

A plan to connect southern Pender County to the future, containing recommended policies and infrastructure that support our community's desire to build on its identity and maximize economic, social, and environmental opportunity.

Pender County Collector Street Plan



Final Report | 3-2016 | Pender County



prepared for Pender County and Wilmington Urban Area Metropolitan Planning Organization by Stantec Consulting Services, Inc.

ACKNOWLEDGMENTS

The development of the Pender County Collector Street Plan was a collaborative process involving numerous stakeholders, including the Pender County Collector Street Plan Steering Committee members, the Pender County Planning and Community Development Department, the Wilmington Urban Area Metropolitan Planning Organization, and members of the public. We profoundly thank everyone involved for making this a successful project.

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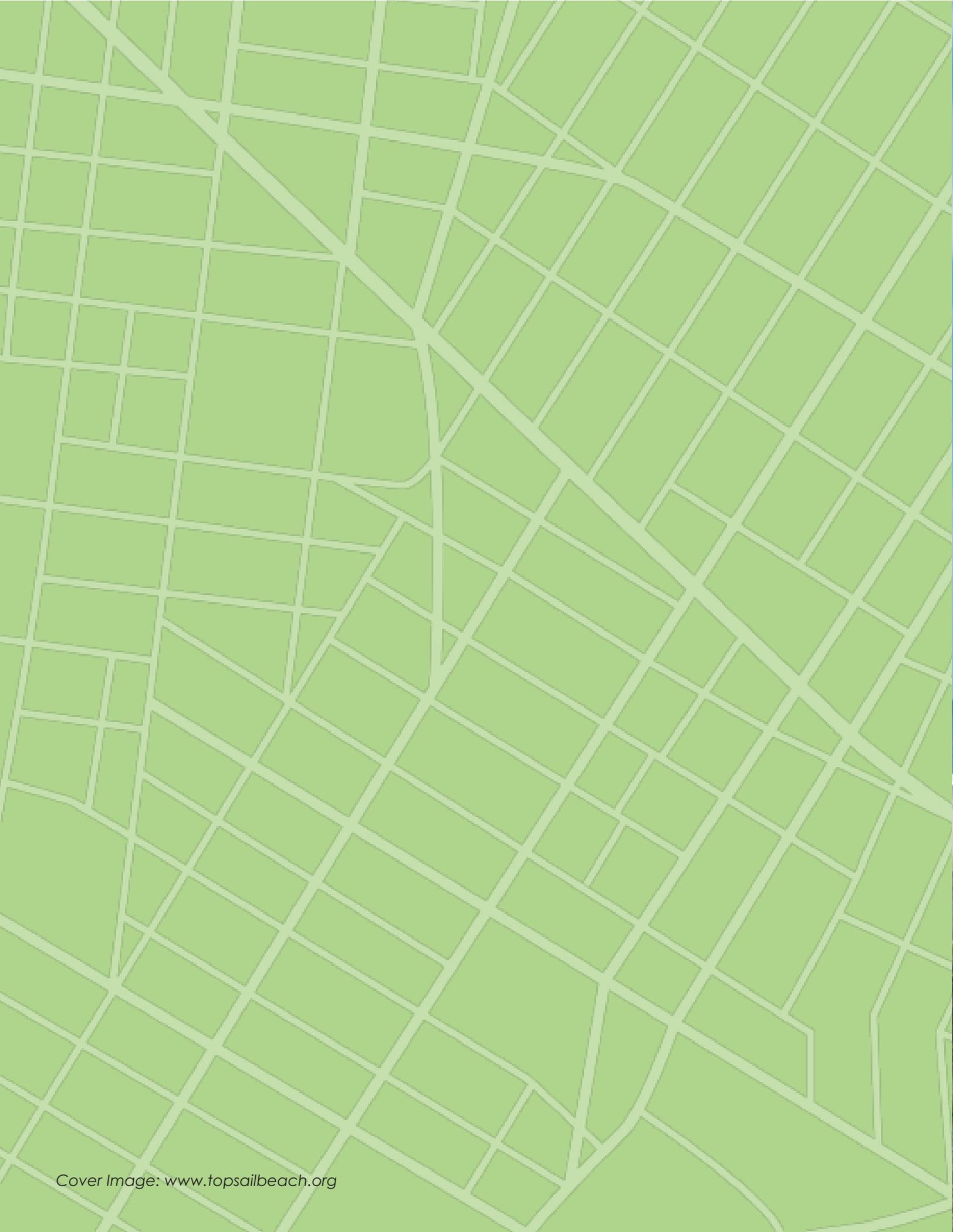
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CONTENTS

Introduction & Purpose	2	Land Use Intensity.....	53
What are Collector Streets?.....	4	Cross-Section Categories.....	53
Mission Statement & Purpose.....	4	Group 1.....	54
Existing Conditions	6	Group 2.....	56
Background.....	7	Group 3.....	57
History.....	8	Group 4.....	58
Demographics.....	10	Policy Strategies	61
Commuting.....	13	Recommended Policy Measures.....	62
Future Growth.....	14	Island Creek Road and NC-210.....	69
Previous Planning Efforts.....	15	Funding.....	70
Environmental Conditions.....	20	Action Plan.....	70
Existing Transportation Conditions.....	22	Appendix A	72
Public Input	38	Appendix B	85
Meeting Summaries.....	39	Appendix C	98
Public Outreach.....	39	Appendix D	103
Survey.....	40	Appendix E	125
Recommendations	44	Appendix F	141
Emergency/ School Vehicles.....	45		
Connectivity/VMT Reduction.....	45		
Spacing Standards.....	46		
Complete Streets.....	49		
Soil Road and Paper Streets.....	49		
Preferred Collector Street Scenario.....	49		
Design Requirements	52		
Cross-Sections.....	53		



1

Introduction & Purpose

In This Chapter

What are Collector Streets? • 4

Mission Statement & Purpose • 4



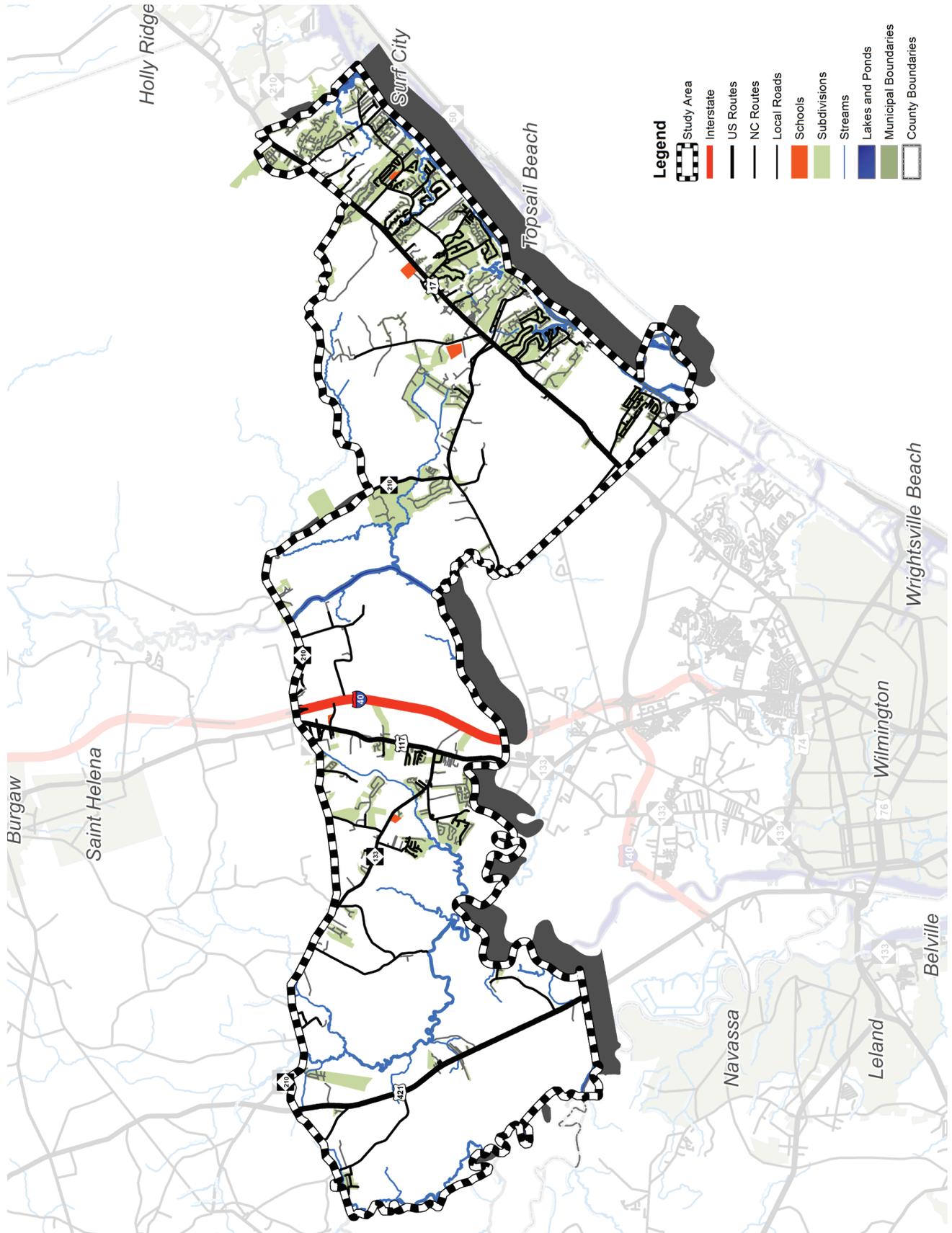


Figure 1. Pender County Collector Street Plan Study Area

The Wilmington Urban Area Metropolitan Planning Organization (WMPO), in partnership with the Pender County Planning and Community Development Department, has commissioned this Collector Street Plan to determine future roadway connectivity needs in the southern portions of Pender County. The study area map is presented in Figure 1 below.

What are Collector Streets?

Collector streets are defined as streets that connect neighborhoods and local roads to the arterial roads. A few existing examples of collector streets in the study area are Country Club Drive, Sloop Point Loop Road, NC-133, and Hoover Road. These streets are typically two lanes, not more than two to three miles long, have speed limits between 25 and 45 mph, and carry lower volumes of traffic.

Collector streets serve a number of important functions within the street network. They are very important in reducing congestion on arterial roads by equitably distributing the traffic burden so that shorter, local trips use the collector street system and long-distance trips remain on the arterial streets. Another important benefit is providing enhanced mobility opportunities for all users of the roadway, including emergency service providers, pedestrians, joggers, bicyclists, school buses, and municipal services. Pender County does not own or maintain roadways. Roads are either public and maintained by NCDOT, or they are privately owned and maintained. Therefore, this plan is an important step toward ensuring that the development community that does build roads maintains appropriate connectivity across the study area.

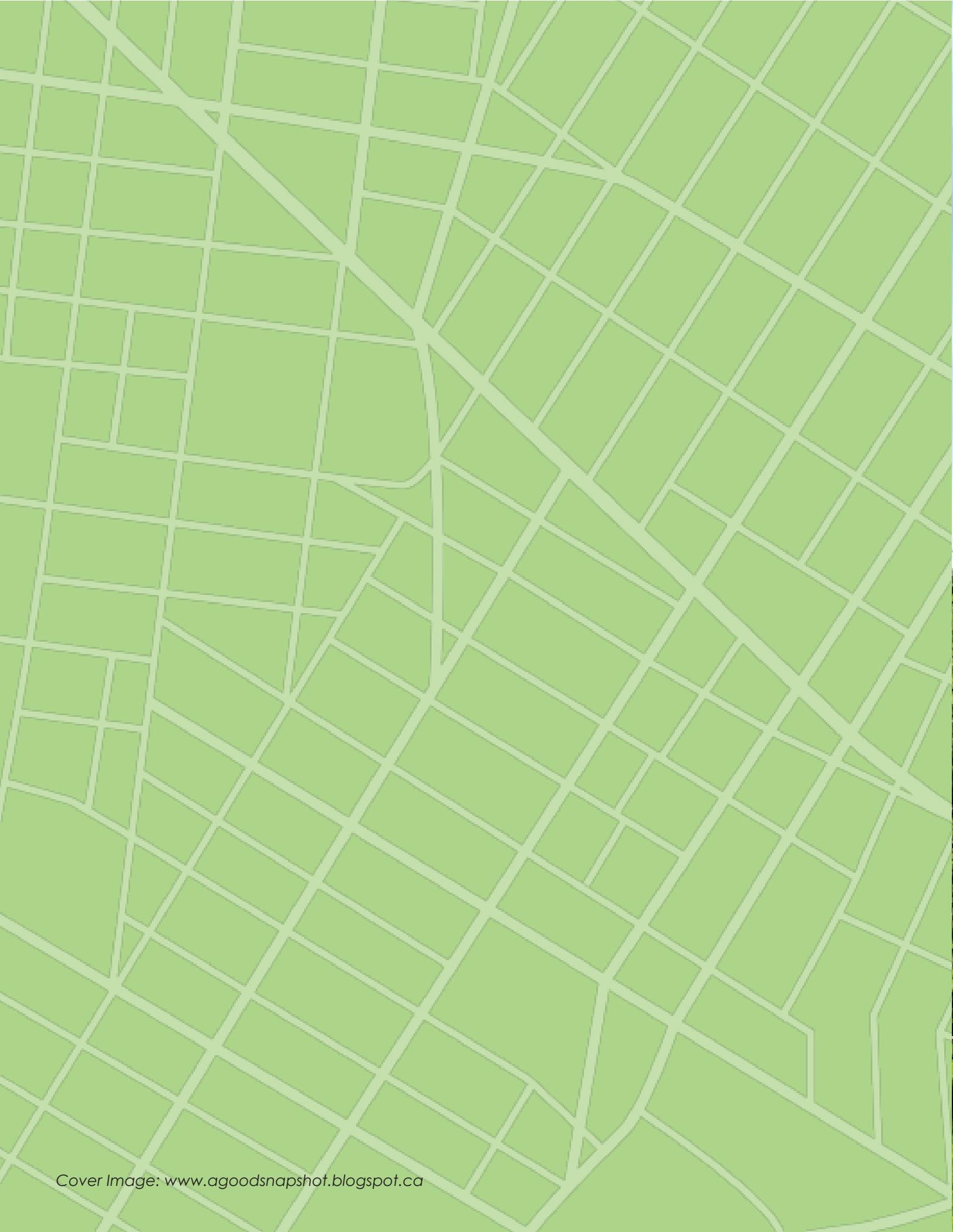
Mission Statement & Purpose

The primary goal of the Pender County Collector Street Plan is to guide investment in new collector streets with the ultimate intention of improving connectivity, focusing land development in suitable areas, encouraging all modes of transportation, maintaining levels-of-service on existing roadways, promoting safety, ensuring that significant natural areas are conserved, and providing a safe and high-quality transportation system for existing and future residents, businesses, and visitors.

To achieve these goals, the Steering Committee, Pender County, and WMPO planners agreed on the following guiding principles and objectives for the Pender County Collector Street Plan.

- 1 Develop a realistic and feasible network of collector streets that support the local street and arterial system
- 2 Work with the development community to ensure proper connectivity and collector street design
- 3 Be sensitive to environmental issues and “build in” context sensitive design approaches where applicable
- 4 Integrate multimodal design features into the street design that support walkability and bikability





2

Existing Conditions

In This Chapter

Background • 7

History • 8

Demographics • 10

Commuting • 13

Future Growth • 14

Previous Planning Efforts • 15

Environmental Conditions • 20

Existing Transportation Conditions • 22



This section provides an overview of the project and information on the history, demographics, future growth, previous planning efforts, environmental conditions, and transportation in southern Pender County.

Background

The WMPO, whose jurisdiction includes seven (7) municipalities and three counties, is the primary organization responsible for regional transportation planning in the Wilmington metropolitan area. The portion of Pender County that is the focus of this collector street planning effort corresponds to the WMPO jurisdiction boundaries in Pender County. This area includes the unincorporated areas of Hampstead, Scotts Hill, and Rocky Point and parts of the Topsail, Long Creek, Holly, and Grady townships. The Pender County Collector Street Plan (CSP) study area encompasses 152 square miles. This CSP is a follow-up to the 2007 Coastal

Pender Collector Street Plan and reflects the new boundary for the WMPO jurisdiction due to the designation of Wilmington as a Transportation Management Area (i.e., an urbanized area of 200,000 or more people).

Growth is expected to continue in the study area, with much of the development in recent years centered around the Topsail Township and unincorporated Hampstead area (also unincorporated Scotts Hill). There is residential development along US 17, NC-210, and US 117. Industrial growth is planned along US 421 within the study area as well.

While rural land uses still dominate the outer reaches of the WMPO jurisdiction, significant infrastructure projects such as the proposed Hampstead Bypass and sewer investments will likely continue to spur growth to the west of US 17 in the Topsail Township of the study area.



Residential Suburban Development in the CSP Study Area

Additionally, the aforementioned industrial growth on US 421 will likely also serve as a catalyst for further development in the CSP study area.

This area is transitioning from primarily rural land uses to more suburban residential, commercial, and industrial development. As this occurs, the transportation network, which is comprised mostly of two-lane farm to market roads, will come under increasing strain. In order to accommodate future growth and allow for the efficient movement of people and goods in the CSP study area, a well-planned collector street system should be implemented. Collector streets serve as the conduit through which people leave their homes on local streets and reach the major mobility carrying arterial streets, such as US 17, NC-210, US 117, and US 421. By planning a collector street network and working with the development community prior to significant land development in the area, traffic congestion can be more effectively managed in the long term, avoiding costly street reconstruction and widening projects. Additionally, the provision of collector streets can help direct growth to locations that are adequately serviced by roadway infrastructure, ultimately leading to the better use of public infrastructure investment dollars.

History

Settlement

European explorers first arrived in Pender County in 1524, reporting a surplus of wild game in the area. The county was gradually settled and, in 1663, the Barbados commissioners explored and founded a community along the northeast branch of the Cape Fear River, naming the area Rocky Point. The town still exists today and retains the same name. Over the next fifty years, the population gradually increased and by 1725 the area was almost entirely settled. Officially, what we now know as Pender County was still part of New Hanover County until 1875.

The first European settlers of the area were Welsh, who came to settle the bottom land and take



Sloop Point Plantation: Courtesy of the Pender County Public Library

advantage of the tidal river transportation, though German and English settlers soon followed. The approximately 150-year period between 1725 and the United States Civil War saw sustained, if gradual, population growth in the area and commercial success. Large plantations were constructed during this period of prosperity, including the Sloop Point and the Belvidere plantations; the Sloop Point plantation house is still standing, while the Belvidere plantation house has since been demolished.

Migration continued unabated through the Revolutionary War. Between 1763 and 1775, nearly 20,000 Scots moved to the Cape Fear region, augmenting the already diverse population in the



area. However, in the early 1800s, technological advances in New England and settlement of cheap land to the west led people to leave eastern North Carolina, accounting for the slow pace of growth in the area. The advent of the railroad in 1840 changed this dramatically and led to a resurgence of both population and economic development in Pender County.

Revolutionary and Civil Wars

Residents of Pender County played an important role in both the Revolutionary and United States Civil Wars, fighting and winning a crucial battle against the Scottish Highlanders at Moores Creek, just northeast of Montague in 1776. In the United States Civil War, the area sent nearly 4,000 troops to war and was home to the youngest Confederate General, William D. Pender, after whom the County is named. He was killed in the Battle of Gettysburg in 1863.

Following the Civil War, the local plantation system declined, though much of the population continued to work in farming, clamming, fishing,

and salt-making, among other professions.

During the tumultuous Reconstruction era, local political machinations led to the formal creation of the County from the northeastern area of New Hanover County. The first Pender County seat was Watha, but was later moved to Burgaw, named after the local Native American tribe.

Transportation through the Years

Prior to the 19th Century, transportation in Pender County was restricted primarily to waterways, with Wilmington achieving important status as a trading hub at the terminus of the Cape Fear River, the only river in the state directly accessible to the ocean. Gradually, however, roads become more and more important as farmers needed a more direct link to markets for their goods. The first roads were cleared to provide access to river wharfs, but as time passed, more and more roads were constructed, eventually becoming the ideal mode of transportation for most Pender County residents.

In 1836, construction on the railroad line between Wilmington and Weldon in Halifax County



Rocky Point Railyard: Courtesy of the Pender County Public Library



began, connecting rural eastern North Carolina counties with Washington D.C. and New York. The development of the railroad had major impacts on life in Pender County, opening new markets for agricultural goods and facilitating passenger travel. Additionally, plank roads began to be constructed during this time. Plank roads are the precursor to asphalt roadways. Initially, these roads provided better access to railroads, but soon became important pieces of transportation infrastructure in their own right.

Into the 20th century, roads continued to be the most important infrastructure, while the railroad system gradually became obsolete. Passenger service was discontinued in 1939, though freight lines still operated on the Pender County railroad until the 1980s. In the early 20th Century, old plank roads, such as the Holly Shelter Plank Road, Duplin Road, and Clinton Road, were improved substantially, becoming US 17, US 117, and US 421, respectively. Over the course of the century, these roads were further improved, while the Interstate highway system was also constructed. Interstate 40 was originally planned to end in Morehead City, but the plans were revised and the Interstate terminated in Wilmington instead.

The Current Day

In the current day, Pender County's economy is predominantly comprised of farming and manufacturing enterprises. Agricultural products include blueberries, strawberries, tobacco, soybeans, and livestock, while factories produce clothing, food and pressure sensitive labels.

Pender County is located on the coastal plain in Southeastern North Carolina and includes six towns and seven communities. The incorporated Town of Burgaw, located to the north, is the county seat and the location of many of the County government buildings. With a land area of 869.79 square miles, Pender County is the fifth-largest county in North Carolina by land area.

The Cape Fear River forms the southern bounds and then traverses the study area east of I-40, while

the Black River serves as the western study area boundary. The NE Cape Fear River and six creeks, including Long Creek, Morgan's Creek, Turkey Creek, Harrison Creek, Godfrey Creek, and Cross Creek make up the other significant water features in the area. The study area abuts the Intracoastal Waterway on the eastern side.

The CSP study area contains five significant highway facilities. Both NC-210 and NC-133 provide east-west mobility and access across the study area, while US 421, US 117, and US 17 serve as north-south roadways. Interstate 40 also bisects the County on a north-south axis. Collectors and local roads provide access to shopping, business, and residential land uses in the study area.

Demographics

The Pender County Collector Street Plan (CSP) study area does not exactly correspond to United State Census Block Group or Census Tract boundaries. For ease of analysis and understanding, Census Tracts and Pender County as a whole are used to calculate demographics. Census data from the 2010 Decennial Census was used to determine population statistics for the Census Tracts referenced in Figure 2. Overall, 30,505 people reside in these Census Tracts, with 85.3 percent identifying as white, 8.8 percent identifying as African-American, 0.6 percent identifying as Native American, and 0.5 percent as Asian. People identifying as belonging to some other race account for 2.8 percent of the population of the study area, while 1.9 percent identify as belonging to two or more races. Approximately 5.5 percent of people are Hispanic or Latino in this area.

Due to the substantial population changes in Pender County, Census Tract boundaries were significantly altered between the 2000 and 2010 Decennial Censuses. As such, comparing population in our specific study area between these two time periods lacks utility for this project. However, in comparing between the 2010 Census and the 2013 American Community Survey, Census tract boundaries remained the same. Overall, the area has seen some population growth,



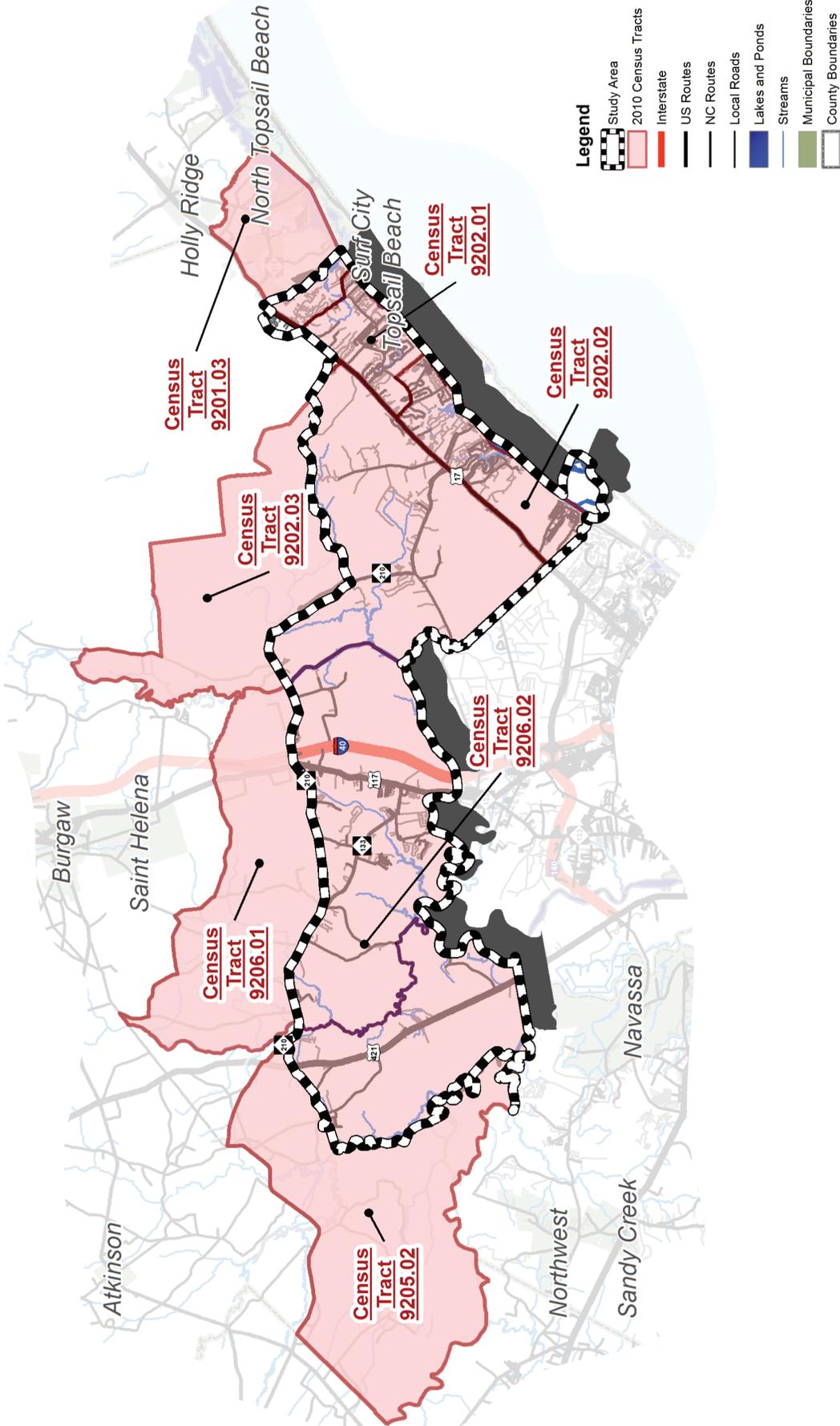


Figure 2: Census Tracts Used for Demographic Analysis



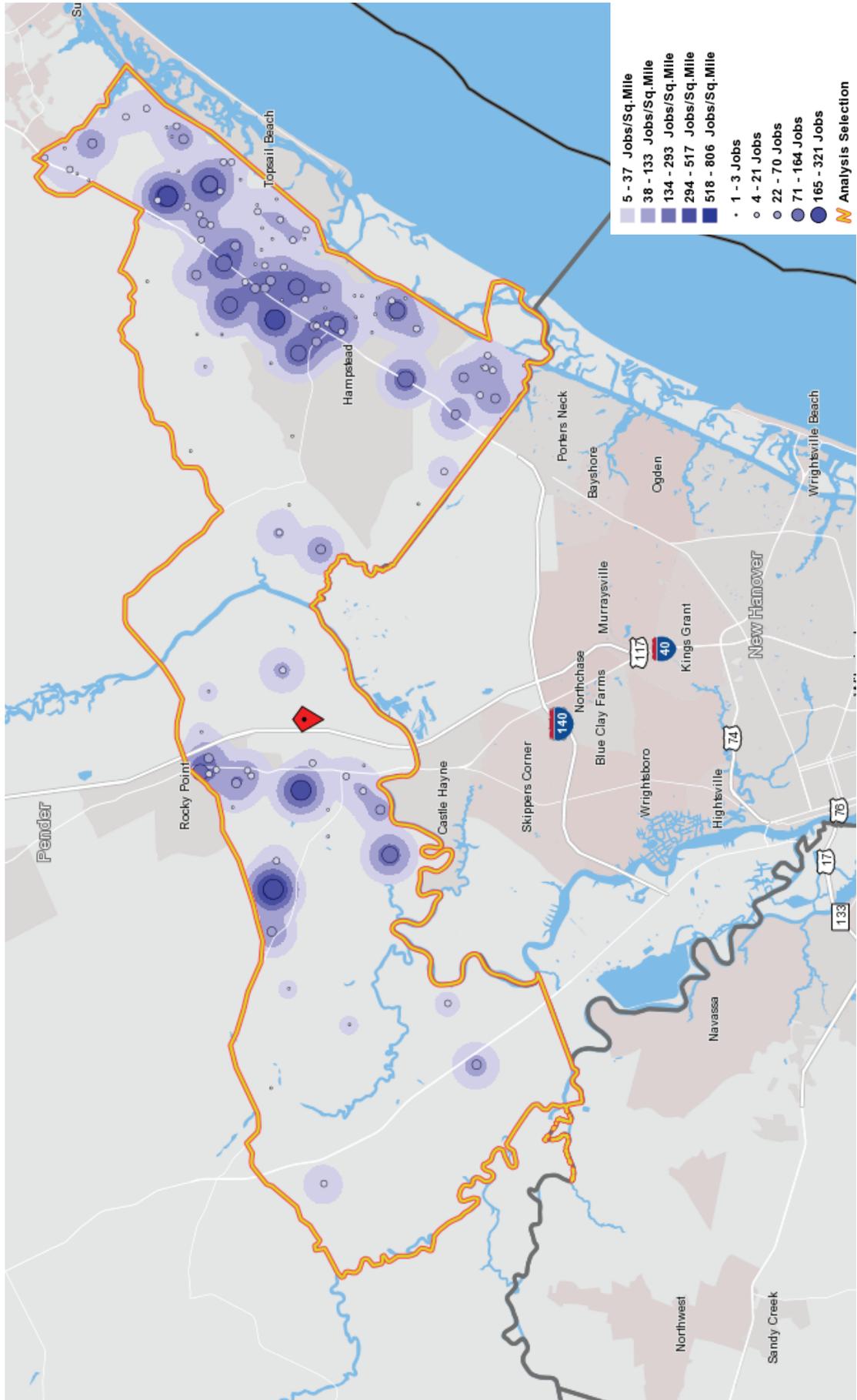


Figure 3: Job Concentrations in CSP Study Area



with an estimated population of 31,533 in 2013. Of the workers aged 16 or over in the selected Census Tracts, almost 80 percent travel to work by driving alone, while 15.6 percent carpool, and less than one percent walk, bike, or take public transportation. The median household income for these Census Tracts ranges from \$41,867 to \$68,152, with an average median household income across all Census Tracts of \$48,951. The highest median income is in Census Tract 92.02, which contains the unincorporated community of Hampstead.

Commuting

In examining primary jobs and commuting patterns, the exact CSP study area boundary was used. Overall, jobs are mostly congregated around the Topsail Township and the more densely populated areas to the east and west of US 17, while areas along US 117, US 421 and NC-133 are also job centers in Pender County, as indicated in Figure 3.

There are 973 people who both live and work in the study area. Less people are commuting to the study area to work from other places at

2,266, while more people live in the study area, but work elsewhere at 10,230 (Figure 4). With this in mind, it is clear that the CSP study area supports a large commuting residential population. Figure 4 indicates that 83 percent of the working population of the CSP study area commutes more than 10 miles to work, with nearly half traveling between 10 and 24 miles to the major urban and employment center of Wilmington, NC. Jacksonville and area military bases are also large employers and represent significant employment destinations for residents of the study area. A significant portion, accounting for 39.4 percent of people, are also commuting northwest from the CSP study area, likely to industrial and commercial centers in the interior of Pender County and in nearby counties. These commuting trips are predominantly for distances of 50 miles or more. Across the CSP study area, average commute times ranged from 25 to 31 minutes (see Figure 5). Overall, these commuting patterns reflect the fact that the study area serves as the location for many homes, but for substantially fewer employers. With such a large commuting population and further development forecast in the area, it will be very important to maintain major mobility carriers at

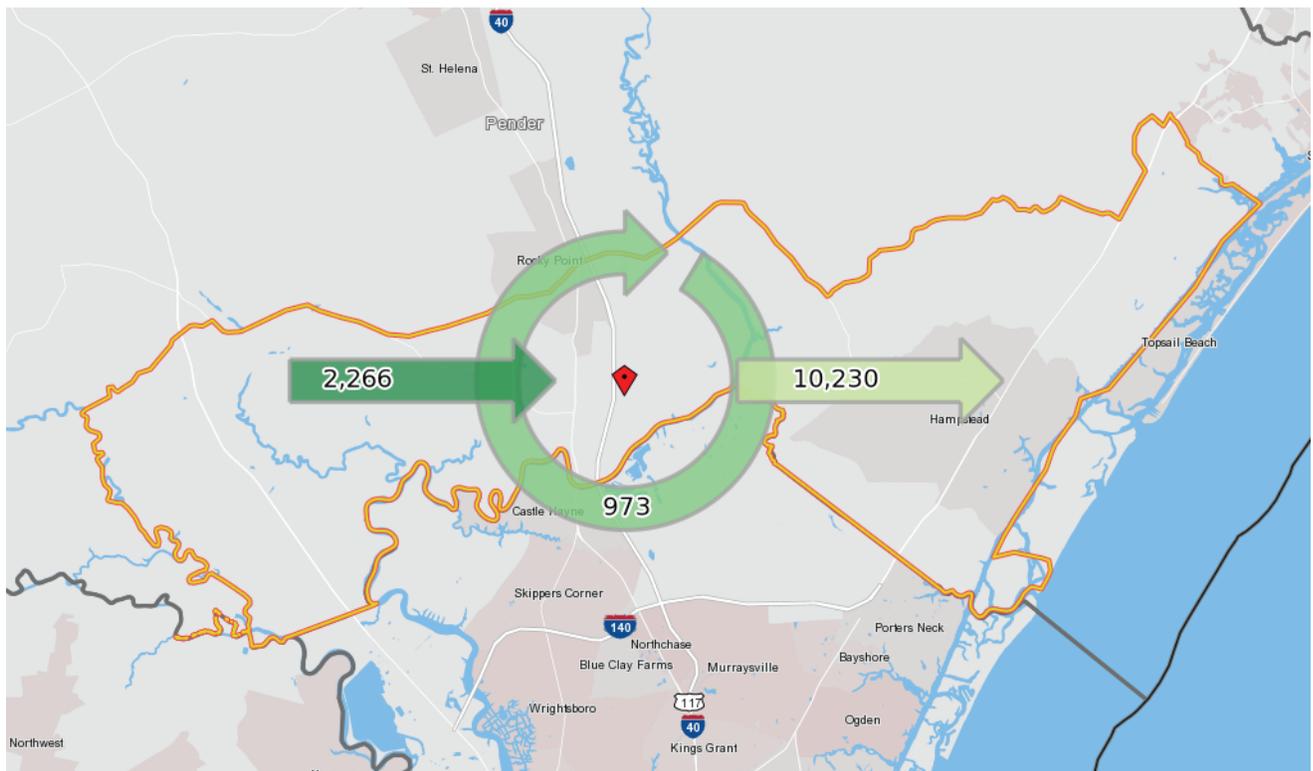


Figure 4: Commuting Statistics for CSP Study Area

relatively uncongested levels.

Of the 3,239 primary jobs in the study area, 21.6 percent are held by people aged 29 or younger, 57 percent by people aged 30 to 54, and 21.4 percent by people aged 55 or older. The most prevalent type of employment in the CSP study area is educational services, which accounts for 20.7 percent of all jobs. Other major job sectors include health care and social assistance (11 percent), retail trade (10.7 percent), construction (9.6 percent), and accommodation and food service (8.9 percent). Agriculture, Forestry, Fishing, and Hunting, historically the leading employment sector in Pender County, now only accounts for 6.2 percent of all jobs.

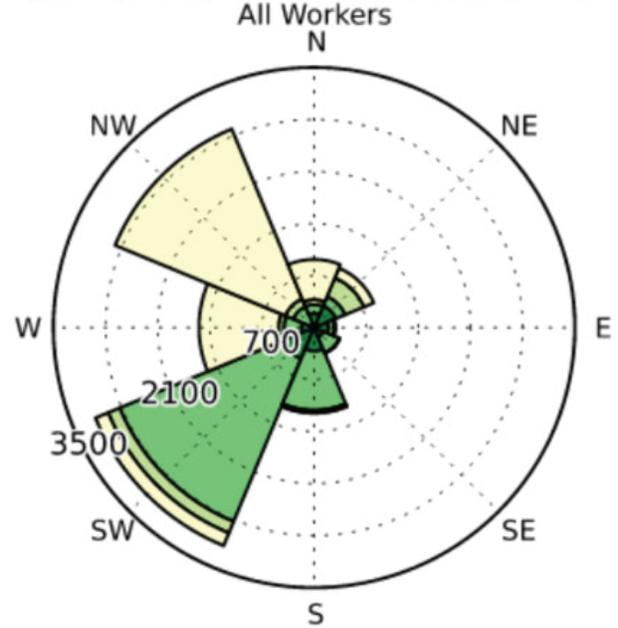
Future Growth

According to the North Carolina Office of State Budget and Management, Pender County as a whole is projected to grow by 11,201 people between 2010 and 2020, roughly a 22 percent increase. The rate of growth continues the existing trend in Pender County between 2010 and 2014, a period which experienced growth in excess of 5.8 percent overall. Looking further into the future, Pender County is forecast to grow by a further 18 percent between 2020 and 2030.

As the County is growing at a rapid rate, much of the projected growth is likely to fall in areas of Pender County close to the Atlantic coastline and in proximity to existing community nodes and metropolitan areas. The CSP study area will likely see a substantial population boost as the Wilmington metropolitan area continues to expand, while Jacksonville and nearby military bases will also continue to spur growth in this area. Residential growth will also likely continue along the major highways in the study area. These areas are particularly ripe for development due to the appeal of rural lifestyles with quick access to Wilmington on US Routes and Interstate 40.

In many cases, rapid land development can leave transportation planners with few options to improve the transportation networks in an area.

Job Counts by Distance/Direction in 2013

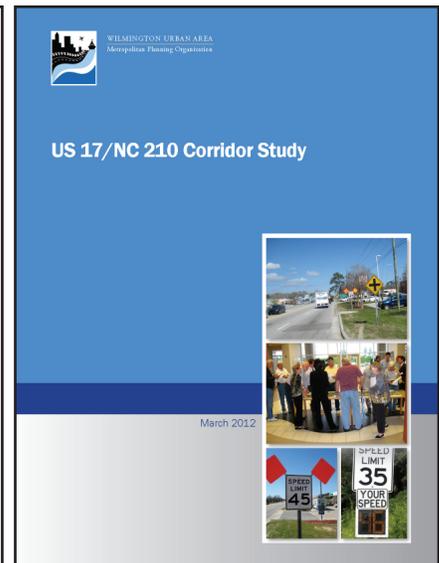
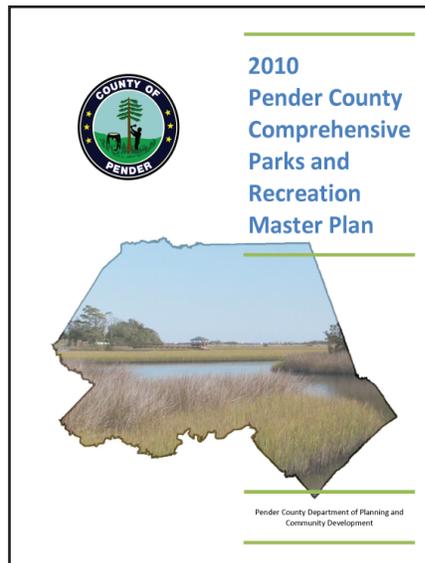
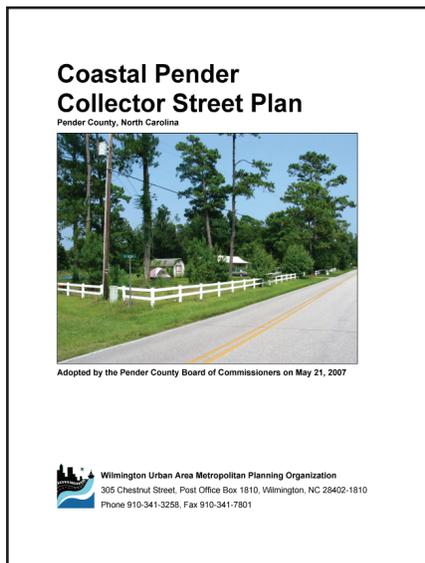


	2013	
	Count	Share
Total Primary Jobs	11,203	100.0%
Less than 10 miles	1,839	16.4%
10 to 24 miles	4,212	37.6%
25 to 50 miles	733	6.5%
Greater than 50 miles	4,419	39.4%

Figure 5: Commuting Distances in the CSP Study Area

The most prevalent type of employment in the CSP study area is educational services, which accounts for 20.7 percent of all jobs.





Constructing new roads or widening existing roads after surrounding parcels have developed is often a controversial and costly process. With new development adding further pressure to the existing roadway network in the CSP study area, the need for a Collector Street Plan that prioritizes roadway investments, is based on community input, and focuses new roadway construction in areas away from sensitive natural features cannot be overstated.

Previous Planning Efforts

The first step in the planning process was to gather existing planning documents. A number of plans were examined including;

- 2007 Coastal Pender Collector Street Plan,
- 2010 Pender County Comprehensive Parks and Recreation Master Plan
- 2012 US 17/NC 210 Corridor Study,
- Cape Fear Transportation 2040 (Metropolitan Transportation Plan), and
- 2010 Pender County Comprehensive Land Use Plan

2007 Coastal Pender Collector Street Plan

The Coastal Pender County Collector Street Plan is the guiding document for the planning of new collector streets within a small area of coastal Pender County. The plan expounds on the

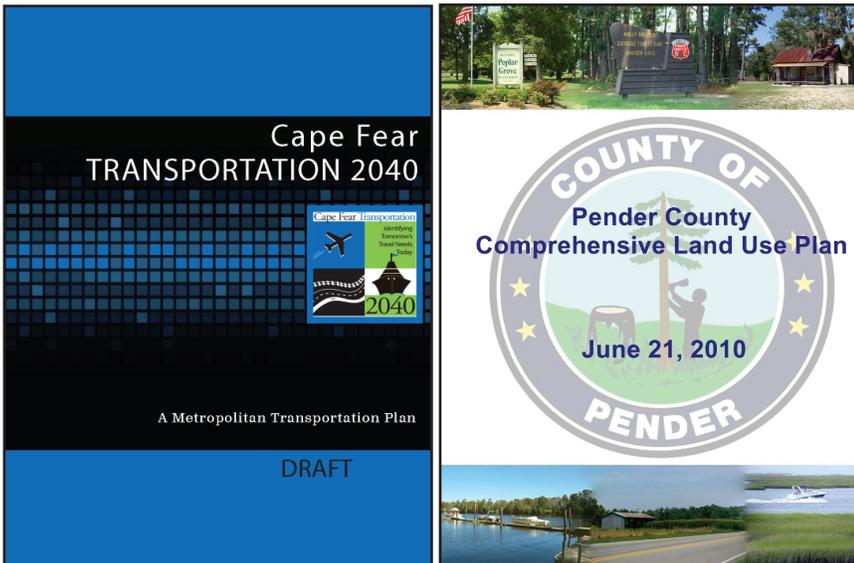
background, history, demographics, and future growth potential within the study area, while also detailing the previous plans and studies relating to collector streets. This plan created specific recommendations for new collector streets based on public outreach and also suggested implementation strategies.

Relationship to the Pender County Collector Street Plan Project

This plan serves as a precursor to the current Pender County Collector Street Plan effort. The current planning effort encompasses the entire Wilmington Urban Area Metropolitan Planning Organization jurisdiction within Pender County, a much larger area than the area examined in the 2007 Coastal Pender Collector Street Plan. This larger area is the result of the WMPO designation as a Transportation Management Area, which expanded the WMPO's boundaries to encompass larger areas of Pender County. The 2007 Coastal Pender Collector Street Plan only addresses collector streets in a small area of north of the New Hanover County line focused on the Topsail Township and the community of Hampstead. This plan is bounded by the Holly Shelter Game Lands on the west and Sloop Point Loop Road in the north and represents a significant population node in Pender County.

The recommendations of this plan include a





Previous Planning Efforts

number of new collector streets as well as new arterials. While some collector streets are proposed in areas between US 17 and the Intracoastal Waterway to improve the current road network, the majority of recommended new collector roadways are located between US 17 and the study area boundary to the west due to land available for development in these areas. Some existing roads are extended to make new connections, such as Godfrey Creek Road, Holiday Drive, and Wolf Pond Road, while a large number of new collector roads are recommended in the areas between Island Creek Road and US 17. These recommendations will be re-evaluated as part of this planning effort and will serve as the basis for recommendations in the 2016 Pender County Collector Street Plan. However, the lack of an environmental analysis component in the 2007 Coastal Pender Collector Street plan requires that any recommendations from this plan be vetted extensively to ensure that construction is feasible before inclusion in the current planning effort.

2010 Pender County Comprehensive Parks and Recreation Master Plan

The 2010 Pender County Comprehensive Parks and Recreation Master Plan provides a framework for the development of future parks and recreation opportunities in Pender County and also catalogs existing facilities and supportive programs. A substantial public outreach effort was conducted

as part of the Plan, which helped identify critical parks and recreation needs and provided insight into the desires of Pender County citizens with regard to recreation opportunities, particularly with respect to the provision of pedestrian and bicycle facilities. The Plan also recommended new park and recreation facilities and identified funding solutions while also addressing proposed bicycle and pedestrian facilities in Pender County.

Relationship to the Pender County Collector Street Plan Project

This Plan recommends numerous parks and greenway facilities in the Pender County Collector Street Plan (CSP) Study Area. Two waterway access areas are proposed in the plan. The first water access, at the terminus of Lewis Road, has been completed and another in the Scotts Hill area has yet to be completed. Additionally, this plan recommends a number of new parks including the Scotts Hill Community Park in the Scotts Hill area, the Island Creek Neighborhood Park in the vicinity of the intersection of NC Highway 210 and Island Creek Road, and the Rocky Point Regional Park near the Heide Trask High School in Rocky Point just outside the CSP Study Area. Other possible parks include the Cape Fear Neighborhood Park near the Cape Fear Elementary School east of Rocky Point on NC-133, the Long Creek Community Park situated at the terminus of Montague Road at NC-210, and the Sand Ridge



Neighborhood Park along US 421. The Sand Ridge Neighborhood Park would serve as a trailhead for the West Pender Rail-Trail. If implemented, these proposed new parks would be likely to generate pedestrian, bicycle, or vehicular traffic on mainline roads and may necessitate other access via new collector streets.

This Plan also identifies recommended bicycle and pedestrian projects in the Study Area. The proposed Coastal Pender Greenway would utilize the Duke Energy's easement, extending from NC-210 near Island Creek Road north to NC-210 near Surf City, ultimately connecting pedestrian and bicycle facilities in Surf City to facilities in New Hanover County. The Coastal Pender Rail-Trail, the Central Pender Rail-Trail, and the West Pender Rail-Trail are also recommended, the first along US 17, the second along the rail corridor parallel to US 117, and the third running parallel to US 421 as indicated in Figure 20.

2012 US 17/NC-210 Corridor Study

US 17 and NC-210 are both vital mobility carriers within the Pender County Collector Street Plan (CSP) study area. This study was convened to identify near-term strategies to address safety and mobility issues on US 17 and NC-210. Ultimately, the goal of this study was to address safety and mobility deficiencies on US 17 and NC-210 in Hampstead and identify strategies to reduce the rate of injuries and fatalities in traffic crashes, reduce delay, and improve the road for pedestrians and bicyclists. Both crashes and pedestrian and bicycle mobility are key issues on this corridor. In fact, a pedestrian facility is planned on US 17 between Washington Acres and Sloop Point Loop, which will support safe pedestrian travel along the corridor. Planning and environmental studies on US 17 resulting from this plan has been programmed in the State Transportation Improvement Program (U-5732 – Superstreet Conversion).

Relationship to the Pender County Collector Street Plan Project

As both US 17 and NC-210 are key roads within the CSP, the proposed improvements will have a tangible effect on traffic volumes as well as access management, including a reduction in left turn volume. It is possible that by reducing left turning movements on US 17, the demand for cross-access via collector streets will become even more important, particularly in the areas east of US 17. These proposed roadways are included in this plan as priority new collectors.

Cape Fear Transportation 2040

The Cape Fear Transportation 2040 plan, prepared by the WMPO, is the Metropolitan Transportation Plan for the Wilmington Urban Area. This plan is designed to present a fiscally-constrained vision of transportation projects within a twenty-year time horizon. This plan includes a substantial public outreach effort and addresses six areas of transportation; aviation, bicycle and pedestrian, ferry and water transportation, freight and rail, mass transportation, and roadways. A robust public involvement process provided the basis for many of the recommended projects and policies.

Relationship to the Pender County Collector Street Plan Project

This plan prioritizes improvements within the CSP study area and also provides some information about growth in the Pender County portion of the WMPO area. Notably, employment is forecast to grow substantially in area west of US 421, while population is forecast to grow across the entire CSP study area.

No ferry and water projects are identified in the Pender County area, while only one freight/rail project extends to the study area, namely a rail line extension from Invista to Pender Commerce Park, located along US 421 in the CSP study area (FR-6).

Three bicycle and pedestrian projects within the CSP study area are identified, including proposed



sidewalks along Jenkins Road from US 17 to Saint Johns Church Road (BP-70), Saint Johns Church Road from Jenkins Road until it ends (BP-72), and Masters Lane from Doral Drive to Sloop Point Loop Road (BP-73). These improvements were included in this study.

Some mass transit improvements are forecast for the CSP study area, mostly in the form of Park and Ride locations, but also in the form of transit stop improvements in the Topsail Township. The Park and Ride locations are located at US 421 and Cowpen Landing Road (MT-128), and US17 at NC-210 in the shopping center parking lot (MT-39), and US 17 at Sidbury Road (MT-75). Transit stop improvements are located at US 17 at NC-210 (MT-18), US 117/NC-133 at Old Blossom Ferry Road (MT-120), and US 421 at Blueberry Road (MT-121). These improvements were examined as part of this study.

Major roadway improvements are also proposed as part of this plan. These improvements include a superstreet on US 17 between Washington Acres Road and Sloop Point Loop Road (R-12); improvements to NC-210 between Island Creek Road and US 17 (R-36); the Hampstead Bypass, which stretches from Porters Neck Road to Sloop Point Road (R-38); and intersection improvements at Country Club Drive/Doral Drive and Sloop Point Loop Road (R-39). Any roadway improvements should align with the proposed cross-sections as detailed in this plan.

This plan also details information about environmental justice in the CSP area. There are substantial areas with low income populations and populations without access to vehicles in the CSP, mostly along the northern edge of the study area boundary.

2010 Pender County Comprehensive Land Use Plan

The 2010 Pender County Comprehensive Land Use Plan is the main planning document for land use planning in the County and provides guidance to support orderly growth and development.

Over the course of the planning process, two main steps were realized by local planners and citizens. The first was to prepare a comprehensive land use planning document that sets goals and policies for the future, while the second was to update regulatory standards, procedures, and combine freestanding ordinances into a unified development ordinance. Overall, the planning process was designed to promote consensus among stakeholders to build broad support for established goals, provide the basis for development of design standards and regulations, and establish the need for coordination among County departments and with other units of government.

Conforming to ten key smart growth tenets, this plan advocates for a mix of land uses; compact building design; a range of housing choices and opportunities; walkable communities; distinctive and attractive communities with a strong sense of place; preserving open space, environmental areas, and farmland; strengthening development towards existing communities; providing a variety of transportation choices; making decisions fair, predictable, and cost effective; and encouraging collaboration from citizens and stakeholders. This plan addresses growth management, infrastructure, development patterns/community appearance, housing and community development, natural resources, historic and cultural preservation, parks and recreation, open space, waterway access, agricultural preservation, hazard mitigation, economic development, small area plans, and the procedures for amending the Comprehensive Plan. This plan also presents a series of important maps, most notably the future land use maps for different areas of the County.

Relationship to the Pender County Collector Street Plan Project

As the main document directing development in Pender County, the plan advocates for development around existing communities, the preservation of rural and agricultural lands, and the avoidance of areas subject to floods, wetlands, high winds, or wildfires. In addition, water and sewer should not be extended to areas designated as rural growth



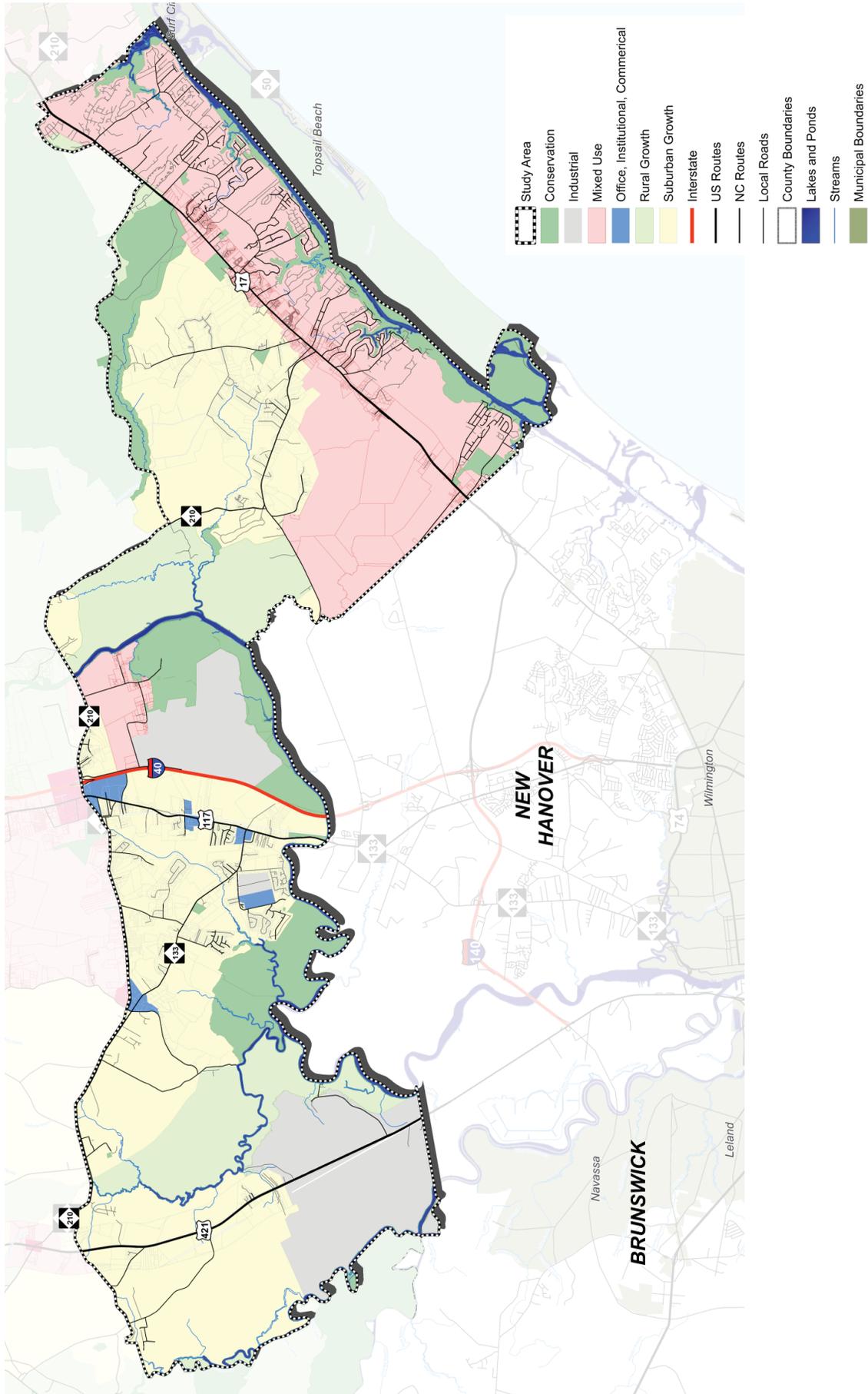


Figure 6: Future Land Use Map (2010)

areas as identified in the 2010 Comprehensive Land Use Plan. Any proposed collector streets were vetted carefully in light of these recommendations. Also, this effort used zoning designations to help identify collector street spacing standards based on the level/density of planned future development. These standards are discussed in greater detail in subsequent sections.

The future land use map indicates that much of the area east of US 17 is classified as mixed use or conservation, while much of the remaining land in the CSP study area is slated for rural or suburban growth, with some areas reserved for conservation purposes, particularly close to the NE Cape Fear River. The land uses in three Small Area Plan geographies are also presented in this document. The Coastal Pender Small Area Plan is primarily noted as mixed use, though an area of suburban growth is indicated to the west of US 17, north of NC-210, and bounded by the Holly Shelter Game lands in the north. The Rocky Point Small Area Plan is centered approximately on the interchange of NC-210 and I-40 and US 117. Land uses are varied in this area, with industrial areas in the southeast, rural growth in the northeast, mixed use in the northwest, and suburban growth with some conservation areas in the southwest. The US 421 South Corridor Small Area Plan is a linear planning area running along US 421 north from the New Hanover County border. The southern portion of the planning area is consumed by a large industrial parcel, while the middle section is designated as a suburban growth area. Farther north, the area is slated to develop as a mixed use area. The future land use map is located in Figure 6.

Any proposed collector streets should support the land uses indicated in this plan. This plan is scheduled for an update in coming years.

Environmental Conditions

Pender County is also known as one of the few natural habitats for the Venus Fly Trap, which is found only in the Carolina Bay region within a seventy-five mile radius of Wilmington. Red Cockaded Woodpeckers are prevalent in this area



Venus Fly Trap, Pender County: Courtesy of the Pender County Public Library

as well. Pender County contains some notable conservation areas, including the southern portion of the Holly Shelter Game Lands, parts of the Cape Fear River Wetlands Game Lands, and areas of the North Carolina Coastal Land Trust Preserves.

As a coastal county, Pender has significant environmental features that have the potential to limit development. In particular, substantial parts of the County are covered by wetland areas. Though buildable in some cases, these areas often require United States Army Corps of Engineers (US ACE) permits and/or North Carolina Coastal Area Management Act (CAMA) impact permits, which can make development more complex and more time-consuming. These lands also support a diverse array of wildlife and serve other important functions including water filtration and flood protection. Appendix B indicates those wetlands that will likely not require permitting to develop, the wetlands which require a US ACE permit, and those that require both a US ACE and CAMA permit to develop, while 7 indicates the location of these areas within the study area. This map is also located in Appendix A, the map book for this document. Figure 8 indicates the percentage of the study area that requires permitting to build.

With population increasing substantially in Pender County, sensitive environmental areas are under increasing pressure from development; it is fundamentally important to protect, manage, and minimize impacts to important environmental areas to ensure that the natural legacy in Pender County is maintained for future generations.



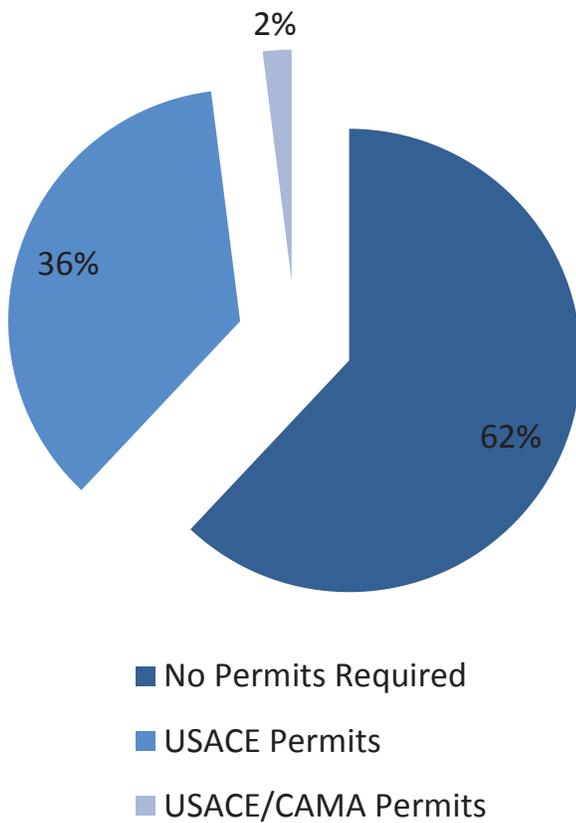


Figure 7: Wetland Permit Requirements

Additionally, irrespective of whether developable lands support uses that are rural or urban in character, Pender County residents expect clean water, while federal and State regulations mandate that land remain unpolluted and air quality is maintained at an acceptable level, as determined by North Carolina standards. Meeting the twin goals of providing clean water and air, and reducing pollution will require that sensitive natural areas be preserved from development, whether it is public or privately funded.

The careful examination of environmental permitting requirements and conservation areas indicates the challenge the County faces in constructing new collector street connections. In order to fulfill the County's commitment to preserving sensitive natural areas, collector streets must be developed in such a way as to avoid these areas or to mitigate the impact of new road construction to ensure that these connections are developed with the least environmental disturbance.

Existing Transportation Conditions

Arterial Streets

Referencing NCDOT Geographic Information Systems (GIS) data for Pender County, there are a number of roadways that fall into the category of arterial roads in the CSP study area. Arterials are defined as roads that provide the highest level of service at the greatest speed for the longest uninterrupted distance, with some degree of access control. Essentially, the primary function of these roads is to support mobility between destinations. These roads provide less accessibility to nearby properties, though some arterials do support access to adjacent land uses. With regard to functional classification, these roadways fall between collector streets and interstates.

In the CSP study area, three US routes and two NC routes constitute the arterial system. One interstate, I-40, is also present in the study area running north-south. US 17, US 117, and US 421 all provide north-south access as well, while NC-210 provides east-west mobility across the study area.





NCDOT Crews Prepare for a Tropical Storm, Flickr: NCDOT Communications 2004.

US 17

US 17 begins in Punta Gorda, Florida and snakes up the eastern coastline north to Winchester, Virginia. US 17 provides mobility in a north-south direction from Wilmington in the south towards Jacksonville in the north, running parallel to the Intracoastal Waterway. It is duplexed with NC-210 between Hampstead and Surf City and runs for 12.6 miles within the project study area. Beginning at Sidbury Road on the southern edge of the CSP study area and continuing as far north as Pearson Lane, US 17 is a four-lane divided full-access facility, configured by NCDOT as a “superstreet”. The “superstreet” facility includes signalized left-turn facilities, U-turn crossovers, and bulb-outs to allow for tractor-trailer U-turn movements. Left-turning movements from driveways and cross-streets are mostly restricted, but are allowed at certain locations. North of Washington Acres Road, US 17 becomes a five-lane, undivided facility with a two-way, left-turn lane through Lodge Road, before the roadway reverts back to a four-lane, divided section with unrestricted median breaks at most major roadway cross-street intersections. There are currently 11 signals along US 17 in the CSP study area, of which three are signalized left turns and seven are fully signalized. These signalized left turns are located at Sidbury Road, at Scotts Hill Loop Road in the northbound direction only, and at a bulbout approximately 1/3 of a mile north of Scotts Hill Loop Road in the southbound



US 17 in the Pender County Collector Street Plan Study Area.

direction only. The fully signalized intersections are located at NC-210/Dan Owen Drive, at Hoover Road, at the Bailey Shoppes commercial amenities approximately 2,000 feet north of the Hoover Road intersection, at Jenkins/Country Club Drive, at the Hampstead Town Center located approximately 1,400 feet north of Country Club Drive, at Vista Lane/Topsail Middle and High School access, and at Sloop Point Loop Road. One emergency traffic signal is in operation at the Hampstead Volunteer Fire Department.

There is a funded STIP project to convert existing US 17 to a superstreet (U 5732), which will implement important access management upgrades along US 17 from Washington Acres Road to Sloop Point Loop Road, ultimately reducing traffic congestion in this area.

Running parallel and occasionally joining I-95, US 17 runs for 1,206.47 miles and has been in existence since 1926. Volumes along US 17 range from 38,000 vehicles per day (vpd) in the southern portion of the CSP study area to 36,000 vpd in Hampstead and 28,000 vpd leading to the split with NC-210 just north of the CSP study area boundary.

This roadway is also used as a primary hurricane evacuation route and serves the military between Camp Lejeune, the Port of Wilmington, and Military Ocean Terminal at Sunny Point.



Hampstead Bypass (R 3300)

The Hampstead Bypass was originally identified in the 1997 Thoroughfare Plan for Pender County as a proposed principal arterial, running parallel to US 17. Beginning just south of Sloop Point Loop Road and connecting into planned portions of the I-140 bypass around the City of Wilmington. The Hampstead Bypass would provide higher speed controlled access around the unincorporated community of Hampstead. This roadway is recommended to improve not only traffic carrying capacity, but also to improve safety in this heavily traveled corridor.

The STIP identifies this project as R-3300. As of September 2015, the final environmental document for this project, the State Record of Decision (SROD) has been completed and indicates that the selected alternative is M1+E-H. This project is currently unfunded.

US 117

US 117 is a two-lane arterial road with occasional turn lanes that traverses the study area just to the west of I-40 in a north-south direction. Running from Wilmington to Wilson, US 117 runs for 114 miles and is contained completely within the state of North Carolina. Within the CSP study area, US 117 provides access to some adjacent land uses over its 5.38 mile span.

There are two signalized intersections along this portion of US 117, one at NC-133 and one at the intersection with NC-210. Some commercial development is present at the NC-210 and US 117 intersection. Volumes along US 117 ranged between 7,100 vpd south of NC-210 and 12,000 vpd north of NC-210 in the CSP study area.

US 421

US 421 is another north-south route through the CSP study area, passing through the western portion of the study area. As a spur route of US 21, US 421 traverses four states, Indiana, Kentucky, Virginia, and North Carolina, running for 941 miles from Wilmington, NC to Michigan City,

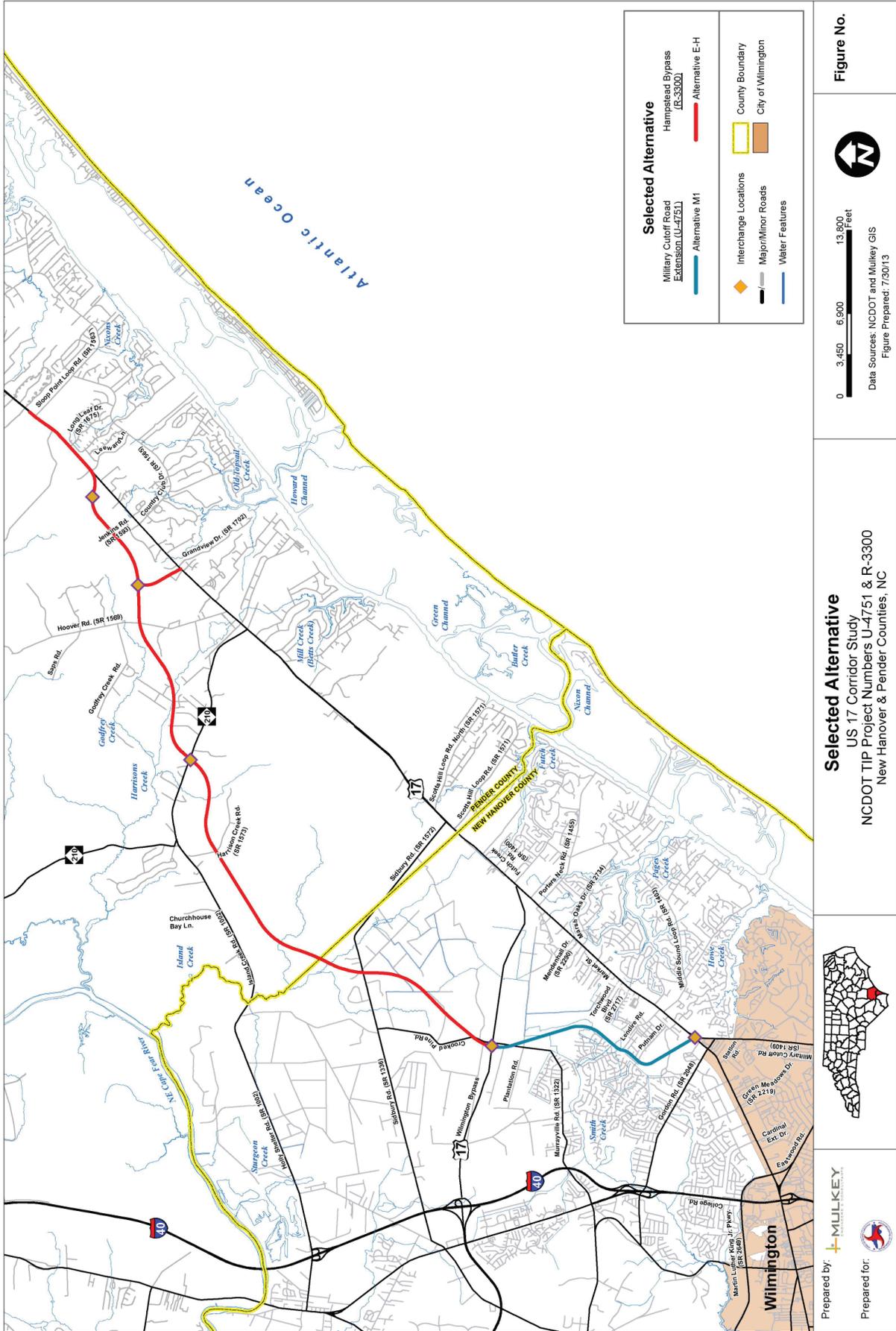
Indiana. US 421 travels for 8.05 miles within the CSP study area, entirely as a four-lane divided facility with no signalized intersections along the portion within the study area. There is relatively little adjacent development along US 421 in this area. However, the Pender County Commerce Park is located along this corridor and is slated for future industrial development. A water facility and wastewater treatment plant and a seafood-processing plant are already located in the park. It is anticipated the Park will see additional development. A discontinued rail line also runs adjacent to US 421. Volumes along US 421 decrease as US 421 continues northward, with volumes of 4,300 vpd close to the New Hanover County line gradually decreasing to 4,900 vpd north of NC-210. However, US 421 does serve as an important freight route, accommodating significant volumes of truck traffic as well as mobility needs for freight and military to and from the Port of Wilmington.

NC-210

NC-210 serves east-west traffic along the north boundary of the CSP study area. Beginning at US 17 in the east, NC-210 runs for approximately 23.5 miles within the study area, not including the portion that is duplexed with US 17 running north between Hampstead and Surf City. The ultimate terminus is just east of Selma/Smithfield, while the terminus in the CSP study area is just shy of the intersection with US 421, commonly known as Johnson's Corner. NC-210 is a two-lane facility for the entirety of the portion in the study area and provides access from homes and subdivisions along the roadway to commercial amenities and other major arterials and highways. Some major agricultural holdings are present in the western portion of the study area along NC-210. The roadway crosses the NE Cape Fear River close to the interchange with I-40.

There are three signals along NC-210 in the CSP study area, located at the US 117 and NC-210, the interchange of I-40 and NC-210, and at NC-210 and US 17. In contrast to other routes in the study area which do not meander, NC-210 makes





Proposed Hampstead Bypass Alignment

Figure No.

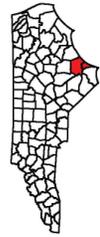


0 3,450 6,900 13,800 Feet

Data Sources: NCDOT and Mulkey GIS
Figure Prepared: 7/30/13

Selected Alternative

US 17 Corridor Study
NCDOT TIP Project Numbers U-4751 & R-3300
New Hanover & Pender Counties, NC



Prepared by: **MULKEY**
Infrastructure Intelligence

Prepared for:





Typical Cross-Section on NC-210

sharp turns along the route, most notably at the intersections with Island Creek Road and NC-133. Volumes along NC-210 vary between 1,900 vpd near US 421 and 7,800 vpd near Hampstead.

Interstate 40

I-40 is a major Interstate Highway that traverses the southern United States beginning in Wilmington and terminating in Barstow, California. Within the CSP study area, I-40 runs northward for 5.5 miles. As an Interstate facility it is controlled access, there are no signalized intersections, though there is one interchange, with NC-210, in the CSP study area. I-40, as an interstate facility, carries substantially more traffic than other roadways in the CSP study area, though not as much as US 17, at 24,000 vpd.

Existing Collector Streets

Collector streets are defined as streets that connect neighborhoods to the major arterial roads. These streets are typically two lanes, not more than two to three miles long, with speed limits between 35 and 45 mph, and lower volumes of traffic. The CSP study area is generally lacking in collector streets, though some streets that fit this criteria are in fact present, predominantly in the vicinity of the unincorporated community of Hampstead. Streets such as Sidbury Road, Scotts Hill Loop, Washington Acres Road, Factory Road, Hoover Road, Country Club Drive, Sloop Point Road, and Sloop Point Loop Road are emblematic of typical collector streets found in the CSP study area.



Typical Local Street in the CSP Study Area

NC-133

NC-133 is the only NC Route designated as a collector street in the CSP study area. Linking US 117 and NC-210, NC-133 only runs for approximately 4.9 miles in the study area. With its genesis in Oak Island, NC-133 runs northward, eventually duplexing with US 117 before extending westward to its terminus at NC-210. NC-133 does include one signalized intersection in the CSP study area, at US 117. This roadway provides access for residences to major roads. Additionally, there are some agricultural lands only accessible via NC-133. Volumes along NC-133 equate to 9,100 vpd.

Local Streets

Local streets, as one would expect, are not used for long distance travel. Their primary function is to provide access to adjacent properties and they often include pedestrian amenities in the form of sidewalks within the right-of-way. Local streets also funnel traffic to the collector and arterial systems and form the basis of the functional classification system.

For the most part, local streets are designed to minimize through traffic. However, local streets will also often provide important connectivity to neighborhood land uses, particularly for non-motorized modes. In the CSP study area, there are a number of local roads. Many of these streets are maintained by NCDOT, which identifies these roads with a Secondary Route number,



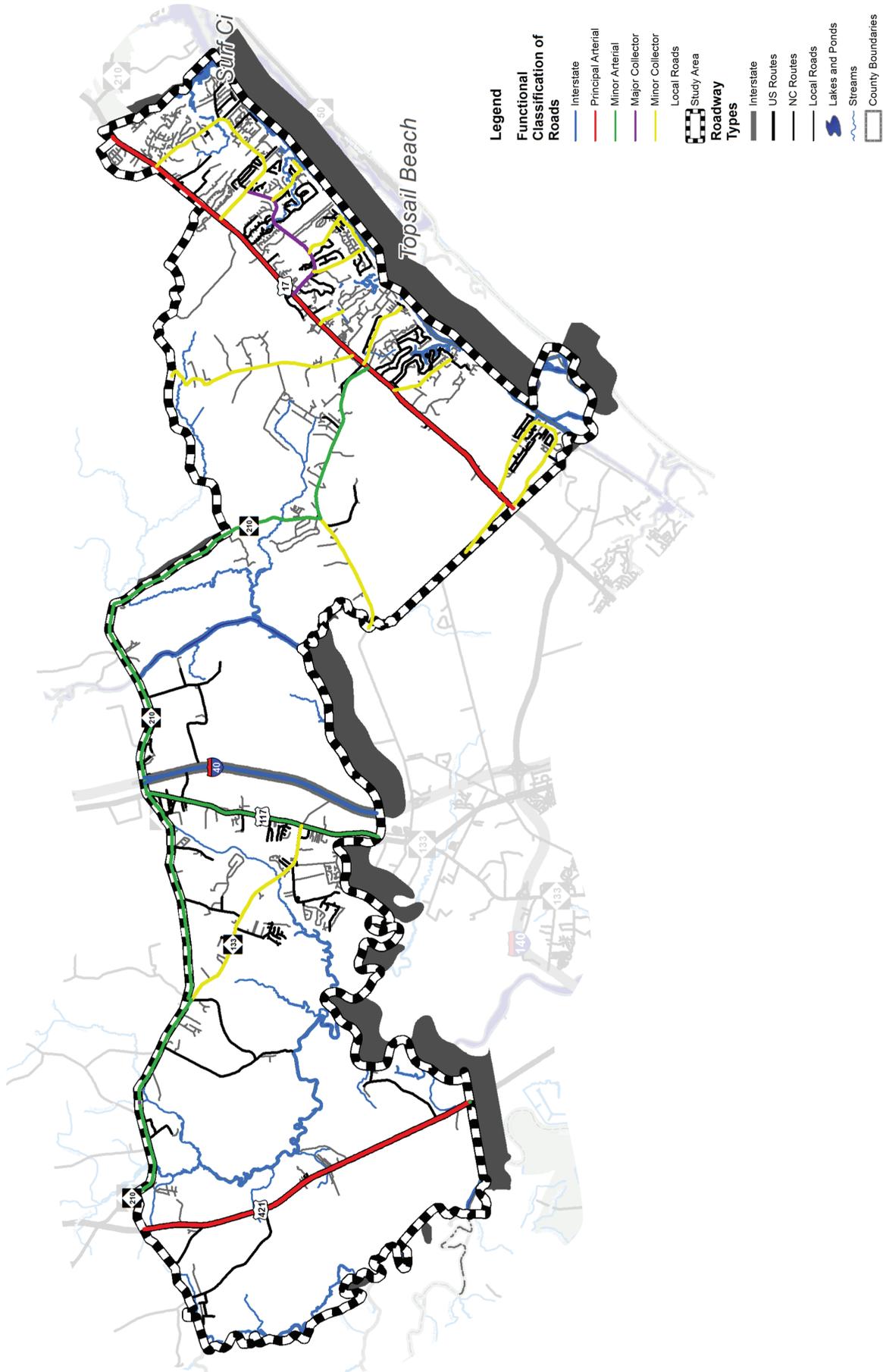


Figure 9: Functional Classification Map - Pender County Collector Street Plan Study Area

while some of the private roads are maintained by Homeowner's Associations (HOAs). Pender County does not own or maintain any roadway facilities.

Functional Classification

The Wilmington Urban Area MPO member jurisdictions refer to the functional classification of roadways in their land development codes and regulations in an effort to better coordinate land use and transportation planning. The WMPO reviewed the federal functional classification of all roadway elements in the WMPO Planning Area Boundary following the decennial census and the organization's Transportation Advisory Committee proposed changes to the federal functional classification of WMPO Planning Area Boundary's roadways. However, several of the proposed changes were not accepted by the NCDOT due to statewide constraints that were not directly related to the functional nature of existing conditions in the WMPO Planning Area Boundary roadway network. Therefore, the Transportation Advisory Committee adopted the "Wilmington Urban Area MPO's Local Functional Classification Maps" for member jurisdictions to refer to for non-federal local planning purposes on August 26, 2015. Figure 9 details these roads within the CSP study area.

Pedestrian and Bicycle

Pedestrian and bicycle facilities are very limited in the CSP study area. There are isolated pockets of developer-built sidewalk present, most notably in the neighborhoods along Crown Pointe Drive, East and West Island View Drive, and in the Avendale neighborhood off of NC-210, but overall, only approximately 8 miles of sidewalk are currently built. However, new developments are adding sidewalks, as a recommendation of the 2007 Collector Street Plan. This accounts for roughly 4 percent of the total roadway mileage in the study area. There are no crosswalks or pedestrian signals at signalized intersections, though some off-road hiking and biking trails are present in the Holly Shelter Game Land. Further bicycle and pedestrian

installations are currently programmed, including a Safe Routes to School and DA funded project, but have not yet been constructed.

In terms of bicycle facilities, there are no dedicated facilities in the CSP study area, though there is one bicycle route, the NC 3: Ports of Call route. NC 3 runs along the coastline from Norfolk, Virginia to North Myrtle Beach, South Carolina and passes along both the Pamlico and Albemarle Sounds. Within the CSP study area, NC 3, also known as the "Venus Flytrap" section, runs along Island Creek Road, NC-210, and north via US 17. Other pedestrian and bicycle facilities are programmed in the study area, including the Mountains-To-Sea Trail, the Coastal Pender Greenway, the Coastal Pender Rail Trail, the Central Pender Rail Trail, and the East Coast Greenway identified on the Bicycle and Pedestrian Facilities Map, located in the mapbook for this document. However, the exact alignments for these trails has not yet been determined. Additionally, Cape Fear Transportation 2040 (Metropolitan Transportation Plan) recommends three pedestrian and bicycle projects in the CSP study area, one along Jenkins Road from US 17 to St Johns Church Road and the other on Master Lane from Doral Drive to Sloop Point Loop Road.

Public Transportation

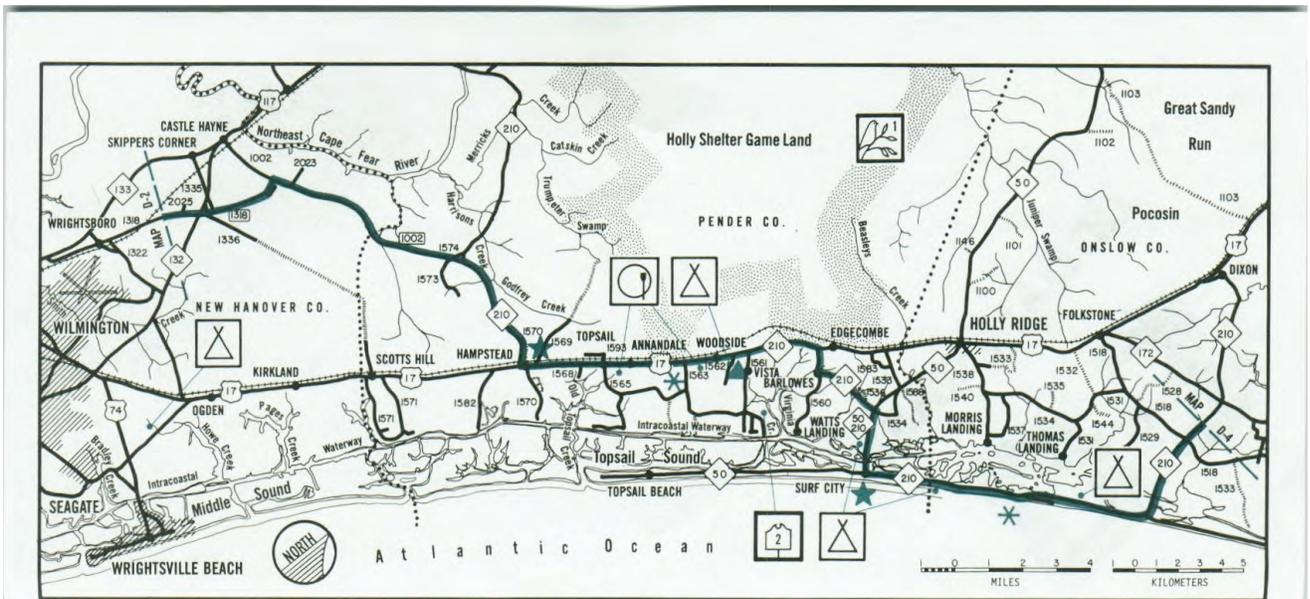
The Cape Fear Public Transportation Authority, which is also known as Wave Transit, provides a variety of public transportation options to residents of the Cape Fear region. However, no fixed transit routes penetrate the CSP study area. Transit service is offered to the CSP study area by the Pender Adult Services Transportation, allowing anyone to ride, though focused primarily on people aged 65 or older and individuals with disabilities. Service begins at the Cape Fear Community College North Campus and continues north on US 17 to the Topsail Senior Center, then doubles back and travels along NC-210 and US 117 north to Burgaw and Wallace. As a deviated fixed route service, passengers can be picked up or dropped off within 15 miles of any of four fixed stop locations.



Cape Fear Transportation 2040 proposes three park-and-ride locations in the PC CSP study area, at US 17 and NC-210, US 17 and Sidbury Road, and US 421 and Cowpen Landing Road. These locations, designed to accommodate 8-20 parking spaces and serve people wishing to access vanpools and carpools, will be contain dedicated spots and signage. Additionally, Cape Fear Transportation 2040 calls for stop amenity upgrades at three locations, US 117/NC-133 at Old Blossom Ferry Road, US 421 at Blueberry Road, and US 17 at NC-210.

Traffic and Safety

The North Carolina Department of Transportation provides annual traffic counts for most streets within the CSP study area. Traffic counts represent a yearly average amount of traffic on that roadway segment and are collected annually for most interstates and NC routes and biannually for secondary routes. The following table (Table 1) provides further detail with regard to certain roadways in the CSP study area.



Venus Flytrap

D-3

Points of Interest

1 Venus Flytrap

The Venus flytrap is the most dramatic of all carnivorous plants. Spreading from its base are leaves three to six inches long, each of which broadens into a pair of kidneyshaped lobes. The leaf has six slender hairs, spaced so as to form a triangle on each lobe. Secretions inside the margin of the leaf act as a lure for insects. When an unfortunate bug touches two of the hairs, the trap springs shut. The plant screens its prey by not immediately pressing too tightly. Tiny insects can escape through the spaces between the long, stiff bristles at the outer edges of the lobes. These bristles form prison bars for prey large enough to constitute a worthwhile meal. After a few minutes, the lobes of the leaf slowly press more and more tightly together, killing the soft bodied-insect. Digestion takes 5 to 10 days, after which the leaf opens again, ready to trap the next victim.

The Venus flytrap is native to a very small area in the southeastern corner of North Carolina and the northeastern corner of South Carolina.

2 Sloop Point

Probably built between 1726 and 1731 by John Baptista Ashe, this house is possibly the earliest surviving house in this part of the state. Of particular interest is the "West Indian" type porch, common to the Carolinas, Deep South and West Indies. One chimney of this house is so large that it contains a door and a porch. This property, which is privately owned, is listed on the National Register of Historic Places.

General Description

Leaving the populated area north of Wilmington, you will travel through a remote, wooded area for about 10 miles. As before, the terrain continues to be flat. Turning onto US 17, the "Ocean Highway", you will parallel the coast for about 9 miles before turning east on NC 210, which will take you to Topsail Island. An 8 mile stretch along the shore gives you plenty of opportunity to stop and enjoy the beautiful sandy beaches. Leaving the oceanfront once again, you will travel inland for a few miles to pick up another road which parallels the coast. Approximately 38 miles/61 kilometers.

Hazardous Areas

US 17, a major route through the area, has much more traffic than is desirable. This road is a three-lane facility, which eases the passing situation for motorists. 9 miles.
NC 210, along Topsail Island has a high volume of seasonal traffic during summer months. 8 miles.

Roadway Condition

The roads in this segment are in good condition. There is a paved shoulder along most of 1002 in New Hanover and Pender counties. US 17 is a three lane road.

Services

Services are limited from the beginning of the segment to the NC 210, US 17 intersection. Periodic stores and restaurants provide needed services along the remainder of the segment. There are a number of private campgrounds and motels along the route. There are no bicycle shops in this segment.

Excerpt from the NC Bicycle Route Brochure. Courtesy of <http://www.ncdot.gov/travel/mappubs/bikemaps/>

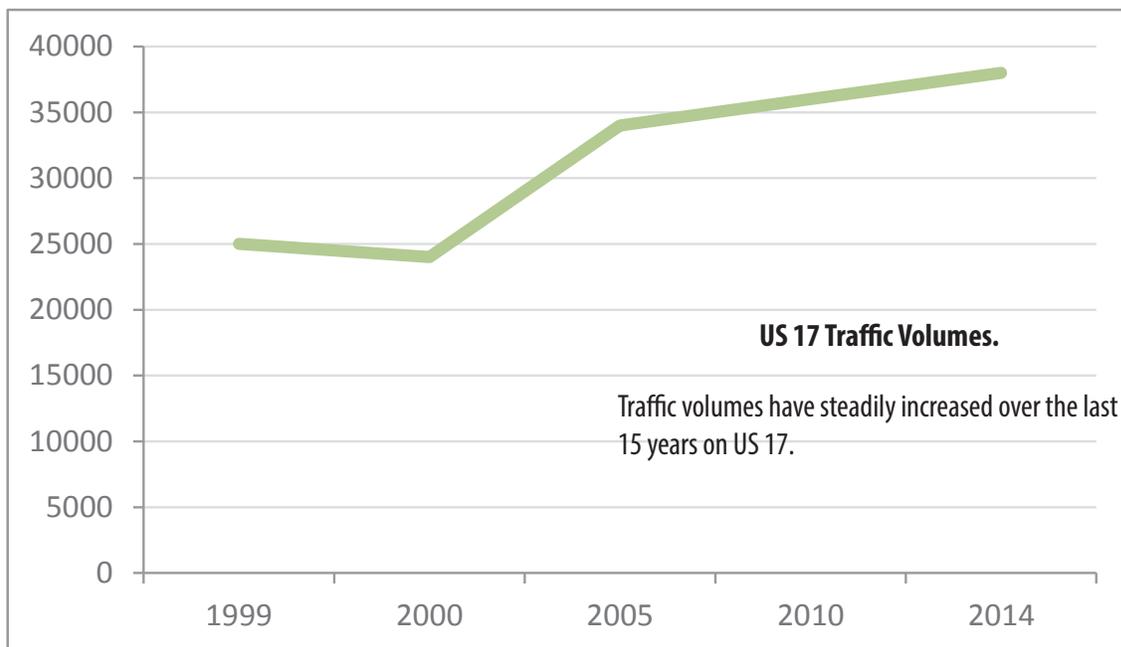
Judging from the changes in ADT between 2006 and counts conducted in 2013/2014, traffic has increased substantially on NC-210 and on US 17 and is reduced on roads within the study area west of I-40. Indeed, even I-40 has a lower ADT, though not by a substantial amount. This is likely due to the growth and development around the Topsail Township and further development between US 17 and the Intracoastal Waterway. As new subdivisions are constructed in that area and on undeveloped parcels along NC-210 between I-40 and US 17, traffic is likely to continue to increase.

Transportation improvements are also likely to focus on these areas. These AADTs may also reflect a difference in population and housing type in the Topsail Township area and with the planned developments in the Scotts Hill area.

In terms of safety, an analysis of crash types and severities was conducted for the entire CSP study area using crash data from the three-year period between 2011 and 2013. Overall, 1,376 crashes occurred during that time, with five crashes (0.4%) resulting in a fatality. A further 25 crashes (1.8%)

Table 1: Selected AADT Comparisons

Roadway Name	2006 ADT	2013/2014 ADT	Percent Change
US 17 – South of NC-210	27,000	33,000	22.2%
US 17/NC-210	33,000	38,000	15.2%
NC-210 – West of US 17	9,000	7,800	-13.3%
I-40 in CSP Study Area	25,000	24,000	-4.2%
NC-210 – West of I-40	12,000	14,000	16.7%
NC-210 – East of I-40	7,400	5,900	-20.2%
US 117 – North of NC-210	12,000	12,000	0%
US 117 – South of NC-210	7,600	7,100	-6.6%
NC-133	10,000	9,100	-9%
US 421	6,000	4,900	-18.3%
NC 210 – East of US 421	2,700	1,900	-29.6%



It is also important to note that new developments are required to conduct a Traffic Impact Study for any new development forecast to generate more than 100 trips in the AM or PM peak hour.

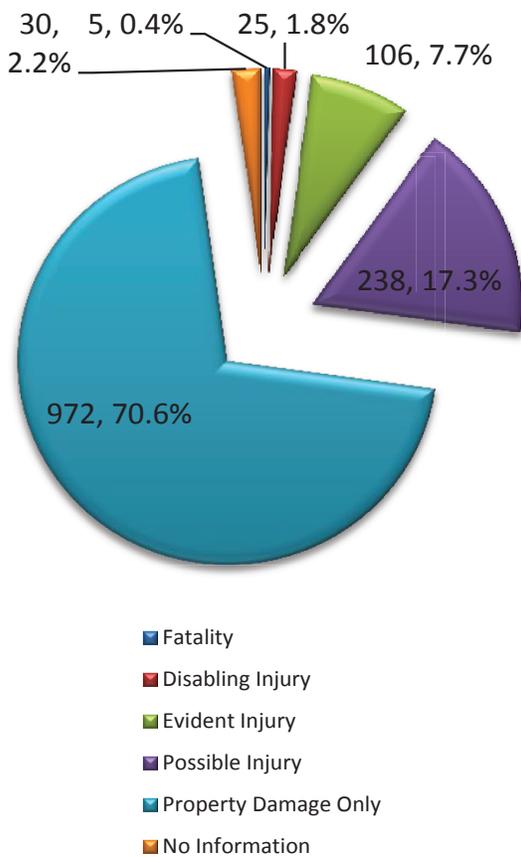


Figure 11: Crash Severities

resulted in a disabling injury, while 106 crashes (7.7%) resulted in an evident injury, 238 crashes (17.3%) resulted in a possible injury, and 972 crashes (70.6%) resulted in property damage only. Figure 11 provides this information. There were 30 crashes (2.2%) with no severity information. The majority of crashes occurred during daylight conditions (61.2%), while 36.7% occurred during dark conditions on roadways without lighting. The remaining percent (3.5%) occurred either during dark conditions on roadways with lighting, at dusk, or at dawn. In terms of crash type, Figure 12 indicates that the most prevalent crash type was a collision with an animal (349, 25%), followed by Rear End, Slow or Stop (307, 22%) and Fixed Object (282, 20%).

In terms of crash location, crashes occurred across the study area, but were most concentrated along US 17, at the interchanges at I-40 and US 117, and at the intersection of US 117 and NC-133. With the exception of the southern portion of US 421, all major US, NC, and Interstate routes experienced higher concentrations of crashes than other roads. US 17, in particular, had the highest concentration of crashes, including two fatal crashes along the roadway. Figure provides further detail. With new signal timing projects occurring along US 17 and the proposed (but currently unfunded) implementation of the Hampstead Bypass, it is possible that there will be a reduction of crashes in this area as these projects will ultimately reduce traffic volumes on existing roadways and streamline flow through the corridor.

TIA: Traffic Impact Analysis

The 2007 Coastal Pender County Collector Street Plan and the current Pender County Unified Development Ordinance speaks to the requirements for a Traffic Impact Analysis (TIA) for various kinds of development. The emphasis on TIAs in the role of determining land use suitability and infrastructure needs for transportation is crucial: the TIA represents a concrete linkage between land use and transportation. A TIA measures the impact of traffic on the existing roadway network

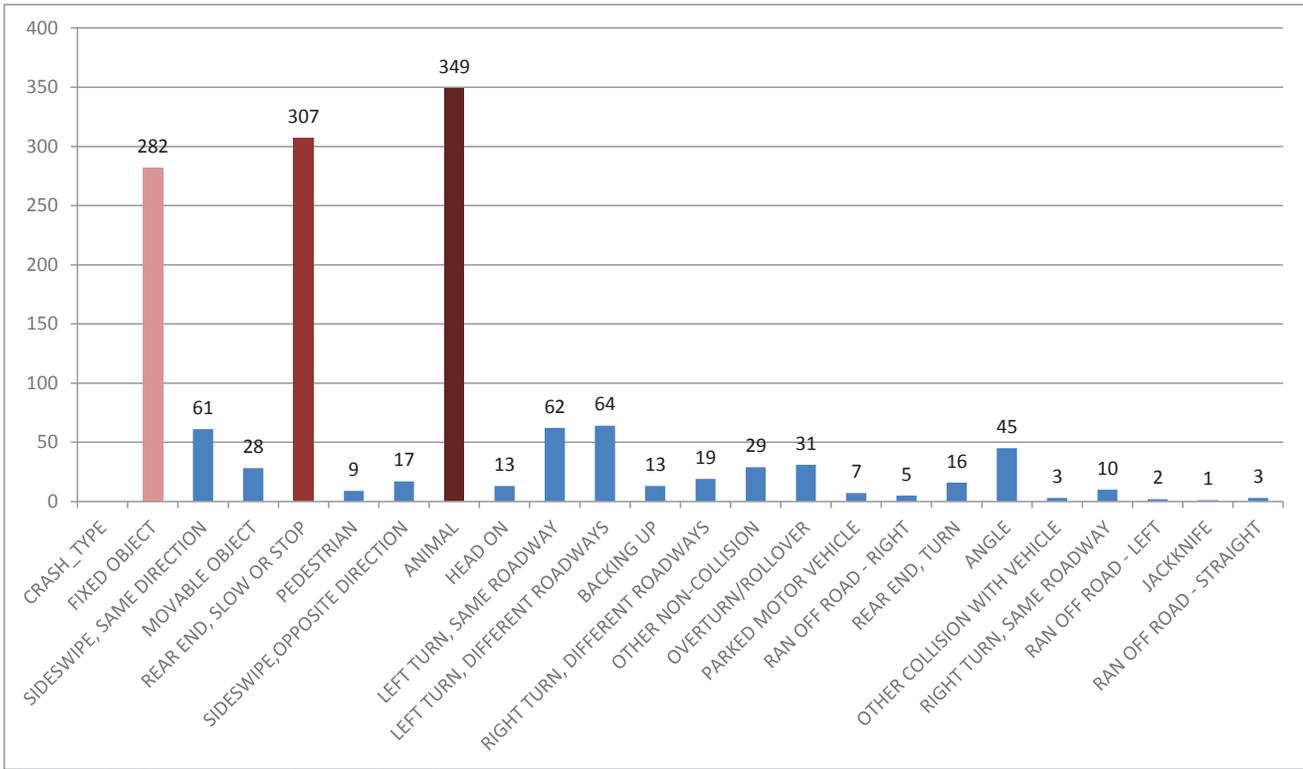


Figure 10: Crash Types in the CSP Study Area

Impact can be measured in multiple ways. One such way is the familiar, letter-based system for evaluating level of service performance is based on vehicular delays, typically as vehicles move through an intersection. The vehicular delay that is incurred increases as more trips are added from new development. Delay can be reduced by redistributing traffic through a more-connected network or making other street improvements to the existing network. An important part of that network is the construction of collector streets, which form connections of streets that balance land accessibility with local mobility needs in a community. Projects that have an impact on the street network can also include mitigation efforts like changes in land use type/intensity or off-site improvements. These mitigation efforts are an important part of the development process, and help manage the negative consequences to valuable roadway capacity in places that are developing faster than publicly funded roadway projects can be built to handle the extra need.

Any new development that is anticipated to generate more than 100 trips in any hour of the day

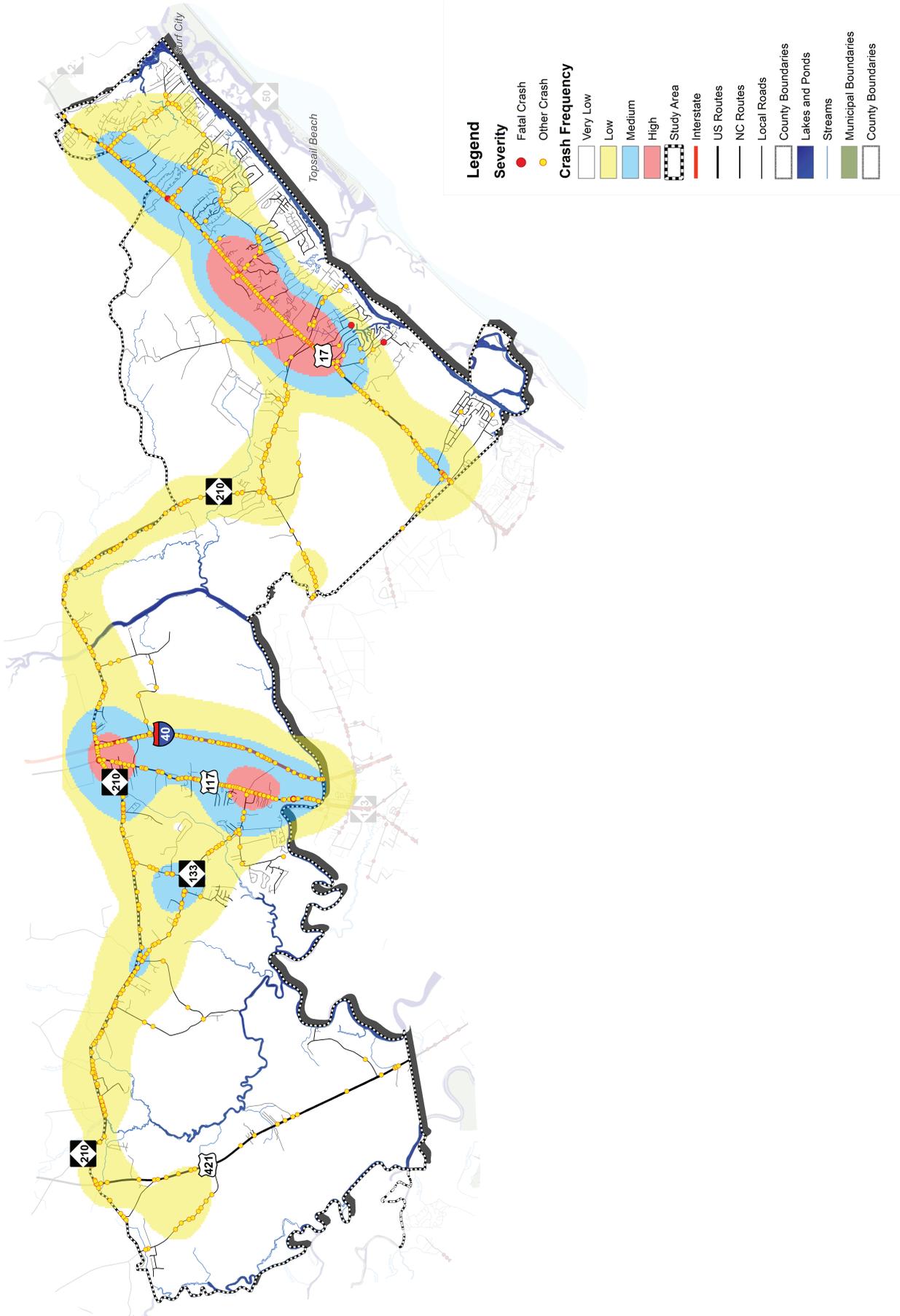
has to prepare and submit a detailed Traffic Impact Analysis to ensure a complete review the anticipated traffic impacts of a particular project proposal. The policy section of this report describes some suggested changes and improvements to the TIA process and documentation.

It is also important to note that new developments are required to conduct a Traffic Impact Study for any new development forecast to generate more than 100 trips in the AM or PM peak hour, as per the 2007 Coastal Pender County Collector Street Plan and the Unified Development Ordinance.

Land Use/Zoning

The future land use map provides a bold vision for the CSP study area. Substantial portions of the study area are designated as mixed use and suburban growth, while rural growth and conservation areas account for proportionally less. Additionally, there is some industrial growth, mostly in the southern portion around US 421 and along the east side of I-40. Figure 13 indicates the proposed land uses by percent of coverage in the study area. The mixed use areas are predominantly





Legend

Severity

- Fatal Crash (Red dot)
- Other Crash (Yellow dot)

Crash Frequency

- Very Low (White)
- Low (Yellow)
- Medium (Light Blue)
- High (Red)

Study Area

- Interstate (Red dashed line)
- US Routes (Black solid line)
- NC Routes (Black dashed line)
- Local Roads (Black dotted line)

County Boundaries

- County Boundaries (White outline)
- Lakes and Ponds (Blue)
- Streams (Light Blue)
- Municipal Boundaries (Green)
- County Boundaries (Black)

Figure 12: Crash Clusters in the CSP Study Area

located in the more developed areas along US 17, while suburban growth is concentrated near the Holly Shelter Game Land just northwest of Hampstead, as well as in areas along the northern portion of US 421 and in areas west of I-40.

These land use categories are very important with regard to the development of a Collector Street Plan, though street spacing standards will be based on current zoning with some consideration of future land use. In terms of current zoning, the existing zoning map paints a vastly different picture of the CSP study area. Much of the area is dominated by Rural Agricultural, which accounts for 52.8 percent, while 22.5 percent is Residential

and 10.8 percent is Planned Development. The remaining categories, such as General Industrial (6.6 percent), Environmental Conservation (5.3 percent), General Business (1.2 percent), Office and Institutional (0.6 percent), and Manufactured Housing Community (0.1 percent), all account for a total of 13.8 percent, a small portion of the study area. The existing zoning map (Figure 14) is included below.

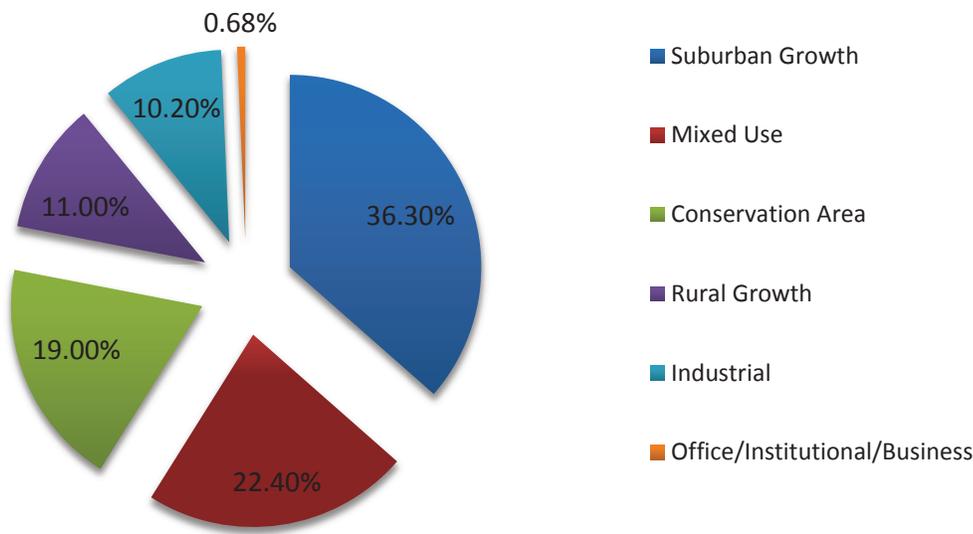
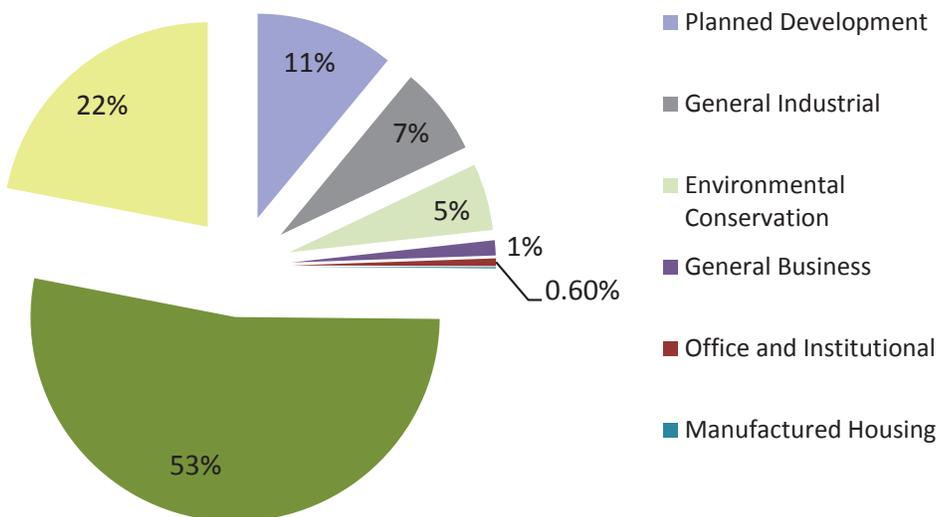


Figure 13: Future Land Uses (2010)



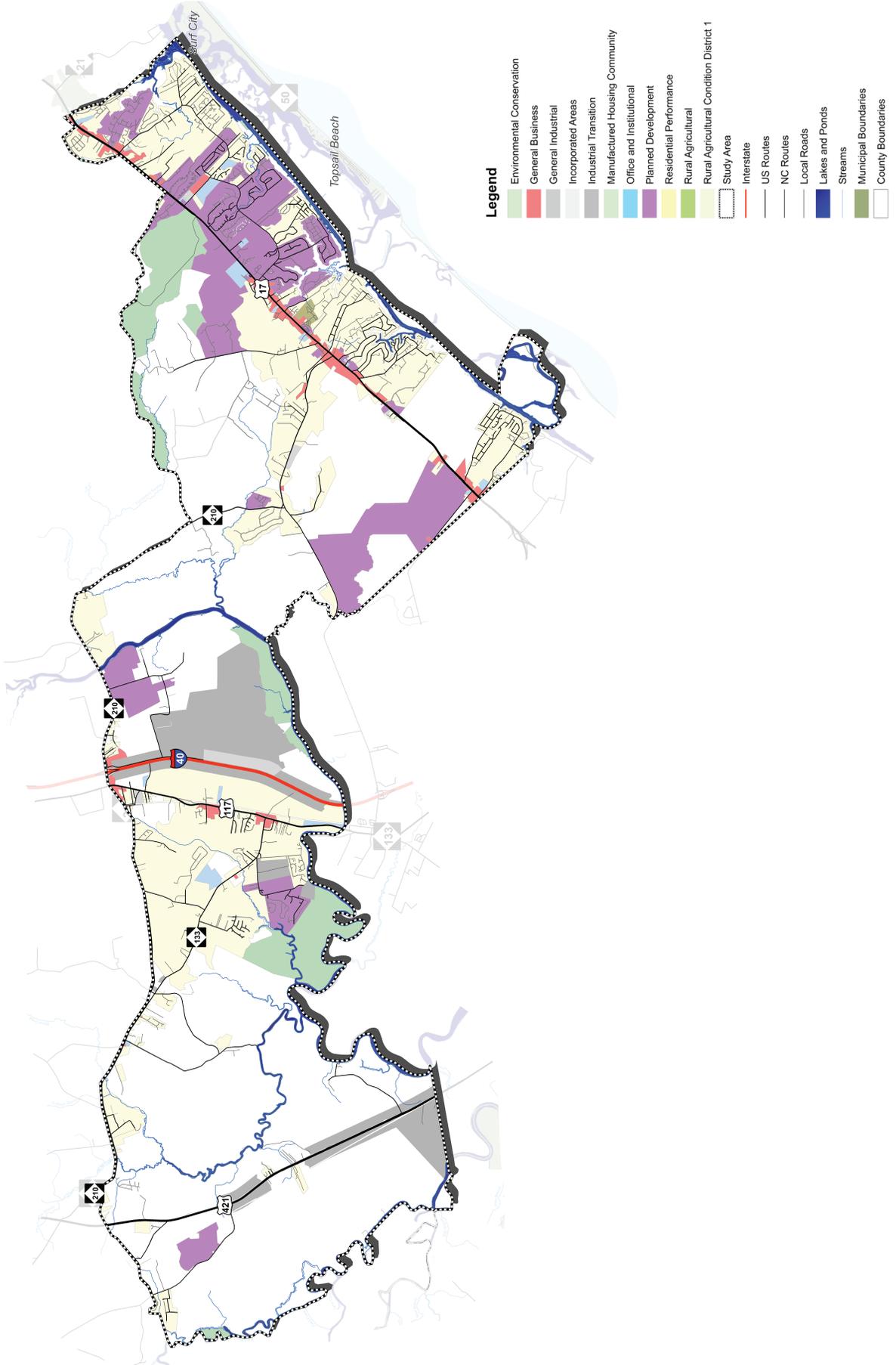


Figure 14: Existing Zoning Map



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3

Public Input

In This Chapter

Meeting Summaries • 39

Public Outreach • 39

Survey • 40



Public outreach is vital to ensuring that a planning process reflects local wishes and desires and ultimately receives support from elected officials and the public. To ensure that public opinion played an important role in shaping this project, a Steering Committee was convened at the outset of this process. Over the course of this project, four Steering Committee meetings and two public outreach meetings were held. Pender County and WMPO staff also presented to local officials and at public meetings.

Meeting Summaries

The Steering Committee was composed of seventeen members, including community members, elected and appointed officials as well as staff from the WMPO, Pender County, and NCDOT. The 17 Steering Committee members provided important oversight and input to the process of developing the preferred collector street

scenario. Using paper maps and markers, Steering Committee members indicated areas on the map in need of greater connectivity and helped revise the collector street alignments. The Steering Committee also provided important feedback on the proposed roadway cross-sections and helped prioritize policy measures for inclusion in this plan. As a result of the Steering Committee's active participation in the project, key stakeholders were able to provide important input into this planning process. With their support, this Pender County Collector Street Plan will have broad buy-in from the public, multiple agencies, as well as, elected officials.

Public Outreach

Two public outreach meetings were held, one at the Heide Trask Senior High School in Rocky Point and the other at the Hampstead Annex in Hampstead. Attendees provided input on where



Figure 14: Steering Committee Members at Work

collector streets are needed in the study area, where pedestrian and bicycle facilities are desired, and which cross-sections apply to specific collector streets. Additionally, Pender County Staff sent the survey and a link to the website to every church in the study area through the Postal Service to solicit feedback as well.

Survey

Another important method to reach people in the CSP study area was the paper and online survey. Disseminated through the project website (www.pendercollector.com) and through advertising at meetings and community events, the survey consisted of 12 questions, asking general questions such related to how long the respondent has lived in Pender County, the experience of traveling in Pender County, and work status. The survey also provided an open-ended question, soliciting feedback from respondents about their experiences

traveling, by any mode, in Pender County. Some of the responses to this question and other information from the survey is provided in Figure 17 on the following page.

Overall, with 112 people responding to the survey and the active participation of members of the Steering Committee, the public outreach component of this planning process solicited substantial feedback. The importance of local champions and ensuring ownership of planning efforts cannot be overstated. Ultimately, the numerous opportunities to provide input and emphasis on citizen and stakeholder collaboration led to the development of a community-supported plan.



Figure 15: Public Outreach Meeting at Heide Trask Senior High School



Pender County Collector Street Plan

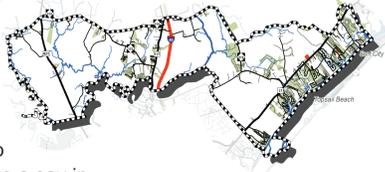
PUBLIC MEETING: October 1, 2015

WE NEED YOUR FEEDBACK! The Pender County Collector Street Plan is underway and we want YOU to participate.

We cordially invite you to attend a **Public Outreach Meeting** for the Pender County Collector Street Plan. This is your community, so stop by to have a say in where roads are built and how the county plans for new roads around Hampstead and Rocky Point and along NC 210, NC 133, I-40, US-117, and US-421.

The meeting will be held at the **Heide Trask High School Library on Thursday, October 1 at 5:30 PM**. The exact address is **14328 NC HWY 210 in Rocky Point**.

If you can't make it, take our **survey!** Just follow this link (<http://questionpro.com/t/AJ8IIZS0ED>) or scan the QR Code to access an online version. It won't take more than 15 minutes, we promise!


Pender County Collector Street Plan

PUBLIC MEETING - January 21, 2016





Concerned about CONGESTION?

Pender County continues to grow. As new development comes in, the number of cars on major roads, such as US 17 in Hampstead, NC 210, US 421, and US 117 will continue to increase. How can the county reduce congestion on these roadways? What are some of the strategies to accommodate the increase in the number of cars on Pender County roads?

What about NEW DEVELOPMENT?

Development is forecast to occur across southern Pender County. How will development affect the transportation system? What are some of the important connections to and from new developments in Pender County?

COLLECTOR STREETS matter!

Collector streets provide crucial access between neighborhoods and major roads. This plan will determine where these important connections need to be made.

All of these questions, and others you didn't know you had, **WILL** be answered! Come to our meeting to find out more about collector streets planning in Pender County!

Attend our Meeting! Give your Feedback! Shape your Community!

Meeting Location:
HAMPSTEAD ANNEX (15060 US Hwy 17, Hampstead, NC 28443) 5:00 - 7:00, Thursday, January 21, 2016

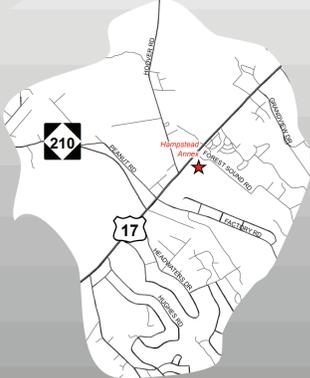
For more information, call or email:
 Josh Lopez - (910) 341-7890, Josh.Lopez@wilmingtncnc.gov
 Megan O'Hare - (910) 259-2110, mohare@pendercountync.gov

www.pendercollector.com



Hampstead Annex

Photo Credit: <http://www.pendercountync.gov/>



Hampstead Annex Location

15060 US Hwy 17
 Hampstead, NC 28443

Figure 16: Flyers for the Public Meeting

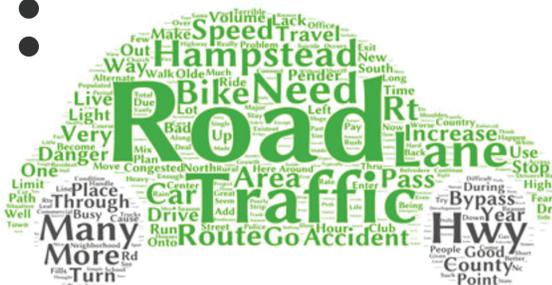
Survey Summary

The most important features to include on collector streets are...

-  Lighting **25%**
-  Bike Lanes or Bikeways **24%**
-  Sidewalks **21%**



rate traveling in Pender County as "Fair"



The most mentioned words in the survey.



7 out of 10 people are not concerned about the impact of collector streets, if they are well designed

39% rate wetlands as most important to avoid



80%

think Hampstead is most in need of collector streets

27% think avoiding a problematic intersection is the most important.

Select Quotes

“

- Heavy traffic on US 17
- Motorists do not observe speed limits. Need that bypass around Hampstead!
- Middle lane is the problem!
- When an accident occurs there is no way to by-pass it as there are few if any roads around the accident.
- Trouble and danger entering and exiting US 17.
- No shoulders on two lane roads, ex. 210 west, no bike lanes, roads with more than 20 homes remain unpaved, "suicide" turning lanes.

”

Figure 17: Selected Survey Responses





4

Recommendations

In This Chapter

- Emergency/ School Vehicles • 45
- Connectivity/VMT Reduction • 45
- Spacing Standards • 46
- Complete Streets • 49
- Soil Road and Paper Streets • 49
- Preferred Collector Street Scenario • 49



As part of the process for recommending new collector streets for the CSP project, the project team undertook a number of steps to ensure that the proposed collector street network reflects existing conditions, land suitability, future proposed land uses, stakeholder input, ongoing roadway design projects, and other current planning processes. It was particularly important to ensure that the recommendations accommodate likely users of the facility. For instance, all collector streets should allow for the efficient movement of emergency vehicles, while only some collector streets will need to support larger vehicles, such as tractor trailer trucks or fire engines among others. It was also important to assess whether pedestrians and/or bicyclists should be accommodated and to what degree. A thorough understanding of these issues as well as how the collector street network supports connectivity between land uses was a crucial component of this planning effort. This section presents the recommended collector street connections.



Bicycle parked outside of the Jade Garden restaurant in Rocky Point

Emergency/ School Vehicles

It is important to note that all roadways, and particularly collector streets, will be designed to accommodate the safe and convenient movement of emergency vehicles, including roll curb where appropriate. Additionally, every effort was made to create alignments conducive to easy and safe access by school buses.

Connectivity/VMT Reduction

Collector streets, while providing access to neighborhoods and facilitating access to the arterial network, also serve another important function, reducing need to access major corridors. Collector streets should provide numerous points of access to the surrounding collector and arterial system. With the provision of additional access points to neighborhoods, commercial centers, and schools, travelers will have additional options to access their local destinations. By allowing back access between land uses, people can reach their destinations without having to drive on major roadways. Connectivity requires that private entities coordinate across different properties to anticipate future, connections between adjacent properties. Providing connectivity to nearby amenities and to the arterial system is important to avoid congestion across the transportation system.

Land Use Connectivity

Certain land uses (for instance major employment centers) generate substantial traffic at particular times of the day. Providing better access from residential neighborhoods to employment centers (especially to areas slated to develop as industrial centers) was an important consideration for this plan. There are large-scale industrial operations in the western portion of the study area; much of the collector street development in these areas is underpinned by the need to connect to industrial facilities or provide an alternate connection to reduce peak hour congestion. It is also important to provide alternative access from US 17, which has the highest population density. It is also important to provide alternative access from US 17, which has



the highest population density. Collector Streets and enhanced connectivity provide needed relief to over-congested facilities like US 17, which has seen a 52% increase in traffic volumes over the past 15 years alone. As it stands, US 17 has experienced significant traffic congestion because majority of neighborhood streets connect directly into it. Enhanced connectivity improvements provide alternative routes for shorter trips and avoid major arterials altogether.

Large Trip Generators

With local shopping amenities, numerous school facilities, and industrial areas in the CSP study area, it will also be important to provide access from arterial roads to these facilities. Hampstead itself is an important regional destination as well. Providing additional access to areas of high traffic is another important consideration in the development of the proposed collector street network.

Spacing Standards

Spacing Standards were developed as part of a modeling exercise (conducted in 2011) to determine the ideal spacing needed for streets to maintain a Level-of-Service “D” on all roadways within a given study area. A Level-of-Service “D” constitutes acceptable conditions under which speed and freedom to maneuver are severely restricted, though traffic flow is still stable. A Level-of-Service “D” serves as a baseline in this instance. The details of the spacing standards are presented in Table 2 below. The parentheses indicate the zoning definition that corresponds to the land use intensity. The Access Function column refers to the amount of access that the collector street will provide. As land use intensity increases, there are more collector streets, allowing transportation network users to access specific areas via different routes, meaning that the access provided per



School Bus Traffic on US 117



Table 2: Spacing Standards

Type of Collector Street (Zoning Designation)	Intensity	Access Function	Approximate Street Spacing
No Collector Streets	27,000	33,000	22.2%
(Environmental Conservation)	No Development	N/A	N/A
Lowest Intensity (Rural Agricultural)	Less than 2 Dwelling Units per Acre	Highest	3,000 to 6,000 feet apart
Medium Intensity (General Business, General Industrial, Industrial Transitional, Manufactured Housing Community, Residential Performance)	2 to 4 Dwelling Units per Acre	High	1,500 to 3,000 feet apart
High Intensity (Residential Mixed, Office Institutional, Planned Development)	More than 4 Dwelling Units per Acre	Medium	750 to 1,500 feet apart

Source: Stantec, Wake County TDM Modeling Analysis, 2011.



"Soil Road" in the project study area



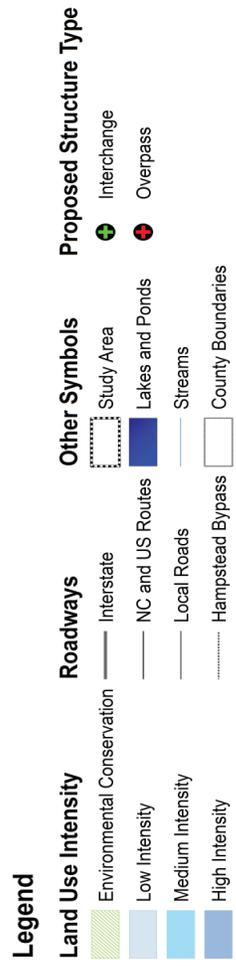
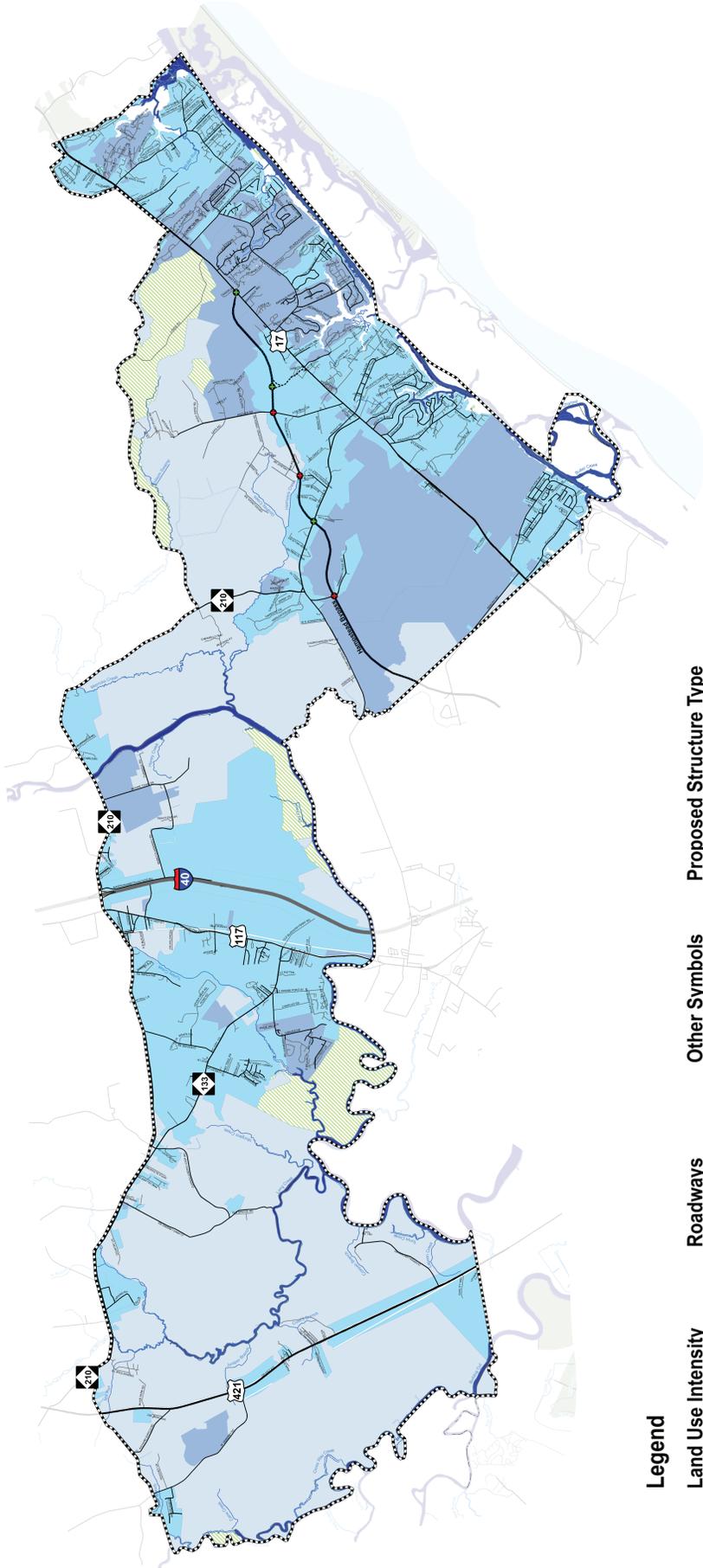


Figure 18: Base Spacing Standards



collector street is lower than if the collector was the only street in a low intensity area. In the “lowest intensity” areas, each collector streets provides substantial access, more than if there were multiple collector streets nearby.

Each land use type is assigned an approximate street spacing based on the density and intensity of land use development; the proposed street spacing may not exactly correspond to the ideal spacing standard, based on the presence of natural or man-made features. Figure 18 provides further detail.

Complete Streets

The NCDOT Complete Streets Design Manual provides guidance on the design and construction of streets that accommodate all users of the transportation system, including bicyclists, pedestrians, transit users, and motorists. The Complete Streets approach incorporates bicycle and pedestrian amenities into new street design, especially collector roadways which serve as important connector roadways to handle high volumes of traffic. It is important to note that existing collector streets may need to be retrofitted to include bicycle and pedestrian amenities, which may not be in existence currently.

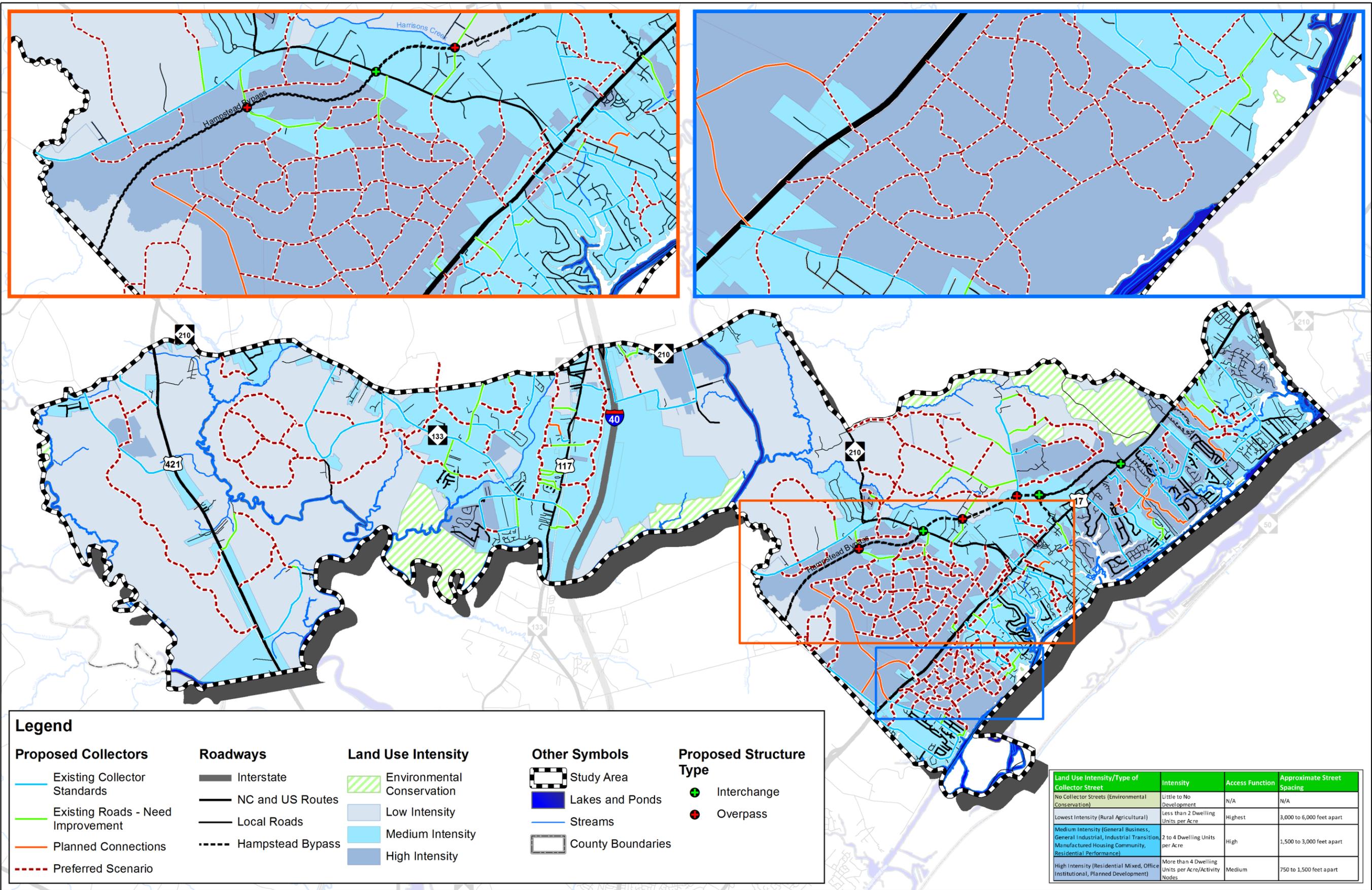
Soil Road and Paper Streets

“Soil roads,” existing unpaved roads in the CSP study area, and “paper streets,” platted connections that are identified as a future connection, were also considered as part of this process. If possible, an unpaved road was considered as a proposed collector street along the existing soil road. This will ultimately reduce the cost of constructing proposed collectors. In a similar vein, project planners endeavored to route collector streets through as few parcels as possible in order to mitigate right-of-way costs for parties responsible for implementing the design and construction of collector streets in the future.

Preferred Collector Street Scenario

With existing conditions in mind, a collector street scenario was created and refined for the CSP area. Pender County, WMPO, and the public commented on the proposed alignment, ultimately leading to a broadly accepted plan. Figure 19 provides more detail. Additionally, a pedestrian and bicycle facility map was also created as part of this planning effort. (Figure 20 indicates those existing signed bicycle routes, proposed multi-use trails, and collector streets designated as bike-friendly connections.





Legend

Proposed Collectors	Roadways	Land Use Intensity	Other Symbols	Proposed Structure Type
Existing Collector Standards	Interstate	Environmental Conservation	Study Area	Interchange
Existing Roads - Need Improvement	NC and US Routes	Low Intensity	Lakes and Ponds	Overpass
Planned Connections	Local Roads	Medium Intensity	Streams	
Preferred Scenario	Hampstead Bypass	High Intensity	County Boundaries	

Land Use Intensity/Type of Collector Street	Intensity	Access Function	Approximate Street Spacing
No Collector Streets (Environmental Conservation)	Little to No Development	N/A	N/A
Lowest Intensity (Rural Agricultural)	Less than 2 Dwelling Units per Acre	Highest	3,000 to 6,000 feet apart
Medium Intensity (General Business, General Industrial, Industrial Transition, Manufactured Housing Community, Residential Performance)	2 to 4 Dwelling Units per Acre	High	1,500 to 3,000 feet apart
High Intensity (Residential Mixed, Office Institutional, Planned Development)	More than 4 Dwelling Units per Acre/Activity Nodes	Medium	750 to 1,500 feet apart

Figure 19: Preferred Collector Street Scenario



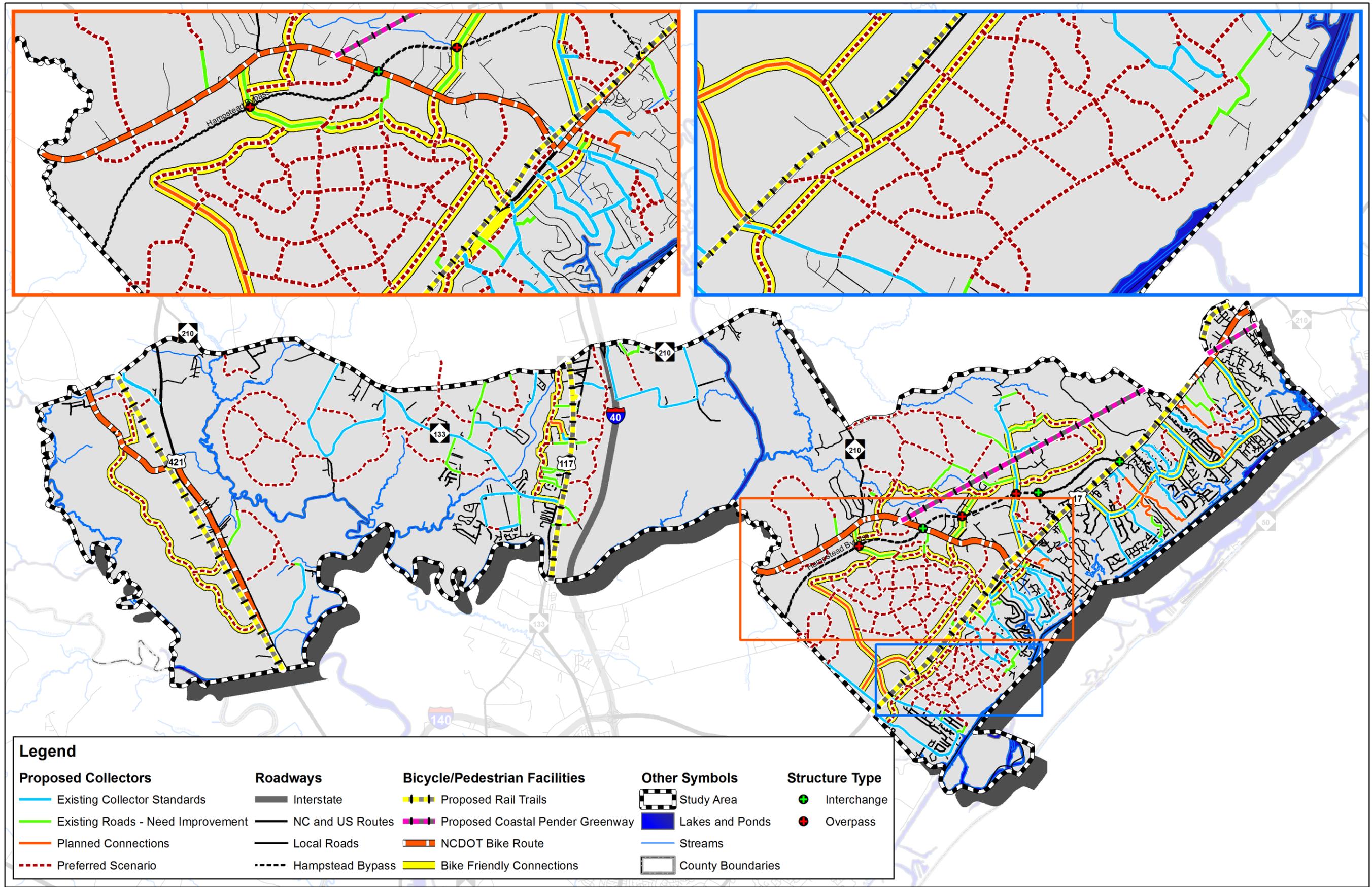


Figure 20: Proposed Pedestrian and Bicycle Facilities



5

Design Requirements

In This Chapter

Cross-Sections • 53

Land Use Intensity • 53

Cross-Section Categories • 53

Group 1 • 54

Group 2 • 56

Group 3 • 57

Group 4 • 58



Cross-Sections

A series of cross-sections were developed as part of this plan, ranging from a rural cross-section (best suited to areas with low density development) to a neighborhood cross-section (designed to accommodate automobiles, pedestrians, and bicyclists in a more densely populated area). These cross-sections are presented in the following figures and are color-coded to the collectors identified on the map. Each color does not represent one cross-section, in fact, an array of cross-sections are presented for each category for flexibility in design, while still maintaining amenities for pedestrians and bicyclists. Each recommended cross section was designed based on the most current version of NCDOT's Complete Streets Policies. This was done to ensure that each road was built to NCDOT design standards.

Land Use Intensity

A series of cross-sections were developed as part of this plan, ranging from a rural cross-section (best suited to areas with low density development) to a neighborhood cross-section (designed to accommodate automobiles, pedestrians, and bicyclists in a more densely populated area). These cross-sections are presented in the following figures and are color-coded to the collectors identified on the map. Each color does not represent one cross-section, in fact, an array of cross-sections are presented for each category for flexibility in design, while still maintaining amenities for pedestrians and bicyclists. Each recommended cross section was designed based on the most current version of NCDOT's Complete Streets Policies. This was done to ensure that each road was built to NCDOT design standards.

Cross-Section Categories

The following tables categorize the cross-sections developed as part of this plan. The requirements reflect the minimum cross-section allowed for each roadway designation. The cross-section may be designed to any higher level designation, but must construct collector streets to the minimum

standards, in accordance with NCDOT standards and to the specifications provided in the cross-sections. To avoid confusion, a sidewalk is defined as a recommended 5' facility, a bike lane as a recommended 5' facility, and a sidepath as a recommended 10' facility. A sidepath is the equivalent of a multi-use path for the purposes of this plan.

Figure 30 is color-coded to match a cross-section category, indicating which cross-section categories apply to which proposed collector street. This allows flexibility in determining which cross-section is most appropriate for the context, while ensuring that pedestrian and bicycle amenities are in fact constructed as part of collector streets. It is important to keep in mind that the exact design of each of these cross-sections will ultimately be determined with input from NCDOT, in accordance with the Complete Streets Manual.



Group 1

Baseline	This facility will include: <ul style="list-style-type: none"> • two travel lanes and • a 2' to 4' shoulder
Baseline with Bike Lanes	This facility will include: <ul style="list-style-type: none"> • two travel lanes and • two on-road bicycle lanes
Baseline with Sidewalk	This facility will include: <ul style="list-style-type: none"> • two travel lanes and • a 2' to 4' shoulder and • sidewalks on one or two sides

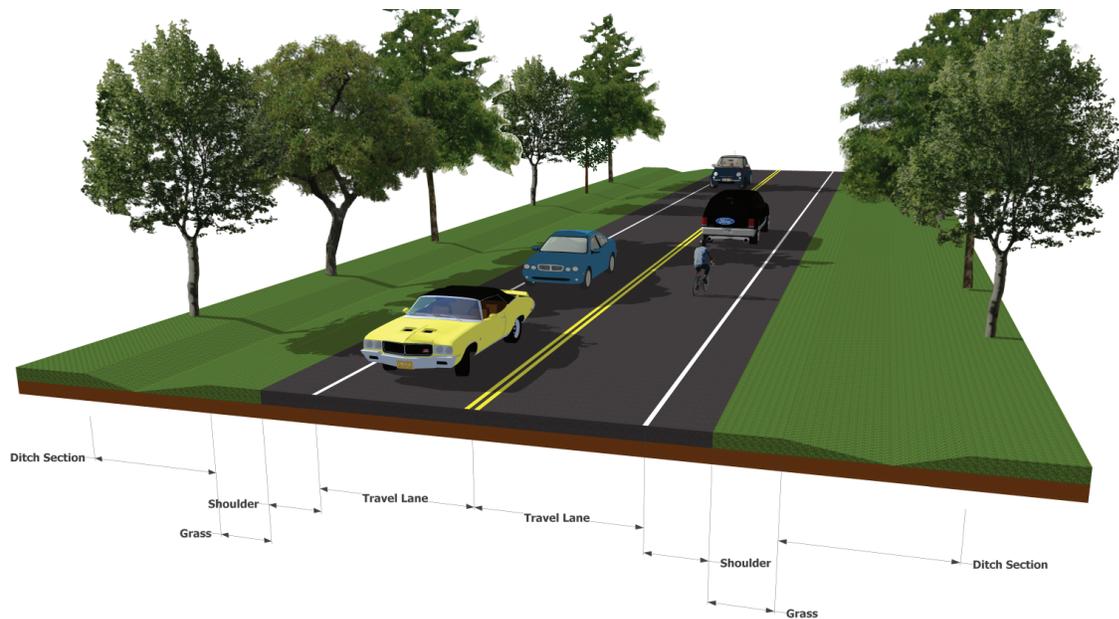


Figure 21: Baseline





Figure 22: Baseline with Bike Lanes



Figure 23: Baseline with Sidewalk (only required on one side)



Baseline with Sidewalk and Bike Lanes	This facility will include: <ul style="list-style-type: none"> two travel lanes, sidewalks on both sides, and two on-road bicycle lanes.
Baseline with Sidepath	This facility will include: <ul style="list-style-type: none"> two travel lanes and one separated sidepath.



Figure 24: Baseline with Sidewalks and Bike Lanes

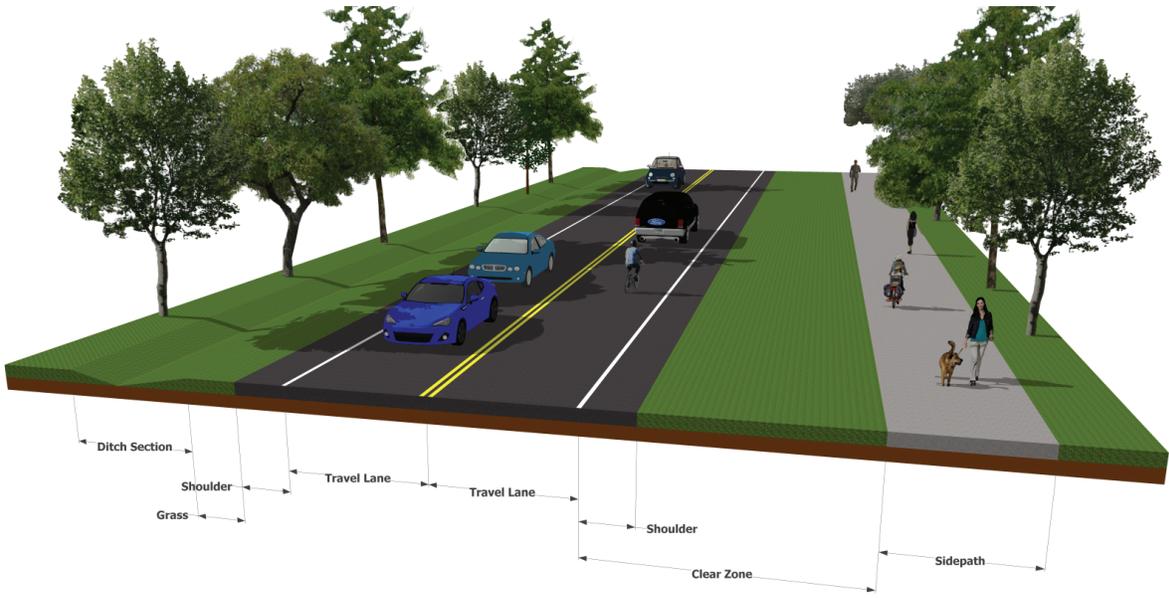


Figure 25: Baseline with Sidepath



Group 3

<p>Residential with Sidepath (one side) or Sidewalk (both sides)</p>	<p>This facility will include:</p> <ul style="list-style-type: none"> • two travel lanes and • either a sidepath on one side or • sidewalks on both sides.
<p>Baseline with Sidepath</p>	<p>This facility will include:</p> <ul style="list-style-type: none"> • two travel lanes and • one separated sidepath.

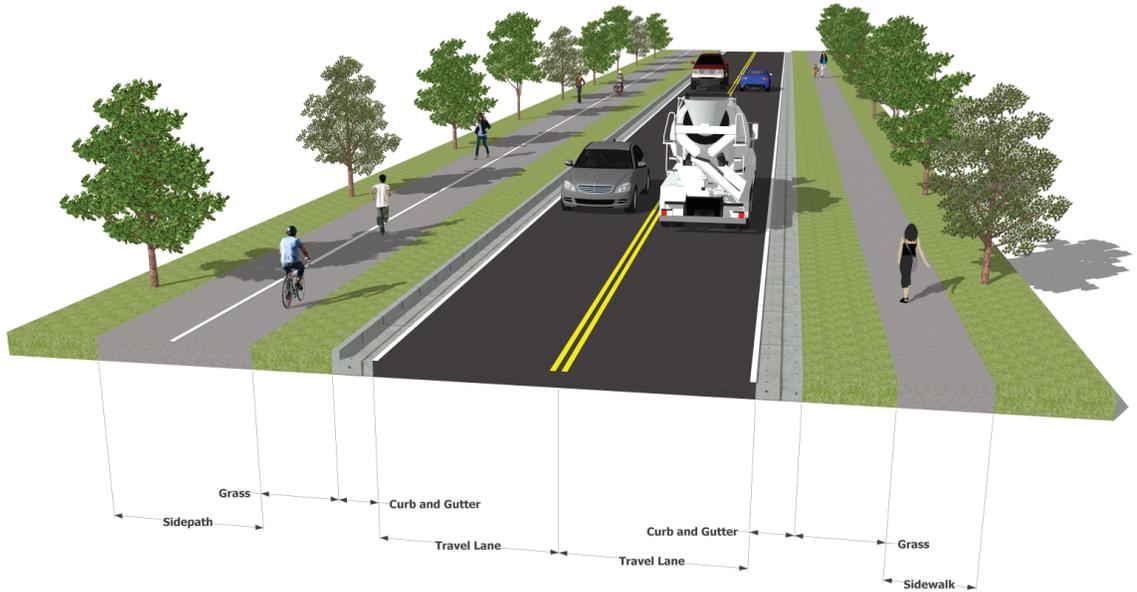


Figure 26: Residential with Sidepath (one side) or Sidewalks (both sides)



Figure 27: Baseline with Sidepath



<p>Residential Median-Divided with Bike Lanes and Sidewalk (both sides)</p>	<p>This facility will include:</p> <ul style="list-style-type: none"> • a planted median; • two travel lanes; • two bike lanes, and • sidewalks on both sides
<p>Neighborhood with Bike Lanes and Sidewalks (both sides)</p>	<p>This facility will include:</p> <ul style="list-style-type: none"> • two travel lanes, • two bike lanes, and • sidewalks on both sides.



Figure 28: Residential Median-Divided with Bike Lanes and Sidewalks (both sides)



Figure 29: Neighborhood with Bike Lanes and Sidewalks (both sides)



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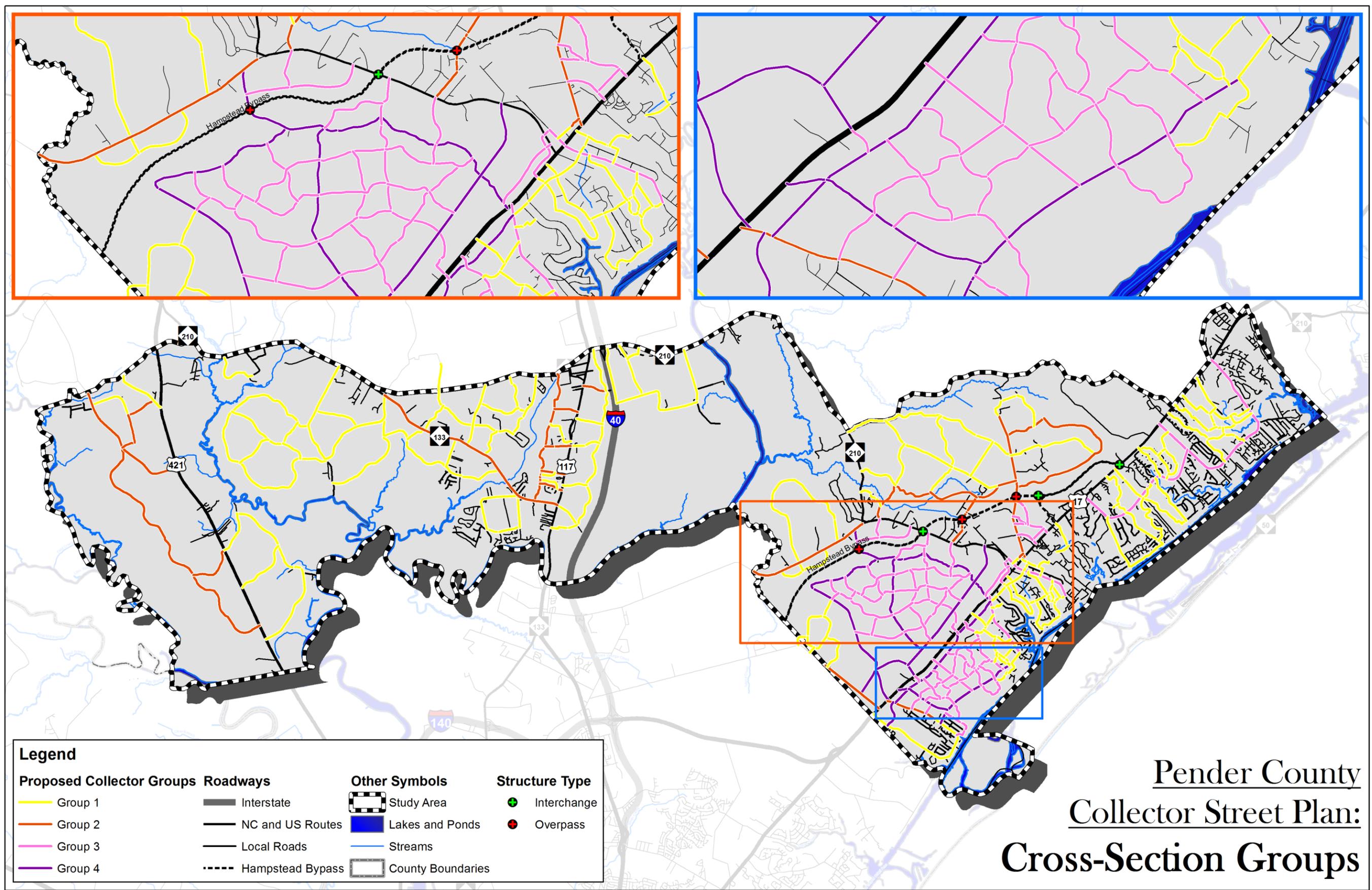


Figure 30: Proposed Cross-Sections

6

Policy Strategies

In This Chapter

Recommended Policy Measures • 62

Island Creek Road and NC-210 • 69

Funding • 70

Action Plan • 70



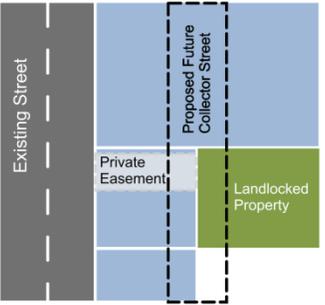
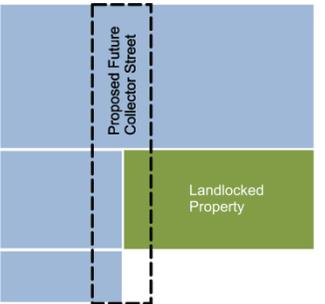
Recommended Policy Measures

Each of the following tables provides further information on the recommended policy measures for Pender County, as they relate to the Pender County Collector Street Plan. The policies in Table 3 through Table 8 were evaluated by the CSP Steering Committee as most important.

Table 3: Stormwater/Green Streets Policy Requirement	
Description/Purpose	Stormwater and Green Streets Policies can help ensure stormwater Best Management Practices (BMPs) are implemented, safeguarding precious natural resources, ensuring water quality, and preventing infrastructure maintenance issues. Both the North Carolina Department of Transportation and the North Carolina Department of Natural Resources provide guidance regarding stormwater BMPs. In Pender County, shellfish areas can be negatively affected as nutrient rich runoff from roads and other impervious surfaces enters streams, rivers, and wetlands. Safely treating stormwater runoff is important in terms of maintaining critical wildlife habitats and ensuring water quality for plant, animal, and human uses.
Target Performance Measure	Pender County will implement a community education campaign regarding the importance of stormwater mitigation; develop a stormwater management and maintenance plan; and explore the possibility of providing incentives to developers for providing stormwater BMPs which will enhance the standard level of treatment. Incentives could include reducing required widths for lanes, sidepaths, or right of way; alternative materials for bicycle and pedestrian facilities such as pervious pavements; and density credits for developments. All provisions should be developed and articulated in a Stormwater Management Plan.
Sample Language / Recommendation	Stormwater BMPS and Green Streets Policies are essential in mitigating pollution and maintaining water quality, particularly in sensitive natural areas. Pender County is home to significant natural resources, which can be negatively impacted by stormwater runoff. To avoid this type environmental degradation, stormwater BMPS are recommended to be implemented as appropriate to local conditions.
Comments	The measure ensures a rigorous implementation of stormwater BMPs and establishes a regulatory framework to require stormwater BMPs where appropriate. Providing stormwater BMPs around critical surface waters and watershed areas can help mitigate water quality issues.



Table 4: Street Spacing and Access Standards

<p>Description/Purpose</p>	<p>This policy creates street spacing standards for collector streets to ensure adequate cross access between land uses.</p>
<p>Target Performance Measure</p>	<p>The benefits of establishing a maximum distance between collector streets (or any “through” street that connects with the rest of the street network) include: traffic relief on major roadways, equitable distribution of traffic, improving emergency response access / reliability, increasing bicycling / walking propensity in an area by shortening the distance between destinations and creating efficiencies for service vehicles to do their jobs in less time.</p> <p>Several of these benefits have the secondary promise of reducing mobile source pollution. When street spacing standards are established by local governments, they often vary considerably, but a reasonable balance between the costs of construction and the desire to achieve the benefits of a tighter-grained network is ¼-mile to ½-mile for collector streets. Local streets should connect to the collector streets together to form a hierarchy of streets that serve their intended uses. Regardless, it is much easier to create a street network as new development occurs rather than “retrofit” new street connections into existing neighborhoods that often feel like more connectivity introduces more problems than it solves. (reference: Driveway and Street Intersection Spacing, Transportation Research Circular No. 456, 1996; Levinson, Herbert, Street Spacing and Scale, TRB Circular E-C019: Urban Street Symposium; and various municipal codes including West Richland, WA; Fairborn, OH; and Fuquay-Varina, NC).</p>
<p>Sample Language / Recommendation</p> <div style="display: flex; flex-direction: column; align-items: flex-start;">  <p>Meets Exclusion Requirements</p>  <p>Not Excluded from Requirements</p> </div>	<p>Any site plan or master development plan requiring the implementation of a collector street as defined by the adopted Pender County CSP or the WMPO non-federal classification shall meet minimum spacing standards as defined by the table below. If modifications or wavier to the spacing standards are warranted for any reason, they must be based on objective criteria including;</p> <ol style="list-style-type: none"> 1. Existing topographical constraints such as; drainage patterns, riparian areas, significant trees or vegetation, steep slopes or are likely to cause unacceptable significant adverse environmental impacts the waiver would avoid such impacts; 2. An existing structure such as a substantial retaining wall makes widening a street or right-of-way or required placement of infrastructure impractical; 3. Building on an existing lot could not occur without the waiver or modification based on the specific Group and selected Cross Section given the defined spacing standards may be achieved by other means; 4. There is insufficient right of way to allow a full width street Cross Section and additional right-of-way cannot be provided, or the required street right-of-way would occupy an unreasonable percentage of the total land area of the tract; 5. The existing infrastructure (a) does not meet current standards, (b) is and will remain functionally equivalent to current standards, and (c) there is little likelihood that current standards will be met in the area; and / or 6. There is no existing or proposed street or street right-of way adjacent to the property, and the street access has been obtained across private property (refer to Figure at left). <p>Maximization of the number of lots or parcels in a land division is not a reason to allow a waiver or modification.</p>



Comments	Each land use type is assigned an approximate street spacing based on the density and intensity of land use development.			
Notes	Type of Collector Street (Zoning Designation)	Intensity	Access Function	Approximate Street Spacing
	No Collector Streets (Environmental Conservation)	Little to No Development	N/A	N/A
	Lowest Intensity (Rural Agricultural)	Less than 2 Dwelling Units per Acre	Highest	3,000 to 6,000 feet apart
	Medium Intensity (General Business, General Industrial, Industrial Transition, Manufactured Housing Community, Residential Performance)	2 to 4 Dwelling Units per Acre	High	1,500 to 3,000 feet apart
	High Intensity (Residential Mixed, Office Institutional, Planned Development)	More than 4 Dwelling Units per Acre/Activity Nodes	Medium	750 to 1,500 feet apart

Table 5: Traffic Impact Analysis Requirement

Description/Purpose	NCDOT requires that Traffic Impact Studies be conducted for developments forecast to generate 3,000 vehicle trips per day (vpd). Pender County requires a lower threshold, 100 vehicle trips during the AM or PM peak hour or 1,000 vpd. This policy ensures that the arterial system in Pender County is not unduly burdened without understanding the impacts of the proposed development impacts to the existing system.
Target Performance Measure	<p>Require new developments forecasted to generate over 100 trips during the AM or PM Peak hour or 1,000 vpd to conduct a Traffic Impact Analysis.</p> <p>The TIA is a useful assessment tool that can have an expanded range and different levels of considerations to make it more suitable for use on collector streets. TIA reports are a critical part of the development review and approval process, as they are the primary tool for identifying the potential net effects from a development proposal. The standard “1,000” thresholds (per day) that trigger a TIA represent a significant fraction (8%-10%) of the total capacity of a collector street. A significant increase in traffic on a collector street can reduce functional integrity and public purpose. A traffic study should consider all modes of travel including cars, transit cyclists and pedestrians.</p>



Sample Language / Recommendation	<p>A Traffic Impact Analysis (TIA) shall be required if one of the following applies to a specific site plan:</p> <ol style="list-style-type: none"> 1. The development generates 1,000 vehicle trips per day or 2. 100 vehicles in the AM or PM peak hour. <p>This requirement applies to all phases of a proposed development. Other stipulations regarding internal capture, trip generation, trip distribution, and peak hour factors will be part of the basic requirements of the TIA. It is recommended to assess and quantify the cumulative impact to the roadway network and establish processes to address additional traffic created as a result of additional development.</p>
Comments	<p>With substantial development likely to occur in the CSP study area of Pender County in the next decades, establishing robust measures to ensure that back access is created to new developments is of paramount concern. Traffic is already heavy on US 17 and the provision of multiple developments without adequate cross-access to other roadways in the area will only worsen existing traffic issues. This measure is a requirement.</p>

Table 6: NCDOT Complete Streets Design Manual

Description/Purpose	<p>The NCDOT Complete Streets Design Manual provides guidance on the design and construction of streets that accommodate all users of the transportation system, including bicyclists, pedestrians, transit users, and motorists. This policy would require implementing a Complete Streets approach in new street design and construction in areas where bicycle and pedestrian amenities are programmed in the adopted Pender County Collector Street Plan.</p>
Target Performance Measure	<p>Proposed collector streets should be designed to Complete Streets standards to accommodate pedestrians and bicyclists when these facilities are recommended in the adopted Pender County Collector Street Plan. It is recommended that providing incentives to developers be explored for building Complete Streets in certain cases. Incentives could include reducing required widths for lanes, sidepaths, or right of way; alternative materials for bike/ped facilities such as pervious pavements; use of curb and gutter (i.e., narrow width); utilizing multiuse path on one side of street; and density credits for developments.</p>
Sample Language / Recommendation	<p>Proposed collector streets as defined by the Pender County Collector Street Plan (CSP) will adhere to the NCDOT Complete Streets Design Manual, including the design of multimodal facilities – i.e., proposed pedestrian and bicycle facilities must be designed and constructed to the applicable standard.</p>
Comments	<p>This measure is based on a stated desire from the public and other adopted plans in the County to include more pedestrian and bicycle amenities along roads in the CSP study area. Future construction of roadways (new or existing) should be constructed to the standards indicated in the NCDOT Complete Streets Design Manual and in the adopted Pender County Collector Street Plan on the collector roadways.</p>
Notes	<p>The information in this table is a requirement. Specific treatments must be implemented as they are programmed within the adopted Pender County Collector Street Plan.</p>



Table 7: Environmental Conservation Policy

Description/Purpose	<p>Extending outward from the need to create interconnected populations (streets and greenways) and a reduced footprint from water quality/quantity impacts is the desire to create interconnected ecologies. This practice is called “landscape ecology,” a subset of conservation biology which requires the consideration of how green spaces can interconnect to provide habitat for species, green space for people, and preserve the rural character that is valued in Pender County. Large, protected areas like parks and preservation zones need to be connected with “stepping stone” areas that allow the movement of wildlife and promotion of biodiversity.</p> <p>It is recommended to develop a “Greenprint” that shows areas that would be preserved based on utility (or lack thereof) to private development; linkages to large, protected areas; and biologically diverse habitat (e.g., streams, older-growth forests).</p> <p>Future developments would incorporate these green areas into their plans as part of the requirements for open space; additional space provisions could be rewarded through clustering bonuses that allow a higher intensity of development elsewhere on the site.</p>
Target Performance Measure	Avoid sensitive natural areas to the degree possible when programming new development or reserving road right-of-way.
Sample Language / Recommendation	In order to preserve the unique natural environment in Pender County, any new development that would require the construction of collector street as defined (alignment) by the Pender County CSP, would avoid or minimize impacts to sensitive natural areas, such as wetlands, floodplains, and areas with endangered flora/fauna. Additional justification (i.e., Corps Delineation, etc.) or other additional resource may be necessary.
Comments	In some cases, development will necessarily encroach into sensitive natural areas. Avoiding these areas is strongly recommended, though it may not always be feasible or even desirable to do so.

Table 8: Tri-Party Agreement

Description/Purpose	The Tri-Party agreement is a framework for the construction and maintenance of new pedestrian and bicycle facilities along collector streets. While NCDOT would ultimately maintain the street, all maintenance and liability costs for the construction and maintenance of pedestrian and bicycle facilities would be borne by Pender County (or HOA) until the construction is complete. At that point, maintenance would be transferred to the Home Owner’s Association or other qualified party, absolving both the NCDOT and Pender County from any liability or maintenance relating to the pedestrian and bicycle amenity.
Target Performance Measure	<p>Negotiate and implement the Tri-Party agreement with NCDOT. (See steps in Appendix F).</p> <p>Inform effected development community/Homeowner’s Associations that this agreement may be warranted for specific situations related to the implementation of bicycle or pedestrian facilities.</p>
Sample Language / Recommendation	See Appendix F.
Comments	The Tri-Party Agreement is fundamental to constructing and maintaining pedestrian and bicycle amenities in the CSP study area. Implementing and abiding by this agreement would be a requirement in situations where bicycle and pedestrian amenities are planned to be constructed.



Table 9: General Connectivity of Collector Roadways

<p>Description/Purpose</p>	<p>Connectivity requires that private entities coordinate across different properties to anticipate future, connections between adjacent properties. Providing connectivity to nearby amenities and to the arterial system is important to avoid congestion across the transportation system. This policy requires that new collector roadways be constructed to provide connections between the collector and arterials systems.</p> <p>As new development is programmed, this policy would require that collector roadways are not closed off, but are “stubbed out” to ensure that future roadway construction could tie back in to the public roadway network. Essentially, this policy stipulates that no collector street can dead end.</p>
<p>Target Performance Measure</p> <div data-bbox="142 590 513 793" style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p style="text-align: center;">NOTICE</p> <p style="text-align: center;">THIS RIGHT-OF-WAY MAY BE EXTENDED IN THE FUTURE TO OTHER DEVELOPMENT AND TO OTHER ROADWAYS.</p> <p style="text-align: center;">COUNTY OF PENDER</p> </div>	<p>Each new development needs to provide connections to another collector or arterial within the recommended spacing, or shall provide a signed stub-out to allow future connections as new development occurs. All practical connections must be included.</p> <p>No collector street should be discontinued without signage (i.e., Future Connection)</p>
<p>Sample Language / Recommendation</p>	<p>By definition, collector streets are not “dead-end” streets: they always connect to (1) adjacent land at a location that allows the continuation of the collector street onto the adjacent property; or (2) another collector street or another, higher-level (e.g., arterial) street.</p> <p>Furthermore, any new development or additions to existing developments such that the total number of dwelling units exceeds one hundred (100) shall be required to provide for vehicular access to at least two (2) public streets.</p> <p>However, in instances where the collector street cannot be constructed in its entirety a temporary turnaround at the end of the street.</p> <ol style="list-style-type: none"> 1. The temporary turnaround shall be reviewed and approved by NCDOT; 2. Stub-outs shall be adequately signed at the time of final plat recordation, with an easement recorded to the adjacent parcel, and their existence shall be noted on all subdivision plats and deed documents; 3. Stub-out streets will connect to adjacent properties in such a way as to ensure that stream crossings, floodplains and other barriers are avoided to create the continuation of the street or any other areas as listed in Table 4
<p>Comments</p>	<p>Collector streets should provide numerous points of access to the surrounding collector and arterial system. This policy would recommend that developments provide connections to ensure that Efforts should be connections are made to existing street stubs and streets rights-of-way.</p>



Table 10: Bicycle and Pedestrian Accommodation

Description/Purpose	As Pender County develops, the demand for safe, comfortable bicycle and pedestrian facilities will continue to increase. This policy requires the accommodation of non-motorized users along collector streets, particularly in areas close to residential developments, schools, or parks, the network of facilities for pedestrians and bicyclists will become a high-quality amenity in the County. Beyond health and mobility related benefits, one additional advantage of accommodations for bike/pedestrians is preservation of capacity along the roadways with reduced vehicular use (active modes of transportation).
Target Performance Measure	Connect key destinations, including schools, parks, commercial centers, and residential developments with pedestrian and bicycle amenities.
Sample Language / Recommendation	All proposed collector streets, as defined by the Pender County CSP, shall have accommodations for bidirectional bicycle or pedestrian facilities. In the case of Group 1 collector streets, requirements for bicycle or pedestrian accommodations will be made in accordance with existing planning documents. Other bicycle and pedestrian accommodations will be considered if afforded by existing planning documents.
Comments	The inclusion of sidewalks/pedestrian paths/bikeways on all collector streets should be viewed as a required minimum standard.

Table 11: Reduced Paper Streets

Description/Purpose	A paper street is a “street shown on a recorded plan but never built on the ground” (Shapiro v. Burton, 23 Mass. App. Ct. 327, 328, 1987). These anticipated roads are shown in planning documents or on plats currently on record. This policy requires that platted right of way becomes built to NCDOT standards to ensure connectivity is implemented.
Target Performance Measure	Minimize the number of new paper streets and mileage. Encourage the construction of paper streets to the greatest extent possible; reduce the number and extent of paper streets.
Sample Language / Recommendation	All platted site plans must honor paper streets, reserving right-of-way and ensuring that streets can be constructed to NCDOT standards. Paper streets must be preserved until such time as they are constructed.
Comments	Proper ROW preservation/width is needed to ensure implementation of an adequate street system with the appropriate non-motorized facilities.



Island Creek Road and NC-210

The intersection of Island Creek road and NC-210 poses a serious safety issue for motorists. Between January 1, 2011 and December 31, 2013, a total of 11 crashes occurred in the direct vicinity of this intersection. Five of the crashes correspond to the “angle” crash type, while four are defined as “rear end, slow or stop” type crashes. One “fixed object” and one “overturn/rollover” crash also occurred at this location. In order to mitigate the crash issue at this location, the proposal is to modify the existing intersection and alignment as needed and potentially; close the cut-through to through traffic, essentially creating a cul-de-sac at this location, and adding a full signal only if warranted at the intersection of what is now Island Creek Road and Dallie Futch Road. In effect, NC -210 would continue onto Island Creek Road before turning right onto Dallie Futch Road before rejoining current NC-210 north of the cut-through. Figure 31 provides more information.



Figure 31: Proposed Infrastructure Changes



Funding

Collector streets are likely to be funded through a variety of sources. The development community may aid in constructing these facilities, while Pender County, the WMPO, and NCDOT may also have a hand in creating new collector streets. What is certain is that finding alternative funding sources will help Pender County and its residents realize this plan quickly and begin to see the results of a more robust collector street network. A few likely funding sources are detailed as potential revenue sources.

Transportation Bonds

Local roadways are often not particularly high on NCDOT Division priority lists, especially in this new era of SPOT funding. With this in mind, strategic bond measures can prove instrumental in helping gather funds to construct needed local facilities. Pedestrian and bicycle facilities, in particular, may be good candidates for local funding sources, though voters have approved bond measures for larger road construction in other communities, both large and small.

Impact Fees

Impact fees are another way that local governments can pay for needed infrastructure. Often used for water or wastewater service, police and fire protection, and schools, impact fees can also be levied to provide funding for new infrastructure. These fees place the burden on developers and remove the burden from local taxpayers, who are often forced to pay for sometimes expensive new public services that may not directly benefit them. While levying impact fees requires approval from the North Carolina General Assembly and is not a typical funding mechanism, these fees are something that Pender County could consider.

TIGER Grants

Short for Transportation Investment Generating Economic Recovery (TIGER), these grants provide discretionary funding for projects (rail, road, port, and transit) that will have a significant impact on

the Nation, a metropolitan area, or a region. Now in the 8th round of grants, this could be funding mechanism to fund a marquee project in the CSP study area.

Private Grants

Foundations and other private organizations will often provide infrastructure grants to communities. Depending on the specific grant, private money may be available, particularly to support the construction of pedestrian and bicycle facilities.

FAST Act Funding

The new Fixing America's Surface Transportation (FAST) Act could be another important funding source for Pender County. This five-year, \$305 billion transportation bill provides substantial funding for roads and bridges, public transportation, highway and motor vehicle safety, truck and bus safety, hazardous materials, railroads, and other provisions. Depending on the State of North Carolina chooses to allocate this funding, some may be available to counties to help construct important infrastructure projects.

Ultimately, it is our assumption that many of the collector streets in Pender County will be constructed by the development community and that the funding sources mentioned above can support collector street construction, but will likely not be primary sources of funding.

Action Plan

The following steps constitute important actions that can be undertaken to implement the recommendations of this Pender County Collector Street Plan. While other funding sources may become available, these actions present a clear way forward with the ultimate goal of achieving plan implementation within a reasonable timeframe.



Action	Responsible Party	Timing
Adopt Pender County Collector Street Plan	Pender County Commissioners	Spring 2016
Research and Apply for FAST Transportation Funding (in coordination with the WMPO)	WMPO, Pender County Planning and Community Development Department	Ongoing
Pursue Funding to Implement Collector Street Recommendations (local, state, private)	Pender County Planning and Community Development Department	Ongoing
Pursue Grants, including TIGER and SRTS, to implement marquee projects, pedestrian and bicycle facilities	WMPO, Pender County Planning and Community Development Department	Ongoing
Adopt Policy Measures into County Ordinances	Pender County Planning and Community Development Department	Fall 2016
Develop Bicycle and Pedestrian Plan to Reflect Collector Street Plan Recommendations	WMPO, Pender County Planning and Community Development Department	2018-2020



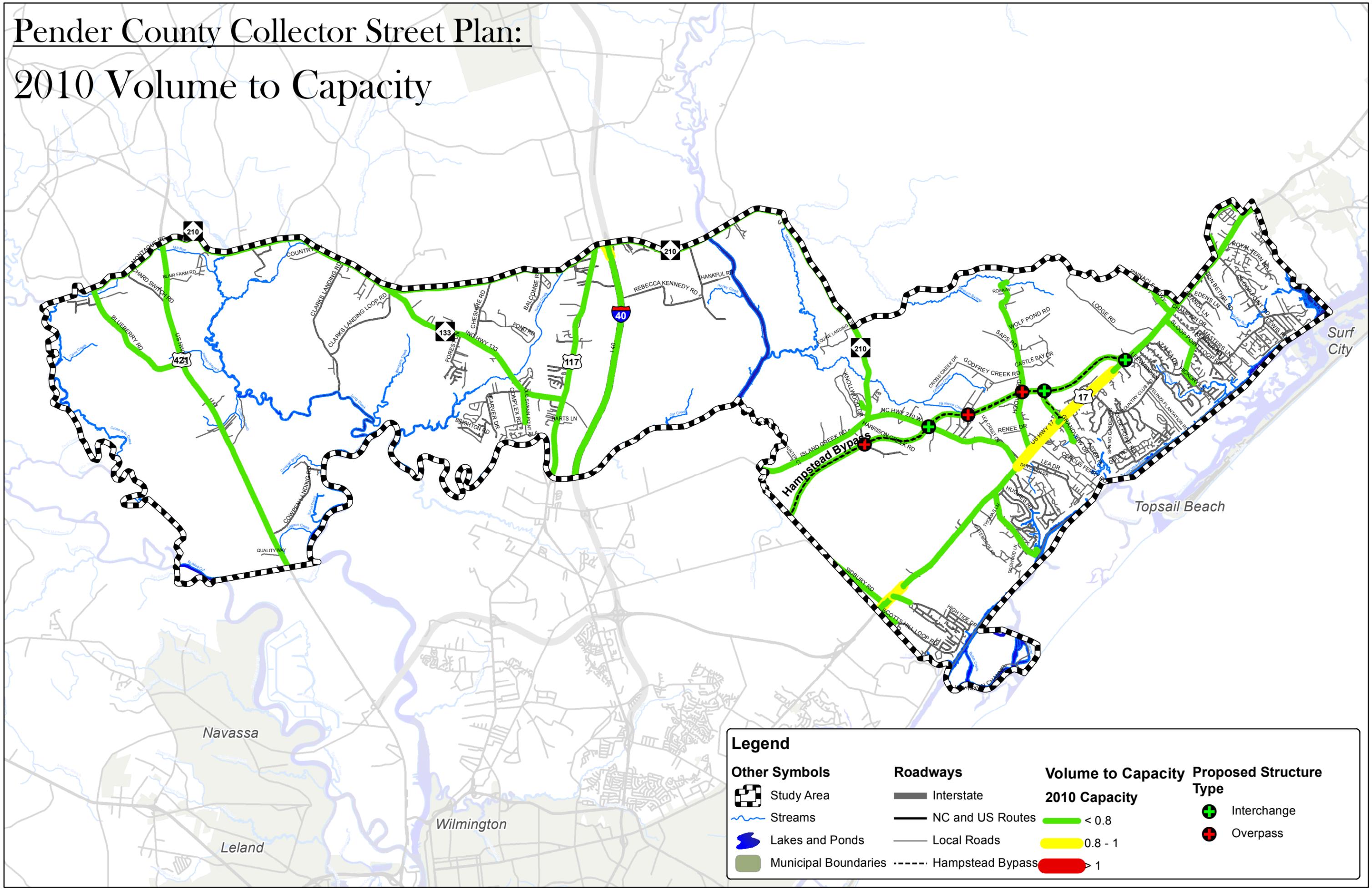
Appendix A

Map Book

This appendix provides full 11x17 versions of all of the maps that were created as part of the Pender County Collector Street Plan. The following maps are provided.

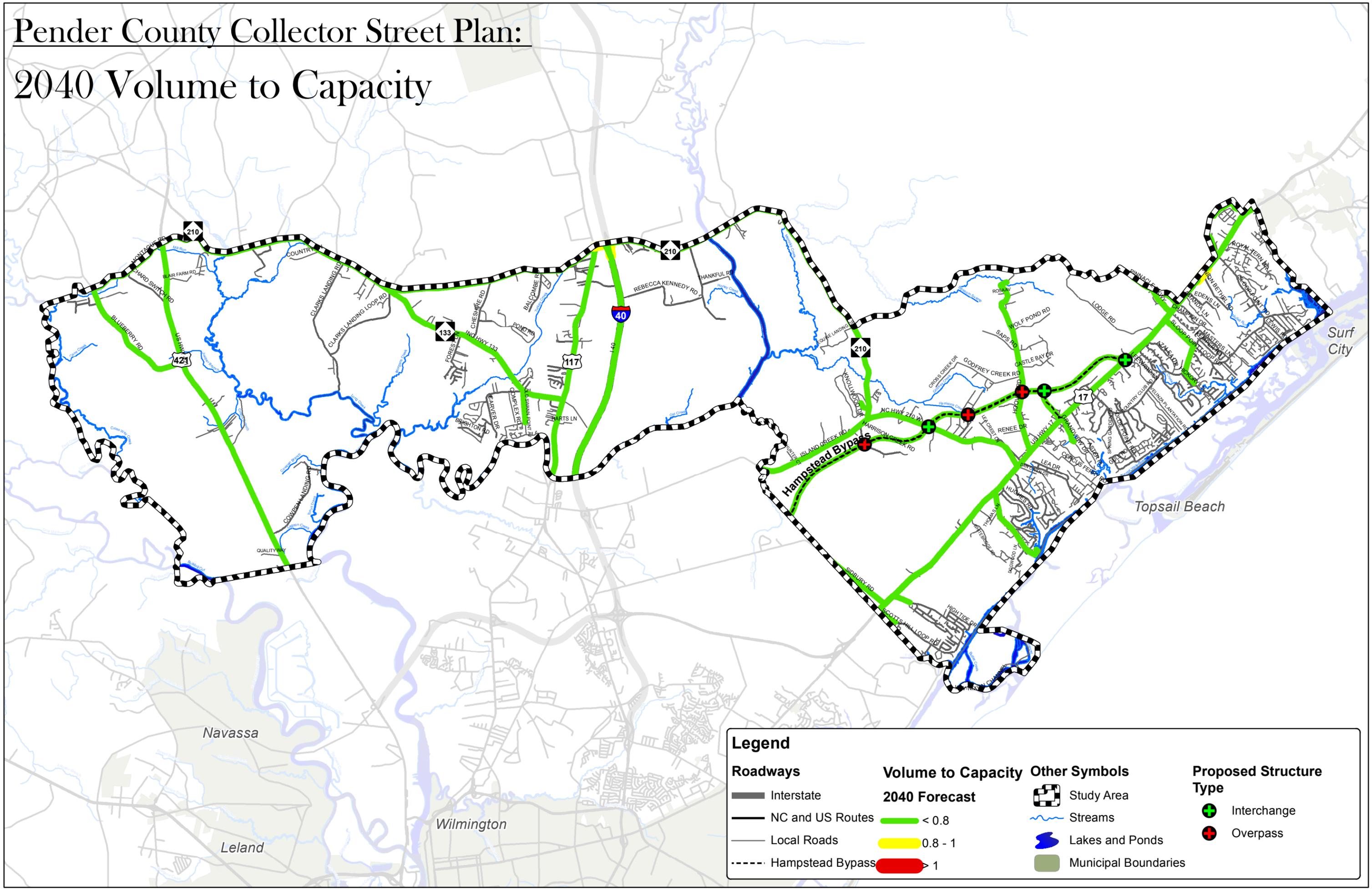
1. 2010 Volume to Capacity Ratios Map
2. 2040 Volume to Capacity Ratios Map
3. Study Area Base Zoning Map
4. Study Area Future Land Use Map (2010 Plan)
5. Crash Cluster Map
6. Environmental Features Map
7. Functional Classification Map
8. Spacing Standards Map
9. Proposed Collector Street Alignments – Aerial Imagery Map
10. Proposed Collector Street Alignments – No Aerial Imagery Map
11. Proposed Cross-Section Locations Map
12. Proposed Pedestrian/Bicycle Facilities Network Map

Pender County Collector Street Plan: 2010 Volume to Capacity



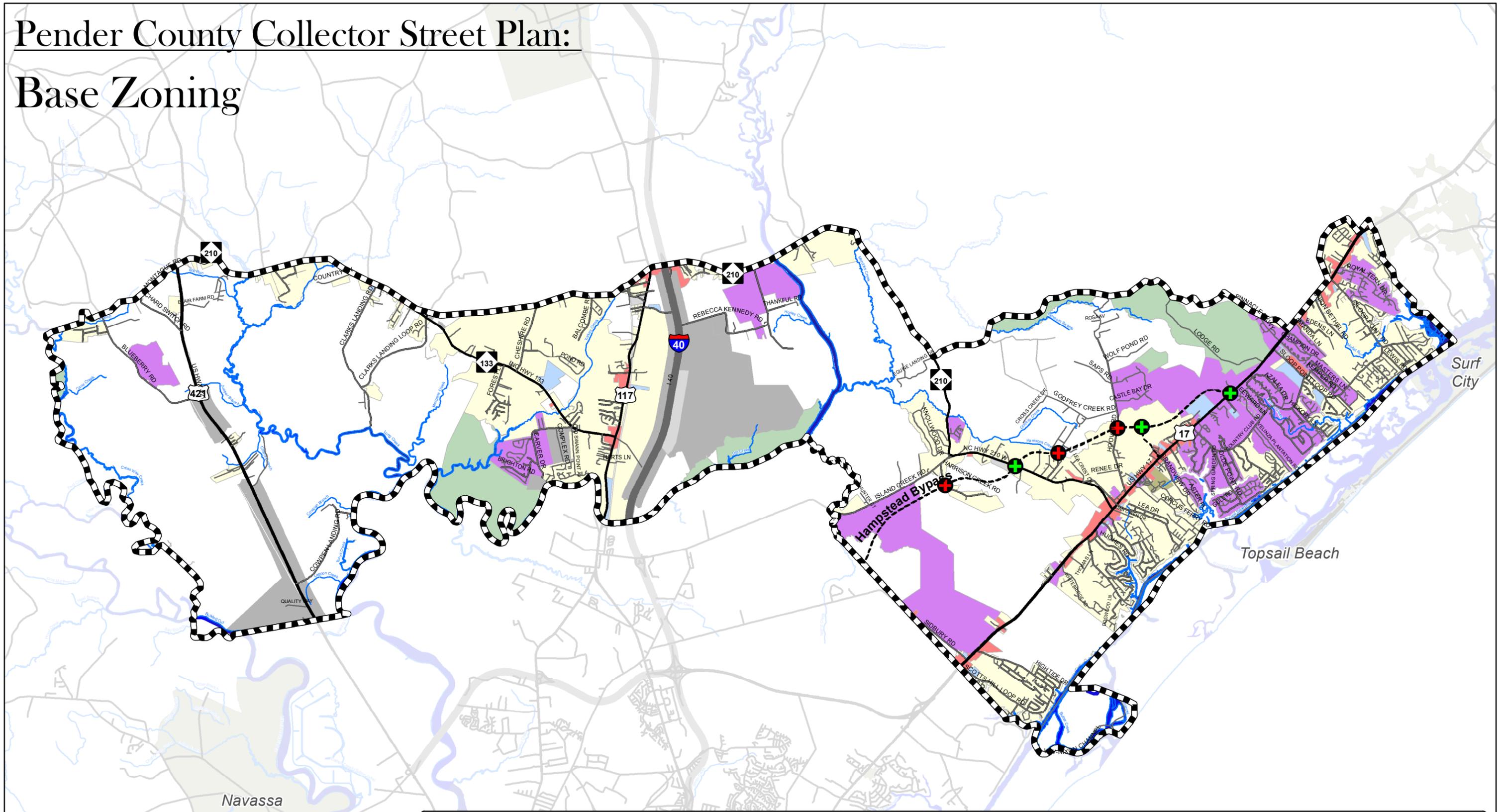
Legend		Volume to Capacity		Proposed Structure Type			
	Study Area		Interstate		<math>< 0.8</math>		Interchange
	Streams		NC and US Routes		$0.8 - 1$		Overpass
	Lakes and Ponds		Local Roads		> 1		
	Municipal Boundaries		Hampstead Bypass				

Pender County Collector Street Plan: 2040 Volume to Capacity



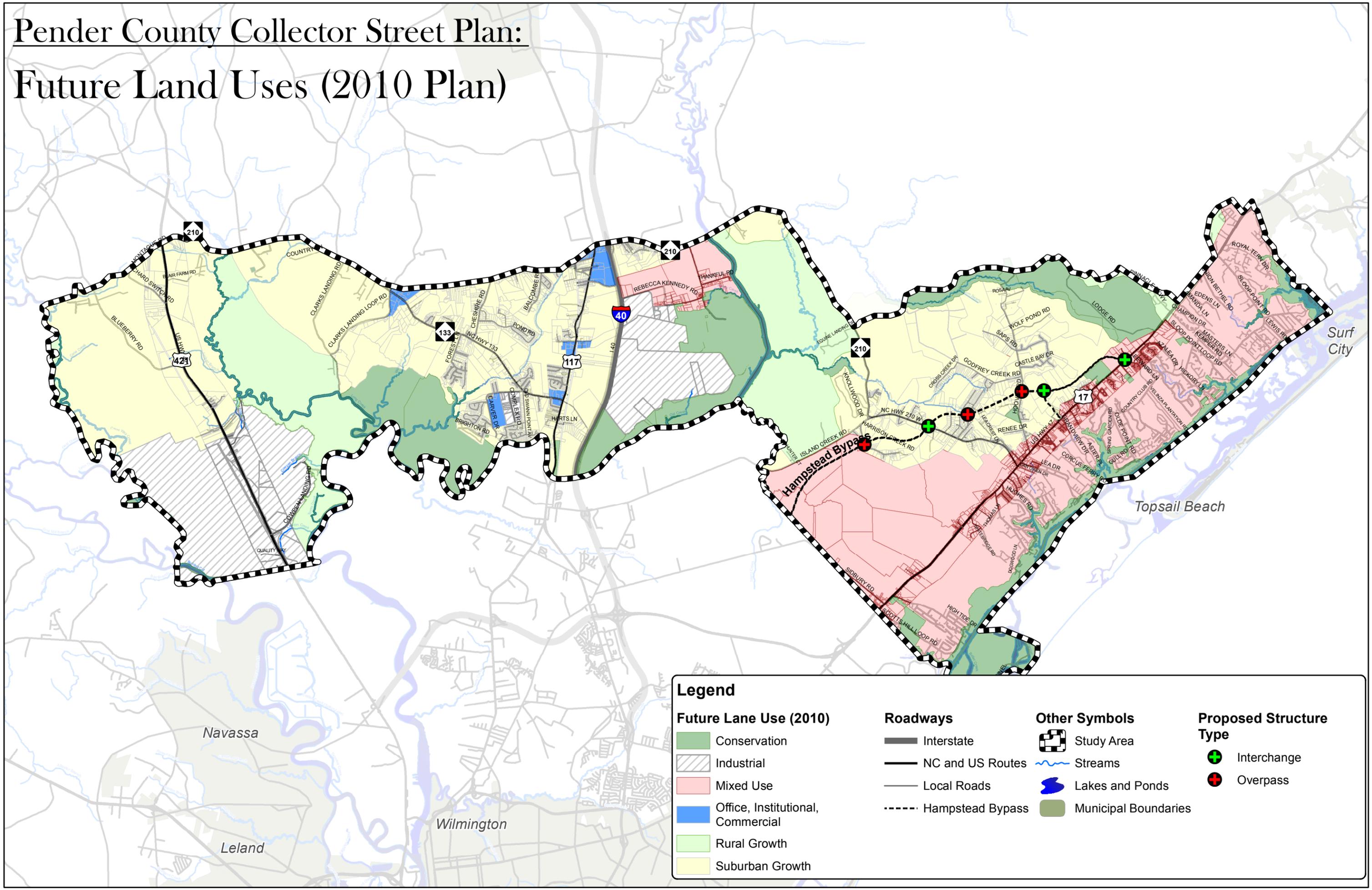
Legend		Other Symbols		Proposed Structure Type	
Roadways	Volume to Capacity 2040 Forecast		Study Area		Interchange
	Interstate		Streams		Overpass
	NC and US Routes		Lakes and Ponds		Municipal Boundaries
	Local Roads				
	Hampstead Bypass				
					
	< 0.8				
					
	0.8 - 1				
					
	> 1				

Pender County Collector Street Plan: Base Zoning



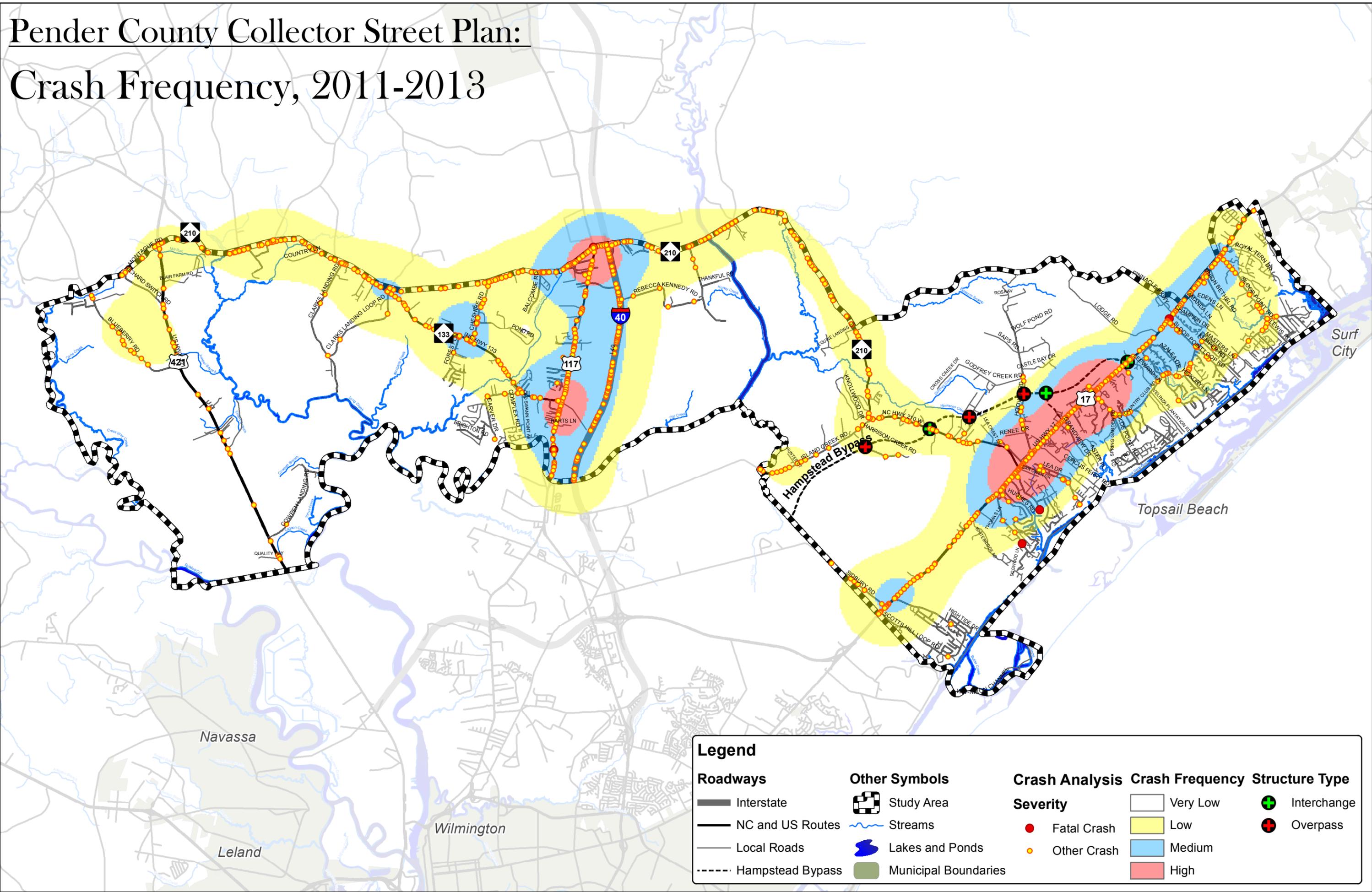
Legend	
Other Symbols	Roadways
Study Area	Interstate
Streams	NC and US Routes
Lakes and Ponds	Local Roads
Municipal Boundaries	Hampstead Bypass
Zoning	Zoning
Environmental Conservation	General Business
General Industrial	Incorporated Areas
Industrial Transition	Manufactured Housing Community
Office and Institutional	Planned Development
Rural Agricultural	Rural Agricultural Condition District 1
Residential Performance	Proposed Structure Type
	Interchange
	Overpass

Pender County Collector Street Plan: Future Land Uses (2010 Plan)



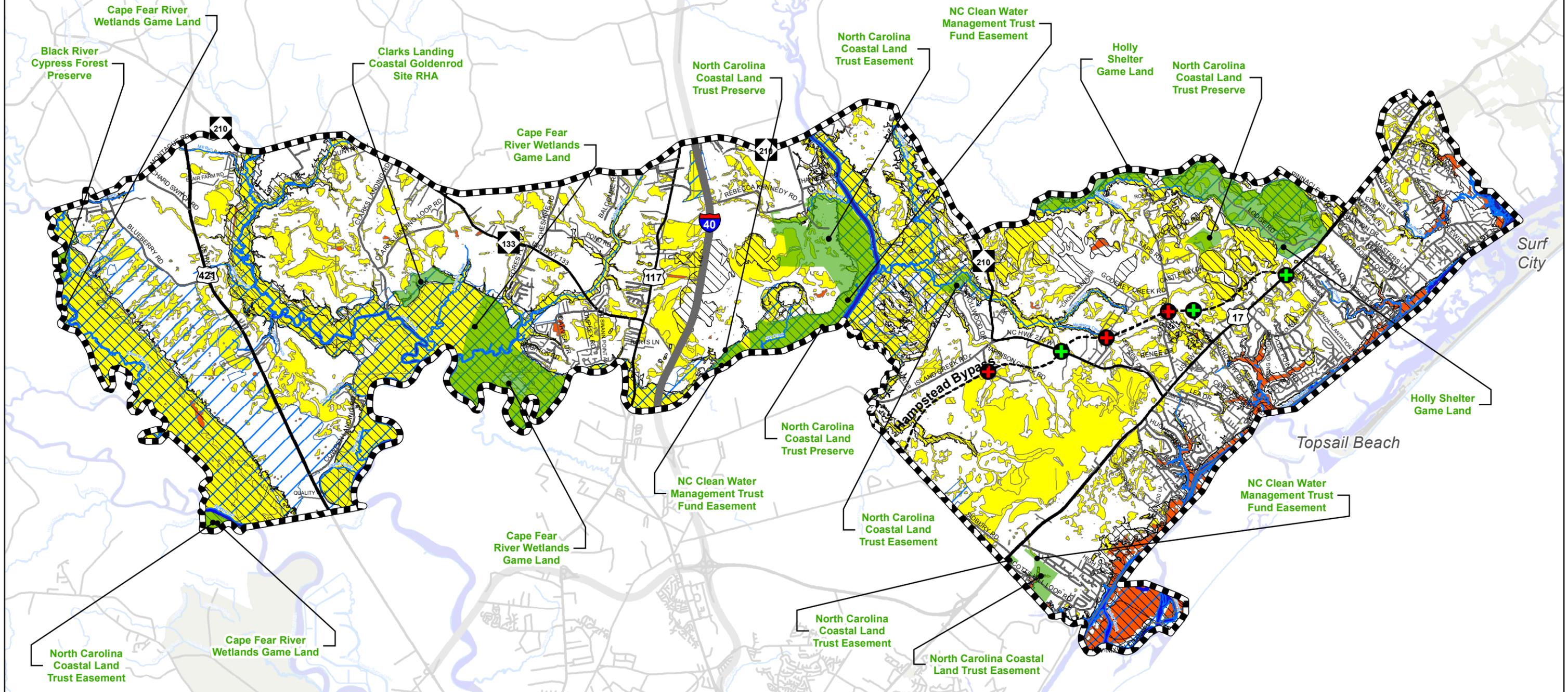
Future Lane Use (2010)		Roadways		Other Symbols		Proposed Structure Type	
	Conservation		Interstate		Study Area		Interchange
	Industrial		NC and US Routes		Streams		Overpass
	Mixed Use		Local Roads		Lakes and Ponds		
	Office, Institutional, Commercial		Hampstead Bypass		Municipal Boundaries		
	Rural Growth						
	Suburban Growth						

Pender County Collector Street Plan: Crash Frequency, 2011-2013



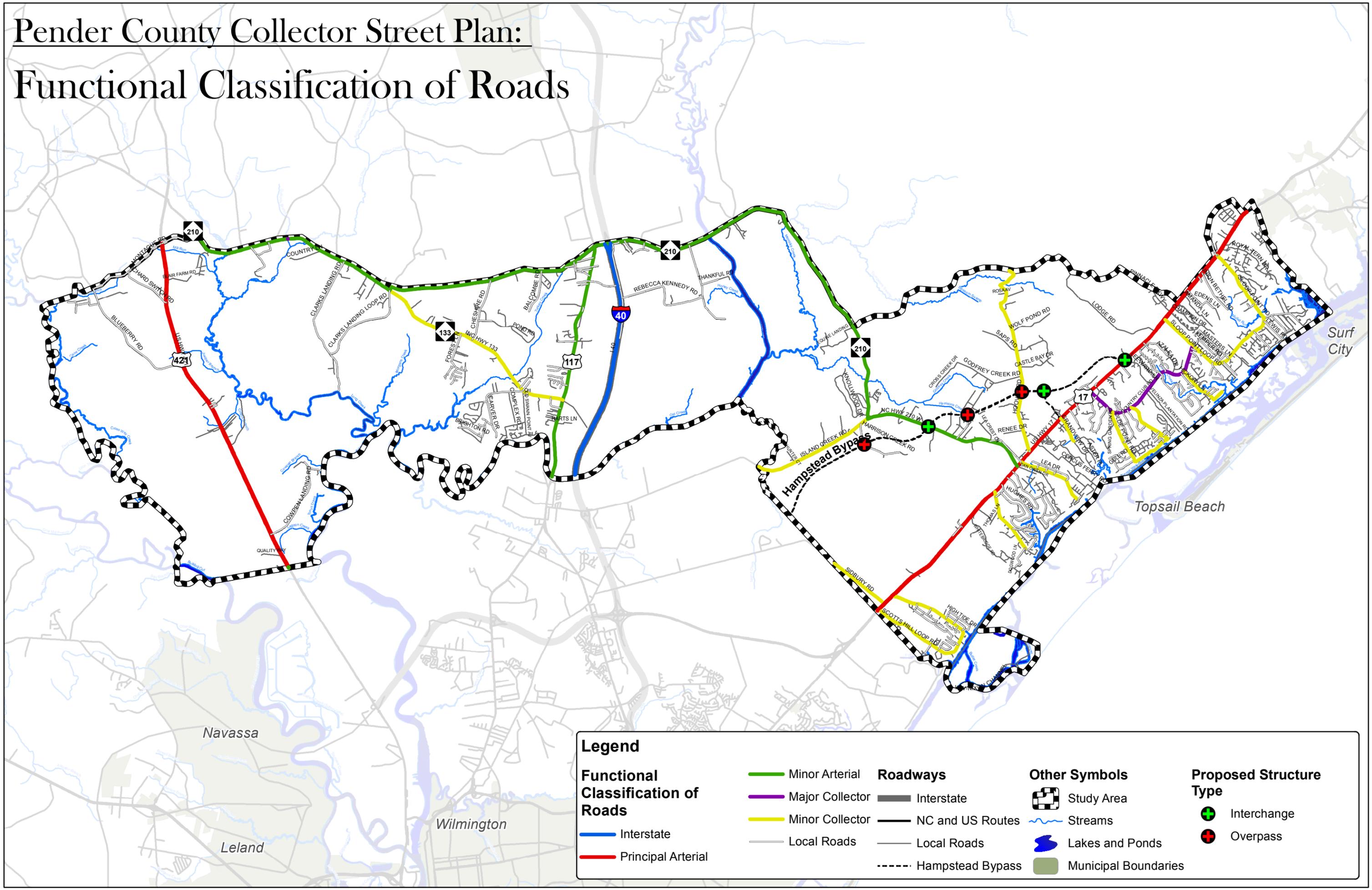
Legend		Crash Analysis		Crash Frequency		Structure Type	
Roadways		Severity		Very Low		Interchange	
— Interstate	▣ Study Area	● Fatal Crash	■ Low	Medium		Overpass	
— NC and US Routes	~ Streams	● Other Crash	■ Medium	High			
— Local Roads	■ Lakes and Ponds						
- - - Hampstead Bypass	■ Municipal Boundaries						

Pender County Collector Street Plan: Environmental Features



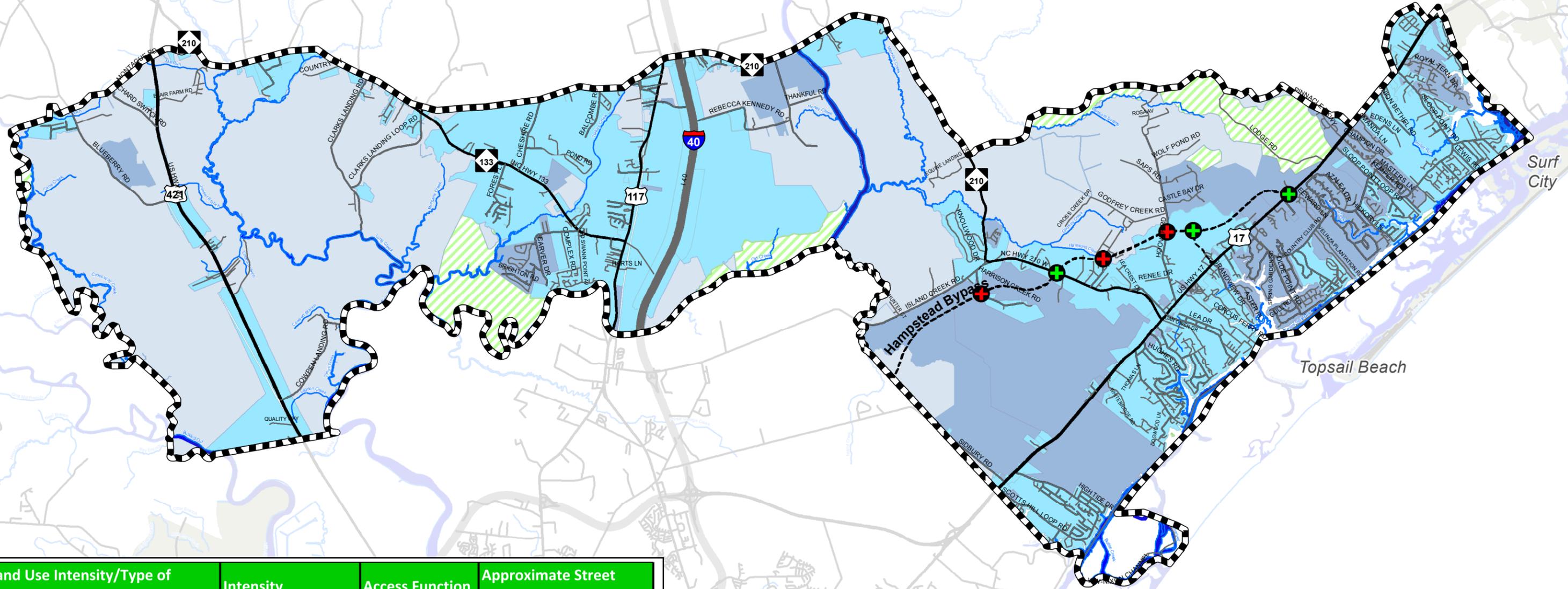
Legend	
Roadways	Other Symbols
Interstate	Study Area
NC and US Routes	Streams
Local Roads	Lakes and Ponds
Hampstead Bypass	Municipal Boundaries
Environmental Considerations	Wetlands
Managed Areas	Wetlands Permitting: US Army Corps of Engineers
100 Yr. Flood Hazard Zone	Wetlands Permitting: US Army Corps of Engineers; CAMA
Natural Heritage Areas	
Proposed Structure Type	
Interchange	
Overpass	

Pender County Collector Street Plan: Functional Classification of Roads



Legend		Roadways		Other Symbols		Proposed Structure Type	
	Minor Arterial		Interstate		Study Area		Interchange
	Major Collector		NC and US Routes		Streams		Overpass
	Minor Collector		Local Roads		Lakes and Ponds		
	Interstate		Hampstead Bypass		Municipal Boundaries		
	Principal Arterial						
	Local Roads						

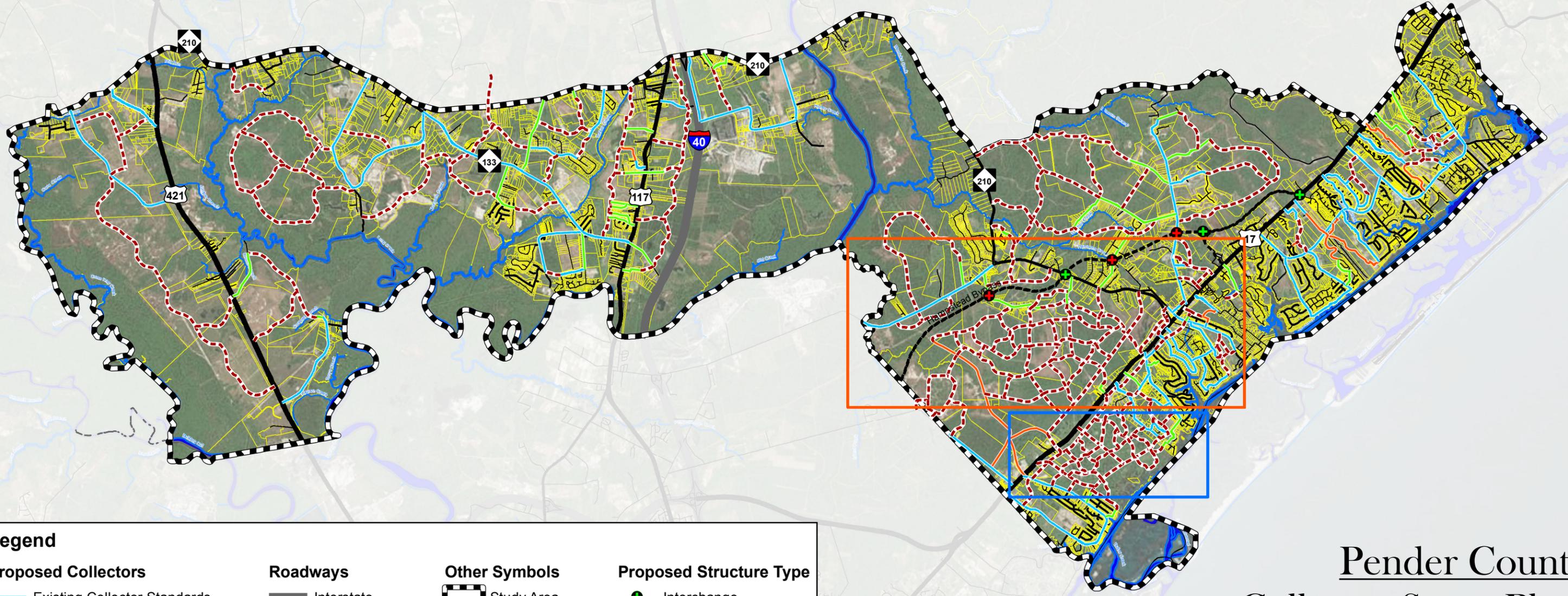
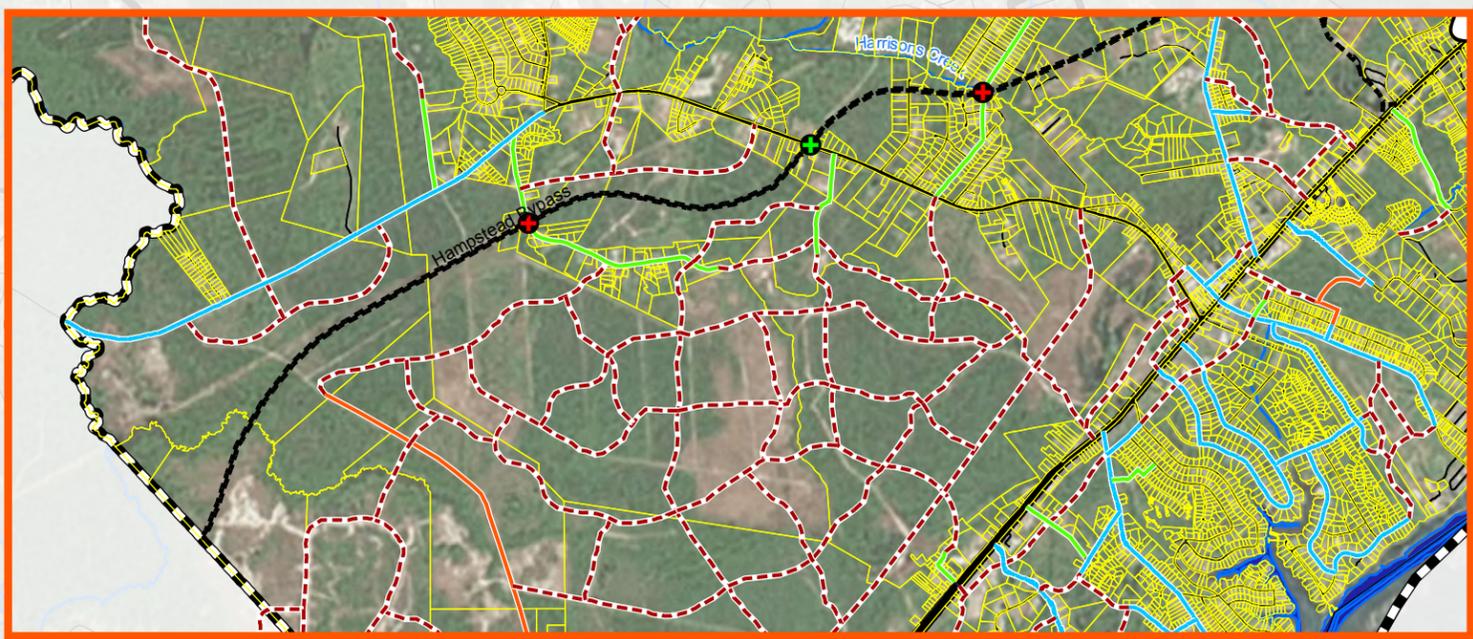
Pender County Collector Street Plan: Land Use Intensity



Land Use Intensity/Type of Collector Street	Intensity	Access Function	Approximate Street Spacing
No Collector Streets (Environmental Conservation)	Little to No Development	N/A	N/A
Lowest Intensity (Rural Agricultural)	Less than 2 Dwelling Units per Acre	Highest	3,000 to 6,000 feet apart
Medium Intensity (General Business, General Industrial, Industrial Transition, Manufactured Housing Community, Residential Performance)	2 to 4 Dwelling Units per Acre	High	1,500 to 3,000 feet apart
High Intensity (Residential Mixed, Office Institutional, Planned Development)	More than 4 Dwelling Units per Acre/Activity Nodes	Medium	750 to 1,500 feet apart

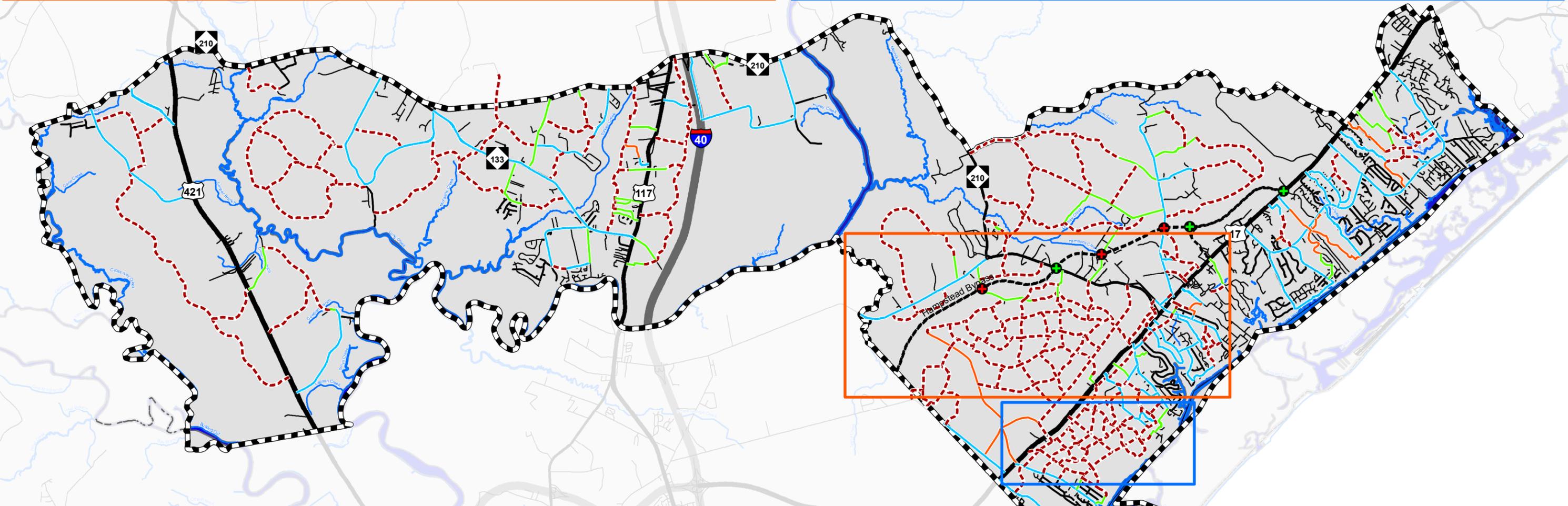
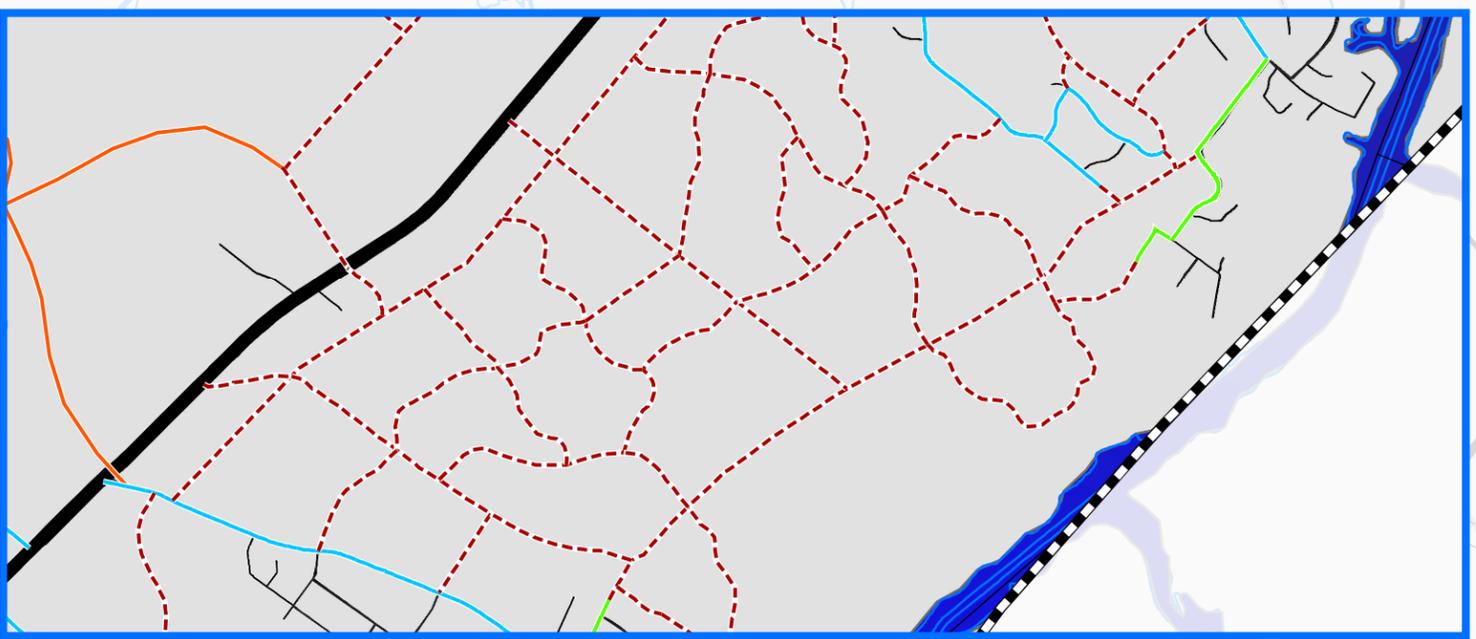
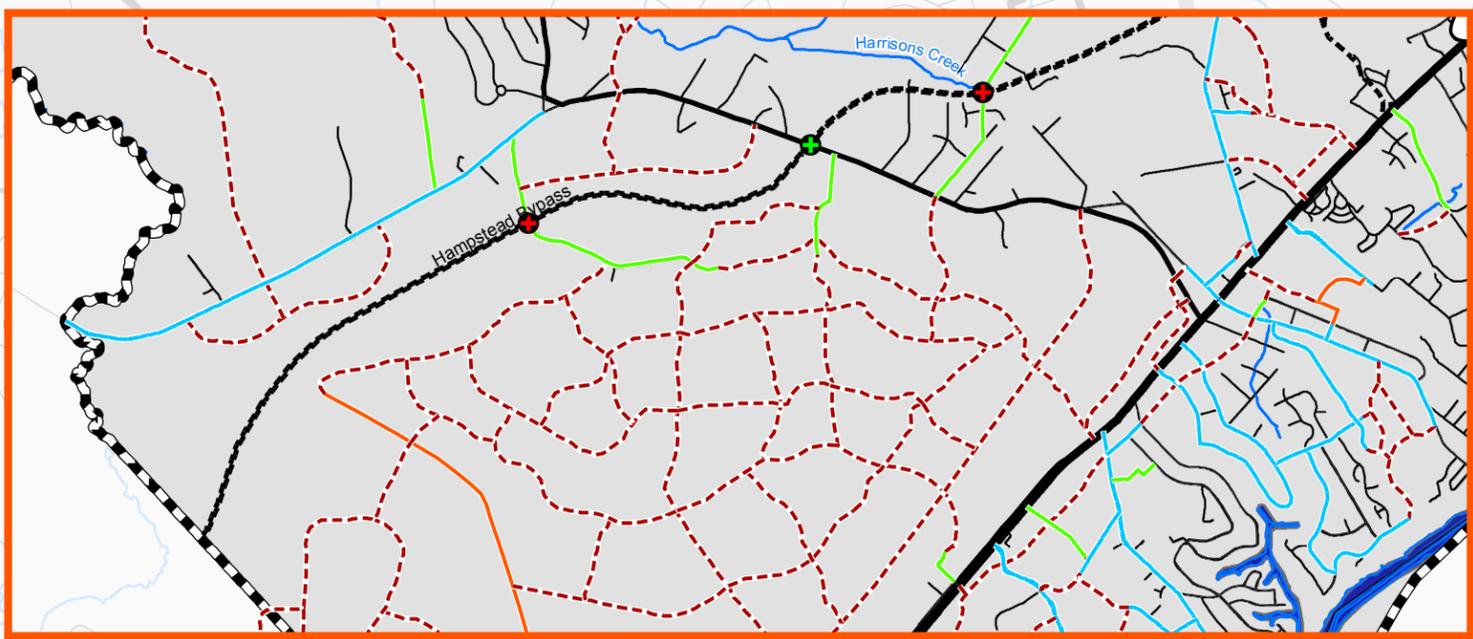
Legend

Roadways	Other Symbols	Land Use Intensity	Proposed Structure Type
— Interstate	▣ Study Area	▨ Environmental Conservation	⊕ Interchange
— NC and US Routes	~ Streams	□ Low Intensity	⊕ Overpass
— Local Roads	☪ Lakes and Ponds	□ Medium Intensity	
- - - Hampstead Bypass	■ Municipal Boundaries	□ High Intensity	



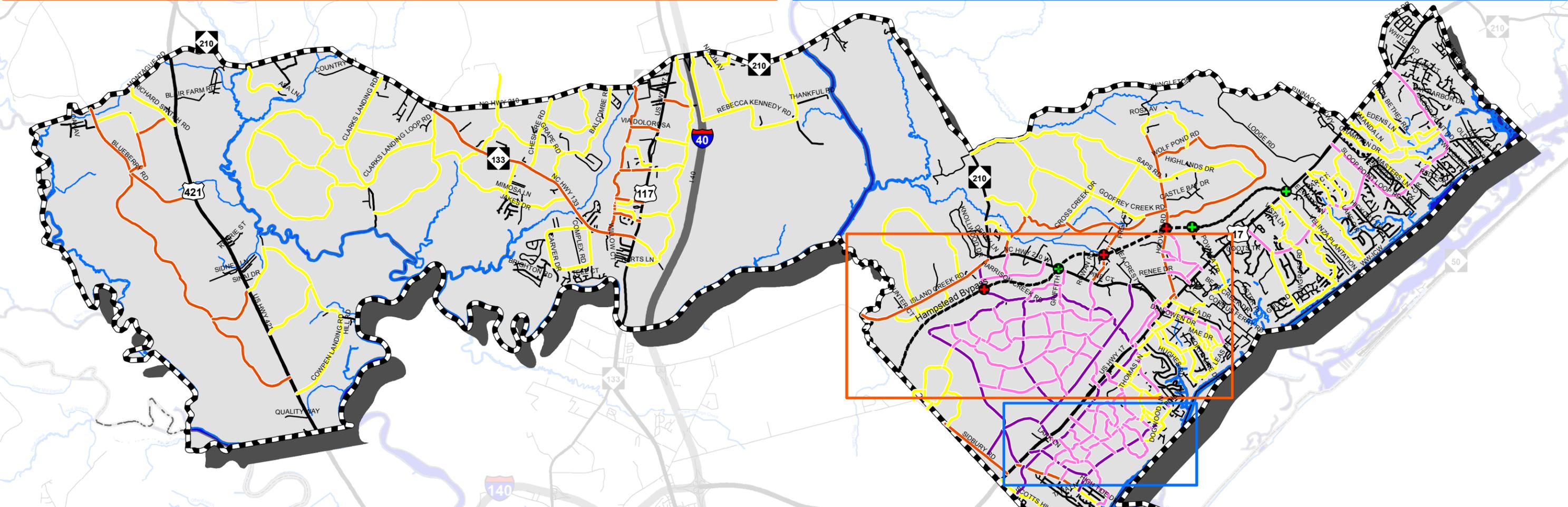
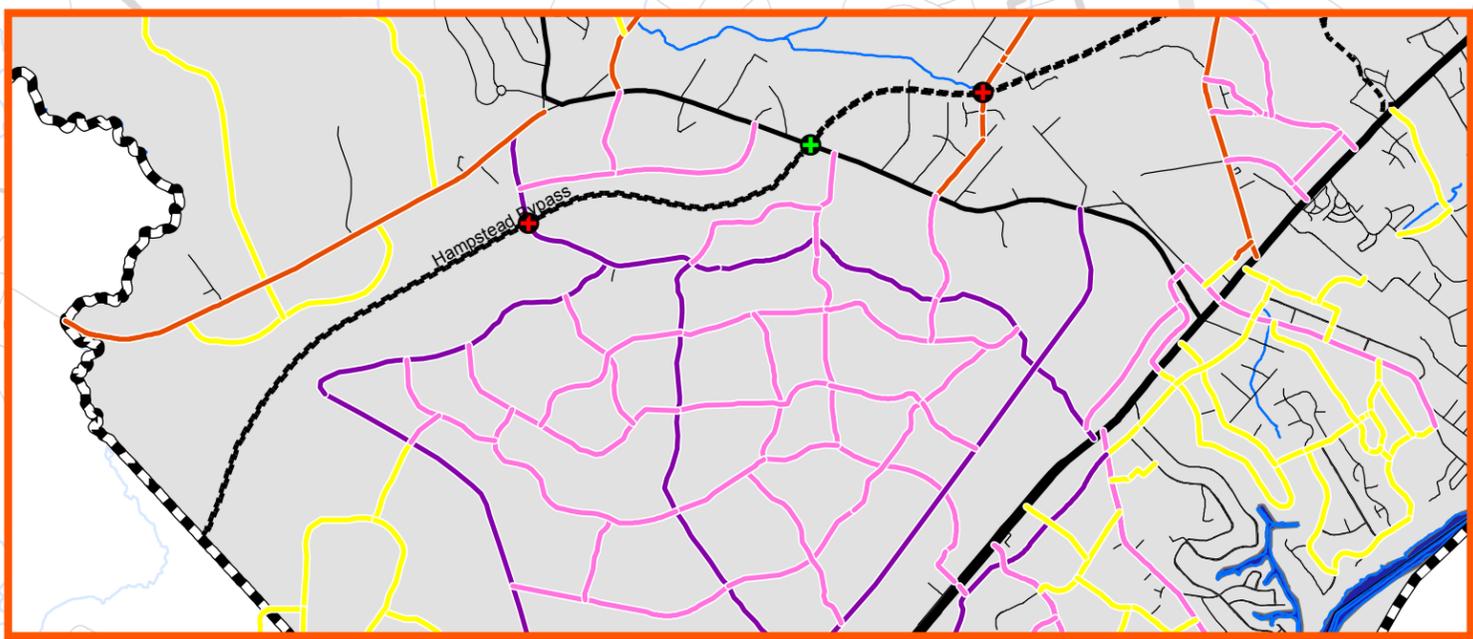
Proposed Collectors	Roadways	Other Symbols	Proposed Structure Type
Existing Collector Standards	Interstate	Study Area	Interchange
Existing Roads - Need Improvement	NC and US Routes	Study Area Parcels	Overpass
Planned Connections	Local Roads	Lakes and Ponds	
Preferred Scenario	Hampstead Bypass	Streams	

Pender County
Collector Street Plan:
Proposed Alignments



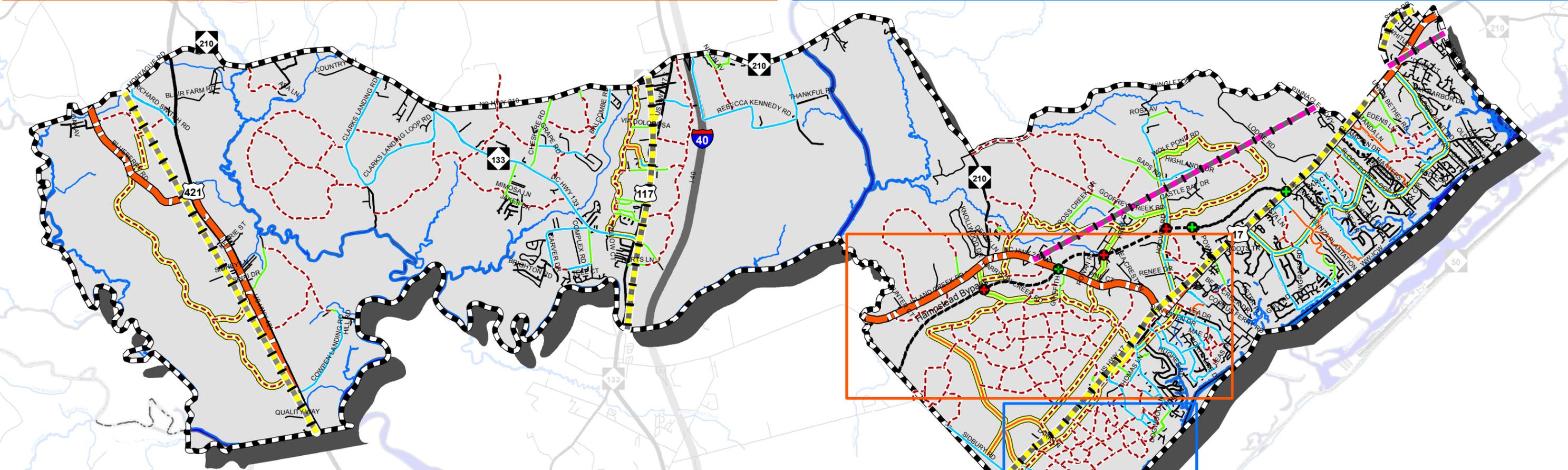
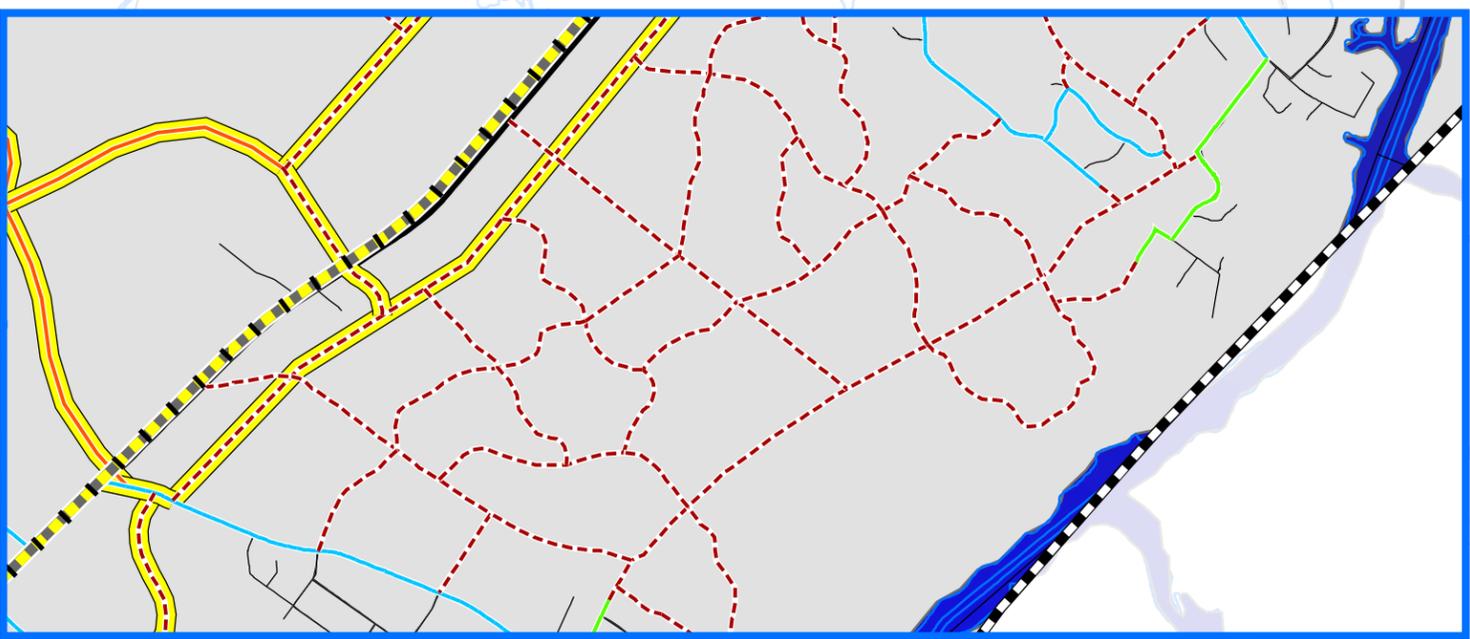
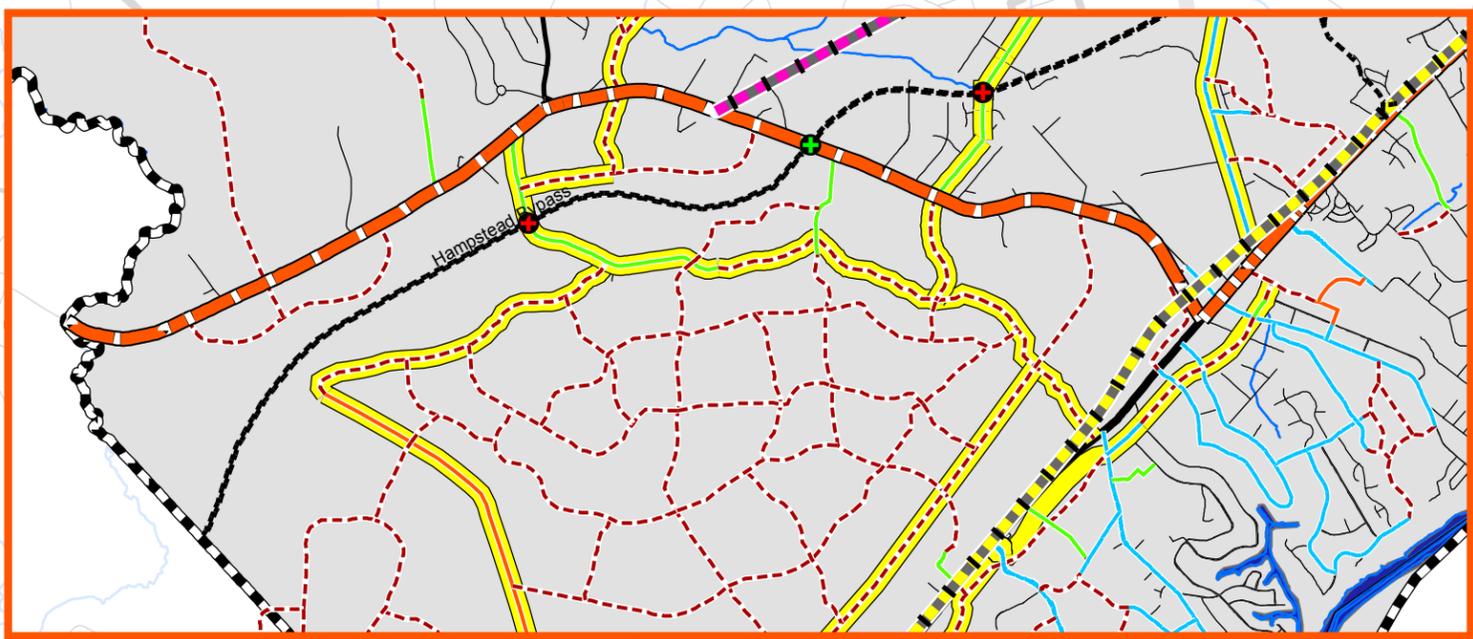
Proposed Collectors	Roadways	Other Symbols	Proposed Structure Type
Existing Collector Standards	Interstate	Study Area	Interchange
Existing Roads - Need Improvement	NC and US Routes	Lakes and Ponds	Overpass
Planned Connections	Local Roads	Streams	
Preferred Scenario	Hampstead Bypass	County Boundaries	

Pender County
Collector Street Plan:
Proposed Alignments



Proposed Collector Groups	Roadways	Other Symbols	Proposed Structure Type
Group 1	Interstate	Study Area	Interchange
Group 2	NC and US Routes	Lakes and Ponds	Overpass
Group 3	Local Roads	Streams	
Group 4	Hampstead Bypass	County Boundaries	

Pender County
Collector Street Plan:
Cross-Section Groups



Legend

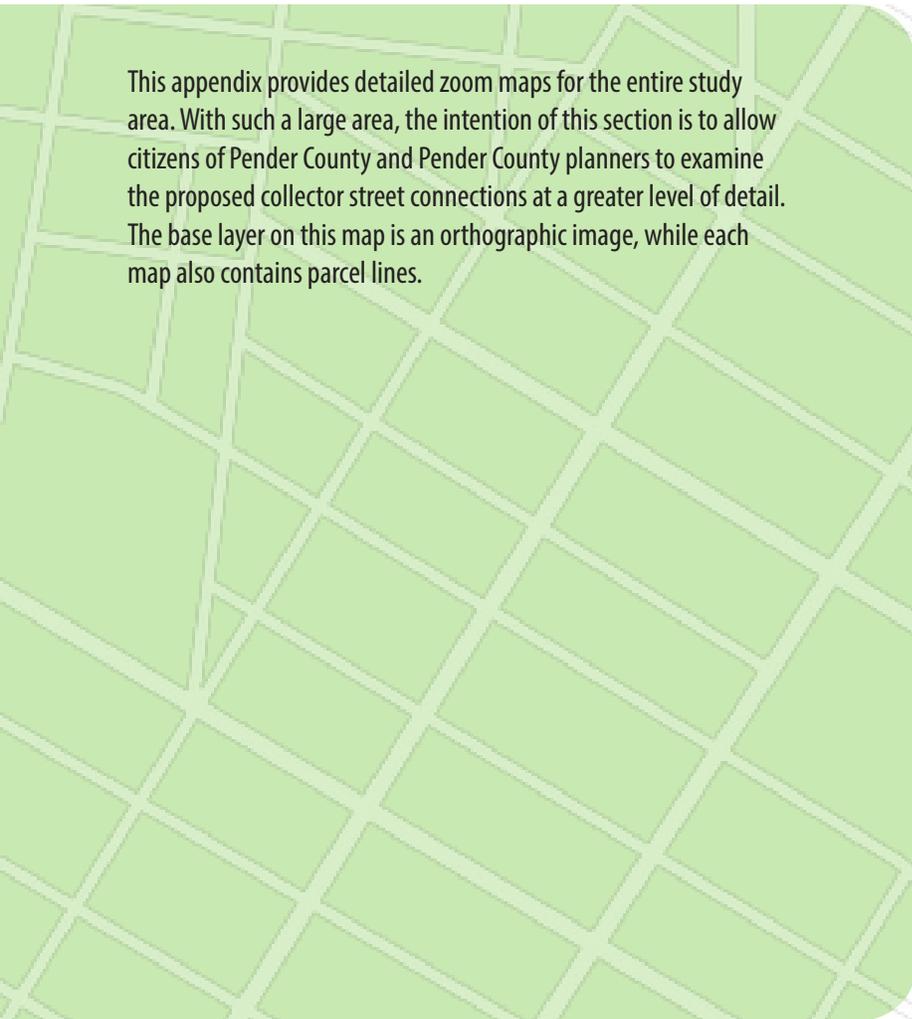
Proposed Collectors	Roadways	Bicycle/Pedestrian Facilities	Other Symbols	Proposed Structure Type
Existing Collector Standards	Interstate	Proposed Rail Trails	Study Area	Interchange
Existing Roads - Need Improvement	NC and US Routes	Proposed Coastal Pender Greenway	Lakes and Ponds	Overpass
Planned Connections	Local Roads	NCDOT Bike Route	Streams	
Preferred Scenario	Hampstead Bypass	Bike Friendly Connections	County Boundaries	

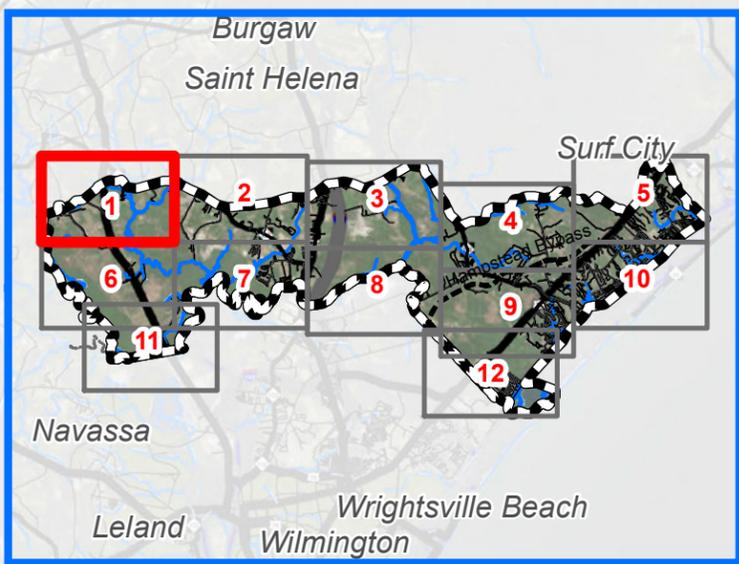
Pender County
Collector Street Plan:
Recommended
Bicycle/Pedestrian Facilities

Appendix B

Detailed Connections Section

This appendix provides detailed zoom maps for the entire study area. With such a large area, the intention of this section is to allow citizens of Pender County and Pender County planners to examine the proposed collector street connections at a greater level of detail. The base layer on this map is an orthographic image, while each map also contains parcel lines.





Legend

Proposed Collectors

- Existing Collector Standards
- Existing Roads - Need Improvement
- Planned Connections
- Preferred Scenario

Roadways

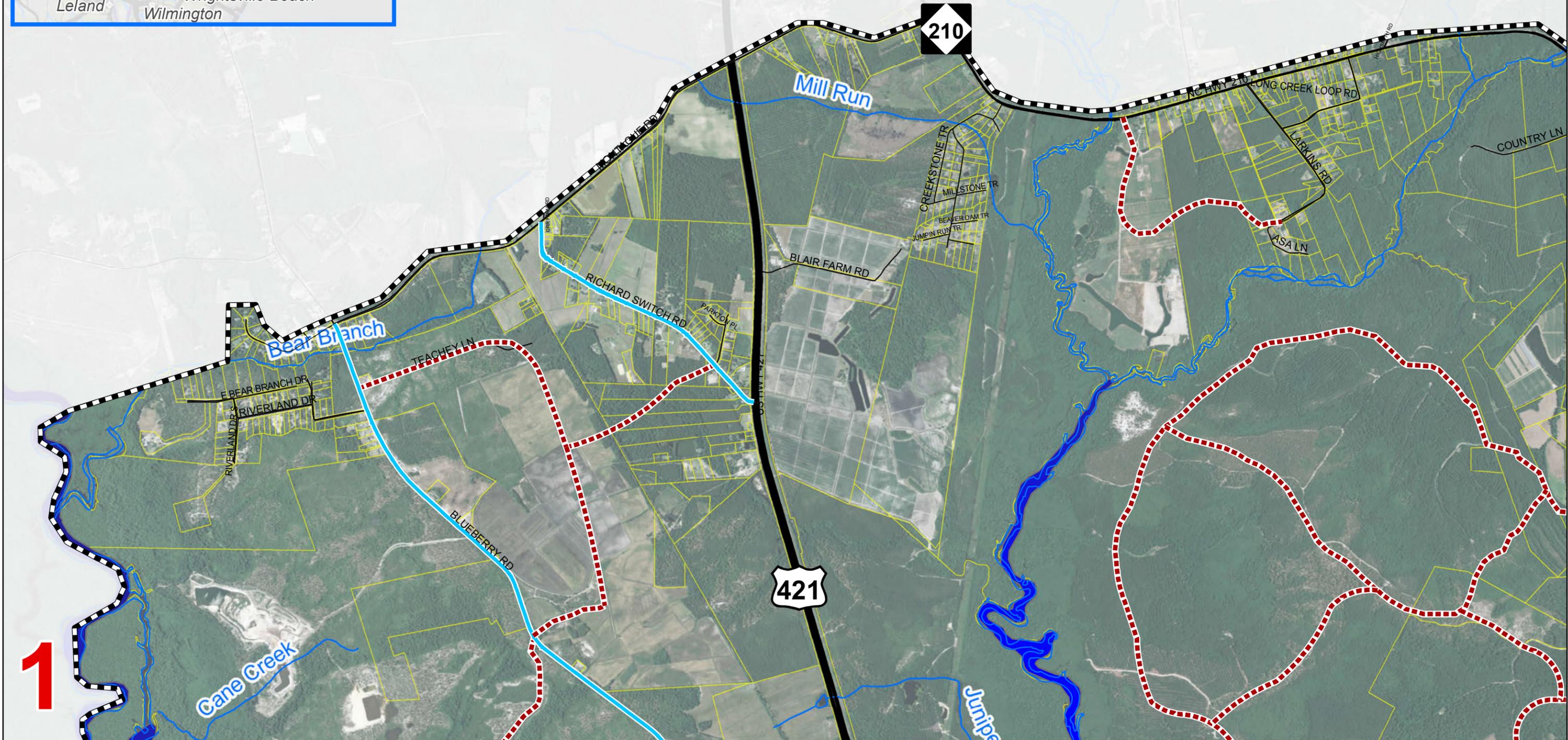
- Interstate
- NC and US Routes
- Local Roads
- Hampstead Bypass

Other Symbols

- Study Area
- Study Area Parcels
- Lakes and Ponds
- Streams

Proposed Structure Type

- + Interchange
- + Overpass



Legend

Proposed Collectors

- Existing Collector Standards
- Existing Roads - Need Improvement
- Planned Connections
- Preferred Scenario

Roadways

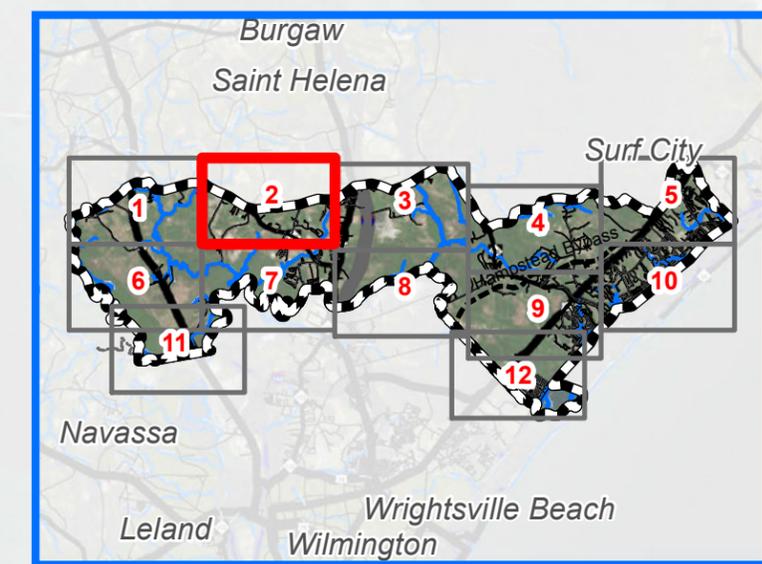
- Interstate
- NC and US Routes
- Local Roads
- Hampstead Bypass

Other Symbols

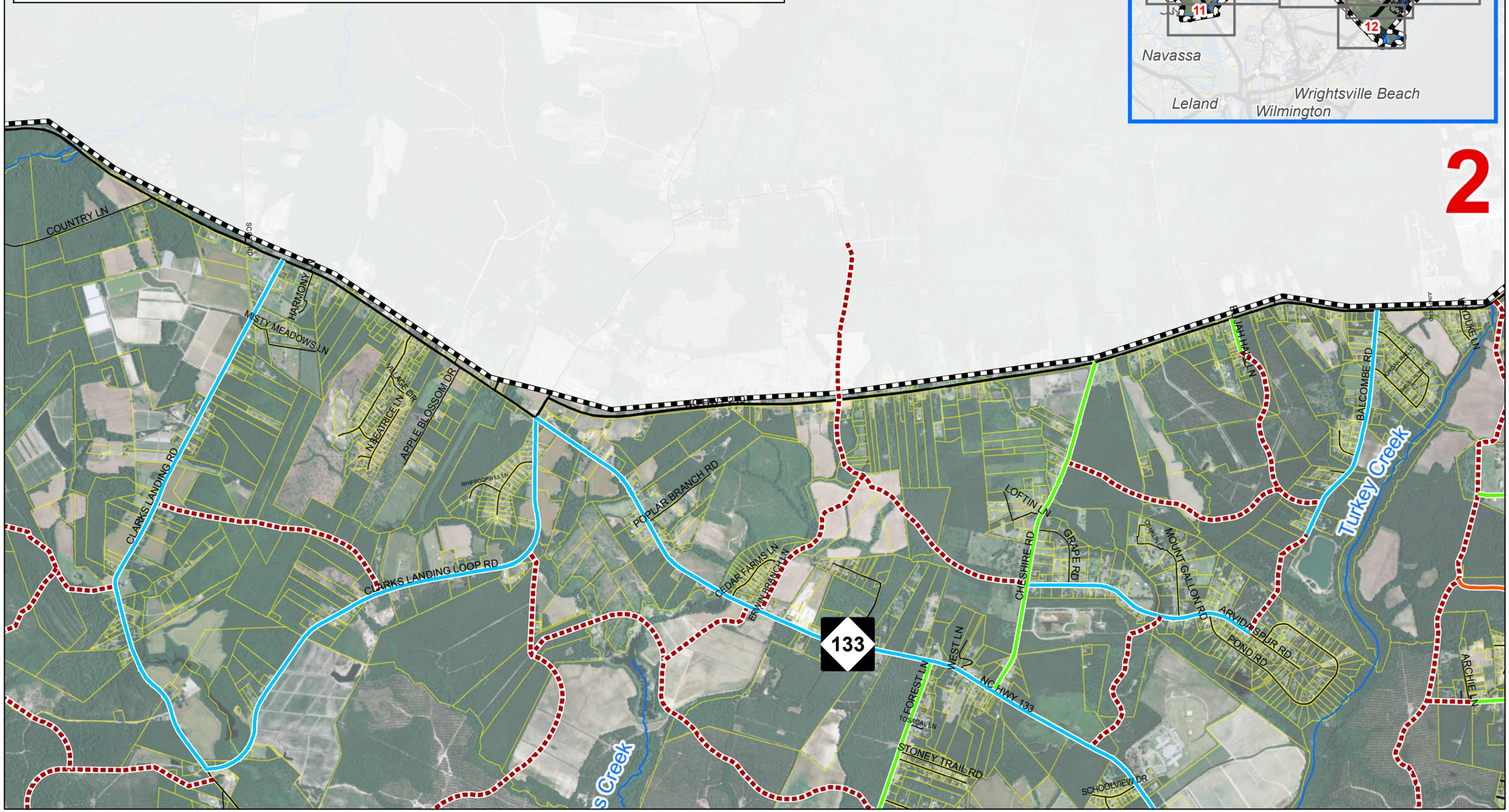
- Study Area
- Study Area Parcels
- Lakes and Ponds
- Streams

Proposed Structure Type

- Interchange
- Overpass



2



Legend

Proposed Collectors

- Existing Collector Standards
- Existing Roads - Need Improvement
- Planned Connections
- Preferred Scenario

Roadways

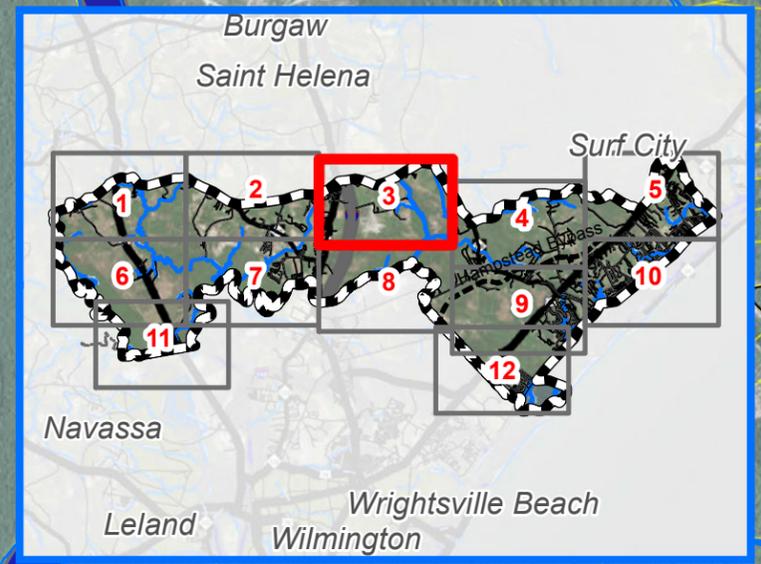
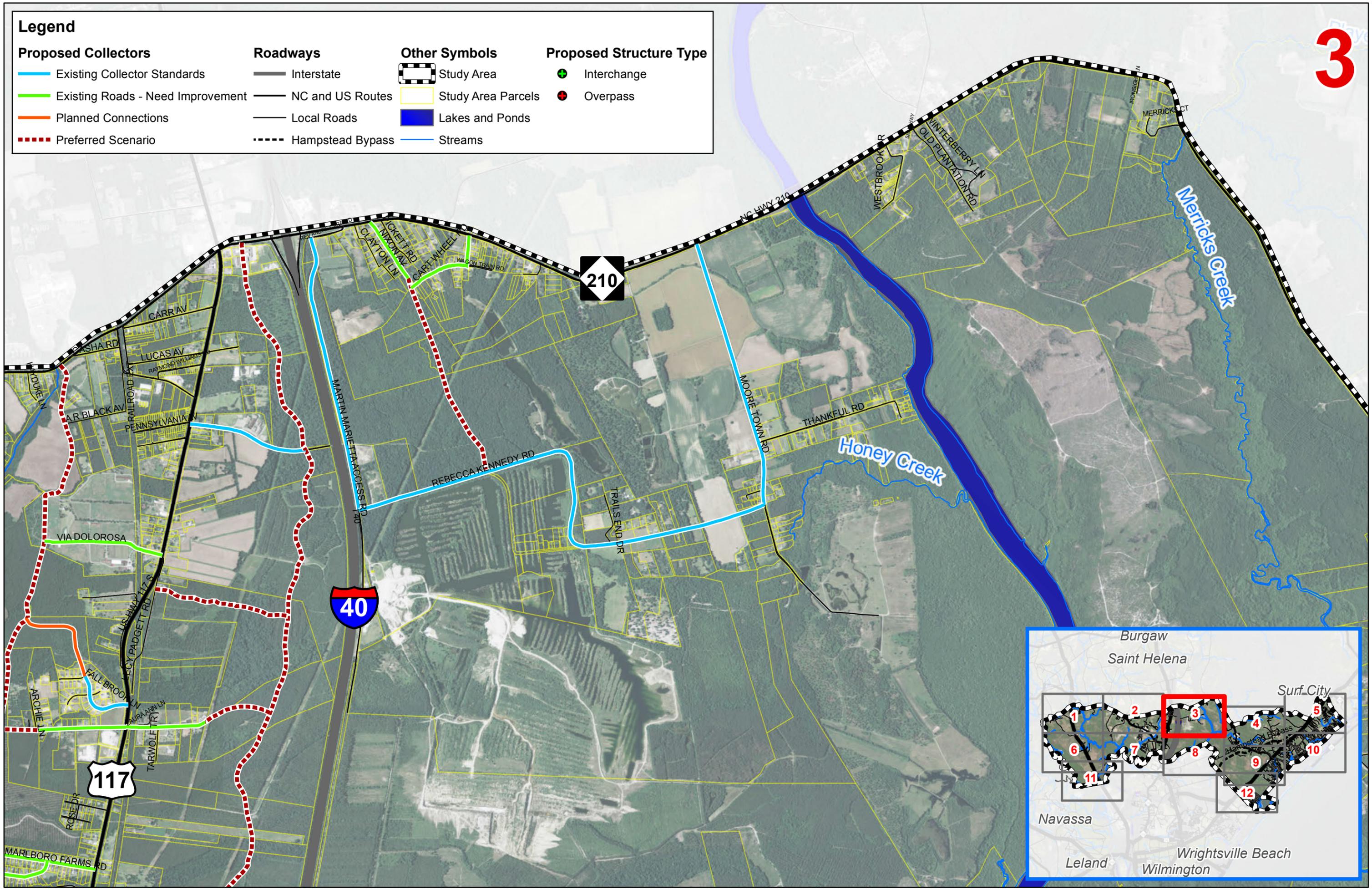
- Interstate
- NC and US Routes
- Local Roads
- Hampstead Bypass

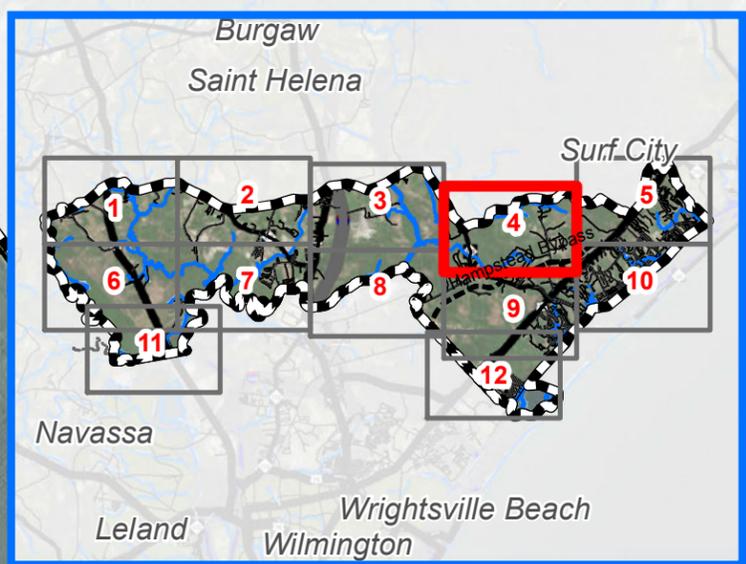
Other Symbols

- Study Area
- Study Area Parcels
- Lakes and Ponds
- Streams

Proposed Structure Type

- Interchange
- Overpass





Legend

Proposed Collectors

- Existing Collector Standards
- Existing Roads - Need Improvement
- Planned Connections
- - - Preferred Scenario

Roadways

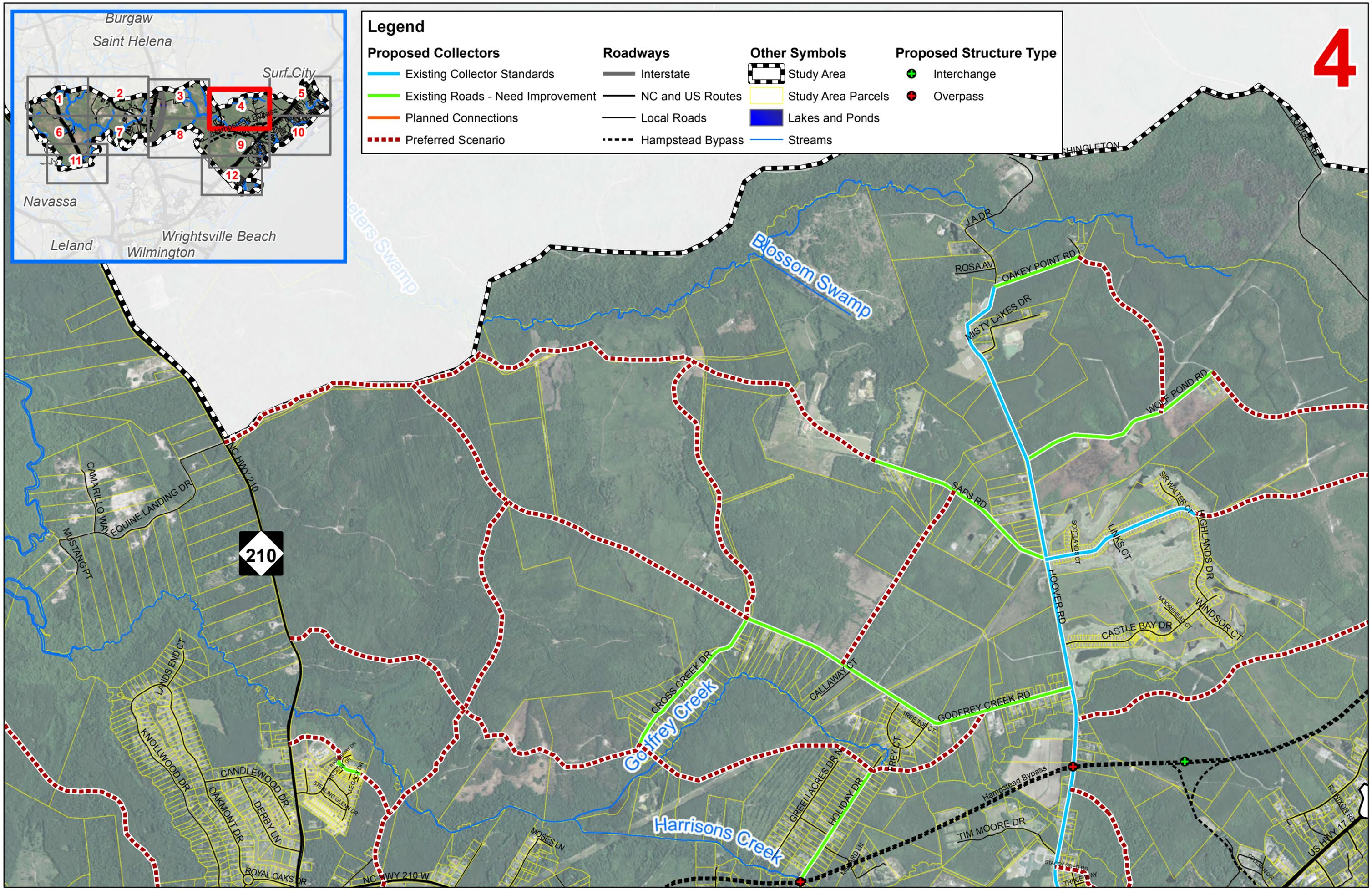
- Interstate
- NC and US Routes
- Local Roads
- - - Hampstead Bypass

Other Symbols

- Study Area
- Study Area Parcels
- Lakes and Ponds
- Streams

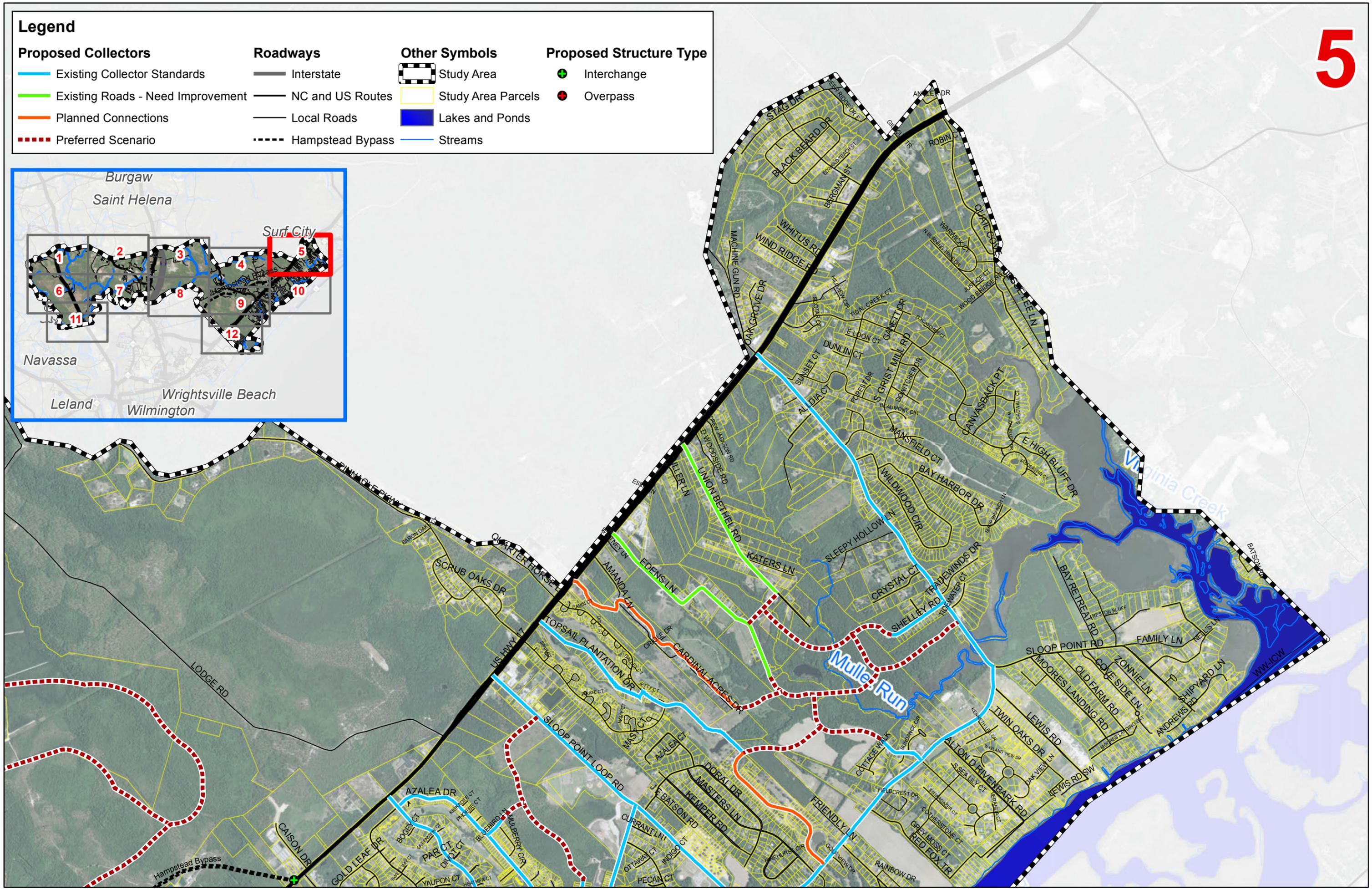
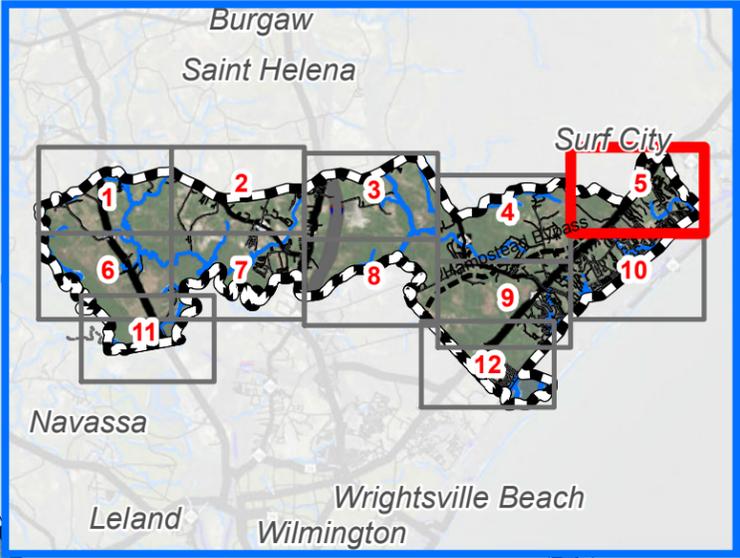
Proposed Structure Type

- Interchange
- Overpass

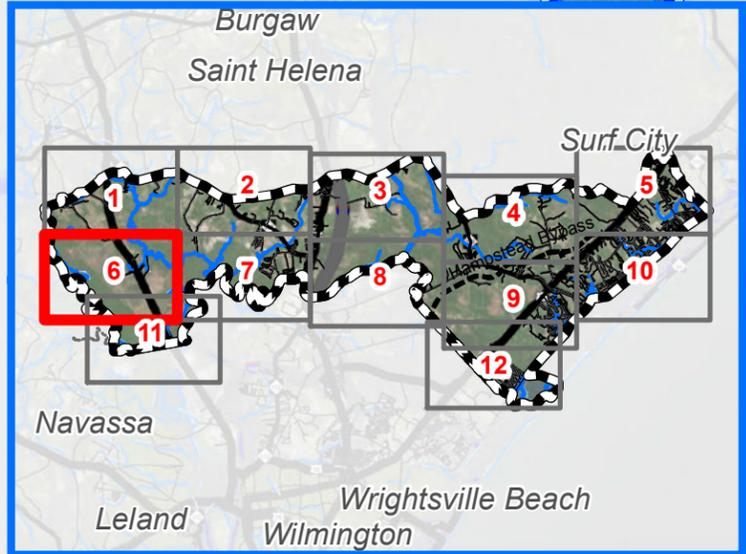
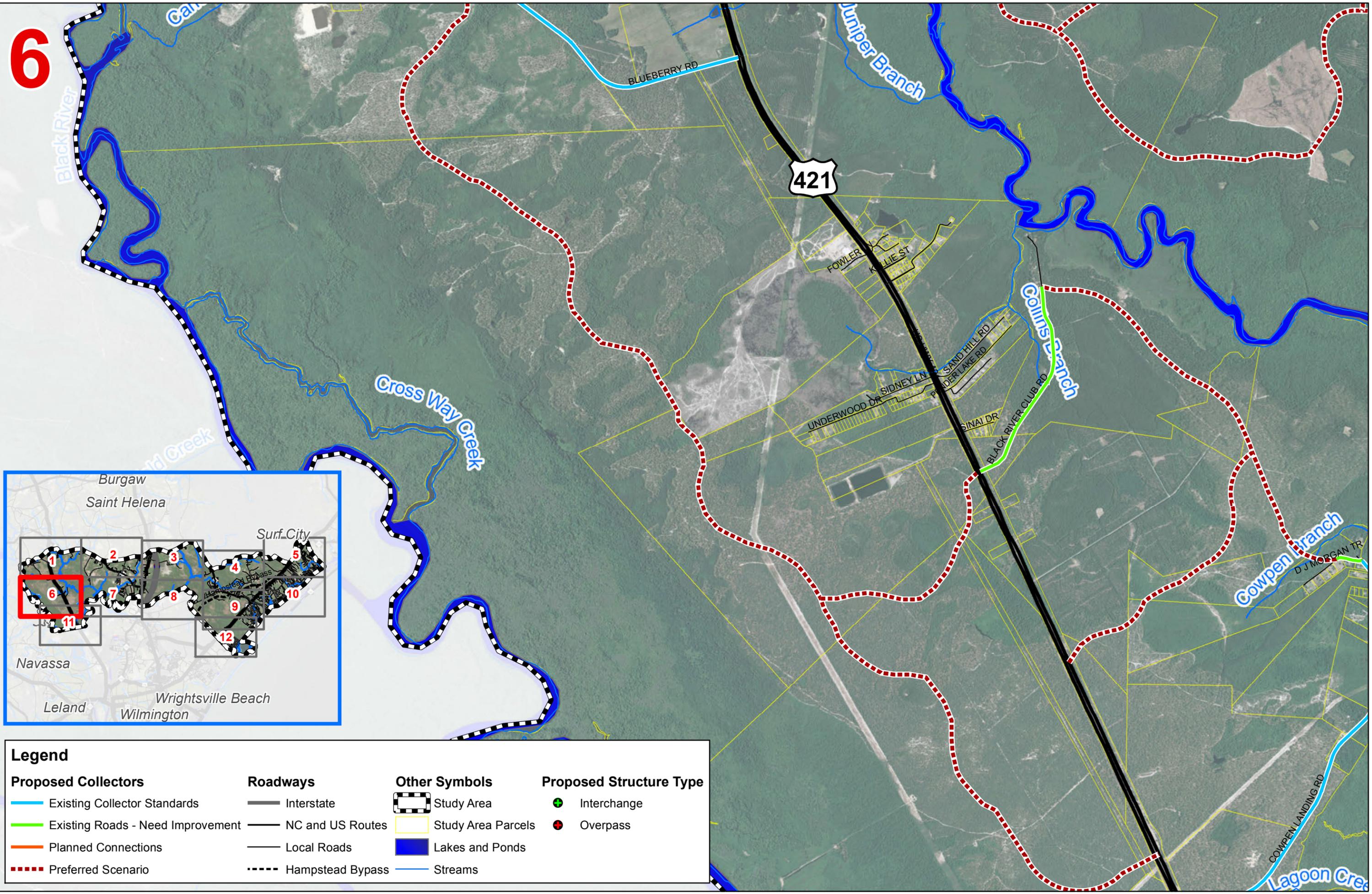


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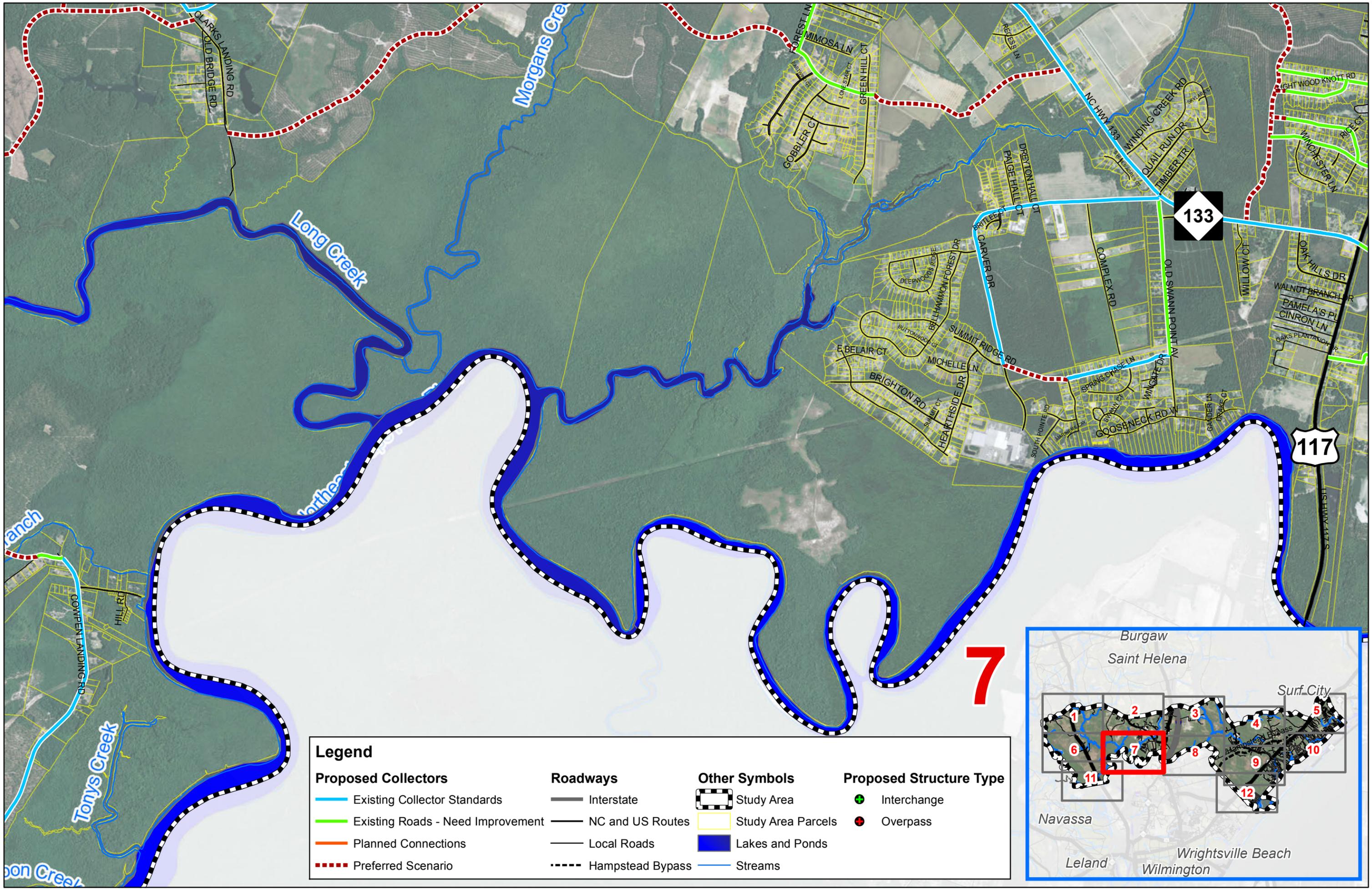
Proposed Collectors	Roadways	Other Symbols	Proposed Structure Type
Existing Collector Standards	Interstate	Study Area	Interchange
Existing Roads - Need Improvement	NC and US Routes	Study Area Parcels	Overpass
Planned Connections	Local Roads	Lakes and Ponds	
Preferred Scenario	Hampstead Bypass	Streams	



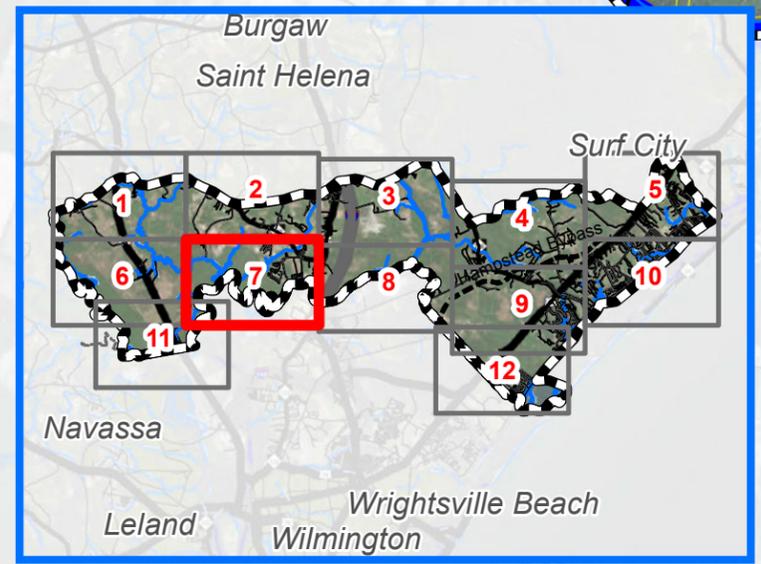
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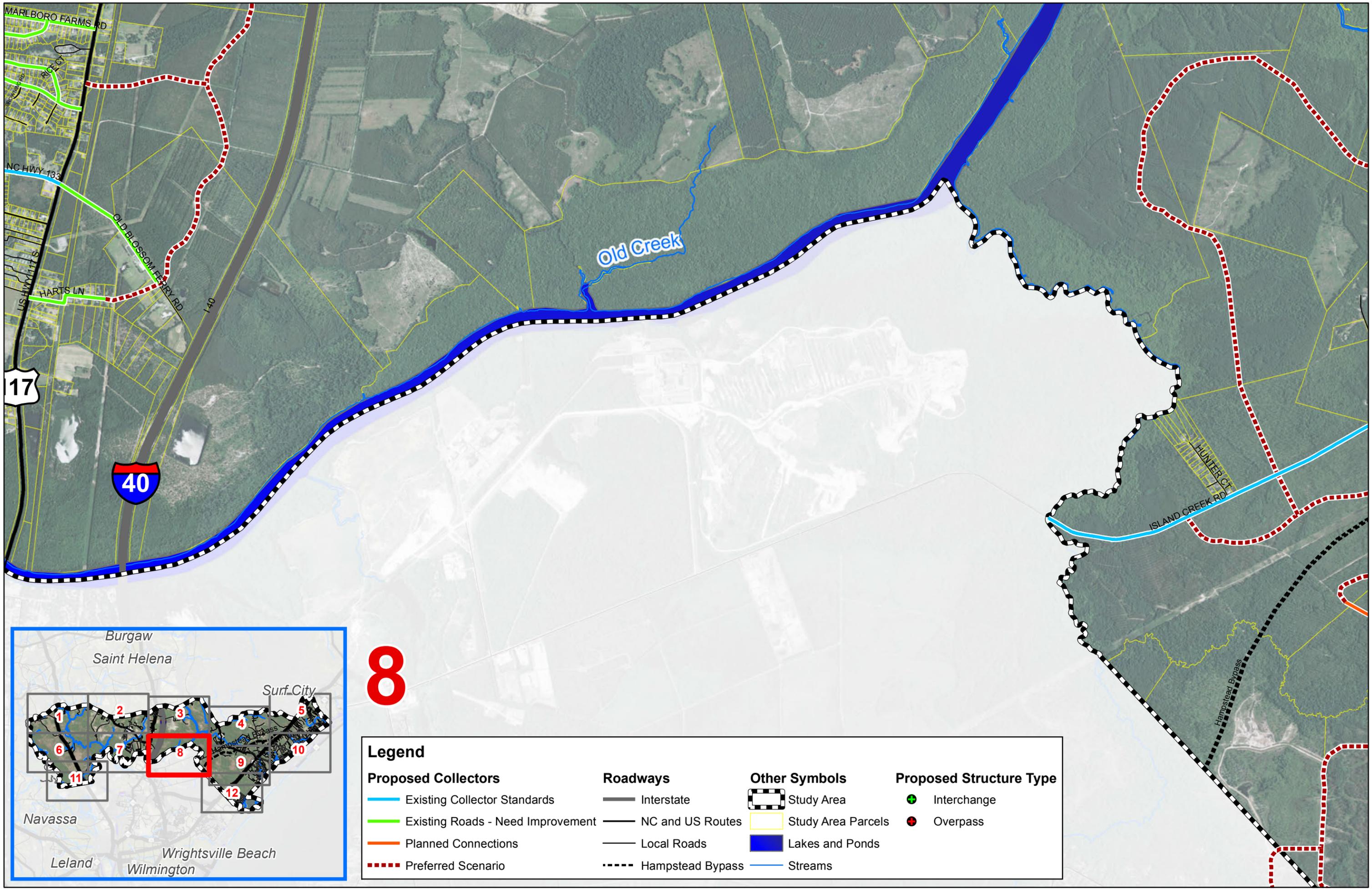


Proposed Collectors	Roadways	Other Symbols	Proposed Structure Type
Existing Collector Standards	Interstate	Study Area	Interchange
Existing Roads - Need Improvement	NC and US Routes	Study Area Parcels	Overpass
Planned Connections	Local Roads	Lakes and Ponds	
Preferred Scenario	Hampstead Bypass	Streams	

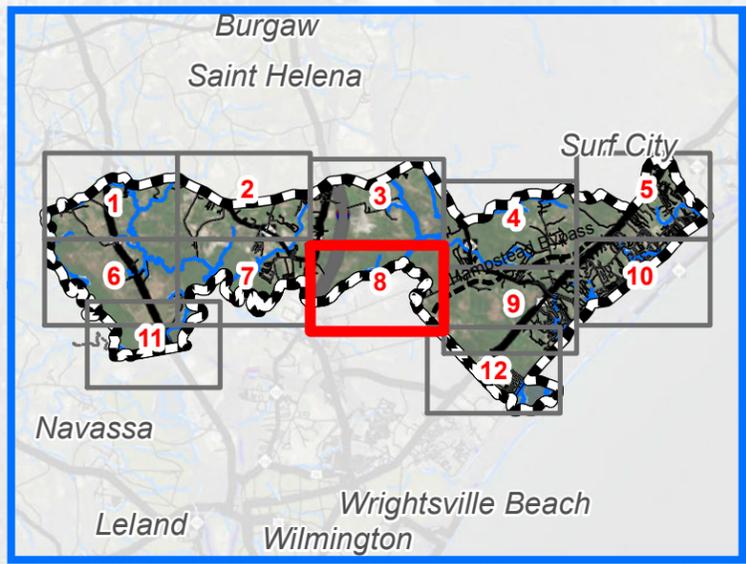


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Existing Roads - Need Improvement	NC and US Routes	Study Area Parcels	Overpass
Planned Connections	Local Roads	Lakes and Ponds	
Preferred Scenario	Hampstead Bypass	Streams	

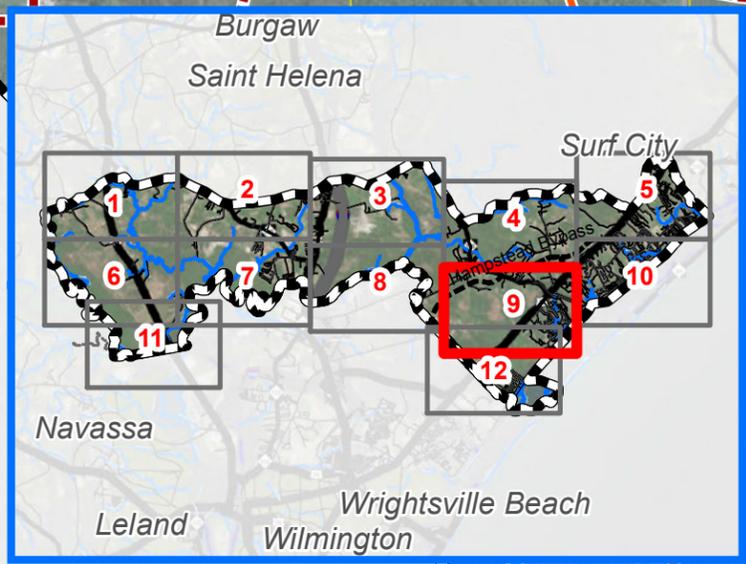
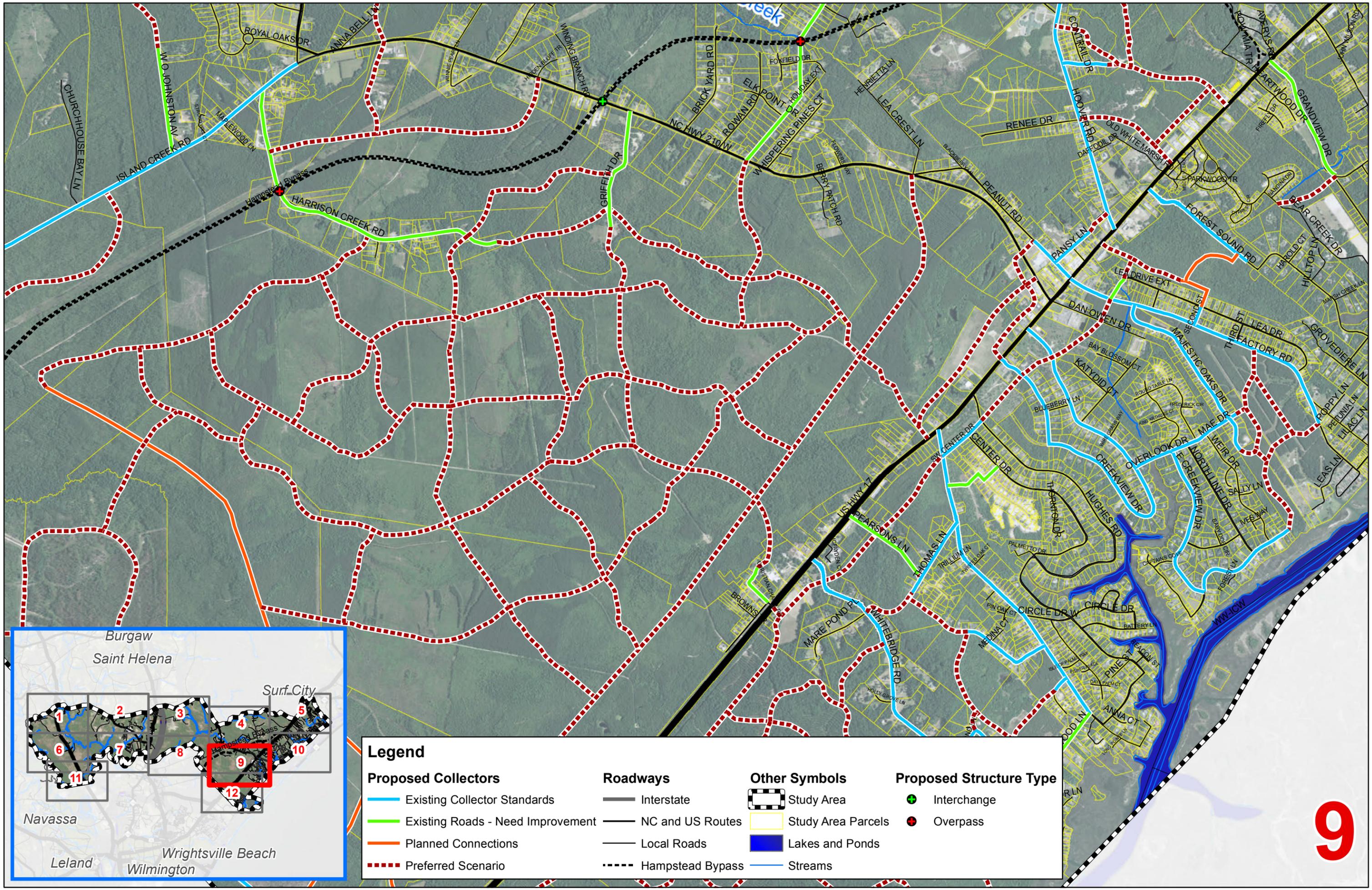




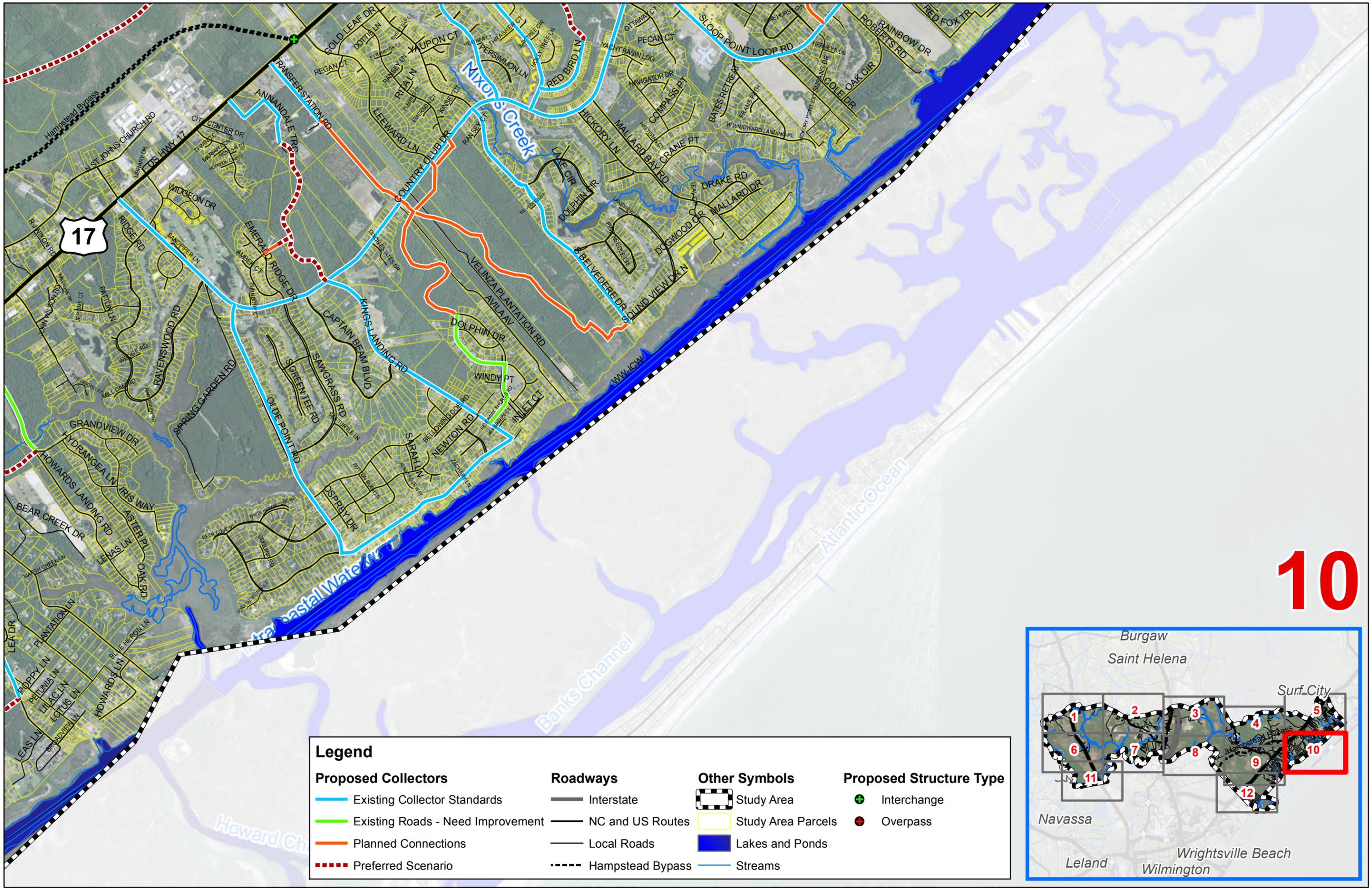
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Proposed Collectors		Roadways		Other Symbols		Proposed Structure Type	
	Existing Collector Standards		Interstate		Study Area		Interchange
	Existing Roads - Need Improvement		NC and US Routes		Study Area Parcels		Overpass
	Planned Connections		Local Roads		Lakes and Ponds		
	Preferred Scenario		Hampstead Bypass		Streams		

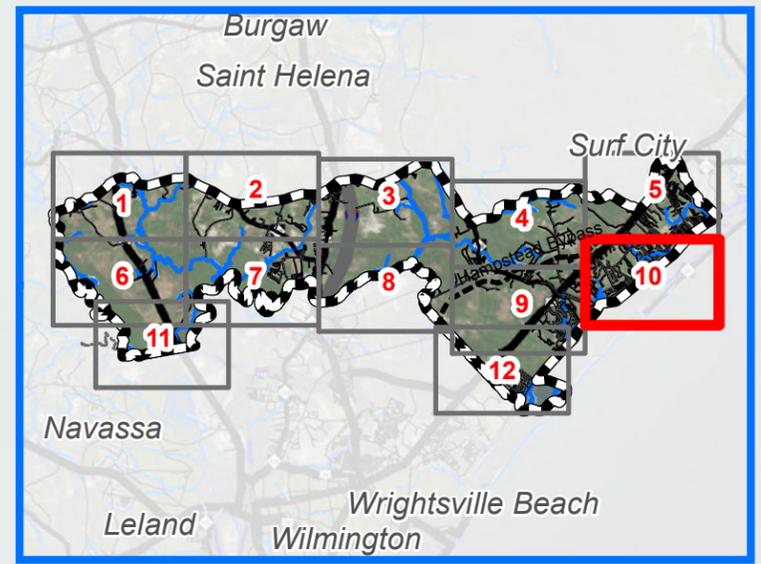


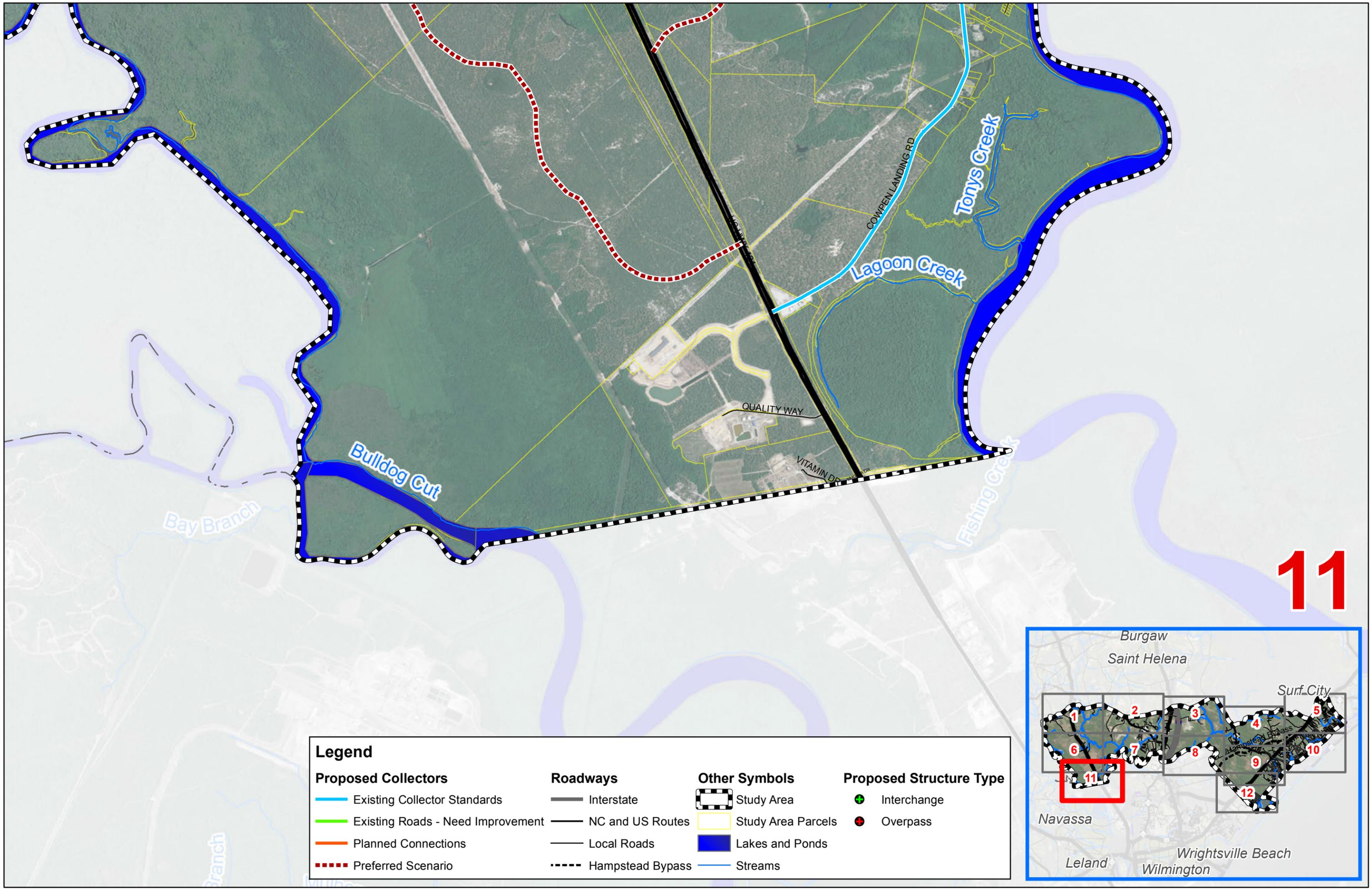
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	Existing Roads - Need Improvement		NC and US Routes		Study Area Parcels		Overpass
	Planned Connections		Local Roads		Lakes and Ponds		
	Preferred Scenario		Hampstead Bypass		Streams		



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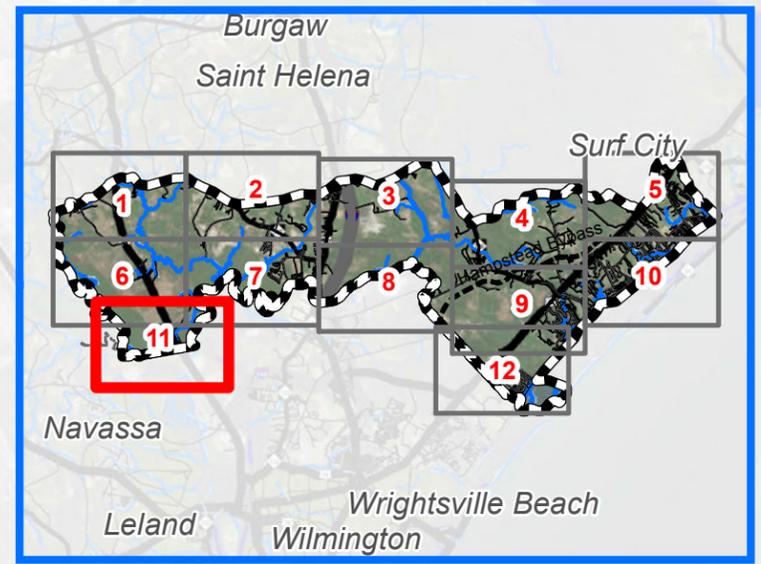
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	Existing Roads - Need Improvement		NC and US Routes		Study Area Parcels		Overpass
	Planned Connections		Local Roads		Lakes and Ponds		
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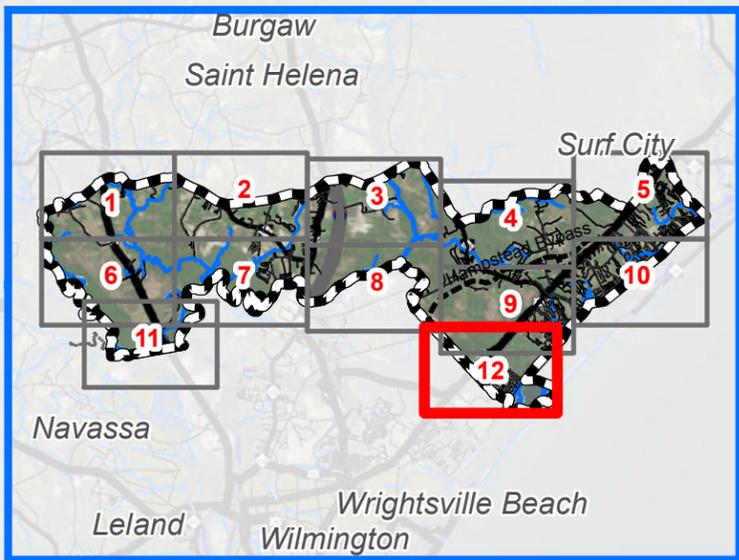
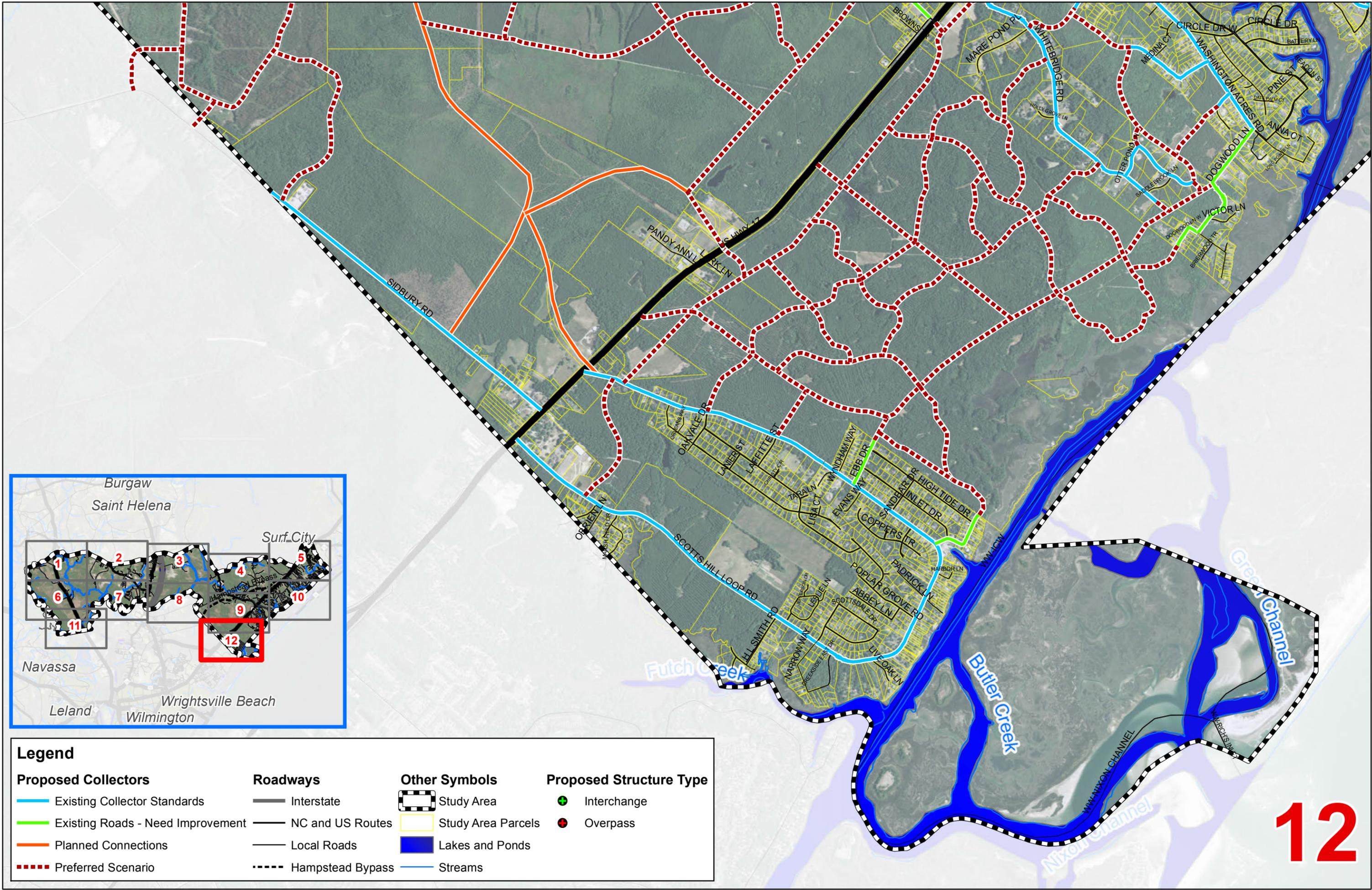




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Legend			
Proposed Collectors	Roadways	Other Symbols	Proposed Structure Type
Existing Collector Standards	Interstate	Study Area	Interchange
Existing Roads - Need Improvement	NC and US Routes	Study Area Parcels	Overpass
Planned Connections	Local Roads	Lakes and Ponds	
Preferred Scenario	Hampstead Bypass	Streams	

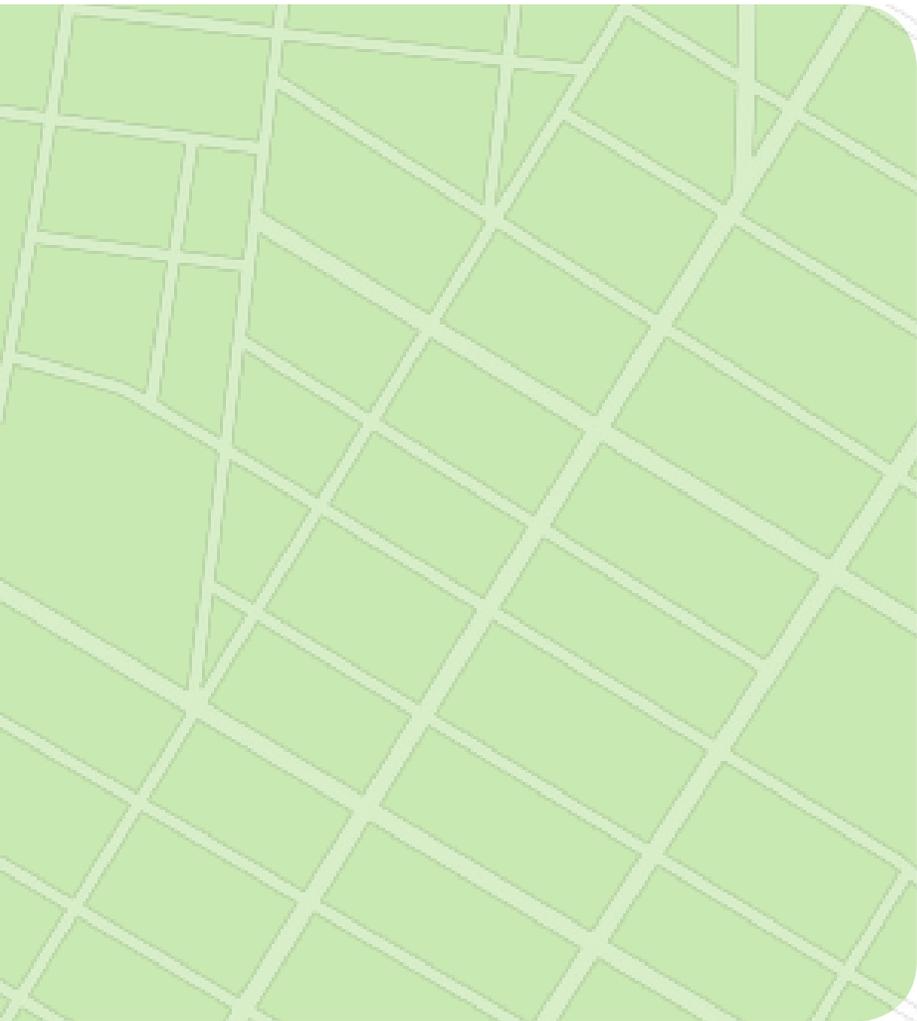




Proposed Collectors		Roadways		Other Symbols		Proposed Structure Type	
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	Existing Roads - Need Improvement		NC and US Routes		Study Area Parcels		Overpass
	Planned Connections		Local Roads		Lakes and Ponds		
	Preferred Scenario		Hampstead Bypass		Streams		

Appendix C

Wetlands Information



Appendix C: Wetlands Information

A large portion of the Pender County Collector Street Plan study area is covered by wetlands. Of the wetland areas in the PC CSP study area; 34,791.73 acres, or 35.7 percent, require a US ACE permit to develop, while 2,059.33 acres, or 2.1 percent, of wetlands require both a US ACE and CAMA permit. Figure 1 provides further detail.

Wetland Permitting Requirements

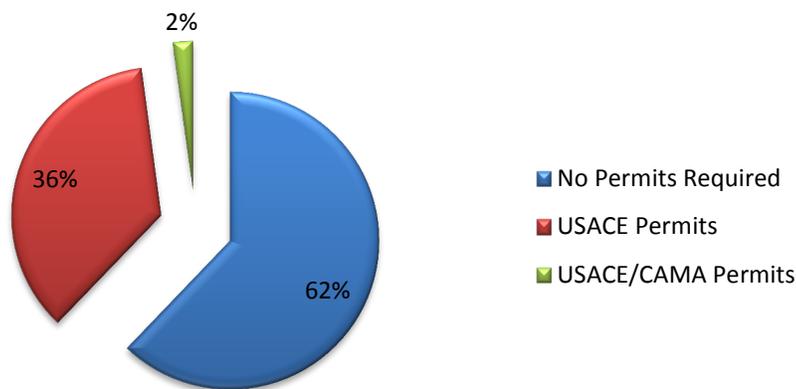


Figure 1: Wetland Permitting Requirements

In creating the wetland permitting map, the following specific wetland types were grouped by permit required. This list was derived through consultation with water resource planners at Stantec Consulting Services, Inc.

Table 1: Wetlands Permitting Information

Wetlands Information	
No Permits Necessary	<ul style="list-style-type: none"> • Drained Bottomland Hardwoods • Drained Depressional Swamp Forest • Drained Hardwood Flat • Drained Headwater Swamp • Drained Pine Flat • Drained Pocosin • Drained Riverene Swamp Forest • Human Impacted • Managed Pineland

Permits: US ACE	<ul style="list-style-type: none"> • Bottomland Hardwood • Cleared Bottomland Hardwood • Cleared Depressional Swamp Forest • Cleared Hardwood Flat • Cleared Headwater Swamp • Cleared Pine Flat • Cleared Pocosin • Cleared Riverine Swamp Forest • Cutover Bottomland Hardwood • Cutover Depressional Swamp Forest • Cutover Hardwood Flat • Cutover Headwater Swamp • Cutover Pine Flat • Cutover Pocosin • Cutover Riverine Swamp Forest • Depressional Swamp Forest • Hardwood Flat • Headwater Swamp • Pine Flat • Pocosin • Riverine Swamp Forest
Permits: US ACE, CAMA	<ul style="list-style-type: none"> • Cleared Estuarine Shrub/Scrub • Cutover Estuarine Shrub/Scrub • Estuarine Shrub/Scrub • Freshwater Marsh • Salt/Brackish Marsh

Additionally, the *Pender County Comprehensive Land Use Plan (2010)* specifically delineates sensitive natural areas under the Conservation Classification I and II designations. These designations either prohibit development entirely or require significant environmental mitigation strategies before development can occur. Figure 2, taken directly from the *Pender County Comprehensive Land Use Plan*, displays those areas contained in the Conservation Classifications I and II. These conservation areas include a number of features, which are delineated in the definitions below.

Conservation 1 includes land and water features where there are serious hazards to personal safety or property, where new development would cause serious damage to the values of natural systems, or where new development is not permitted by local, state, or federal policy. Only public or private open space or uses that require water access and cannot function elsewhere are appropriate.

Conservation 2 includes areas where new development may impact public health or areas where there are significant development limitations, such as non-coastal wetlands and water-supply watersheds. Pender County allows limited net density in Conservation 2 areas.

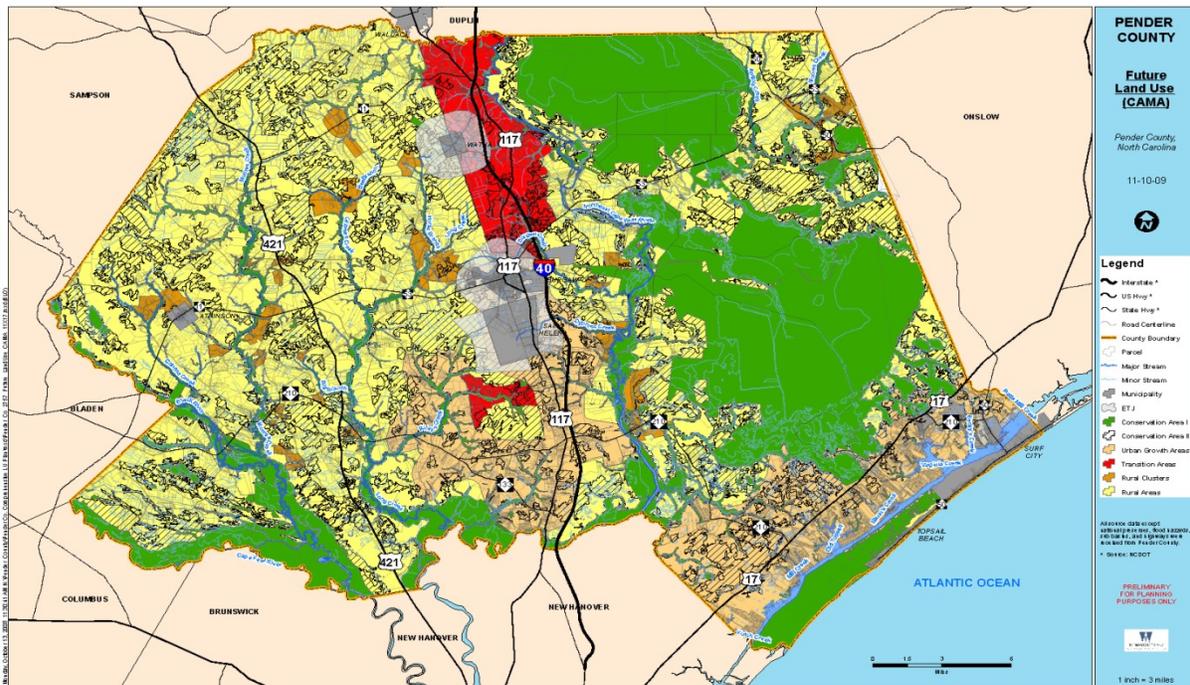


Figure 2: Conservation Areas I and II from the Pender County Comprehensive Land Use Plan (2010)

While these conservation areas do not necessarily preclude development in all cases, enhanced sensitivity to environmental conditions is important in these areas.

For the purposes of this plan, this information was examined, but proposed collector streets were ultimately programmed based on wetland and floodplain delineations and local input, rather than these conservation areas, due to the fact that these areas will be updated during the development of the Pender County Comprehensive Plan. The comprehensive planning process is currently ongoing.

Appendix D

Green Streets Strategy Best Management Practices and Policy Guidelines



Appendix D: Green Streets Strategy Best Management Practices and Policy Guidelines

Contents

- Green Streets Strategy Best Management Practices and Policy Guidelines 1
 - Low Impact Design Strategies 2
 - Stormwater and Collector Streets 6
 - Stormwater Best Management Practices (BMPs)..... 6
 - Stormwater Pollutant Removal Mechanisms 7
 - Locating a BMP 7
 - Specific BMPs 8
 - Level Spreader..... 8
 - Preformed Scour Hole..... 9
 - Dry Detention Basin 10
 - Swale 11
 - Forebay 12
 - Hazardous Spill Basin 13
 - Infiltration Basin..... 14
 - Media Filters 15
 - Wet Detention Basin 16
 - Stormwater Wetland 17
 - Filter Strip..... 18
 - Design of BMPs 19
 - Pender County Policy Recommendations..... 19

As land develops and new buildings and roadways are constructed, much of the area that was once covered by vegetation is replaced with impervious surfaces. During rainfall events, impervious surfaces (e.g. asphalt, concrete, etc.) do not allow water to penetrate into the ground, disrupting the natural hydrologic cycle and creating environmental issues around water runoff. Roadways, buildings and, in particular, parking lots have the potential to generate substantial amounts of runoff into streams, rivers, and lakes; water will often carry pollutants from roofs or from automobiles (e.g. spilled motor oil, antifreeze, etc.) into the watershed. It is imperative to control stormwater runoff and protect the watershed for a number of reasons, not least to safeguard drinking water supplies, preserve fish and wildlife habitats, protect human health, and maintain recreation amenities.

This section describes a few **Low Impact Design (LID)** strategies and **Stormwater Best Management Practices (BMPs)** that can be integrated into the design and maintenance of roadways. Generally, incorporating stormwater BMPs and LID design into the roadway environment is known as Green Streets implementation. All applicable measures are consistent with NCDOT’s Best Management Practices Toolbox document. Additionally, the North Carolina Department of Environment and Natural Resources (NCDENR) also provides another BMP Manual that may provide other supplemental information about LID and stormwater BMPs. While LID strategies focus more on development and less on the design and implementation of roadways, Stormwater BMPs and LID practices often work together as integrated systems and should be considered in conjunction with one another.



Some LID strategies include the implementation of permeable pavement, planter boxes, and rain gardens. (Credit: US EPA – Green Infrastructure)

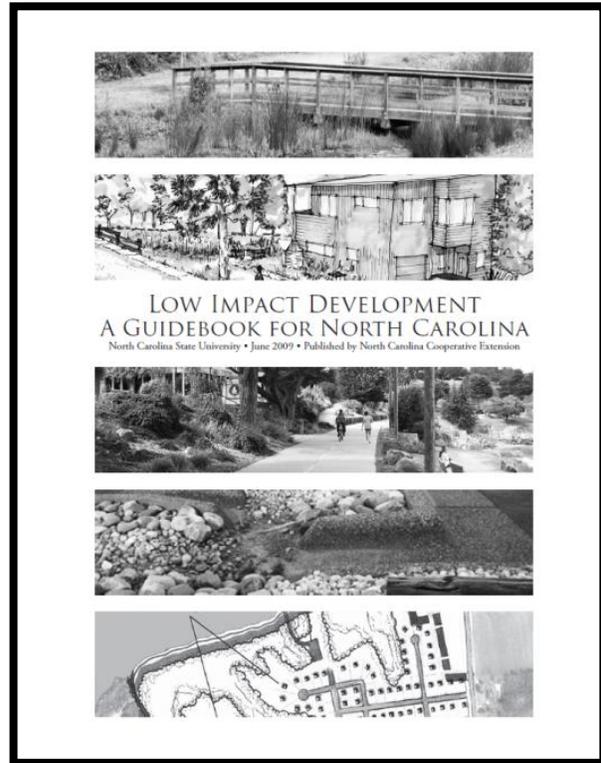
Low Impact Design Strategies

While this section of this collector street plan focuses on the street/corridor applications of Green Streets, Low Impact Design can be applied to development as well. LID is a land use planning and

engineering design method that incorporates planning and management strategies for development that has minimum impact on the environment. Managing stormwater runoff is often a major concern during development and LID principles can aid with this. The ultimate goal of LID is to attempt to sustain pre-development hydrologic conditions by developing in such a way as to avoid substantial stormwater runoff. High-quality LID implementation will often emphasize infiltration, evapotranspiration, or stormwater reuse to minimize heavy water flows during rain events and allow for adequate water treatment. The philosophy and range of treatments are nicely summarized in Figure 1.¹

LID principles such as cluster building and the use of open land and buffer preservation are strategies that can help preserve natural drainage patterns. In addition, conservation strategies and design implementation of natural features can be used to mitigate the impact of pollutants to the watershed, some of which are shown in Figure 2 on the following page.

Ultimately, LID development embodies the following fundamental tenets: resource conservation including trees, water, wetlands, drainage patterns, topography, and soils; impact minimization on hydrologic cycles and ecological systems; water infiltration optimization through landscaping and swales; and local storage areas and filtration treatment on site. LID treatments, such as swales and rain gardens, do require some maintenance. Ensuring that the public understands the function of LID treatments, the importance of maintaining natural hydrologic and ecological systems, and how the treatments work is crucial to effectively maintaining water quality in the long term. As such, the implementation of LID will likely require some educational component among both the development community and staff. NC State University sponsors a complete four-course certification series that may be useful in this regard (www.bae.ncsu.edu/topic/lid/).



The Low Impact Development Guidebook (Credit: NCSU: BAE)

¹ Huber, Jeff, Presentation made at the Economic & Environmental Issues in Arkansas: A Policy Perspective Symposium, October 26, 2010.

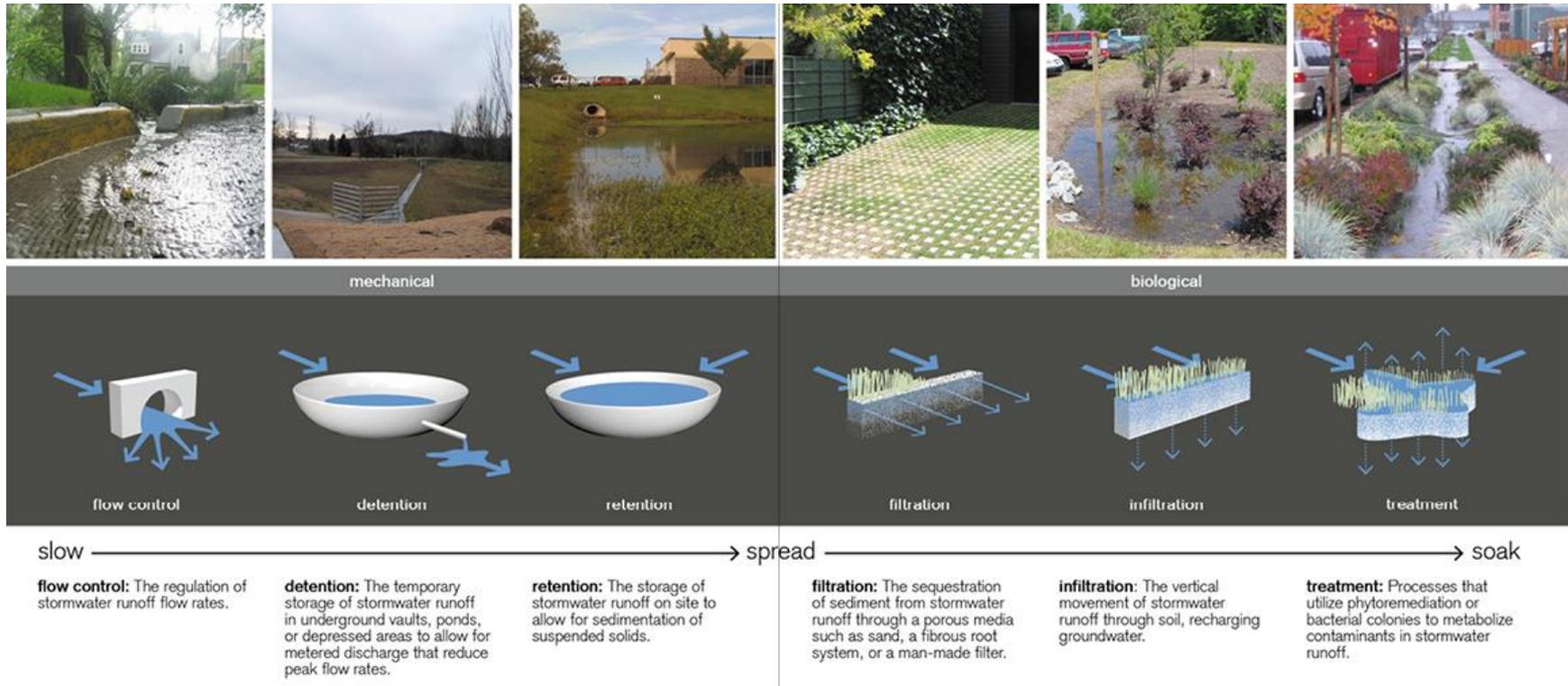


Figure 1. Spectrum of LID Approaches

The LID Approach to Storm Water Management

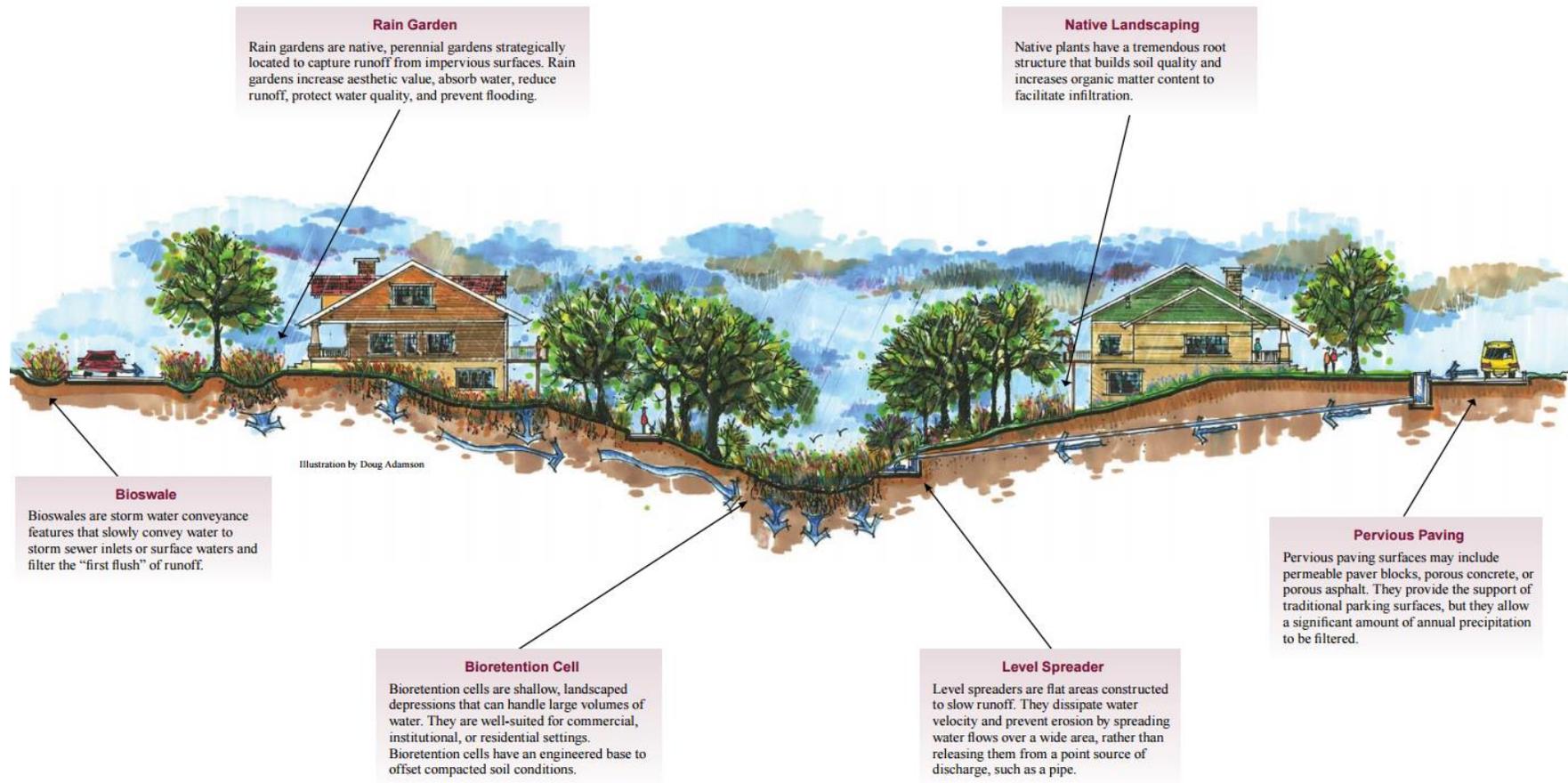


Figure 2. Various LID Treatments (Building Sites)

Photo Credit: Illustration by Doug Adamson, RDG Planning & Design, provided by USDA-NRCS in Des Moines, Iowa.

Additionally, it is important to note that LID and Stormwater BMPs may advocate for the removal of impervious surfaces. However, in the case of sidewalks, removing the facility will conflict with community quality of life goals. With this in mind, tradeoffs will need to be made on a case by case basis. In most instances, stormwater controls can be incorporated into the design for roadways and sidewalk, allowing for high-quality transportation facilities as well as for the preservation of the hydrologic cycle.

Stormwater and Collector Streets

Just as LID provides a strong directive for managing environmental impacts on building sites, the “green street” concept facilitates better environmental conditions inside the street right-of-way. The proliferation of professional accreditations now available to transportation and other planning/design professionals (e.g., Envision and Greenroads Rating System) is one indicator of the increasing level of awareness of the importance of incorporating environmental management within street design practices to minimize long-term maintenance and replacement costs as well as better managing stormwater and other negative environmental consequences.

Stormwater Best Management Practices (BMPs)

The control and mitigation of stormwater to avoid the introduction of pollutants into the water supply can be accomplished via a number of strategies, generally categorized as Best Management Practices (BMPs). The North Carolina Department of Transportation (NCDOT) provides a comprehensive manual entitled the “Stormwater Best Management Practices Toolbox” (NCDOT 2014), which serves a guiding document for implementing Stormwater BMPs. As mentioned earlier, NCDENR offers a Stormwater BMP Manual that provides minimum design criteria and guidelines for engineers. Private development and development outside of the NCDOT right-of-way is required to meet the NCDENR guidelines, with consideration given to NCDOT approved BMPs that are not listed in the State Stormwater BMP Manual. This chapter summarizes the major treatments in the manual and their applicability to Pender County.

BMPs are divided into two categories, structural and nonstructural practices. Nonstructural BMPs are those that function as operational or management strategies, like preventative maintenance activities, in addition to proactive education. Some examples might include street sweeping, litter control, and public outreach and education. Careful management of fertilizer application would also be construed as a nonstructural BMP. Structural BMPs, on the other hand, are those that seek to reduce the volume of pollutants that enter the hydrologic system by managing water flows or treating runoff, typically during storm events. These, in turn, are also divided into two categories, temporary (during construction) or permanent (post-construction). Detention basins and swales are examples of structural BMPs. While temporary structural BMPs are used only during construction (to minimize erosion and



Figure 3: This humorous graphic illustrates the difference between adsorption and absorption. (Credit: <http://www.eric.ni/Chemviron/P%20adsorption.htm>)

control sedimentation in streams), the BMPs in this memorandum are permanent controls that are designed to treat stormwater runoff over longer time periods.

Stormwater Pollutant Removal Mechanisms

Before discussing individual stormwater BMPs, it is important to note a few pollutant removal mechanisms, some of which have already been introduced in the previous LID section. Sedimentation is the process whereby suspended solids are removed from stormwater runoff through settling. Suspended solids are of concern because they create turbidity (cloudiness) in receiving waters and are carriers for other pollutants. Larger particles, such as roadway grit, sand, and gravel are easily removed through sedimentation, while others, such as clay, can be more difficult to remove. As one of the most common methods of removing pollutants, this treatment can either *absorb* or *adsorb* the pollutant, the difference being that *absorbing* incorporates and holds the pollutant in another substance, while *adsorbing* adheres the pollutant to a substance. When using this type of stormwater BMP, it is important to note that the sediments must be removed when a critical mass of pollutants has been trapped in the material. Otherwise, the pollutants may dissolve during other stormwater events, rendering the BMP ineffective. Filtration is the process by which pollutants pass through a filter material, such as sand or soil, and are strained by the material. Infiltration, on the other hand, is a more complex process by which stormwater migrates below the surface and passes through subsoils to groundwater. Depending on the type and extent of groundcover, groundwater conditions, and properties of the soil, infiltration both filters the water and adsorbs the pollutants to soil particles.

Two other important mechanisms are also helpful; these are pollutant removal through microbial transformation and biological uptake. Microbes can often transform chemicals from harmful substances into non-harmful substances. By supporting the key elements to diverse microbial life, BMPs can create conditions conducive to microbial transformation. Biological uptake refers to the process by which plants or other organisms take pollutants and incorporate them in their cellular structure. The following paragraphs provide more information on specific BMPs.

Locating a BMP

In discussing stormwater BMPs, it is very important to ensure that the BMPs are applied in areas that are appropriate to the treatment. Some key factors to take into consideration are

- slope and topographic constraints,
- adjacent land use,
- contributing drainage area,
- available right-of-way, soils,
- water table,
- groundwater conditions,
- and, of course, cost.

Particularly in Pender County, a thorough examination of the environmental context is absolutely crucial. As part of the small number of counties that constitute the natural habitat for the Venus Fly-Trap and other endangered species, ensuring that stormwater BMPs do not negatively affect sensitive

environmental areas should be a prime consideration. Ultimately, using a site-specific approach to implement the appropriate BMP will ensure that stormwater treatments are appropriate for local conditions.

Specific BMPs

Level Spreader

Stormwater often flows in a concentrated torrent towards lower elevations. A Level Spreader is a device, usually in form of a concrete trough with a nonerosive lip that diffuses stormwater along a stable slope. Figure 5 provides more detail. A level spreader diffuses concentrated flow, reducing erosive velocities, filtering water through vegetation, and enhancing nutrient uptake through vegetation and infiltration.



Figure 4: Level Spreader (Credit: NCSU BAE)

Installation of a level spreader is usually comprised of a number of stormwater infrastructure components, including a flow bypass structure, forebay, level spreader trough, level spreader lip, and a drawdown system. Generally, water enters the level spreader through the flow bypass structure, collects in the trough, and then, when enough water is collected, it is released over the spreader lip, distributing the flow evenly across the downgrade slope.

Caveats

Level spreaders require a uniform, diffuse flow downgrade from the treatment, i.e. a uniform slope that is stable with a moderate grade. In general, this treatment functions best and is most appropriate in areas where the runoff flows either directly or is conveyed to the level spreader and then onwards to the buffer zone of a water body at a lower elevation. As level spreaders may collect sediments carried by the stormwater runoff, periodic maintenance to remove debris from the trough will be necessary.

Benefits

This treatment will increase infiltration as the water flow is slower and spread over a larger area. Generally, slower water flows allow larger particles to settle, reducing sedimentation in streams and rivers. Additionally, this treatment will reduce erosion and mitigate ponding downgrade from the level spreader.

Suitable Locations

Level spreaders are typically suitable for most roadway applications, including along linear roadways, at interchanges and intersections, and at bridges. However, level spreaders are not suitable for areas with steep slopes or limited right-of-way.

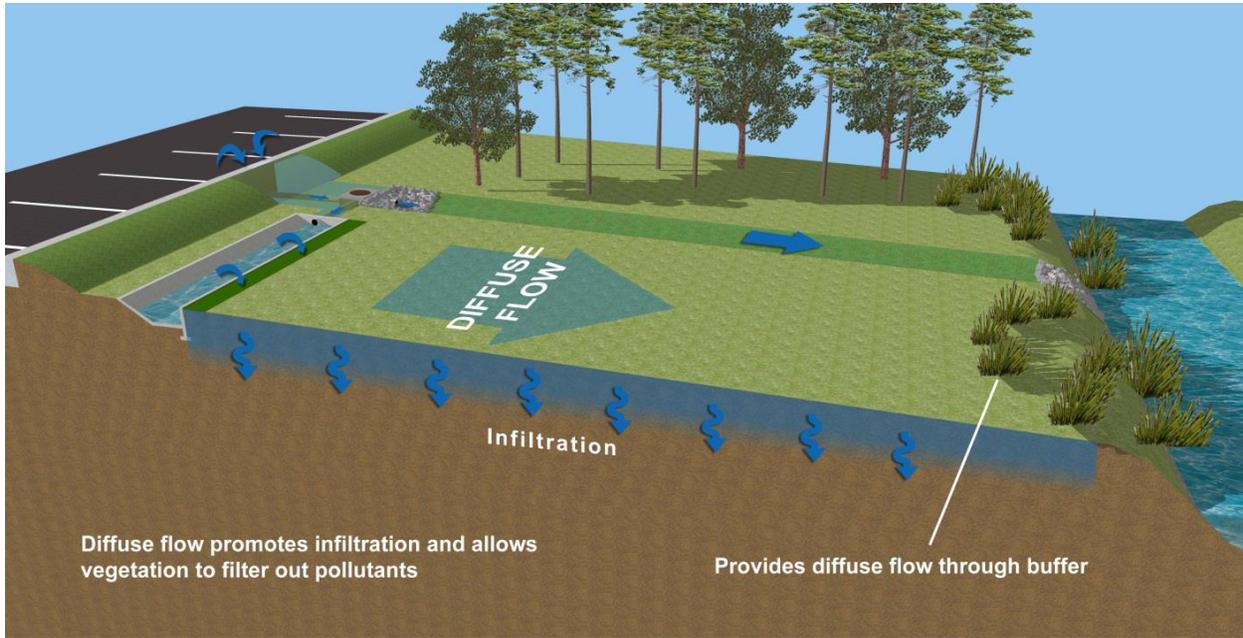


Figure 5: Level Spreader Configuration and Process for Removing Pollutants (Credit: NCDOT BMP Toolbox 2014).

Preformed Scour Hole

Routing stormwater through a storm drain and into a drainage pipe will often channelize the water at the pipe outlet, creating rapid water velocities and concentrated flows. Preformed scour holes are treatments at the end of drain pipes to dissipate stormwater energy and promote the diffusion of the water across a drainage area. Typically, a preformed scour hole is a depression at the end of a drainage pipe lined with riprap stone and, in many cases, filter fabric. The application of permanent soil reinforcement matting (PRSM) to prevent erosion downgrade from the preformed scour hole is required for this treatment.



Figure 6: Preformed Scour Hole (Credit: NCDOT BMP Toolbox 2014).

Caveats

Preformed scour holes are only suitable for small drainage areas and flat outlet areas outside the clear recovery zone. Specifically, the ground around this treatment must be flat in order to avoid the pooling of runoff below the treatment. Other BMPs should be considered if these specific site conditions are not met. Also, it is important to ensure that the scour hole is installed on undisturbed soil.

Benefits

This treatment is particularly useful in reducing erosion and avoiding “scour” around drain pipe release points. Soils are unlikely to erode if the velocity of the runoff is abated, while the diffusion of water can aid in water infiltration.

Suitable Locations

Preformed Scour Holes must be installed outside of clear recovery zones and environmentally sensitive areas and must be flush with natural ground. Areas surrounding the scour hole should be stabilized with vegetation.

Dry Detention Basin

Comprehensive stormwater runoff treatment involves both the reduction of peak stormwater flows as well as the removal of sediments and suspended solids. The Dry Detention Basin treatment achieves this by capturing stormwater and releasing it over time. Comprised of a forebay, basin, outlet control structure, drawdown device, embankment, emergency spillway, access road, and optional underdrain system, the treatment first captures sediments and then allows for the removal of suspended solids, before finally releasing the stormwater over a period of days. Figure 7 provides more detail.

Caveats

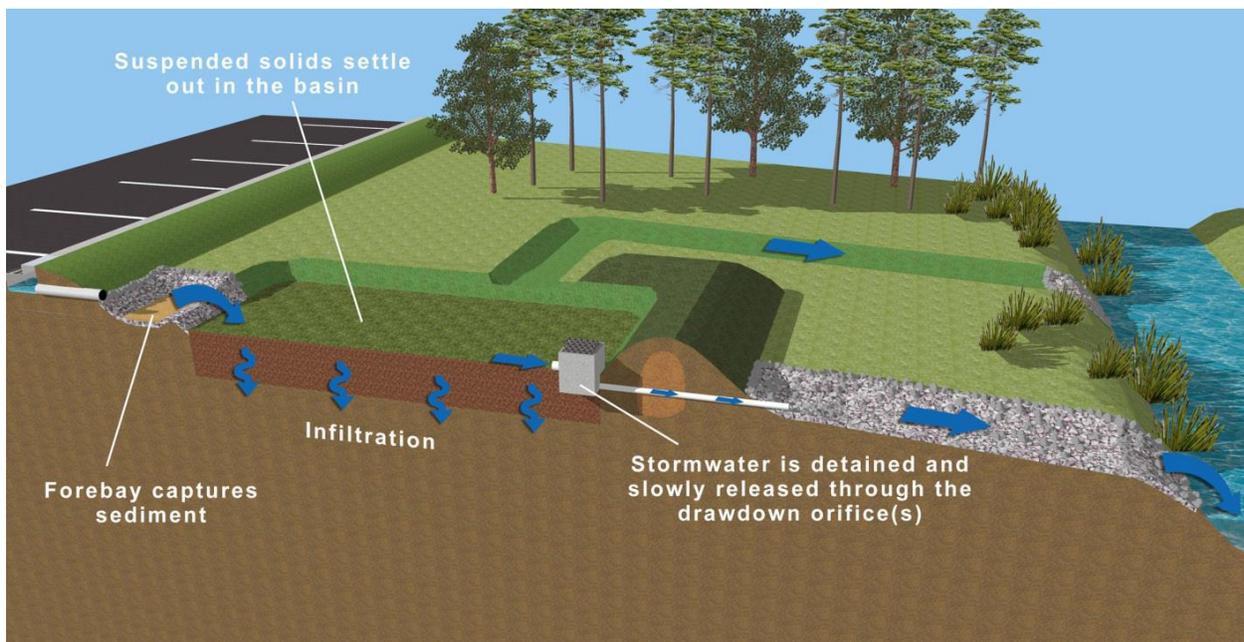


Figure 7: The Configuration of a Dry Detention Basin Treatment (Credit: NCDOT BMP Toolbox 2014).

This comprehensive treatment is approved for use around both linear roadways as well as at interchanges, intersections, and around facilities. However, dry detention basins require a large amount of space as compared with other BMPs; this may make this treatment less desirable in areas with limited right-of-way. In areas with very permeable soils, impacts to groundwater should be considered and the application of an impermeable liner used where appropriate.

Benefits

Dry Detention Basins comprehensively treat stormwater by promoting infiltration, while they also capture sediment and suspended solids. As a comprehensive treatment, this BMP prevents erosion as well as hydrologic impacts and, coupled with an underdrain system, can also remove particle and particulate-bound pollutants.

Suitable Locations

Dry detention basins are best installed in areas with enough space to facilitate the slow release of runoff. If the water table is less than 2 feet below the bottom of the basin, this treatment should not be used. Particularly in Pender County, as in other areas with karst topography, the use of impermeable liners is required. This will help prevent soil collapse. Basins should be located outside of the clear recovery zone, on undisturbed soils, and compactable materials should be used for backfill. Direct access is imperative to provide to allow for maintenance and repair.

Swale

Two-lane roadways do not typically generate a substantial amount of runoff. Swales, defined as broad, shallow, vegetated channels, are usually adequate to handle the volume of runoff from small drainage areas. Swales serve to decrease the velocity of runoff, which allows for the sedimentation of suspended solids as well as the trapping of particulate pollutants by vegetation and infiltration. Generally, swales are broader and flatter than other types of drainage ditches. The presence of vegetation around and within the swale can spur biological uptake as well, further removing particular pollutants from stormwater runoff.



Figure 8: Swale Example

Caveats

As broad channels, swales have a maximum 3:1 slope, requiring some right-of-way on either side of the roadway. Additionally, swales are best utilized for small drainage areas; in areas with larger drainage, flows and velocities of runoff are likely to increase, reducing the swales effectiveness and, in some cases, leading to significant erosion concerns. Vegetation can increase the capacity of a swale by reducing the likelihood of erosion.

Benefits

Swales reduce runoff velocities and facilitate infiltration, filtration, and sedimentation. The most effective swales include dense vegetation, relatively flat slopes, and permeable soils.

Suitable Locations

Swales are suitable for linear rights-of-way, interchanges, and other facilities, though swales are most common on secondary roadways with small drainage areas. Swales can be appropriate at locations with larger drainage areas as well, but only in combination with other stormwater runoff treatments.

Forebay

In contrast to the previous treatments, forebays are classified as a pretreatment BMP, i.e. a treatment that is used in conjunction with other treatments. A forebay is defined as a basin that captures debris and allows for sedimentation, while dissipating stormwater energy and promoting diffuse flow to other types of BMPs downgrade from the forebay. Forebays are typically used in conjunction with other BMPs, for instance infiltration basins, wet and dry detention basins, stormwater wetlands, bioretention basins, filtration basins, and level spreaders.

Indeed, forebays are integral to these BMPs. They serve the important purpose of allowing suspended particles to settle and trapping debris, thereby reducing clogging in downstream outlet control devices and sedimentation in the final receiving water body. Forebays are often designed to include riprap and filter fabric, though grass and concrete are also used in some applications.

Caveats

Forebays, like many BMPs, do require some roadside space to function and will also need periodic maintenance to remove sediments from the treatment. Additionally, forebays should be located out of the clear recovery zone and should have easy maintenance access.

Benefits

Forebays provide a multitude of benefits. Apart from dissipating stormwater velocities and allowing suspended particles to settle, forebays also collect trash and debris and prevent these materials from entering downgrade BMPs. They also provide diffuse runoff, reducing erosion and extending the life of associated BMPs as well.



Figure 9: Forebay Example (Credit: NCDOT BMP Toolbox 2014).

Suitable Locations

Forebays should be implemented in conjunction with other stormwater BMPs and are an appropriate measure where concentrated runoff from a highway project is funneled to a BMP from roadside ditches and/or storm pipes.

Hazardous Spill Basin

In areas close to major industrial centers, near sensitive water supplies, or along routes with heavy truck traffic, such as US 17, US 421, NC 210, etc. there is a higher possibility that hazardous materials could be accidentally released into the water supply, if a crash were to occur. Hazardous spill basins are designed to capture hazardous materials and ensure that hazardous materials do not permeate into groundwater or contaminate downgrade water supplies.



Figure 10: Hazardous Spill Basin (Credit: NCDOT BMP Toolbox 2014).

Comprised of a basin, outlet structure, and optional obstruction materials, a hazardous spill basin allows for the normal flow of stormwater during a rain event, but can be closed off by way of sluce gate in the event of a crash or spill involving hazardous materials. Runoff can enter the hazardous spill basin in a number of ways, including from a point discharge from a roadway or parking facility, as diffuse flow, or from a pretreatment BMP.

Caveats

Hazardous spill basins can be difficult to locate in some cases. It is paramount to ensure that access for emergency first responders and maintenance crews is provided.

Benefits

This is a hugely important treatment in terms of ensuring public and environmental health, as hazardous spill basins can prevent the contamination of receiving waters with harmful pollutants.

Suitable Locations

It can be difficult to determine where to install a hazardous spill basin. The NCDOT provides guidance in various publications, but it is common to find hazardous spill basins near rural and urban roadway stream crossings, weigh stations, runaway truck ramps, and rest area truck parking lots. Some additional considerations are to ensure that there is enough space to construct the basin, maintenance crews can reach the basin easily, and the basin can be constructed easily.

Infiltration Basin

Used in areas with permeable soils, infiltration basins are stormwater treatments that collect stormwater with the goal of allowing the water to infiltrate the soil. This type of treatment is very effective if trapping pollutants, as stormwater does not leave the basin by any other outlet other than via infiltration and pollutants are consequently trapped in soils. Most applications of infiltration basins are coupled with a pretreatment BMP, such as a forebay, to remove larger particles and prevent them from entering the basin. A typical infiltration basin is comprised of a bypass structure, pretreatment BMP of some variety, basin, embankment, and emergency control structure.

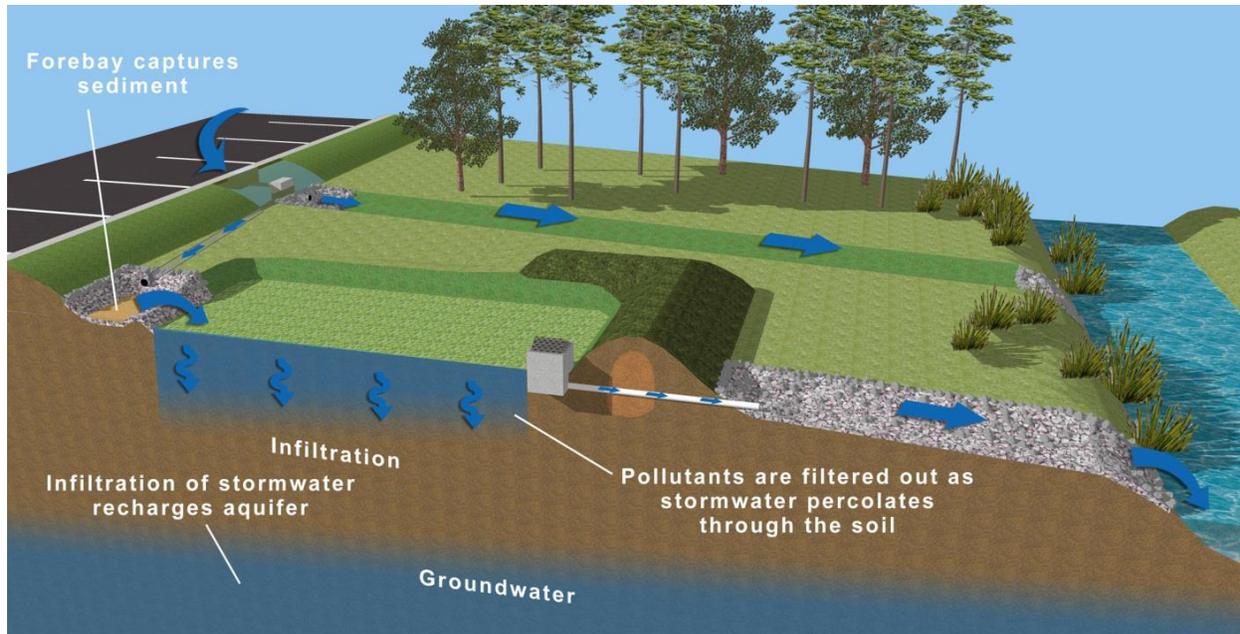


Figure 11: Infiltration Diagram (Credit: NCDOT BMP Toolbox 2014).

Some infiltration basins have an emergency outlet control structure, which allows water that exceeds a certain limit (the water quality volume elevation) to discharge from the basin. A riser and outlet pipe are the usual components of the discharge system.

Caveats

As with many other types of stormwater BMPs, providing adequate access for maintenance crews is very important; infiltration basins are no different. Additionally, erosion and sediment controls are crucial, especially during site construction, as coarse particles can make the treatment unusable. It is also important to avoid using heavy equipment in the basin in order to reduce soil compaction. Spacing is another consideration as infiltration basins are often used in conjunction with other treatments, such as swales or filter strips to treat excess stormwater.

Benefits

This treatment is highly applicable in the coastal plain of North Carolina, as the soils are highly permeable. Infiltration basins are particularly helpful in terms of recharging groundwater and reducing surface water degradation, since no stormwater is discharged and is instead treated onsite and infiltrates to groundwater aquifers.

Suitable Locations

Infiltration basins are only suitable in certain situations. Buffers, including 50 feet from any Class SA waters, 30 feet from other waters, and 100 feet from water supply wells, are important to observe, while soil permeability is another important consideration. Site soils must be able to draw down stormwater within a five day period. This treatment must also be located at least two feet above the seasonal groundwater table and three feet above any impervious materials, such as bedrock. All of these conditions must be met to implement an infiltration basin.

Media Filters

As a general category that encompasses a number of treatments, media filters are BMPs that treat stormwater by filtering it through as specific media, such as amended soil, sand, or another material, and then capture it and route it elsewhere. Two types of media filters are addressed here, filtration basins and bioretention basins.



Figure 12: Bioretention Basin Example (Credit: NCSU-BAE)

Media filters remove pollutants by using either a natural, manufactured, or engineered material. Filtration basins are typically comprised of coarse sand or recycled aggregate combined with organic material and covered with a layer of turfgrass, while bioretention basins are comprised of a mix of sand, fines, and organic materials. Bioretention basins support ornamental plants and are mulched with some variety of groundcover. Underdrains capture the treated stormwater and convey it to an outlet control structure. Overall, media filters typically include a forebay, basin, media, landscaping (bioretention basin), underdrain system, outlet control structure, embankment, emergency spillway, and access road.

Caveats

Sedimentation is an issue with media filters. It is important to locate in watersheds that are fully developed to minimize excess sedimentation. If sediment loads cannot be reduced through pretreatment in a forebay or vegetated conveyance, media filters will not function as designed. Also, these treatments are recommended in areas with drainage of less than five acres. As with most stormwater BMPs, regular maintenance, particularly to landscaped bioretention basins, is necessary to ensure that these treatments function properly, while these treatments should not be located within 50 feet of Class SA water, within 30 feet of other waters, or within 100 feet of water supply wells.

Benefits

Bioretention basins and filtration basins are designed to capture and release water over a period of 48 hours, which reduces the peak flow and keeps downgrade erosion to a minimum. This type of treatment

is comprehensive by nature, removing solids and adsorbing dissolved pollutants. Ultimately, the use of a media filter treatment reduces total suspended solids, nutrients, metals, hydrocarbons, and pathogens. Bioretention basins, in particular, also remove a substantial amount of nutrients in runoff. These treatments also support microbial activity that can remove pollutants as well. Additionally, media filters provide an aesthetic benefit and help create attractive roadside environments.

Suitable Locations

While not suited to unstable drainage areas, media filters are relatively versatile and can be integrated in various patterns into existing topography. Indeed, the size, shape, media, and vegetation type can all be altered to fit the local context, whether it is along a highway or at a facility. However, slopes of greater than 20% are not desirable in the vicinity of these treatments.

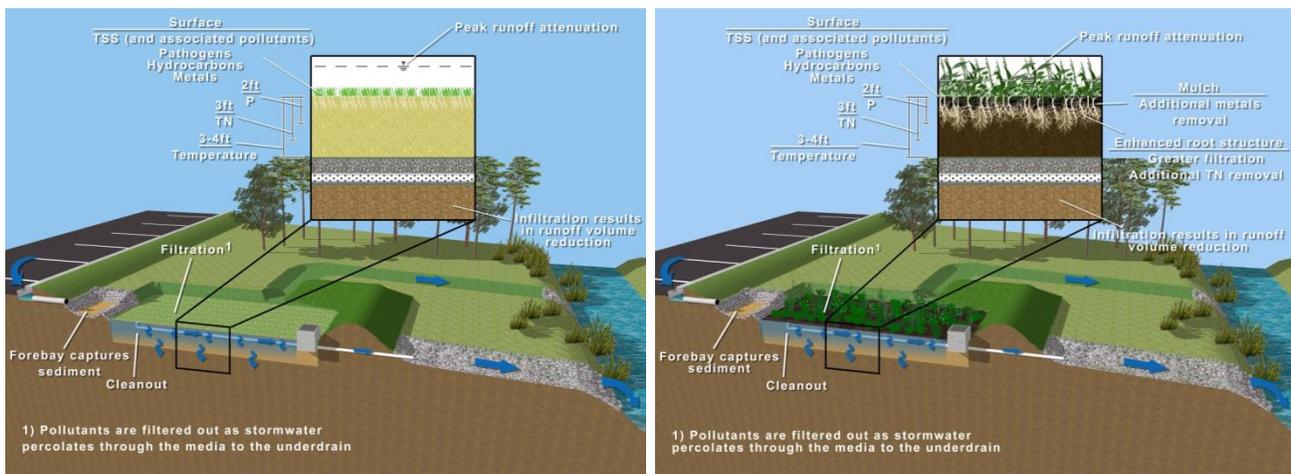


Figure 13: Filtration and Bioretention Basin Functionality (Credit: NC BMP Toolbox 2014).

Wet Detention Basin

A wet detention basin is a structural BMP that consists of a permanent pool of water, an outlet structure, and a drawdown device. During a storm event, water is funneled into the wet detention basin via a forebay, where it remains until it exceeds the top of the outlet control structure. The drawdown device allows for the discharge of the water in the outlet control structure over a period of two to five days. This treatment slows stormwater flows, reduces erosive velocities downgrade of the treatment, and promotes biological uptake and the settling of suspended solids. In the event of a moderate storm, water may not exceed the height of the outlet control structure; in these instances, water remains in the wet detention basin. The components of a wet detention basin are a forebay, basin, vegetated shelf, outlet control structure, drawdown device, and embankment. An emergency spillway may need to be implemented to avoid flooding during severe storm events.

Caveats

Spillways may be necessary to avoid flooding and downgrade erosion around wet detention basins, while sizing for wet detention basins should be considered carefully. The average depth should be between three and four feet, while slopes leading to the basin should not exceed 3:1. Landscaping should also be considered carefully, as specific plants will play an important role in stormwater treatment and management. It is important to keep in mind that some maintenance will be necessary

for this treatment and including space for an access road during any landscaping planning is another important consideration. Additional considerations include placing the basin in undisturbed soil, ensuring that all outlets are stabilized to avoid erosion issues, and locating the basin outside the clear recovery zone. Stagnant water should also be avoided as it provides a breeding ground for unwanted pests. A well maintained aquatic shelf can also help deter unwanted geese.

Benefits

This treatment provides extra capacity for stormwater, reducing the likelihood of downgrade erosion and hydrologic impacts to other water bodies. In terms of water quality, wet detention basins promote the sedimentation of suspended solids, while also supporting biological uptake through vegetation, algae, and bacteria that proliferates in the permanent pond.



Figure 14: Example of a Wet Detention Basin (Credit: NCSU-BAE)

Suitable Locations

The best location to implement a wet detention basin is in areas that are low-lying and have a high water table. In areas where concerns regarding water temperature are present, for instance in areas that drain to trout streams, wet detention basins are not recommended.

Stormwater Wetland

Most of the preceding stormwater BMPs have focused on removing pollutants through sedimentation, infiltration, and filtration processes. The stormwater wetland, however, primarily removes pollution through biological processes. Mimicking a natural wetland, this treatment is an engineered marsh or swamp that includes wetland vegetation, which process the pollutants. Water is ultimately released over a period of two to five days via a drawdown component. The components of this treatment include a forebay, shallow water zone, shallow land zone, deep pools, landscaping, drawdown device, outlet control structure, embankment, emergency spillway, and access road.

Caveats

A landscaping plan should be performed when implementing this treatment, as pollutant removal for this treatment is determined primarily via biological uptake, requiring a dense cover of emergent plant vegetation. Non-invasive, native plant species that continue through the winter season are the most desirable for this treatment. This treatment may also require substantial space, which may not be available in some rights-of-way. To avoid pest problems and unwanted vegetation, a wetland has to be

maintained regularly. Public perception can also be a concern, so public education and maintenance is key to the success of this BMP.

Benefits

This treatment provides substantial water quality benefits by capturing stormwater and allowing for the settling of suspended solids and biological uptake of nutrients. This treatment will also mitigate erosion resulting from storm events. A stormwater feature can enhance a community's environmental education program in addition to providing biological diversity and habitat.

Suitable Locations

Stormwater wetlands are best suited to low-lying areas with a high water table, which help maintain a permanent pool.

Pender County has large areas that meet these criteria. This treatment should be located on undisturbed soil and include direct access to facilitate access by maintenance crews.

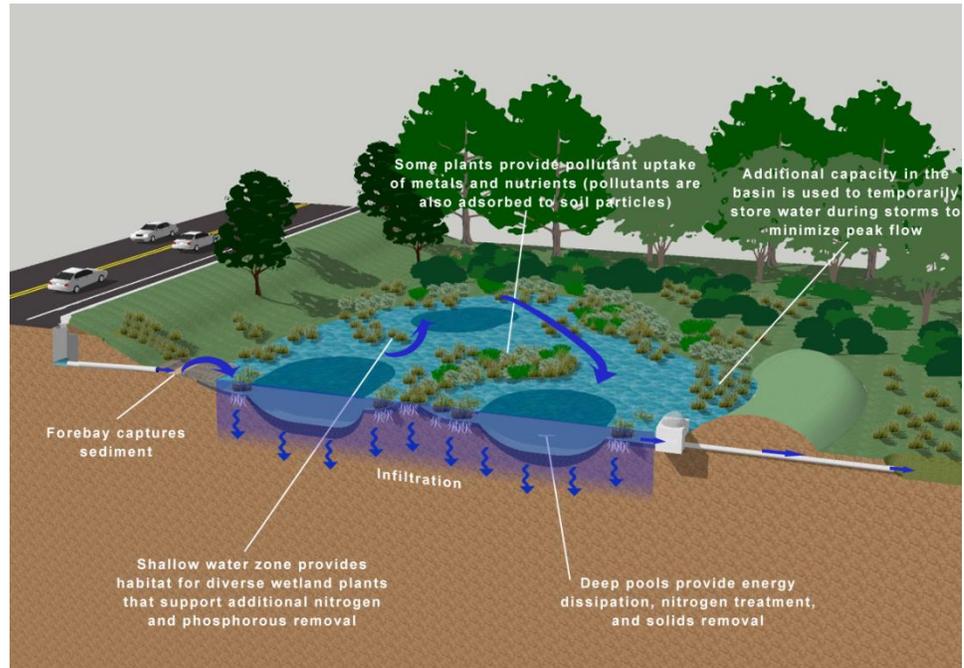


Figure 15: Stormwater Wetland Functionality (Credit: NC BMP Toolbox 2014).

Filter Strip

This treatment consists of a uniformly graded, highly vegetated space alongside roadways or other linear facilities that support increased sedimentation, vegetative filtering, and infiltration. This treatment, which supports groundwater recharging, is often used in conjunction with other stormwater BMPs, including level spreaders and preformed scour holes, among others.



Figure 16: Filter Strip (Credit: NCSU-BAE)

Caveats

There are two main caveats to using filter strips, the treatment of small drainage areas and overland flow length. In terms of small drainage areas, a ratio of 20-40:1 is desirable to achieve reasonable total suspended solids removal and a reduction of stormwater volumes. For overland flow lengths upgrade of the filter strip, it is recommended that a

maximum slope of 5% is observed to avoid the re-concentration of runoff flow.

Benefits

Filter strips yield water quality benefits by promoting particulate settling and infiltration as well as reducing water velocities. Additionally, this treatment reduces suspended solids, metals, and some nutrients in stormwater runoff through a number of methods, including sedimentation, interceptions, vegetated filtration, and biological uptake. This treatment is also easy to maintain.

Suitable Locations

Typical implementation locations for filter strips are along rural roads or in areas with sufficient right-of-way to allow space for diffuse flow over the filter strip and into receiving water bodies.

Overall, these treatments provide a menu of options for most situations. As indicated, appropriately evaluating local site conditions will be fundamental to understanding the right treatment; it is important to keep in mind that the use of separate treatments together may be the best option. Also, while these represent best practices, local officials or representatives from NCDOT may have other options not considered here that yield similar water quality benefits. In any case, coordination with local NCDOT officials during the design phase of any collector streets project is mandatory and will likely lead to a refined solution(s) for any specific location.

Design of BMPs

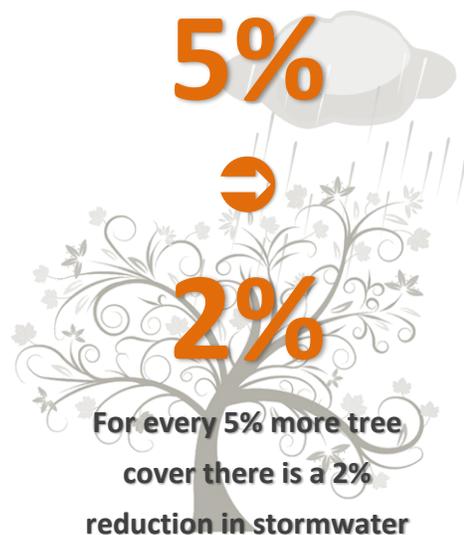
BMPs should be designed by a landscape architect, engineer, or other qualified design professional. Hydrologic and hydraulic analyses should be conducted to determine the appropriate BMP sizing, establish elevations, and determine treatment capacities. Street design and stormwater control should be complementary to each other. Guidance for the design of stormwater BMPs is available in NCDENR's BMP Design Manual and NCDOT's BMP Toolbox. Pender County is located in the coastal plain of North Carolina and BMPs should be designed accordingly.

Further information, including information on the design of stormwater BMPs, NCDOT-based research on BMP effectiveness, and checklists for each treatment, is provided in the NCDOT BMP Toolbox (NCDOT, 2014). Specific design information is provided in the NCDENR BMP Manual (NCDENR, 2015)

Pender County Policy Recommendations

Pender County can provide mandates or incentives to private (and public) development to support the creation of environmental management in the collector street network in a number of ways.

- **Inventory of Stormwater Infrastructure**
Understanding what stormwater infrastructure exists within the county and where current drainage patterns



exist is crucial to establishing connectivity and understanding sources of runoff. This can also help ensure that stormwater assets are functioning as designed and are well maintained.

- **Provide understanding and guidelines for the city, developers, and designers**
Pender County, along with designers, planners, developers, and engineers, should be able to easily establish green streets by using the document as development guidelines. The approach outlined should be clearly understood to facilitate implementation throughout the community. Additionally, information about the cost-saving benefits that accompany good stormwater design should be incorporated into community education programs. Community workshops and public outreach campaigns should be implemented to help educate stakeholders on stormwater and the County's Green Streets strategy.
- **Develop source stormwater management**
Pender County is dedicated to developing sustainable methods of stormwater treatment and disposal within the ROW. The county recognizes that over story planting, vegetative swales and planters have proven effective throughout the country in the treatment, slowing and dispersing of surface runoff and would like to incorporate these methodologies into their stormwater management plan.
- **Improve multi-modal connectivity**
Pender County would like to promote the use of Green Streets within the community. Redevelopment of existing streets and the development of new ones are holistic undertakings with the goal of improving connectivity through enhanced multi-modal circulation.
- **Development of a materials list and maintenance plan**
For a comprehensive understanding of the effects of Green Streets and their comparable cost with traditional street systems, a base development unit cost and a maintenance outline should be developed for the county.
- **Work with NCDOT**
Use existing NCDOT resources, including the Stormwater Best Management Practices Toolbox, to ensure that design standards are met and that BMPs are implemented appropriately. Ensure that private development is constructing stormwater BMPs to NCDOT standards.
- **Create a stormwater ordinance and set up a stormwater utility**
Stormwater ordinances provide the necessary regulatory framework to require stormwater BMPs with new road construction and with new development, often only in areas close to sensitive water resources, in the floodplain, or in/near wetland areas. Landscaping and tree conservation ordinances also help to implement LID principles that aid in stormwater management. A few sample stormwater ordinances are listed below.
 - Brunswick County:
http://www.brunswickcountync.gov/engineering/files/2015/02/Storm_Water_Manual.pdf
 - Beaufort County:
<https://www.google.ca/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwj3uuHm097JAhUS5GMKHbvpBPcQFggBMAA&url=http%3A%2F%2Fwww.co.beaufort.nc.us%2Fgovernment%2Fcounty-ordinances%3Fdownload%3D11%3Astormwater-ordinance&usg=AFQjCNH7uHv39NT0OvtTWbbx21v7aEh1cQ&sig2=PVW75luxKgvSZIuf3APx3g&bvm=bv.110151844,d.cGc>

The actual design for a “green street” is relatively straightforward: wider green swales between the curb line and sidewalk (if present), street trees, minimization of pavement, and maximization of porous materials for non-heavy load areas (e.g., overflow parking). More aggressive stormwater capture treatments typically a system of detention areas that capture and hold rainwater until it can be absorbed into the ground or by a collection of native planting materials that require low maintenance. These bioretention cells can be readily incorporated into street designs that feature on-street parking, curb extensions (to help reduce crossing distances for pedestrians), or both (see Figure 17).

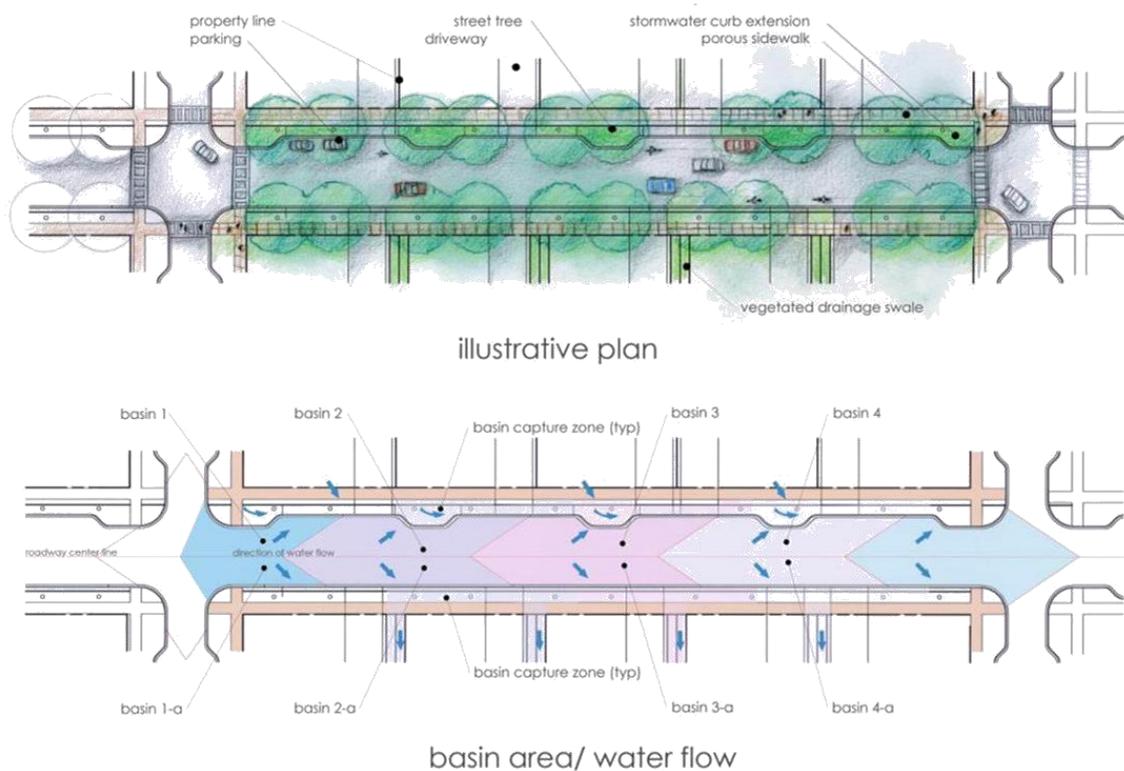


Figure 17. Illustrative Plan for Green Street Design (source: Jacksonville Green Streets Program, Louis Berger Group, Inc.)

Appendix E

Survey Summary

An online survey was prepared as part of this Pender County Collector Street Plan planning effort. The survey was available in both an online and paper format. Pender County planners provided surveys to every church within the study area boundaries, while surveys were also distributed at project meetings. A complete survey summary is provided in this appendix.

It is important to note that the Stantec (the consultant on this plan) IT department is located in Canada and that all paper surveys were entered into the online survey tool using a Stantec computer. For this reason, the list of countries, which appears on the first page of the survey summary, includes Canada.

Survey Report: Pender County Collector Street Plan

VIEWED  489	STARTED  166	COMPLETED  112	COMPLETION RATE  67%	DROP OUTS  54	TIME TO COMPLETE  9 mins
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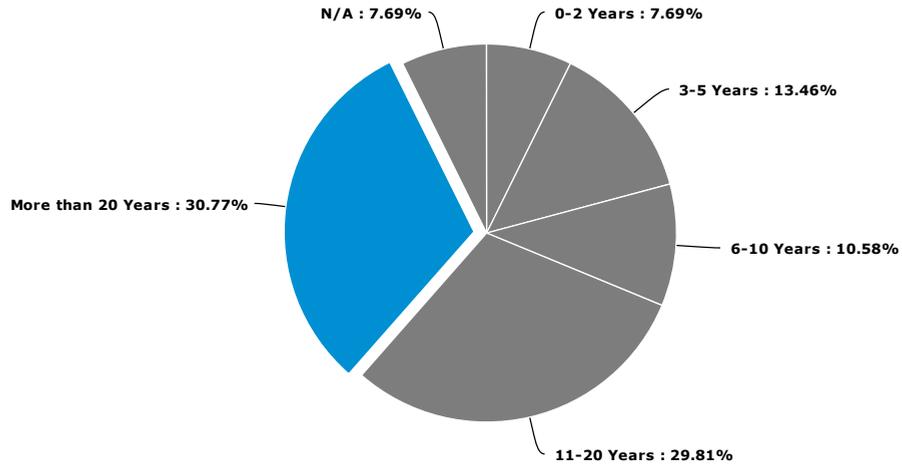


List of countries

US	71.08%
CA	16.27%
Unknown	12.05%
CO	0.60%
Total	100.00%

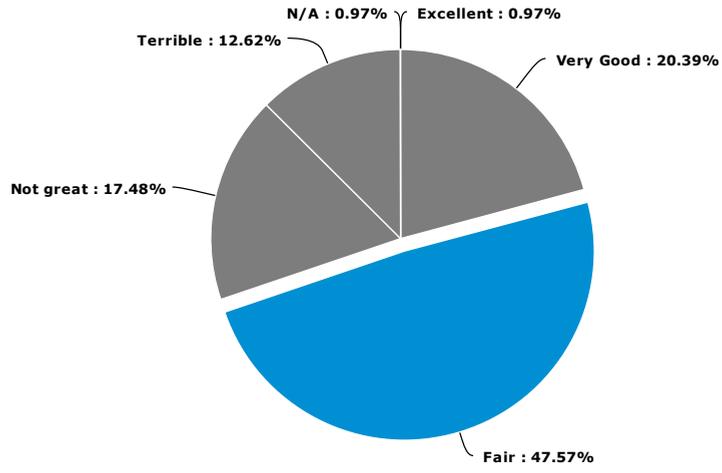
 74% DESKTOP LAPTOP	5%  Windows 8	9%  Mac	86%  Windows (other)	0%  Other
 16% SMARTPHONES	50%  Android	50%  iPhone	0%  Windows 8	0%  Other
 10% TABLETS	82%  iPad	12%  Android	0%  Windows 8	6%  Other

How long have you lived in Pender County?



Answer	Count	Percent	20%	40%	60%	80%	100%
1. 0-2 Years	8	7.69%	<div style="width: 7.69%;"></div>				
2. 3-5 Years	14	13.46%	<div style="width: 13.46%;"></div>				
3. 6-10 Years	11	10.58%	<div style="width: 10.58%;"></div>				
4. 11-20 Years	31	29.81%	<div style="width: 29.81%;"></div>				
5. More than 20 Years	32	30.77%	<div style="width: 30.77%; background-color: #007bff;"></div>				
6. N/A	8	7.69%	<div style="width: 7.69%;"></div>				
Total	104	100%					
Mean: 3.856	Confidence Interval @ 95%: [3.587 - 4.124]		Standard Deviation: 1.396		Standard Error: 0.137		

Overall, how would you rate your experience traveling (by car, bike, or foot) in southern Pender County?

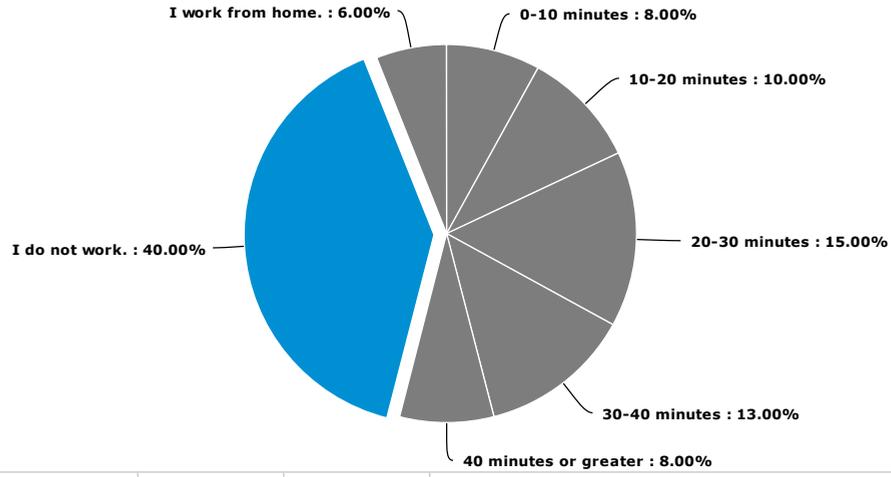


Answer	Count	Percent	20%	40%	60%	80%	100%
1. Excellent	1	0.97%					
2. Very Good	21	20.39%					
3. Fair	49	47.57%					
4. Not great	18	17.48%					
5. Terrible	13	12.62%					
6. N/A	1	0.97%					
Total	103	100%					
Mean: 3.233	Confidence Interval @ 95%: [3.043 - 3.423]		Standard Deviation: 0.982		Standard Error: 0.097		

17140399	09/28/2015	
17140735	09/28/2015	Travelling in PenderCounty is made more difficult because Route 17 is the only main route in the Hampstead area and all roads have to feed into this main thorfare.
17147692	09/29/2015	There are no bike paths nor any walking paths/sidewalks. All roads except Hwy 17 are only 2 lanes. Neighborhood roads frequently have washouts due to lack of maintenance to the existing trenches and swales; and lack of proper sewer. The county owns many right of ways to alienate the rain-run-off issues, but has not made any movement to use these right of ways to help with flooding and washout issues. Traffic stop lights are outdated and only few have been replaced. The bypass should help traffic through town, but the roads and infrastructure in neighborhoods and connecting streets MUST be expanded with bike path lanes to accommodate the growing community.
17148509	09/29/2015	Middle lane is the problem!
17153036	09/29/2015	It is bad because there are too many semi-trucks and cars, especially during rush hours. The lack of deceleration lanes from Rt 17 to strip malls, churches, etc. causes traffic to back up as cars try to leave rt. 17. The increase in housing developments adds to making rt.17 a very dangerous road. The need for a by-pass around Hampstead becomes more of a safety necessity with each new development.
17154054	09/29/2015	Terrible drivers!!!
17154479	09/29/2015	No Bike or foot paths along roads. Nothing connecting the eastern side of hwy 17 with holly shelter for bike riding and walking (this could be easily incorporated into the by pass project.
17165101	09/30/2015	
17169819	10/01/2015	Congestion
17169850	10/01/2015	Too many damn yankees
17175832	10/01/2015	
17181985	10/02/2015	I'm 2/10 mile from I-40.
17182055	10/02/2015	
17182078	10/02/2015	Interstate is good. Bad = 210
17182096	10/02/2015	Route 17 is increasingly busy/dangerous, Difficult to get out of my subdivision onto US 17 as there is not traffic light.
17182125	10/02/2015	Speeding on US 17 make travel uncomfortable
17182138	10/02/2015	It is moderate but population is outpacing infrastructure
17182149	10/02/2015	Highway 17 through Hampstead is only North/South route and is becoming more crowded.
17182173	10/02/2015	
17182184	10/02/2015	Access to major routes (Hwy 17) is very dangerous, also lack of traffic speed enforcement
17182199	10/02/2015	Lack of Signs - Directional - easy to get lost - need turn lanes for schools
17182326	10/02/2015	Poor Roads, Indirect Routes
17182363	10/02/2015	HWY 17 (rush hour) is congested
17182391	10/02/2015	
17186840	10/03/2015	When an accident occurs there is no way to by-pass it as there are few if any roads around the accident.
17187991	10/03/2015	We desperately need a by pass. Was needed 20 years ago.
17191690	10/04/2015	The area we frequently travel in includes unpaved roads that are in poor condition. Not a good statement for the 1000's of visitors that use some of them for shortcuts during the summer and fishing season.
17196433	10/05/2015	Total time from my home to enter US17 corridor is short, including increased time to enter caused by Lowe's shopping center light. (I typically enter US 17 from Longleaf Dr.) Also, time thru Hampstead is typically acceptable. During high school arrival/departure times, traffic gets really heavy.
17245414	10/09/2015	
17426460	10/27/2015	Coastal Pender current size and projected growth in: population, single and multi-family residences, retail stores, other businesses, schools, traffic and plans for even greater residential and commercial size and density, outweigh our ability or willingness to limit this growth that will eventually negatively impact the quality of life that is the primary reason that people choose to locate here. Bigger is not necessarily better. Hampstead is the largest community in Pender County by all measurements. Hwy 17 is the only north-south coastal route in Pender County. Traffic on Hwy 17 is an incompatible mix now and projected to get even worse unless an alternative to Hwy. 17 is provided. The plans for the Hampstead Bypass, or better said "The Wilmington Bypass" must be given higher priority and the necessary funding if we are to avoid the inevitable attractiveness, loss of value and eventual decay of coastal Pender.
17427472	10/27/2015	Not adequate roads for Hampstead area. Need bypass
17427649	10/27/2015	Trouble and danger entering and exiting Route 17.
17428023	10/27/2015	The various roads are not adequate for the huge increase in volume. Clearly, both planning and execution have been well behind the curve. I have lived in many places over the course of my life and the resistance to change and lack of foresight by state and local politicians is the worst I have ever seen.
17430744	10/28/2015	
17431210	10/28/2015	Too much traffic. Too few turn off roads on 17 when entering businesses. A center lane is probably correctly named a "suicide lane". No alternative to going anywhere without being on Hwy 17.
17431201	10/28/2015	There is too much traffic on highway 17 going north and south. It is bumper to bumper during rush hour traffic causing more accidents and other hours during the day it is super busy.
17431117	10/28/2015	THE ROADS WE TRAVEL ARE IN REASONABLE CONDITION
17431429	10/28/2015	
17431432	10/28/2015	Need the bypass. Too many cars on Hwy 17 through Hampstead
17431604	10/28/2015	Traffic lessons as you exit Wilmington.
17432632	10/28/2015	
17432656	10/28/2015	
17433219	10/28/2015	
17658904	11/09/2015	
17692810	11/11/2015	The Highway 17 corridor through the Hampstead/Topsail/Holly Ridge area is a very dangerous road. The need for the bypass, extended out at least past Sea Lawn Cemetery, is essential. That one addition would allow Hampstead to become a village, slow down traffic, and greatly increase safety. ASs it is, the highway is a terror!
17785681	11/17/2015	As long as traffic is flowing it is not bad, however, getting onto 17 can take a while if you are entering from any place that does not have a traffic light. Any type of accident on Hwy. 17 is a traffic nightmare.
17787729	11/17/2015	
17788994	11/17/2015	Highway 17 is a bottleneck and the bypass cannot come soon enough for this Hampstead resident. Turning left onto suicide lanes is dangerous so connector streets leading to stop lights would be great.
17792762	11/17/2015	No shoulders on two lane roads, ex.210 west., no bike lanes, roads with more than 20 homes remain unpaved, "suicide turning lanes",
17804050	11/18/2015	t
17807364	11/18/2015	I live in Hampstead. Driving on US 17 thru Hampstead does make a lot of people fearful. Would like something done to relieve some of that fear.
17850831	11/22/2015	Not enough 4 lane roads
17898997	11/25/2015	Far too much traffic for the roads. Too many left hand turns across busy lanes of traffic, too few traffic lights, too many entrances/exits that require crossing multiple lanes.
17902553	11/25/2015	Roads are not large enough to handle the volume of cars, bikes and foot traffic
17902472	11/25/2015	Traffic continues to get heavier Cannot understand why the Sheriff's office cannot add a couple of Officer's dedicated to catching speeders on Rt17/Rt210 and use the money from fines to more than pay for the officer's pay - seems pretty simple. There is one accident after another on this stretch of road
17903310	11/25/2015	Too much development and way too many stoplights are the cause of the bottleneck in Hampstead. Let's remove the stoplight and put the speed back to 55 to keep traffic moving. STOP all development in the area. We are born and raised here and didn't leave for a reason....we like it the way it was. This is a small rural community and needs to stay

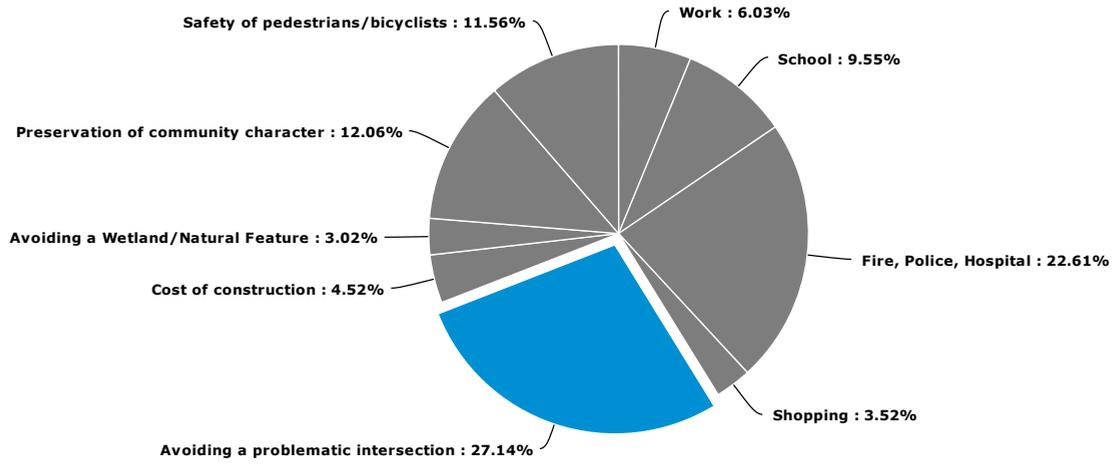
		this way.
17909742	11/26/2015	the county has many rural roads that are inadequate to handle the increasing county population. In many cases it is necessary to travel a circuitous route to reach a destination when headed E/W.
17997353	12/04/2015	My comments are very specific to Olde Point neighborhood in Hampstead; I have thoughts on US17 as well but will not commingle it. I think it is dangerous to be out on the road without a car in Olde Point. I like to run in the morning in Olde Point (Hampstead). It is dangerous though on Country Club Drive and Olde Point Rd. Cars are speeding and many don't really pay attention to pedestrians or bicyclist. I have seen youth trying to run from Topsail High School through Olde Point and I honestly fear for their safety running down on Country Club Drive until they reach side streets. The bad things are: - Speeding cars on Country Club Drive and Olde Point Road - Increased volume of people walking, running, and cycling in the neighborhood over the past 5 years - Soft (muddy), uneven and often not maintained shoulder/verge where the grass is often knee high in summer
18009992	12/06/2015	no bike lanes
18017586	12/07/2015	congestion on US 17 in Hampstead during commute
18017598	12/07/2015	road conditions
18205164	01/04/2016	Good - Traffic is normally light Bad - when accidents happen, they cause traffic jams
18205186	01/04/2016	Places I travel are usually good, however, there are some roads that need repairing.
18233129	01/07/2016	Roads have pot holes, need expansion of 2-lane roads, shoulders are terrible
18307121	01/19/2016	US 17 only route. Collector streets are not the problem. The Hampstead bypass is vastly more important.

How far is your commute to work?



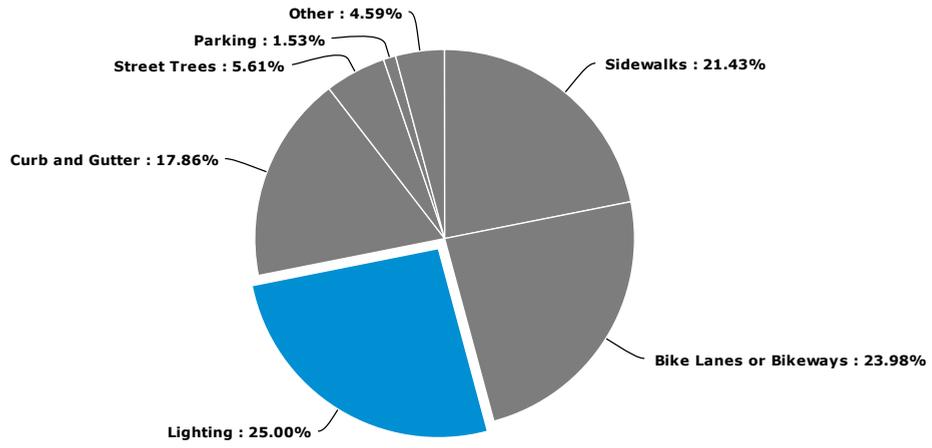
Answer	Count	Percent	20%	40%	60%	80%	100%
1. 0-10 minutes	8	8.00%					
2. 10-20 minutes	10	10.00%					
3. 20-30 minutes	15	15.00%					
4. 30-40 minutes	13	13.00%					
5. 40 minutes or greater	8	8.00%					
6. I do not work.	40	40.00%					
7. I work from home.	6	6.00%					
Total	100	100%					
Mean: 4.470	Confidence Interval @ 95%: [4.114 - 4.826]		Standard Deviation: 1.817		Standard Error: 0.182		

What are the most important considerations when prioritizing which collector streets to construct first? (choose top two)



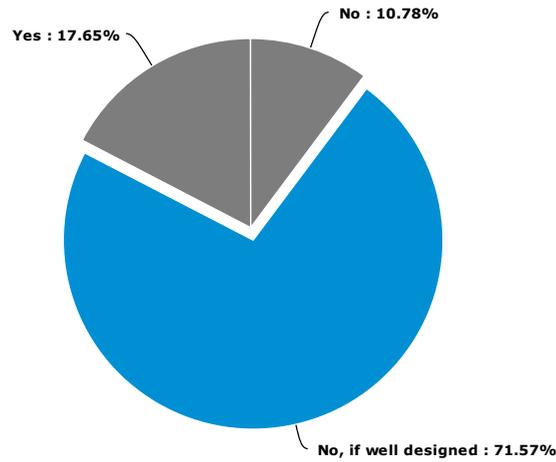
Answer	Count	Percent	20%	40%	60%	80%	100%
1. Work	12	6.03%					
2. School	19	9.55%					
3. Fire, Police, Hospital	45	22.61%					
4. Shopping	7	3.52%					
5. Avoiding a problematic intersection	54	27.14%					
6. Cost of construction	9	4.52%					
7. Avoiding a Wetland/Natural Feature	6	3.02%					
8. Preservation of community character	24	12.06%					
9. Safety of pedestrians/bicyclists	23	11.56%					
Total	199	100%					
Mean: 4.915	Confidence Interval @ 95%: [4.577 - 5.252]		Standard Deviation: 2.426		Standard Error: 0.172		

When designing collector streets, what features should they include? (choose top two)



Answer	Count	Percent	20%	40%	60%	80%	100%
1. Sidewalks	42	21.43%					
2. Bike Lanes or Bikeways	47	23.98%					
3. Lighting	49	25.00%					
4. Curb and Gutter	35	17.86%					
5. Street Trees	11	5.61%					
6. Parking	3	1.53%					
7. Other	9	4.59%					
Total	196	100%					
Mean: 2.852	Confidence Interval @ 95%: [2.637 - 3.067]		Standard Deviation: 1.537		Standard Error: 0.110		

Do you have concerns about how collector streets would impact your community?

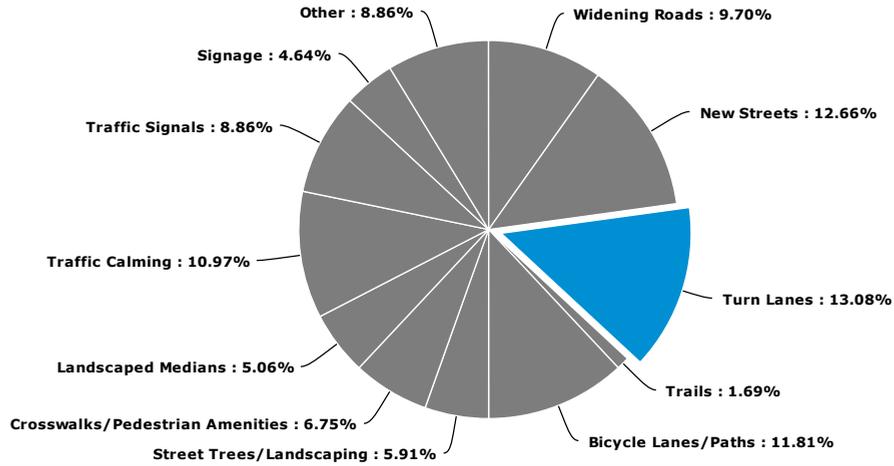


Answer	Count	Percent	20%	40%	60%	80%	100%
1. No	11	10.78%	<div style="width: 10.78%;"></div>				
2. No, if well designed	73	71.57%	<div style="width: 71.57%;"></div>				
3. Yes	18	17.65%	<div style="width: 17.65%;"></div>				
Total	102	100%					
Mean: 2.069	Confidence Interval @ 95%: [1.966 - 2.172]		Standard Deviation: 0.531		Standard Error: 0.053		

Do you have concerns about how collector streets would impact your community? - [Text Data for Yes]

17001137	09/14/2015	Having "collector streets" seems to be a blanket desire without the most important factors in consideration like best traffic patterns, times of use, highest benefit as to where and how many connections.
17121806	09/25/2015	Not clear that Country Club Drive IS a major arterial road as described above "major arterial roads, for example Country Club Drive." It is NOT wide enough to handle the predictable traffic from all the recent construction. If the intent is to lessen traffic on Country Club, then still must include safer intersections than are now provided.
17130239	09/27/2015	I do not want any more traffic in my neighborhood than there already is. We have lots of walkers and runners and too many speeding vehicles now.
17130302	09/27/2015	A great deal of traffic has only Country Club Road as an outlet. Restrict development to road capacity or create more roads.
17131602	09/27/2015	Who decides? Where are they proposed? Why haven't we heard about this before? Many of the considerations in the last question should be considered as a whole plan. Curbs are important and so are bike lanes. Too many people walking and riding in streets is too dangerous.
17136607	09/28/2015	I do not want leeward lane to become a connector street. There are WAY too many kids that live and play on this road. Not to mention the people that walk their dogs in this part of belvedere.
17136409	09/28/2015	Stop the builders from building unless roads are constructed along with them.
17136724	09/28/2015	If they will cause more traffic or more accidents (people turning right on red when there is heavy traffic on right of way - causing right of way vehicles to have to urgently brake.)
17137662	09/28/2015	Not sure what your designation for collector streets is
17169850	10/01/2015	Please don't take down the Ogden OAK!
17182363	10/02/2015	YES - Build Bypass Yesterday
17426460	10/27/2015	costs...DOT does not have a great track record on spending wisely and coastal Pender pays the most taxes.
17431117	10/28/2015	THE HAMPSTEAD "CENTER COMMERCIAL AREA" IS RT 17 AND WE DO NOT WANT THAT BROKEN UP BY HAVING A BYPASS INTERSECTION IN THE MIDDLE OF OUR "TOWN".

If you had \$100,000 to spend on transportation projects in southern Pender County, what would you spend it on? (choose top three)

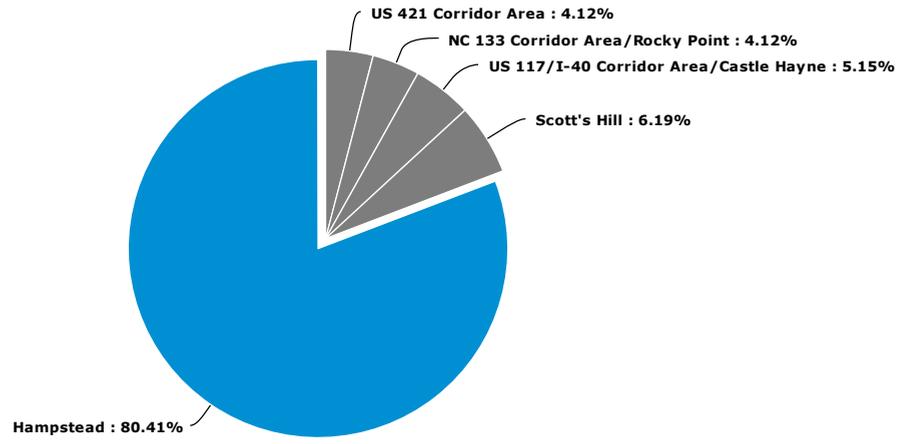


Answer	Count	Percent	20%	40%	60%	80%	100%
1. Widening Roads	23	9.70%					
2. New Streets	30	12.66%					
3. Turn Lanes	31	13.08%					
4. Trails	4	1.69%					
5. Bicycle Lanes/Paths	28	11.81%					
6. Street Trees/Landscaping	14	5.91%					
7. Crosswalks/Pedestrian Amenities	16	6.75%					
8. Landscaped Medians	12	5.06%					
9. Traffic Calming	26	10.97%					
10. Traffic Signals	21	8.86%					
11. Signage	11	4.64%					
12. Other	21	8.86%					
Total	237	100%					
Mean: 6.080	Confidence Interval @ 95%: [5.623 - 6.537]		Standard Deviation: 3.590		Standard Error: 0.233		

If you had \$100,000 to spend on transportation projects in southern Pender County, what would you spend it on? (choose top three) - [Text Data for Other]

17001137	09/14/2015	better timing of signals to match traffic times
17121806	09/25/2015	Ensuring proper drainage -- finding places for water to GO TO from the roadside ditches.
17131479	09/27/2015	\$100K would do very little to address any of these options
17131602	09/27/2015	Incorporate Hampstead!
17135047	09/28/2015	Sheriffs deputies to issue more summons
17136409	09/28/2015	Hampstead bypass road as it would take care of many of the above. Now , not 20 years from now !!!!!
17137226	09/28/2015	I know this would have a higher cost, but convert HWY 17 through Hampstead into a superstreet like Leland has in the Mganolia Waterford areas.
17137596	09/28/2015	deceleration lanes to allow traffic to exit Rt. 17 without causing accidents.
17137662	09/28/2015	roundabouts
17153036	09/29/2015	A by-pass
17182363	10/02/2015	BYPASS
17191690	10/04/2015	improving existing roads
17245414	10/09/2015	Cleaning up trash on exiting roadways and repair of exiting roads, and cutting grass and trees
17426460	10/27/2015	Acquisition of land to build the Hampstead leg of the Wilmington Metro Bypass.
17428023	10/27/2015	Stop playing politics with the by-pass and build the damn thing.
17431201	10/28/2015	Side streets to get to businesses without having to get on highway 17. Drainage is some neighborhoods to prevent flooding.
17433219	10/28/2015	by-pass
17792762	11/17/2015	paving roads with more than 20 homes on it
17902553	11/25/2015	Bypass hampstead
17903310	11/25/2015	Bypass with no center exit. Bypass from one end of Hampstead to the other.
18205164	01/04/2016	Make Topsail Greens Dr a county road.

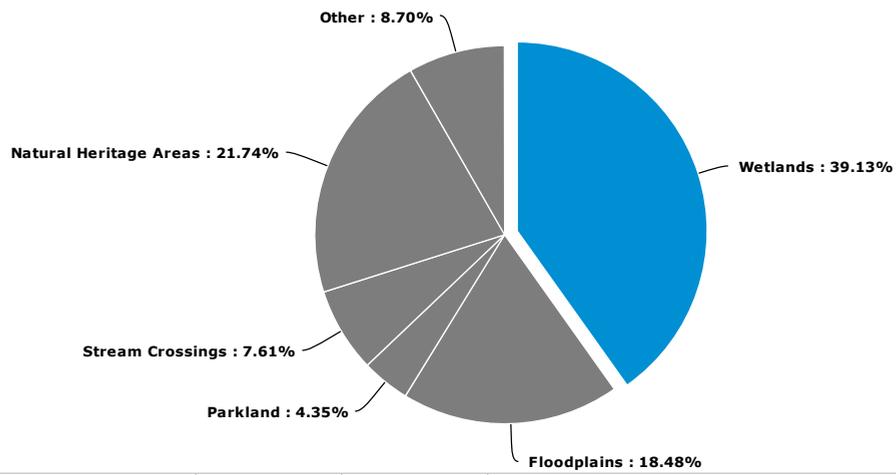
Which areas are most in need of Collector Streets? (choose top choice)



Answer	Count	Percent	20%	40%	60%	80%	100%
1. US 421 Corridor Area	4	4.12%					
2. NC 133 Corridor Area/Rocky Point	4	4.12%					
3. US 117/I-40 Corridor Area/Castle Hayne	5	5.15%					
4. Scott's Hill	6	6.19%					
5. Hampstead	78	80.41%					
Total	97	100%					

Mean: 4.546 Confidence Interval @ 95%: [4.337 - 4.756] Standard Deviation: 1.051 Standard Error: 0.107

Collector Street construction could open new lands to development. Are there any areas that should be preserved from collector street development to avoid subjecting these areas to development pressures? (choose top choice)



Answer	Count	Percent	20%	40%	60%	80%	100%
1. Wetlands	36	39.13%					
2. Floodplains	17	18.48%					
3. Parkland	4	4.35%					
4. Stream Crossings	7	7.61%					
5. Natural Heritage Areas	20	21.74%					
6. Other	8	8.70%					
Total	92	100%					

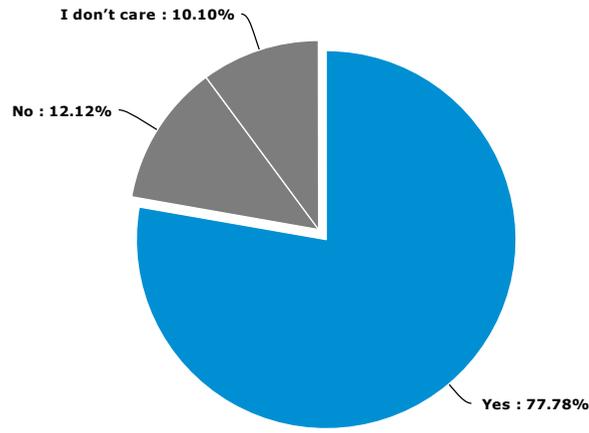
Mean: 2.804

Confidence Interval @ 95%: [2.423 - 3.185]

Standard Deviation: 1.865

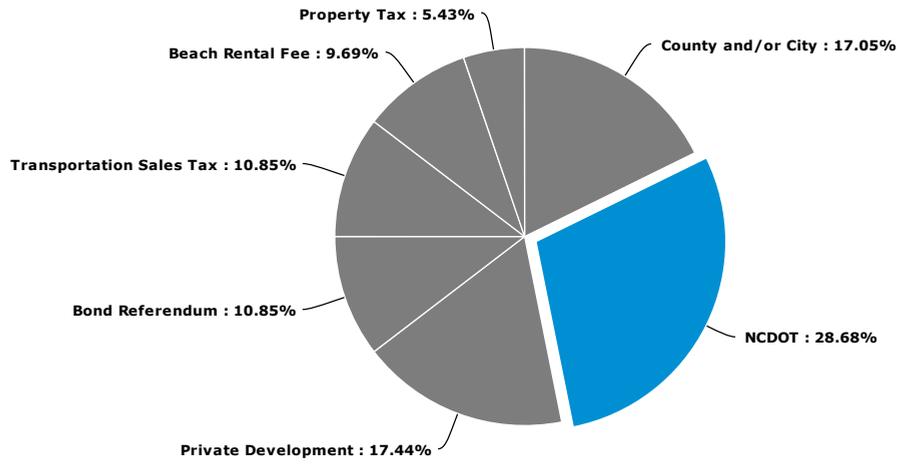
Standard Error: 0.194

If there is a need, do you support connecting new streets to existing roads or dead end streets?



Answer	Count	Percent	20%	40%	60%	80%	100%
1. Yes	77	77.78%					
2. No	12	12.12%					
3. I don't care	10	10.10%					
Total	99	100%					
Mean: 1.323	Confidence Interval @ 95%: [1.195 - 1.452]		Standard Deviation: 0.652		Standard Error: 0.066		

How do we help pay/build new collector streets? (choose all that apply)



Answer	Count	Percent	20%	40%	60%	80%	100%
1. County and/or City	44	17.05%	<div style="width: 17.05%;"></div>				
2. NCDOT	74	28.68%	<div style="width: 28.68%;"></div>				
3. Private Development	45	17.44%	<div style="width: 17.44%;"></div>				
4. Bond Referendum	28	10.85%	<div style="width: 10.85%;"></div>				
5. Transportation Sales Tax	28	10.85%	<div style="width: 10.85%;"></div>				
6. Beach Rental Fee	25	9.69%	<div style="width: 9.69%;"></div>				
7. Property Tax	14	5.43%	<div style="width: 5.43%;"></div>				
Total	258	100%					
Mean: 3.205	Confidence Interval @ 95%: [2.986 - 3.424]		Standard Deviation: 1.795		Standard Error: 0.112		

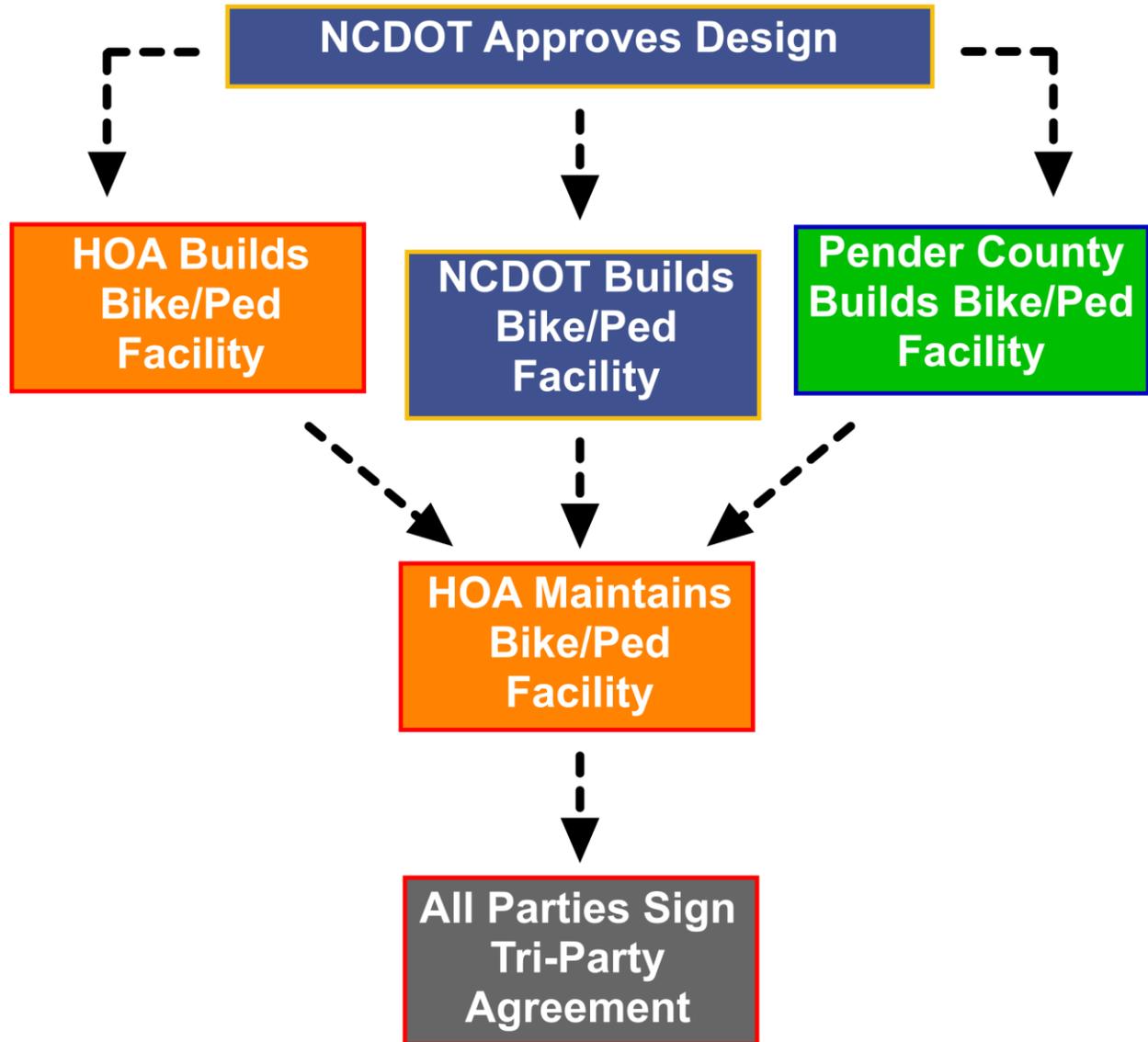
Appendix F

Tri-Party Agreement

A Tri-Party agreement between Pender County, Developers, and Home-Owners Associations (HOAs) was developed as part of this plan. The following flow chart provides further information about this agreement.

Appendix F: Tri-Party Agreement

A Tri-Party agreement between Pender County, Developers, and Home-Owners Associations (HOAs) was developed as part of this plan. The following flow chart provides further information about this agreement.



Description and Purpose

The following three-party agreement was created to serve as a template for NCDOT, a North Carolina county/municipality, and (legal entity) private third-party to enter into an arrangement whereby construction (city/county) and maintenance (private party) would be undertaken to NCDOT standards. This document is intended to serve as a starting point for a final agreement, and was derived from the NCDOT three-party agreement for a right-of-way encroachment. Separate agreements for ROW encroachment, construction, or a more detailed maintenance schedule may supplement this sample agreement. In the event that only two parties (e.g., DOT and HOA) are involved, minimal text changes would be required, as noted in the margins.

Any and all agreements should be reviewed by legal authorities prior to signing.

It may also be the case that the city/county wishes to hold a surety bond provided by the third party in the eventuality that the private third party is unable or unwilling to meet their maintenance responsibilities.

Additional comments are provided in the margins of this template.

ROUTE _____ PROJECT _____ COUNTY OF _____

DEPARTMENT OF TRANSPORTATION

-AND-

**THREE PARTY
AGREEMENT FOR
ACTIVE**

Text in the prelude sections would need to be modified in the event that there are only two parties signing; remove second set of fields at left and the third-party description lines below.

-AND-

**TRANSPORTATION
FACILITY ON OR NEAR**

**PRIMARY AND
SECONDARY ROAD**

THIS AGREEMENT, made and entered into this the _____ day of _____, 20____, by and between the Department of Transportation, party of the first part; and _____ party of the second part; and _____ party of the third part,

WITNESSETH

THAT WHEREAS, the party of the second part desires to develop a public [sidewalk/greenway/trail] named [name of sidewalk/greenway/trail], hereafter referred to as the Facility, on or near the right-of-way of the public road designated as:

Route(s) _____, located _____

with the construction and/or erection of: _____

WHEREAS, it is to the material advantage of the party of the second part to effect the Facility, and the party of the first part in the exercise of authority conferred upon it by statute, is willing to permit the encroachment within the limits of the right of way as indicated, subject to the conditions of this agreement;

NOW, THEREFORE, IT IS AGREED that the party of the first part hereby grants to the party of the second part the right and privilege to construct the Facility as shown on attached plan sheet(s), specifications and special provisions which are made a part hereof upon the following conditions, to wit:

That the installation, operation, and maintenance of the above described facility will be accomplished in accordance with the party of the first part's latest policies, guidance and construction standards, and such revisions and amendments thereto as may be in effect at the date of this agreement. Information as to these policies and procedures may be obtained from the Division Engineer of the party of the first part.

That the said party of the second part binds and obligates himself to install and maintain the Facility in such safe and proper condition that it will not interfere with or endanger travel upon said highway, nor obstruct nor interfere with the proper maintenance thereof, to reimburse the party of the first part for the cost incurred for any repairs or maintenance to its roadways and structures necessary due to installation and existence of the facilities of the party of the second part, and if at

*Party of the First Part:
NCDOT
Party of the Second Part:
County/City that is
constructing the facility
Party of the Third Part:
HOA or other licensed,
legal entity that will
assume maintenance
upon completion*

*City/County builds the
Facility to standards
maintained by NCDOT*

any time the party of the first part shall require the removal of or changes in the location of the said facilities, that the said party of the second part binds himself, his successors and assigns, to promptly remove or alter the said facilities, in order to conform to the said requirement, without any cost to the party of the first part.

That the party of the second part agrees to provide during construction and any subsequent maintenance proper signs, signal lights, flagmen and other warning devices for the protection of traffic in conformance with the latest Manual on Uniform Traffic Control Devices for Streets and Highways and Amendments or Supplements thereto. Information as to the above rules and regulations may be obtained from the Division Engineer of the party of the first.

That the party of the second part hereby agrees to indemnify and save harmless the party of the first part from all damages and claims for damage that may arise by reason of the installation and maintenance of Facility.

That the party of the second part agrees to restore all areas disturbed during installation and maintenance to the satisfaction of the Division Engineer of the party of the first part. The party of the second part agrees to exercise every reasonable precaution during construction and maintenance to prevent eroding of soil; silting or pollution of rivers, streams, lakes, reservoirs, other water impoundments, ground surfaces or other property; or pollution of the air. There shall be compliance with applicable rules and regulations of the North Carolina Division of Environmental Management, North Carolina Sedimentation Control Commission, and with ordinances and regulations of various counties, municipalities and other official agencies relating to pollution prevention and control. When any installation or maintenance operation disturbs the ground surface and existing ground cover, the party of the second part agrees to remove and replace the sod or otherwise reestablish the grass cover to meet the satisfaction of the Division Engineer of the party of the first part.

That the party of the second part agrees to have available at the construction site, at all times during construction, a copy of this agreement showing evidence of approval by the party of the first part. The party of the first part reserves the right to stop all work unless evidence of approval can be shown.

Provided the work contained in this agreement is being performed on or within the right-of-way of a completed highway open to traffic; the party of the second part agrees to give written notice to the Division Engineer of the party of the first part when all work contained herein has been completed. Unless specifically requested by the party of the first part, written notice of completion of work on highway projects under construction will not be required.

That in the case of noncompliance with the terms of this agreement by the party of the second part, the party of the first part reserves the right to stop all work until the facility has been brought into compliance or removed from the right of way at no cost to the party of the first part.

That it is agreed by both parties that this agreement shall become void if actual construction of the work contemplated herein is not begun within one (1) year from the date of authorization by the party of the first part unless written waiver is secured by the party of the second part from the party of the first part.

During the performance of this contract, the second party, for itself, its assignees and successors in interest (hereinafter referred to as the "contractor"), agrees as follows:

- a. Compliance with Regulations: The contractor shall comply with the Regulations relative to nondiscrimination in Federally-assisted programs of the U. S. Department of Transportation, Title 49, Code of Federal

City/County is responsible for demolition and removal of the Facility if it ever fails to meet requirements

City/County is responsible for damages or disturbances to the natural environment incurred during construction

NCDOT can stop work in the event of noncompliance

City/County has to start work within one year of the date of the agreement

City/County agrees to comply with regulations for procurement of services

Regulations, Part 21, as they may be amended from time to time, (hereinafter referred to as the Regulations), which are herein incorporated by reference and made a part of this contract.

- b. Nondiscrimination: The contractor, with regard to the work performed by it during the contract, shall not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor shall not participate either directly or indirectly in the discrimination prohibited by Section 21.5 of the Regulations.
- c. Solicitations for Subcontracts, including Procurements of Materials and Equipment: In all solicitations either by competitive bidding or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials or leases of equipment, each potential subcontractor or supplier shall be notified by the contractor of the contractor's obligations under this contract and the Regulations relative to nondiscrimination on the grounds of race, color, or national origin.
- d. Information and Reports: The contractor shall provide all information and reports required by the Regulations, or directives issued pursuant thereto, and shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Department of Transportation [or the Federal Highway Administration] to be pertinent to ascertain compliance with such Regulations or directives. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish this information, the contractor shall so certify to the Department of Transportation [or the Federal Highway Administration] and shall set forth what efforts it has made to obtain the information.
- e. Sanctions for Noncompliance: In the event of the contractor's noncompliance with the nondiscrimination provisions of this contract, the Department of Transportation shall impose such contract sanctions as it or the Federal Highway Administration may determine to be appropriate, including, but not limited to,
 - (1) withholding of payments to the contractor under the contract until the contractor complies, and/or
 - (2) cancellation, termination or suspension of the contract, in whole or in part.
- f. Incorporation of Provisions: The contractor shall include the provisions of paragraphs "a" through "f" in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Regulations, or directives issued pursuant thereto. The contractor shall take such action with respect to any subcontract or procurement as the Department of Transportation [or the Federal Highway Administration] may direct as a means of enforcing such provisions including sanctions for noncompliance: Provided, however, that, in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or supplier as a result of such direction, the contractor may request the Department of Transportation to enter into such litigation to protect the interests of the State, and, in addition, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

City/County agrees to comply with regulations for procurement of services (continued)

The contractor, which is presumably familiar with NCDOT [or FHWA , if appropriate] regulations and requirements, has to adhere to those requirements as do subcontractors.

That when title to the subject that constitutes the aforesaid Facility passes from the party of the second part and vests in the party of the third part, the party of the third part agrees to assume all responsibilities and rights and to perform all obligations as

agreed to herein by the party of the second part in perpetuity. The First Party and Second Party agree that, following Facility completion and acceptance by the First Party and Second Party, the Facility shall be included as a component of the [Third Party Development Name]. The Facility will be owned and managed by, and the responsibility of, the Third Party, including operation, maintenance, and repair. Such maintenance and repair includes [mowing minimum of four times per year, landscaping, pavement / paver repairs, edge trees, trash/litter removal, and repair replacement of signage, materials, benches, markings, and other appurtenances.] All appropriate signage installed for the Facility shall include acknowledgement of the Second Party's participation, by name, in the Facility.

Upon completion of construction, all of the responsibilities assigned to the City/County are turned over to the Third Party (HOA or other entity) including all maintenance; this paragraph is revised in the event that there are only two parties in the agreement.

R/W (166) : Party of the Second Part certifies that this agreement is true and accurate copy of the form

R/W (166) incorporating all revisions to date.

IN WITNESS WHEREOF, each of the parties to this agreement has caused the same to be executed the day and year first above written.

DEPARTMENT OF TRANSPORTATION

BY:

DIVISION ENGINEER

WITNESS:

Second Party

WITNESS:

Third Party

