash donations could be placed into a trust fund to be accessed for certain construction or acquisition projects associated with the greenways and open space system.

Some recognition of the donors is appropriate and can be accomplished through the placement of a plaque, the naming of a trail segment, and/or special recognition at an opening ceremony. Types of gifts other than cash could include donations of services, equipment, labor, or reduced costs for supplies.

VOLUNTEER WORK

It is expected that many citizens will be excited about the development of a greenway corridor. Individual volunteers from the community can be brought together with groups of volunteers form church groups, civic groups, scout troops and environmental groups to work on greenway development on special community work days. Volunteers can also be used for fund-raising, maintenance, and programming needs. The Town of Wake Forest's Greenway Advisory Board (GAB) could initiate and/or lead these types of efforts.

PRIVATE FOUNDATIONS AND ORGANIZATIONS

Many communities have solicited greenway funding assistance from private foundations and other conservation-minded benefactors. Below are a few examples of private funding opportunities available in North Carolina.

LAND FOR TOMORROW CAMPAIGN

Land for Tomorrow is a diverse partnership of businesses, conservationists, farmers, environmental groups, health professionals and community groups committed to securing support from the public and General Assembly for protecting land, water and historic places. The campaign is asking the North Carolina General Assembly to support issuance of a bond for $200 million a year for five years to preserve and protect its special land and water resources. Land for Tomorrow will enable North Carolina to reach a goal of ensuring that working farms and forests; sanctuaries for wildlife; land bordering streams, parks and greenways; land that helps strengthen communities and promotes job growth; historic downtowns and neighborhoods; and more, will be there to enhance the quality of life for generations to come. For more information, visit www.landfortomorrow.org/

THE TRUST FOR PUBLIC LAND

Land conservation is central to the mission of the Trust for Public Land (TPL). Founded in 1972, the Trust for Public Land is the only national nonprofit working exclusively to protect land for human enjoyment and well being. TPL helps conserve land for recreation and spiritual nourishment and to improve the health and quality of life of American communities. TPL's legal and real estate specialists work with landowners,

government agencies, and community groups to:

- Create urban parks, gardens, greenways, riverways
- Build livable communities by setting aside open space in the path of growth
- Conserve land for watershed protection, scenic beauty, and close-to home recreation safeguard the character of communities by preserving historic landmarks and landscapes.

The following are TPL's Conservation Services:

- Conservation Vision: TPL helps agencies and communities define conservation priorities, identify lands to be protected, and plan networks of conserved land that meet public need.
- Conservation Finance: TPL helps agencies and communities identify and raise funds for conservation from federal, state, local, and philanthropic sources.
- Conservation Transactions: TPL helps structure, negotiate, and complete land transactions that create parks, playgrounds, and protected natural areas.
- Research and Education: TPL acquires and shares knowledge of conservation issues and techniques to improve the practice of conservation and promote its public benefits.

Since 1972, TPL has worked with willing landowners, community groups, and national, state, and local agencies to complete more than 3,000 land conservation projects in 46 states, protecting more than 2 million acres. Since 1994, TPL has helped states and communities craft and pass over 330 ballot measures, generating almost $25 billion in new conservation-related funding. For more information, visit www.tpl.org/.

Z. SMITH REYNOLDS FOUNDATION

This Winston-Salem based Foundation has been assisting the environmental projects of local governments and non-profits in North Carolina for many years. The foundation has two grant cycles per year and generally does not fund land acquisition. However, the foundation may be able to support municipalities in other areas of greenways development. More information is available at www.zsr.org.

NORTH CAROLINA COMMUNITY FOUNDATION

The North Carolina Community Foundation, established in 1988, is a statewide foundation seeking gifts from individuals, corporations, and other foundations to build endowments and ensure financial security for nonprofit organizations and institutions throughout the state. Based in Raleigh, North Carolina, the foundation also manages a number of com-

munity affiliates throughout North Carolina that make grants in the areas of human services, education, health, arts, religion, civic affairs, and the conservation and preservation of historical, cultural, and environmental resources. In addition, the foundation manages various scholarship programs statewide. Web site: http://nccommunityfoundation.org/

NATIONAL TRAILS FUND

In 1998, the American Hiking Society created the National Trails Fund, the only privately supported national grants program providing funding to grassroots organizations working toward establishing, protecting and maintaining foot trails in America. Each year, 73 million people enjoy foot trails, yet many of our favorite trails need major repairs due to a $200 million in badly needed maintenance. National Trails Fund grants give local organizations the resources they need to secure access, volunteers, tools and materials to protect America's cherished public trails. For 2005, American Hiking distributed over $40,000 in grants thanks to the generous support of Cascade Designs and L.L.Bean, the program's Charter Sponsors. To date, American Hiking has granted nearly $382,000 to 105 different trail projects across the U.S. for land acquisition, constituency building campaigns, and a variety of trail work projects. Awards typically range from $500 to $5,000 per project.

What types of projects will American Hiking Society consider? Securing trail lands, including acquisition of trails and trail corridors, and the costs associated with acquiring conservation easements. Building and maintaining trails which will result in visible and substantial ease of access, improved hiker safety, and/or avoidance of environmental damage. Constituency building surrounding specific trail projects - including volunteer recruitment and support. Web site: www.americanhiking.org/NTF.aspx

ANNUAL AZALEA CELEBRATION

Each year, NC Beautiful and sponsor WRAL-TV 5 partner together to make thousands of azalea plants available to non-profit organizations who wish to beautify their grounds. To date, close to 200,000 plants have been awarded to over 2,500 non-profit organizations statewide. Last year, NC Beautiful distributed over 13,000 azaleas to 144 non-profits. Azaleas from the Celebration now enhance the beauty of hundreds of acres on the grounds of schools, churches, parks, greenways, public rights-of-way, and community and senior centers across North Carolina. Applications for non-profit organizations that could benefit from 100 azaleas are available in June. Applications must be postmarked by September 10, 2008. For more information, visit www.ncbeautiful.org/programs/celebration.html.

D: Operations, Maintenance & Management

Sanford Creek Greenway

Chapter Outline:

Overview

Greenway Facility Safety and Security

Routine and Remedial Operations

Routine and Remedial Maintenance

Administration and Responsibilities

Cost of the Operations & Maintenance Program

Funding the Operations & Maintenance Program

Operations and Maintenance Resources for Conflict Resolution

OVERVIEW

Operations and maintenance refers to specific day-to-day tasks and programs performed to assure resources and facilities are kept in good, safe, usable condition. This begins with sound design, durable components, and a comprehensive management plan. A management plan should be embraced by the entities responsible for maintaining the greenway and trail network, at the beginning of the implementation process. In addition, community groups, residents, business owners, developers and other stakeholders should be engaged in the long term stewardship of the resources preserved and enhanced by this plan as discussed later in this chapter.

GUIDING PRINCIPLES FOR EFFECTIVE OPERATIONS AND MAINTENANCE

The Wake Forest greenway and trail system should be viewed and maintained as a public resource. Indeed it will become infrastructure similar to the street system or utility networks, serving the community for generations to come. The following guiding principles will help assure the preservation of a first class system:

- Good maintenance begins with sound planning and design
- Foremost, protect life, property and the environment
- Promote and maintain a quality outdoor recreation and transportation experience
- Develop a management plan that is reviewed and updated annually with tasks, operational policies, standards, and routine and remedial maintenance goals
- Maintain quality control and conduct regular inspections
- Include field crews, police and fire/rescue personnel in both the design review and on-going management process
- Maintain an effective, responsive public feedback system and promote public participation

- Be a good neighbor to adjacent properties
- Operate a cost-effective program with sustainable funding sources

RESOURCE STEWARDSHIP AND ENHANCEMENT

A well-managed greenway and trail system is critical to the long-term success of this Plan. This involves stewardship, the oversight of resources, and operations and maintenance. Stewardship might range from cleaning up litter to assuring that a project does not visually scar the surrounding landscape.

The stewardship process must consider both private sector- such as land subdivision and development- and public sector activities- such as the construction of roads and utilities. In pursuit of this, coordination among agencies at the local, regional, state, and federal level is vital to assure that these activities are supportive of the plan and complementary to each other. Long term stewardship also calls for the enduring commitment of agency staff, elected officials and concerned citizens all working together. This suggests the need for a shared community vision and value system centered on the protection of greenway, trail, bicycle, pedestrian, and outdoor recreational resources. This plan and similar plans can help coordinate and guide that action.

GREENWAY FACILITY SAFETY AND SECURITY

Safety is a duty and obligation of all public facility managers. Therefore, as the construction documents for the Wake Forest greenway are completed, appropriate local, state, and federal agencies should review these plans and specifications to ensure that they meet all existing regulations.

In order to provide reasonable and ordinary safety measures, Wake Forest should develop and implement a Safety and Security Program. This program should consist of well-defined safety and security policies; the identification of trail management, law enforcement, emergency and fire protection policies; and a system that offers timely response to the public for issues or problems related to safety and security. The Town will need to implement internal coordination for safety and security between Parks and Recreation, Police, Fire, Public Works, and Administration Departments. Additionally, procedures and policies should be established for external coordination among the Town, local alliances, local neighborhood watch associations, and “Adopt-a-Greenway” organizations. Important components of the Safety and Security Program should include:

1. Establishment of a safety committee or coordinator
2. Preparation of a trail safety manual for employees and agencies
3. Establishment of user rules and regulations
4. Development of greenway and trails emergency procedures
5. Preparation of a safety checklist for the trail
6. Preparation of a trail user response form
7. A system for accident reporting and analysis
8. Regular maintenance and inspection program
9. Site and facility development and review
10. Public information program
11. Employee training program for safety and emergency response
12. Ongoing research and evaluation of program objectives

RISK MANAGEMENT AND LIABILITY

The design, development, management, and operation of the Wake Forest greenway must be carefully and accurately executed in order to provide a resource that protects the health, welfare, and safety of the public.

Liability most often occurs when a facility has been under-designed for the intended volume of use, when management of the facility is poor, or when unexpected accidents occur because the trail manager failed to recognize the possibilities of a potentially hazardous situation. To reduce the exposure to liability, the Town should have in place the following measures prior to opening the first phase of the trail:

1. A complete maintenance program that provides the appropriate duty or level of care to trail users;
2. A risk management plan that appropriately covers all aspects of the trail
3. A comprehensive working knowledge of public use laws and recent case history applicable in North Carolina

Public use of the Wake Forest greenway should be covered under existing municipal policies for the use of parkland and public spaces. The Wake Forest greenway is available for public use as defined by the Hours of Operation Policy (described below); therefore, any individual found using the trail outside the normal hours of operation would be treated as a trespasser and would not be covered by the municipal insurance policies for public use.

The Town should exercise reasonable care in the construction of all trail facilities to reduce hazardous, public nuisance and life threatening situations. Once the trail is open for use, liability can be further reduced by adopting the following practices:

- Posting and enforcement of trail regulations.
- Regular inspection of the trail by a person qualified to identify hazardous conditions and maintenance problems.
- Timely correction and documentation (e.g., notes, photographs) of maintenance problems. When a problem cannot be promptly corrected, warnings to trail users should be erected.
- Maintenance of inspection records including findings and responses.
- Development of procedures for handling medical emergencies and documentation of their occurrence.

These risk management techniques will not only help to ensure that hazardous conditions are identified and corrected in a timely manner, thereby averting injury to trail users, but will also serve to protect the Town from liability. Showing that the Town had been acting in a responsible manner can serve as an excellent defense in the event that a lawsuit develops (BCEMC 1997, p. 58).

For more information on trail-related liability laws, risk management techniques, and special risk situations, refer to the Rails-to-Trails Conservancy report "Rails-with-Trails: Design, Management, and Operating Characteristics of 61 Trails Along Active Rail Lines" (2000).

HOURS OF OPERATION

The consultant recommends that the Wake Forest greenway be operated like all other non-lighted public parks and recreation facilities open for public use from dawn to dusk, 365 days a year, except as specifically designated by the local Parks and Recreation Department. Individuals who are found using these facilities after dusk and before dawn should be deemed in violation of this policy and subject to fines and/or prosecution. Additionally, trail segments should not be considered officially opened for public use until a formal dedication ceremony and authorized agents of the Town have completed an official opening. Individuals who use greenway segments that are under construction, without written permission from an authorized agent, should also be deemed in violation of the Wake Forest greenway Hours of Operation policy.

TRAIL USER RULES AND REGULATIONS

One of the emerging safety issues in greenway trail planning, design, and development is multi-user conflict. Typically, these conflicts are caused by overuse of a trail. However, other factors may be lead to user conflicts and problems including poorly designed and engineered trail alignments, inappropriate user behavior, or inadequate facility capacity. The

most effective trail use management plan is a well-conceived safety program that provides the individual user with a Code of Conduct for the trail, sometimes called a Trail Ordinance. Several multi-use trail systems across the United States have adopted progressive ordinances for public use. The consultant recommends that the following Rules and Regulations be implemented for the Wake Forest greenway. These rules should be displayed in both brochures and on information signs throughout the trail. The consultant recommends that these rules and regulations be reviewed by the appropriate authorities and legally adopted by the Town.

1. Be Courteous: All trail users, including bicyclists, joggers, walkers, wheelchairs, skateboarders and skaters, should be respectful of other users regardless of their mode of travel, speed, or level of skill. Never spook animals like horses and dogs - talk to them in a calm voice as you approach. Respect the privacy of adjacent landowners.
2. Keep Right: Always stay to the right as you use the trail, or stay in the lane that has been designated for your user group. The exception to this rule occurs when you need to pass another user.
3. Pass on the Left: Pass others going in your direction on their left. Look ahead and behind to make sure that your lane is clear before you pull out an around the other user. Pass with ample separation. Do not move back to the right until you have safely gained distance and speed on the other user. Faster traffic should always yield to slower and oncoming traffic.
4. Give Audible Signal When Passing: All users should give a clear warning signal before passing. This signal may be produced by voice, bell, or soft horn. Voice signals might include "Passing on the Left!" or "Cyclist on the left!" Always be courteous when providing the audible signal- profanity is unacceptable.
5. Be Predictable: Travel in a consistent and predictable manner. Always look behind before changing position on the trail, regardless of your mode of travel.
6. Control Your Bicycle: Inattention, even for a second can cause disaster- always stay alert! Maintain a safe and legal speed at all times.
7. Don't Block the Trail: When in a group, including your pets, use no more than half the trailway, so as not to block the flow of other users. If users approach your group from both directions, form a single line, or stop and move to the far right edge of the trail to allow safe passage by these users.
8. Yield when entering or Crossing Trails: When entering or crossing a trail at uncontrolled intersections, yield to traffic already using the other trail.

9. The Use of Lights: When using a trail during periods of low visibility each cyclist should be equipped with proper lights. Cyclists should have a white light that is visible from five hundred feet to the front, and a red or amber light that is visible from five hundred feet to the rear. Other trail users should use white lights (bright flashlights) visible two hundred fifty feet to the front, and wear light or reflective clothing.
10. Don't Use this Trail Under the Influence of Alcohol or Drugs: It is illegal to use this trail if you have consumed alcohol in excess of the statutory limits, or if you have consumed illegal drugs. Persons who use a prescribed medication should check with their doctor or pharmacist to ensure that it will not impair their ability to safely operate a bicycle or other wheeled vehicle.
11. Clean up Your Litter: Please keep this trail clean and neat for other users to enjoy. Do not leave glass, paper, cans, or other debris on or near the trail. Please clean up after your pets. Pack out what you bring in- and remember to always recycle your trash.
12. Keep Pets on Leashes: All pets must be kept on a secure and tethered leash. Failure to do so will result in fines and possible detention of the pet.
13. Use the Buddy System: Use the trail system with a friend!
14. Trail Subject to Flash Flooding: Please be aware that the Wake Forest greenway is officially closed during times when floodwaters overflow the creek banks and cover the trail surface. For your personal safety, please be prepared to leave the trail immediately during periods of heavy rainfall.
15. Swimming Prohibited: Swimming is prohibited in creeks and tributary streams.
16. Vegetation Removal: It is illegal to remove vegetation of any type, size, or species from the trail. Please contact the Parks and Recreation Department or Planning and Inspections Department should you have concerns about noxious weeds, poisonous vegetation, dying or dead vegetation, or other concerns about vegetation growth in the greenway.
17. Share the Trail: Always exercise due care and caution when using the trail!

POLICE/PARK RANGER PATROL AND EMERGENCY RESPONSE SYSTEM

In order to provide effective patrol and emergency response to the needs of trail users and adjacent property owners, the consultant recommends that the Town Police and Parks and Recreation Departments work together, to develop a specific patrol and emergency response plan for the Wake Forest greenway. This plan should define a cooperative law enforce-

ment strategy for the trail based on the capabilities of different agencies and services typically required for the facility. There will be numerous phases of the trail until completion, each consultant as they are hired for each phase should be required to work with the designated departments to deliver a site plan that illustrates points of access to the trail; approved design details for making these access points safe, secure, and accessible to law enforcement officials; and potential locations for a system of cellular-type emergency phones. The consultant will also work with appropriate officials to locate other mechanisms or project elements that will aid local agencies in managing the trail in a safe and secure manner.

The Police and Parks and Recreation Departments should also define an emergency response system in conjunction with appropriate local fire stations and paramedic units that defines which agencies should respond to 911 calls, and provides easy-to-understand routing plans and access points for emergency vehicles. Local hospitals should be notified of these routes so that they may also be familiar with the size and scope of the project. The entire trail system will be designed and developed to support a minimum gross vehicle weight of 6.5 tons to allow emergency vehicle access.

At all public entrances to the Wake Forest greenway, appropriate signage should be installed to notify trail users of the potential for flash flooding and the need to quickly exit the trail during periods of heavy rainfall.

REFERENCES AND ADDITIONAL RESOURCES

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RTC, 2000. "Rails-with-Trails: Design, Management, and Operating Characteristics of 61 Trails Along Active Rail Lines." Rails-to-Trails Conservancy. Washington, D.C., 2000.

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ROUTINE AND REMEDIAL OPERATIONS

The following task lists describe the general routine and remedial operations responsibilities for all network facilities.

ROUTINE OPERATIONS DEFINED

Routine operations refer to the daily activities required to oversee a greenway and trail system.

Task: Inter-agency design review

Coordination between and commitment of agencies responsible for greenway facilities is crucial to complete the following routine maintenance tasks. In addition to department managers, planners, designers and engineers, police and fire/rescue, and field maintenance personnel should be consulted in the design and review process. The creation of a Greenway Committee (recommended in Chapter 4: Implementation) is recommended to carry out the following tasks.

- Establish a coordinating committee with representatives from each of the participating agencies and stakeholders
- Identify an entity to provide on-going oversight, coordination, and leadership for the overall network
- Review critical public and private sector projects that might impact

the greenway, bicycle, and pedestrian projects as they come on line
- Pursue grants and cooperative agreements
- Monitor operations and maintenance and other advocacy functions now and over the years to come.
- Review accident and crime reports and take the necessary up-front actions, on a case by case basis, to assure that greenway, bicycle, and pedestrian facilities do not deteriorate due to safety concerns, crime, or from fear of criminal activity

Task: Accurate and Organized Record Keeping

Good record-keeping techniques are essential to a comprehensive operations and maintenance program. This information can be used to eliminate overlap or gaps in maintenance services provided, identify levels of use, and prioritize management needs.

- Daily activities
- Schedule of routine (and remedial) maintenance tasks
- Hazards, incidents, safety issues observed and action taken
- Inspection reports
- Annual maintenance budget, pursuing various funding sources
- Projected costs for subsequent years (short-, medium-, and long-term) to reflect on project prioritization as shown in Chapter 4: Implementation
- Internal working database for existing, planned, or proposed projects for greenway and trail system

REMEDIAL OPERATIONS DEFINED

Remedial operations refer to activities required to sustain the quality of the greenway and trail network.

Task: Program Development

- Update informational signage (rules and regulations) to communicate proper usage of all network facility types
- Update directional signage to integrate greenway, bicycle, and pedestrian systems and as new projects are implemented
- Update user maps to reflect any additions or changes to the systems or overall network and also reference the connections between greenway, bicycle, and pedestrian facilities

Task: General Operations

- Provide contact information and institute an agency response for facility users to report questions, comments, concerns, or complaints regarding the network, and a feedback phone number and Web address

Routine Maintenance Activities					
		Low Impact Trail	Multi-use Trail	On-road Bicycle and Pedestrian Facilities	Recommendations
Facility Maintenance	Sweeping	N/A	2 times/year	See Table E(b)	Paved facilities will be swept by machine or spot sweeping of bad areas will be swept by hand or with blowers. Some trails require a combination of methods. Transition areas between unpaved and paved facilities will require extra attention to remove potentially hazardous debris from the paved surfaces.
	Trash removal	2-4 times/year	6 times/year	Sidepaths 6 times/year or See Table E(b)	This includes removing ground debris. Emptying trash containers is discussed in Table E(b). Volunteers should be utilized for this task, such as Adopt-a-trail programs.
Vegetation Management	Tree and shrub trimming and pruning	Spring and fall and as needed, such as after a storm to maintain 8' high and 6-8' wide clearance	Spring and fall and as needed such as after a storm to maintain 10' high (12' high for equestrian) and 12-14' wide clearance	Spring and fall and as needed such as after a storm to maintain 10' high and 12-14' wide clearance (depending on the facility type)	Tree and shrub trimming and pruning should be performed to the Town's specifications and should be scheduled according to species type. This service will be performed for the safety of trail users, to maintain safe use of all facilities without physical obstacles, such as low-hanging tree limbs, and visual obstructions, such as limited line of sight.
	Mowing of vegetation	N/A	30 times/year	30 times/year	Vegetation along trail corridors should be mowed on a regularly scheduled basis.
	Mulching and edging	Once a year or as needed	N/A	N/A	Low impact trails may require mulch in some areas to maintain a usable trail surface. Edging to prevent encroachment of grass vegetation on trail is also needed.
	Invasive species control	Once a year and as needed in problem areas	Once a year and as needed in problem areas	As scheduled for routine maintenance of adjacent roadway	Vegetation, weed, and pest management plans should be put into place to control invasive species, protect endangered plant and animal species, and preserve wetlands, riparian buffers, and other resources of special natural, cultural, or urban infrastructure value.

Above: Maintenance of Trail Facilities

Remedial Maintenance Activities					
		Low Impact Trail	Multi-use Trail	On-road Bicycle and Pedestrian Facilities	Recommendations
Facility Repair or Replacement	Replenish gravel, mulch, or other surface materials	Once a year and as needed	N/A	N/A	
	Repaint/ restripe/ stain	N/A	N/A	N/A	
	Replace asphalt or concrete	N/A	10-12 years	10-12 years	
	Remove encroaching debris along paved trail/sidewalk edges	As needed	As needed	Edging as needed	
	Regrade to prevent or eliminate low spots and drainage issues	Only if absolutely necessary	As needed	Responsibility of Town department as part of remedial maintenance of the adjacent roadway	
	Addition or repair of culverts, bridges, boardwalks, retaining walls, etc., to prevent or eliminate drainage/ erosion issues	N/A	30 years or as needed	30 years or as needed	
	Reroute trail, if necessary, to avoid environmentally sensitive or over-used areas, safety issues, or construction projects	As needed	As needed	Responsibility of Town department with input from Committee to reroute bicycle and pedestrian facilities if the adjacent roadway is rerouted or closed	

Above: Maintenance of Trail Facilities, continued

Remedial Maintenance Activities, continued					
		Low Impact Trail	Multi-use Trail	On-road Bicycle and Pedestrian Facilities	Recommendations
Seasonal Maintenance	Remove leaf litter	N/A	As needed	As needed by Town department for sidepaths. See Table E(b).	Prioritize removal by the most heavily used facilities and geographic location. Limited development trails should be emphasized as natural environments and warnings should be posted that hazardous conditions may exist with the changing seasons.
	Remove snow and ice	N/A	As needed	As needed by Town department for sidepaths. See Table E(b).	Prioritize removal by the most heavily used facilities and geographic location. Limited development trails should be emphasized as natural environments and warnings should be posted that hazardous conditions may exist with the changing seasons.
Habitat Enhancement and Control	Plant vegetation, such as trees and shrubs	As needed to prevent erosion and introduce native plant materials into the landscape	As needed to prevent erosion or introduce landscape features during installation of a trail	Responsibility of Town department	
	Take preventative measures to protect the landscape from wildlife	As needed	As needed	As needed	
	Apply herbicide to eliminate any problem areas	As needed to discourage the growth of invasive or problem species, such as kudzu and poison ivy	As needed to discourage the growth of invasive or problem species, such as kudzu and poison ivy	As needed to discourage the growth of invasive or problem species, such as kudzu and poison ivy	
	Apply herbicide to maintain edges and prevent encroaching vegetation, such as along trails and sidewalks	N/A	As needed	As needed	

Above: Maintenance of Trail Facilities, continued

- Continue to provide and establish new public education and citizen participation programs for network users
- Pursue development of an easy to use management manual and training program and incorporate it into existing and new maintenance programs and procedures within the participating agencies

Routine and Remedial Maintenance

The following task lists describe the general routine and remedial maintenance responsibilities for all greenway and trail facilities. To complement this text, Table E(a) illustrates maintenance recommendations.

Table E(b) below lays out maintenance tasks for facilities such as pedestrian signals, crosswalks, bicycle lanes, and roadway shoulders. These types of pedestrian and bicycle facilities are provided within the roadway right-of-way and should be maintained by either the North Carolina Department of Transportation (NCDOT) or the Town of Wake Forest Public Works Department. A Wake Forest staff member should be designated as the main contact for the maintenance of pedestrian and bicycle facilities in the roadway right-of-way. This staff member should coordinate with the appropriate departments to conduct maintenance activities in the field. Funding for an ongoing maintenance program should be included in the Town's operating budget or Capital Improvements Program.

Note that the schedule is intended to provide general guidance for routine and remedial maintenance activities. The frequency of pedestrian and bicycle facility maintenance within the roadway right-of-way will vary. Maintenance needs will depend upon many factors, including pavement surface type, the use of paint or thermoplastic for markings, and traffic volumes. The Town of Wake Forest Public Works Department and NCDOT should make immediate repairs to any on-road pedestrian and bicycle facilities that are damaged or have hazardous conditions. The Wake Forest staff member in charge of maintenance should set up a free maintenance hotline for people to provide information about spot maintenance needs in the urban area.

ROUTINE MAINTENANCE DEFINED

Routine maintenance refers to the day-to-day regimen of litter pick-up, trash and debris removal, weed and dust control, trail sweeping, sign replacement, tree and shrub trimming, and other regularly scheduled activities. Routine maintenance also includes minor repairs and replacements such as fixing cracks and potholes or repairing a broken hand railing.

Task	Frequency	Comments
Regular Inspection	2 times/year	Includes all on-road bikeways, identify needed repairs of pavement signs, markings, etc.
Shoulder and bike lane sweeping	2 times/year	All roadways with bicycle facilities
Shoulder and bike lane repairs	As needed	Repair of road surface, including potholes, cracks, or other problems on bicycle facilities
Median island and curb extension repairs	As needed	Repair of curb and gutters, removal of debris
Shoulder and bike lane resurfacing	During regular roadway repaving	Ensure that pavement width is maintained or increased during repaving projects
Debris removal from shoulders	As needed	Remove debris from roadway shoulders and bike lanes such as limbs, silt, and broken glass
Snow and ice removal	As needed	Plow snow off roadway shoulders and bike lanes, and require property owners to shovel sidewalks
Pedestrian signals	As needed	Replace burned out or broken pedestrian signal heads; adjust pedestrian signal timing to accommodate MUTCD standard pedestrian walking speed
Signs and markings	As needed	Repair or replace pedestrian and bicycle warning signs, bicycle route signs, crosswalk markings, bicycle lane markings, and any other similar facilities identified during inspections
Vegetation control	During regular roadway maintenance	Mow grass and trim limbs and shrubs 2 feet back from sidewalk edge
Litter removal	6 times/year	Could be done with volunteers

Above: Maintenance of Pedestrian and Bicycle Facilities Within Roadway Rights-of-Way of Town of Wake Forest and North Carolina DOT

The following tasks should be performed on a regular basis to keep all network facilities in good, usable condition. Maintenance tasks should be conducted more frequently for greenway, bike, and pedestrian facilities where use is the most concentrated. Methods such as pedestrian and bicycle counts, sketch plan analysis methods for estimating pedestrian and bicycle demand, public survey results, and public meeting comments can be used to determine which resources are the most heavily used and may require the most maintenance attention. The frequency of required maintenance tasks should be established as new facilities are implemented and should be reviewed and updated annually to reflect any changes in usage, safety issues, etc.

Task: Facility Maintenance

Basic housekeeping of greenway and trail facilities will ensure that the network is clean and functional and will also improve the life of each facility. Volunteer efforts should be utilized in the performance of this maintenance task.

- Sweeping
- Trash removal

Task: Vegetation Management

To maintain a high quality network, regular attention should be given to the surrounding landscape, both natural and man-made. This not only improves the aesthetic quality of the network but also improves the users' sense of safety, as well.

- Tree and shrub trimming and pruning
- Mowing of vegetation
- Mulching and edging
- Invasive species control

REMEDIAL MAINTENANCE DEFINED

Remedial Maintenance refers to correcting significant defects in the network, as well as repairing, replacing or restoring major components that have been destroyed, damaged, or significantly deteriorated from normal usage and old age. Some items ("minor repairs") may occur on a five to ten year cycle such as repainting, seal coating asphalt pavement or replacing signage. Major reconstruction items will occur over a longer period or after an event such as a flood. Examples of major reconstruction remedial maintenance include stabilization of a severely eroded hillside, repaving a trail surface or a street used for biking, or replacing a footbridge. Remedial maintenance should be part of a long-term capital improvement plan.

The following tasks should be performed on an as needed basis to keep network facilities in good, usable condition. Table E(c) depicts the average life of each facility type, as well as general ancillary facilities, with normal wear and tear. The repair or replacement of existing facilities should be reflected in a projected budget for future maintenance costs.

Task: Facility Repair or Replacement

All facilities will require repair or replacement at one time or another. The time between observation and repair/replacement will depend on whether the needed repair is deemed a hazard, to what degree the needed repair will affect the safety of the user, and whether the needed repair can be performed by an in-house maintenance crew or if it is so extensive that the needed repair must be done by outside entities or replaced completely. Some repairs are minor, such as repainting or resurfacing bicycle lanes and can be done in conjunction with other capital projects, such as repaving the adjacent street.

- Replenish gravel, mulch, or other materials
- Repaint/restripe/stain
- Repave/seal
- Replace asphalt or concrete
- Remove encroaching debris along paved trail/sidewalk edges
- Regrade to prevent or eliminate low spots and drainage issues

Facility	Lifespan
Mulch	2-3 years
Granular stone	7-10 years
Asphalt	7-15 years
Concrete	20+ years
Boardwalk	7-10 years
Bridge/underpass/tunnel	100+ years

Above: Longevity of Facilities

- Add culverts, bridges, boardwalks, retaining walls, etc., to prevent or eliminate drainage/erosion issues
- Reroute trail, if necessary, to avoid environmentally sensitive or overused areas and any safety issues

Task: Seasonal Maintenance

Seasonal tasks should be performed as needed. When conditions cannot be improved to provide for safe use, the facility should be closed to prevent the risk of injury to facility users. Designated maintenance crews will remove leaf debris, snow, and ice, etc. from all network facilities as soon as possible. Leaf debris is potentially hazardous when wet and special attention should be given to facilities with heavier usage. Ice control and removal of ice build-up is a continual factor because of the freeze-thaw cycle. Ice control is most important on grade changes and curves. Ice can be removed or gravel/ice melt applied. After the ice is gone, left-over gravel should be swept as soon as possible.

- Remove leaf litter from network facilities, via raking, blowing, mulching, etc. as needed to sustain the safe usability of all network facilities and prevent any storm water drainage and/or erosion issues
- Remove snow and ice from network facilities, via shoveling, picking, salt, sand, etc. as soon as possible after storm

Task: Habitat Enhancement and Control

Habitat enhancement and control can improve aesthetics, help prevent erosion, and provide for wildlife habitat. Habitat control involves mitigation of damage caused by wildlife.

- Plant vegetation, such as trees and shrubs
- Take preventative measures to protect landscape features from wildlife, such as installing fencing around sensitive or newly planted plant materials
- Apply herbicide to eliminate any problem plant species, such as poison ivy or kudzu, etc.
- Apply herbicide to maintain facility edges and prevent encroaching vegetation, such as along trails and sidewalks
- Deter interaction between facility users and facility inhabitants, such as feeding the wildlife, etc.

ADMINISTRATION RESPONSIBILITIES

OPERATION RESPONSIBILITIES BY DEPARTMENT

For a successful Open Space and Greenway System to be developed it is critical for the players to understand their role in supporting and managing the system.

Role of Wake Forest

The Wake Forest Open Space and Greenway System will be developed and managed by the Town and its departments. Listed below and on the following pages are the key departments and organizations that will play a role in this implementation.

Role of Parks and Recreation Department

As the primary developer of greenways, the Parks and Recreation Department is the most prominent participant in the Open Space and Greenway Plan. The Department will be responsible for the design, management and maintenance of the greenway system. The Parks and Recreation Department will need to work closely with the Planning Department in the siting of greenways.

Role of the Planning Department

The Planning Department should provide support for the Open Space and Greenway Plan and assistance with future implementation of the system. This can be accomplished by defining future greenways within related planning efforts; utilizing the rezoning process to encourage dedication of lands, including sidewalks and bicycle facilities for the Open Space and Greenway System; and planning transportation improvements in coordination with greenways.

Role of Public Utilities Department and Water Resources Department

The Public Utilities Department and Water Resources Department are important players in the implementation strategy for the Open Space and Greenway System. The Departments manage the systems of sanitary and stormwater sewers which offers enormous potential for shared use with greenway development objectives. For the expansion and development of new sanitary sewer lines, the Water Resources Department should consider the use of a joint-use easement document during right-of- way negotiations to acquire subsurface and surface rights from willing sellers. Additionally, Public Utilities stormwater management objectives can be enhanced through the development of the Open Space and Greenway System through the use of funds obtained from federal and state grants. The Departments could function as greenway developers in partnership with the Parks and Recreation Department.

Role of Department of Police Services

The Department of Police Services should assist the Parks and Recreation Department with patrolling and law enforcement for Open Space and Greenway System lands and facilities.

ROLE OF PRIVATE SECTOR

The private sector throughout Wake Forest is the primary beneficiary of the Wake Forest Open Space and Greenway System. As such, private organizations, businesses and individuals can and should play an important role in the development and management of the system. Private sector groups and businesses can sponsor implementation projects for open space and greenways as a partner of the Town. These groups can also help to maintain open space and greenway lands through cooperative management agreements with the Town.

Role of Local Businesses and Corporations

Wake Forest businesses and corporations might choose to sponsor a segment of greenway for development or maintenance. Businesses and corporations can work with the Parks and Recreation Department to give money, materials, products and labor toward the development of a greenway facility. Businesses can also consider installing facilities, such as bike racks or lockers, benches, and signage that links their operations to the Open Space and Greenway System.

Role of Civic Organizations

Local civic groups and organizations, including the Junior League, Boy Scouts and Girl Scouts, Women's Club, Chamber of Commerce, garden clubs, YMCA, Kiwanis and Rotary Clubs, to name a few, can be participants in the Wake Forest Open Space and Greenway System. These organizations can play a vital role in building sections of greenway trails, maintaining and managing greenway lands and facilities, and co-hosting events that raise money for the Open Space and Greenway System.

There are many ways in which civic organizations can participate in the development of the Open Space and Greenway System. The most appropriate involvement can be determined by matching the goals and objectives of each organization to the needs of the greenway program.

ROLE OF INDIVIDUAL CITIZENS

Local residents who are interested in the development of Wake Forest's Open Space Greenway System can participate by agreeing to donate their time, labor, and expertise to the Parks and Recreation Department.

Residents might choose to partner with a friend or form a local neighborhood group that adopts a section of greenway for maintenance and management purposes. As an adopt-a-greenway organization, individuals might help pick-up trash, plant flowers and trees, care for newly planted vegetation and serve as additional "eyes and ears" for safety and security on open space and greenway lands. All volunteer efforts would be recognized by the Parks and Recreation Department through a community-wide program.

MAINTENANCE RESPONSIBILITIES BY FACILITY TYPE

Maintenance responsibility will continue to be with the Parks and Recreation and Public Works Departments depending on the type of facility to be maintained and whether or not it is routine or remedial. A number of other jurisdictions and entities, homeowner associations, and business groups will also have roles in maintaining specific facilities in the pedestrian, bicycle, and greenway networks. It will be helpful to create a citizens' group that could ultimately play an important role in coordinating and advocacy (See stewardship discussion, Section E.1.2). A recommended maintenance schedule is included in Tables E(a) and E(b) for each system.

Low Impact Trail

These spaces would be maintained by Town Parks and Recreation crews or by homeowner associations where appropriate, for dedicated areas added into the system by new development.

Multi-use Trail

The Town Parks and Recreation and Public Works Departments will continue to be the key agencies in the maintenance of facilities along roads, utility corridors, and stream corridors. The Parks and Recreation Department, or where appropriate, homeowners associations, should conduct routine maintenance of greenways. Public Works should be responsible for remedial maintenance of hardscape components.

On-road Bicycle Facilities

A key to continued success will be the establishment and acceptance of bicycle facility operations and maintenance guidelines and proper training of both supervisory and field personnel regarding on-road bicycle facility upkeep. There should also be interagency coordination and user feedback protocols that assure timely response to citizen complaints and suggestions, including a website and toll-free hotline for pedestrian and bicycle maintenance requests. Bicycle route signs and bicycle racks should also be maintained by NCDOT, depending on the types and locations of facilities. Refer to the Wake Forest Bicycle Transportation Plan for more information on on-road bicycle facilities.

Pedestrian Facilities (On-road sidewalk/sidepath)
Within the Town of Wake Forest, major sidewalk repairs are made by the Public Works Department. Routine sidewalk maintenance should also be performed by the adjacent property owners and tenants, as prescribed by town ordinances. This may include individual owners, business and resident associations and special districts, as applicable. In suburban and rural areas outside the Town, sidewalks on main roadways should be maintained by NCDOT and sidewalks on residential streets should be maintained by property owners.

Trailheads and Feature Areas
These areas are to be maintained by the Public Works and Parks and Recreation Department or the respective homeowners associations if appropriate.

Other Ancillary Facilities
Special furnishings and amenities such as benches and signage will be the responsibility of the appropriate jurisdictional entity such as the Public Works and Parks and Recreation Departments.

ADMINISTRATIVE AND JURISDICTIONAL RECOMMENDATIONS

Actions to implement the following administrative and jurisdictional recommendations are described below. Collaboration between off-road greenways and on-road bicycle and pedestrian facility development should occur between the Greenway Committee (discussed in Chapter 4: Implementation) and the Town Parks and Recreation Department.

Greenway
Currently, the Park and Recreation Department is responsible for 561 acres of parkland, including greenway planning, operations, and maintenance. However, funding can be increased to assist in these efforts. In order to increase the revenue generated for operations and maintenance of greenway facilities, the following actions are recommended.

Action: Develop a non-profit group or coalition for greenways.

The following is an example list of the duties associated with the Friends of the Little Tennessee River Greenway in Macon County, NC. Friends of the Greenway (FROGs) assist Macon County in the management and development of the Little Tennessee River Greenway in a number of ways:

- Serve the public through the acquisition, restoration, protection, and enhancement of the natural resources.
- Integrate public recreational, historical, and cultural facilities with compatible commercial interest adjoining the Greenway.
- Develop an informational center and educational materials to enhance awareness of environmental and historical value of the Greenway.
- Assist local government in funding through grants, donations, leasing of concessions, and special events.
- Maintain a board and committees that fairly represent a diversity of interests in the community

The Town of Wake Forest should work to establish a "Friends of the Greenway" organization that can help to advocate for and promote the full development of the community-wide greenway system. Friends groups can help to raise awareness and funds for greenway facility development and operation. The mission of these groups can be very simple, for example, the Friends of the Grand Forks Greenway has the following mission:

"The Friends of the Greenway is a volunteer community grass-roots effort to support the development of the Red River and Red Lake River corridors that exist between the Army Corps of Engineers Flood Protection Project within the cities of Grand Forks, ND and East Grand Forks, MN."

Typically, Friends of the Greenway will assist the Town with promoting and advocating for the greenway system. They can sponsor events that raise funds for the system. They can host community forums and meetings that increase awareness. They can sponsor events, such as hikes and races, which encourage residents of the community to use the greenways more often. Many Friends organizations operate under a non-profit, 501c3 status so that they can receive contributions from individuals and private sector groups.

Action: Hire and train new greenway maintenance crew personnel

- To maintain greenway facilities as described in Table E(b), Greenway Routine and Remedial Maintenance Tasks

The Parks and Recreation and Public Works Departments currently maintain recreational and trail facilities. Maintenance responsibilities include mowing, weed eating, repair of storm damage, blowing trails, removing leaves, rail painting, installing drainage, pesticide application (with license), etc. To improve maintenance standards for greenway

facilities and predict future maintenance needs, the consultant recommends one maintenance crew person for every 15 miles of trail in need of maintenance. As additional mileage is added to the system, staff should be added in part-time or full-time positions to accommodate greater maintenance needs.

COST OF THE OPERATIONS & MAINTENANCE PROGRAM

Annual operations and maintenance costs vary, depending upon the facility to be maintained, level of use, location, and standard of maintenance. Operations and maintenance budgets should take into account routine and remedial maintenance over the life cycle of the improvements and on-going administrative costs for the operations and maintenance program. Table E(d) provides an overview of approximate costs for basic bicycle, pedestrian and greenway trail operations and maintenance services. The estimates include field labor, materials, equipment and administrative costs.

ROUTINE OPERATIONS AND MAINTENANCE COSTS

While actual costs will vary depending upon a number of factors, such as future availability of water and labor rates, the following estimates can provide a general idea of potential operations and maintenance obligations. Refer to the Wake Forest Bicycle Transportation Plan for more information on activities and costs.

Low Impact Trails

Annual maintenance costs range from nominal to $2,000 per mile/year depending on usage and level of development. Volunteers may absorb all or part of this function.

Multi-use Trails

Crew sizes tend to range from 0.5 to 5 full-time employees (FTEs) per 10 miles of off-street trail. This plan recommends at least one FTE per 15 miles of trail. Annual routine maintenance costs may range from less than $3,000 to over $7,000 per mile. Routine cleanup and monitoring of facility conditions should be handled by volunteers and maintenance crews.

On-road Bicycle Facilities

It is assumed that the Town of Wake Forest Public Works Department and NCDOT Maintenance Division will be able to maintain the on-roadway bicycle facility system. Some provision should be made, however, for 15 regular inspections per year, to include minor repair or replacement of signs, vegetation grooming and other items that an inspector could

Description/ Activity	Frequency	Costs
Drainage maintenance	4 times/year	$750/mi
Sweeping/ blowing trails	20 times/year	$1500/mi
Pick up and trash removal	20 times/year	$1500/mi
Weed control	10 times/year	$1250/mi
Mowing 3-foot safe zone	20 times/year	$1800/mi
Minor repairs	Once/year	$750/mi
Maintenance and supplies	Once/year	$500/mi
Equipment fuel and repairs	Once/year	$1000/mi
Total maintenance per mile per year		**$9050**

remedy in the field. Additional attention should be paid to any potholes or other pavement damage. Some additional sweeping will be required where bicycle lanes and wider shoulders are provided along roads.

Pedestrian Facilities (On Road Sidewalk/Sidepath)

In the Town of Wake Forest, the Public Works Department maintains sidewalk facilities. Local property owners or Homeowner Associations (HOAs) should be responsible for routine maintenance of sidewalks with the Town responsible for more significant repairs. Crosswalks, pedestrian signals, curb ramps, median crossing islands, and other pedestrian facilities should be maintained by Public Works and NCDOT, depending on right-of-way ownership. It is recommended that NCDOT maintain all sidewalks on NCDOT rights of way. Maintaining these pedestrian facilities is an important part of maintaining the complete right of way for all users. NCDOT should maintain sidewalks and pedestrian crossing facilities on major roadways in areas outside of the Town of Wake Forest. Cracks, surface defects, tree root damage, and other problems should be identified on a regular basis and fixed to ensure that sidewalks remain accessible to all types of pedestrians.

REMEDIAL OPERATIONS AND MAINTENANCE COSTS

Low Impact Trails
For purposes of this study, remedial work on non-paved trails will be assumed to be negligible, since volunteers may accomplish much of this work. There may be some administrative costs associated with this.

Multi-use Trails
A 10- to-12-year life is assumed for asphalt and crushed fine trails after which an overlay may be required. A complete resurfacing after 20 to 25 years is anticipated. Concrete is assumed to last twice as long. Bridges, tunnels, retaining walls and other heavy infrastructure are assumed to have a 100-year life or longer.

On-road Bicycle Facilities
Remedial work for on-road bicycle facilities includes asphalt repaving (5' on either side of the street for a two-way bike route, total 10' width) along with curb and gutter, sewer-grate and manhole repair. Pothole and crack repair are considered routine. Pavement markings, such as bicycle lane lines, bicycle stencil markings, and edgelines should be re-installed when other roadway pavement markings are improved. Since this work is done as part of the current street maintenance regime the cost is assumed to be covered.

Pedestrian Facilities (On Road Sidewalk/Sidepath)
Sidewalks should be constructed with concrete, which requires replacement in 50 to 75 years. A rough cost estimate for a linear mile of concrete sidewalk could be provided by the Town's Public Works Department, including the base material, concrete, and construction work. Costs for design and Right-of-Way (ROW)/easement purchases should also be considered.

FUNDING THE OPERATIONS & MAINTENANCE PROGRAM

Identifying funding sources, creating funding sources and sustaining reliable funding over the long term is critical to the overall success of operations and maintenance and, ultimately, the success and growth of the Wake Forest greenway and trail network. Several types of funding sources can be identified and a combination of these might offer the best solutions. The following are potential sources for operations and maintenance. Appendix C identifies funding sources for project design and implementation.

Budget Allocations to Current Agency Programs
These are funds coming directly from existing agency and department programs as part of annual budget contributions. Typically this is the base revenue source for operations and management.

Multi-Objective Partnerships
Most trails serve multiple public and private benefits including access for floodway and ditch upkeep, utility access, street maintenance, and enhancement of adjacent private properties. This may pose a number of opportunities for task sharing and cost sharing among the various beneficiaries, particularly with respect to storm drainage management along river, creek, and wetland corridors.

In-Kind Services
In-kind services involve people, such as volunteers, youth and student labor, and seniors to provide routine maintenance practices to network facilities. In-kind services may also include donations of material and equipment. Another consideration is the adopt-a-trail program, which works with service clubs, scouts, school groups, businesses and others. Adopt-a-trail programs should include credit signage and written agreements with the adopting group.

Trust Fund
Working in partnership with a Friends of the Greenway group, the Town of Wake Forest may be able to establish a Greenway Trust Fund. This trust fund would be a dedicated source of funding that supports the operation and management of portions of the greenway system. The Friends of the Greenway would work with a private financial institution to set up an investment account or work with a local foundation to establish an endowment. Contributions to the fund would be solicited from greenway advocates, businesses, civic groups, and other foundations. The goal would be to establish a capital account that would earn interest and use the interest monies to support greenway maintenance and operations. Special events could be held whose sole purpose is to raise capital money for the Trust Fund. A trust fund can also be used in the acquisition of high-priority properties that may be lost if not acquired by private sector initiative.

Example: The Mountains-to-Sound Greenway Legacy Fund, Washington- The Mountains-to-Sound Greenway Legacy Fund is an endowment fund managed by The Seattle Foundation. Its purpose is the protection of the Mountains-to-Sound Greenway, for the public good, in perpetuity. It will be used to support restoration, enhancement, education and advocacy programs of the Mountains-to-Sound Greenway Trust. It is currently involved in a multi-year endowment fund campaign with a goal to raise $5 million.

Revenue from Programming

The Town of Wake Forest should also work with a Friends of the Greenway to capture and direct fees and revenues that are derived from greenway events and activities into an account that can be dedicated to operating and managing the greenway system. Revenues could be used to support the Greenway Trust Fund. There are numerous opportunities to program greenway lands and facilities for activities that can generate revenues. The Town of Wake Forest should work actively, and in partnership with a Friends of the Greenway organization, to define events that can occur throughout the calendar year, and determine which of these events has the capability of generating revenues that support operations and management of the greenway. Grand Forks, North Dakota, has demonstrated that a properly operated greenway can generate upwards of $250,000 in direct revenues annually for use in offsetting the cost of operations and maintenance costs.

OPERATIONS AND MAINTENANCE RESOURCES FOR CONFLICT RESOLUTION

- Plan, design, and manage to reduce conflicts among users, with adjacent properties including: reckless and unsafe behavior; incompatible uses; trespassing; disturbances and adverse environmental impacts
- Recognize the different goals of different users, such as equestrians and bicyclists, and separate where feasible
- Provide user education through signage, patrol, volunteers, brochures, and media
- Provide adequate trail mileage and bicycle, pedestrian, and greenway acreage to accommodate user populations
- Solicit input from user groups by providing contact information to report problems and responding promptly and effectively to complaints, concerns, or suggestions

- Monitor, document, and log problem areas and address problems through design and management
- Promote trail etiquette
- Educate bicyclists and hikers on how to pass horses using subdued voice cues rather than bells, horns, or sudden loud noise that might startle a horse
- Avoid excessive regulatory signage
- Employ temporary closure of facilities when conditions dictate or for resource recovery
- Maintain facilities as specified in this chapter
- Distribute or publish a maintenance schedule
- Respond to illegal or disturbing activity quickly

Executive Summary

Greenway Bridge over Smith Creek

Executive Summary Outline:

The 2009 Open Space & Greenway Plan Update

Benefits of Open Space and Greenways

Public Input

Greenways System Recommendations

Implementation

Additional Resources

THE 2009 OPEN SPACE & GREENWAY PLAN UPDATE

The Town of Wake Forest adopted its Open Space and Greenway Plan in January 2002. In the years since the plan's adoption, much has changed in Wake Forest and in Wake County as a whole. Aside from continued population growth and development in and around Wake Forest, there have been numerous plans adopted and other changes in both local and regional land use and transportation patterns. This update expands upon key recommendations from the 2002 Plan and provides the Town of Wake Forest with new ideas and tools to effectively create and maintain a comprehensive open space and greenway network. The Plan Update also incorporates new design standards for trails and trail amenities, trail operations and management guidelines, and current trail construction cost estimates.

The goals of this update are as follows:

> ***1) Provide specific recommendations for developing new priority greenway segments and facilities.*** *(Chapter 4 Action Steps and Appendices B, C, and D)*
>
> ***2) Explore potential connections that can be derived from linking the greenway plan to the adopted pedestrian, bicycle, and parks and recreation plans.*** *(Chapters 2 and 3)*
>
> ***3) Expand on recent planning efforts for the Smith, Richland, and Sanford Creek corridors by identifying trail locations within their more broadly defined greenway corridors.*** *(Chapter 4 Project Cut-Sheets and Trail Segment Cost-Estimates)*

The goals for this plan are in concert with the goals of other Wake Forest planning initiatives. Supporting statements from the Wake Forest Land Use Management Plan, the Land Development Plan, the Parks and Recreation Plan Update, the Pedestrian Plan and the Bicycle Plan were consolidated and are found on page 1-3.

BENEFITS OF OPEN SPACE AND GREENWAYS

Open space and greenways provide a variety of benefits that ultimately affect the sustainability of economic, environmental, and social health. A summary of these benefits can also be found in the Town of Wake Forest brochure, *The Benefits of Open Space and Greenways*, and are described in full on pages 1-6 to 1-11. These benefits include:

- *Creating Value and Generating Economic Activity*
- *Transportation Benefits*
- *Improving Health through Active Living*
- *Clear Skies, Clean Rivers, and Protected Wildlife*
- *Protecting People and Property from Flood Damage*
- *Enhancing Cultural Awareness and Community Identity*

PUBLIC INPUT

More than 150 people filled out comment forms (both online and at a public workshop) for this 2009 Plan Update. Public input helped project planners identify where people most often use trails in Wake Forest, their preferences related to the trail system, and their priorities for future trail projects. The responses have been tabulated and are featured in Appendix A.

GREENWAY SYSTEM RECOMMENDATIONS

The recommendations of the Wake Forest Open Space and Greenway Plan are broken down into two primary phases for future development. Priority preferences for the Dunn Creek Corridor and Smith Creek Corridor are reflected in both the public input responses (page A-6) and the implementation chapter, which outlines the following corridors as priorities.

Priority Greenway Corridors (2.35 miles of 12 miles complete = 17% complete)

Cut Sheet #	Greenway Corridor	From	To	Miles	Feet	Development Stage
Dunn Creek Corridor (0.0 miles of 3.05 miles complete)						
1	Dunn Creek	Flaherty Park	Oak Grove Church Road	0.91	4,800	Planning
2	Dunn Creek	Oak Grove Church Road	NC 98 Bypass	1.14	6,000	Planning
3	Dunn Creek	NC 98 Bypass	Smith Creek Soccer Complex	0.92	4,850	Design
			Total	*2.96*	*15,650*	
			Percentage Complete	*0%*		
Smith Creek Corridor (1.15 miles of 2.85 miles complete)						
-	Smith Creek	Reservoir	Smith Creek Soccer Complex	1.50	7,920	Planning
-	Smith Creek	Smith Creek Soccer Complex	Rogers Road	0.63	3,326	Completed
4	Smith Creek	Rogers Road	Sanford Creek	1.00	5,280	Planning
5	Smith Creek	Sanford Creek	Ligon Mill	0.91	4,820	Planning
6	Smith Creek	Ligon Mill	Burlington Mill	0.94	4,950	Planning
-	Smith Creek	Burlington Mill	Neuse River	0.65	3,432	Completed
			Total	*5.63*	*21,808*	
			Percentage Complete	*29%*		
Richland Creek Corridor (0.35 miles of 3.91 miles complete)						
7	Richland Creek	Wake Forest Town Limits	N. End of Olde Mill Stream Gwy	0.87	4,600	Planning
-	Richland Creek	N. End of Olde Mill Stream Gwy	Harris Road	0.35	1,848	Completed
8	Richland Creek	Harris Road	Stadium Drive	0.98	5,200	Planning
9	Richland Creek	Stadium Drive	Bennet Park Neighborhood	1.17	6,175	Planning
10	Richland Creek	Bennet Park Neighborhood	Villas at Caveness Farms	1.10	5,800	Planning
			Total	*4.47*	*23,623*	
			Percentage Complete	*8%*		
Sanford Creek Corridor (0.85 miles of 1.5 miles complete)						
11	Sanford Creek	Smith Creek Greenway	Marshall Farm Road	1.16	6,100	Planning
-	Sanford Creek	Marshall Farm Road	W. End of Sanford Creek Gwy	0.85	4,488	Completed
-	Sanford Creek	W. End of Sanford Creek Gwy	Rogers Road	0.50	2,640	Construction
			Total	*2.51*	*13,228*	
			Percentage Complete	*33%*		

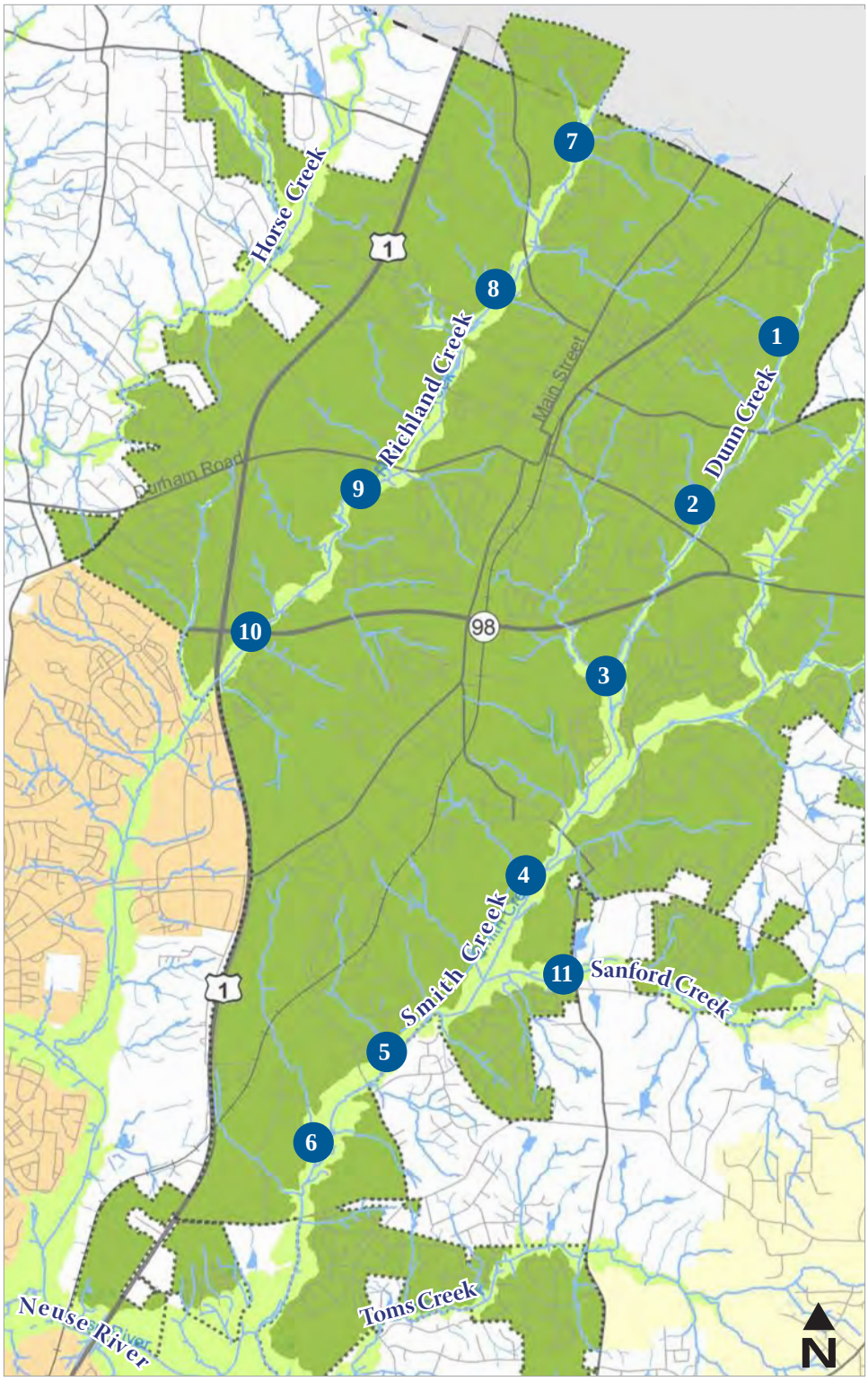
This table lists priority greenway corridors, broken down into segments. The 'cut-sheet' number for each segment also corresponds to the following map.

IMPEMENTATION

The action steps in Chapter Four are integral to achieving the goals and vision of this Plan. As guiding recommendations and the clearest representation of specific items to accomplish, they should be referred to often. Chapter Four also provides project cut-sheets for 11 of the priority segments, which feature detailed cost estimates and corresponding maps.

The map below shows the locations of the key projects (note that the numbers correspond to the cut-sheets and do not necessarily indicate order of priority).

Locator Key for Project Cut-Sheets on pages 4-8 to 4-29



PHASE 1: SMITH CREEK AND DUNN CREEK CORRIDORS

Smith Creek and Dunn Creek are key north/south corridors that connect Wake Forest with the Neuse River. Within only four years, the Smith Creek Corridor will connect to the Neuse River Trail (NRT) and the North Carolina Mountains-to-Sea Trail (MST). It will be beneficial for Wake Forest to tie into this trail for recreation, transportation and economic benefits. *See Smith Creek Corridor Project Cut-Sheets and Cost Estimates, pages 4-8 to 4-19.*

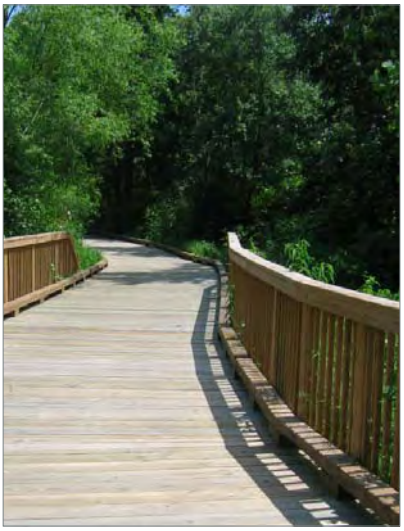
PHASE 2: RICHLAND CREEK CORRIDOR, SANFORD CREEK CORRIDOR, and the NC 98 BYPASS CORRIDOR

The greenway trails to be constructed along the Richland Creek corridor will enhance connectivity by providing access to the parks, schools, and neighborhoods along the corridor. *See Richland Creek Corridor Project Cut-Sheets and Cost Estimates, pages 4-20 to 4-27.*

The Sanford Creek corridor offers an incredible opportunity to build a trail that connects hundreds of students to Heritage High School, Middle School and Elementary School with a relatively small amount of trail. This trail will also require continued cooperation and coordination with the Town of Rolesville and Wake County. *See Sanford Creek Corridor Project Cut-Sheets and Cost Estimates, pages 4-28 to 4-29.*

The Town of Wake Forest Pedestrian Plan lists the NC 98 Bypass Corridor as the top priority greenway corridor. Though slightly different, this recommendation is supported by the 2002 Open Space and Greenway Plan, which stresses the importance of creating an east/west connection for economic and transportation objectives. The detailed bicycle and pedestrian recommendations contained in the *NC 98 Bypass Corridor Master Plan (page 3-7)* should be incorporated into the Phase Two recommendations of this plan to facilitate the planning process and ensure efficiency in the development of an east/west trail.

Above: Field evaluation of the Dunn Creek Corridor.



Above: Boardwalk portion of the Sanford Creek Greenway.

ADDITIONAL RESOURCES

Appendix A: Public Input Summary: Responses from public comment forms indicate support for local funding of trails. Even though this was not a statistically valid survey, the strong show of support warrants serious consideration of a bond fund, with 85% responding favorably to the idea of a bond fund to complete key recommendations of this plan.

Appendix B: Design Guidelines: This appendix provides standards for both public and private entities during implementation of the Wake Forest Open Space & Greenway Plan. The guidelines noted are based on the best practices in use throughout the United States, as well as accepted national standards for greenway facilities.

Appendix C: Funding: For the past two decades, a variety of funding has been used throughout North Carolina to support the planning, design and construction of urban and rural greenway projects. This appendix describes possible funding sources to support local greenway improvements. In addition to outside sources, implementing the recommendations of this plan will require a strong level of local support and commitment through a variety of local funding mechanisms.

Appendix D: Operations and Management: The Wake Forest greenway and trail system should be viewed and maintained as a public resource. Indeed it will become infrastructure similar to the street system or utility networks, serving the community for generations to come. This appendix provides guiding principles that will help assure the preservation of a first class trail system.