

Green Network Master Plan Framework Guide

Guide to Connecting People to Nature

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1: Overview

Introduction

Located in the southern coastal plain of North Carolina in northern Brunswick County, the Town of Leland is conveniently situated between the City of Wilmington and the Brunswick County Beaches. The Town, comprised of over 27 square miles, continues to rapidly grow in population, expand physically, and is among the fastest growing municipalities in North Carolina. Leland positions itself as being an attractive and highly desired community for residents who are seeking a more affordable, relaxed, and slower paced lifestyle surrounded by ample cultural, environmental, and recreational opportunities.

Leland is located along the scenic Brunswick River, just ten minutes west of historic downtown Wilmington. The Town was incorporated in 1989, and since that date, has experienced tremendous growth. According to census information from the American Community Survey, Leland jumped from a population of 11,925 in 2010, to an estimated 24,473 in 2022, over a 105 percent increase. Growth within the Town and within the Leland 2045 planning area has come mainly in the form of planned unit developments, which are primarily single-family residential subdivisions, but also includes multi-family residential developments, a mixture of commercial uses, and the expansion of commercial and industrial uses. This development balances the conservation and preservation of the Town's environmentally sensitive areas, which include forests, isolated wetlands, streams, wetlands, and waterways such as the Brunswick River, and Sturgeon, Jackeys, Little Mallory, Mallory Creek, Hook, and Town Creeks. The planning area extends along US Highway 74 and NC Highway 87, down to Town Creek, and east to the Brunswick River, Cape Fear River, and Eagles Island.

Navigating the influx of development while preserving and maintaining the environmental integrity of the surrounding area is a key goal of the Town. To manage the Town's explosive growth, Leland adopted its comprehensive plan, Leland 2045, which seeks to guide the development of the Town while maintaining its attractiveness, the quality of life, and the environmental integrity of the surrounding area. One goal of that plan is to develop a green network. This document, titled the Green Network Master Plan Framework Guide, seeks to advance that goal, emphasizing the environmentally focused strategies, actions,

and priorities as identified within the Leland 2045 Comprehensive Plan. This document serves to support proactive, responsible, and sustainable planning by promoting the connectivity of residents and visitors of Leland to nearby environmental resources and recreational opportunities within the planning area.

About the Leland Green Network

The Town of Leland Green Network is the culmination of shared goals and visions: To protect and maintain the health and ecological function of the Town's natural resources that are fundamental to the lifestyle, economy, well-being, and resilience of the community.

To fulfill that aspiration, the development of this plan followed these guiding principles:

1. We value our unique and complex natural environment as a source of life, recreation, economy, culture, and sense of place.
2. Our natural environment supports and defines the location of our built environment and is essential to our economy and way of life.
3. Our development is done in balance with preserving our natural systems.
4. We leverage environmental preservation and conservation to build resiliency and hazard mitigation.
5. We take efforts to preserve our critical natural environments so that future generations can enjoy them.
6. We promote safe and sensitive access to our open spaces and waterways.
7. We value our cultural history and respectfully promote it whenever we can.
8. We value walkable and bikeable connections between neighborhoods to promote a sense of community and belonging.
9. Our neighborhoods have accessible parks, open spaces, and places to gather, which provides a place of neighborhood identity.
10. We support the growth of environmentally friendly infrastructure that protects our air, water, comfort, and landscape.

The Green Network initiative is rooted in Leland 2045 Comprehensive Plan which integrates existing plans that were created to advance the quality of Leland's growth.

2: Town Profile and Components

Environmental Conditions

I. Summary of Environmental Conditions

Leland’s planning area is located in an environmentally diverse and ecologically sensitive region. Within the area, are multiple managed and natural areas, as identified by the North Carolina Natural Heritage Program (NCNHP) and a variety of wildlife habitats filled with biodiversity. Physical characteristics of Leland also include sizable amounts of vacant and undeveloped parcels, an extensive tree canopy, and existing active and open spaces. It is important to take these features into account when developing the Green Network.

II. Managed and Natural Areas

Leland has multiple Managed and Natural Areas within the municipality. Per the NCNHP, Managed Areas are a diverse collection of properties and easements where conservation of biodiversity and ecosystem function are among the goals of the land manager. The Managed Areas within the Town consist of preserved areas, areas designated for conservation, private easements, and other protections that are maintained at the federal, state, and local governmental level. Privately-owned Managed Areas exist as well.



Natural Areas are also present throughout the area. Natural Heritage Natural Areas (NHNAs) are defined as “site[s] of special biodiversity significance due to the presence of rare species, unique natural communities, important animal assemblages, or other ecological features.” NHNAs are extremely important to the conservation of Leland’s biodiversity and natural resources. Some of these sites are of global significance for biodiversity. These sites are great priorities for new natural area parks and conservation lands.

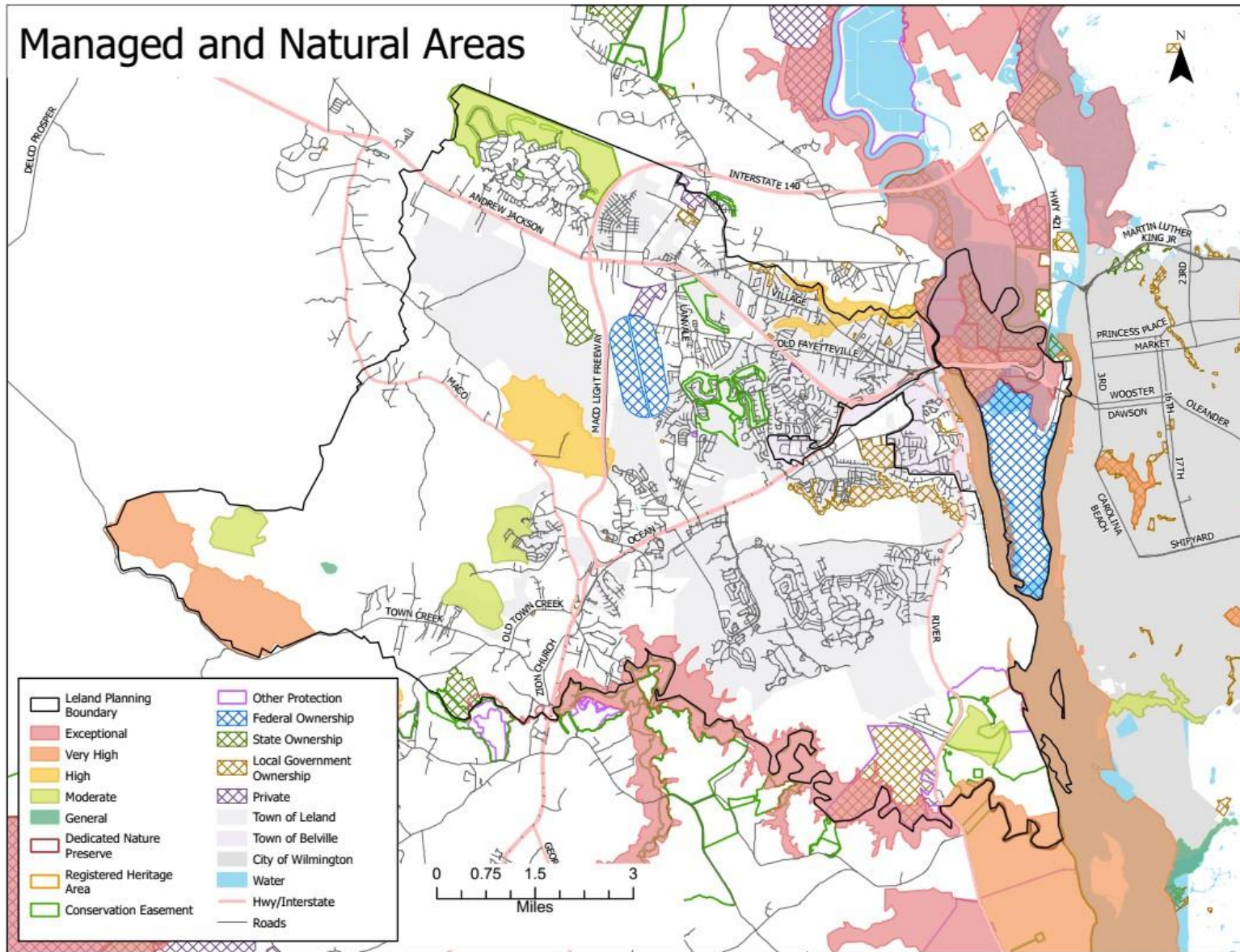
The Town of Leland has the following NHNAs¹ within its planning area, and their associated rating:

Natural Heritage Natural Area	Rank
Sturgeon Creek Tidal Wetlands	High
Brunswick River/Cape Fear River Marshes	Exceptional
Battle Royal Bay	High
Rattlesnake Branch Sandhills	Moderate
Goose Pond Limesinks	Very High
Little Green Swamp	Moderate
Henrytown Savanna	Moderate
Rabontown Limesinks	Very High
Turkey Branch Sandhill	General
Town Creek Marshes and Swamp	Exceptional
Alligator Branch Sandhill and Flatwoods	Moderate
Pleasant Oaks/Goose Landing Plantations	Very High
CPF/Lower Campe Fear River Aquatic Habitat	Very High
Clarendon Plantation Limesinks	Moderate
CPF/Town Creek Aquatic Habitat	Exceptional

The Managed Areas and the NHNAs that are present within the Town of Leland and within the planning area are displayed within *Figure 1: Managed and Natural Areas*.

¹ North Carolina Natural Heritage Program. <2024>. Natural Heritage Data Explorer [web application]. NCDNCR, Raleigh, NC. Available at www.ncnhp.org. (Accessed: <March 15, 2024>).

Figure 1: Managed and Natural Areas.



III. Biodiversity and Wildlife Habitats

Leland's residents share their community with many species of plants and wildlife. The southeastern coastal plain of North Carolina contains an abundance of biodiversity: there are rare, threatened, and endangered wildlife species that rely on a healthy ecosystem for survival and reproduction.² Additionally, rare, threatened, and endangered plant species are known to occur in the area. Brunswick County is home to nine federally endangered wildlife species, one proposed endangered species, and eight federally threatened species, all of which have the potential to occur in Leland, along with other protected species such as migratory birds and bald eagles. Federally listed species are protected by the Endangered Species Act. The US Fish and Wildlife Service Information for Planning and Consultation application (IPaC: Home (fws.gov)) is available to project planners for use early in site planning. The IPaC tool indicates whether the site may or may not have federally protected species and habitats. Project planners can generate an official report from the US Fish and Wildlife Service to aid in their planning and permitting processes. Species have also been classified both at the federal and the state level regarding vulnerability to extinction and rarity.

The following habitats are present locally and may host these threatened species:

Forested Floodplains and Riverine Aquatic Communities

- Forested Floodplains and Riverine Aquatic habitat types are associated with and adjacent to blackwater and brownwater river systems.
- Forests can be composed of flood tolerant tree species, including cypress species and many types of hardwoods. Wading bird rookeries of heron and egret species are reliant on these floodplain systems.
- Rivers and streams are important habitats for aquatic animals, as well as species that use aquatic habitat during part of their life cycle (like amphibians). Semi-aquatic wildlife such as otters and beavers rely on this habitat for their food base.



Photo courtesy of NCWRC

² See Appendices 1 & 2 for a list of rare, threatened, and endangered species likely to occur in Leland.

In the Cape Fear River near Leland, short-nosed sturgeon (*Acipenser brevirostrum*, Federally and State Endangered) are known to be present.

Wetland Habitats

- **Tidal swamp forest and wetlands:** These habitats are found along rivers, where flooding is caused by tides. Tidal wetlands occur along the Brunswick and Cape Fear rivers, and Sturgeon Creek and Town Creek. These areas provide important habitat for American alligator, wading and shore birds, like bitterns and rails, and nursery habitat for marine species, like flounder, crab, and shrimp.
- **Non-Alluvial Mineral Wetlands:** Mineral wetlands that are not associated with rivers and streams are found in the Coastal Plain where high water tables are present. Historically, most of these wetlands were drained for farmland or forestry since they can support heavy machinery better than peatland, and mineral soils are especially fertile. Rafinesque's big-eared bat, (*Corynorhinus rafinesquii*, Federally Threatened), roosts in large hollow trees found in these wetland habitats.
- **Pocosins:** Pocosins are shrub dominated habitats occurring on peat-filled Carolina Bays and depressions. Many species of wildlife use this habitat, including a variety of neo-tropical migratory birds. Little Green Swamp NHNA is a local example.
- **Wet pine savannas:** Wet pine savannas are mineral wetlands characterized by an open canopy of pine and an understory of wiregrass, herbs, or shrubs. The Carolina gopher frog (*Rana capito capito*, State Threatened) and the pine barrens treefrog (*Hyla andersonii*; State Rare) use this habitat.



Photo courtesy of NCWRC



Photo courtesy of NCWRC

- **Vernal pools:** Vernal pools are isolated, usually small wetlands that form in the late winter and spring and provide critical breeding habitat for imperiled amphibians and reptiles, like Mabee’s salamanders (*Ambystoma mabeei*) and chicken turtles (*Deirochelys reticularia*). Many species that use these wetlands also need large buffers of upland habitat to complete their life cycle requirements.



Photo courtesy of the NCWRC

Upland Habitats

- **Longleaf pine:** These communities are one of the most endangered habitats in the United States, due to development and lack of management through controlled burns. Species that depend on longleaf pine forest include many rare species that depend on natural fire regimes such as the Bachmann’s sparrow (*Peucaea aestivalis*), the fox squirrel (*Sciurus niger*, State Rare); and red-cockaded woodpecker (*Dryobates borealis*, Federal and State Endangered).



Photo courtesy of NCWRC

- Mesic forest occurs on moist upland soils and is composed of hardwoods. The canebrake rattlesnake (*Crotalus horridus*) is a species of concern that lives in mesic forests.
- Early successional habitats are areas dominated by grasses, flowers, and other herbaceous vegetation. They may also have shrubs and saplings. They are often found at the edge of agriculture fields and woodlands. Naturally, these habitats are formed by fires, disease, or storms, or due to soil types. Most often they are maintained by mowing or prescribed fire. Grassland birds, like Eastern meadowlark (*Sturnella magna*) and Henslow’s sparrow (*Centronyx henslowii*), and small mammals thrive in this habitat.

IV. Environmental Composite Map

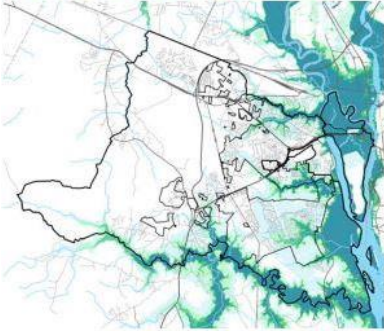
As part of the Leland 2045 plan, Leland’s natural resources and environmental constraints were mapped and prioritized based on the environmental composite framework to determine areas best suited for protection and areas that are more suited for development. The framework included following community priorities:

| HYDROLOGIC SOIL GROUPS



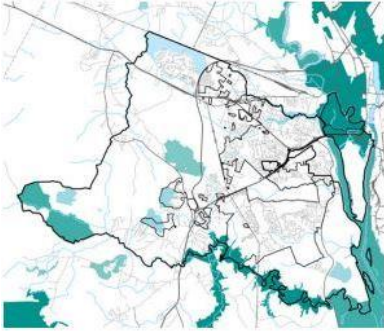
▪ *Hydrological Soil Groups.* Per the USDA National Resources Conservation Service (NRCS), the definition of a hydric soil is a “soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part.”

| STORM SURGE (SLOSH MODEL)



▪ *Storm Surge.* The SLOSH model is a numerical model used by the National Weather Service to compute storm surge. Storm surge is defined as the abnormal rise of water generated by a storm, over and above the predicted astronomical tides.

| NATURAL AREAS



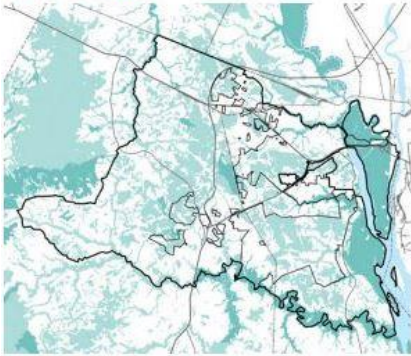
▪ *Natural Areas.* As mentioned in Section III, Natural Areas are defined as “a site of special biodiversity significance due to the presence of rare species, unique natural communities, important animal assemblages, or other ecological features.” NHNAs are the highest priority for protection due to their documented occurrences of multiple rare species or contain the highest quality of ecosystems.

FLOOD HAZARD ZONES (FEMA)



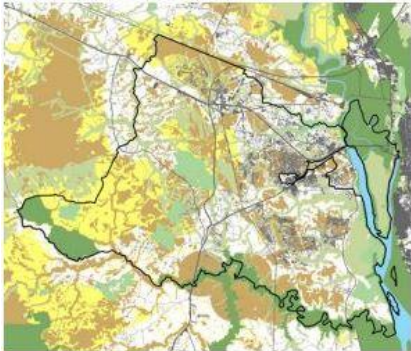
▪ *Flood Hazard Zones.* The planning area's most prominent hazard is flooding caused by rain events and storm surge. The flooding is concentrated in the stream margins along Sturgeon, Jackey's, Mallory, Town, and Hood Creeks, as well as the Brunswick and Cape Fear River. These areas are based on the most current FEMA Flood Insurance Rate Maps (FIRMs).

WETLANDS



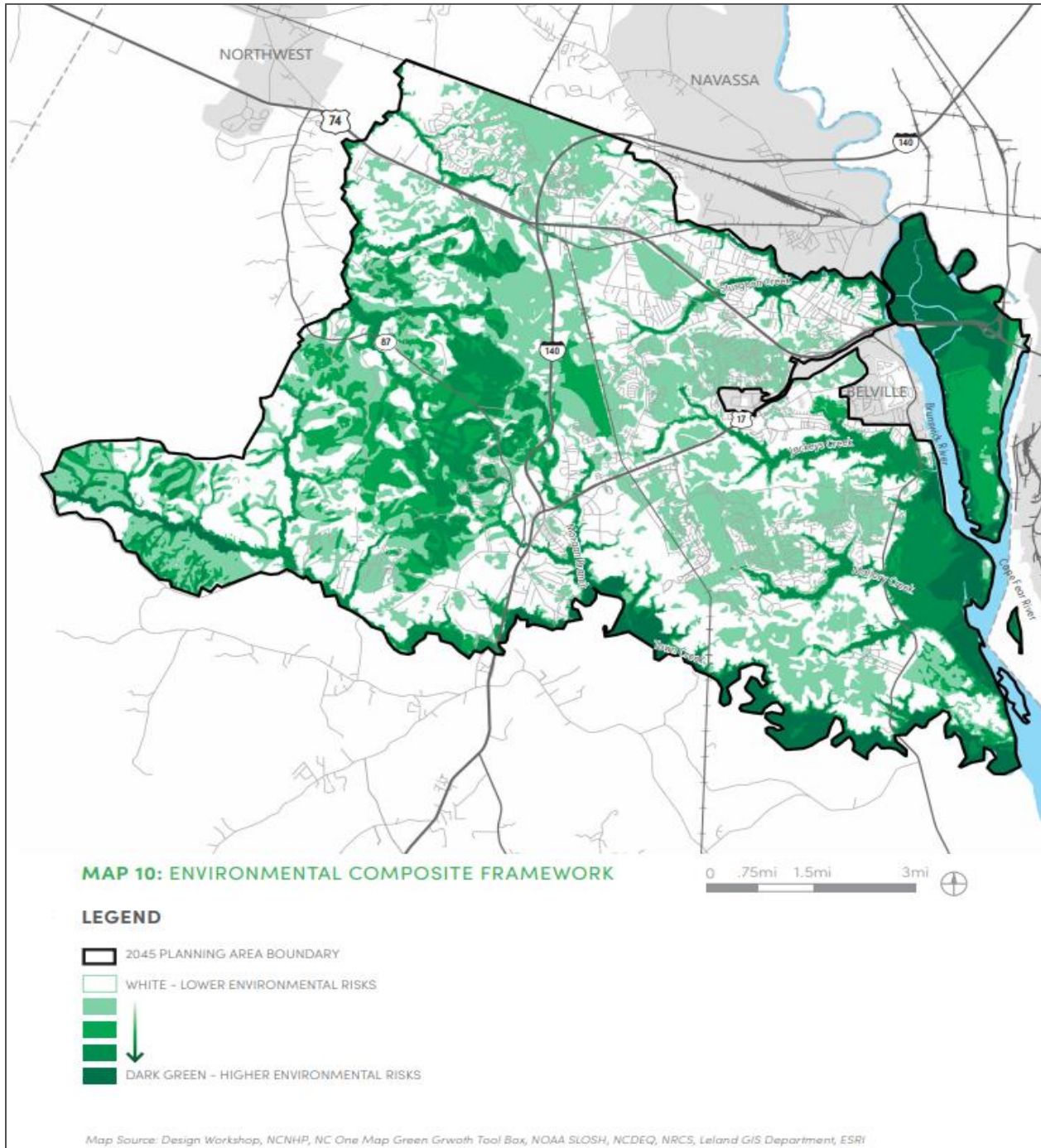
▪ *Wetland Function Assessment.* NC-CREWS, or the North Carolina Coastal Region Evaluation of Wetland Significance, is a watershed-based wetland functional assessment model that uses Geographic Information Systems (GIS) software and data to assess the level of water quality, wildlife habitat, and hydrologic functions of individual wetlands.

BIODIVERSITY + WILDLIFE



▪ *Biodiversity and Wildlife Habitat Assessment.* The Biodiversity and Wildlife Habitat Assessment is a map that represents the highest priority areas for conservation of wildlife habitat and biodiversity in North Carolina.

Figure 2: Environmental Composite Map.



The components of the Environmental Composite Map were weighted and distributed in a particular methodology. This methodology does not yield the higher environmental risks associated with the NHNAs that are located within the planning area. These areas carry an added element of sensitivity and would be prudent to conserve, given the species that have been identified within these areas.

Physical Conditions

V. Vacant and Undeveloped Properties

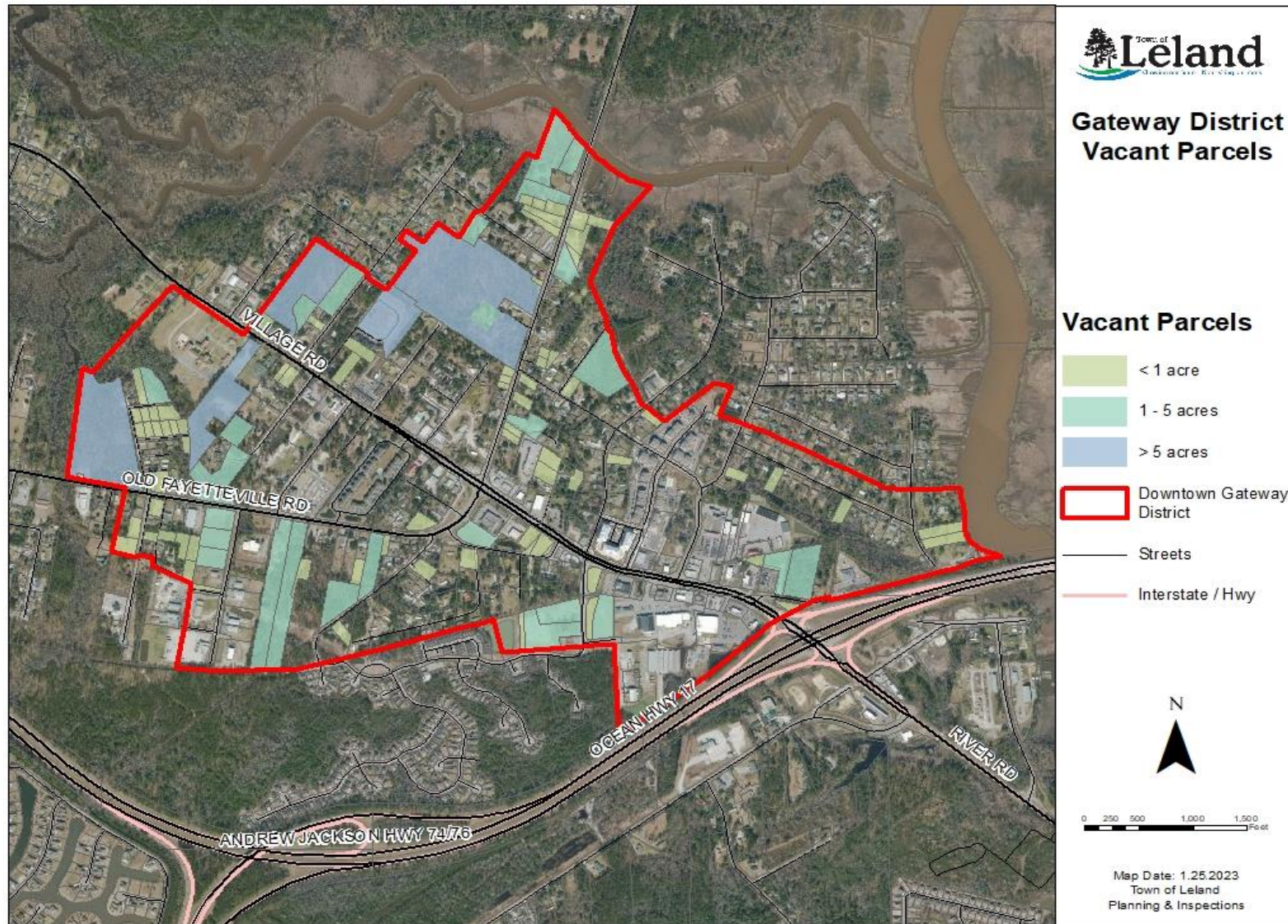
Vacant lots and undeveloped properties are spread throughout the planning area, but some areas have higher concentrations than others. These areas of higher concentration provide an opportunity to consider rehabilitation, designate areas for conservation, and promote greening strategies that support the community and connectivity.

Where vacant lots currently exist or are created through demolition, an opportunity is created for residents, community groups, Town agencies, or non-profits to create new greenspaces, either permanently or as a temporary holding strategy for future development or preservation opportunities. Identifying key vacant parcels that, prior to development taking place, can serve as vital pieces into an integrated network can be a proactive and effective tactic in creating a connected system. Having parcels pre-determined for acquisition can serve as a piece-meal method in creating a connected system.

While the Town is greater than 27 square miles, development has not been uniform, and the presence of vacant lots is more concentrated than others depending on locality within the Town, and the planning area as a whole. Also, while larger undeveloped tracts are primarily found in the periphery of the Town, large swaths of undeveloped land can be found in more centrally located areas. These areas are typically of higher environmental value and located along the major creeks (Jackeys, Sturgeon, etc.), and may also be subject to development regulations, such as CAMA Areas of Environmental Concern or 404 Wetlands, further restricting development. Flood Damage Prevention Ordinance requirements further limit the amount of development within applicable portions of the area.

Identifying all undeveloped and vacant parcels Townwide has not been conducted, however, an analysis for the Gateway District was conducted in 2023. Field observations aided in the development of an inventory map of the Gateway District, identifying vacant parcels and classified based on parcel size within the district. This map is shown in *Figure 3: Gateway District Vacant Parcels*. By identifying environmentally sensitive areas, protected or conservation areas, areas unsuitable for development, and recreational points of interest within the area of study, then parcels can be proactively identified to be a part of the Green Network.

Figure 3: Gateway District Vacant Parcels

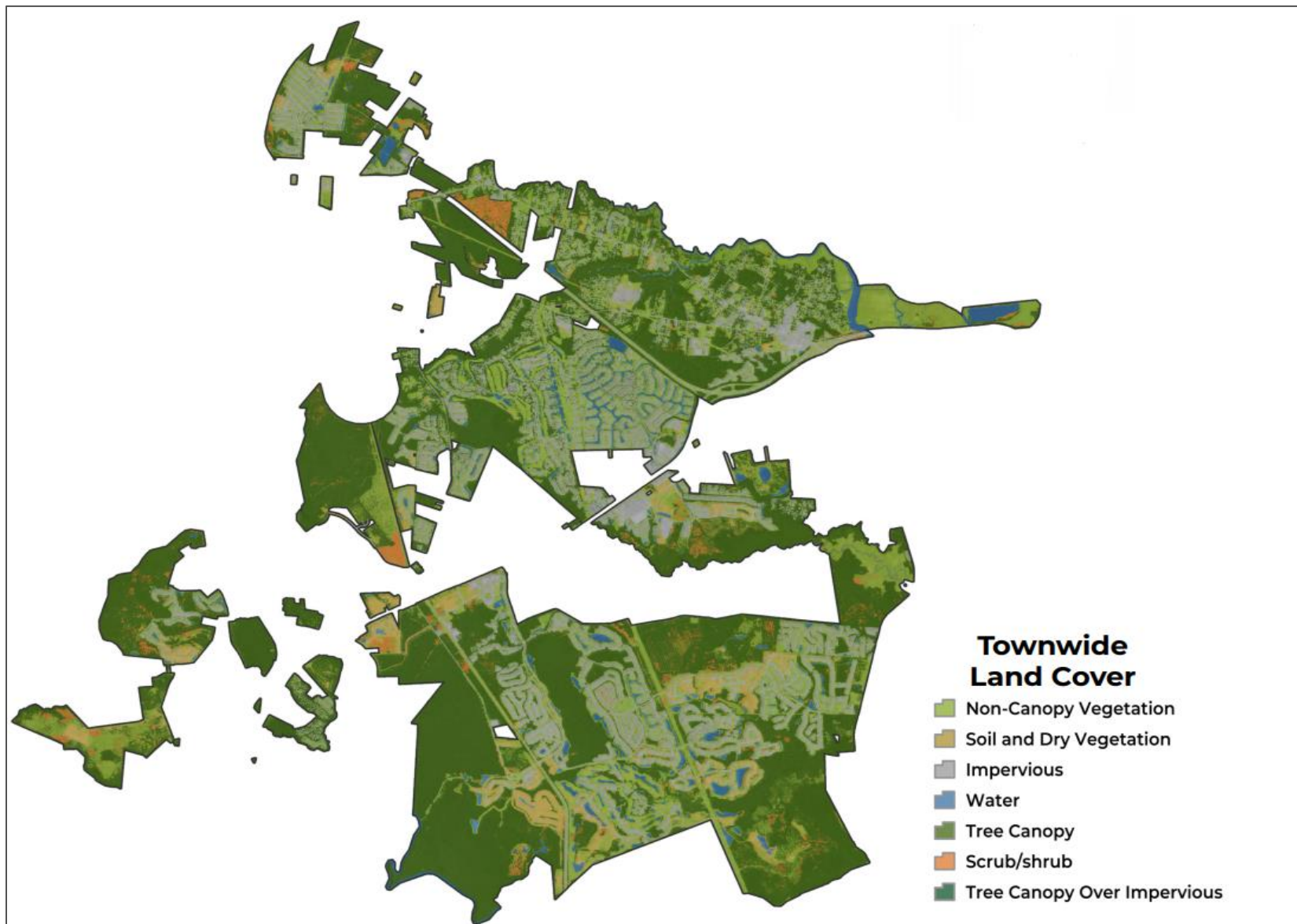


VI. Tree Canopy

As one of the fastest growing towns in southeastern North Carolina, the landscape of the planning area is quickly changing. The canopy cover in Leland is a valuable asset providing residents and visitors with many environmental, social, and economic benefits. This assessment mapped tree canopy cover, possible planting area (PPA), and tree canopy change from 2014 to 2020 and analyzed how they are distributed throughout Leland's town boundary, zoning, right-of-way (ROW), and census block groups.

The 7,369 acres of tree canopy in Leland provide ecosystem benefits valued at over \$2.6 million per year through air quality improvements, stormwater runoff prevention, and carbon sequestration. Results from this assessment found that canopy cover changed from 48% to 51% from 2014 to 2020 (+3% or 459 acres) using the current town boundary.

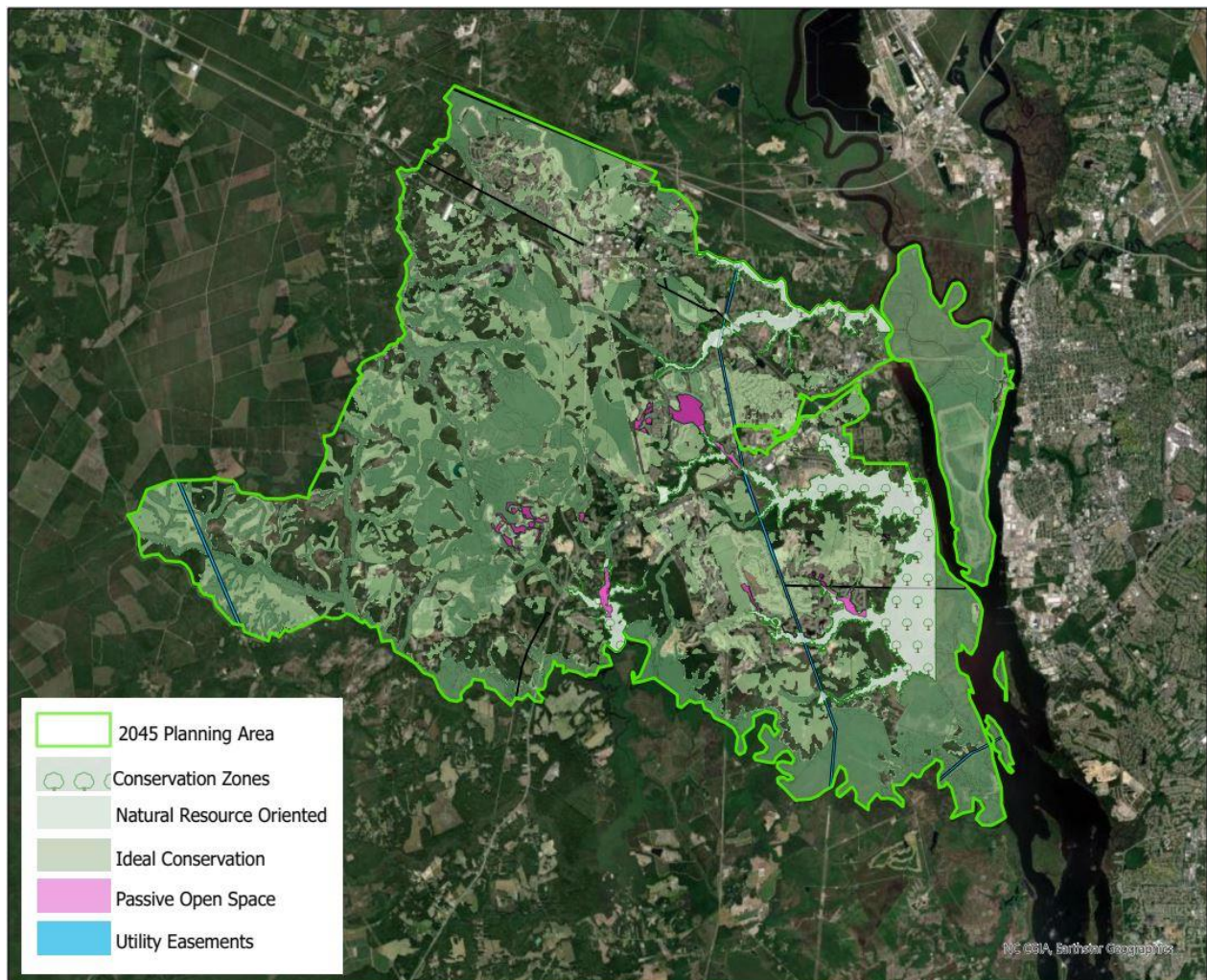
Figure 4: Townwide Tree Canopy



VII. Active and Passive Open Spaces Inventory

The Town of Leland's Code of Ordinances require certain types of development to provide active (areas for physical, activated recreation like ball fields and playgrounds) and passive (areas left undisturbed and natural) open spaces. Figure 5 below depicts the areas within the Town that have been designated and recorded as passive and active open spaces, highlighted in magenta. These areas could potentially be woven into the Green Network. Furthermore, the figure displays recorded utility easements, identified in blue, that could be utilized to further advance connectivity to various portions of the area.

Figure 5: Existing Easements, Passive, and Active Open Spaces



3: Long Range Growth

I. Goals and Objectives

The establishment of a Green Growth Network can help support the aspirations, strategies, and goals of the Town. The Town seeks to be proactive in its approach of managing future growth, with the aim to create a connected, livable, and accessible community through environmentally responsible development patterns. Goals and objectives of the Town from the Leland 2045 plan related to the Green Growth approach include the following:

- 1. Protect and augment the components of Leland’s natural environment that will keep people and investments more safe from flooding, provide recreation and access to nature, enhance the tourism economy, and protect valuable natural resources.**
 - Consider designating areas of environmental importance, such as the floodplain, as areas that have unique development standards that protect the natural environment they are within or adjacent to.
 - Consider development forms that are more resilient to environmental hazards, while accommodating future growth.

- 2. Create strategies for future conservation/protection efforts that preserve critical natural environments.**
 - Create a plan to put more land in conservation through open space requirements based on a regularly updated land / environmental suitability analysis.
 - Consider open space requirements for all development types based on best practices.
 - Incentivize land purchases and development restrictions in flood-prone areas for open space preservation.
 - Create a strategic and prioritized open space acquisition plan that targets lands that will aid in resiliency planning and mitigation efforts.

3. Promote green building and development techniques as a part of Leland's image, character, and brand.

- Implement use of green building and Low Impact Development (LID) techniques for new home, commercial, and institutional developments.
- Explore design standards and innovative road construction techniques to link wildlife habitat and preserve wetlands.

4. Create a linked open space network that supports environmental connectivity, trails, and blueways.

- Develop a masterplan for a Green Network that will connect existing and proposed conservation areas, neighborhoods, riparian corridors, and sensitive natural environments.
- Create requirements for developments to connect open spaces designated on the Green Network plan through their projects where feasible.
- Coordinate park plans, future land use plans, zoning, conservation plans, scenic corridor plans, and greenway plans with environmental systems mapping to create a consolidated green network plan that expands green/open space connectivity.

5. Maximize public access to public trust waters.

- Create plans for water access, blueways, and greenways in coordination with the Green Network plan.

6. Resiliency and open space planning linked with growth management planning – grow where it is suitable to do so from an environmental and economic standpoint.

- Create policies to limit growth or reduce impact of development in 100-year and 500-year flood plains.
- Use the Environmental Composite Framework, created in this Comprehensive Plan, that designates areas of environmental importance, such as the floodplain, wetlands, critical habitat, etc. to craft development standards that protect the natural environment and to review all development and land use proposals for their compatibility with the natural environment.

- Use regulatory tools such as lower-density zoning, conservation-based planning, LID standards, open space set-a-side requirements and buffers, and natural resource protection standards, as the primary tools to protect areas of environmental importance.

7. Planning frameworks that create a complete community.

- Consider the use of “Node Types” that define mixed-use nodes and centers of varying scales located along major roadways and the Green Network.

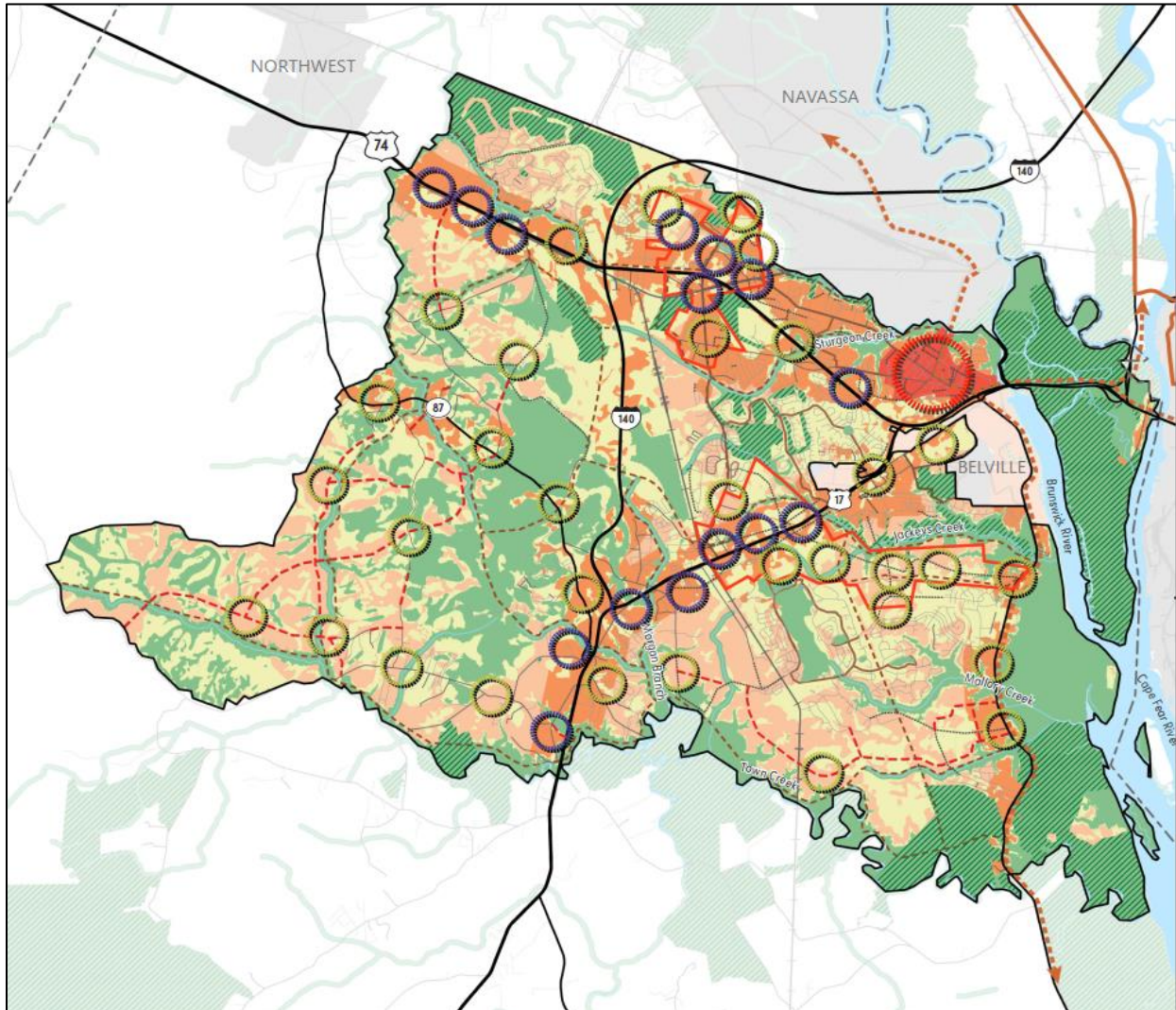
8. Connectivity through trails and greenways.

- Plan for Trail Ready Nodes along the Green Network.

II. Future Land Use Map

The Future Land Use Map (FLUM) depicts visually how Leland can continue to grow and prosper, while also protecting its valuable natural resources. The map displays ideal locations of community types and nodes, and how they can work in harmony with the underlying environmental conditions.

Figure 6: Leland 2045 Future Land Use Map



Community Nodes

Community node types were envisioned to help the community visualize and choose the most appropriate scale, type, density, and form of growth for Leland's future. These community and node types can also influence future zoning, zoning overlays, small area plans, and policies that will ensure that Leland grows in alignment with the vision of this comprehensive plan.

COMMUNITY TYPES



NATURAL / PRESERVE



CONSERVATION
COMMUNITY



AMENITY
COMMUNITY



TRADITIONAL
NEIGHBORHOOD



COMMERCIAL/
EMPLOYMENT



URBAN MIXED-USE
NEIGHBORHOOD



NODE TYPES



NEIGHBORHOOD NODE



VILLAGE NODE



URBAN CENTER NODE

The Future Land Use Map and Focal Area Plans that follow utilize Community Types and Node Types and promote their use across the planning area.

III. Focus Areas

As identified within Leland 2045, there are key areas within Leland that have been specifically identified and studied to demonstrate, in concept, how they might be developed to align with Leland’s vision, principles, and policies. These areas were identified as being poised for the next areas of growth since they are centrally located major roadways and existing infrastructure.

As it pertains to green growth, it is important to note that these areas are largely undeveloped or underutilized and are in close proximity to environmentally sensitive areas. As such, these areas could be shaped by recommendations and principles outlined within this document. Furthermore, these areas could serve as key areas for enhanced public engagement opportunities such as design charrettes, small area planning, and engagement workshops.

1. US Highways 74/76 Focal Area

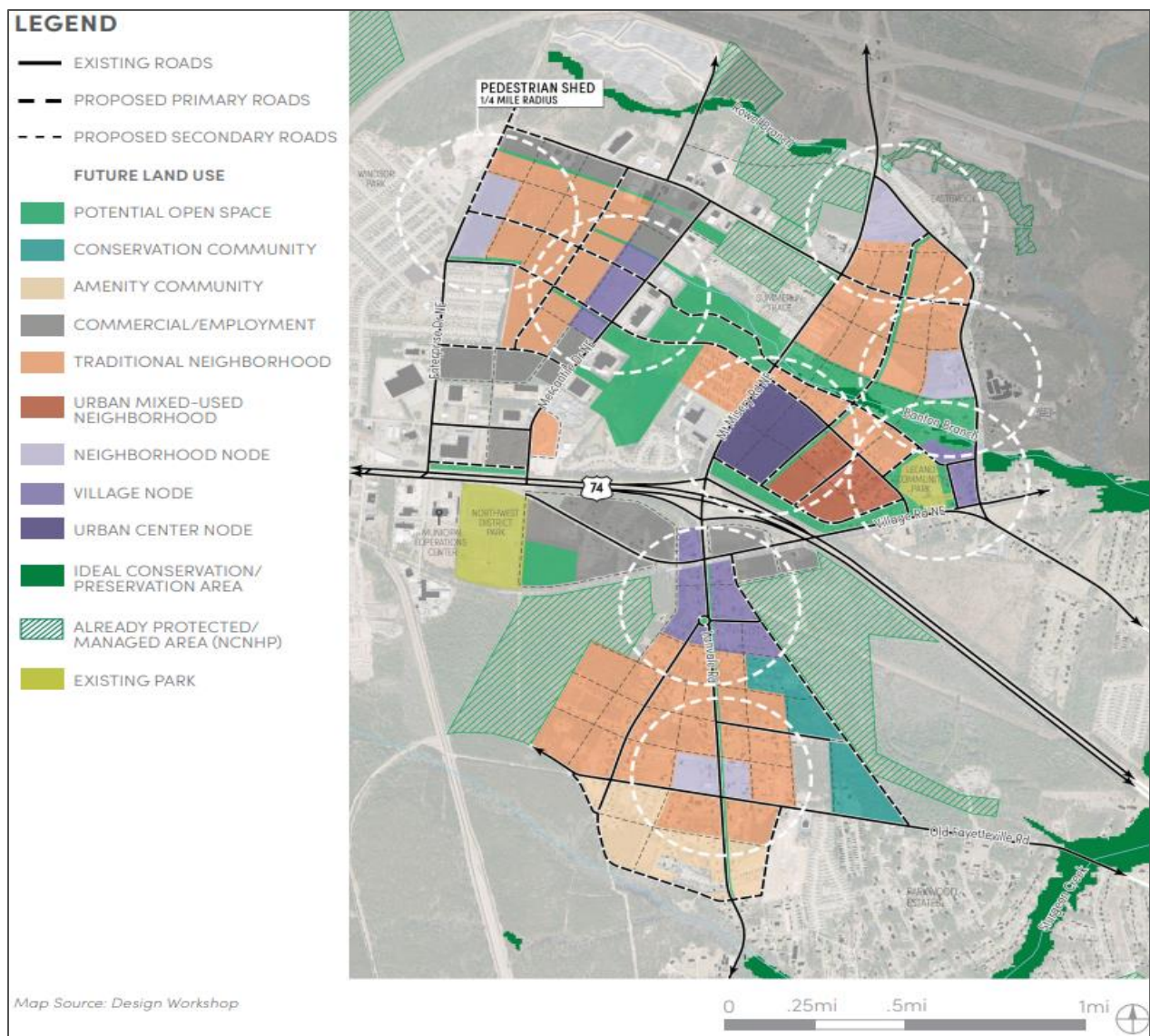
The area located along Highway 74 at the interchange of Mt Misery and Lanvale Roads is a primary access into Leland from the west. This area supports urbanizing development forms and promotes a medium to high density and mix of uses that enable people to live, work, and recreate within a compact footprint. Every quality-of-life element, such as employment, education, recreation, and safety, is considered within this Focal Area and planned so that they are located within accessible nodes along pedestrian- and bike-friendly streets.

Key Planning considerations:

- Promote job creation of all types including office, light industrial, commercial, lodging, entertainment, incubator, and others while discouraging heavy industrial uses.
- Provide for a variety of housing types from conservation communities (preferred design on projects adjacent to existing natural areas) to amenity communities, traditional neighborhoods and urban neighborhoods depending upon locations along transportation corridors, open spaces and natural areas, and existing land uses.
- Preserve environmentally sensitive open spaces, natural drainage ways, and floodplains within a connected corridor that also provides opportunities for multipurpose trail connectivity.

- Design trails to be on the edge of these natural areas to reduce impacts to natural areas (like habitat fragmentation and increased edge habitats)
- There are no NHP Natural Areas within this area but encourage 200' wide stream buffers one each side to protect streams and reduce impacts downstream.
- Rowel Branch (northern) and Banton Branch) extends into this area from Mill Creek that flows into Sturgeon Creek (which is a NHNA).
- Encourage Conservation Communities on projects that are adjacent to protected natural areas so that these natural areas are buffered.

Figure 7: US 74/76 Focal Area



2. Cameron/Goodman Focal Area

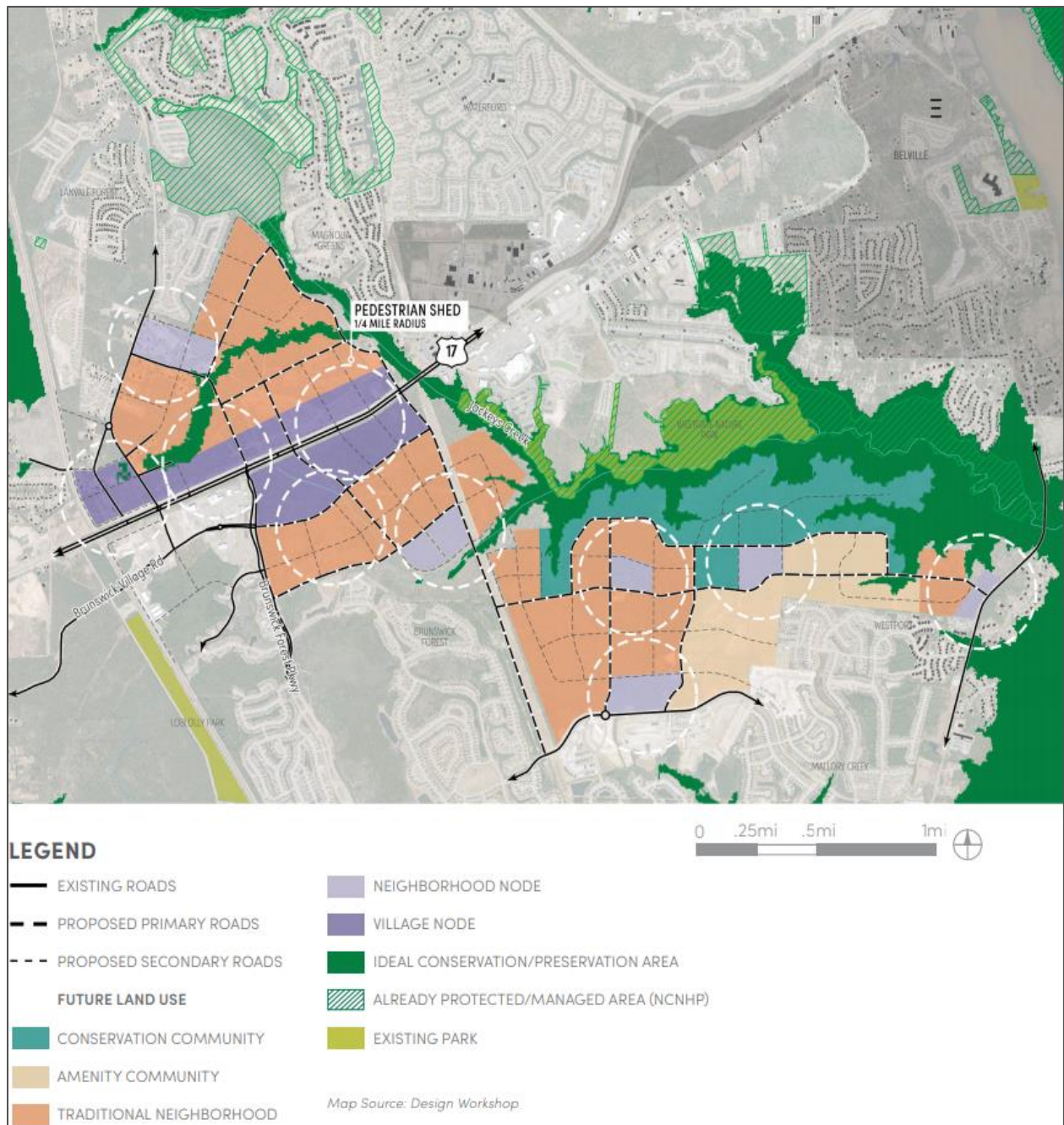
This area is located along US Highway 17 (Ocean Highway E), the primary access into Leland from the south, between West Gate and Brunswick Forest. It also has access from NC Highway 133 (River Rd SE), which is a roadway with scenic qualities with future plans for improvements as part of the conceptual Gullah Geechee Heritage Trail that will connect to larger regional trail systems. Focal Area 2 supports urbanizing development forms and promotes a medium to high density and mix of uses that enable people to live, work and recreate within a compact footprint. Quality-of-life elements, such as employment, education, recreation, and safety, is considered within this Focal Area and planned so that they are located within accessible nodes along pedestrian- and bike-friendly streets.

Key Planning considerations:

- Locate village centers along Highway 17 (Ocean Highway E) to take advantage of commercial and retail opportunities within mixed-use destinations.
- Locate higher densities, mixed uses, parks, schools, gathering areas and community services within mixed-use nodes that range from neighborhood nodes to village nodes.
- Encourage higher density development next to existing infrastructure to reduce development pressure in more sensitive natural areas.
- Preserve sensitive open spaces and natural drainage ways and floodplains within a connected corridor that also provides opportunities for multipurpose trail connectivity.
 - Design trails to be on the edge of these natural areas to reduce impacts to natural areas (like habitat fragmentation and increased edge habitats).
- Reduce mass grading and clear-cutting activities in developed areas, especially adjacent to floodplains (500 – year, ideally).
- Encourage Conservation Design on projects that are adjacent to protected natural areas so that these natural areas are buffered.
- Prohibit non-native and invasive plants for landscaping.

- Buffer floodplain from impacts of adjacent developed land uses, 300' buffer around protected natural areas can reduce edge impacts to sensitive areas (use conservation community developments to provide for these buffers).
 - Limit/restrict infrastructure in floodplains (i.e., no stormwater ponds, etc. in protected areas, floodplains, riparian buffers).

Figure 8: Cameron/Goodman Focal Area



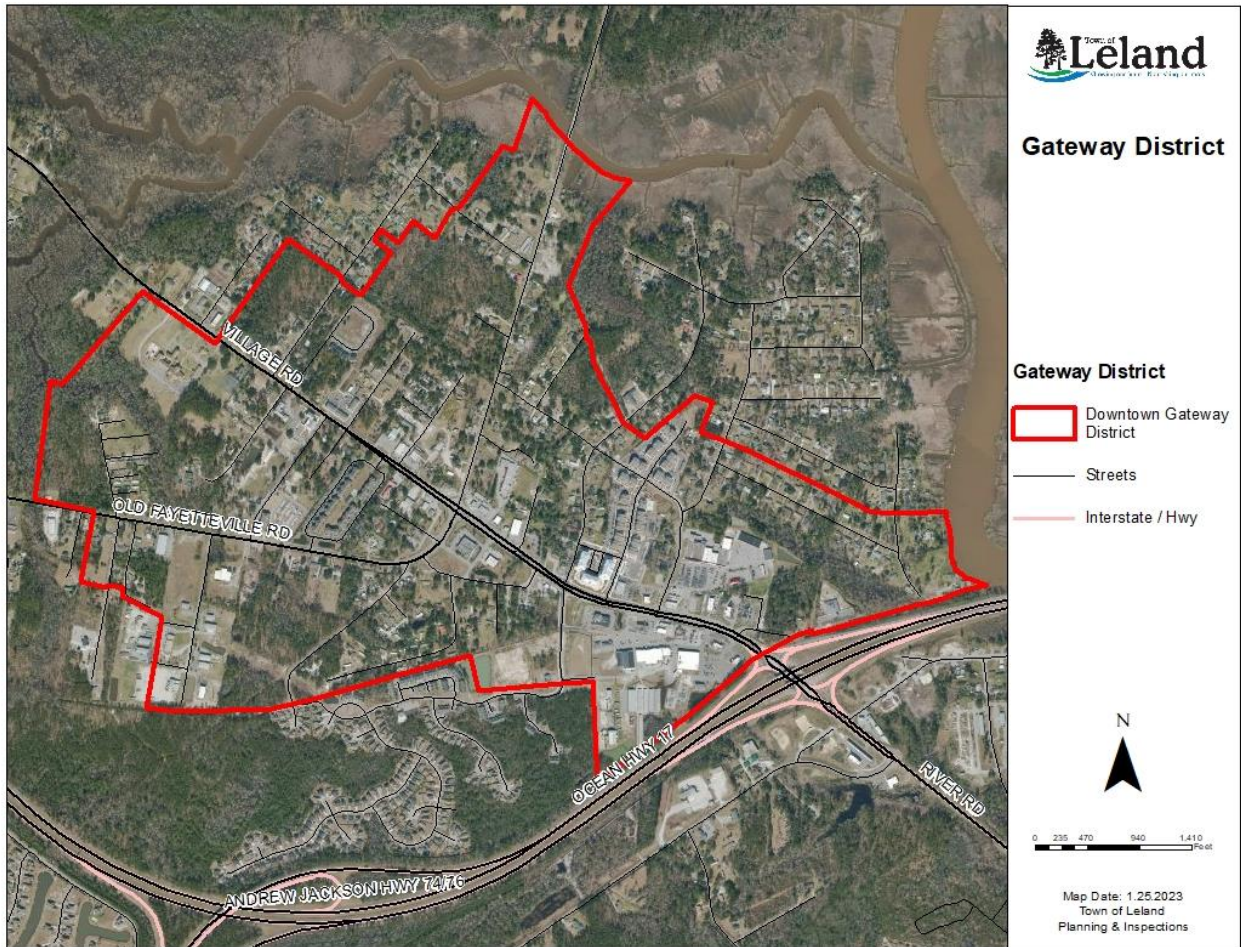
3. Gateway District

The area west of the Village Road interchange with US Highway 74/76 that includes much of the original area of Leland. This area has been referred to as the “gateway to Brunswick County from the east” and was identified as the Gateway District in the 2013 Gateway Infill Plan which is a direct implementation of the 2009 Master Plan. The area forms the nucleus of the community’s vision of a town center and a discernible “downtown.”

Key Planning Considerations:

- Proponent of a code that emphasizes standards and parameters for form with predictable physical outcomes rather than relying on numerical parameters whose outcomes are impossible to predict.
- Utilizes Smart Growth as the overall approach that encourages a mix of building types and uses, diverse housing options, and walkable development within existing neighborhoods.
- Encourage higher density development next to existing infrastructure to reduce development pressure in more sensitive natural areas.
- Promotes and conserves an interconnected street network and pedestrian-scaled blocks.
- The Gateway District is bordered by two important NHNAs (Sturgeon Creek Tidal Wetlands to the north and Brunswick River/Cape Fear River Marshes to the east).
 - Sturgeon Creek is mostly unprotected.
 - These NHNAs are critical areas to protect to maintain biodiversity and ecological integrity into the future.
 - Prioritize permanent protection of these NHNAs by pursuing conservation easements.
- Buffer NHNAs from impacts of adjacent developed land uses, 300’ buffer around protected natural areas can reduce edge impacts to sensitive areas.
 - Limit/restrict development and all infrastructure in floodplains (i.e., no stormwater ponds, etc. in protected areas, floodplains, riparian buffers).
- Encourage (by providing incentives) or require conservation communities in areas that are adjacent to these NHNAs.

Figure 9: Gateway District



4. NC Highway 87 South

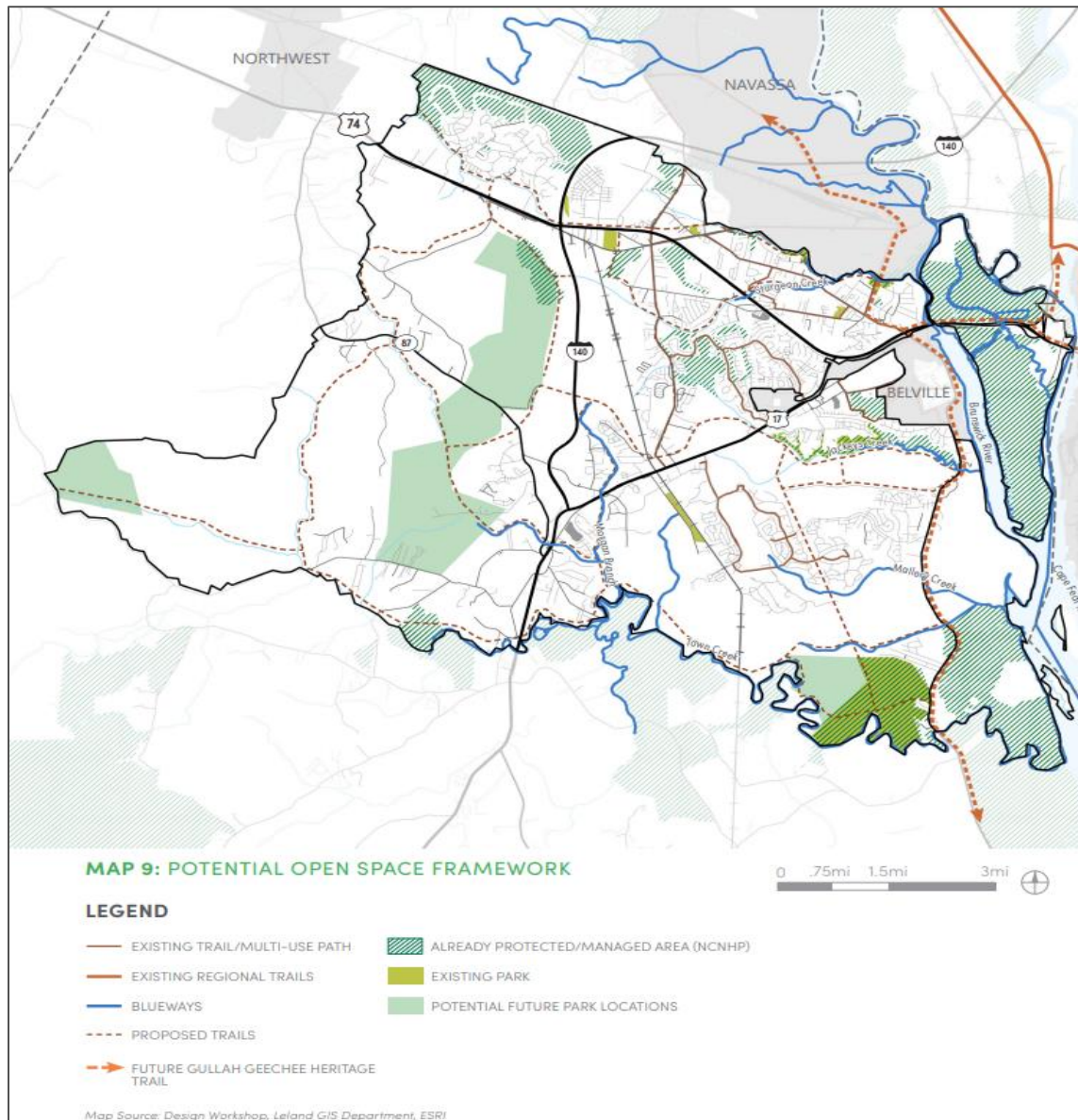
This portion of the planning area, running along NC Highway 87 between US Highway 74-76 and US 17, is largely undeveloped. This area, as depicted within the Future Land Use Map, has portions of high development potential as well as areas identified for conservation, with neighborhood nodes envisioned for this corridor. The area also ranks high in environmental value and sensitivity. Given the large tracts of unfragmented natural lands and habitats, development that maintains a habitat network of large natural areas connected with wide wildlife corridors is encouraged. Providing for this habitat connectivity can also allow plant areas to remain connected and wildlife to move through the landscape and get to another habitat elsewhere. Furthermore, it is important to recognize the allowance of water to inland wetland pockets, and for runoff to be of high quality through the use of BMPs. It is recommended, where possible, to maintain 150' to 300' of

connected, native forest greenways, with up to 1,000' in priority areas, riparian buffers of 300' to 600' on either side of streams, and 150' to 600' of native, forested buffers around small wetlands.

IV. Open Space Framework

Leland and Brunswick County have large areas of protected open space, along with plans for more land conservation. The Town has been proactive to try and connect these areas by identifying potential trails, as depicted in the Open Space Framework, displayed below:

Figure 10: Open Space Framework



Leland can become a major destination for hiking and biking in all forms, and a comprehensive and accessible trail network can link Leland's neighborhoods with its natural areas and gathering places. The trail system will provide cyclists and pedestrians numerous ways of moving through and around Leland safely, for both active transportation and recreation, to create a truly connected town — one that is connected to the Cape Fear River, regional trails, and the proposed Gullah Geechee Heritage Trail. Blueway trails can also be envisioned and planned to expand access to Leland's waterways.

The connectivity of these areas has benefits beyond tourism and health-related aspects. A well-connected network within the greater Leland area of these environmentally sensitive areas can help maintain the integrity of the ecological function of these important and vital areas. As exemplified within this document, these environmentally sensitive areas contain key flora and fauna that are rare and/or federally or state listed endangered or threatened. These pieces of the environmental fabric maintain the balance of the local ecosystem. By providing the environment with an established, well-connected, preserved, and conserved network of natural areas, the Town can help foster a more resilient ecosystem.

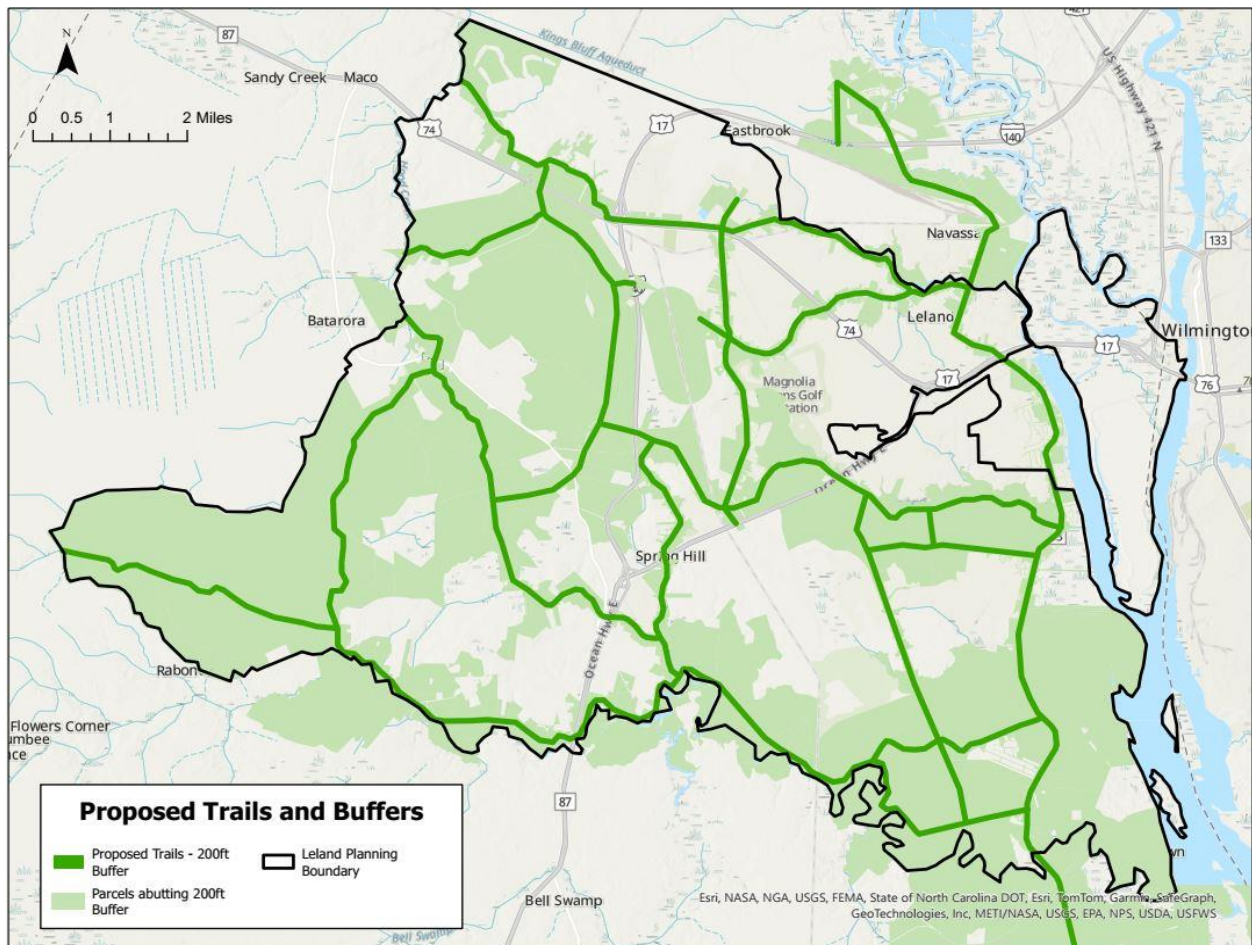
As shown on the open space framework map, a comprehensive open space and greenway/blueway network (the Green Network) can link new and existing neighborhoods across the Town with its surrounding natural environment and recreational assets. Trails can also help protect and/or restore ecological connectivity within and beyond Leland. Ecological connectivity is essential to maintain functional ecosystems and protect biodiversity over the long term.

4: Leland Green Network and Guiding Principles

As identified within Leland 2045, the purpose of the Green Network is to identify and describe the terrestrial and aquatic priority wildlife habitats that currently exist in and around Leland and develop strategies for conserving habitat core areas. These areas should not only be protected but connected to maintain functional habitat corridors while simultaneously providing access for residents to enjoy.

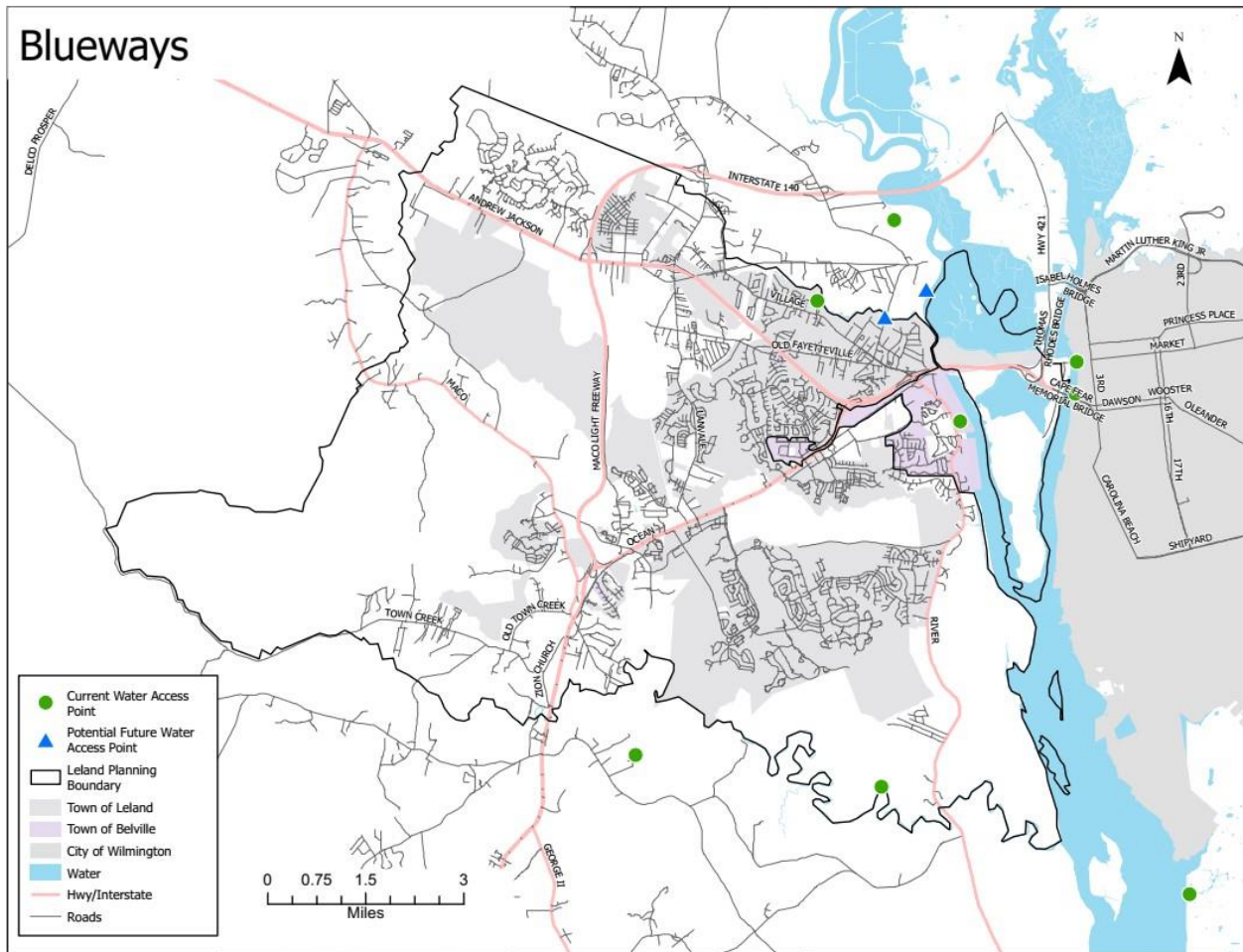
I. Trails and Blueways Network

Figure 11: Proposed Future Trails and Abutting Parcels



Building upon the Open Space Framework, there are a number of identified potential future trails within the planning area. These potential trails primarily follow utility and conservation easements. In an effort to create connected and functional corridors, Figure 11 displays the potential future trails from the Open Space Network with a 200' buffer. Parcels that are located within this buffer have been highlighted in green and could play a fundamental role in developing habitat corridors through enhanced regulations and potential property acquisitions.

Figure 12: Green Network – Blueway Access Points



Aside from greenways and trails, the Green Network should incorporate blueways. A blueway is a designated water trail designed with launch points, and occasionally camp sites and other points of interest along the route, for recreational use with canoes, kayaks, and paddle boards.

There are multiple public access points to local waterways, as displayed in Figure 12. Several of these are part of the Coastal Area Management Act (CAMA)-designated public water access points network. One such access point is within Cypress Cove Park along Sturgeon Creek, which is equipped with a kayak launch, and another CAMA access point is located at the Brunswick Nature Park.

Expanding this network is an aspiration of the Town, including a potential future blueway water access point at the future Sturgeon Creek Park. This, along with a potential future water access point within the Town of Navassa, could further strengthen the connectivity for a blueway network and provide better accessibility to public waters for residents and visitors alike within the greater region.

II. Future Nodes and Community Designs

The nodes identified within the Future Land Use (FLU) Map and the protected and highly-valued NHNAs within the planning area were cross referenced in this analysis. It is important to note that there are anticipated future nodes located within, or in very close proximity to key NHNA areas. As it has been stated, these NHNA areas have the highest concentration of vulnerable, at-risk species within the area. As such, the following recommendations on a design of 'Nature Nodes' has been provided below:

Neighborhood Nature Nodes

When analyzing the FLU Map, the Environmental Composite Map, and the NHNAs Map, there are concentrations of Neighborhood Nodes in close proximity to NHNAs within higher environmentally sensitive and at-risk areas along NC Highway 87, along NC Highway 133, and close to Jackey's Creek (undeveloped parcels between NC Highway 133 and US Highway 17). These identified nodes could be a subset of the Neighborhood Nodes with some form of extra environmental caveats and become a designated neighborhood nature node.

The primary features of a nature-oriented neighborhood ensure that important natural features are permanently protected, buffered from developed land uses, and connected to one another to create a contiguous natural landscape.

The Town could require or encourage conservation subdivision design where large, preserved natural areas are designated to maximize protection of environmentally sensitive/highest priority natural areas. Furthermore, requirements could be adopted that strive to maximize connectivity of protected natural areas and implement best practices to minimize impacts on wildlife populations.

Neighborhood nature nodes could possess the following elements:

- Prohibit development projects in areas with high priority environmental resources.
- Priority design element: protect, buffer, and connect sensitive natural lands from developed land uses.
 - Require (or use incentives, such as density bonuses) protection of the highest priority natural areas.
 - Require identification of priority natural areas ahead of major design work and set these areas aside for conservation.
 - Limit mass grading and clear-cutting throughout developing areas.

- Protect natural areas with a binding perpetual conservation agreement, such as a conservation easement.
- Aim for natural areas to be connected within and between tracts.
- Aim for natural areas to be as large as possible.
- Aim for buffers on natural areas to be as wide as possible.
- Develop and implement a management plan to protect the integrity of natural areas.
- Require native plant landscaping in developed spaces.
- Minimize lighting impacts on wildlife.
- Prohibit stormwater management practices in conserved natural areas.

Village Nature Nodes

Similar to the Neighborhood Nodes geographical assessment, there are Village Nodes in close proximity to environmentally sensitive areas. There are less Village Nodes located in these areas when compared to Neighborhood Nodes. The Neighborhood Nodes are located at Morgan Branch at I-140 and US Highway 17, by Town Creek along US Highway 17, and close to Jackeys Creek and US Highway 17.

Village nodes are envisioned to have more commercial and mixed-use elements, versus the Neighborhood Nodes, containing more regional-scaled retail and employment center characteristics. Village nodes, like Neighborhood Nodes, also promote greenway and trail access.

Incorporating similar recommendations as outlined within the Neighborhood Nature Nodes section within nodes identified as 'Village Nature Nodes' could help maintain the environmental integrity of these areas.

5: Model Ordinance Language

Understanding that the important natural areas in Leland are susceptible to impactful developments, there are multiple avenues the Town can take to proactively protect, enhance, and strengthen the existing environmentally sensitive areas within the planning area. The following overarching themes have been identified in which the Town can adopt regulations and ordinances within, to advance green growth principles:

- Conservation-oriented Development and Design Standards
- Habitat Protection Regulations
- Transportation Strategies
- Parks and Open Space Strategies

I. Conservation-oriented Development and Design Standards

Natural areas in the planning area are threatened by development. Below are potential strategies that incorporates conservation where appropriate:

Conservation-oriented Development and Design Standards
<i>Consider developing an environmental advisory board and appointing people with a natural resources background to review development proposals to support conservation goals.</i>
<i>Consider adopting a conservation overlay district, where development is discouraged. This conservation overlay district could be defined to include Natural Heritage Natural Areas and Managed Areas, stream and wetland habitats, buffers around all of these locations, and a network of natural areas that connects these to one another. A geographic representation of these priority natural areas is depicted as areas with values 6 and above in the Biodiversity and Wildlife Habitat Assessment.</i>
<i>When development is proposed within the bounds of a conservation district: consider not permitting conventional development design and require or highly encourage conservation development design.</i>
<i>When not required, consider providing incentives, such as a density bonus or expedited review, to encourage developers to choose a conservation design.</i>
<i>Make data on high priority conservation areas easily accessible to the public through online mapping tools, such as ArcGIS Online.</i>

<p><i>Consider updating subdivision ordinances to include measures:</i></p> <ul style="list-style-type: none"> <i>• Require developer to identify high priority natural areas in predevelopment sketch/concept plans; and</i> <i>• Require that developers address how they will minimize impacts to identified priority areas.</i>
<p><i>Configure development design so high priority natural resources are protected, buffered, and connected within the development.</i></p>
<p><i>Allow for flexibility on development standards to allow for developments to be more clustered:</i></p> <ul style="list-style-type: none"> <i>• Remove minimum lot size requirements and allow for development units per acre to provide for design flexibility; and</i> <i>• Review the ordinance to see what else could be made more flexible.</i>
<p><i>Utilize NCWRC Habitat Conservation Recommendations to provide guidance on appropriate land uses within proximity to natural areas.</i></p>
<p><i>Configure natural area set-asides to maximize their connectivity with high priority natural areas in adjacent parcels.</i></p>
<p><i>Require developers to place natural area set-asides in permanent conservation.</i></p>
<p><i>Work with conservation partners to assist in holding and monitoring conservation easements.</i></p>
<p><i>Require developers to develop a management plan for natural area set-asides.</i></p>
<p><i>List major subdivisions and other major development types such as Planned Use Developments, as a land use in the Table of Permitted Uses and consider permitting them only in districts where major development is appropriate.</i></p>
<p><i>Remove invasive and exotic species from the approved landscaping list, if present.</i></p>
<p><i>Require developments to incorporate BMPs that mitigate negative impacts on stormwater runoff and degrade water quality, such as limiting grading, terrain, and land alteration or requiring contour and drainage patterns to be left intact wherever practicable.</i></p>
<p><i>Incentivize developers to include LID techniques and principles within projects, such as permeable paving, green roofs, avoid compacting soil in undeveloped areas, minimizing grading/tree removal, and increasing site evapotranspiration.</i></p>
<p><i>Require setbacks that serve as a buffer to mitigate edge impacts of developments on adjacent, environmentally sensitive natural areas.</i></p>
<p><i>Use the Model Natural Resources Conservation Ordinance as a template to develop a legally-vetted conservation overlay and conservation design standards.</i></p>

II. Habitat Protection Strategies

The following strategies can help provide enhanced protection for key habitats:

Habitat Protection Strategies
<i>Aim to protect and restore longleaf pine forests; large blocks of contiguous longleaf pine forest is an important habitat for many imperiled species.</i>
<i>Longleaf pine forests are a fire-dependent ecosystem. Some developments are smoke-sensitive, i.e., hospitals, schools, prisons, high traffic roads, avoid these developments in areas near longleaf pine forests to protect their ability to be managed with prescribed fire.</i>
<i>Tree protection ordinances should be written to protect longleaf pine, as well as other native tree species. Old growth longleaf pine trees have a small diameter at breast height. Enabling state legislation would be necessary for such ordinances.</i>
<i>Upland habitats, like forests and early successional habitats, also need to be buffered from developed land uses to reduce edge impacts. A 300' buffer on upland habitats will reduce the severity of these impacts.</i>
<i>Upland habitats should be connected throughout the landscape to provide for safe movement of wildlife.</i>
<i>Aim to protect the 500-year floodplain in order to maintain the hydrological function of floodplains, including flood water storage, groundwater recharge, sediment and pollution capture resulting in cleaner water, and reducing flood water velocity.</i>
<i>Since all streams within Leland drain to habitat for federally endangered species, NCWRC recommends a minimum 200' forested buffer along perennial streams and rivers and a 100' buffer along intermittent streams to maintain aquatic habitat for these sensitive species.</i>
<i>NCWRC recommends a minimum 150' no-touch forested buffer on wetlands to protect water quality and habitat. Beyond the 150' buffer, developed land uses should be minimized, and ideally clustered together, within an additional 600' beyond the no-touch buffer.</i>
<i>NCWRC recommends that communities maintain rural land uses within two miles of wetlands, due to the sensitivity and movement patterns of the wildlife that use these wetlands, such as diamond frogs which will move two miles into the uplands when it's not breeding in the wetlands.</i>
<i>Provide protections for isolated wetlands, which should remain connected via natural corridors to one another, as many wildlife rely on a network of habitats to fulfil their habitat needs to survive and successfully reproduce.</i>

III. Transportation Strategies

There are opportunities within transportation-related regulations that could promote and maintain the environmental integrity of nearby habitats:

Transportation Strategies
<i>Requiring connectivity, specifically trails and paths, between developments.</i>
<i>Ensuring that natural corridors are wide enough for wildlife to safely and easily navigate.</i>
<i>Allow trail paths to be not paved and/or impervious in certain circumstances.</i>
<i>Avoid roads through and between wetlands.</i>
<i>Avoid road crossings over streams. When crossings occur, encourage the use of bridges to support wildlife passage.</i>
<i>Implement best practices in culvert design to support aquatic and terrestrial passage.</i>
<i>Limit the impact future roads have on the natural flow of the water.</i>
<i>Identify high priority wildlife crossing opportunities and work with NCDOT and local conservation partners to protect and/or restore these corridors.</i>

IV. Parks and Open Space Strategies

Areas of opportunity in regards to parks and open space include the following:

Parks and Open Space Strategies
<i>Aim to protect the highest quality natural areas into the future by placing them in conservation easements or through strategic property acquisition.</i>
<i>Develop an overall goal of percentage/acres of open space desired, i.e., 30%, 50%, through the Town.</i>
<i>Update subdivision ordinances to increase the percentage of open space required within major subdivisions; consider adding open space requirements for non-residential developments when placement aligns with the open space framework.</i>
<i>Require developers to provide greenway facilities when their project intersects the desired greenway network.</i>
<i>Seek grant funding to support conservation acquisitions and easements, including the NC Park and Recreation Trust and NC Land and Water Fund.</i>
<ul style="list-style-type: none"> • <i>Build relationships and share conservation vision with local land trusts; the Coastal Land Trust of NC and the North American Land Trust have conserved land in and around Leland.</i> • <i>NCWRC can partner with communities to support acquisition efforts.</i>

Design trails and parks to minimize impacts of sensitive environmental areas.

- *Avoid trails through the most environmentally sensitive areas.*
- *Build trails on the edges of these areas to reduce fragmentation and edge impacts.*
- *Trails should be pervious or made of materials that maintain and support the environmental integrity of the area it traverses.*

6: Appendixes

AMPHIBIANS			
SCIENTIFIC NAME	COMMON NAME	STATUS	HABITATS
<i>Ambystoma mabeei</i>	Mabee's Salamander	State Threatened	shallow ephemeral wetlands, such as Carolina bays, vernal pools, and sinkholes
<i>Eurycea quadridigitata</i>	Dwarf Salamander	Special Concern	pocosins, Carolina bays, pine flatwoods, savannas, and other wetland habitats
<i>Hemidactylium scutatum</i>	Four-toed Salamander	Special Concern	pools, bogs, and other wetlands in hardwood forests
<i>Pseudacris ornata</i>	Ornate Chorus Frog	State Endangered	swamps, savannas, wooded ponds and pools
<i>Rana capito</i>	Carolina Gopher Frog	State Endangered	breeds in temporary fish-free pools; forages in sandy woods, especially pine-oak sandhills
<i>Anaxyrus quercicus</i>	Oak Toad	State Rare	pine flatwoods and savannas, pine sandhills where near water

AQUATIC SPECIES			
SCIENTIFIC NAME	COMMON NAME	STATUS	HABITATS
<i>Procambarus pearsei</i>	Sandhills Crayfish	State Threatened	roadside ditches, small streams, and still-water habitats in the Cape Fear, Waccamaw, and Lumber drainages
<i>Elliptio folliculata</i>	Pod Lance	Special Concern	Cape Fear, Lumber, and Yadkin-Pee Dee drainages
<i>Acipenser brevirostrum</i>	Shortnose Sturgeon	State and Federal Endangered	brackish water of large rivers and estuaries; spawns in freshwater areas
<i>Acipenser oxyrinchus oxyrinchus</i>	Atlantic Sturgeon	State and Federal Endangered	coastal waters, estuaries, large rivers
<i>Enneacanthus obesus</i>	Banded Sunfish	State Rare	most Atlantic drainages
<i>Heterandria formosa</i>	Least Killifish	Special Concern	streams and lakes near Wilmington
<i>Notropis chalybaeus</i>	Ironcolor Shiner	State Threatened	coastal plain rivers and creeks
<i>Planorbella magnifica</i>	Magnificent Ramshorn	State and Federal Endangered	Orton Pond and pond on Sand Hill Creek; formerly Greenfield Lake (endemic to North Carolina)
<i>Triodopsis soelneri</i>	Cape Fear Threetooth	State Threatened	swampy habitats in the southeastern portion of the state (endemic to North Carolina)

BIRDS			
SCIENTIFIC NAME	COMMON NAME	STATUS	HABITATS
<i>Ammospiza caudacuta</i>	Saltmarsh Sparrow	State Rare	tidal marshes [wintering sites]
<i>Calidris canutus rufa</i>	Red Knot - rufa subspecies	State and Federal Threatened	beaches and sand flats [wintering sites]
<i>Charadrius wilsonia</i>	Wilson's Plover	Special Concern	beaches, island-end flats, estuarine islands [breeding evidence only]
<i>Circus hudsonius</i>	Northern Harrier	State Rare	extensive brackish marshes (for nesting) [breeding evidence only]
<i>Dryobates borealis</i>	Red-cockaded Woodpecker	State and Federal Endangered	mature open pine forests, mainly in longleaf pine [breeding evidence only]
<i>Egretta caerulea</i>	Little Blue Heron	Special Concern	forests or thickets on maritime islands, rarely in swamps or at ponds [breeding evidence only]
<i>Ammodramus henslowii</i>	Henslow's Sparrow	State Endangered	clearcut pocosins and other damp weedy fields [breeding season only]
<i>Egretta thula</i>	Snowy Egret	Special Concern	forests or thickets on maritime islands, rarely in swamps or at ponds [breeding evidence only]
<i>Egretta tricolor</i>	Tricolored Heron	Special Concern	forests or thickets on maritime islands [breeding evidence only]
<i>Elanoides forficatus</i>	Swallow-tailed Kite	State Rare	swamps and bottomlands near lower Cape Fear River, often forages over nearby fields or marshes [breeding evidence only]
<i>Gelochelidon nilotica</i>	Gull-billed Tern	State Threatened	
<i>Haematopus palliatus</i>	American Oystercatcher	Special Concern	sand flats on maritime islands [breeding evidence only]
<i>Haliaeetus leucocephalus</i>	Bald Eagle	State Threatened and Federal Bald and Golden Eagle Protection Act	estuaries, oyster beds, mudflats [breeding evidence only]
<i>Ixobrychus exilis</i>	Least Bittern	Special Concern	nonriverine wet hardwoods, pocosins [breeding evidence only]
<i>Lanius ludovicianus</i>	Loggerhead Shrike	Special Concern	fresh or brackish marshes [breeding evidence only]
<i>Mycteria americana</i>	Wood Stork	State and Federal Threatened	swamps, fresh or brackish ponds (foraging) [breeding evidence and regular non-breeding sites]
<i>Nyctanassa violacea</i>	Yellow-crowned Night-Heron	State Rare	inland swamps; woods or thickets on maritime islands [breeding evidence only]
<i>Passerina ciris</i>	Painted Bunting	Special Concern	maritime shrub thickets and forest edges [breeding evidence only]
<i>Pelecanus occidentalis</i>	Brown Pelican	State Rare	maritime islands [breeding evidence only]

<i>Peucaea aestivalis</i>	Bachman's Sparrow	Special Concern	open longleaf pine forests, old fields [breeding evidence only]
<i>Plegadis falcinellus</i>	Glossy Ibis	Special Concern	forests or thickets on maritime islands [breeding evidence only]
<i>Porphyrio martinicus</i>	Purple Gallinule	State Rare	freshwater ponds with floating vegetation [breeding evidence only]
<i>Setophaga virens waynei</i>	Wayne's Black-throated Green Warbler	Endangered	nonriverine wetland forests, especially where white cedar or cypress are mixed with hardwoods [breeding evidence only]
<i>Sternula antillarum</i>	Least Tern	Special Concern	beaches, sand flats, open dunes, gravel rooftops [breeding evidence only]

MAMMALS			
SCIENTIFIC NAME	COMMON NAME	STATUS	HABITATS
<i>Corynorhinus rafinesquii macrotis</i>	Eastern Big-eared Bat	Special Concern	roosts in hollow trees, old buildings, and beneath bridges, usually near water
<i>Lasiurus intermedius floridanus</i>	Florida Yellow Bat	Special Concern	roosts in Spanish moss and other thick vegetation near water, often in longleaf pine habitats
<i>Myotis austroriparius</i>	Southeastern Bat	Special Concern	roosts in buildings, hollow trees; forages near water; mainly in the Coastal Plain
<i>Myotis septentrionalis</i>	Northern Long-eared Bat	State Threatened and Federal Endangered	roosts in hollow trees and buildings (warmer months), in caves and mines (winter); mainly in the mountains
<i>Perimyotis subflavus</i>	Tricolored Bat	State and Federal Endangered ³	roosts in clumps of leaves (mainly in summer), caves, rock crevices, and other dark and sheltered places

³ Proposed Endangered by the USFWS as of March 27, 2024

REPTILES			
SCIENTIFIC NAME	COMMON NAME	STATUS	HABITATS
<i>Alligator mississippiensis</i>	American Alligator	State and Federal Threatened ⁴	fresh to slightly brackish lakes, ponds, rivers, and marshes
<i>Caretta caretta</i>	Loggerhead Seaturtle	State and Federal Threatened	nests on beaches; forages in ocean and sounds [breeding evidence only]
<i>Chelonia mydas</i>	Green Seaturtle	State and Federal Threatened	nests on beaches; forages in ocean and sounds [breeding evidence only]
<i>Coluber flagellum flagellum</i>	Eastern Coachwhip	Special Concern	dry and sandy woods, mainly in pine/oak sandhills
<i>Crotalus adamanteus</i>	Eastern Diamondback Rattlesnake	State Endangered	pine flatwoods, savannas, pine-oak sandhills
<i>Crotalus horridus</i>	Timber Rattlesnake	Special Concern	wetland forests in the Coastal Plain; rocky, upland forests elsewhere
<i>Deirochelys reticularia reticularia</i>	Eastern Chicken Turtle	Special Concern	quiet waters of ponds, ditches, and sluggish streams
<i>Dermochelys coriacea</i>	Leatherback Seaturtle	State and Federal Endangered	nests on beaches; forages in oceans, rarely in sounds [breeding evidence only]
<i>Farancia erythrogramma</i>	Rainbow Snake	State Rare	swamps, lakes, rivers, and other sluggish water
<i>Heterodon simus</i>	Southern Hognose Snake	State Threatened	sandy woods, particularly pine-oak sandhills
<i>Lepidochelys kempii</i>	Kemp's Ridley Seaturtle	State and Federal Endangered	nests on beaches, forages in ocean and sounds [breeding evidence only]
<i>Liodytes rigida</i>	Glossy Crayfish Snake	State Rare	marshes, cypress ponds, other wetlands
<i>Malaclemys terrapin</i>	Diamondback Terrapin	Special Concern	salt or brackish marshes, estuaries
<i>Pituophis melanoleucus melanoleucus</i>	Northern Pinesnake	State Threatened	dry and sandy woods, mainly in pine/oak sandhills
<i>Sistrurus miliarius miliarius</i>	Carolina Pigmy Rattlesnake	Special Concern	pine flatwoods, pine/oak sandhills, other pine/oak forests

⁴ Due to similarity of appearance to the Endangered American Crocodile (*Crocodylus acutus*)