

Final Report

Wake County



Collector Street Plan

A companion to the Wake County Transportation Plan

Wake County *Collector Street Plan*



Kimley-Horn
and Associates, Inc.

April 2004

Table of Contents

Preface

Chapter 1—Introduction

Overview

Why Plan Collector Streets?

Issues

Goals and Objectives

Plan Input

Public Meetings

Chapter 2—Existing Conditions

Background

Street Development Patterns

Why Haven't Enough Collectors Been Built?

Existing Roadway Types

Transportation Plan

Chapter 3—Methodology

Background

Opportunities

Constraints

Land Use Plans and Zoning

Modeling and Collector Street Spacing

Identifying the Network

Chapter 4—Recommended Plan

Introduction

Functional Classification

Guidelines

Traffic Calming

Recommended Plan

Collector Street Plan Maps

Chapter 5—Policy and Implementation

General Recommendations

Recommended Policy Amendments

Water Quality and Stream Crossings

Funding and Phasing

Additional Policy Recommendation

Acknowledgements

Preface

Like most communities, development patterns in Wake County have changed over time. The original plan for Raleigh—platted in 1792 by William Christmas—included 400-foot block lengths with interconnected streets. In rings of growth beyond downtown, a map of Raleigh illustrates how block length has increased over time. Today, typical residential development patterns in unincorporated areas of Wake County do not include streets that connect with neighboring subdivisions. Over time the lack of connectivity will have an increasingly negative impact on the quality of life for the citizens of Wake County.

As planners continue to evaluate suburban development patterns, it is clear that transportation facilities and services greatly impact quality of life. Reduced connectivity minimizes travelers' choices and increases the reliance on the region's major transportation arteries to facilitate a larger share of travel demand. Streets intended to carry cross-town traffic do double duty, carrying cross-town and local trips. Likewise, the scale of new development has increased to the point where it gravitates to the busiest transportation corridors in the community. The end result: a transportation system reliant on a few larger streets rather than an interconnected network of larger (arterial) and smaller (collector) streets. Planners and engineers have identified the shortcomings of this pattern and have documented the impacts such as increased congestion, reduced air quality, and automobile and pedestrian conflicts.

The *Wake County Collector Street Plan* (CSP) was developed to complement the existing transportation and comprehensive plans. It builds on the premise that connections provide choices, improve air quality and safety, reduce congestion, and contribute to an improved quality of life.

The CSP includes this written document and a map, which identify existing and future collector streets. The map identifies a connected transportation network of generalized future corridors for collector streets, not exact street locations. The specific location of future collector streets and the time frame in which they will be constructed will be determined by future development.

It is important to note, however, that simply promoting connectivity will not be enough to ensure “buy-in” from local residents. To function properly, the transportation system will need to demonstrate the benefits of increased mode and route choice as well as provide improved trip convenience. Other benefits may include improved safety by providing enhanced pedestrian and bicycle connections and improved response times for emergency vehicles. It will also be important to engage and educate the public about the potential benefits associated with an enhanced multimodal transportation system that includes vehicular, bicycle, and pedestrian linkages to nearby activity centers and transportation facilities.

The recommendations of the *Wake County Collector Street Plan* will not rid the region of all congestion, air and noise pollution, and crashes. However, by implementing recommendations contained within the plan, Wake County will be planning for the future and making choices that improve the quality of life for its residents.



Low Intensity Residential Collector Street

Overview

An outgrowth of the previously completed *Wake County Transportation Plan*, the collector street plan builds on the success of that plan by identifying existing and future collector street connections to complement and support the thoroughfare plan. Whereas the *Wake County Transportation Plan* was primarily focused on major streets, the collector street plan begins with connector streets and identifies additional locally-oriented travel corridors throughout the County.

adopted *Wake County Transportation Plan*. On a separate summary poster, existing street classifications and alignments as well as future street classifications and connections are identified. The future street network that is identified in the collector street plan emphasizes *CONNECTION* versus *ALIGNMENT*, although numerous potential natural and built environment constraints were considered as connections were included.

Why Plan Collector Streets?

Collector streets are the tributaries of the local transportation network. They provide critical connections throughout the transportation network and bridge the gap between local streets and the arterials of a community. While there are issues related to the implementation of collector streets, the benefits are numerous and include:

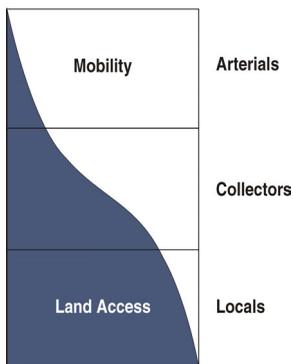
Benefits:

- More reliable and timely emergency response—more as well as direct routes
- Better public services/utilities—interconnected service networks (that generally follow the street) contribute to even and reliable distribution
- More efficient refuse collection—less back-tracking
- Potential for congestion reduction—short trips can be made without using thoroughfares, protecting their capacity for longer trips
- Improved access—locate driveways on collectors, rather than thoroughfares
- Improved local mobility—collectors are frequently ideal corridors for pedestrians, bicyclists, and transit services
- Cost—can be shared between public and private entities, may reduce the need for costly roadway improvements

Issues:

- Impacted water quality—more stream crossings and potential wetland impacts
- Affected wildlife—streets can be barriers and change plant and animal spread/movement and migratory patterns
- Perception—connections may not always be viewed positively by those concerned
- Cost—who pays and how much is contributed by each?

Portion of Service



Arterials primarily serve mobility needs whereas local streets primarily serve land access needs

Mobility and Access

Freeways and thoroughfares fall into the classification of arterials and are primarily focused on providing mobility; collectors balance mobility and access; and local streets are intended to serve an access function with a minimal role in providing mobility. The planning process for this plan was accomplished over a period of approximately 10 months by a project team that included Wake County staff, a project technical steering committee, the general public, and project consultant (Kimley-Horn and Associates, Inc.).

Study Area

The study area for the plan includes the projected long- and short-range urban service areas for the County's municipalities — essentially, the unincorporated areas and locations outside of municipal extra-territorial planning jurisdictions (ETJ). While the

study area includes non-urban areas, it does not include the critical watershed supply areas. These areas were specifically excluded due to their environmental sensitivity and lack of development potential.

This plan is intended to serve as an addendum to the transportation plan and augment that plan with collector street recommendations. The collector street plan includes mapping that indicates collector street facilities throughout the County as well as other elements from the



From a broader perspective, collector streets play an intricate role in the overall transportation network. Nationally, there are interstates and major US routes that provide movement between regions of the country; within the state, these same facilities are joined by State Highways and thoroughfares to accommodate longer distance and cross-town travel. Meanwhile, the local network works in conjunction with collector streets to facilitate access to the higher order streets and to facilitate local trips and land access. In recent years, continued emphasis on thoroughfare planning has overshadowed the importance and benefits of a well integrated network of collector streets.

Issues

As an addendum to the *Wake County Transportation Plan*, this plan is encumbered by a similar set of constraints as was dealt with previously. These include:

- Built environment
- Natural environment (parks, open space, historic/cultural resources, hazardous sites/superfund sites, threatened and endangered species, bodies of water, rivers and streams, wetlands, floodplains, topography, etc.)
- Land use and zoning
- Jurisdictional boundaries

Figures depicting these constraints can be found in Chapter 3 of the *Wake County Transportation Plan* in **Figures 3.2-1** through **Figure 3.2-5**.

Goals and Objectives

The intent of the collector street plan was to build on the success of the transportation plan and focus on collector street interconnectivity. Goals were identified to guide the planning process and generally include:

- Minimizing environmental impacts (general)
- Limiting stream crossings (number and individual impact)
- Identifying street connections (from point A to point B)
- Inventorying existing stub-out streets
- Promoting street connectivity
- Providing opportunities for bicycling and walking
- Developing street spacing guidelines
- Developing traffic calming guidelines
- Developing street cross sections
- Identifying street design considerations
- Recommending new (and enhancement to existing) policies

In addition, the *Wake County Transportation Plan* indicates streets within the County's jurisdiction according to their recommended cross section (i.e., construction plan). The collector street plan adds to this information by also indicating the recommended functional classification of these roadways in the following classes:

- Freeway
- Major thoroughfare
- Minor thoroughfare
- Collector street

Plan Input

A steering committee was formed to provide additional plan guidance and technical expertise. Members of the steering committee represented numerous public agencies throughout the County and also included members of the Wake County Planning Board. The primary role of the steering committee was to provide technical guidance and review of recommendations in the plan. Throughout the planning process, the steering committee met on a monthly basis.

Meeting topics included:

- A “super-block” summary
- Identification of opportunities and constraints
- Suitability (environmental constraints) mapping
- Definition of a collector street
- What a collector street looks like (street typology)
- Street network density (street spacing)
- Collector street design guidelines
- Traffic calming
- Multimodal links
- Policies
- Cost implications
- Plan recommendations

Public Meetings

Three public workshops were held during the early portion of the planning process to gather public input on the components of the collector street plan. The workshops were held on the following dates and locations:

- Tuesday, August 12, 2003—Wake County Office Park
- Thursday, August 14, 2003—Wake Forest Town Hall
- Tuesday, August 19, 2003—Apex Town Hall

The collector street plan map was distributed to all of the municipalities within Wake County as well as the following agencies: NCDOT, Capital Area Metropolitan Planning Organization, and NC Division of Water Quality. These entities were asked to review and provide comments on the map during a 30-day comment period that occurred from mid-December 2003 through mid-January 2004; revisions to the map were based on these comments. The plan was presented to the Wake County Planning Board on the following dates: January 21, February 11, and March 3, 2004. The final plan was presented to the Wake County Board of Commissioners on April 5, 2004.

Existing Conditions

Background

The *Wake County Transportation Plan* includes a higher level of connector streets; however, it primarily focuses on thoroughfares throughout the County. Freeways and major thoroughfares are characterized by high traffic volumes and speed, wide right-of-way, limited access, and geometric considerations. Minor thoroughfares have similar characteristics, but on a lesser scale. Collectors fall in the middle between thoroughfares and local streets and balance mobility and access. The development of the collector street plan is in response to an implementation step in the transportation plan.

Street Development Patterns

In general, transportation networks are interconnected. At the interstate level on a national scale, the network of freeways and primary highways connects major destinations. Within individual states, interstate and major highways are the backbones of the transportation network and are augmented with numerous major thoroughfares. Regionally, freeways and major highways primarily serve long-distance travel; at this level, however, the importance of the interconnected network of major thoroughfares increases in importance. When the scale of transportation reaches the sub-area level, the street network is less connected and the absence of collector streets becomes apparent.

Neighborhoods Rely on Major Thoroughfare Facilities to Travel Between One Another

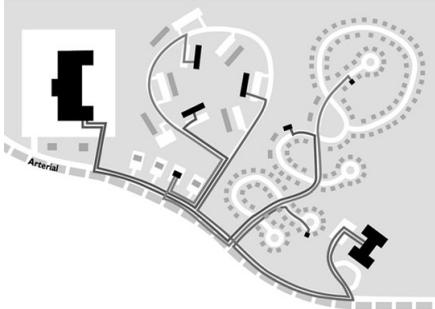
Throughout Wake County there are large and small developments—often adjacent to one another—that are not connected. For local mobility—neighborhood to neighborhood—these developments rely on the system of major and minor thoroughfares due to a lack of connectivity and the absence of a suitable collector street system. Traffic generated by this trip-making pattern adds unnecessary trips to the major street network and contributes to traffic congestion at intersections and along corridors.

Pre-War and Post-War Development Patterns

In communities throughout Wake County and in others across the United States, the post-war (WWII) development pattern has impacted the transportation system. Likewise, the growth of the

twelve municipalities in Wake County has impacted areas well outside of town limits. In the past, most state, county, and local governmental agencies focused on planning, constructing, and maintaining thoroughfare networks—leaving collector street and local street issues to be addressed by private real estate and development entities. Times have changed. Collector and local street planning is being emphasized more often in local and regional planning efforts through specific collector/local street plans, small area plans, street guidelines, and numerous other planning initiatives.

A profound shift in development patterns began to occur in the 1940s as development strayed from the creation of neighborhood units with interconnected street systems and a complementary mixture of land uses in favor of a regionally-oriented, single-use development pattern. Traditional town development patterns declined and homogeneous, residential suburbs began to form. As suburbs replaced rural areas, commercial development—in response to market conditions—followed. In the same trend, office and employment centers decentralized and relocated to the suburbs. A number of factors contributed to this new pattern of development including:



Typical post-war development patterns

- Increased homeownership rates attributed to financing incentives for post-war military personnel and tax incentives associated with home mortgage interest deductions
- Increased auto sales
- Market trends
- National trends in land use policy
- Un-regulated growth

In the city, traffic is distributed over an interconnected grid of streets—some streets carrying higher volumes than others, but as a whole, traffic volume and congestion spread across the



grid. As cities and towns first grew and development occurred, the grid of streets was expanded. The expansion of the grid included thoroughfares, collector streets, and local streets.

In the County, traffic is distributed over a lower density, less connected network of streets. In this condition, traffic is not evenly distributed throughout the transportation network resulting in a smaller proportion of streets carrying a larger proportion of traffic. Even with development at a lower density than that of a typical city or town, demand on these streets often exceeds available capacity resulting in significant congestion. Historically, capacity increasing roadway improvements (typically road widening) have been completed along major corridors to improve traffic conditions, but more often the improvements encourage further development and result in a continuation of congested conditions. Furthermore, limited funding reduces the ability of NCDOT and local governments to keep up with the need for additional roadway capacity as competition for transportation resources also increase.

Developing an interconnected system of local streets will not erase traffic congestion; it will, however, reduce the volume of locally-oriented trips being made on the major street network and potentially reduce the rate at which surplus capacity is consumed.

Why Haven't Enough Collectors Been Built?

For the most part, growth in unincorporated Wake County occurs at the subdivision level in an entirely rural context. Developers and/or land owners start with large parcels of land and an idea. It is likely that the land is sparsely populated or even unpopulated, and forested or used for agricultural purposes. The development plan is usually created to maximize the market opportunity under a set of given constraints, while at the same time providing for suitable returns on investment.

In many cases, these new developments are physically isolated from other developments. Most sizable subdivisions in the County have been physically constructed with stub-out streets, but in many cases, the lack of adjacent development has meant that these are acting as cul-de-sacs instead of through streets. Often, connections to adjacent developments go unrealized. Reasons for not connecting collector streets between adjacent developments include:

- **Neighborhood Opposition**—Some residents of stub streets consider their streets as dead-ends or cul-de-sacs and oppose the connection of new streets to the stubs.
- **Environmental Constraints**—Many stub streets are not extended due to the presence of a stream, a steep slope, or other environmental constraint; the justification of impact to which is not warranted at the collector street level.
- **Permitting**—Environmental-related permits are difficult to obtain from regulatory agencies for streets that are not on an adopted thoroughfare plan or are not part of a larger comprehensive planning effort.
- **Cost**—Streams, bodies of water, and other natural features often form the boundaries of properties. It is difficult and expensive for a developer to construct a crossing that has no immediate purpose for the property and may involve the purchase of additional unneeded property from another adjacent land owner.

In short, a number of factors have contributed to a lack of a well-defined collector street system; many of these, however, can be and are being overcome. A key first step in working toward an interconnected street system is adopting a collector street plan that coincides with and supports an adopted thoroughfare plan.

Existing Roadway Types

Currently, unincorporated areas of Wake County have a diverse inventory of streets that includes a well-developed system of freeways, major thoroughfares, and minor thoroughfares.

- **Freeways**—I-40 and sections of US 64 and US 1 are full-access controlled freeways found in unincorporated areas of Wake County. These corridors generally carry travelers who have longer distances to traverse within Wake County in addition to those without an origin or destination within the County. In general, these corridors carry 50,000 vehicles per day (vpd) or more.
- **Major and Minor Thoroughfares**—Facilities include streets such as US 401, US 70, NC 50, NC 55, NC 96, NC 98, Buffalo Road, Poole Road, and Ten Ten Road. These

roadways range from having partial to no access control and provide mobility and property access within Wake County. Characteristics of these facilities vary and include multi-lane median divided cross sections with high operating speeds to two-lane rural roads with lower operating speeds. In general, these roadways carry 10,000 vpd to 45,000 vpd.

- **Collector Streets**—While some roads function as collectors, these facilities are not currently designated within the County. In general, characteristics of collector streets include low operating speeds, low volumes, narrower cross sections, more frequent driveways, and good property access.
- **Local and Residential Streets**—These facilities almost exclusively serve adjacent properties' access needs. They are primarily two-lane roadways with narrow cross sections, low traffic volumes, and numerous individual driveways. These streets include the majority of publicly maintained subdivision streets within the County.

Transportation Plan

The *Wake County Transportation Plan* is the foundation for the collector street plan. The transportation plan is primarily focused on freeways, major thoroughfares, minor thoroughfares, and connector streets. The transportation plan includes the following chapters:

- **Introduction and Vision**—This chapter describes the general purpose of the plan; the process that the plan follows; the groups involved in the development of the plan; and the vision, goals, and objectives of the transportation plan. Primary goals of the plan include elements to support the development of an interconnected street network, a provisional framework for multimodal transportation, and minimizing negative impacts of transportation.
- **Existing Conditions**—This chapter describes existing transportation conditions in Wake County. It identifies high crash locations, congested corridors and intersections, existing traffic volumes, and other existing transportation conditions. Correspondingly,

short-term mitigation measures to mitigate traffic congestion and safety issues are also described.

- **Future Conditions**—This chapter includes a discussion of travel demand modeling, identifies environmental features and constraints in the County, and describes alternatives studied in the development of the transportation plan.
- **Thoroughfare Plan**—Roadway recommendations for 2025 are described in this chapter. For freeways, major thoroughfares, and minor thoroughfares throughout the unincorporated areas of Wake County, cross section recommendations are discussed and illustrated on a plan map. The thoroughfare plan map indicates existing and future roadway connections, corridor cross sections, spot roadway improvements, and interchange locations within the study area.
- **Pedestrian and Bicycle Element**—Existing bicycling and walking conditions as well as recommendations related to travel by walking and bicycling are included in this chapter. These recommendations include non-vehicular facilities parallel to the street such as wide outside lanes, striped bike lanes, sidewalks, and multi-use paths. The pedestrian and bicycle plan map illustrates the proposed pedestrian and bicycle network by facility type throughout the study area.
- **Transit Element**—This chapter describes existing transit conditions and plans in Wake County as well as a recommended framework for future transit services countywide. The chapter includes a transit plan map that describes the conceptual transit network in Wake County.
- **Implementation Plan**—This chapter provides strategies for implementing specific elements of the plan and includes suggested new policies to further plan implementation. Also included in this chapter are planning level costs associated with specific elements of the transportation plan.

Background

A number of factors guide the designation and planning for new collector streets. Many of these factors can be quantified or qualified in one way or another—that is, a number of specific references can be made to each of them in determination of an action or inaction. The methodology described in this chapter outlines steps that were taken as a part of the collector street planning process. The following are included in this chapter:

- Identification of opportunities and constraints
- Identification of existing and future land use plans and zoning
- Travel demand modeling

Opportunities

Throughout the County there are numerous existing and proposed developments that have been or will be constructed with stub-out streets. Stub streets are intended, by definition, to be connected with a street from an adjoining property or properties. In many cases people who live on these streets view them as permanent dead-end streets; however, under most subdivision ordinances and conditions of approval, these stubs are provided (and required) as future roadway connection points.

Outside of the unincorporated areas of Wake County there are expanses of undeveloped tracts of land. Some of these are under agricultural cultivation, while others are a part of the open space system (permanent) and will be held to preserve natural resources. It is likely that at some point in the future most undeveloped property that is not protected by conservation easement or other means will be assembled, zoned for development, and presumably developed. Existing land use plans prepared by the County increase our understanding of the likely development intensity and pattern in these undeveloped portions of the County. The acknowledgment of development trends presents an opportunity to plan and incrementally implement an interconnected collector street network as development occurs. While in locations where development currently exists, an interconnected collector street system must be retrofitted or may not be able to be constructed;

therefore undeveloped parcels represent the greatest opportunity for augmenting the existing transportation network.

Constraints

A number of opportunities exist for the identification of collector street connections countywide; however, the built environment, current policy, and natural resources limit locations and numbers of new connections that can be reasonably identified. In the collector street planning process, natural and built environment constraints were identified and taken into consideration. Figures of these constraints can be referenced in Chapter 3 of the *Wake County Transportation Plan* in **Figures 3.2-1** through **3.2-5**. The figures in Chapter 3 illustrate the locations of streams and bodies of water; historic districts and properties; potential hazardous waste sites; parks and open space; gamelands; threatened and endangered species; the existing transportation system; wetlands and floodplains; water supply watersheds; and County and municipal facilities. All of these features were considered when developing the collector street plan.

Land Use Plans and Zoning

In the development of the collector street plan, land use plans and zoning were important considerations. Understanding the development potential of undeveloped areas in the County was a primary consideration in the determination of where collector streets will and will not be needed in the future. To better understand the development potential of study areas in the County, available future land use plans were obtained from municipalities and from Wake County.

These land use plans were assembled and displayed on a single map with generalized land use classifications and intensities. General commercial land uses that included office, retail, and industrial were grouped into a single classification. Proposed activity centers were generalized by size. Residential intensities indicated on individual plans were grouped into three intensity classifications:

- Low intensity—fewer than 2 dwelling units per acre



- Medium intensity—2 to 4 dwelling units per acre
- High intensity—more than 4 dwelling units per acre

Where land use plans were not available, Wake County’s existing zoning information was displayed as a substitute. From a study of this collected land use and zoning information, a consensus was reached that the majority of areas that will remain unincorporated (i.e., outside of municipal limits) are likely (and under regulatory control) to develop at low residential intensities—fewer than 2 dwelling units per acre. Areas that are currently under County jurisdiction but likely to be incorporated in the next 10 to 20 years were primarily medium intensity residential (2 to 4 dwelling units per acre). Areas that will most likely be annexed in a shorter time frame—within 10 years—were mostly high intensity residential (more than 4 dwelling units per acre).



Low Intensity



Medium Intensity

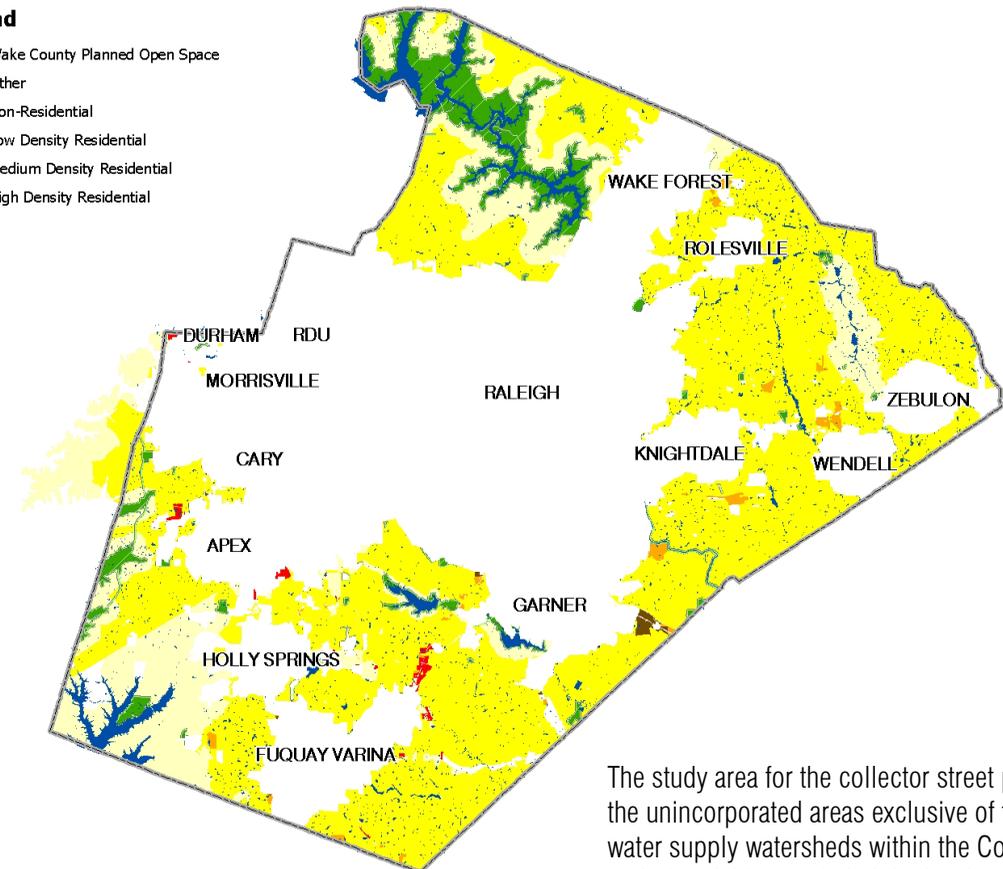


High Intensity

Proportionally, low intensity areas comprised approximately 80 percent of unincorporated land in the County; medium intensity areas comprised approximately 15 percent; and high intensity areas 5 or less percent. It should be noted that the areas classified as low intensity were significantly impacted by the presence of primary water supply watersheds thereby reducing the level of intensity at which development can occur (within the water supply watersheds).

Legend

- Wake County Planned Open Space
- Other
- Non-Residential
- Low Density Residential
- Medium Density Residential
- High Density Residential



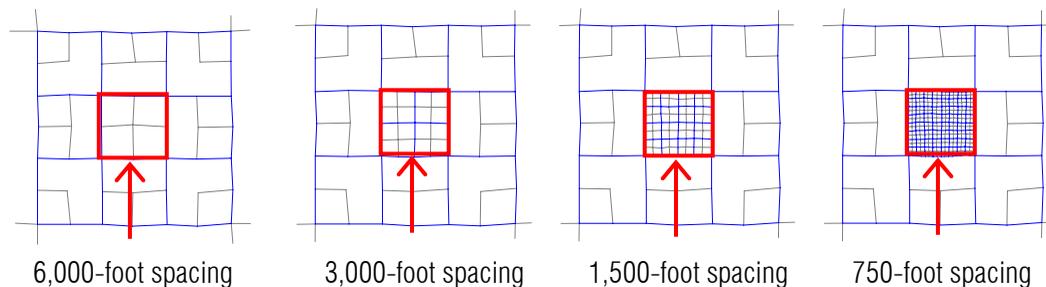
The study area for the collector street plan includes the unincorporated areas exclusive of the critical water supply watersheds within the County. The majority of this area is lightly developed and indicated in future plans for low intensity residential uses. Higher land use intensities are planned in areas adjacent to municipalities.

Modeling and Collector Street Spacing

The determination of an appropriate set of collector street spacing guidelines was an important exercise undertaken as a part of this plan. It has been theorized that 1,500 feet is an appropriate spacing for collector streets in a suburban area; unincorporated areas of Wake County, however, have much lower commercial and residential development intensities than suburban areas that are serviced by municipal water and sewer. Understanding this reality, a theoretical model largely influenced by land use intensity ranges was developed to determine the desired collector street spacing for a given area. This modeling exercise is further described in the following section.

Process

To test the effects of land use intensity and transportation system density in the setting of rural Wake County, a TRANPLAN computer model was developed for a theoretic area. This model addressed an area approximately 18,000 feet by 18,000 feet—roughly 3 ½ miles x 3 ½ miles in 9 super blocks. In the context of this modeling exercise, a super block is defined as an area of land bordered on four sides by a major roadway — a freeway, or thoroughfare. Each super block is approximately 6,000 feet by 6,000 feet. To test the impacts of varying land use mixtures and intensity as well as differing levels of street connectivity, eight land use scenarios were tested under four street spacing alternatives. The center super block was used to test the effect of varying land use intensities and transportation network density. Street spacing alternatives tested included:



The eight land use scenarios tested included:

- Low intensity residential, low intensity employment
- Low intensity residential, high intensity employment
- Medium intensity residential, low intensity employment
- Medium intensity residential, medium intensity employment
- Medium intensity residential, high intensity employment
- High intensity residential, low intensity employment
- High intensity residential, medium intensity employment
- High intensity residential, high intensity employment

Land use intensity and mixture and transportation network density in the remaining eight super blocks were held constant throughout the exercise. Land uses in the eight outer super blocks varied in employment and housing intensity levels in order to simulate development patterns in typical suburban and rural areas. In addition to internal trips (to the study network), through trips (trips without an origin or destination in the model area) were assigned to the network to simulate the effect of increases in traffic volumes associated with commuter patterns.

Simply by location, most areas have peak hour travel patterns that are weighted in one direction during the morning commute and the opposite direction in the afternoon commute. This effect was added to the theoretic network by weighting traffic flows to the north as if being attracted to an employment center or major regional transportation facility such as a freeway.

To understand the effect of land use intensity and transportation system density, the model was run for each potential scenario—a total of 32 model runs were completed. For each model run, trips were assigned to the network using equilibrium techniques, which allowed for traffic to divert to the most desirable path based on the level of congestion (length of travel time) experienced.



Conclusions and Results

Following the completion of the 32 model runs, TRANPLAN output reports were used to evaluate individual scenario performance. For each of the eight land use scenarios studied, the transportation network in the central super block was evaluated using the following measures of effectiveness (MOE) and qualitative rating basis:

- Vehicle-hours traveled (VHT)—minimize
- Vehicle-miles traveled (VMT)—minimize
- Congested VMT (volume/capacity ratio > 1)—minimize

Each grid size was scored using a relative scale of 1 to 4 for each of the three MOEs to determine which grid size was most appropriate for a given land use scenario. If all four grids performed similarly, they were given equal scores for that MOE. Cost was a consideration, and factored into the rankings: if all four grids performed equally, the larger of the grid sizes would prevail. In other words, a smaller grid size would have to show an order of improvement to justify the additional infrastructure. Logically, a tighter grid will perform better, but also will incur a higher cost. Similarly, a grid with larger blocks may experience a lower level of performance, but enjoy a lower overall cost. In general, performance was balanced with cost to achieve equilibrium between the two important elements.

The results show that a 3,000' grid is typically the most appropriate for the mixed suburban and rural development pattern that prevails throughout most of Wake County. For more intense development a 750' grid proves optimal, but this is independent of the costs that would be incurred to build a network of such intensity. In addition, this modeling exercise revealed a greater sensitivity to housing than employment. This is logical when one considers that even in high employment areas, the employment is focused at nodes (intersections), whereas housing in highly developed areas is more likely to be distributed throughout the superblock. Summary results of the analysis are indicated in **Table 3.1**.

Table 3.1—Summary Results

		Street Spacing		
Employment	High	3,000 ft	3,000 ft	750 ft
	Medium	6,000 ft	3,000 ft	750 ft
	Low	6,000 ft	3,000 ft	1,500 ft
Land Use Type and Intensity		Low	Medium	High
		Residential		

For the majority of Wake County, high and medium employment land use intensities will not apply due to zoning, social, environmental, and land use plan constraints. Based on this reality and the evaluation of the model results, the following conclusions regarding spacing of collector streets were drawn:

- Low intensity residential areas—6,000 feet
- Medium intensity residential areas—3,000 feet
- High intensity residential areas—750 feet to 1,500 feet

Identifying the Network

Working with the technical committee, the study team identified a list of collector street criteria and characteristics for consideration. The resulting criteria were used to evaluate the existing transportation plan network as well as existing streets that function as collectors. These streets were identified and classified as existing collector streets on the plan. Specific qualitative and quantitative criteria were used to evaluate collector streets in addition to the relation between land use and street function. The following summarizes evaluation criteria:

Quantitative Considerations:

- Traffic volume (1,000-7,500 vpd)
- Posted speed (20-35 mph)
- Truck traffic
- Section length
- Number of travel lanes (2 + turn lanes)
- Points of access per mile
- Capacity (7,500-10,000 vpd)

Qualitative Considerations:

- Adjacent land use (existing and planned)
- Access function (important)
- Mobility function (important)
- Emergency vehicle routing
- Transit route
- Parking (on-street parallel, diagonal, other)
- Median treatment

Once the existing network was identified, the project team worked with the technical committee to identify the future collector street network. This included the identification of new streets needed to serve future travel demand. As discussed in previous sections of this report, it was assumed that the majority of these streets would be constructed as development occurs.

A workshop was conducted with the technical committee using large scale maps denoting significant environmental features as well as existing and projected land uses. The group was instructed to apply the land use intensity/street spacing criteria in the evaluation of the existing and planned street network as well as in the identification of new collector streets. In addition, recommendations for roadway alignment and connectivity were exercised. The resulting set of future collector streets was refined by the project team and field verified as necessary.

Following revisions, the draft collector street network was coordinated with adopted local (municipal) transportation and thoroughfare plans. Once this exercise was completed, copies of the plan were distributed to each municipality as well as to NCDOT for review and comment. Based on comments received, the collector street plan was revised as necessary. The collector street plan is illustrated in **Figures 4.1** through **4.5**, found in Chapter 4 of this report.

Guidelines:

- Avoid steep slopes and otherwise unsuitable topography
- Minimize impact to the built environment
- Avoid FEMA designated floodplains
- Minimize the number of wetland (National Wetland Inventory) impacts
- Minimize wetland and floodplain impacts (i.e., identify 90 degree stream crossings and narrowest point possible)
- Avoid redundant stream crossings
- Minimize the number of high-quality (larger) stream crossings
- Minimize the length of stream crossings
- Minimize school impacts



-
- Minimize the number and size of each impact to other environmental features such as historic features and districts, threatened and endangered species, hazardous waste sites, and superfund sites
 - Avoid parks and minimize crossings through designated open spaces
 - Minimize gameland impacts
 - Minimize the number of new facilities in critical watershed areas
 - Be aware of existing development patterns
 - Look at land use potential: low density areas, street spacing 6,000 feet; medium density, 3,000 feet; and high density, 1,500 feet
 - Promote connections to existing stub streets
 - Develop feasible alignments based on available data

Introduction

The recommended collector street plan functions as a subset of the *Wake County Transportation Plan*. The plan presents an interconnected street system that complements recommendations in the transportation plan. This chapter includes the following sections:

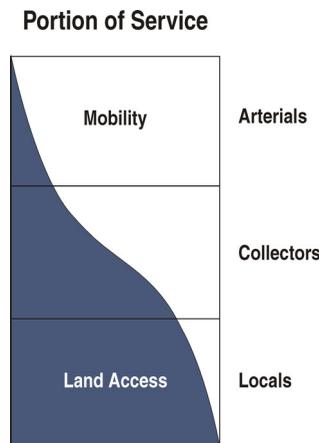
- Functional classification
- Policies and guidelines for collector streets
- Traffic calming
- Street spacing
- Street typology
- Future collector streets

Functional Classification

Functional classification refers to a prescribed hierarchy of street types typically including arterial, collector, and local streets. This hierarchy of streets helps to describe the way collector streets relate to other roadway classes in terms of street function, access, and mobility. Each type of street has a specific function and corresponding set of characteristics.

Definition of functional classification—The process by which streets of different characteristics and usage are grouped into broad classifications using a fixed set of criteria

The classification of Wake County’s street system required close examination of the role that each street performs in the overall transportation system. The collector street planning process included the classification of the transportation plan network and also includes the addition of newly planned collector streets. The street classification mapping is located later in this section. Criteria for the identification of collector streets were developed to evaluate and identify existing and future (new location and re-classification of existing) collector streets as well as to develop recommended collector street cross sections.



Thoroughfares primarily serve mobility needs whereas local streets primarily serve land access needs

Guidelines

This study is focused on transportation; a number of design and land use issues, however, must be considered as they impact the character and function of streets. To reinforce the County’s desire to create an interconnected network of streets that is pedestrian, bicycle, transit, and automobile friendly, a number of general guidelines are described in the following, including:

- General connectivity
- Street spacing
- Driveway access
- Parking
- Medians
- Ditches (swales)
- Street lighting
- Street trees
- Pedestrian crossings
- Stream and floodplain crossings
- Sidewalks and bikeways

General Connectivity

The County has a desire to encourage an interconnected street network. Studies have shown that an interconnected street network has wide-reaching benefits that affect transportation, the environment, and overall quality of life. These benefits include:

- Accommodating short “local trips” on local streets
- Providing for direct travel routes
- A reduction in local traffic demand on major roadways (freeways and thoroughfares)
- Providing a framework of streets that supports development patterns
- Encouraging and providing infrastructure for non-vehicular travel modes such as walking and bicycling
- Providing a framework for transit services



The creation of an integrated street network will not be possible if neighborhoods (subdivisions) continue to develop without being required to connect to one another. Throughout the County the following should be applied to new subdivisions so that the number of dead-end streets is limited and that opportunities are provided for the creation of an interconnected street network.

- Require all subdivisions smaller than 100 dwelling units to include at least one stub-out street to extend and connect with future streets
- Require all subdivisions larger than 100 dwelling units to include at least two stub-out streets to extend and connect with future streets; more stub-out streets may be required based on the size of the development
- Require that a traffic impact study—prepared by a professional engineer—accompany all development applications that may generate 100 or more peak-hour trips, more than 1,000 daily trips, and any other development at the discretion of the County
- Incorporate adopted collector streets in development plans (implement the *Collector Street Plan*)



High Intensity Residential Development

Street Spacing

In addition to guidelines that require sidewalks, traffic impact analyses, and connections between neighborhoods, overall future street spacing guidelines are recommended. **Table 4.1** illustrates the relationship between land use intensity and collector street spacing:

Table 4.1—Street Spacing Guidelines

Land Use/Type of Collector Street	Intensity	Access Function	Approximate Street Spacing
	Low Intensity Residential	Less than 2 dwelling units per acre	High
Medium Intensity Residential	2 to 4 dwelling units per acre	High	1,500 to 3,000 ft apart
High Intensity Residential	More than 4 dwelling units per acre	High	750 to 1,500 ft apart
Activity Center	n/a	Medium	750 to 1,500 ft apart

Driveway Access

To preserve the capacity of thoroughfares, it is desirable to provide all driveway access from local and collectors streets; however, in some cases it will be necessary to provide property access driveways on major and minor thoroughfares. Access from thoroughfares should be limited. Side-street (collector-street) access should be encouraged.

Parking

In some cases, on-street parking is essential to support an adjacent land use or to the livability of a community. The majority of the collector streets identified in this plan will be on state maintained roadways within and outside of subdivisions. The nature of the cross sections presented in this plan for low and medium intensity residential collector streets is such that on-street parking will not be accommodated or permitted in paved areas along the roadway. To accommodate temporary parallel parking, recommended collector street cross sections should provide a suitably graded grass shoulder.



High Intensity Development



Medians

Medians provide refuge for pedestrians, control access, reduce vehicular conflicts, increase capacity and safety, and enhance the street environment. As street designs for subdivisions and activity center developments are reviewed and considered, collector street sections should be evaluated for the placement of landscaped medians. The minimum width of a landscaped median is 10 feet; other widths, however, are permissible as approved by the County and NCDOT.

Ditches (Swales)

The majority of future and improved roadways in Wake County's jurisdiction will not be constructed with curb and gutter. In the absence of curb and gutter, a section incorporating a graded shoulder and ditch is used. Typically, these sections have gradual cross-slopes that form a narrow "V" shaped channel to transport run-off to a larger channel. The construction of a swale is the new alternative for shoulder section roadways that would otherwise use a typically narrow drainage channel. A swale is still a drainage channel, but with a wider, flatter base (trapezoidal in cross section)—shaped more like a "U" or flat bottomed "V". Swales are designed to allow water to travel at a lower velocity, a shallower depth, to encourage greater water infiltration into the soil, and reduce the amount of sediment transported by run-off flows. As streets are improved and new streets are constructed throughout the County, swales or a similar ditch section that allows for sedimentation settlement and water infiltration should be incorporated into the street cross section.

Street Lighting

Street lighting should not be extensive on collector streets throughout the County. At a minimum, street lights should be installed at locations where collector streets intersect major and minor thoroughfares and where collector streets intersect one another.

Street Trees

Street trees should be planted along collector streets and spaced such that they create a continuous canopy along the street. Small species of trees can be spaced as closely as 15 feet

apart, medium sized species 15 to 40 feet apart, and large species spaced nearer to 40 feet apart.

Pedestrian Crossings

Collector streets can be attractive and safe places to walk and bicycle. For the most part, collector roadways will be within residential subdivisions and on low volume and speed roadways; however, within activity centers and where they carry higher traffic volumes at increased speeds, it may be necessary to designate crosswalks. In these cases, at intersections and mid-blocks where pedestrians and cyclists frequently cross the street, crosswalks and appropriate refuges (minimum of 6 feet wide) may be needed to accommodate safe passage across the street. On roadways with curb and gutter, in all cases, ADA (Americans with Disabilities Act) accessible curb ramps should be provided at each crossing. On shoulder section roadways, a short off-street accommodation—to cross the swale or ditch—may be needed to connect the sidewalk to the street. When considering the design, location, and placement of crossings, manuals such as the *Policy on Geometric Design of Highways and Streets* (AASHTO), *Manual on Uniform Traffic Control Devices* (FHWA), and other state and local guidelines should be consulted.

Stream and Floodplain Crossings

Street patterns will be affected by the natural courses of streams and floodplains. Streams, open bodies of water, and floodplains challenge the development of an interconnected street network. These waterways require sensitive design treatments when crossings occur. In cases where street crossings are unable to be accommodated, pedestrian and bicycle crossings should be pursued at regular intervals. The location of a suitable crossing should minimize or cause no impacts to the natural course of the stream and should avoid stream confluences. Other considerations include locations where little or no bank or channel hardening will be required, where minimal filling will be required, where the natural riparian buffer will be the least impacted, and where the placement of structural elements can occur outside of the natural water channel.



Once a suitable crossing location is selected, the following general design considerations should be made to minimize negative impacts:

- Perpendicular alignment of the crossing or an alignment that minimizes the actual crossing distance
- Narrow right-of-way through the riparian buffer and crossing area
- Adequate hydraulic opening to provide for increased flow conditions
- Stormwater best management practices to regulate the amount of flow into the stream

The actual physical structure selected for a crossing is important. While bridges are preferred, they are costly and not always necessary. When bridges are unnecessary or not feasible, other crossing options include standard culverts and stream simulation culverts. Standard culverts include concrete boxes and pipes as well as corrugated metal arched pipes and round pipes. The type of standard culvert will most likely be selected based on design cover and stream flow characteristics and requirements. Stream simulation culverts are a hybrid of a bridge and a culvert. They provide a more open channel than a standard culvert, but not a clear span like a bridge. They are essentially an open-bottomed arch embedded in bedrock, providing space for a simulated stream channel (bottom) under the roadway.

Pedestrian and Bicycle Accommodations

Collector streets are likely to be popular routes for bicycling and walking. To accommodate these types of users, high intensity residential and activity center collector streets are recommended to include pedestrian and/or bicycle amenities. These may take the form of sidewalks, multi-use paths, and bike lanes. Pedestrian amenities and bikeways are optional on medium and low intensity residential collectors due to the anticipated minimal traffic volumes and low speeds.

Where sidewalks are recommended, they should be a minimum of 5 feet wide and provide an even walking surface that is free of trip hazards. Sidewalks should be physically separated from the adjacent travel lane, placed behind the ditch (swale) or behind a verge.

In many cases collector streets have frequent driveway cuts; therefore, it is not recommended to provide off-street bicycle accommodations. In cases where there are few driveway and access breaks along a collector street and bicycles are frequent, it is recommended to provide a 10-foot wide (8-foot minimum) asphalt multi-use path along one side of the roadway.



Well-marked crosswalk

Traffic Calming

Cases may exist where even the most well-designed collector streets experience unwanted cut-through traffic and have prevailing traffic speeds above safe and posted speed limits. The inclusion of traffic calming measures in affected areas can help mitigate these types of issues.

Overview

Increasing congestion on thoroughfares and automobile technology improvements have isolated drivers from the surrounding environment and at the same time attracted them to neighborhood streets. While increased traffic volumes on local streets do not directly equate to reduced safety, driving erratically and in excess of the speed limit does contribute to safety issues in neighborhoods.

Although it is easy to target those drivers who cut-through (do not have an origin or destination) in a neighborhood, the problem is more widespread. In many cases, the majority of speeding drivers reside within the affected neighborhood. Several studies confirm that most speeders are aware of the posted speed limit, but choose to ignore it or are unaware that they are traveling at an excessive speed. These same studies also reveal that street design and vehicle technology can contribute to this undesirable driver behavior.

Balancing traditional traffic engineering practices and policies with neighborhood interests will be paramount to the success of traffic calming in Wake County. These interests must also be weighed against known constraints such as traffic mobility, emergency response, property rights, and available resources.

What is Traffic Calming?

Traffic calming generally refers to the use of a variety of physical and non-physical measures that are intended to slow and/or divert traffic. Nationwide, engineers and planners are working together to develop measures that emulate those originating in Europe and Australia. Common objectives of traffic calming include:

- Encouraging/forcing lower vehicle speeds
- Reducing cut-through traffic
- Reducing crash frequency and severity
- Increasing safety and perceived safety for pedestrians and bicyclists
- Reducing the need for police enforcement of speed limits
- Enhancing the street environment

Although the objectives of traffic calming are consistent, the lack of standards in the United States has resulted in individual communities having tailored policies to address local traffic conditions. Additionally, the lack of definitive “warrants” and standards allows for design and implementation flexibility to best represent the values and vision of local communities.

Measures

Traffic calming measures can be grouped into passive and two types of active measures—vertical and horizontal deflections.

- **Passive** measures are intended to alter a driver’s perception. They include streetscape, gateway treatments, street trees, sidewalks, pavement marking/textures, and signage.
- **Vertical** (shift) measures include features that drivers must drive over to proceed on their desired path. Measures include speed humps, speed tables, raised crosswalks, and raised intersections.
- **Horizontal** (shift) measures include features that drivers must drive around to proceed on their desired path. In some cases, horizontal measures physically divert drivers to

other routes. Measures include chokers, bulb-outs, medians, traffic circles, roundabouts, realigned intersections, and chicanes.

The following describes typical traffic calming measures, their advantages, disadvantages, and approximate ranges of cost.

- **Speed hump, speed table, and raised crosswalk**—A raised hump in the roadway or at an entry with a parabolic or flat top extending the width of a street. Advantages include speed reductions and improved pedestrian/motorist visibility. Disadvantages include increased noise, slight increases in emergency response time, and maintenance cost. (Approximate cost: \$2,500-\$4,000)
- **Median**—An island that is placed at the center of a roadway for a short or extended distance that reduces the width of the travel lane. Advantages include aesthetics, speed reductions, and the provision for pedestrian refuge. Disadvantages include parking reductions and driveway conflicts. (Approximate cost: \$10,000-\$20,000)
- **Neighborhood traffic circle**—Created by constructing a circular elevated area in the middle of an intersection that creates circular (counterclockwise) traffic flow. Advantages include speed reductions, left-turn vehicle accident reductions, fewer points of conflict, and aesthetics. Disadvantages include potential parking reductions, right-of-way impacts, and cost. (Approximate cost: \$15,000-\$20,000)

What about STOP Signs?

STOP signs are not traffic calming devices. The *Manual on Uniform Traffic Control Devices* (MUTCD) clearly defines the intended purpose of a STOP sign as traffic control device and identifies warrants for installation. In addition, studies have shown that where STOP signs have been installed to be used as traffic calming devices, prevailing travel speeds in mid-block have increased substantially.



Recommended Plan

To address the issue of context sensitivity within the classification of collector street, this plan identifies four types of collectors. These types consider adjacent land use and development as well as the composition of the traffic stream using the street. The four collector streets are the following:

- **Low intensity collectors**—in areas where land use designates less than 2 dwelling units per acre (rural conservation)
- **Medium intensity collectors**—in areas where land use plans designate 2 to 4 dwelling units per acre
- **High intensity collectors**—in areas where land use plans designate 4 or more dwelling units per acre
- **Activity center collectors**—in areas where activity centers are planned

It should be noted that all public streets constructed in unincorporated areas of Wake County must be designed in accordance with standards and procedures set forth by the North Carolina Department of Transportation to ensure acceptance for maintenance.

Low Intensity Collector Street

Purpose—To serve rural and low intensity residential land uses

Development Intensity

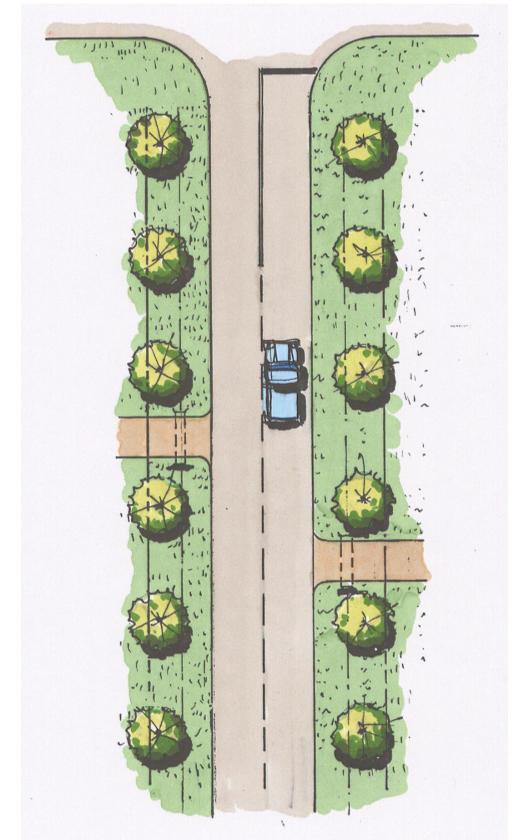
- Residential—Less than 2 units per acre
- Commercial—Little to none

General Alignment—Follows terrain wherever possible

Street Design Standards

- Design speed—25 to 35 mph
- Posted speed—25 to 35 mph
- Street spacing—One connection every 3,000 feet
- Driveway frequency—One driveway per parcel/residence

Typical Traffic Volume—2,500 vehicles per day



Potential Low Intensity Collector Street Plan View



Sample Cross Section

Medium Intensity Collector Street

Purpose—To provide access to local properties and activities among local parcels

Development Intensity

- Residential—2 to 4 units per acre
- Commercial—Little to none

General Alignment—Follows terrain to form a curvilinear grid (minimize cul-de-sacs)

Street Design Standards

- Design speed—25 to 35 mph
- Posted speed—25 to 35 mph
- Street spacing—One connection every 1,500 to 3,000 feet
- Driveway frequency—Limited access where feasible

Typical Traffic Volume—2,500 vehicles per day (maximum)



Existing Medium Intensity Collector Street
Without Curb and Gutter

High Intensity Residential Collector Street

Purpose—To provide access to local properties and activities among local parcels

Development Intensity

- Residential—More than 4 units per acre
- Commercial—Some

General Alignment—Interconnected grid with few (if any) cul-de-sacs

Street Design Standards

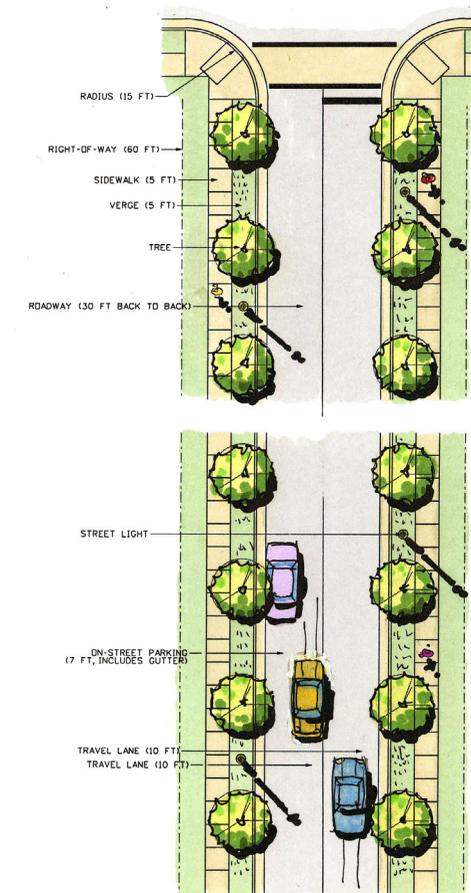
- Design speed—25 to 35 mph
- Posted speed—25 to 35 mph
- Sidewalks—Both sides
- Street spacing—One connection every 750 to 1,500 feet

Typical Traffic Volume—2,500 to 5,000 vehicles per day



Existing High Intensity Collector Street

Potential High Intensity Collector Street Plan View





Activity Center Collector Street

Purpose—To provide access and mobility among non-residential land uses

Development Intensity

- Residential—Varies by activity center type
- Commercial—Varies by activity center type

General Alignment—Interconnected grid with no cul-de-sacs

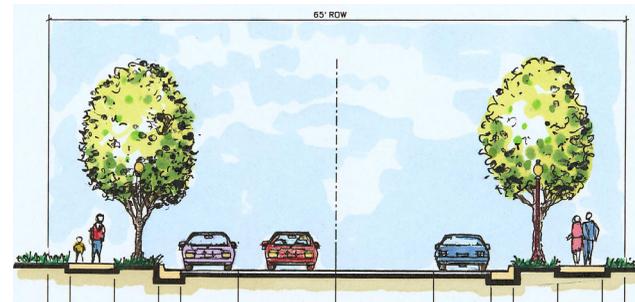
Street Design Standards

- Design speed—35 mph
- Posted speed—25 mph
- On-street parking—Permitted
- Curb and gutter—Case-by-case basis
- Sidewalks—Both sides

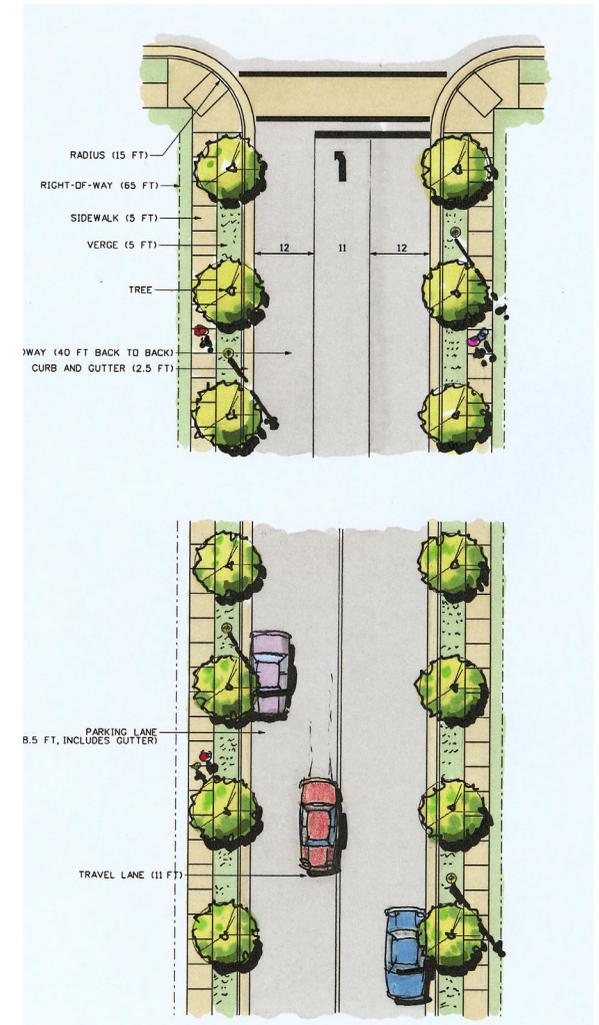
Projected Volume—2,500 to 7,500 vpd



Illustrative Activity Center



Sample Cross Section



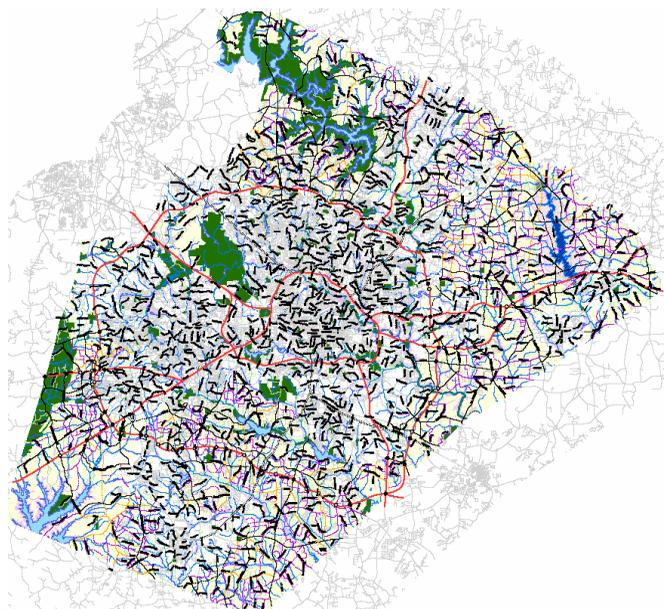
Potential Activity Center Collector Street Plan View

Plan Statistics

Through the collective efforts of those involved in the collector street planning process, a substantial number of new (future) collector streets were identified and a number of existing streets were re-classified as collectors. The following statistics present the total mileage of the planned collector street system (existing and proposed streets) as well as summary totals of existing streets (classified as collectors) and planned streets (currently unbuilt):

- Total system mileage (existing and proposed streets)—491 miles
- Existing collector streets (existing streets classified/re-classified as collectors)—281 miles
- Future collector streets (currently unbuilt streets)—210 miles

The *Wake County Collector Street Plan* represents a total estimated investment of approximately \$385 million in new transportation infrastructure. This cost assumes construction only.



Collector Street Plan Maps

To illustrate the recommended collector street network, the countywide plan map is shown in the following five area maps:

- **Western Wake Area (Figure 4.1)**—Includes areas adjacent to southern Cary, Apex, Holly Springs, and Harris Lake as well as areas west of Fuquay-Varina. This area's primary natural and cultural environment constraints include the Swift Creek basin, Harris Lake, Shearon-Harris nuclear power plant, numerous water courses, wetlands, floodplains, topography, and the developed fringe of the incorporated areas.
- **Southern Wake Area (Figure 4.2)**—Includes parts of the Swift Creek basin, the Middle Creek basin, areas adjacent to Fuquay-Varina, south of Raleigh, and south of Garner. This area's primary natural and cultural environment constraints relate to the Swift and Middle Creek basins and associated features (actual stream, watersheds, wetlands, and floodplains).
- **Southeastern Wake Area (Figure 4.3)**—Includes the Neuse River and basins and streams that immediately feed the southern Wake County sections of the river. It also includes areas adjacent to Wendell, Knightdale, and east of Raleigh.
- **Northeastern Wake Area (Figure 4.4)**—Includes areas adjacent to Wake Forest, Rolesville, Zebulon, north of Knightdale, and north of Wendell. This area's primary natural and cultural environment constraints include the potential Little River Reservoir, numerous historic sites, and several watercourses.
- **Falls Lake Area (Figure 4.5)**—Includes areas west of Wake Forest, north of Raleigh, and areas generally north of I-540 to the Wake County line. This area is constrained by extensive development, Falls Lake, the Falls Lake water supply watershed, and numerous water courses. In response to the natural environment, already developed areas south of Falls Lake are unlikely to intensify and areas north of Falls Lake will develop at low densities and include few new thoroughfares and collector streets.

Figure 4.1 - Southwest Area

Legend

Interchanges

- Existing Interchange (white circle)
- Future Interchange (black circle)
- Future Grade Separation (grey circle)

Other Streets

- Existing (solid line)
- Future (dashed line)

Roadways

- Freeway (thick orange line)
- Freeway (new location) (dashed orange line)
- Major Route (grey line)
- Collector (red line)
- Collector (new location) (dashed red line)
- Thoroughfare (grey line)
- Thoroughfare (new location) (dashed grey line)

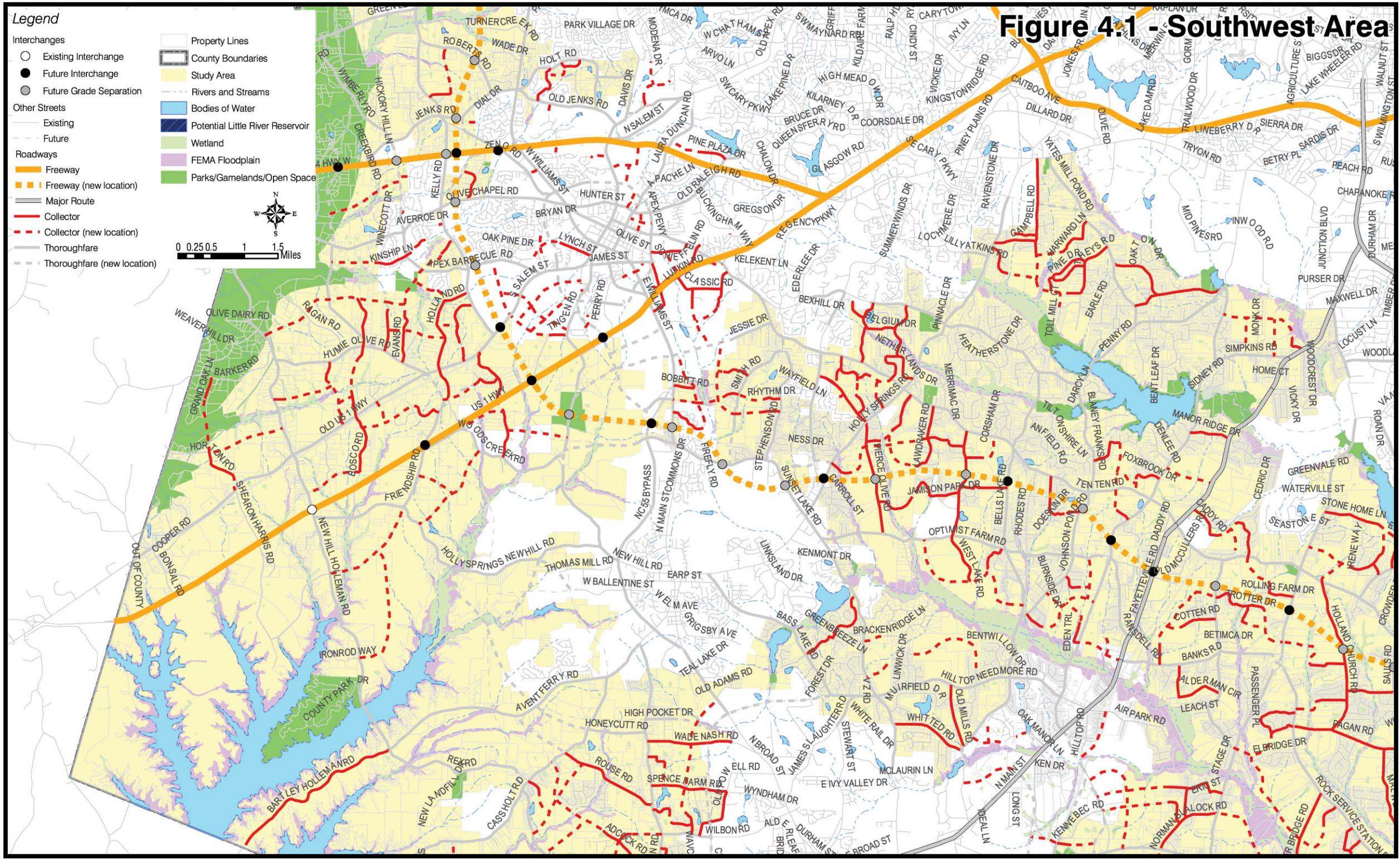
Property Lines

- County Boundaries (thick black line)

Natural Features

- Rivers and Streams (blue line)
- Bodies of Water (light blue area)
- Potential Little River Reservoir (dark blue area)
- Wetland (light green area)
- FEMA Floodplain (purple area)
- Parks/Gamelands/Open Space (dark green area)

Scale: 0 0.25 0.5 1 1.5 Miles



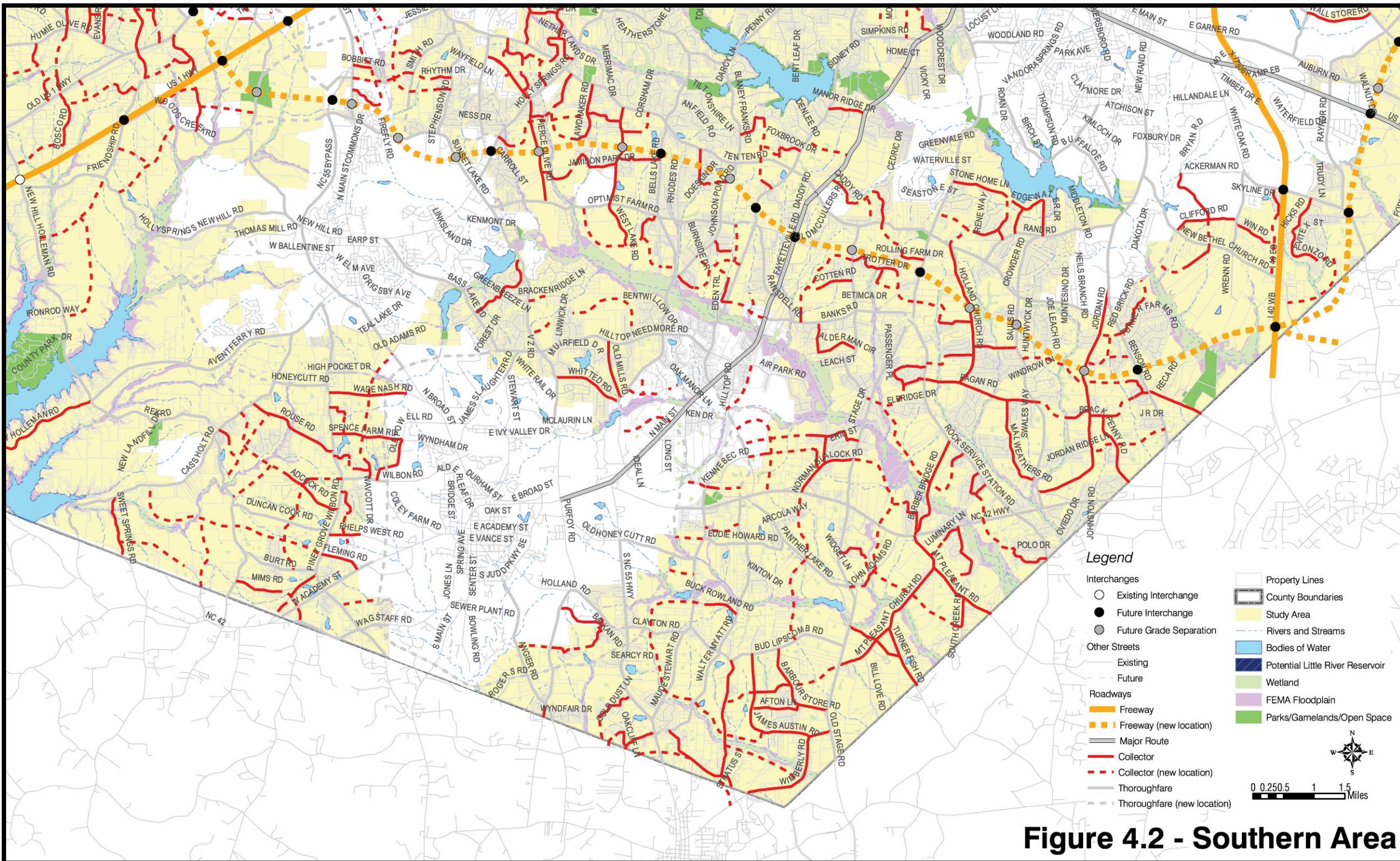


Figure 4.2 - Southern Area

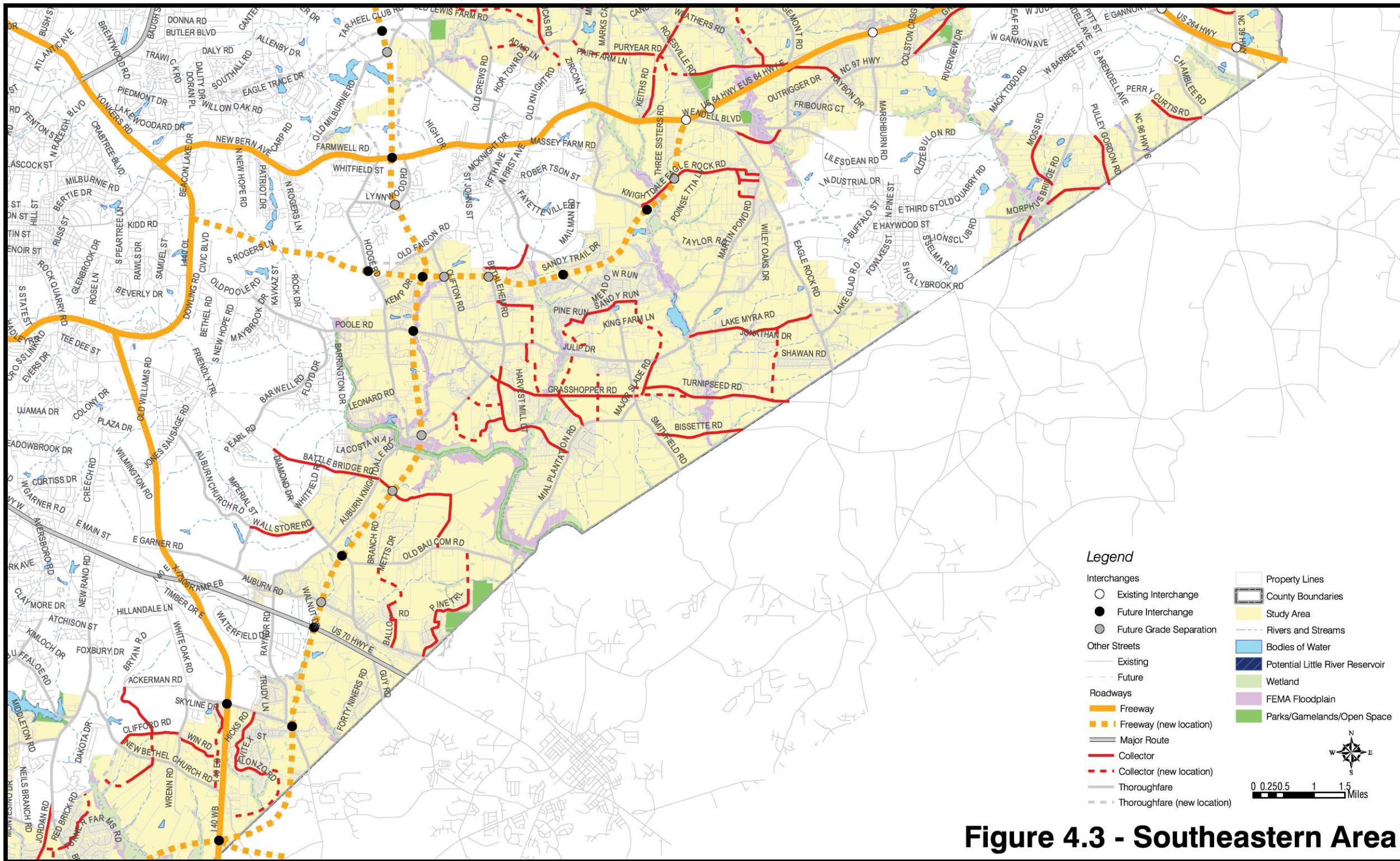


Figure 4.3 - Southeastern Area

Figure 4.4 - Northeastern Area

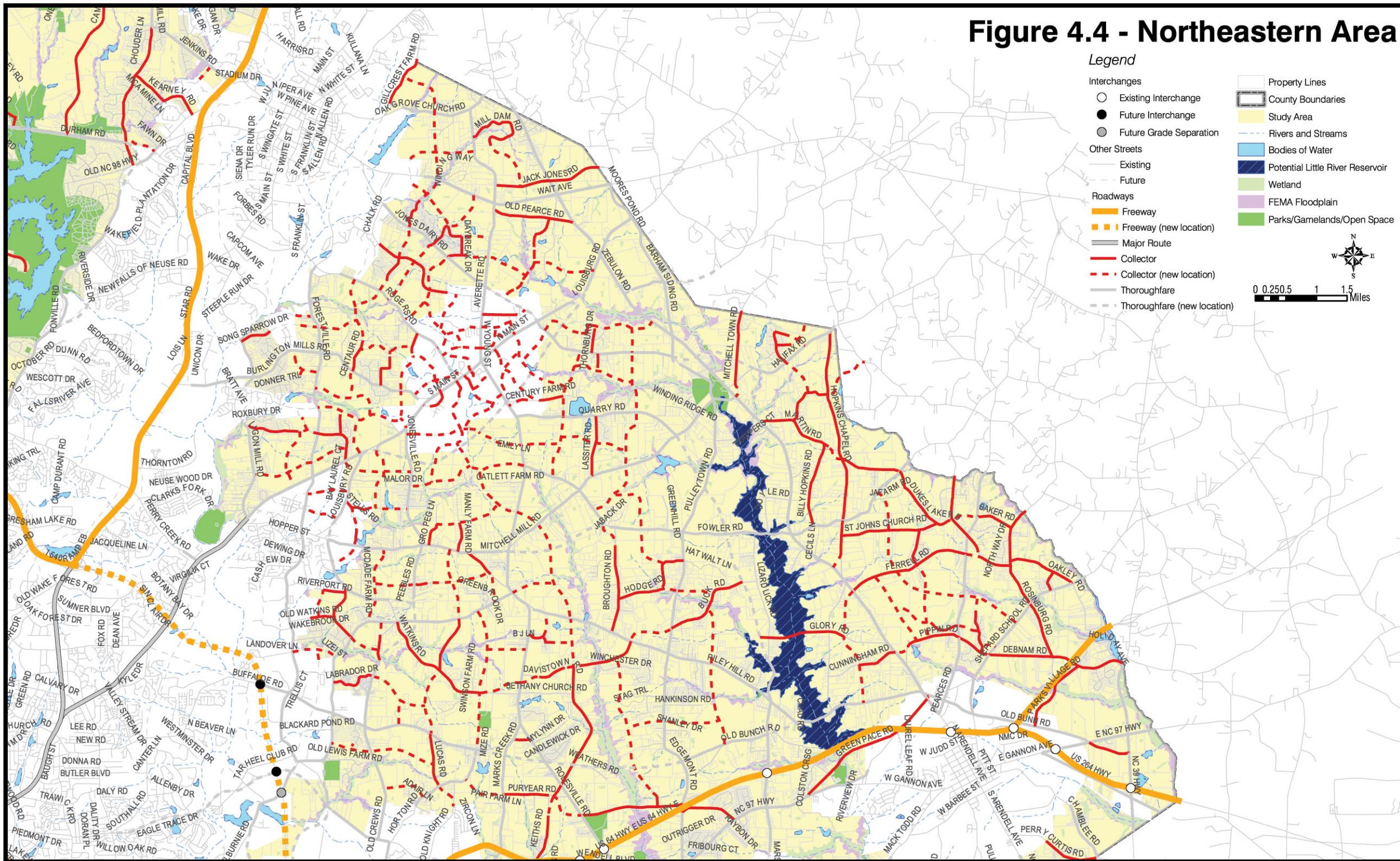


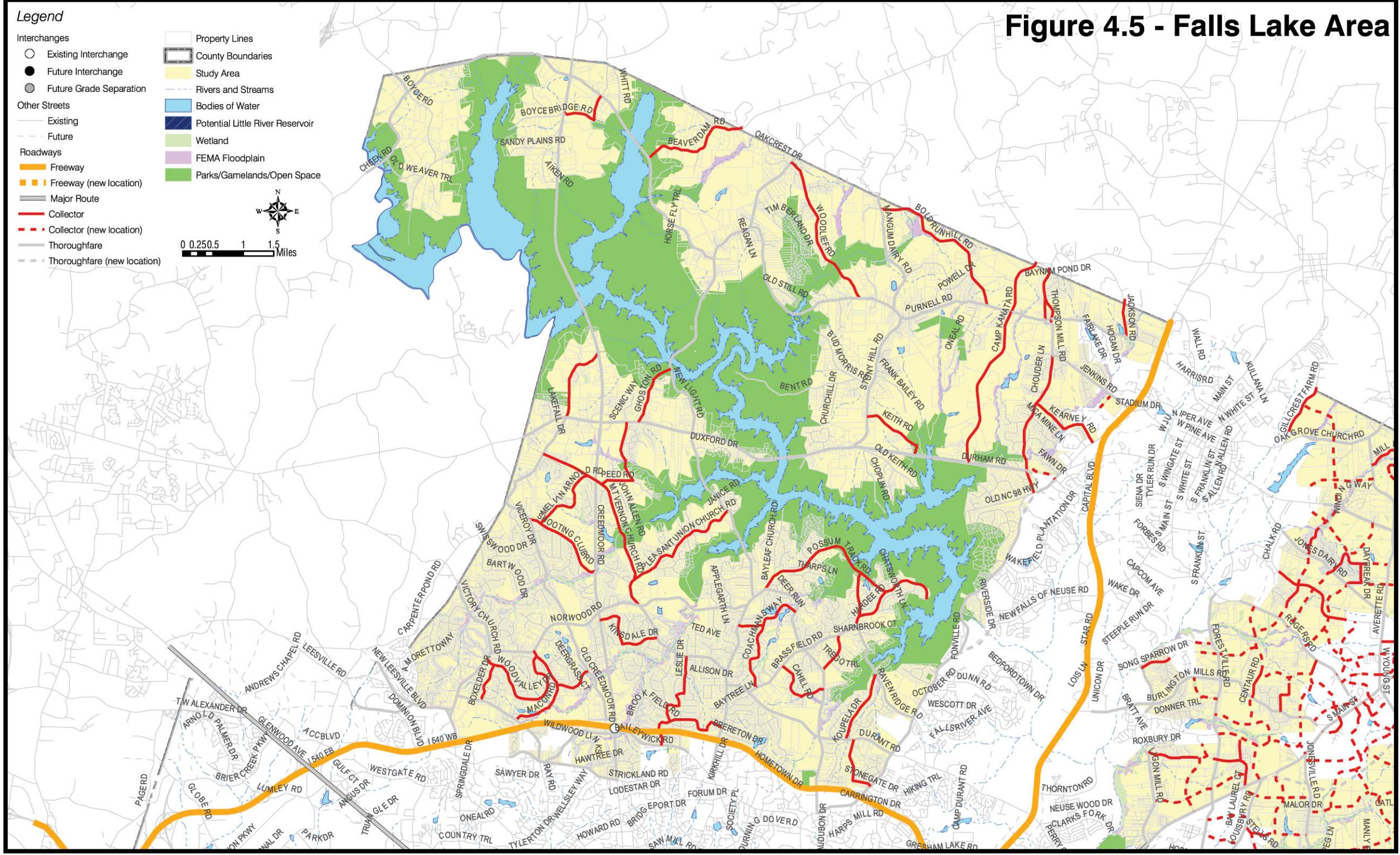
Figure 4.5 - Falls Lake Area

Legend

- Interchanges
 - Existing Interchange
 - Future Interchange
 - Future Grade Separation
- Other Streets
 - Existing
 - - - Future
- Roadways
 - Freeway
 - Freeway (new location)
 - Major Route
 - Collector
 - Collector (new location)
 - Thoroughfare
 - Thoroughfare (new location)
- Property Lines
 - County Boundaries
 - Study Area
 - Rivers and Streams
 - Bodies of Water
 - Potential Little River Reservoir
 - Wetland
 - FEMA Floodplain
 - Parks/Gamelands/Open Space



0 0.25 0.5 1 1.5 Miles



General Recommendations

The following general recommendations are to be implemented as a part of the *Wake County Collector Street Plan*:

- Increase the number of collector streets to better facilitate travel between local streets and arterials
- Improve accessibility to higher intensity residential areas and activity centers
- Integrate design standards and provisions for residential collector streets through the residential development process
- Amend the *Wake County Collector Street Plan* as necessary to include new streets as they are identified during the development review process
- Use the plan as a tool to communicate desired roadway connectivity as development projects are proposed
- Review all development proposals for consistency with the approved collector street plan and place an emphasis on *connections rather than alignments*
- Require that new developments reserve right-of-way for, and construct, future collector streets
- Integrate future bikeway, greenway, and trail networks with the *Wake County Collector Street Plan* to improve access and enhance connectivity between systems
- Avoid and/or minimize impacts to environmentally sensitive areas to preserve the natural environment
- As the transportation system is improved and expanded, minimize impacts that negatively affect the character and integrity of neighborhoods
- Consider the *Wake County Collector Street Plan* as a supplement to Chapter 4 (page 4-23) of the *Wake County Transportation Plan* and incorporate with the Unified Development Ordinance (UDO)
- Present the *Wake County Transportation Plan* and the *Wake County Collector Street Plan* to the Capital Area Metropolitan Planning Organization (CAMPO) for consideration and coordination with the *Long Range Transportation Plan*

Recommended Policy Amendments

To firmly establish collector street plan principles into the normal course of business in Wake County, several amendments to County policy are recommended.

1. **Collector Street Plan**—Wake County should adopt the *Wake County Transportation Plan* and *Collector Street Plan*. The County, in cooperation with NCDOT and CAMPO, will serve as the lead agency to implement the collector street plan, using all available strategies to obtain rights-of-way, ensure connectivity, approve requested variations, and secure funding agreements, where appropriate.

The County will include in the UDO either explicitly or by reference the *Street Design Standards* including classification criteria, street spacing guidelines, and general street design requirements identified in the *Wake County Transportation Plan* and *Collector Street Plan*.

2. **Interconnectivity**—The County should include in the UDO a requirement that all new subdivisions with fewer than 100 dwelling units be required to provide at least one stub-out street to extend and connect with future streets. In the event that adjacent land is already developed with stub-out requirements, the County should require the new development to build the street connections. Required collector street connections are included in this calculation.

The County should require all new subdivisions with 100 or more dwelling units to include street connections or stubs at a ratio of one stub/connection per 100 dwelling units. In the event that adjacent land is already developed with street stubs, the County should require the new development to connect to these existing street stubs. Required collector street connections are included in this calculation.



3. **Traffic Impact Studies**—The County Unified Development Ordinance (UDO) should require traffic impact studies to be prepared by a professional engineer and accompany all development applications when any of the following are identified:

- An increase of 100 or more peak hour vehicular trips (approximately 100 single-family residential units)
- An increase of 1,000 or more daily vehicular trips (approximately 100 single-family residential units)
- When existing safety conditions or deficiencies are identified, the Wake County Planning Department should reserve the right to require a study

The cost for traffic impact studies should be paid entirely by the developer.

4. **Bicycle and Pedestrian Accommodations**—The County should adopt the *Bicycle and Pedestrian Plan* as outlined in Chapter 5 of the *Wake County Transportation Plan*. This plan element includes an interconnected system of signed bicycle routes, striped bike lanes, and off-street bike paths that serve popular bicycling destinations such as schools, parks, libraries, community centers, and shopping areas. The plan should take advantage of low-volume, low-speed residential local and collector streets to the extent possible. The plan should coordinate with existing and proposed plans including local (municipal), regional (CAMPO), state (NCDOT), and County greenway plans.

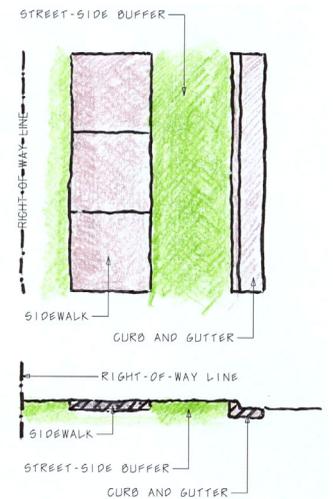
Following the adoption of the *Bicycle and Pedestrian Plan*, the County should amend the UDO to require new streets identified on the transportation plan map and collector street plan map that are designated bicycle/pedestrian routes to incorporate appropriate accommodations in their design. Other priorities for bicycle and pedestrian accommodations should be given when the following are present:

- The property is adjacent to public schools, parks, libraries, or other pedestrian-related public facilities

- The property has access to or is adjacent to existing or designated greenway corridors (access to these corridors should be incorporated into overall development plans)
- Development is connecting to an adjacent development with pedestrian accommodations (consistent cross section is recommended for connecting streets)
- Developments within or adjacent to designated or non-designated activity centers including institutional and commercial land uses

Bicycle and pedestrian accommodations can take many forms and typically include the use of sidewalks, bike lanes, trails, and greenways. Given the diversity of development within Wake County it is not likely that one type of facility will fulfill all future needs. However, to the extent practical, the following recommendations are offered regarding the use of bicycle and pedestrian facilities.

Accommodation Options: The County should encourage/require the inclusion of bicycle and pedestrian accommodations throughout the County where appropriate. However, the diversity of both the natural and built environment will influence the type of accommodations that are provided. A broad array of choices exist to support the implementation of an interconnected bicycle and pedestrian network including sidewalks, trails, multi-use paths, greenways, and on-street bike lanes and routes. Sidewalks should be designated primarily for use by pedestrians while multi-use paths may accommodate both pedestrians and bicyclist and should be signed accordingly. These facilities are described in more detail in the *Wake County Open Space Plan* and *Transportation Plan*. A few of these choices are described below.



Sidewalks—The sidewalks should be a minimum of 5 feet wide. Where curb and gutter is planned, a verge with a width of at least 2.5 feet (5-foot utility strip preferred) should separate the back-of-curb from the edge of sidewalk. In locations where there is no edge treatment, the sidewalk should be positioned behind the drainage feature (ditch or swale) unless adequate separation can be provided between the roadway edge and the ditch (recommended separation is 10 feet from edge of pavement). Maintenance sidewalks should be the responsibility of the local homeowners associations.

Trails—While sidewalks are the traditional means for accommodating pedestrians, the County should not overlook other alternative treatments. This may include the use of semi-permeable and permeable trails. These trails can follow open spaces, streams, or roads. They can be constructed of materials other than concrete, including crushed stone, asphalt as well as other all weather materials as may be approved by the County. The use of trails can be offered as an alternative to the more urban option of sidewalks, especially in rural areas. Where trails are used, efforts should be made to create not only recreational loops, but also connections to roadways, destinations, and other pedestrian facilities (sidewalks and greenways). Maintenance for these trails should be the responsibility of the local homeowners associations. Appendix C *Design Guidelines* of the *Wake County Open Space Plan* describes appropriate design standards for multi-use paths and trails.

5. **Traffic Calming**—The County should work cooperatively with NCDOT on the development and adoption of a residential traffic calming program and policy. The program should address the retrofit of existing residential streets while the policy should relate to developer requirements as new residential streets are built. The intent of the policy should be to eliminate the need for retrofits on future streets as the County continues to grow and build new residential neighborhoods.
6. **Minimize Curb and Gutter Use** — Wake County lies within the Cape Fear and Neuse River Basins and has numerous water supply watersheds. Best management practices

suggested by the North Carolina Division of Water Quality (DWQ) as well as other technical resources suggest that curb and gutter be used sparingly within the unincorporated areas of the County. A full set of recommended typical sections with varying edge treatments can be found in the street profiles section of the *Wake County Transportation Plan*. Recommended locations where curb and gutter should be considered include:

- Activity centers where stormwater runoff can be captured and controlled through the use of approved water quality/quantity devices prior to release
- Along streets where on-street parking is desired (likely in activity centers and other dense non-residential applications)
- When connecting to an existing street facility where curb and gutter is present, especially when adjacent to existing municipal boundaries and areas designated for future municipal annexation such as extra-territorial jurisdictions (ETJs)

Water Quality and Stream Crossings

Wake County has a number of lakes, streams, and tributaries distributed throughout the County. Given the quantity of streams, it would be nearly impossible to implement a meaningful collector street network without crossing some of these streams. Therefore, despite best efforts to avoid unnecessary or redundant stream crossings, a number of crossings remain in the recommended collector street plan.

These crossings will require some degree of land disturbance and structure in the form of a culvert or bridge. In order to implement these connections, permits from the following will be required: NCDOT, North Carolina Division of Water Quality (DWQ), and the U.S. Army Corps of Engineers. It is important to note that identification of a crossing on the collector street plan is in no way a guarantee that permits will be issued. In fact, meetings with representatives of DWQ confirm that permitted crossings are often the exception rather than the rule.

More specifically, the crossing of streams may require Section 401 and 404 permits from the U.S. Army Corps of Engineers and DWQ. In the case of streams and wetlands located within the



Neuse River Basin, certification of compliance with the Neuse River Buffer rules will be required. These buffer rules have been established for the sole purpose of protecting and preserving existing riparian buffers in an effort to maintain their nutrient removal function. The ultimate goal is to improve the overall water quality within the basin and Neuse River.

Working with representatives from DWQ, the project team and technical committee developed the following recommendation regarding water quality and stream crossings:

1. **Curb and Gutter**—Minimize the use of curb and gutter edge treatments (see previous curb and gutter policy recommendation)
2. **Avoidance**—Avoid unnecessary stream and wetlands crossings; seek alternate connections that achieve similar connectivity
3. **Subdivision Review and Zoning Procedures**—The planning staff should consider the referral of development proposals that encompass identified stream crossings (either as a part of the development proposal and/or on any approved public plan such as the *Collector Street Plan*) to DWQ. The following process is therefore recommended when reviewing plans for consistency with adopted transportation plans:
 - a) Development Review Staff Meeting (DRS) — During this meeting, the planning staff will identify proposals affected by the transportation plan or collector street plan.
 - b) Next, the staff will identify any required stream crossings.
 - c) If crossings are indicated, the staff will review the reasonableness of the crossing. In limited cases, the staff may decide that the crossing is no longer necessary or desired given changes in the natural or built environment. Staff may choose not to pursue the implementation of the crossing in limited circumstances including when:
 - The crossing is no longer feasible due to conditions on the opposite side of the stream *and* there are no other options that are feasible within the confines of the proposed development.

- The crossing is no longer necessary to achieve the desired connectivity given the implementation of a parallel or nearby crossing/connection that achieves the same connectivity purpose.
 - When staff identifies other criteria and circumstances that deem the stream crossing impractical or unlikely to be permitted.
- d) Desired crossings will be identified during the DRS process and indicated in comments communicated to the applicant. These comments will include referral to the appropriate reviewing agencies including the NC Division of Water Quality. Consultation with the reviewing agency will minimize the possibility of approval by the County prior to environmental permitting.
 - e) Letter of Denial for Crossing Exemptions—Require that a letter of denial from DWQ be provided as evidence that the agency has reviewed the merits of those development applications that have been referred by the Wake County planning staff. This may include subdivision, conditional, and special use zoning proceedings. This will ensure that efforts have been made to secure the crossing permit and will provide County staff sufficient information to recommend exemption from the crossing as a part of the development review and zoning process.
4. **Best Management Practices**—Develop a Wake County Water Quality Best Management Practices manual. Working cooperatively with DWQ, the County’s environmental services and planning departments can work to establish a series of strategies to improve water quality through environmentally sensitive development designs, preservation tools, greens streets, and technology.
 5. **Bicycle and Pedestrian Crossings**—Where stream crossing permits are denied for road, pursue less intrusive pedestrian and bicycle crossings. See Chapter 5 of the *Wake County Transportation Plan* for bicycle and pedestrian priorities and routes.

Funding and Phasing

One of the primary purposes of the *Wake County Collector Street Plan* is to communicate the framework for the future road network. While the future collector streets proposed as part of the plan do not depict specific alignments, the plan conveys a concept system of collector streets that work together to provide for an interconnected street network. Through the adoption of local policies and procedures, the incremental construction of the collector street network can effectively occur. With this in mind, it is recommended that the development review process include consideration of the future collector street network. Just as with the thoroughfare plan, development should be required to proceed in such a way that it is responsive to and consistent with the proposed future year street network. Identification of the future street connections also should be given consideration during the zoning and review process.

Collector streets are generally maintained by NCDOT, therefore the implementation of this plan can be achieved either by private development through the development approval process or through public/private partnerships. In general, funding from NCDOT is not available for collector streets. Collector streets proposed as a part of the *Wake County Collector Street Plan* generally fall into one of three categories. They include (1) new collector streets to be constructed as land is developed; (2) proposed connections to eliminate a discontinuity along an existing collector street; and (3) the extension of an existing collector street to an existing arterial or thoroughfare. For the most part, the responsibility for funding and constructing a collector street will depend on its category.

The *Wake County Growth Management Strategy* outlines a number of financing options to accommodate the necessary facilities and services associated with continued growth. The authors of this report appropriately identify the most important collaborative priority for Wake County and its local governments as “the immediate need to implement tools for the recovery of development costs, as well as tools to generate revenue for needed public facilities.”

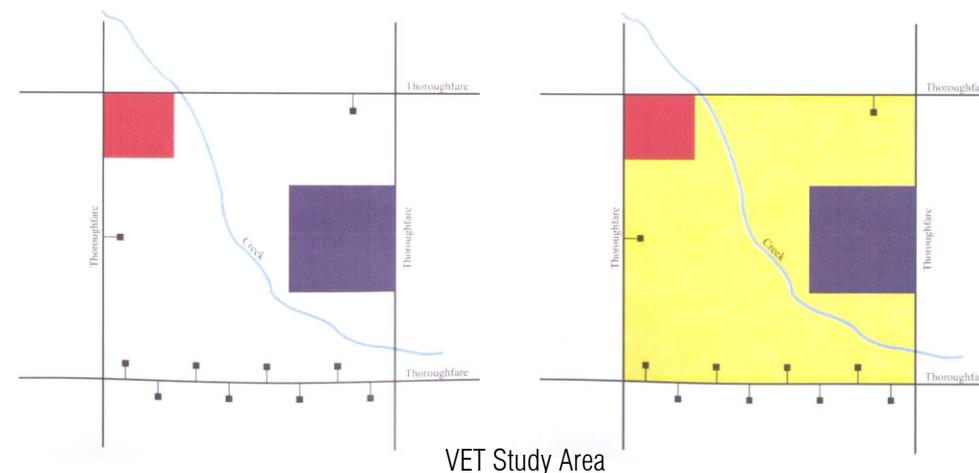
According to the report, special legislation and voter approval may be required for some or all of the strategies to be implemented by the County. Other transportation recommendations can be found in Chapters 4 and 9 of the growth management strategy. Included within these chapters

are regional transportation strategies as well as sample ordinances and legislation. The recommendations contained within this report are consistent with the goals and objectives of both the *Wake County Transportation Plan* and *Collector Street Plan*. Further study of the financial strategies contained in the *Wake County Growth Management Strategy* is recommended.

Additional Policy Recommendation

The following represents a recommendation intended for future consideration. It is offered as one additional strategy that supports the goals and objectives outlined in the *Wake County Collector Street Plan*, *Transportation Plan*, and *Comprehensive Plan*.

VET Studies—The visual, environmental, and transportation effects of land development raise concerns by citizens and a host of organizations interested in maintaining a good quality of life in Wake County. Information is needed by decision-makers to respond to citizens’ concerns and to better understand the larger context in which land development applications are made. A visual, environmental, and transportation — or VET — analysis is intended to serve this need.





A VET analysis would be prepared by applicants and submitted for County review at the time of site plan review. The cost to prepare the analysis would be paid by the applicant. Guidelines and sample documents could be offered by County planning staff to assist applicants.

The area to be covered in a VET analysis would extend from the boundaries of the project site out to the nearest thoroughfares in all directions. This is called the catchment area. The components are described as follows.

- **Visual**—The visual analysis would use illustrations to compare the existing and proposed conditions from the viewpoint of nearby public rights-of-way including thoroughfares fronting the development. Using computer software or hand renderings, the proposed development would be shown along with any proposed loss of vegetation buffering the viewshed from the perspective of someone in the public right-of-way.
- **Environmental**—The environmental analysis would graphically map any environmentally-sensitive areas within the catchment area using information available from the County GIS and other data resources. The map should show all bodies of water and riparian buffers. Property lines also should be shown. Recommendations of the *Wake County Collector Street Plan* regarding the location of future collector streets should be reviewed when preparing the environmental analysis to study the best location of the collector streets relative to environmentally-sensitive areas within the catchment area. A study should be conducted as to whether a bridge or culvert is recommended for the collector street crossing of any environmentally-sensitive area.
- **Transportation**—The transportation analysis would document existing and projected levels of service at key study locations along the periphery of the catchment area, including intersections where the applicant proposes access for the site and at the intersection of thoroughfares. Pedestrian access within the development as well as connectors to adjacent neighborhoods, schools, shopping centers, parks, greenways, bikeways, and workplaces should also be illustrated.

Acknowledgements

County Planning Staff

Melanie Wilson, Planning Director
Tim Clark, Project Manager
Ekem Lartson, Planner III
Melinda Clark, Land Development Administrator
Keith Lankford, Planner III

Technical Committee

Bill McLaurin, Citizen Advisor
Bobby Lewis, Wake County Planning Board
Brandon Jones, NCDOT Wake County District Engineer
Britt Stoddard, Wake County Environmental Services
Mike Jennings, Wake County Environmental Services
Ed Johnson, CAMPO
Eric Lamb, Raleigh DOT
Jim Parajon, Cary Planning
John Hodges-Copple, TJCOG
Loftee Smith, Wake County Planning Board
Marcia Lieber, Soil and Water Conservation Board
Mary Grady Bell, Citizen Advisor
Phil Hinton, Citizen Advisor
Richard Stockett, Homebuilders Association
Robin Hammond, Wake County Planning Board
Sara Smith, NCDOT Statewide Planning

Project Consultants

Roger Henderson
Stephen Stansbery
David Whyte
Mike Rutkowski
Craig Gresham
Julie Barker

Disclaimer

The opinions and recommendations contained in this draft report are those of the project consultants.
