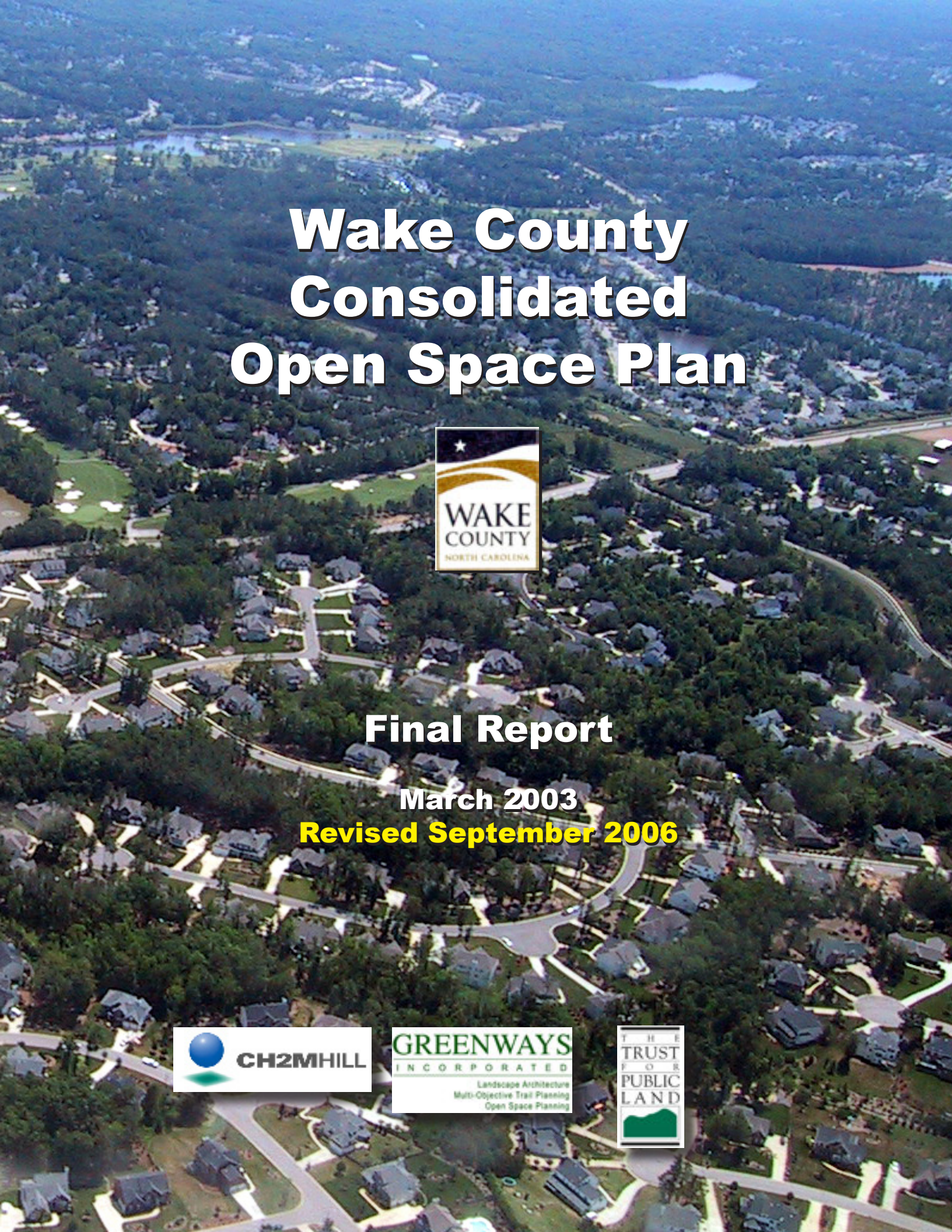

Wake County Consolidated Open Space Plan

Final Report

March 2003
Revised September 2006

CH2MHILL

GREENWAYS INCORPORATED
Landscape Architecture
Multi-Objective Trail Planning
Open Space Planning

THE TRUST FOR PUBLIC LAND

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Acknowledgments

Wake County would like to thank all of the individuals, organizations and agencies that have contributed to the preparation of this Open Space Plan. The work presented in this report is the result of a common vision and goal to make Wake County a better place to live, work, raise a family and call home. The following individuals and agencies deserve special recognition for their efforts in helping to develop this Plan.

The Board of County Commissioners
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Wake County Agencies:
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- Planning
- General Services
- Facilities Design and Construction

Wake County Open Space Advisory Committee
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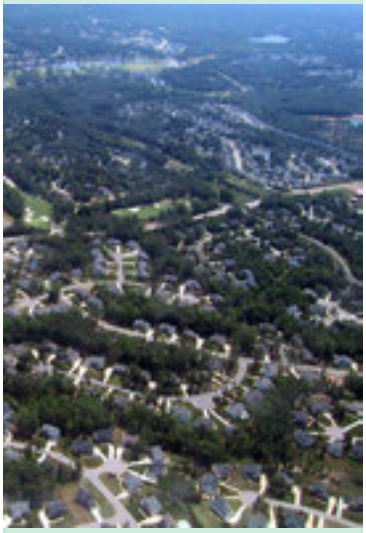
Executive Summary

Purpose

The purpose of the Wake County Consolidated Open Space Plan is to protect and conserve county land and water for current residents and future generations. Open space is defined as **protected** lands and waters that are owned and managed by the County, its public sector partners, the municipal governments of Wake County, State of North Carolina, the United States government, and the County's private sector partners, including non-profit land trusts. Open space consists of any parcel or area of land and water that is devoted to 1) the preservation of natural resources and habitat; 2) the managed production of resources (forest and farm land); 3) outdoor recreation; 4) preservation of historic and cultural property; 5) protection of scenic landscapes; and 6) protection of public health, safety and welfare.



This Open Space Plan, a "greenprint" for the future, was one of several tools developed by County government. Simultaneously, the County prepared a Watershed Management Plan, Growth Management Plan, Groundwater Study, Transportation Plan and a Unified Development Ordinance. Additionally, the County updated its Parks and Recreation Master Plan. Together, these plans establish a foundation for future growth and development that is both sustainable and economically viable.

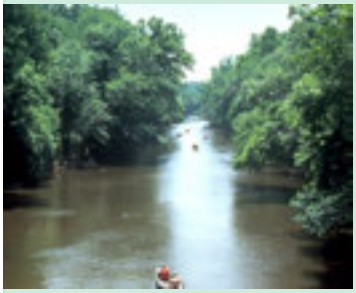
Wake County has an estimated 55,719 acres of protected open space as of May 30, 2006, or roughly ten percent of the total county land mass. The majority of these lands are protected by federal and state agencies. Less than half of this total is land that local governments have protected and conserved as open space.

Currently, more than 27 acres of land is being converted each day from its natural state to a built condition throughout Wake County. More than 45 percent of the county has already been developed. Given the current rate of growth and development, if the County does not begin to emphasize land conservation policies and programs, an estimated 78 percent of the county land area will be developed by the year 2020. (Source: Triangle Land Conservancy) It is imperative that the County take action, as defined within this plan, to conserve and protect open space resources.

Key Recommend-ations

This Open Space Plan is a set of recommended strategies required to achieve balanced and sustainable growth. The Plan is a workbook with guidelines, policy recommendations, and tools that can be utilized by the County and its partners to conserve valued open space resources before they are converted to developed uses.

The future Wake County Open Space system is envisioned as a series of natural, interconnected landscapes that protect environmental resources that are critical to the well-being of county residents, most importantly the creeks, streams and lakes that supply fresh water. The Plan establishes four important and interrelated activities for open space conservation:



1) Identify key parcels of land and corridors that should be acquired and protected as open space;
2) Recommend new regulatory programs that improve the protection of resources that safeguard public health, safety and welfare;
3) Establish a new program of land stewardship to manage open space resources;
4) Define recurring sources of revenue that support open space conservation.

One goal of the Plan is to eventually protect a minimum of 30 percent of the county's land area, or roughly 165,000 acres. To accomplish this goal, the County partnered in 2002 and 2003 with each of its 12 municipal governments to support open space planning. The County awarded monetary grants and asked that each municipal government devise and adopt a local open space plan. The County used these municipal plans as the basis for a consolidated county-wide open space plan, knitting together the recommendations of each to form an interconnected greenprint.

Each of the municipal governments prepared and adopted individual open space plans. The municipal open space plans focused on protecting water resources, improving access to open space, park and greenway lands and linking municipal open space and greenway systems together. Approximately 90 targeted open space areas have been identified through the municipal plans as future priority open space acquisitions. Additionally, many towns defined the location of greenway corridors, and the need to protect scenic landscapes along key roadway corridors.

Through this multi-objective planning process, the County engaged citizens in a variety of public forums to discuss and define the future of sustainable growth. From this discussion a list of community issues emerged that applies to open space planning and other county-sponsored planning efforts.

Implementing the recommendations within this Plan will require leadership, new government sponsored programs, private sector collaboration and input, recurring sources of funding and a broad partnership that is committed to establishing a greenprint for Wake County.

Prioritize Open Space

One conservation strategy that is introduced by the Plan is prioritizing land for targeted acquisition. Utilizing the County's Geographic Information System (GIS) data base, a process of decision making has been devised to select the most highly desired open space lands in the county. The selection of these properties has been made on the basis of lands that protect water supply, limit exposure to flooding, support water contact recreation, improve access to outdoor resources, protect wetlands and unique species of plants and animals native to the county. Using this data, properties are queried from the remaining supply of undeveloped land for possible future protection and conservation. From this strategy, an estimated 27,000 acres of land is identified for targeted acquisition.

Promote Sustainable Development

Another conservation strategy is to protect land that is already subject to flooding from rainstorm events. To accomplish this, the County GIS system was used to calculate the amount of land that is currently regulated by the Federal Emergency Management Agency (FEMA). This Plan recommends that the County and municipal governments prohibit future development and building within these flood prone lands. This would effectively conserve an estimated 60,000 acres of land as protected open space.

A third strategy of the Plan is to protect valued open space during the land development process. The plan recommends the adoption of Conservation Subdivision Design (CSD) as one preferred method for future land subdivision and development. Utilizing the principles of CSD, natural landscapes would be identified and protected, while homes and buildings would be arranged in a more compact form to conserve as much open space as possible. Utilizing CSD, and other innovative methods for subdividing and developing land, it may be possible to conserve as much as 22,000 acres of land in future years.

Future Wake County System of Protected Open Space		(Minimum)
Category of Open Space	(Minimum) **Goal in Acres**	**Percent of Total Open Space**
Existing Protected Open Space	55,719	10.00%
Conserved Floodplain Lands (future)	60,000	11.00%
Protected Open Space through land development process (future)	22,000	4.00%
Future Open Space Acquisitions	27,281	5.00%
Total Protected Open Space	**165,000**	**30.00%**
Total Land Area of Wake County	**550,000**	

Establish a Stewardship Program

With potentially thousands of acres of new open space land being acquired and protected, Wake County will need to increase its land management operations and programs, as well as partner with municipalities and private sector interests, to keep pace with conservation efforts. A land stewardship program should be established by Wake County in collaboration with the Soil and Water Conservation District, municipalities, state and federal agencies and non-governmental organizations.

An "ecosystem approach" should be used to manage open space land in a natural and low-cost manner. An urban forestry program should also be established to catalog and manage the declining forest canopy of the county. These programs will be supported by partnerships with the private sector and through coordinated efforts with municipal, state and federal programs.

The goal of the stewardship program will be to connect the people of Wake County to the natural resources that are so important to their quality of life. This can be accomplished through many different avenues including the County's environmental education programs.

Funding the Open Space Program

A Blue Ribbon Committee convened by Wake County in 2005 identified $300 million in open space conservation need in the coming years. In order for Wake County to implement the recommendations of this Consolidated Open Space Plan, it will require a combination of funding sources that include local, state, federal, and private money. Of the many funding options that are possible, the following strategies were identified by the Blue Ribbon Committee as recommended options for Wake County:

1) Apply for matching funds from federal, state and local municipal goverernments.
2) Request matching funds from corporate and private donors.
3) Conduct fund raising in partnership with philanthropic organizations.
4) Use tools, such as Bargain Sale, to obtain open space at less than fair market value.
5) Work with Wake County Schools to partner on school and open space projects, maximizing the return on public dollars invested.
6) Provide more economic incentives for developers to conserve open space, thereby reducing the demand on public funds.
7) Work with farmers and working lands owners to conserve open space.

Summary

The implementation of this Open Space Plan is an ambitious endeavor which can be accomplished through a partnership effort between Wake County, its municipal, state, federal and private sector partners. The goals of this plan can not be accomplished by the County acting alone. The County will lead these efforts, and will depend on the support of its partners to carry out the objectives outlined by this Plan.

When the Wake County Open Space program becomes fully operational, it will become a model for other communities throughout North Carolina and the nation. This report represents the beginning of a process that is likely to take 25 to 30 years to implement. The ultimate goal is to provide Wake County and its residents with the tools necessary to protect open space. This will happen when open space is thought of as an integral and valued element of the developed landscape.

Leadership from Wake County is required to ensure that the proper steps are taken to define a greenprint for the future; and to oversee the successful implementation of this Open Space Plan -- for the health and well-being of future generations.

Wake County 2103: A 100-year Vision

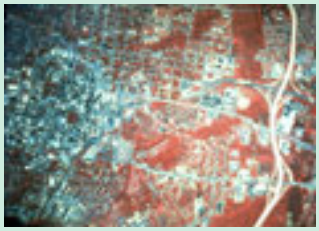
In the year 2103, Wake County, North Carolina is nationally and internationally regarded as one of the best places to live, work and raise a family. With a population of more than 2 million residents, the county enjoy's a robust blend of new age businesses, sustainable land uses and a landscape character that promotes quality living. Twelve municipalities within the County offer a distinctive choice in lifestyle ranging from the "big city" to the "rural village." The majority of residents live in close proximity to greenspace, providing easy access to outdoor resources such as parks, greenways and nature preserves. Children can ride their bikes to school and their friend's homes along an interconnected system of trails, just as their great-grandparents did in the late 20th Century. Commuters can choose from several modes of speedy and efficient transportation to and from work. Local schools are among the nation's finest, offering interactive indoor and outdoor teaching laboratories, and sharing resources with highly acclaimed local universities and colleges. The water and wastewater systems are some of the most advanced in the world. Water supply supports the burgeoning population and wastewater is recycled for a variety of community uses. Aquatic and terrestrial wildlife flourishes throughout the county, especially along creeks, streams, rivers and lakes, which support generous corridors of native vegetation. Agriculture continues to be a viable business in Wake County as local farmers engage in innovative practices pioneered in the early part of the 21st Century. Wake County's population is healthy and diverse, supporting cultures and lifestyles from around the world.

Much of the success that Wake County enjoys in 2103 can be directly traced to series of important actions that began at the beginning of the 21st Century. Four cornerstone and landmark elements of the County's comprehensive Growth Management Plan were completed in 2003. First, the County established a progressive greenprint for growth, a Consolidated Open Space Plan that defined critical green infrastructure resources for protection and conservation. Second, the County developed a comprehensive Watershed Management Plan, which determined best management practices for water resources throughout the County. Third, the County completed a Growth Management Plan, which depicted sustainable land use development strategies. Fourth, the County implemented one of the nation's most progressive transportation programs, which served to reduce the County's reliance on automobile travel and implemented a diverse multi-modal transportation program. Each of these four programs that began in 2003 played an important role in keeping Wake County a unique and beautiful place to live..

Chapter 1: Overview

Vision

What will Wake County look like 100 years from now? Will the landscapes of the County resemble anything that is familiar to the residents of today? Will there be enough land to support a diverse economy and enough water to support a growing population? Will the air be clean to breathe? Will the tall pines and stately oak trees continue to frame the horizon? Will our environment become a landscape crowded with buildings and highways? Or will the county retain the landscapes that have attracted thousands of new residents during the past three decades?



In 1970, the Raleigh-Durham MSA (Metropolitan Statistical Area) was home to 540,000 people. Today, our regional population surpasses one million. In 2020, the region will be home to two million people, larger than the present-day Charlotte, San Antonio, Orlando, or New Orleans regions. Each month, more than 2,000 people take up residency in the Raleigh-Durham area. With this rate of growth, what will the future hold for the new generations of Wake County residents?

Purpose

The purpose of the Wake County Consolidated Open Space Plan is to set forth methods for protecting and conserving the lands and waters that Wake County will need for our current residents and future generations. To begin this process, it is first necessary to understand the current condition of our open space -- the lands and waters not developed, and those lands already considered to be in some form of protection and conservation.

The issue of “open space planning” is not a new concept. However, it is a concept that has not been practiced with vigor during the past 30 years. As a result, growth and land development has far outstripped conservation and protection measures. From 1987 to 1997 the Triangle Region transformed 190,500 acres of previously undeveloped land into new residential subdivisions, office parks, shopping malls, highways, schools and other commercial uses. The County converted 10,000 acres of open space to development in 2005. In fact, the County has already developed 45 percent of its available real estate. Conversely, approximately 10 percent of our land area has been conserved and protected as open space. Given the current rate of growth and development, if the County does not begin to emphasize land conservation policies and programs, an estimated 78 percent of the county land area will be developed by the year 2020. (source: Triangle Land Conservancy, 2000).

As evidence by the formation of a Growth Management Task Force, Watershed Management Task Force and Open Space Advisory Committee, Wake County is concerned about future growth and land development, and the impact that this has on the quality of life throughout the county. Wake County Government has begun an earnest effort to protect lands and waters that are of value, and which help ensure that the quality of life that residents enjoy today remains desirable for years to come.

Wake County wants to implement a strategy for sustainable growth and development. This Open Space Action Plan, a "greenprint" for the future, is one of several tools currently being implemented by County government to set a new course. A Watershed Plan assessed the impact that growth and development is having on the water supply, watersheds and associated floodplain landscapes. A Growth Management Plan defined new strategies for accommodating future land development activities. A Transportation Master Plan explored ways in which residents travel throughout the county using a variety of modes. Together, these plans ae working to establish a foundation for future growth and development that is both sustainable and economically viable.

Regional Cooperation

Wake County did not undertake the preparation of this "greenprint for growth" alone. The County formed strategic partnerships with its 12 municipal governments, and worked with the State of North Carolina, federal agencies, private corporations in the county, landowners, and non-profit organizations that support land conservation. The County understands that it alone cannot accomplish all that must happen to achieve balanced growth and sustainable development.

Toward this end, the County sought and received from voters the authority to issue Open Space Bonds totalling $41 million through referendums approved in 2000 and 2004. This money has been used to purchase land and protect it as open space. In 2002 and 2003, the County awarded more than $250,000 in planning grants to eleven of the twelve municipal governments so that they could complete their own open space plans, and established Partners for Open Space and the Environment (POSE) to produce and implement these local plans. These actions are a first for a North Carolina county and clearly demonstrate the progressive objectives and evolving support for open space conservation in Wake County.

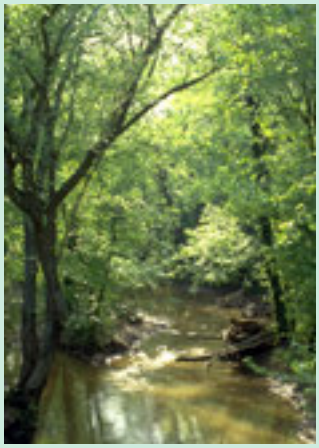
Additionally, open space protection and conservation is not the exclusive concern of local governments. County residents have clearly voiced their concerns and shown their support for land conservation programs. Private landowners, businesses and corporations in Wake County are doing their part to advocate for and participate in open space conservation efforts. A broad-based partnership among the public and private sector will be essential if Wake County is to be successful in conserving its valued undeveloped lands and waters.

Importance of Open Space

Open space has long been synonymous with park and recreation development. It will become apparent throughout this report that much of the open space protection and conservation strategies of local governments has been closely associated with the provision of park and recreation lands and facilities. Open space can and must be thought of in broader terms as the “green infrastructure” upon which communities build and grow. Open space is the infrastructure that provides our communities with clean water. Open space can be used to absorb floodwaters in flood-prone landscapes and reduce impervious surface areas throughout a watershed. Open space absorbs floodwaters and therefore can serve to keep people and property out of hazardous flood prone landscapes. Open space provides the land area necessary to grow healthy stands of native trees which clean air and moderate climate. Open space also defines our sense of place, it is what makes living in Wake County different from Chester County, Pennsylvania, Broward County, Florida, Boone County, Missouri and King County, Washington.

Water Quality

Water is one of our most precious resources. All life depends on a stable source of clean water. In Wake County, our water is drawn from several surface lakes, including the Falls Lake reservoir, Jordan Lake reservoir and several secondary sources including Lake Benson and ground water. Fresh water is not an infinite resource. In fact, the fresh water supply is a finite resource that must be properly managed, especially given the demands of our growing population. While we take our drinking water for granted, America is one of the few nations in the world to enjoy this diminishing luxury. The Centers for Disease Control in Atlanta reports that each year more than one million Americans become ill, and annually 900 die, from drinking polluted water. The CDC expects these incidents to increase as more pressure is exerted on the nation's fresh water delivery systems.



The signs of stress are beginning to emerge as Wake County's population continues to grow. Moratoriums on new growth and development have been declared in several Wake County municipalities in years past due to restrictions on water usage. The drought of 2002 also caused communities to examine growth management in light of water shortages. New strategies are emerging in several communities that involve piping water from adjoining counties into Wake County to ensure a plentiful supply in the future. It is important to implement sound water management principals and practices today so that our water supply will keep up with the demands of the future. This means Wake County must not allow its water supply to become degraded and polluted.

The protection of our water supply should begin with the protection of the infrastructure that produces clean water. This includes the wetlands, vegetated stream buffers, aquatic habitat, and biological processes that remove pollution from our water and keep it clean. Toward this end, the

County's Watershed Management Plan is closely tied to the efforts of the Open Space Action Plan. Protecting and conserving open space is the least costly and most effective method for protecting our water supply. As one example of this strategy, the state of New Jersey spent $55 million to acquire property in the State of New York, to safeguard its drinking water supply. The City of New York estimated that it would cost between $6 and $8 billion to continue to upgrade its water filtration systems in order to provide clean water to NYC residents. Instead the City is spending $1.5 billion to purchase land around its upstate water reservoirs in order to keep its water supply from becoming polluted so that treatment costs will be reduced. These are the types of strategies that Wake County must employ, and request that surrounding counties employ, to protect the water supply reservoirs of our region.

Ecological Values

The lands that serve to filter pollution from our water supply serve other important purposes. We can strategically access and use the land for recreation. Viable forestry operations can be sustained on these lands, which in turn will support a diversity of plant and animal life, and help to keep our air clean. Maintaining vegetative buffers, healthy streams and biologically diverse landscapes mitigates the effects of urbanization on our local climate. Our soil will remain rich and receptive to rainwater. Our landscapes will remain distinctive.

These ecological values are important in defining our quality of life. They are essential in sustaining life for plants and animals that are native to Wake County. In 1987, the Triangle Land Conservancy in partnership with the North Carolina Natural Heritage Program and Wake County government conducted a Natural Heritage Inventory of the County. This effort identified more than 53 natural area landscapes considered to be significant and in need of protection. Many of these sites contained rare plant and animal species. Some sites were of local significance, while others merited regional and state significance. The greatest threats to these landscapes in 1987 was the rapid growth in population and resulting land development.

Since the Natural Heritage Report was published, some of these sites have been protected, while others remain unprotected. Some of these sites have been lost to development. In 1999, Wake County commissioned phase one of this Open Space Action Plan. The purpose of the Phase One study was to examine four watersheds (Falls Lake, Neuse River corridor, Swift Creek and Harris Lake) and determine lands that were in need of immediate protection. From this study, 44 sites were identified for further study. Many of these sites remain unprotected, as of this date.

Despite the 12 year difference in time between these two studies and reports, one thing remains clear. The natural heritage in Wake County is not going to be protected by studies and reports, it will be protected by our actions or lost by our lack of action. Now is the time to take action.

Economic Values

Protecting open space is not in conflict with a healthy and vibrant economy. Both are possible under the principles of sustainable development. Open space represents value added in the American landscape. Increasing numbers of communities throughout the nation have come to realize that protecting open space is a good investment and not an unwarranted expense. In Austin, Texas, community residents have decided to "invest" $130 million in local bonds to protect open space in critical watersheds and create new parks and greenways. This is being done to enhance the quality of life and offer a new, competitive national model for sustainable urban growth that will be used to lure new business and industry to the community.

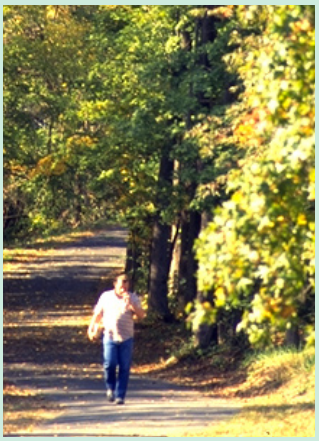
Open space has value in Wake County's economy. In fact, the sprawl that Wake County has experienced during the past three decades has been costly. Howard County, Maryland, found that providing services for open space, parks and farmland cost the community $0.35 for every $1.00 collected in taxes, while providing services to residential property cost the community $1.25 for every dollar collected. Minneapolis-St.. Paul, MN, reports that rural undeveloped landscapes require $0.50 in services for every tax dollar paid, while its residential properties require $1.04 in services for every tax dollar paid. Similar studies are found throughout the nation.

Open space can also prevent economic loss. Former Raleigh City Manager Dempsey Benton stated that the financial impact from flooding resulting from Hurricane Fran (1996) could have been much worse had it not been for the 25-year old Capital Area Greenway program, which has served to keep homes and businesses out of flood prone landscapes (source: News and Observer)

Open Space attracts new business and industry. After conducting a five-state search for a new manufacturing site that would bring 700 new jobs to a community, Reichold Chemical settled on its present day site in the Research Triangle Park (RTP). Reichold publicly stated that the development of RTP's trails and greenways was the deciding factor in its relocation decision. Reichold sponsors on-site health and wellness programs and its proximity to RTP's greenway system influenced its final decision and was an enticement that no other site offered. In fact, recent surveys of small business owners rank recreation/parks/open space as the highest priority in choosing a new location for their business (source: Trust for Public Land).

Open space also improves the value of adjacent land. Shepherds Vineyard subdivision in Apex reports land values are 20% higher for properties that are located adjacent to the community open space and greenway, versus those that are not immediately adjacent. As an investment in the future, property that is conserved for open space and subsequently removed from the tax rolls will serve to improve the economic value of land

immediately adjacent, resulting in little or no net loss in taxable value. For example, in Oakland, CA, a three-mile long greenway was found to add $41 million in value to surrounding properties. Also, between 1980 and 1990, the percentage of Denver residents who said they would pay more to live near or on one of its famed greenways rose from 16 percent to 48 percent. Chattanooga, TN's investment in its public greenway system has attracted more than $750 million in private sector investment to properties that surround the greenway. Open space enhances property values.



Connectivity

One of the central ideas and purposes of the Open Space Action Plan is to support connections. Aldo Leopold said, "Everything is connected to everything else." Protecting open space, creating greenways and establishing a Greenprint for Wake County is all about maintaining connections. This plan is concerned with many different types of connections, ecological and human.

In most cases ecological systems don't share human-created geopolitical boundaries. Many of our watersheds for example, one of the largest organizational frameworks for ecological systems, extend beyond the county boundaries. Wake County does not control the actions of other local governments with respect to how water and land is managed within a watershed that is outside our political boundary. Conversely, the actions in Wake County affect our neighboring downstream counties. It is easier to control the subwatersheds that are entirely contained within our boundaries. Many of these subwatersheds are experiencing severe degradation and pollution resulting from land development activities, including an increase in flooding from upstream urbanization. For example, the Nature Conservancy and the Association for Biodiversity Information has named the Upper Neuse Watershed, which includes Wake County, as one of 15% of all watershed in the United States that must be protected to preserve at risk freshwater mussels and fish species.

Understanding ecology and its role in defining our quality of life is one of the most important "connections" to make. The County must strive to make future land development "sustainable." These subwatersheds do have a carrying capacity -- there is a limit as to how much land development and landscape alteration can take place before ecological systems are degraded.

Many Wake Countians enjoy being "connected" to the great outdoors. Hiking, cycling, skating, fishing, picnicking, hunting (on state and federal gamelands), participating in organized sports, boating, and many other activities are enjoyed every day by residents of the county. These connections can be strengthened by improving access to the unique landscapes of the county through the provision of more greenways, parks and open space. Many of these connections need to occur closer to our urban centers and towns, where the greatest number of people of the county reside.

These physical connections can and should be linked together to form an interconnected network of open space resources that can improve recreation and offer alternatives to automobile travel.

Our Sense of Place

As Wallace Stegner said, “If you don’t know where you are, you don’t know who you are.” During the past 30 to 40 years many of our communities all across America have begun to look alike, indistinguishable one from another. It is difficult to determine a difference in the suburban landscapes throughout Wake County. Are you in Raleigh, Cary, Garner, Wake Forest or Fuquay-Varina? Additionally, the landscapes that were created during this period, miles of strip malls, fast food restaurants, auto dealerships and gas stations, are often inhospitable to everyone except automobile visitors.

This strip development along our entry roadways tell visitors and residents alike very little about Wake County. Our culture and heritage is better defined by our open space and best articulated in the stewardship of the land. Due to the fact that Wake County is not located in the mountains, or along the ocean’s edge, or on a major river, the most significant natural resources of Wake County include the green forests of loblolly pine, oak and maple. Our community grew along the creeks and streams that flow from abundant watersheds throughout the county. Our rolling terrain has been the building block for our agricultural and industrial economy. Our natural heritage has served to define who we are as well as where we live. We can’t afford to turn our back on this heritage. We must do our part to protect and conserve this place for future generations.

Chapter 2: Summary of Existing Open Space System

Existing Open Space System

In 1976, the Wake County Board of Commissioners established the Wake County Parks and Recreation Department in order to provide park facilities and programs for the growing population that resides outside municipal corporate limits. The goal of the program has been to coordinate and collaborate with existing agencies already providing park and recreation services in the county. During the past 25 years, the Department has been successful in this collaborative process, beginning with the first "school/park" at Apex Elementary School (est. 1981) and continuing today with the development of County and District Parks. To date the Division of Parks, Recreation and Open Space has been involved in the development of 22 additional school/parks. Wake County is regarded as a national leader in the planning and development of school/parks, with at least one located in every municipality, as well as unincorporated areas.

The Department has also been successful in collaborating with other agencies and the Wake County Public School System. The first independent county park, Lake Crabtree, opened in 1988. This park was established in partnership with the Raleigh/Durham Airport Authority and is adjacent to a 520-acre lake and flood control structure. Blue Jay Point County Park has been developed on land owned by the US Army Corps of Engineers. Historic Oak View County Park is one element of a larger County Office Park developed on the outskirts of Raleigh. Crowder District Park is developed on land donated by Mrs. Doris P. Crowder. Cedar Fork District Park is located on land acquired through the Crabtree Creek Flood Control Project, which is administered by the Wake County Soil and Water Conservation District. Harris Lake County Park opened in 1999 and is being developed on land leased from Carolina Power and Light. The Historic Yates Mill County Park was developed through a partnership with North Carolina State University and Yates Mill Associates, a non-profit association.

Wake County has also implemented a Grant-in-Aid Program which allows other agencies involved in the delivery of recreation services to more than double funding for parks through a 50/50 matching grant program. This program is especially helpful to smaller municipalities and non-profit organizations in Wake County who are economically challenged to meet the park and recreation needs of citizens. Monies from this program have gone toward land acquisition, recreation services, and amenities at schools, municipal parks, and non-profit organizations.

Wake County has become serious about the need to protect open space land for reasons that extend beyond the provision of recreation and leisure services. The Division of Parks, Recreation and Open Space leads the County's institutional effort, and is supported by a citizens committee, the Open Space Advisory Committee. By definition, the County regards open space as **protected** lands and waters that are owned and managed by the County, its public sector partners, the municipal governments of Wake County, State of North Carolina, the United States government, and the County's private sector partners, including non-profit land trusts. Open space consists of any parcel or area of land and water that is devoted to 1) the preservation of natural resources; 2) the managed production of resources (farmland); 3) outdoor recreation; 4) preservation of historic and cultural property; 5) protection of scenic landscapes; and 6) protection of public health, safety and welfare.

There are numerous other agencies, organizations and land managers that conserve and protect open space in Wake County, including the federal government, State of North Carolina, municipal governments, universities and colleges, private corporations and businesses, non-profit organizations and citizens. Wake County is fortunate to have an estimated 55,719 acres of open space under some form of protection and conservation (see listing below). Some of the land is used, for example, at the municipal level for active recreation pursuits. Most of the land is conserved for other reasons such as water supply protection, floodplain management, habitat conservation or educational purposes. The good news is Wake County is starting with a good base of conserved and protected lands. The bad news is that the County is rapidly losing the opportunity to maintain an equitable balance of conserved lands as development continues at a rapid pace.

Source of Statistics:
Triangle Land Conservancy

Vital Statistics Wake County:
Population: 748,815 (2005 Census)
Total Open Space: 55,719 acres
Ratio: People to Protected Open Space: .007 ac/person

Wake County Parks, Recreation and Open Space Statistics:
Acres of County Parkland: 1,795
Acres in Natural State: 1,535
Acres non-park Open Space: 2,578
Miles of Greenway: 5.5

Protected Open Space in Wake County
Federal Landholdings:
US Army Corps of Engineers
Falls Lake: 18,532 acres (5,035 ac. Falls Lake State Recreation Area and 6,512 ac. of water)
Jordan Lake: 1,715 acres

State Landholdings:
Umstead State Park: 5,481 acres
Mitchell Mill State Natural Area: 93 acres
Hemlock Bluffs State Natural Area: 92 acres (Cary Nature Preserve)
Clemmons Educational State Forest: 147 acres

NCDOT Mitigation Lands: 606 acres
Yates Mill Pond: 314 acres
NCSU Schenck Forest: 21 acres

Corporate land leased for Parks/Game Land
Shearon Harris Game Lands: 8,250 acres (Wake County leases from Progress Energy)
Harris Lake County Park: 680 acres (Wake County leases from Progress Energy)
Lake Crabtree County Park: 200 acres (Wake County leases from Airport Authority)
Harris Research Tract: 1,267 acres (NC State University leases from Progress Energy)

Municipal Greenspace
Municipal Parks and Greenways: 10,527 acres
Water Supply Buffer Lands: 1,100 acres

University/College Landholdings
NCSU Agriculture Labs: 2,329 acres
NCSU Leased for Yates Mill Pond: 212 acres
NCSU Schenck Forest: 262 acres

Land Trusts and Other Non-Profits
Triangle Land Conservancy: 188 acres
Nature Conservancy: 12 acres
People for Parks: 19 acres

Source of Statistics: Triangle Land Conservancy

Wake County Park Sites

The following pages define the park and open space lands that Wake County currently manages. A brief description is provided for each park site.

Cedar Fork District Park

This thirty-three acres of land is part of the Crabtree Creek flood control system. The County maintains a dozen fields and the parking areas for them.

Little River Reservoir

This proposed 1700 acre reservoir with another 300 acres of buffer and 300 acres for a regional park comprise a future major park site in northeast Wake County.

Blue Jay Point County Park

Located on the shores of Falls Lake in northwestern Wake County, Blue Jay Point County Park offers residents a variety of recreation and environmental education opportunities. This 236-acre park includes an Environmental Education Center which houses classrooms, exhibit space and offices for park staff. The Park also offers hiking trails, picnic areas, a children's playground and open play fields for visitors.

An extensive trail system at Blue Jay Point offers county residents an opportunity to enjoy the spectacular beauty of Falls Lake. A 3.1 mile trail meanders along the shoreline of Falls Lake from Lower Barton Creek to Upper Barton Creek on Six Forks Road, part of the Falls Lake Trail and NC Mountains to the Sea Trail. Paved access trails are found closer to the Environmental Education Center and offer access to pedestrians only.

Crowder District County Park

Situated on 33-acres of gently rolling wooded land in southwestern Wake County, Crowder District County Park provides visitors a variety of recreation and environmental opportunities. This park site was donated to Wake County in 1992 by Mrs. Doris P. Crowder, a strong supporter of public parks. The county constructed recreational facilities at the park using funds from a 1993 parks bond referendum. The park provides visitors with paved trails, picnic shelters, a children's playground, open play fields and a 2.7 acre pond for fishing. The park also provides 0.8 miles of paved trails that encircle the park and allow visitors to enjoy the unique flora and fauna of southwestern Wake County.

Harris Lake County Park

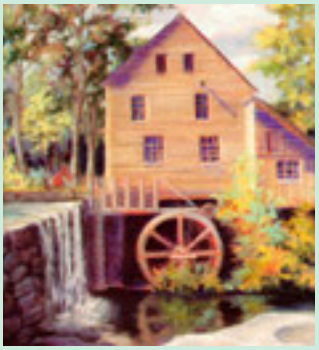
Wake County's largest park site is Harris Lake County Park. Covering 680 acres of land, this park is located in the southwestern portion of the County. Currently the park is undergoing phased construction and development. With the first phase complete, visitors can now enjoy picnic shelters, public restrooms, a children's playground, an environmental education center and hiking and mountain bike trails. Future phases call for historical interpretation facilities, an overnight lodge, a park center and more trails. Two primary trails offer different outdoor hiking and biking experiences. The Peninsula Trail is for walking and hiking only and winds along the shoreline of Harris Lake. Four loop trails provide approximately 6 miles of footpaths. The Hog Run trail is for mountain biking and consists of three loop trails that total six miles in length.

Historic Oak View County Park

This historic park offers visitors with an opportunity to visit life on a 19th century farmstead. The park provides a hands-on approach to learning and understanding Wake County's heritage. The 17-acre park includes a 19th century farmhouse, picnic grounds, a Farm History Center, Cotton Museum, a pecan grove, herb garden and walkways.

Lake Crabtree County Park

Located on a 200-acre site, and adjacent to a 520-acre flood control lake, Lake Crabtree County park offers visitors a variety of outdoor recreation experiences. The park's main attractions include fishing, boating, hiking, group and individual picnicking, mountain biking and nature study. Visitors can rent boats and fish from piers and platforms built into the lake. Picnic Shelters are also available.



Historic Yates Mill County Park

Located off of Lake Wheeler Road just south of downtown Raleigh, Yates Mill County Park contains the only remaining grist mill in Wake County. In partnership with the Yates Mill Associates and North Carolina State University, the park provides visitors with a variety of historical and environmental education activities. Through phase one construction, the park will offer access to the restored grist mill, research labs, hiking trails, the restored mill pond, boardwalks and outdoor classrooms.

Municipal Open Space Systems

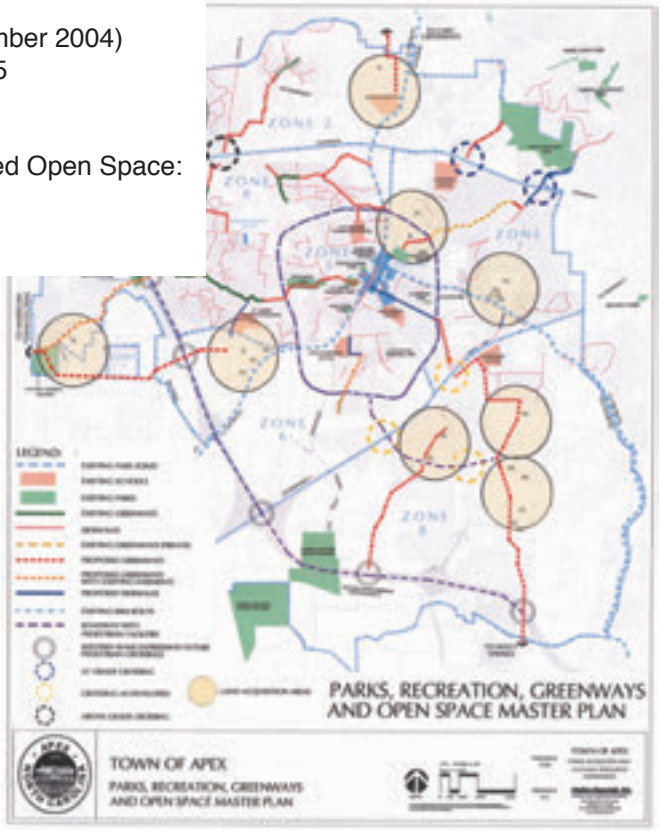
Apex

Apex's inventory of protected open space consists primarily of active recreation parkland, with is largest park, the 158-acre Apex Community Park, holding the majority of the passive recreation acreage. Most of the neighborhood parks are located in downtown Apex and include Clairmont Park (2 acres), Senior Citizens Park (2 acres), WHOPS Park (1.33 acres), Sue Helton Memorial Park (.25 acres), and West Street Neighborhood Park (2 acres). Larger parks include Apex Jaycee Park (20 acres), and Kelly Road Park (23 acres). Apex also has two undeveloped parks: Holland Crossing property (± 40 acres), and the Walden Creek Tract (8 acres). Both of these undeveloped parks are expected to allocate a portion of land for passive recreation to remain predominantly undeveloped, and a portion to meet active recreation needs.

Several greenway segments have been constructed primarily as a result of residential development and required recreation land dedication. Greenways consist of a variety of surface material types and remain fairly dispersed and segmented.

More open space will be protected as the Town's Unified Development Ordinance evolves in response to rapid growth in Apex. In addition to recreation fees or land dedication requirements, Apex has recently implemented land dedication to Resource Conservation Area's (RCA's), as a part of the development process. Additionally, Apex has a watershed protection overlay district which defines development requirements and enforces development within buffers along protected tributaries.

Vital Statistics:
Population: 29,277 (November 2004)
Acres of Parkland: 373.25
Miles of Greenway:
9 miles public,
Ratio of People to Protected Open Space:
.001 ac/person

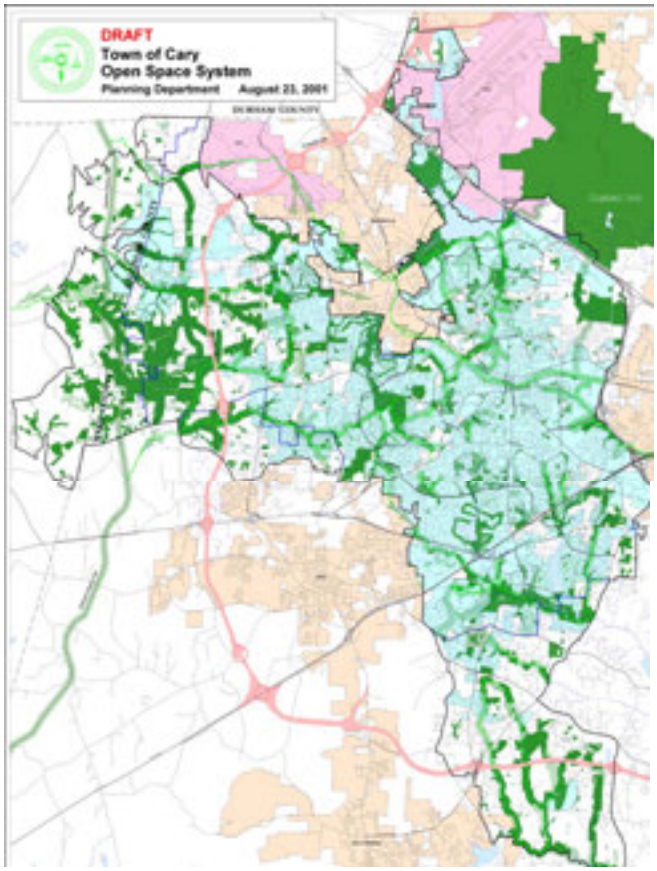


Cary

The Town of Cary was the first municipal government in Wake County to complete an open space plan. As an element of the Town's comprehensive plan, the "Open Space and Historic Resources Plan" boldly defines the future conservation of approximately 8,000 acres of land. Cary is North Carolina's 7th largest city with a population of more than 94,500. The town has committed to spend an estimated $12.5 million for open space to preserve land so the town will remain an attractive place to live, raise a family and conduct business. Cary is acting on the belief that preserving open space is one way of ensuring a bright economic future for the community.

Cary envisions protecting and conserving open space in three different ways: through the use of regulatory measures, land preservation techniques and voluntary landowner participation. The town is committed to purchasing lands for open space, however, this is acknowledged to be the most expensive way to preserve land. The town will employ other strategies, including restricting land development activities and using tools such as conservation easements and management agreements with property owners.

<u>Vital Statistics</u>:
Population: 115,854
Acres of Parkland: 750
Miles of Greenway: 20
Ratio of People to Open Space: .006 ac/person

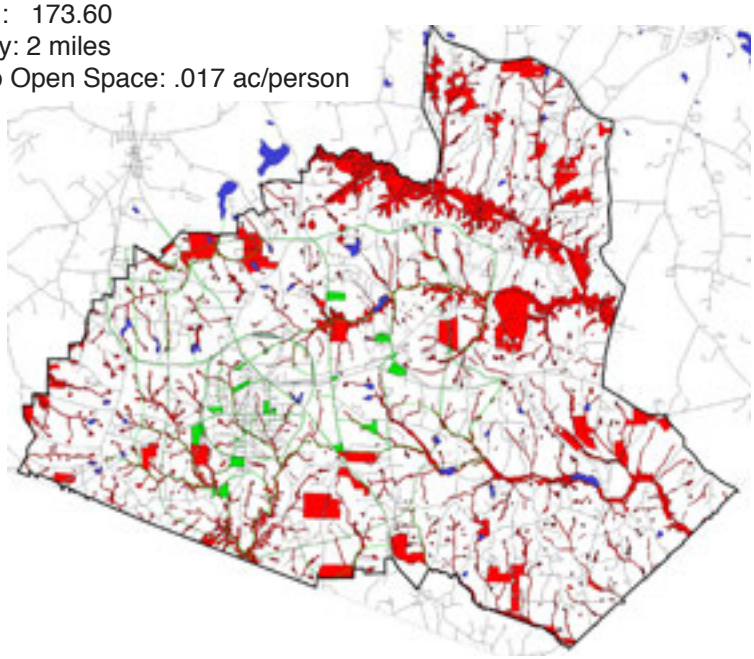


Fuquay-Varina

The Parks, Recreation and Cultural Resources Department is responsible for maintaining the Town's parks, athletic fields and for planning Town sponsored community activities. The Department also manages the Community Center which offers seasonal and year-round programs for fitness, education, recreation and adult athletics. The following is a listing of the current park, recreation, open space and greenway facilities managed by the Town.

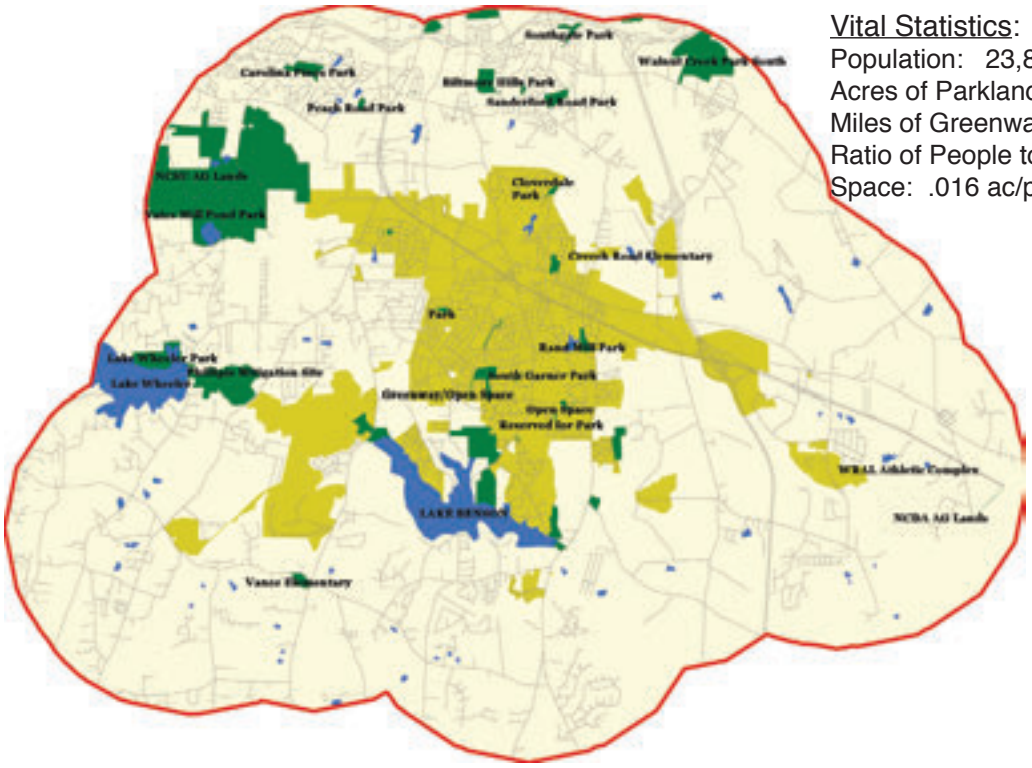
Park Name	**Size (ac)**
South Park and Community Center	25.25
Honeycutt Road Park	22
Action Park	14
Falcon Park and Council Gym	5.75
Ballentine Elementary School/Park	15
Library Park	1.6
Historic Fuquay Spring Park	1.5
Carroll Howard Johnson EEP	27
Fuquay-Varina Middle School Fields	3
Fleming Loop Soccer Fields	36
Jones Street Field	2
Kinton Field	2.5
Ransdell Field	4.5
Wake Chapel Field	3
Woodrow Street Recreation Facility	0.5
Heritage Walking Trail & Open Space	10
Total	**173.6**

Vital Statistics:
Population: 10,089 (2003)
Acres of Parkland: 173.60
Miles of Greenway: 2 miles
Ratio of People to Open Space: .017 ac/person



Garner

There are 13 existing parks in Garner, along with the protected land owned by the Town of Garner, North Carolina State University, Wake County and the City of Raleigh. Lake Benson Park, a 64-acre property is the largest developed Town-owned facility. White Deer Park, a 96-acre tract is scheduled for Phase I development in 2007/08. These parks, along with a 120-acre parcel on Swift Creek west of the Lake, act as a buffer for the Lake Benson Reservoir. The Phillips Mitigation site straddles Swift Creek between Lake Wheeler and Lake Benson. Lake Benson is designated as a future primary drinking water source for the area. These properties along Lake Benson and Swift Creek serve as links in a future greenway corridor between Garner and Raleigh. The undeveloped Bryan Nature Park is a wildlife preserve on Mahler's Creek. Cloverdale Park is an existing linear park. Garner Recreational Park contains several trails that connect the park with Creech Road Elementary School and the Garner Senior Center. A future greenway corridor connecting the Historic Downtown, Garner Recreational Park, Garner Senior Center, Creech Road Elementary School and Park, North Garner Middle School, Avery Street Recreation Center and the Garner Historic Auditorium has been identified. Rand Mill Park is a smaller neighborhood park. South Garner Park sits in the midst of a residential community just north of Lake Benson. Jaycee Park, another linear park, is owned by the Wake County Public School System. Other protected open space areas include land along Highway 50 at the eastern end of Lake Benson. Raleigh owns the buffer around the perimeter of Lake Benson. The Town has acquired buffers for many years along waterways that have potential as future greenway links.



Vital Statistics:
Population: 23,821
Acres of Parkland: 395
Miles of Greenway: 0
Ratio of People to Open Space: .016 ac/person

Holly Springs

The Parks and Recreation Department was established in 1996 with the hiring of a director and the passage of a $2 million Parks & Recreation Bond. Prior to 1996, the town had only one park and few recreation programs. Since its inception in 1996, the Department has expanded its parks and recreational programs to complement the rapidly growing diverse population of the community. The goal of the Parks & Recreation Department is to provide all residents with diverse opportunities to achieve a quality leisure experience.

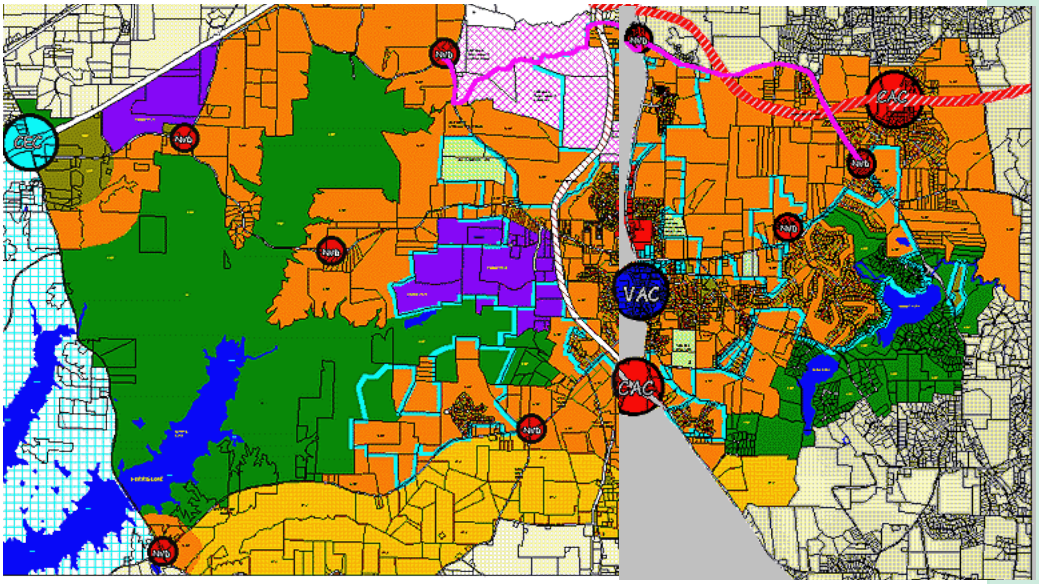
Parrish Womble Park - The Town purchased this 46-acre site in 1997. The park is currently under construction and when completed will be the site of an athletic complex with lighted baseball/softball fields, a football field, soccer fields, horseshoe court, and a volleyball court.

Holly Springs Elementary School Park - This 20-acre tract is located adjacent to Holly Springs Elementary School. Plans are for an environmental and educational park to compliment the school and the developing neighborhood, in conjunction with an age appropriate playground and athletics.

Bass Lake - The town purchased the lake and dam in 1999. Plans are to restore the 114-acre park and lake, destroyed by Hurricane Fran in 1996, to provide passive water based leisure opportunities to its residents and the surrounding communities. The main emphasis will be community fishing lake management and water quality.

Holleman Soccer Fields - A 6 + acre tract the Town leases for use as a soccer complex.

Vital Statistics:
Population: 9,192
Acres of Parkland: 197
Miles of Greenway: 4 miles
Ratio of People to Open Space: .021 ac/person



Knightdale

Within the Town of Knightdale's Urban Service Area (USA) there are approximately 116.34 acres of protected open space. The majority of Raleigh and Wake County land is located along the Neuse River Corridor. The Triangle Land Conservancy owns a 38 acre tract of land, Temple Flat Rock, northeast of Knightdale. Currently Knightdale is in the process of acquiring land for Phase I of the Mingo Creek Greenway as well as securing open space dedications from new developments.

Vital Statistics:
Population: 8,041
Acres of Parkland: 116.34
Miles of Greenway: .76
Ratio of People to Open Space: .018 ac/person

Morrisville

The Town of Morrisville, like many other municipalities in Wake County, has seen a surge in development in the last few years. This increase in activity has absorbed many areas that were once wooded and changed the overall character of the town. Morrisville has understood these changes and is committed to creating an open space master plan that will preserve the town's charm and quality of life for years to come.

Morrisville currently has 92 acres of parks and open space land. The Morrisville Community Park (34 acres), Luther Green Park (6 acres), and Ruritan Park (.5 acres) serve the community's existing needs. Morrisville Community Park is in the midst of a rennovation/expansion project that will include the addition of two baseball/softball fields, the construction of the initial leg of the town's greenway system, additional walking trails, new concessions and restroom facilities, additional parking, and updates to the existing playground. In addition, the Town owns three other parcels of open space land, the Weston Park Site (34 acres), Morrisville Square (10 acres) and Breckenridge Park (8 acres), which will be developed in the future to serve new residents. The majority of the current land and facilities is located in the historic area of the Town, near Crabtree Creek. Wake County owns more than 260 acres of land in and around Morrisville, including parks, open space, floodplain and wetland mitigation lands.

Morrisville plans to conserve open space throughout the community by focusing on the protection of hardwood forests, and by dividing up large masses of developed land. The recently adopted greenway master plan will link these areas with existing and future park lands, residential and commercial areas, and other municipalities, creating an interwoven system of open space lands.

Vital Statistics:
Population: 12,195 (July 2005)
Acres of Parkland: 92
Miles of Greenway: .75 miles
Ratio of People to Open Space: .007 ac/person

Raleigh

The City of Raleigh has more than 8,499 acres of open space and almost 1,400 acres of water, offering recreational activities year-round. A nationally acclaimed greenway system spans 54 miles, providing walking, jogging and hiking trails that connect many of the city's 115 major parks. Programs are offered for the mentally, physically, and visually impaired and the deaf and hard-of-hearing.

In an effort to preserve natural areas in the face of rapid urban growth, Raleigh city leaders started the city's greenway system in 1974. With more than 54 miles of trails, the system is the oldest of its kind in the southeastern U.S. More than 40 miles of the trail system is surfaced for jogging, hiking, nature study and biking, and many of the trails are conveniently located throughout the city, making them easily accessible for residents and visitors alike.

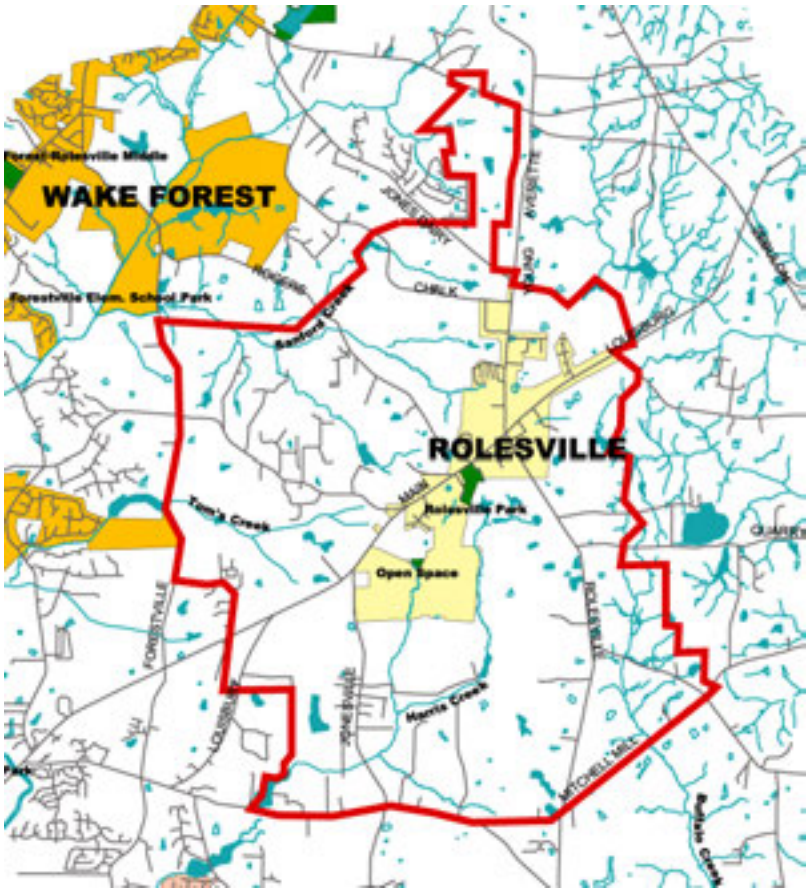
The City of Raleigh has conserved an estimated 1,100 acres of water supply buffer lands around Falls Lake and the Neuse River. These undeveloped lands provide the infrastructure necessary to protect some of the drinking water supply for Wake County.

Vital Statistics:
Population: 353,604 (July 2006)
Acres of Parkland and Greenways: 8,499
Miles of Greenway: 54
Ratio of People to Open Space:.024 ac/person

Rolesville

The Town of Rolesville manages three (3) parks totaling 49.54 acres. The Rolesville Community School Park is adjacent to Rolesville Elementary School. This park contains three (3) baseball/softball fields, a picnic shelter, a playground, and a restroom/concession stand facility. Main Street Park is located off of South Main Street (US 401) near downtown Rolesville. The first phase of Main Street Park includes a gazebo and three (3) large picnic shelters, a playground, ¼ mile paved walking trail, and a 915 linear foot mulched trail. The second phase of the park (master plan in progress in 2006) is planned to include a community center, extension of the paved walking trail, and more athletic facilities. The third park is nestled between three large subdivisions. This small passive park, being developed in 2006, will included a ¼ mile walking trail and gazebo placed around a running creek. There are five creek corridors (Sanford, Tom's, Harris, Buffalo, and Cedar Fork) that are vital open space resources to the Town. In addition, there are a number of scenic road corridors within the Town.

Vital Statistics:
Population: 1,200 (2006)
Acres of Parkland: 49.54
Miles of Greenway: 0.5
Ratio of People to Open Space: .07 ac/person



Wake Forest

Parkland in the Town of Wake Forest is primarily located in and around the center of town, where historically most of the residential development has occurred. However, in recent years, parks and open spaces have been more evenly distributed. Park resources in Wake Forest include:

Park	Category	Size (ac)
Forrest Park	Mini Park	1
HL Miller Park	Mini Park	2
Kiwanis Park	Mini Park	1
North Taylor Street Park	Mini Park	1.5
Plummer Park	Mini Park	0.5
Alley Young Park	Neighborhood Park	15
Holding Park	Neighborhood Park	5
JL Warren Park	Neighborhood Park	10
Oak Street Park	Neighborhood Park	13
Smith Creek Soccer Center	Neighborhood Park	17
Tyler Run Park	Neighborhood Park	9
Dubois School Park	School Park	20
Wake Forest-Rolesville High School	School Park	1
Wake Forest-Rolesville Middle School	School Park	12.5
JB Flaherty Park	Metro Park	100
Joyner Park	Metro Park	117
Town Reservoir	Metro Park	174
Totals		**499.5**

Greenway trails in Wake Forest are widely distributed and typically short in length. The total length is 2.11 miles.

Wake Forest is increasing its amount of protected open space. Recently, the town has acquired ecologically valuable property along the north bank of the Neuse River and on both sides of Smith Creek.

Vital Statistics:
Population: 20,300
Acres of Parkland: 499.50
Miles of Greenway: 2.11
Ratio of People to Open Space: .025 ac/person

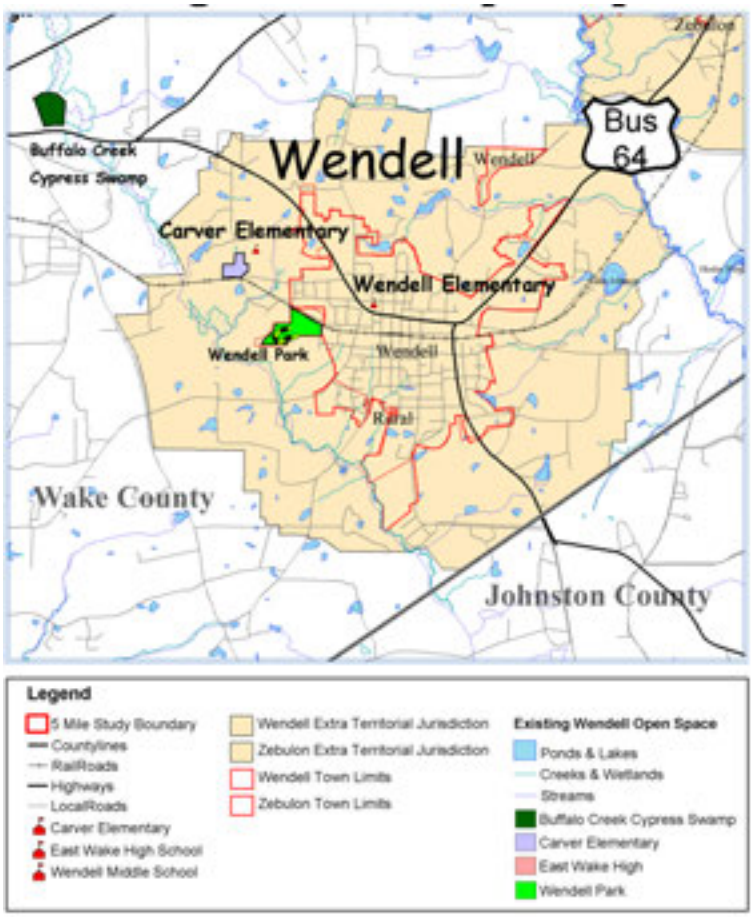
Wendell

The parks included within the ETJ of Wendell include Carver Elementary School (12.90 acres) and Wendell Park (31.18 acres). Wendell Park is the only true park in the system and is classified as a “Community Park”. Carver Elementary is currently managed by Wake County as part of their school system. Wendell park is managed by the Town of Wendell Parks & Recreation Department.

Carver Elementary has a track and various configurations of soccer, football, and ball fields. Wendell Park is open to the general public, and consists of ball fields and picnic areas.

Wendell currently has only one greenway trail in place. The Wendell Park Greenway is located within Wendell Park and consists of 0.34 miles trail.

Vital Statistics:
Population: 4,516 (July 2005)
Acres of Parkland: 44.08
Miles of Greenway: .34
Ratio of People to Open Space: .01 ac/person



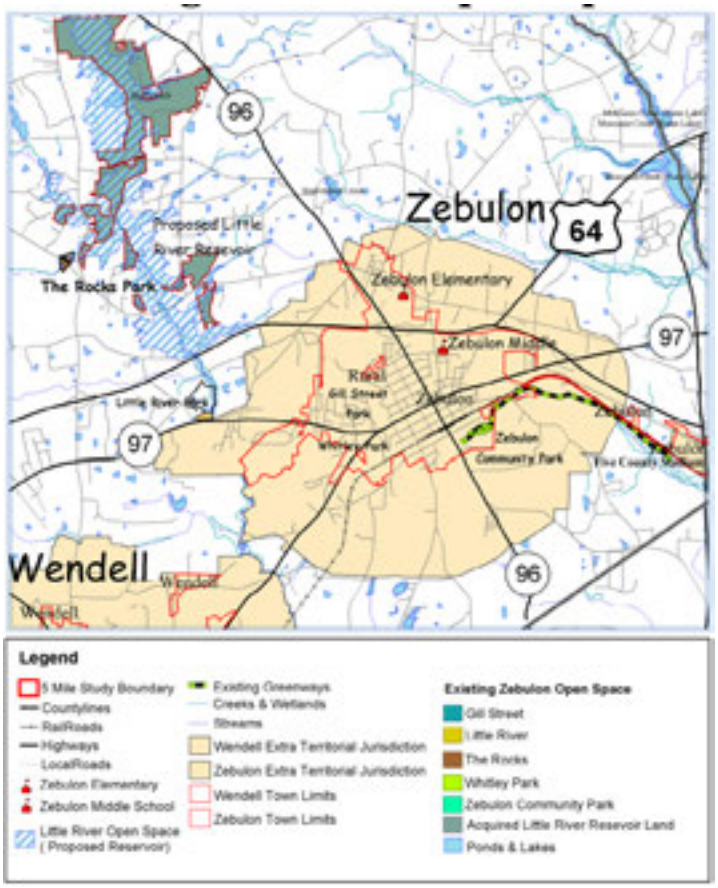
Zebulon

The parks included within the ETJ of Zebulon include two community parks: Little River Park (9.10 acres) and Zebulon Community Park (46.14 acres). Zebulon also has two “mini” parks which are located within the urban infrastructure of downtown Zebulon; Gill Street Park (1.42 acres) and Whitley Park (2.57 acres). In addition to the community parks and mini parks, Zebulon has Five County Stadium (46.42 acres), which hosts a minor league baseball team, and also provides passive recreational use (picnic areas).

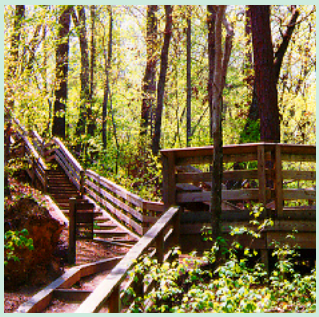
All Zebulon Parks are currently managed by the Town of Zebulon Parks & Recreation Department. Zebulon Community Park is open to the general public, and consists of ball fields and picnic areas. Little River Park is a passive park type that features the remnants of a mill and features picnic areas. Whitley and Gill Street Parks are urban parks that focus on passive use.

Zebulon currently has only one greenway trail in place. The Zebulon Community Greenway Trail is (1.96) miles in length.

<u>Vital Statistics</u>:
Population: 4,218 (July 2005)
Acres of Parkland: 105.65
Miles of Greenway: 1.96
Ratio of People to Open Space: .026 ac/person



State Parkland and Open Space



Within Wake County there are three state owned and operated lands and facilities: William B. Umstead State Park, Mitchell Mill Natural Area and Hemlock Bluffs (operated by Town of Cary). The County also leases Falls Lake Recreation Area from the Corps of Engineers.

William B. Umstead State Park
Surrounded by the cities of Raleigh, Cary, Durham and the Research Triangle Park, this state park is an oasis of tranquility, a peaceful haven. The 5,481-acre park support a diversity of activity including hiking, boating, fishing and picnicking. This park supports nineteen miles of hiking trails.

The Mitchell Mill State Natural Area
Mitchell Mill Natural Area is a 93 acre tract of land that contains some of the finest examples of granitic flatrock in the eastern Piedmont of North Carolina. More than 10 flatrocks can be seen on the site, covering 15-20 acres of the parcel. The ecosystem of the flatrocks is unique and fragile. The entire site is a registered Natural Heritage Area. With its proximity to local populations in Wake County, Mitchell Mill offers a destination for environmental education.

Hemlock Bluffs State Natural Area (aka Cary Nature Preserve)
Hemlock Bluffs is a landscape that is widely known for its unique stand of Canada hemlock trees, which grow more than 200 miles from the hemlock populations of the Appalachian mountains. This 92 acres site is owned by the State and managed by the Town of Cary through a lease with the State. The Town also owns 50 acres east of the state owned land. The Hemlock Bluffs Nature Trail is actually comprised of three different trails. The Swift Creek Trail, (.63 miles) includes a system of boardwalks and loop trails through a floodplain area. The Beech Tree Cove, (.34 miles) is a small, protected floodplain area along Swift Creek. The Chestnut Oak Trail, (1.1 miles) loops throughout an upland hardwood forest with ridges, ravines and creeks. An observation deck along the north section of the trail offers a dramatic view down a Galax covered slope to a tributary of Swift Creek.

Falls Lake
With a 12,000-acre lake and 26,000 acres of woodlands, Falls Lake offers a choice of recreation areas. Within the 5,035 acre State Recreation Area is Beaverdam, B.W. Wells, Highway 50, Holly Point, Rolling View, Sandling Beach and Shinleaf. Fishing, boating and swimming are only a few of the activities at the park. On land, visitors can enjoy walking, mountain biking or camping along a portion of the state's Mountains-to-Sea Trail.

State of Open Space and Triangle Greenprint

State of Open Space, written and published by Triangle Land Conservancy, is a series of reports that assesses the status of the Triangle's green infrastructure every two years. The report examines land use changes in the region, inventory protected open space, catalog and review government and non-profit land conservation initiatives, and recommend ways for the region to strengthen its open space preservation programs. The

first State of Open Space report resulted in the preparation of the Triangle Greenprint to identify important places for protection of open space at a regional scale. The Triangle Land Conservancy, Triangle J Council of Governments, and NC Department of Environment and Natural Resources partnered to begin the Triangle Greenprint process. The resulting report, GIS database, and collection of maps constitute the technical data to underpin an action plan. (www.trianglegreenprint.org)

One NC Naturally Program

The One NC Naturally Program (originally called the Million Acre Initiative) is a challenge for North Carolinians, issued in January 2000 by Governor Jim Hunt, to preserve an additional one million acres of open space by 2010. The economic prosperity, recreational and educational needs, public and environmental health, and spiritual enrichment of North Carolina communities depends on a balance between growth and land preservation. Parks, forests, farms, greenways, and green spaces are vital for North Carolinians' quality of life, but these open spaces are increasingly being lost to development. The One NC Naturally plan establishes a specific goal for open space preservation that all North Carolinians can share, and offers a framework for tracking our progress toward that goal. About 2.8 million acres, the majority in state and national parks and forests, already is set aside from development in North Carolina. However, the vast majority of this land is located outside the major population centers and in many cases is a considerable distance from the major urban centers. The current open space total constitutes about 8.6 percent of the state's land mass. Preserving one million additional acres would bring the total to about 12 percent.

The goal of preserving one million acres was enacted into law in June 2000 by North Carolina's General Assembly when they voted to approve the legislation initially sponsored by Senator Fountain Odom. This challenge to preserve one million acres is an aggressive plan to build public-private partnerships with local governments, business leaders, developers and conservationists to preserve open space in North Carolina. Preserving additional acreage in the state will protect the quality of streams, rivers, lakes, estuaries, sounds, coastal waters, water supplies and wetlands, as well as other significant or sensitive natural areas, rare species, and wildlife habitat. It will also protect forestland and farmland, especially small family farms, from conversion to non-related uses, as well as protecting urban greenspaces.

One NC Naturally focuses on lands permanently protected through voluntary acquisition of title interest or conservation easements by federal, state, local, or private non-profit land managing organizations. Priorities for open space will be set by the local and regional governments across the state. The program includes farmland, passive and active recreational areas, hazard prone lands, natural areas, hunting lands, water quality buffers, forest land, trails and greenways, wetlands, scenic or culturally significant areas, archaeologically significant lands, urban greenspaces, wildlife habitats, and related areas. To be included, the open space must be permanently protected.

The One NC Naturally Initiative will not be a large scale state buyout of land in North Carolina. Over the next 10 years, the Million Acre Initiative will provide incentives and information for voluntary land preservation and acquisition. Successful existing programs of open space preservation will be further supported, and coordination between state and federal agencies, local governments, private organizations, and individuals will be enhanced and encouraged. Open space protection throughout North Carolina will occur in a manner appropriate for each town, county, region, and participating land owner.

Neuse River Corridor Plan

The City of Raleigh's Comprehensive Plan of 1989 envisioned a Neuse River Corridor Regional Park. The Neuse River Corridor Master Plan provides the basis for implementing the original vision. The Master Plan provides clear direction and strategies to guide the creation of a new linear river park and should extend as a regional facility south into Johnston County, and north into Durham County and the Eno River State Park. Though sponsored by the City of Raleigh, the project is regional in nature and encourages a partnership of communities including Raleigh, Wake Forest, Wake County and Knightdale, each implementing their respective segments to achieve the entire vision presented by the Master Plan. There are four essential elements that comprise the Conceptual Framework for the Neuse River Corridor: 1) Greenway Corridor, 2) Greenway Trail System, 3) Arrival and Gateway Parks, 4) Parkway Road System.

The concept for a regional park is built upon the conservation of the 100-year flood plain and the provision of trails along both sides of the river wherever feasible. The plan uses existing park sites as core facilities and identifies key upland sites suitable to expand traditional recreation facilities. Private, quasi-public and public properties in other jurisdictions are identified as potential partners in structuring and providing access to this regional park. The Corridor Master Plan is built on a strong foundation of existing policies and public land holdings which support and make feasible its development.

Mountains to Sea Trail

The Mountains-to-the-Sea Trail (MST) is a proposed 900-mile trail comprised of footpaths, roads, state bike routes and paved trails extending from the North Carolina mountains to the Outer Banks. The trail was begun in 1973 when the North Carolina General Assembly passed the North Carolina Trails System Act. In the Triangle region, the trail extends through Orange, Durham, Wake and Franklin counties. Within Wake County, the trail will extend along Falls Lake on the pedestrian footpath that has been created by the Triangle Greenways Council and its partners. This natural footpath along the shoreline of Falls Lake provides county residents with access to scenic landscapes that are far away from the hustle and bustle of urban living. With the prospect of a connection to a state-wide network of trails from the mountains to the sea, residents of Wake County are linked to an outdoor experience that is unique in North Carolina.

East Coast Greenway

The East Coast Greenway (ECG) extends more than 2,600 miles from Calis, Maine to Key West, Florida, and will pass through the heart of the Triangle region in North Carolina. The trail is intended to be the urban equivalent of the Appalachian Trail, winding through suburbs, cities, villages and the American countryside. The Greenway is viewed by its supporters as a “linear park” for the east coast region of the United States. People of all ages and abilities will be able to use the Greenway for recreation, tourism, fitness, and transportation. The Greenway is currently being promoted and developed through a unique public-private partnership among the East Coast Greenway Alliance, a national non-profit organization, and local, state and federal government agencies.

In the Triangle region, the first leg of the East Coast Greenway, a six mile stretch of the American Tobacco Trail in Durham, was dedicated and designated in 2000. In Wake County, future completed sections of the American Tobacco Trail will become designated sections of the ECG. Additionally, portions of Raleigh’s Capital Area Greenway system and Cary’s Greenway system will comprise elements of the East Coast Greenway. The Falls Lake Trail that is currently part of the Mountains to the Sea Trail will also eventually become part of the East Coast Greenway. Thus, for residents of Wake County, our region is quickly becoming a crossroads for two of our state's most significant long distance trails.

Circle-the-Triangle Trail

The Circle-the-Triangle Trail is a project originally envisioned by the Triangle Greenways Council to link the communities of Wake County, principally, Wake Forest, Raleigh and Cary, with communities in Durham and Chatham counties. The project is estimated to extend more than 140 miles and would roughly follow the alignments of the following trail corridors: Falls Lake Trail, Neuse River Greenway Trail, Walnut Creek Greenway Trail, Swift Creek Greenway Trail, White Oak Creek Greenway Trail and American Tobacco Trail. The trail is envisioned as an off-road and on-road multi-purpose facility. Some sections of the trail will be footpaths, others will be paved trails that support cycling and in-line skating. Most importantly, the trail will connect some of the county's most scenic landscapes, including Falls Lake, the Neuse River, Walnut Creek, Lake Raleigh, Lake Johnson, Swift Creek and White Oak Creek. Miles of the trail are already in existence throughout Wake County and many more miles are scheduled to come on-line in the coming years.

American Tobacco Trail

The American Tobacco Trail (ATT) is a 23-mile rails-to-trails project located in the Triangle Region of North Carolina. The route crosses through the City of Durham; Durham, Chatham, and Wake counties; the planning jurisdictions of the Towns of Cary and Apex; and passes through the Lake Jordan project of the U.S. Army Corps of Engineers. This multi-use trail will traverse urban, suburban, and rural landscapes en route from downtown Durham at the site of the Durham Bulls Athletic park, to New Hill Road in western Wake County. At this terminus point, trail users will have the option to board the New Hope Valley Railway and take a train

ride to the community of Bonsal. A three-mile spur trail, part of the original railroad route from Durham to Duncan, provides a connection to Jordan Lake. This section of the Jordan Lake State Recreation Area, which is currently managed by the North Carolina Wildlife Resources Commission, is reportedly the largest summertime roost of bald eagles in the Eastern United States.

Wake County completed a master plan for its portion of the ATT in December 1999. The County opened its first 3.75-mile section, from New Hill-Olive Chapel Road to Wimberly Road, in 2003, and opened phase II of the Trail in July 2005, extending the length from 3.75 miles to 5.5 miles long.

CAMPO Greenway & Sidewalk Inventory

The Capital Area Metropolitan Planning Organization (CAMPO) finalized a complete inventory of pedestrian and greenway facilities in October 2000. This project was developed using a grant from the Governor's Highway Safety Program (GHSP). The purpose of the project was to establish an initial inventory, identify gaps in pedestrian facilities, and locate where to provide necessary improvements. By doing so, CAMPO hopes to promote more effective and efficient transportation coordination and planning throughout the capital region.

Triangle Transit Authority

The Triangle Transit Authority (TTA) is a regional public transportation provider, offering a wide variety of transit services to North Carolina's greater Triangle area and outlying counties. The services include: a regional bus line with connector shuttles, van-pool service bringing commuters into the major work centers, rideshare matching service, and in the future, a regional rail system that will link the Triangle together. The principal goal of the TTA is to plan, facilitate, and promote, for the Greater Triangle Community, an affordable, customer-oriented public transportation network which provides mobility, promotes economic opportunities, and protects the environment. In eastern Wake County, the newly formed Eastrans Commuter Rail Alliance is working in conjunction with the Triangle Transit Authority to bring rail transit to areas currently under affected by sprawl in a direct effort to preserve open space, agricultural operations, and to promote denser development by expanding transportation opportunity and land use policies.

TTA through its services can help to promote the protection of the natural environment and a sustainable development pattern throughout the Triangle region and in Wake County. A sound, functioning transit system can be used to support the protection of open space. This can be accomplished by promoting more compact, less consumptive land development strategies which maximize the use of land. Clustering development around transit facilities can alter land development strategies and be used to promote walkable and bikeable neighborhoods and communities. Transit oriented development envisions the transit facility as the hub or centerpiece from which other land development radiates. Close to the transit hub would be commercial, retail, office, institutional and high density land

uses. Outside this core would exist residential development that can be interwoven with parks, greenways and open space. The outer core of land use could be reserved for agriculture, forestry and open space. This pattern is much different from the typical development pattern in Wake County and the Triangle during the past 30 years.

In Wake County, few examples of transit-oriented development have been built. Perhaps the best known is Carpenter Village in Morrisville, which promotes a compact urban form, walkable community and integrated open space network.

NCDOT Bicycle Routes for Wake County

To highlight the unlimited cycling opportunities that North Carolina offers, the Division of Bicycle and Pedestrian Transportation designated a system of Bicycling Highways. These routes generally parallel the major highways along which cyclists often wish to travel, but offer a more lightly traveled alternative than the busy, major roads. Nine different routes covering approximately 3,000 miles comprise the current system. Each route is described in a printed guide, which includes a series of segment maps with accompanying narrative that provides information on terrain, road conditions, services, and points of interest. In Wake County, there are two designated bicycling highways: Route 1 and Route 2.

Carolina Connection - Route 1

Designated as a portion of US Bike Route 1, which runs from Maine to Florida, this route covers almost 200 miles of rolling terrain north-south through central North Carolina. San-Lee Park, Umstead State Park, and Kerr Lake State Recreation Area lie along this route, providing an opportunity to incorporate activities such as swimming, fishing, hiking, and nature study into the trip. Other points of interest include the Indian Museum of the Carolinas, Weymouth Woods Sandhills Nature Preserve, House in the Horseshoe State Historic Site, and the numerous historic sites and museums of the Raleigh/Capital City area.

Mountains-to-the-Sea - Route 2

From Murphy in the mountains to Manteo on the coast, this 700-mile route traverses the state from west to east. On the way, you'll pass the loftiest peaks east of the Mississippi, traverse portions of the Blue Ridge Parkway, then drop 2,000 feet from the Blue Ridge escarpment to the rolling foothills of the Piedmont. Quiet rural lanes take you through lush farm country to most of the major cities in the state. Once past Raleigh, the flat land of the coastal plain makes the ride to the coast seem easy. Several miles from the end of the route, you have the choice of taking the ferry to Ocracoke and the Outer Banks or continuing to Manteo. Either way, wide Atlantic beaches are your reward at the end of the trip.

Raleigh Bikeways Map

This map highlights a 150-mile system of signed bicycle routes. Nine cross-town routes connect neighborhoods, parks, schools and points

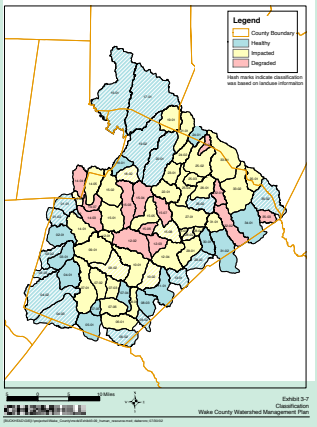
of interest. Four short recreational loop routes, one in each quadrant of the city, highlight good places for novice cyclists or families to ride. The system of off-road greenways and bike paths is also shown. A park matrix shows the facilities at 45 parks in the area. Comprehensive information on laws, safety tips and safe riding techniques is included.

Private Open Space

There are numerous other forms of potential open space not included in this plan including university and college landholdings, privately owned community and neighborhood open space, open space within corporate parks, and other privately held lands. The primary effort of this report is to identify the open space holdings of local governments.

Wake County Watershed Master Plan

On November 20, 2000, the Wake County Board of Commissioners unanimously approved a staff recommendation to proceed with the preparation of a comprehensive watershed management plan for Wake County. The Wake County Watershed Management Plan serves as the County's strategic plan for protecting and restoring the designated uses of Wake County's streams. This is critical to the community's desire to remain one of America's "Best Places" to live, work and raise a family.



Wake County's streams function to meet a number of important benefits and uses for the community, including water supply, recreation, and habitat for wildlife, aquatic organisms and endangered species. The County's groundwater resources also provide important benefits, including water supply and maintenance of base flow in streams during extended droughts. Land use and methods of land development, as well as people's daily activities on the land can impact a stream's ability to meet its intended uses for the community.

As of July, 2002, the State of North Carolina had designated an estimated 135 miles of streams within the Wake County Watershed Plan study area as impaired (approximately 8.8% of the County's stream miles). These streams do not meet their designated uses as classified by the Division of Water Quality and have been placed on the 2000 303(d) list and draft 2002 303(d) list, the official list of impaired water that the federal Clean Water Act requires each state to submit to EPA. These streams have been rated as impaired based on the following factors:

- Chemical Data
- Biological Data
- Habitat Data

If not managed properly, the future growth and development of the County, as well as the daily activities of the existing population, could lead to further impairment of streams within Wake County. If the miles of impaired streams increase, then the community will lose the uses and functions provided by those streams. Changes in behavior throughout all segments of the community may be needed in order to minimize the potential for future water resource impairment within the County.

The Wake County Watershed Management Plan is a regional strategy for protecting and restoring the uses and functions of the County's streams in a manner that is consistent with the community's values for balancing economic development, environmental protection and natural resource conservation and management. The Plan identifies strategies to mitigate potential adverse impacts on streams that are associated with the future growth and development of the County, as well as the daily activities of the community's current population.

The Wake County Watershed Management Task Force adopted cost-effective and practical watershed management strategies that will be implemented uniformly and consistently throughout Wake County to protect and restore the uses and functions provided by the County's streams. The objectives of the Wake County Watershed Management Plan are as follows:

(1) A safe, adequate and sustainable drinking water supply system that relies on both surface water and groundwater resources;
(2) Management of storm-related stream flows to protect streambank stability, stream habitat and other physical characteristics of the County's streams, as well as to protect human life and property from flood damage;
(3) At a minimum, compliance with state and federal regulations so that the levels of nutrients, sediment and other pollutants will not cause impairment or result in a loss of a stream's use and value to the community;
(4) An educated community that:
    a) Recognizes the importance of watershed management for protecting a stream's use and value to the community;
    b) Understands how its daily activities and individual and collective decisions can affect the health of the community streams; and
    c) Modifies its behavior to create stream environments that provide healthy habitats for wildlife, fish and other aquatic organisms and are free of trash;
(5) A funding program that is supported by the public sector, private sector, and individual citizens to protect and restore the uses and functions provided by the County's streams for the benefit of current and future residents and businesses within the County. The funding strategy must provide sufficient and reliable sources of funds to implement the watershed management plan including ongoing operation and maintenance as well as an ongoing public education campaign;
(6) A focused implementation plan that relies on the following guiding principles to establish priorities:
    a) Maintenance and protection of streams that are meeting their intended uses for the community;
    b) No further degradation of streams that have been identified as impaired and can no longer support their intended uses for the community;
    c) Restoration of impaired streams where it is practical and cost effective.

Summary and Conclusion

Wake County government is undertaking its most serious considerations regarding future land use and the economic make-up of the community. The County is joined in this effort by a coalition of municipal governments, open space, park and greenway advocates, non-profits, business leaders, and experts in the fields of water quality management, open space preservation and greenway development. This chapter has defined the current status of open space, park and greenways resources in Wake County. It provides a snapshot of efforts to date in the area of park, open space and greenway resource protection and development. This chapter also illustrates that programs at the federal, state and local government level support open space conservation within Wake County. It is clear that residents of Wake County have a strong interest in conserving open space resources for recreation, water quality protection, water quantity management and aesthetic consideration.

Chapter 3: Open Space System Recommendations

3

Open Space Defined

Wake County defines open space as protected lands and waters that are owned and managed by the County, its public sector partners, the municipal governments of Wake County, State of North Carolina, the United States government, and the County's private sector partners, including non-profit land trusts. Open space consists of any parcel or area of land and water that is essentially unimproved and devoted to 1) the preservation of natural resources and habitat; 2) the managed production of resources (forest and farm land); 3) outdoor recreation; 4) preservation of historic and cultural property; 5) protection of scenic landscapes; and 6) protection of public health, safety and welfare.

Further, open space is a protected living system of natural and cultural resources provided and maintained for the benefit of residents, businesses, and visitors. This “green infrastructure” is essential in protecting our water supply, keeping people and property out of high risk flood hazard areas, providing places where residents can recreate for health and fitness, and protecting the biological diversity of irreplaceable landscapes.

Wake County Open Space System

The Wake County Open Space system is envisioned as a series of natural, interconnected landscapes that will protect vital natural resources and link city to countryside, suburb to urban center, and county residents to the landscapes they cherish. To achieve this vision the County will need to implement an open space program that focuses on four major components:

1) Identify key parcels of land and corridors that should be acquired and protected as open space;
2) Recommend new regulatory programs that improve the protection of resources that safeguard public health, safety and welfare;
3) Establish a new program of land stewardship program to manage open space resources;
4) Define recurring sources of revenue that support the conservation, protection and stewardship of open space.

The concept of the Open Space Plan is simple. Identify the most valued lands within watersheds of the County that can be protected and preserved, and link these lands together with corridors of multi-purpose greenways. Where appropriate, build pathways that people can travel by

foot, bicycle, rollerblade or on horseback. And make the corridors wide enough so that they will help to protect water courses, conserve habitat for wildlife, preserve historic landscapes, and beautify area roadways.

One goal of this Open Space Plan is to protect a minimum of 30 percent of the county's land area, or roughly 165,000 acres. Presently, the county has approximately 52,519 acres (9.5%) that has been protected through federal, state, county and municipal efforts. Therefore, an additional 113,000 acres is needed to meet the minimum 30% protected open space goal defined by this plan.

The value of open space is linked to the watershed management, growth management and transportation planning objectives of Wake County, as defined in companion planning reports. Implementation of this open space plan should be accomplished in a manner that makes the most efficient use of the key recommendations of each plan.

A 30% Goal for Protected Open Space

This Plan promotes the protection of at least 30% of Wake County's land and water as permanent open space. The goal of 30% is a minimum level of protection for open space. This goal does not represent an optimal condition for protected open space. It is intended to serve as a minimum target in order to promote conservation and protection strategies.

The 30% goal is not a product of a scientific formula, but rather, is based on layers of understanding related to two popular concepts – ecological carrying capacity and balance between developed and undeveloped land. The first concept relates to the county's need to sustain terrestrial and aquatic wildlife habitats, ensure good air quality, and allow groundwater aquifers to recharge. The second measure is more human related and deals with economic and political realities, values associated with aesthetics and sense of place, and maintaining sufficient recreational opportunities.

The issue of ecological sustainability was first defined in 1987 by the Georgia Institute of Ecology in a paper called "The Georgia Landscape: A Changing Ecology." This paper, authored by Dr. Eugene Odum, Chair of the Kellogg Physical Resources Task Force, examined 50-year trends in land use and resources throughout the State of Georgia. The report recommended, that as a minimum, Georgia should set aside 20% of its land as protected, by the year 2000. The report states "Accomplishing such a goal would reduce pollution and congestion, and thus go a long way toward improving the quality of life for all Georgians." This became the number one recommendation to emerge from the report, and was used by Georgia Governor Roy Barnes as the basis for establishing Georgia's statewide open space program launched in 2000.

Combining ecological sustainability with growth and development to determine an appropriate conservation target is the state-of-the-practice land use planning philosophy emerging across the country from the American "Smart Growth" movement. Examples from other communities include New York City, which has protected nearly 30% of its land area as open space, the Bay Area of San Francisco which has protected approximately 25%, and Connecticut which established rules and programs promoting the protection of roughly 21% open space. Additionally, communities such as The Woodlands, Texas and Damascus, Oregon have set open space protection goals at a minimum of 30%. At the higher end of the spectrum of open space protection is nationally renowned conservation planner, Randall Arendt who suggests a standard of 50% open space in all new developments.

Wake County currently has about 10% of its land area in permanent protection – much of that in Federal, State, and local recreational areas, but while 10% is permanently protected another 50% of the County (the remaining open space) is providing essential quality of life benefits without any permanent protection. This puts critical open space resources at very high risk.

Wake County has been developing approximately 19,000 acres a year over the last decade, if this trend is projected out to 2020, the County will be left with less than 22% of its land in an undeveloped state. At the same time, the population will have nearly doubled. The loss of such significant amount of open space is inconsistent with promoting a high quality of life and sustainable development practices.

Setting a goal of protecting 30% of the county's land as open space helps check this undesirable scenario. The 30% goal is provided as a minimum target based on the ecological, social, economic, and political realities of Wake County. The goal is designed to help realize the vision of a 22nd century community that includes farming as a viable way of life, and is a flourishing community that delivers clean water to more than 2 million residents.

Which Percentage Goal is Right for Wake County?

A higher target goal for open space protection could be safer, but while the benefits that could come from setting a target of 40% open space are certainly desirable, it is unclear whether permanent protection of that much property is necessary. Privately held open spaces can serve important open space functions and proper stewardship can occur on these lands without them being permanently protected through some legal mechanism. In addition, numbers greater than 30% can appear unrealistic or too aggressive and can destabilize the cooperative environment that will be needed to accelerate the rate of land protection in Wake County.

On the other hand, 20% permanent protection is clearly not enough. With 53,000 acres already protected, a 20% target does little more than set aside floodplain land. Over the long term, as the population doubles, the 20% goal does not provide for new parks and trails, it does not set aside significant non-riparian habitat, and it does not protect farming as a way of life. (see table right).

30% is the appropriate first step. It is a goal that is achievable and appropriate for the next 5 – 10 years. It respects political and economic realities but also acknowledges the need to do more. Reaching this goal will not be easy. It will require new recurring sources of revenue from Wake County and it municipal partners, it will involve more stringent land use planning, and it will create a greater stewardship responsibility for the County and its partners. However, it is also a number that has been received well across the country and is at the heart of the current experiment in balancing resource protection needs with land development needs. Thirty percent permanently protected open space will require Wake County to curb its rate of land development, and increase its rate of open space protection. It will serve as the first step towards a sustainable future for Wake County and achieving the vision that County residents have set for themselves.

	Open Space Percentage Goals		
	20 Percent	**30 Percent**	**40 Percent**
Flood Prone Land Protected	**Yes**	**Yes**	**Yes**
Water Quality, recreation, wildlife	No	**Yes**	**Yes**
Conservation subdivision lands	No	**Yes**	**Yes**
Gamelands and other open space	No	No	**Yes**
Narrative Description	Protects all flood prone land and does little else	Protects all flood prone lands, targets ecologically sensitive land, greenway connectors, acquires land for parks, and protects farmland	Does the same as the 30% goal, but also adds land for county, municipal, state or federal lands, including gamelands, state and federal forests or parks.

Protecting Land

One of the continuing challenges for Wake County is balancing future growth and land development with conservation of the landscapes that benefit the public. This Open Space Plan is one tool that can be used to achieve this balance. Land can be protected by purchase through a targeted acquisition process (described in greater detail in Chapter 4 and Appendix F) and through regulation of the land development process. This plan supports both of these methods.

The plan strongly recommends that the county and all 12 municipal governments consider adopting land development practices that promote conservation during the land development process. This can take several forms, including educating agency and development organizations about the need for conservation, supporting local land trust organizations, utilizing state and federal programs that encourage the donation of land, and updating development regulations. The primary effort should be to foster growth that results in sustainable development that is walkable, bikeable and supports a diversity of land uses.

One land development practice that the county and municipalities should consider is Conservation Subdivision Design (CSD). Using CSD, the yield of a particular property slated for development would be similar to that of a conventional subdivision design (see below). However, instead of parceling out all of the land into private lots, conservation subdivision design arranges houses and buildings on a site so that natural landscape features remain open, undeveloped and in common ownership. Using CSD principles, it may be possible to conserve as much as 40,000 acres of open space during the land development process.

Additionally, the county and municipalities should encourage growth near existing urban centers, towns and villages. Building traditional neighborhoods, office parks, shopping centers and schools in close proximity to built landscapes will help to protect the rural character of Wake County.

Conservation subdivision design is an improved method for subdividing rural land and building neighborhoods. In short, it is the equivalent of building a "golf course" community without the golf course.

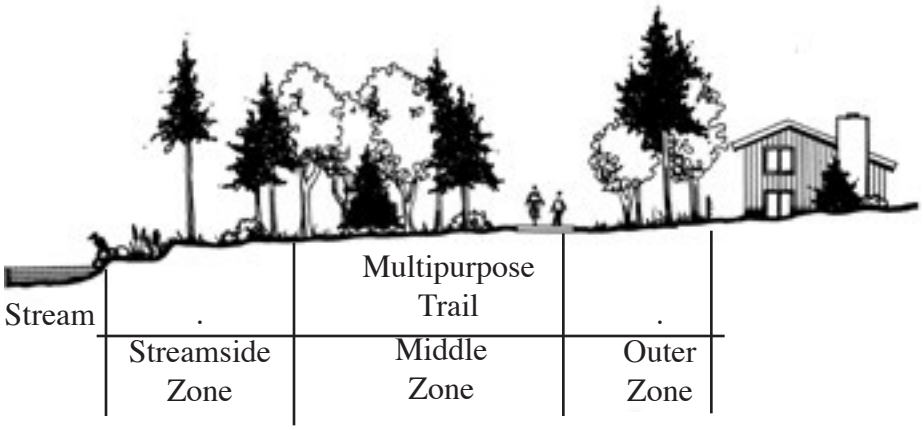
Conservation Subdivision Design Concept
Source: Growing Greener, Randall Arendt

Protecting Water Quality with Riparian Buffers

As defined in the Watershed Management Plan, one of the most important objectives of open space is the protection of water courses. This can be achieved by establishing riparian buffers along streams within the county. Riparian buffers are strips of trees, grass or shrubs along the banks of rivers and streams. They are used to protect stream bank integrity, minimize in stream temperature changes, provide pollutant removal for runoff and interflow, serve as a source of organic material for stream aquatic life, and provide necessary wildlife habitat and corridors for movement between areas of more substantial habitat. Buffers are often considered the last line of defense between water resources and pollution sources. This Open Space Plan recommends that local governments establish riparian buffers as defined within the Wake County Watershed Management Plan. Buffers should accommodate the possible development of greenway trails for recreation and transportation purposes (as depicted in graphic illustration below).

The Watershed Management Plan recommends that 100 foot buffers be applied to perennial streams within the priority watersheds in Wake County. Local governments should also consider the following items when adopting wider buffer ordinances for these watersheds:

- Grandfather agriculture and forestry uses
- Allow some flexibility for smaller buffers if the slope is less than 10 percent and the developer can show adequate water quality protection
- Compensate landowners if they have a loss of use
- Make the ordinance language flexible by allowing variance processes for situations where the buffers may be better applied in a different manner and to address hardship conditions
- Consider allowing existing homeowners (or platted lots) to comply with current requirements. This would enable them to use their land as they had planned when they purchased their home or lot.
- Consider density bonuses if larger buffers are required



One Concept for Riparian Buffers

Floodplains as Open Space

Floodplains are the low lying areas next to a stream or river that become covered with water when a significant amount of rain falls. Floodplains are defined by the National Flood Insurance Program as comprised of two distinct zones: the flood fringe and the floodway. For the purposes of this Open Space Plan, it is recommended that the entire floodplain be protected as permanent open space. Maintaining floodplains as open space allows them to be used for their highest and best function – the storage of floodwaters. Recent hurricanes and their associated flood events have demonstrated the importance of keeping land development out of flood hazard lands.

Protecting floodplains also helps protect property and human life during storm events in urbanized areas. As land development increases within a watershed, many characteristics of streams change, including the location and elevation of the floodplain. As development occurs and impervious surfaces increase, there is more runoff during storms, and the water levels within urban streams rise quickly. Floodplain remapping studies in Charlotte, NC show an average increase in the flood elevation of 1.9 feet from previous maps to maps based on 1999 land use. When the maps were further modified to examine impacts under build out conditions, the flood elevations increased an average of 4.3 feet from the existing maps. The floodway width increased from an average of 290 feet to 454 feet, and the floodplain width increased from an average of 429 feet to 611 feet. Thus structures previously built in the floodplain as allowed by FEMA might now be located in the floodway, and would not be permitted if in a FEMA area if the structure was being built today. Wake County is currently working with the Federal Emergency Management Agency (FEMA) to remap some of the floodplains within the County based on built-out conditions.

Source of Photo: The News and Observer

The flooding of Crabtree Valley Mall during Hurricane Floyd in 1999 is a constant reminder of the need to protect floodplain landscapes as open space

Protecting the floodplain also helps protect the riparian corridors and can provide the same functions as riparian buffers in terms of protecting water quality. Protecting floodplains provides the ecological functions of open space, such as protecting habitat for wildlife.

This Open Space Plan supports the recommendations of the Watershed Management Plan, which includes the following:

There should be no development or filling in the 100-year floodplain with the exception of what would be needed for utilities and infrastructure. The Task Force recognized that road and utility crossings would be necessary

within the floodplain, and those uses should be allowed. Roads should be elevated to the 100-year flood elevation in order to ensure access to residences and to protect human safety. In addition, it was recognized that within the County's jurisdiction, it may be necessary to allow septic systems within the flood fringe (assuming presence of suitable soils and outside restricted riparian buffer areas) in order to protect the use of property.

Using this approach to floodplain protection, it may be possible to protect an estimated 60,000 acres of land within Wake County as open space.

Limiting Sediment in Streams

Wake County, the State of North Carolina and municipal governments should work together to strengthen the site plan review process and enforcement of existing sediment and erosion control laws. The goal of the program should be to use open space to reduce the amount of sediment flowing into county streams, thereby improving water quality. Open space, in the form of buffers, can absorb sediment in the event an erosion and sediment control device should fail. Preserving open space on slopes and other erodible soils also minimizes the risk of sediment flowing into county streams.

The photo to the left illustrates how open space can be used in riparian corridors to buffer adjacent land uses and absorb sediment and pollution.

Connecting People to the Land

With all of this additional publicly owned open space, it will be important to carefully manage and protect the land so that it serves a public purpose. One public purpose would be the ability to access and use portions of the open space. Connections to the land are one of the most tangible products of this Open Space Plan. The physical framework of the Wake County Open Space Plan is based on a popular national concept known as "Hubs and Spokes." Under this concept, residential, commercial and business landscapes are linked to parks, preserves and open spaces via greenway corridors. For residents of the county, this will mean improved access to the outdoors for recreation, non-automobile transportation, and participation in activities that can improve health, fitness and quality of life.

Each municipal government has designated a future "central park" for its community. These can become important hubs in the system. As one element of the County transportation system, greenway trails can be aligned along roadways with ample rights-of-way that can accommodate bicycle/pedestrian trails. Greenways would also be built along the edges of streams and within existing utility or railroad rights-of-way. The greenway corridors identified in this plan can be used to form a county trail system to accommodate bicyclists, in-line skaters, joggers, pedestrians, equestrians, and mountain bikers. In addition to the county greenway corridors, municipal greenways and private trails provide connections to the county system, offering a web of interconnected landscapes that would allow residents to travel on off-road corridors throughout the County.

Hubs and Spokes Concept

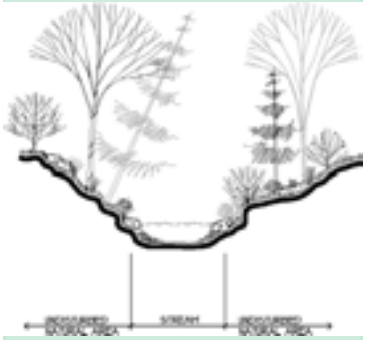
The Future Open Space System

The Open Space system that is represented on the inserted map (see Wake County Open Space Plan map) illustrates how the Hub and Spoke system would be achieved throughout the county. Green circles illustrate where municipal open space plans call for targeted acquisition of open space parcels (hubs) and dashed lines show where greenway corridors can be developed. Blue shaded areas show the FEMA regulated floodplains that should be protected. The future open space system is summarized in the chart below.

Future Wake County System of Protected Open Space		(Minimum)
Category of Open Space (numbers are rounded up to nearest 1000)	(Minimum) Goal in Acres	Percent of Total Open Space
Existing Protected Open Space	55,719	10.00%
Conserved Floodplain Lands (future)	60,000	11.00%
Protected Open Space through land development process (future)	22,000	4.00%
Future Open Space Acquisitions	27,281	5.00%
Total Protected Open Space	165,000	30.00%
Total Land Area of Wake County	550,000	

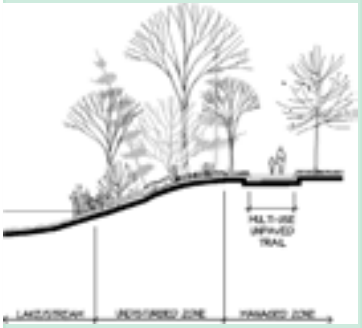
Types of Greenways

The Wake County Open Space Plan provides for a full range of greenway trail types to meet the objectives of open space protection, and at the same time offer quality outdoor space for public use. There are five different types of greenways that will comprise the system. Wake County greenway corridors may contain more than one type of trail. The selection of a type is not defined for each open space corridor and will be determined after further evaluation of the physical and future use characteristics for each corridor. The five types are described as follows. More specific information can be found in the design guidelines provided within this report.



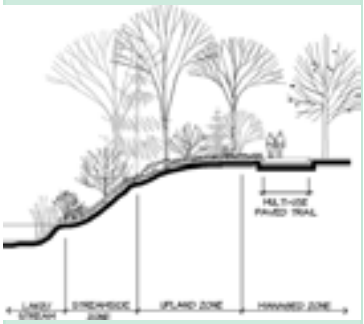
Type 1: No Facility Development
For corridors that are environmentally sensitive and contain steep slopes, wetlands, or rare habitat, a no-facility development type is recommended under the Wake County Open Space Plan. It is anticipated that many corridors defined for water quality, habitat protection, and floodplain management purposes would also fit under this category. Typically, these corridors would remain in a natural, undeveloped condition.

Type 2: Limited Development, Low-Impact Uses
The second type of greenway facility would be found within corridors that are environmentally sensitive but can also support limited trail development. These corridors would support bare earth, wood chip, or boardwalk trails. Typically, use would be limited to pedestrian.



Type 3: Multi-Use Unpaved Trail Development
This designation would apply to corridors that are capable of supporting a broader range of uses. Greenway trail development, if it occurs along a stream, would be located outside of the floodway. A variety of surface materials could be used, but crushed gravel is the most likely. These trails can be used by pedestrians, cyclists, equestrians and persons with disabilities (ADA).

Type 4: Multi-Use Paved Trail Development
Multi-use paved trails may become one of the most common types of off-road trails in the Wake County greenway system. These trails will support the greatest diversity of users, and can be used year round. They will be more expensive than other types to construct, and they will serve the needs of most users. These trails can be constructed within floodprone landscapes as well as upland corridors.



Type 5: Bike & Pedestrian Facilities in Rights-of-Way
Type 5 trails are generally located within the rights-of-way of roadways throughout the metropolitan area. One of the primary purposes for this trail type is to serve as a connector to the off-road network of Wake County greenways. Sidewalks, bike routes, bike lanes and wide multi-purpose side paths are envisioned as constructed facilities.

Unicorporated Wake County

For the unincorporated areas of Wake County, the primary goal of the open space plan has been to ensure that the municipal open space plans are properly connected across jurisdictional boundaries, and to identify any parcels of land that should be acquired in order to satisfy water quality goals and objectives as identified in the Watershed Management Plan. Additionally, coordination occurred between the Open Space Plan and the Wake County Transportation Plan to identify potential activity centers where a transportation hub might form in the future. These hubs would be connected with greenway corridors to ensure alternative transportation access.

Municipal Open Space Plans Summary

Implementing the Wake County Open Space Plan will take place at the county and municipal government level. Municipal governments will be expected to fund and implement the recommendations that are provided within their open space plans. To guide this future implementation, this plan envisions continuing the partnership effort begun by the County and municipal governments, currently represented by Partners for Open Space and the Environment (POSE). This partnership should be expanded in the future to include representatives and organizations from the private sector. This county-wide Open Space Plan also unifies the efforts of all local governments. Toward this end, each municipal plan is featured on the following pages. A brief description of the municipal open space system is accompanied by a corresponding map. The individual plans represent an essential building block in what will become a consolidated and unified county wide open space system.

Wake County Open Space Plan

Open Space & Greenway Network

Revised
June 2006

Granville
Franklin
Durham
Chatham
Johnston

WAKE FOREST
ROLESVILLE
DURHAM
MORRISVILLE
RALEIGH
ZEBULON
CARY
KNIGHTDALE
WENDELL
APEX
GARNER
HOLLY SPRINGS
FUQUAY-VARINA
ANGIER

0 2 4 Miles

Legend

- Existing Greenways
- Proposed Greenways
- Major Roads
- Hydrology
- Raleigh Developed Parks/OS/Greenways
- Raleigh Undeveloped Parks/OS/Greenways
- Cary OS
- Zebulon OS
- Wake Forest OS
- Rolesville OS
- Garner OS
- Fuquay-Varina OS
- Knightdale OS
- TJCOG OS
- Wake County OS
- Urban Areas

WAKE COUNTY NORTH CAROLINA

GREENWAYS INCORPORATED
Landscape Architecture
Multi-Objective Trail Planning
Open Space Planning

Apex

The Parks, Recreation, Greenways and Open Space Master Plan identifies existing community recreation resources (both active and passive) and plans for the anticipated future needs of community members. There are four primary guiding principles of the plan:

1) incorporate cultural, aesthetic and environmental influences into the planning of programs, services and facilities;
2) seek the acquisition of environmentally and culturally significant tracts of land throughout the community as open space assets for the Town of Apex to assure quality of life for the future;
3) utilize greenways as a means of linking neighborhoods, businesses, institutions and recreation facilities within Apex and the surrounding region; and
4) continue and maximize, to the extent possible, shared use opportunities where such relationships are equitable, mutually beneficial and appropriate.

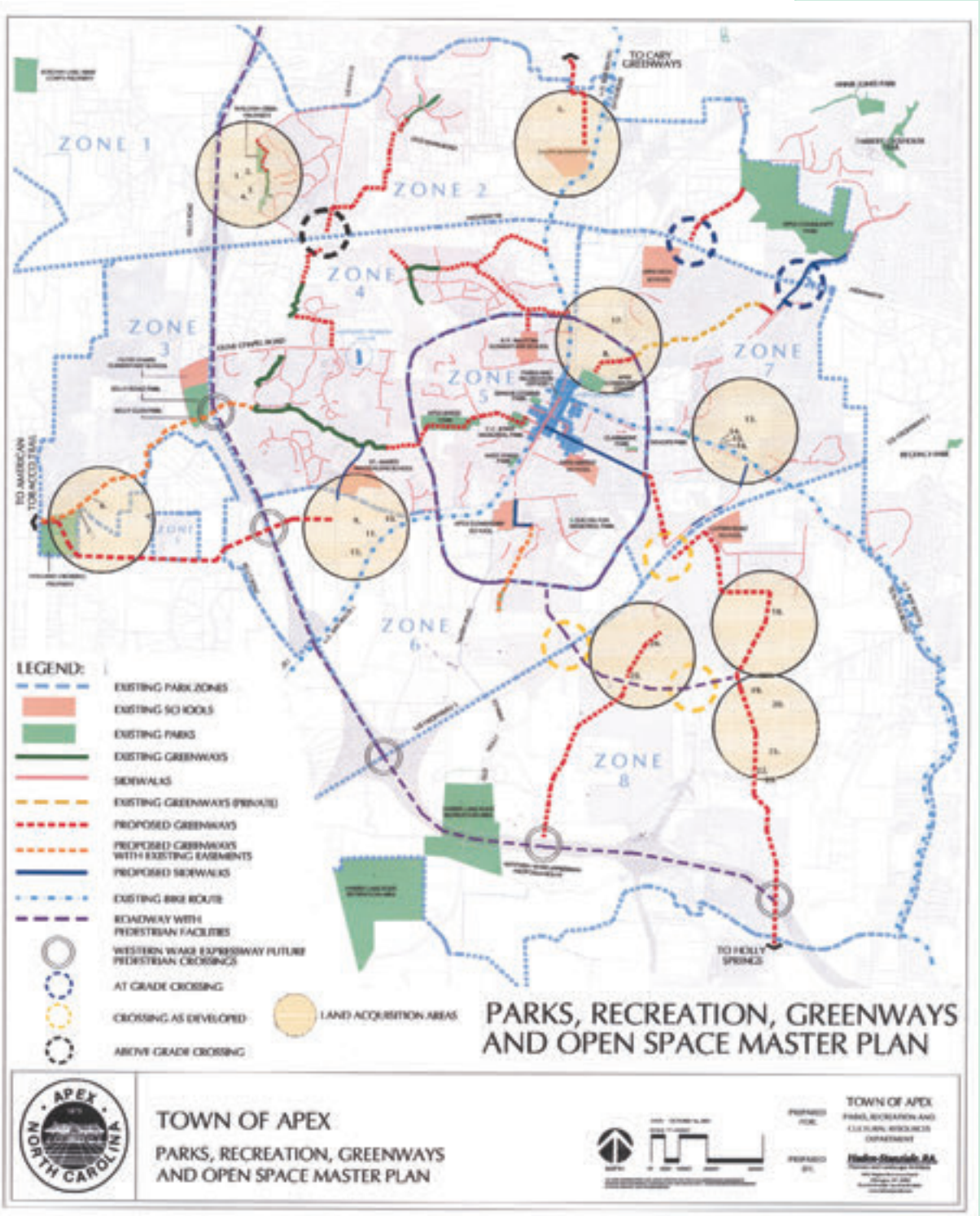
In order to determine the needs of Apex residents, a list of existing open space site features and programs was created to gain an understanding of current site conditions and amenities offered. A series of workshops and surveys were conducted to gain public input about current programs and facilities and define how Apex residents view future open space and recreation resources. The analysis of open space and recreation resources included identifying important natural features and growth patterns, as well as gathering information on parks and recreation facilities available to residents in adjacent communities. Identifying these features created a standard for comparison and helped determine the relative surplus and/or deficit of recreational facilities in Apex. Geographic analysis incorporated key site features such as streams, floodplains, and projected growth areas into the planning process.

As a result of participatory activities used to craft this plan, the Town of Apex has identified the following open space action items:

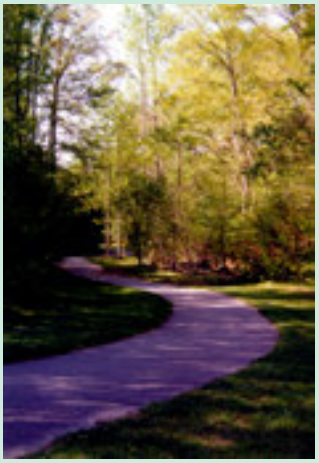
- acquiring 112 acres of active and 70 acres of passive recreation lands
- acquiring up to nine specific Resource Conservation Area tracts
- addressing the number one citizen activity, walking, by enhancing the sidewalk and greenway systems. Specifically, this means developing the Beaver Creek Greenway and the Lexington Greenway and the near term development of 2.5 miles of sidewalks.

The following greenways are proposed to connect the community open space, neighborhoods, businesses and other towns within the county:

- Beaver Creek Greenway (Phase 1 under construction)
- Lexington Greenway
- North Beaver Creek Greenway (Phase 1complete)
- Apex High School to Apex Community Park
- Lower Beaver Creek Greenway (Phase 1a complete)
- Middle Creek Greenway
- South White Oak Branch Greenway
- Haddon Hall Greenway to Apex Parkway
- Salem Elementary School to Town of Cary Greenway System


ZONE 1
ZONE 2
ZONE 3
ZONE 4
ZONE 5
ZONE 6
ZONE 7
ZONE 8
TO CARY GREENWAYS
TO HOLLY SPRINGS
LEGEND:
EXISTING PARK ZONES
EXISTING SCHOOLS
EXISTING PARKS
EXISTING GREENWAYS
SIDEWALKS
EXISTING GREENWAYS (PRIVATE)
PROPOSED GREENWAYS
PROPOSED GREENWAYS WITH EXISTING EASEMENTS
PROPOSED SIDEWALKS
EXISTING BIKE ROUTE
ROADWAY WITH PEDESTRIAN FACILITIES
WESTERN WAKE EXPRESSWAY FUTURE PEDESTRIAN CROSSINGS
AT GRADE CROSSING
CROSSING AS DEVELOPED
ABOVE GRADE CROSSING
LAND ACQUISITION AREAS
PARKS, RECREATION, GREENWAYS AND OPEN SPACE MASTER PLAN
TOWN OF APEX
PARKS, RECREATION, GREENWAYS AND OPEN SPACE MASTER PLAN
TOWN OF APEX

Cary



The Cary Open Space and Historic Resources Plan determined actions required to identify Cary's natural and historic resources, special environmental features and cultural sites. Through this plan, Cary anticipates protecting approximately 12,000 acres of open space that would include both publicly and privately owned properties. There are three primary methods that will be used to preserve this land:

1) regulatory measures;
2) land preservation techniques;
3) voluntary landowner contributions.

The Town has been using an $11 million FY 2002 bond campaign to fund acquisition of open space. The goal is to use these funds to purchase more than 500 acres of targeted open space. The Town is also using a $1 million annual contribution from utility fee revenues to support acquisition.

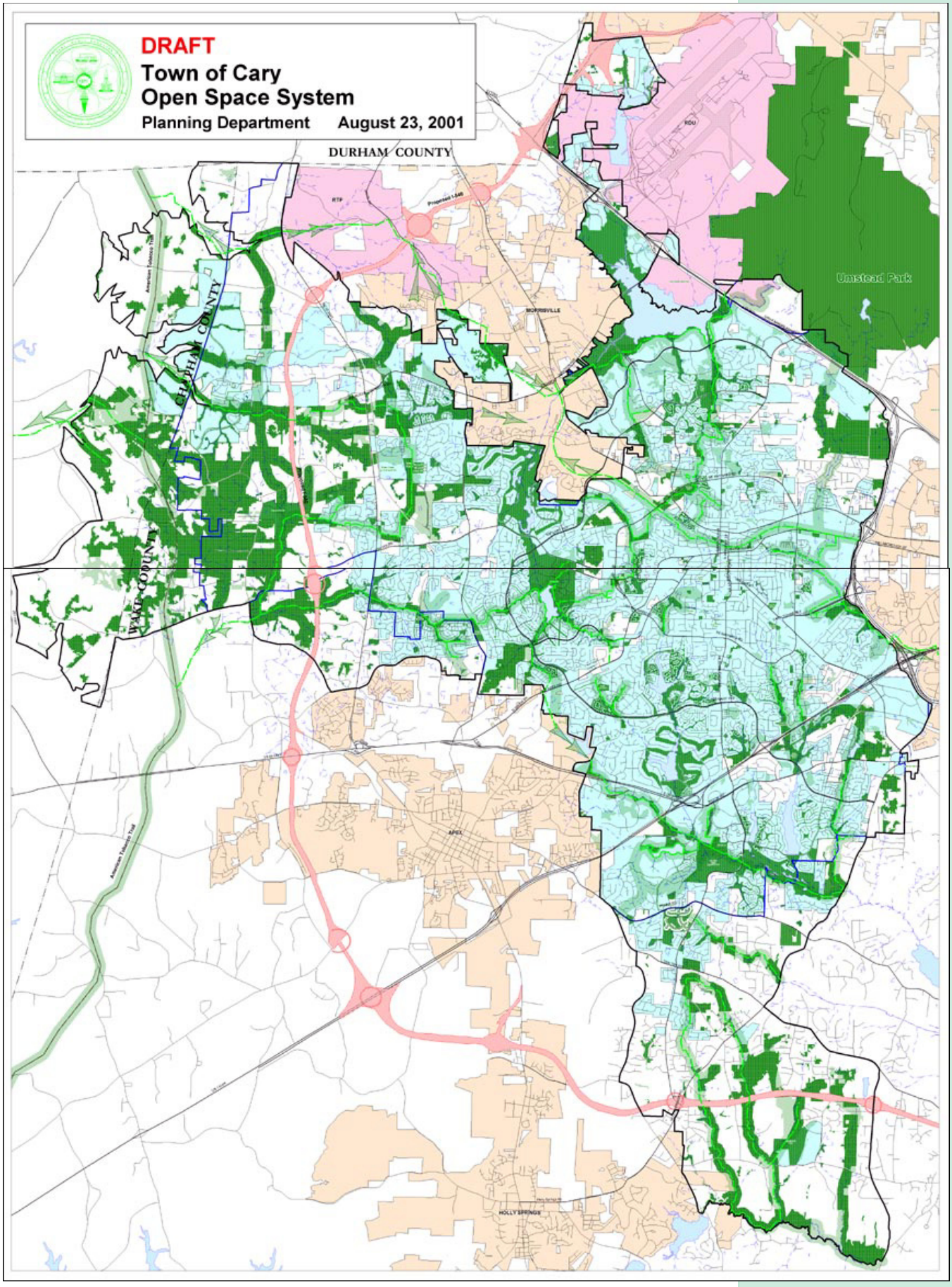
The Town used an ecological analysis process to define lands that were at the greatest threat of loss. From this, the Town has put threat of loss in order and has listed geographic areas of the Town where protection strategies will be focused.

<u>First Order of Threat</u>
Incorporated Parcels inside Cary Parkway Loop
Selected incorporated parcels inside RTP Activity Center
Selected parcels under threat by growth of Holly Springs

<u>Second Order of Threat</u>
Unincorporated Parcels inside Cary Parkway Loop
Selected unincorporated parcels inside RTP Activity Center
Remaining incorporated and unincorporated parcels in the project study area.

<u>Third Order of Threat</u>
All remaining parcels not otherwise identified in study area.

The Town provides a "preservation toolbox" that can be utilized to help protect valued properties identified by the plan. (/www.townofcary.org/depts/dsdept/P&Z/openspace/thepreservationtoolbox.pdf)


DRAFT
Town of Cary
Open Space System
Planning Department August 23, 2001
DURHAM COUNTY
WAKE COUNTY
CHATHAM COUNTY
Umstead Park
MORRISVILLE
APEX
HOLLY SPRINGS
RTP
ROU
American Tobacco Trail
American Tobacco Trail

Fuquay-Varina

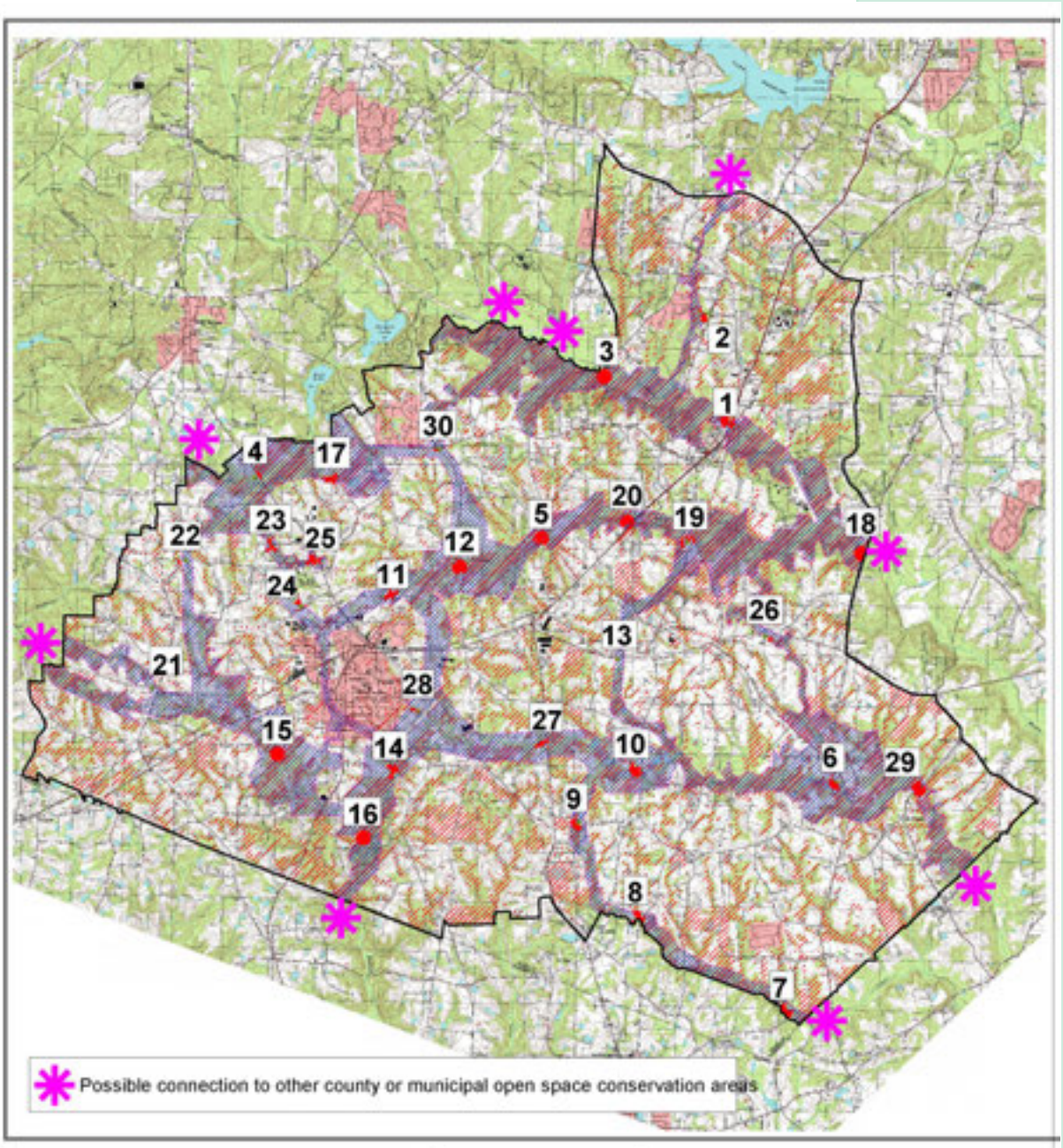
Using the Wake County adopted definition, open space areas were assessed through objective screening to identify significant natural and cultural resources within the 71 square mile Fuquay-Varina Urban Services Area (USA). The assessment includes an analysis of these resources within the study area using available sources and limited field reconnaissance. This proposed effort involved the following tasks:

1) a study area definition was obtained from TFV staff;
2) natural and cultural data source information was collected from TFV as well as other public and private sources;
3) an objective ranking system (the "Matrix") was developed to quantify and rank significant features of multiple themes;
4) the information collected was developed into themes using Geographical Information System (GIS) software and analyzed in different combinations in an effort to prioritize resource areas for further field evaluation;
5) 30 targeted resource areas were evaluated in the field in an effort to verify mapping and conclusions; and
6) digital and photographic databases were developed along with the technical report to summarize the methodologies and findings.

Thirty targeted areas of Open Space were identified for consideration for protection by the Town. (See map on page 3-15). Additionally, the Fuquay-Varina Open Space Plan advocates the protection of stream buffers and greenways along its streams:

- Middle Creek
- Terrible Creek
- Black Creek
- Little Black Creek
- Basal Creek
- Kenneth Creek
- Kenneth Branch

In order to preserve the scenic quality of the town, it was determined that Academy Street (Highway 42), Main Street (Highway 401) and Broad Street (Highway 55) should be protected as entrances into the town.



Fuquay-Varina Open Space Plan

Phase V

Field Verification Site Location

LEGEND

- Study Boundary
- County Lines
- Roads
- Site Location
- Open Space Network

Figure 7

EcoScience

Garner

Public participation was an integral part of Garner's Plan. Two evening community meetings were held to gather public input and display working maps of the community. All Board and planning meetings were open to the public. The input and feedback received from these groups were combined to craft Garner's open space recommendations. Field research and Geographic Information System (GIS) analysis were also used to identify open space and greenways for this plan.

As a result of community meetings, and staff and stakeholder comments, it is recommended that the Town of Garner supplement its existing park system with the following parks and open space acquisitions. These future parks would serve multiple purposes; including active and passive recreation, protection of water quality, floodplain management, and environmental education.

- Central Park - regional park combining Lake Benson Park, White Deer Park, and Thompson Park.
- Adams Branch Park - passive greenway node at Cloverdale.
- Echo Branch Park - neighborhood park near Smith Elementary.
- Yates Mill Branch Park - regional park along Swift Creek.
- West Panther Branch - district park near Vance Elementary.
- East Panther Branch - neighborhood park near the intersection of Jordan Road and Ten Ten.
- White Oak Park - regional park near the Raleigh treatment site.
- Big Branch Park - district park along Big Branch
- Rand Mill Road Park - neighborhood park that expands the existing Rand Mill Road Park.

Two main greenway axes and several loop trails provide alternative transportation and passive recreation options. The greenway network connects the community with businesses, parks, schools and proposed open space parcels.

- Reedy Branch North-South Axis
- Swift Creek East West Axis
- Cloverdale Greenway
- Historic District Greenway
- Lake Benson Greenway
- Vandora Springs Greenway
- Mahler's Creek Greenway
- White Oak Creek Greenway
- Timber Drive Greenway
- Yates Branch Greenway
- Buck's Branch Greenway
- Benson Greenway
- Panther Branch

This Plan also advocates the protection and conservation of the primary streams of Garner, such as White Oak Creek, Buck's Branch, Mahlers Creek, Adams Branch, Mile Creek, Big Branch, Swift Creek, Yates Branch, etc. Additionally, in order to preserve the character of Garner, it is recommended that several scenic corridors or "viewsheds" are protected, such as Benson Highway, Timber Drive, Main Street and Old Stage Road.


LEGEND
Middle School
Elementary School
Streams
Streets
Railroads
Proposed Greenways
Existing Sidewalks
Proposed Sidewalks
Proposed Open Space
Garner City Limits
Existing Open Space
Lakes
Existing Parks
Wetlands
Project Boundary
Town Sewer and Pump Stations
Buffers
Project Boundary
Viewsheds
GREENWAYS
1 0 1 2 Miles

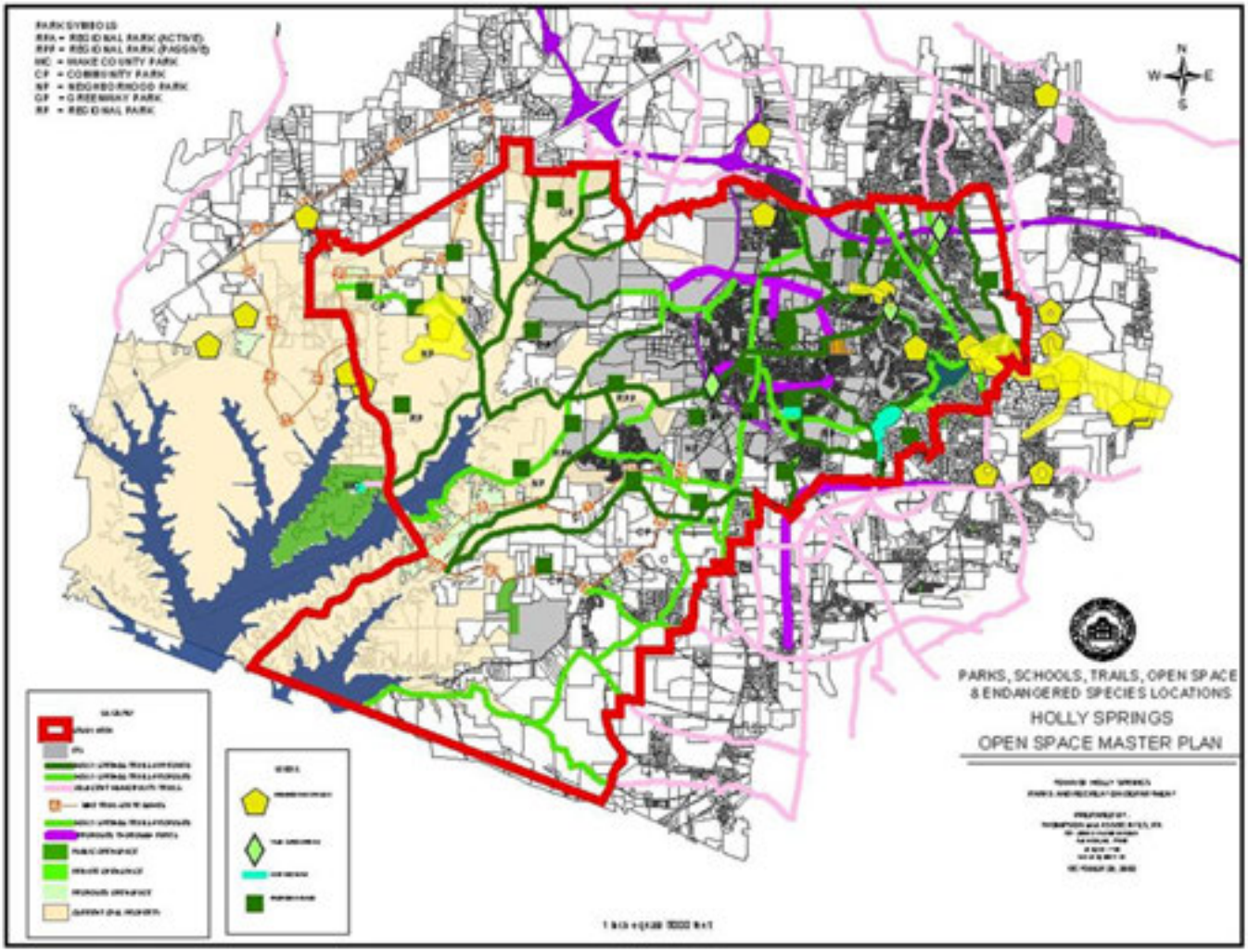
Holly Springs

The Town of Holly Springs adopted an Open Space Plan that identifies both parcels and corridors of land to be protected in the future. The Holly Springs Open Space system is based on several different factors including: watershed protection, proximity, core values that are consistent with Wake County's Open Space program and specific determinations defined by Town officials.

Top ranked parcels for future open space protection include:

- Thomas Millpond
- The Springs adjacent to Leslie-Alford-Mims House
- Suggs Farmland upstream of Bass Lake
- Windy Hill Farm
- Ashley Stephens property
- Sorrell House
- Laseur Stables Property
- Burt Land
- Nash-Weathers-Stephens property
- Properties downstream from Sunset Lake
- Properties in the Middle Creek basin
- Properties in the Rocky Branch Creek basin

Additionally, Greenway corridors have been identified along the Colonial Pipeline, along Sunset Lake and Sunset Lake Road, from the White Oak greenway trail to Apex municipal trails and to New Hill-Holleman Road at Friendship Park. Greenway trails would also be established from the Fuquay-Varina railroad corridor to other Fuquay-Varina greenway trails and to Buckhorn Creek. And from Friendship Road and New Hill-Holleman Road to the American Tobacco Trail corridor.


PARKS, SCHOOLS, TRAILS, OPEN SPACE
& ENDANGERED SPECIES LOCATIONS
HOLLY SPRINGS
OPEN SPACE MASTER PLAN

Knightdale

The Knightdale Plan incorporated various public comments from stakeholders, staff and the general public. These groups were actively engaged through open house meetings that were held to gather community input and display working maps of the community. The input and feedback received were combined to craft the recommendations contained within this Plan. Field research and Geographic Information System (GIS) analysis were also key in determining the location of proposed open space and greenways.

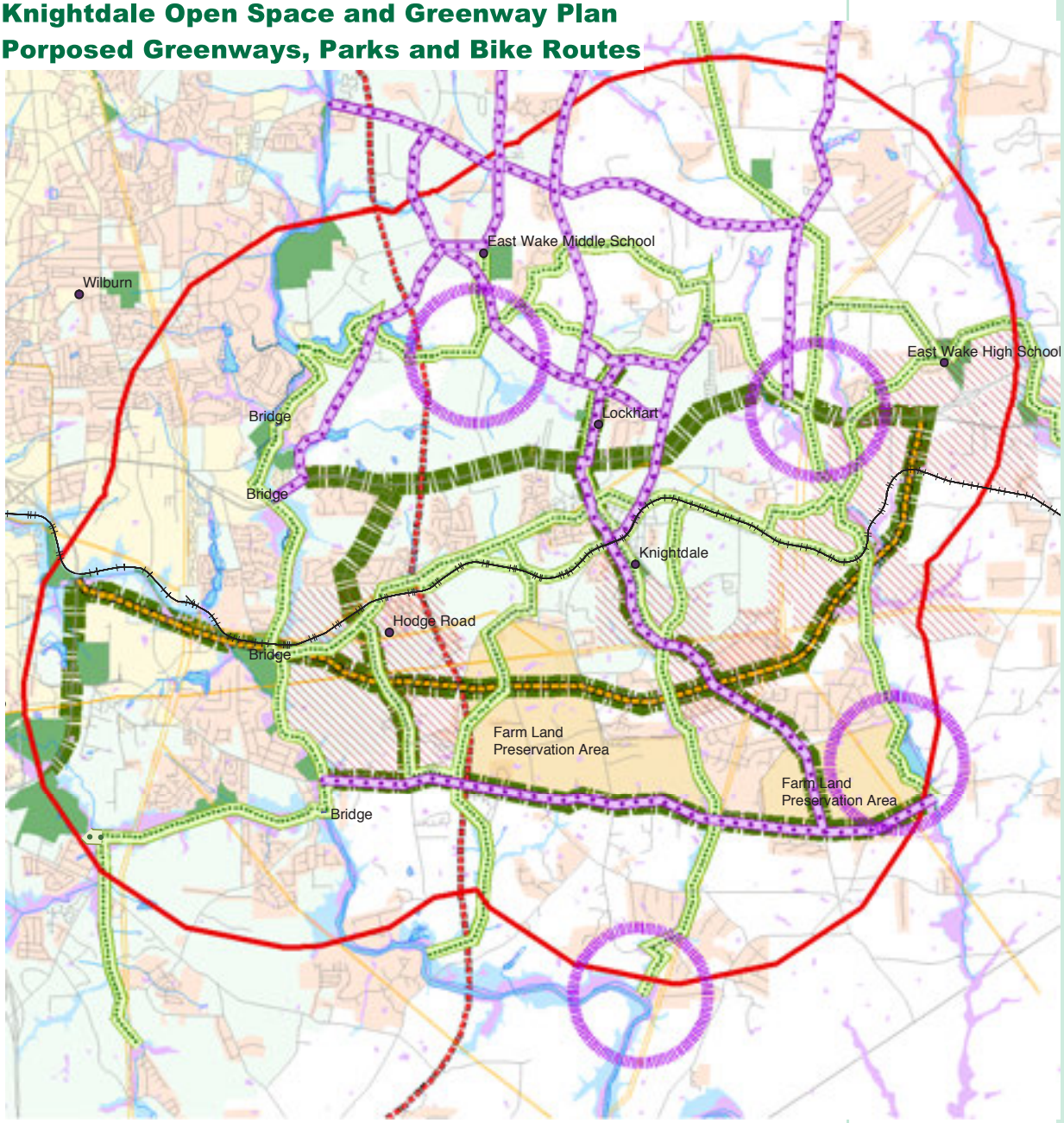
As a result of community and staff input, it is recommended that the Town of Knightdale supplement its existing park system with the following parks and open space acquisitions.

- Lake Myra Open Space - joint park with Wendell
- Poplar Creek Open Space
- Mark's Creek Open Space
- Beaverdam Creek Open Space

The following proposed bike routes and greenways will allow for alternative transportation and passive recreation options.

- Highway 64 Bike Route
- Old Milburnie Road Bike Route
- Forestville Road Bike Route
- Smithfield Road Bike Route
- Poole Road Bike Route
- 1st Avenue Bike Route
- Old Crews Road Bike Route
- Buffalo Road Bike Route
- Neuse River Greenway (in conjunction with Raleigh)
- Mingo Creek Greenway
- Railroad Greenway
- Walnut Creek Greenway
- Big Branch Greenway
- Cross Creek Greenway
- Poplar Creek Greenway
- Smithfield Road Greenway
- Marks Creek Greenway
- Beaverdam Creek Greenway
- East Wake High School Greenway Loop
- Knightdale High School Greenway Loop

Knightdale Open Space and Greenway Plan
Porposed Greenways, Parks and Bike Routes



DRAFT
July 2002

Prepared By:

GREENWAYS

Morrisville

The Town of Morrisville Comprehensive Parks, Recreation, Greenways and Open Space Master Plan identifies active and passive recreation needs, including greenways and open space. Morrisville is currently the fastest growing municipality in North Carolina and acquisition is competitive. Due to the Town's location within Wake County, expansion opportunities are non-existent and land acquisition is limited. The following summary was developed through the planning process to guide recommendations for greenways and open space land acquisition.

Greenways

Immediate Needs:

- Land Acquisition and property easements for future greenways
- Indian Creek Greenway (1.8 miles)
- Downing Glen Connector (0.37 miles)

Short Term Needs:

- Crabtree Creek Greenway (2.75 miles)
- Sawmill Creek Greenway (1.2 miles)
- County Park Connector (0.25 miles)
- Airport Boulevard Connector (0.48 miles)

Long Term Needs:

- Fairview Greenway (0.51 miles)
- Cedar Creek Greenway (1.19 miles)

Morrisville currently manages 127.63 acres of active and passive recreational land. The Town currently reserves 80.49 acres as open space and property for future passive recreational purposes, primarily greenway development. In order for Morrisville to meet current and future recreational needs and protect open space in the future additional land needs to be acquired. In order to maintain a sufficient standard of parkland acquisition until the year 2030, the Town of Morrisville's projected build-out date, 10.21 acres of additional parkland will need to be acquired annually. To meet the growing demand for parks and facilities within Morrisville, the Town should pursue a balanced planning approach to acquire land that satisfies both active and passive recreational needs.

Land Acquisition

Immediate Need:

- Acquisition of land for active recreational needs: 30.5 acres
- Acquisition of parcels within identified greenway corridors and trailheads

Short Term Needs

- Easement and development rights for active and passive recreational needs

Long Term Needs

- Will very depending upon future capital infrastructure projects


PROPOSED
MASTER PLAN
LEGEND
LAND ACQUISITION AREAS
HISTORIC AREA
CEMETERY
WAKE COUNTY SCHOOLS AND FACILITIES
MORRISVILLE TOWN BOUNDARY
MORRISVILLE PARKS AND PUBLIC FACILITIES
WAKE COUNTY PARKS AND PUBLIC FACILITIES
COUNTY WATERSHED AND WETLAND PROTECTION AREAS
PROPOSED PEDESTRIAN CROSSING
MORRISVILLE EXISTING GREENWAYS
MORRISVILLE PROPOSED GREENWAYS
CARY GREENWAYS
RAILROAD CORRIDORS
MORRISVILLE PROPOSED GREENWAYS ADDITIONS
MORRISVILLE PROPOSED BIKE LANES
MORRISVILLE FUTURE ROADWAYS
CEDAR FORK DISTRICT PARK
WESTON PARK SITE
WESTON
CIVIL WAR BATTLE FIELD
BRIDGEMONT
CARPENTER PARK
MORRISVILLE COMMUNITY PARK
PRESTON
MORRISVILLE COMMUNITY CENTER
BRECKENRIDGE
TOWN OF MORRISVILLE
COMPREHENSIVE PARKS, RECREATION, GREENWAYS, AND OPEN SPACE MASTER PLAN
PREPARED FOR:
TOWN OF MORRISVILLE
PARKS, RECREATION and CULTURAL RESOURCES
PREPARED BY:
HadenStanziale

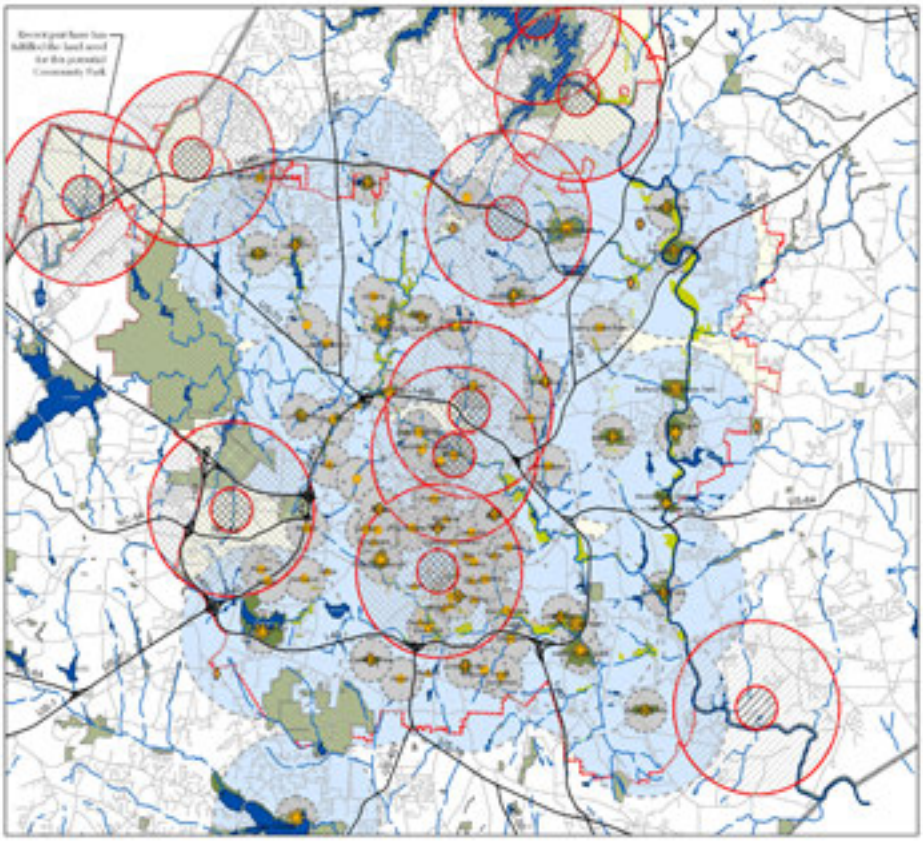
Raleigh

The Raleigh Parks, Recreation and Greenways Element of the Comprehensive Plan, also known as the Parks Plan, sets a framework for City park planners to use as they define programming, maintenance and development of the city park system in the next two decades. The Plan "envisions a system of aesthetically pleasing, conveniently located and inter-connected parks, greenways and public open spaces that provide opportunities for recreation and the enjoyment of nature."

"The overall goal of the City's Parks and Open Space Program is to provide a balanced leisure service system to contribute to the well being of individuals and families, the attractiveness of neighborhoods and the social, economic and environmental health of the City of Raleigh." There are six major goals of the parks recreation and greenways program:

1) Provide park and open space opportunities to all residents.
2) Provide a diverse, well-balanced, well-managed range of recreational facilities.
3) Optimize the appreciation, use and stewardship of Raleigh's historic, cultural and natural resource heritage.
4) Provide the opportunity for community involvement.
5) Encourage intergovernmental collaboration.
6) Encourage private recreation initiatives to supplement public facilities.

Raleigh's annual growth rate of 2.3% means that the City will need to add an estimated 10% of new park and open space land every four years. The City has defined 51 new "park search areas" and has stated a need to acquire approximately 4,794.29 acres of park and open space land by the year 2025 in order to keep pace with future growth and development. Additionally, the City anticipates that it will also need to acquire an additonal 600 acres of land to supplement the Capital Area Greenway system. Finally, the City is also interested in pursuing a regional parks initiative that would occur in partnership with Wake County and other municipal governments.



Capital Area Greenway

RALEIGH Parks and Recreation
parks.raleighnc.gov

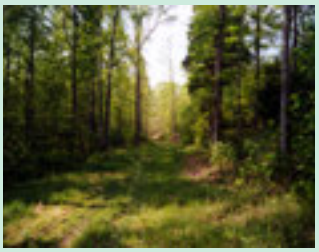
Trails (Proposed)

1. Walnut Creek Eliza Pool Trail
2. Walnut Creek-City Farm Road Trail
3. Crabtree-Duraleigh Trail

Existing Trails

#	Trail Name	Location	Distance	Surface
1	Alleghany Trail	Lassiter Mill Rd.	2.4 miles	Paved
2	Beaver Dam Trail	Wade Ave./Dixie Tr.	1.4 miles	Earth/Concrete
3	Bent Creek Trail	Longstreet Dr.	1.35 miles	Paved
4	Brentwood Trail	Ingram Dr.	0.75 miles	Paved
5	Buckeye Trail	Raleigh Blvd./Milburnie Rd.	2.5 miles	Paved
6	Crabtree - Oak Park Trail	Lindsay Drive	1.6 miles	Paved
7	Crabtree Valley Trail	Crabtree Valley Ave.	1.0 mile	Paved
8	Durant Trails	Camp Durant Rd.	1.1 miles	Paved
9	Fallon Creek Trail	Noble Rd.	0.5 miles	Paved
10	Falls River Trail	Falls River Ave.	1.1 miles	Paved
11	Gardner Street Trail	Gardner St.	0.7 miles	Earth/Concrete
12	Ironwood Trail	Millbrook Rd.	1.3 miles	Paved
13	Lake Johnson Trail System	Avent Ferry Rd.	5.5 miles	Paved/Natural
14	Lake Lynn Trail	Lynn Rd.	2.2 miles	Paved
15	Lake Park Trail	Rushing Brook Dr.	0.6 miles	Earth
16	Little Rock Trail	Martin Luther King, Jr. Blvd.	0.9 miles	Paved
17	Lobloly Trail	RBC Center	6.0 miles	Earth
18	Lower Walnut Creek Trail	Cooper Rd.	2.1 miles	Paved
19	Middle Crabtree Creek	Noble Rd. / Raleigh Blvd.	2.2 miles	Paved
20	Neuse River Trail	Rogers Ln.	4.0 miles	Earth
21	North Hills Trail	North Hills Dr.	1.0 miles	Paved
22	Reedy Creek	Blue Ridge Rd.	1.0 miles	Paved
23	Rocky Branch Trail	Western Blvd.	1.5 miles	Paved
24	Rocky Branch (NCSU)	Sullivan Rd.	1.5 miles	Paved
25	Sawmill Trail	Sawmill Rd.	0.9 miles	Earth
26	Shelley Lake Trail	West Millbrook Rd.	3.0 miles	Paved
27	Upper Walnut Trail	Lake Dam Rd.	1.1 miles	Paved
28	Wakefield Trail	Wakefield Plantation Rd.	1.2 miles	Paved
29	West Millbrook Trail	Strickland Rd.	0.3 miles	Paved/Concrete

Rolesville



The future of open space and greenways in Rolesville is envisioned as a system of outdoor spaces that function as healthy, protected ecosystems and protect the natural and cultural resources that community residents value most. There are three principal goals of the plan: 1) to identify parcels and corridors of land that are in need of protection and conservation measures; 2) to establish a comprehensive approach that will 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.

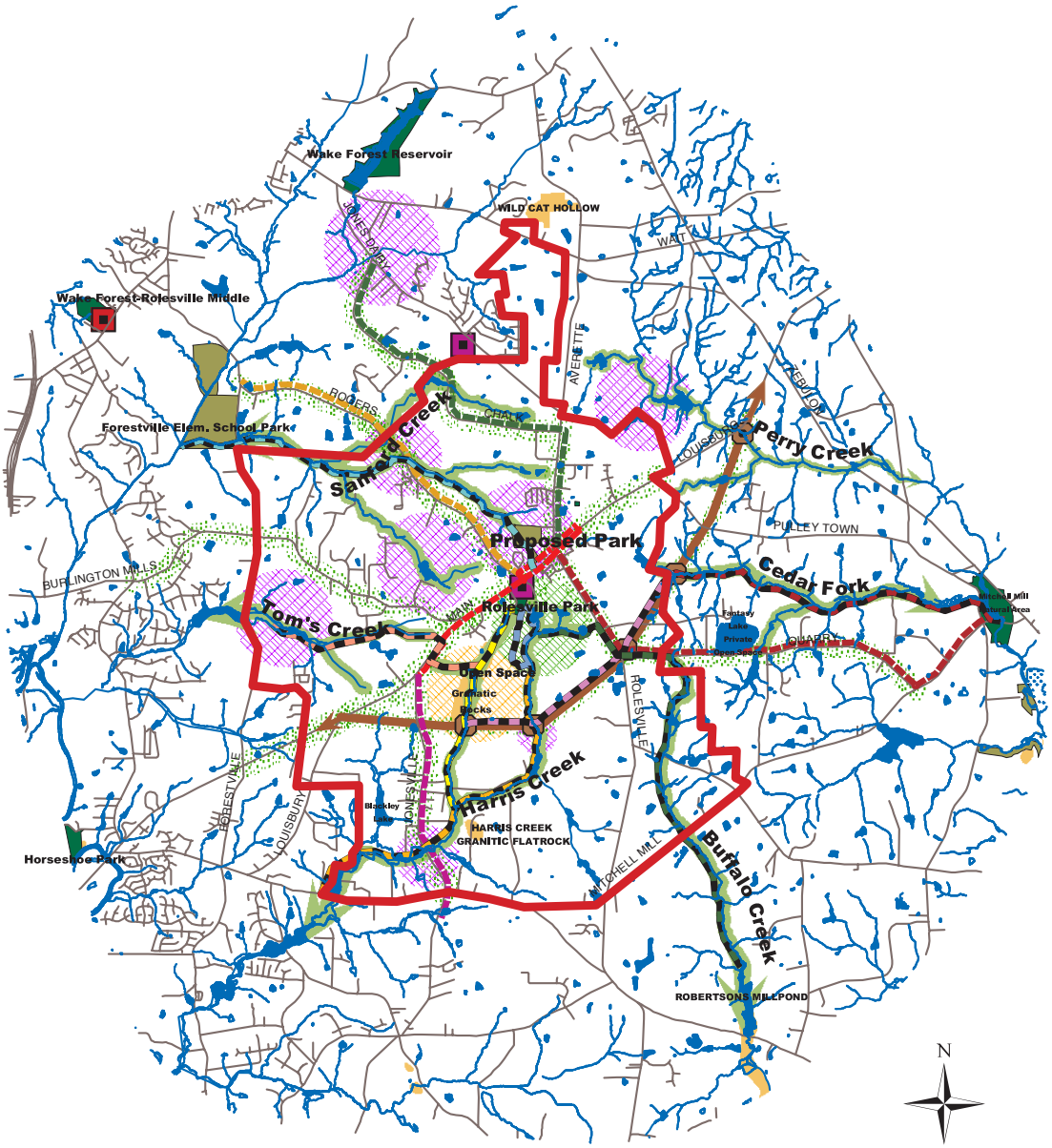
Corridors and open space locations were identified and presented in GIS map form at meetings with Rolesville staff and public workshops. All public comments received from these meetings and workshops were incorporated into the recommendations for the open space and greenways system.

Open spaces identified in this plan are larger properties that contribute to the preservation of Rolesville's natural character and scenic beauty as well as performing ecological functions. The desire of the citizens of Rolesville to have a central park as a focal point for their community is a major part of this plan. In addition, the plan recommends eight satellite parks and one natural area.

- Central Park – located at current city park and enlarged to include Parker Pond and part of the proposed development to the south.
- Eight Satellite Parks – Main Street Park, Rolesville/Wake Forest Partnership Park, Old Mill Site on Sanford Creek, Burlington Mills Park and passive recreation parks on Perry Creek, two on Harris Creek, and on Tom's Creek.
- Natural Area – located on Harris Creek to protect a large outcrop of Granitic Rock.

Corridors were selected to ensure development of a continuous system of greenways located throughout Rolesville and extending to neighboring jurisdictions. The following corridors are recommended for greenways and bike routes:

- Harris Creek Greenway
- Sanford Creek Greenway
- Cedar Fork Creek Greenway
- Buffalo Creek Greenway
- Tom's Creek Greenway
- Perry Creek Greenway
- Main Street Bike Trail
- 401 Bypass Bike Trail
- Rogers Road Bike Route
- Chalk road Bike Route
- Quarry Road Bike Route
- Burlington Mills Bike Route
- Jonesville Bike Route



GREENWAYS INCORPORATED
Landscape Architecture
Multi-Objective Trail Planning
Open Space Planning

Prepared:
January 2002

Data Sources:
Wake County Planning GIS Dept.
Wake Forest Planning Dept.
NCGIA Corporate Database

4,900 2,450 0 4,900 Feet

Wake Forest

Incorporating public participation was central to the process for producing this plan. The community was actively engaged through meetings with stakeholders, Town staff, and the general public. Two evening open house type meetings were held to gather community input and display working maps of the community. The feedback received from the groups mentioned above were combined to craft the Wake Forest Open Space and Greenways Master Plan recommendations. Also incorporated into the process was field research and Geographic Information System (GIS) analysis.

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

- a “central park” between the downtown area and the new bypass.
- a community park in the east-central area of the community, and there is a possibility that this park could be developed in partnership with Rolesville.
- a future community park in the northwestern quadrant of the community.
- a future park along the Neuse River at the intersection with Capital Boulevard.

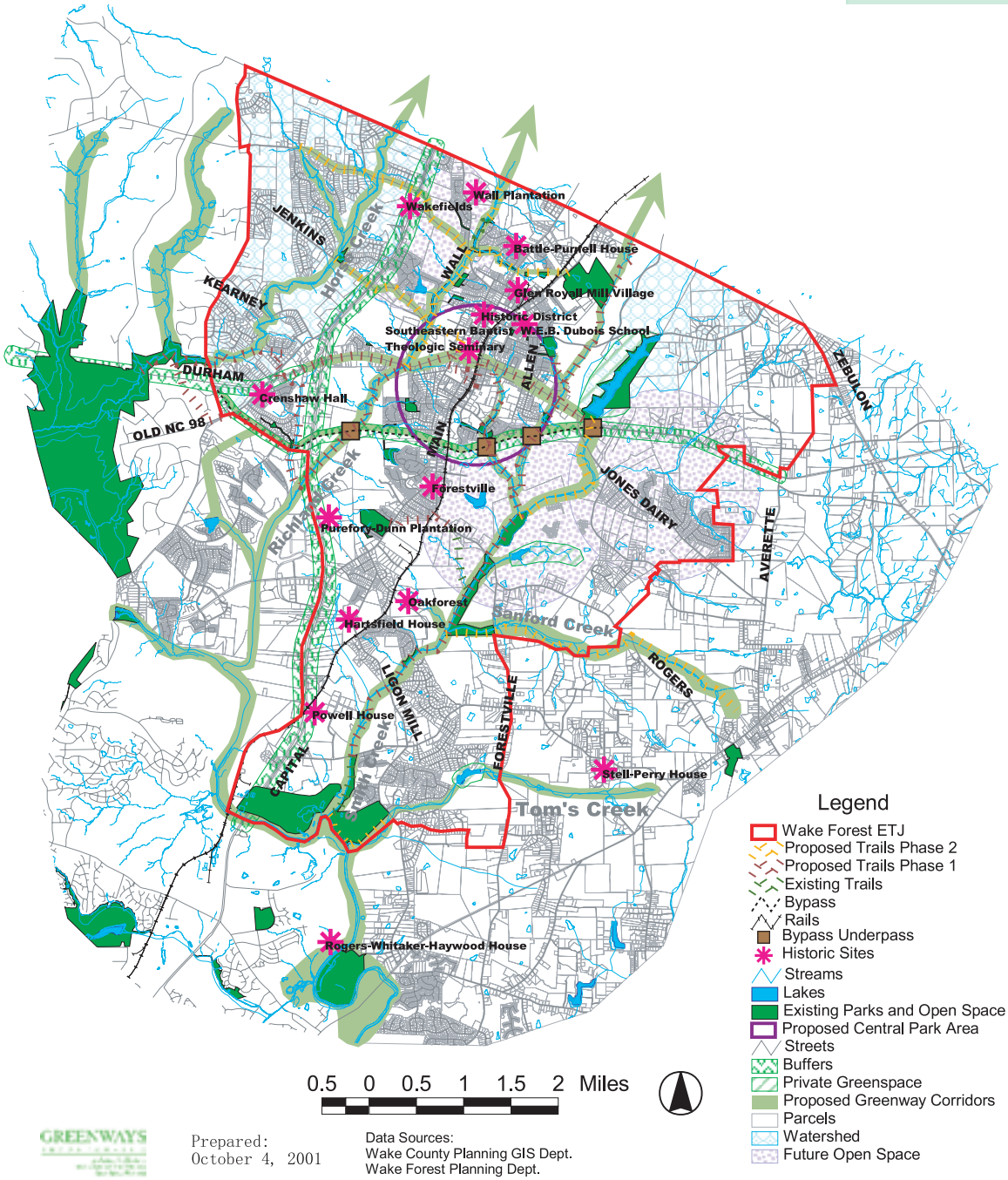
Proposed greenways include:

- Smith Creek Greenway
- Richland Creek Greenway
- Horse Creek Greenway
- Sanford Creek Greenway
- Tom’s Creek Greenway
- Wait Avenue Greenway
- Purnell Road Greenway
- Jenkins Road Greenway

Additionally, the Open Space and Greenway Plan advocates the protection and conservation of the primary streams of Wake Forest:

- Horse Creek
- Richland Creek
- Smith Creek
- Sanford Creek.

Finally, it is important to conserve and protect the small town character of Wake Forest by enhancing the main community thoroughfares (US 1/ Capital Boulevard, Durham Road/Wait Avenue, and the new 98-bypass).



GREENWAYS

Prepared:
October 4, 2001

Data Sources:
Wake County Planning GIS Dept.
Wake Forest Planning Dept.

Wendell and Zebulon

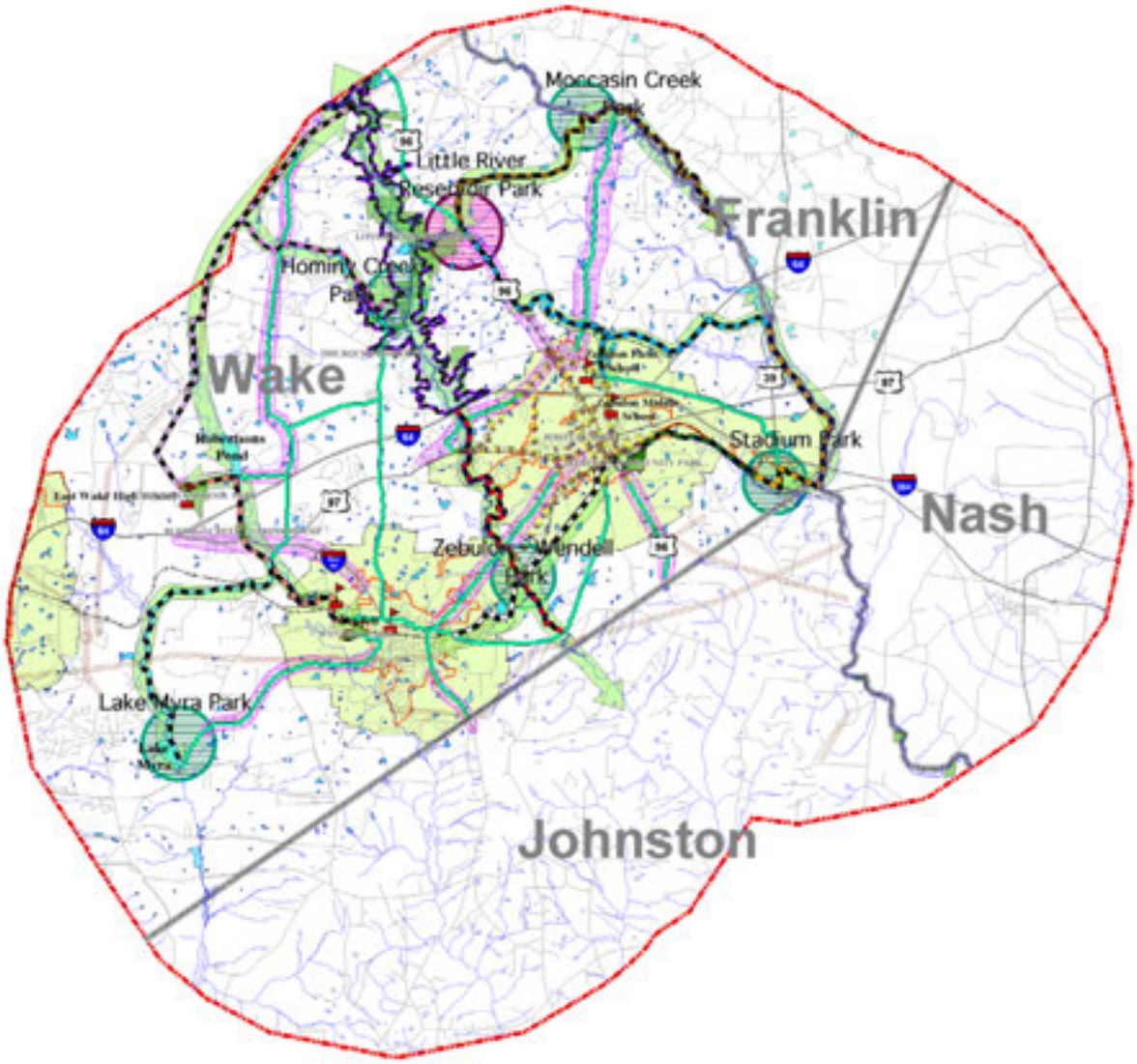
The towns of Wendell and Zebulon formed a partnership in the Open Space and Greenway Study. The study area boundary was determined from the combination of each towns Extra Territorial Jurisdiction (ETJ) boundary. From this combined land area, it was apparent that a much larger area would need to be included because of the close proximity to and rapid growth occurring Johnston, Nash, and Franklin Counties. A five-mile radius was determined to cover a wide enough area to focus on the regional growth.

The planning process included public involvement, community meetings, and field evaluations. The public meetings were held August 2001, October 2001, December 2001 and featured displays, an informative video, questionnaire and interactive maps. These community meetings were meant to gather public input, share ideas, update on progress and process and disperse public opinion surveys. Field evaluations entailed in-house research, field visits, GIS analysis, visual field inspection and review of web-based and published materials.

The Zebulon study area focused on two of the four watersheds in the joint Wendell and Zebulon Plan, Little River Moccasin Creek watersheds. The Wendell study area focused on the other two watersheds: Marks Creek and Buffalo Creek. Several parks were located through staff recommendations, public feedback and GIS mapping.

- Central Park - Develop a “central park” adjacent to the proposed Little River Reservoir in conjunction with Wake County and the two towns.
- Little River Corridor Park - Develop an open space park along the Little River, in partnership with Wake County and the two towns.
- Northeast Park site - Develop an open space park along Moccasin Creek; consider partnership with Wake, Nash, and Franklin Counties. (Zebulon)
- Southeast Park Site - Develop a community park in the eastern area of the Study area, possibly in partnership with Wake County, Franklin County, and Johnston County. (Zebulon)

- Southwest Park Site - Work with Knightdale to acquire land for a community park near Lake Myra and along Buffalo Creek in the west ern quadrant of the Study area. (Wendell)
- Northwest Park Site - Develop an open space park along Hominy Creek; consider partnership with Rolesville and Wake County. (Wendell)



Proposed Greenways, Protected Corridors, Bike Routes and Sidewalks

Prepared for:

Town of Zebulon
North Carolina

Town of Wendell

Prepared by:

GREENWAYS INCORPORATED

Data Sources:
Wake County Planning Depart.
Zebulon Planning Depart.
Wendell Planning Depart.
NCDOT GIS Unit
NCGIA Corporate Database (GIS)

N
W E
S

Spring 2002

0 1 Miles

Legend

- Study Boundary
- Countylines
- Streams & Creeks
- Ponds & Lakes
- ETJ Limits
- Corporate Limits
- Railroads
- Powerlines
- Roads
- Highways
- Schools
- Proposed Little River Reservoir
- Proposed Central Park
- Proposed Satellite Parks (Passive)
- Proposed East/West Greenway
- Proposed Lower Buffalo Greenway
- Proposed Upper Buffalo Creek Greenway
- Proposed Hominy Creek Greenway
- Proposed Little River Greenway
- Existing Zebulon Greenway
- Upper Moccasin Creek Greenway
- Beaverdam Creek Greenway
- Lower Moccasin Creek Greenway
- Marks Creek Greenway
- Sidewalks Proposed Zebulon Multi-Modal Transporation Plan 2001
- Bike Routes Proposed Zebulon Multi-Modal Transporation Plan 2001
- Proposed Hikes Routes and Sidewalk Connectors
- Proposed Scenic Byway Corridors
- Proposed Protected Corridors
- Existing Open Space & Parks

The following stream corridors and greenways will be protected for water quality, wildlife habitat and passive recreation in Zebulon:

- Moccasin Creek
- Little River
- Beaverdam Creek

The following stream corridors will be protected in Wendell:

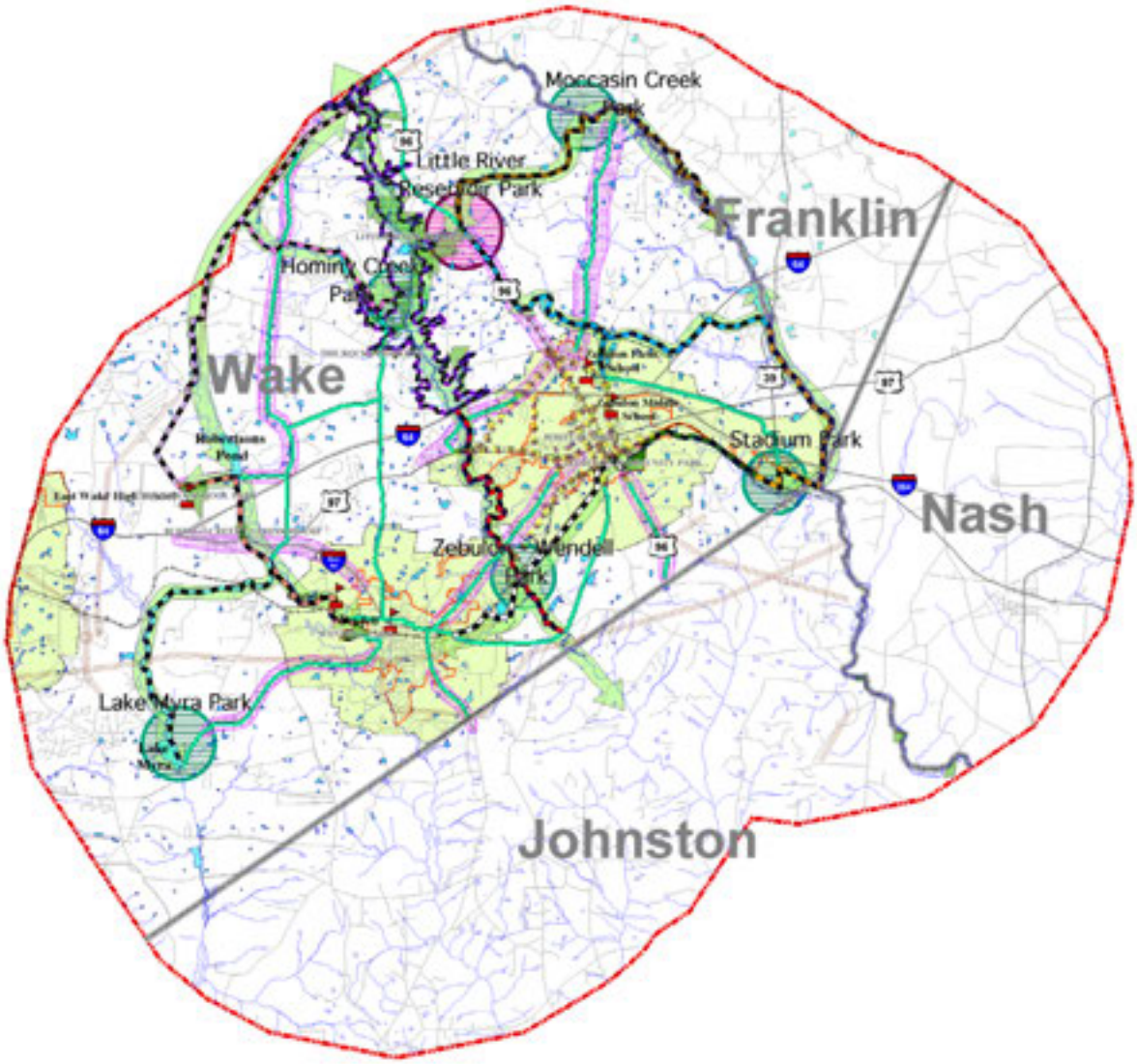
- Buffalo Creek
- Little River
- Hominy Creek.

A Model Stream Buffer Ordinance is recommended to establish a stream buffer program that is based on Watershed Classification System defined by base line water quality measurements developed by Wake County Water Quality Study and State Standards. The suggested standards are:

- 100 foot minimum buffers from stream bank both sides of stream on all lands that drain more than one square mile
- Includes all FEMA identified streams in Wake County
- First 70 feet undisturbed (w/utilities), remaining 30 feet minor disturbance

A Model Conservation Subdivision Ordinance is proposed for Wendell and Zebulon. The general guidelines for this ordinance are:

- Replace the current Cluster Ordinance with a new Conservation Subdivision Ordinance
- Goal of 40% (min. 30%) contiguous open space set aside
- Flexible program that offers a better arrangement of land development
- Protect land for future open space during the land development process
- Land development “Yield” remains unchanged
- Greenspace protected via conservation easement
- Open space is shared by all homeowners
- Can be accomplished in rural landscapes w/out water and sewer



Proposed Greenways, Protected Corridors, Bike Routes and Sidewalks

Prepared for:

Town of Zebulon
North Carolina

Town of Wendell

Prepared by:

GREENWAYS INCORPORATED

Data Sources:
Wake County Planning Depart.
Zebulon Planning Depart.
Wendell Planning Depart.
NCDOT GIS Unit
NCGIA Corporate Database (GIS)

N
W E
S

Spring 2002

0 1 Miles

Legend

- Study Boundary
- Countylines
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- Proposed Hikes Routes and Sidewalk Connectors
- Proposed Scenic Byway Corridors
- Proposed Protected Corridors
- Existing Open Space & Parks

Chapter 4: Implementation Program

Overview

Implementing the recommendations contained within this Open Space Plan will require leadership, new programs, new sources of revenue, and a partnership between the public and private sectors in Wake County. Wake County will need to define an appropriate internal structure for managing the emerging open space program. It will be necessary for County government to assume a leadership position with respect to stewardship of open space resources, and work in collaboration with municipalities, state and federal agencies and non-governmental organizations to implement this program. The County and its municipal partners will need to establish new sources of funding to carry out the objectives of this plan. The County will not be able to accomplish the recommendations of this Plan acting alone. County government will need to build upon the partnerships already begun with municipal governments (Partners for Open Space and the Environment - POSE) and join with private sector land conservation organizations, landowners and businesses to accomplish the goals of the Plan.

Prioritization Process

One of the primary goals of the Plan is to introduce a methodology and process for selecting and prioritizing land for conservation and preservation. Appendix F of this report describes in detail the process that is recommended for use by County staff to prioritize land for open space protection. This prioritization process has as its core value the protection of land for water supply and flood management purposes. Put another way, land that serves to keep our surface and subsurface waters clean and potable, and which at the same time can absorb and mitigate the impacts of flooding, is the highest rated open space land.

The process used for this Plan combines Human Resource Needs and Natural Resource Needs to form a matrix for decision making. Under human resource needs water supply watersheds, waters that support recreation, groundwater recharge lands, parkland and greenways are the principal components. For natural resource needs, rare and threatened species, significant natural heritage areas and soils are the principal components. Using Geographic Information System (GIS) data from a variety of public and private sources, a macro-level analysis has been conducted to select areas of the county that would receive the highest level of prior-

ity for open space acquisition strategies. With the macro level of analysis complete, attention can be directed to identifying parcels within the priority areas of the county that would best serve the county's open space needs.

A second level of evaluation identifies more site specific features of the landscape, including land coverage (forested lands receive the highest rating), land use, the presence of streams and wetlands, hydric soils and lands regulated by Federal Emergency Management Agency (FEMA) for flood abatement. In addition, parcels of 50 acres and larger were queried from the Wake County GIS data. A scoring system was devised to rank properties within priority areas of the county. From this scoring, a list of properties has been developed and will be further evaluated by the County for future actions.

Using these methods, this plan makes recommendations for the highest priority lands found within the highest ranked subwatersheds in Wake County. Approximately 27,000 acres have been identified through this process for targeted acquisition. Given an average value of $20,000 an acre, a budget of $600 million (2002 dollars) would need to be raised, over the life of the open space acquisition efforts (estimated at 25 years), to purchase the targeted open space identified by this plan.

Strategies for Acquisition of Land for Open Space

A variety of methods, other than outright purchase of land, can be employed by Wake County to protect the open space that has been defined for protection within this Plan. The following offers a listing of techniques and methods most commonly used for open space protection, conservation and preservation.

I. Methods for Acquisition of Land through Management

Management is a method of conserving the resources of a specific open space parcel through either an established set of policies called Management Plans, or through negotiated agreements or easements with private property owners.

Management Plans

Management plans are prepared for County-owned lands. Management plans should identify valuable resources; determine compatible uses for the parcel; determine administrative needs of the parcel, such as maintenance, security and funding requirements; and recommend short-term and long-term action plans for the treatment and protection of the resources.

II. Methods for Acquisition of Land through Regulation

A second method of protecting land is through government regulation. Regulation is defined as the government's ability to control the use and development of land through legislative powers. Regulation of land is not regarded as permanent protection, and should be coupled with the other protection measures. The following types of development ordinances

are regulatory tools that can meet the challenges of projected suburban growth and development and, at the same time, conserve and protect open space resources.

Dedication/Density Transfers
Also known as incentive zoning, this mechanism allows open spaces to be dedicated to the County for density transfers on the development of a property. The potential for improving or subdividing part or all of a parcel of real property, as permitted by the County land use development laws, can be expressed in dwelling unit equivalents or other measures of development density or intensity. Known as density transfers, these dwelling unit equivalents may be relocated to other portions of the same parcel or to contiguous land that is part of a common development plan. Dedicated density transfers can also be conveyed to subsequent holders if properly noted in transfer deeds.

Negotiated Dedications
The County may ask a landowner to enter into negotiations for certain parcels of land that are deemed beneficial to the protection and preservation of specific stream corridors. The County may ask for the dedication of land for open spaces when landowners subdivide property (a minimum size would be determined). Such dedications would be proportionate to the relationship between the impact of the subdivision on community services and the percentage of land required for dedication as defined by the US Supreme Court in Dolan v Tigard.

Fee-in-Lieu
To complement negotiated dedications, a fee-in-lieu program may be necessary to serve as a funding source for other land acquisition pursuits of the Open Space Plan. Based on the density of development, this allows a developer the alternative of paying money for the development/protection of open spaces in lieu of dedicating land for open spaces. This money is then used to implement open space management programs or acquire additional open space lands.

Reservation of Land
A reservation of land does not involve any transfer of property rights but simply constitutes an obligation to keep property free from development for a stated period of time. Reservations are normally subject to a specified period of time, such as 6 or 12 months. At the end of this period, if an agreement has not already been reached to transfer certain property rights, the reservation expires.

Buffer/Transition Zones
This mechanism recognizes the problem of reconciling different, potentially incompatible land uses by preserving open spaces that function as buffers or transition zones between uses. Care must be taken to ensure that use of this mechanism is reasonable and will not destroy the value of a property.

Overlay Zones
An overlay zone and its regulations are established in addition to the zoning classification and regulations already in place.

Subdivision Exactions
An exaction is a condition of development approval that requires a developer to provide or contribute to the financing of public facilities at his own expense. For example, a developer may be required to set aside open space on-site as a condition of developing a certain number of units because the development will create need for new parks or will harm existing parks due to overuse. The mechanism can be used to protect or preserve open space which is then dedicated to the County. Consideration should be given to including open space development in future exaction programs.

III. Methods for Protection of Open Space through Acquisition

A third method of protecting open spaces is through the acquisition of property. A variety of methods can be used to acquire property for open space purposes.

Donation/Tax Incentives
The County agrees to receive full title to a parcel of land at virtually no cost. In most cases, the donor is eligible to receive federal and state deductions on personal income, as previously described under conservation easements. In addition, property owners may be able to avoid inheritance taxes, capital gains taxes and recurring property taxes.

Fee Simple Purchase
This is a common method of acquisition where a local government agency or private open space manager purchases property outright. Fee simple ownership conveys full title to the land and the entire "bundle" of property rights including the right to possess land, to exclude others, to use land and to alienate or sell land.

Easements
Easements are the conveyance of property rights in which the County receives less than full interest in a parcel of land in order to protect a valuable resource. The purpose of these agreements is to establish legally binding contracts or a mutual understanding of the specific use, treatment and protection that these open space lands will receive. Property owners who grant easements retain all rights to the property except those which have been granted by the easement. The property owner is responsible for all taxes associated with the property, though the taxes can be lower because the value of the property will be lower without the right to develop. Easements are generally restricted to certain portions of property, although in certain cases an easement can be applied to an entire parcel of land. Easements are transferable through title transactions, thus the easement remains in effect in perpetuity. Three types of easements are:

Conservation Easements
This type of easement generally establishes permanent limits on the use and development of land to protect the natural resources of that land. Dedicated conservation easements can qualify for both federal income tax deductions and state tax credits. Tax deductions are allowed by the Federal government for donations of certain conservation easements. The donations may reduce the donor's taxable income.

Preservation Easements
This type of easement is intended to protect the historical integrity of a structure or important elements of the landscape by sound management practices. Preservation easements may qualify for the same federal income tax deductions and state tax credits as conservation easements.

Public Access Easements
Right of public access easements provide the general public with the right to access and use a specific parcel of property. Both conservation easements and preservation easements may contain clauses for the right of public access and still be eligible for tax incentives.

Easement Purchase
This mechanism is the fee simple purchase of an easement. Full title to the land is not purchased, only those rights granted in the easement agreement. Therefore the easement purchase price is less than full title value.

Purchase/Lease Back
The County or private land conservation organization can purchase a piece of land and then lease it back to the seller for a specified period of time. The lease may contain restrictions regarding the use and development of the property.

Bargain Sale
A property owner can sell property at a price less than the appraised fair market value of the land. Sometimes the seller can derive the same benefits as if the property were donated. Bargain Sale is attractive to sellers when the seller wants cash for the property, the seller paid a low cash price and thus is not liable for high capital gains tax, and/or the seller has a fairly high current income and could benefit from a donation of the property as an income tax deduction.

Option/First Right of Refusal
A local government agency or private organization establishes an agreement with a public agency or private property owner to provide the right of first refusal on a parcel of land that is scheduled to be sold. This form of agreement can be used in conjunction with other techniques, such as an easement, to protect the land in the short term. An option would provide the agency with sufficient time to obtain capital to purchase the property or successfully negotiate some other means of conserving the open space resource.

Purchase of Development Rights
A voluntary Purchase of Development Rights (PDR) program has been established in Wake County and could be used to protect agricultural lands. PDR involves purchasing the development rights from a private property owner at a fair market value. The landowner retains all ownership rights under current use, but exchanges the right to develop the property for cash payment.

Condemnation
The practice of condemning private land for use as open spaces is viewed as a last resort policy. Using condemnation to acquire property or property rights can be avoided if private and public support for the Open Space Program is present. Condemnation is seldom used for the purpose of dealing with an unwilling property owner. In most cases, condemnation for open space purposes has been exercised when there has been absentee property ownership, when title to the property is not clear, or when it becomes apparent that obtaining the consent for purchase will be difficult because there are numerous heirs located in other parts of the United States, or in different countries.

Wake County Voluntary Agricultural District Program
In September 2002, the Board of Commissioners enacted a new ordinance that will provide for the voluntary preservation and protection of farmland from non-farm development, recognizing the importance of agriculture to the economic and cultural life of the county. Under this ordinance, the Wake Soil and Water Conservation District Board of Supervisors will serve as an Agricultural Advisory Board to provide advice to the Board of Commissioners on the program. Primarily, the Board will advise the Commissioners on the establishment and modifications of qualified farmland to the district, projects programs or issues effecting the agricultural economy as related to the districts, and perform specific tasks assigned by the Commission.

Stewardship Program

With potentially thousands of acres of new open space being acquired, protected, conserved and preserved in the future, Wake County will need to increase its land management operations and programs to keep pace. To accomplish this, a land stewardship program should be established within County government, and in partnership with municipalities, state and federal agencies and non-governmental organizations. An "ecosystem approach" should be adopted to accomplish future management objectives. The ecosystem approach will encourage natural and low-cost land management techniques. This approach will understand the natural and inherent values of individual properties and manage these properties accordingly so that the ecological systems are protected and enhanced.

To accomplish this program, County government may need to add new staff positions in future years. To keep the costs of the program affordable, the County may need to partner with other public and private sector

organizations that have similar missions and objectives. Additionally, a volunteer coordinator could work with private sector groups to both adopt open space parcels and establish programs that make use of the youth in the county.

An Urban Forestry Program should also emerge within County government that can begin to quantify and manage the forest canopy throughout the County. This program should be conducted in partnership with like minded organizations, including the North Carolina Urban Forest Council, NC State University and the State of North Carolina. Further information about the stewardship program can be found within Appendix E of this report.

Funding and Financing the Open Space Program

In November 2000, Wake County voters approved a $15 million bond to acquire open space as a way to mitigate the effects of growth and protect the environment. While the $15 million bond is a significant achievement for the community, it represents a fraction of the future financial needs for open space conservation. If Wake County is to develop a viable Open Space Program, it will need greater funding for parcel acquisition and continued financing for stewardship and program implementation.

Wake County and its municipal partners need a broad base of funding to support open space protection. This plan envisions a "funding quilt" that will combine a variety of sources in support of the open space program. These sources will come from local, state, federal, and private sectors. In Appendix D of this document, a more thorough review of potential financing strategies is provided and includes a variety of federal, state and local government and private funding options. Appendix D also addresses how other communities are financing their open space systems.

Wake County will need to fully evaluate its options and develop a funding strategy that can maximize local resources, leverage outside funding, and sustain an Open Space Program. A successful funding strategy will need to account for the administration of the Plan, the acquisition of parcels or easements, and the management and maintenance of properties in the open space system.

Of the many funding options that are possible, the following strategies were identified by the Wake County Blue Ribbon Committee in 2006 as recommended options:

1) Apply for matching funds from federal, state and local municipal governments.
2) Request matching funds from corporate and private donors.
3) Conduct fund raising in partnership with philanthropic organizations.
4) Use tools, such as Bargain Sale, to obtain open space at less than fair market value.
5) Work with Wake County Schools to partner on school and open space projects, maximizing the return on public dollars invested.

6) Provide more economic incentives for developers to conserve open space, thereby reducing the demand on public funds.
7) Work with farmers and working lands owners to conserve open space.

Implementing the Open Space Program

Implementation of the Wake County Open Space program has been on-going for years, but began in earnest in 1999 with the acquisition of key parcels of land. After the completion of the 2003 Consoildated Open Space Plan, the County began to implement elements of the Plan by first focusing its efforts on 9 key corridors and watersheds. As of May 2006, the County has made progress in conservation of open space, adding an estimated 3,200 acres to its open space program. The following provides a snapshot of this success within the nine priority corridors:

1) Neuse River Corridor - 145.11 acres protected at a cost of $1,805,724
2) Little River Corridor - 183.76 acres protected at a cost of $1,270,259
3) Lowery Creek Corridor - 164.57 acres protected at a cost of $1,357,935
4) Beaver Creek Corridor 109.36 acres protected at a cost of $2,650,460
5) Cedar Fork Corridor 107.13 acres protected at a cost of $780,003
6) Hominy Creek Corridor 7.69 acres protected at a cost of $38,280
7) Steep Hill Creek Corridor 125.82 acres protected at a cost of $527,540
8) Swift Creek Corridor 178.81 acres protected at a cost of $770,852
9) Marks Creek Corridor 359.02 acres protected at a cost of $3,980,000

Action Plan

Building on the momentum of the 2000 and 2004 Bond Referendum, Wake County has been undertaking definitive actions necessary to protect and conserve open space. The following pages contain a list of activities which Wake County may undertake in future years. In Fiscal Year 2011, it is recommended that this Open Space Plan be updated to reflect changes in the program. The purpose of the action plan listing is to define a program of activity necessary to implement the recommendations provided within this Plan.
Recommendations are divided into several key areas of activity:

1. Policy and Program Activities
2. Land Acquisition Activities
3. Stewardship Activities

The Wake County Open Space Program is envisioned as a series of interconnected programs and activities, best summarized by the graphic model below. With all of these interrelated parts working together, Wake County will be successful in its goal to balance growth and development with the protection of its valuable and irreplaceable green infrastructure. If the recommendations of this plan are followed, Wake County will have positioned itself as a community for the 21st Century. The proper balance of open undeveloped land and developed land will have been achieved. The protection of land and water resources will ensure that the county has sustainable development, and remains a desirable place to live, work and raise a family.

Fiscal Year 2007

Policy and Program Activities

• OSAPAC reviews goals for open space protection based on recommendations of the Wake County Blue Ribbon Committee.

• Modify partnerships with municipal governments to break these into two separate tiers. Tier one communities might include Raleigh and Cary. Tier two communities could include the other municipalities within the County.

• Partner with state and federal agencies, and non-profits, and make the open space program more transparent and accessible to potential funding partners.

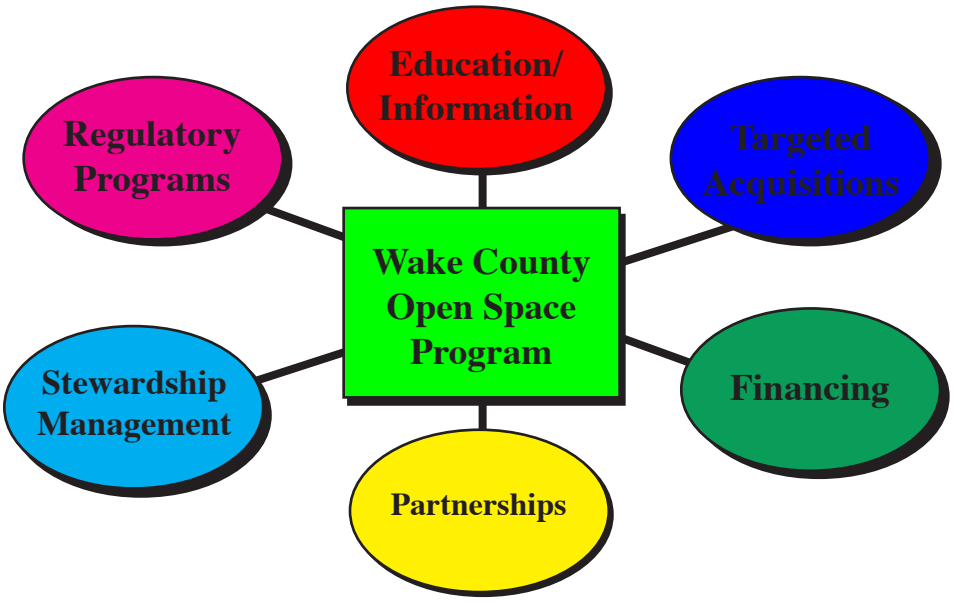
• Work with OSAPAC to establish a marketing program for the open space program.

Land Acquisition Activities

• Complete acquisition of priority parcels as described in Open Space Plan.

• Formalize acquisition policies for priority one watershed parcels as defined within the Plan.

• Expand GIS database to incorporate priority one parcel information defined within the Plan.



• Refine the highest ranked parcels within priority one watersheds to streamline acquisition strategy.

Stewardship Activities
• Survey county-owned open space properties in accordance with recommendations in the Plan.

• Establish a Youth Corps program for county teenagers.

Fiscal Year 2008

Policy and Program Activities
• Adopt Conservation Subdivision Design as part of the subdivision regulations for the county. Encourage municipal governments to accomplish the same.

• Convene a task force comprised of municipal officials and work with the Wake County delegation to the NC General Assembly to define new funding opportunities for the county and municipal governments.

Land Acquisition Activities
• Continue acquisition of #1 ranked parcels within priority one watersheds.

• Use GIS to refine # 2 and # 3 ranked priority parcels identified within priority one watersheds.

• Catalog and map new county land dedications that are derived from new regulatory programs.

• Expand GIS data to incorporate priority one parcels identified through refinement work.

• Map new lands that fall within the newly defined boundaries of the stream buffer program

• Notify landowners of new stream buffer regulations and the location of stream buffer boundary lines.

Stewardship Activities
• Employ new Stewardship Coordinator

• Map and sign new county lands acquired during fiscal year.

• Stewardship coordinator to institute county-wide stewardship program aligned with watersheds.

Fiscal Year 2009

Policy and Program Activities
• Implement county and municipal funding program to generate funds to support open space program.

Land Acquisition Activities
• Acquire # 2 and # 3 ranked parcels within priority one watersheds.

• Refine # 1 ranked parcels within priority two watersheds.

• Catalog and map new county land acquisitions and dedications.

• Map new lands that fall within the newly defined boundaries of the revised regulated floodplains.

• Notify landowners of new floodplain regulations and the revisions to flood boundary lines.

Stewardship Activities
• Employ biologist.

• Employ urban forester. Establish Wake County Urban Forestry program.

• Map and sign new county lands acquired during fiscal year.

• Complete promotional video that explains County Open Space Program. Air program on community access television channels.

Fiscal Year 2010

Policy and Program Activities
• Have OSAC sponsor an open space conference in partnership with municipal governments and non-profits to present “State of Open Space.”

Land Acquisition Activities
• Acquire # 1 ranked parcels located within priority two watersheds.

• Refine # 2 and # 3 ranked parcels within priority two watersheds.

• Catalog and map new county land acquisitions and dedications.

• Map all forested areas of county using satellite imagery and GIS.

• Work with municipal governments to identify additional open space needs.

Stewardship Activities
• Map and sign new county lands acquired during fiscal year.

• Host open space and environmental educational fair for middle school and high school students to define benefits of open space protection.

• Produce and distribute promotional video to define County open space program.

Fiscal Year 2011

Policy and Program Activities
• Begin update of the 2006 Revised County Open Space Plan.

Land Acquisition Activities
• Acquire # 2 and # 3 ranked parcels identified within priority two watersheds.

• Expand GIS data base to catalog lands identified through acquisition process.

Stewardship Activities
• Map and sign new county lands acquired.

A

Appendix A: Summary of Public Input

The citizens of Wake County have been provided with numerous opportunities to become involved with the development of this Open Space Plan. First, Wake County provided grants to 10 of the 11 municipalities within the County to prepare individual open space plans. For each municipality, public workshops were advertised and conducted. The Town of Knightdale, as one example, sent notification to all residents, farm families and landowners through their water billing system. An estimated 55 workshops, meetings and public events took place during the calendar years 2001 and 2002, at which time the citizens of each municipality and the county were invited to view open space materials and maps, fill out public opinion surveys and direct questions about open space planning to consultants and staff of each municipality. Additionally, prior to adopting each municipal open space plan, public hearings were conducted by the elected officials of each community.

Second, the electronic and print media of Wake County featured the preparation of both the municipal open space plans and the county-wide consolidated open space effort within numerous stories during calendar years 2001 and 2002. For example, the Wendell Gazette prepared an article entitled "Keep the Green." Additionally, the Wake County Public Information Officer worked with county staff and the team of consultants employed by the county to publish a quarterly newsletter, called "Growth and Community Initiatives," that summarized the work of the Open Space, Watershed, Growth Management and Transportation planning efforts.

Third, several working committees were established by Wake County to work in conjunction with staff and consultants to prepare the various growth and environmental initiatives plans. For the open space plan, staff and the consultant worked with the county Open Space Advisory Committee (OSAC) and with Partners for Open Space and the Environment (POSE), which is comprised of municipal staff, to prepare this plan. Further, the staff and consultants for the open space plan also attended and solicited input from other working committees, including the Watershed Management Task Force, Growth Management Task Force and Transportation Task Force. This has resulted in a coordinated set of policies, programs and recommendations which are shared by each of the individual plans.

How the Public Was Involved

Citizens of Wake Forest participate in one of the public workshops conducted for the Town's Open Space Plan.

Keep the green

An editorial from the Wendell Gazette illustrates the coverage and support that news media have provided the open space planning effort.

Citizens view some of the open space maps that were made available during the fall 2001 Park Fest event.

Fourth, the County has utilized its web site (www.co.wake.nc.us) to inform the public about the progress of the Growth and Environmental Initiative work. The web site has been used to post meeting dates and times, summaries of recommendations and conclusions and feature articles on issues. Additionally, the municipal governments have also used their web sites to furnish information to their residents. For example, the Town of Cary has published its Open Space and Historic Resources Plan on its web site (www.townofcary.org/depts/dsdept/P&Z/openspace/openspacehome.htm) and provides regular updates for residents. This has proven to be one of the most popular programs among Cary citizens. Other towns and cities in Wake County are also utilizing the internet to furnish information about their open space activities.

Fifth, Wake County also used public festivals and events as avenues to solicit input from the public for the open space plan. In the fall 2001, the annual Park Fest celebration featured a booth on the Open Space Plan. Earth Day 2002 and Artsplosure 2002 were other events that featured information about the plan. The county staff will continue to use these venues to both inform the public about open space and invite comment on the goals of the program.

Finally, Wake County has always had cooperative relations with private sector groups as it carries out the objectives of environmental stewardship, park and recreation programming. Toward this end, Wake County has worked closely with the Triangle Land Conservancy, the Trust for Public Land, the Triangle Greenways Council and other groups to establish recommendations that are featured in this Open Space Plan.

The recommendations contained within the plan are representative of the desires of the citizens of Wake County. The plan resolves the diverse range of opinions and views about open space and its importance to the quality of life, economy, environment and the future growth of Wake County. The process used throughout the preparation of this plan has been open and participatory.

Public Support for Open Space Protection

Throughout the preparation of this master plan, the citizens of Wake County have shown enthusiastic support for the protection of critical open space resources. Most of the municipal governments conducted surveys of the public to better gauge the level of support for open space protection. When asked what should be accomplished by open space preservation, a majority of residents concluded that acquiring land to protect water supply and native habitat, linking people to the natural resources of the County, and protecting land that offers places to interpret local history, were the most important pursuits.

When asked who should manage and care for open space lands, the majority of residents felt that a partnership among public and private organizations was the preferred method, followed by a commitment on the part of municipal and county governments.

When asked if they supported the use of public funds for the preservation of open space, an overwhelming majority of residents responded yes.

When asked the type of activities that they would most likely want to participate in within an open space or greenway landscape, the majority of residents concluded that walking along a creek or stream, picnicking with friends and family members, and riding a bicycle for fun or fitness were their top three activities.

In addition to responding to the opinion surveys, residents defined that their most important issues regarding open space protection included:

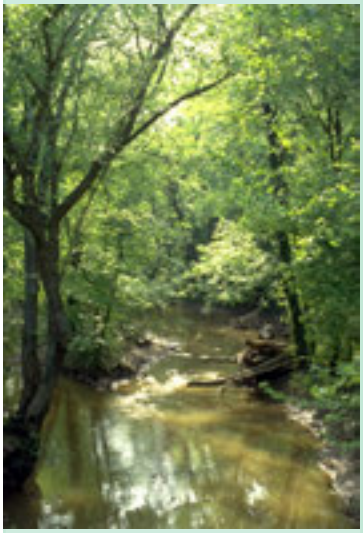
- the rapid loss of the native landscape throughout Wake County,
- how the County and municipal governments will pay for open space protection,
- putting a halt on development that adversely affects streams and wildlife habitat, and
- encouraging developers to dedicate open space during the land development process.

Matt Cusak, of EcoScience Corporation, leads citizens from Fuquay-Varina through a discussion of open space resources found with the municipal government urban service area.

B

Appendix B: Benefits of Open Space

There are various ways in which open space benefits each of us in Wake County. Protecting water recharge areas and wetlands, and buffering streams helps preserve the water quality and, in turn, Wake County's drinking water. Buffers along our streams slow down storm runoff and decrease the chance of flooding. Allowing adjacent wetlands and floodplains to store water without obstructions during storm events keep homes and businesses from flooding. Open space and greenways increase the value of nearby land, and recreational opportunities encourage corporations to bring their headquarters to this area. By supplementing agriculture, farms and scenic vistas. open space helps offset the visual impact of ever growing cities and towns. Open space ensures that the quality of life found in Wake County will continue to attract people to this area in the future. Recreational opportunities are also important to the quality of life. Active and passive recreation requires open space and parkland. It is also necessary to preserve the cultural and historical landscapes of Wake County for future generations. Finally, large, contiguous tracts of land and good water quality are needed for wildlife habitat. As one can see, there are many reasons why open space is beneficial to Wake County. All of the mentioned benefits of open space are explored further in the following section.



Water Quality and Water Quantity Benefits

Open space and greenways often preserve wooded landscapes along creeks and streams which filter pollutants and absorb flood waters. Open space improves water quality in three distinct ways. First, any land that remains in a natural, undisturbed (no cars, buildings, parking lots, etc.) condition generally does not contribute pollutants to surface and ground water.

Second and most importantly, open space contains natural vegetation that serves as filters, removing pollutants before they are deposited in water bodies. These vegetated areas slow down water and allow for pollution to drop out of the storm water before they get to our surface and ground water. Some plants, particularly wetland species, soak up pollut-

Water Quality and Water Quantity Benefits

ants. These pollutants are not removed if storm water is collected in pipes and discharged directly into water bodies.

Third, open space can be used to protect water recharge areas. These areas are where surface water returns to aquifers (underground rivers and lakes) to replenish ground water. If these are not protected, groundwater can become contaminated with pollutants.

In general, the lands immediately surrounding bodies of water are the most useful for filtering pollution from surface and sub-surface waters. Surface runoff is most concentrated near these bodies of water. Wetlands that filter surface water and allow it to recharge aquifers also tend to be found in low areas near other bodies of water. The Triangle region will soon be home to nearly a million people. Improving surface water quality in streams not only benefits local residents but also aquatic and terrestrial wildlife that depend on streams for their habitat. Finding creative and unobtrusive ways of preserving the lands that protect our water quality is a high priority for this Open Space Plan.

Open space and greenways also help to control water quantity. Flooding has been a problem in Wake County in the past. In some areas, buildings and other land uses have encroached into flood prone areas. By designating floodplains as greenways, the encroachments can be better managed. In some cases, these can be replaced with linear open space that serves as an amenity to local residents and businesses, as well as provides important flood water storage capacity.

As a flood control measure, open space near bodies of water and greenways act as a primary storage zone during periods of heavy rainfall. The protected floodplain can also be used during non-flood periods for other activities, including recreation and alternative transportation.

Impervious surfaces also affect the quantity of water during a storm event. The more pavement and buildings that cover the soil, the less water penetrates it during a storm event. When rain soaks into the ground, it becomes "groundwater". As this groundwater slowly percolates through the soil, it either joins underground water reserves, "aquifers", or eventually feeds a body of water. Aquifers are often used for drinking water, and contamination could be hazardous. In water recharge areas, wetlands can be used to hold water, releasing it back into the groundwater gradually. This allows for pollutants to either settle out or be soaked up by plants. If we continue to withdraw water from aquifers without letting it replenish, these underground reservoirs will become depleted.

Fast moving flood waters not only increases the risk of losing structures, it can deplete water quality. If rain does not soak into the ground because of a high amount of impervious surfaces within a watershed, this rain will flow at higher velocities into surface water bodies. With increased velocity and flow, storm water will scour the soil surface and the sides of streams

and rivers, dumping more and more sediment into our water bodies, in turn, depleting our water quality.

Other human activities have contributed to the flooding problem, even though they were well intended. For many years, it was believed that floods could be controlled by straightening and deepening stream channels, or by building dikes and flood walls to contain excess water. These efforts have proven to make overall flooding worse by increasing the velocity of water. By allowing water bodies to use their natural floodplains and wetlands again, these streams will be slowed.

Protecting open space, such as wetlands, and greenway buffers will help keep valuable structures from flooding, remove pollutants from the water supply, and permit our groundwater to replenish. In conjunction with existing storm water management policies and programs implemented in the county, open space and greenway lands can be established as development occurs.

Plant and Animal Habitat Benefits

Open space areas and greenway corridors can serve as viable habitat for many species of plants and wildlife. They provide essential food sources and, most importantly, access to water that is required by all wildlife. Large tracts of forested land (over 50 acres) help protect interior species. Additionally, greenways protect the habitat of edge species, such as deer, squirrel and rabbit. Contiguous tracts of open space, along with greenways also preserve primary migratory corridors for terrestrial wildlife, serving to help maintain the integrity of many plant and animal gene pools. Some wildlife biologists have extolled greenways as future “gene-ways” and determined that migration routes are essential to maintaining healthy wildlife populations. Contiguous tracts of open space and greenways can also serve as “gene-ways” for plant species, which migrate with changes in climate and habitat. These “gene-ways” often follow river and stream corridors that have long served as transportation routes for animals and humans. Programs can be established to not only protect the valuable existing forested and wetland areas, but also to reclaim and restore streams to support higher quality habitat.

Large, undisturbed areas of particular plant species should also be protected. Large areas are mature trees have been on the decline as development continues in the area. Stands of trees, especially mast producing hardwoods and bottomland forest are important to wildlife. Several endangered plant species have been identified in Wake County. Efforts should be made to protect any endangered or unique plant and animal species in the county.

Plant and Animal Habitat Benefits

Economic Benefits

Economic Benefits

Open space preservation offers numerous economic benefits, including higher real property values, increased tourism and recreation related revenues, and cost savings for public services. Greenways have been shown to raise the value of immediately adjacent properties by as much as 5 to 20 percent. For example, in a new development in Raleigh, North Carolina, new lots situated on greenways were priced $5,000 higher than comparable lots off the greenway. Many home buyers and corporations are looking for real estate that provides direct access to public and private greenway systems. Open space is viewed as amenities by residential, commercial and office park developers who, in turn, are realizing higher rental values and profits. Additionally, greenways can also save local tax dollars by utilizing resource-based strategies for managing community storm water and hazard mitigation, thus productively using landscapes that could not be conventionally developed.

Open space can enhance the role that tourism plays in the economy. Tourism is currently ranked as the number one economic force in the world. In several states, regional areas and localities throughout the nation, greenways have been specifically created to capture the tourism potential of a regional landscape or cultural destination.

Open space and buffers help filter pollutants from drinking water sources. It costs much more to pretreat water than to let open space do it naturally. The maintenance of open space reduces the need for future spending on environmental clean-up and revitalization.

Transportation Benefits

Transportation Benefits

Most American communities have grown in a sprawling, suburban form as a result of dependence upon the automobile as the sole means of transportation. Americans have abandoned some traditional forms of transportation (such as passenger train service), and have been slow to improve other forms of transportation (bicycle and pedestrian networks, bus systems, local train service). In order to provide relief from congested streets and highways in the metro area, future transportation planning and development should be concentrated on providing a choice in mode of travel to local residents. These mode choices should offer the same benefits and appeal currently offered by the automobile: efficiency, safety, comfort, reliability and flexibility.

Greenway corridors can serve as extensions of the road network, offering realistic and viable connections between origins and destinations such as work, schools, libraries, parks, shopping areas and tourist attractions. According to national surveys by the Federal Highway Administration, Americans are willing to walk as far as two miles to a destination, and bike as far as five miles. Using these limitations as a guide, destinations can be linked to multiple origins throughout Wake County with a combination of off-road trails and on-road bicycle and pedestrian facilities.

Health and Recreation Benefits

Studies have shown that as little as 30 minutes a day of moderate-intensity exercise (such as bicycling, walking, in-line skating or cross-country skiing) can significantly improve a person's mental and physical health and prevent certain diseases. Providing opportunities for participation in these outdoor activities, close to where people live and work, is an important component of promoting healthy lifestyles for area residents.

In 1987, the President's Commission on Americans Outdoors released a report that profiled the modern pursuit of leisure and defined the current quality of life for many Americans. Limited access to outdoor resources was cited as a growing problem throughout the nation. The Commission recommended that a national system of greenways could provide all Americans with access to linear open space resources.

There are two types of recreation that the Wake County Open Space Program will provide for: active and passive. Active recreation is the type that we are most familiar with. It includes activities that are most commonly associated with parks, such as soccer, softball, football, bicycling, etc. Passive recreation includes walking in the woods, fishing, picnicking, etc.

Open space can be managed and intended for either or both types of recreation, or none at all. An area of bottomland hardwoods surrounding a stream may be an excellent place for passive recreational activities, such as bird-watching, but not well suited for active recreation, like a field team sport. It is important to determine what type of recreation is appropriate for each site.

The Wake County Open Space system will be developed to complement the community's existing parks and open space system. The open space system can be developed to serve as a primary recreation and fitness resource.

Health and Recreation Benefits

Air Quality Benefits

As the population increases in the Triangle, the air quality decreases. Traffic along Interstate 40 has left Wake County with more and more 'Code Red' days. The combination of open space and greenways helps keep Wake County's air clean. Open space, especially mature stands of trees, helps filter pollutants from the air. Greenways as alternative transportation corridors could serve to reduce traffic congestion, helping to improve local air quality. Since the majority of automobile trips are less than two miles in length, offering viable, alternative transportation choices through greenways would encourage people to bicycle and walk more often, especially on short trips, thereby reducing traffic congestion and automobile emissions.

Air Quality Benefits

Cultural and Historical Benefits

Cultural and Historical Benefits

Open space can enhance the culture and protect historic resources in Wake County. For cities and towns large and small, parks and greenways have become a cultural asset and focal point for community activities. Parks are utilized for festivals to attract tourist and entertain locals, alike. Some communities sponsor local events to celebrate the outdoors and local traditions. Various walking and running events are also held in parks and on greenways to support charity events or extend traditional sporting events. Many civic groups adopt segments of open space and parks for clean-up, litter removal and environmental awareness programs. Some central parks and greenways, like San Antonio's Riverwalk, are the focal point not only for community activities, but also for economic development.

The richness and diversity of area historic resources are represented by numerous National Register of Historic Places and locally significant sites and historic districts. The purchase or protection of historic sites as open space, such as Yates Mill Pond and Mitchell Mill, helps protect them for future generations. The interpretation of historic and archeological sites along greenways can serve to increase the awareness and appreciation of the area's rich history. Open space can also be a vehicle to provide controlled public access to important cultural sites in a manner that promotes preservation and enhances interpretive opportunities.

C

Design Guidelines

Description

The design development guidelines featured in this Appendix have been tailored to meet the specific facility development needs of the Wake County Consolidated Open Space System. The purpose of these guidelines is to assist the County and its municipalities and partnering organizations in developing open space and greenway facilities.

These guidelines provide a variety of trail facility and ecological system restoration concepts and ideas. These guidelines are not a substitute for a more thorough examination and detailed landscape architectural and engineering evaluation of each project segment. These guidelines serve as minimum standards for greenway facility development. Wake County disclaims any liability for the use, appropriateness and accuracy of these guidelines as they apply to a specific project. They are not to be used for construction.

The following resource materials have been used in the preparation of these guidelines:

- Adherence to national design standards for off-road trails and greenway facilities, as defined by the American Association of State Highway Transportation Officials (AASHTO), the Americans with Disabilities Act (ADA), Designing Sidewalks and Trails for Access: Part 2 and the Manual on Uniform Traffic Control Devices.

Resources

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
For more information visit www.greenways.com

Trails for the Twenty-First Century
Published by Island Press, 2001
Authors: Charles A. Flink, Robert Searns and Kristine Olka
For more information visit www.greenways.com

Additional Resources

Guide to the Development of Bicycle Facilities
Updated in 2000 by the American Association of State Highway Transportation Officials (AASHTO). Available from FHWA or AASHTO. www.aashto.org/bookstore/abs.html

Manual on Uniform Traffic Control Devices (MUTCD)
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

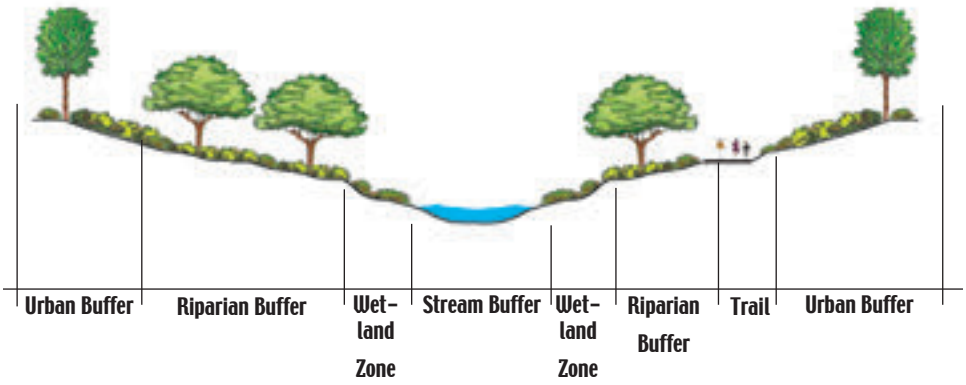
Designing Sidewalks and Trails for Access: Part Two - Best Practices Design Guide
Published by U.S. Department of Transportation, Washington, DC, 2001

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.

Other useful web sites for information include:

Rails-to-Trails Conservancy - www.railtrails.org
National Park Service - www.nps.org
U.S. Department of Transportation - www.walkinginfo.org and www.bicyclinginfo.org
Trails and Greenways Clearinghouse - www.trailsandgreenways.org
National Bicycle and Pedestrian Clearinghouse - www.bikefed.org/clear.htm
Greenways Incorporated - www.greenways.com

Stream Corridor Buffer



Riparian buffers serve many functions. They filter stormwater pollutants, help moderate stream flow, stabilize streambanks, moderate stream temperature, and provide aquatic and terrestrial habitat. The Neuse Nutrient Sensitive Waters (NSW) rules require that new developments maintain an existing 50-foot vegetated buffer on both sides of all intermittent and perennial streams, lakes and ponds within the Neuse River Basin. Approximately 85 percent of Wake County lies within the Neuse River Basin. For the purpose of the rules, a waterbody exists if the feature is present on either the most recent version of the soil map or 7.5 minute quadrangle topographic map prepared by United States Geographical Systems (USGS). The required buffers consist of two zones: a 30-foot undisturbed zone adjacent to each side of the waterbody, and a vegetated zone that extends from the outer edge of the 30 foot zone for a distance of at least 20 feet.

Buffers are required in water supply watersheds throughout the state as part of the Water Supply Watershed Management Program. The Division of Water Quality manages the program through oversight of local ordinances and monitoring of land use activities. Local water supply watershed programs must be approved by the NC Environmental Management Commission (EMC). The program requires local governments to adopt land use controls that include buffer protection. For low-density development, 30-foot buffers are required along perennial streams, and 100-foot buffers are required for high-density development. There are five major water supply watersheds within Wake County: Falls Lake, Jordan Lake, Wake Forest Reservoir, Swift Creek, and Little River. In addition, a small portion of the County near Fuquay-Varina drains to the Cape Fear River, which is used as a water supply by Lillington.

Stream buffers within Wake County should be established to protect water quality and animal habitat. For the purpose of greenway facility development, a minimum of 50-feet wide buffer (150-feet preferred) as measured from the top of streambank is required in order to mitigate the damaging effects of flooding from storms, filter pollutants from overland flow and develop appropriately sized greenway trail facilities.

Wake County has applied the Neuse River Basin 50-foot buffer throughout the county. (See the attached Neuse River Buffer Rules.) Some of the municipalities within the county (Garner, Apex, Cary and Morrisville) have placed additional buffers up to 100-feet on their streams, according to each stream's order.

Instead of using this conventional method of prescriptive buffers, stream buffers should be a varied width according to ecological features of the watershed. Each buffer width will be site specific, depending on the following characteristics of the stream, riparian buffer and watershed:

- Slope
- Soil
- Hydrology
- Vegetation
- Water Quality
- Impervious Surface

The appropriate width for a variety of characteristic combinations will be discussed more in depth in the Wake County Consolidated Open Space and Greenways Plan.

Corridor Planting

Some basic guides for planting in corridors is as follows:

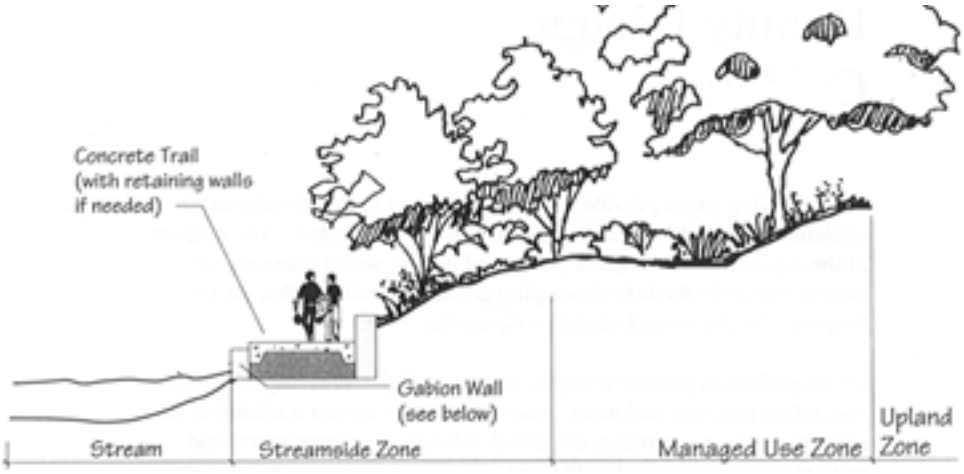
- Efforts should be made to eliminate non-native invasive species, such as privet, from corridors.
- Native overstory and understory trees/shrubs should be replanted where vegetation is removed or harmed due to construction of parks, trails, etc. in greenway corridors or open space.
- Fallen trees should not be removed unless they obstruct trails or present danger. Otherwise, they should be left to decay naturally.
- Evergreens, conifers (pines) and deciduous trees should all be used proportionally.
- Mast producing trees and shrubs with berries should be utilized for wildlife food whenever possible.
- Flowering trees and shrubs can be used to draw attention to important intersections and entrances.
- Evergreen shade trees are needed near seating areas and picnic tables.
- Evergreen shrubs, such as wax myrtle, can help separate public

Types of Trail Treads

One of the following types of trail treads should be used when designing greenway trails and sidewalks. The appropriate trail type will depend on the specific site conditions of the trail segment. Some of the characteristics of the trail corridor to consider are soil type, vegetation cover, flooding, slope and wildlife habitat sensitivity, among others.

Creekside Trail Tread

Creekside trails are located only in urban areas, where right-of-way constraints and channelized streams restrict trail development to the floodway. Creekside trails are designed to accommodate walkers, bicyclists, rollerbladers, and joggers. These multi-use trails are typically positioned directly adjacent to the stream channel and are therefore subject to frequent flooding. These trails require hard-paved surfaces of concrete to withstand high-velocity stream flows. Retaining walls or other structural elements may also be required for stable construction and to protect the trail from erosion and flood damage.



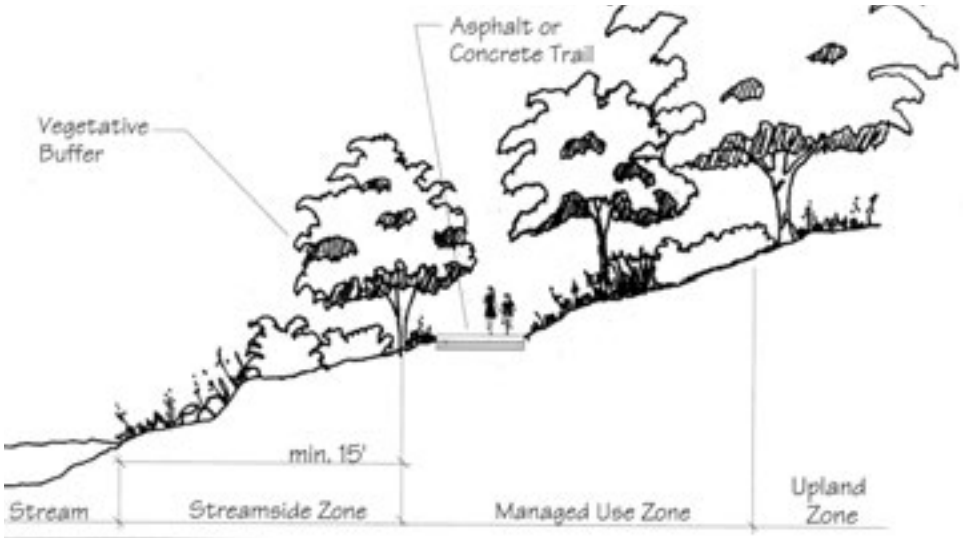
Typical Multi-Use Creekside Trail Cross Section

Creekside trails should be a minimum of 10'-wide for multi-use trails. The installation of railings, benches, signage, and trash receptacles that could obstruct flow during storm events, should be carefully considered. Creekside trails must be designed and installed in a manner that minimizes their effect on flood waters and protects the amenities from flood damage. The use of retaining walls as seat walls is one way in which non-obtrusive amenities can be included on this type of trail facility. Special consideration should be paid to mitigating the impacts of trail construction on the natural environment.

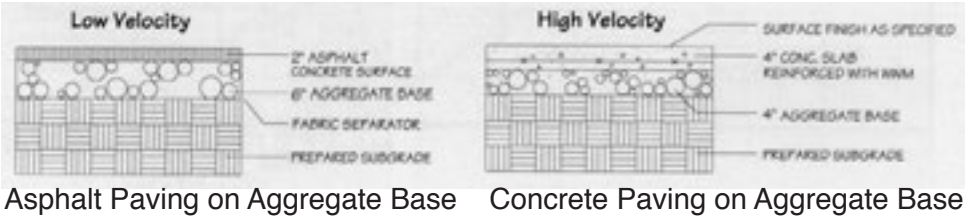
Floodway Trail Tread

Multi-use trails within the floodway are designed to accommodate a variety of users including walkers, joggers, cyclists, and rollerbladers. These multi-use trails are typically positioned within the floodway but not directly adjacent to streams. Some vegetative buffer between the stream and trail should be left intact. Like the streamside trails, trails within the floodway are subject to periodic flooding, however, not as frequently. These trails require paved surfaces of either asphalt or concrete depending on frequency of flooding and expected velocity of flow. A proper trail foundation is important and will increase the longevity of the trail. No soft shoulder should be constructed due to flood considerations. Special consideration should be given to the mitigation of negative impacts from trail development on the natural stream environment.

Multi-use trails within the floodway should be built with a minimum width of 10 feet. All elements of the trail including the trail tread, railings, benches, and trash receptacles will be periodically flooded. The design and materials for these trails should be carefully selected accordingly.



Typical Multi-Use Trail Cross Section (Within the Floodway)



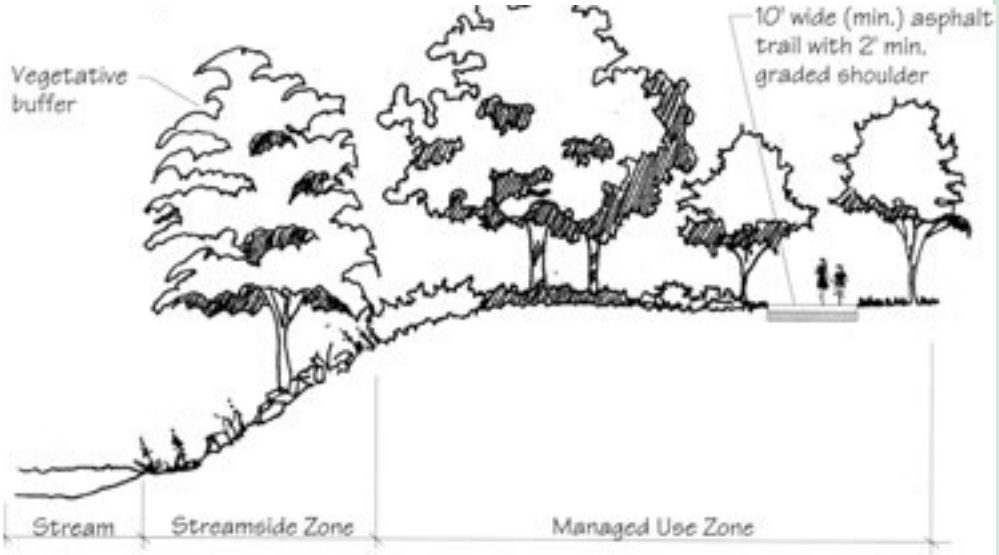
Asphalt Paving on Aggregate Base Concrete Paving on Aggregate Base

Paving Cross Section

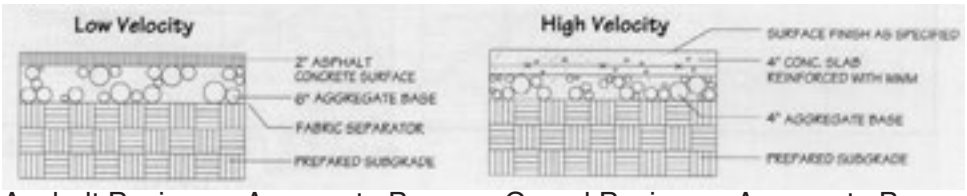
Floodplain Trail Tread

Multi-use trails within the floodplain are designed to accommodate a variety of users including walkers, joggers, cyclists, and in-line skaters. These multi-use trails are typically positioned outside the floodway but within the floodplain. Significant vegetative buffers between the stream and trail should be left intact. Multi-use trails within the floodplain are subject to occasional flooding during large storm events. It is recommended that these trails be built with paved asphalt, however an aggregate stone surface may be adequate in some locations.

Multi-use trails within the floodplain should be built to a minimum width of 10', although12' to 14' is preferred. The graphics below illustrate two suitable pavement cross sections that can be used to build multi-use trails within the floodplain.



Typical Multi-Use Trail Cross Section (Within the Floodplain)

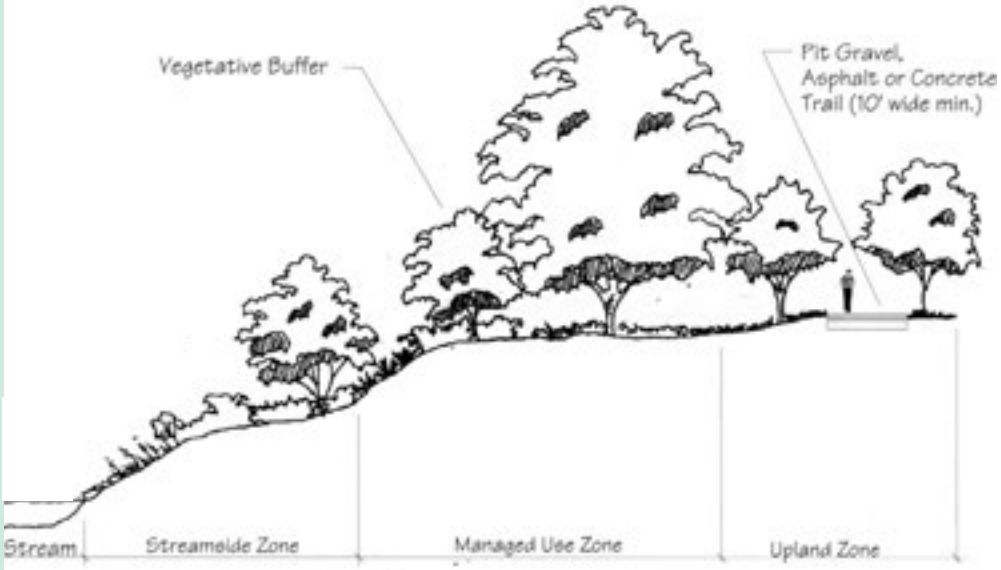


Asphalt Paving on Aggregate Base Gravel Paving on Aggregate Base

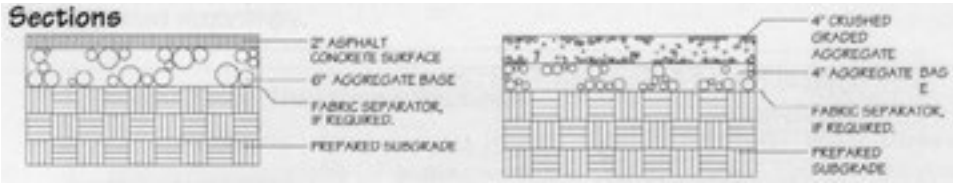
Paving Cross Section

Upland Trail Tread

Upland multi-use trails are designed to accommodate a variety of users including walkers, joggers, cyclists and in-line skaters. These upland multi-use trails are typically positioned completely outside designated floodplains. Significant vegetative buffer between any streams and the trail should be left intact. It is recommended that these trails be built with paved asphalt or aggregate stone, depending on the preference of local user groups. Upland multi-use trails should be built to a minimum width of 10', though 12' is preferred.



Upland Trail Cross Section



Asphalt Paving on Aggregate Base Gravel Paving on Aggregate Base

Paving Cross Section

Footpath/Hiking Trail

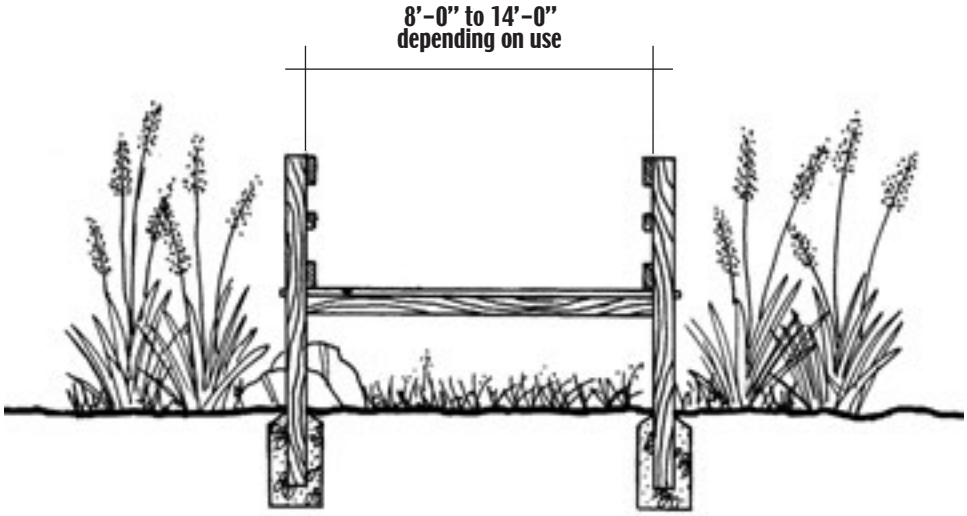
Footpaths or hiking trails are designed to accommodate pedestrians and are not intended for cyclists or other wheeled users. These natural surface trails typically make use of dirt, rock, soil, forest litter, pine mulch and other native materials for the trail surface. Preparation varies from machine-worked surfaces to those worn only by usage. This is the most appropriate surface for ecologically sensitive areas.

Footpath Cross Section

These pathways, often very narrow, sometimes follow strenuous routes and may limit access to all but skilled users. Construction of these trails mainly consists of providing positive drainage for the trail tread and should not involve extensive removal of existing vegetation. Timbers may be used for steps along steep slopes. These trails vary in width from 3 feet to 6 feet and vertical clearance should be maintained at 9 feet. These trails are most commonly found within the streamside zone.

Boardwalk Trail Tread

Boardwalks, or wood surface trails, are typically required when crossing wetlands or poorly-drained areas. While boardwalks can be considered multi-use trails, the surface tends to be slippery when wet and not best suited for wheeled users. Boardwalks intended for use by bikes, pedestrians, in-line skaters and others should be a minimum of 14 feet wide. However, boardwalk trails limited to pedestrian use can be as narrow as 8 feet. If maintenance vehicles use the boardwalk for access, it should be a minimum of 14 feet.



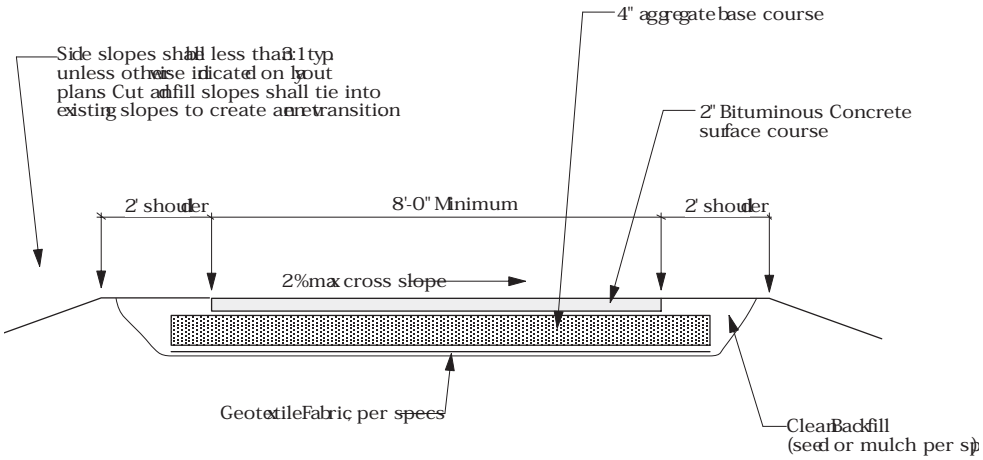
Boardwalk Cross Section

Wood surfaced trails are usually composed of sawn wooden planks or lumber that forms the top layer of a bridge, boardwalk or deck. The most commonly used woods for trail surfacing are exposure- and decay- resistant species such as pine, redwood, fir, larch, cedar, hemlock and spruce. Wood is a preferred surface type for special applications because of its strength and comparative weight, its aesthetic appeal and its versatility. Synthetic wood, manufactured from recycled plastics, is now available for use as a substitute in conventional outdoor wood construction. While these products are more expensive than wood lumber, recycled plastic lumber lasts much longer, does not splinter or warp and will not discolor.

Paved Multi-Use Trail

Typical pavement design for paved, off-road, multi-use trails should be based upon the specific loading and soil conditions for each project. These trails, typically composed of asphalt or concrete, should be designed to withstand the loading requirements of occasional maintenance and emergency vehicles. In areas prone to frequent flooding, it is recommended that concrete be used because of its excellent durability.

One important concern for asphalt, multi-use trails is the deterioration of trail edges. Installation of a geotextile fabric beneath a layer of aggregate base course (ABC) can help to maintain the edge of a trail. It is important to provide a 2'- wide graded shoulder to prevent trail edges from crumbling.



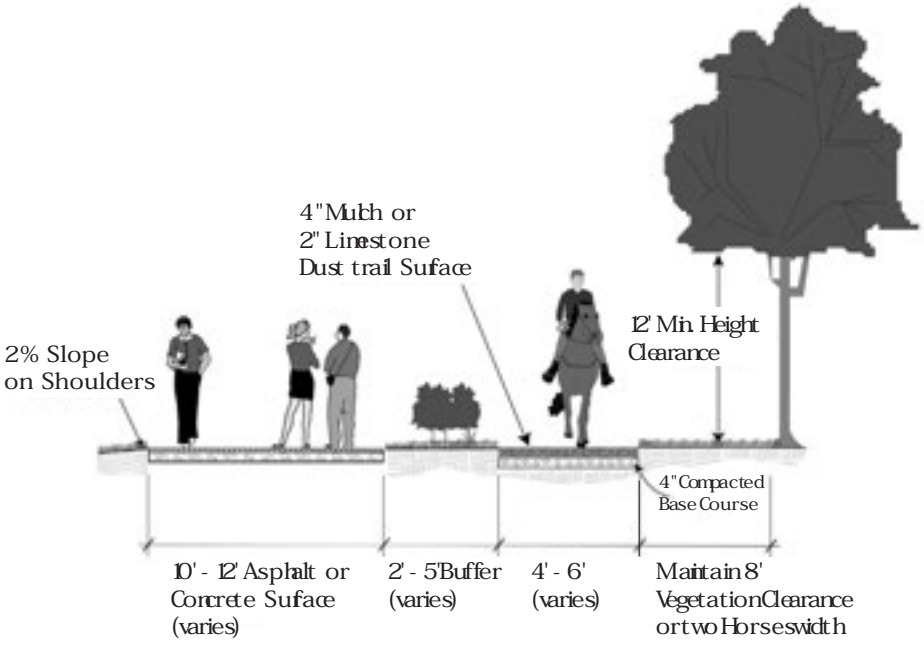
Multi-Use Trail Cross Section

The minimum width for two-directional trails is 10', however 12'-14' widths are preferred where heavy traffic is expected. Centerline stripes should be considered for paths that generate substantial amounts of pedestrian traffic. Possible conflicts between user groups must be considered during the design phase, as cyclists often travel at a faster speed than other users. Radii minimums should also be considered depending on the different user groups.

Asphalt is a hard surface material that is popular for a variety of rural, suburban and urban trails. It is composed of asphalt cement and graded aggregate stone. It is a flexible pavement and can be installed on virtually any slope.

Concrete surfaces are capable of withstanding the most powerful environmental forces. They hold up well against the erosive action of water, root intrusion and subgrade deficiencies such as soft soils. Most often, concrete is used for intensive urban applications. Of all surface types, it is the strongest and has the lowest maintenance requirement, if it is properly installed.

Dual Trail Tread



Typical Equestrian and Pedestrian Trail Cross Section

Dual tread trails are suggested on multi-use trail systems where different users travel at different speeds, such as equestrians and walkers. If hard surfacing is being used on the multi-use trail, a softer, 5-foot-wide tread for horses should be considered. Mulch, dirt, stabilized dirt or limestone dust can be used. Hard surfaces, such as concrete and asphalt are undesirable for equestrians because they can injure horses' hooves. Granular stone may also present problems because it can get stuck in horse hooves.

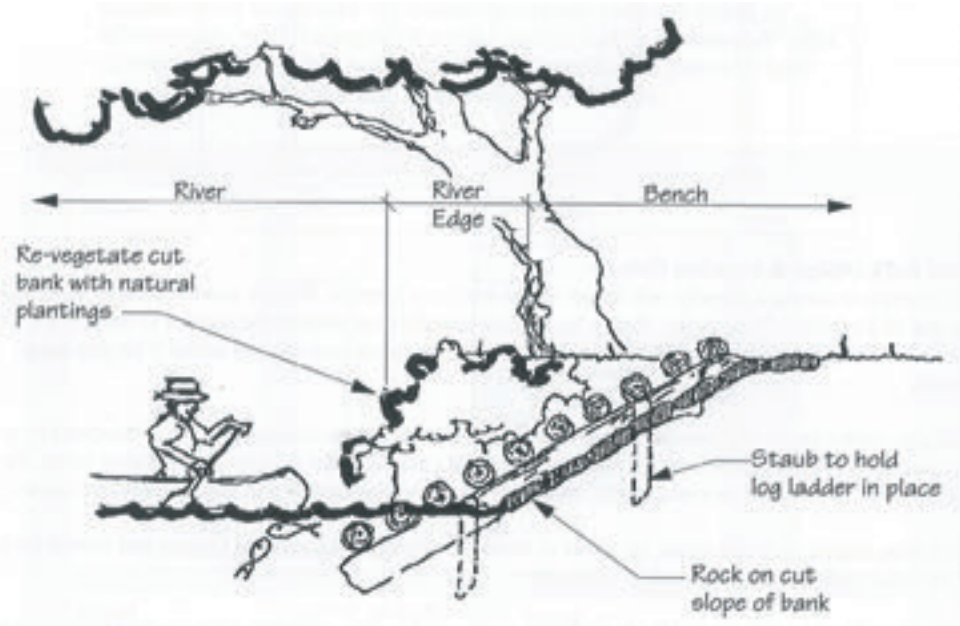
Vertical clearance for equestrians should be at least 12 feet, with a horizontal clearance of at least 5 feet. Low-hanging tree limbs should be cut flush with the trunk. Leaves, branches and other protrusions that could injure the horse, rider or gear should be removed. Within the tread, stumps, large rocks and other debris should be cleared. Sight distances for equestrians, who usually travel between 4 and 6 miles per hour, should be at lest 100'.

Dual treads may also be required for mountain biking trails.

Water Based Trail

This designation applies to those rivers and streams that can successfully accommodate and/or which are designated to support canoeing, kayaking 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.

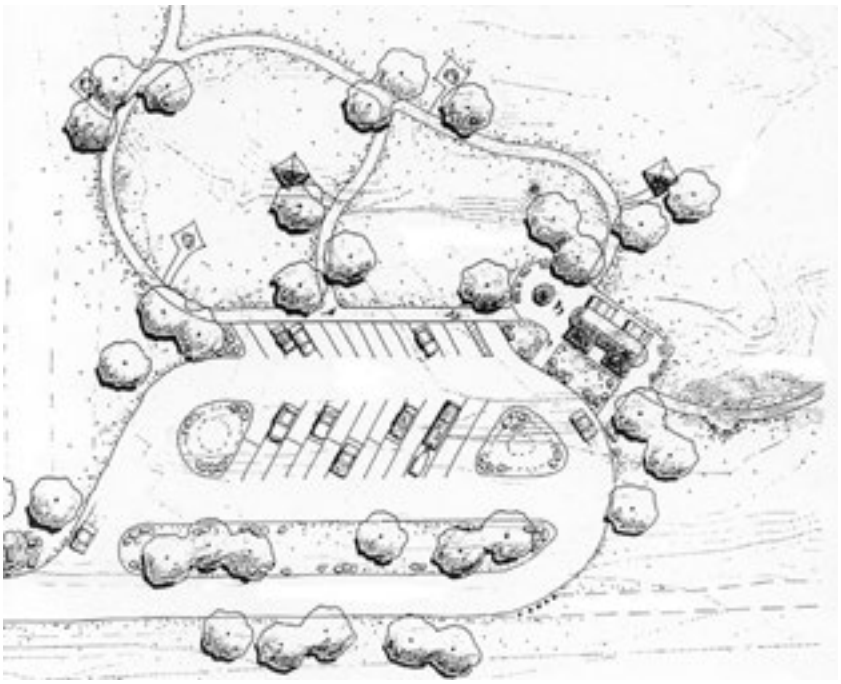
Example of a Water Based Trail in Use



Small Boat Access

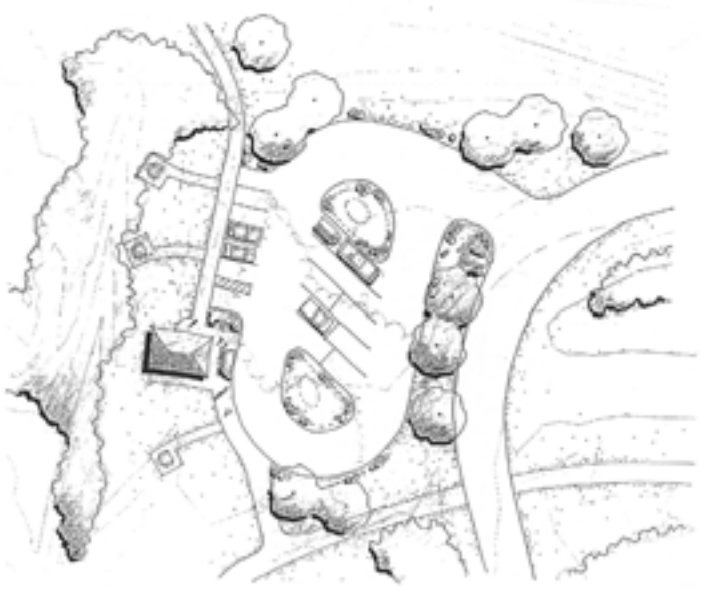
Trailheads

Major and Minor Trailheads



Typical Major Trailhead Plan View

Trail heads should be installed throughout the greenway system to give the public access. A “trail head” 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 trail heads and minor trail heads are suggested. Major trail heads 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 trail heads can be used to connect a smaller number of people to surrounding trails, open space, parks, etc.



Typical Minor Trailhead Plan View

Restrooms

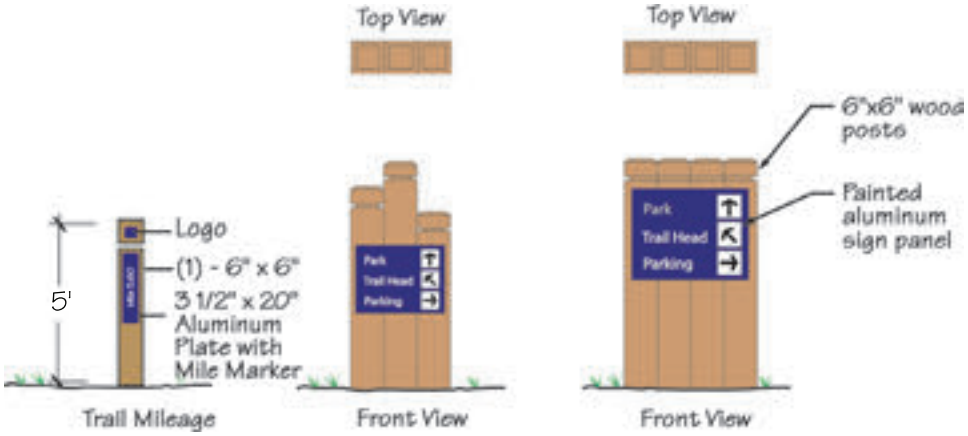
Public amenities, such as phones, restrooms, etc., shall be located and concentrated at the confluence of vehicular and pedestrian traffic. ADA accessible restrooms should be placed at major trail access points in order to accommodate trail users. Where possible, other uses should be incorporated into the structure, such as storage for maintenance equipment. These structures should be located adjacent to thoroughfares for security, maintenance and access to utility hookups. They should also make use of natural light and ventilation as much as possible.

Typical Restrooms

Waterless Restroom Option

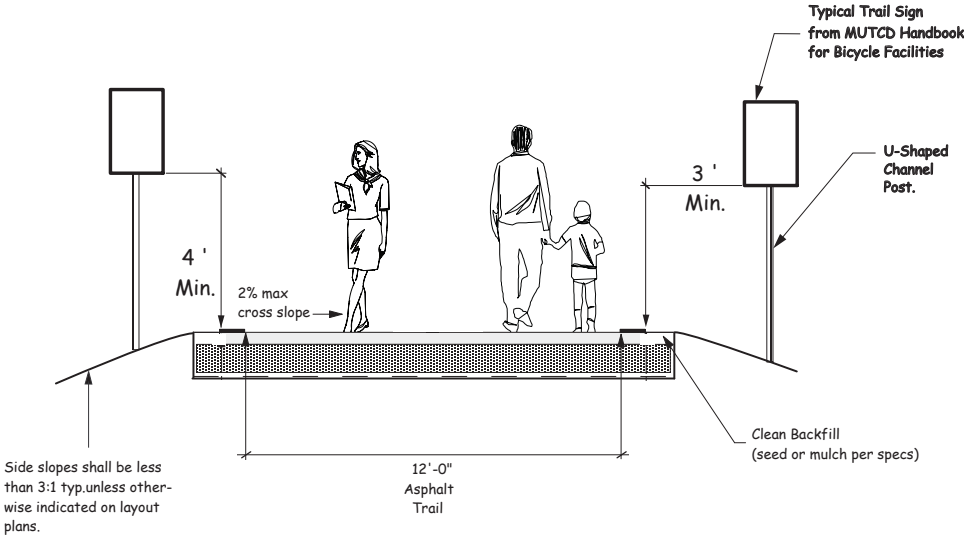
Signage Details

Directional Signage



Signage Examples

Typical Trail Signage Location

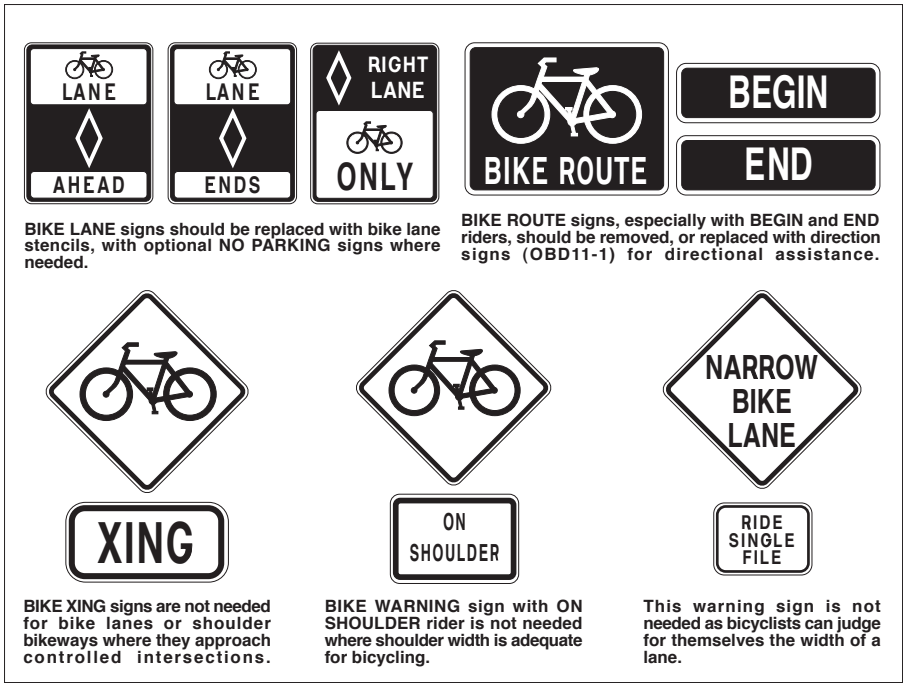


Typical Signage Location

DOT Bike Signage

The MUTCD specifies standard signage for bicycle lanes. According to section 9B-8, the R3-16 sign should be used in advance of the beginning of a designated bicycle lane to call attention to the lane and to the possible presence of bicycles. The MCTUD requires that the diamond lane symbol be used with both the R3-16 and R3-17 signs.

According to Section 9B-ll of the MUTCD, the R7-9 R7-9a signs can be used along streets where motorists are likely to park or frequently pull into the bike lane.



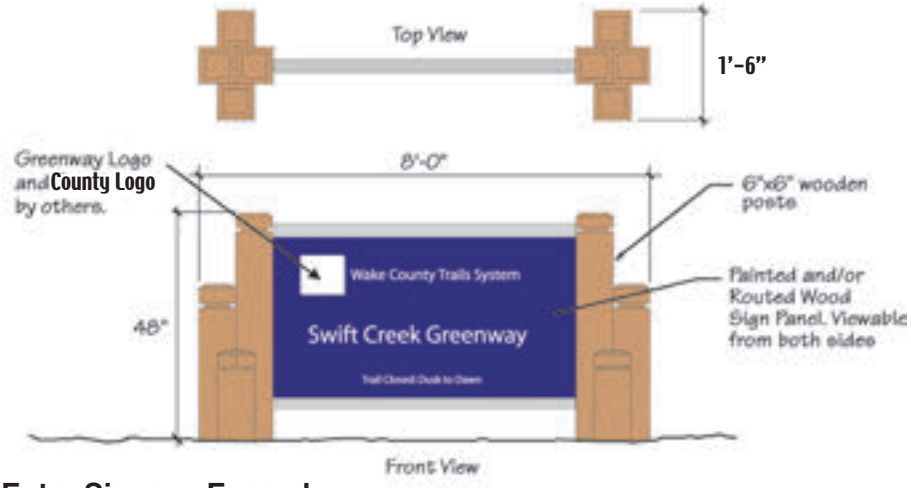
Signage Examples

Interpretive Signage

Signage Examples

Entry Signage

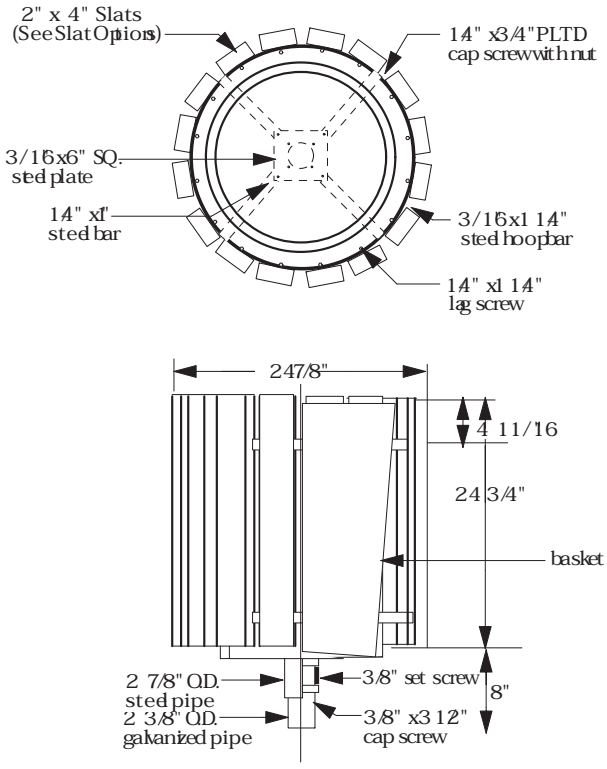
Proper trail identification at trail terminal point and major intersections is important in the development of a comprehensive trail network. A system of signage is important throughout Wake County to ensure that information is provided to trail users regarding the safe and appropriate use of all facilities. Greenway entry signage may also include mileage to provide users with a reference as to how far he or she has traveled, and the remaining distance to specific destinations.



Entry Signage Examples

Trash Receptacles

Trash containers are necessary along all trails. They can be attractive as well as functional and should be selected based on the amount of trash expected, overall maintenance program of the trail, and types of users. Trash cans need to be accessible to both trail users and maintenance personnel. At a minimum, 22-gallon or 32-gallon containers should be located at each entranceway and at each bench seating area. They should be set back three feet from the edge of the trail. The location of additional trash cans will depend upon the location of concessions, facilities adjacent to the trail and areas where trail users tend to congregate.

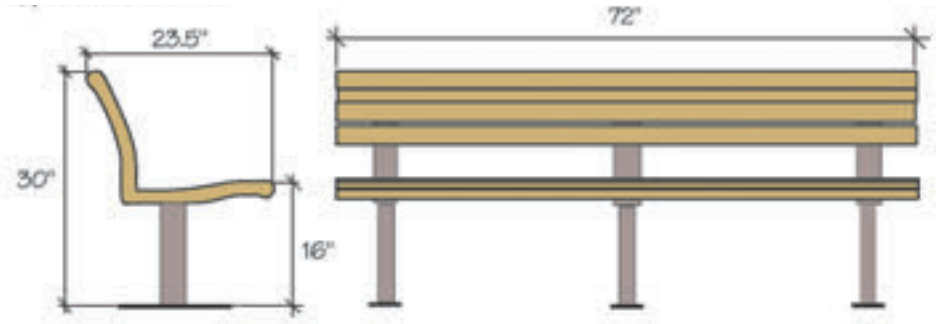


Typical Trash Receptacle Detail

Benches

Benches along trails allow users to rest, congregate or contemplate. Trail benches should comfortably accommodate the average adult. They should be located at the primary and secondary entrances to the trail and at regular intervals, and should be set back three feet from the trail edge.

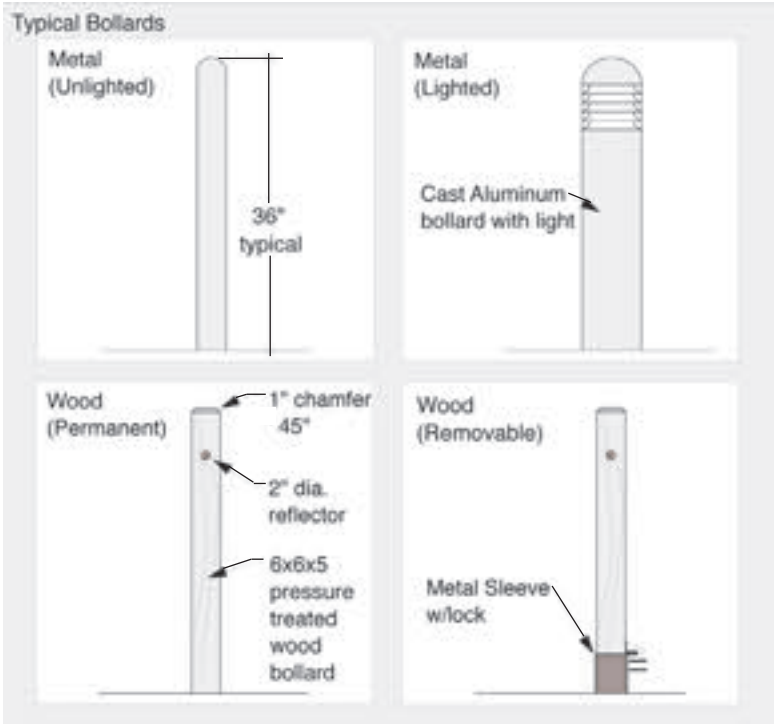
The graphics below illustrate a bench that can be manufactured using recycled plastic lumber or conventional treated wood lumber. The prefabricated plastic lumber units cost more initially but last longer and require little or no maintenance.



Typical Bench Detail

Bollards

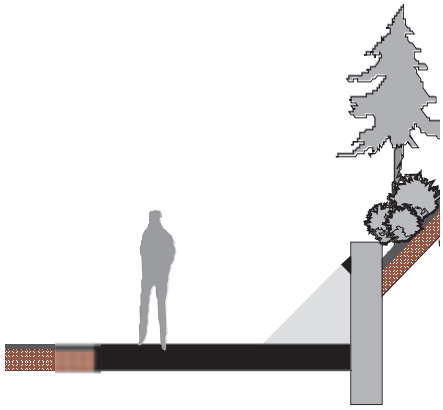
Bollards are intended to provide separation between vehicles and trail users. They are available in a variety of shapes, sizes, and colors and come with a variety of features. Lighted bollards are intended to provide visitors with minimum levels of safety and security along trails which are open after dark. Bollards should be chosen according to the specific needs of the site and should be similar in style to the surrounding elements. Typical construction materials for bollards include painted steel or aluminum, with halogen or metal halide lights in weather tight casings. Removable bollards can be installed to provide trail access for emergency and maintenance vehicles. The graphic below illustrates several typical bollard examples.



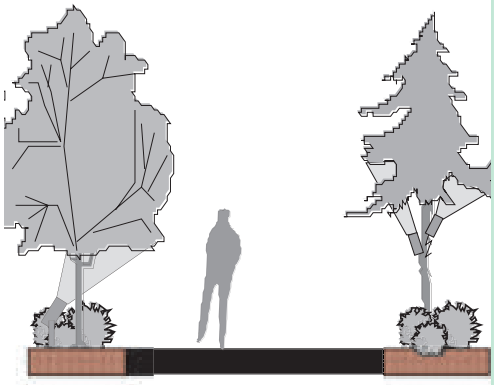
Typical Bollard Details

Trail Lighting

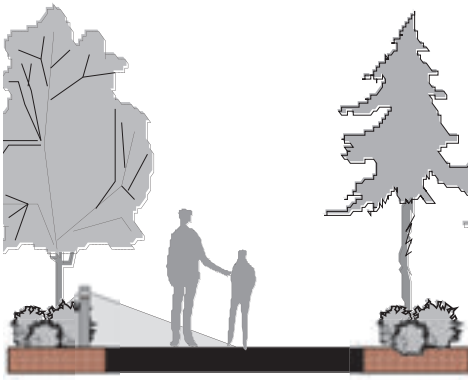
Particularly during winter months when trips to and from work are made in the dark, adequate lighting can make the difference in a person's choice to bicycle or walk. However, due to liability and security concerns, many off-road bicycle paths are closed at night, and therefore unlit.Lighting for multi-use 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 light-ing requires.



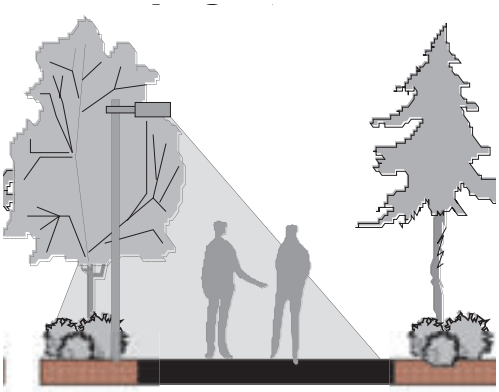
Wall Lighting



Up Lighting



Path Lighting



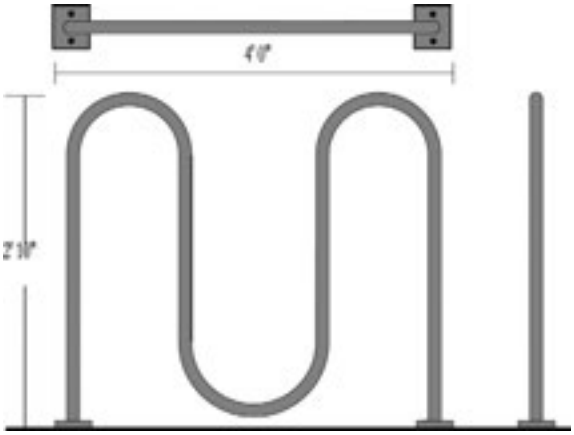
Spot Lighting

Various Lighting Types

Bike Rack

It is important to choose a bicycle rack design that is simple for cyclists to operate. Bicycle racks should be designed to allow use of a variety of lock types. It may be difficult initially to determine the number of bicycle parking spaces needed. Therefore, bike racks should be situated on-site so that more can be added if bicycle usage increases.

The design shown below has proven popular and effective in numerous communities. It is inexpensive to fabricate locally, easy to install, vandal resistant and works well with popular high-security locks. In addition, it can be installed as a single unit, on a sidewalk, or in quantity, at major recreation nodes.



Typical Bike Rack

Location Criteria:

- Racks should be located within 50' of building entrances (where bicyclists would naturally transition into pedestrian mode).

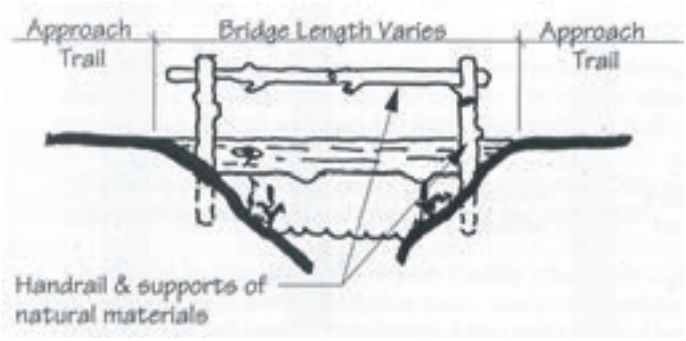
- Racks should be installed in a public area within easy viewing distance from a main pedestrian walkway, usually on a wide sidewalk with five or more feet of clear sidewalk space remaining (a minimum of 24" clear space from a parallel wall and 30" from a perpendicular wall).

- Racks are placed to avoid conflicts with pedestrians. They are usually installed near the curb and at a reasonable distance from the building entrances and crosswalks.

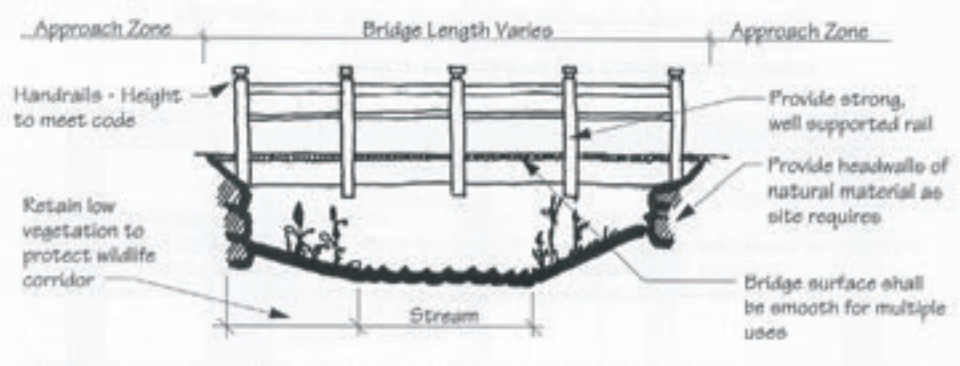
- Racks can be installed at bus stops or at loading zones (only if they do not interfere with boarding or loading patterns and there are no alternatives). Bike racks on busses also facilitate bike-on-transit travel.

Bridges

Bridges are an important element of almost any trail project. 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. Bridges intended for occasional vehicular use must be designed to handle up to 10,000 pound loads safely and at least 14'-wide to allow for vehicle passage.



Foot Bridge



Urban Trail Bridge

Span Bridge

Note: Prefabricated span bridges are ordered directly from the manufacturer. Approximate cost is $100/foot. For examples and quotes, see www.steadfastbridge.com.

Underpass

Trail underpasses and overpasses can be used to avoid undesirable at-grade intersections of trails and freeways or high volume arterial highways . Neither should be used frequently in suburban, fringe or rural areas. Underpasses typically utilize existing overhead roadway bridges adjacent to a stream or culverts under the roadway that are large enough to accommodate trail users. There are several key issues that must be addressed in the design of the roadway underpass:

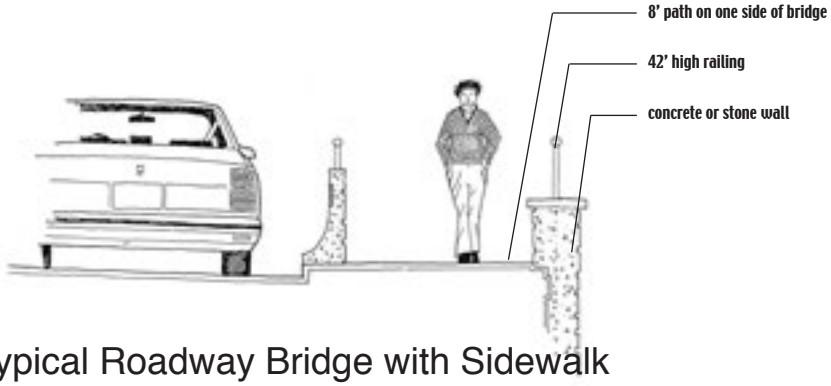
1. The vertical clearance of the underpass must be at least 10 feet
2. The width of the underpass must be at least 12 feet
3. Proper drainage must be established to avoid pooling of stormwater inside the underpass
4. It is recommended that underpasses be lighted for safety

Roadway underpasses that utilize box culverts can sometimes be installed as part of a roadway improvement or construction project at a greatly reduced cost.

Overpass

Trail overpasses can be used in high traffic volume areas where underpasses are not possible. Overpass options include sidewalks on bridges, freestanding pedestrian/bike bridges or lanes attached to an existing bridge. AASHTO requires that bridges be a minimum of 36 inches, but prefers that they are at least as wide as the trail. Fourty-two inch high railing is also required. A fenced cover, as shown below, provides a safer environment over highways and busy streets. The NCDOT should be referenced for height requirements, which vary depending on the type of road. ADA should also be referenced for ramp requirements.

It is important to remember that pedestrians and cyclists will opt not to use an overpass or an underpass if it takes more than twice the time as crossing the street at-grade. For this reason, at-grade fencing should be considered in some instances .



Typical Roadway Bridge with Sidewalk

Miscellaneous Trail Details

Vegetative Clearing

Vegetative clearing refers to the amount of vegetation removal that is required for various levels of trail development. The amount of vegetative clearing required for any one trail will depend on the type of trail being developed. While footpaths or hiking trails require little or no vegetation removal, paved pathways may require significantly more.

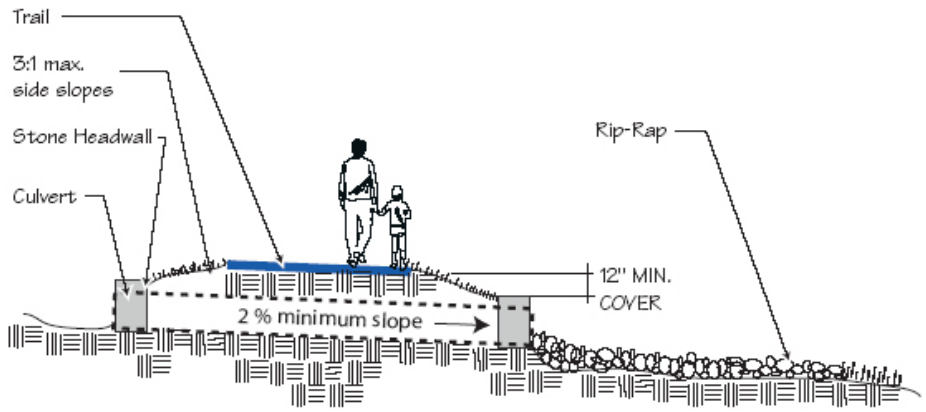
Single-tread, multi-use trails are the most common trail type in the nation. These trails vary in width, can accommodate a wide variety of users and are especially popular in urban areas. While the vegetative clearing needed for these trails varies with the width of the trail, the graphic below outlines typical requirements.

Typical Tree Trimming Distances

Clearing and grubbing consists of tree, shrub and stump removal. The minimum width for clearing and grubbing of a 14'-wide trail is 16 feet (2'-wide shoulders). Selective thinning includes removal of underbrush and limbs to create open pockets within a forest canopy. Selective thinning increases sight lines and distances and enhances the safety of the trail user. Selective thinning does not include the removal of the forest canopy.

Trail Culvert

Proper installation of trail culverts is important to ensure proper stormwater runoff drainage, trail user safety and longevity of the trail surface. Pipe length, diameter and material specifications will vary depending on specific site needs. Two materials typically used for trail culverts are reinforced concrete pipe (typically required when the trail is within NCDOT Right of Way), and High Density Polyethylene (HDPE) recycled plastic pipe. Plastic pipes are typically less expensive on a per foot basis. Outlet protection varies per site needs and in some cases a flow spreader may be required at the outlet location. Rock check dams can be placed after the outlet to slow and filter drainage. The graphic below outlines proper installation parameters for greenway trail culverts.

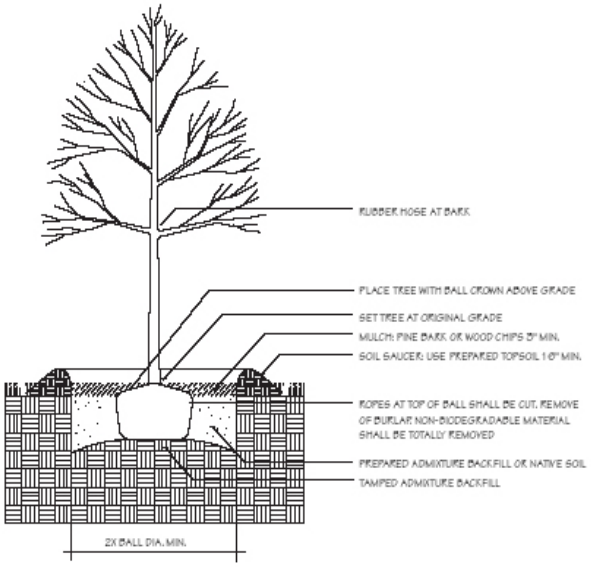


Culvert Placement Cross Section

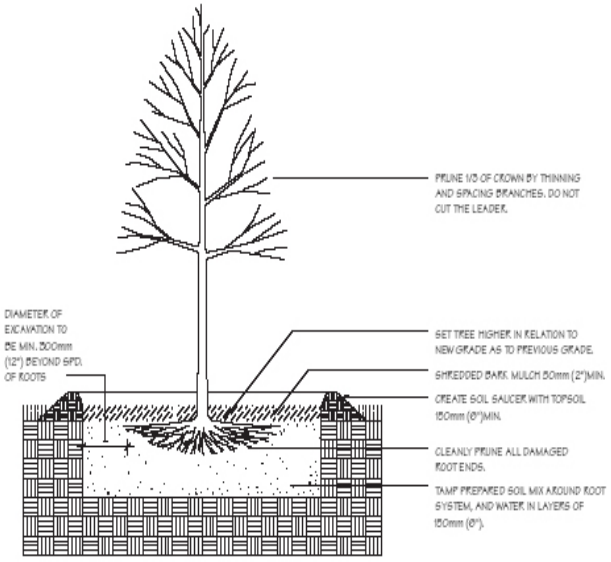
Planting Details

Tree Plantings

Trees are important to greenways and trails for both aesthetic and environmental reasons. Not only do they contribute to the appearance of a trail, their shade cools the environment for trail users and provides habitat for birds and wildlife. Trees also help keep streams healthy by providing shade (which regulates the temperature), filtering pollutants in storm runoff and adding leaf litter to feed small insects and fish. When choosing trees and shrubs for greenway corridors, it is recommended that indigenous and well-adapted species be used. This will reduce the need for chemical and water applications as a part of long term maintenance. The following graphics represent common installation practices used for several different types of plant material.



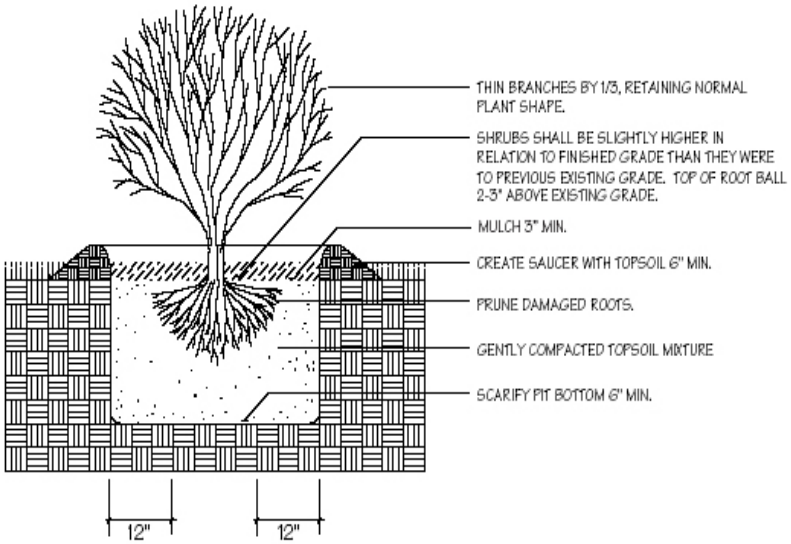
Ball and Burlap Tree Planting Detail



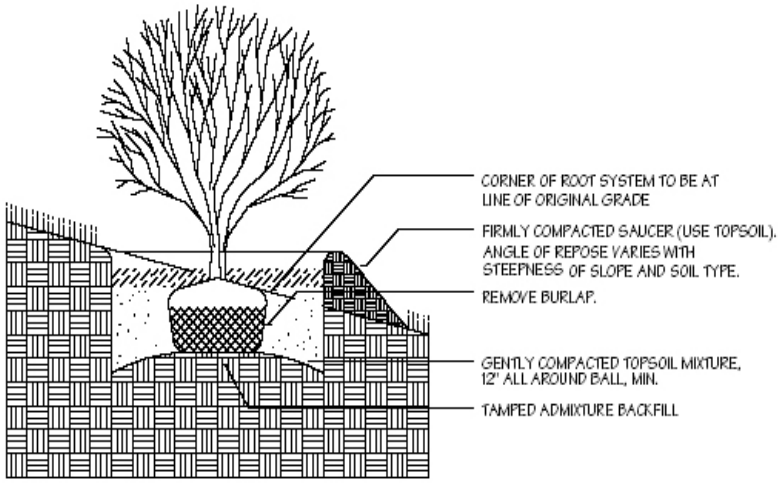
Bare Root Tree Planting Detail

Shrub Plantings

The amount of planting needed will vary depending on the project. While some projects will require little or no planting, other projects may require it for vegetative screening, habitat restoration, erosion control or aesthetics. The graphics below illustrate planting techniques for two types of shrub material (ball & burlap and bare root) which can be used.



Shrub Planting Detail

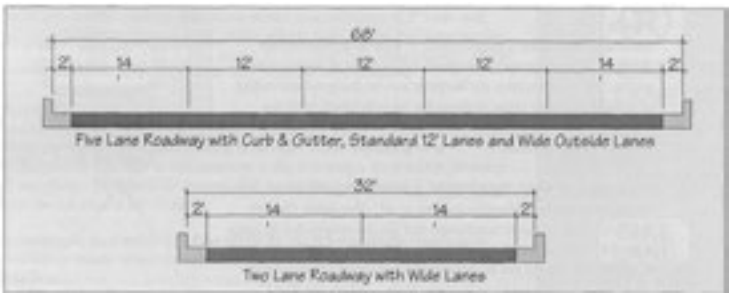


Ball and Burlap Shrub Planting Detail

Bike Considerations - Wide Curb Lanes

There are three types of on-road bicycle facilities: wide curb lanes, bike lanes and paved shoulders. Wide curb lanes, or outside lanes, are wider than the standard 12' travel lane and can provide more space for cyclists and easier passing for motorists. Under most conditions, automobiles and bicycles can coexist in a 14' wide curb lane, without the need for the motorist to move into the next adjacent lane.

Location and Width
Wide curb lanes best accommodate advanced cyclists, as these riders are more comfortable operating directly in traffic. The wide curb lane is always the furthest right-hand lane, and should optimally be 14'-16' wide, not including the gutter pan (curb lanes that are wider than 16' are not recommended). Wide curb lanes are not required to have curb and gutter. In order to achieve the extra space needed for a 14' wide outside lane, the roadway may either be physically widened or restriped to reduce the lane width of inner lanes and increase the width of outer lanes. Restriping proposals should be reviewed by a transportation engineer to ensure adequate safety for the motorists as well as bicyclists.



Signage
There is no special "wide curb lane" sign, however, on high volume urban arterials, the designer may choose to install "Share the Road" warning signs (standard bicycle warning plate with a subplate stating SHARE THE ROAD).

Intersection Design
When the curb lanes approach intersections with turning lanes, the 14' wide lane should continue through the intersection as the outside through-lane.

Design Issues
Acceptance: Bicycle programs in numerous communities have found that less experienced bicyclists seldom see a difference when wide curb lanes are provided. Therefore, if the desired outcome is greater numbers of bicyclists or a visible "pro bicycle" statement, this option will not satisfy the need.

Traffic: Wider curb travel lanes may tend to increase motorist speeds. Whether a marginal increase in speeds is important in a particular situation should be a subject for analysis.

Bike Considerations - Bike Lanes

Bicycle lanes in Wake County should conform to the standards in AASHTO's Guide for the Development of Bicycle Facilities (2000). Bicycle lanes are an on-road type of facility. They should not be separated from other motor vehicle lanes by curbs, parking lanes, or other obstructions. General standards for width, striping, and intersections are provided below.

Location and Use
Bicycle lanes serve the needs of experienced and inexperienced bicyclists in urban and suburban areas, providing them with their own travel lane. Bicycle lanes are always located on both sides of the road (except when they are constructed on one-way streets). By this design, cyclists are encouraged to follow the rules of the road, which require them to travel in the same direction as adjacent motor vehicle traffic.

Width
The minimum width of bike lanes should be 4', exclusive of the gutter pan. On roads with parallel parking, bike lanes should be a minimum of 5' wide, and should be installed adjacent to the motor vehicle lanes, rather than between the parking lane and the curb. Along streets in Wake County with higher motor vehicle speeds and traffic volumes, 6' wide bike lanes are recommended.

Signage
The MUTCD specifies standard signage for bicycle lanes. According to section 9B-8, the R3-16 sign should be used in advance of the beginning of a designated bicycle lane to call attention to the lane and to the possible presence of bicyclists. The MUTCD requires that the diamond lane symbol be used with both the R3-16 and R3-17 signs. (See page xx for signage examples.)

According to Section 9B-11 of the MUTCD, the R7-9 or R7-9a signs can be used along streets where motorists are likely to park or frequently pull into the bike lane.

Striping
Bicycle lane stripes should be solid, 6"-wide white lines. Care should be taken to use pavement striping that is skid resistant. Bicycle-shaped pavement symbols and directional arrows should be placed in the bicycle lane to clarify its use. avement letters that spell "ONLY BIKE" are also highly recommended. Symbols should be installed at regular intervals, immediately after intersections, and at areas where bicycle lanes begin.

Bike lane striping at intersections is challenging. Traffic has a tendency to mix at intersections: motorists who are turning right must cross paths with cyclists who wish to continue straight, and cyclists who wish to turn left must cross into left-hand turn lanes. Several intersection striping patterns are provided by AASHTO's Guide for the Development of Bicycle Facilities (2000) and the MUTCD.

Bike Route

A bicycle route is a “suggested way” for a cyclist to get from a point of origin to a destination. Bike routes do not necessarily require physical improvements in order to accommodate bicyclists, given that they meet minimum safety criteria in their present condition (see below). Bike routes can be preferable for a number of reasons including directness, scenery, less congestion and lower speed limits.

Location and Use
Bicycle routes may be used by all types of cyclists. In urban areas bike routes are most often designated on residential streets with low traffic volumes, and are typically used to direct cyclists to a destination within the community, or to provide a through-route for bicyclists. In rural areas, bike routes are most often designated on roadways that are popular touring routes for recreational cyclists, or long-distance commuting routes for advanced cyclists.

Safety Criteria
A street does not necessary have to be physically widened in order to be designated as a bicycle route. A road with standard 12' wide lanes can be designated as a bike route with the appropriate signage, given that each condition below is met:

- In its present state (or with planned improvements), the roadway sufficiently accommodates cyclists. The evaluation should take into account roadway width and traffic volumes. Candidate bike routes should have good sight distances and adequate pavement conditions. In addition, traffic should not regularly exceed posted speed limits.

- All bicycle hazards have been removed from the roadway or otherwise remedied, including unsafe drainage grates and angled railroad crossings.

- The bicycle route is designated as one segment within an interconnected system of bicycle facilities.

Bicycle route signage should be used according to the standards in the MUTCD, which provides several choices in styles. Bicycle route signs should be placed at all areas where new traffic enters the roadway. The distance between signs should not be greater than two miles. In urban areas, it is helpful to include directional arrows and captions that indicate nearby destinations, particularly at intersections.

Bike Pavement

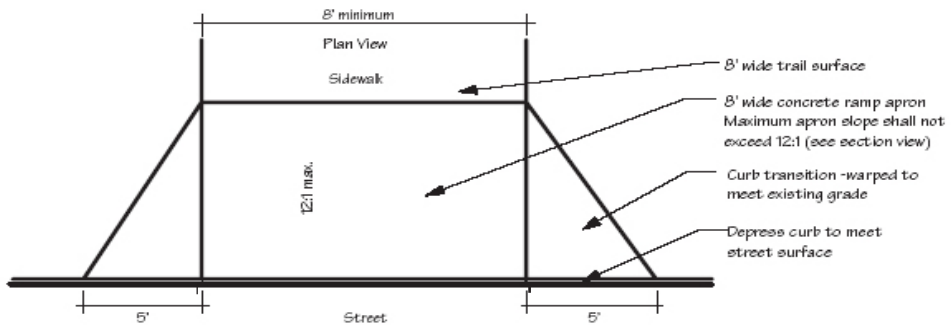
Bike lane pavement and sub-base should always have the same depth and quality as the adjacent roadway. Bike lanes are not required to have a curb and gutter.

Every effort should be made to provide a smooth and even surface for bicycles, particularly for designated bicycle routes and lanes. Bicycles are much more vulnerable to surface irregularities than motor vehicles, because they rely on very narrow, highly pressurized wheel with no suspension. A simple pothole that might cause a slight jarring to the passengers of a car can cause a serious crash for a cyclist.

Potholes aren't the only surface hazard for cyclist. Bumps, corrugations, seams, rumble strips, unraveled pavement and bridge expansion joints can cause bicyclists to lose their balance. In addition, temporary roadway construction zones often include surface hazards such as milled pavements and sudden pavement changes. Temporary signage can be used to warn bicyclist of upcoming irregularities.

When paved shoulders or bicycle lanes are added to the edge of the existing roadway, a resulting seam between the two can be hazardous to bicyclists. One solution is to install 10' wide strips of asphalt, partially overlapping the existing motor vehicles lanes.

Pavement with large aggregates can also put additional stress on the mechanical parts of road bikes, especially for distance riders. Smooth pavement is preferred to avoid accidents due to the loss and/or looseness of bike parts.

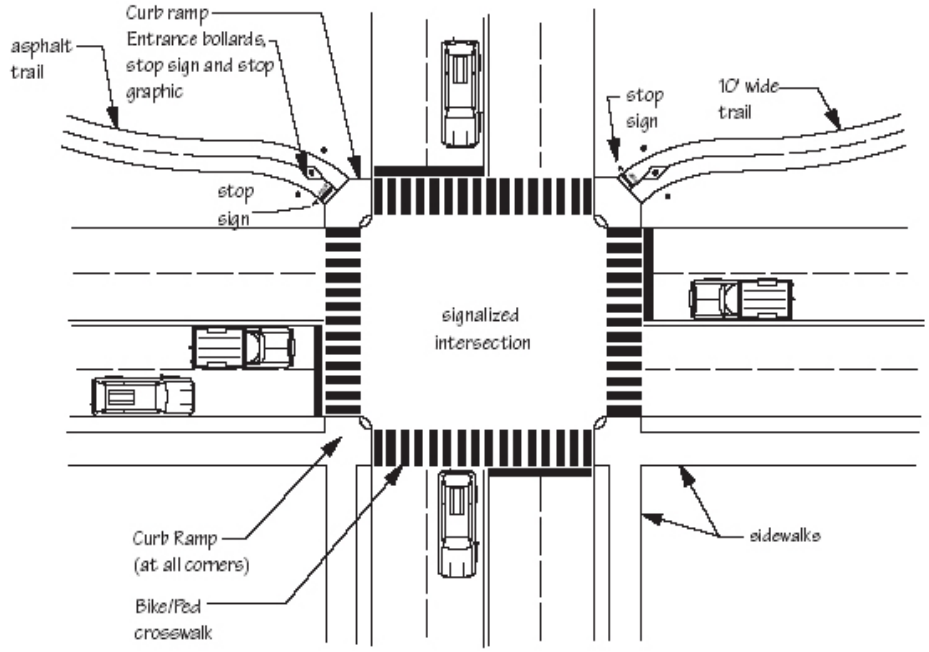


Bike Curb Ramp Plan View

Bike Intersections

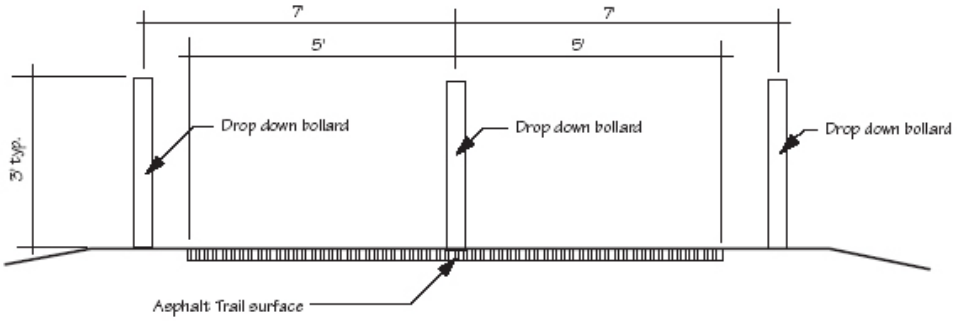
Trail/Roadway intersections can become dangerous conflict areas if not carefully designed. For at-grade intersections, there are usually several design objectives:

1. Site the crossing area at a logical and visible location.
2. Warn motorists of the upcoming crossing.
3. Maintain visibility between trail users and motorists.
4. Inform trail users of the upcoming intersection.

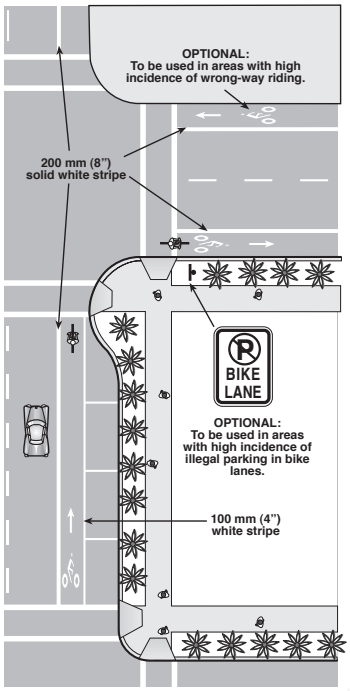


Typical Signalized Intersection Plan View

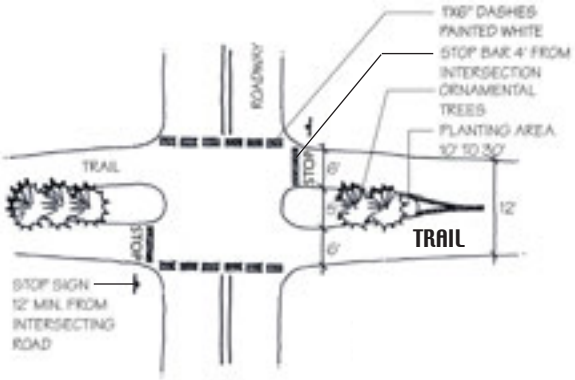
Intersections and approaches should be on relatively flat grades. In particular, the bicyclist should not be required to stop at the bottom of the hill. If the intersection is more than 75 feet from the curb to curb, it is preferable to provide a center median refuge area, per ADA (Americans with Disabilities Act) or ANSI (American National Standards Institute) standards. If crossing traffic is expected to be heavy, it may be necessary to provide a traffic signal that responds to bicycles and/or can be pedestrian activated.



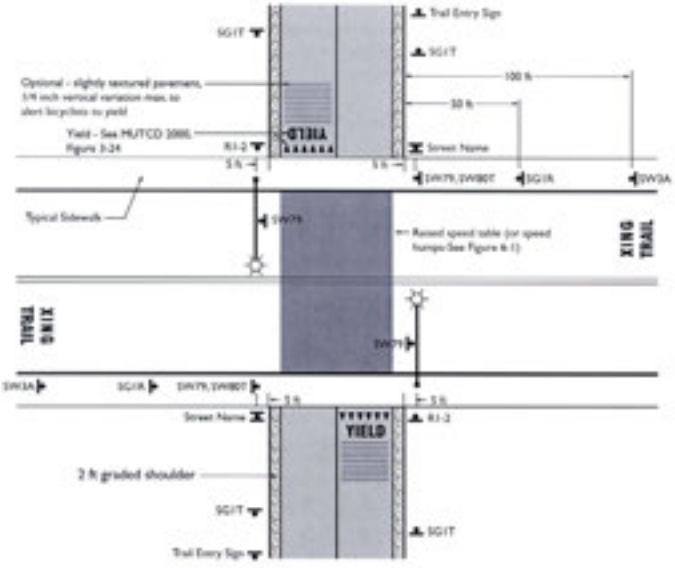
Typical Bollard Placement



Typical Intersection Signage Layout Plan View



Typical Perpendicular Trail and Road Intersection



Typical Trail Crossing at Local Street
(from Contra Costa County Trail Design Guidelines)

Sidewalk

Sidewalk Considerations

Sidewalks are a critical component of this Open Space and Greenways Plan. They not only encourage walking, but they also improve the safety of pedestrians. An individual's decision to walk is as much a factor of convenience as it is the perceived quality of the experience. Pedestrian facilities should be designed with the following factors in mind:

Sufficient width
Sidewalks should accommodate anticipated volumes based on adjacent land uses, and should at a minimum allow for two adults to walk abreast (min. 5 feet, prefer 6 feet).

Protection from traffic
High volume and/or high speed (greater than 35 mph) motor vehicle traffic creates dangerous and uncomfortable conditions for pedestrians. Physical (and perceptual) separation can be achieved through a combination of methods: a grassy planting strip with trees, a raised planter, bicycle lanes, on-street parallel parking, etc.

Street trees
Street trees are an essential element in a high quality pedestrian environment. Not only do they provide shade, they also give a sense of enclosure to the sidewalk environment which enhances the pedestrian's sense of a protected environment.

Pedestrian-scaled design
Large highway-scale signage reinforces the general notion that pedestrians are out of place. Signage should be designed to be seen by the pedestrian. Street lighting should likewise be scaled to the level of the pedestrian (14 feet tall), rather than providing light poles that are more appropriate on high-speed freeways.

Continuity
Pedestrian facilities are often discontinuous, particularly when private developers are not encouraged to link on-site pedestrian facilities to adjacent developments and nearby sidewalks or street corners. New development should be designed to encourage pedestrian access from nearby streets. Existing gaps in the system should be placed on a prioritized list for new sidewalk construction.

Clearances
Vertical clearance above sidewalks for landscaping, trees, signs and similar obstructions should be at least 10 feet. In commercial areas and the downtown, the vertical clearance for awnings should be 10 feet. The vertical clearance for building overhangs which cover the majority of the sidewalk should be 12 feet.

Conformance with national standards
Sidewalk design should be consistent with Americans with Disabilities Act requirements and/or ANSI requirements. Specific guidance is provided by the Architectural and Transportation Barriers Compliance Board's American's with Disabilities Act Accessibility Guidelines.

Sidewalk Obstacles
Street furniture and utility poles create obstacles to pedestrian travel when located directly on the sidewalk. At a minimum, there should be 36 inches of sidewalk width to allow wheelchairs to pass. Where possible, utilities should be relocated so as not to block the sidewalk. Benches should not be sited directly on the sidewalk, but set back at least 3 feet. The design of new intersections or re-design of existing intersections presents an opportunity to improve pedestrian circulation. Street furniture located near intersections can block sight lines. In general, the designer should consider the impact on sight distance for all features located in the vicinity of roadway intersections.

Sidewalk pavement design
Sidewalks and roadside pathways should be constructed of a solid, debris-free surface. Regardless of the type of surface chosen, it must be designed to withstand adequate load requirements. Pavement depth should reflect site specific soil conditions but never be less than 4.5 inches. Brick and concrete pavers are popular materials for more decorative sidewalks. The use of stylized surfaces is encouraged, however they must be installed properly or they will deteriorate more rapidly.

Sidewalk width and setback guidelines
It is important to note that there are some areas that warrant wider sidewalks . For example, sidewalks in and around local universities and colleges must accommodate a much higher volume of pedestrians and, therefore, warrant additional width. The recommendations below are based upon standards used by other pedestrian-friendly communities in the U.S. Following the recommenations below ensures that basic needs of pedestrians are addressed in developing areas. In existing residential and commercial areas that lack sidewalks, new sidewalk construction (independent of new development) should occur first in locations that demonstrate the most need.

Sidewalks on local streets in residential areas:
Five-foot wide sidewalks are recommended on at least one side of the street, with a 5 feet wide planting strip. The planting strip may need to be slightly wider to accommodate the roots of street trees, if they are included in the design. Sidewalks are not necessary on cul-de-sacs that are less than 500 feet in length.

Sidewalks on collector streets in residential and commercial areas:
Five-foot wide sidewalks are recommended on both sides of the street. However, one option may be to install a 6 feet wide sidewalk on the side

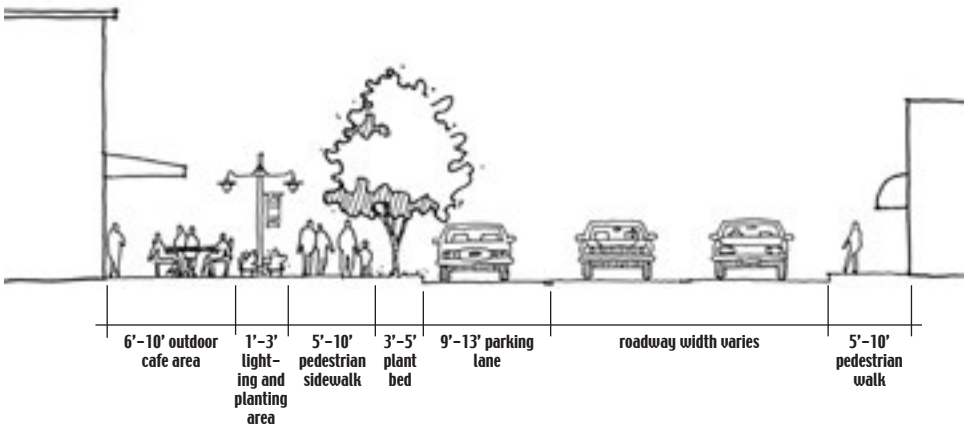
of the street that generates the most activity. A 7 foot wide planting strip is recommended.

Sidewalks on arterial streets in residential and commercial areas:
Six foot sidewalks are recommended on both sides of the street, with an 8' wide planting strip.

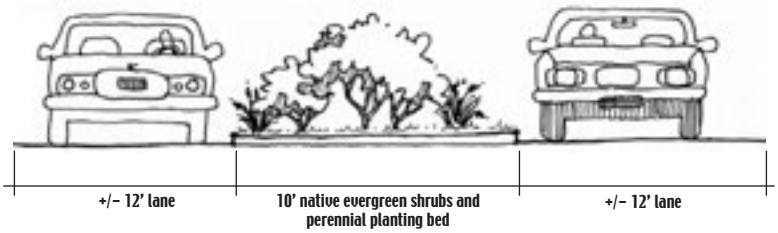
Sidewalks on streets within 2000' of schools:
Width and setback should be based on the specific roadway type as described above. For all roadway types, however, sidewalks should be installed on both sides of the road, and should include well-marked crosswalks and school crossing signs.

Sidewalks on streets with no curb and gutter
Sidewalks located immediately adjacent to "ribbon pavement" (pavement with no curb and gutter) are not recommended. However, if no other solution is possible, sidewalks adjacent to ribbon pavement have a much greater setback requirement, depending on roadway conditions. Engineers should consult the AASHTO Policy on Geometric Design of Highways and Streets for more specific guidelines.

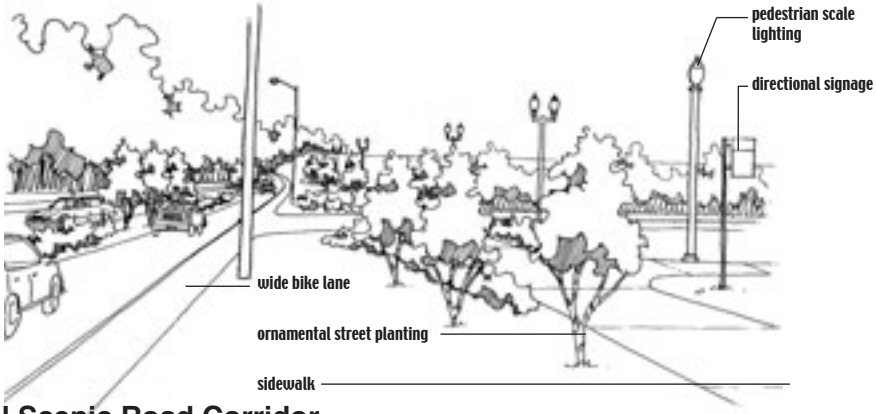
Sidewalks in rural areas
In most rural areas, the low volume of pedestrians does not warrant sidewalk construction. In most cases, 4'-6' wide paved shoulders can provide an adequate area for pedestrians to walk on rural roadways, while also serving the needs of bicyclists. Exceptions should be made in areas where isolated developments such as schools, ballparks or housing communities create more pedestrian use. For example, motorists might regularly park along a rural road to access a nearby ballpark. A sidewalk may be warranted in this circumstance so that the pedestrians can walk separately from traffic. Sidewalks in rural areas should be provided at a width based on anticipated or real volume of pedestrians, with 5' being the minimum width.



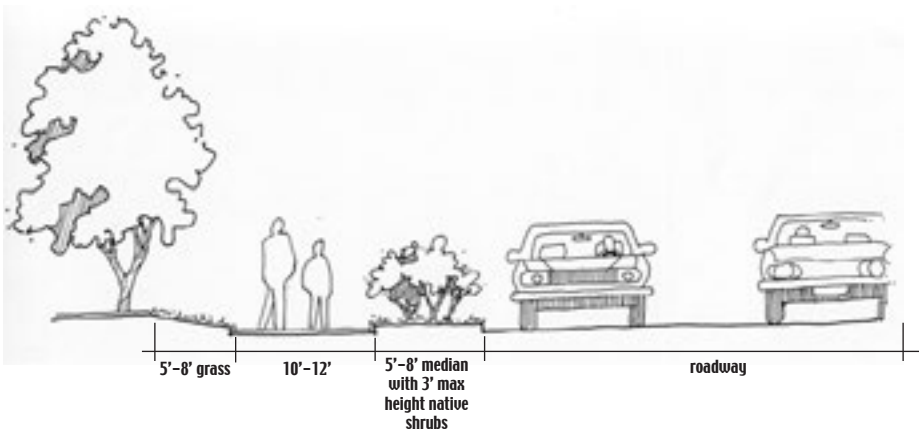
Typical Street Section



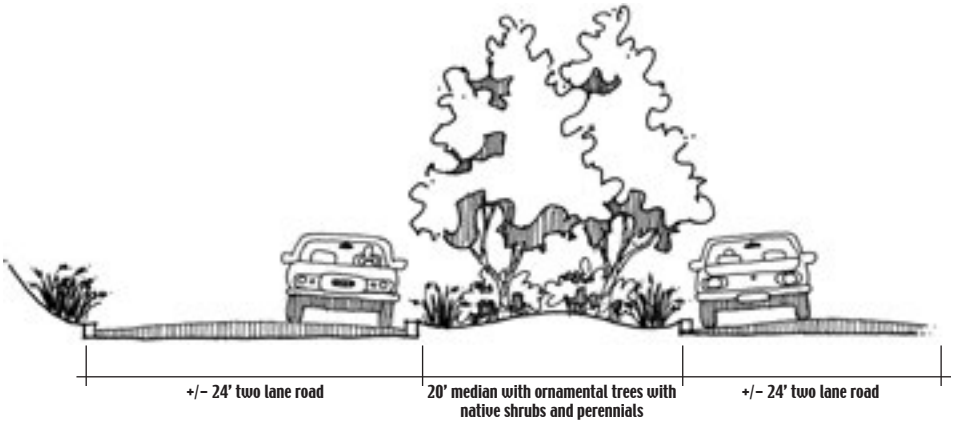
Typical Median Shrub Planting



Typical Scenic Road Corridor



Typical Road with Adjacent Sidewalk



Typical Median Planting

D

Appendix D: Funding & Finance Strategy

Introduction

In 2000, Wake County voters approved a $15 million bond to acquire open space in this rapidly urbanizing county. The bond promised to acquire parcels that would preserve Wake County's natural character and mitigate the effects of development (including: retail, roads, schools, manufacturing, residential, institutional and other forms of development). The 2000 bond measured passed with 78% of voters approving the referendum. The success of this measure was followed in 2004 with the approval of a second bond for $26 million.

A Blue Ribbon Committee convened by Wake County in 2005 identified $300 million in need for open space conservation in the coming years. In order for Wake County to implement the recommendations of this Consolidated Open Space Plan, it will require a combination of funding sources that include local, state, federal, and private money. Wake County will need to fully evaluate all options and develop a funding strategy that can maximize local resources, leverage outside funding, and sustain an Open Space Program. A successful funding strategy will need to account for the administration of the Plan, the acquisition of parcels or easements, and the management and maintenance of properties in the open space system.

Of the many funding options that are possible, the following strategies were identified by the Blue Ribbon Committee as recommended options for Wake County:

1) Apply for matching funds from federal, state and local municipal goverernments.
2) Request matching funds from corporate and private donors.
3) Conduct fund raising in partnership with philanthropic organizations.
4) Use tools, such as Bargain Sale, to obtain open space at less than fair market value.
5) Work with Wake County Schools to partner on school and open space projects, maximizing the return on public dollars invested.
6) Provide more economic incentives for developers to conserve open space, thereby reducing the demand on public funds.
7) Work with farmers and working lands owners to conserve open space.

This appendix provides an overview of different strategies that Wake County can use to accomplish its funding goals, including: a stormwater

utility fee, impact fees/ developer dedications, sales taxes, property taxes, and issuing bonds.

Review of Funding Mechanisms

This appendix does not estimate the funding necessary to fully execute this Open Space Plan. The Wake County Blueribbon Committee in the Spring of 2006 estimated the financial need for open space to be approximately $300 million.

In 2003, CH2MHill prepared a detailed analysis of the funding options available to Wake County for implementing its Watershed Management Plan (see also Wake County Watershed Management Plan – Funding and Institutional Options by CH2MHill for further discussion of funding mechanisms). Because open space can produce water quality benefits (by remaining as permeable surfaces, filtering stormwater runoff, etc.) it is worthwhile to consider the financing options in concert, where applicable. Central to both watershed management and open space preservation are land use planning, land conservation, and aquatic buffers.

Below is a review of the potential funding sources that can be used for open space acquisition and/or management. Many of the funding options could be used as mechanisms for a stand-alone Open Space Program or as a part of the watershed management activities where preserving open space is a function of watershed protection.

User Fees and Charges

Stormwater Utility Fees

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 discharges 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 stormwater utility fee-structures frequently relate non-residential customer charges to an equivalent residential user (ERU), or the typical charges incurred by a single-family residential unit. Thus, a commercial business with 10 times the amount of impervious area as a typical residential property would pay for 10 ERUs or 10 times the amount that a residential customer would be charged. Single-family residential customers are typically charged a uniform monthly fee per ERU, although some communities do vary the charges based on the footprint of the home. Multifamily users may be charged the same rate per dwelling unit as a single-family user, charged a fraction of the single-family rate per dwelling unit, or charged based on the measured impervious surface of their building.

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

The City of Lenexa, Kansas has a "Rain to Recreation" program designed to connect park-like detention basins that process stormwater and meet recreation needs. The system uses natural filtration processes to improve water quality. Stream buffers along the connecting corridors provide recreational opportunities in the form of trails. The program is expected to cost $82.6 million over 10 years compared to the $99 million estimated to maintain the current, traditional stormwater system. In 2000, voters approved a 1/8-cent sales tax for stormwater/recreation improvements. This tax will cost residents about $20 per year. Additionally, the city levy's a stormwater utility fee of $30 per household. Commercial and industrial utility charges are based upon the amount of impervious surface on the property ($2.50 per 2,750 square feet per month).

Impact Fees

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"). Open space impact fees are designed to reflect the costs incurred to provide sufficient capacity in the system to meet the additional needs. These charges are set in a fee schedule applied uniformly to all new development. Utilities strive to ensure that impact fees reflect customers' demands on the system. 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, types of subdivision improvements, and other applicable measures.

If Wake County is interested in pursuing the collection of impact fees for open space acquisition, it will require enabling legislation to authorize the collection of these fees.

Developer Dedications

A developer dedication requires new subdivisions to set aside a portion of the site as open space. Development approval is conditional upon the site plan preserving the requisite amount of undeveloped space. The use of dedications assures that a specific amount of land is preserved, however it is difficult to ensure that the land will meet the intended needs. Often-

times, the land set-aside as a dedication includes wetlands, steep slopes or other features that render the set-aside land as unbuildable anyway. Protecting these lands is consistent with the goals of open space preservation, because they tend to be ecologically sensitive and their protection frequently has water quality benefits. However, ecologically sensitive lands are not always suitable for passive recreation and their protection may fall short of offsetting the anticipated need for increased recreational space.

In-Lieu-Of Fees

As an alternative to requiring developers to dedicate open space that would serve their development, some communities provide developers a choice of paying a front-end charge for off-site open space protection, as opposed to requiring the developer to dedicate the open space on-site. Payment is a condition of development approval. A payment recovers the cost of the off-site open space acquisition or the development's proportionate share of the cost of a regional parcel 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.

Mitigation Banking

Mitigation banking presents another opportunity for furthering the objectives of the Wake County Open Space Program. Developers are required by local governments to mitigate the impacts of their development on wetlands, streams, or animal habitat. For every acre of wetlands, streambed, or habitat that their development destroys, the developer is typically required to create other wetlands, habitats, or waterways to mitigate the impact of the development. Developers can mitigate these impacts on the site of their development or nearby.

If a mitigation bank were available, developers could also satisfy this requirement by purchasing credits from a mitigation bank. Mitigation banks are created by property owners who restore and/or preserve their land in its natural condition. Such banks have been developed by public, nonprofit, and private entities. In exchange for preserving the land, the "bankers" get permission from the state (or the Army Corps of Engineers or other appropriate Federal agency) to sell mitigation banking credits to developers wanting to mitigate the impacts of their proposed development. By purchasing the mitigation bank credits, the developer avoids having to mitigate the impacts of their development on site. Public and nonprofit mitigation banks generally use the funds generated from the sale of the credits to fund the purchase of additional land for preservation and/or for the restoration of the lands to a natural state.

In North Carolina, counties and municipalities appear to have the authority to require that developers set aside open space as a condition to their developing land within the local government jurisdiction. Mitigation bank-

ing could provide an alternative to developers for meeting such a requirement (Hartzell-Jordan, 2000). Chatham County is a nearby example of one county that has received statutory authority from the State Legislature to establish mitigation programs; the Triangle Land Conservancy and Haw River Assembly are examples of local conservation groups that could sell mitigation credits to developers, in order to help reduce prices through competition and economies of scale (Dixon, 2000).

Taxing Options

Taxes are used to fund activities that do not provide a specific benefit, rather a more general benefit, to the community, whereas assessments must show a benefit to the property owned by the user. The various forms of common taxes are described below. It is important to note that while taxes can create a solid funding base that can be used to fund annual capital and operating costs, there is often political pressure to keep taxes low and the natural conflict of setting tax-supported priorities.

Sales Tax

In North Carolina, like many other states, the state has authorized a sales tax at the state and county levels. Local governments that choose to exercise the local option sales tax, use the tax revenues to provide funding for a wide variety of projects and activities. Currently, the North Carolina sales tax is 4.5 per dollar of sale (four and one-half percent) for the state tax and two cents (two percent) for the county tax, for a total authorized sales tax of six and a half cents (six and one-half percent). All counties currently have a total sales tax of at least six cents. Any increase in the sales tax, even if applying to a single county, must gain approval of the state legislature. In 1998, Mecklenburg County was granted authority to institute a one-half cent sales tax increase for mass transit. That is the only time North Carolina's lawmakers have granted the local option sales tax (Chamber of Commerce, 2000). It is estimated that each gross one-half cent of sales tax collections in Wake County would generate around $44 million in revenue annually (Chamber of Commerce, 2000). Dedicated sales taxes can generate considerable sums of money, are easily administered, and tap tourism expenditures. Objections to the sales tax generally revolve around the regressive nature of the tax and the reduction of funds in an economic slowdown. Objections can be alleviated by exempting basic necessity items such as food and drugs. By exempting basic necessity items, the sales tax becomes a consumptive tax.

Property Tax

Property taxes are assessments charged to real property owners based on a percentage (millage rate) of the assessed property value. These taxes generally support a significant portion of a county's or municipality's non-public enterprise activities. However, the revenues from property taxes can also be used for public enterprise projects and to pay debt

service on general obligation bonds issued to finance open space system acquisitions. Because communities are limited in the total level of the millage rate, use of property taxes to fund open space could limit the county's or a 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.

Borrowing

Bonds and loans can be used to finance capital improvements. The cost of the improvements is borrowed through the issuance of bonds or a loan and the costs of repayment are spread into the future for current and future beneficiaries to bear. However, financing charges are accrued and voter approval is usually required. There must be a source of funding (for the payment of the resulting debt service on the loan or bonds) tied to the issuance of a bond or loan.

Revenue Bonds

Revenue bonds are bonds that are secured by a pledge of the revenues of the public enterprise or local government. 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) times a factor, termed the coverage factor, which is designed to provide additional protection to the bondholders. The coverage factor generally ranges from 110 to 150 percent of the utility's annual or maximum annual debt service requirement in the current or any future year. Revenue bonds are not constrained by the debt ceilings of general obligation bonds, but they are 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 open space acquisition and makes funds available for immediate purchases. 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).

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 upfront 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.

State Funding Sources

The following are examples of selected North Carolina State funding programs.

Agriculture Cost Share Program

Established in 1984, this program assists farmers with the cost of installing best management practices (BMPs) that benefit water quality. This program covers as much as 75 percent of the costs to implement BMPs. The NC Soil and Water Conservation Commission (within the NC Department of Environment and Natural Resources) administers this program through local Soil and Water Conservation Districts. Allocations from this program to the Wake County Soil and Water Conservation District amount to $50,000 - $100,000 annually.

Conservation Reserve Enhancement Program (CREP)

The Conservation Reserve Enhancement Program (CREP) is a joint effort between the North Carolina Division of Soil and Water Conservation, the North Carolina Clean Water Management Trust Fund, the North Carolina Wetlands Restoration Program, and the United States Department of Agriculture to address water quality programs of specific river basin and watershed areas. These areas include the Neuse River basin as well as the Jordan Lake watershed component of the Cape Fear basin. The focus of this national initiative has identified nonpoint source pollution as the source of significant estuarine degradation.

CREP is a voluntary program that seeks to protect land (along watercourses) that is currently in agricultural production. Land management practices associated with this program include vegetative enhancements to reduce runoff impacts while providing beneficial habitat for wildlife species currently threatened by habitat loss. The funding for program participation mixes Federal Conservation Reserve Program (CRP), with state funds from North Carolina's Clean Water Trust Fund, Agricultural Cost Share Program, and Wetlands Restoration Program. Enrollment contracts for this cost-sharing program are available for limited time spans of 10-, 15-, and 30-years as well as permanent participation.

North Carolina's Clean Water Management Trust Fund (CWMTF)

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, which was established in 1996, is allocated as grants to local governments, state agencies and conservation non-profits to help finance projects that specifically address water pollution problems. The CWMTF funds projects that (1) enhance or restore degraded waters, (2) protect unpolluted waters, and/or (3) contribute toward a network of riparian buffers and greenways for environmental, educational, and recreational benefits.

North Carolina Parks and Recreation Trust Fund (PARTF)

The Park and Recreation Trust Fund is the primary funding source for new facilities and land acquisition in the state park system. The fund was established in 1994 by the North Carolina General Assembly and is administered by the Parks and Recreation Authority. 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.

North Carolina Farmland Preservation Trust Fund (FPTF)

The North Carolina Farmland Preservation Trust Fund is administered by the Commissioner of Agriculture. The Trust Fund consists of all monies received for the purpose of purchasing agricultural conservation easements transferred from counties or private sources. The Commissioner can use Trust Fund monies for the purchase of agricultural conservation easements, including transaction costs, and distributes Trust Fund monies to counties and private nonprofit conservation organizations for such purchases.

North Carolina Natural Heritage Trust Fund (NHTF)

The North Carolina Natural Heritage Trust Fund was established as a supplemental funding source for state agencies to acquire and protect important natural areas, preserve the state's ecological diversity and cultural heritage, and to inventory natural heritage resources of the state. The Natural Heritage Trust Fund was established by the General Assembly (General Statute 113, Article 5A (113-77.6.9) in 1987. It was provided with a continuing funding source by the General Assembly in 1989 and an additional source in 1991.

The Natural Heritage Trust Fund is financed by receipts from the annual fees for automobile personalized license plates, and in 1991, by 15% of the deed stamp tax. In July 1996, funding from the deed stamp tax increased to 25% of the state's share. Moneys not extended remain in the interest-accumulating Natural Heritage Trust account and do not revert to the general fund.

Grant applications are received from state agencies (the Department of Environment and Natural Resources, the Wildlife Resources Commission, the Department of Cultural Resources, and the Department of Agriculture) for purposes of acquiring and managing natural lands for state parks, preserves, wildlife conservation areas, coastal reserves, natural and scenic rivers, historic site properties, and other outdoor recreation and natural areas. Inventories by the Natural Heritage Program are also eligible for grants. Funding priorities are given to projects which will protect areas containing significant and threatened environmental resources.

North Carolina Conservation Tax Credit Program

The North Carolina Conservation Tax Credit is an incentive program (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 see: http://ncctc.enr.state.nc.us/).

North Carolina Wetlands Restoration Program (NCWRP): Wetlands Restoration Fund

The North Carolina Wetlands Restoration Program (NCWRP) is a non-regulatory program established in 1996 to restore wetlands, streams and streamside (riparian) areas throughout the state. The NCWRP Wetlands Restoration Fund was established as a nonreverting fund within the Department of Environment and Natural Resources. This Fund provides a repository for monetary contributions and donations or dedications of interests in real property to promote wetland restoration projects, and for payments made in lieu of compensatory mitigation. The Fund strictly supports the acquisition, perpetual maintenance, enhancement, restoration, or creation of wetlands and riparian areas in accordance with the basin-wide restoration plans for North Carolina's 17 major river basins.

Transfer of Development Rights

The community of Huntersville, N.C. is considering the implementation of a voluntary transfer of development rights program, whereby a landowner could transfer the rights to develop his land to another landowner. The receiving landowner is then allowed to develop her land at a higher density of use than would otherwise have been allowed. The landowner transferring his development rights is generally compensated by the receiving landowner for the value of these rights. This allows a landowner that wishes to keep his land in farming (or in a natural state) to receive some of the benefits of land value appreciation due to nearby development. This type of program could provide a means of setting aside land as open space while allowing the same number of development units to be constructed.

Federal Sources of Funding

As stated in the introduction, federal and state sources of funding cannot be expected to carry much of the burden of financing a Wake County Open Space Program. Rather, these funding sources must be viewed as supplementary to a dedicated, local financing strategy. Fortunately, there are a number of federal programs that offer funding for state and local programs that seek to conserve land and water resources, provide recreational opportunities, or to mitigate the effects of stormwaters. Most programs require state or local matching funds. Project eligibility requirements can be quite stringent.

CARA

Federal conservation funds are available through the Conservation and Reinvestment Act (CARA). CARA will provide $12 billion over six years beginning in FY 2002. Funding for each CARA category is subject to annual appropriations, however minimum levels have been guaranteed. A sample of federal funding sources is discussed below. Additional programs are described on the EPA website (http://www.epa.gov/owow/watershed/wacademy/fund.html).

Environmental Quality Incentive Program (EQIP)

The Environmental Quality Incentive Program (EQIP) is a federal program authorized in the 1996 Farm Bill that provides assistance to agricultural producers in complying with federal, state, and other environmental laws. Assistance provided through this program may be in the form of technical, cost-sharing, financial incentives, and producer education related to a broad range of soil, water, air, wildlife, and related natural resource concerns on North Carolina's farms and ranches.

The EQIP assistance programs are available to crop, forage and forest products producers as well as wetlands and wildlife landowners who choose to enter into 5- and 10-year contracts based on conservation plans for their operations. These conservation plans may include a combination of structural, vegetative, and land management components. The program prioritization is led, coordinated, and implemented on the local level. In FY 2001, North Carolina had $3.7 million available to eligible participants. The cost share mix for these funds is 75 percent for implementation actions up to $10,000 annually and $50,000 per project contract. The distribution of these funds is based on a split where 70 percent of funds are directed to the 18 identified priority areas and the remainder to address concerns in the remaining counties.

Farmland Protection Program

The federal Farmland Protection Program (FPP) was created in the 1996 Farm Bill. This program is administered by the Natural Resources Conservation Service and provides federal matching funds for state and local farmland protection efforts. Funds are used to help purchase development rights to keep productive farmland in agricultural uses. Through this program the USDA provides up to 50 percent of the fair market easement value to acquire conservation easements or other interests from farmland owners. To be eligible for funding, a state, county or local jurisdiction must have a complementary program of funding for the purchase of conservation easements, and grants are awarded competitively through the USDA's Natural Resources Conservation Service (NRCS). (For more information visit http://www.info.usda.gov/nrcs/fpcp/fpp.htm).

Hazardous Mitigation Grant Program

This program provides financial assistance to state and local governments for projects that reduce or eliminate the long-term risk to human life and property from the effects of natural hazards. The grant program

has 75 percent federal and 25 percent local contribution. The nonfederal share may be met with local cash contributions, in-kind services, or certain other grants such as Community Development Block Grants. The Federal Emergency Management Agency makes the final decisions on project eligibility, but the state agencies administer the program. Eligible projects include acquisition of property, retrofitting of buildings, development of standards with implementation as an essential component, and structural hazard control or protection measures such as dams and sea walls.

Land and Water Conservation Fund

The Land and Water Conservation Fund is the largest source of federal money for park, wildlife, and open space land acquisition. 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 fraction of this amount. Between 1995 and 1998, no funds were provided for the state-and-local grant portion of the program, which provides up to 50 percent of the cost of a project, with the balance of the funds paid by states or municipalities.

LWCF funds are apportioned by formula to all 50 states, the District of Columbia and territories. Cities, counties, state agencies, and school districts are eligible for LWCF fund monies. These funds can be used for outdoor recreation projects, including acquisition, renovation, and development. Projects require a 50 percent match.
In fiscal year 2000, Congress approved stateside grant funding at $40 million. In FY 2001, $89 million was approved. In the current fiscal year, the stateside amount has been increased to $140 million nationwide, which will provide North Carolina with an apportionment of $3,250,596.

The President's budget request for FY 2003 proposes a $200 million stateside program, a portion of which will be earmarked for a Cooperative Conservation Initiative (CCI). The CCI will provide additional funding for competitive matching grants for natural resource restoration.

For more information contact:
Headquarters: U.S. Department of the Interior
National Park Service, Recreation Programs
Room MIB-MS 3622
1849 C Street NW
Washington, DC 20240
(202) 565-1200
http://www.ncrc.nps.gov/lwcf/

Nonpoint Source Implementation Grants (319 Program)

The 319 Program provides formula grants to states so that they may implement nonpoint source mitigation projects and programs in accordance with section 319 of the Clean Water Act (CWA). Nonpoint source pollution reduction projects can be used to protect source water areas and the general quality of water resources in a watershed. Examples of previously

funded projects include installation of best management practices (BMPs) for animal waste; design and implementation of BMP systems for stream, lake, and estuary watersheds; and basin-wide education programs. These grants allow for 60 percent of the cost of the project to be funded federally with a 40 percent local match.

For more information contact:
U.S. Environmental Protection Agency
Office of Wetlands, Oceans and Watersheds
Nonpoint Source Control Branch (4503F)
Ariel Rios Bldg., 1200 Pennsylvania Ave., NW,
Washington, DC 20460
(202) 260-7100
http://aspe.os.dhhs.gov/cfda/p66460.htm
http://www.epa.gov/owow/nps/

Pittman-Robertson Act

The Federal Aid in Wildlife Restoration Act, popularly known as the Pittman-Robertson Act, provides funding for the selection, restoration, rehabilitation, and improvement of wildlife habitat, and wildlife management research. Funds from an 11-percent excise tax on sporting arms and ammunition are appropriated to the Secretary of the Interior and apportioned to states on a formula basis for covering costs (up to 75 percent) of approved projects. The program is cost-reimbursement in nature, requiring states to apply for reimbursement of up to 75 percent of project expenses. At least 25 percent of the project costs must be provided by the state and originate from non-federal sources.

Surface Transportation Act (SAFETEA-LU)

For the past 15 years, the Surface Transportation Act has been the largest single source of funding for the development of greenways. Prior to 1990, the nation, as a whole, spent approximately $25 million on building community-based bicycle and pedestrian projects, with the vast majority of this money spent in one state. Since the passage of ISTEA, funding has been increased dramatically for bicycle, pedestrian and greenway projects, with total spending north of $5 billion. SAFETEA-LU will more than double the total amount of funding for bicycle/pedestrian/trail projects as compared to its predecessor TEA-21, with approximately $800 million available each year. States may spend up to 20 percent of their STP dollars (used for transportation facility reconstruction, rehabilitation, resurfacing, or restoration projects) for environmental restoration and pollution abatement projects. Additionally, each state sets aside 10 percent of STP funds for transportation enhancement projects, which can include acquisition of conservation and scenic easements, wetland mitigation, and pollution abatement, as well as scenic beautification, pedestrian and bicycle trails, archaeological planning, and historic preservation.

For more information contact:
U.S. Department of Transportation
Federal Highway Administration

400 7th Street, SW, Washington, DC 20590
(202) 366-5004
http://www.fhwa.dot.gov

Wetlands Reserve Program

The Wetlands Reserve Program is administered through the Department of Agriculture's Natural Resources Conservation Service. This program provides landowners with financial incentives to restore and protect wetlands in exchange for retiring marginal agricultural land. Landowners may sell a permanent or a 30-year conservation easement, or they may enter into a cost-share restoration agreement for a minimum of 10-years. Participating landowners voluntarily limit future agricultural use of the land. They continue to own and control access to the land, and they may lease the land for recreational activities. The amount of funding available in a given fiscal year depends on the amount of acres Congress permits to be enrolled in the program, and a per acre value is assigned in each state.

For more information contact:
U.S. Department of Agriculture
Natural Resources Conservation Service
Watersheds and Wetlands Division
P.O. Box 2890, Washington, DC 20013
(202) 690-0848

Private - Corporate and Philanthropic

Land Donations

While land donations are an inexpensive way to acquire property, it is imperative that donated parcels be considered critically in relation to the overall open space management strategy and its implementation costs. It is possible for donated parcels to augment a well-designed system of connected parcels, environmentally significant landscapes, or culturally valuable sites. However, it is unlikely that the most valuable parcels (as identified in the Wake County Open Space Plan, Phase II) will be donated as a matter of coincidence. In fact, the County will want to be selective in the parcels it accepts as donations. Careful consideration will be needed before deciding that the cultural and/or environmental benefits of a donated parcel outweigh the management and maintenance expense of adding it to the overall system.

Nonprofit Partners

Nonprofit organizations are capable of raising money from individual and corporate donors, large grant foundations, and state and federal grant programs. Partnering with land preservation foundations is often a beneficial arrangement for public agencies. Some granting authorities have policies that prohibit awarding grants directly to governmental agencies, or will only grant funds when a nonprofit agent is involved. Developing an agreement, in support of the Wake County Open Space Program, with a land conservation foundation could produce financial benefits and other

support for the preservation and protection of Wake County open space. Corporate partnerships are also worthy of cultivation. Their funds can be used as local matches for grants, and they can play leadership roles in civic activities and promotions.

Wake County will need to employ a combination of conservation methods in order to protect and preserve the maximum amount of valuable open space. Plan administrators will need to consider:

- the intensity of land management;
- public access requirements;
- interests that the owners are willing to sell;
- administrative or management issues;
- and available funds.

Land Acquisition Methods

Common forms of acquiring land are as follows:

• Fee-simple acquisition - the outright purchase of a property. Fee-simple acquisition provides permanent protection. It typically raises the value of nearby property (thereby increasing their tax burden). However, it is too expensive to purchase all desirable land, and it removes purchased land from the tax rolls.

• Conservation easement – the payment to landowners that agree to manage and maintain their land in a manner that preserves or enhances the ecological integrity of a parcel. Conservation easements are more restrictive than regulations but less expensive than fee-simple acquisition. Land under a conservation easement remains in private ownership (often denying public access to the property) and on the tax rolls. Participating landowners may benefit from tax incentives.

• Leasing (short or long-term) – generally, one of the least expensive options. It also provides the least control in terms of conservation activities and duration.

• Charitable Remainder Trusts – a vehicle for property-owning individuals to transfer property to a non-profit or government entity. A charitable remainder trust (CRT) is a special, tax-exempt, irrevocable trust written to comply with federal tax laws and regulations. One of the major reasons why individuals use CRT's is to make charitable donations and to avoid capital gains on the sale of appreciated assets. The initial transfer of assets to the trust is followed by a distribution of income for life (or a predetermined term of years). By law, a charitable trust must have a payout rate between 5% and 50%. Payouts normally range from 5% to 7%. Income can be paid over the donor's life, spouse's life and even the donor's children's and grandchildren's lives. Normally, trusts are funded with assets valued at $100,000 or more. Transfers to a CRT will generate an income tax deduction for the donor in the year of the contribution. Excess deductions may be carried forward for five years after the initial year of the transfer.

Examples of Other Community Financing Efforts

A representative sample of communities nationwide is reviewed below. The most noticeable commonality in their approaches is the passing of bond measures ($130 million to $400 million) to kick-start the purchase of significant open space parcels. In addition to illustrating the expense of implementing an aggressive purchase program, the passage of these bonds are testaments to the commitment of the various communities and the perceived importance (nationwide) of land preservation.

Austin, Texas

In the 1990's, Austin grew from a population of 400,000 to 600,000. A million people now live in the Austin metro area. The effects of sprawl were evident in Austin's clogged traffic, declining air quality, threatened drinking water, and loss of rural character. In 1998, the city council launched a smart growth initiative that included regulatory changes that encourage denser development and efforts to protect open space. Throughout the 1990's, Austin voters approved more than $130 million in local bonds to protect critical watershed lands and create parks and greenways.

Some of these funds will go towards the purchase of open space as a part of a "desired development zone." The 5,000-acre development will set aside the "most sensitive, the most beautiful, the most threatened lands in terms of water quality, so the desired development zone will have a spine of natural beauty down the middle of it, and that will attract folks to live and work there."

(For more information visit: http://www.tpl.org/tier3_cdl.cfm?content_item_id=1150&folder_id=727).

Broward County, Florida

In 1990, Broward County had 2,900 acres remaining of pristine land. The county passed a $78 million bond to purchase this land, but it was not enough. Only 1,200 acres could be purchased, and another 1,200 of the targeted acres were lost to development.

In 2000, the county sought to purchase the remaining ecologically sensitive 500 acres for conservation and to add another 525 acres (of moderate ecological health) to the county open space system. Additionally, the county was looking to purchase 400 acres of inappropriately located agricultural fields and industrial sites so that the land could be reclaimed for passive recreation areas. The voters approved (by 74 percent) a bond referendum of $400 million to add the 1,425 acres to the county's open space resources. (For more information visit: http://www.tpl.org/tier3_cdl.cfm?content_item_id=1355&folder_id=947).

Gwinnett County, Georgia

Gwinnett County uses a variety of sources to collect its open space and recreation funding. In FY2001, the county received $3,302,522 as a participant in the Georgia Greenspace Program. Due to increasing par-

ticipation by other Georgia counties, the FY2002 allocation for Gwinnett is $2,948,970. Additional funding for open space acquisition comes from the recreation tax levee of 0.86 mill. However, the most significant funding comes from Special Purpose Local Option Sales Tax (SPLOST).

The state of Georgia permits local governments, via a referendum, to assess an additional one percent sales tax for special projects. In November of 2000, Gwinnett County voters approved a four-year, one percent SPLOST. The SPLOST is expected to generate between $450 million and $750 million for open space preservation, parks, libraries and transportation. The eventual amount collected in SPLOST funds will be dependant upon the actual dollars spent on taxable goods in Gwinnett County. The allocation for parks and open space is anticipated to be a minimum of $192 million.

Portland, Oregon

For the fiscal year 2001/02, Portland Parks & Recreation will spend nearly $60 million to operate, maintain, and expand the park system. The greatest single source of revenue will come from Portland's General Fund (50%). Additional funding comes from user fees (27%), interagency agreements (7%), grants and donations (0.5%), Park System Development Charge (1.5%), and other sources (14%).

In the spring of 1995, metro-area voters approved an Open Spaces Parks & Streams Bond Measure of $135 million to acquire regionally significant natural areas. The money will be spent to acquire approximately 6,000 acres of open space and complete six regional trail and greenway projects. The measure also provides resources for local parks providers, including $7.4 million for parks within the City of Portland.

In 1998, the Portland City Council approved a residential Park Systems Development Charge (SDC) to partially offset the costs associated with needed services for housing developments. The residential development fee generates about $1 million a year for park capital improvements based on the current rate of about $1,500 per unit. SDC funds are restricted to land acquisition and capital improvements in areas of population growth and new development. SDC funds cannot be used to correct existing parkland deficiencies, nor can they be used to offset operations or maintenance costs. Currently, the fee is only assessed for residential development. (For more information visit: http://www.parks.ci.portland.or.us/).

Conclusion

The success of Wake County's $41 million in bond programs demonstrates voter support and a perceived understanding of open space importance. The funds from this measure, however, will be gone soon. If Wake County wants to continue preserving and protecting open space, it will need established funding to implement an open space program, acquire more open space parcels, and manage and maintain parcels already in the system and those that are acquired in the future.

Wake County will have to employ a variety of funding sources that include local, state, federal, and private money. While state and federal funds are attractive, the Open Space Program will have to be primarily funded locally. Many of the methods mentioned above will require voter approval and/or be limited by the County's taxing capacity.

After determining the possible and practical options available to fund the Wake County Open Space Program, it is strongly recommended that Wake County engage a financing strategist and polling firm (such as the Trust for Public Land) to further explore the feasibility, public acceptability, and potential real returns before implementing a specific funding mechanism or strategy. Careful consideration should be given to the implementation of financing techniques that require voter approval. To implement most voter-approved taxing/borrowing options, a three-step approach is recommended: feasibility research, public opinion polling, and measure design. First, a jurisdiction's financing capacity and the potential revenues that could be raised via different financing options are determined. This research will help local leaders estimate how much revenue different options would raise and the potential impact on residents.

Scientific public opinion polling should be conducted to assess voter preferences (their willingness to fund open space in relation to other public needs) and how much they are willing to spend. Polling will gauge the public's local conservation priorities and help determine the preferred type and size of financing measure. If the research and polling indicates a favorable response, a ballot measure can then be designed to reflect public priorities and a community's conservation needs.

Notes:

Draft Report on the Blue Ribbon Committee of the Future of Wake County, June 2006

Dixon, Kate. November 10, 2000. Memorandum to the Subcommittee on Farmland and Open Space, Legislative Smart Growth Commission, re: Mitigation Banking for Open Space.

Gwinnett County Open Space and Greenway Master Plan. Prepared for the Gwinnett County Commission, by Lose & Associates, Inc., the University of Georgia Institute of Ecology and Greenways Incorporated.

Hartzell-Jordan, Stephan. November 17, 2000. Memorandum to Steven Levitas, re: Local Government Authority to Establish Open-space Mitigation Banking Programs.

"MetroGreen Funding Strategy," from MetroGreen, a Regional Greenway Initiative for Metropolitan Kansas City. Prepared for the Mid-America Regional Council, by Greenways Incorporated and the Trust for Public Land, 2001.

Parks 2020 Vision. Released on the world wide web by Portland Parks & Recreation (http://www.parks.ci.portland.or.us/).

Wake County Watershed Management Plan – Funding and Institutional Options (Technical Memorandum No. 5). Prepared for the Wake County Watershed Management Plan Task Force, by CH2MHill, 2001.

E

Appendix E: Stewardship Program

Introduction

This section of the Open Space Plan establishes the basis and provides recommendations for a Stewardship Program for the Wake County Open Space Program. As Wake County moves forward with a purposeful and progressive open space program, it will be necessary for County government to assume a leadership position with respect to stewardship of open space resources, and work in collaboration with municipalities, state and federal agencies and non-governmental organizations to implement this program.

The Wake County Open Space program will include publicly owned lands that require various forms of management. This report defines a framework for the stewardship and management of these lands through a county-sponsored program that is based on nationally popular implementation models. Similar programs are in operation today within Boulder, CO, Jefferson County, CO, San Francisco, CA, Mecklenburg County, NC and Missoula, MT. These programs were referenced as part of the preparation of this report.

Conceptual Framework - An Ecosystem Approach

Wake County should manage open space to preserve, protect, maintain, and restore native ecosystems. Typically these ecosystems consist of plants, animals, water, soil, terrain, geologic formations, aesthetic values such as scenic vistas, and natural buffers. Additionally, an ecosystem is an interconnected community of living things, including humans and the physical environment in which we interact. The goal of an "ecosystem approach" is to restore and sustain the health, productivity, and biological diversity of native ecological systems and landscapes while supporting sustainable human economies and communities. Many factors, such as interagency conflicts, incompatible data bases, a lack of research on ecosystem functioning, inconsistent planning and budgetary cycles, and differing agency goals and organizational structures, can hamper development of a coordinated approach to actively restoring or sustaining the health of ecosystems that are the cornerstones of viable economies.

Because ecosystems do not follow jurisdictional or administrative boundaries, such as the borders of a city or county, working to restore or sustain ecosystem productivity involves a perspective that crosses these human imposed boundaries. This entails a shift from local government focus on individual agency jurisdiction to a broader focus on the actions of multiple agencies within larger ecological boundaries. Just as collaboration is important, finding ways to increase voluntary cooperation with state and

local governments, as well as with nongovernmental organizations and the public, is key to an effective ecosystem approach.

Ecosystems are comprised of three important factors: ecological concerns, economic concerns and social concerns. Ecology is the relationship of organisms and their environment, which includes human habitat and activity. Economics involves the production and management of material wealth, including farming, industry, and business derived from local resources. Social concerns are derived from people living together in communities, including population trends, land use practices, health, education and livability.

In order to have the most effective open space stewardship program, it must be led by an agency or organization that has experience dealing with all three areas of ecosystem concern. Wake County will need to define, in the near future, the make-up, resources and program objectives that are required to properly steward the land and water resources of the Open Space program. To accomplish this work, a team of staff, comprised of persons with backgrounds in natural resource and human resource management, will need to work together in order to implement the open space stewardship program.

Components of Ecosystem Approach

In order to achieve the ecosystem approach prescribed, the Wake County Open Space Program should consist of three areas of management focus: natural areas management, human use management and historic properties and resource management. For each property that is added to the Wake County Open Space Program, a physical inventory and assessment should be made of these three focus areas. A specific management plan should then be developed that addresses and resolves these areas.

Natural Areas Management consists of the identification of native vegetation, geologic and land formations and wildlife habitat. Native vegetation provides the basic structure for natural communities. Plant species diversity is key to supporting wildlife and maintaining ecological balance. Geology and landform are unique within a regional landscape and define a sense of place. Wildlife management can be complex involving the identification of native and non-native populations, migratory assessment, pest management and aquatic species identification.

Natural Areas Management should also involve an identification of natural hazards that can influence short-term and long-term stewardship goals. Hazard mitigation should be part of every assessment and stewardship plan, and include a plan for fire, flood, soil resource and air quality management.

Human Resource Management consists of the identification of areas that can support human access and use. Typically, within the Wake County Open Space system, parks and greenways will become the primary sites and landscapes that support human use. To best understand

how this use is accommodated within a given site, a capacity analysis of each open space resource should be performed. Wake County should define who the users of the landscape will be, what their needs will be and the types of activities that will be undertaken within the landscape. Programming of the landscape should be defined and taken into consideration. Human access and use may, by necessity, be limited to certain open space parcels and properties.

Historic Properties and Resources Management consists of identifying property and buildings that qualify for designation as local historic resources or national historic property or buildings. If specific criteria are met, and such designation can be applied, Wake County will need to fill out appropriate materials and proceed with designation of the properties. If designation is achieved, certain management responsibilities will follow that are specific to historic properties. These should be enumerated within the property assessment that is conducted for these resource areas.

The Stewardship Program

The Wake County Open Space Stewardship Program will come with a host of new operational components that need to become institutionalized within the normal operating framework of Wake County government. The following offers a listing of some of these components and work tasks.

Mapping County Owned Properties

An important element of the Open Space Stewardship program will be the development of GIS-based mapping. The County should begin to build a database that contains, by parcel description, the location of existing open space resources. GIS technology can also be used to catalog all park facilities, trails, buildings and other open space resources. The Wake County Sheriffs Department should also be made aware of new properties that are added to the county open space inventory.

Boundary Establishment and Marking

All open space properties should receive appropriate boundary markings. Boundary signs should be installed on each open space property which state “Property Boundary, Conservation Area, No Trespassing,” along with a graphic depiction for open space. The Wake County logo/seal will be printed on all signs. These markers along with marking paint and should be placed at 100-foot intervals around the property, with a property line cut along the surveyed line. The Department of Facilities Design and Construction Management will be responsible for contracting to have the surveyed boundary cut, painted, and for the installation of boundary signs. The cutting, painting and signage of the surveyed boundary will be incorporated into the surveying contracts for all future acquisitions. General Services Administration will provide the boundary markers and the printing of the signs. Additionally General Services Administration will ensure that the property lines are maintained after installation.

Preliminary Inventory and Management Needs Assessment

Following the marking of the boundaries, staff from PROS and the Wake Soil and Water Conservation District will inspect these properties, walk the boundaries and assess the property in whole to determine what if any immediate management needs should be addressed, and what may need to be considered long term. Generally, the staff should follow the list of stewardship components defined within this report. Examples will include but not be limited to: timber harvesting, stream restoration, public access, rare and endangered species protection, eradication of invasive and destructive non-native species, hazard reduction, etc. As a result of this investigation a draft management plan will be developed and circulated for review and group discussion at an appropriate time. Management needs will be expressed by priority.

Public Assess and Use

County staff will need to define if a property is important for public access and use. If so, appropriate locations for access and use should be described within the assessment reports for each parcel.

Hazard Reduction

As part of performing due diligence prior to the purchase of an open space property an environmental assessment should be made by County staff and any needed mitigation should be made through an appropriate contractor. Any hazardous items or situations encountered by County staff that occur after the county has assumed title, will be dealt with by PROS and/or Soil and Water Staff if minor in nature and if the immediate resources of time, expertise, and equipment are available to address it. Any hazards requiring significant work and remediation, or of a serious nature, will be called to the attention of the General Services Administration for quick remediation.

Monitoring and Enforcement

Monitoring should be conducted on all of these properties on a routine basis. Monitoring will initially take place on a quarterly basis to ensure properties are not being trespassed upon or degraded in any way. Should a problem be found appropriate steps will be taken to address it, and the Wake County Sheriffs Department will be notified as necessary. County staff will establish a schedule to ensure that all of the properties are monitored on a quarterly basis, by assigning a walk-though of the property to PROS staff located in proximity to parcels, and to Soil and Water in areas of the county routinely serviced by them. Wake Soil and Water Conservation District will be provided with information regarding properties purchased by Wake County to determine those having a current farm plan. The District will then provide routine inspections of these properties to assure compliance with the farm plan and note any potential problems.

Restoration and Mitigation

For some properties, restoration and mitigation will be necessary. If so, PROS will need to define what is required, who will perform the work, the cost of this work and a timeframe for its completion.

Volunteer Programs

PROS should work with local citizens, advocacy organizations and civic groups to establish programs for volunteers to assist with stewardship activities. The following offers more specific recommendations for volunteer activity.

Wake County Youth Corps

Wake County government should consider the establishment of a Youth Corps program under the Cooperative Extension, similar in scope to the one operated by Boulder County, CO. Under this program, teenagers between the ages of 14-17 work with the Open Space Program Volunteer Coordinator to assist the county with stewardship activities. Participants work through a paid eight-week summer program on a variety of field-oriented tasks. All participants work cooperatively under a team-oriented philosophy and would learn a variety of skills, work habits, and the value of environmental and civic stewardship. Wake County and its partners benefit from tangible projects that could range from maintenance, to property boundary identification, to the construction of open space facilities for public access and use. Information on Boulder County's program can be obtained by contacting Rick Meyers, Program Coordinator at (303) 441-4960, or by e-mail at rzmad@co.boulder.co.us.

Watershed Stewards

Wake County should also consider establishing or formalizing relationships with stewardship groups within each of the 81 subwatersheds defined by the CH2M Hill, County-funded Watershed Management Plan. A Watershed Stewards program could be comprised of volunteers from residential neighborhoods and area businesses. Local school programs and civic organizations, such as the Boy Scouts, could also be involved in these efforts. Stewards would adopt each subwatershed and begin to assist the county with monitoring the health and condition of waters flowing within the watershed. One such program is the Cherry Creek Stewardship Partners in Denver, CO. This program is coordinated by Chris Rowe (303) 291-7437. The partners have their own web site at www.cherry-creek.org.

Such a partnership could identify outside funding from the EPA and other federal agencies which Wake County could use to fund the programs. Wake County might choose to establish a couple of pilot watershed stewardship programs in more critical subwatersheds throughout the county to determine the benefits and costs of operating such programs.

Coupled with the stewardship program, the County may also want to consider a “Challenge Grant” program that offers financial and technical assistance to each watershed group. A similar program is operated by the Bay Area Open Space Council in San Francisco, CA. This program offers a way for local citizens to get involved and stay involved in stewardship activities. Challenge grants range from $1,000 to $10,000, and typically pay for equipment necessary to complete monitoring activities. Grants can also be used for training, documentation, mapping and paying for services associated with monitoring activities.

Wake County Urban Forestry Program

As an integral part of the land stewardship program, Wake County should also institute an urban forestry program. The urban forest of Wake County is the aggregate of all vegetation within the county's urban communities, neglected landscapes and rural areas. This urban forest has evolved over time, from the early days of Wake County when the landscape was dominated by pine and mixed hardwood forests, to present day where the forest canopy had been and continues to be depleted and replaced by homes, businesses, and roads.

Wake County has been losing its forest canopy during the past 25 years as urban and suburban development begin to dominate the landscape and deplete tracts of forested land.

The purpose of the Wake County Urban Forestry Program would be to establish policies, programs and activities that would recognize the economic, quality of life, recreational, aesthetic and educational values of the urban forest. Most importantly, an urban forestry program would serve to protect the remaining forest canopy, enhance habitat for existing trees and seek to replace trees lost to urban, suburban and rural land development practices.

To accomplish this, Wake County should implement an urban forestry program that would:

- Improve public awareness of urban forestry
- promote partnerships with the public and private sector
- foster community involvement in forestry practices
- define new regulations to protect the County's urban forest
- establish tree planting programs
- map and monitor the health of the urban forest.

The urban forestry program would satisfy the above stated goals through the following programs and activities.

Public Awareness and Education:
Wake County should develop a variety of public education programs and tools to disseminate information about the value and importance of the urban forest. These could include promotional videos or compact disks that discuss the importance of trees to the environment, quality of life and local economy. A brochure should be prepared that defines actions and activities that county residents can participate in to improve the health of the urban forest. The county's web site should also be used to disseminate information about the urban forest.

Public and Private Partnerships:
Wake County will need to form partnerships with other public sector agencies such as municipal governments, the North Carolina Division of Forest Resources, the North Carolina Urban Forest Council and North Carolina State University. These partnerships can become the operational foundation for the program and the county can utilize the expertise and resources of these agencies to carry out its urban forestry mission.

Community Forestry Practices:
The County should partner with NC State University College of Natural Resources and other organizations to sponsor educational sessions for residents to participate in hands-on training for tree planting and maintenance programs. The County can utilize its partnerships to promote tree giveaway programs, National Arbor Day programs, backyard planting programs for wildlife and erosion control practices that utilize trees and vegetation plantings.

Tree Protection Regulations:
Wake County may choose to implement county-wide regulations that would serve to protect trees and the forest canopy. Ordinances are public policy tools that are used to protect the health, safety and welfare of the community. There are many different types of regulatory approaches that can be pursued, and each would require further study to determine an appropriate strategy.

One regulatory approach would be to establish landscape and tree protection requirements for new land use development. Under this ordinance, existing trees would be protected as land is transformed from forested to urban, suburban and rural uses. Normally, tree protection plans would be submitted and approved by the County.

Another regulatory approach would protect trees on public lands and rights of way. Through this approach, only qualified persons employed by agencies would be allowed to care for and remove trees located on public rights of way and public lands.

A final regulatory program would regulate the timbering of private lands. This is a common practice in North Carolina and serves to supply a significant amount of annual timber harvest in our state. A timber harvest ordinance would not prevent harvesting, but rather seek to define best management practices, limit where hauling trucks can travel to prevent damage to roads and surrounding lands, and define the range of timber that can be removed from a property.

Tree Giveaway and Planting Programs:
One of the most effective programs that Wake County can implement would be annual or quarterly tree giveaway programs. Through an urban forestry program, the county can work with local residents to plant seed-

lings and saplings in strategic locations throughout the county to restore the urban forest canopy. The county again can achieve this program through its partnership with other public and private sector groups.

Mapping and Monitoring of Tree Canopy:
Wake County should begin to compile a GIS-based program that would monitor the health of the urban forest. Using image enhancement software and infra-red aerial photography, the County would first establish a baseline for the urban forest. With the baseline established, the County would then conduct an annual update to define the status of the forest canopy and determine where urban forest management activities and programs are needed.

Wake County Environmental Stewardship Policy

Wake County has a broadly focused agenda and program for environmental stewardship and protection. Wake County is one of the leaders in the State of North Carolina and the nation with respect to defining the need for an integrated approach to growth management and environmental stewardship. The Open Space Plan is one of the programs that is implemented by the County towards this end. The following Environmental Stewardship Agenda was adopted by the Board of County Commissioners and has been instrumental in guiding the planning and implementation activities of the County.

ENVIRONMENTAL STEWARDSHIP AGENDA
ADOPTED APRIL 1, 2002
Executive Summary
Wake County, North Carolina
Fiscal Year 2001-02

VISION
Wake County will have clean air and water; adequate, convenient open space; properly managed solid waste; and a healthy environment protected against terrorist threats. People in Wake County will be environmentally literate and will take personal responsibility to support this vision.

1. WATER QUALITY
Wake County will protect and restore the uses and functions of the County's water resources in a manner that is consistent with the community's values. Lead groups- Watershed Management Task Force, Department of Environmental Services
A. Complete a countywide Watershed Management Plan by July 2002.
B. Initiate a Groundwater Sustainability Study by June 2002.

2. OPEN SPACE
Wake County will maintain its "Green Infrastructure and maintain water quality. Lead groups- Open Space Advisory Committee; Partners for Open space and the Environment and Parks Recreation and Open Space
A. Complete a Consolidated Open Space Plan by the fall of 2002
B. Acquire Open Spaces in priority areas in accordance with Phase I of the open space plan.
C. Adopt Parks and Recreation Master Plan by June 30, 2002

3. AIR QUALITY
Wake County will supplement the state's air quality monitoring program with programs to improve air quality and to educate and involve people in ways that they can improve air quality and protect themselves during periods of poor air quality. Lead groups- Environmental Services Committee, General Services, Department of Environmental Services
A. Assess Wake County Operations and Practices that affect air quality in Fiscal Year 03.
B. Encourage Alternatives to the Single-Occupant Automobile through support of Triangle Transit Authority, Capital Area Metropolitan Planning Organization.
C. Explore use of Alternative Fuel Vehicles and Enhanced Fuel Mileage Vehicles for Wake County fleet in Fiscal Year 03
D. Actively participate in the State's Air Awareness Program

4. SOLID WASTE
Wake County will take the lead to reduce the amount of solid waste per capita being landfilled and determine the optimal long-term option for disposal of municipal solid waste. Lead groups- Solid Waste division of Department of Environmental Services; Facilities Design and Construction.
A. The Board of Commissioners will decide on the optimal solution for Solid Waste Disposal by February 2003.
B. Enhance opportunities to Reduce, Reuse and Recycle Solid Waste on a continuing basis.
C. Encourage Recycling Businesses and Markets through the Solid Waste Reduction Grant Program- two funding cycles during the Fiscal Year.

5. PUBLIC/ENVIRONMENTAL HEALTH
Wake County will enhance its capabilities to ensure that the public is not exposed to illness or injury. Lead groups- Food, Institution and Sanitation and Animal Control divisions of Environmental Services.
A. Expand the spay/neutering program into municipalities by July 2002.
B. Expand programs to train 100 Food Service Managers annually
C. Reduce risks related to on-site water and wastewater pollution through enhanced inspections, field surveys and responses to complaints.
D. Respond to reports of elevated Blood Lead Levels within 10 days.
E. Prepare for possible Bio-terrorism

6. ENVIRONMENTAL EDUCATION AND ETHICS

Wake County will enhance the potential for success of the Environmental Stewardship Agenda by educating and encouraging an environmental ethic among the general public. Lead groups- Environmental Services Committee, Environmental Network.

A. The Wake County Environmental Network will prepare a collaborative environmental education program addressing the general public, schools in Wake County and Wake County Personnel.

B. The Environmental Services Committee will conduct a forum to be called Community Success Forum- Partnerships for the Environment on September 25, 2002 in conjunction with the Greater Raleigh Chamber of Commerce.

F

Appendix F: Open Space Prioritization Process

Introduction

The Wake County Open Space Plan has been developed from four primary sources of information: the Wake County Watershed Management Plan (prepared by CH2M Hill in conjunction with this study), Wake County's Geographic Information System (GIS), identification of natural and human resources from county and state planning agencies, and input from citizens and municipal staff and officials. The maps presented in this chapter have been produced using GIS. GIS is an application-based tool used to analyze spatial data and provide for detailed geographic analysis. The strength of GIS is its ability to overlay separate layers of information and reveal patterns of interrelated landscape features. Once spatial relationships are determined and patterns revealed, decisions can be made and implemented to meet the goals defined.

For the Wake County Open Space Plan, GIS has been used to document existing open space, parks and greenway facilities, municipal boundaries, roads, streams and other pertinent geographical data. The Watershed Management Plan examined 81 watersheds within Wake County for water quality and quantity issues and prioritized resources to define landscapes that are in need of protection. This Open Space Plan has taken 12 of the top 25 prioritized watersheds and conducted additional analysis in order to define the highest prioirty lands for acquisition. By combining the results of these two studies, along with the completed municipal open space plans, critical open space areas and potential corridors for protection have emerged. The County will complete the evaluation for the remaining 13 top priority watersheds. Additionally, the County will evaluate and prioritize land for each of the 81 watersheds using the methodology outlined within this appendix.

The strength of using GIS to define the future Wake County Open Space system is its ability to combine complex information through a dynamic matrix so that important interrelationships are identified. Additionally, the matrix can evolve as more data is assembled and made available. The benefit of producing the Wake County Open Space Plan in GIS is that the information can easily be reproduced, updated, shared and incorporated immediately for local and county-wide planning strategies. The result of this effort will allow local municipal governments to coordinate future and present open space acquisition and protection efforts.

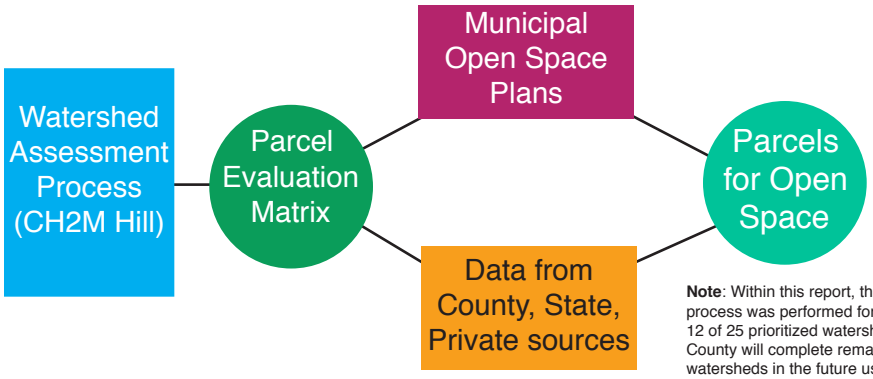
From Watersheds to Parcels

The Watershed Management Plan conducted an assessment of 81 subwatersheds throughout the County to determined the ecological health of the county's streams and rivers. This assessment focused on ecological, cultural, spatial, and temporal elements. In addition to this assessment, each of the twelve municipalities in Wake County formulated individual open space plans. This chapter of the Open Space Plan report combines these separate efforts into one comprehensive approach. The focus of this chapter was to develop a resource list, based on a parcel prioritization process, that identifies key land areas in Wake County (down to the parcel level) suitable for open space acquisition.

The analysis and classification of watersheds was conducted at the macro-level. The watershed assessment methodology by CH2M Hill focused and identified areas for protection and/or restoration activities in which resources should be concentrated. In order to prioritize parcels targeted for open space, a multi-layered, weighted analysis matrix was developed by Greenways Incorporated. This matrix was developed using the existing Geographic Information System (GIS) database provided by Wake County, as well as information obtained from the State of North Carolina and non-profit organizations. in addition, each municipality prioritized other land areas.

Evaluating individual parcels for potential acquisition, using the Parcel Prioritization Methodology, requires a thorough process, based on objective criteria, in order to justify acquisition decisions. This is especially important when prospective open space and conservation land sellers are 'competing' for limited acquisition funds. Furthermore, a Wake County decision to decline an offer or donation of land or easement must also be defensible, based on the best available data for that parcel. Described on the following pages is a summary of the watershed assessment process used by CH2M Hill, the parcel prioritization methodology by Greenways Incorporated, and the municipal-level property evaluation process that have been used to define specific parcels of land to be included within the Wake County Open Space Plan.

Parcel Identification and Prioritization Process



Note: Within this report, this process was performed for the top 12 of 25 prioritized watersheds. County will complete remaining watersheds in the future using this

Watershed Assessment (Macro-level)

All 81 watersheds in Wake County were prioritized by combining multiple GIS layers. Each layer is described below. Each feature within the GIS layer was given a rank between 1 and 5 (1 having the lowest priority and 5 having the highest). For example, within the rare, threatened, or endangered species layer, a threatened species was assigned a value of 4, while an endangered species was assigned a value of 5. The overlapping features of the layers were then summed to give an overall rank by watershed.

The following priority watershed maps were created:

- Human Resources Needs Watersheds – These are watersheds prioritized based on the potential to have an impact on human health within the County. The parameters include areas that contain water supply waters, organized aquatic recreation, groundwater recharge areas, or parkland.
- Natural Resources Needs Watersheds – These are watersheds prioritized based on the potential to have an impact on sensitive aquatic and terrestrial species. The parameters include areas that contain significant natural heritage areas or rare, threatened, or endangered species.

Human Resource Needs

A GIS analysis was performed to rank the relative priority of the County's 81 watersheds from a human resources needs perspective. The following layers were considered when assigning priority to the watersheds:

- water supply watersheds
- recreational waters
- groundwater recharge areas
- parklands

Water Supply Watersheds

At the first Watershed Management Plan Task Force (TF) meeting, it was agreed that water supply watersheds should be given highest priority for protection. Thus, the land area within each watershed classified as water supply was assigned a weighted value of 5, the highest weight assigned to any feature.

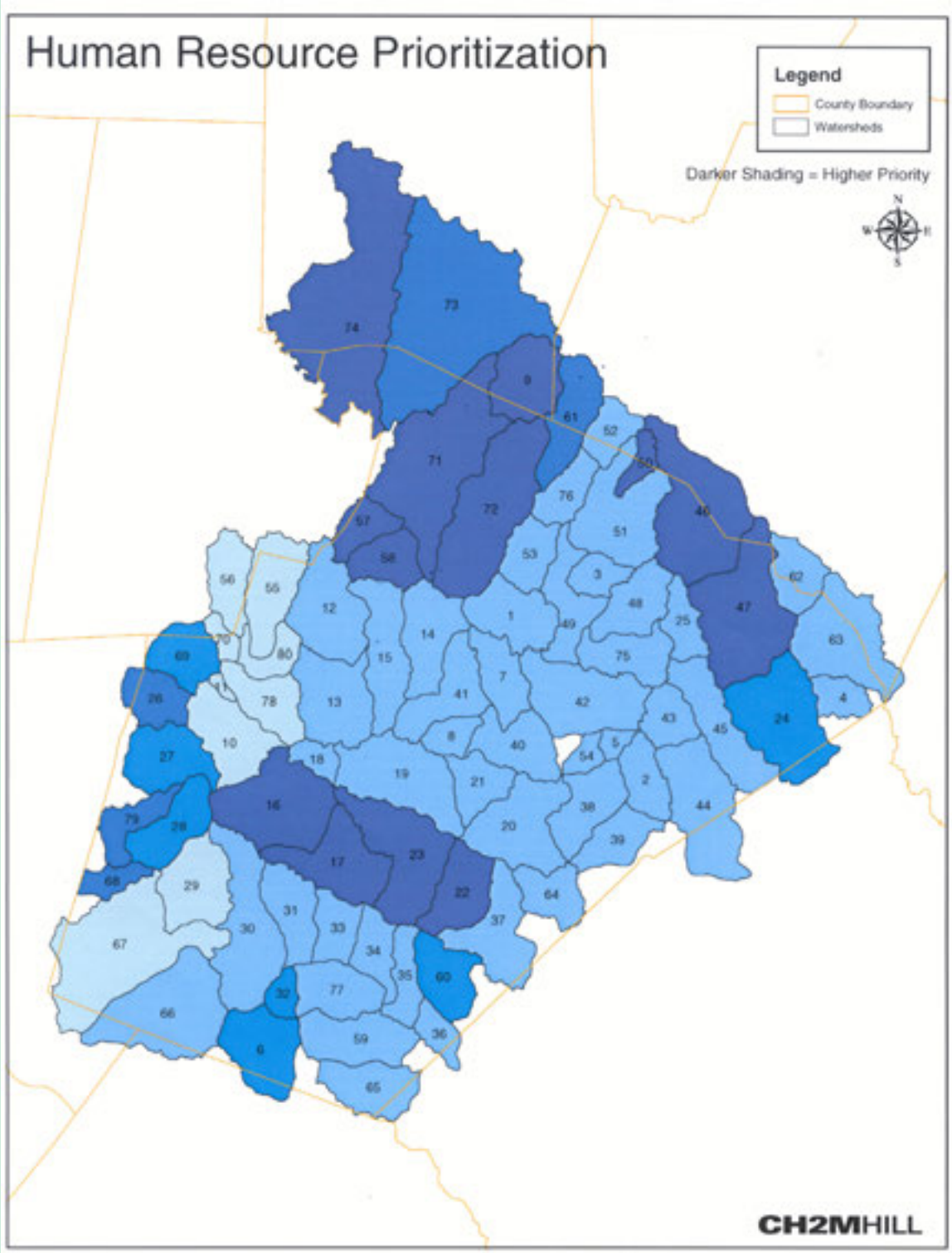
Recreation Waters

A second layer is recreational waters. These waters were identified by two methods. First, waters classified as "B" waters by the North Carolina Division of Water Quality were included. These are waters that can support organized recreation. In addition, streams running through parkland that were not already rated as "B" waters were included. These waters were added because they could be used on a more frequent basis for wading and other activities and should be protected as a human resource need. These two layers were assigned a weighted value of 4 to determine the relative importance of recreation waters in each watershed.

Groundwater Recharge Areas

The Task Force indicated that maintaining an adequate groundwater supply was one of the objectives of the Watershed Management Plan.

Therefore, the entire study area was given a ranked value of 1-5 based on the groundwater recharge rate. A value of 1 was assigned to those areas with low recharge rates while a value of 5 was assigned to those areas with higher recharge rates. The groundwater recharge rates were based on the draft results of a study being done by the Division of Water Quality's Groundwater Section.



Parkland
From a public use perspective, parks need protection since they are utilized for recreation. In addition, parks that have waters running through them may have public support for protection for health issues as well as aesthetics. Since the public health threat is low however, parks were given a lower weighting factor than other human resource needs and were assigned a value of 1.

Overall Human Resource Needs Priorities
The priority values for water supply, recreational waters, groundwater recharge and parkland were summed for each watershed. The watersheds were then normalized by watershed area to allow comparison. Normalized watersheds did not receive a higher priority score simply based on its size. The highest value corresponds to the highest priority from a human resources need standpoint.

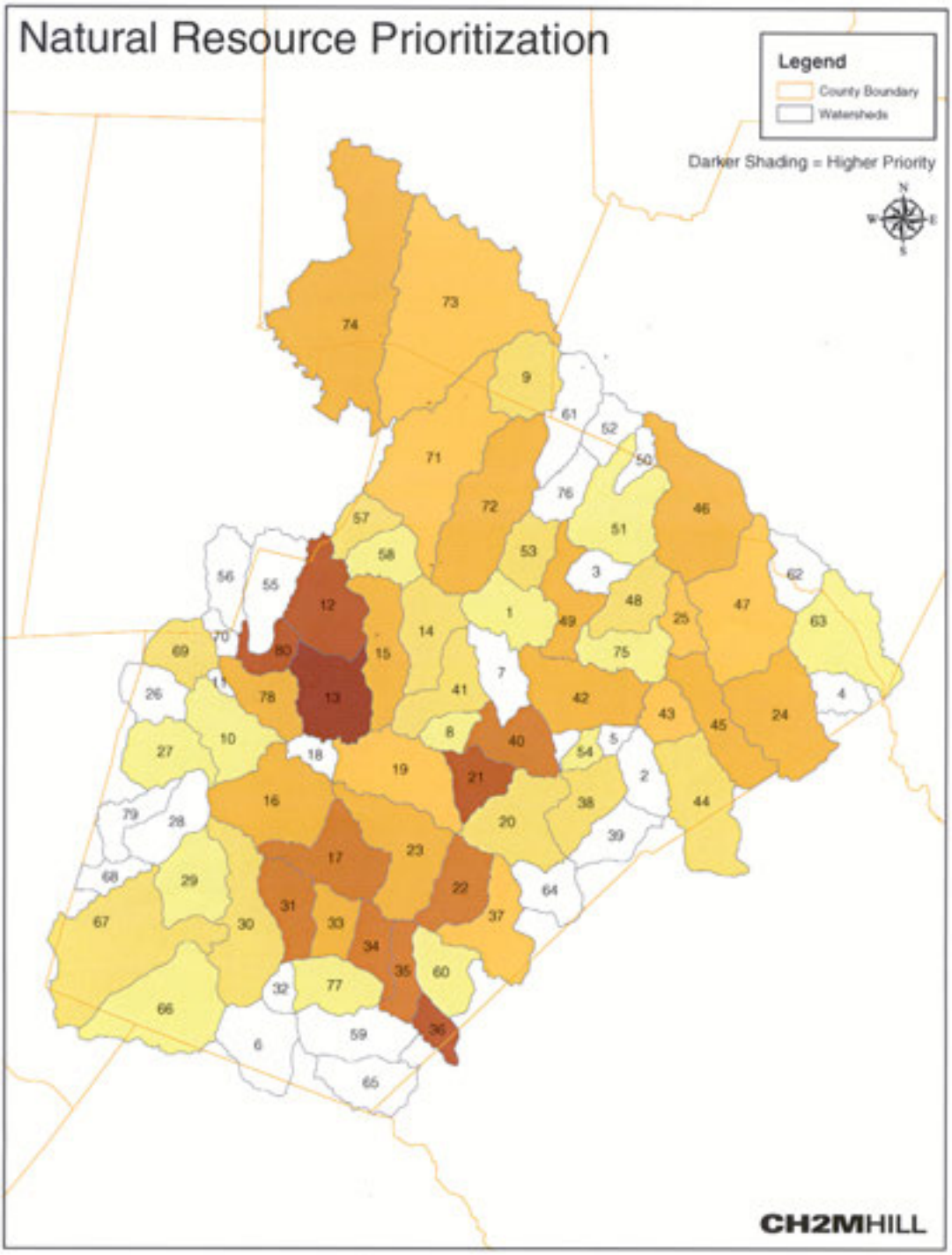
Natural Resources Needs

A GIS analysis was performed to rank the relative priority of the County's 81 watersheds from a natural resources needs perspective. Specifically, watersheds with rare, threatened, or endangered species or which contain a significant natural heritage area (sites that contain a biodiverse habitat) were given priority.

Rare, Threatened, and Endangered Species
The state status (rare, threatened, or endangered) was used to prioritize watersheds. After reviewing the list of rare, threatened, and endangered species within the County, it was determined aquatic and terrestrial species should be assigned an equivalent weight since the majority of the terrestrial species were dependent on good water quality. Their habitats were described as wetlands, streambanks, and lakes. Natural Heritage Program staff (Linda Pearsall, personal communication) indicated they concurred with that approach. Natural Heritage Program staff also indicated aquatic species should be evaluated to include a 200-foot corridor on either side of the stream, and portions of the watershed upstream of the aquatic occurrence should be included. A one-mile segment upstream of the element occurrence was included in the analysis. The entire watershed was not included since some of the natural heritage elements were located within lakes and large watersheds, and it was felt that these occurrences would get higher priority based simply on the size of the watershed.

The state's database also indicates whether a given species occurrence was historic or based on more recent observations. Historic sitings were given a lower weight based on input from the Natural Heritage Program. It should be noted that for historic listings, there is no evidence the species has been destroyed at that location.
The following weights were applied to each occurrence (note the aquatic corridor included for aquatic species):

- Endangered- recent or historic observation – 5
- Threatened/recent observation – 4



- Threatened/historic observation – 3
- Special Concern/recent observation – 3
- Special Concern/historic observation – 2
- Significantly rare/recent or historic observation – 1

The final comment from Natural Heritage Program was that sites with more occurrences of rare, threatened, or endangered species should get higher priority. Since each occurrence was accounted for, a watershed with multiple sitings of rare, threatened, and endangered species should receive a higher weight.

The Natural Heritage Program's database also includes natural communities or special habitats. Most of these communities overlapped with the significant natural heritage areas and were not included in this portion of the analysis in order to avoid double counting them. However, there was one natural community that was not on the significant natural heritage area list, and this community was assigned a priority value based on the size of the area and a weight of 5 was applied based on the endangered status code.

Significant Natural Heritage Areas
A significant natural heritage area is an area within the State that contains a habitat that supports biodiversity. These sites are rated in terms of their significance. For this analysis, the following weights were assigned and normalized by the area of the watershed:

- National significance – 3
- State significance – 2
- Regional or Local significance – 1

Overall Natural Resources Needs Priorities
The priority values for all rare, threatened, and endangered species and significant natural heritage areas within a given watershed were summed, then normalized by the watershed area. This normalization ensures a watershed was not assigned a higher priority based solely on its size.

Prioritization Analysis

Greenways Incorporated utilized a prioritization analysis to identify areas that may warrant additional watershed protection measures, and where resources should be concentrated to protect and restore watersheds.

Priority watershed areas (based on sub-watershed basins), were determined for identifying water quality needs, and those watersheds impacted by future growth (see watershed prioritization methodology). The criterion in the Watershed Assessment (CH2M Hill) used two separate categories of data to reflect Human Resource Prioritization, and Natural Resource Prioritization. Each category based the criteria on levels of overall water quality health and future growth's affect on water quality.

The parcel prioritization methodology targeted areas for open space acquisition and protection based on a two-tiered process of evaluation. The first component is an objective, scientific evaluation of the 81 watersheds. The second component is a community-based evaluation comprised of the 12 individual municipalities of Wake County and the unincorporated areas within the county. The results of this two-tiered approach led to the identification of lands for open space acquisition and protection. The results of both ecological evaluation and community evaluation areas are shown on the accompanying maps.

Matrix Evaluation Criteria

Parcel Prioritization Methodology

Resource Evaluation

The resource evaluation focuses both the ecological and community resources for the priority watersheds that are identified in the Watershed Management Plan. Of the 81 watersheds that make up Wake County, this study prioritized areas for water quality protection. The priority watershed areas were then evaluated for ecological factors that contained criteria such as:

- land coverage (forested tracts, and associated vegetative areas)
- land use (urban, rural, suburban)
- streams
- wetlands
- water recharge areas
- soils (hydric, slope, erodibility)
- FEMA (flood zones)
- areas supporting unique or rare natural communities

A matrix was developed that selected land areas based on size (parcels 50 acres to 500 acres), and proximity to four water quality based criteria:

- water recharge areas
- wetlands (NWI)
- hydric soils (perennially and seasonally wet)
- Federal Emergency Management Agency (FEMA) streams

Using a set of queries that focused on these characteristics, a prioritized listing for open space was developed.

Digital information obtained from Wake County, the State of North Carolina, and North Carolina CGIA, along with ArcView and Arc Map GIS software, was used to identify, rank, and prioritize areas of existing open space with the highest natural values suitable for acquisition or conservation.

In order to apply the matrix, the data from the two watershed prioritization study categories where combined and then ranked by sub-basin. This was then further broken into seven ranked watershed priority areas for each category. The 81 watersheds in Wake County were classified from highest to lowest priority based on water quality, with 1 having the lowest priority and 7 having the highest priority. A score of 6.0 to 7.0+ indicates that parcels within these individual watershed areas should be the highest priority in the system. A score of 5.0 to 5.99 indicates that a parcel should be considered for inclusion within the system. A score of 4.0 to 4.99 indicates that the parcel should be considered for inclusion within the system under objective criteria established by outside factors that are not identified by the applied matrix, such as the inclusion of a significant natural site. A score of 3.0 to 3.99 indicates that the parcel should be considered for inclusion within the system under subjective criteria established by outside factors that are not identified by the applied matrix, such as the inclusion of a significant historic site. A score of 2.0 to 2.99 indicates that the area should not be considered unless there are special circumstances. A score of 0.0 to 1.99 indicates that the area should not

be considered unless there are special circumstances, such as a donation of land. The highest ranked categories (those ranked 7, 6.0-7.0+) were combined to formulate the final targeted areas. The macro-level targeted parcel information derived from the matrix was further prioritized by the subjective identification of parcels from two separate categories ranked further by municipal, county, and nonprofit organization data input. The matrix was then applied to this final targeted priority watershed area.

Matrix Application Process

The matrix derived from the macro-level view of the county (watershed assessment and municipal plans) was used to determine potential target areas for parcel identification for open space acquisition. The criteria that makes up the matrix includes four separate categories:

- water recharge areas
- wetlands
- FEMA (100 year flood)
- hydric soils (both perennial and seasonally wet

Within these separate categories, criteria were established based on two functions: all parcels meeting the criteria of the category that are 30 feet from the category and all parcels 50 acres or greater. Thirty feet was used because studies have shown that this is the minimum distance that will function as a buffer to protect water quality (Wenger and Flower, 2000). Fifty acres was used because studies have shown this is the smallest size in acreage that can function as wildlife habitat (Stutz, B., 1989). A matrix (parcel identification) was developed from all parcels within 30 feet and 50 acres in size or greater from criteria listed below:

- Criteria Soil Moisture:
  1. Hydric soils
  2. Contains areas of perennial wet soils and seasonally wet soils within 30 feet
  3. 50 acres or greater in size

- Criteria FEMA (100-year flood zone):
  1. Parcel within 30 feet
  2. 50 acres or greater in size
  3. current FEMA 100-year flood data

- Criteria Wetlands:
  1. Parcel within 30 feet
  2. 50 acres or greater in size, as defined by the current GIS data

- Criteria Water Recharge Areas:
  1. Parcel within 30 feet
  2. 50 acres or greater in size, as defined by the current GIS data

Use of Matrix Prioritization Analysis

In order to apply the matrix to the final targeted priority watershed area, each parcel was subjected to a set of equally weighted criteria that was used to rank and identify the final targeted parcel areas. To arrive at the individual parcel level, categories that where not considered in the macro-level watershed analysis, such as micro-level municipal, county, and nonprofit input data, where integrated into the final analysis. The categories where broken down into two areas: ecological resources and community resources. Each category was made up of criteria that ranked three levels for parcel identification.

The criteria focused on the micro-level of each parcel (unlike the macro-level determination) where every one was ranked for each category. The parcel areas then could be classified from highest to lowest priority based on the matrix criteria with 1 having the lowest priority and 3 having the highest priority. Each parcel was given priority based on the total score, or total number of criteria each met. The highest total score would be 21 and the lowest 0. It must be noted that not all parcels will meet all of the criteria or a total score of 21 (for the highest priority). In addition, all criteria in each category must be ranked separately and then combined to determine the overall ranking. Attempts to validate the ranking of a property based on one category criterion should not be used. As an example, the highest cumulative score (divided by the number of criteria in each category) indicates that a parcel should be included within the Open Space System. Conversely, a cumulative lowest score indicates that a parcel should not be included within the system at this time unless there are special circumstances.

By equally weighting the criteria, the model allows the ranking score to be adjusted to reflect the number of criteria each parcel meets for the highest score. As example, if all criteria are met in a selected priority watershed area, a score of 15 to 21 indicates that a parcel should be considered for inclusion within the system. Therefore, it should be given the highest priority for acquisition or protection. A score of 8.0 to 14 indicates that the parcel should be considered for inclusion within the system under objective criteria established by outside factors that are not identified by the applied matrix, such as the inclusion of a significant natural site. A score of 0.0 to 7.0 indicates that the parcel should be considered for inclusion within the system under subjective criteria established by outside factors that are not identified by the applied matrix, or there are special circumstances. The highest ranked categories (those ranked 15.0-21.0) were combined to formulate the final targeted areas.

The GIS database consists of several variables (or “layers”) that the criteria was derived from. These include natural and cultural resource data. Each variable represents different resources or features, such as:

- parcel proximity to hydric soils
- ecology
- vegetation communities
- wildlife habitat
- parks and greenways

- historic sites and buildings
- riparian buffers
- natural heritage resources
- wetlands
- water recharge areas
- floodplains

Before applying the matrix, parcels within a city or town's municipal limits, along with outlying sub-divisions, were excluded because they are either developed, contain mostly impervious areas, and/or are less than 50 acres in size. Each variable is ranked on a scale from 0 to 3 according to a specific value. As an example, the variable "Vegetation Communities" is ranked according to the type of existing vegetation.

Bottomland forests, hardwood swamps and mixed upland hardwoods would contain the highest quality for wildlife habitat, and are assigned a value of 3. An area in cultivation, managed herbaceous cover, and/or southern yellow pine has a value of 1.

Another example would be historic sites. A site listed on the National Register of Historic Places is given a value of 3, while a site on the state's National Register Study List has a value of 2.

Variables are then 'weighted' according to planning objectives. For example, the Wake County Open Space Plan Matrix gives a higher significance to upland hardwood forests, bottomland forests, floodplain forests and wetlands, because they are areas critical to water quality issues. While the variable rankings are based on objective scientific criteria and GIS analysis, the weighting of variables lends a subjective element to the analysis. Currently, upland hardwood forests, hardwood swamps and bottomland forests (ranking of 3) are weighted by a factor of 3. Although the Mixed Hardwoods/Conifers, evergreen shrubland, and deciduous shrubland are also weighted by a factor of 3, the data is only as good as the current GIS information and is weighted based on water quality issues.

The matrix was then applied to this final targeted priority watershed area using the following criteria. The matrix prioritization analysis can be used to identify areas where additional watershed protection measures may be warranted, where resources should be concentrated to protect and restore watersheds and where open space acquisition should occur.

The final level of prioritization must remain in a steady state of dynamic analysis. For example, the matrix allows for each individual community to use both public and private inputs to enrich the overall goal of protection or use of open space parcels. Municipal Prioritization Analysis is a needed tool to focus on subjective inputs that in the end reveal the refined micro-level parcel identification on a manageable acquisition level.

Category 1 Ecological Evaluation:

This is an evaluation of important vegetation, soil-limiting factors, and habitat for wildlife that is listed on the NC Natural Heritage Element Occurrence list within the Wake County, region, or state. Parcels that possess significant natural composition are also added. The lands that could be targeted for open space acquisition based on ecological factors alone and/or protection are identified.

These areas are important open space lands (no matter which sub-watershed they are in) to target for acquisition or protection because they are the most ecologically significant areas within the highest priority watershed areas. They may include areas of agricultural, historical, and recreational significance.

For example, a parcel within one of these targeted areas could serve to improve water quality while supporting wildlife habitat, and protecting historic property and offering hiking opportunities. The areas are based on the results of the ecological evaluation alone. The targeted areas are only one component of the larger plan, as ecological factors are one component being considered into the development of plan recommendations.

- Criteria Vegetative Communities:

  1). Parcel is not considered significant, does not possess any unique vegetation, and is quite commonly found in other portions of the Wake County. These areas include cultivated, managed herbaceous cover, and southern yellow pine.
  2). Parcel is considered significant because of vegetation that is significant, but is common in other parts of the Wake County. These areas include, mixed hardwoods/conifers, evergreen shrubland, and deciduous shrubland.
  3). Parcel possesses good examples of unique vegetation, and is common only to selected regions of the Wake County. These areas include bottomland forest, hardwood swamps, and mixed upland hardwoods.

- Criteria Wildlife Habitat:

  1). Parcel is not considered significant, does not possess any unique, wildlife habitat, or natural composition, and is quite commonly found in other portions of the Wake County.
  2). Parcel is considered significant because of unique/significant wildlife habitat or natural composition, but is common in other parts of the Wake County.
  3). Parcel possesses good examples of wildlife habitat, and species listed on the NC Natural Heritage Element Occurrence list, and is common only to selected regions of the Wake County.

- Criteria Soil Limitations: (soil erodibility)
  These factors affect water quality and are identified from the Wake

County Soil Survey pages 78-79, and SSURGO information.

1). Severe - Parcel is not considered because of severe soil erosion if disturbed, and or slopes are greater than 10 percent
2). Moderate - Parcel is considered moderate where best management practices can minimize soil erosion, and or slopes are between 6 and 10 percent.
3). Slight - Parcels have low or slight soil erosion limitations, and or have slopes between 0 and 6 percent.

Category score equals cumulative points divided by three.

Category 2: Community Evaluation

An evaluation of where the property is located within the Wake County Open Space Plan as it relates to the human influences upon the land, and the human uses of the landscape.

For the open space strategies in Wake County to work in partnership with the 12 communities that fall within the county, additional resources need to be evaluated based on factors other than ecological. Human-based factors need to be considered. Each community underwent an evaluation as part of the open space study that examined such features as historic sites, farmland, land use, schools, existing/future municipal boundaries, and proximity of proposed/existing parks and greenways. Information was obtained from Wake County and local government open space plans.

The community evaluation examined lands that met many of the criteria listed in the prioritization section of this study, and other significant areas identified by public input through workshops held as part of each community's open space planning efforts. Each community evaluation included lands within corporate limits, ETJ's of local governments, and within each municipal study boundary. These areas are the responsibility of each individual municipality. However Wake County will serve as a facilitator and partner by assisting local governments in protecting open space within their jurisdictions and helping to complete open space connections between municipal areas.

- Criteria: Historic sites and significant buildings

  1). Parcel is not considered significant, does not possess any unique feature, and does not meet 50-year historic age.
  2). Parcel is considered significant because of, unique feature or is listed on the National Register Study List. Parcel also meets 50-year age requirement.
  3). Parcel possesses good examples of historic features and/or building and is listed as a NC Historic site, Wake County site, or is a site listed on the National Register of Historic Places. Parcel meets 50-year age requirement.

  Category score equals cumulative points.

- Criteria: Location
  An evaluation of where the property is located outside of a municipality's town limits.
  1). Parcel is located within a town ETJ and adjacent to existing Open Space areas.
  2). Parcel is located in an area outside of a town Extraterritorial Jurisdiction (ETJ).
  3). Parcel is located within the ETJ, not associated with existing Open Space areas.

- Criteria: Recreation
  An evaluation of the parcel's connectivity to existing open space, parks, and/or natural areas.

  1). Parcel is unsuitable for any form of open space or recreational use, and will require significant repair to bring it to Wake County of Wake County standards for these purposes.

  2). Parcel has limited potential for open space or recreational use. The parcel can support limited passive recreation if carefully managed. The parcel can be used for limited scientific, utility, or educational purposes.
  3). Parcel has potential for unlimited passive recreational uses, and has several qualities which make it desirable for utility, infrastructure, scientific, or educational purposes.

- Criteria: Schools
  A potential to host recreational activities, proximity to existing public/private open space parcels and other public facilities.

  1). Parcel is located in an area 2 miles or greater from an existing School.
  2). Parcel is located 1/2 to 2 miles from an existing School.
  3). Parcel is located within 1/2 mile or less from an existing School.

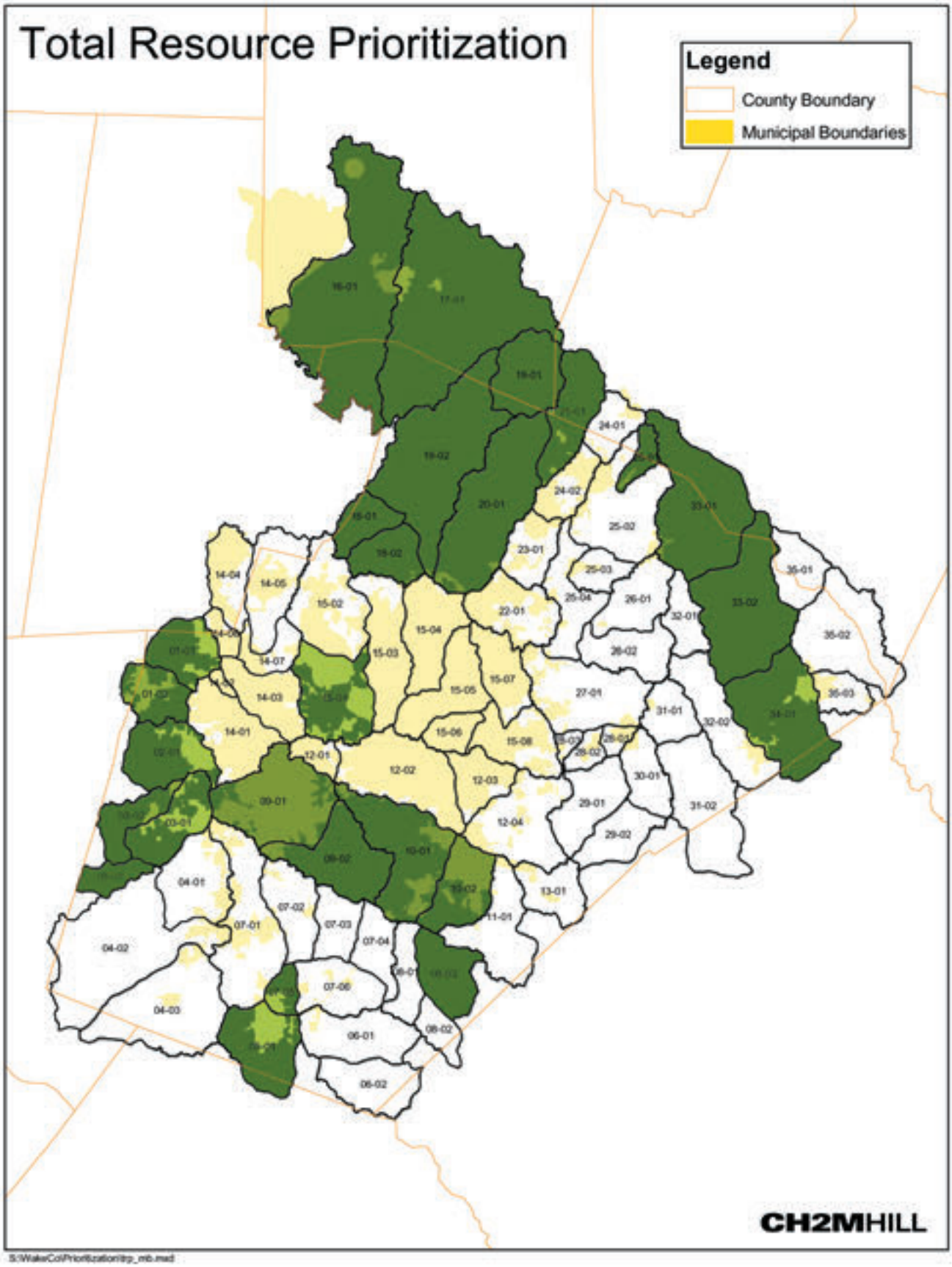
  Category score equals cumulative points divide by 3.

Cumulative Matrix Methodology

After each category is ranked, it can then be included in the final parcel area determination. In order to narrow the parcel areas down even further, the cumulative scores of categories 1 (Ecology, Culture and Space) and 2 (Time/Opportunity) are tallied. The highest score available is 21. The higher the score is, the higher the priority for acquisition. The scores will be ranked as follows:

- 15 to 21 - 1st priority acquisition
- 8 to 14 - 2nd priority acquisition
- 0 to 7 - 3rd priority acquisition

The ecological evaluation and community evaluation employed a sequential multi-level ranking procedure. A set of queries for increasingly detailed spatial scales is answered (e.g., first levels looks at County-wide

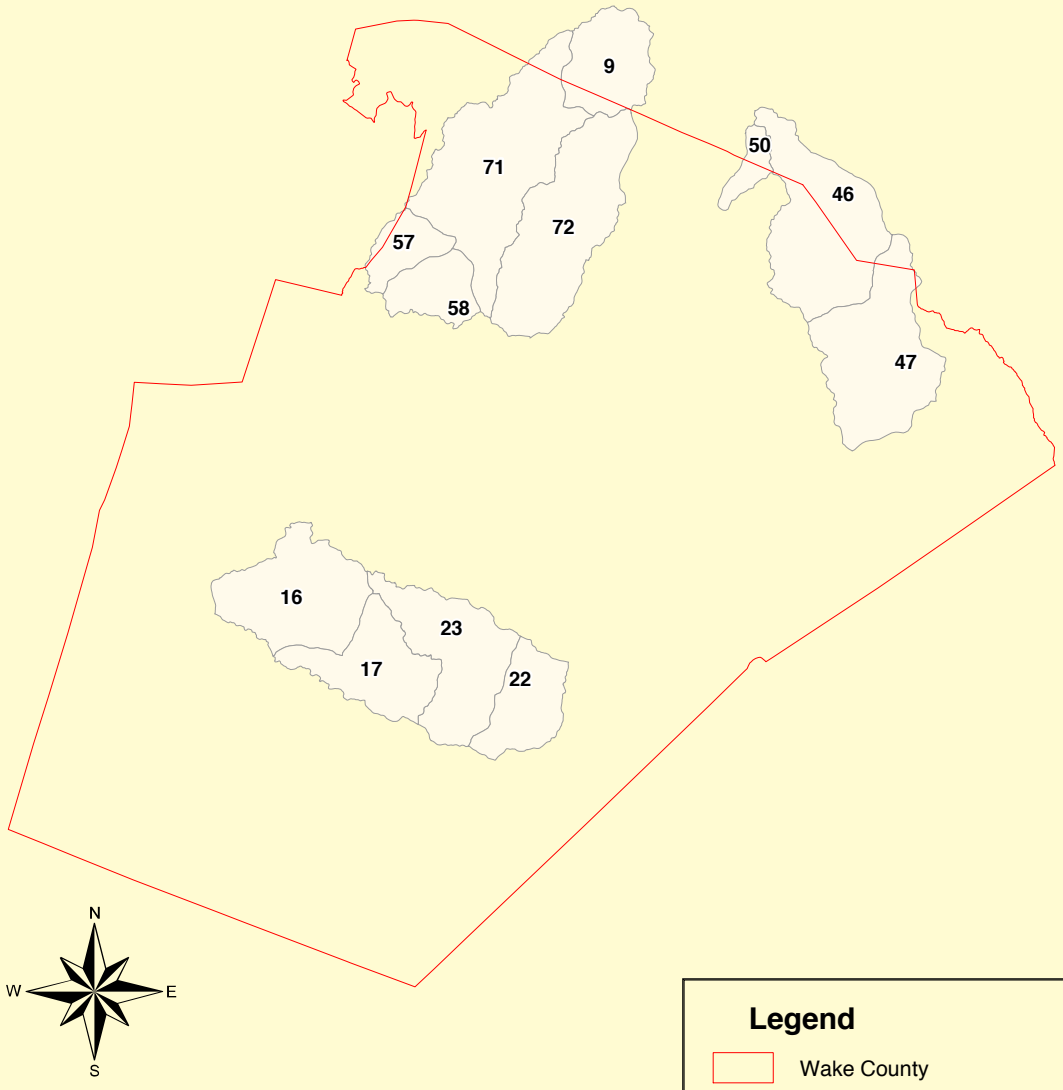

Total Resource Prioritization
Legend
County Boundary
Municipal Boundaries
CH2MHILL

level while the last level focuses on characteristics of specific parcel areas). Scores for each query are weighted to reflect the importance of the particular characteristic, and the sites are ranked based on the sum of the weighted scores. The highest scored site for each of the priority watershed areas goes onto the next level of more spatially detailed evaluation and ranking. Scores, weighting and rankings were conducted to identify sites for both conservation and acquisition goals (for both active and passive recreation).

The **level one** analysis is a coarse evaluation at the county scale which evaluates and ranks watersheds on characteristics such as whether

Priority One Watershed Area

Level Two



NOTE:
Level Two prioritizes sub-basin watersheds based on discrete characteristics such as Human Resources Needs and Natural Resources Needs.

the sub-watershed is classified as healthy, healthy based on land use, impacted, impacted/restorable, impacted based on land use, impacted based on land use\restorable, degraded, and degraded/restorable.

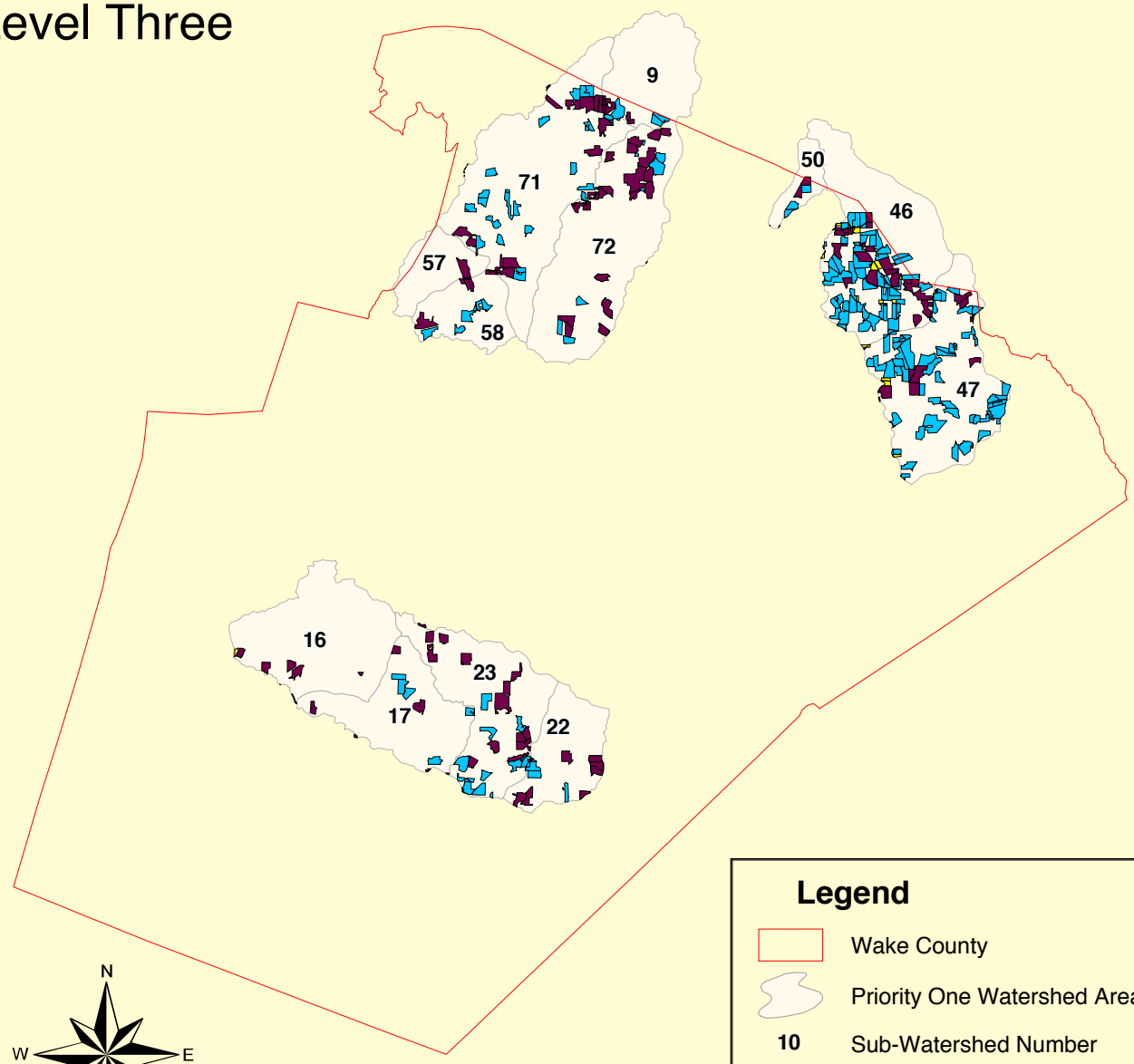
Level two was developed to prioritize sub watersheds within Wake County, which evaluated each based on natural resource and human resource prioritization (see CH2MHILL Water Quality Study). This level combines the highest ranked watersheds into seven areas of prioritization with 1 being the highest priority watershed area to acquire or protect. This ranking focused on characteristics for natural resource prioritization as plant, animal, special habitat, natural community, hydrology, and occurrence as a State Natural Heritage Area (SNHA); National, State, Regional, or Local. The Human Resource Prioritization focused on water wells, hydrology, recreational waters, open space (parks, etc.), and water supply watersheds. The highest ranked sub watersheds in each watershed were then subjected to level three ranking.

Level three prioritizes areas based on discrete characteristics such as water recharge areas, wetlands (NWI data), hydric soils, and FEMA flood data.

Level 4 is the last filter applied to prioritize the highest ranked areas of interest for immediate acquisition and/or protection. This level evaluates and ranks each selected area based on the score obtained from significant criteria for both environmental resources and human resources. Each criteria focuses on the micro-level of each selected area and the significance of occurrence and/or the proximity to a selected area. The criteria includes wildlife habitat, recreation (connectivity to open space, parks, etc.), ecology of vegetative areas (forested or managed land coverage's), and soils (slope and erodibility factors). The Human Resource criteria included historic sites/buildings, schools, and municipality location to selected areas.

Priority One Watershed Area

Level Three



NOTE:
Level Three prioritizes parcels based on discrete characteristics such as Water Recharge Areas, FEMA Stream data, Wetlands, and Hydric Soils. Level 3 Priority One Parcels are the highest ranked followed by Level 3 Priority Two Parcels, and Level 3 Priority Three Parcels which are ranked the lowest.

By using a matrix evaluation system to quantify and rank variables according to cumulative values, the evaluation can be performed at a scale necessary to incorporate resource areas and arrive at an individual parcel level through subjective inputs by individual municipalities. The system is then used to establish a 'priority list' of sites for acquisition or protection. The priority list should then be used to field verify the existence of priority resources within previously identified areas by county, municipal, and/or nonprofit organizations.

Though the above categories will already be identified through the matrix, the MPA parcel data input would enrich the process by identifying parcels not included in the matrix, but that are deemed important to each individual community, the county, and citizens.

The MPA Map can be overlaid on the Cumulative Matrix Map to determine where it is ideal to protect land, not only from a water quality perspective, but also from an ecological, cultural and opportunity perspective.

Municipal Prioritization Analysis

The Municipal Prioritization Analysis (MPA) is a separate analysis from the Watershed Prioritization analysis. Both share the common goals of protection and open space acquisition, but the MPA acts like a final filter that has inputs to the matrix.

The Information was gathered for this analysis from existing Wake County, State and Federal GIS databases, along with public input. The primary focus of the municipal plans were to help identify areas that were deemed important due to the unique attributes and or character of the area.

Individual Open Space Plans were developed to be consistent with the larger comprehensive Open Space Plan for Wake County. The County has encouraged and supported the preparation and adoption of the municipal open space plans to ensure that there is continuity across jurisdictions. Each municipal plan focused on a multi-objective system, largely based on community input from the public, businesses, civic and community organizations, and public agencies. Open space was prioritized to fulfill multiple objectives, including:

- Better Floodplain Management
- Protecting Wildlife Habitat
- Improving Water Quality
- Providing for Recreation
- Encouraging Environmental and Cultural Education
- Promoting Personal Fitness
- Accommodating Alternative Transportation
- Serving as Recreational Resources

Results

In the Wake County Water Quality Watershed Study, seven priority watershed areas were selected from the 81, sub-watersheds included within Wake County (Level one). Focusing on these seven watersheds, the methodology (Level two) was used to evaluate and rank the opportunities for conserving open space in these priority areas. The result of the Level two analysis was that areas in the upper falls lake watershed, swift creek watershed, and upper little river and moccasin creek watershed were ranked first of the seven for both natural resource and human resource prioritization (see CH2MHILL Water Quality Watershed Study).

Following this effort, the methodology (level three) was used to identify, rank, and prioritize the open space areas in the number one ranked watershed areas as determined by the matrix. The level three ranking identified the highest-ranking parcel areas within the watershed area based on the size and influence on water quality. Finally, level four identified the most significant parcel areas as determined by the set of criteria in the micro-level determination for acquisition and/or protection.

Each individual municipal plan offers a more detailed explanation of the significance of the community areas selected. Refer to Chapter 3 and accompanying maps for individual municipalities. The community areas selected for parks (passive and/or active use), or greenways are based on the results of both public and local government inputs.

The areas selected are only one part of the overall plan, and each section should be looked at as a component of the larger county plan. Ecological factors have been considered in the development of these plan recommendations, with a focus on water quality as the most desirable goal. For the most part, many of these areas are not a contiguous set of parcels of land, but are instead streamside buffers and overland connections. Local residents and local governments, in addition to Task members, expressed a desire to protect the connection of open space, instead of isolating areas, while focusing on water quality protection, during the planning process.

References:

Wenger, S.J., and Flower, L. 2000. Protecting Stream and River Corridors: Creating Effective Local Riparian Buffer Ordinances. Carl Vinson Institute of Government, University of Georgia. USA.

Stutz, B. 1989. Up Against Ecology. Landscape Architecture. Washington DC. Pp. 44-49.

Individual Parcel Evaluation Process

The following is a property evaluation process that will be used to compare properties identified through the macro-level prioritization process. The purpose of using the following criteria would be to compare and contrast nominated parcels and determine which properties would rank highest for acquisition within the Wake County Open Space System.

Qualitative Evaluation Criteria

The ranking system used to evaluate each criteria of the parcel in question is itemized below. All criteria must be ranked separately and combined to determine the overall ranking. A score of 50 and higher indicates that a parcel should be included within the System. A score of 30 to 49 indicates that the parcel should be considered for inclusion. A score of 0 to 29 indicates that the parcel should not be included within the System at this time.

Location—An evaluation of where the property is located within the county. (Note: Location is the position of the parcel within rural, suburban or urban areas of the County. A parcel that is surrounded by highly urbanized lands would rate higher than a parcel in a rural area because of the potential for imminent loss). For parcels of 25 acres or less that are located in the most densley populated areas of the County, add a multiplier of 2 to the score.

1—Parcel is located in a rural area of county, but not within a sensitive watershed area.

2—Parcel is located within an urban growth area, but outside a sensitive watershed area, and the area is not experiencing immediate suburban growth and development.

3—Parcel is located within an urban growth area, outside a sensitive watershed area, and within an area which is experiencing rapid growth.

4—Parcel is located within an urban growth area, is within a sensitive watershed area, and is within an area experiencing rapid growth.

5—Parcel is located within an urban growth area, outside a sensitive watershed area, and is included within a project for which development plans have been submitted to the county for approval.

6— Parcel is located within an urban growth area, is located within a sensitive watershed area, and is included within a project for which development plans have been submitted to the county for approval.

7—Parcel is located within an urban area of the county, outside a sen-

sitive watershed area, and is currently surrounded by urban/suburban development.

8—Parcel is located within an urban area of the county, is located within a sensitive watershed area, and is currently surrounded by urban/suburban development.

Linkage – Defines the importance of the parcel within the overall greenway system and its ability to serve as a vital link or connector to the overall greenway system.

0—Parcel does not link to any portion of the Greenway system.

1—Parcel is at the end of an undeveloped greenway corridor, and does not link to any existing adjacent development portions of the county.

3—Parcel is at the end of an undeveloped greenway corridor, and links to surrounding parks, residential neighborhoods, schools, businesses or other community destinations.

4—Parcel is located in the mid section of an undeveloped greenway corridor and also links to surrounding parks, residential neighborhoods, schools, businesses or other community destinations.

5—Parcel is located between two segments of existing developed greenway facilities, as well as to surrounding park, residential neighborhoods, schools, businesses or other community facility.

Proximity—Where is the parcel of land located in terms of its proximity to surrounding, existing public/private open space parcels, schools, activity centers, residential neighborhoods or community destinations? (Note: Proximity is the relative position of the parcel of land to other important landscapes throughout the County. A potential parcel gets a higher score if it is located in close proximity to an important landscape. It gets a lower score if it is farther away from an important landscape.)

1—Parcel is two miles from an existing park, school, activity center, residential neighborhood or community destination.

2—Parcel is between one-quarter mile and two miles from an existing existing park, school, activity center, residential neighborhood or community destination.

3—Parcel is separated from existing park, school, activity center, residential neighborhood or community destination by more than one property or less than one-quarter mile.

4—Parcel is separated from existing park, school, activity center, residential neighborhood or community destination by one property

5—The property lines of the parcel abut an existing park, school, activity center, residential neighborhood or community destination.

Accessibility—The relationship of the property to other transportation routes.

1—Parcel is not accessible to the public. Parcel is totally isolated from all existing and proposed forms of access.

2—Parcel is not currently accessible to the public, but is in close proximity to at least one form of existing public access. Adjacent landowners are not willing to grant right of public access.

3—Parcel has at least one form of public access, adjacent property owners are willing to grant the right of public access.

4—Parcel has at least one form of public access but does not have existing infrastructure in place to provide for immediate public access.

5—Parcel has at least two forms of public access and can be immediately accessed by public.

6--Parcel is located within 1/4 mile of a mass transit station.

Aesthetic Quality—An evaluation of the property's scenic qualities or outstanding physical characteristics, such as significant geologic formation, unique vegetation, outstanding views of surrounding landscape, or is a significant parcel of land due to the composition of its natural resources.

1—Parcel has little or no aesthetic quality, and very little natural value remains.

2—Parcel has very limited aesthetic quality and would require extensive human modifications to become an appealing property.

3—Parcel has a variety of dispersed aesthetic qualities which, if successfully exposed, would make the site appealing and a valued natural resource.

4—Parcel has one significant aesthetic quality which makes it an appealing and attractive natural resource.

5—Parcel has several outstanding aesthetic qualities which have made it an attractive, noteworthy property and one which serves as a natural landmark within the overall landscape.

Use/Utility—An evaluation of the property's ability to accept a number of specific uses for active or passive recreation, scientific (biological, zoological), or educational (parochial, college) purposes.

1—Parcel is unsuitable for any form of human use.

2—Parcel has limited potential for human use. The parcel can support limited passive recreation if this recreation is carefully managed. The parcel can be used for limited scientific or educational purposes.

3—Parcel has opportunity for unlimited passive recreation use, and can support a limited range of active recreation uses. Parcel has limited scientific and educational value.

4—Parcel provides opportunity for unlimited passive recreation uses, and is capable of supporting a wide range of active recreation uses. Parcel has several qualities which make it desirable for scientific or educational purposes.

5—Parcel provides opportunity for unlimited range of passive and active recreation uses. Parcel has several qualities which make it desirable for educational and scientific purposes.

On Open Space Plan—The property is located within one of the designated land types in the adopted Wake County Open Space Plan.

1—Parcel is not located within selected land types as illustrated on Open Space Plan, nor is included within land types as defined by Open Space Plan.

2—Parcel is not located within selected land types as illustrated on Open Space Plan, nor is included within land types as defined by Open Space Plan, but should receive consideration for inclusion within Plan because it has received a high overall ranking.

3—Parcel is located within selected land types as illustrated on Open Space Plan, and is included within land types as defined by Open Space Plan, but is not located in a high priority category.

4—Parcel is located within selected land types as illustrated on Open Space Plan, and is included within land types as defined by Open Space Plan, and is located in a high priority category.

5—Parcel is located within selected land types as illustrated on Open Space Plan, and is included within land types as defined by Open Space Plan, and is located in a high priority category, and requires immediate action for protection.

Threat of Loss—An evaluation of the property in terms of the current land use and the pace of urban/suburban growth.

1—Parcel is guaranteed to be conserved and protected by a deed restriction, easement, or established regulatory authority in its natural condition.

2—Some regulatory authority currently protects property in its natural condition. Potential for urban/suburban development is low.

3—Regulatory authority does not provide adequate protection of property in its natural condition. Property is considered average for potential urban/suburban development.

4—Current owner has expressed a desire to sell property or develop property in near future. No regulatory authority exists to protect property in its natural condition. Property is considered excellent for potential urban/suburban development.

5—Parcel is slated for immediate development. No regulatory authority exists to protect property in its natural condition.

Rarity—An evaluation of whether the parcel contains rare species of vegetation, supports a habitat for wildlife which is rapidly disappearing within the county, or is regarded as a property which possesses significant natural composition.
1—Parcel is not considered rare, does not possess any unique vegetation, wildlife habitat, or natural composition, and is quite commonly found in other portions of the county.

2—Parcel is considered significant because of vegetation, wildlife habitat, or natural composition that is significant, but is common in other parts of the county.

3—Parcel possesses good examples of rare vegetation, or wildlife habitat, or natural composition, and is common only to selected regions of the county.

4—Parcel contains rare vegetation, or wildlife habitat, or natural composition, and is found only in a few properties located within the county.

5—Parcel contains rare vegetation, or wildlife habitat, or natural composition, and is considered to be the only parcel within the county to exhibit these resources.

Flood Plain Protection—An evaluation of the property reveals that it contains flood plain and drainage basins that are part of the county's stormwater or drinking water system, or the stormwater or drinking water system for another city government. The stream is subject to the Clean Water Act permitting process due to the stormwater or drinking water system. Add a multiplier of 2 to the total score.

1—Parcel contains a flood plain and drainage conveyance, but the stream is not a regulated stream of the state or federal government.

2—Parcel contains a flood plain and drainage conveyance, and is a federal, state or county regulated stream.

3—Parcel contains a flood plain and drainage conveyance, and is a federal, state or county regulated stream, but is not a primary source for a stormwwater or drinking water system, but is a tributary stream to the system.

4—Parcel contains a flood plain and drainage conveyance, is a federal, state or county regulated stream, is on the primary stream of the stormwater or drinking water system, but has limited development potential due to frequent flooding.

5—Parcel contains a flood plain and drainage conveyance, is a federal, state or county regulated stream, is on the primary stream of the stormwater or drinking water system, and has high development potential but no approved development plan.

6—Parcel contains a flood plain and drainage conveyance, is a federal, state or county regulated stream, is on the primary stream of the waste water or drinking water system, and has high development potential and a development plan has been submitted to the county for approval.

Cultural/Historic Resources—An evaluation of whether the parcel contains documented cultural resources, listed historic buildings or landscapes, or known cultural resources, or historical buildings or landscapes that are rapidly disappearing or being encroached upon within the county. (Note: For properties that are eligible for the Registry of Historic Places or for state or federal list of Protected Properties, add a multiplier of 2 to the total score)

1—Parcel does not contain documented cultural resources, or listed historic building or landscapes, or known cultural resources, or historical buildings and landscapes.

2—Parcel is considered significant because of documented or known cultural resources, listed historic buildings or landscapes, or historical buildings or landscapes, but these are common throughout the county.

3—Parcel possesses good examples of documented or known cultural resources, listed historic buildings or landscapes, or historical buildings or landscapes, but these are common to selected sections of the county.

4—Parcel contains documented or known cultural resources, listed historic buildings or landscapes, or historical buildings or landscapes, that are rare in the county.

5—Parcel contains documented or known cultural resources, listed historic buildings or landscapes, or historical buildings or landscapes that are considered to be the best, or only parcel within the county to contain these resources.

Manageability—An evaluation of the parcel based upon the ability of a public or private agency to effectively manage the land so that it does not become a nuisance to the community.

1--Parcel is unmanageable due to location, size. Proper management from a public or private agency, other than the county, is unlikely. Landform is unmanageable.

2--Parcel is difficult to manage due to frequent occurrence of natural disasters, because it is located outside reasonable distance for proper management, and is too expensive to effectively manage. Landform is difficult to manage. Proper management may be inefficient.
3--Parcel will require constant management. Landform provides opportunity for effective management. Public or private agency is able to assume responsibilities. Difficult location for management.

4--Parcel will require regular management. Landform lends itself to ease of management. Public or private agency can assume immediate management. Location of parcel is convenient for management.

5--Parcel requires little management. Public or private agency is already managing property.

Quantitative Evaluation

The following criteria could be used to determine which specific parcels of land are to be included within the Open Space System.

Cost—A complete financial evaluation should be prepared by the county to determine the value of the property, whether the county will be required to purchase the property, if the sale of the property to the county will result in a loss of tax revenues, and the ability of the county to purchase the land.

Present tax value of property $_____

Appraised value of property $_____

$_____

$_____

_____Parcel will require purchase at fair market value.
_____Parcel can be purchased at less than fair market value.
_____Parcel can be purchased at a negotiated price.
_____Parcel will be donated to county.
_____Sale of property will result in a loss of tax revenues which are considerable.
_____Sale of property will result in a loss of tax revenues which are considered to be insignificant.
_____County is unable to purchase property.
_____County is able to allocate partial funds for purchase of property, must find another source of funding.
_____County is able to obtain full title to property in part through payment of funds to landowner and donation of property to county.
_____No cost is involved in obtaining full title to property.

Property Evaluation Form

Size of Parcel: _____ acres
Shape of Parcel: Please attach survey or a reproduction of property configuration from County Planning GIS maps.
Name of Parcel:
File No: _____
Tax Map Parcel Number: _____
Owner/Phone: _____
Address: _____
_____
_____

SITE CHARACTERISTICS
Topography:_____
Vegetation:_____
Stream or lake:_____
Soils:_____
Utility lines, easements:_____
Existing structures & conditions:_____
Flood Plain:_____
Wetlands:_____
Accessible by the following road type:
Residential _____ Collector_____ Arterial _____
Other (please specify) _____
Unique features:_____

SITE LIABILITIES
(Note concerns about erosion, trash, dumping, mosquitoes, water, pests, access, maintenance & policing capabilities, etc.)
_____
_____

Level 1 Environmental assessment is available:
Yes_____ No _____

USE/UTILITY: (good, fair, poor?)
Unique flora/fauna:_____
Wildlife habitat:_____
Groundwater recharge:_____
Flood protection:_____
Active recreation:_____
Passive recreation:_____
Historic interpretation:_____
Scientific research:_____

RANKING: Overall Score:_____ (from Qualitative Criteria)

Criteria	Score*	Comments
Location	_____	_____
Linkage	_____	_____
Proximity	_____	_____
Accessibility	_____	_____
Aesthetic Quality	_____	_____
Use/Utility	_____	_____
On Open Space Plan		_____
Threat of Loss	_____	_____
Rarity	_____	_____
Flood Plain Protection		_____
Cultural Historic Resources		_____

(*include any multipliers in total)

SUMMARY: _____
_____

STAFF RECOMMENDATION:
Zoning:_____
Purchase:_____
Reservation:_____
Density Credits:_____
Dedication:_____
Fee-in-Lieu:_____
Accept as Gift:_____
Lease:_____
Easement Required:_____
Option:_____
TDR:_____
PDR:_____
Non-profit organization:_____

Completed By:_____

Date_____

G

Appendix G: ArcView GIS Data Sets

GIS Files Received from Wake County

Wake County
- Streets (streets.shp)
- Lakes (lakes.shp)
- Hydro (hydro.shp)
- Outer Loop (outerloop.shp)
- FEMA Flood Zone (femafloods_wake.shp)
- Existing Parks and Open Space (parks_open_space.shp)
- Federal Land (fedlandclip.shp)
- County Lines (outercounties.shp)

GIS Files Created

Greenways Incorporated
- Existing Private Greenways (existing private gw.shp) - combined file of private greenway files
- Existing Wake County Greenway System (existing wake county gw system.shp) - combined file of existing greenway files
- Proposed Wake County Greenway System (proposed wake county gw system.shp) - combined file of proposed greenway files
- Proposed Connection Greenways (propconnectiongreenways.shp)
- Proposed Conservation Greenways (conservation greenways.shp)
- Proposed Central Parks (central parks.shp) - combined file of all proposed central park files
- Proposed Satellite Parks (proposed satellite parks.shp) - combined file of all proposed satellite park files
- Proposed Connection Bike Routes (prop connect bike.shp)
- Proposed Wake County Bike Routes (proposed wake county bike routes.shp) - combined file of proposed bike route files
- Existing Wake County Bike Routes (ex_bike_rte.shp) - combined file of existing bike route files

GIS Files Submitted by Municipalities

Town of Apex/Haden Stanziale
- Existing Bike Routes (Ex_Bike_Rte.shp)
- Existing Greenways (Ex_Greenway.shp)
- Existing Private Greenways (Ex_private_greenway.shp)
- Proposed Greenways (Proposed_Greenway.shp)
- Land Acquisition Zones (Land_Aquistion_Zones.shp)

Town of Cary/Cary Parks and Recreation
- Cary Greenways (Cary GW.shp)
- Open Space (cary_openspace_sa.shp)

Town of Fuquay-Varina/Greenways Incorporated & EcoScience
- Fuquay-Varina Greenways (Fuquay GW.shp)

Town of Garner/Greenways Incorporated
- Central Park (Garner Central Park.shp)
- Proposed Greenways (Garnerprogreenwaysgwi.shp)
- Proposed Open Space (garproopenspacegwi.shp)
- Existing Open Space (garnerexiopenspacegwi.shp)
- Proposed Sidewalks (garnerprosidewalksgwi.shp)
- Existing Sidewalks (garnerexisidewalkgwi.shp)
- Existing Parks (garnerexiparks.shp)

Town of Holly Springs/Thompson & Associates
- No Data Provided, Plan in Progress

Town of Knightdale/Greenways Incorporated
- Central Park (KnightCentralPark_gwi.shp)
- Proposed Parks (proposedparksgwi.shp)
- Proposed Bike Routes (KnightBikeroutes_gwi.shp)
- Proposed Greenway Alignment (progreenwayalignment_ gwijp.shp)

Town of Morrisville/Haden Stanziale
- Morrisville Greenways (Morrisville_greenways.shp)

City of Raleigh
- Existing and Proposed Greenways (greenway.mdb)
- Existing and Proposed Parks (Raleigh_Parks.shp)

Town of Rolesville/Greenways Incorporated
- Central Park (centralpark.shp)
- Satellite Parks (satelliteparks.shp)
- Main Street Park (mainstreetpark.shp)
- Natural Area Park (NaturalAreaPark.shp

- Buffalo Creek Trail (BuffaloCreekTrail.shp)
- Bypass Trail (BypassTrail.shp)
- Cedar Fork Trail (CedarForkTrail.shp)
- Granatic Rock Trail (GranaticRockTrail.shp)
- Harris Creek Trail (HarrisCreekTrail.shp)
- Main Street Trail (MainStreetTrail.shp)
- Perry Creek Trail (PerryCreekTrail.shp)
- Sanford Creek Trail (SanfordCreekTrail.shp)
- Toms Creek Trail (TomsCreekTrail.shp)
- Nature Trail Loop (NatureTrailLoop.shp)
- Chalk Road Bike Route (ChalkBikeRoute.shp)
- Jonesville Road Bike Route (JonesvilleBikeRoute.shp)
- Quarry Road Bike Route (QuarryBikeRoute.shp)
- Rogers Road Bike Route (RogersBikeRoute.shp)

Town of Wake Forest/Greenways Incorporated

- Central Park (wfcentralpark.shp)
- Proposed Greenways (wfgreenwaysPL_JP.shp)
- Future Open Space (wffutureopenspace1015.shp)
- Bypass (wfbypass.shp)

Towns of Wendell & Zebulon/Greenways Incorporated

- Central Park (centralpark.shp)
- Satellite Parks (satelliteparks.shp)
- Upper Buffalo Trail (upperbuffalo.shp)
- Little River Greenways (littlerivergrwy.shp)
- Little River Reservoir Greenway (little riverrestrail.shp)
- Upper Moccasin Greenway (uppermoccasingwy.shp)
- Beaver Dam Trail (beaverdam.shp)
- Lower Moccasin Greenway (lowermoccasin.shp)
- East/West Greenway (eastwestgreenway.shp)
- Lower Buffalo Trail (lowerbuffalo.shp)
- Hominy Creek Trail (hominycreek.shp)
- Marks Creek Trail (markscreek.shp)
- Selma Bike Route (selmabike.shp)
- Bike Plan (bikeplan.shp)

Other GIS Data Sets Used

Triangle J Council of Governments
- Triangle J Trails (TriangleJTrails_JCOG.shp)

Town of Zebulon
- Multi-Modal Transportation Plan (multimodal.shp)

Town of Cary
- Cary Parks and Recreation Web Site
- Cary Open Space Plan Web Site

City of Raleigh
- Raleigh Parks and Recreation Web Site

Appendix H: Stream Habitat Assessment

Introduction

CH2MHill and Greenways Incorporated conducted Stream Habitat Assessments on several streams throughout Wake County to determine the affect of development density and stream buffers on water quality. The two reasons that these assessments were done was:

- to see how well various widths of buffers work with different types of development densities; and
- to establish base information for prescriptive buffers for future development.

Two types of stream testing were used. Stream Habitat was observed to determine the opportunity for wildlife. Stream Stability was rated to show the amount a stream will change because of human influences. (See attached form).

Methodology

Visual stream habitat assessment protocols have evolved from approaches that generally focused on using habitat indices (such as physical features) to relate the population of a target species (such as trout) to habitat characteristics in a stream. The usual goal of such work is to define limiting habitat factors to allow managers to manipulate stream habitat conditions to enhance fish populations. Another use of habitat indices is to determine the minimum or optimal stream flows that would protect habitat characteristics essential to the life history of one or more target species.

Most recently, habitat indices have been used as an integral part of water pollution control programs. These habitat assessment programs are visually based and use habitat indices to characterize the conditions in streams and help verify the potential for waters to support aquatic communities. Most of these habitat techniques focus on aquatic community response rather than species-specific responses to changes in habitat quality, although the concepts are similar.

In 1999, the Mecklenburg County Department of Environmental Protection (MCDEP) conducted a watershed-scale pilot study evaluating the usefulness of three standardized habitat assessment protocols that were selected from a detailed screening and selection process of several standardized stream habitat assessment forms. Three habitat protocols

that were selected for further evaluation were the method adopted by the Georgia Department of Natural Resources (GDNR); the North Carolina Department of Environment and Natural Resources (NCDENR) protocol; and the Ohio EPA's Qualitative Habitat Evaluation Index (QHEI) (Mecklenburg County, 2000).

The results of the pilot study demonstrated that the GDNR protocol, with some minor modifications, was the most appropriate protocol for integrating the Mecklenburg County habitat assessment data with existing biological and water quality program data. This revised GDNR protocol was named Mecklenburg Habitat Assessment Protocol (MHAP). MHAP was selected because of its overall responsiveness and capabilities to semi-quantitatively document habitat conditions. Also, this protocol included a user-friendly procedure (dichotomous key) that minimizes some of the subjectivity inherent in the habitat assessment protocols as a whole. DWQ has concurred with the use of MHAP in North Carolina.

The MHAP protocol has been slightly revised based on refinements made during other projects in Georgia and Virginia. This revised MHAP protocol will be used to collect physical habitat data for the Wake County Open Space Plan. See attached habitat form.

The revised MHAP approach includes assessment parameters for riffle/run-prevalent streams and a different set of parameters more appropriate for glide/pool-prevalent streams. Riffle/run-prevalent streams are those in moderate to high gradient landscapes that sustain water velocities of about 1.0 feet per second (ft/sec) or greater. These streams typically have stream bed sediments (called substrates) primarily composed of coarse sediment particles (such as gravel or larger) or frequent coarse particulate accumulations along the stream reaches. Glide/pool-prevalent streams are those in low to moderate gradient landscapes that have water velocities rarely greater than 1.0 ft/sec, except during storm events. Glide/pool streams have substrates of fine sediment or infrequent accumulations of coarser sediment particles (gravel or larger) along the stream reaches (Barbour and Stribling, 1994).

The physical parameters of the habitat assessment are divided into primary, secondary, and tertiary categories. Primary parameters refer to those in-stream physical characteristics that directly affect the biological community. Primary conditions include substrate and available cover (e.g., logs, rocks to hide under), the extent to which rocks and snags are covered by silt (embeddedness), velocity and depth regimes, and pool variability. Field personnel can evaluate the primary parameters within the location of the riffle/pool sequence.

Secondary parameters (channel alteration, bottom scouring and deposition, channel shape, and channel sinuosity [how much the stream turns or meanders]) relate to channel morphology, which controls the behavior of stream flow and the sediment deposits the stream collects.

The tertiary parameter set deals with the riparian vegetation and stream bank structure. The stability of a stream bank indirectly affects the type of

habitat available within a stream. Vegetated banks reduce the amount of sediment that washes from the stream bank by absorbing energy from the raindrops, binding soil particles, and reducing the velocity of runoff. Less sediment to cover rocks and logs results in more habitats available for colonization by invertebrates or fish (Plafkin et al., 1989; Ball, 1982; Platts et al., 1983).

The habitat assessments conducted followed the methodology outlined in the draft MHAP (2000). (See attached habitat assessment forms). Habitat assessments were conducted to document how various land practices can impact aquatic habitat and potentially the diversity of the aquatic community.

Location Identification

Greenways Incorporated contacted the planning staff of each municipality in Wake County for nominations of testing locations. Eight types of development scenarios were nominated and tested. They include:

- Forest
- Farm with 50-foot Buffer
- Pasture with 25 to 50-foot buffer
- Low Density with buffer
- Low Density without buffer
- Medium Density with buffer
- High Density with buffer
- High Density without buffer

Ten of the nominated sites were then picked in the Cary, Garner and Zebulon areas. The site were picked for their proximity to each other, ease of access and how well they fit the above descriptions. Though the site conditions will vary, keeping all of the sites relatively close to each other helps limit outside influential conditions.

Results

The stream habitat and stream stability assessments reinforced several theories about the relationship between development and water quality:

1. Buffers help protect water quality, as measured by aquatic habitat.
2. Larger buffers do appear to help protect water quality, although buffers by themselves do not protect water quality in developed areas.
3. In order to favorably influence water quality, buffers must be kept intact.
4. It is important to not only buffer major streams, but all tributaries that flow into them.
5. The higher the development density, the lower the habitat score.

Sites with a buffer were more likely to have a higher habitat score and a higher stream stability score than those without buffers. (See graph on page H-6). In each case where there is similar density, the score on the sites with buffers are higher than the sites without buffers. The two exceptions were the low density subdivision without a buffer, Cloverdale,

and the medium density subdivision with a buffer, Hunter's Mark. Cloverdale's habitat score was higher than expected and stability score was lower than expected because it was a well established neighborhood that was over 30 years old. Hunter's Mark, on the other hand, was still under construction, so the scores were not as good as expected. The runoff from construction will temporarily influence the stream's stability and habitat because of the increased sediment load and disturbance. As the Cloverdale site did, these influences will stabilize over time.

Even if a significant buffer is preserved, several other things can influence stream habitat and stability. Some of the favorable influences are Best Management Practices (BMP), like roadside ditches, porous concrete and sand filters, as seen in the Bryarton Subdivision. The age of a project can also favorably influence its stability scores. The older a development becomes, the more stable it becomes, as the Cloverdale Neighborhood showed. Some unfavorable influences to stream habitat and stability are sediment and erosion control failure, mowing and edging of a stream bank, dumping and even the behavior of the property owner across the stream. As an example, even though the Pony Road site was forested on the right side, the homeowner on the left side was mowing his lawn to the edge of the stream. He also increased the instability of the stream bank by filling soil up to the edge to extend his yard. His actions affected the health of the entire stream, despite the ample buffer on the right side.

Even if buffers are sufficient widths, they must be kept intact to be effective. This is apparent at the Rolling Hills Pasture site. Even though the mature buffer was between 25 and 50-feet, cows had eaten all of the herbaceous and shrubby growth. As a result, the buffer was now insufficient to filter the sediment and nitrogen from the pasture. The cows were also allowed to drink from the stream. This practice may have caused the most damage to the stream by breaking up the banks and making them increasingly more unstable. Stepping on the banks also contributes to the amount of sediment in the stream.

If runoff bypasses the majority of a buffer, it does not get filtered. This is exemplified by the Rolling Hills Pasture site. A tributary that was flowing into the main channel split the 50 foot buffer in half. Therefore, the water flowing into this tributary only had a 25-foot buffer, instead of the 50-foot buffer. This bypass influenced the habitat scores of this stream.

The final conclusion from this study is that as the development density increases, the stream habitat score decreases. The influential factor in this relationship is the percentage of impervious surface. The higher the density, the higher the impervious surface. Buffers can help, along with BMP's, as seen in Bryarton Subdivision. The preservation of the buffers and the uses of BMP's, such as porous concrete and roadside ditches, positively influenced the habitat and stability scores of this site. In fact,

the scores were almost as high as the low density neighborhood because of them. Without these BMP's and buffers, the habitat scores decrease rapidly and the stream become more unstable with increased density.

In conclusion, this study shows: density negatively influences stream habitat and stability and BMP's, and buffers can be used to mitigate the impact of development on streams.

The following table summarizes the habitat and stability scores from all of the sites. A habitat score can range from 0 to 200, with 200 being the

Wake County Water Quality Site Visits 3/11/02 - 3/12/02
Habitat Assessments

Density	Site	Habitat	Stability	Comments
1) Farm/Forrest with 100' Buffer	Cedar Fork Creek Reach 2 - Upper	137	3	just downstream of pond, pond will catch sediments, also bed-rock bottom
2) Farm with 50' buffer	Cedar Fork Creek Reach 1 - Lower	130.5	1	sediment from field washing down ditch to bridge (outside of reach)
3) Farm with buffer/ Pasture with no buffer	Pony Road	60.5	21	fill from adjacent pond mass wasting, 15 yr. old buffer on one side, horse damage
4) Pasture with Buffer	Rolling Hills	57		no shrubs in buffer, trib cut buffer in half for 1/2 of the reach
5) Low Density with Buffer (.75 to 1 acre lots)	Rolling Hills	95.5		highly erodible clay soil, some landsliding
6) Low Density without Buffer	Cloverdale	87.25 (113.5+ 61/2)	8	older nieghborhood, yard waste and animal waste dumping
7) Medium Density with Buffer	Hunter's Mark	58	11	lots of sediment, new development, double buffer b/c of sewer easement
8) High Density with Buffer	Bryanton Subdivision	88.5	13.5	hurricane damage, porous concrete, roadside ditches, gutters run into gravel filter
9) High Density without Buffer	George Towne Manor (townhomes)	60	23.5	townhome
10) High Density without Buffer	Forrest Hills (apartments)	43.5	5.5	all rip rap channel, straight, sewer overflows, down-stream highly eroded

best habitat. The opposite is true for stability scores; the lower the better. In general, the breaking point is 20. Any stream over 20 is considered an unstable stream.

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Platts, W.S., W.F. Megahan, and G.W. Minshall. 1983. Methods for Evaluating Stream, Riparian, and Biotic Conditions. General Technical Report No. INT-138, U.s. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah.

Appendix I: Definitions

acquisition – the process of acquiring fee title or interest of real property

Adopt-A-Trail – program in which groups or businesses "adopt" trails and provide volunteer work parties to help maintain trails on a periodic basis

alignment – the layout of a trail in horizontal and vertical planes; the drawing of the curves and slopes of a trail

assessment, trail and corridor – site visits to help understand a trail corridor better, including descriptions/documentations of native elements and built structures

buffer – large strips of forested land adjacent to a water body that filters sediments and pollution from runoff

bike lane – portion of road designated for cyclists by striping and signage

bike route – road segment that is designated as a "bike route" by signage; cyclist must share the road with cars

bikeway – any road, path, trail that is open to bike travel

connectivity – functionally contiguous blacks of land or water through the linkage of parcels of land; linking of trails, greenways and communities

conservation – controlled use and protection of natural resources

conservation easement – places permanent restrictions on property in order to protect natural resources

conservation subdivision – a method for subdividing land in which open space and natural landscape features are set aside, and the building of homes, roads and infrastructure is accomplished in a compact form to reduce the amount of land that is developed.

design standards/guidelines – minimal design details; criteria for designing facilities for this plan

easement – grants the right to use a specific portion of land for a specific purpose

ecosystem – system formed by interaction of plants and animals, including humans, with their environments

flood fringe – difference (width) between the floodplain and floodway

floodplain – elevation and width of water in a hundred year storm

floodway – width needed to contain 100 year flood water if flood elevation is raised one foot; used to determine how high to build roads and structures

GIS – Geographical Information Systems – spatial database mapping system that contains natural and cultural features of a site; used to determine the appropriate place for open space and greenways

greenway – linear open space that is established along a corridor that can be used for connectivity (trails) or water quality protection

impact fee – a fee levied on a developer or builder by a public agency as compensation for impacts produced by their project; can be used for the purchase or maintenance of parks, open space, trails or recreation facilities

intermittent stream – channels that naturally carry water part of the year and are dry other parts of the year

loop trails – circular trails that give users the option of not traveling in the same section more than once

multiuse trails – corridors that are physically separated from vehicular traffic and can be accessed by multiple users, such as cyclists, walkers, runners, wheelchairs, rollerbladers, etc.

open space – **protected** lands and waters that are owned and managed by the County, its public sector partners, the municipal governments of Wake County, State of North Carolina, the United States government, and the County's private sector partners, including non-profit land trusts. Open space consists of any parcel or area of land and water that is devoted to 1) the preservation of natural resources and habitat; 2) the managed production of resources (farmland); 3) outdoor recreation; 4) preservation of historic and cultural property; 5) protection of scenic landscapes; and 6) protection of public health, safety and welfare.

perennial streams – channels that carry water year round

preservation – maintaining an area or structure intact or unchanged

rail corridor – path of a railroad right-of-way, including the tracks and any land owned by the railway on either side; generally 100' wide

revegetation – process of restoring a denuded and/or eroded area close to its original condition.

riparian zone – the land and vegetation directly adjacent to a body of water

runoff – water that is not absorbed by the soil and therefore runs over the soil surface

sidewalk – paved strip directly adjacent to a roadway for pedestrian and wheelchair use

sustainable development – development practice that maintains economic opportunity while protecting the natural environment within a community

tread width – width of the portion of a trail used for travel

watershed – area bounded by a water parting formation, such as ridge, hill, mountain range, and ultimately draining into a body of water