Attachment 6A:

Mid-Currituck Bridge
ICE Technical Report

November 2011

MID-CURRITUCK BRIDGE STUDY

INDIRECT AND CUMULATIVE EFFECTS TECHNICAL REPORT

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CURRITUCK COUNTY
DARE COUNTY

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Raleigh, North Carolina

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List of Abbreviations

AEC	Areas of Environmental Concern
APES	Albemarle-Pamlico Estuarine Study
CAMA	Coastal Area Management Act
CBRA	Coastal Barrier Resources Act
CBRS	Coastal Barrier Resources System
CCA	Coastal Conservation Association
CHPP	Coastal Habitat Protection Plan
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DCM	Division of Coastal Management
DEIS	Draft Environmental Impact Statement
DWQ	Division of Water Quality
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Act
FHWA	Federal Highway Administration
ICE	Indirect and Cumulative Effects
NAAQS	National Ambient Air Quality Standards
NCBBA	North Carolina Beach Buggy Association
NCDENR	North Carolina Department of Environment and Natural Resources
NCDOT	North Carolina Department of Transportation
NCNHP	North Carolina Natural Heritage Program
NCTA	North Carolina Turnpike Authority
NFIP	National Flood Insurance Program
NGO	Non Governmental Organization
NPDES	National Pollutant Discharge Elimination System
PCD	Planned Commercial Development
PUD	Planned Unit Development
RPO	Rural Transportation Planning Organization
SAV	Submerged Aquatic Vegetation
SNHA	North Carolina Significant Natural Heritage Areas
STIP	State Transportation Improvement Program
SWCS	Soil and Water Conservation Society
TEAC	Turnpike Environmental Agency Coordination

List of Abbreviations (concluded)

USACE	United States Army Corps of Engineers
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
VMT	Vehicle Miles Travelled

Preface

This technical report was prepared following the guidance contained in *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina* (NCDOT, 2001). The guidance defines the study process as consisting of the following eight steps:

1. Define the Study Area Boundaries;
2. Identify the Study Area's Directions and Goals;
3. Inventory Notable Features;
4. Identify Impact Causing Activities of the Proposed Action and Alternatives;
5. Identify Potential Indirect/Cumulative Effects For Analysis;
6. Analyze Indirect/Cumulative Effects;
7. Evaluate Analysis Results; and
8. Assess the Consequences and Appropriate Avoidance and Minimization Strategies.

The chapters of this report address the findings of each of these steps in turn. The remainder of this preface briefly describes the proposed action, the project area, the project need, and the project's detailed study alternatives.

A review draft of this revised *Indirect and Cumulative Effects Technical Report* was distributed to the community planning directors in the study area for verification of community representations and affirmation of the analytic scenarios. Follow up conversations and correspondence were undertaken and minor corrections made based on the feedback.

Proposed Action

The North Carolina Turnpike Authority (NCTA), a division of the North Carolina Department of Transportation (NCDOT), in cooperation with the Federal Highway Administration (FHWA), is preparing a Final Environmental Impact Statement (FEIS) to evaluate proposed improvements in the Currituck Sound area. The proposed action is included in NCDOT's 2009-2015 *State Transportation Improvement Program* (STIP), the North Carolina Intrastate System, the *Strategic Highway Corridors Concept Development Report* (NCDOT, 2005), and the *Thoroughfare Plan for Currituck County* (NCDOT, 1999). In those plans, the proposed action is defined as a bridge across Currituck Sound from the mainland to the Outer Banks. When considering the construction of a major transportation investment, decision makers are required to examine multiple options under the requirements of the National Environmental Policy Act (NEPA) and associated regulations. Thus, the detailed study alternatives evaluated in the FEIS

include options that involve improvements to the existing road network, both with and without a Mid-Currituck Bridge. The No-Build Alternative also is an option.

Project Area

The project area is in northeastern North Carolina and includes the Currituck County peninsula on the mainland and its Outer Banks, as well as a portion of the Dare County Outer Banks (see Figure P-1). The project area encompasses two thoroughfares, US 158 from NC 168 to NC 12 (including the Wright Memorial Bridge) and NC 12 north of its intersection with US 158 to its terminus. US 158 is the primary north-south route on the mainland. NC 12 is the primary north-south route on the Outer Banks. The Wright Memorial Bridge connects the mainland with the Outer Banks.

Project Need

The proposed action responds to three underlying needs in the project area. These needs are based on the following travel conditions:

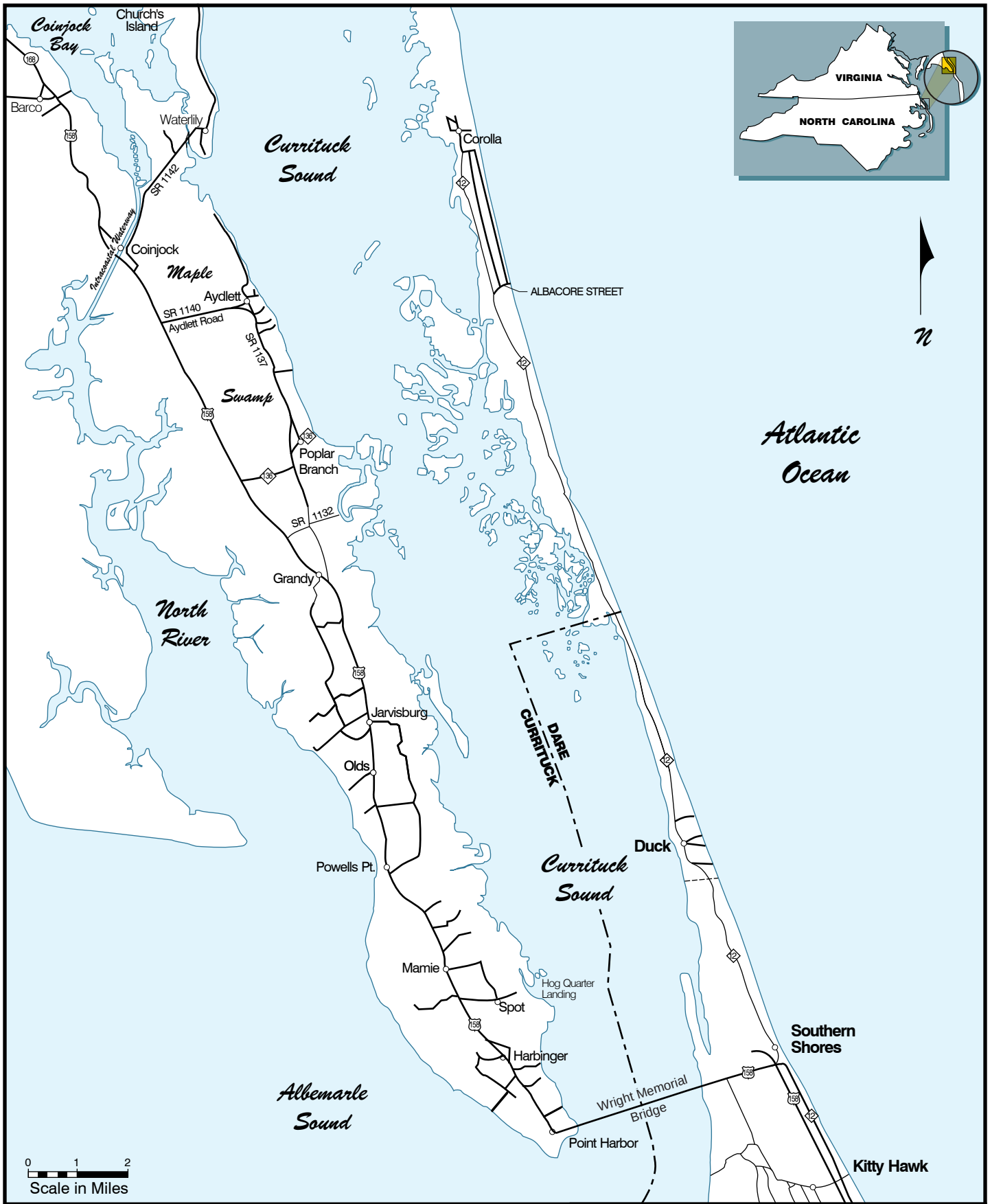
- The project area's main thoroughfares (US 158 and NC 12) are becoming increasingly congested, and congestion will become even more severe in the future.
- Increasing congestion is causing travel time between the Currituck County mainland and the Currituck County Outer Banks to increase, especially during the summer.
- Evacuation times for residents and visitors who use US 158 and NC 168 as an evacuation route far exceed the state-designated standard of 18 hours.

Detailed Study Alternatives

An alternatives screening study was conducted for the project. Its findings were discussed with federal and state environmental resource and regulatory agencies in a series of Turnpike Environmental Agency Coordination (TEAC) meetings in 2006, 2007, 2008, and 2009. Based on discussions at TEAC meetings, and written comments received from the agencies and public, the *Alternatives Screening Report* (Parsons Brinckerhoff, 2009) for the proposed project identified three alternatives to be carried forward for detailed study in the FEIS along with the No-Build Alternative. The Draft Environmental Impact Statement (DEIS) detailed study alternatives identified are ER2, MCB2, and MCB4. MCB2 and MCB4 also include two bridge corridor alternatives, C1 and C2. The Preferred Alternative is MCB4/C1 with design refinements to reduce potential impacts.

DEIS Detailed Study Alternatives

The detailed study alternatives assessed in the DEIS are shown on Figure P-2. These same alternatives also are assessed in the FEIS and this technical report. They are described below:



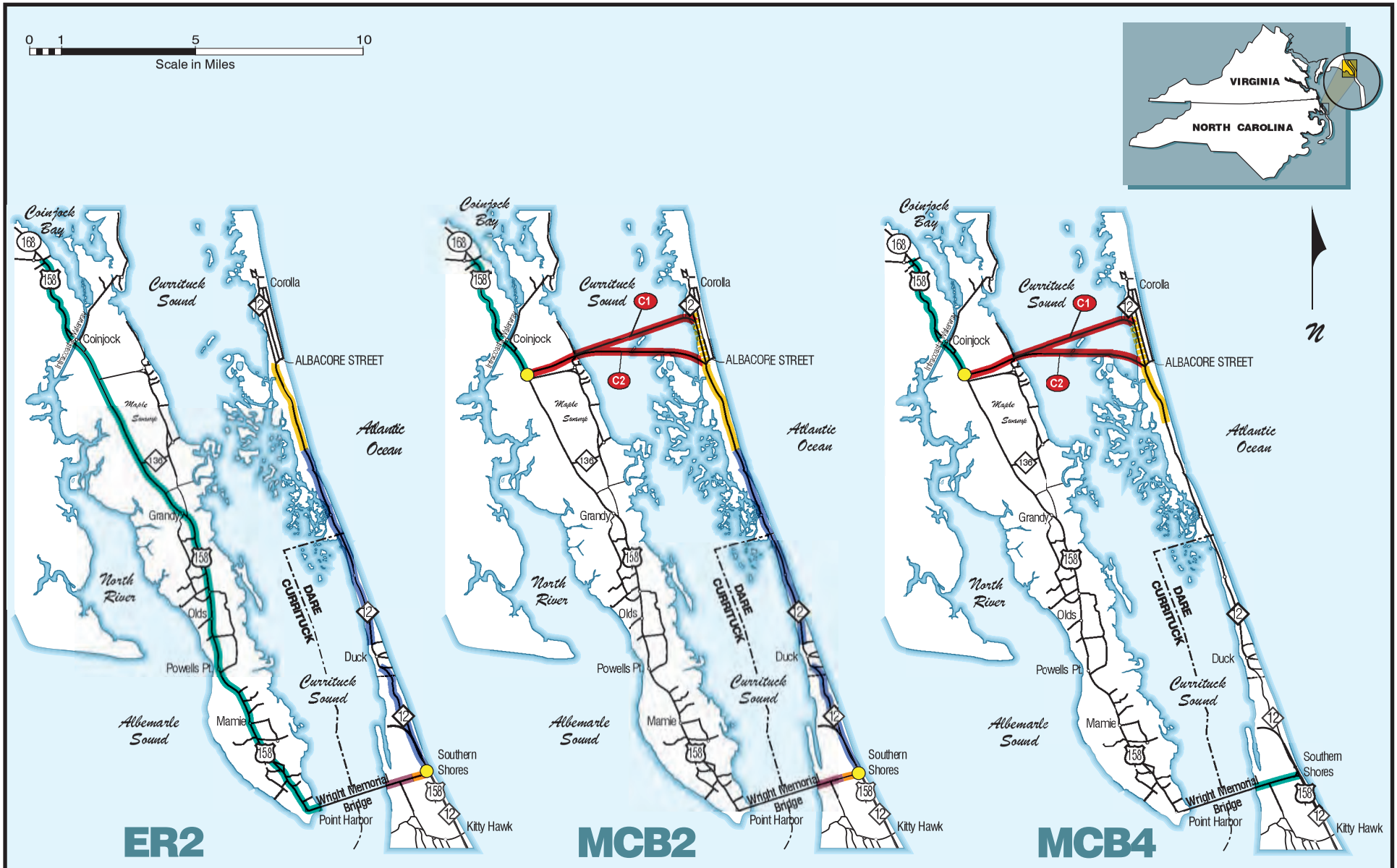
LEGEND

— - — County Boundaries

Project Area

Figure

P-1



LEGEND

- Eight Lanes (Super-street)
- Six Lanes (Super-street)
- Four Lanes
- Four Lanes (Only with C1)
- Three Lanes
- Mid-Currituck Bridge
- Third Outbound Lane (Contraflow of an existing lane is an option)
- C1 / C2 Bridge Corridor Alternatives
- Interchange

NOTE: Existing 3-lane segment of NC 12 in Duck is unchanged.

DEIS Detailed Study Alternatives

Figure

P-2

- **ER2**

  - Adding for evacuation use only, a third outbound evacuation lane on US 158 between NC 168 and the Wright Memorial Bridge as a hurricane evacuation improvement or using the existing center turn lane as a third outbound evacuation lane; in either case one inbound lane on the Wright Memorial Bridge and on the Knapp (Intracoastal Waterway) Bridge would be used as a third outbound evacuation lane;

  – Widening US 158 to a six-lane super-street between the Wright Memorial Bridge and Cypress Knee Trail that widens to eight lanes between Cypress Knee Trail and the Home Depot driveway;

  - Constructing an interchange at the current intersection of US 158, NC 12, and the Aycock Brown Welcome Center entrance, including six through lanes on US 158 starting at the Home Depot driveway and returning to four lanes just south of Grissom Street; and

  – Widening NC 12 to three lanes between US 158 and a point just north of Hunt Club Drive in Currituck County (except where NC 12 is already three lanes in Duck) and to four lanes with a median from just north of Hunt Club Drive to Albacore Street.

  – ER2 would reduce travel times in 2035 between Aydlett Road on the mainland and Albacore Street on the Outer Banks from 154 minutes to 125 minutes.

- **MCB2**

  – Constructing a two-lane toll bridge across Currituck Sound, as well as approach roads and/or bridges and an interchange at US 158;

  – Adding for evacuation use only, a third outbound evacuation lane on US 158 between NC 168 and the Mid-Currituck Bridge as a hurricane evacuation improvement or using the existing center turn lane as a third outbound evacuation lane; in either case one inbound lane on the Knapp (Intracoastal Waterway) Bridge would be used as a third outbound evacuation lane;

  – Widening US 158 to a six-lane super-street between the Wright Memorial Bridge and Cypress Knee Trail and an eight-lane super-street between Cypress Knee Trail and the Home Depot driveway;

  – Constructing an interchange at the intersection of US 158, NC 12, and the Aycock Brown Welcome Center entrance, including six through lanes on US 158 starting at the Home Depot driveway and returning to four lanes just south of Grissom Street; and

- Widening NC 12 to three lanes between US 158 and a point just north of Hunt Club Drive in Currituck County (except where NC 12 is already three lanes in Duck) and to four lanes with a median from just north of Hunt Club Drive to NC 12's intersection with the Mid-Currituck Bridge.

- MCB2 would reduce travel times in 2035 between Aydlett Road on the mainland and Albacore Street on the Outer Banks from 154 minutes to 86 minutes via the Wright Memorial Bridge and from 154 minutes to 11 minutes via the Mid-Currituck Bridge.

- **MCB4**

  - Constructing a two-lane toll bridge across Currituck Sound, as well as approach roads and/or bridges and an interchange at US 158;

  - Adding for evacuation use only, a third outbound evacuation lane on US 158 between NC 168 and the Mid-Currituck Bridge as a hurricane evacuation improvement or using the existing center turn lane as a third outbound evacuation lane; in either case one inbound lane on the Knapp (Intracoastal Waterway) Bridge would be used as a third outbound evacuation lane;

  - Adding for evacuation use only, a third outbound evacuation lane on US 158 between the Wright Memorial Bridge and NC 12 as a hurricane evacuation improvement or using the existing center turn lane as a third outbound evacuation lane; in either case one inbound lane on the Wright Memorial Bridge would be used as a third outbound evacuation lane; and

  - Widening NC 12 in Currituck County to four lanes with a median from Seashell Lane to NC 12's intersection with the Mid-Currituck Bridge.

  - MCB4 would reduce travel times in 2035 between Aydlett Road on the mainland and Albacore Street on the Outer Banks from 154 minutes to 107 minutes via the Wright Memorial Bridge and from 154 minutes to 11 minutes via the Mid-Currituck Bridge.

The unique characteristic of a super-street, included along US 158 east of the Wright Memorial Bridge with ER2 and MCB2, is the configuration of the intersections. Side-street traffic wishing to turn left or go straight must turn right onto the divided highway where it can make a U-turn through the median a short distance away from the intersection. After making the U-turn, drivers can then either go straight (having now accomplished the equivalent of an intended left turn) or make a right turn at their original intersection (having now accomplished the equivalent of an intention to drive straight through the intersection).

The level of direct access from individual parcels to the road network would be similar to the No-Build Alternative for all of the detailed study alternatives, including the

Preferred Alternative described below. No direct access to individual parcels would be allowed from the bridge alternatives between US 158 on the mainland and NC 12 on the Outer Banks. Control of access to individual parcels would generally remain the same along US 158 and NC 12. The right to direct access from individual parcels to US 158 and NC 12 would be purchased in the US 158/NC 12 interchange area for ER2 and MCB2. In this area, alternate access is available or would be provided. The median in the four-lane sections of ER2, MCB2, MCB4, and the Preferred Alternative along NC 12 would alter the route one takes to reach a few individual homes and businesses, e.g., limits on left turns would require drivers to proceed to an adjoining intersection to make a u-turn and then backtrack to make a right turn into their destination.

For MCB2 and MCB4, two design options are evaluated for the approach to the bridge over Currituck Sound, between US 158 and Currituck Sound. Option A would place a toll plaza within the US 158 interchange. The mainland approach road to the bridge over Currituck Sound would include a bridge over Maple Swamp. With Option B, the approach to the bridge over Currituck Sound would be a road placed on fill within Maple Swamp. Aydlett Road would be removed and the roadbed restored as a wetland. Traffic traveling between US 158 and Aydlett would use the new bridge approach road. A local connection would be provided between the bridge approach road and the local Aydlett street system. The toll plaza would be placed in Aydlett east of that local connection so that Aydlett traffic would not pass through the toll plaza when traveling between US 158 and Aydlett. No access to and from the Mid-Currituck Bridge would be provided at Aydlett.

Also, for MCB2 and MCB4, there are two variations of the proposed bridge corridor (see Figure P-2) in terms of its terminus on the Outer Banks. Bridge corridor C1 would connect with NC 12 at an intersection approximately two miles north of the Albacore Street retail area, whereas bridge corridor C2 would connect with NC 12 approximately one-half mile south of this area. The length of the proposed Mid-Currituck Bridge would be approximately 7.0 miles with bridge corridor C1, whereas it would be approximately 7.5 miles with bridge corridor C2.

When impacts differ for the three alternatives (ER2, MCB2, and MCB4) between the mainland approach road design options (Option A and Option B) and/or the two bridge corridors (C1 and C2), the names of the alternatives are augmented with suffixes for the mainland approach road design option and/or the bridge corridor. For example, MCB2 with mainland design Option B and the C1 corridor is referred to as MCB2/B/C1. In situations where impacts differ between the bridge corridors but the design option on the mainland is not relevant to the comparison, only the corridor suffix is used (e.g., MCB2/C1). When differences are confined to the mainland design options, only the design option suffix is used (e.g., MCB2/A). If no suffix is provided (e.g., MCB2), then the reader can assume that impacts would be identical irrespective of the mainland design option or corridor terminus alternative used.

Preferred Alternative

The Preferred Alternative is MCB4/C1 with Option A (Figure P-3). It also includes several design refinements to reduce impacts, in response to government agency and public input and comments. These refinements include:

- Provision of a median acceleration lane at Waterlily Road. This safety feature would allow left turns to continue to be made at Waterlily Road and US 158. Bulb-outs for u-turning vehicles also would be provided at the re-aligned US 158/Aydlett Road intersection and the US 158/Worth Guard Road intersection to provide greater flexibility for local traffic in turning to and from existing side streets near the US 158/ Mid-Currituck Bridge interchange.

- Reducing the amount of four-lane widening along NC 12 from that with MCB4/C1 from approximately 4 miles to approximately 2.1 miles, plus left turn lanes at two additional locations over approximately 0.5 mile. The 2.1 miles of NC 12 widening would be concentrated at three locations: the bridge terminus, the commercial area surrounding Albacore Street, and Currituck Clubhouse Drive.

- Constructing roundabouts on NC 12 instead of signalized intersections at the bridge terminus and Currituck Clubhouse Drive.

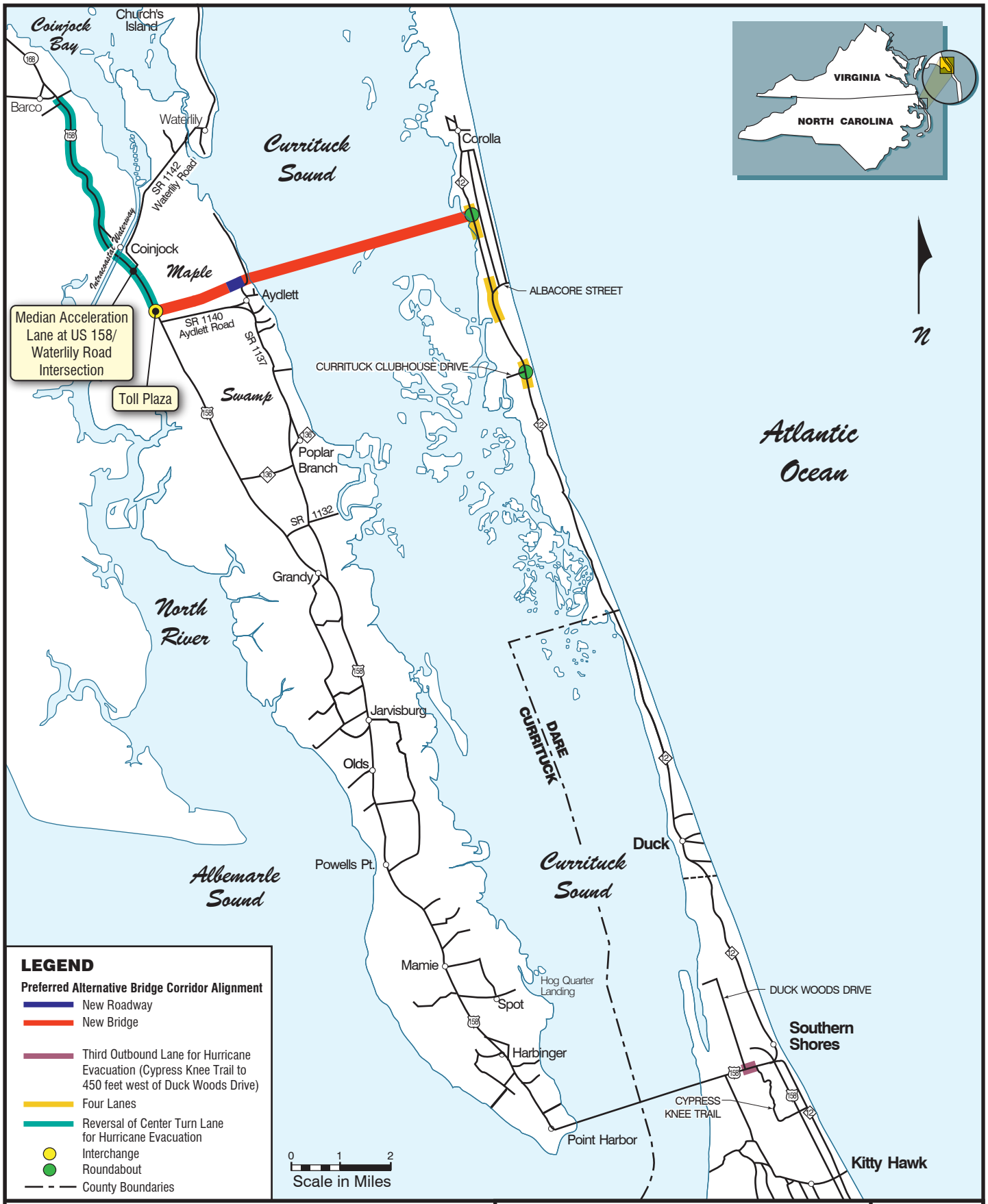
- Terminating the bridge in a roundabout at NC 12 also allowed the C1 bridge alignment to be adjusted to remove curves and thereby reduced its length across Currituck Sound by approximately 250 feet (from approximately 24,950 feet [4.7 miles] to 24,700 feet).

- Provision of marked pedestrian crossings along NC 12 where it would be widened. They would be placed at locations identified by Currituck County plans (Albacore Street, Orion's Way, and Currituck Clubhouse Drive are under consideration for inclusion in the next Currituck County thoroughfare plan), as well as at North Harbor View Drive and the bridge terminus (one across NC 12 and one across the bridge approach road).

- For hurricane evacuation, the Preferred Alternative includes:

- On the mainland, reversing the center turn lane on US 158 between the US 158/Mid-Currituck Bridge interchange and NC 168.

- On the Outer Banks, adding approximately 1,600 feet of new third outbound lane to the west of the NC 12/US 158 intersection to provide additional road capacity during a hurricane evacuation. The additional lane would start at the US 158/Cypress Knee Trail/Market Place Shopping Center intersection and end approximately 450 feet west of the Duck Woods Drive intersection, a total distance of approximately 1,600 feet. From this point, the new lane would merge back into the existing US 158 westbound lanes over a distance of approximately 300 feet.



Preferred Alternative

Figure
P-3

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Summary

This assessment of indirect and cumulative effects was prepared in accordance with the *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina* (NCDOT, 2001). The specific approach used for each step of the assessment was developed by the study team at East Carolina University, in association with an indirect and cumulative effects analysis specialist at the private engineering firm of Parsons Brinckerhoff and NCTA staff. The approaches were reviewed and discussed with state and federal environmental resource and regulatory agencies at a meeting on October 7, 2008. Currituck and Dare county land use and economic development plans were an important input into the assessment. The time horizon for this assessment is 2035. Comments made on the November 2009 *Indirect and Cumulative Effects Technical Report* and the related text in the March 2010 DEIS were taken into consideration in developing this report.

In the indirect and cumulative effects (ICE) study area, impact-causing activities are primarily associated with:

1. The proposed project and its detailed study alternatives;
2. Private development and the provision of infrastructure to serve that development;
3. Other transportation projects presented in the *2009 to 2015 State Transportation Improvement Program* (STIP) and included in the No-Build Alternative;
4. Logging in forested areas, including wetlands;
5. Beach driving; and
6. Accelerated sea level rise.

Activities associated with 2 to 6 generally would occur with or without the implementation of one of the detailed study alternatives, including the Preferred Alternative.

Activities associated with 1, the proposed project and its detailed study alternatives, are under consideration in the FEIS. Direct project-related actions are found in six types.

1. Modification of regime;
2. Land transformation and construction;
3. Resources extraction;
4. Land alteration;
5. Changes in traffic, and

6. Access alteration.

The alternatives, however, also could alter the patterns of private development through the changes in access, road capacity, and circulation patterns that they involve. Thus, the study examined this possibility of project-induced change from five perspectives.

1. What is the potential for an increase in permanent residents on the Outer Banks?

   It was concluded that negligible change in permanent population would be associated with ER2 and a negligible or slight increase would be associated with MCB2, MCB4, and the Preferred Alternative.

2. What is the potential for an increase in the number of day trips to the Outer Banks? Where would an increased number of day trips potentially occur? What would be the nature of those trips?

   It was concluded that a negligible increase in day trips would be associated with ER2. With MCB2, MCB4, and the Preferred Alternative there would be some potential for an increase over the No-Build Alternative with the potential higher in the non-road, four-wheel drive accessible area.

3. Would development in the paved NC 12-accessible Outer Banks change in terms of future development location, rate, or type?

   It was concluded that for the NC 12-accessible Outer Banks, there would be no reasonably foreseeable change in the demand for homes and businesses with implementation of the detailed study alternatives, including the Preferred Alternative, compared to the No-Build Alternative. Furthermore, the communities are currently planning for this level of development. Consequently, there is no reasonably foreseeable change in the type and density of development. No notable increase in the rate of development on the Outer Banks as a whole would be foreseeable over the No-Build Alternative, although the detailed study alternatives, including the Preferred Alternative, would reduce the potential for severe congestion to constrain the demand for new development in the ICE study area. Congestion is most acute on changeover days (summer weekends), when the levels of service associated with the No-Build Alternative or ER2 could result in a differential effect on development. Severe congestion could limit the practical development of rental cottages and hotel rooms north of Duck as congestion becomes a more prevalent factor in a tourist's decision to come to these beaches or go elsewhere. MCB2 would reduce this potential constraint the most, followed by MCB4 and the Preferred Alternative, and then ER2.

   The introduction of a Mid-Currituck Bridge with MCB2, MCB4, or the Preferred Alternative would substantially reduce travel time from points north of the bridge on the mainland to the Currituck County Outer Banks. As such, the order in which available lots on the NC 12-accessible Outer Banks would develop in response to

market demand would likely change, with more Currituck County lots developing before Dare County lots.

4. Would development within the non-paved-road accessible area north of the terminus of NC 12 on the Currituck County Outer Banks change in terms of future development location, rate, or type?

   For the non-road-accessible Outer Banks, it was concluded that there would be no reasonably foreseeable change in the demand for development with implementation of the detailed study alternatives compared to the No-Build Alternative. Consequently, there is no reasonably foreseeable change in the location, rate, or type of development with implementation of the detailed study alternatives, including the Preferred Alternative, compared to the No-Build Alternative.

   Given the severe congestion forecasted for the Outer Banks on changeover days (summer weekends), the levels of service associated with the No-Build Alternative or ER2 could result in a differential effect on development. Although the demand for development on the Outer Banks does not vary with the different scenarios, severe congestion could limit the practical development of rental cottages as congestion becomes a more prevalent factor in a tourist's decision to come to the non-road accessible area or go elsewhere. Although any of the bridge alternatives will bypass the traffic chokepoint at the Dare-Currituck County line, there would be no difference between any of the alternatives in the level of service at the end of NC 12.

5. Would development in mainland Currituck County change in terms of future development location, rate, or type?

   It was concluded that it is reasonably foreseeable that the introduction of a Mid-Currituck Bridge with MCB2, MCB4, and the Preferred Alternative would alter the location of some future Outer Banks service-oriented businesses. Some business development that might otherwise have been scattered in planned commercial areas on the Outer Banks and mainland near the Wright Memorial Bridge would concentrate at locations on the mainland near the terminus of the Mid-Currituck Bridge at US 158. This change would represent a net gain in business development in a concentrated location on the Currituck County mainland, creating a potential for a notable indirect and cumulative impact focused on the mainland bridge terminus. Land potentially involved is estimated to be approximately 68 acres. This estimate is based on analysis presented here as well as in *Economic Development Strategy "Vision Plan" for Currituck County, North Carolina* (Lane and Jolley, 2008). Considering the performance requirements that Currituck County enforces for commercial development, this might be expected to increase impervious cover in the county by 44 acres. This would be a shift in impervious cover from the Outer Banks to the Currituck County mainland. Although ER2 would increase road capacity and improve traffic flow, it would not change the accessibility of the road system to developable properties. Thus, it is not reasonably foreseeable that ER2 would shift expected new business development to a concentrated location on the mainland.

The assessment of indirect effects found that there is adequate land considered suitable for development to accommodate business development likely to occur near the US 158/Mid-Currituck Bridge interchange with MCB2, MCB4, and the Preferred Alternative. Potential visual and traffic impacts would be associated with that development. Also, with MCB2, MCB4, and the Preferred Alternative, shifts in the timing of development on the Outer Banks are likely, i.e. more Currituck County lots developing before Dare County lots. These two effects would be compatible with area land use plans, social health and well-being goals, economic opportunity goals, and ecosystem protection goals.

The assessment of cumulative effects found that those effects would be primarily associated with future growth in Currituck County irrespective of a detailed study alternative, including the Preferred Alternative, being implemented. The growth trend assumed in area land use plans, with a horizon year of 2025, does not appear to be sustainable to 2035 on the Currituck County mainland. If plan densities and growth continue, then most land suitable for development, including land designated as Rural Areas in the current plan, would be developed. This appears to conflict with current plan goals.

Should forecasted 2035 development occur, based on Currituck County requirements, such development could add 10,000 acres of impervious surface. This increase would occur with the No-Build Alternative and would be generally unaffected by the detailed study alternatives, including the Preferred Alternative. The total additional impervious surface of the detailed study alternatives would be 89 acres for ER2 (54.3 acres without a third outbound lane for hurricane evacuation), 120.0 to 126.8 acres for MCB2 (114.8 to 121.6 without a third outbound lane), 80.6 to 86.6 acres for MCB4 (74.0 to 80.0 without a third outbound lane), and 71.5 acres for the Preferred Alternative. Induced development with MCB2, MCB4, and the Preferred Alternative would shift approximately 44 acres of future impervious surface growth from the Outer Banks to the mainland. Thus, in the worst case scenario, the detailed study alternatives account for less than 2 percent of the increase in impervious surface in the ICE study area by 2035.

Substantial indirect effects would be visual and traffic effects at the US 158/Mid-Currituck Bridge interchange with MCB2, MCB4, and the Preferred Alternative. Substantial cumulative effects are those associated with continued development in Currituck County. NCTA would mitigate direct impacts associated with the US 158/Mid-Currituck Bridge interchange itself. Minimization of other impacts, including the indirect visual and traffic effects of induced development, would be the responsibility of Currituck County.

1.0 Definition of Indirect and Cumulative Effects Assessment Study Area Boundaries

This chapter defines the study area boundaries for the indirect and cumulative effects assessment (ICE study area), as called for in Step 1 of the *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina* (NCDOT, 2001). These ICE study area boundaries are defined in terms of both space (Section 1.1) and timeframe (Section 1.2).

Indirect effects are impacts caused by the project but, compared to direct impacts, are later in time or farther removed in distance, but are still reasonably foreseeable. In the case of this project, indirect effects include project-induced changes in the pattern of land use and the impacts on the community and natural environment of that change.

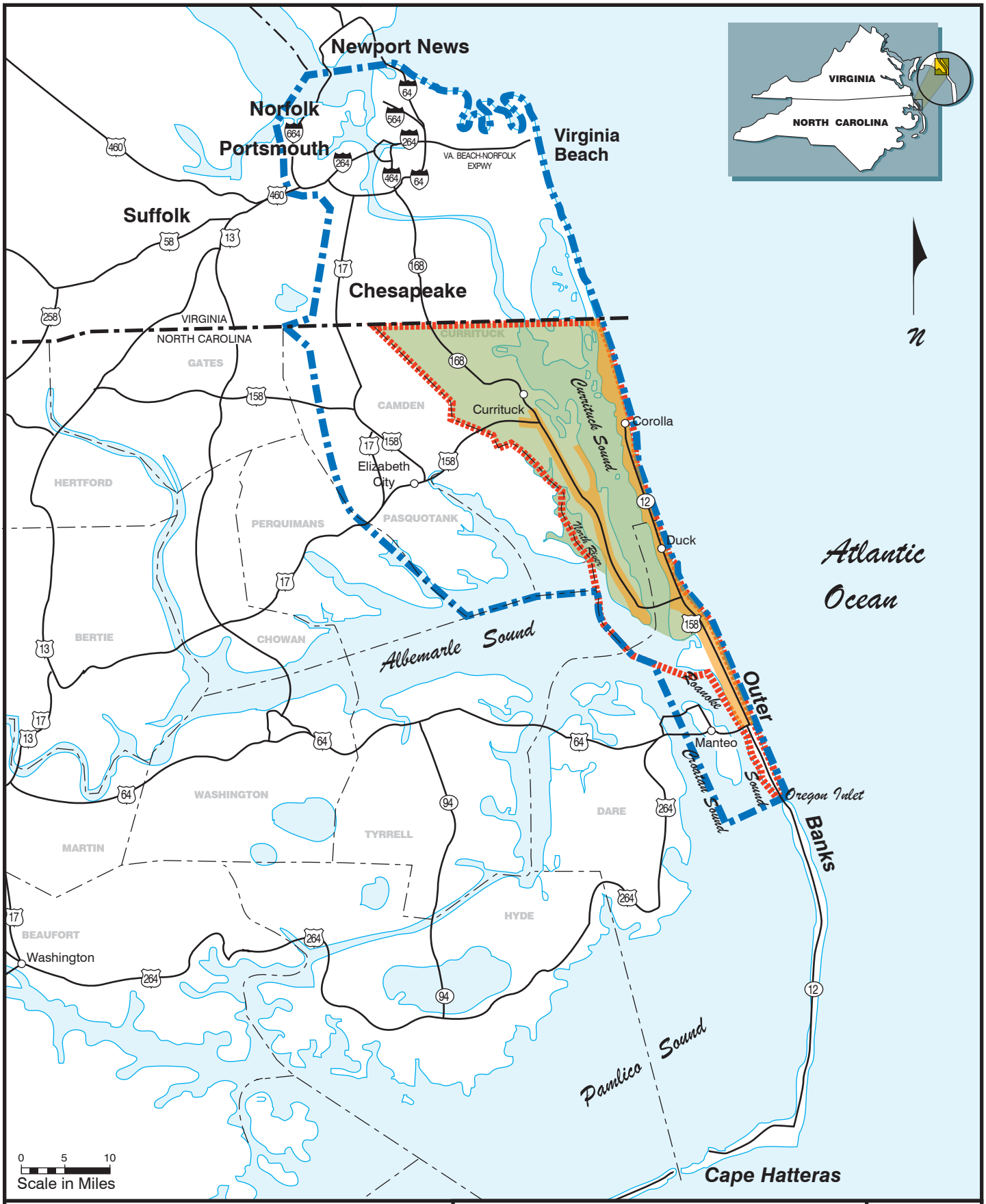
Cumulative effects are impacts on the environment that result from the incremental impact of the proposed project when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects are considered because they can result from individually minor but collectively significant actions taking place over a period of time. In the case of the proposed project, cumulative effects result from the project, land use changes induced by the project, and all other development activities expected through 2035.

1.1 Spatial Boundaries

Because indirect and cumulative effects can occur at a greater distance from the proposed project than direct impacts, the spatial boundaries for the area analyzed for indirect and cumulative effects is larger than the direct impacts project area shown on Figure P-1. These spatial boundaries also vary by issue, or category, because the boundaries for each category are delineated to evaluate reasonably foreseeable indirect and cumulative effects from the proposed project related to that specific category. The ICE study area boundaries for the Mid-Currituck Bridge indirect and cumulative effects assessment are shown on Figure 1-1 and discussed in the following sections.

1.1.1 Political/Planning Boundaries

The political and planning jurisdictions boundaries include all of Currituck County and the Outer Banks portion of Dare County between Currituck County and Oregon Inlet (see Figure 1-1). This study area includes the Dare County municipalities of Kitty Hawk, Duck, Southern Shores, Kill Devil Hills, and Nags Head. The detailed study alternatives, including the Preferred Alternative would not be expected to affect activity on Roanoke Island, Hatteras Island, mainland portions of Dare County, other adjoining North Carolina counties, or southeast Virginia. Travel time changes associated with the



LEGEND

- Commuteshed
- Political Boundaries
- Growth/Development Study Area
- Habitat/Water Quality Study Area

Indirect and Cumulative Effects Assessment Study Area Boundaries

Figure 1-1

detailed study alternatives that might cause an alteration in future activity decisions become a negligible portion of total travel as one moves further from the project area and, thus, the influence of the project becomes insignificant.

1.1.2 Commuteshed

The US Census commuting data presented in Table 3-4 and Table 3-5 in Chapter 3 indicate travel into the project area by commuters from a multi-county area in North Carolina and a part of southeastern Virginia. Considering this, the commuteshed boundary for this study (see Figure 1-1) is defined by limits of commuting trips between counties in the region including the Hampton Roads metropolitan statistical area south of Hampton Roads Bay and nearby North Carolina counties. The relevant Hampton Roads municipalities in Virginia include the following: Chesapeake, Norfolk, Portsmouth, and Virginia Beach. North Carolina counties having commuter relationships to the project area are: Camden, Currituck, Dare, and Pasquotank. The only portions of Dare County that are considered are Roanoke Island and the Outer Banks towns north of Oregon Inlet. This not only encompasses the vast majority of businesses and residences in the county, but also is the most proximate to the project alternatives. The commuteshed boundary also represents the likely source of any potential day trips to the Outer Banks.

The North Carolina Department of Environment and Natural Resources (NCDENR) in a letter to the US Environmental Protection Agency (USEPA) indicated that from an air quality perspective, Currituck County makes no substantial motor vehicle travel contribution to the Virginia Beach-Newport News-Norfolk (Hampton Roads) metropolitan statistical area.

1.1.3 Growth/Development Study Area

Only the potential growth areas with a notable direct travel benefit associated with the project were incorporated into the growth or development study area. Inclusion in this boundary does not assume that growth and development will occur, but rather that the construction of one of the detailed study alternatives is sufficient to warrant study of the potential growth or development issues. The growth/development study area (see Figure 1-1) includes areas identified in project-area land use plans that are either planned for development or expected to see growth in population or employment. The growth area boundary also encompasses the likely future service area limits in the project area. Since the project area is within Currituck County and Dare County, including the Towns of Kitty Hawk, Southern Shores, and Duck, the Coastal Area Management Act (CAMA) land use plans for these jurisdictions were reviewed to ascertain the areas having potential for growth and development and their proximity to the project. Important to the selection of this boundary was:

- The potential demand by Outer Banks residents and visitors for services in reasonable proximity to their dwellings;

- The likely distance they would be willing to travel for such services and the change in travel time and distance associated with the detailed study alternatives (including the Preferred Alternative); and

- The accessibility of developable land on the mainland to Outer Banks dwellings based on the assumption that services would locate on land with optimal accessibility to their customers, given the demand for services and the availability of developable land.

Also important was the assumption that services would want to capture potential customers traveling to the Outer Banks before they reach the Outer Banks and, as such, would want to place services in locations passed by as many vehicles as possible before crossing the bridges leading to the Outer Banks.

Finally, it was kept in mind that patterns of residential development on the Currituck County mainland for people who work on the Outer Banks could change based on the new access point provided by a Mid-Currituck Bridge to the northern-most Outer Banks development areas.

Potential growth or development areas boundary are not contiguous. They are broken up by swampland, Currituck Sound, and protected lands.

1.1.4 Habitat/Water Quality Study Area

The habitat/water quality study area includes the extent of the landscape and waterscape areas where there potentially would be cumulative activities or indirect effects on the natural environment (see Figure 1-1). This study area is discussed further in Section 3.1.

The water quality areas include the estuarine waters of Currituck Sound and North River, as well as the streams and wetlands on potentially affected lands. The water quality information centers on lower part of sub-basin 03-01-54 (Currituck basin). Information was developed using published data from the US Environmental Protection Agency (USEPA) and the North Carolina Department of Environment and Natural Resources (NCDENR), Division of Water Quality (DWQ) that indicates land surfaces and water bodies that shed into Currituck Sound. The historic watershed boundary was not used because, in a low coastal area such as this, the watershed delineations are inexact. The landscape is very low relief and is highly altered with drainage ditches. In Currituck County the drainage network rarely crosses the state line. Furthermore, land uses "upstream" in Virginia or up the Albemarle are not likely to be connected to the project activities in an indirect or cumulative way.

The habitat areas studied (see Figure 1-1) were developed using information from the North Carolina Natural Heritage Program (NCNHP) database, and from aerial

photographs showing the locations of swamps and marsh lands. This boundary encompasses:

- Natural areas that could be affected by changes in future development patterns associated with the detailed study alternatives, including the Preferred Alternative;
- Wildlife travelways and large habitat areas that could be segmented by the project and other past, present, and reasonably foreseeable future actions; and
- Areas where water quality and hydrologic changes could result from the project and other past, present, and reasonably foreseeable future actions.

1.2 Timeframe

The planned timeframe for the indirect and cumulative effects assessment generally will be the same timeframe used in the 1998 DEIS (FHWA and NCDOT, 1998) which used the early 1970s as the primary starting point for assessing trends in land use change. Contemporary residential development on the Currituck County Outer Banks began in the late 1960s and early 1970s with the subdivisions of Carova Beach, North Swan Beach, Swan Beach, Seagull, and Ocean Beach (all between the northern terminus of NC 12 and the Virginia state line). The first land use plan for Outer Banks development was created in 1973. The first sand beach road was introduced to Currituck County in 1974, extending to Ocean Beach from Dare County. The three towns of northern Dare County began being incorporated in 1979. A road to Corolla (NC 12) was paved in 1984. As in the 1998 DEIS, the 1950 US Census will be used as the starting point for identifying trends in population and economic growth.

The typical long-range planning period or design life is 20 to 25 years for transportation projects. The Federal Highway Administration (FHWA) April 1992 position paper on secondary and cumulative impacts assessment calls for the use of the project's design life as the future limits for an indirect and cumulative effects assessment. In addition, NCDOT's guidance on indirect and cumulative effects assessment notes that the design life of the project is used for most projects (NCDOT, 2001). The design year for Mid-Currituck Bridge improvements is 2035, so the year 2035 will generally be used as the outer limit of the indirect and cumulative effects assessment. The population forecasts used in the traffic forecasts for 2035 assume full build-out of the road accessible portion of the Outer Banks in the project area.

2.0 Indirect/Cumulative Effects Study Area Directions and Goals

This chapter presents data regarding general trends and goals on social, economic, and environmental conditions within the indirect and cumulative effects assessment ICE study area. This chapter incorporates the work of Step 2 of the *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina* (NCDOT, 2001).

2.1 Local and Regional Growth Trends

2.1.1 Population

2.1.1.1 Currituck County

Currituck County was settled around 1650 by families and individuals from the Virginia colonies. Historically, Currituck County's economy centered on agriculture, but more recently mainland Currituck County has become a bedroom community for Dare County and the Hampton Roads metropolitan area. In addition, Currituck County's Outer Banks are becoming a popular tourist destination. Most of Currituck County's permanent population resides on the mainland.

The Currituck County mainland primarily consists of agricultural lands, rural development, small subdivisions, and growing commercial development along major thoroughfares. Much of the mainland area is within floodplains and has soil unsuitable for septic service. Most mainland development is occurring along the North Carolina/Virginia border and along the US 158 and NC 168 highway corridors. Overall, the paces of development on the mainland and on the Outer Banks have proceeded differently due to being driven by different factors.

There are no incorporated communities in Currituck County. In 2004, however, the NC 12-accessible portion of the Currituck County Outer Banks began an initiative to incorporate. Others are proposing to incorporate the county as a whole a combined county-municipality. The Currituck County Outer Banks consists of sixteen residential subdivisions occupied by multi-story single family, condominium, and town home rental units. Rental units found along the Outer Banks represent the primary tax base for Currituck County.

Permanent population growth is presented in Table 2-1. The greatest percent of permanent growth in Currituck County occurred between 1970 and 1980. Higher levels are expected to continue to occur through 2010. Growth in permanent population is expected to be greater than state levels in the foreseeable future. Currituck County continues to grow in popularity as a tourist destination. Exact figures on the peak seasonal population are difficult to determine. The *Currituck County 2006 Land Use Plan* (Currituck County, 2006) indicates a total seasonal population of 51,988 persons for 2000. Added to the 18,190 total year round population, the total peak seasonal population was 70,178.

Table 2-1. Permanent Population in Currituck and Dare Counties

Year	Currituck Population	Percent Change	Dare Population	Percent Change
1950	6,201	-	5,405	-
1960	6,601	6.06%	5,935	8.93%
1970	6,976	5.38%	6,995	15.15%
1980	11,089	37.09%	13,377	52.29%
1990	13,736	19.27%	22,746	41.19%
2000	18,190	24.49%	29,967	24.10%
2010[1]	26,533	31.44%	38,458	22.08%
2020[1]	33,557	20.93%	46,455	17.21%
2030[1]	40,369	16.87%	53,843	13.72%
2035[2]	43,774	8.44%	57,537	6.86%

Source: US Census.

[1] Forecasted by the North Carolina State Data Center, 2007.

[2] Data for the design year extrapolated from the last forecasted growth rate.

2.1.1.2 Dare County

Dare County is south of Currituck County and includes a portion of the North Carolina Outer Banks, Roanoke Island, and some mainland. More than 70 percent of the County's permanent population resides on the Outer Banks. Much of Dare County's mainland is owned by the federal government or restricted from development by environmental constraints.

The main area of Dare County considered for impact analysis is the strip of barrier dunes adjacent to Currituck Sound, which includes the incorporated towns of Duck, Southern Shores, and Kitty Hawk, as well as the unincorporated area called Martins' Point Subdivision. Martins Point is a narrow peninsula in the Currituck Sound just north of Wright Memorial Bridge. It is fully developed as a gated community. Dare County currently has planning jurisdiction over Martin's Point.

In 1928, a bridge opened that connected the Outer Banks at Nags Head to Roanoke Island. Roanoke Island was connected to the mainland by a bridge in 1957. It was with the construction of these bridges and the bridge between the mainland and Kitty Hawk in the 1930s (Wright Memorial Bridge) that the era of tourism began in Dare County, with the boom coming after the 1960s.

Dare County has six incorporated municipalities. The municipalities of Kitty Hawk, Southern Shores, and Duck are in the growth area boundary of the ICE study area and are briefly discussed in the following sections.

2.1.1.3 Kitty Hawk

The Town of Kitty Hawk was incorporated in 1981. It is immediately south of the east-west portion of US 158 on the Dare County Outer Banks. It is bounded by the Town of Southern Shores to the north (the east-west portion of US 158 is the municipal boundary between Kitty Hawk and Southern Shores), Kitty Hawk Bay and the Town of Kill Devil Hills to the south, the Atlantic Ocean to the east, and Currituck Sound and Albemarle Sound to the west. The US 158/NC 12 intersection is near the northeastern corner of the town, and US 158 and NC 12 run north-south through the eastern portion of Kitty Hawk. The total land area of the town is 5,248 acres.

The predominant land use in the town is undeveloped or vacant (approximately 47 percent of the total land area of the town). Conservation is the second largest land use at approximately 25 percent of the total land area, with single-family residential next at approximately 20 percent. Commercial development comprises only about four percent of the total land area. According to the 2000 Census, the permanent population of the town was 2,991; however, the peak seasonal population is estimated to be approximately 16,300 (Community Planning Collaborative Inc., 2004).

2.1.1.4 Southern Shores

The Town of Southern Shores was incorporated in 1979. It is immediately north of the east-west portion of US 158 on the Dare County Outer Banks. It is bounded by the Town of Kitty Hawk to the south, the Town of Duck to the north, the Atlantic Ocean to the east, and Currituck Sound to the west. The US 158/NC 12 intersection is near the southeastern corner of the town and NC 12 runs north-south through the eastern portion of Southern Shores. The total land area of the town is approximately 2,600 acres.

The predominant land use in the town is single-family residential, with only limited property zoned for commercial use, primarily along US 158. In 2005, the permanent population of the town was 2,612, up from a 2000 population of 2,201 (Town of Southern Shores, 2010). The peak seasonal population is estimated to be approximately 10,000.

2.1.1.5 Duck

The Town of Duck was originally settled in 1879. The town was incorporated in May 2002. It is at the northern limits of the Dare County Outer Banks. It is bounded by Currituck County to the north, the Town of Southern Shores to the south, the Atlantic Ocean to the east, and Currituck Sound to the west. NC 12 runs north-south through the western portion of Duck. The total land area of the town is 1,510 acres.

The predominant land use in Duck is single-family residential (approximately 51 percent of the total land area of the town). Commercial development comprises only about six percent of the town's total land area and is primarily limited to the NC 12 corridor. According to the 2000 Census, the permanent population of the town was 448;

however, the peak seasonal population prior to 2005 is estimated to be approximately 14,600 (Community Planning Collaborative, Inc., 2005), and by 2009, 21,704 persons (personal communication, Andy Garman, Town of Duck, July 7, 2011).

2.1.2 Housing

Population growth in Currituck and Dare counties has been supported by housing development. Table 2-2 shows the growth of total housing units in Currituck and Dare counties from 1960 to 2000. A surge in new housing units in Currituck County between 1970 and 1980 corresponds to a substantial increase in its population. During this period, Currituck County began to grow as a suburb of the Virginia Beach/Norfolk metropolitan area. In addition, some of the growth in housing units during this period is attributable to vacation home development along the Outer Banks. Between 1980 and 2000, growth in total housing units also reflects continued growth of the area as a bedroom community and surge in seasonal housing along the Outer Banks. The decrease in the average number of persons per housing units reflects the growing emphasis on rental vacation home development.

Table 2-2. Housing Units in Currituck and Dare Counties

Year	Currituck County			Dare County		
	Total Units	Percent Change	Persons Per Housing Unit	Total Units	Percent Change	Persons Per Housing Unit
1950	2,054	-	-	2,009	-	-
1960	2,280	11.0%	2.90	4,045	101.3%	1.47
1970	2,735	20.0%	2.55	5,057	25.0%	1.38
1980	5,405	97.6%	2.05	11,006	117.6%	1.22
1990	7,367	36.3%	1.86	21,567	96.0%	1.05
2000	10,687	45.1%	1.70	26,671	23.7%	1.12

Source: US Census

The median value of owner-occupied housing has increased considerably in Currituck and Dare counties (see Table 2-3). Information on the average value of all housing units in the counties is not available. Census data account only for owner-occupied units. In 1970, the median value of owner-occupied housing in both counties was below the state average. By 1980, Dare County surged well above the state average. By 1990, both counties exceeded the state average, with ten-year increases far surpassing state figures. Both county values in 2000 were above the state average.

The *Outer Banks Economic & Demographic Package* (The Outer Banks Chamber of Commerce, 2002) includes statistics on the number of new housing units built in

Table 2-3. Owner- Occupied Housing Values in Currituck and Dare Counties

	Currituck		Dare		North Carolina	
	Median	%	Median	%	Median	%
Year	Value	Change	Value	Change	Value	Change
1970	$8,500	-	$9,800	-	$12,800	-
1980	$33,800	+297.7%	$46,500	+374.5%	$36,000	+181.3%
1990	$79,200	+134.3%	$108,100	+132.5%	$65,800	+82.7%
2000	$115,000	+45.2%	$137,200	+26.9%	$108,300	+64.6%

Source: US Census

Currituck and Dare counties and their value. Numbers relevant to this assessment are shown in Table 2-4. The number of housing starts was generally stable in Currituck County in the ten-year period from 1992 to 2001 and rising in Dare County. The value of the homes built increased in both counties. The value of homes built increased 150 percent in Currituck County and 97 percent in Dare County between 1992 and 2001. This is far greater than the percent increase in the median home value in the two counties in the roughly comparable 1990 to 2000 period presented in Table 2-3, indicating an increasing emphasis on building higher priced vacation housing in the two counties. This finding fits also with opinions expressed during stakeholder involvement, which noted that the size of vacation homes built on the Outer Banks is larger than in past years (The Outer Banks Chamber of Commerce, 2002).

Table 2-4. Housing Starts in Currituck and Dare Counties

	No. of Housing Starts			Average Price Per Unit		
	1992	1996	2001	1992	1996	2001
Currituck County	449	476	458	$67,656	$135,314	$168,947
Dare County	442	515	964	$112,095	$129,922	$220,849

Source: The Outer Banks Chamber of Commerce, 2002.

Table 2-5 shows housing vacancy rates for the two counties and the State of North Carolina. Table 2-6 shows the four Outer Banks jurisdictions within the project area. Vacancy rates did not change substantially between 1990 and 2000. Vacancy rates are high on the Outer Banks, reflecting the large number of rental vacation homes. The older communities of Southern Shores and Kitty Hawk have lower vacancy rates than Duck and the Currituck County Outer Banks, indicating permanent residents can be found in these communities.

Table 2-5. Regional Housing Vacancy Rates

Year	Currituck		Dare		North Carolina	
	Housing Units	% Vacant	Housing Units	% Vacant	Housing Units	% Vacant
1980	5,405	13.1%	11,006	42.2%	2,274,737	8.0%
1990	7,367	31.6%	21,567	56.7%	2,818,193	10.7%
2000	10,687	35.2%	26,671	52.4%	3,523,944	11.1%

Source: US Census

Table 2-6. Outer Banks Housing Vacancy Rates

Year	Currituck County Outer Banks		Kitty Hawk (Dare County)		Southern Shores (Dare County)		Duck (Dare County)	
	Housing Units	% Vacant	Housing Units	% Vacant	Housing Units	% Vacant	Housing Units	% Vacant
1990	1,330	88.9%	2,198	62.6%	1,625	57.7%	1,257	87.4%
2000	3,023	89.4%	2,682	52.3%	2,813	61.0%	1,351	84.2%

Source: US Census; Currituck County, 2006

2.1.3 Employment

The composition of employment within Currituck and Dare counties, shown in Table 2-7, has been consistently different from the State. This is a reflection of the region's economic base in tourism and development. In particular, both counties have had only limited employment in manufacturing and a high proportion of trade sector employment (retail and wholesale trade). The proportions of different employment categories in Currituck and Dare counties reflect the recreational emphasis of their Outer Banks.

Currituck County's employment grew by 141.0 percent between 1992 and 2007, from 2,354 to 5,673. The four largest employment sectors in 2007 were retail trade (20.0 percent of total employment), accommodation and food services (10.6 percent), real estate services (10.0 percent), and construction (9.2 percent). These four account for 49.8 percent of the employment in the county. Retail trade's share of total employment in 2007 was 8.4 points higher than the proportion of trade sector employment for the state. Between 1992 and 2007, the following categories grew faster than the county average: construction, transportation and warehousing, real estate and rental leasing, professional and technical services, arts entertainment and recreation, accommodation and food services, and other services.

Dare County's employment grew by 68.6 percent between 1992 and 2007, from 11,756 to 19,824. The four largest employment sectors in 2007 were accommodation and food services (21.7 percent of total employment), retail trade (17.8 percent), real estate services (12.2 percent), and public administration (8.3 percent). These four account for 60.0 percent of the employment in the County. Accommodation and food service's share of total employment in 2007 was 13.2 points higher than the proportion of that sector employment for the state. Between 1992 and 2007, the following categories grew faster

Table 2-7. Employment by Sector 1992 to 2007

	Currituck County			Dare County			North Carolina		
	1992	2007	Change	1992	2007	Change	1992	2007	Change
Total	2,354	5,673	141.0%	11,756	19,824	68.6%	3,098,984	4,064,981	31.2%
	100.0%	100.0%		100.0%	100.0%		100.0%	100.0%	
Agriculture, Forestry, Fishing & Hunting	NA	54	NA	NA	4	NA	23,860	29,623	24.2%
		1.0%			0.0%		0.77%	0.73%	
Mining	NA	NA	NA	NA	NA	NA	3,764	3,973	5.6%
							0.1%	0.1%	
Utilities	NA	NA	NA	105	102	-2.9%	27,211	14,175	-47.9%
				0.9%	0.5%		0.9%	0.3%	
Construction	160	523	226.9%	858	1,413	64.7%	148,675	254,686	71.3%
	6.8%	9.2%		7.3%	7.1%		4.8%	6.3%	
Manufacturing	65	80	23.1%	193	711	268.4%	792,252	537,919	-32.1%
	2.8%	1.4%		1.6%	3.6%		25.6%	13.2%	
Wholesale Trade	94	130	38.3%	353	489	32.9%	141,509	182,706	29.1%
	4.0%	2.3%		3.0%	2.5%		4.6%	4.5%	
Retail Trade	476	1,135	138.4%	2,321	3,534	52.3%	363,428	470,432	29.4%
	20.2%	20.0%		19.7%	17.8%		11.7%	11.6%	
Transportation and Warehousing	60	202	236.7%	202	193	-4.5%	109,736	140,067	27.6%
	2.5%	3.6%		1.7%	1.0%		3.5%	3.4%	
Information	NA	20	NA	219	241	10.0%	55,586	74,069	33.3%
		0.4%		1.9%	1.2%		1.8%	1.8%	
Finance and Insurance	33	88	166.7%	214	460	115.0%	103,837	153,075	47.4%
	1.4%	1.6%		1.8%	2.3%		3.4%	3.8%	
Real Estate and Rental and Leasing	20	569	2745.0%	771	2,411	212.7%	32,373	54,143	67.2%
	0.8%	10.0%		6.6%	12.2%		1.0%	1.3%	
Professional and Technical Services	29	100	244.8%	254	584	129.9%	99,534	186,115	87.0%
	1.2%	1.8%		2.2%	2.9%		3.2%	4.6%	
Management of Companies and Enterprises	NA	NA	NA	NA	NA	NA	36,650	70,771	93.1%
							1.2%	1.7%	
Administrative and Waste Services	91	202	122.0%	447	667	49.2%	123,902	246,446	98.9%
	3.9%	3.6%		3.8%	3.4%		4.0%	6.1%	
Educational Services	NA	NA	NA	NA	901	NA	237,848	362,901	52.6%
				NA	4.5%		7.7%	8.9%	
Health Care and Social Assistance	149	221	48.3%	360	911	153.1%	289,591	534,227	84.5%
	6.3%	3.9%		3.1%	4.6%		9.3%	13.1%	
Arts, Entertainment, and Recreation	67	250	273.1%	473	611	29.2%	30,953	56,057	81.1%
	2.8%	4.4%		4.0%	3.1%		1.0%	1.4%	
Accommodation and Food Services	189	603	219.0%	2,964	4,292	44.8%	215,320	343,872	59.7%
	8.0%	10.6%		25.2%	21.7%		6.9%	8.5%	
Other Services	36	244	577.8%	270	560	107.4%	82,050	104,202	27.0%
	1.5%	4.3%		2.3%	2.8%		2.6%	2.6%	
Public Administration	311	477	53.4%	1,131	1,640	45.0%	180,834	228,583	26.4%
	13.2%	8.4%		9.6%	8.3%		5.8%	5.6%	
Unclassified	NA	44	NA	NA	86	NA	NA	16,953	NA
		0.8%			0.4%			0.4%	

Note: Percentages below counts represent share of total employment for that year
Source: North Carolina Employment Security Commission, 2009.

than the county average: manufacturing, finance and insurance, real estate and rental leasing, professional and technical services, health care and social assistance, and other services.

2.2 Local/Regional Goals

2.2.1 Agencies and Organizations with Stated Goals

Table 2-8 indicates agencies and organizations that have specific goals relating to the social, economic, and ecological conditions in the growth area of the ICE study area. Appendix A details the goals of these organizations. The primary agencies establishing goals for the communities in the project area are the municipal governments of Currituck County, the towns of Duck, Southern Shores, and Kitty Hawk, and Dare County. These goals are articulated by the respective planning departments and approved by the electorates or their representatives. In addition, Currituck County commissioned a "Vision Plan" from the UNC Center for Competitive Economies, which was released in final draft form in June 2008 (Lane and Jolley, 2008). This vision plan did not state goals, per se, but did articulate ten strategic options that could be adopted by the county commissioners. Other agencies empowered at the state and federal levels establish goals for specific social and environmental conditions. Non-governmental organizations also express particular goals of organized community groups or national organizations with a stake in the region. In the sections that follow, these goals are summarized in the following categories:

- Social health and well being goals;
- Economic opportunity goals; and
- Ecosystem protection goals.

2.2.2 Social Health and Well Being Goals

The social health and well being goals are expressions of communities that are experiencing rapid growth in a sensitive coastal environment. Table 2-9 summarizes the social health and well being goals expressed by the official agencies. Appendix A gives greater detail. All five communities include using some form of growth management techniques as a goal. Several of them have adopted multiple forms of growth management through their zoning, development, and preservation ordinances. Currituck County in particular has enacted a Unified Development Ordinance that includes planned unit development (PUD) provisions as well as a Farmland Preservation Ordinance. On the Outer Banks, growth management is directed towards minimizing the urbanization of the beach towns. On the mainland, the goal is to protect sensitive ecosystems and encourage development suitable to the community needs and the environment. In all areas, aesthetics are considered whether for townscapes, working landscapes, or viewsheds.

Table 2-8. Agencies and Organizations

Agency	Documentation	Year	Authority
Currituck County	Currituck County Land Use Plan (Currituck County, 2006)	2006	County
Currituck County	Economic Development Strategy "Vision Plan" for Currituck County (Lane and Jolley, 2008)	2008	County
Currituck County	Unified Development Ordinance (Currituck County, 2004)	2004	County
Currituck County	Farmland Preservation Ordinance (Currituck County, 2007)	2001	County
Currituck County	Adequate Facilities Ordinance (Currituck County, 1994)	1994	County
Town of Duck	Town of Duck CAMA (Community Planning Collaborative, 2005)	2005	Town
Town of Southern Shores	Town of Southern Shores Land Use Plan (Town of Southern Shores, 1998); Draft Update (Town of Southern Shores, 2010)	1998/ 2010	Town
Town of Kitty Hawk	Town of Kitty Hawk CAMA (Community Planning Collaborative, 2004)	2004	Town
Dare County	Dare County Land Use Plan	2003	County
NCDENR- DCM	CAMA (http://dcm2.enr.state.nc.us/Handbook/contents.htm)	2004	State
Albemarle RPO	Albemarle Rural Planning Organization (http://www.co.dare.nc.us/BOC/2005/Attachments /1017at10.pdf)	2007	State
Hampton Roads MPO	Hampton Roads Metropolitan Planning Organization (MPO) (http://www.hrmpo.org/)	2006	State (VA)
NCDOT	Charting New Direction for NCDOT (http://www.ncdot.org/doh/PRECONSTRUCT/traffic /echs/DOCS/plan.pdf)	2004	State
NCDENR	CAMA accomplishments since 1974 (http://dcm2.enr.state.nc.us/News/accomp.htm)	2004	State
EPA/NCDENR	Albemarle-Pamlico Estuarine Study (http://www.apnep.org/techpubs/9314.pdf)	1994	Fed/State
NCDENR	Coastal Zone Management Act (http://www.nps.gov/history/local-law /FHPL_CstlZoneMngmt.pdf)	1972	State
NCDENR	Coastal Barrier Resources Act (http://www.fws.gov/laws/lawsdigest/coasbar.html)	1982	State
FEMA	Federal Emergency Management Act (http://classweb.gmu.edu/jkozlows/fema1.htm)	1992	Federal
USEPA	Coastal Barrier Resource Act (http://www.fws.gov/laws/lawsdigest/coasbar.html)	2007	Federal
USACE	Currituck Sound Ecosystem Restoration Feasibility Study (http://www.saw.usace.army.mil/Currituck)	2010	Federal

Table 2-8 (concluded). Agencies and Organizations

Agency	Documentation	Year	Authority
Beach Huggers of the Outer Banks	http://www.beachhuggers.com/		NGO
Blue Sky Foundation	http://www.bluesky-foundation.net/		NGO
Build the Bridge	http://www.buildthebridge.org/about.htm		NGO
Coastal Conservation Association	http://www.joincca.org/ http://www.ccanc.org/		NGO
Currituck Chamber of Commerce	http://www.currituckchamber.org /aboutchamber.htm#mission		NGO
Ducks Unlimited	http://www.ducks.org/Aboutdu/default.aspx		NGO
Environment North Carolina	http://www.environmentnorthcarolina.org/		NGO
NC Coastal Federation	http://www.nccoast.org/		NGO
NC Wildlife Resources Commission	http://www.ncwildlife.org/ http://www.ncwildlife.org /fs_index_07_conservation.htm		NGO
Outer Banks Assn. of Realtors	http://www.outerbanksrealtors.com/		NGO
Outer Banks Home Builders Association	http://www.obhomebuilders.org/		NGO
Outer Banks Preservation Association	http://www.obpa.org/default.asp		NGO
Soil and Water Conservation Society	http://www.swcs.org/		NGO
Surfrider Foundation	http://www.surfrider.org/outerbanks/index.cfm		NGO
The American Wild Horse Preservation Campaign	http://www.wildhorsepreservation.com/about.html http://www.corollawildhorses.com/		NGO
The Nature Conservancy NC Chapter	http://www.nature.org/wherewework/northamerica /states/northcarolina/preserves/art5601.html		NGO

Table 2-9. Social Health and Well-Being Goals

Stated Social Health and Well Being Goals
Achieve adequate, appropriate and accessible open space and recreation
Comply with state and federal water and air quality laws
Preserve heritage
Promote land use patterns with a sense of community
Promote a healthy and safe environment
Promote equitable use of public trust assets, particularly in the form of beach access
Use growth management techniques to achieve land use goals
Ensure efficient transportation system
Protect landscape aesthetics
Protect floodways and wetlands

Source: Review of the documents and websites shown in Table 2-8.

An efficient transportation system was seen as being important throughout the ICE study area, with several explicit endorsements of the Mid-Currituck Bridge by local municipalities. Beach access was an important stated goal for the communities.

There was no explicit mention of mass transit as a goal. There were only indirect expressions of housing affordability as a goal. There were no expressions of multicultural diversity as a goal.

2.2.3 Economic Opportunity Goals

The economic opportunity goals in the ICE study area reflect the dependence on tourism as the cornerstone of the local economy with a desire to diversify the economic base. This is particularly true of Currituck County, which, by its proximity, is increasingly integrated with the economy of metropolitan Hampton Roads. Table 2-10 summarizes the economic opportunity goals expressed by official agencies. Appendix A gives greater detail. All the communities in the ICE study area make strong goal statements that economic development occur with the protection of environmental and landscape assets. There is also a strong sense that economic development must be compatible with the particular hazards of a low-lying coastal area. Not surprisingly, real estate development and property management are viewed as key elements of local economic activity. Development is largely directed at undeveloped land. Most of the existing development in the region has occurred in recent decades.

There is no stated goal to increase manufacturing in this coastal region. Export industries are not perceived to play a significant role. There is some mention of a goal of attracting and maintaining a workforce, particularly in the coastal towns.

Table 2-10. Economic Opportunity Goals

Stated Economic Opportunity Goals
Support activities to meet changing economic conditions
Preserve agriculture and agricultural land
Diversify economy
Promote tourism
Attract and maintain a workforce
Development industries that are compatible with traditional forms

Source: Review of the documents and websites shown in Table 2-8.

2.2.4 Ecosystem Protection Goals

The goals for ecosystem and environmental protection in the region are strong expressions of the communities' desires to protect their greatest assets—the coastal landscapes and water resources. Table 2-11 summarizes the ecosystem protection goals expressed by official agencies, as well as stakeholding NGOs. Appendix A provides greater detail. Because of the nature of low-lying coastal and estuarine ecosystems, there are significant critical ecosystem assets. These goals are reinforced by state and federal legislation that mandate certain environment policies. All of the communities in the growth area of the ICE study area are covered by North Carolina's CAMA that, among other things, stipulates a five-year cycle for comprehensive land use planning.

Table 2-11. Ecosystem Protection Goals

Stated Ecosystem Protection Goals
Protect ecosystems
Promote native species
Protect rare and keystone species
Protect sensitive environments
Maintain natural processes
Protect coastal ecosystems
Protect environmentally fragile areas
Protect aquatic ecosystems
Restore estuarine quality

Source: Review of the documents and websites shown in Table 2-8.

The environmental goals of the municipalities are largely focused on protecting specific features or ecosystems. There is not a strong expression of landscape-level goals for the area with respect to structure, function, or processes. The concept of green infrastructure is not mentioned.

Because of the valuable and sensitive environments in the region, there are many other non-municipal stakeholders. The US Fish and Wildlife Service (USFWS) maintains

wildlife areas on Currituck Sound. The US Army Corps of Engineers (USACE) has been conducting a feasibility study for improving the quality of Currituck Sound. There are also numerous non-governmental organizations with conservation agendas active in the region.

2.3 Land Use Plans

2.3.1 Currituck County

Currituck County is covered by North Carolina's Coastal Area Management Act. There are no incorporated towns in the county. The Currituck County land use plan designates its desired future land use pattern using the following four land use classifications:

- Conservation Areas. The principal future purpose of land with this classification is to provide for the long-term management and protection of lands considered significant, limited, or irreplaceable. Public or private infrastructure in these areas is discouraged and not provided by Currituck County. Residential uses of one unit per three acres or less is permitted and non-residential uses are encouraged.

- Rural Areas. This classification is intended to provide for traditional rural uses (e.g., agriculture, forestry, etc.). The preferred use is very low-density, farm-associated residential and open space.

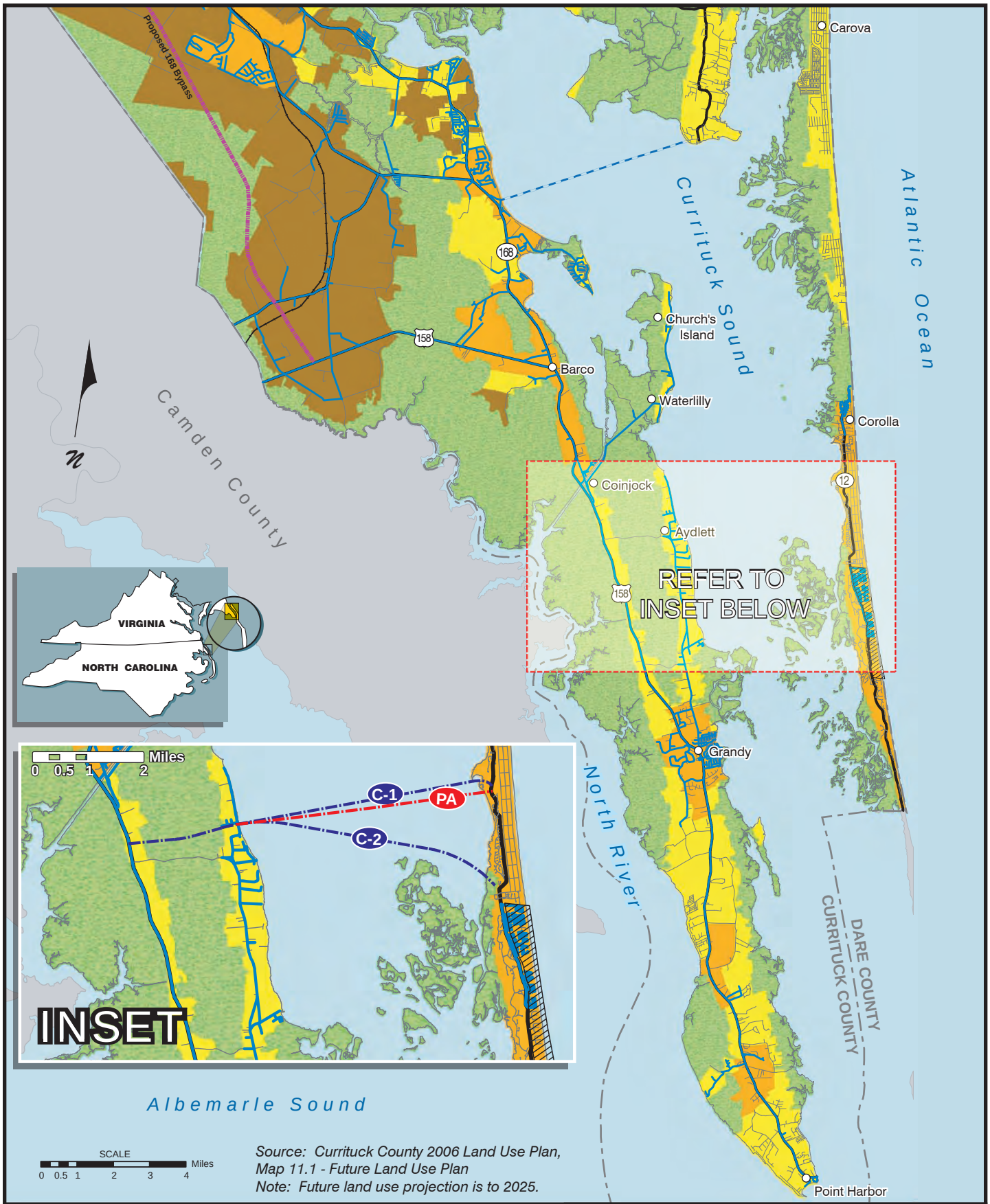
- Limited Service Areas. The primary purpose of this classification is to provide for low density residential development. Non-residential uses are allowed with a preference for tourist-serving businesses. Only limited municipal services may be available (e.g., fire, emergency management services, water) and centralized sewage systems are not appropriate.

- Full Service Areas. The primary purpose of this classification is to provide for a broad range of services and uses including centralized water, parks, schools, fire and rescue facilities, and central waste water treatment. The residential development in this classification area is two units per acre, but can be increased to up to four units per acre and could include semi-detached, attached, and multi-family dwellings. Non-residential uses may include clustered local or regional service businesses.

Figure 2-1 shows Currituck County's desired future land pattern in 2025 based on these four land use classifications.

Land suitability plays an important role in the ability to develop an area. Figure 2-2 shows the land suitability classifications for Currituck County. Lands with low suitability for development include:

- Wetlands and Waters. These include coastal wetlands, exceptional and substantial non-coastal wetlands, estuarine waters and beneficial non-coastal wetlands.



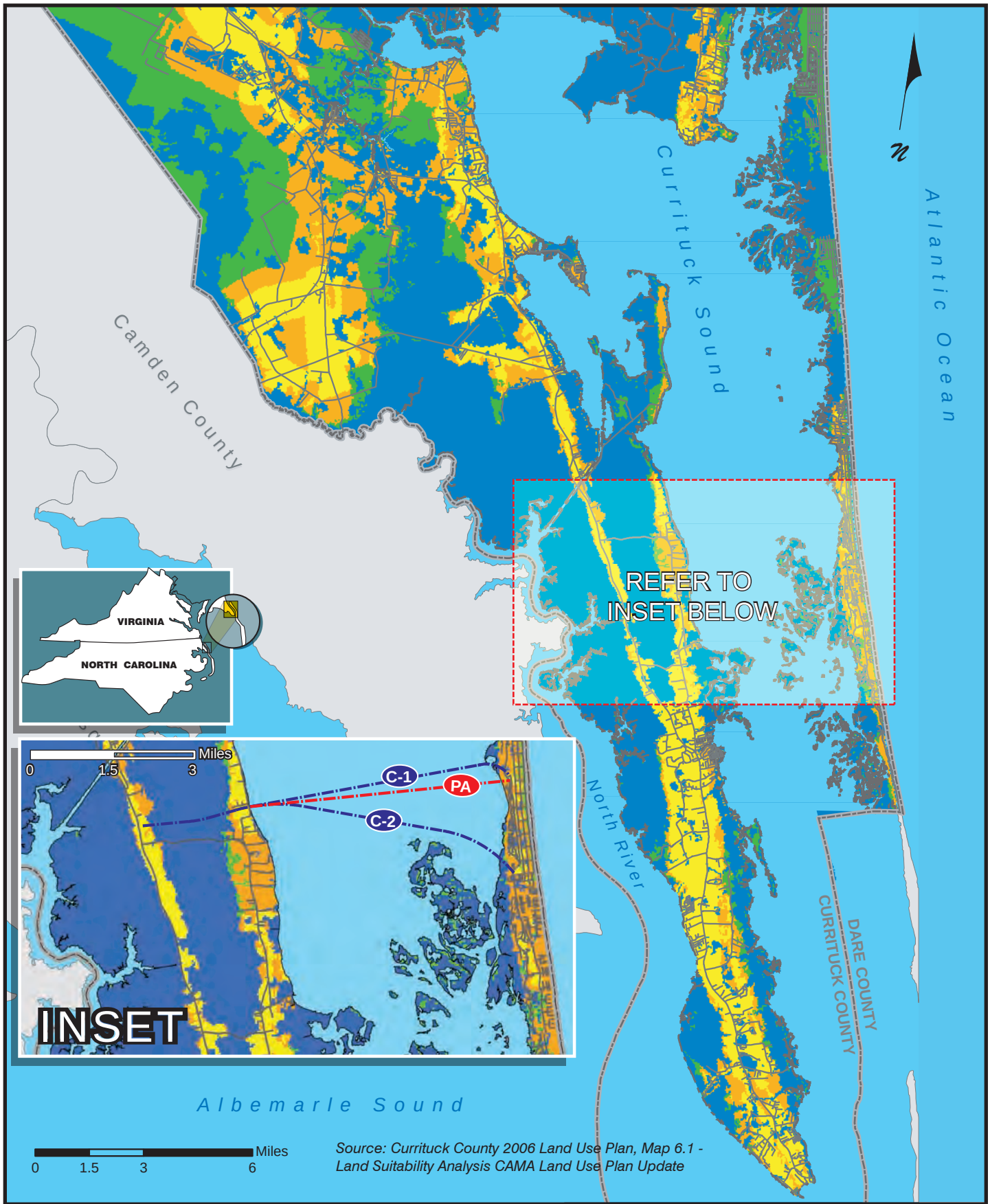
Source: Currituck County 2006 Land Use Plan, Map 11.1 - Future Land Use Plan
Note: Future land use projection is to 2025.

LEGEND

- DEIS Bridge Corridors
- Preferred Alternative Bridge Corridor
- County Boundaries
- Conservation Areas
- Full Service Areas
- Limited Service Areas
- Rural Areas

Currituck County Future Land Use

Figure
2-1



Source: Currituck County 2006 Land Use Plan, Map 6.1 - Land Suitability Analysis CAMA Land Use Plan Update

LEGEND

- DEIS Bridge Corridors
- Preferred Alternative Bridge Corridor
- County Boundaries
- Least Suitable
- Low Suitability
- Medium Suitability
- High Suitability

Currituck County Land Suitability

Figure
2-2

- Hazard Zones. These include flood zones, storm surge areas and airport use zones.

- Potentially Hazardous Sites. These include hazardous substance disposal sites and National Pollutant Discharge Elimination System (NPDES) sites.

- Lands with Existing Regulatory Protection. These include agency protected lands and North Carolina Significant Natural Heritage Areas (SNHA).

- Lands with Physical Limitations or Development Facilitating Factors. These include soils with septic limitations, existence of primary roads, water and sewer lines and land that has reached its developmental maximum.

- The following observations can be made from Figure 2-1 and Figure 2-2 related to the areas included in the growth/development study area boundary shown on Figure 1-1.

- The Barco/Coinjock/Airport area is primarily classified as a full service area with a land suitability that is generally high.

- The intersection of the Mid-Currituck Bridge and US 158 area is entirely a limited service area, with a land suitability that is generally high.

- The Aydlett/Waterlily/Churches Island area is entirely a limited service area with a roughly equal mixture of high and medium land suitability.

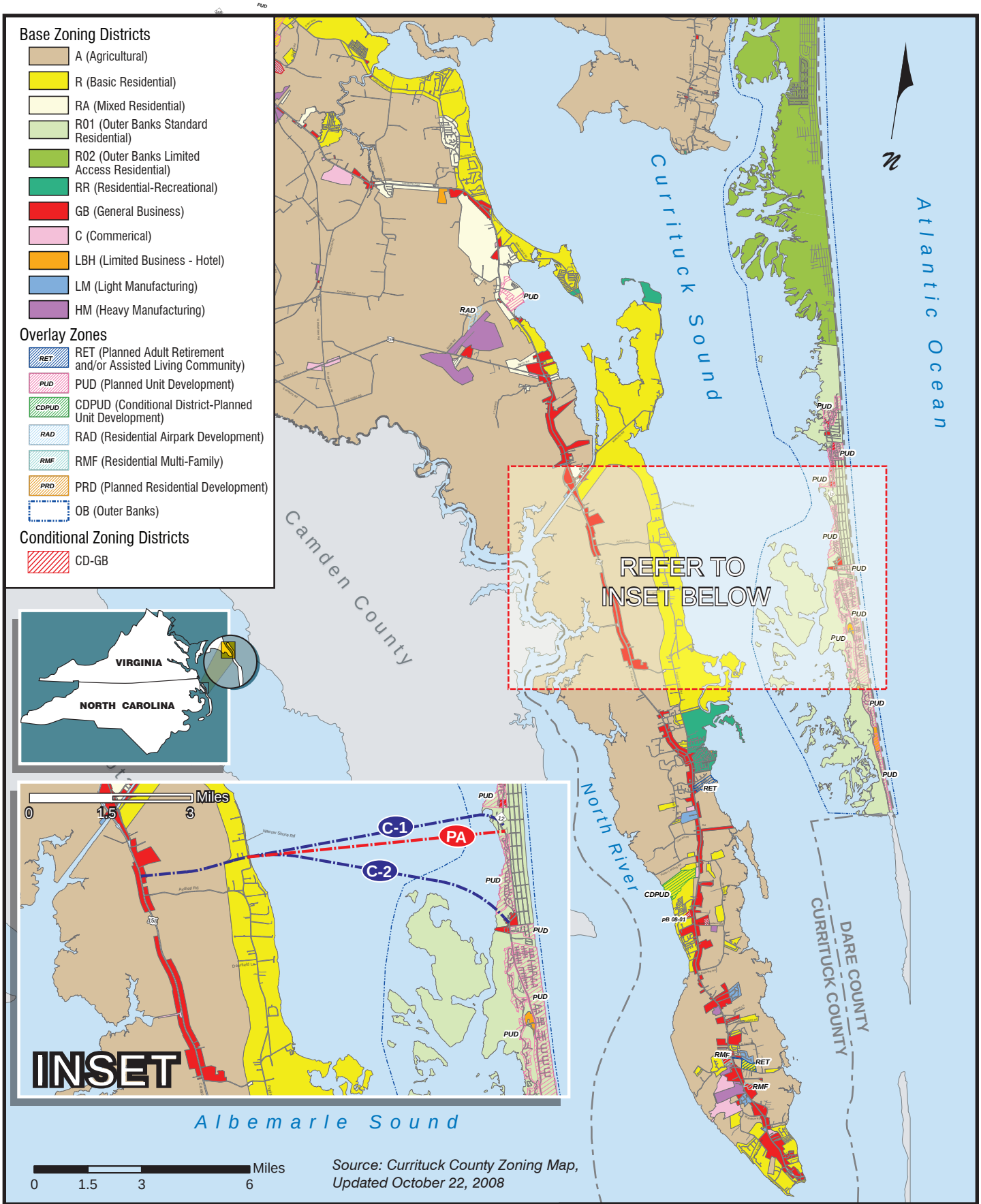
- The Grandy area is largely a full service area with some limited service area at its southeastern portion, and its land suitability is primarily high.

- The Jarvisburg area is approximately 75 percent limited service area and 25 percent full service area, with primarily high land suitability with medium land suitability to the west and east.

- The Point Harbor area is approximately 60 percent limited service area and 40 percent full service area, with a roughly equal mixture between high and medium land suitability and some pockets of least suitability.

- The Corolla area is full service are that is primarily comprised of land with a medium suitability, with land of least suitability on the Currituck Sound side.

- Carova is a limited service area on land with a low suitability with lands of least suitability on the sound side. Currituck County's zoning map is shown as Figure 2-3. The zoning map is adopted and updated separately from the county's land use plan. However, the map indicates a strong consistency with the plan's land suitability analysis and future land use designations. Importantly, most of US 158 in the center of the county is bordered by a general business zone, which is the county's most flexible zone for future commercial activity. On the Outer Banks, the area north of NC 12 is zoned Outer Banks limited access residential, which is a reflection of the lack of services planned there. In the NC 12-accessible area the base zoning



LEGEND

- DEIS Bridge Corridors
- Preferred Alternative Bridge Corridor
- County Boundaries

Currituck County Zoning

Figure

2-3

district is predominately Outer Banks standard residential with a few areas of general business.

- The zoning map is presented for Currituck County particularly because it would be the location for a new bridge and within the ICE study area Currituck County has the most undeveloped land that could be affected by induced development.

2.3.2 Dare County

Dare County and its towns are covered by North Carolina's Coastal Area Management Act. Land use plans applicable to the Dare County portion of the growth area of the ICE study area are those of the Towns of Kitty Hawk, Southern Shores, and Duck.

2.3.2.1 Kitty Hawk

The *Kitty Hawk CAMA Core Land Use Plan 2003-2004 Update* (Community Planning Collaborative Inc., 2004) includes maps of Kitty Hawk detailing existing land use (see Figure 2-4), future land use (see Figure 2-5), and land suitability for development (see Figure 2-6). Of particular interest are the future land use and land use suitability maps. No projection date in given in the land use plan for these future land uses. Kitty Hawk currently has 1,586 acres of undeveloped/vacant land, representing approximately 30 percent of the Town's total existing land area. However, the total amount of 1,586 acres cannot be considered as area for growth for the following reasons:

- Much of the undeveloped/vacant land is designated as conservation area (see Figure 2-4 and Figure 2-5).

- Nearly all of the undeveloped/vacant land is shown as "least suitable" for development (see Figure 2-6), and much of the remainder falls within the "low suitability" or "medium suitability" classifications.

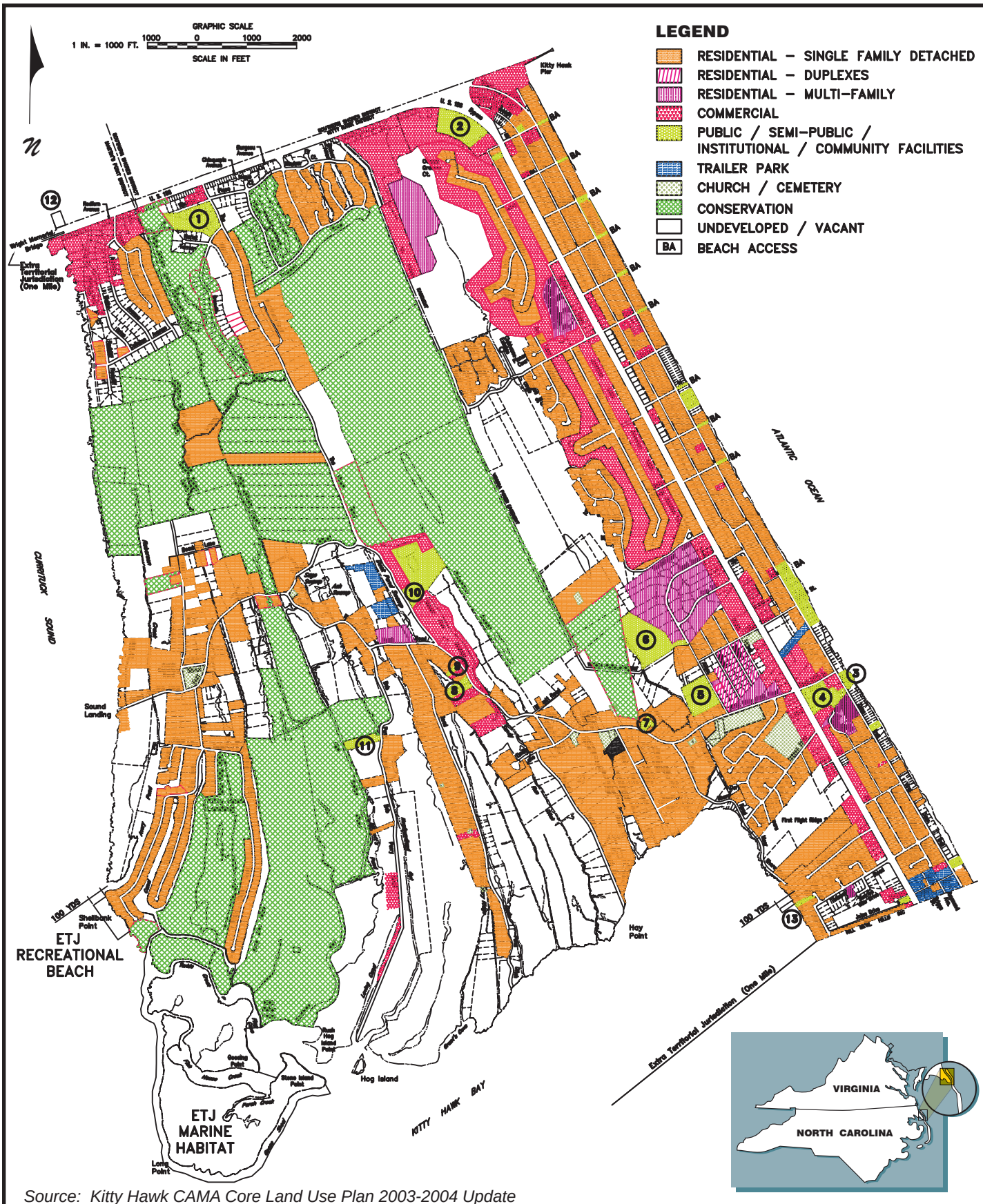
- Chapter II, Section 3 of the land use plan indicates that the town may place oceanfront properties under greater scrutiny for development. This is evidenced by the statement that the town has condemned some properties along the oceanfront in an attempt to allow for stabilization of the beach, as well as for protection of NC 12 and adjacent properties.

- Chapter II of the Kitty Hawk land use plan indicates the concern that development in Kitty Hawk could potentially exceed the capability of the land to support it.

The above are all indications that notable additional development on vacant land is not expected in Kitty Hawk.

2.3.2.2 Southern Shores

The Town of Southern Shores recently completed a draft update of its CAMA land use plan (Town of Southern Shores, 2010), which is pending approval of the North Carolina Division of Coastal Management (DCM). Maps detailing existing and future land use



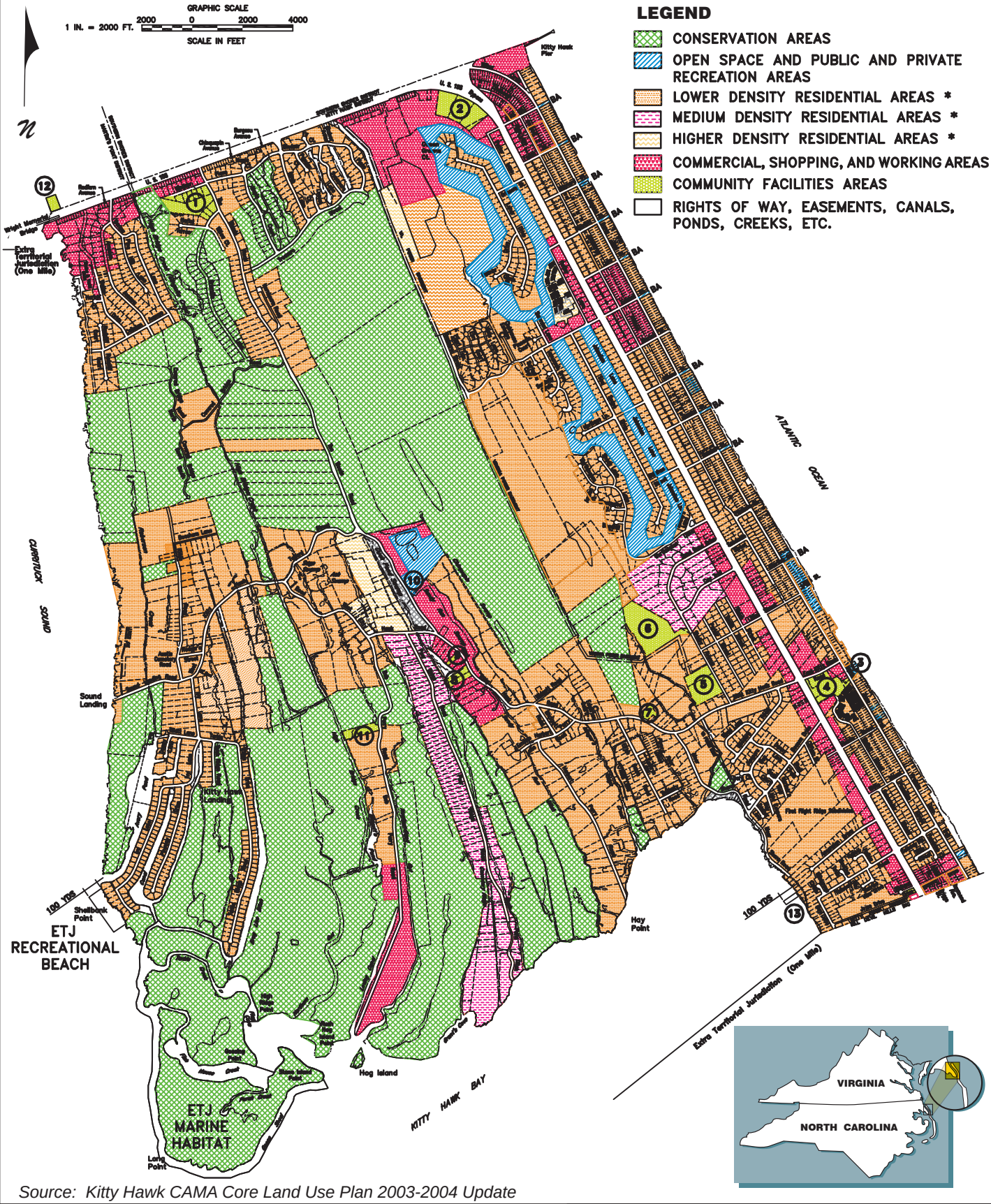
Source: Kitty Hawk CAMA Core Land Use Plan 2003-2004 Update

Community Facilities

1. NORTH CAROLINA DOMINION POWER & WOODS ROAD PARK AND MULTI–USE TRAIL
2. NORTH CAROLINA WELCOME CENTER
3. KITTY HAWK BATH HOUSE & BEACH ACCESS
4. UNITED STATES POST OFFICE
5. NORTH CAROLINA DOMINION. POWER.
6. KITTY HAWK TOWN HALL
7. KITTY HAWK POLICE DEPARTMENT
8. KITTY HAWK FIRE DEPARTMENT
9. KITTY HAWK PUBLIC WORKS
10. HARRIS TRACT RECREATION AREA
11. DARE COUNTY BOAT LANDING
12. ROANOKE ISLAND SOUND ACCESS
13. WINDGRASS CIRCLE SOUND ACCESS

Kitty Hawk Existing Land Use

Figure 2-4



Source: Kitty Hawk CAMA Core Land Use Plan 2003-2004 Update

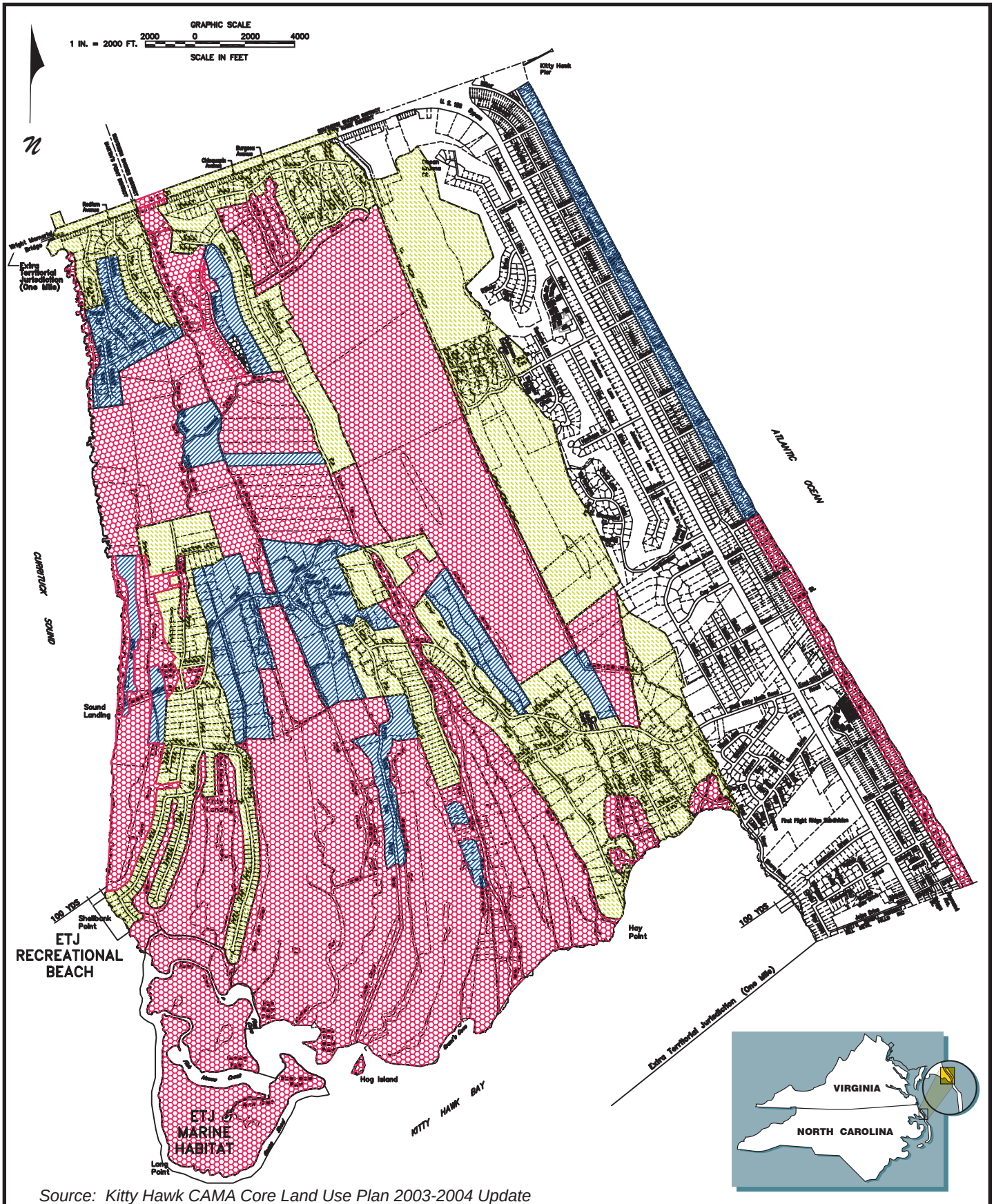
Community Facilities

1. NORTH CAROLINA DOMINION POWER & WOODS ROAD PARK AND MULTI-USE TRAIL
2. NORTH CAROLINA WELCOME CENTER
3. KITTY HAWK BATH HOUSE & BEACH ACCESS
4. UNITED STATES POST OFFICE
5. NORTH CAROLINA DOMINION POWER
6. KITTY HAWK TOWN HALL
7. KITTY HAWK POLICE DEPARTMENT
8. KITTY HAWK FIRE DEPARTMENT
9. KITTY HAWK PUBLIC WORKS
10. HARRIS TRACT RECREATION AREA
11. DARE COUNTY BOAT LANDING
12. ROANOKE ISLAND SOUND ACCESS
13. WINDGRASS CIRCLE SOUND ACCESS

BA BEACH ACCESS

Kitty Hawk Future Land Use

Figure 2-5



Source: Kitty Hawk CAMA Core Land Use Plan 2003-2004 Update

LEGEND

- Least Suitable
- Low Suitability
- Medium Suitability
- High Suitability

Kitty Hawk Land Suitability

Figure

2-6

(see Figure 2-7), and land suitability for development (see Figure 2-8) indicate a beach community that has a high level of development. The most suitable areas for development are along the west side of NC 12. The town covers 2,175 acres of land, and the dominant land use is residential, with several large areas of conservation. The Town of Southern Shores handles its planning issues through its Code Enforcement Department. As of January 2007, there were approximately 2,800 single-family lots, of which an estimated 490 were vacant lots in Southern Shores (Town of Southern Shores, 2010). No notable additional subdivision is expected. At the current rate of development, the town's supply of vacant lots will be developed in approximately seven to eight years. The 490 remaining vacant lots in Southern Shores, coupled with the near build-out of the neighboring Towns of Kitty Hawk and Duck, prevent any future expansion of the town. Future development will be in the form of development of the remaining lots and redevelopment through teardowns of existing residential properties.

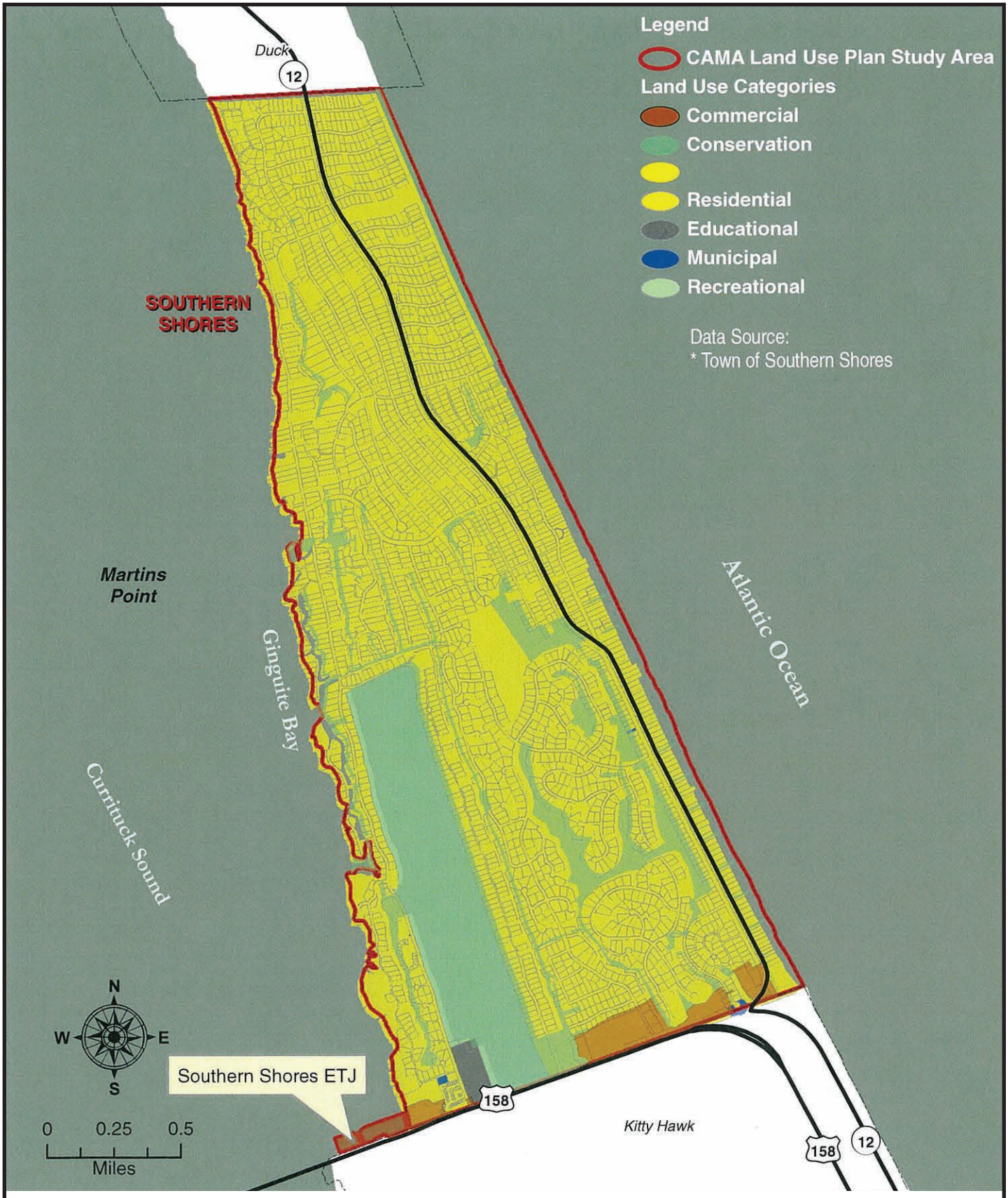
2.3.2.3 Duck

The *Duck, North Carolina CAMA Core Land Use Plan* (Community Planning Collaborative, Inc., 2005) has an existing land use map and a land suitability analysis map that graphically depict the potential for the town's growth. Duck has land use categories of single family residential (50.80 percent of land area), multi-family residential (3.75 percent), commercial (5.86 percent), institutional (10.51 percent), and undeveloped (16.02 percent). There is no agriculture or forestry in Duck, nor are there any industrially-zoned parcels. According to the existing land use map (see Figure 2-9), the bulk of growth opportunities are in the southern portion of Duck. According to the future land use map (see Figure 2-10), land use changes will largely take the form of infill development along the village pattern that has already been established. No projection date in given in the land use plan for these future land uses. According to the land use suitability map (see Figure 2-11), the land with the highest suitability for growth also is in the southern portion of Duck. According the CAMA land use plan, "anticipated conversions of seasonal housing to permanent occupancy and the development of remaining platted and zoned lots and tracts will more than accommodate the populations projected in Duck for the ensuing 5-, 10-, and 20- year periods. The amount of commercially zoned land in Duck is also deemed adequate to meet the projected populations for the planning period (Community Planning Collaborative Inc., 2005).

2.3.3 Local Plans' Consistency with AEC Protection

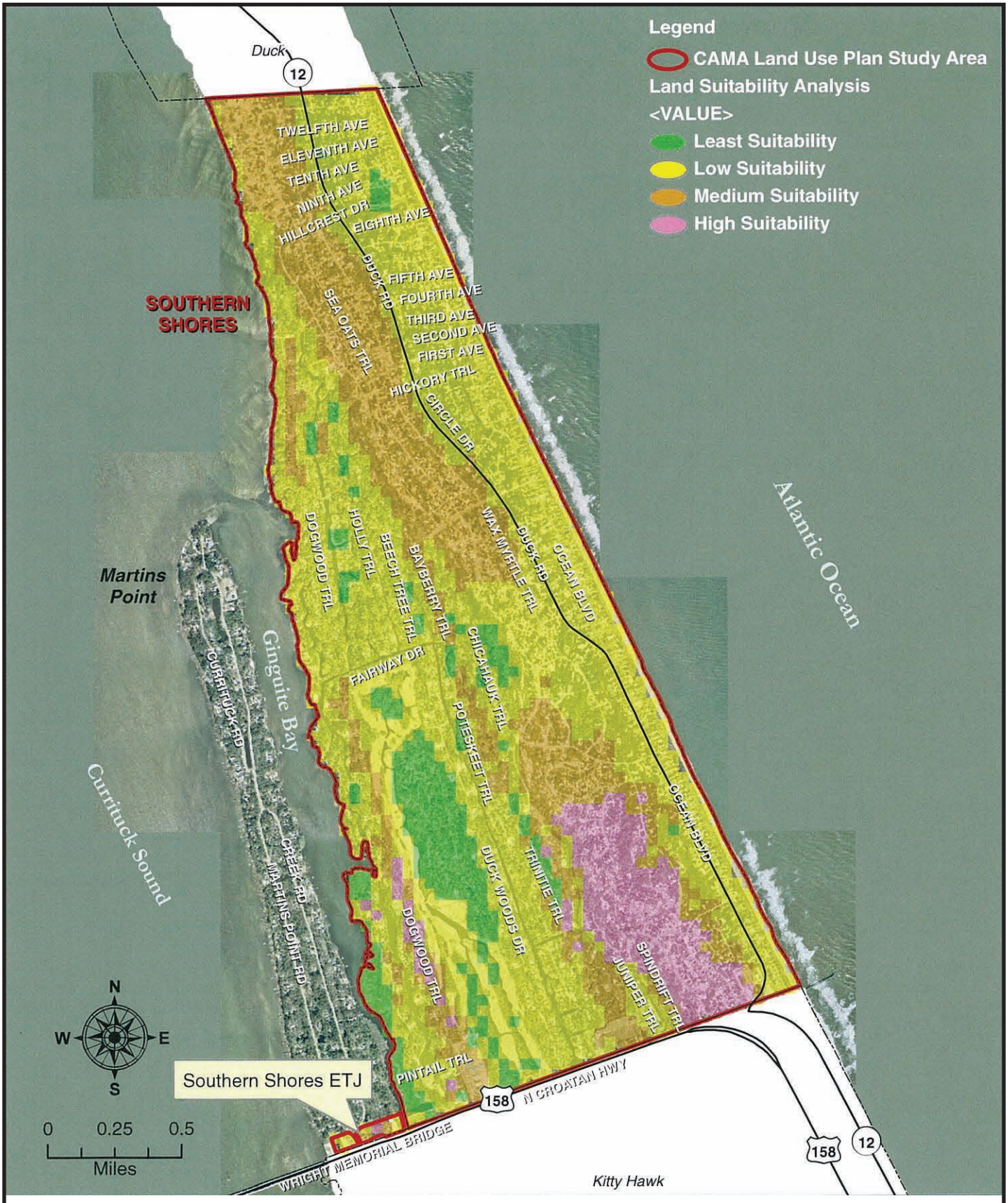
Areas of environmental concern (AECs) are a core element of CAMA rules and policies and key factors in CAMA land use planning. A general discussion of these policies is contained in Appendix A, Section A.8.1. There are four broad categories of potential AECs, estuarine and ocean systems, ocean hazard areas, natural and cultural resources, and public water supplies. Figure 2-12 shows the AECs in the ICE study area as presented in the local CAMA plans. These include estuarine shorelines, public trust waters, ocean hazard areas, coastal wetlands.

Policies in the local land use plans are strongly consistent with protecting AECs. Coastal area management in North Carolina is designed to facilitate professional, updated coastal area plans and create consistency between broad state goals and local land uses,



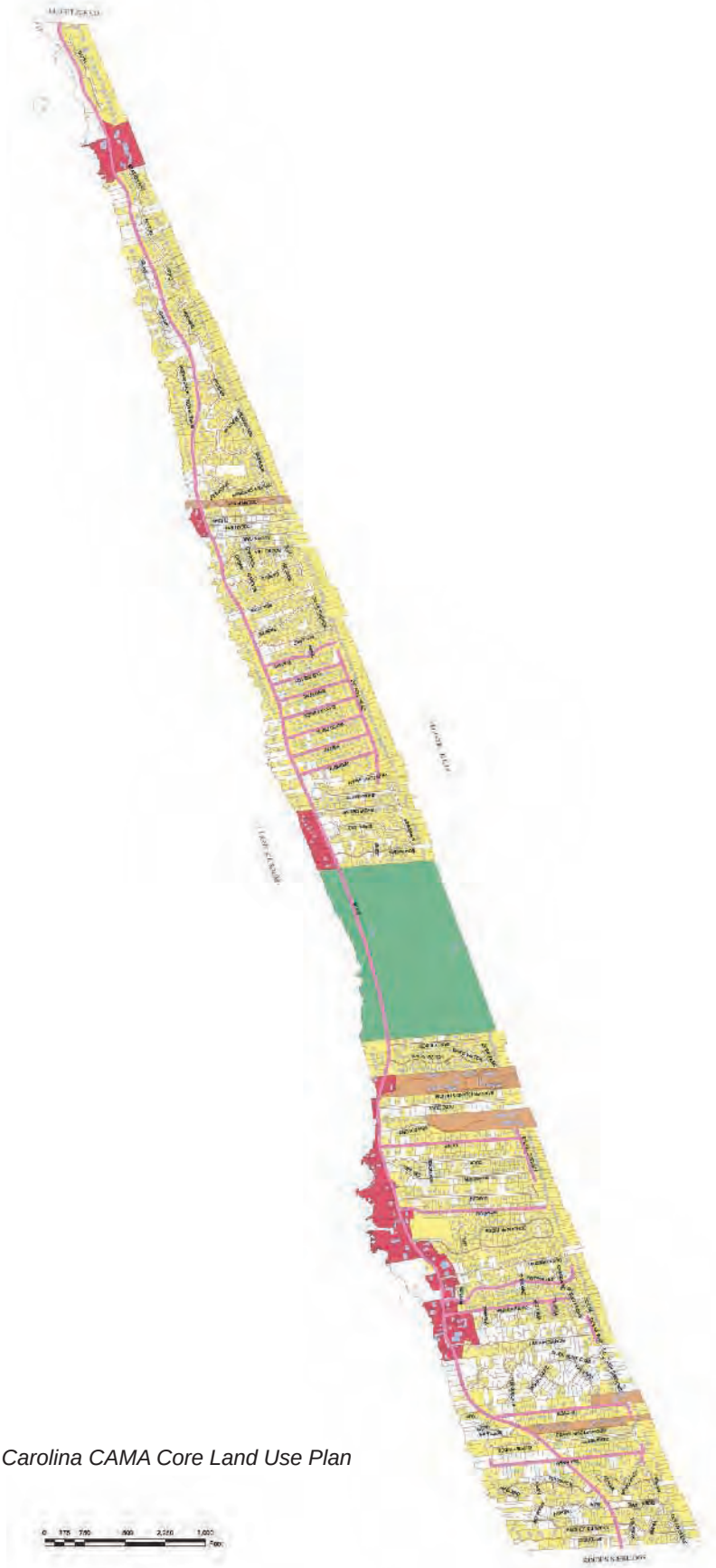
Source: Town of Southern Shores

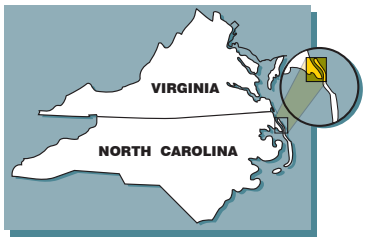
	Southern Shores Existing and Future Land Use	**Figure** 2-7



Source: Town of Southern Shores

	Southern Shores Land Suitability	**Figure** 2-8





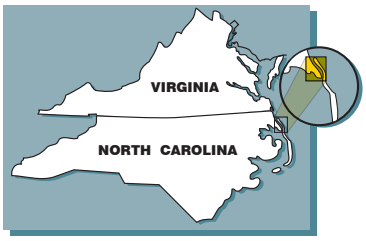
Source: Duck, North Carolina CAMA Core Land Use Plan

LEGEND

- Single Family Residential
- Multi-Family Residential
- Commercial
- Institutional
- Undeveloped

Town of Duck
Existing Land Use

Figure
2-9



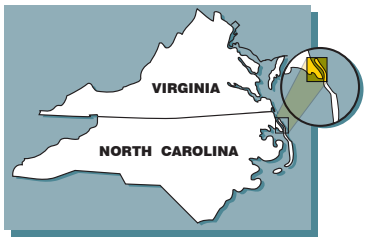
Source: Duck, North Carolina CAMA Core Land Use Plan

LEGEND

- Conservation, Open Space, and Community Facilities Areas
- Village Commercial Area
- General Commercial Areas
- Residential Areas
- Transitional Areas
- In-fill and Growth Areas

Town of Duck Future Land Use

Figure
2-10



NOTE: Area shown (least suitable) extends inland approximately 120' and runs the length of the Atlantic Ocean shoreline.

SANDERLING

CAROLINA DUNES

NOTE: Area shown (least suitable) extends inland approximately 30' and runs the length of the Currituck Sound shoreline.

SHIPS WATCH

FOUR SEASONS

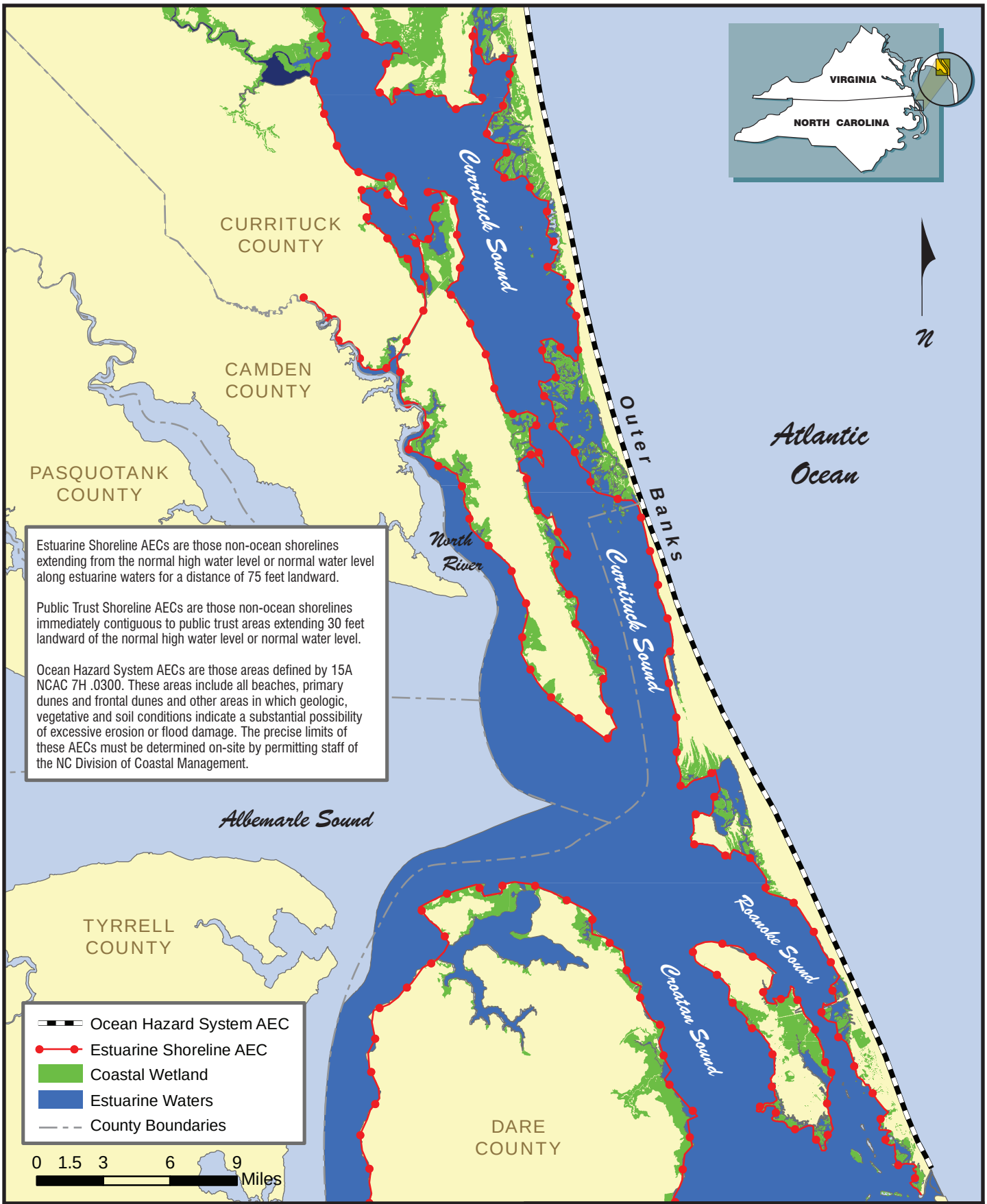
Source: Duck, North Carolina CAMA Core Land Use Plan

LEGEND

- Least Suitable
- Low Suitability
- Medium Suitability
- High Suitability

Town of Duck
Land Use Suitability

Figure
2-11



Currituck and Dare County AECs

Figure
2-12

policies, and outcomes. Looking at the CAMA plans for the three jurisdictions surrounding Currituck Sound reveals this consistency explicitly. A comparison of the map of AEC with the land use and land suitability maps contained in this section (Figure 2-1 to Figure 2-11) also indicates this consistency.

In Currituck County, the land use plan (Currituck County, 2006, pages 9-5 to 9-6) presents nine policies specifically to protect environmentally sensitive areas, that are inclusive of the state directed AECs. These are:

- Policy ES1: New development shall be permitted to locate only in areas with SUITABLE SOIL and where ADEQUATE INFRASTRUCTURE is available…. [emphasis original]
- Policy ES2: NON-COASTAL WETLANDS, including FRESHWATER SWAMPS, AND INLAND, NON-TIDAL WETLANDS, shall be conserved….
- Policy ES3: COASTAL WETLANDS shall be conserved….
- Policy ES4: In approving new developments, Currituck County shall support the retention or creation of a vegetated area along ESTUARINE SHORELINES….
- Policy ES5: Uses allowed in ESTUARINE WATERS must be water-dependent and must not interfere with the function, cleanliness, salinity, and circulation of the resource.
- Policy ES6: The location and design of piers and docks shall not unduly interfere with the rights of the public to the free and unobstructed use of PUBLIC TRUST WATERS….
- Policy ES7: MARITIME FORESTS and SAND DUNES shall receive a high level of environmental protection and special consideration….
- Policy ES8: Areas of the County identified for significant future growth shall avoid NATURAL HERITAGE AREAS.

The Town of Duck also has numerous relevant protective policies. The most explicit statement of consistency is Policy #12a: "Duck will use its police powers to adopt and enforce ordinances and procedures to regulate land use, development, and redevelopment in accordance with the goals and policies of the land use plan and supports applicable State and Federal laws and regulations regarding land uses and development in areas of environmental concern." (Community Planning Collaborative Inc., 2005, page ix-15).

Similarly, in its new draft plan, the Town of Southern Shores includes the following land use goal: "Ensure that providing infrastructure services do not affect the quality and productivity of Areas of Environmental Concern, important resources, and other fragile areas." (Town of Southern Shores, 2010, page 51).

3.0 Inventory of Notable Features

This chapter incorporates the work of Step 3 of the *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina* (NCDOT, 2001).

3.1 Landscape and Waterscape Inventory

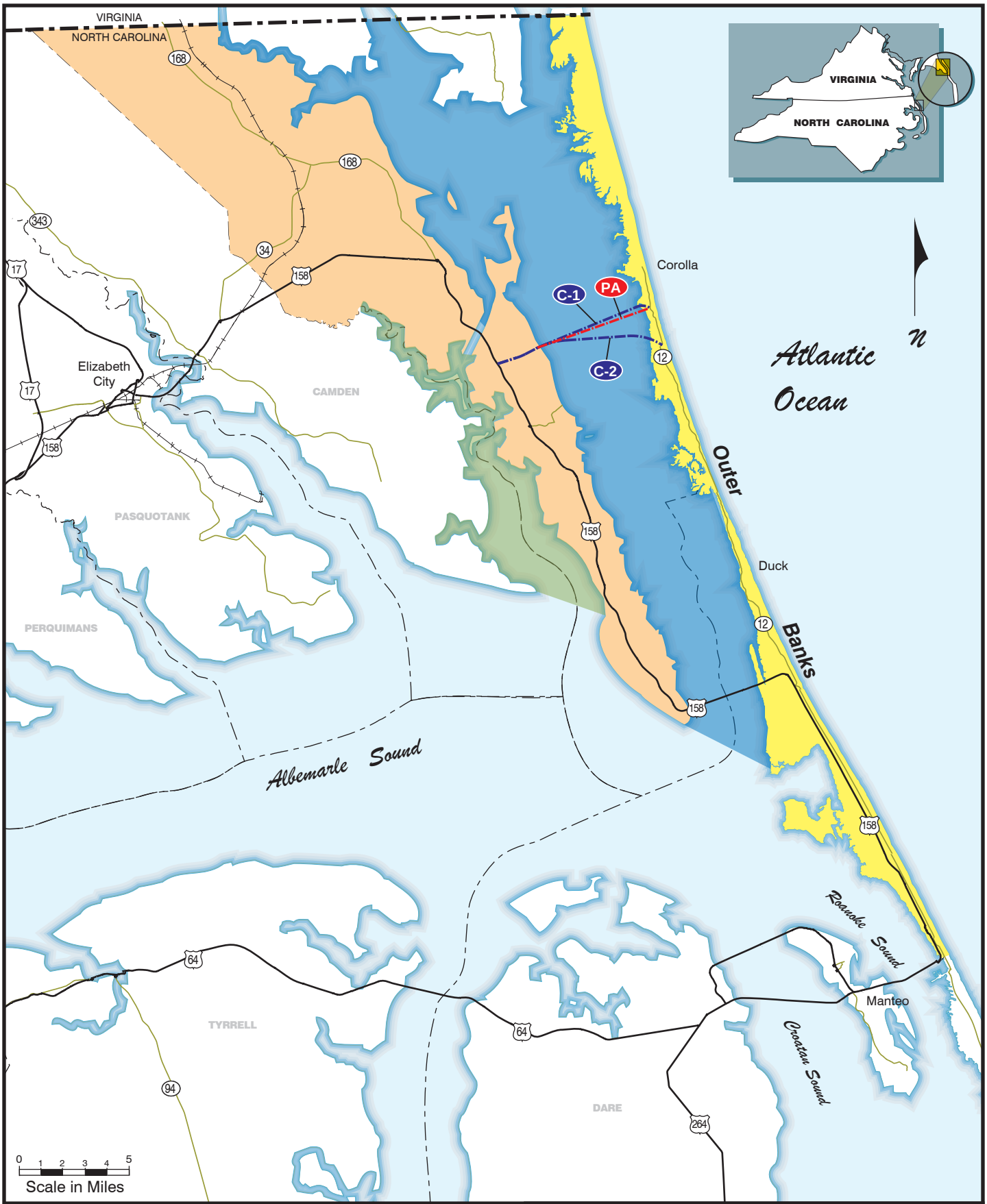
There are four distinguishable landscapes and waterscapes of interest in the ICE study area. These are Currituck County mainland, North River estuary, Currituck Sound, and Outer Banks (includes portions of Currituck and Dare counties). Figure 3-1 shows the general location of these areas. Knott's Island and its connecting lands in Virginia represent another distinct landscape and Back Bay in Virginia represents a distinct waterscape, but they are outside of the impact area for the Mid-Currituck Bridge.

Landscapes and waterscapes are defined because each has a set of structural, functional, and temporal characteristics. As such, these areas are useful frameworks for analysis. Research has found "landscapes" to be a useful level of analysis because they are at the scale of human interventions, which is to say that intentional planning, zoning, and infrastructure improvements occur at this scale (Hersperger, 1994; Steiner, 2008). As is often the case, but especially in this region, the delineations between these areas are soft. In a place where the land is low and the water is shallow, the marsh margins are very broad. Change is occurring that will also move the dividing line between these areas. Even a minor change in sea level will dramatically affect the shorelines in the regions. Changes on the land will expand the exurban landscape from the north in Virginia onto the still rural landscape of the Currituck County mainland.

3.1.1 Currituck County Mainland

The Currituck County mainland is a rural landscape matrix with large patches of natural lands in the form of forests, logged wetlands, and estuarine wetlands. Development is dispersed across the higher elevations of the mainland and concentrated in several village areas. Corridors on the mainland landscape include roadways, power line cuts, and the Intracoastal Waterway. The landscape here is very low, with a maximum elevation of 23 feet. It exists largely as a traditional working landscape with agriculture on the higher ridges and clustered village areas. Higher up in the watershed, the agricultural land merges with the rural landscape in Pasquotank and Camden Counties. While the trend is for an expansion of agricultural land in these two counties, the Currituck County mainland is losing agricultural land. The patches of exurban development are increasing in size and number. The trend on the Currituck County mainland is toward a suburban landscape.

The matrix of this landscape is highly altered with fields being the predominant land cover. Natural areas in the landscape exist at the margins in the form of low-lying woodlands. At the shoreline margins of this landscape are marshlands that provide important habitat (North Carolina Natural Heritage Program, 2006).



LEGEND

- DEIS Bridge Corridors
- Preferred Alternative Bridge Corridor
- Currituck County Mainland
- North River Estuary
- Currituck Sound
- Outer Banks

Landscapes and Waterscapes

Figure

3-1

3.1.2 North River Estuary

The North River estuary consists of the tidal areas of the North River and the marginal marshes. North River is a tidal river, approximately 18 miles long. It forms the boundary between Currituck and Camden counties. There is a strong connection between activities in the surrounding landscape, surface runoff, and the estuary. Land use in these counties has the potential to impact water quality. (See Section 3.3.2.2.)

3.1.3 Currituck Sound

Currituck Sound is the large estuarine waterscape at the center of the ICE study area. It is an oligohaline (brackish) estuary extending from the North Carolina/Virginia state line approximately 29 miles south to its confluence with Albemarle Sound. The surface area of Currituck Sound is approximately 97,850 acres. The total drainage area for Currituck Sound is approximately 280 square miles. (See Section 3.3.2.1.)

3.1.4 Outer Banks

The Outer Banks, bounded by Currituck Sound on the west and the Atlantic Ocean on the east, includes portions of Currituck and Dare counties. The project area on the Outer Banks stretches from Kitty Hawk to the Virginia state line. The Outer Banks landscape matrix alternates between coastal village and natural areas that are dominated by dune fields, maritime forests, or coastal marshes. Because of the geography of the barrier landscape, the primary features tend to be linear, including beach, dune field, and forests. A dominant corridor in the landscape is NC 12, which runs the length of the barrier island, terminating in the Corolla area. North of that point, there are no paved roads creating transportation corridors on the land.

3.2 Notable Features Inventory

Table 3-1 and Table 3-2 list the notable ecosystem and socioeconomic features in the ICE study area and identify the corresponding landscapes or waterscapes. The notable features are derived from the environmental elements, as well as the cultural and socioeconomic conditions, as indicated in the indirect and cumulative effects guidance (NCDOT, 2001). For greater detail and transparency, these conditions and elements are described subsequently in Sections 3.3 and 3.4, including, as required by Step 3 of the *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina* (NCDOT, 2001), information that inventories the broader context associated with these notable features.

3.3 Environmental Elements

3.3.1 Geologic Landform

Currituck County is in the northeastern corner of the coastal plain of North Carolina, on the north side of Albemarle Sound. It is bounded on the east by the Atlantic Ocean, on the south by the Albemarle Sound and Dare County, and on the west by the North River forming the border of Camden County. To the north is the Commonwealth of Virginia.

Table 3-1. Notable Ecosystem Features

Notable Feature	Landscape/Waterscape
Dune System	Outer Banks
Floodplains	Currituck County Mainland, Outer Banks
Estuaries/ Water Quality	Currituck Sound, North River Estuary
Public Water Supplies	Currituck County Mainland, Outer Banks
Groundwater	Currituck County Mainland, Outer Banks
Maritime Forests	Outer Banks
Submerged Aquatic Vegetation	Currituck Sound, North River Estuary
Unconsolidated Estuarine Bottom	Currituck Sound, North River Estuary
Coastal Marshes	Currituck Sound, North River Estuary
Non-coastal Wetlands	Currituck County Mainland (esp. Maple Swamp)
Waterbirds	Currituck County Mainland, North River, Currituck Sound, Outer Banks
Atlantic Flyway	Currituck County Mainland, North River, Currituck Sound, Outer Banks
Anadromous Fish Spawning Areas	Currituck County Mainland (streams)
Protected Species	Currituck County Mainland, North River, Currituck Sound, Outer Banks
Wild Horses	Outer Banks (north end)
Coastal Barrier Resources Act Areas, Natural Heritage Areas, and Conservation Areas	Currituck County Mainland, Outer Banks
Areas of Environmental Concern (AECs)	Currituck County Mainland, North River, Currituck Sound, Outer Banks

Table 3-2. Notable Socioeconomic Features

Notable Feature	Landscape/Waterscape
Workforce Housing	Currituck County Mainland
Tourist Housing	Outer Banks
Agriculture	Currituck County Mainland
Historic Structures and Places	Currituck County Mainland, Outer Banks
Circulation and Access	Currituck County Mainland, Outer Banks
Neighborhoods and Village Communities	Currituck County Mainland, Outer Banks
Scenic and Natural Area Character	Currituck County Mainland, North River, Currituck Sound, Outer Banks

Within the watershed, Currituck County is quite flat with elevation generally ranging from sea level to 10 feet above sea level along the Outer Banks with a high point at Penny's Hill, a dune in the non-road area. The county is a series of ridges and low areas roughly parallel to the coastline. On the mainland, elevation ranges from sea level to approximately 20 feet at Moyock. On the mainland, US 158 follows a natural ridge ranging from 10 to 20 feet above sea level. This ridge splits near Grandy with one arm following north through Poplar Branch, Aydlett and across the sound to Knotts Island and the other veering north-northwest towards Coinjock. Although of relatively low relief, the high ground in the county is critical for development and transportation.

Dare County is along the coastal plain of North Carolina and is best noted for its lengthy strands of barrier island beaches. The county's boundaries encompass approximately 800 square miles of which 390 square miles are land area and the remaining 410 square miles are covered by water. Dare County's Outer Banks are surrounded by water bodies that include the Atlantic Ocean to the east, and to the west include the Pamlico Sound, the Albemarle Sound, and the Currituck Sound.

On Dare County's northern beach communities, physical conditions serve as a natural limitation on development and land use. The lack of natural ground elevation to preclude flooding from adjacent water bodies is a factor in every development project. The barrier islands of Dare far north are bordered by the Atlantic Ocean and subject to overwash because of hurricanes and other storm events. The estuarine shoreline is subject to flooding from hurricanes and other storm events.

3.3.1.1 Dune System

The Currituck County Outer Banks dune system, north of US 158, is more stable in the southern half than the northern half. Shoreline erosion studies published by NCDENR-DCM in 1992 show higher variability from Corolla north to the Virginia state line. The North Carolina CAMA classifies the shoreline as an Ocean Erodible Area of Environmental Concern (AEC). By definition, Ocean Erodible AECs include beaches and other oceanfront lands that are subject to long term erosion and significant shoreline changes. The 1992 shoreline study conducted by NCDENR-DCM concluded that the shoreline from Corolla to the Virginia border is most vulnerable to erosion, with an average of approximately 5 feet per year in some places. Some locations are gaining sand beach: the beach adjacent to the North Carolina/Virginia border is gaining about one foot per year in width.

Farther south, in Dare County, the dunes include vegetative sand hills that occasionally reach elevations of 50 feet or more above mean sea level. Large maritime forests areas are found in Buxton Woods, Nags Head Woods and Kitty Hawk Woods. The frontal dune system along the county's ocean shoreline was originally created in the 1930s as a storm surge protection measure.

3.3.1.2 Floodplains

Flood hazard areas are usually defined by the 100-year floodplain (one percent chance of flooding in any year). Because of its low elevation, much of Currituck County is

included in these hazard areas. Virtually all of the Outer Banks area is included in the 100-year flood hazard area as well as substantial portions of the mainland, as indicated by Zone AE on Figure 3-2. Estimated flood elevations are based on tidal storm surges resulting from hurricanes, tropical storms, and nor'easters.

3.3.2 Water Resources

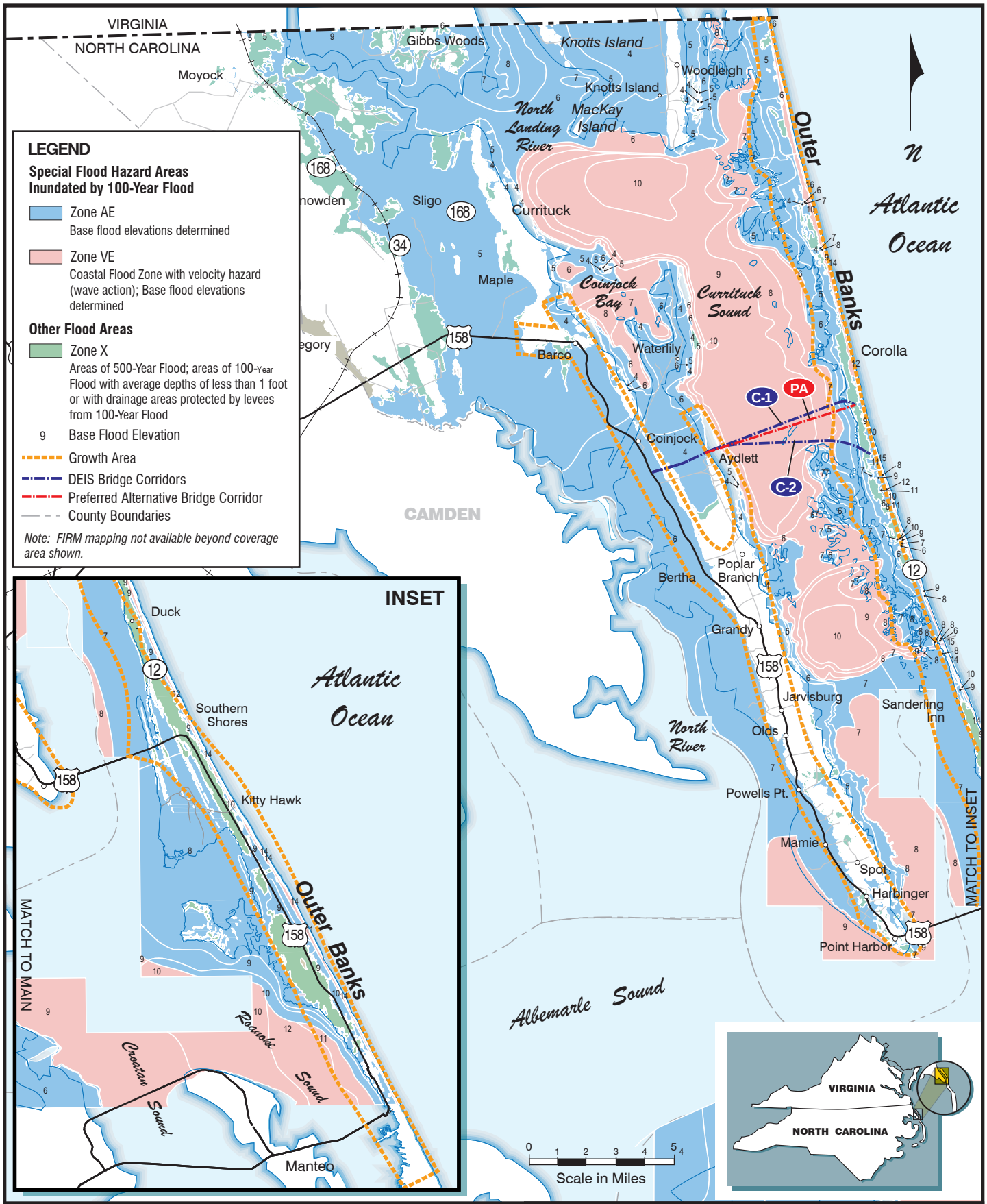
Major water bodies in Currituck County include Currituck Sound and its tributaries North Landing River and Northwest River. Coinjock Bay, on the western shore of the sound drains Maple Swamp. The North River makes up a portion of the county's southwestern boundary. This study focuses primarily on Currituck Sound and its tributaries but also includes the North River and Maple Swamp. The Intracoastal Waterway traverses North River, cuts across the mainland, and continues north through Coinjock Bay and Currituck Sound. (See Figure 3-3.) There are no High Quality Waters (including Outstanding Resource Waters or class SA waters) in or adjacent to Currituck or Dare counties in the habitat/water quality study area.

3.3.2.1 Currituck Sound

Currituck Sound is approximately 29 miles long, extending from the Virginia state line to its confluence with Albemarle Sound. It is approximately 97,850 acres and has an average depth between 3.61 feet and 5.25 feet. Over 80 percent of the sound is less than 7 feet deep. Currituck Sound is brackish, with three primary sources of water: rivers and streams, precipitation, and ocean water. Water circulation is primarily wind-driven with substantial surge effects from storm events. The sound is shallower in the northern portions, and deepens as it reaches the Albemarle Sound. It is within sub-basin 03-01-54 of the Pasquotank River Basin in the Albemarle Sound Drainage Basin. The sub-basin boundary roughly makes up the Currituck County boundary line, but also includes a small portion of Camden County. The total drainage area for the Pasquotank River Basin is 733 square miles. Currituck Sound has a drainage area 153 square miles (US Army Corp of Engineers, 2006).

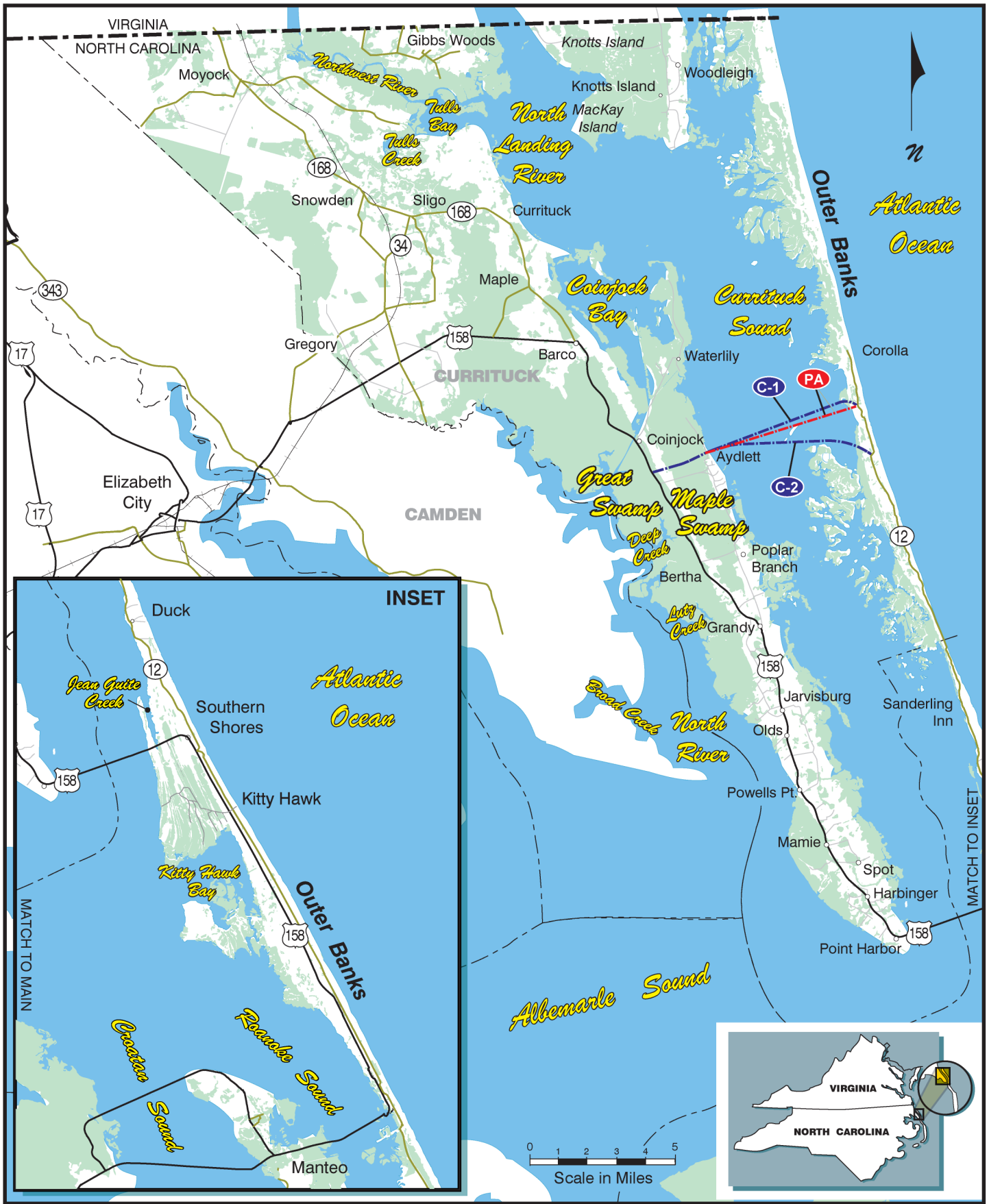
Currituck Sound has three main freshwater tributaries: North Landing River, Northwest River, and Tull Creek. Other inflows include the Atlantic Intracoastal Waterway and the Westneck Creek-Canal Number 2 from Virginia. Currituck Sound's nearest saltwater inlet from the Atlantic Ocean is the Oregon Inlet at the southern end of Hatteras Island, approximately 60 miles away. The Coinjock Canal, part of the Intracoastal Waterway, provides a hydrologic corridor between North River (a tributary to Albemarle Sound) and Currituck Sound.

Currituck Sound, including Back Bay, is the subject of an ongoing restoration plan being prepared by USACE. The project delivery team published a feasibility study in February 2010 (USACE, 2010). After the closing of Caffey's Inlet in 1830, the sound became a distinctive oligohaline estuary with extensive submerged aquatic vegetation (SAV) and important habitats supporting bass, waterfowl, and other notable species. By 1950 all of these started to decline with declining water quality. It is hypothesized that land uses, including agriculture and the growth of the Hampton Roads metropolitan region at top of the watershed, contributed to this decline.



Floodplains

Figure 3-2



LEGEND

- DEIS Bridge Corridors
- Preferred Alternative Bridge Corridor
- Water Bodies
- Wetlands

Water Resources and Wetlands

Figure 3-3

3.3.2.2 North River

North River is a tidal river, approximately 18 miles long. It forms the boundary between Currituck and Camden counties. The river rises in the Great Swamp, 10 miles east of Elizabeth City at the juncture of Indiantown Creek. The river's mouth, where it is approximately four miles wide, is in Albemarle Sound, midway between the mouth of the Pasquotank River to the west and the south end of Currituck Sound to the east. The lower two-thirds of the river is part of the Intracoastal Waterway.

3.3.2.3 Estuarine/Water Quality

The Currituck Banks lie within the Pasquotank River Basin, which is part of the Albemarle-Pamlico Estuarine system. The system is generally categorized as a low-salinity estuarine system (National Estuarine Research Reserve System, 2008). The estuarine water quality within this region is classified by NCDENR-DWQ as good. The water quality is assigned to a primary classification as well as a potential supplementary classification. The area contains a combination of each type of primary classification possible in North Carolina ranging from Class B, C, SB, SC to SA (NCDENR, 2008).

3.3.2.4 Public Water Supplies

Natural potable water supplies in Currituck County are derived from ground water and reverse osmosis sources. Therefore, there are no surface water supply watersheds in the county. Further, concerning groundwater resources in particular, there have been no wellhead protection plans submitted or approved for any of the three county-owned water supply systems in Currituck County: 1) Currituck County mainland; Water Department in Maple; 2) Ocean Sands Water and Sewer District in Corolla; and 3) the Southern Outer Banks Water System, also in Corolla. The mainland plant in Maple, North Carolina is rated at 2.9 million gallons per day (mgd) with an average day usage of approximately 1 mgd. There is currently excess capacity of 1.9 mgd at this newly completed plant. In addition to the services provided by the Maple plant the county also owns the Southern Outer Banks Water System (SOBWS), which is in Corolla, North Carolina and is rated at 2.1 mgd with an average day usage of 1.3 mgd. There is unused capacity of 0.8 mgd for the NC 12-accessible Outer Banks.

US 158 is serviced by a public water main, as is Poplar Branch and the part of Aydlett Road running along the shoreline. The part of Aydlett Road crossing Maple Swamp does not have a water main. The road accessible Outer Banks has water service. There is no public water in the roadless area.

The coastal communities in North Carolina are becoming increasingly dependent on desalination as a form of water treatment. Reverse osmosis has continued to become an important source of clean water for many towns in coastal regions. One of the largest facilities is in Kill Devils Hills at the Dare County North Reverse Osmosis (RO) Water Plant. The facility, which is the largest in the state and one of four in the county, has a capacity to provide up to 5 million gallons of water per day. The Dare RO serves 25,000 people from Roanoke Island, Stumpy Point, Colington, Kitty Hawk, Southern Shores,

and Duck. Duck is the farthest north that this RO plant serves (Dare County Water Department, 2008).

Southern Outer Banks Water Treatment Plant is on the Outer Banks. The capacity of this plant is 2 million gallons of water per day, with 1 million gallons of water per day produced through RO and the remaining 1 million gallons of water per day produced by greensand and anion exchange (filter). This plant serves the Currituck County Outer Banks. The Mainland Water Treatment Plant is scheduled to be completed June 2009. It will produce 2.9 million gallons of water per day, 1.5 million gallons of water per day RO and 1.4 million gallons of water per day filter (greensand). This plant will serve customers on the Currituck County mainland.

3.3.2.5 Point Source Pollution and NPDES

According to Currituck County's land use plan, there are no large central sewer systems in Currituck County. There are nine large surface sewage treatment plants and 64 on-site wastewater treatment systems that serve individual developments on the mainland and in the southern section of the Outer Banks. There are no large surface sewage treatment plants in the northern portion of the Outer Banks or extensive sections of the mainland. These areas are primarily served by individual septic systems. The large surface sewage treatment plants are listed below:

- Sewer Services on the mainland

  Carolina Village Mobile Home Park
  Moyock Commons Shopping Center
  Mill Run / Eagle Creek
  Maple Prison
  New Town Sewer System

- Sewer Services on the Outer Banks

  Villages at Ocean Hill
  Corolla Light Plant #1
  Monteray Shores
  Ocean Sands Water and Sewer District
  Currituck Club / Pine Island

There is also no county-wide wastewater treatment system in Dare County (The Outer Banks Chamber of Commerce, 2009) and no large sewer services in the ICE study area.

3.3.2.6 Stormwater

Currituck County fully adheres to the established NCDENR-DWQ stormwater regulatory requirements. NCDENR-DWQ requires that upon completion of construction and prior to operation of the permitted treatment units, a Certification of Completion Form must be submitted by the designer certifying that the permitted facility has been installed in accordance with the permit. Subsequently, every 10 years

the owner of the stormwater facility must renew the permit including an Operations and Maintenance Verification from the owner for permit renewal.

According to the Unified Development Ordinance for Currituck County (2008), the maximum lot coverage for commercial districts is 65 percent impervious. The maximum lot coverage permitted for residential zones depends upon the lot size. Large lots over 19,000 square feet may be up to 30 percent impervious. Small lots less than 10,000 square feet may be up to 45 percent impervious. Medium-sized lots may be up to 35 percent impervious.

3.3.2.7 Groundwater

The ICE study area is underlain by surficial and Yorktown Aquifers, both of which are used for water supply. The surficial aquifer is shallow and consequently susceptible to contamination from septic systems and spills, as well as saltwater intrusion.

3.3.3 Living Resources

3.3.3.1 Plant Communities

Important plant communities in the ICE study area include estuarine wetlands, Maple Swamp and other area swamps, and the maritime forests on the Currituck County Outer Banks. These ecosystems are particular to coastal areas. On the Currituck County mainland, the upland vegetation is highly altered because of a long history of agriculture, which was facilitated by extensive ditching and drainage, logging, and settlement. Also on the Outer Banks, a distinctive plant community is associated with the dune ecosystem. The *Amaranthus pumilis* (Seabeach amaranth) is a significant member of this community as is *Uniola paniculata* (sea oats).

3.3.3.2 Maritime Forests

Maritime forests usually occur on the mainland side of a barrier beach or island and consist of a large area of dense growth of trees, plants, and underbrush. Maritime forests are often distinguishable by their high canopies and harsh conditions for plant species. Plant species often found in these areas are Live Oak, Palmetto, Cedar, Bay, and Wax Myrtle. These plants are particularly tolerant of the intense conditions associated with maritime forests such as, salt, sun, sea spray, and wind. Maritime forests can occur in soils that are generally dry and well drained to soils that are persistently wet. Maritime forests serve as a protective buffer between the mainland and the sea by anchoring the soils on the barrier lands and reducing the force of wave action. It is important to remove as little vegetation as possible and encourage marsh vegetation growth to help slow erosion. They also provide critical habitat. An abundance of animal species live in maritime forests year-round and many bird species use maritime forests for migratory purposes as well as a source of food and shelter.

The historical trend has been for maritime forests to be destroyed for development. In many areas of the northern Outer Banks this has occurred but in newer residential developments the maritime forests have not been clear cut. Rather, building lots have been carved out of the forests, leaving as much native vegetation as possible. While this

is effective in preserving native vegetation, at best, it fragments the habitats and degrades them. Once degraded or destroyed, maritime forests require greater than 25 years to re-grow. Currently the most intact patches of maritime forests are in the non-road area of the Outer Banks. If the development in the non-road areas were to increase, the impact on remaining intact maritime forests would be substantial.

3.3.3.3 Submerged Aquatic Vegetation

The North Carolina Coastal Habitat Protection Plan (CHPP) defines submerged aquatic vegetation (SAV) as "fish habitat dominated by one or more species of underwater vascular plants" (Street et al., 2005). Within CHPP, the coastal area of North Carolina is divided into eight river basins; Currituck County is within the Albemarle River Basin (NCDCM, 2007). North Carolina contains approximately 200,000 acres of SAV (Street et al., 2005). The Albemarle Sound River Basin contains 4,430 acres of SAV (Street et al., 2005). CHPP identified percentage of SAV in low salinity waters, such as the Albemarle and Currituck Sounds, and their tributaries, to be low. The percent of SAV within the Albemarle management unit was 2.26 percent (Street et al., 2005). CHPP noted specific SAV changes in Currituck Sound. The changes were:

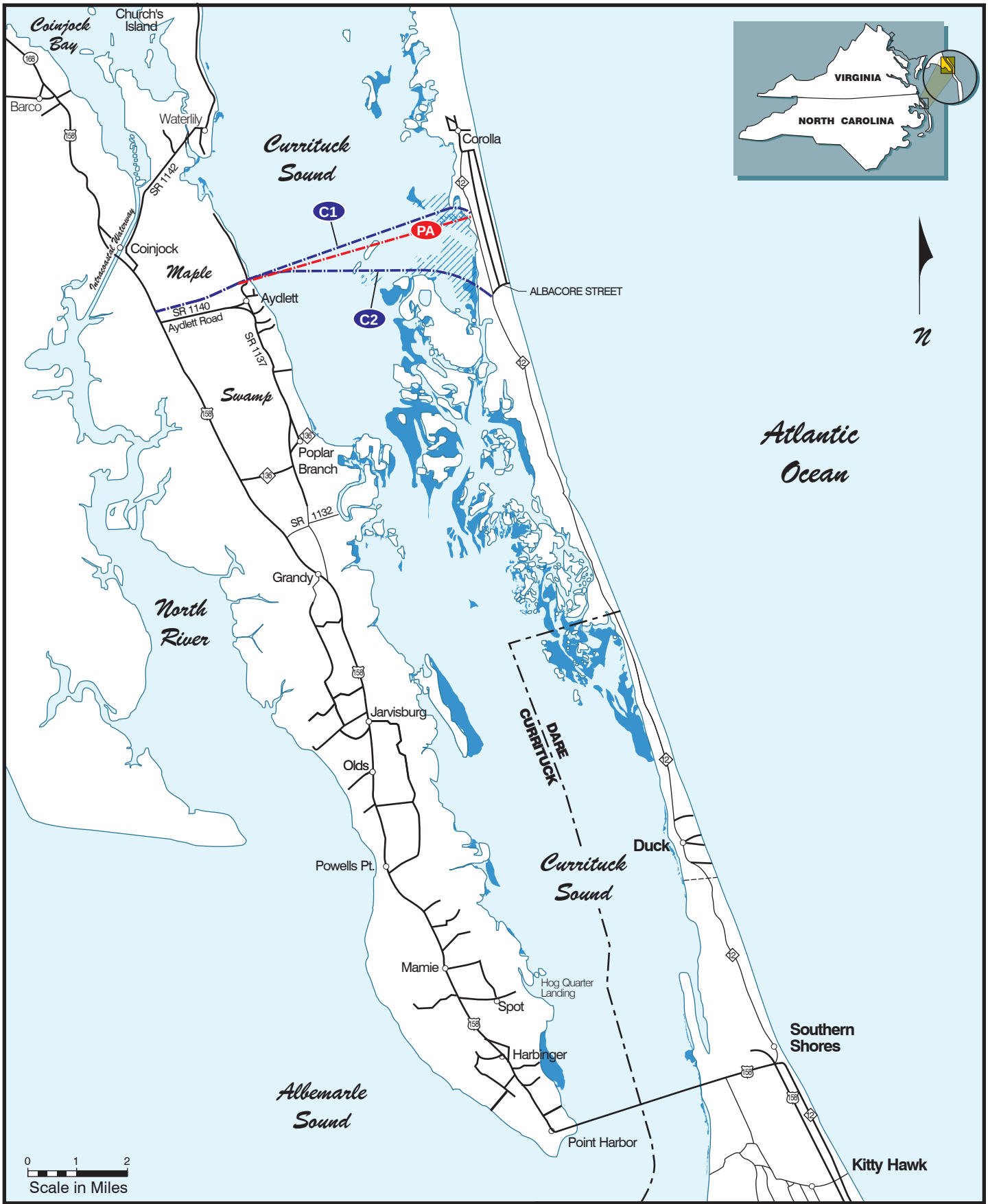
- 1918 – 1919: Major decline in Currituck Sound as a result of turbidity from opening the Albemarle and Chesapeake Canal;
- 1952: Full recovery in Currituck Sound from improved management of canal locks;
- 1955: Four hurricanes caused major loss to SAV in Currituck Sound, but it recovered within two years; and
- 1962: Decline in native freshwater species in Currituck Sound as a result of saltwater intrusion and displacement by non-native Eurasian watermilfoil (Street et al., 2005).

Since 1962, changes again in the salinity of Currituck Sound caused the non-native species to disappear and native species are beginning to appear again as reflected on Figure 3-4.

SAV beds in Currituck County have been documented since 1901 (Street et al., 2005). The historical record of SAV abundance in CHPP stresses SAV sensitivity to weather events, site conditions, and human activity (Street et al., 2005).

3.3.3.4 Unconsolidated Estuarine Bottoms

Unconsolidated estuarine bottoms are soft bottom habitats characterized by a cover of loose particles smaller than stones. They stand in contrast to more structured bottoms such as shell beds or SAV beds. The state's coastal habitat protection plan includes a chapter on the attributes of soft bottom habitats (Deaton et al., 2005). Although they are not specially designated or protected in North Carolina, they are important habitats and provide a key role in primary production. Benthic microalgae live in the top layers of sediment and become suspended in the water column. Benthic invertebrates also occur



LEGEND

- County Boundaries
- DEIS Bridge Corridors
- Preferred Alternative Bridge Corridor
- Submerged Aquatic Vegetation *(Source: Elizabeth City State University, 2003)*
- Submerged Aquatic Vegetation *(Source: Corps of Engineers, 2007)*
- Submerged Aquatic Vegetation *(Source: NCTA, 2010)*

Submerged Aquatic Vegetation in Currituck Sound

Figure 3-4

here. This habitat provides spawning and nursery areas for fish as well. Nonetheless, unregulated as they are, they are not well mapped. The trend is for increased areas of unconsolidated estuarine bottoms as shellfish beds and SAVs shrink. The productivity and ecology of these habitats vary. Threats are dredging or fill of productive areas, other bottom disturbing construction, toxic contamination, and oxygen depletion.

3.3.3.5 Wetlands

USACE regulates development in wetlands under Section 404 of the Clean Water Act. These areas are extensive in Currituck. On the Outer Banks, wetlands are generally coastal wetlands and uplands along Currituck Sound. Major areas of non-coastal wetlands on the mainland occur along the Northwest River, along the western County boundary, and generally on either side of US Highway 158 between the communities of Maple and Grandy. The general location of wetlands in the ICE study area based on Geographic Information Systems data is presented on Figure 3-3.

North Carolina's CAMA provides protection to coastal wetlands. CAMA defines a coastal wetland as any marsh subject to regular or occasional flooding by wind or lunar tides. NCDENR-DCM identifies coastal wetlands if any of the following ten plant species are present in the marshland area:

- *Spartina alterniflora:* Salt Marsh Cordgrass or Smooth Cordgrass;
- *Juncus roemerianus*: Black Needlerush;
- *Salicornia spp*.: Glasswort;
- *Distichlis spicata:* Salt or Spike Grass;
- *Limonium spp*.: Sea Lavender;
- *Scirpus spp*.: Bulrush;
- *Cladium jamaicense*: Saw Grass;
- *Typha spp*.: Cattail;
- *Spartina patens:* Salt Meadow Grass or Hay; and
- *Spartina cynosuroides:* Salt Reed or Giant Cordgrass.

3.3.3.6 Maple Swamp

Maple Swamp is approximately 4,350 acres, and borders Coinjock Bay and the central western portions of Currituck Sound. Maple Swamp is recognized by NCNHP as a SNHA with a priority ranking of B, which means it contains ecological resources that are among the best occurrences of their type in North Carolina. The significant features associated with this site include an unusually extensive stand of loblolly bay, which may represent the largest stand in the state and the most northern range of this community. The area dominated by loblolly bay covers approximately 150 acres and contains trees with an average diameter at breast height of 18 inches with some individuals up to 32 inches. Maple Swamp's natural area also contains a variety of extensive natural communities. Predominant communities associated with Maple Swamp and found within the project area include non-riverine swamp forest and non-riverine wet hardwood forest. Maple Swamp is one part of an extensive system of wetlands within the Currituck Sound watershed. Hunting and timber are the primary uses of the swamp.

There has been extensive logging in Maple Swamp over the last ten years. Table 3-3 shows the logging history in Maple Swamp since 1998. Maple Swamp is currently being used by the logging industry as a source of hardwood. Because of the demand in hardwood pulp, portions of Maple Swamp are being clear cut. Locations on both sides of the swamp across Aydlett Road are being logged. Some land owners want to preserve their land, but most owners want to log (personal communication, Dan McCarthy, February 2009). Most of the owners choosing to log are middle aged or elderly owners, and chose logging to make ends meet. Heavy logging is occurring and the areas are left to regenerate naturally. The North Carolina Division of Forest Resources makes sure water quality standards are upheld during logging and best management practices-forestry guidelines also are upheld during logging.

Table 3-3. Maple Swamp Logging History since 2000

Year	Acres Logged	Land Owners
2010	0	0
2009	804	13
2008	184	4
2007	95	1
2006	18	1
2005	81	1
2004	0	0
2003	0	0
2002	110	3
2001	65	2
2000	36	1
Total	1,393	23 unique landowners

Source: Personal communication Aaron Gay, NC Forest Service, February 2011.

3.3.3.7 Animal Communities

The ICE study area is within the Atlantic Flyway. According to the National Estuarine Research Reserve System, this area attracts accipiters, falcons, ducks, geese, warblers, gulls, terns, herons, and egrets (National Estuarine Reserve Research System, 2008). Indigo buntings, bobwhites and other mainland species also use the islands for nesting. The ICE study area has particular significance with respect to waterfowl. Currituck Sound harbors an estimated six percent of the Atlantic Flyway overwintering waterfowl population and 32 percent of North Carolina's wintering fowl. Typical types of waterfowl include dabbling ducks, diving ducks, geese, swans, and coots.

Currituck Sound contains a rich resource of forage, commercial and game fish. Largemouth bass, yellow perch, striped bass, tidewater silverside, and pumpkinseed

fish are the ecologically dominant species. Other game fish found in the area include white perch, bluegill, black crappie, chain pickerel, and channel catfish. Carp, shad, herring, and eels are also found in the area (National Estuarine Reserve Research System, 2008). Mammals include muskrats, river otters and minks, as well as deer, gray foxes, raccoons, opossums, nutrias and feral hogs. Feral horses are a well established and iconic component of the community in the non-road Outer Banks.

Mole crabs, ghost crabs, and coquina clams among other invertebrates are common in the intertidal zone. Common fish include striped bass, bluefish, mullet, croaker, spot, and weakfish.

There are endangered threatened and species-of-concern on the federal and state endangered species lists in the ICE study area. A list of such species and their habitat preferences in Dare and Currituck counties is contained in the *Biological Assessment* (CZR Incorporated, 2011a), the *Natural Resources Technical Report* (CZR Incorporated, 2011b) and in Appendix B.

3.3.3.8 Waterbirds

Waterfowl and shorebirds comprise the important avian species in the ICE study area. Numerous species of migratory waterfowl are found in Currituck County during various times of the year. In addition to ducks, other waterfowl species include: Canada Geese, Snow Geese; wading birds, such as Great Blue Heron, Great Egret, Little Blue Heron, Green Heron, Glossy Ibis; shore birds, such as Greater and Lesser Yellow Legs, Sandpipers, Plovers, Killdeer, American Oystercatchers. Many of these wading and shore birds are found in Currituck Sound year-round.

Ducks are culturally and ecologically iconic species in the ICE study area. Both dabbling ducks and diving ducks are found in Currituck County (Davis and Fuller 2008). Based on Sibley's (2000) National Audubon Society guide book, there are 24 species of duck migrating, nesting, or colonizing in Currituck County, lands or waters, in any given year (Sibley 2000). Sibley defines the range of duck species by five categories; (1) Winter, (2) Summer, (3) Year-round, (4) Migration, and (5) Rare.

Although duck populations have declined in the last 50 years, the ICE study area remains an important duck habitat. Estuarine marshes, hardwood swamps, and even impoundments on private fields are important areas for ducks and other waterfowl. Mackay Island National Wildlife Refuge, on a peninsula separating Back Bay from Currituck Sound, is the largest conservation area actively managed for migratory birds in the ICE study area. There are hundreds of duck blinds in Currituck Sound.

3.3.3.9 Atlantic Flyway

North Carolina, the Outer Banks, and Currituck Sound are in the middle of the Atlantic flyway for migrating waterfowl. The flyway stretches from Mexico to Canada.

Duck population statistics were derived from the midwinter waterfowl survey in the Atlantic flyway population survey (Raftovich, Padding, and USFWS, 2007). Generally,

there is a trend toward decline in both dabbler and diver duck populations in North Carolina. For example, mallard populations show a trend toward decline in North Carolina. In 1955 there were 44,380 mallard ducks recorded in the midwinter waterfowl survey, with decreasing numbers through to 2007. Since 2003, mallard populations have been in very low numbers in North Carolina, and only 4,029 were recorded in 2007. Similarly, black duck populations in North Carolina also show a general trend toward decline since 1955, where 40,585 ducks were recorded. Again, this trend was not constant and fluctuations were observed. In 2007, 7,199 black ducks were recorded in North Carolina.

3.3.3.10 Anadromous Fish Spawning Areas

Anadromous fish spawning areas are those tributary streams where fish spawn. Anadromous fish migrate from their primary ocean habitat to spawn, or breed, in freshwater areas. Anadromous fish are valuable recreational and commercial species and are an important component of the ecosystem. In Currituck County, anadromous fish spawning areas are on the mainland drainage streams. The largest spawning area is the upper reaches of the North River. There are no primary coastal fisheries in Currituck County.

3.3.3.11 Shellfish Waters

As noted, there are no water bodies in Currituck County that are rated SA (suitable for commercial shellfish harvesting) as the waters of Currituck County generally have insufficient salinity levels to support commercial shellfish. While the North River is a water body that has physical characteristics appropriate for shellfish beds, high fecal coliform counts require that the river be closed to shell fishing. Prospects for opening the area for shellfish harvesting are not good, given the trend toward increased development around the North River and greater stormwater runoff amounts draining into the river.

3.3.3.12 Protected Species

Protected species in the ICE study area are identified in Appendix B. Currituck Sound is potential foraging habitat for four species of sea turtles, the shortnose sturgeon, and the West Indian Manatee. The occurrence of these species in Currituck Sound is either rare or not recorded. The only federally listed plant is the seabeach amaranth, which was last cited in 1989. Loggerhead turtles and piping plovers have been recorded nesting infrequently on the dunes in the last 20 years. It is poor habitat for both species because of unrestricted beach driving and absence of washover habitat (US Department of the Interior, 2006).

3.3.3.13 Wild Horses

Wild horses roam the non-road accessible Currituck County Outer Banks. These Colonial Spanish Mustangs are on the Threatened Breed list of the American Livestock Conservancy and on the Critical list of the Equus Survival Trust (Corolla Wild Horse Inc., 2008). These horses are descendants of Spanish horses brought to the Outer Banks nearly 500 years ago.

Coastal development over the last 30 years has severely affected their habitat. Currently they are contained by a horse fence near the end of NC 12 and a horse fence and cattle gate at the Virginia state line. Seventeen horses have been killed in car accidents since 1989 (Hause, 2008). The Corolla Wild Horse Fund is a 501 (c)(3) corporation, whose mission is to protect and preserve this herd.

3.3.4 Landscape Structure

A summary of the landscape ecological structure for the two landscapes is given in sections 3.1.1 and 3.1.4. A majority of the land in the county is either rural areas, which are areas preferred for open space and agricultural preservation or conservation areas. Much of the land included in the conservation area is classified as environmentally sensitive. Because of the large extent of conservation areas within Currituck County, there is little loss of connectivity between the various patches throughout that part of the ICE study area.

3.3.4.1 Conservation Patches

There are 21 National Heritage areas that contain plant and animal species that are particularly rare, as well as natural communities that are equally significant, and together they warrant special attention when deciding on land use issues (Currituck County, 2006). These include four nationally significant sites, 10 state significant sites, five regionally significant sites, and two locally significant sites. Additionally, there are designated Coastal Barrier Resources System (CBRS) areas within the ICE study area as described in the next section.

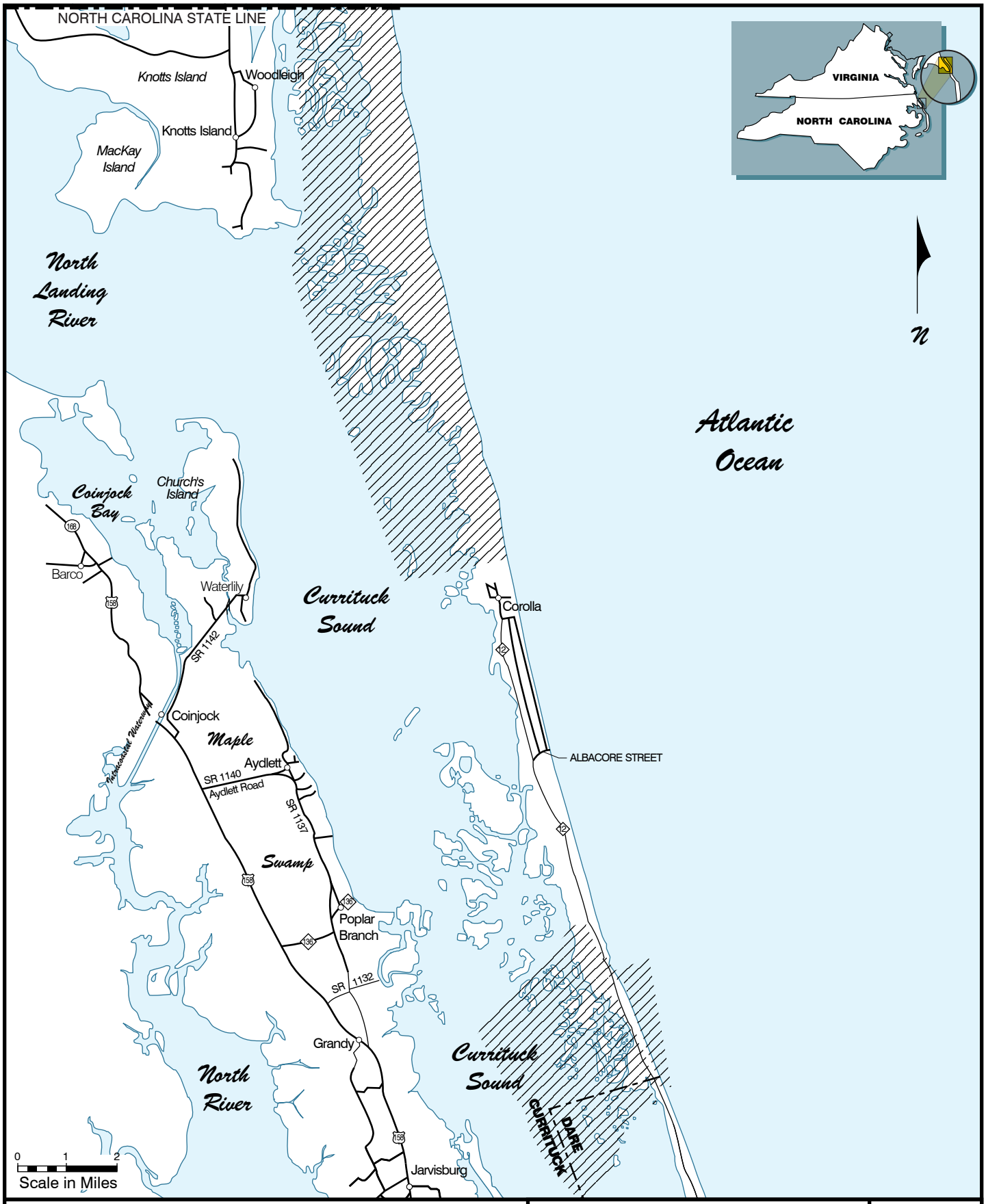
3.3.4.2 Coastal Barrier Resources Act

The Coastal Barrier Resources Act (CBRA) of 1982 was established to "minimize the loss of human life, reduce wasteful expenditure of federal revenues, and reduce the damage to fish and wildlife and other natural resources that can occur when coastal barriers are developed" (US Department of Interior, 1989). This legislation establishes the federal government's intent to protect undeveloped portions of the coastal barriers from further development. It does so by withdrawing Federal incentives for development, including federal flood insurance and assistance for infrastructure. This act does not prohibit landowners from developing their property, but it withdraws all federal support from such endeavors (Godschalk, 1984).

The federal government established specific guidelines for defining "undeveloped" stretches of coastal barriers and included these areas within a CBRS. CBRS areas in the ICE study area are shown on Figure 3-5.

3.3.4.3 Areas of Environmental Concern

Areas of environmental concern are a compendium of regulatory designations that the NC Coastal Resources Commission has defined for planning and permitting processes. They are not a single notable feature, but rather a class of features. AECs in the ICE study area include ocean hazard system AECs, estuarine shoreline AECs, coastal wetlands, and estuarine waters. Individual instances of AECs as notable features are



LEGEND

— - — County Boundaries

Coastal Barrier Resources System

Soruce: USFWS dated May 31, 2007.

Coastal Barrier Resources System Locations

Figure

3-5

discussed throughout Section 3.3. The general distribution of AECs is shown in Figure 2-12 and discussed in Section 2.3.3 and Appendix A, Section A.8.1.

3.4 Cultural and Socioeconomic Conditions

3.4.1 Physical

3.4.1.1 Housing Stock Mix and Values

Of the Currituck County mainland's housing stock in 2000, the majority, or 68.2 percent consisted of single-family detached dwellings. Mobile homes are the second largest type of housing at 29 percent.

Of the housing stock on Outer Banks in 2000 almost all (93.1 percent) consisted of single-family detached dwellings. The Outer Banks housing stock is mainly seasonal/rental units. The number of units is shown in Table 2-6. On the Currituck County Outer Banks in 2000, there were 3,023 housing units of which 314 were occupied (268-owner, 46-renter) and 2,709 were vacant (2,693-seasonal/rental, 16-other vacant) (Currituck County, 2006).

As indicated in Table 2-5, there were 26,671 housing units in Dare County in 2000, with 52.4 percent listed as vacant. This large percentage of vacant housing units reflects the abundance of housing units that are offered for short-term occupancy in Dare County. Over 50 percent of the vacant housing units in Dare County are categorized as seasonal or recreational use.

As indicated in Table 2-3, the 2000 median housing value in Currituck County was $115,000 compared to the state average of $108,300. The median gross rent was $590 monthly compared to the state average of $548. Although the county's economy is growing substantially and because the housing cost is only marginally above the state average, Currituck County is not currently exclusionary to low or moderate-income persons on the mainland.

3.4.1.2 Open Space Percentage

3.4.1.2.1 Currituck County

As of 2006, 128,169 acres (82 percent) of the land in Currituck County is undeveloped. This includes 45,134 acres (29 percent) of the land that is being used for agricultural purposes and 83,062 acres (53 percent) that is deemed undeveloped. According to the 2006 Currituck County land use plan, there are approximately 9,412 acres of the undeveloped land classified as protected lands (Currituck County, 2006).

3.4.1.2.2 Kitty Hawk

According to its 2004 CAMA land use plan update, Kitty Hawk had 1,836 acres of undeveloped/vacant land. Of the 1,836 acres of undeveloped/vacant land, 250 acres were devoted to roadway rights-of-way and easements. The 1,836 acres makes up 35 percent of the total area of Kitty Hawk. There were 1,900 acres of land designated as conservation, which is 36 percent of the total area of Kitty Hawk. These two categories

total 3,736 acres or 71 percent of Kitty Hawk (Community Planning Collaborative Inc., 2004).

3.4.1.2.3 Southern Shores

The 2010 *CAMA Land Use Plan* update for Southern Shores found that in January 2007 there were an estimated 490 vacant lots in the town, according to building permit data. These 490 vacant lots correlated to a total of approximately 447 acres. These 447 acres make up 18 percent of the total area of Southern Shores (Town of Southern Shores, 2010).

3.4.1.2.4 Duck

Vacant land in Duck is primarily limited to undeveloped lots in previously recorded subdivisions. Although there are a couple of isolated tracts of 2 to 3 acres of undeveloped land, the land use pattern for Duck is now established pending redevelopment proposals. According to the 2005 Duck CAMA Core Land Use Plan, there were 550 parcels undeveloped totaling 241.76 acres of land. This represents 16 percent of land area in Duck (Community Planning Collaborative Inc., 2005). A 2007 estimate by the Town of Duck indicated that 160 undeveloped lots remain.

3.4.1.3 Town Area and Form

The communities in the ICE study area historically developed in the form of rural or maritime villages. With the high level of tourism and development since 1970, these communities are evolving into bedroom communities in the Hampton Roads metropolitan area on the mainland and resort communities on the Outer Banks. These communities still retain their village heritage. Development in the ICE study area is strongly linear guided by topography and the road network.

3.4.1.4 Residential Density

3.4.1.4.1 Currituck County Mainland

There are many small communities on the Currituck County mainland. The Currituck County mainland is influenced by the metropolitan areas of southeastern Virginia to the north and Dare County to the south. Since development in the northern portion of the mainland in the Moyock area is strongly affected by the economic engines of neighboring Virginia, new residential growth in this area tends to be of a "bedroom community" nature. Agricultural uses continue to comprise a substantial amount of land, approximately 32 percent of the mainland. Zoning on the mainland allows there to be one unit per acre in basic residential (Currituck County Unified Development Ordinance, 2004). As such residential densities are low consisting of individual homes on agricultural tracts and small low density subdivisions scattered among multiple small rural communities. In 2000, there were 11,247 acres developed in residential use on the mainland containing 7,046 housing units for a general density of 0.63 units per acre (Currituck County, 2006).

3.4.1.4.2 Currituck County Outer Banks

On the Currituck County Outer Banks in 2000 there were 3,023 housing units on 1,741 developed residential acres yielding a general density of 1.74 units per acre. Zoning on the Currituck County Outer Banks is typically one unit per acre in Corolla, while in the Carova Beach area one unit per three acres (Currituck County Unified Development Ordinance, 2004).

3.4.1.4.3 Kitty Hawk

According to the 2004 CAMA land use plan update, Kitty Hawk had 2,016 housing units on 1,188 acres of residential land for a housing density of 1.7 units per acre. Zoning in Kitty Hawk like in all of Dare County limit minimum lot sizes for new subdivisions to 15,000 square feet for central water or 20,000 square feet for private well use. The maximum dwelling density allowed under the current zoning codes is 10 units per acre.

3.4.1.4.4 Southern Shores

In Southern Shores there are 2,310 housing units on 1,608 acres of developed residential land. Residential density averages 1.44 units per acre. There are two residential areas that have a higher density than the other areas of the town. The higher density areas include: Pelican Watch with permitted densities of six units per acre and Mallard Cove with densities of 10 units per acre. Most of Southern Shores has a minimum of 20,000 square foot lots with permitted densities of two units per acre (Town of Southern Shores, 2010).

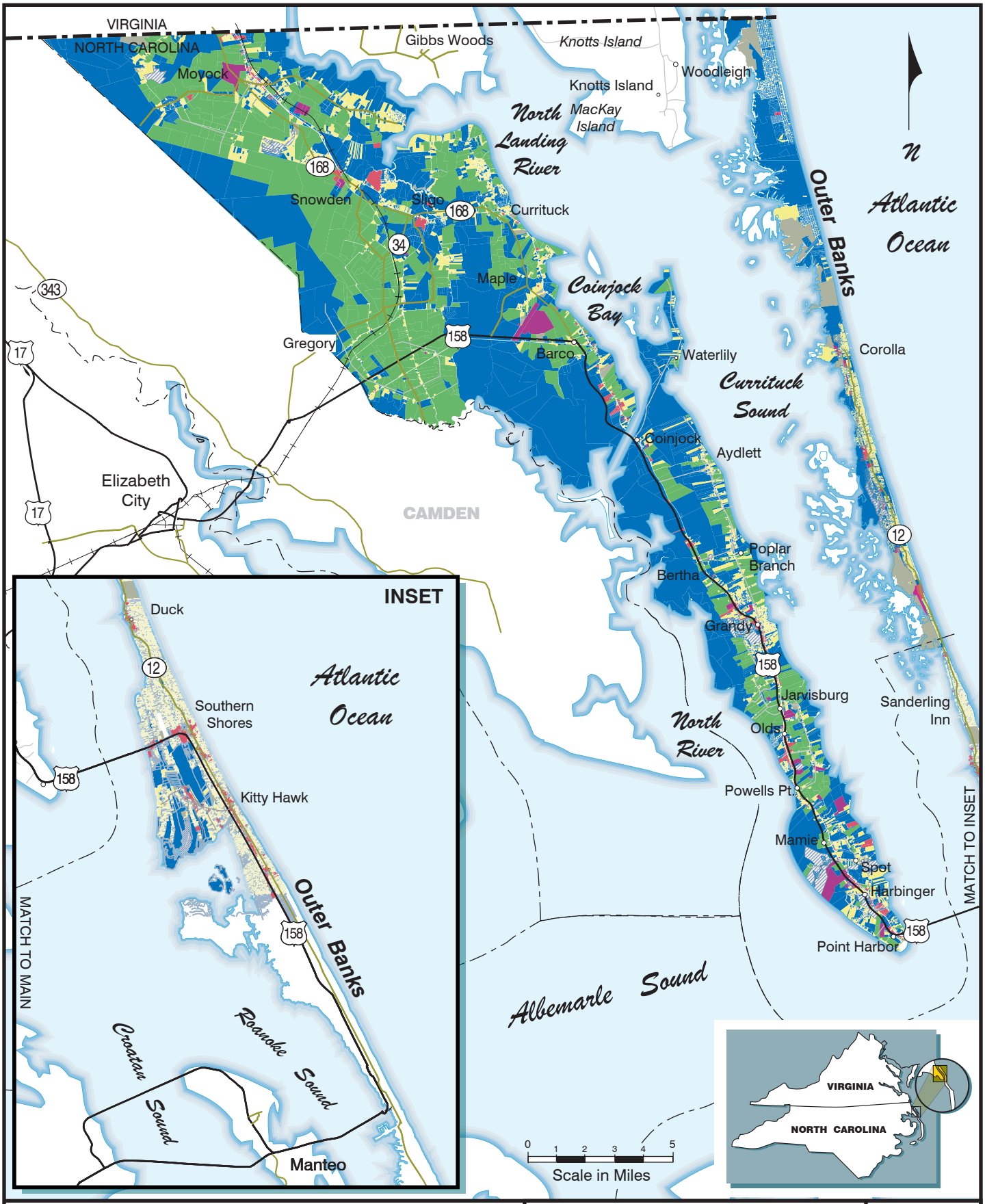
3.4.1.4.5 Duck

In Duck there are 2,068 housing units on 823 developed residential acres yielding a general density of 2.51 units per acre (Community Planning Collaborative, 2005). The Town of Duck indicated that in 2007 there were 2,351 housing units. One emerging trend has been the increase in the size of residential structures versus the existing residential development that had been a more traditional three-bedroom, two-bath "cottage." This concept has evolved into multiple bedrooms, multi-bathroom up-scale structures, many with individual pools.

3.4.1.5 Mix of Land Uses

The mix of existing land use in the ICE study area is shown on Figure 3-6. The developable areas of the Currituck County mainland are largely undeveloped. Substantial areas of agriculture remain in Currituck County. In 2000, there were 43,878 acres classified as agricultural land use covering 32.3 percent of the mainland. Developed land consists primarily of small rural subdivisions, isolated homes, and some commercial development.

On the Outer Banks served by NC 12 from Kitty Hawk to Corolla, the land is largely platted and developed in residential and some commercial development. The areas on the Outer Banks, north of Corolla lack paved roads and are a patchwork of conservation land and isolated development. Private lands are largely platted, but not built-out. There is no agricultural land on the Outer Banks.



LEGEND

- Undesignated
- Agricultural
- Commercial
- Industrial
- Institutional
- Other
- Residential
- Undeveloped

Existing Land Use

Figure

3-6

3.4.1.6 Historic Structures and Places

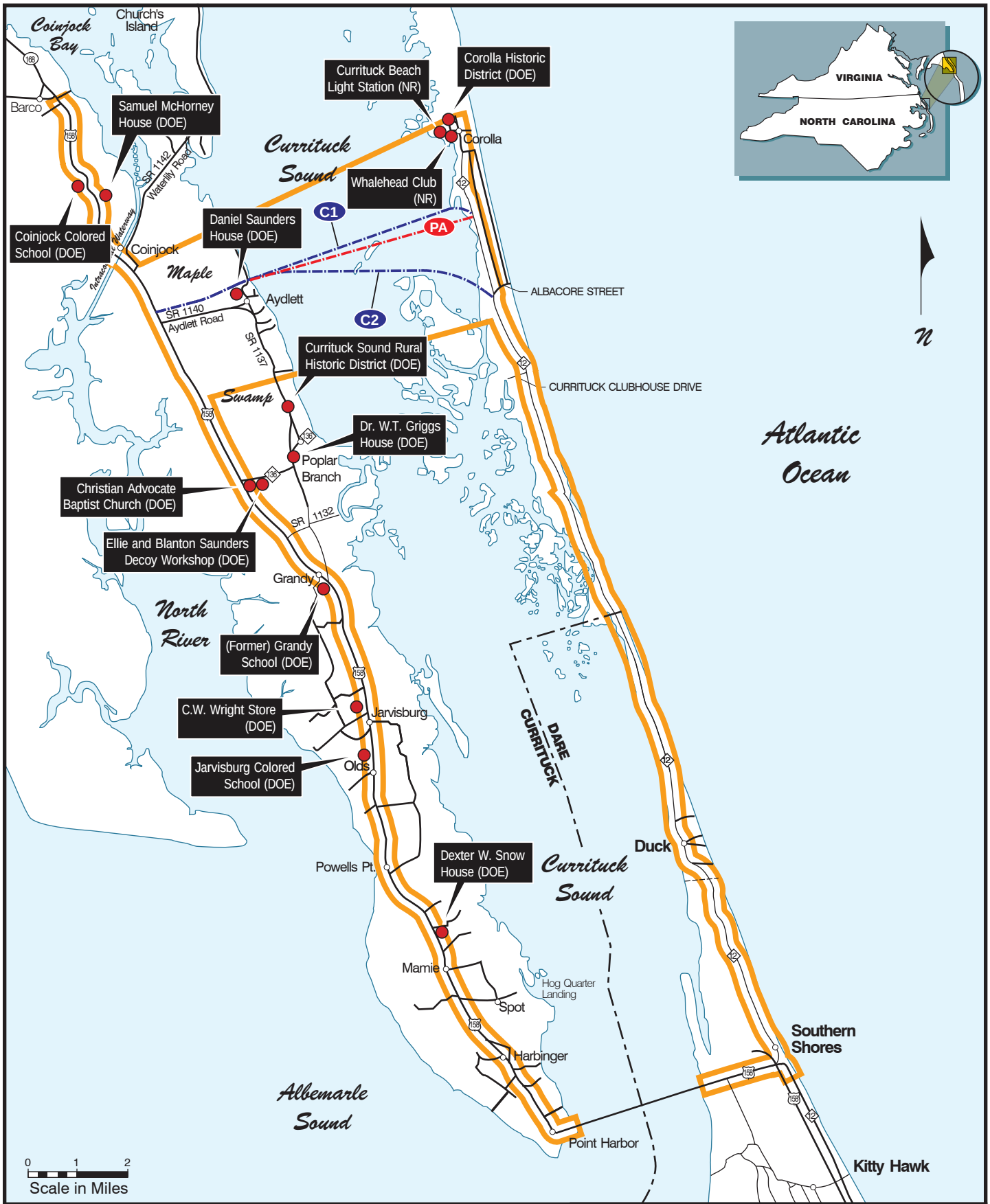
Fourteen historic resources are listed on or eligible for inclusion in the National Register of Historic Places in the project area are described in the *Historic Architectural Resources Report: Mid-Currituck Bridge Project* (NCDOT, 2009) and are:

- On the Currituck County mainland (all eligible):
  - Coinjock Colored School;
  - Samuel McHorney House;
  - Daniel Saunders House;
  - Currituck Sound Rural Historic District;
  - Dr. W. T. Griggs House;
  - Ellie and Blanton Saunders Decoy Workshop;
  - Christian Advocate Baptist Church;
  - (Former) Grandy School;
  - C. W. Wright Store;
  - Jarvisburg Colored School; and
  - Dexter W. Snow House.
- On the Currituck County Outer Banks:
  - Whalehead Club (listed);
  - Currituck Beach Lighthouse (listed); and
  - Corolla Historic District (eligible).

Their locations of these resources are shown on Figure 3-7, as is the area of potential effect.

3.4.1.7 Circulation and Traffic Characteristics

Figure 1-1 shows the traffic network in the project area. VA 168, NC 168, US 158, and NC 12 are the ICE study area's thoroughfares and connectors. VA 168, except for the last two miles before the state line, is a four-lane tolled freeway leading into the Hampton Roads metropolitan area. The last two miles is a four-lane divided road. NC 168 is a five-lane road from the state line to its terminus at US 158. US 158, with the exception of the Joseph P. Knapp Bridge over the Intracoastal Waterway at Coinjock, is a



LEGEND

- DEIS Bridge Corridors
- Preferred Alternative Bridge Corridor
- County Boundaries
- Area of Potential Effect (APE)
- Resource listed (NR) on or eligible (DOE) for inclusion in the National Register of Historic Places

Historic Properties

Figure 3-7

five-lane road south from its intersection with NC 168. West of its intersection with NC 168, US 158 is two lanes. US 158 continues south of the project area serving Kitty Hawk, Kill Devil Hills, and Nags Head. US 158 enters the Outer Banks over the Wright Memorial Bridge, which consists of two two-lane bridges. It ends at the intersection of US 64 at Whalebone, an east-west thoroughfare. NC 12 is a two-lane road that runs the length of the Outer Banks from the southern end of Ocracoke Island in Dare County to just north of Corolla in Currituck County.

As indicated in the *Statement of Purpose and Need* (Parsons Brinckerhoff, 2008), in 2035, substantial congestion will occur along both NC 12 and US 158 in 2035. Along US 158 on the mainland, congestion problems will be confined to the summer weekend peak period. In general, NC 12 will be congested during peak periods at all times of year, with congestion being at its worst in the summer. The worst congestion will occur on US 158 east of the Wright Memorial Bridge and NC 12 in Dare County during the summer. Elsewhere on the ICE study area thoroughfare network, congestion is expected primarily during the summer weekend, when tourists are traveling between the Outer Banks and their homes. It will be worst on US 158 and NC 168 in North Carolina, because the adjoining properties and connecting roads have full surface access, and the least on VA 168 since it is a limited access freeway.

3.4.1.8 Neighborhood Design Characteristics

There are a variety of neighborhood types on the Outer Banks and mainland. The Outer Banks are characterized by variations of what is referred to as beach villages. The preference and zoning regulations across all communities on the Outer Banks are for low-rise detached residential structures. Architecturally, the houses represent the expected styles of beach housing from the last 40 years. Development on the Outer Banks along NC 12 is oriented towards the beach. The newer communities further north on NC 12 such as Duck and Corolla contain larger, more expensive houses. The dominant use of all these neighborhoods is seasonal housing either by owner or vacation renters. At several points there are village centers that have a cluster of commercial structures.

On the mainland there are older traditional village centers, such as Aydlett and Currituck, and newer housing developments. The neighborhoods in all cases are composed of single family detached housing. Neighborhoods are generally either located on US 158/NC 168 or along the sound. There are mobile homes both in neighbors and dispersed across the landscape. Commercial areas on the mainland tend to be on the highways.

3.4.1.9 Infrastructure Character

Infrastructure in the ICE study area consists of schools, some parks and public access points to the beach, post offices, hospitals, sidewalks, and bicycle routes on the Outer Banks, utilities, and two general aviation airports.

To travel between Currituck County's Outer Banks and its mainland, one must travel through Dare County. This is primarily an issue in terms of schools. (See the

Community Impact Assessment Technical Report (Parsons Brinckerhoff, 2009) for a full description of the public services available on the Outer Banks.) To reach Currituck County schools on the mainland from the Currituck County Outer Banks, students must travel through Dare County, across the Wright Memorial Bridge. The minimum distance from the Currituck County Outer Banks to Jarvisburg Elementary School is approximately 20 miles and to the middle and high schools at least 40 miles. In 2006, there were 18 school-aged children living on the Currituck County Outer Banks (Currituck County, 2006).

3.4.1.10 Commercial Building Scale

Commercial buildings are generally associated with retail or service establishments. Except for the two hotels in the ICE study area on the Outer Banks they are one story. On the Currituck County mainland, they are single independent establishments, generally fronting on US 158 or NC 168. On the Outer Banks in Kitty Hawk are larger establishments that include a Wal-Mart and a Home Depot. The Wal-Mart anchors a multi-store shopping center. Commercial uses also are concentrated around the US 158/NC 12 intersection, including a hotel. They are either individual businesses or buildings that contain several small businesses that cater to tourists. A tourist-oriented commercial concentration also is found in Duck on NC 12, again either individual businesses or buildings that contain several small businesses. In Currituck County, commercial development comprised of small stand-alone shops and medium-sized shopping centers that include two grocery stores and small stores and restaurants to serve tourists.

3.4.1.11 Scenic and Natural Area Character

The Currituck County mainland viewshed is largely comprised of agricultural and forested lands that are punctuated by residences and roadside businesses. Although the mainland viewshed provides relatively pleasant and restful views, its economy and identity are not dependant on its viewshed. Notable views on the mainland are those of Currituck Sound, which can be seen from development that occurs along the shoreline. Such views consist of the water and in the distant background, the profile of the Outer Banks and taller structures, such as the Corolla light lighthouse and elevated water tanks. Aesthetically, the sound is a large open expanse that is generally calm.

The Outer Banks portion of the ICE study area is largely developed in vacation homes for the entire length of NC 12. Vacant land that retains its natural character largely consist of undeveloped lands distributed throughout subdivisions and a few locations protected from development or undeveloped. Notable views are of Currituck Sound from residential properties along the sound and in part of Duck from NC 12, as well as the Atlantic Ocean from homes and other residential properties that line the shore. Dunes block the view of the ocean from NC 12. Another important visual feature is trees and other vegetation in many residential neighborhoods that shield homes from views of NC 12 in many locations, particularly in Southern Shores and Duck.

3.4.1.12 Section 4(f) of the Department of Transportation Act of 1966 Resources

Section 4(f) of the US Department of Transportation Act of 1966 requires that the proposed use of land from a publicly-owned park, recreation area, wildlife and/or waterfowl refuge, or any significant historic or archeological site, by a transportation project is permissible only if there is no feasible and prudent alternative to the use. This law only applies to US Department of Transportation projects. Potential direct impacts of the detailed study alternatives to Section 4(f) resources are discussed in the DEIS and this FEIS. For two historic resources, the DEIS proposed a finding of *de minimis* (minimal) impact for both properties. A finding of *de minimis* impact for both properties was not needed for the Preferred Alternative since it would not include a third outbound lane on US 158 and would not affect these properties. Other highway projects in the ICE study area (see Table 4-2) are in different locations in the study area and could not also affect these two historic resources, creating the potential for a cumulative impact to these two resources. Therefore, Section 4(f) resources within the ICE study area are not identified in this report unless they are relevant to the assessment for reasons other than their status as Section 4(f) resources, e.g., the historic resources listed in Section 3.4.1.6.

3.4.1.13 Section 6(f) of the Land and Water Conservation Fund Act

No parks or recreation facilities built with funds provided under Section 6(f) of the Land and Water Conservation Fund Act would be affected by the detailed study alternatives. Further, it is unlikely that Currituck or Dare Counties would sell park land to a developer for redevelopment. Therefore, Section 6(f) resources within the ICE study area are not identified in this report.

3.4.2 Economic

3.4.2.1 Residents' Occupational Mix

As discussed in Section 2.1.3, both counties have had only limited employment in manufacturing and a high proportion of trade sector employment (retail and wholesale trade). The proportions of different employment categories in Currituck and Dare counties reflect the recreational emphasis of their Outer Banks.

3.4.2.2 Journey to Work (Origin and Mode)

Travel to work in the ICE study area is exclusively by motor vehicle. There is no bus or rail transit service.

Currituck County is a bedroom community in that residents travel outside the county in large numbers to find employment. Commuting patterns are presented in Table 3-4.

In 1990, 61.0 percent of employed residents commuted to jobs beyond the county's borders. This rose to 66.5 percent by 2000. Commuting patterns were similar in both 1990 and 2000. Cities and counties to which more than ten percent of Currituck County's residents commuted in 2000 in order are Dare (NC), Chesapeake (VA), Virginia Beach (VA), Norfolk (VA), and Pasquotank (NC). In 1990 and in 2000, the three

Table 3-4. Persons Commuting from Currituck and Dare Counties

	1990		2000	
	Number of Employees	% of Total Resident Workforce	Number of Employees	% of Total Resident Workforce
Currituck County				
Total Employed Residents	6,397	100.0%	8,603	100.0%
Working in Currituck	2,495	39.0%	2,881	33.5%
Working Outside of Currituck	3,902	61.0%	5,722	66.5%
Major Destinations:				
Dare County, NC	876	13.7%	1,539	17.9%
Pasquotank County, NC	379	5.9%	428	5.0%
Norfolk, VA	764	11.9%	771	9.0%
Chesapeake (city), VA	698	10.9%	1,270	14.8%
Virginia Beach, VA	592	9.3%	1,032	12.0%
Portsmouth, VA	172	2.7%	171	2.0%
Other Nearby NC Counties[1]	62	1.0%	128	1.5%
Other Nearby Virginia[2]	52	0.8%	74	0.9%
Dare County				
Total Employed Residents	12,175	100.0%	15,419	100.0%
Working in Dare	10,925	89.7%	13,881	90.0%
Working Outside of Dare	1,250	10.3%	1,538	10.0%
Major Destinations:				
Currituck County, NC	325	2.7%	703	4.6%
Pasquotank County, NC	94	0.8%	138	0.9%
Other Nearby NC Counties[1]	54	0.4%	122	0.8%
Nearby Virginia[3]	243	2.0%	178	1.2%

[1]Hyde, Tyrrell, Beaufort, Washington, Camden, Chowan, Perquimans, and Gates counties
[2]Hampton City, Newport News, and Suffolk (city), Virginia
[3]Hampton City, Newport News, Suffolk, Norfolk, Chesapeake City, Virginia Beach, and Portsmouth, Virginia
NA=Not Available
Source: US Census, 2000

most common destinations for Currituck County workers, in order, were: Dare County, NC; Norfolk, VA; and Chesapeake, VA.

Dare County is a larger employment center and is further from downtown Norfolk. Consequently, it does not experience the same level of commuting to destinations outside the county. In both 1990 and 2000, approximately 10 percent of employed Dare County residents worked outside the County. The destination receiving the greatest number of commuters was Currituck County, where 2.7 percent of employed Dare County residents worked in 1990 and 4.6 percent in 2000.

Table 3-5 indicates the regional travel pattern of people coming to Currituck and Dare counties for work. Although Currituck County remained a net exporter of workers, growth of county employment grew substantially between 1990 and 2000. The total number of workers commuting into Currituck and Dare counties increased from 1990 to 2000. The number of commuters working in Currituck County from points in North Carolina and from Virginia increased 47 percent from 1990 to 2000. The number of commuters working in Dare County from points north (including Currituck County) increased 59 percent from 1990 to 2000.

Table 3-5. Persons Commuting to Currituck and Dare Counties

	Work in Currituck County			Work in Dare County		
	1990	2000	% Change	1990	2000	% Change
From Currituck County, NC	2,495	2,881	15.47	876	1,539	75.68
From Dare County, NC	312	703	125.32	10,925	13,881	27.06
From Nearby Counties North						
• Camden County, NC	83	172	107.23	58	92	58.62
• Pasquotank County, NC	168	340	102.38	324	453	39.81
• Other Nearby NC[1]	107	65	-39.25	73	172	135.62
From Nearby Counties West						
• Hyde County, NC	21	19	-9.52	148	111	-25.00
• Tyrrell County, NC	0	0	0.00	363	276	-23.97
• Washington County, NC	0	16	100.00	110	194	76.36
Chesapeake city, VA	73	157	115.07	43	46	6.98
Other Nearby Virginia[2]	129	91	-29.46	110	62	-43.64

[1]Bertie, Chowan, Perquimans, and Gates counties
[2]Hampton City, Newport News, Suffolk, Norfolk, Virginia Beach, and Portsmouth, Virginia
Source: US Census 2000

The Virginia to Outer Banks trip-shed is illustrated on Figure 1-1.

3.4.3 Social

3.4.3.1 Community Cohesion

Community cohesion is reflected in the ICE study area in four ways:

1. In identification with a named unincorporated rural community, such as Coinjock, Aydlett, or Grandy. These communities in the ICE study area are reflected on Figure 3-8.

2. Identification with an incorporated town, i.e. Kitty Hawk, Southern Shores, and Duck.

3. Membership in an Outer Banks property owners association, such as Whalehead Beach, Monteray Shores, and The Currituck Club. The property owners associations on the Outer Banks are shown on Figure 3-8.

4. Common pedestrian crossings on NC 12 in the southern part of Southern Shores (beach access) and in the Duck commercial area. At other locations, NC 12 and on US 158, these roads act as a dividing point between communities, either because of high-speed traffic (US 158) or the boundary between subdivisions (NC 12).

3.4.3.2 Sense of Control over Change

County and municipal government within the ICE study area has made a conscious effort to guide change in the community through its land use plans and development regulations. Stakeholder involvement activities have yielded an indication of a reluctance to see change. This is reflected in:

- A desire to retain rural densities in new housing development on the mainland;

- Disappointment in the extent and rapid rate of development on the Currituck County Outer Banks and the associated loss of the area's former feeling of isolation;

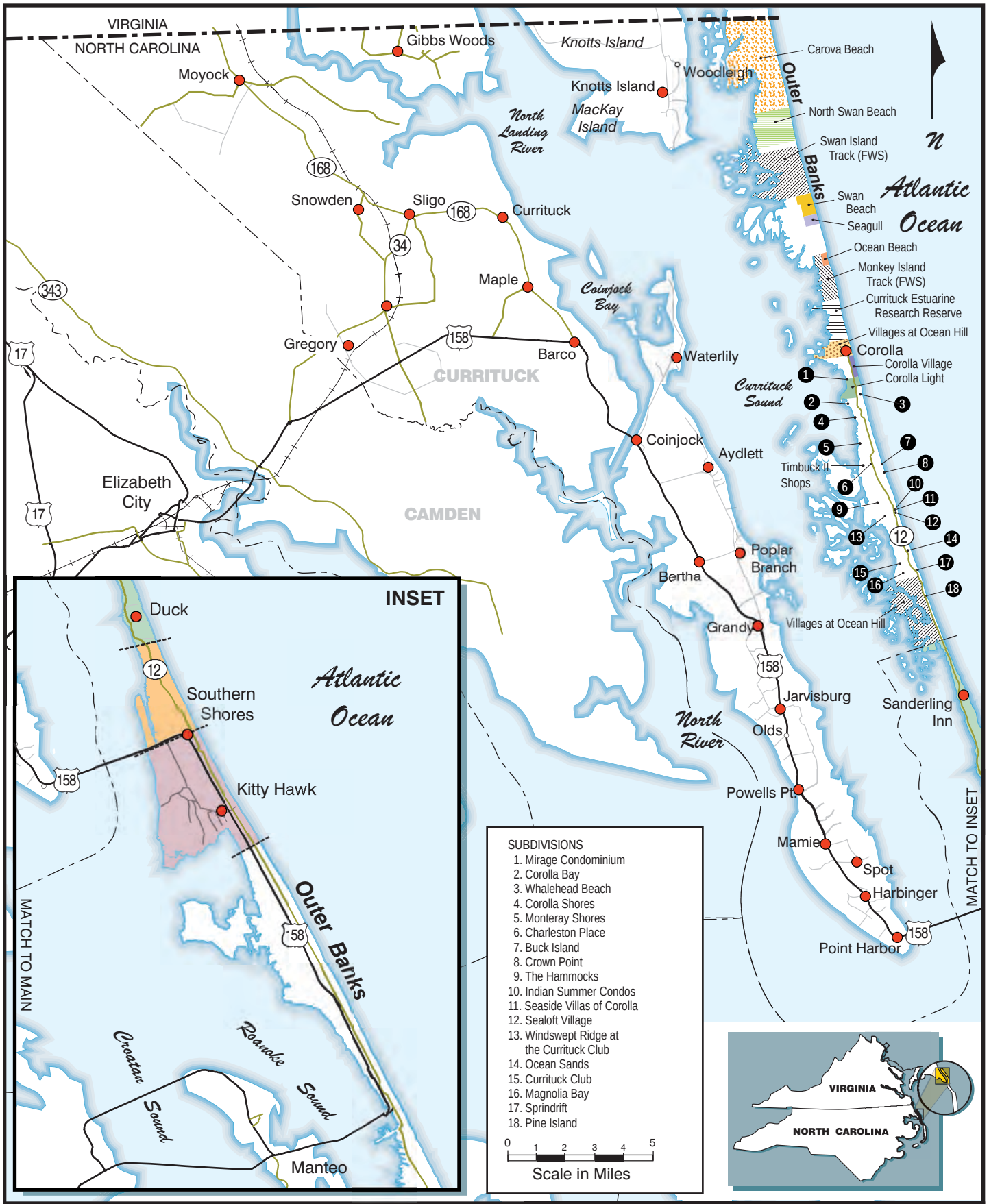
- Resistance to commercial and multi-family development in the non-road accessible portion of the Currituck County Outer Banks;

- Efforts to restrain redevelopment of older portions of the Outer Banks in Dare County to larger homes that can serve larger family groups; and

- Concerns about traffic whose destinations are in Currituck County passing through Dare County on NC 12.

3.4.3.3 Balance of Long-term Residents and Newcomers

The influx of newcomers, both new permanent residents and new tourists is reflected in the growth of the housing stock in the ICE study area, as discussed in Section 2.1.2. The influx of newcomers is most strongly felt on the Currituck County Outer Banks, where the greatest increases in housing units have occurred.



LEGEND

- Study Area Communities
- 1 Study Area Subdivisions

ICE Study Area Communities

Figure

3-8

4.0 Impact-Causing Activities

This chapter has been developed in general accordance with Step 4 of the *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina* (NCDOT, 2001). Step 4 identifies impact-causing activities that have the potential to result in impacts based on their incompatibility with the goals and notable features discussed in the previous sections. Specifically, this chapter examines the following:

- Encroachment-Alteration Effects (Project and Other Actions). Past, present, and reasonably foreseeable future actions, including potential project actions, that have the potential to alter the behavior and function of the physical environment. They can be separated from the project by time and distance (indirect). These effects can be considered cumulative in nature when they are additive over time or have an interactive (non-linear) net effect on the environment.

- Access-Alteration Effects (Project-Induced Growth). Changes to the traffic patterns and accessibility in the project area that have the potential to result in residential and commercial growth (induced growth).

In the ICE study area, impact-causing activities are primarily associated with the following:

- The proposed project and its detailed study alternatives (defined in the Preface to this document);

- Private development and the provision of infrastructure to serve that development;

- Other transportation projects presented in the *2009 to 2015 State Transportation Improvement Program* (STIP), including those included in the No-Build Alternative;

- Logging in forested areas, including wetlands;

- Beach driving; and

- Accelerated sea level rise.

The extent of expected future private development is reflected in the land use plans of the local jurisdictions in the ICE study area, as described in Section 2.3 and the population trends described in Section 2.1. An indication of the current level and location of development activity in the ICE study area is provided in Table 4-1. This information in Table 4-1 reflects activity at a single point in time in 2008.

Other reasonably foreseeable transportation improvement projects are listed in Table 4-2.

Table 4-1. 2008 ICE Study Area Development Activity

Description and/or Responsible Party	Location	Status
Residential		
Currituck Reserve, 688 dwelling units (DU), 41 acres commercial, and 49 acres school	Approximately 2 miles southeast of Moyock	Under construction
Shingle Landing, an 82 lot subdivision	Approximately ½ miles northeast of Moyock	Under construction
Creekside Estates, a 62 DU subdivision	Approximately ½ west of Moyock	Under construction
Waterside Villages, a 250 DU condominium complex	Approximately 1 mile southeast of Grandy on Currituck Sound	Under construction
Laurel Woods Estates, a 160 DU subdivision	Currituck/Crawford area	Proposed
Southridge, a 146 DU subdivision	Moyock	Proposed
Corolla Bay, 200 DU subdivision and commercial	Currituck County Outer Banks north of Monteray shores	Partially approved and under construction
339 Unit Multi-Family Housing development	Jarvisburg	County decision on developer's request for Conditional Use District delayed until County agrees on the roadway design standards for US 158
Industrial/Commercial		
Chesapeake Lakes Gateway Center, a large mixed commercial project crossing the VA/NC state line	101 Caratoke Highway, Moyock	Site plan under review by City of Chesapeake, no plans submitted to Currituck for approval.
Tulls Creek Center, a 5 unit commercial building	100 Currituck Commercial Drive, Moyock	Site plan under review by Currituck County
Two 3 unit office buildings	4130 Caratoke Highway, Barco	Under construction
Three 5 unit buildings	6339 Caratoke Highway, Grandy	Under construction
Commercial development	8418 Caratoke Highway, Powell's Point	Site plan under review
Commercial development	8400 Caratoke Highway, Powell's Point	Site plan under review
Outer Banks Office Center, six buildings of 2 units each	8443 Caratoke Highway, Powell's Point	Under construction
Sampat Professional Center, a 16 unit office complex	8460 Caratoke Highway, Powell's Point	Under construction
452 Room Hotel	Jarvisburg	See above under "339 Unit Multi-Family Housing"
Major Utilities		
Kitty Hawk to Nags Head 115 kilovolt above ground power transmission line	A 7.3 mile route from Dominion's power station in Nag's Head, running along US 158 right-of-way to the YMCA in Kitty Hawk	Construction between Labor Day 2008 and Memorial Day 2009

Table 4-1 (concluded). 2008 ICE Study Area Development Activity

Description and/or Responsible Party	Location	Status
One million gallon per day septic system attributed to *Currituck Reserve Project*	Approx. 2 miles southeast of Moyock	Under construction
Mainland Water Treatment Plant. 2.9 million gallons per day through a combination of reverse osmosis and greensand filtration.	Maple	Under construction, scheduled completion June 2009
Southern Outer Banks Water Treatment Plant. 2.0 million gallons per day when completed through a combination of reverse osmosis and greensand and anion filtration	Corolla	Approved

Source: Currituck and Dare county planning staff.

Table 4-2. Other Proposed Transportation Projects

Description and/or Responsible Party	Location	Status
STIP Project No. R-4457 – Convert the existing at grade intersection of US 158 and NC 12 to an intersection.	Southern Shores, Dare County	Not funded for right-of-way acquisition or construction.
STIP Project No. R-2545—Widen US 64 to multi-lanes east of Columbia to east of the Alligator River.	Columbia, NC to the Alligator River in Dare County	Planning and design for the project is currently underway and right-of-way acquisition, mitigation, and structures related work is scheduled for FFY 2012. Construction is unfunded.
STIP Project No. R-2544 -- Widen US 64 to multi-lanes east of the Alligator River to US 264.	Alligator River in Dare County to Manns Harbor, NC area	Right-of-way acquisition is scheduled for FFY 2012. Construction is unfunded.
STIP Project No. R-2574.—Widen US 158 to multi-lanes from NC 168 to east of NC 34 at Belcross in Camden County	Belcross in Camden County, NC to Barco, NC	This project is not funded.
STIP Project No. R-4429—Upgrade NC 168 to north of SR 1232 and SR 1213 to SR 1216	Northern Currituck County	This project is partially complete and construction is underway for the rest of the project.
STIP Project No. B-2500—Replacement of Bonner Bridge	Dare County	Record of Decision signed 12/20/2010. Construction contract awarded July 2011.

Sources: NC DOT State Transportation Improvement Program 2009-2015; http://www.ncdot.org/projects/bonnerbridgerepairs/

Logging continues to be an activity that substantially affects the landscape in the ICE study area, particularly in Maple Swamp (see Section 3.3.3.6). Over the last ten years, 1,393 acres have been logged by 23 separate landowners. As Maple Swamp is privately owned, logging is expected to continue.

Beach driving, which is currently unrestricted north of the paved NC 12, affects the dune and beach ecosystems. It is an activity that occurs on recreational beaches that are in the wild horse area, and adjacent to conservation units. It has been credited with limiting presence of protected species on the northern beaches (US Department of the Interior, 2006).

Accelerated sea level rise is a phenomenon that is emerging as a pernicious event in coastal regions. Assuming a 1 meter (39.4 inches) rise in sea level by the year 2100, the rise in 2035, the time horizon for this study, would be approximately 17 centimeters (6.9 inches) (North Carolina Coastal Resources Commission's Science Panel on Coastal Hazards, 2010).

As discussed in Section 4.1, the indirect and cumulative effects associated with transportation improvement and development activities would be similar in their nature. As discussed in Section 4.2, they can differ in terms of the location and extent of these impacts between the No-Build Alternative and the detailed study alternatives because of the access-alteration effects of the detailed study alternatives, particularly access changes associated with MCB2, MCB4, and the Preferred Alternative, which include a Mid-Currituck Bridge.

4.1 Encroachment-Alteration Effects (Project and Other Actions)

Impact-causing activities that are encroachment-alteration effects of the detailed study alternatives, as well as other development activities in the ICE study area are shown in Table 4-3. The impact categories and activities were derived from Figure III-11 of Step 4 of the *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina* (The Louis Berger Group, 2001). Where the Figure III-11 categories in the guidance do not apply, they are so indicated in Table 4-3. Only applicable activities are listed for each category.

4.1.1 Modification of Regime

The construction of the project and development in the ICE study area would result in the following:

- Alteration of habitat and ground cover, including landscape fragmentation;
- Potential introduction of (invasive) exotic flora by construction equipment and exposure of soil during grading and construction (Forman, Sperling et al., 2003);

Table 4-3. Impact Causing Activities

Impact Type	Activities
Modification of Regime	Alteration of habitat, ground cover, introduction of exotic flora, alteration of groundwater recharge, alteration of drainage, and noise.
Land Transformation and Construction	Cut and fill
Resource Extraction	Logging
Processing	Not applicable
Land Alteration	Landscaping and wetland or open water fill
Resource Renewal Activities	No applicable
Changes in Traffic	Changes in motor vehicle operating characteristics by new thoroughfares or increased capacity of thoroughfares, including off-road rights-of-way in the northern beaches.
Waste Emplacement	Not applicable
Chemical Treatment	Not applicable
Access Alteration	Changes in access, circulation patterns, travel times to major attractors

- An increase of impervious ground cover and related potential to add to the cumulative loss of groundwater recharge;
- Changes in drainage patterns; and
- Changes in noise levels, particularly traffic noise associated with changed travel patterns.

The potential location of these changes is reflected in the land suitability and future land use plan figures presented in Chapter 2.0 (Figure 2-1 to Figure 2-11) for the various local jurisdictions within the growth/development study area. The potential for the detailed study alternatives, including the Preferred Alternative, to alter these patterns of planned development is addressed in Section 4.2 and Section 6.1. Changes associated with the detailed study alternatives would occur during their construction. Changes associated with development would occur gradually over time through the design year of 2035.

4.1.2 Land Transformation and Construction

Land transformation would result from the cuts and fills associated with construction. The extent of these changes is not expected to be great given the generally flat terrain of the project study area (see Section 3.3.1). On the Outer Banks, alteration of terrain by cuts and fills is largely complete given that land available for development has already been subdivided and associated grading completed. Cuts and fills would be associated

with the detailed study alternatives. The location and timing of these changes would be the same as those discussed in Section 4.1.1.

4.1.3 Resource Extraction

Logging and land clearance in the ICE study area are associated with harvesting timber for sale, development, and agriculture. The detailed study alternatives (except the No-Build Alternative) also would involve land clearance. Cutting down forest lands also would be associated with a Maple Swamp bridge with MCB2, MCB4, and the Preferred Alternative in areas not already logged as a part of timber harvesting. Logging in this area is guided by the best management practices for silviculture in wetlands (North Carolina Division of Forest Resources, 2006).

4.1.4 Land Alteration

Land alteration would include new landscaping associated with the detailed study alternatives and other development, as well as wetland or open water fill. As reflected in the land suitability and future land use plan figures presented in Chapter 2.0 (Figure 2-1 to Figure 2-11), wetlands are not considered suitable for development and open water fill is not presumed. Logging in wetlands is generally done in a manner that does not involve fill or change in the wetland's topography. Thus, impacts on wetlands and open water would be those associated with the detailed study alternatives. Changes associated with the detailed study alternatives would occur during their construction.

4.1.5 Changes in Traffic and Access Alteration

Notable changes in motor vehicle operating characteristics (by new thoroughfares or increased capacity of existing thoroughfares), access, circulation patterns, and travel times to major attractors would be primarily associated with the project and its detailed study alternatives.

Access alteration associated with future development in the ICE study area would involve the connection of new local streets or driveways to area thoroughfares. New local street connections would only affect travel at the new connection and not travel on the larger street and thoroughfare network. The primary effect of development would be changes in operating characteristics on the ICE study area's thoroughfares.

Additional travel demand associated with planned and expected development would increase congestion in the ICE study area on its major thoroughfares. The *Statement of Purpose and Need* (Parsons Brinckerhoff, 2008) indicates the following travel characteristics for the No-Build Alternative with levels of service (LOS) E and F indicating low and high levels of peak travel period congestion and LOS A and D indicating differing levels of uncongested levels of service, with differing traffic volumes (A to D represent lower to higher volumes):

- Current (2006) LOS E and F operations occur on all segments of NC 12 between the US 158/NC 12 intersection and Corolla during summer weekend conditions, with exception of the northernmost link near Corolla. The worst segments are on NC 12

just south of Southern Shores and Duck, respectively, where LOS E and F conditions also occur on the summer weekday.

- In 2035, LOS F operations will occur on all project area segments of NC 12 and US 158 east of the Wright Memorial Bridge during summer weekday and weekend conditions, with the exception of the northern links in Currituck County, which would be LOS D or E. On the summer weekend, LOS F operations also will occur on all US 158 segments between NC 168 and NC 12.

- In 2035, on the summer weekday, US 158 east of the Wright Memorial Bridge and NC 12 in Southern Shores and parts of Duck will operate at a poor LOS F (30 percent above capacity or more) for 6 to 7 hours per day with demand 81 percent above the capacity of US 158 and as much as 54 percent above the capacity of NC 12.

- In 2035, on the summer weekend, US 158 in Currituck County between NC 168 and the Wright Memorial Bridge will operate at LOS F for 10 to 11 hours a day with demand 16 to 19 percent above the capacity of US 158.

- In 2035, on the summer weekend, US 158 east of the Wright Memorial Bridge and NC 12 in Dare County will operate at a poor LOS F for 15 to 18 hours per day with demand 117 percent above the capacity of US 158 and as much as 62 percent above the capacity of NC 12.

The *Statement of Purpose and Need* also indicates that the trip between Aydlett Road (SR 1140) on US 158 (on the Currituck County mainland) and Albacore Street (SR 1402) on NC 12 (on the Currituck County Outer Banks) is a distance of 40.9 miles. The uncongested travel time for this trip, allowing for stops at signalized intersections, is approximately 1 hour. Under existing (2006) conditions, this trip takes approximately 1 hour and 8 minutes on a summer weekday, but takes approximately 1 hour and 42 minutes on a summer weekend. The weighted average summer travel time is 1 hour and 18 minutes. In 2035, travel time for this trip is expected to be just over 2 hours on the summer weekday and more than 3 hours and 53 minutes on the summer weekend with the No-Build Alternative. The weighted average summer travel time is expected to be approximately 2 hours and 34 minutes. Increases in travel time would result from increasing peak period congestion.

Within the ICE study area are unpaved rights-of-way in the northern beaches in Currituck County. This includes approximately 10 miles of access on the beach itself between the end of NC 12 in Corolla and the Virginia Line in Carova, as well as numerous sand roads behind the dune line in the subdivisions. Traffic is associated with commuting to the 611 residences (2007) in the area, as well as day visitors who want to see the wild horses, visit this beach, or simply drive in the sand. Currently, beach driving is unrestricted. There are no level of service standards developed for beaches as roadways. There are also no comprehensive traffic counts. Public comments regarding the DEIS by area citizens familiar with the beaches noted that summer peak days experience congested traffic and crowded beaches. The presence of persons or

horses on the beach lowers the speed limit, thereby increasing congestion. Continued development of the permanent, weekly, and daily populations will be associated with increased beach driving in the absence of access restrictions.

As described in the *Alternatives Screening Report* (Parsons Brinckerhoff, 2009) the introduction of the detailed study alternatives, including the Preferred Alternative, would introduce reductions in congestion and travel time on NC 12 and US 158 as forecasted for 2035. ER2, which would include capacity improvements to US 158 and NC 12 on the Outer Banks would reduce poor LOS F conditions by 44 percent(15.8 million annual vehicle miles traveled (VMT) reduced to 8.9 million annual VMT), but would leave some extensive periods of severe congestion, particularly on NC 12 in Southern Shores and Duck. ER2 would reduce those travel times to and from the Outer Banks by 19 percent (from 153.7 minutes to 125.0 minutes).

MCB2 would provide the greatest travel changes of any of the detailed study alternatives. It includes both capacity improvements to US 158 and NC 12 on the Outer Banks and a Mid-Currituck Bridge. It would eliminate poor LOS F operations in the project area and LOS F operations on the summer weekday. It would reduce travel times to and from the Currituck County Outer Banks by 44 percent (for the "U-shaped" trip from Aydlett Road to Albacore Street across the Wright Memorial Bridge) (from 153.7 minutes to 86.3 minutes). Travel times for Mid-Currituck Bridge users would be reduced by up to 93 percent (from 153.7 minutes to 11 minutes).

MCB4 and the Preferred Alternative would involve a Mid-Currituck Bridge and limited improvements to US 158 and NC 12. Without the widening of much of NC 12 and US 158 between the Wright Memorial Bridge and NC 12, the travel change would be less than MCB2. For example, there would be a 39 percent reduction (66.1 million annual VMT reduced to 40.2 million annual VMT) in congested travel compared to a 52 percent reduction (66.1 million annual VMT to 31.4 million annual VMT) associated with MCB2. Travel time via the Wright Memorial Bridge would decrease 31 percent (from 153.7 minutes to 106.7 minutes) compared to the 44 percent reduction (from 153.7 minutes to 86.0 minutes) associated with MCB2. The travel time change of using the bridge would be identical (up to a 93 percent reduction over the current route) to MCB2.

The travel change associated with the detailed study alternatives, including the Preferred Alternative, would occur immediately after the completion of one of these alternatives. Prior to 2035, congestion levels would be less and travel times would be lower than those in 2035 because travel demand would be lower. Growing travel demand between the present and 2035 is reflective of additional development expected to occur between the present and 2035.

These findings assume that development patterns would not substantially change from that currently planned for the ICE study area, and that substantial induced development above what is currently planned, and substantial numbers of new Outer Banks permanent residents would not occur with the introduction of the detailed study alternatives. Shortened distance and/or travel times to the unpaved northern beach roads is assumed to cause an increased demand for day visitors over the No-Build

Alternative, if beach driving access remains unregulated. The potential for changes in development patterns, induced development, day visitors, and permanent Outer Banks residents is discussed in Section 4.2 and their potential impact on travel patterns is discussed in Section 6.0.

The additional transportation projects listed in Table 4-2 are proposed by NCDOT primarily to reduce forecasted congestion and improve hurricane evacuation clearance times. They consist of widening existing thoroughfares and not new roads in new corridors. As such, they would not alter access or circulation patterns in the ICE study area. Thus, it is reasonably foreseeable to conclude based on these characteristics, that the change they might bring would be confined to reductions in congestion and improved travel times and not substantial changes in development patterns or demand. None of the additional transportation projects are funded for construction in the *2009 to 2015 State Transportation Improvement Program* (STIP). Their time of implementation is not known except that it is reasonably foreseeable that these projects will built prior to 2035, thus their inclusion in the No-Build Alternative.

4.2 Access-Alteration Effects (Project-Induced Growth)

As described in Section 4.1.5, access alteration varies among the detailed study alternatives, including the Preferred Alternative. Table 4-4 shows the travel times for each alternative. The times are weighted averages of the summer weekday and summer weekend in 2035.

Table 4-4. Travel Time Improvement between Aydlett Road and Albacore Street with the Detailed Study Alternatives

	No-Build Alternative	Detailed Study Alternatives					
		ER2		MCB2		MCB4 and the Preferred Alternative	
		Minutes	Percent Reduction	Minutes	Percent Reduction	Minutes	Percent Reduction
Summer Travel Time via Wright Memorial Bridge	153.7	125.0	19%	86.3	44%	106.7	31%
Summer Travel Time via Currituck Sound Crossing	NA	NA	NA	11	93%	11	93%

Note: Travel times are the weighted average in 2035 for the summer weekday and the summer weekend.
Source: *Alternatives Screening Report* (Parsons Brinckerhoff, 2009).

ER2, which would include capacity improvements to US 158 and NC 12 on the Outer Banks, would reduce travel times in 2035 between Aydlett Road on the mainland and Albacore Street on the Outer Banks by 29 minutes (19 percent). MCB2, which would

include capacity improvements to US 158 and NC 12 on the Outer Banks, would reduce travel times in 2035 between Aydlett Road on the mainland and Albacore Street on the Outer Banks via the Wright Memorial Bridge by 68 minutes (44 percent). The travel time for the same trip via the Mid-Currituck Bridge would be 143 minutes less (93 percent reduction). MCB4 and the Preferred Alternative, which would include limited capacity improvements to US 158 and NC 12 on the Outer Banks and a Mid-Currituck Bridge, would reduce travel times in 2035 between Aydlett Road on the mainland and Albacore Street on the Outer Banks via the Wright Memorial Bridge by 47 minutes (31 percent). Like MCB2, the travel time for the same trip via the Mid-Currituck Bridge would be 143 minutes less (93 percent reduction).

ER2 would change access by improving existing roads, reducing congestion, and improving travel time. MCB2 would change access both by improving existing roads and building the Mid-Currituck Bridge, reducing congestion and improving travel time for all users of the project area's road network, but particularly for those with origins or destinations on the Currituck County Outer Banks. Those with origins or destinations on the Dare County Outer Banks, would experience congestion reduction and travel time improvements resulting from both capacity improvements on existing roads and a reduction in forecasted users on US 158 and NC 12, because of the diversion of many Currituck County travelers using the Mid-Currituck Bridge. Changes in access with MCB4 and the Preferred Alternative would result primarily from the Mid-Currituck Bridge that would result in reduced travel times for persons with origins or destinations on the Currituck County Outer Banks. Those with origins or destinations on the Dare County Outer Banks, would experience congestion reduction and travel time improvements resulting only from a reduction in forecasted users on US 158 and NC 12 because of the diversion of many Currituck County travelers using the Mid-Currituck Bridge.

The change in access indicated by the detailed study alternatives, including the Preferred Alternative, could potentially create access-alteration effects (induced growth) in five ways. These five ways are defined by the following questions:

1. What is the potential for an increase in permanent residents on the Outer Banks?

2. What is the potential for an increase in the number of day trips to the Outer Banks? Where would an increased number of day trips potentially occur? What would be the nature of those trips?

3. Would development in the paved NC 12-accessible Outer Banks change in terms of future development location, rate, or type?

4. Would development in the non-paved road accessible area north of the terminus of NC 12 on Currituck County Outer Banks change in terms of future development location, rate, or type?

5. Would development in mainland Currituck County change in terms of future development location, rate, or type?

The sections that follow address the potential for access-alteration effects in each of these five ways. Because bridge corridor alternatives connect to US 158 in the same location on the mainland and both connect to NC 12 in the northern portion of the Currituck County Outer Banks with similar travel time benefits, the answers to the five questions are the same for both the C1 and C2 bridge corridors. The Mid-Currituck Bridge mainland approach design Options A and B differ in terms of the route taken by travelers between US 158 and Aydlett. Analysis found that this difference would not result in differing effects on development trends. The reasons why are addressed in Section 4.2.5, "Potential for Development Location, Rate, or Type in Mainland Currituck County to Change."

4.2.1 Potential to Increase Permanent Residents on the Outer Banks

The potential to increase the number of permanent residents on the Outer Banks relates specifically to:

- The commuteshed boundary of the study area;
- The commuting pattern of a region; and
- Other factors that individuals consider in choosing a permanent residence.

An increase in permanent residents on the Outer Banks, if it were to occur with the detailed study alternatives, could potentially create upward pressure on real estate prices and housing demand, as well as create demands for additional public services such as schools. Findings for the detailed study alternatives are:

- ER2: No or negligible increase;
- MCB2: Negligible or slight increase; and
- MCB4 and the Preferred Alternative: Negligible or slight increase.

Any increase in permanent residents would not be sufficient to affect the real estate market or municipal governance.

In large part, these findings result because the Outer Banks is a unique resort community with a high average price of housing (see Section 2.1.2). Table 2-6 indicates that vacancy rates (a measure of homes without permanent residents) are 89.4 percent on the Currituck County Outer Banks, 84.2 percent in Duck, 61.0 percent in Southern Shores, and 52.3 percent in Kitty Hawk. Census data reports on the value of owner-occupied units. In 1970, the median value of owner-occupied housing in both counties was below the state average. By 1980, Dare County surged well above the state average. By 1990, both counties exceeded the state average, with ten-year increases far surpassing state figures (see Section 2.1.2). By 2000, Currituck County had an increase in housing value of 45.1 percent and in Dare County there was a 23.7 percent increase. There is not likely to be affordable or "workforce" housing on the Outer Banks, limiting the number of workers that could live there irrespective of the changes in access to the Outer Banks.

Even with the reductions in travel time associated with a bridge, the travel times from Corolla to the main employment centers of the commutershed that are in Hampton Roads, Virginia (areas with jobs that have incomes sufficient to live at the beach) would be over an hour to almost an hour and a half, without rush hour congestion. This, combined with tolls at the bridge and in Virginia, could create a burdensome daily commute, especially given closer options like Virginia Beach and Sandbridge, Virginia. The Currituck County mainland is not a significant employment center. Additional information on housing affordability and change in travel time and distance is presented below.

4.2.1.1 Housing Prices and Affordability

Affordability of housing on the Outer Banks is reflected in the price of residences relative to wages. According to Table 4-5, in North Carolina, the 2007 price of an average new home was 4.04 times the 2007 statewide average annual wage. For Currituck County, the price of an average new home was 9.65 times the 2007 County's average annual wage. It was 12.28 times in Dare County.

Table 4-5. Housing Affordability

Year 2007 Condition	North Carolina	Currituck County	Dare County
Average Annual Wage	$38,896	$28,652	$27,294
Residential Unit Average Value (building only) for New Construction	$157,046	$276,491	$335,301
Affordability Ratio	4.04	9.65	12.28

Source: Average annual wages – Employment and Wage Data, North Carolina Employment Security Commission; Permit Value – US Census; Affordability Ratio and Data Compiled by ECU Bureau for Business Research.

4.2.1.2 Change in Travel Time and Distance

Three household types were considered for potential in-migration as permanent residents on the Currituck County Outer Banks as a result of travel time and distance savings associated with the detailed study alternatives, including the Preferred Alternative:

1. Non-working households (retirees);

2. Working households that drive to work; and

3. Telecommuting (primarily work from home with some travel to a major airport in Norfolk when business travel is required) households.

In any of these three cases, the numbers who could choose the Outer Banks as their home first would be limited by the affordability of housing and land and then by the factors discussed in this section.

4.2.1.2.1 Nonworking Households

Nonworking households, generally retirees, have the greatest discretion where they live. Retirees choose a place based on a variety of personal factors. Amenities usually top the list, but other important factors are personal affinity and proximity to family members, as well as affordability. This population does not have to travel throughout the region on a daily basis and they usually have discretion as to when they choose to travel. The Outer Banks is a high end location that is suitable for wealthy households to consider. Because these individuals have choices independent of work location, they may be selecting between many communities along the Atlantic seacoast.

The distance to conveniences such as shopping, restaurants, and entertainment is a potential draw for this population. Because the greatest disposable income is and will continue to be on the Outer Banks, these convenience businesses are located there. Thus, reduced travel time to the mainland either by increased road capacity or the change in access provided by a Mid-Currituck Bridge would not likely be an important factor in location decisions for this group. Therefore, the extent to which retirees would be drawn to the Outer Banks would be similar between the No-Build Alternative and the detailed study alternatives, including the Preferred Alternative, as long as the fundamental character of the beach communities remained.

4.2.1.2.2 Drive-to-Work Households

Although the northern part of the Currituck County mainland is integrated into the Hampton Roads metropolitan area, it is still at the exurban edge or the outer fringe of areas from which people choose to commute. The Outer Banks are even more remote. Other beach communities are within the commute shed of the Hampton Roads area, i.e. Virginia Beach and Sandbridge. Table 4-6 provides the distance to the several employment centers in the commuteshed study area and travel times. These are uncongested travel times. Travel times would likely be higher during peak weekday travel periods. Table 4-6 indicates that the mileage and travel time from the Outer Banks to area employment centers is substantially greater than the miles and times from other beach communities.

The sole exception is the travel time from Kitty Hawk to Elizabeth City. This is the case with and without a Mid-Currituck Bridge again except for the trip to Elizabeth City where the introduction of a Mid-Currituck Bridge would bring the trip from Corolla to Elizabeth City into the lower range of the trip mileages and times of the trips presented.

Even with a Mid-Currituck Bridge, one-way commute times to the Hampton Roads area would be at a minimum over an hour, and longer commutes create increasing disincentives for living on the Outer Banks. Another material disincentive for Virginia workers would be the daily expense of tolls. Currently, the Chesapeake Expressway in Virginia is $4.50 roundtrip (with discounts) and there would also be roundtrip tolls for a

Table 4-6. Uncongested Drive to Employment Centers in Miles (Minutes)

		Chesapeake	Norfolk	Virginia Beach (CBD)	Elizabeth City
Drive from Beach Communities	Virginia Beach (Resort Area)	25 *(32 min.)*	18 (24 *min*.)	10 (13 *min*.)	64 (81 *min*.)
	Sandbridge, VA	18 (41 *min.)*	23 (42 *min*.)	16 (34 *min*.)	66 (102 *min*.)
	Kitty Hawk, NC	61 (91 *min*.)	72 (103 *min*.)	77 (109 *min*.)	46 (55 *min*.)
	Corolla, NC (via Wright Memorial Bridge)	80 (142 *min*.)	91 (156 *min*.)	96 (160 *min*.)	65 (107 *min*.)
	Corolla, NC (via Mid-Currituck Bridge)	45 (67 *min*.)	56 (80 *min*.)	61 (86 *min*.)	30 (36 *min*.)

Source: Google Maps and *Alternatives Screening Report* (Parsons Brinckerhoff, 2009)

Mid-Currituck Bridge (currently undetermined). In addition, there are beach communities in Virginia at a more reasonable commuting time from Hampton Roads employment centers. A less than one hour commute (as low as 36 minutes) from the Outer Banks to Elizabeth City would result from a Mid-Currituck Bridge, but Elizabeth City is a small employment center compared to the Hampton Roads area and does not include a notable number of jobs that would generate levels of personal income needed to live on the Outer Banks. In 2003, Pasquotank County, in which Elizabeth City is situated, had a reported employment of 15,593 with an average weekly wage of $505. The average wage in North Carolina at the time was $629 (The Wooten Company, 2005). Table 3-5 indicates that in 2000, only 340 persons commuted from Pasquotank to Currituck County.

Thus, when one considers these times and distances to areas of employment, the cost of tolls, and the high cost housing on the Outer Banks relative to nearby wages, and the presence of other regional options to live in beach communities, the benefit of improved access either through upgraded existing roads or with a tolled Mid-Currituck Bridge, is only predicted to cause a negligible increased demand for new permanent residents living on the Outer Banks and commuting to the mainland for work.

4.2.1.2.3 Telecommuting Households

Travel time would not be an issue for households that telecommute. Such households would work at home. This opportunity, however, exists today on the Outer Banks. Thus, like retirees, reduced travel time to the mainland either by increased road capacity or the change in access provided by a Mid-Currituck Bridge would not likely be an important factor in location decisions for this group. In general, the extent to which telecommuters would be drawn to the Outer Banks would be similar between the No-Build Alternative and the detailed study alternatives, including the Preferred Alternative, as long as the fundamental character of the beach communities remained. One difference, in the case of some telecommuters, is the potential importance of travel time to a major airport; in this case Norfolk International Airport.

Based on the information in Table 4-6, the introduction of a Mid-Currituck Bridge would reduce the mileage from the nearest point on the Outer Banks to Norfolk by 16 miles (from Kitty Hawk versus from Corolla with a bridge) or 23 minutes. This reduction in mileage and time is not considered large enough to result in a substantial change in permanent telecommuting residents on the Outer Banks. Given the low number of current permanent residents and the cost of housing there are many other factors besides time to the airport for influencing a telecommuter decision to locate on the Outer Banks.

4.2.2 Potential for Increase in the Number of Day Trips to the Outer Banks

Currently day trip visitors to the Currituck County Outer Banks are in the small minority of its visitors. Only 5.56 percent of respondents to a mail-in survey of visitors conducted by Currituck County Department of Travel and Tourism (Randall Travel Marketing Inc., 2007) indicated their visit was a day trip. There are no data that indicate the preferred activity of day trip visitors to the Currituck County Outer Banks. However, the preferred activities of all visitors to the Currituck County Outer Banks are dining out, shopping, driving/sightseeing, beach swimming, visiting a historic site, sleeping late or napping, visiting a park, or looking for wild horses. A study performed in 2002 indicated that the top reasons for visiting the Cape Hatteras National Seashore (Reed, Le, & Littlejohn, 2002) were visiting the beach, swimming, and escaping crowds. Commenters at the public hearings indicated that they believe that beach driving is or could be popular with day visitors. Day trip visitors to the Currituck County Outer Banks are most likely interested in visiting the beach, swimming, sightseeing, or driving on the beach.

In terms of the potential for an increase in the number of day trips to the Outer Banks, the findings for the detailed study alternatives are:

- ER2: No or negligible increase;
- MCB2: Some potential for an increase over the No-Build Alternative with the potential higher in the non-road accessible area; and
- MCB4 and the Preferred Alternative: Some potential for an increase over the No-Build Alternative with the potential higher in the non-road accessible area.

The potential market area for substantial additional visitors to the Outer Banks would be in Virginia, particularly the Hampton Roads area. The Mid-Currituck Bridge (MCB2, MCB4, and the Preferred Alternative) would notably reduce the travel time from Hampton Roads to Currituck County's Outer Banks, as indicated in Table 4-6. This would not be the case with ER2. With the popularity of beaches, especially in season, reducing travel time from northeastern North Carolina and southeastern Virginia would increase the potential demand for day visitors to the Currituck Outer Banks. However, there are mitigating factors that would act to hinder day visitation, even with the benefit of a bridge. These factors are:

- Potential day visitors have a selection of options in Virginia, on Bodie Island, and on Hatteras Island.

- Combined tolls would be a deterrent to day trips traveling on the Mid-Currituck Bridge and the Chesapeake Expressway, the primary route in Virginia leading to the Outer Banks.

- Beach access, parking, public facilities, and services are important amenities in attracting day visitors. Beaches in Currituck and Dare counties, however, have limited to modest public facilities, especially when compared to Virginia Beach, which is closer to the largest potential source of day visitors, the Hampton Roads area.

The non-road accessible northern Currituck County Outer Banks is a unique area that would appeal to a specialized market of day visitors (e.g., beach drivers, sport fishermen, and surfers). On one hand, these beaches are only accessible to a subset of all excursionists; on the other hand they are distinctive for the unrestricted beach driving, wild horses, and free parking that do not exist elsewhere. Thus, the potential for increased day trips would be higher in this area than in the NC 12-accessible area. Already, the summer beaches in this area become thick with day visitors and weeklong visitors renting in the area. Additional detail related to these findings is presented in the sections that follow.

4.2.2.1 Beach Options in Virginia

The potential market area for substantial additional visitors to the Outer Banks would be in Virginia, particularly the Hampton Roads area. However, this area does have its own beaches that are closer and involve shorter travel times. This difference is reflected in the distance and driving times presented in Table 4-6. A Mid-Currituck Bridge would shorten travel times between Chesapeake/Norfolk and the Outer Banks, but they would still be notably longer than travel times to Virginia beaches.

4.2.2.2 Tolls

The opening year toll on the Mid-Currituck Bridge is expected to be $8 to $12 one way. The one way cash toll on the Chesapeake Expressway is $3. Thus, in addition to increased travel time, a day trip to the Currituck County Outer Banks via a Mid-Currituck Bridge would cost a driver $20 to $28, a cost they would not incur going to a Virginia Beach.

4.2.2.3 Beach Access and Facilities Limitations

Public beach access points are frequent in Dare and Currituck counties. They occur in two different types. The first is an access that is in between houses that exists to serve visitors to houses on the second or third rows. The second access type has parking and, in some limited cases, showers and restrooms that could serve day trip visitors.

There are at least 32 public beach access points in Currituck and Dare counties, 10 in Currituck County, and the remaining 22 in Dare County. Six of the public access points

access Currituck Sound and the other 26 access Atlantic Ocean beaches. The actual total number of beach access points is likely higher, because accurate inventories of all access and parking facilities under all types of ownership do not exist consistently.

However, public beach access points with facilities are more limited in Currituck County. The county's regional beach access near Pine Island has parking and public restrooms. There are several lots with only public parking and access in the Whalehead Subdivision. On-street parking is allowed at the Corolla Village Drive Public beach access and facilities are more available in Dare County. All 22 beach accesses in Dare County have public parking available, with restrooms available at seven of the public access points. For example, a recent inventory listed 707 public parking spaces in Nags Head (personal communication, Dave Clark, Town of Nags Head, August 22, 2011).

4.2.2.3.1 Public Beach Access Points in Virginia Beaches

In the 2006 to 2007 Fiscal Year, there were nine parking lots, five garages, and extensive on street parking spaces totaling 10,457 spaces in all of the municipality of Virginia Beach. The oceanfront area has 7,662 spaces. There is an annual occupancy rate of 62 percent. Seasonally between April and September there was an occupancy rate of 109 percent, which means that there is more than one car per space per day. During the warm summer months and on weekends the parking hits peak demand with over 300 percent occupancy, meaning spaces are filled with more than three cars per day (City of Virginia Beach, 2007). The Oceanfront Resort Area Plan (City of Virginia Beach, 2005) has proposed the construction of two parking garages, several public parking lot enhancements, and a trolley system to alleviate the parking situation.

In spite of the parking concerns in Virginia Beach, it still remains an attractive day trip. The Virginia Beach area contains 19 miles and 258 acres of beach access, many of which have public restrooms and parking. Compared to the Currituck County Outer Banks, amenities for day use are far greater.

Besides resort area assets, the village of Sandbridge, Virginia to the south has public facilities and parking at the village center and at a city park at the southern edge of Sandbridge. The latter includes a fishing pier. The state and federal parks in Virginia Beach have limited road access and beach-oriented facilities.

4.2.2.3.2 Day Trip Facilities in Currituck County versus Virginia Beach and Dare County

Currituck County beach access points offer limited parking and restroom facilities. The Cape Hatteras National Seashore Visitor Study (Reed, Le, & Littlejohn, 2002) indicates that availability of parking and restrooms is among the key decision-making criteria for visitors to the Seashore. This would suggest that the limited amount of parking in Currituck County would constrain day trip demand in Currituck County irrespective of its accessibility.

While parking and restroom facilities in Virginia Beach are considered deficient, there are substantially more parking and facilities available in Virginia Beach than the Currituck County Outer Banks and additional facilities are planned. Thus, Virginia

beaches would remain the primary focus of day trips from the Hampton Roads area irrespective of changes in the road system in the project area. Also, day trip visitors to the Outer Banks would be more likely to visit the Dare County beaches instead of Currituck County beaches because of the greater availability of parking and restroom facilities.

Despite these limiting factors, this scenario concerning day trips to the Outer Banks does indicate that potential demand would increase for day trips, which could be influenced in the future by either accommodating or mitigating actions of Currituck County.

The one feature unique to Currituck County is opportunities for unrestricted beach driving (see Section 4.2.2.4). The effect of the Mid-Currituck Bridge on demand for this one activity is discussed in the next sub-section.

4.2.2.4 Non-Road Accessible Currituck County Outer Banks

Beach driving has become an increasingly popular activity on the Outer Banks. The formation of the North Carolina Beach Buggy Association (NCBBA) in 1964 formalized beach driving as a form of recreation in the Cape Hatteras National Seashore. The current membership of NCBBA is over 4,700 (North Carolina Beach Buggy Association, 2008).

Beach driving is particularly popular among amateur sport fishermen, surfers, beach-goers, and wild horse sight-seers. In addition, beach driving is a necessity in the non-road accessible area of northern Currituck County to access houses and vacation rentals. Services exist that allow tourists staying in the towns to rent four-wheel drive vehicles specifically to drive on the beach. There are no data indicating the origination of current beach drivers north of paved NC 12.

Beach driving access varies in both Currituck and Dare counties. Beach driving is allowed year round in the non-road accessible Currituck County Outer Banks. In the NC 12-accessible area, driving is prohibited between May 1 and September 30. The Town of Duck restricts beach driving for a similar portion of the year; however, there are no public beach driving access points, as the only access is available through private subdivisions. The Town of Kitty Hawk and the Town of Southern Shores have banned beach driving year round. Beach driving is allowed in the Town of Kill Devil Hills and the Town of Nags Head from October 1 to April 30.

The closest year round beach driving access point to the non-road accessible area of the Currituck County Outer Banks is Ramp 2 in the Cape Hatteras National Seashore, located 42.4 miles south of the non-road accessible area.

Opportunities to drive on the beach do not exist in the Virginia Beach/Sandbridge Area. The only beach driving available in Virginia is on Assateague Island, far outside of the ICE study area.

The non-road accessible beach north of NC 12 has two traffic generators. Beach driving is necessary to access the developed parcels in the non-road accessible areas.

Recreational driving occurs by day visitors to the beach and by tourists in the southern towns that rent four-wheel drive jeeps to drive on the beach and see the wild horses. Currently, driving is allowed year round to all licensed drivers with four-wheel drive vehicles. There are currently no permits or fees required. Access is limited by the need to have a four-wheel drive vehicle suitable for beach driving and by the congestion that develops. Inexperienced drivers often get stuck and have to be towed out of the sand. The normal speed limit is 35 miles per hour; however, county ordinance states "when driving on the foreshore or beach strand, such vehicles shall not exceed 15 miles per hour when located within 300 feet of pedestrians, sunbathers, swimmers, fisherman, or other persons using the beach or beach strand or foreshore. Whenever possible, such vehicles so operated shall pass by such persons using the beach and foreshore at a distance of at least 100 feet." Traffic comingles with beachgoers, which becomes crowded in season, causing a trip of a few miles to take an hour or more. Also, the beach as a roadway is confined to the area of hard sand nearer the ocean, which becomes narrow at high tide (soft sand between here and the dune line is designated for parking). It is essentially a ten-mile dead end street with no way out other than the connection on the south back to NC 12. Compounding the issue is the presence of wild horses, which come onto the beach and in the surf. It is against county ordinance to come within 50 feet of a wild horse. Tourist and commercial concerns inform their clients of these regulations. Also, a sign is maintained at the beginning of the four-wheel drive area, although it contains a lot of information and stopping and standing there is prohibited. A bridge would decrease the travel time to the terminus of NC 12 by shortening the distance and/or reducing congestion. This would logically increase the potential demand for day visitors to the four-wheel drive area, which is already crowded in the summer. The speed limit automatically drops in the presence of a person or wild horse so that the trip to the Virginia Line can take over an hour. Actions by the county to begin restricting beach driving access would influence the incidence of beach driving as an activity.

4.2.3 Potential for Development Location, Rate, or Type in the Road-Accessible Outer Banks to Change

For the NC 12-accessible Outer Banks there would be no reasonably foreseeable change in the overall type and density of development with the implementation of the detailed study alternatives, including the Preferred Alternative, in contrast with the No-Build Alternative. Negligible or no increase in the demand for houses and businesses throughout the Outer Banks resort area would be foreseeable over the No-Build Alternative. Furthermore, the communities are currently planning for this anticipated level of development. A potential differential in realized development could occur if traffic congestion becomes a constraint. There would be no such constraint posed by MCB2, MCB4, and the Preferred Alternative, but the No-Build Alternative could create a practical build-out of 70 percent for the Outer Banks from the Virginia Line to Southern Shores. It would be 75 percent for ER2. The traffic forecasts for the project assume 86 percent of full build-out from the Virginia Line to Southern Shores in 2035.

The introduction of a Mid-Currituck Bridge with MCB2, MCB4, or the Preferred Alternative would substantially reduce travel time from points north of the bridge on

the mainland to the Currituck County Outer Banks. As such, the order in which available lots on the NC 12-accessible Outer Banks would develop in response to market demand would likely change with more Currituck County lots developing before Dare County lots.

These findings are based on the following factors:

- Extent of Development. The road-accessible portion of the Outer Banks is already subdivided and substantially developed today, with a disproportionate share of the underdeveloped capacity being hotel rooms. Sixty-four percent of the residential lots are developed, although only 12 percent of the hotel rooms have been built. This is one major difference between the current analysis and the 1998 DEIS. Another important difference is the maximum number of potential lots and hotel rooms has been reduced since the 1998 DEIS as subdivisions have been finalized.

- Developmental Regulations and Preferences. Currituck County, Kitty Hawk, Southern Shores, and Duck all have land use plans required by the Coastal Area Management Act of 1974. Current development regulations and past trends associated with the implementation of these plans are indicative of the local jurisdictions' commitments to implement these plans as they stand.

- Similarity of Land Use Plans. The types of development called for in the land use plans of Currituck County, Kitty Hawk, Southern Shores, and Duck are similar. Thus, changes in accessibility associated with the detailed study alternatives could not shift planned high density development into a low density area or vice versa.

- Driver of Growth is Not Transportation. The Outer Banks represent a distinctive tourist destination. Area property owners recognize this and capitalize on it by providing beach rentals for those desiring short-term vacations. Transportation was once an important determinant of the development in the area. Today, given the complex network of streets and roads that now exists, and that much of the NC 12-accessible Outer Banks has been subdivided, transportation improvements have little effect on the demand for and rate of development. Transportation improvements can, however, influence the location of development that occurs first.

- Future Severe Congestion. The lack of transportation improvements and associated growing congestion could potentially constrain future development under the No-Build Alternative or ER2.

4.2.3.1 Extent of Development

As of 2007, the NC 12-accessible communities were nearly entirely subdivided and 59 percent of the residential parcels or hotel rooms were built from the Virginia Line to Southern Shores. The data are given for these communities from north to south and shown in Table 4-7.

Table 4-7. Residential and Hotel Development: Virginia Line to Southern Shores circa 2007

Community	Parcels or Hotel Rooms	Developed	Percent Developed
Non-Road Accessible	3,150	611	19%
Crown Point	93	87	94%
Spindrift	31	30	97%
Ocean Hill One	113	111	98%
Whalehead	864	824	95%
Corolla Village	115	72	63%
The Villages at Ocean Hill	219	147	67%
Corolla Light	398	358	90%
Monteray Shores	385	227	59%
Buck Island	113	99	88%
Ocean Sands	2,298	1,032	45%
Currituck Club	535	240	45%
Pine Island	291	285	98%
Currituck County Hotel Rooms	1,414	164	12%
Duck	2,511	2,351	94%
Duck Hotel Rooms	88	88	100%
Southern Shores	2,800	2,310	83%
NON-ROAD ACCESSIBLE SUBTOTAL	3,150	611	19%
NC 12 CURRITUCK COUNTY SUBTOTAL	6,869	3,676	54%
NC 12 DARE COUNTY SUBTOTAL	5,399	4,749	88%
NC 12 SUBTOTAL	12,268	8,425	69%
TOTAL	15,418	9,036	59%

Sources: Personal communication, Ben Woody, Currituck County Planning Director, June 2011; Dare County tax records; Town of Southern Shores, 2010.

Since the 1998 DEIS, developers have chosen to finalize development plans associated with approved planned unit developments with fewer units than allowed by general planned unit development guidelines. Lots have been consolidated in the non-road accessible Outer Banks. Thus, assumed build-out numbers are lower in the 2010 DEIS and this FEIS than the 1998 DEIS. Total build-out (homes and hotel rooms) from the Virginia Line to Southern Shores was 16,871 in the 1998 DEIS. As of 2007, total build-out was 15,418, as shown in Table 4-7.

4.2.3.2 Development Regulations and Preferences

Among the states, North Carolina took an early and progressive approach to coastal planning when it passed the Coastal Area Management Act in 1974. This act required and funded comprehensive land use plans in the twenty counties designated as coastal.

Many of these communities at the time would have been too small to afford county-wide or town-wide planning on their own. CAMA also established the Coastal Resources Commission, which has oversight of the land use plans. The overall features of the land use plans for Currituck County and the Towns of Kitty Hawk, Duck, and Southern Shores are described in Section 2.3. Development regulations and trends associated with the implementation of these plans are indicative of the jurisdictions' commitments to implement these plans, including the type and density of development, and are described in the paragraphs that follow.

4.2.3.2.1 Currituck County

The NC 12 accessible portion of the Currituck County Outer Banks is referred to in the Currituck County land use plan as Corolla. The Currituck County land use plan and development regulations contain several conditions that preclude future development from straying from the existing land use and developmental pattern visible in Corolla and the county land use plan. Past trends and public preferences also are a factor. These include:

- Planned Unit Developments (PUDs) prevail in the area. Although vacant parcels may exist within the PUDs, their future development must be in accordance with requirements determined with the county in their establishment.

- The residential design requirements found in the *Currituck Unified Development Ordinance* prohibit dense development (Currituck County, 2008). For example, the Corolla area is designated as a RO1 Zoning District. This means a maximum density of three dwelling units per acre, at a maximum of 35 feet of height, with minimum lot sizes of 20,000 square feet with centralized water and on-site sewer, and 10,000 square feet with centralized water and sewer.

- Home Owner Associations that are prevalent in the Corolla area are likely to resist changes to the PUDs or re-consolidation of lots for higher density development, since such change could affect the investment of current owners.

- Higher density development has a history of being resisted in Currituck County, particularly in the Corolla area. While the county senses pressure for different development types, it appears to be prepared to stop this from occurring. This is exemplified in the text of the County's land use plan:

  > While the Corolla area is nearly fully developed, the near-term future of the area rests largely with the redevelopment of existing properties. As the value of Outer Banks real estate has sky rocketed, the economic incentive to tear down and replace first and second generation beach cottages with much larger structures has grown commensurately. The intensification of land use on existing properties in this area will only add to the inappropriateness of intensive development in this fragile barrier island ecosystem. Even so, this conflict between development and land suitability is inherent throughout North Carolina's barrier island chain. It

appears that efforts to mitigate development impacts through improved building practices and caps on the size of replacement structures may be the best recourse available (Currituck County, 2006).

- Since most of Corolla was subdivided for development more than 15 years ago, most of Corolla's lots that are available for sale and development are scattered in various subdivision and not concentrated in a single area where they might be consolidated.

4.2.3.2.2 Kitty Hawk and Duck

Kitty Hawk and Duck had their most recent CAMA land use plans prepared by the same consultant. Their development regulations and preferences are congruent (Community Planning Collaborative Inc., 2004; Community Planning Collaborative Inc., 2005). The development regulations and preferences include the following two enumerated sections that express development preferences and controls.

> 16. (in the Kitty Hawk plan) or 18. (in the Duck plan) Redevelopment concerns the towns' interests in monitoring and evaluating redevelopment proposals for consistency with state and federal laws and regulations. The policies for redevelopment include regulating buildings for intensity and oversized structures by enforcing, and amending as necessary, the zoning ordinance. Zoning regulates setback(s) for commercial and residential building development. Also, the ordinance specifies maximum and minimum building sizes for commercial buildings.
>
> 17. (in the Kitty Hawk plan) or 19. (in the Duck plan) Residential Development concerns ensuring the continuance of established residential development patterns and ensuring that future development is in character with the existing development with regard to size, lot coverage, architecture design, and construction materials and methods. The policies for residential development indicate that detached residential structures are the preferred type of residential land use in Kitty Hawk and Duck.

Kitty Hawk developed an Open Space and Recreation zoning ordinance. In addition, there are two overlay districts, namely a PCD (Planned Commercial Development) and PUD (Planned Unit Development).

In the case of Duck, the land use plan unambiguously articulates the town's vision for its future development, by stating: "The continuation of its present physical appearance and form is important-if not critical-to the town if it is to maintain its unique character among coastal villages. Development patterns are well established. Redevelopment proposals which seek to build "higher and closer" will challenge the Town with respect to maintaining and enhancing its physical appearance and form" (Community Planning Collaborative Inc., 2005). This illustrates the town's aversion to development changes.

4.2.3.2.3 Southern Shores

Southern Shores has recently produced a draft update of its CAMA land use plan (Town of Southern Shores, 2010). The town does have a zoning ordinance that establishes nine

zoning districts. The code also allows for residential, planned unit development, and commercial uses and establishes an Ocean, Sound, and Water District. Southern Shores is almost entirely residential and intends to stay that way. There were an estimated 490 vacant lots in Southern Shores in 2007. The town estimates that full build-out will occur around 2015 at which time there will be 2,800 total dwelling units. As with all of the other Outer Bank communities, there are a number of conditions that preclude future development from straying from the land use and development pattern that is currently visible in the town. These include the town's zoning ordinance restricting house size to seven bedrooms and one unit per 20,000 square feet of land in the RS-1 zone.

4.2.3.3 Similarity of Land Use Plans

Overall, all four jurisdictions have similar objectives in terms of the type and density of development that is considered desirable: namely, family beach houses on individual lots with some small scale hotel and commercial development. Details of the goals for each community are presented in Appendix A. All four jurisdictions have been successful in the past in requiring this type of development and seeing it developed. As such, changes in accessibility with the detailed study alternatives cannot shift planned high density development into a low density area or vice versa.

4.2.3.4 Driver of Growth is Not Transportation

The Outer Banks are in themselves the primary engine of growth for the region. They are a powerful destination for tourists. The barrier island beach environment is the resource base for this growth. The development that has occurred in recent decades has been strongly reflective of this. Because of this, the dominant employment sectors on the Outer Banks are construction, real estate, and tourism (see Section 2.1.3).

Historically, growth in the region was preceded by highway and bridge development and improved access. In 1928, the Washington Baum Bridge was opened, establishing a connection from Roanoke Island to the Outer Banks. In the 1930's the Wright Memorial Bridge established a northern Dare County connection from the mainland to Kitty Hawk. In 1957 the opening of the William B. Umstead Memorial Bridge from Roanoke to the mainland established a southern Dare County mainland to Outer Banks connection. These bridges facilitated the beginning of the era of automobile tourism on the Outer Banks, with the boom coming after the 1960s. The region's circulation system now includes a complex network of Outer Banks roadways. This has provided sufficient access for a highly built-out landscape serviced by paved roads and resort amenities. The case of the non-road accessible area on the northern Currituck County Outer Banks is a unique landscape that is discussed in detail in Section 4.2.4 below.

Today, the important determinants of demand for and rate of resort development are the potential tourist market generated by the national economy, marketing the Outer Banks as a destination, land available for development or redevelopment, and planning and land use controls on the beach landscapes. In fact, the quantity of housing in Currituck and Dare communities has already exceeded the No-Build Alternative limit forecast in the 1998 DEIS. The number of developed housing units (homes and hotel rooms) in 2007 was 9,036 from the Virginia Line south to Southern Shores. The

maximum number of units with the No-Build Alternative was found to be 8,422 in 2020 in the 1998 DEIS.

Transportation improvements, however, still have an influence on development. While they are not likely to increase the demand for or character of development, they can affect the location of development, i.e. which land will develop first. Locations with better access would develop before locations with poorer access. Given that the road accessible area on the Outer Banks is almost entirely subdivided, the effect of transportation is further narrowed to one of which individual parcels will develop first.

As indicated in Section 4.1.5, the introduction of a Mid-Currituck Bridge with MCB2, MCB4, and the Preferred Alternative would reduce the 2035 travel time between Aydlett Road on the mainland from 153.7 minutes to 11 minutes. ER2 would reduce the time for that trip from 153.7 minutes to 125 minutes. The Mid-Currituck Bridge would make the Currituck County Outer Banks the closest Outer Banks location for tourists from outside the region. This would increase the desirability of lots on the road-accessible Currituck County Outer Banks to serve the future market demand for beach homes. As such, the order in which available lots on the road-accessible Outer Banks would develop in response to market demand would likely change with more Currituck County lots developing before Dare County lots.

4.2.3.5 Future Severe Congestion

Given the severe congestion forecasted for the Outer Banks on changeover days (summer weekends), the levels of service associated with the No-Build Alternative or ER2 could result in a differential effect on development. Although the demand for houses and businesses on the Outer Banks does not appreciably vary with the different scenarios, severe congestion could limit the practical development of rental cottages and hotel rooms as congestion becomes a more prevalent factor in a tourist's decision to come to these Outer Banks beaches or go elsewhere.

This potential was tested using the following assumptions:

- Current build-out numbers for residential parcels and hotel rooms (Table 4-7).
- A maximum two-lane hourly volume on NC 12 of 2,218 vehicles per hour (vph). This is higher than the 1,600 vph assumed for the same analysis in the 1998 DEIS. This increase reflects a reanalysis of flow thresholds that was conducted using updated 2000 Highway Capacity Software that was not available when the analysis used in the 1998 DEIS was prepared.
- A maximum daily capacity of NC 12 at Duck of 35,000 vpd. The 1998 DEIS assumed a maximum daily capacity of 23,400 vpd. The 2006 Summer Weekend traffic volumes were estimated to be 28,800 vpd, exceeding the maximum daily capacity assumed in the 1998 DEIS analysis. In both the 1998 DEIS and this study, a 10-hour period of maximum volumes was assumed, with volumes tapering off on either side of the 10-hour period.

With the above assumptions, a potential for a reduction in realized development from that which is anticipated and planned for could occur if traffic congestion becomes a constraint. There would be no such constraint posed by MCB2, MCB4, and the Preferred Alternative. However, such traffic congestion could create such a constraint with the No-Build Alternative and ER2. The 2035 traffic forecasts used in assessing project need and the benefits of the detailed study alternatives assessed in the DEIS and FEIS assume full build-out of the NC 12-accessible area and a continuation of recent building trends in the non-road accessible area and collectively represent 86 percent build-out from Southern Shores to the Virginia Line. As shown in Table 4-7, the maximum build-out in terms of homes or hotel rooms is approximately 15,400. Around 2007, there were approximately 9,000 homes or hotel rooms on the Outer Banks from the Virginia Line to Southern Shores. The number of anticipated and planned units forecast for 2035 is 13,200, an increase of 4,200 from 2007, if one assumes an average growth rate of 150 units per year. Thus, the anticipated and planned build-out, based on existing plans and trends, of 13,200 units represents 86 percent of the maximum build-out of approximately 15,400. It is important to note that this is for the entire Outer Banks from the Virginia Line to Southern Shores, including the NC 12-accessible area and the non-road accessible areas. (See also Section 4.2.4.)

With the No-Build Alternative, traffic congestion on NC 12 could be great enough to constrain development in the Outer Banks, such that it could cause a practical limit of 10,800 homes or hotel rooms from the Virginia Line to Southern Shores. This would be 2,400 units fewer than the 2035 anticipated and planned forecast of 13,200. This constraint would yield a practical build-out at approximately 70 percent of the maximum build-out. Assuming 150 new units per year, the constraint identified for the No-Build Alternative could manifest itself around 2019.

For ER2, traffic congestion could cause a practical limit of 11,600 homes or hotels rooms from the Virginia Line to Southern Shores. This would be 1,600 units fewer than the 2035 anticipated and planned forecast of 13,200. This constraint would yield a practical build-out at approximately 75 percent of the maximum build-out. Assuming 150 new units a year, the constraint identified for ER2 could manifest itself around 2024.

This constraint on development would result from a reduction in the demand for new vacation homes and hotel rooms caused by heavy congestion on NC 12 and is not a constraint imposed by permit conditions, building moratoriums, and growth management ordinances. If real estate business or travel practices adapt to avoid activity during the worst congestion, then there possibly could be no constraint on planned development. Adaptation could be as simple as vacation rentals varying the "changeover" times to a larger window from Friday to Sunday, vacationers in future years having an increased tolerance for congestion, or season-long residents avoiding travel during peak hours.

4.2.4 Potential for Development Location, Rate, or Type on the Non Road-Accessible Outer Banks to Change

For the non-road-accessible Outer Banks there would be no reasonably foreseeable change in the location, rate, or type of development with the implementation of the detailed study alternatives, in comparison to the No-Build Alternative. Substantial travel time savings associated with a Mid-Currituck Bridge (MCB2, MCB4, and the Preferred Alternative) would occur and a simple gravitational model (used to predict the movement of people, goods, and information between two places) would suggest that the potential demand for this area would increase. However, several factors would minimize the influence of travel time savings on development decisions in this area.

The possibility of extreme congestion with the No-Build Alternative constraining development as described in Section 4.2.3.5 applies here as well, although in this case a bridge would do nothing to mitigate the congestion point of driving into the sand at the end of NC 12. That limiting factor is constant across all of the detailed study alternatives based on the conclusion that an extension of NC 12 is not reasonably foreseeable (as discussed below).

This finding is based on the following factors:

- Uniqueness of Area and Associated Development Trends. Demand for the unique experience offered by Carova has been a primary reason development in this area is occurring. Its uniqueness comes from its lack of road accessibility. The lack of accessibility both makes it attractive and helps limit development.

- Government Policy Constraints. Numerous government policy constraints related to development and the extension of NC 12 into the Carova area render unlikely both a change in the rate and characteristics of development from current trends in the non-road accessibility area as well as an extension of NC 12 to support development there.

- Lot Size Requirements. All new subdivisions in the non-road accessible area have minimum three acre lot size. Smaller grandfathered lots exist but may not have acceptable septic conditions.

- Resistance to Development Conflicting with the Land Use Plan. In November 2008, Currituck County Commissioners turned down a request to allow a commercial development in this area that was not in keeping with their land use plan's policy emphasis for this area. Other property owners in the area also opposed the project.

The non-road accessible Currituck County Outer Banks is referred to as Carova in the county's land use plan. This designation is used in the discussion that follows.

4.2.4.1 Uniqueness of Area and Associated Development Trends

The northern dunes contain five platted subdivisions, which are adjacent to six units of the Currituck National Wildlife Reserve. There are fences that transect the dunes at the

end of NC 12 and at the Virginia Line corralling the Currituck wild horses into this area. In 2007, the northern Outer Banks contained approximately 3,150 residential lots, of which 611 (19 percent) were built-out (personal communication, Ben Woody, Currituck County Planning Department, February 2011 and June 2011). Building permits have tapered off with the recent downturn in the economy, as shown in Table 4-8. Future subdivision in this area is limited to 3-acre minimum lots. A fire station is the only public service. There is no commercial development in Carova and none indicated in the future land use plan.

Table 4-8. Recent Building Permits North of NC 12

Year	Permits Issued
2005	35
2006	37
2007	19
2008	19
2009	9
2010	11

Source: Personal communication, Ben Woody, Currituck County Planning Department, February 2011.

Development in Carova in the last decade is markedly different from the original housing that was installed in the 1970s. Then, the housing was modest and was in the dunes and maritime forest. Now the new construction is oriented to the beach and is characterized by large residential structures appropriate for vacation rentals. The most ecent "houses" are targeted for the destination market and targeted for weddings and other large parties. Four-wheel drive vehicles are required to access this area. The form, density, and nature of this investment are a function of local and state regulations, as well as the local real estate market.

Development on the northern beaches is expected to continue regardless of a bridge. In Carova, the beach experience is unlike anything in the region. Its uniqueness comes from its lack of road accessibility, providing a sense of remoteness and isolation. Access is only along the beach using four-wheel drive vehicles. One is isolated from commercial development and generally vacationers take their provisions for the week. It is a low-service, high-ticket vacation. There is a strong "land's end" quality to the experience where people can drive to the beach and "camp" in luxury accommodations, among the sand dunes and wild horses. As the communities along NC 12 have become more densely developed, individuals wanting a less crowded, less commercial beach week are drawn to the area, thus encouraging increased development there. Demand for this unique experience has been a primary reason development in this area is occurring. Lack of accessibility both makes it attractive and, in combination with the remaining factors discussed in this section, limits development.

Because Carova offers a unique experience and serves a unique demand, when the nearby NC 12-accessible areas build-out, surplus demand would likely be split with other parts of the road-accessible Outer Banks. Substantial numbers of lots in Dare County, south of the Wright Memorial Bridge, are available for development and redevelopment where there is not only public road and beach access, but commercial and community services as well. Kitty Hawk, for example has 1,200 acres of vacant, non-conservation land. As indicated in Section 4.2.3.4, the Outer Banks in general represent a unique tourist destination. Area property owners recognize this and capitalize on its uniqueness. Today, the important determinants of demand for and the rate of resort development are the potential tourist market generated by the national economy, marketing the Outer Banks as a destination, land available for development or redevelopment, and planning and land use controls on the beach landscapes.

4.2.4.2 Government Policy Constraints

There are numerous government policy constraints related to development and the extension of NC 12 into the Carova area that make it unlikely that a change would occur in the rate and characteristics of development from current trends in Carova and an associated extension of NC 12 to support that development. Individually, these constraints might be surmountable. Taken together, however, the preponderance of the conditions leads to the conclusion that the elimination of government constraint is not reasonably foreseeable.

Carova is designated by the US Congress as a Coastal Barrier Resources Act (CBRA) unit. The three important goals of the CBRA are to: minimize loss of human life by discouraging development in high-risk areas; reduce wasteful expenditure of federal resources; and protect the natural resources associated with coastal barriers. Being designated as a CBRA unit, structures in Carova are not eligible for federal flood insurance, and other forms of federal financial assistance are severely restricted. Carova area residences must be self-insured or privately insured. Federal flood insurance is available in most of the rest of the Outer Banks. Its lack here is one disincentive to build in Carova.

The National Wildlife Refuge System Improvement Act of 1997 gives a refuge manager the authority to determine whether a use of a refuge is compatible with a refuge's goals, objectives, and establishing legislation. It is considered unlikely that an extended NC 12 passing through the two areas of refuge lands in Carova would be found compatible with the refuges.

The Currituck County land use plan states "We want to protect our vital land and water natural resources and preserve farmland and open spaces while building a thriving and sustainable local economy (Currituck County, 2006) ." Furthermore, the policy emphasis for Carova is stated: "The policy emphasis of this plan is to allow for very low to medium density residential development [one unit per 120,000 sq. ft.] without infrastructure or service investments that could stimulate growth and development. In terms of infrastructure, this means that no centralized water and sewer services, public or private, will be approved and no hard surface roads will be allowed. Further, only

services that protect the health, safety, and welfare (i.e. law enforcement, fire, and rescue) will be authorized. Commercial and other convenience services shall not be allowed (Currituck County, 2006)." In North Carolina, local land use planning in coastal counties is reinforced by the Coastal Resources Commission, which establishes issues that must be addressed in CAMA plans and ultimately approves them. The objective of this structure is to strengthen the consistency and environmental protection in coastal planning.

In 1984, the private road to Corolla from Duck was paved and made a part of North Carolina's highway system as an extension of NC 12. No further changes to the public road system in Currituck County have been made since that time. The NCDOT Board of Transportation Resolution that authorized the extension of NC 12 also included the following related policy determinations.

- The NC 12 extension north to Corolla under no circumstances should become part of a through road system along the Outer Banks to Virginia.

- Public access north of Corolla along the beaches should be maintained as long as this use continues to be environmentally acceptable. "If public access north of Corolla should become impassable, an alternate inland access corridor should be considered."

4.2.4.3 Substandard Lot Sizes

The communities in Carova area were largely subdivided in the late 1960s and early 1970s when plans existed for a paved road to reach into North Carolina from the Sandbridge section of Virginia Beach. The sand roads that exist today in Carova are a reflection of the roads in Sandbridge. At the time, there were no public roads in Currituck County on the Outer Banks. These northern subdivisions were laid out for cottages according to the beach development criteria of the time. In the intervening years, plans for a road in Virginia were cancelled and beach driving from Virginia through a state park and national wildlife refuge prohibited. The lots in Carova are today substandard-sized according to present development ordinances.

According to the current zoning map of Currituck County, lots in Carova are designated as an Outer Banks Limited Access Residential (RO2) district. The RO2 district is designed to accommodate low density residential development (other than mobile homes) within the portion of the Currituck County Outer Banks that is not accessible by a publicly maintained road. Residential densities are typically one dwelling unit per 120,000 square feet (approximately three acres.) Many of the original house lots were platted as small as 1/3 of an acre, and are grandfathered in. Future subdivision must adhere to minimum 3 acre lots. There is no public water or sewer in the RO2 zone.

4.2.4.4 Resistance to Development Conflicting with the Land Use Plan

As indicated in Section 4.2.4.2, commercial and other convenience development is not allowed in Carova according to the Currituck County land use plan. The plan calls for

low to medium density development. This policy emphasis and the county's commitment to it were recently tested.

In September 2008, plans for a commercial development, including a 50-room inn in the Carova area were brought to the Currituck County Commissioners (Hampton, 2008). The plan relied on the original subdivision plats for the areas north of Corolla from the 1960s and 1970s. These show a commercial area labeled "business district." The original plats were developed prior to the current Currituck County zoning map. In November 2008, Currituck County Commissioners denied the proposed plan based on the reason that old subdivision plats do not override the current residential zoning. This was not the first time that this proposal was denied. The same proposal was made four years ago and was met with the same response by county planning officials.

Further, property owners in Carova opposed the commercial development plan, as they did four years ago, when the project was first withdrawn by the developer. Proposals in 2008 by Currituck County to re-grade sand roads in developed areas of Carova also met with substantial local opposition. This is a further indication of the sensitivity of property owners to change in this area.

4.2.5 Potential for Development Location, Rate, or Type in Mainland Currituck County to Change

It is reasonably foreseeable that the introduction of a Mid-Currituck Bridge with MCB2, MCB4, and the Preferred Alternative would alter the location of some new future Outer Banks service-oriented businesses. Some business development that might otherwise have been scattered in planned commercial areas on the Outer Banks and mainland near the Wright Memorial Bridge would concentrate at locations on the mainland near the terminus of the Mid-Currituck Bridge at US 158. This change would represent a net gain in business development in a concentrated location on the Currituck County mainland, creating a potential for a notable indirect and cumulative impact focused on the mainland bridge terminus.

Given that decisions to build would be made by individual business owners with a variety of personal objectives, it is not foreseeable that new development shifted to the mainland bridge terminus would be shifted from a single location elsewhere in the ICE study area. Thus, notable changes in the impact of development associated with this shift are expected only at the end to the Mid-Currituck Bridge. A notable impact is not foreseeable at the numerous and scattered locations in the midst of other development where this development might otherwise have located had a Mid-Currituck Bridge not been built.

Although ER2 would increase road capacity and improve traffic flow, it would not change the accessibility of the road system to developable properties. Thus, it is not reasonably foreseeable that ER2 would shift expected new business development to a concentrated location on the mainland.

Thus, development patterns associated with Outer Banks service oriented businesses would be different with MCB2, MCB4, and the Preferred Alternative, which include a Mid-Currituck Bridge, than for the No-Build Alternative and ER2, which do not include a Mid-Currituck Bridge.

There would be no reasonably foreseeable difference of note in future mainland residential development characteristics and concentrations between the detailed study alternatives and the No-Build Alternative. The introduction of a Mid-Currituck Bridge could cause people to choose different places to live than they might otherwise. However, travel time to work is one of many factors people consider when deciding where to live. While a Mid-Currituck Bridge would provide better access to retail and service jobs on part of the Outer Banks, if a short travel distance to the Outer Banks was an important determinate in deciding where to live, one would expect to see today a greater concentration of residential and commercial development in Point Harbor near the Wright Memorial Bridge. Also, except for new Outer Banks businesses locating at the end of the bridge on the mainland, the location of employment centers is not expected to change. Thus, while the pattern of residential development on the mainland could change with a Mid-Currituck Bridge, the change would not be concentrated in a single location, but rather scattered among lands considered suitable for development in the Currituck County land use plan.

Finally, neither Mid-Currituck Bridge mainland approach Option A nor Option B would alter future development patterns or trends in Aydlett, except to the extent that people might choose not to live in the vicinity of the project. A bridge would change the visual scene of Currituck Sound and at night would introduce lighting in an otherwise dark night sky area. Also, although within acceptable levels, traffic noise from the bridge would be audible in Aydlett. These changes could influence individuals' preferences for living in Aydlett.

These findings are based on the following factors:

- Currituck County is Actively Pursuing Economic Development Options. The commissioners of Currituck County are considering options that will increase the economic development and direction of the county into the future. While it is the expressed goal of the county to see a bridge constructed, the economic development goals exists regardless. The county commissioned an economic development strategy from The UNC Institute for Competitive Economies (Lane and Jolley, 2008). The final report was submitted in November 2008. This plan calls for and forecasts development near the US 158/Mid-Currituck Bridge interchange on the mainland.

- Negligible Increase in the Potential for New Development on the Outer Banks. Conclusions in Section 4.2.3 do not indicate a net increase in overall business or residential development on the Outer Banks because of the detailed study alternatives. This also is the conclusion of Lane and Jolley (2008). As such, additional demand for homes and businesses on the mainland for Outer Banks workers and customers would not occur.

- No Change in Access between the Community of Aydlett and the Outer Banks. No direct connection would be made between the community of Aydlett and the Outer Banks via a Mid-Currituck Bridge. This would be the case with either mainland approach design option.

4.2.5.1 Currituck County Is Actively Pursuing Economic Development Options

A "vision study" conducted by The UNC Center for Competitive Economies was prepared to help assist with Currituck County's economic development efforts. The report states that the economy of Currituck County is developing quickly. Based on the research conducted for this report, the county's economy is prospering and growth is steadily continuing. Between 1990 and 2000, county population grew by 32 percent, and between 2000 and 2006, the growth rate reached 31percent (Lane and Jolley, 2008). An underlying problem found through this research is that the county has not seen any increase in job creation. The job levels throughout the county have remained static, while other areas of the state are seeing small increases.

More than 76 percent of the residents in Currituck County commute to jobs in adjoining areas as well as causing over 5,000 low-income residents to move out of the county during the years 2000 and 2005 (Lane and Jolley, 2008). The overwhelming lack of skilled workers has exacerbated the region's inability to bring corporations into the area. Although employment characteristics are viewed as dismal, the UNC analysis revealed that there is great market potential for Currituck County. Because of the high amount of out-commuting by Currituck residents for employment, they likely pursue alternative retail options that are closer to their place of employment. This causes the county to lose a great deal of its retail sales and sales tax revenue to neighboring counties, particularly Dare County (Lane and Jolley, 2008).

The "vision study" addresses the potential building of the Mid-Currituck Bridge. The report states that the Mid-Currituck Bridge should provide easier mainland access to Currituck County Outer Banks tourists and will likely capture a considerable amount of tourism spending currently leaked to Dare County (Lane and Jolley, 2008). It also states that increases in mainland business development also are expected, with tourists crossing a Mid-Currituck Bridge mid-week to access new retail, entertainment, and hospitality establishments (Lane and Jolley, 2008).

Specifically the report finds that a mix of businesses will occur within the approximately 7.6 square mile vicinity of the mainland terminus of a Mid-Currituck Bridge. The report does not attempt to say specifically where in that area development would occur or relate the location of that development to developable areas specified in the Currituck County land use plan. It estimates 34 mainland businesses, including retail stores, restaurants, service businesses, and a hotel, with estimated total annual sales of $78 million. These would attract 468 new jobs with $9.6 million in new labor income. This number is considered a strong indicator of the order of magnitude of development, but the actual number of induced businesses would likely be somewhat below or above this number. These are businesses that do not currently exist in that location and are not likely to locate in that location in the absence of a bridge. Lane and Jolley (2008) also do

not specify precisely where they would otherwise locate but rather imply generally that they would occur throughout the coastal sections of Dare County . Considering the high level of development in the study area these businesses would otherwise redevelop existing commercial parcels or possibly occur on undeveloped, appropriately zoned parcels.

The 34 businesses figure is based on a proportion of future expected business scattered throughout the Outer Banks in Dare County being diverted and concentrated to the bridge area on the mainland. Growth similar in character to that of Dare County is expected in the areas surrounding the bridge. The report also notes that there will need to be changes to the infrastructure of the area to support business functioning such as access to central water and sewer, garbage collection, effective stormwater management, Internet, and perhaps structural changes in existing roadways and sidewalks to provide safely accommodation for all forms of traffic (Lane and Jolley, 2008). These 34 businesses are not expected to consume the 7.6 square mile area indicated, but rather will be located within that proximity.

Although much of the land is currently in agricultural uses or undeveloped, the land along US 158 between Aydlett Road and NC 168 is currently zoned "General Business," which is the "least restricted commercial district and is designed to accommodate the widest range of business uses." There are 474 acres with road frontage on US 158 zoned commercial and another 191 acres with near access to the highway. In addition, there are 11 acres zoned "Light Manufacturing." All of this land is planned as having limited services, which includes public water but relies on on-site septic service. A broader discussion of land considered suitable for development in the vicinity of the mainland access of a bridge is given in Section 6.1.2.

4.2.5.2 Negligible Increase in the Potential for New Development on the Outer Banks

Conclusions in Section 4.2.3 do not indicate a net increase in overall business or residential development on the Outer Banks because of the detailed study alternatives. This also is the conclusion of Lane and Jolley (2008). As such, additional demand for homes and businesses on the mainland for Outer Banks workers and customers would not occur. The reasons given for this conclusion in Section 4.2.3 were:

- The road-accessible portion of the Outer Banks is already largely developed or subdivided for planned development today;
- Local jurisdictions are committed to implement these plans as they stand;
- The types of development called for in the land use plans of Currituck County, Kitty Hawk, Southern Shores, and Duck are similar; and
- Transportation improvements can, however, influence the location of development that occurs first but is no longer the primary driver of development.

4.2.5.3 No Change in Access between the Community of Aydlett and the Outer Banks

Neither Mid-Currituck Bridge mainland approach Option A nor Option B would alter future development patterns or trends in Aydlett, except to the extent that people might choose not to live within view of the project as it passes through Aydlett. This is the case with either mainland approach design Option A or B. No direct connection would be made between the community of Aydlett and the Outer Banks via a Mid-Currituck Bridge. With either option, travelers between Aydlett and the Outer Banks would have to travel between Aydlett and US 158 and enter the Mid-Currituck Bridge project at its interchange with US 158. The difference between Options A and B lies only in how drivers travel between US 158 and Aydlett, via Aydlett Road in the case of Option A and via the bridge's mainland approach road in the case of Option B.

The added convenience offered for travelers between Aydlett and the Outer Banks would be similar to that offered for travelers between any point on the mainland and the Outer Banks. Thus, the conclusion presented above for mainland residential characteristics in general, that there would be no reasonably foreseeable difference of note in future mainland residential development characteristics and concentrations between the detailed study alternatives and the No-Build Alternative, also would apply in the case of Aydlett.

5.0 Potential Indirect/Cumulative Effects for Analysis

This chapter incorporates the work of Step 5 of the *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina* (NCDOT, 2001).This step in the analysis identifies potential impacts that might warrant further analysis. This is accomplished by creating matrices that list notable features of the ICE study area from Step 3 along with impact causing activities both from the project and otherwise in the area from Step 4. The matrix then uses a binary notation to indicate whether the particular activity might have an impact on the notable feature. Notable ecosystem features are considered in Table 5-1, while notable socioeconomic features are considered in Table 5-2.

The tables reflect the location and characteristics of the notable ecosystem and socioeconomic features, as well as the characteristics of the detailed study alternatives (including the Preferred Alternative) (as described in the Preface and Section 4.1), project-induced changes (as described in Section 4.2), and other activities (also as described in Section 4.1).

Table 5-1. Impact-Causing Activities for Notable Ecosystem Features

		Project-Related Activities						Project-Induced Change					Other Activities				
		Modification of Regime	Land Transformation and Construction	Resource Extraction	Land Alteration	Changes in Traffic	Access Alteration	Increase in Permanent Residents on the Outer Banks	Increase in the Number of Day Trips to the Outer Banks	Development Location, Rate, or Type in the Road-Accessible Outer Banks to Change	Development Location, Rate, or Type in the Non Road-Accessible Outer Banks to Change	Development Location, Rate, or Type in Mainland Currituck County to Change	Private Development and Provisions for Infrastructure	Other Transportation Projects	Logging	Beach Driving	Accelerated Sea Level Rise
Notable Ecosystem Features	Dune System												●			●	●
	Floodplains	●	●									●	●				●
	Estuaries/ Water Quality	●	●									●	●				●
	Public Water Supplies											●	●				
	Groundwater												●		●		●
	Maritime Forests												●				
	Submerged Aquatic Vegetation	●	●										●				●
	Unconsolidated Estuarine Bottom	●															●
	Coastal Marshes	●	●		●												●
	Non-coastal wetlands	●	●		●							●		●	●		
	Waterbirds	●	●										●			●	
	Atlantic Flyway	●	●	●									●		●		
	Anadromous Fish Spawning Areas	●															
	Protected Species	●		●					●				●		●	●	
	Wild Horses								●				●			●	
	CBRA Areas, Natural Heritage, Conservation Areas	●	●		●				●				●		●	●	●
	Areas of Environmental Concern	●											●			●	●

Table 5-2. Impact-Causing Activities for Notable Socioeconomic Features

		Project-Related Activities						Project-Induced Change					Other Activities				
		Modification of Regime	Land Transformation and Construction	Resource Extraction	Land Alteration	Changes in Traffic	Access Alteration	Increase in Permanent Residents on the Outer Banks	Increase in the Number of Day Trips to the Outer Banks	Development Location, Rate, or Type in the Road-Accessible Outer Banks to Change	Development Location, Rate, or Type in the Non Road-Accessible Outer Banks to Change	Development Location, Rate, or Type in Mainland Currituck County to Change	Private Development and Provisions for Infrastructure	Other Transportation Projects	Logging	Beach Driving	Accelerated Sea Level Rise
Notable Socioeconomic Features	Workforce Housing						●					●	●				
	Tourist Housing						●			●		●	●				
	Agriculture	●										●	●				
	Historic Structures and Places												●				
	Circulation and Access					●	●		●	●		●	●	●		●	●
	Neighborhoods and Village Communities					●	●			●		●	●	●			
	Scenic and Natural Area Character	●	●		●				●			●	●		●	●	●

6.0 Analyze Indirect/Cumulative Effects

This chapter presents analysis of the potential effects identified in the previous section, including methodology, magnitude, probability of occurrence, geographical extent, timing and duration, the degree to which the effect can be avoided or minimized, and evaluation of significance. This section was developed in accordance with Step 6 of the *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina* (NCDOT, 2001).

This chapter has three parts:

1. An assessment of the relationship of reasonably foreseeable changes in land development patterns with the detailed study alternatives, including the Preferred Alternative, on the Currituck County mainland.

   Land considered suitable for development is defined by the Currituck County land use plan and was presented on Figure 2-2. The nature of the reasonably foreseeable changes in land development patterns with the detailed study alternatives is presented in Section 6.1.

2. Assessment of the effects of changed development (land use) patterns defined in item 1 above, as well as the potential for increased day visitors on the area's notable ecosystem and cultural/socioeconomic features, and their compatibility with local/regional goals, land use plans, and development regulations.

   These indirect impacts are presented in Section 6.2.

3. Assessment of the cumulative effects of the detailed study alternatives, project-induced changes, and other activities are presented in Section 6.3 for the same items listed under item 2.

6.1 Land Suitability Analysis for Changed Development Patterns

The findings of Section 4.2 were that there would be two induced land use changes associated with the detailed study alternatives. Both would be associated with a Mid-Currituck Bridge, which is included in MCB2, MCB4, and the Preferred Alternative. They are:

- A change in the order in which available lots on the NC 12-accessible Outer Banks would develop in response to market demand (this would likely change with more Currituck County lots developing before Dare County lots [Section 4.2.3]). Also, severe congestion on NC 12 during peak traffic times (summer weekends) with ER2 or the No-Build Alternative could constrain anticipated and planned development of rental and hotel units (Section 4.2.3.5).

- Business development in the area of the US 158/Mid-Currituck Bridge interchange (Section 4.2.5).

As discussed in Section 4.2.3, the first item would involve a change in the order of development of lots in existing subdivisions and the development of currently un-subdivided land. This is not the case with the second item. Thus, this section focuses on defining the relationship of the potential new business development on the mainland and land considered suitable for such development by Currituck County.

6.1.1 Land Available for Development into 2035 Horizon Year

According to the Currituck County land use plan, the high and medium land suitability rating categories are those that are generally considered for development. Jointly, these two categories comprise 34,435 acres of available land in the county at present. The 34,435 acres were derived by subtracting the total 2005 acres in development (18,065) from the total 2005 acres of high and medium suitable land (52,500).

The county land use plan provides population and land development estimates to the horizon year of 2025. Because the Mid-Currituck Bridge project has established a horizon year of 2035, it was necessary to extrapolate trend data from the land use plan's Table 2.8 (population) and Table 4.9 (land to be developed) and develop a calculation that provided a reasonable estimate of the acres to be developed between 2005 and the project horizon year of 2035. Table 6-1 below provides the steps that were used to obtain the extended estimate.

Table 6-1. Population and Land Calculation Factors

Calculation Factor	Result	Source
Difference Between County's 2005 and 2025 Land in Development Estimates	19,118 acres	Currituck County land use plan Table 4.9
Difference Between County's 2005 and 2025 Population Estimates	14,300 persons	Currituck County land use plan Table 2.8
Land Needed per Person to Accommodate Population Growth between 2005 and 2025	1.34 acres/person	Product of dividing 19,118 by 14,300
Difference Between 2025 and 2035 Population Estimates	10,300 persons	Assuming 2.5 percent annual growth as shown in the medium growth scenario in land use plan Table 2.8 from 2005 to 2025
Acres Needed to Accommodate Population Growth Between 2025 and 2035	13,800 acres	Result of multiplying 1.34 acres/person by 10,300 persons
Total Acres of Development Between 2005 and 2035	**32,988 acres**	Sum of 19,188 acres plus 13,800

Source: Based data *Currituck County 2006 Land Use Plan* (Currituck County, 2006)

Based on the trend extrapolation of land to be developed and population growth as shown on Table 6-1, a total of 32,988 acres of land would be developed in the County between 2005 and 2035. This indicates that the County has enough medium and high suitable land to continue its density assumptions from 2025 into 2035. However, that would include use of suitable land classified as rural areas in the 2025 plan. This is by no means certain. Currituck County, in developing future land use plans, could choose to increase densities and reserve more land for agricultural use.

6.1.2 Land Available for Development near the Mid-Currituck Bridge

Land available for development in the high and medium land suitability rating categories within 1, 1.5, 5, and 10 mile radii of the US 158/Aydlett Road intersection was calculated by using a geographic information system (GIS). The amount of acres of available and suitable land in these search distances is shown below in Table 6-2. The University of North Carolina at Chapel Hill developed the *Economic Development Strategy "Vision Plan" for Currituck County, North Carolina* (Lane and Jolley, 2008). In this study, UNC indicated that development could occur within 7.5 square miles of the Mid-Currituck Bridge. The 7.5 square mile area translates to a 1.5 mile radius. In order also to consider the UNC area identified for development, the 1.5 mile radius was one of the four radii examined.

Table 6-2. Available Land near Mid-Currituck Bridge

		Acres of Developable Land[1]			
		Within 1 mile Radius	Within 1.5 Mile Radius	Within 5 Mile Radius	Within 10 Mile Radius
Future Land Use Service Level	Full	0	0	1,328	6,998
	Limited	438	626	4,157	9,916
Land Suitability Rating Category	High	315	437	2,506	10,580
	Medium	107	163	1,803	6,146
Future Full Service Land Overlain on High and Medium Land Suitability Areas	High	0	0	601	4,093
	Medium	0	0	411	1,404
Future Limited Service Land Overlain on High and Medium Land Suitability Areas	High	311	428	1,812	5,283
	Medium	93	127	1,167	2,762

[1]The center for this analysis is at the US 158/Aydlett Road corner west of Aydlett.

The county uses the future land use categories of Full Service and Limited Service to infer areas appropriate for two densities of development. The Full Service future land use category refers to areas that have been, or are planned to be developed with a broad range of infrastructure and municipal services (centralized water, sewer, parks, schools, fire, and rescue facilities). A Full Service area would allow for higher building densities and large scale commercial areas. The Limited Service future land use category refers to areas that have far less to no centralized infrastructure and municipal services. A Limited Service area is more fitting for lower density development. These future land use categories also were calculated within a 1, 1.5, 5, and 10 mile radii of the US 158/Aydlett Road intersection. The results also are shown in Table 6-2.

Based on a review of the future land use areas shown on Figure 2-1, the full service future land use areas are along the US 158 corridor from Coinjock to Moyock and along the US 158 corridor in Grandy. The limited service future land use areas are: along the Aydlett Road corridor from approximately 1.5 miles north of Aydlett to Grandy; along the US 158 corridor from Coinjock to north of Grandy; and between the southern part of Grandy to the northern part of Jarvisburg. There are no plans to install public sewer in this area, although the entire length of US 158 has public water. These full and limited service areas are all shown as being within areas also shown as having high and medium land suitability, and therefore developable.

Section 4.2.5 indicates that some commercial development would shift from points elsewhere in the ICE study area to the area around the Mid-Currituck Bridge. The UNC economic study cited in that section indicated, with reasonable certainty, the potential for 34 businesses to shift to this area. Their assessment is based on modeling assumptions that market conditions would spur a commercial and business mix similar to that in Dare County (Lane and Jolley, 2008). In addition, their assessment assumes the absence of additional land use and development controls that would limit development in this area. These businesses would be defined as occurring within an approximately 7.5 square mile vicinity of the mainland terminus of a Mid-Currituck Bridge. In other words, the area roughly approximated by a radius of 1.5 miles around the end of the bridge would potentially be influenced by this new tourist-oriented development. Based on past trends, these businesses could use approximately an average of 2 acres per business, or approximately 68 acres. As indicated in Table 6-2, there is more than adequate suitable land for such development, even within 1 mile of the bridge. Much of this land is currently in agricultural uses or otherwise undeveloped and thus available for development, particularly south of the interchange. It is all land planned as having limited services, e.g., well and septic services.

Therefore, based on the number of available acres and developable locations discussed above, commercial development that would be indirectly related to the implementation of the Mid-Currituck Bridge would not likely cause a demand of land unsuitable for development.

6.2 Indirect Effects

This section is an assessment of the indirect effects of changed development patterns on the area's notable ecosystem and cultural/socioeconomic features, and their compatibility with local/regional goals, land use plans, and development regulations. As noted in Section 6.1, the findings of Section 4.2 were that there would be two notable induced land use changes and one visitor use change associated with MCB2, MCB4, and the Preferred Alternative:

- A change in the order in which available lots on the NC 12-accessible Outer Banks would develop. This would include the order of residences as well as hotel properties.

- Approximately 68 acres of business development likely would occur using land as indicated in Section 6.1 near the US 158/Mid-Currituck Bridge interchange immediately north of Aydlett Road.

- Day visitor potential demand would increase, which could have some effect in the NC 12 area, but likely would have more impact in the unregulated beach-driving area.

This assessment focuses on the effects of these three changes.

Two other possible induced changes were discussed in Section 4.2—potential to increase permanent population on the Outer Banks; and the potential for development location, rate, or type in the non road-accessible Outer Banks to change. In both cases, it was concluded that the differentials between the alternatives were low or not reasonably foreseeable. Thus, the potential for induced impacts or making a contribution to cumulative effects would be minimal and need not be addressed in either the indirect or cumulative effects assessment.

The No-Build Alternative reflects the status quo and, as such, there are normally no indirect effects. However, summer weekend congestion on NC 12 potentially could constrain development of rental houses and hotel rooms north of Duck. There could reach a point with the No-Build Alternative where summer weekend traffic congestion is severe enough to affect the practical demand for beach rentals. This could constrain practical development to 70 percent of maximum build-out on the Outer Banks from the Virginia Line to Southern Shores. If property rental or travel practices adapt to avoid activity during the worst congestion, then there could be no constraint on anticipated and planned development. (See Section 4.2.3.)

With ER2, there are no reasonably foreseeable project-induced land use changes except for the possibility of severe congestion constraining practical development at 75 percent of maximum build-out from the Virginia Line to Southern Shores. If property rental or travel practices adapt to avoid activity during the worst congestion, then there could be no constraint on anticipated and planned development. (See Section 4.2.3.)

Therefore, the indirect impact assessment focuses on the impacts of MCB2, MCB4, and the Preferred Alternative, with an assessment on potentially constrained development with ER2 and the No-Build Alternative included where appropriate.

6.2.1 Effects of Induced Change on Notable Landscape and Waterscape Features

This section is a systematic consideration of the MCB2, MCB4, and Preferred Alternative induced change that has the potential to affect the landscape ecology (structure and function) of the landscapes and waterscapes shown on Figure 3-1.

6.2.1.1 Currituck County Mainland

The development that is foreseeable in this area is a concentration of businesses in the area along US 158 near Aydlett Road described in Sections 4.2.5 and 6.1.2. The UNC economic study (Lane and Jolley, 2008) indicated that up to 34 additional businesses consuming approximately 68 acres of land can be foreseen (see Section 6.1). This "induced development zone" on the mainland with MCB2, MCB4, and the Preferred Alternative would be within the vicinity of the bridge access. These are businesses that do not currently exist in that location and are not likely to locate in that location in the absence of a bridge. These are businesses that would have occurred elsewhere in the region. There is no forecasted increase in residential development. This would have the effect of creating a large patch or several medium sized patches of commercial land along US 158. Increased development here could create a barrier for specimen exchanges between Great Swamp and Maple Swamp. Other than this, there would be no additional fragmentation of the mainland from induced development.

6.2.1.2 North River Estuary

Neither of the project-induced changes (order of development on NC 12 or induced commercial development on the Currituck County mainland) would cause indirect effects to the structure or function of the North River estuary. Only the commercial development (MCB2, MCB4, and the Preferred Alternative) occurring near the mainland access to the bridge would be near the estuary. Compliance with existing environmental regulations by any new development will serve to minimize degradation to Great Swamp and the North River Estuary. Great Swamp itself is conservation land, largely protected by the North Carolina Wildlife Resources Commission.

6.2.1.3 Currituck Sound

Neither of the project-induced changes (order of development on NC 12 or induced commercial development on the Currituck County mainland) would cause indirect effects to the structure or function of Currituck Sound. In both cases the induced change is negligible or too distant from the shoreline to flow directly into Currituck Sound. In addition, both state law and county ordinance require detention of stormwater runoff from new developments.

6.2.1.4 Currituck County Outer Banks

The only reasonably foreseeable induced growth changes on the Currituck County Outer Banks would occur from the bridge alternatives (MCB2, MCB4, and the Preferred Alternative) in the form of altering the order of development of already subdivided lots. There would be no net impact to the structure and function of the landscape; therefore there are no indirect effects on this landscape.

6.2.2 Effects of Induced Change on Notable Environmental Elements

This section is a systematic consideration of MCB2, MCB4, and the Preferred Alternative induced changes that have the potential to affect notable ecosystem features as presented in Table 5-1.

6.2.2.1 Dune System

The dune system could potentially be impacted by increased day visitors. This would occur largely through driving or walking through prohibited areas and destroying vegetation. Enforcement of regulations and laws prohibiting trespass and protecting the dunes would avoid or reduce this effect. Currituck County Ordinance, Section 10-61 – Destruction of Natural Features Prohibited, specifically protects all dunes in the county from vehicular damage: "No person shall operate any vehicle, moped, motorcycle or motor vehicle or use any horse on or across any dune barrier or in such a manner as would destroy natural vegetation." In addition the Currituck National Wildlife Refuge routinely closes critical habitat areas to all entry. Currently, the large parcel that includes the beach and dunes in the first mile of the non-road area is closed to parking and the dunes are closed to any access (pedestrian and vehicular) whatsoever. There is no reasonably foreseeable induced development on the Outer Banks; however, if development is constrained because of traffic congestion in the absence of a bridge (No-Build Alternative or ER2), there could be less land disturbance in the dunes. Regulations exist through CAMA to protect ocean erodible areas from development.

6.2.2.2 Floodplains

In the absence of effective regulation, new development could infringe upon floodplains and floodways on the mainland. The low-lying coastal nature of the county results in the floodplains co-existing on wetlands. Currituck County, through its CAMA land use planning process, has determined land suitable for development, which specifically avoids development on floodplains and wetlands.

6.2.2.3 Estuaries / Water Quality

The area of the induced development zone would be adjacent to Great Swamp and Maple Swamp and near the Intracoastal Waterway. The primary threat to water quality would be additional loading from impervious service run-off and onsite septic facilities. The 68 acres that are likely to see induced development on the Currituck mainland would be governed by the County's Unified Development Ordinance (Currituck County, 2008). This permits up to 65 percent lot coverage for commercial development, which would translate to increased impervious coverage of 44 acres. Also, current county regulations require new development to detain run-off, which is the lesser of

predevelopment levels or the predicted runoff from a 10-year storm event, which is approximately a 6-inch rainfall (Currituck County, 2004). Furthermore, at the state level, all new development also must comply with NC Session Law 2008-211(An Act to Provide for Improvements in the Management of Stormwater in the Coastal Counties in Order to Protect Water Quality), which requires new development to capture and treat the first 1.5 inches of runoff from new impervious surfaces. The period of actual construction is also a window where increased sediment could be transported to estuaries, although this would be avoided or minimized through the use of erosion and sedimentation control measures.

The runoff impact would be partially offset by the fact that most of the land suitable for development is currently in agricultural use. Agricultural land has perennial negative impacts to runoff water quality stemming from increased sediment from plowed fields as well as fertilizer and pesticide/herbicide transport. The Currituck County mainland does not have a significant livestock presence so the common agricultural problem of animal waste is less of an issue here.

On the Currituck County Outer Banks, where development could occur sooner in the near term, runoff is generally handled by infiltration into the soil, with runoff entering Currituck Sound only from properties immediately adjacent to the sound. Thus, the impact of this change would be minimal.

With regard to project-related runoff, NCTA would comply with NC Session Law 2008-211 to the maximum extent practicable for the additional impervious surface area that would be created by the construction of the Preferred Alternative if it is selected for implementation. Of the approximately 71.5 acres of additional impervious surface area (new built upon area) with the Preferred Alternative, about 28 acres would be associated with the bridge over Currituck Sound and 11 acres would be associated with the bridge over Maple Swamp. The remaining approximately 33 acres would be associated with US 158 improvements, interchange ramps/bridges, toll facilities, local road connections, parking areas, and NC 12 widening. In addition, there are about 18 acres of existing impervious surface area in the project area associated with existing US 158 and the portions of existing NC 12 to be widened.

Compliance with NC Session Law 2008-211's requirement for new development to capture and treat the first 1.5 inches of runoff from additional impervious surface areas would be met, to the maximum extent practicable, through a combination of pollutant source control and capture and treatment. Source control would be through the use of pavement sweeping and vacuuming on bridge decks. Capture and treatment would be through the use of bridge closed drainage systems for parts of the Maple Swamp and Currituck Sound bridges, stormwater wetlands, wet detention basins, rooftop rainwater harvesting, and other traditional roadway Best Management Practices (BMPs), to the maximum extent practicable. (See Section 2.1.7 of the FEIS.)

6.2.2.4 Public Water Supplies

A reasonably foreseeable increase of approximately 34 retail and service businesses (as identified in the UNC study) would cause a marginally increased demand for water. There are no induced industrial land uses foreseen. The Mainland Water Treatment Plant in Maple has a capacity of 2.9 mgd, although it currently only has demand for 1.0 mgd, on average. The primary demand for additional water supplies in Currituck County would come from additional residential development, which is unconnected to any of the detailed study alternatives, including the Preferred Alternative.

6.2.2.5 Groundwater

Retail and service businesses would be required to conform to best management practices, including proper sewage treatment and stormwater management. There are no indirect effects on the surficial or Yorktown aquifers from induced development on the mainland other than increased withdrawals by the public utility to service the development. If traffic congestion in the absence of a bridge were to constrain Outer Banks development, there could be fewer, or less use of, septic and on-site sewer systems. This reduces the probability of a failure that would negatively impact the surficial aquifer.

6.2.2.6 Maritime Forests

Maritime forests do not exist on the Currituck County mainland. They do exist on the Outer Banks in lots subdivided by development. As those lots develop that forest is fragmented even if some forest remains. However, subdivided forest already has been fragmented by existing development even if not all lots have been developed. Therefore, there would be no indirect effect from any of the detailed study alternatives, including the Preferred Alternative. If traffic congestion in the absence of a bridge constrains Outer Banks development, there could be less land clearance for construction, which could result in more remnant patches of maritime forest.

6.2.2.7 Submerged Aquatic Vegetation

Submerged aquatic vegetation is not affected by development; therefore, there would be no indirect effect from any of the detailed study alternatives, including the Preferred Alternative.

6.2.2.8 Unconsolidated Estuarine Bottom

Unconsolidated estuarine bottom is not affected by development; therefore, there would be no indirect effect from any of the detailed study alternatives, including the Preferred Alternative.

6.2.2.9 Coastal Marshes

Coastal marshes around Currituck Sound are not developable; therefore, there would be no indirect effect from any of the detailed study alternatives, including the Preferred Alternative, except to the extent that degraded runoff from sound side lots might affect these marshes.

6.2.2.10 Non-Coastal Wetlands

There are non-coastal wetlands in the areas likely to see additional development. There is sufficient suitable land for the induced development (see Section 6.1) on the higher ground immediately adjacent to US 158 on the mainland. Shifting development on the Outer Banks would be to existing lots. However, the proximity of development to wetlands could adversely affect these wetlands through degraded runoff.

6.2.2.11 Waterbirds

The induced land use changes would not substantially affect waterbirds or their habitat. None of the areas of induced land use change are notable areas of waterbird habitat. On the mainland, induced development is expected along US 158 in areas that are largely developed or agricultural and not important bird areas. Neither changing the order of development on the Outer Banks nor increasing day visitors to the beaches would cause a net impact on waterbird habitat. Even in the case of induced beach driving, the marginal effect would be minor; current levels and growth of year-round beach driving already degrade the beaches north of NC 12 for shorebirds.

6.2.2.12 Atlantic Flyway

The Atlantic Flyway is continental in scale. The land suitable for development in the induced development zone is not important habitat for the Atlantic Flyway. The important flyway habitats are coastal marshes, non-coastal wetlands, woodlands, and grainfields. The additional business development would have no measureable impact on the Atlantic Flyway. The induced change of order of development in existing partially developed subdivisions on the Outer Banks leading to a full build-out would have no functional impact on the Atlantic Flyway.

6.2.2.13 Anadromous Fish Spawning Areas

There are no anadromous fish spawning areas on the land suitable for development on the Currituck County mainland or on the Outer Banks; therefore, there would be no indirect effect from any of the detailed study alternatives, including the Preferred Alternative.

6.2.2.14 Protected Species

Protected species in Currituck and Dare counties are listed in Appendix B. They include species on the federally endangered species list, as well as bald eagles, protected by the Bald and Golden Eagle Protection Act. As per the *Biological Assessment* (CZR Incorporated, 2011a) and the *Natural Resources Technical Report* (CZR Incorporated, 2011b), there are no protected species habitats in the induced development zone on the Currituck County mainland or in developable habitats on the Outer Banks; therefore, there would be no indirect effect from any of the detailed study alternatives, including the Preferred Alternative, in these areas. The northern beaches have in the last 20 years provided habitat to piping plovers and loggerhead sea turtles, although incidents have been infrequent. Unrestricted beach driving is credited with degrading this habitat. Increased beach driving because of induced additional day visitors could exacerbate this problem. Seabeach amaranth has not been noted in the ICE study area since 1988. This

species requires extensive areas of barrier island beaches and inlets that function in a relatively natural and dynamic manner, allowing it to move around and colonize sparsely vegetated sand. These do not occur in the area.

6.2.2.15 Wild Horses

Wild horse habitat in the northern beaches could be affected with increased day visitors to this area. The presence of more four-wheel drive beachgoers increases the chance of horse-human interactions. Also, increased beach traffic increases the likelihood of collisions with the animals.

6.2.2.16 CBRA Areas, Natural Heritage Areas, and Conservation Areas

In Currituck County, the non-road accessible northern Outer Banks and the Audubon Society's refuge near the Currituck/Dare County Line are designated Coastal Barrier Resources Act areas (see Figure 3-5). Also, there are 34 natural heritage areas listed in the Currituck County land use plan, as well as natural heritage elements in the Dare County towns, notable Kitty Hawk Woods. Two areas (Maple Swamp and Great Swamp) are adjacent to the induced development zone on the Currituck County mainland. Section 6.2.2.10 discusses the absence of indirect impacts on these natural areas with development in the induced development zone. On the Outer Banks, the induced change between the different scenarios would be to alter the order of development of lots that are already subdivided. There would be no net indirect impact on designated conservation areas on the Outer Banks other than those that could be associated with increased day visitors to the beach in the non-road accessible northern Outer Banks.

Induced development and activity on the mainland would have potential to cause the introduction of invasive species during both the construction phase and the ongoing use of the facilities. This effect could spread out from the site. Studies have found that in the case of invasive species being introduced along roads, species spread from roadside into adjoining land the farthest distance reported was 394 feet, but the bulk of species invaded only 33 feet from a roadside (Forman, Sperling et al., 2003).

There were five species from the NCDOT Invasive Exotic Plant List for North Carolina (Smith, 2008) observed within the Mid-Currituck Bridge project area. Threat Level 1 species (common read, Chinese privet, and Nepalese browntop) are known to be invasive and degrade habitat. Threat Level 2 species (Japanese honeysuckle and mimosa) do not currently pose a substantial threat to natural communities (CZR, Incorporated, 2011b).

6.2.2.17 Areas of Environmental Concern

AECs are an important regulatory category that includes ocean hazard areas, estuarine shoreline, coastal wetlands, and estuarine waters. CAMA land use plans protect areas that are generally unsuitable for development. Development affecting estuaries has to be permitted. The anticipated induced development on the mainland would not affect AECs in the ICE study area.

6.2.3 Effects of Induced Change on Notable Cultural and Socioeconomic Conditions

This section is a systematic consideration of the project-induced change that has the potential to affect notable cultural and socioeconomic conditions as presented in Table 5-2.

6.2.3.1 Workforce Housing

Section 4.2.5 indicates that with the Mid-Currituck Bridge, the location of employment centers are not expected to change substantially. It also indicates that while the pattern of residential development on the mainland could change, the change would not be concentrated in a single location, but rather scattered among lands considered suitable for development by the Currituck County land use plan. Based on the above, the probability of project-induced changes on housing for the workforce with MCB2, MCB4, and the Preferred Alternative would be low. The timing and degree of any changes in workforce housing would be subject to the regulatory controls of Currituck County.

6.2.3.2 Tourist Housing

As indicated in Section 4.2.3, the demand for houses on the Outer Banks resort area does not notably vary with any of the detailed study alternatives and this level of demand is anticipated and planned for in local plans. However, it was concluded that possible severe congestion during peak times (summer weekends) in the ER2 and No-Build Alternative could cause a practical constraint on the demand for new rental cottage and hotel development north of Duck.

The introduction of a Mid-Currituck Bridge with MCB2, MCB4, or the Preferred Alternative would substantially reduce travel time from points north of the bridge on the mainland to the Currituck County Outer Banks. As such, the order in which available lots on the NC 12-accessible Outer Banks would develop in response to market demand would likely change with more Currituck County lots developing before Dare County lots. This change would affect the holders of developable lots in terms of when they might see a return on their investment in that land.

With any of the detailed study alternatives, there would be minimal or no noticeable effect on the commercial and business services that tourist housing would receive, because service businesses would locate to where the tourist housing develops. The one exception to this, which is common to all detailed study alternatives, is that commercial and service businesses would be expected to continue to be prohibited from the non-road accessible Outer Banks.

6.2.3.3 Agriculture

There is no agricultural land on the Outer Banks and thus, a shift in the order of the development of tourist housing would not affect agricultural lands. The undeveloped land suitable for development near the US 158/NC 168 intersection is almost all in agricultural uses and as such the induced commercial development would likely occur on agricultural land. None of the agricultural land near the interchange is classified in

the Currituck County future land use map to remain rural in the future. The Currituck County land use plan indicates that agricultural land comprises 32 percent of the mainland or 43,878 acres out of the total mainland acreage.

6.2.3.4 Historic Structures and Places

The two induced development pattern changes associated with MCB2, MCB4, and the Preferred Alternative would not affect areas containing the historic resources shown on Figure 3-7. Historic resources on the mainland are not in the US 158/Mid-Currituck Bridge area where induced development is expected to occur. On the Outer Banks, only the order of development is expected to change and not its location or character.

6.2.3.5 Circulation and Access

The two induced development pattern changes associated with MCB2, MCB4, and the Preferred Alternative would not cause additional changes in access. In terms of circulation, development on the Outer Banks would circulate in the manner in which was intended when the Outer Banks subdivisions were established. Because only the order of Outer Banks development would be affected, levels of congestion forecasted for 2035 would be unchanged. Increased day visitors could increase traffic on the Currituck Outer Banks.

Commercial development on the mainland, if allowed to develop with individual driveways for each business, would create additional turning movements off US 158, potentially increasing congestion. Consolidated driveways in new concentrations of development are today common practice and this would be expected to be required both by the county and the North Carolina Department of Transportation.

6.2.3.6 Neighborhoods and Village Communities

The shifting of the order of development that would occur in Outer Banks subdivisions would not affect the manner in which these communities would develop. As discussed in Section 4.2.3, for the NC 12-accessible Outer Banks, there would be no reasonably foreseeable change in the type and density of development with the implementation of the detailed study alternatives, including the Preferred Alternative, in contrast with the No-Build Alternative.

Commercial development near the US 158/Mid-Currituck Bridge interchange is expected to be confined to lands along US 158 and not occur in the nearby rural community of Aydlett. This is the case for two reasons:

1. No connection to Aydlett is provided from the Mid-Currituck Bridge. The route to Aydlett from the bridge would involve backtracking to the sound on a two-lane local road, an inconvenience to potential customers.

2. Businesses are expected to prefer a site that can be seen from US 158 so that potential customers can see the business and be aware of its presence when traveling to their vacation homes on the Outer Banks.

6.2.3.7 Scenic and Natural Area Character

The shifting of the order of development that would occur in Outer Banks subdivisions would not affect the manner in which these communities would develop. It also would not affect the already expected effect of Outer Banks subdivisions on scenic and natural character. Increased day visitation would increase the intensity of beach use – the beaches would be more crowded.

With MCB2, MCB4, and the Preferred Alternative, the introduction of the US 158/Mid-Currituck Bridge interchange would substantially change the visual character of that area (as discussed in the revised *Other Physical Features Technical Report* [Parsons Brinckerhoff, 2011] in its assessment of visual impacts). Existing features would be lost and new man-made vertical elements would be introduced. The interchange would be a substantial change for an area defined in the visual impact assessment as having high visual quality. The introduction of businesses in the interchange area would have a similar impact. The extent of the visual impact would depend upon the appearance requirements that would be the responsibility of Currituck County.

6.2.4 Compatibility of Induced Change with Local/Regional Goals

This section discusses the compatibility of the two induced land use changes (shifting of the order of development on the Outer Banks and the shifting of approximately 34 future businesses to the US 158/Mid-Currituck Bridge interchange area), as well as increased day visitation, with the goals presented in Section 2.2, including:

- Social health and well-being goals;
- Economic opportunity goals; and
- Ecosystem protection goals.

6.2.4.1 Social Health and Well-Being Goals

Table 2-9 lists the social health and well-being goals expressed by the agencies and public organizations. Each goal is addressed separately below.

6.2.4.1.1 Achieving Adequate, Appropriate and Accessible Open Space and Recreation

Neither induced land use change would use land intended for open space and recreation in area land use plans. Additional businesses would provide convenient support services for tourists using recreation opportunities on the Outer Banks.

6.2.4.1.2 Comply with State and Federal Water and Air Quality Laws

The project is in Currituck and Dare counties, which have been determined to have air pollutant levels that meet the National Ambient Air Quality Standards (NAAQS) and are, therefore an attainment area. Since the proposed project is in an attainment area, Title 40 *Code of Federal Regulations* Parts 51 (the NAAQS) and 93 (determination of conformity with a state implementation plan for air quality reduction) are not applicable. The project is not anticipated to create any adverse effects on the air quality of this attainment area. The approximately 34 businesses represent a shift of business

development from the Outer Banks to the mainland, as discussed in Section 4.2.5. Thus, neither this change nor the change in the order of development on the Outer Banks would alter this finding.

As discussed in Section 6.1, adequate suitable land for the anticipated approximately 68 acres of businesses forecasted to shift on the mainland is available. Thus, this development is not expected to use jurisdictional resources regulated under the Clean Water Act. Potential impacts on water resources are discussed in Sections 6.2.1 and 6.2.2. State and federal water quality laws enforced by local, state, and federal agencies would apply to new development. Therefore, induced changes would likely remain in compliance with state and federal water quality laws.

6.2.4.1.3 Preserve Heritage

Both of the potential induced land use changes (shifting of the order of Outer Banks development and shifting the future businesses) fit within area land use plans. Shifting the order of development would be to land already subdivided. New businesses on the mainland would use existing agricultural land designated in the Currituck County land use plan for future development. Thus, aspects of land use plans focusing on preserving the areas heritage would be unaffected.

6.2.4.1.4 Promote Land Use Patterns with a Sense of Community

Again, both of the potential induced land use changes fit within area land use plans. Shifting the order of development would be toward land already subdivided. Thus, the ability of jurisdictions within the ICE study area to promote land use patterns with a sense of community would be unaffected.

6.2.4.1.5 Promote a Healthy and Safe Environment

Again, both of the potential induced land use changes fit within area land use plans. Increased day visitation would require increased policing. There is scant research on the actual correlation between increased tourists and increased rates of crime. What research exists does not establish a correlation between the two. In the most comprehensive research on US resorts to date (Grinols, Mustard, and Staha, 2009), a study of national parks and crime indicated that park visitors were not statistically correlated to any discernable change in crime rates for either violent crimes or property crimes. The study also found that there is no discernable difference in crime rates if the visitors are day visitors or overnight visitors. Thus, the ability of jurisdictions within the ICE study area to promote a healthy and safe environment would be unaffected.

6.2.4.1.6 Promote Equitable Use of Public Trust Assets, Particularly in the Form of Beach Access

Neither of the potential induced land use changes would affect access to public trust assets in the ICE study area. Increased potential demand for day visitation is consistent with promoting equitable public access; however, commenters on the DEIS expressed concern that promoting further use of beaches is not desirable because of a lack of public facilities and current problems associated with beach driving. ER2, which would have some improvements to travel time but would not reduce distance traveled, would not

alter access in a way that would induce more day visitors. MCB2, MCB4, and the Preferred Alternative, with their reduction in distance from the mainland to the Currituck County Outer Banks, would have the potential to increase day visitor demand to public beaches.

6.2.4.1.7 Use Growth Management Techniques to Achieve Land Use Goals

Counties and each respective incorporated town in Dare County have active and aggressive growth management tools, which may include density requirements, zoning, PUDs, land use plans, unified development ordinances, and impacts fees (see Table A-1 in Appendix A). Again, both of the potential induced changes fit within the goals of area land use plans. Thus, the ability of jurisdictions within the ICE study area to apply growth management techniques would be unaffected.

6.2.4.1.8 Ensure an Efficient Transportation System

The direct beneficial impact of the Preferred Alternative (in addition to ER2, MCB2, and MCB4) would be improving the efficiency of the transportation system. The two potential induced changes would result from developers taking advantage of those improvements in efficiency. The 2035 improvements in efficiency associated with MCB2, MCB4, and the Preferred Alternative would not change as a result of shifting the order of development on the Outer Banks or the marginal (in contrast with the total million annual vehicle-miles traveled in the project area) additional traffic generation of the forecasted approximately 34 businesses.

6.2.4.1.9 Protect Landscape Aesthetics

The potential impact on landscape aesthetic goals would be the same as described for scenic and natural character in Section 6.2.3.7.

6.2.4.1.10 Protect Floodways and Wetlands

There are no floodways in the project area. Floodplains and wetlands are not included in land suitable for development as identified in area land use plans. It is expected that development would have to demonstrate compliance with floodplain ordinances and the Clean Water Acts related to the use of wetlands. Thus, indirect impacts to floodways and wetlands would not be expected.

6.2.4.2 Economic Opportunity Goals

Table 2-10 provides a list of the economic opportunity goals expressed by agencies and public organizations. The achievement of these goals also is closely tied to area land use plans. Both of the potential induced changes (shifting of the order of Outer Banks development and shifting the future businesses) fit within those plans. Each goal is addressed separately below.

6.2.4.2.1 Support Activities to Meet Changing Economic Conditions

The induced changes would not constrain local governments in the ICE study area from supporting activities that would meet changing economic conditions.

6.2.4.2.2 Preserve Agriculture and Agricultural Land

As indicated above in Section 6.2.3.3, the two induced land use changes would either not use agricultural land or would use agricultural land designated for development in future land use plans.

6.2.4.2.3 Diversify Economy

The induced changes would not constrain local governments in the ICE study area from efforts to diversify their economies. The business development on the mainland is one part of a large effort related to economic diversity presented in the county's economic development vision study described in Section 4.2.5.1 (Lane and Jolley, 2008).

6.2.4.2.4 Promote Tourism

The induced changes would not constrain local governments in the ICE study area from supporting activities that promote tourism.

6.2.4.2.5 Attract and Maintain a Workforce

The induced changes would not constrain local governments in the ICE study area from supporting activities that attract and maintain a workforce.

6.2.4.2.6 Develop Industries that are Compatible with Traditional Forms

The induced changes would not constrain local governments in the ICE study area from supporting activities that would develop industries that are compatible with traditional forms.

6.2.4.3 Ecosystem Protection Goals

Table 2-11 lists the ecosystem protection goals expressed by the agencies and public organizations. The achievement of these goals is closely tied to area land use plans. Both of the potential induced changes (shifting of the order of Outer Banks development and shifting the future businesses) fit within those plans. Each goal is addressed separately below. These itemized goals, which are summarized from a variety of plans, contain considerable overlap. In general, as discussed in Section 6.1, the additional approximately 68 acres forecasted for development would occur on land considered suitable for development by the Currituck County land use plan. Areas not considered suitable for development contain the county's most notable ecosystem features. Development on the road-accessible Outer Banks would continue to occur in existing subdivisions where habitat is generally already disturbed by fragmented habitat. Area local governments considered these ecosystem goals in establishing their land use plans and both potential induced changes would fit within the context of those plans and thus these goals.

6.2.4.3.1 Protect Ecosystems

The induced changes would not constrain local governments in the ICE study area or the state or federal governments from protecting ecosystems.

6.2.4.3.2 Promote Native Species

The induced changes would not constrain local governments in the ICE study area or the state or federal governments from promoting native species.

6.2.4.3.3 Protect Rare and Keystone Species

The induced changes would not constrain local governments in the ICE study area or the state or federal governments from protecting sensitive environments.

6.2.4.3.4 Protect Sensitive Environments

The induced changes would not constrain local governments in the ICE study area or the state or federal governments from protecting sensitive environments. The areas affected by either of the induced changes are outside of the natural heritage and conservation areas (North Carolina Coastal Land Trust, 2006).

6.2.4.3.5 Maintain Natural Processes

The induced changes would not prevent local governments in the ICE study area or the state or federal governments from maintaining natural processes. Induced development on the mainland has the potential to limit connectivity between two large forested wetland areas (Great Swamp and Maple Swamp); however, this connection is not identified as a specific goal.

6.2.4.3.6 Protect Coastal Ecosystems

The induced changes would not constrain local governments in the ICE study area or the state or federal governments from protecting sensitive environments. Shifting the order of Outer Banks development would only affect the sequence of development identified for development in existing CAMA land use plans and in already subdivided areas.

6.2.4.3.7 Protect Environmentally Fragile Areas

The induced changes would not constrain local governments in the ICE study area or the state or federal governments from protecting environmentally fragile areas.

6.2.4.3.8 Protect Aquatic Ecosystems

The induced changes would not constrain local governments in the ICE study area or the state or federal governments from protecting sensitive environments.

6.2.5 Compatibility of Induced Change with Land Use Plans and Development Regulations

This section discusses the compatibility of the two induced changes (shifting of the order of development on the Outer Banks and the shifting of a forecasted approximately 34 businesses to mainland Currituck County from the Outer Banks) with land use plans and development regulations presented in Section 2.3, including those for:

- Currituck County;

- Kitty Hawk,
- Southern Shores; and
- Duck.

6.2.5.1 Currituck County

The induced changes would be consistent with the Currituck County land use plan. The area near the Mid-Currituck Bridge was found in Section 6.1 to have enough suitable land to accommodate business development in the US 158/Mid-Currituck Bridge interchange area. This land is already zoned commercial and light industrial. Shifted development would occur in already subdivided lots. This development would be required to comply with the county's development regulations.

6.2.5.2 Kitty Hawk, Southern Shores, and Duck

Shifted future business and residential development could come from these towns, as well as other towns in the ICE study area. This change would not affect the towns' ability to apply the objectives of their land use plans or development regulations to the development that does occur. Some undeveloped properties would simply remain undeveloped or develop later than what might have occurred with the No-Build Alternative or ER2.

6.3 Cumulative Effects

This section is an assessment of the cumulative effects of the detailed study alternatives, including the Preferred Alternative, the induced changes associated with MCB2, MCB4, and the Preferred Alternative, and all other reasonably foreseeable activities in the ICE study area on its notable ecosystem and cultural/socioeconomic features, and their compatibility with local/regional goals, land use plans, and development regulations.

The ICE study area's directions and goals are described in detail in Section 2.0. The study area is shown to have been a continuously growing region for both permanent residents and resort development. At times the growth has been rapid. This was spurred on the Outer Banks by the continuation of NC 12 from the Dare-Currituck County line to Corolla in 1984. Development of public infrastructure has kept pace with this development. The ICE study area includes all of Currituck County and portions of Dare County. Both of these counties are covered by North Carolina's Coastal Area Management Act and, as such, have a multi-decade history of well-funded professional municipal planning.

The notable features in the ICE study area are described in detail in Section 3.0 and shown in Table 3-1 and Table 3-2. The notable ecosystem features are: dune system, floodplains, estuaries/water quality, public water supplies, groundwater, maritime forests, submerged aquatic vegetation, unconsolidated estuarine bottom, coastal marshes, non-coastal wetlands, waterbirds, Atlantic flyway, anadromous fish spawning areas, protected species, wild horses, Coastal Barrier Resources Act areas, natural

heritage areas, conservation areas, and areas of environmental concern (AEC). The notable socioeconomic features are: workforce housing, tourist housing, agriculture, historic structures and places, circulation and access, neighborhoods and village communities, and scenic and natural area character.

The project-related activities and project-induced changes (described in Sections 4.2.3 and 4.2.5), as well as other reasonably foreseeable impact-causing activities, are indicated in Table 5-1 and Table 5-2. Other reasonably foreseeable impact-causing activities are:

- Private development and the provision of infrastructure to serve that development;
- Other transportation projects presented in the *2009 to 2015 State Transportation Improvement Program* (STIP) and included in the No-Build Alternative;
- Logging in forested areas, including wetlands;
- Beach driving; and
- Accelerated sea level rise.

Of these five, the most notable other activity is the projected development through 2035. The population and land consumption figures in Table 6-1 were based on the medium growth rate in the Currituck County land use plan. These projections yield a population increase from 22,500 in 2005 to 47,100 in 2035, an increase of 110 percent in 30 years. This growth, based on densities assumed in the land use plan, could correspond to an additional development of 32,988 acres. At this average density, such residential development would be large lots and according to the UDO (Currituck County, 2008) could be expected to yield 30 percent impervious surface or 9,896 acres. Best management practices in the future would minimize the effects of runoff from this development. The actual development in the future is likely to include mixed uses as well as smaller lot subdivisions in village centers and conservation subdivision design. In such scenarios, the percentage of impervious coverage by lot would increase but, the total acres developed would decrease. Thus, anticipated development in Currituck County through 2035 with the No-Build Alternative could be expected to yield new impervious surface on the order of magnitude of 10,000 acres.

The detailed study alternatives, including the Preferred Alternative, are defined in the Preface. This assessment addresses the impacts of four future scenarios:

1. Continuation of existing trends (No-Build Alternative);
2. Continuation of existing trends plus the introduction of existing road improvements associated with ER2;

3. Continuation of existing trends plus the introduction of the existing road improvements and the Mid-Currituck Bridge associated with MCB2 (Options A and B) and the induced change resulting from a Mid-Currituck Bridge; and

4. Continuation of existing trends plus the introduction of the existing road improvements and the Mid-Currituck Bridge associated with MCB4 (Options A and B) or the Preferred Alternative and the induced change resulting from a Mid-Currituck Bridge.

The primary factor potentially affecting existing trends would be a Mid-Currituck Bridge with MCB2, MCB4, or the Preferred Alternative. Because neither the No-Build Alternative nor ER2 includes a Mid-Currituck Bridge, the cumulative effects of either are expected to be similar in type, although ER2 does provide traffic benefits that would reduce congestion and travel times. Further, the cumulative effects of MCB2, MCB4, and the Preferred Alternative are expected to be similar in that all include a Mid-Currituck Bridge. As noted above, forecasted growth in Currituck County through 2035 could result in additional development of 32,988 acres, with a potential increase in impervious surface of 10,000 acres. The direct land use impacts of the detailed study alternatives, including the Preferred Alternative, plus the corresponding indirect impacts would be an insignificant addition to the impact of development in Currituck County. NCTA would mitigate direct project impacts. Natural resource direct impacts are being addressed by avoidance, minimization, or mitigation consistent with programmatic agreements with natural resource agencies during the obtaining of required permits. The bottom line is that, for most of the notable features, the detailed study alternatives would not notably contribute to cumulative impacts on the resource. The cumulative effects for all the study alternatives are discussed by itemized notable features in Sections 6.3.1, 6.3.2, and 6.3.3.

Of these, noteworthy natural environmental features impacts would be as follows.

- Estuaries / Water Quality (Section 6.3.2.3) would be largely affected by the anticipated growth independent of any detailed study alternative. With any of the bridge alternatives, the potential additional commercial growth on the mainland with forecasted approximately 44 acres of impervious surface, and the direct impacts of runoff from additional roadways (for example, 71.5 acres with the Preferred Alternative, the least of the detailed study alternatives) are minor components of the cumulative impacts.

- Public Water Supplies (Section 6.3.2.4) similarly would be mostly affected by planned development. With any of the bridge alternatives, the location of a forecasted approximately 34 businesses on the mainland would exert minor additional water demand there.

- Submerged Aquatic Vegetation (Section 6.3.2.7) would be affected by the general conversion of agricultural land to developed land and, in the case of bridge alternatives, from shading by the bridge. During land development, the increase in sediment loading and turbidity would increase, although once developed with a

perennial ground cover, the conditions likely would be an improvement over tilled agricultural land. The Preferred Alternative would shade existing SAV beds, SAV habitat (as defined by the North Carolina Marine Fisheries Commission [NCMFC], which includes existing beds), and potential SAV habitat (water depths 6 feet or less with suitable substrate). Such impacts would be at 3.8 acres, 4.8 acres (inclusive of the 3.8 acres of existing beds), and 4.9 acres, respectively.

- Non-Coastal Wetlands (Section 6.3.2.10) would be affected by the cumulative effect of logging and, in the case of bridge alternatives, the direct impacts of land alteration and construction through Maple Swamp. Logging is the major factor and is a historic land use in non-coastal wetlands in the ICE study area.

Noteworthy socioeconomic features experiencing cumulative effects would be as follows:

- Agriculture (Section 6.3.3.3) currently is a major land use on the Currituck County mainland. The greatest factor affecting agriculture would be the projected 33,000 acres of new development between 2005 and 2035. With the bridge alternatives, possible induced commercial development of approximately 68 acres of current agricultural land would be a very minor contributing factor. ER2 would affect less than 2 acres of prime farmland soils and less than 2 acres of state and locally important farmland soils. The Preferred Alternative would affect approximately 37 acres of prime farmland soils and 72 acres of state and locally important farmland soils, primarily in the US 158/Mid-Currituck Bridge interchange area. This amount of farmland impact is comparable to the other detailed study alternatives that include a Mid-Currituck Bridge.

- Neighborhoods and Village Communities (Section 6.3.3.6) and Scenic and Natural Area Character (Section 6.3.3.7) would be most affected by 2035 by the extensive development forecasted for the ICE study area regardless of any detailed study alternatives. Control of these attributes would be most strongly determined by municipal planning measures. There also are potential project-related impacts. With ER2 or MCB2, the visual character and sense of place on the Outer Banks would be affected by a widening of NC 12. With MCB2, MCB4, or the Preferred Alternative, the scenic character of Currituck Sound would be affected by the presence of a bridge. The communities at either end of the bridge also would be affected by the visual and aural sense of the bridge.

6.3.1 Cumulative Effects on Notable Landscape and Waterscape Features

6.3.1.1 Currituck County Mainland

Like all landscapes, the Currituck County mainland is the cumulative legacy of physical features and past activities and actions. The phenomena that are influential enough to shape the landscape are considered driving forces or keystone processes. Even as late as 1950, Currituck County was a rural county with a sparse population (see Table 2-1). Agriculture was the primary activity, which was made possible by a program of ditching and draining of land to make it arable. There were village areas, but no town

centers emerged. Even through to today, there are no incorporated municipalities in the county.

However, since 1970, the mainland has experienced rapid population growth, largely as a bedroom community for people driving to work in the Hampton Roads area, the Outer Banks resort areas, and Elizabeth City. The first CAMA land use plan for the county was adopted in 1990. It was updated in 1998 but a Coastal Resources Commission (CRC)-certified update did not occur until 2006 and population continued to expand with the expanding Hampton Roads metropolitan region. This history of planning provided important county-driven management of future growth. In 2001 the Chesapeake Expressway opened, a 16.5 mile tolled highway in Chesapeake City, Virginia, connecting the urban interstates directly with northern Currituck County.

Looking at a landscape scale, the cumulative effects of all actions on the structure and function of the Currituck County mainland landscape would be dominated by ongoing development. This would occur with all of the detailed study alternatives. The most important factor on the landscape would be planning, directing, and setting standards for new residential development. At current projections, with current densities, development would spread to suitable land that is currently designated rural (See Section 6.1). The other important phenomenon that would be reasonably foreseeable is the continued fragmentation of the landscape. As stated, this would be the cumulative effects on the landscape under all of the detailed study alternatives, including the Preferred Alternative, and the No-Build Alternative.

6.3.1.2 North River Estuary

The cumulative effects from all actions on the structure and function of the North River estuary during the study period (to 2035) would be largely determined by the regulation of land uses on shore. Onshore development would affect the amount and quality of runoff into the estuary and create a need for more point source discharges, especially from water filtration plants and wastewater treatment plants. None of the activities associated with any of detailed study alternatives, including the Preferred Alternative, would have a measurable impact on the structure and function of the estuary.

6.3.1.3 Currituck Sound

A summary of the cumulative legacy of physical features, actions, activities, and events in Currituck Sound is discussed in Section 6.3.2.3 on estuaries and water quality as well as Section 6.3.1.4 on the Outer Banks landscape. The noteworthy driving forces have been the shoaling of the New Currituck Inlet in 1828 with the associated change in salinity, the changing populations of waterfowl, the decline of water quality since 1950, and, just recently, the water quality initiatives being developed by the USACE.

The cumulative effects from all actions on the structure and function of the Currituck Sound during the study period (to 2035) would be largely determined by the regulation of land uses on shore. Onshore development would affect the amount and quality of runoff into the estuary and create a need for more point source discharges, especially from water filtration plants and wastewater treatment plants. Under a bridge

alternative (MCB2, MCB4, or the Preferred Alternative), the sound would be bisected by the bridge. The primary impact of the bridge on the sound would be the introduction of pollutants from runoff, which would primarily affect the sound near the bridge. NCTA would comply with NC Session Law 2008-211 (An Act to Provide for Improvements in the Management of Stormwater in the Coastal Counties in Order to Protect Water Quality), to the maximum extent practicable, to minimize the impact of bridge runoff if the Preferred Alternative is selected for implementation. None of the activities associated with any of the detailed study alternatives would have a measurable impact on the structure and function of Currituck Sound.

6.3.1.4 Currituck County Outer Banks

The northern Outer Banks also manifests the cumulative legacy of physical features and past actions and activities. The recent history of the northern Outer Banks exposes the cumulative impacts of past actions and belies the effects of reasonably foreseeable activities on the landscape and its notable features.

The waterfowl resort period for the northern Outer Banks began after the last inlet closed in 1828. This changed Currituck Sound from an estuary with direct access to the ocean to an inland, low salinity water body that supported a large migratory bird population. In the latter half of the 19th century, sport hunting clubs began dominating the northern Outer Banks. These interests, often controlled out of state, assembled large property holdings. The most notable construction in the period was the Whalehead Club (originally Currituck Island), completed in 1925. Except for a small village at Corolla, next to the club and Currituck Light, all the hamlets north of Kitty Hawk died out.

The opening of Wright Memorial Bridge changed the course of the Outer Banks when it established a fixed hard link to the mainland in 1930. But the paved roadway, the Virginia Dare Trail, was built to the south, towards Roanoke Island. Travel to the northern Outer Banks still required ferries or driving on unpaved roads or beaches.

After the depression and the war, the hunting club lands began finding other uses. Two principal trajectories occurred: towards beach resort development or towards creation of wildlife refuges. The first areas to be subdivided were actually at the northern end next to the Virginia border. In the 1960s, this area was the closest to the resort areas of Virginia Beach and developers from there laid out new resorts with a planned road, Ocean Pearl Highway, coming down the Sandbridge area. However, in 1979, the US Fish and Wildlife Service (USFWS) closed regular access through Back Bay National Wildlife Refuge, effectively putting the new subdivisions more than 100 miles away from Sandbridge by car, the last 20 of which were past the end of NC 12. In the 1970s the northern Dare County beach resort communities of Southern Shores and Duck began developing and were incorporated as towns in 1979 and 2004, respectively.

However, up until 1984, the public roadway only extended north to the Dare County line where there was a gatehouse limiting use of the private road in Currituck County to property owners. In 1984, two important events occurred that continue to shape the

northern Outer Banks. The State of North Carolina purchased the private road in Currituck County, thereby extending NC 12 to Corolla. Also, the USFWS established the Currituck National Wildlife Refuge (CNWR), one unit of which straddles the width of the barrier island at the end of NC 12. Access to a paved road encouraged resort development on that portion of the Currituck Outer Banks. At the same time, the increase in conservation properties restricted activities on environmentally important lands. Both actions served to solidify the land use patterns that emerged on the northern Outer Banks.

One other important activity that has been significant on the Outer Banks is the passage of CAMA in 1974 by North Carolina. This law enabled a variety of environmental protections on coastal lands and waters including important regulations on beach management. It also enabled CAMA land use plans by counties and, by option, towns. Currituck County, Dare County, Kitty Hawk, Southern Shores, and Duck have all adopted and updated CRC-certified local land use plans, with Currituck County's first plan dating back to 1990. This has established a process and culture for community-oriented land use planning to plan for future growth.

Looking at a landscape scale, the cumulative effects of all actions on the structure and function of the Outer Banks landscape would be dominated by ongoing development. Storm processes and accelerated sea-level rise may also affect the Outer Banks in the study time period (to 2035). These would occur with all of the detailed study alternatives, including the Preferred Alternative. The Outer Banks are a distinctive landscape. The most important factor on the landscape would be planning, directing, and setting standards for new residential development. Currently, the landscape is actively planned and monitored at the local and state levels and developable land is generally subdivided. Still, land conversion, habitat loss, and landscape fragmentation would be expected for the Outer Banks. As stated, this would be the cumulative effects on the landscape under all of the detailed study alternatives and the No-Build Alternative.

6.3.2 Cumulative Effects on Notable Environmental Elements

6.3.2.1 Dune System

Increased day visitation north of NC 12 combined with trends in beach access and visitation could create added impacts on the dune system. The dunes, particularly in the conservation areas, are not equipped to accommodate foot traffic. The cumulative impacts of increased foot traffic by beach goers seeking privacy could trample important vegetation and disturb animal habitat. Anticipated and planned development would occur in part in the dune area.

There are no bridge-related actions that would combine with accelerated sea level rise to create a cumulative effect on this notable feature. Private development in the next 25 years could begin to be concerned with sea level rise. Dune maintenance could be seen as desirable and occur to protect existing and future beach front homes from beach erosion or sea level rise.

6.3.2.2 Floodplains

Floodplains in the ICE study area are ocean hazard zones, estuarine wetlands, or non-coastal wetlands. The various CAMA land use plans, as well as federal and state regulations, severely restrict land development in the 100-year floodplains. Floodplains are not considered suitable for development in area land use plans. Homes are built on piles above the 100-year flood elevation at coastal properties within the 100-year floodplain. Thus, there would be no cumulative effects expected from project related activities, induced change (MCB2 or MCB4), or private land development. The floodplain impacts of project-related activities are discussed in the revised *Other Physical Features Technical Report* (Parsons Brinckerhoff, 2011). If the floodplain were to change as a result of accelerated sea level rise, existing and future development would be at greater risk.

6.3.2.3 Estuaries / Water Quality

Recent investigations indicate that waters of Currituck Sound are potentially threatened by four sources: nutrient loading associated with non-point source runoff from agriculture, logging, and urban development; septic wastewater contamination from increased development on the Currituck Outer Banks; increased turbidity caused by human and naturally induced perturbations; and saltwater intrusion and pollution from canals linking Currituck Sound to southeast Virginia (USACE, 2010). Indirect and cumulative effects to water quality of construction, operation, and induced growth of a Mid-Currituck Bridge would largely be increased turbidity and its negative feedback loop. SAV is often used as an indicator of system health because of its importance in trophic webs and its sensitivity to environmental perturbations. Studies have well documented the decline of SAV in Currituck Sound and have concluded that turbidity is the leading cause and hypothesized that salinity is a correlated factor (USACE, 2010; Fine, 2008). Many factors can contribute to turbidity. There would be no dredging in Currituck Sound with the Preferred Alternative. In SAV habitat (including existing beds), turbidity curtains would be used when driving piles and pile jetting would be avoided.

Estuaries and water quality in the ICE study area would be affected by current (all of the detailed study alternatives) and induced (MCB2, MCB4, or the Preferred Alternative) land use trends and the operation of a Mid-Currituck Bridge. In comparing the No-Build Alternative and the detailed study alternatives and their associated future land use scenarios, the important factors are land uses in the watershed, bridge runoff, and land disturbance during construction. The first two are enduring through the study period (to 2035). The effects of induced growth associated with MCB2, MCB4, and the Preferred Alternative would be minor since the induced growth area on the mainland would be small (see Section 6.2.2.3). The constraining of development with the No-Build Alternative or ER2 would result in less potential for impact to estuaries and water quality. However, the reduction would be small within the context of all future development in the ICE study area, and by state law the first 1.5 inches of runoff from new impervious surfaces must be captured and treated. Thus, the impact of

development on estuaries and water quality would be virtually the same for all of the detailed study alternatives, including the Preferred Alternative.

Increased development in the ICE study area would create greater impervious surface (however, by state law the first 1.5 inches of runoff from new impervious surfaces must be captured and treated) and more septic or package treatment systems that would have the potential to negatively affect both Currituck Sound and North River. Some of the land converted would be current agricultural land, which has its own existing negative effects on water quality. The majority of this new development is expected to be residential. Bridge operations would affect water quality through runoff. With MCB2, MCB4, and the Preferred Alternative, runoff from bridges would flush pollutants directly into Maple Swamp and Currituck Sound from the bridge. (See the water quality discussion in the revised *Natural Resources Technical Report* [CZR Incorporated, 2011b].) With regard to project-related runoff, NCTA would comply with NC Session Law 2008-211 to the maximum extent practicable for the Maple Swamp and Currituck Sound bridges. Source control would be through the use of pavement sweeping and vacuuming on bridge decks. Capture and treatment would be through the use of bridge closed drainage systems for parts of the Maple Swamp and Currituck Sound bridges. (See Section 2.1.7 of this FEIS.)

While models of the levels of pollution in the sound do not exist, an increase in development using septic systems and traffic crossing the sound are both likely to diminish the quality of Currituck Sound. Land development regulations, low impact development, and best management practices are all local policies that can be used to limit the extent of non-point source pollution from the land.

The North River estuary would be similarly affected by increased development, although much of its shoreline in the upper reaches of the estuary is protected or managed conservation areas of Great Swamp. There would be no bridge runoff effect in North River.

6.3.2.4 Public Water Supplies

Public water supplies would continue to be an important issue in the ICE study area. Section 6.2.2.4 indicated that the only indirect effect of a Mid-Currituck Bridge on mainland water supplies would be the water necessary to support a forecasted approximately 34 additional commercial businesses on US 158. In the former case there would be sufficient water available in the near future with the completion of the Mainland Water Treatment Plant scheduled in June 2009.

Because a bridge project would have minor impacts beyond the capacity of the public water supply, all the detailed study alternatives, including the Preferred Alternative, would have similar outcomes with respect to public water supply. The primary driver of that outcome would be demand for water on the mainland because of residential and commercial growth. Section 3.3.2.4 explains the current water supply system. The Currituck County land use plan recognizes the impacts of development on residential water demand and warns that water supply demands are expected to grow rapidly by

2020. Currently planned capacity is unlikely to be sufficient to supply demand on the mainland in 2035. The non-road accessible northern Outer Banks are planned to be always on private (wells) water supply. Development in Dare and Currituck counties on the Outer Banks is foreseen to be within forecasted capacity.

6.3.2.5 Groundwater

The primary actions affecting groundwater are withdrawals for use and failing septic systems. These can combine to cause a saline or contaminated surficial aquifer. The project is not expected to affect substantially the cumulative impacts on groundwater resources. There are no direct impacts from the detailed study alternatives, including the Preferred Alternative, on groundwater. All of Currituck County's public water supply comes from groundwater. As of the 2006 CAMA land use plan (Currituck County, 2006), there were no wellhead protection plans submitted or approved for the three county-owned systems.

On the Outer Banks, there are no reasonably foreseeable project-related or induced impacts on groundwater. The induced land use change with MCB2, MCB4, and the Preferred Alternative, shifting the order of development on the Outer Banks, would merely affect the jurisdiction for permitting and monitoring development, but would not change the overall condition. If anticipated and planned development is constrained, there could be fewer septic systems to potentially fail and less demand on groundwater resources in the surface aquifer in the non-road accessible area.

Potential impacts on groundwater exist on the Currituck County mainland where the conversion of farmland to residential development is an independent activity that is expected to occur with or without the proposed project. Because of the lack of centralized sewage treatment and the preponderance of severely limited soils for infiltration, the ongoing private development of the mainland would increase threats to groundwater. The indirect land use change with MCB2, MCB4, and the Preferred Alternative, induced commercial development near the US 158 interchange, would add to this impact, although the magnitude of the induced development would be dwarfed by the anticipated extensive development throughout the mainland even without the project. Recognizing the importance of the groundwater resources, the number one (POLICY WQ1) water quality policy in the county's CAMA plan is: "Currituck County's GROUND WATER RESOURCES shall receive a level of protection commensurate with their enormous value. Efforts shall be made to monitor the quantity and quality of groundwater resources, with an eye toward preventing pollution, saltwater intrusion, or excessive drawdowns. Particular attention shall be given to locations near water and sewer treatment plants and areas with concentrations of septic tanks." (Currituck County, 2006)

6.3.2.6 Maritime Forests

There are no foreseen project-related activities or project-induced changes that would affect the maritime forests. Thus, future impacts to maritime forests would be the same for all of the detailed study alternatives, including the Preferred Alternative, and the No-Build Alternative. Large patches of maritime forest exist in protected conservation

areas. Existing trends of maritime forest loss would continue as existing subdivided lots are developed as described in Section 3.3.3.2. However, maritime forests occurring on wetlands would be less likely to be affected because of unsuitability for construction and wetlands protections. Similarly, the maritime forests on private land in the non-road accessible northern Outer Banks would be less affected because the limited development there is in the dunes closer to the ocean. Nonetheless, increased development throughout the Outer Banks would continue to degrade and fragment maritime forests.

6.3.2.7 Submerged Aquatic Vegetation

With the No-Build Alternative and all of the detailed study alternatives, including the Preferred Alternative, submerged aquatic vegetation (SAV) would be affected negatively by increased siltation and pollution caused by ongoing land development, especially on the mainland. To the degree that new residential development replaces tilled fields, the ultimate sediment load from runoff would be expected to decline. Also, accelerated sea level rise, even within the time-frame of this analysis, would likely affect SAV by increasing the depth of the sound in areas of existing SAV and SAV habitat (less than 6 feet deep with suitable substrate). In the case of a Mid-Currituck Bridge (MCB2, MCB4, and the Preferred Alternative), project related activities would negatively affect SAV in the project area. Specifically, a bridge would cause disturbance of SAV in the project area during the placement of bridge piles, although that impact would be minimized by the use of turbidity curtains and the avoidance of pile jetting. After completion, shading of the sound in the area of the bridge would also be detrimental to SAV. Shaded SAV would be mitigated. (See the revised *Natural Resources Technical Report* [CZR Incorporated, 2011b].)

6.3.2.8 Unconsolidated Estuarine Bottom

Unconsolidated estuarine bottoms would be directly impacted in the area of the bridge site, but there would be no indirect impacts from any of the detailed study alternatives. Sediment and turbulence would be the primary determinant of the size and health of these areas. There are no reasonably foreseeable cumulative effects on unconsolidated estuarine bottoms with any of the detailed study alternatives beyond that associated with the Mid-Currituck Bridge. The Preferred Alternative would place piles in 0.1 acre of estuarine bottom and shade 27.8 acres.

6.3.2.9 Coastal Marshes

Coastal marshes are Class III land, which indicates serious hazards for development (Currituck County, 2006). They are strongly protected from land development activities by the municipal plans, as well as state and federal laws. Therefore, the only reasonably foreseeable cumulative effect on coastal wetlands in the ICE study area would come in the case of a Mid-Currituck Bridge. However, the Preferred Alternative would be located so that no coastal marshes would be disturbed. (See the revised *Natural Resources Technical Report* [CZR Incorporated, 2011b].)

6.3.2.10 Non-Coastal Wetlands

Non-coastal wetlands are extensive in the ICE study area. One large wetland, known as Maple Swamp, is particularly critical for its size and because MCB2, MCB4, and the

Preferred Alternative would place a bridge in Maple Swamp (Option A), or would place fill in Maple Swamp for the mainland bridge approach while removing existing Aydlett Road through the swamp and making provisions for wildlife passage under the fill for both large and small animals (Option B). Option B is not included in the Preferred Alternative. With any of the detailed study alternatives, the non-coastal wetlands that are forested, and Maple Swamp in particular, would continue to experience logging. Extensive logging is occurring in Maple Swamp, as discussed in Section 3.3.3.6.

For the detailed study alternatives that include a bridge (MCB2, MCB4, and the Preferred Alternative), Maple Swamp would experience the cumulative effects of project related activities (modification of regime, land transformation and construction, and land alteration), project-induced development, and logging. The modification of regime would come about through shading (Option A, which is included in the Preferred Alternative) or filling (Option B) of wetland habitat, further opening permanently the forest canopy along the existing powerline easement, and adding traffic noise levels in the swamp. Option B also would involve revegetating the existing Aydlett Road right-of-way, which ultimately would restore the canopy and eliminate this forest edge. Land alteration in Maple Swamp would be shading or filling and the permanent loss of trees under and adjacent to the bridge. Option A also would result in the purchase of land in Maple Swamp and Great Swamp in addition to the project right-of-way. This is land that would no longer have direct highway access. Thus, these landlocked parcels would be purchased (assuming successful negotiations with willing sellers) and protected from future logging. Option B, which would close Aydlett Road, also would result in the purchase of landlocked parcels. See the revised *Natural Resources Technical Report* (CZR Incorporated, 2011b) for additional discussion of these impacts. The indirect effects of induced growth are discussed in Section 6.2.2.10.

The cumulative effects of a Mid-Currituck Bridge and other activities would be to create a slightly more fragmented forested wetland and less interior forested space. The recent and ongoing logging of private lands in Maple Swamp is the largest contributing factor to this phenomenon rather than the bridge, some of which will be built in recently logged areas. Option A would reduce by the acreages noted above, the opportunity for logging in Maple Swamp.

6.3.2.11 Waterbirds

The ICE study area contains extensive waterbird habitats. Declining numbers since 1950 suggest environmental stresses to the habitats (USACE, 2010). The No-Build Alternative and ER2 would pose the least potential cumulative impact because they would utilize already developed land. With MCB2, MCB4, and the Preferred Alternative, the activity of some waterbirds could be disrupted near the Mid-Currituck Bridge during construction, mostly during winter months, but the primary feeding/foraging, resting, and nesting sites for waterfowl and water birds throughout the year are associated with marshy and shallow water areas to the north and south of the preferred bridge alignment. Although waterfowl usage of the sound is often variable year to year and over time and seems to be declining, the sound could easily become more important to waterfowl in the future. The presence of a bridge in the mid-portion of the sound would

be unlikely to alter substantially the existing or future number of waterfowl that may use Currituck Sound because impacts to habitat would be confined to 4.8 acres of SAV habitat (including existing beds) by shading. This impact would be mitigated.

6.3.2.12 Atlantic Flyway

As the landscapes of the ICE study area are altered, with a trend towards greater residential development, the Atlantic Flyway for migrating species would be negatively affected. This would occur as a cumulative effect under all five detailed study alternatives as this development is expected regardless of the project. The only induced land use change from a bridge alternative is discussed in section 6.2.2.12 and is found to have no measureable impact on the Atlantic flyway. While a bridge would affect the ICE study area both through land disturbance and regime modification in the project site area, this area is small in comparison to the continental scale of the flyway. In the ICE study area, there are extensive patches of conservation land protected by state, federal, and conservancy agencies.

6.3.2.13 Anadromous Fish Spawning Areas

Anadromous fish spawning areas are in the upland streams on the mainland, especially North River and Northwest River. There are no reasonably foreseeable activities that would create cumulative effects on anadromous fish spawning areas.

6.3.2.14 Protected Species

Protected species in Currituck and Dare counties are listed in Appendix B. They include species on the federally endangered species list as well as bald eagles, protected by the Bald and Golden Eagle Protection Act. The terrestrial protected species in the ICE study area are largely associated with the natural heritage areas (see Section 6.3.2.16) or the Outer Banks ecosystems (see Sections 6.3.2.1 and 6.3.2.6). Beach areas for protected turtle species and piping plovers are especially critical. Aquatic species are associated with the estuarine system.

The revised *Natural Resources Technical Report* (CZR Incorporated, 2011b) indicates no adverse direct impacts on protected species from project-related activities for the five detailed study alternatives. Similarly, project-induced change would not adversely affect protected species as indicated in Section 6.2.2.14. With MCB2, MCB4 and the Preferred Alternative, there is a reasonable expectation of induced beach driving if it remains unregulated, which would, in effect, represent a marginal increase of an existing activity. The current and ongoing beach driving already substantially degrades this habitat for nesting of protected species. Negative impacts on protected species habitats in the ICE study area would be dominated by ongoing private development of the landscapes and private land management, notably logging in non-coastal wetlands such as Maple Swamp. Increased beach use and habitat fragmentation associated with these land use issues have the potential to degrade opportunities for protected species. As noted in Section 6.3.2.16, there are extensive conservation areas in the ICE study area protecting critical coastal habitats.

6.3.2.15 Wild Horses

There are no foreseen project-related activities which would affect the wild horses or their habitat. Continued future private development of the non-road accessible northern Outer Banks would be expected to affect the horses adversely. Increased land development and altered vegetation would reduce and fragment the habitat. Furthermore, increased vehicular traffic that would occur because of increased development, seasonal population, and day visitors would create a greater likelihood of horse-vehicle collisions. Cumulatively, these would combine to degrade horse habitat. The county's policy emphasis for the area is to allow "very low to medium density residential development without infrastructure or service investments" (Currituck County, 2006).

6.3.2.16 CBRA Areas, Natural Heritage Areas and Conservation Areas

In Currituck County, the non-road accessible northern Outer Banks is a designated Coastal Barrier Resources Act area, as is the Audubon Society refuge at the Currituck/Dare County Line. Also, there are 34 natural heritage areas listed in the Currituck County land use plan, as well as natural heritage sites listed in the Dare County towns, most notably Kitty Hawk Woods. Neither of these designations is by itself regulatory, and much of the land is privately owned, while in other cases large parcels are owned by the National Park Service, North Carolina Wildlife Resources Commission, and others. The county and town land use plans (Currituck County, 2006; Community Planning Collaborative Inc., 2004; Town of Southern Shores, 2010; and Community Planning Collaborative Inc., 2005), which are approved by the North Carolina Coastal Resources Commission, are sensitive to conservation areas in these coastal landscapes and guide development in a way to minimize detrimental impacts.

Taken as a whole, the natural areas in the ICE study area are a patchwork of sites that are largely discussed in the notable features. One of the most important is Maple Swamp, whose cumulative effects are discussed in Section 6.3.2.10. As a system, the cumulative effects coming from all of the detailed study alternatives, including the Preferred Alternative, and the No-Build Alternative would be dominated by the ongoing patterns of development. To the degree that local land use plans and the CAMA permitting process protects natural areas, the impacts on the designated areas should be minimal.

Any future development in ICE study area would have potential to cause the introduction of invasive species during both the construction phase and the ongoing use of the facilities. See Section 6.3.2.16 regarding the potential to spread of invasive species once introduced and known species in the Mid-Currituck Bridge project area.

6.3.2.17 Areas of Environmental Concern (AECs)

Project-related impacts on AECs are not landscape wide, but associated with the project site alone. The Preferred Alternative would not affect CAMA wetlands. Bridge piles would affect 0.1 acre of the bottom of Currituck Sound and bridge the sound's shorelines. Both are CAMA AECs. MCB2/C2 would have the greatest impact to CAMA wetlands, with 2.2 acres of CAMA wetlands affected by fill and clearing. MCB2/C2 also

would have the greatest impact to CAMA AECs, with 2.5 acres of mainly fill and clearing impacts. ER2 and MCB4/C1 would result in a minimal effect (less than 1 acre of impacts) on CAMA resources. A CAMA major permit would be required for all of the detailed study alternatives. A Mid-Currituck Bridge with MCB2, MCB4, and the Preferred Alternative would cross coastal shoreline areas on its eastern and western ends.

Induced land use changes resulting from MCB2, MCB4, and the Preferred Alternative would occur in accordance with the Currituck County land use plan and zoning. The land use plan, approved by the North Carolina Coastal Resources Commission, specifically protects AECs from new development through a land use suitability analysis. Private development and accelerated sea level rise could also affect AECs. Cumulative effects on water quality in the sound are discussed in Section 6.3.2.3. While the cumulative impacts from all sources would remain an important issue in future planning of this growing region, there are no other reasonably foreseeable cumulative effects from actions related to the detailed study alternatives, including the Preferred Alternative.

6.3.3 Cumulative Effects on Notable Socioeconomic Features

This section is a systematic consideration of potential cumulative effects on notable cultural and socioeconomic conditions as presented in Table 5-2.

6.3.3.1 Workforce Housing

As indicated in Section 4.2.1, there is not likely to be affordable or "workforce" housing on the Outer Banks, limiting the number of workers that could live there irrespective of the changes in access to the Outer Banks. Thus, the development of workforce housing in mainland Currituck County would be expected with the No-Build Alternative and the detailed study alternatives, including the Preferred Alternative. As discussed in Section 4.2.5, while the pattern of residential development on the mainland could change with a Mid-Currituck Bridge, the change would not be concentrated in a single location, but rather scattered among lands considered suitable for development in the Currituck County land use plan.

6.3.3.2 Tourist Housing

The development of tourist housing on the Outer Banks would be expected to occur in the form reflected by the current subdivisions and local government development requirements, as discussed in Sections 4.2.3 to 4.2.5. As discussed in Section 4.2.3, the detailed study alternatives, including the Preferred Alternative, would reduce the potential for severe congestion to constrain the demand for new development in the ICE study area. MCB2 would reduce this potential constraint the most, followed by MCB4 and the Preferred Alternative, and then ER2.

6.3.3.3 Agriculture

There is no agricultural land in the Dare County portion of the ICE study area. Agriculture exists in Currituck County on the mainland. The biggest impact on

agricultural land use during the study timeframe will be the continued private development of land to serve a growing population. Section 6.1 found that Currituck County has enough medium and highly suitable land to continue its 2025 land use plan density assumptions into 2035. However, that would include use of development-suitable land classified as rural areas in the 2025 plan. This is by no means certain. Currituck County, in developing its 2035 plan, could choose to increase densities and reserve more land for agricultural use. As it stands, the impact on agricultural land between now and 2035 would be substantial.

The Currituck County land use plan indicates that agricultural land comprises 32 percent of the mainland, or 43,878 acres out of the total mainland acreage. The Currituck County land use plan also indicates that out of the 43,878 acres, there are approximately 30,000 acres in production as well as one commercial timbering operation. The amount of agricultural land has been diminishing by 500 acres per year, as per 2006 estimates. If that rate continues, by 2035 there will be 14,000 fewer acres in agriculture than in 2007. Additionally, Currituck County's agricultural employment sector has seen a steady decline over the last several years. This reduction of agricultural land and activity has resulted from the pressure for residential development. In order to reduce the loss of agricultural resources, the county is actively engaged in the NC Farmland Trust Program and is seeking to preserve 5,000 acres of farmland over a ten-year period through its Farmland Preservation Agricultural Advisory Board.

MCB2, MCB4, and the Preferred Alternative are forecasted to introduce approximately 68 acres of business development at the US 158/Mid-Currituck Bridge interchange area in Currituck County. This represents 0.2 percent of the 33,000 acres of land projected to develop between 2005 and 2035, a minimal difference. Assuming all 68 acres are on existing farmland, this added burden to agriculture would be 0.5 percent of the lost agricultural land by 2035.

In addition to the induced development, MCB2, MCB4, and the Preferred Alternative can be expected to use up to 117 acres of prime soils or state and locally important soils. (For example, for the Preferred Alternative it is 37 acres of prime soils and 72 acres of state and locally important soils.) This represents 0.4 percent of the acres of land projected to develop by 2035. Assuming all 117 acres are currently in active agriculture, this would be 0.8 percent of the lost agricultural land by 2035.

The combined direct and indirect effects of MCB2, MCB4, and the Preferred Alternative on agricultural land may be as high as 185 acres by 2035. This is 0.4 percent of the total current agricultural land on the mainland and 1.3 percent of the agriculture land that will be lost by 2035, given current rates of development. Thus, cumulative agricultural impacts would essentially be the same for the No-Build Alternative and the detailed study alternatives.

6.3.3.4 Historic Structures and Places

Continued development of the Currituck County mainland would put its historic resources at risk. The level of risk would be the same for the No-Build Alternative and the detailed study alternatives since the risk is associated with the occurrence of currently forecasted development and not changes in development patterns or rates caused by the detailed study alternatives. The risk also is not related to the number of day visitors since the potential for impact relates to the redevelopment of properties containing historic resources and increased day visitors will be concentrated mostly in the northern Currituck beaches with some increase in the NC 12-accessible beaches. As shown in Figure 3-7, the only historic resources on the Outer Banks are in the Corolla Historic District on the sound side in Corolla. The primary assets here are protected. Although general economic activity could increase from increased day visitors thereby putting pressure on historic resources to be redeveloped, this potential for increased economic activity is dwarfed as a component of cumulative impacts compared to anticipated and planned development on the mainland and Outer Banks. As discussed in Section 6.2.3.4, the induced development pattern changes associated with MCB2, MCB4, and the Preferred Alternative would not affect areas containing historic resources. Historic resources on the mainland are not in the US 158/Mid-Currituck Bridge area where induced development is expected to occur. On the Outer Banks, only the order of development is expected to change with the detailed study alternatives and not its location or character.

6.3.3.5 Circulation and Access

Changes in circulation and access would result from the detailed study alternatives, including the Preferred Alternative, and the other transportation projects presented in NCDOT's *2009 to 2015 State Transportation Improvement Program* (STIP) and included in the No-Build Alternative, as described in the *Alternatives Screening Report* (Parsons Brinckerhoff, 2009). These projects would result in the following impacts to circulation and access:

- With the detailed study alternatives, reductions in congestion and travel time in the project area (see Chapter 2 of the FEIS), with the Mid-Currituck Bridge offering substantial travel time reductions for those traveling to the Currituck County Outer Banks;

- Changes in local property access associated with improving existing roads with the detailed study alternatives, whose impacts are discussed in Sections 6.4.1 and 6.4.2 of the revised *Community Impact Assessment Technical Report* (Parsons Brinckerhoff, 2011);

- Reductions in congestion on other road improvement projects included in the No-Build Alternative and assumed as built in the detailed study alternatives; and

- Reductions in hurricane evacuation clearance times associated with the detailed study alternatives, as discussed in Chapter 2 of the FEIS, as well as additional

hurricane clearance times associated with the road projects in the No-Build Alternative.

Taken together, while causing isolated small inconveniences where property access is changed, the improvements would create a beneficial impact on travel in the ICE study area. As discussed in Chapter 2 of the FEIS, the greatest benefit would come with MCB2, followed by MCB4 and the Preferred Alternative, and then ER2.

One additional potential cumulative impact occurs when considering forecasted sea-level rise. As this phenomenon occurs, the probability of the Outer Banks being inundated and breached increases. This is most likely to occur on NC 12 at the north end of Duck. Were this to happen, then only MCB2, MCB4, and the Preferred Alternative would provide an egress off the Currituck Outer Banks.

6.3.3.6 Neighborhoods and Village Communities

Since the detailed study alternatives, including the Preferred Alternative, would only shift the timing of development, the cumulative effects of the No-Build Alternative and the detailed study alternatives would consist of the impacts of expected future development plus the additional localized direct impacts of the detailed study alternatives.

In general with any of the detailed study alternatives, given the forecasted extent of development expected in Currituck County, the presumed build-out of the road accessible Outer Banks, and continued development in the non-road accessible Outer Banks (although small), as well as traffic growth associated with development, substantial changes in the character of the ICE study area can be expected.

In the non-road accessible Outer Banks, feelings of isolation would diminish as beach and near-beach lots continue to develop and travel by motor vehicles on the beach continues to increase. The mainland would change from a mostly rural area with expanses of farmland to a near-continuous low density residential development and their associated supporting services, including businesses and public services. On the NC 12-accessible Outer Banks, the remaining undisturbed developable land would be in-filled, eliminating remaining feelings of isolation.

The addition of widened roads associated with ER2 and MCB2 also would change the visual character of the parts of the Outer Banks through which they would pass. On NC 12, vegetation would be cleared for drainage features, opening up views of and from the wider road. Some of the sense of intimacy and isolation along NC 12 would be lost with this change. Along US 158 east of the Wright Memorial Bridge, the super-street would be the only street of its scale on the Outer Banks. The interchange would be the only interchange on the Outer Banks. MCB4 and the Preferred Alternative would not include the improvements on US 158 east of the Wright Memorial Bridge (except for the addition of a third outbound evacuation lane), and NC 12 widening would be confined to approximately 2 to 4 miles in Currituck County, so its impacts on neighborhood and village communities along NC 12 would be less.

The C1 terminus of MCB2, MCB4, and the Preferred Alternative would have substantial impacts on the Corolla Bay subdivision. However, the C1 terminus was adjusted with the Preferred Alternative to reduce Corolla Bay impacts. The Preferred Alternative would pass through the currently unimproved Phase II of Corolla Bay, so Phase I would not be divided.

Finally, as discussed in the revised *Community Impact Assessment Technical Report* (Parsons Brinckerhoff, 2011), a Mid-Currituck Bridge with MCB2, MCB4, and the Preferred Alternative would affect the community of Aydlett. Although there would be no traffic impacts from the bridge alternatives, a bridge would change the visual scene of Currituck Sound and at night would introduce lighting in an otherwise dark night sky area. Also, although within levels that do not require consideration of noise barriers as mitigation, traffic noise from the bridge would be audible in Aydlett. Combined with the development expected on the mainland and Outer Banks, Aydlett will feel less like a remote, dark-sky place.

6.3.3.7 Scenic and Natural Area Character

Change in scenic and natural character in the ICE study area would mirror those described for neighborhoods and villages. Except for those portions of the ICE study area considered unsuitable for development and water features, by 2035 much of the scenic and natural character in the ICE study area would be lost. This change would be similar for the No-Build Alternative and the detailed study alternatives. The one difference among the detailed study alternatives is that MCB2, MCB4, and the Preferred Alternative would introduce the Mid-Currituck Bridge to views of Currituck Sound. Logging would affect the scenic and natural character of the areas logged. Sea-level rise would affect the estuarine edges by changing ecosystems determined by depth to water table. Of particular note would be the expansion of coastal marshes into areas that are currently forested swamps.

6.3.4 Compatibility with Local/Regional Goals

This section discusses the cumulative effects as they relate to the goals expressed by local and regional agencies and public organizations, including:

- Social health and well-being goals;
- Economic opportunity goals; and
- Ecosystem protection goals.

The achievement of these goals is closely tied to area land use plans. Each goal is addressed below.

6.3.4.1 Social Health and Well-Being Goals

Table 2-9 lists the social health and well-being goals expressed by the agencies and public organizations. The achievement of these goals is closely tied to area land use

plans, whose goals are generally achieved with the No-Build Alternative and the detailed study alternatives, including the Preferred Alternative.

6.3.4.1.1 Achieving Adequate, Appropriate and Accessible Open Space and Recreation

These goals would be achieved over the long term as the land use plan is implemented. Open space and recreation opportunities would be similar with all of the detailed study alternatives. The detailed study alternatives, including the Preferred Alternative, would include space for a multi-use path along NC 12 in Currituck County where one does not exist today. The Mid-Currituck Bridge would have a 10-foot wide shoulder that could be used by bicyclists. Additional provisions for bicyclists and pedestrians to use the bridge would be considered during final design.

6.3.4.1.2 Comply with State and Federal Water and Air Quality Laws

It would be presumed that as development occurs, the requirements of state and federal water and air quality laws would be met. However, as more development occurs, the potential for water quality and air quality impacts would increase. Differences in this potential between the detailed study alternatives, including the Preferred Alternative, are not expected because the extent of future development would be essentially identical for all of the detailed study alternatives.

6.3.4.1.3 Preserve Heritage

Given the impacts to the notable cultural and socioeconomic features of the ICE study area, as described above in Section 6.3.3, it would seem that much that symbolizes the heritage of the area, except for remaining historic resources and wildlife refuges would be lost to development with the No-Build Alternative and any of the detailed study alternatives, including the Preferred Alternative.

6.3.4.1.4 Promote Land Use Patterns with a Sense of Community

These goals would be achieved over the long term as the land use plan is implemented with any of the detailed study alternatives, including the Preferred Alternative. However, as more development occurs, the spaces between existing communities would disappear. New development would dominate over older communities. Both of these factors would cause a loss in the sense of community.

6.3.4.1.5 Promote a Healthy and Safe Environment

These goals would be achieved over the long term as the land use plan is implemented with any of the detailed study alternatives, including the Preferred Alternative.

6.3.4.1.6 Promote Equitable Use of Public Trust Assets, Particularly in the Form of Beach Access

These goals would be achieved over the long term as the land use plan is implemented with any of the detailed study alternatives, including the Preferred Alternative. However, as in-fill development or increased day visitation occurs on the Outer Banks, more visitors would seek access to public trust assets, and land use plans do not call for increasing the number of public access points and associated facilities.

6.3.4.1.7 Use Growth Management Techniques to Achieve Land Use Goals

Currituck and Dare counties and each respective incorporated town in Dare County have active and aggressive growth management tools which may include density requirements, zoning, PUDs, land use plans, unified development ordinances, and impacts fees (see Table A-1 in Appendix A). These tools have been used in the past to achieve land use goals and it is expected that they would continue to be used in the future with the No-Build Alternative and the detailed study alternatives, including the Preferred Alternative.

6.3.4.1.8 Ensure an Efficient Transportation System

The manner in which the No-Build Alternative and the detailed study alternatives, including the Preferred Alternative, would help ensure an efficient transportation system is discussed in Section 6.3.3.5. As discussed in Chapter 2 of the FEIS, the greatest benefit to transportation efficiency would come with MCB2, followed by MCB4 and the Preferred Alternative, and then ER2.

6.3.4.1.9 Protect Landscape Aesthetics

Given the impacts to the scenic and natural area character discussed in Section 6.2.3.7, it would seem that much of the existing landscape aesthetics would be lost to development with the No-Build Alternative and any of the detailed study alternatives, including the Preferred Alternative.

6.3.4.1.10 Protect Floodways and Wetlands

Floodplains and any associated floodways are not included in land suitable for development in area land use plans. It is expected that development would have to demonstrate compliance with floodplain ordinances. Thus, cumulative effects to floodways would not be expected. Cumulative effects to wetlands are discussed in Sections 6.3.2.9 and 6.3.2.10.

6.3.4.2 Economic Opportunity Goals

Table 2-10 provides a list of the economic opportunity goals expressed by the agencies and public organizations. The achievement of these goals also is closely tied to area land use plans. Each goal is addressed separately below.

6.3.4.2.1 Support Activities to Meet Changing Economic Conditions

None of the activities associated with cumulative effects would constrain local governments in the ICE study area from supporting activities that would meet changing economic conditions.

6.3.4.2.2 Preserve Agriculture and Agricultural Land

No agricultural land is in the Dare County portion of the ICE study area. This goal could be met through 2025 as defined by the Currituck County land use plan, whose horizon year is 2025. This goal may not be achieved in the years after 2025 for reasons discussed in Section 6.3.3.3.

6.3.4.2.3 Diversify Economy

None of the activities associated with cumulative effects would constrain local governments in the ICE study area from supporting activities that would diversify the economy.

6.3.4.2.4 Promote Tourism

None of the activities associated with cumulative effects would constrain local governments in the ICE study area from promoting tourism.

6.3.4.2.5 Attract and Maintain a Workforce

None of the activities associated with cumulative effects would constrain local governments in the ICE study area from attracting and maintaining a workforce.

6.3.4.2.6 Develop Industries that are Compatible with Traditional Forms

None of the activities associated with cumulative effects would constrain local governments in the ICE study area from developing industries that are compatible with traditional forms.

6.3.4.3 Ecosystem Protection Goals

Table 2-11 lists the ecosystem protection goals expressed by the agencies and public organizations. The achievement of these goals is closely tied to area land use plans. Since the ICE study area is within counties covered by CAMA, land use plans are available that are required to be in place and periodically updated. These plans are professionally prepared and approved by the North Carolina Coastal Resources Commission and county and town governments. This progressive protocol has led to a planning regime in which ecosystem protection goals are well articulated and consistent with adopted plans and zoning ordinances.

In general, development is planned to occur on land considered suitable for development by the Currituck County land use plan and by the plans of Kitty Hawk, Southern Shores, and Duck. Areas not considered suitable for development contain the county's most notable ecosystem features. Development on the road-accessible Outer Banks would continue to occur in existing subdivisions where habitat is generally already disturbed by fragmented habitat. Area local governments considered these ecosystem goals in establishing their land use plans and both potential induced changes would fit within the context of those plans and thus these goals. The one area that is not considered desirable for development is the non-road accessible northern Outer Banks. This area was subdivided before the county had a land use plan or zoning ordinance. County goals are to limit the amount and intensity of development in that location (see Section 4.2.3).

These itemized goals, which are summarized from a variety of plans and the goals of non-governmental organizations (see Appendix A), contain considerable overlap.

6.3.4.3.1 Protect Ecosystems

The cumulative effects of reasonably foreseeable activities in the ICE study area, including a continued progressive regime of land use planning, would not constrain local governments or the state or federal governments from protecting ecosystems.

6.3.4.3.2 Promote Native Species

The cumulative effects of reasonably foreseeable activities in the ICE study area, including a continued progressive regime of land use planning, would not constrain local governments or the state or federal governments from promoting native species.

6.3.4.3.3 Protect Rare and Keystone Species

The cumulative effects of reasonably foreseeable activities in the ICE study area, including a continued progressive regime of land use planning, would not constrain local governments or the state or federal governments from protecting rare and keystone species.

6.3.4.3.4 Protect Sensitive Environments

The cumulative effects of reasonably foreseeable activities in the ICE study area, including a continued progressive regime of land use planning, would not constrain local governments or the state or federal governments from protecting sensitive environments.

6.3.4.3.5 Maintain Natural Processes

The cumulative effects of reasonably foreseeable activities in the ICE study area, including a continued progressive regime of land use planning, would not prevent local governments or the state or federal governments from maintaining natural processes. Although natural processes are identified as a general goal, none of the planning jurisdictions currently state a specific planning goal of landscape connectivity and protecting green infrastructure as a way to protect natural processes. The natural areas are mapped as discrete patches, but the region-wide planning does not incorporate a green infrastructure strategy. Cumulative activities, especially development, on these landscapes are likely to affect negatively the opportunities for green infrastructure in the future.

6.3.4.3.6 Protect Coastal Ecosystems

The cumulative effects of reasonably foreseeable activities in the ICE study area, including a continued progressive regime of land use planning, would not constrain local governments or the state or federal governments from protecting coastal ecosystems.

6.3.4.3.7 Protect Environmentally Fragile Areas

The cumulative effects of reasonably foreseeable activities in the ICE study area, including a continued progressive regime of land use planning, would not constrain local governments or the state or federal governments from protecting environmentally fragile areas.

6.3.4.3.8 Protect Aquatic Ecosystems

The cumulative effects of reasonably foreseeable activities in the ICE study area, including a continued progressive regime of land use planning, would not constrain local governments or the state or federal governments from protecting aquatic ecosystems.

6.3.5 Compatibility with Land Use Plans and Development Regulations

The Mid-Currituck Bridge and other improvements to existing roads assumed in the No-Build Alternative would be compatible with plans, as would the two induced changes associated with MCB2, MCB4, and the Preferred Alternative. Development forms in the ICE study area are expected to follow area land use plans and development regulations, as discussed in Section 4.2. In two areas, an incompatibility with plans would be found:

1. The NC 12 widening components of the detailed study alternatives are not proposed in area plans, except those on the Currituck County Outer Banks for NC 12 (Currituck County, 2006; Community Planning Collaborative, 2005; and Town of Southern Shores, 2010). Active opposition to any widening of NC 12 in Southern Shores and Duck was expressed during the citizen involvement process for the DEIS.

2. Once beyond the 2025 horizon year of the Currituck County land use plan, if population and density trends prior to 2025 were to continue to 2035, land suitable for development but designated as rural areas would begin to develop.

7.0 Evaluation of Analysis Results

This chapter evaluates the assumptions made in the previous sections and considers uncertainty and how that uncertainty could influence the range of indirect and cumulative effects. This consideration is called for in Step 7 of the *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina* (NCDOT, 2001).

The impact causing activities, described in Chapter 4, are primarily associated with development. The exceptions are logging and accelerated sea-level rise. Development impacts include encroachment alteration effects from development forecasted for the No-Build Alternative (Section 4.1) and the access alteration effects associated with the detailed study alternatives, including the Preferred Alternative, (Section 4.2), including those related to:

1. Increased permanent residents;

2. Increased day visitors;

3. Increased development on the NC 12-accessible Outer Banks;

4. Increased development on the non-road accessible Outer Banks; and

5. Increased development in mainland Currituck County.

As documented in Section 4.2, only items 2, 3, and 5 are expected to be of note, with only items 3 and 5 related to actual land use changes. In the case of the two other possible induced changes discussed in Section 4.2, it was concluded that their potential was minimal or not reasonably foreseeable. Thus, the potential for induced impacts or for making a contribution to cumulative effects would be minimal, and they were not addressed in either the indirect or cumulative effects assessment in Chapter 6.

The question this chapter considers is the sensitivity of the assessment of impacts in Chapter 6 to change, should the impact-causing activities be different from what was concluded in Chapter 4 in terms of their characteristics, extent, and rate of occurrence. Development, with associated land use change, is the primary impact-causing activity in the ICE study area. The nature of the impacts from future activities is highly dependent on the existing subdivision of land, the guidance for development contained in land use plans, and the requirements of development associated with local, state, and federal ordinances and laws. Thus, the principal question in this sensitivity analysis is whether these considerations can accommodate changes in development trends without notably altering the impact of that development on notable ecosystem and socioeconomic features. The cause-effect relationships of development to impacts would be similar if this is the case.

To answer this overriding question, the following questions are considered in this evaluation:

1. Is the amount of land classified as suitable for development or subdivided for development in Currituck County and the Dare County portion of the ICE study area only adequate to serve forecasted 2035 development or would additional land remain available; and if so, how much? It is presumed that such additional suitable land, if not classified for conservation, could be used if development rates are higher than anticipated before 2035. The more land forecasted to remain available after 2035, the lower the risk that there would be a demand for development of conservation lands and lands not suitable for development prior to 2035. On the other hand, development could be less than anticipated, particularly if the No-Build Alternative could lead to traffic conditions so bad that congestion retarded expected economic activity and development.

2. Is the amount of land classified as suitable for development within the vicinity of the end of the bridge where new business development is considered likely to occur only adequate to serve the approximately 34 new businesses forecasted or would additional land remain available; and if so, how much?

3. If notable numbers of new permanent residents were to move to the Outer Banks, particularly with MCB2, MCB4, and the Preferred Alternative, what type of impacts might occur?

4. If notable numbers of day visitors, particularly with MCB2, MCB4, and the Preferred Alternative, were to visit to the Outer Banks, what type of impacts might occur?

5. If demand for homes on the non-road accessible Outer Banks were to increase substantially, what type of impacts might occur?

The rest of this chapter addresses each of these questions and reaches conclusions on the risk that impacts to notable features would be substantially different from what is discussed in Chapter 6.

7.1 Cumulative Development and Land Availability

Section 6.1 indicates that Currituck County has 34,435 acres of available high and medium suitability rated land, with 32,988 acres that are anticipated for development by 2035. This finding indicates that 1,447 acres of high and medium suitability rated land would remain in 2035 if development densities planned through the 2035 horizon year of the Currituck County land use plan were to continue to occur through 2035.

The 1,447 acres of high and medium suitability rated land that would be available in 2035 was calculated based on the county's existing land use and population trend assumptions. Should the county increase its residential density per acre in its future land use plans, then there likely would be additional high and medium suitability rated land in 2035. In any event, by 2035, suitable land designated as rural in 2025 in the

current land use plan would likely need to be developed to accommodate a 2035 population.

On the Outer Banks, assumptions used in the impact assessment were that full build-out would occur before 2025 in the NC 12-acccessible areas, with some development continuing to occur in the non-road accessible areas.

Risks here relate solely to cumulative effects because induced change in this case would be a small part of overall development trends. Risks are related more to the occurrence of more-than-forecasted development, but there are socioeconomic risks were there to be less-than-anticipated development. Risks are:

- Ecosystem impacts
  - On the mainland, two scenarios could unfold. Market forces could encourage development on land that is currently deemed less than suitable or unsuitable for development because of environmental constraints, but that is nonetheless in private ownership. Such development would infringe on sensitive systems such as estuarine coastlines, wetlands, or critical habitat areas. The other, and more likely alternative, would be for development to become denser as the county urbanizes. While this would restrict land conversion to suitable parcels, it would nonetheless place an increased demand on ecosystem services that filter runoff and provide adequate wastewater treatment. Water usage and septic systems would intensify. Unexpected development would increase the demand for public water on the mainland, but this was already identified at a potential problem by 2035 (see Section 6.3.2.4). Regardless, the indirect impacts on water usage from any of the project alternatives would remain a minor factor. Since the county does not provide public sewers, unexpected development would not increase use of public wastewater treatment services. Another ecosystem impact from unexpectedly high development is increased impervious surfaces. Also, retention of natural vegetation in the developed areas would decrease. The potential for the introduction of invasive exotics would increase.
  - On the Outer Banks, an unexpected acceleration of development would either force more development into the non-road accessible Outer Banks (which is discussed in Section 7.5), or, more likely it will see increased density in land use on the NC 12-accessible area from Corolla to Nags Head. Similar to dense mainland development, this would put increased demand on ecosystem services (most notably groundwater supply and wastewater infiltration), but it would not likely result in conservation areas being destroyed because the distinction between protected conservation land and private developable or redevelopable land is more clearly drawn on the Outer Banks towns.
- Socioeconomic impacts
  - On the mainland, primarily more of the same types of effects described in Chapter 6 would occur, particularly in terms of loss of agricultural land, effects

on neighborhoods and village communities, and scenic and natural character. The need would increase for Currituck County to develop new density strategies.

- On the Outer Banks, full build-out could increase pressures to increase densities. In addition, demand to extend NC 12 could occur, but given the limits associated with such an undertaking (see Section 4.2.4), it is unlikely that such an effort would be successful. Pressures to build a bridge from Monkey Island to the non-road accessible Outer Banks could occur, but this has never been considered in area infrastructure planning.

The risks described above would occur with the No-Build Alternative and any of the detailed study alternatives, including the Preferred Alternative, since these risks are related to larger area development trends and not trends that might be initiated by the construction of one of the detailed study alternatives.

The one exception to this is if the No-Build Alternative or ER2 yields congestion so severe that it actually constrains the northern Outer Banks as a destination area for tourists, thereby depressing economic activity and development on both the Outer Banks and the mainland. The peak summer weekend travel time forecasted for 2035 of 233 minutes from Aydlett Road to Albacore Street might be endured once for week-long vacationers. But if it is not, or if the travel time and congestion is worse, then the No-Build Alternative or ER2 could actually have less rental cottage and hotel room development on the Outer Banks north of Duck. Based on the assumptions presented in Section 4.2.3, this practical build-out is estimated to be 70 percent of the maximum build-out with the No-Build Alternative, and 75 percent of the maximum build-out with ER2, for the Outer Banks from the Virginia Line to Southern Shores. The implications of this situation would be as follows:

- Ecosystem impacts

  This would slow the rate of development in the towns north of the Wright Memorial Bridge short of full development. In this event the indirect effects on notable ecosystem features as described in Section 4.2.3 would generally be less. Fewer residences and businesses on the Outer Banks would cause less land to be converted to development and result in smaller impervious cover. There would also be less demand on the water supply and fewer septic and sewage systems. An indirect reduction in tourist-industry worker housing on the mainland would have comparable effects.

- Socioeconomic impacts

  Crippling congestion would proportionately slow the growth of the local tourist economy which is the most important local industry. Not only would development and redevelopment activity slow, but the attraction to the area could be diminished, thereby lowering rental prices. Furthermore excessive congestion would have a

dampening effect on local travel, reducing tourists' abilities to move around and patronize local establishments.

Reduced growth of tourism could slow development of local employment for residents in the study area. On the one hand, less worker housing on the mainland could reduce detrimental ecosystem impacts, but on the other hand, socioeconomic impacts could be negative.

7.2 Development near the Mid-Currituck Bridge

As indicated above, the anticipated amount of commercial area shift to the Mid-Currituck Bridge area (with MCB2, MCB4, and the Preferred Alternative only) would be approximately 68 acres. This would be an induced change and would result in indirect impacts, as discussed in Section 6.2. Table 6-2 shows the amounts of available high and medium suitable land within 1, 1.5, 5, and 10 miles of the approximate location of the US 158/Mid-Currituck Bridge interchange. There is more than adequate suitable land for such development if there were demand for more than 68 acres of commercial development. Since the suitable land around the bridge is of similar character, the ecosystem and socioeconomic effects that would be associated with the use of more than 68 acres would be similar to those with 68 acres.

7.3 Potential Impacts of Permanent Resident Increase on the Outer Banks

Section 4.2.1 concluded that there would be a negligible or slight potential for an increase in permanent residents on the Outer Banks with MCB2, MCB4, or the Preferred Alternative. If notable numbers of new permanent residents were to move to the Outer Banks, the following effects could occur:

- The construction of smaller single family residences in existing subdivisions;
- Increased non-summer traffic;
- Loss of vacationer tourism and summer sales tax revenue, but an increase in year-round sales tax revenue;
- Change in the pattern of use of utilities; and
- Increased need for businesses and public services, such as schools, places of worship and police protection, which cater to permanent residents.

These changes do not represent a notable change in the patterns, location, and densities of development from what is currently expected. As such, no changes in ecosystem impacts or the area's ability to meet its ecosystem goals would be expected. None of the changes listed above would create substantial impacts on socioeconomic features or the area's ability to meet its socioeconomic goals. More permanent residents would simply create a change in community planning and public service focus.

7.4 Potential Impacts of Increased Amounts of Day Visitors on the Outer Banks

Section 4.2.2 concluded that with MCB2, MCB4, or the Preferred Alternative, there would be an increased demand for day visits to the Outer Banks, but the realized demand would be mitigated by significant constraints. Nonetheless, increased day visits to the NC 12 communities could occur, with a greater increase to the northern beaches. Errors in this assessment could come from unforeseen construction of new day service areas, insufficient services for day visitors from Virginia Beach, or a miscalculated demand for 4-wheel drive beach excursions in the non-road accessible areas. If the numbers of day visitors did increase significantly in the NC 12 or non-road accessible areas, the following effects could occur:

- NC 12-Accessible Communities. The effects in these town areas from increased day visitors would all be socioeconomic.
  - Traffic would increase, although there is feedback in this variable because if traffic increased to the point of substantially reduced level of service, it would then slow the number of day visitors.
  - Parking would likely become the greatest concern because of the relatively limited public parking areas on the Currituck County Outer Banks. This could lead to calls for more parking to be constructed or increased day parking regulation and enforcement.
  - Facilities with restrooms and/or changing facilities would be in greater demand.
  - Economic activity for tourist-serving establishments would increase.
  - Issues of public order from the increased day population could require additional police and paramedic services.
- Non-Road Accessible Northern Outer Banks. The effects in the non-road accessible area would be both ecosystem and socioeconomic as this is a more natural landscape that has no tourist related services. It is conceivable that if day visitor demands were great enough that day passes could be instituted for the area.
  - Increased use of the beach areas would also lead to increased use of the dune areas in conservation even though access is technically restricted. Such increased uses could lead to destruction of important vegetation and bird and turtle nesting sites.
  - Additional traffic and pedestrian visitors would create greater likelihood of conflicts between humans and wild horses.

- Traffic would increase on NC 12 and on the beach itself. With increased use and persons present on the beach, the speed limit goes down to 15 mph. The beach, as a road itself, could experience a serious reduction in level of service.

- There are no restroom facilities and unsanitary practices would increase, creating environmental and public health problems.

- Economic activity for the businesses on NC 12 would increase.

- Issues of public order from the increased day population could require additional police and paramedic services.

7.5 Potential Impacts of Increased Demand for Residences on the Non-Road Accessible Outer Banks

Section 4.2.4 concluded that there would be no foreseeable difference in the location, rate, or type of development between the detailed study alternatives, including the Preferred Alternative, and the No-Build Alternative. This could be in error in one of two ways. Under the No-Build Alternative, congestion could become so bad that economic activity and development are slowed in this area. Or, with improvements in access associated with the detailed study alternatives, unexpected and unmet demand for Outer Banks housing is diverted to this area, despite the severe hindrances of difficult access, CBRA restrictions, lack of public services, and absence of tourist amenities.

A slowing of activity in this area would lessen the detrimental effects from development on notable ecological features, such as the dunes, wild horses, maritime forests, and protected species. This would not be inconsistent with the goals of the Currituck County land use plan. It would also reduce the amount of economic activity, although this area represents only about one tenth of the rental capacity on the Currituck County Outer Banks (Currituck County, 2006).

An unexpected acceleration of development on the non-road accessible northern Outer Banks could arise from unforeseen and unlikely development of a paved road access, miscalculation in the popularity of "high end, low service" beach vacations, or unexpectedly high investments on the Outer Banks as an entire region. If the demand for residences in the area did increase beyond predictions, the ecosystem and socioeconomic effects could be:

- Accelerated loss of important dune, forest, and estuarine coast habitats. Currently, new development is oriented towards the oceanfront. Accelerated development could affect the sound front and interior properties to a greater extent.

- The free ranging wild horses could become increasingly seen as a nuisance.

- Pressure could mount for a better access than that which currently exists. This pressure would likely conflict with the county, state, and federal goals of limiting road access. Hurricane evacuation issues could become more critical.

- Pressure could mount for "improved" roads within the non-road accessible communities. These could be anything from bladed sand to paved roads within existing subdivisions.

- With an increase in potential residents or vacationers going back and forth between the road-accessible and non-road accessible areas, traffic on the beach road would increase, leading to potentially more accidents between vehicles, persons and any horses that may venture into the area.

- With the development of more vacation homes the need for a greater police, fire, and emergency medical service presence would increase.

- Under current plans, residences here must rely on onsite sewer and water. If the carrying capacity of the landscape is exceeded with respect to these services, demands would grow for public services.

- A large amount of investment, especially at the oceanfront, could increase calls by property owners to have protections for their investments. Potentially, this could range from delisting from CBRA to beach nourishment projects.

- However, under the current planning and regulatory regimes, there is no support to encourage development in the non-road accessible northern Outer Banks. In fact, there are redundant limitations put in place by the county and federal governments as well as North Carolina and Virginia.

8.0 Assess Consequences and Appropriate Avoidance/Minimization Strategies

This chapter considers potential appropriate avoidance and minimization strategies based on the consequences of the indirect and cumulative effects described in Chapter 6. This consideration is based on Step 8 of the *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina* (NCDOT, 2001).

This chapter considers:

- Does the analysis of effects provide a reasonable basis for informed decision-making?
- Would there be significant effects that are seen as undesirable?
- Would there be practicable avoidance/minimization measures?
- Would avoidance/minimization measures be within the jurisdiction of the North Carolina Turnpike Authority (NCTA)?
- What is NCTA's role when avoidance/minimization measures are not within its jurisdiction?

8.1 Reasonable Basis for Informed Decision-Making

The North Carolina Turnpike Authority (NCTA), a division of the North Carolina Department of Transportation (NCDOT), and the Federal Highway Administration (FHWA) believe that this indirect and cumulative effects assessment provides a reasonable basis for informed decision-making.

During the agency involvement process documented in the *Stakeholder Involvement for Draft Environmental Impact Statement Technical Memorandum* (Parsons Brinckerhoff, 2009), as well as in the comments received during the review of the Draft Environmental Impact Statement (DEIS), a principal concern raised by regulatory agencies was the potential for induced development and other induced change with the detailed study alternatives and particularly with a Mid-Currituck Bridge. In light of this concern, NCTA commissioned this comprehensive assessment of indirect and cumulative effects. This assessment includes a thorough consideration of each of the five issues associated with induced impacts. It is included in Section 4.2.

In determining what future activities are reasonably foreseeable, this assessment places a heavy reliance on assessing impacts (and their significance) on achieving the growth-related goals and objectives contained in the area's Coastal Area Management Act (CAMA) land use plans and associated development requirements. A primary focus of these plans is protecting coastal natural resources.

Issues and concerns raised related to the assessment and its findings during the DEIS review period are addressed in the Final Environmental Impact Statement (FEIS) and this revised technical report.

This revised report was submitted to the planning directors in the study area, with particular attention drawn to the analytic scenarios in Chapter 4. These local planning directors were Ben Woody (Currituck County), Andy Garman (Town of Duck), Wes Haskett (Town of Southern Shores), and Joe Heard (Town of Kitty Hawk). The review draft was distributed in June, 2011, and follow-up interviews were conducted by the principal investigator of this report in June and July. In addition, each of the planners responded in writing.

In all cases, the planning directors affirmed the representation of their community and the analysis of induced impacts for the various project alternatives. At the same time, they provided important updates and corrections on details and data relevant to their communities. Particular topics raised included improved data on development and land parcelization, seasonal population, and beach access and public parking. This new information was incorporated into this report. Some also inquired about detailed topics related to analysis of commercial activity in their respected communities. These questions were followed up in concurrent telephone conversations by the principal investigator of this report.

8.2 Substantial Negative Effects

8.2.1 Indirect Effects

With the implementation of MCB2, MCB4, or the Preferred Alternative, induced commercial development on the mainland would occur at a US 158/NC 12 interchange. A study commissioned by Currituck County estimates that this would consist of approximately 34 businesses. If these businesses were allowed to develop with individual access points on US 158, the associated turning movements would have the potential to increase congestion on US 158. In addition, the presence of a US 158/Mid-Currituck Bridge interchange and its induced commercial development would be a substantial visual change for an area described in the project's visual impact assessment as having a high visual quality. Also with these two alternatives increased day visitation could occur on the Outer Banks. This could strain existing visitor services and increase four-wheel drive traffic on the northern beaches. Access to public trust resources and tourist activity are consistent with area goals and objectives. Planning and management by local authorities would be effective in managing this impact.

8.2.2 Cumulative Effects

The growth trend assumed in area land use plans, whose horizon year is 2025, does not appear to be sustainable to 2035 on the Currituck County mainland. Section 6.1 indicates that if plan densities and growth continue, that most land suitable for development, including land designated as Rural Areas in the current plan, would be developed. This appears to conflict with current plan goals related to agricultural

preservation, neighborhood and village communities, scenic and natural character, preservation of heritage, promotion of land use patterns with a sense of community, and protection of landscape aesthetics. Historic resources could be affected. This result would occur with all of the detailed study alternatives, including the Preferred Alternative, and the No-Build Alternative. The detailed study alternatives would not make a substantial contribution to this trend. The project alternatives would not notably contribute to these cumulative impacts.

On the Outer Banks, induced day visits combined with current trends in beach driving and development in Carova could further degrade the habitat, beach experience, and level of service of the beach roadway. However, the induced day visitors would be a marginal increase above the ongoing trends in traffic in the four-wheel drive area. Because there is such a strong resistance to extending a paved NC 12 through the four-wheel drive area, it is not seen as reasonably foreseeable. Consequently, the cumulative impacts of development on the northern beaches and total day visits is expected to cause planning and management actions by the county under any scenario.

8.3 Practicable Avoidance/Minimization Measures

8.3.1 Indirect Effects Avoidance/Minimization

The extent of the visual impact of new businesses would depend upon the appearance requirements that might be imposed by Currituck County. Appearance controls by the county on the placement of parking, building exteriors, landscaping, and signage could permit the creation of development that would be an attractive prelude to the developed areas on the Outer Banks.

Much of the visual change associated with the interchange could not be substantially avoided. Its presence and the associated visual impact could not be hidden. As a part of final design, a landscaping plan would be developed. Sensitivity to the context would be considered in bridge and interchange related structure design.

Consolidated driveways in new concentrations of development are today common practice and this would be expected to be required both by the county and the North Carolina Department of Transportation.

8.3.2 Cumulative Effects Avoidance/Minimization

The cumulative effects of development on the mainland could be addressed in Currituck County's next land use plan, including:

- Re-examining potential growth trends;
- Refining their focus on the type of economic development they would like to attract in the context of larger land use planning;
- Creating small area plans to accommodate multiple community goals;

- Establishing high density village areas and/or clustered mixed-used developments;
- Continuing promotion of conservation subdivision design;
- Continuing promotion of a farmland conservancy and transfer of development rights (if authorized by the North Carolina General Assembly);
- Considering viewsheds and visual elements in land use plans;
- Advocating "low impact development" as a best management practice that reduces the runoff impacts of development, as defined by the Coastal Studies Institute in Manteo;
- Supporting the efforts of historical and heritage associations;
- Taking into account the preservation of the connectivity between valued natural resource features;
- Use of a nuisance vegetation ordinance that prohibits invasive exotic species from being sold or planted in the county; and
- Developing and implementing regulations governing beach driving.

The Currituck County land use plan includes plans to establish a "Task Force to look at the broad implications of a mid county bridge and its potential impacts, such as growth in the RO2 CBRA zone, beach access and other infrastructure needs of increased numbers of day visitors, changes in county services such as law enforcement, economic impacts on the Mainland and the Outer Banks, etc. The findings of such a task force should be made available well in advance of the construction of the bridge." The county commissioners already have plans to appoint a task force, once the bridge termini are located. They expect this effort will take approximately one year to complete (personal communication Ben Woody, Currituck County Planning Director, May 2008 and February 2009). Currituck County has the legal authority to regulate and manage driving on its beaches.

8.4 Transportation Agency Jurisdiction Related to Avoidance/Minimization Measures

Except for direct impacts associated with the detailed study alternatives, including the Preferred Alternative, NCTA and FHWA generally have no mitigation jurisdiction over indirect and cumulative effects. The principal substantial negative effects would arise from a continuation of long-term development trends beyond the horizon year used in the Currituck County land use plan. Addressing those effects is under the jurisdiction of the county in the context of the development of future land use plans under CAMA.

Within NCTA and/or FHWA's jurisdiction are:

- Selecting a Preferred Alternative that meets the project's purpose and need while considering the degree of travel benefit offered, state transportation network efficiency, project affordability, and the manner in which each alternative avoids or minimizes environmental impacts.

- Mitigating direct construction, maintenance, and operation impacts of the Preferred Alternative where feasible, practicable, and reasonable. Examples of how this was done in the preliminary designs assessed in the FEIS include:

  – Providing no direct access from the bridge to Aydlett, to help be sure induced development would focus on US 158 (with either Option A or Option B).

  – Bridging Maple Swamp to minimize potential hydrologic impacts and impacts to wildlife movement (Option A, included in the Preferred Alternative), or placing fill in Maple Swamp, removing Aydlett Road and restoring its right-of-way as a wetland, and providing for wildlife passage through the fill (Option B).

  – Locating the US 158/Mid-Currituck Bridge interchange in an area considered suitable for development. Land suitable for development surrounds the interchange to help ensure induced development occurs on suitable lands.

- Developing a project design that is sensitive to its context.

- Controlling access of induced and other development to public thoroughfares so that access is provided in a manner that does not reduce the efficiency of public thoroughfares.

8.5 Transportation Agencies' Roles When Avoidance/Minimization Measures Are Not within Their Jurisdictions

NCTA, NCDOT, and FHWA's roles include:

- Guiding future thoroughfare planning in Currituck and Dare counties; and

- Identifying indirect and cumulative impact concerns under the jurisdiction of others in the FEIS.

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Appendix A

Stated Goals of Agencies and Stakeholder Groups

A. Stated Goals of Agencies and Stakeholder Groups

A.1 Currituck County

Since Currituck County's first land use plan in 1976, there have been updates in 1980, 1985, 1990, and 2006. As the plan was updated between 1980 and 1990, it focused more on implementation. In the 1990 plan and the 2006 plan, county planners made a conscious effort to survey local citizens to determine community goals for local planning. Currituck County's current land use plan is an extension of the 1990 plan which implemented the Unified Development Ordinance (Currituck County, 2004). This ordinance outlines the specifics of permitted development. Growth management tools in the Unified Development Ordinance include Planned Unit Developments and an Adequate Facilities Ordinance.

A.1.1 Land Use Planning Goals

Currituck County's most recent land use plan was completed in March 2006. The county has completed Phase I and Phase 2 of the process of updating its land use plan. In this plan, the county lists ten land use and development goals (Currituck County, 2006).

A.1.1.1 Ten Land Use and Development Goals

1. To protect and conserve the area's natural beauty and coastal resources as the county's greatest asset for economic development and a high quality of life.

2. To provide suitable public access opportunities to the County's public trust waters and shorelines so as to allow for a wide range of activities.

3. To conserve the county's remaining prime agricultural areas, while recognizing the economic realities of farm operations and private property rights.

4. To avoid taking or approving actions related to infrastructure and the provision of services that could induce intensive development in environmentally fragile areas; examples include the north beaches of the Outer Banks and Knotts Island.

5. To diversify the county's economic base, to include environmentally compatible businesses and industries that reach beyond the tourist-based economy.

6. To preserve critical natural areas as the source of biological diversity and productivity of the county's ocean and estuarine environments.

7. To exercise caution, foresight, and common sense in dealing with the risks of coastal development.

8. To preserve the traffic carrying capacity of existing roadways and provision of new roadways and roadway improvements in accordance with carefully developed plans.

9. To preserve and improve water quality in the coastal waters of Currituck County.

10. To properly distribute development forms in accordance with the suitability of the land, infrastructure available and the compatibility of surrounding land uses.

A.1.1.2 Land Use Goals Relevant to Study

In addition to the ten land use goals contained in the *Currituck County Land Use Plan* (Currituck County, 2006) there were explicit goals stated that are relevant to development trends:

1. Goal 3.1: "Expand the economic base of Currituck County to improve employment opportunities while ensuring adequate environmental protection."

2. Goal 3.4: "Continue to expand the role tourism plays in Currituck County."

3. Goal 4.2: "Encourage development patterns on Highway 158/168 that will enhance economic development in the county, will be aesthetically pleasing, and will provide for safe and efficient movement of traffic."

4. Goal 5: "Protect Currituck County's heritage by preserving historic buildings and promoting development compatible with the county's rural character and encourage the preservation of agriculture."

5. Goal 6.1: "Ensure that rapid development occurring in Currituck County will not detract from the quality of life nor cause a loss in quality of providing community services."

6. Goal 6.3: "Encourage development that will not negatively impact potable water supplies in terms of water quality and quantity."

7. Goal 6.6: "Allow the development of islands that would best promote public interest."

8. Goal 7.1: "Maintain and improve the water quality in the Currituck and Albemarle Sounds."

9. Goal 8.2: "Increase the number of public beach and sound accesses and associated facilities."

10. Goal 8.5: "Provide centralized water throughout the county."

11. Goal 8.6: "To ensure the Currituck Outer Banks is provided with suitable electrical service"

A.1.2 Unified Development Ordinance

Currituck County's Unified Development Ordinance (Currituck County, 2004) provides information on the permitted density of development, height restrictions, the type of development allowed, setback requirements, and other restrictions. The county uses this document to enforce development guidelines. This ordinance draws on its relationship with the land use plan in one of its opening sections: "It is the intention of the board that this ordinance implements the planning policies adopted by the Board for the County as reflected in the Land Use Plan and other planning documents" (Currituck County, 2006).

The Unified Development Ordinance specifies that land that is submerged or regularly under water or intended in the future to be in such condition in canals, sounds, streams, ocean, Coastal Area Management Act (CAMA) wetlands, etc. cannot be included in the area of any lot for purpose of meeting minimum square footage requirements except where the area is designated as open space. In addition, at least 33 percent of the required minimum lot areas must be uplands that do not contain Section 404 wetlands.

The Unified Development Ordinance establishes separate zoning districts for development including: residential districts, commercial districts, manufacturing districts, planned unit development districts, floodplain and floodway districts, and an Outer Banks overlay district. Residential districts are designated as follows: A (Agricultural), RA (Mixed Residential), R (Basic Residential), RO1 (Outer Banks Standard Residential), RO2 (Outer Banks Limited Access Residential), and RR (Residential/Recreational). Currituck County zoning districts are shown in general and within these districts, residential development may occur at a density of approximately one unit per acre with the exception of the A and RO2 districts. Provisions for some limited multi-family development allow up to eight units on three acres with an additional 17,000 square feet of land for each additional unit. Nevertheless, multi-family structures are limited to 160 feet in length and are subject to the countywide height restriction of 35 feet, except in the Poplar Branch Township portion of the Outer Banks where a 40-foot height restriction is established. Within the A and RO2 zoning districts, density is limited to approximately one unit per three acres.

Density provisions allow for the clustering of development to preserve open space. With clustering, "primary conservation areas" first must be preserved as open space. Primary areas are Section 404 (of the Clean Water Act) and CAMA-defined wetlands. Fifty percent of the development site, after primary conservation areas and an allotment for roads are subtracted, must be designated as "secondary conservation areas." Secondary conservation areas are those with soils unsuitable for septic systems, mature woodland, significant wildlife habitat, historic and archaeological features, important viewsheds, aquifer recharge areas, and prime farmland. Guidelines are provided for ownership and preservation of these areas, and limits on recreational use are set.

In evaluating the layout of lots and open space, Currituck County uses criteria that indicate whether the design is appropriate to the site's natural, historic, and cultural features. The criteria ask if the development plan:

1. Provides a 50 foot buffer with wildlife plantings along open space utilized as active farmland;

2. Protects and preserves floodways and wetlands;

3. Preserves and maintains mature woodlands, existing fields, pastures, meadows, and orchards, and creates sufficient buffer areas to minimize conflicts between residential and agricultural uses;

4. Maintains or creates an upland buffer of natural native species vegetation of at least 50 feet in depth adjacent to wetlands and surface waters, including creeks, streams, springs, lakes and ponds;

5. Protects wildlife habitat areas of species listed as endangered, threatened, or of special concern;

6. Designs around and preserves sites of historic, archaeological or cultural value, and their environs;

7. Protects rural roadside character and improves public safety and vehicular carrying capacity by avoiding development fronting onto existing public roads and establishes buffer zones along the scenic corridor of rural roads with historic buildings, hedgerows, etc;

8. Landscapes common areas (such as community greens), cul-de-sac islands, and both sides of new streets with native species shade trees and flowering shrubs with high wildlife conservation value;

9. Provides active recreational areas in suitable locations offering convenient access by residents, and adequately screened from nearby house lots;

10. Includes a pedestrian circulation system designed to assure that pedestrians can walk safely and easily on the site and between properties and activities or special features within the neighborhood open space system; and

11. Provides open space that is reasonably contiguous, minimizing fragmentation of open space.

Commercial districts include areas defined as GB (General Business), C (Commercial, but most residential is not allowed in the district), and LBH (Limited Business, hotels allowed) on the county's zoning map. General Business allows the widest range of activities. Maximum floor-to-land area ratios are also established at 0.4 for all three commercial districts. In addition, hotels are limited to 40 units per acre in GB zones and 20 units per acre in LBH zones. All of these commercially-zoned areas are adjacent to

US 158, NC 168, and other thoroughfares. Only one is on the Outer Banks at Albacore Street and NC 12. Most commercially zoned areas in the county are GB with few designated as C or LBH.

The county also has established two manufacturing districts, one for light manufacturing and the other for heavy manufacturing. In addition, the county has a "floating zone" which allows for planned industrial development. This zone is subject to approval by county commissioners and can be established anywhere in the county.

A.1.3 Planned Unit Developments/Planned Residential Developments

A Planned Unit Development (PUD) is defined in Currituck County's Unified Development Ordinance as the total development of one tract of land under central control or ownership. The stated purpose of PUDs is to promote a more efficient use of land with a higher level of amenities. PUDs are permitted only on tracts of at least 50 acres in area within the R, RA, and RO1 zoning districts. A PUD district containing a RO1 component may not be applied to property on the Currituck County mainland or the RO2 zoning district on the Outer Banks (the non-road-accessible area). PUDs represent a substantial form of development in Currituck County since most of the road-accessible area of the Currituck County Outer Banks that is available for development is subdivided in approved PUDs.

When PUDs are established, they must distinguish residential and commercial zones within each development. Residential zones must comply with the requirements of the standard residential zones, but they are exempt from standard density requirements. The maximum density allowed for PUDs is three units per acre, excluding commercial areas and CAMA wetlands. Dwelling units may include any variation of single and multi-family units. Commercial portions of the PUD must comply with either the LBH zoning regulations.

Commercial areas are allowed only in PUDs of at least 50 acres and are limited to 10 percent of the total development. A special use permit must be approved for a PUD to proceed. This special use permit applies to the entire development and specifies the location of commercial and residential districts. In addition, commercial areas may be designated as reserved for future development. However, any areas reserved for future use must have specific plans approved before any development can proceed.

PUDs must include the allocation of 35 percent of the total land area to common open space, with 50 percent of that allocated to passive or active recreation facilities. PUDs also must contain plans for water service and central treatment of sewage.

The approval process for PUDs includes a pre-application conference, an initial review of development sketch plans by a county-appointed administrator, a review by the County Planning Board, and a final review by the County Board of Commissioners. The sketch plan is submitted to the administrator who reviews the plan for deficiencies. Changes are recommended to the developer prior to submission to the Planning Board. The Planning Board then reviews the plan and makes recommendations to the Board of

Commissioners. It is up to the Commissioners to approve, approve conditionally, or not approve the request. If the sketch plan is approved by the commissioners, a preliminary plat application is prepared which outlines exactly what the developer intends to construct. After the preliminary plat application is completed, all construction permits and approvals must be obtained by local, state, and federal agencies prior to submission to the Planning Board.

Any re-platting or re-subdivision of land is subject to the same procedures, rules, and regulations required for the original approval of the subdivision. This is important because it does not allow the developer to change original plans, unless those plans go through an extensive review procedure with final approval by the Board of Commissioners.

Planned Residential Developments are similar to PUDs, except that they do not have commercial development. They are permitted only on tracts of at least 10 acres within the R, RA, and R01 Zoning Districts. They also include a minimum of 75 percent detached single-family units. A PRD district containing a RO1 component may not be applied to property on the Currituck County mainland or the RO2 zoning district. A Special Use Permit is required.

A.1.4 General Regulations

Other restrictions applicable to the Currituck County Outer Banks include a prohibition on mobile homes. In addition, development cannot encroach on significant dunes or impair its natural state (including its evolutionary growth and movement and its natural vegetation). Additional requirements apply to areas of the maritime forest, but have little effect on building density. Developers are encouraged to leave the largest contiguous area of maritime forest intact, creating as few edges as possible, and to concentrate development in less sensitive areas away from shear zones, wetlands, and other ecologically important vegetation. Preserved maritime forest counts for meeting open space requirements.

Overall, land use restrictions in Currituck County have been consistent, with some movement toward more restrictive ordinances. Lot sizes within PUDs have remained constant since the early 1970s, but outside of PUDs, the minimum lot size has increased from 30,000 square feet to 40,000 square feet. Some new provisions have been made to allow for multi-family development in Planned Residential Developments (PRD), and Planned Unit Developments (PUD), and planned adult retirement communities in order to encourage more affordable housing.

A.1.5 Other Planning Regulations

Currituck County has gone beyond the general planning requirements of CAMA and is now developing other regulations that will affect the pace of development.

The county adopted an Adequate Facilities Ordinance in 1994. The latest amendment was in 1995 (Saita, 1995). This ordinance requires that any subdivision of 20 or more units receive a special use permit. The county may deny the Special Use Permit if the

proposed development "will exceed the county's ability to provide adequate public facilities, including, but not limited to, schools, fire and rescue, law enforcement, and other county facilities." Any need for increased capacity must be planned within two years of approval. The intent is to give county officials more oversight of developments and to ensure the adequate provision of county services.

Currituck County is seeking (as of 2008) state legislative authority to implement impact fees and raise the title transfer tax to pay for increased service costs associated with new development. Impact fees would tie the increased demand for public services generated by new development to a fee paid by the developer to offset these increased costs.

A.1.6 Currituck Farmland Preservation Ordinance

Currituck County passed a Farmland Preservation Ordinance in 2001 (Currituck County, 2007). Funding for the program began in 2003; since then, the county has set aside $400,000 in funding to use for preservation purposes. The county purchases the development rights of the farm (perpetual easement). The tract can still be farmed, rented, leased and can still be willed to heirs, but once development rights are sold, houses cannot be put on the property. Federal and state tax credits are available for individuals who participate in the farmland preservation program.

A.1.7 Economic Development Strategy "Vision Plan" for Currituck County, North Carolina.

Currituck County commissioned an economic development report from the UNC Center for Competitive Economies (Lane and Jolley, 2008). Included in that report are ten "strategic options" that the county could undertake to improve its economic development. They are:

1. Armed with enhanced market demand information and visitor characterizations, the county should proactively market Currituck County as a location for the specific businesses present in other northeastern North Carolina micropolitans but absent in Currituck County (page 21);

2. Currituck County can target families with school age children as prospective shoulder season visitors by direct internet marketing of the county's natural resource attractions as an "edu-vacation opportunity", combining vacation with natural science educational opportunities (page 23);

3. Convene meetings of eco-tourism business and wildlife management leaders who understand the need to more completely incorporate this underutilized natural resource into the county's overall tourism strategy (page 24);

4. Target the attraction and establishment of entrepreneurs developing eco-tourism attractions and hospitality offering based around the Currituck Sound (page 27);

5. Examine comparable area to identify ways to direct mainland development resulting from the Mid-Currituck Bridge toward up market retail, hospitality and service businesses (page 28);

6. Get involved in Mid-Currituck Bridge tolls deliberations to ensure policies encourage mid-week tourism "rebound" traffic (page 29);

7. Undertake a comprehensive business site and infrastructure inventory of both in-county and regional facilities to identify Currituck's competitive position and develop appropriate marketing materials (page 31);

8. Incorporate corrected resident workforce information into County economic development literature and promotional materials (page 32);

9. Capitalize on off-season vacation capacity to invite executives of targeted companies to experience Currituck as both a tourism destination and a business location (page 35); and

10. Develop a multi-tenant, flex space 'beachhead' industrial facility to attract relocating growth firms to Currituck County (page 36).

A.2 Dare County

A.2.1 Land Use Plan

Dare County's most recent land use plan update was completed in 2003 (Dare County, 2003). A 2008 updated land use plan is current in process. The 2003 *Dare County Land Use Plan* includes the area of Duck, which was incorporated in 2002. The Town of Duck has since adopted its own CAMA land use plan. Northern Dare County, the part of the county in the land use impacts study area, is comprised almost entirely of the incorporated areas of Duck, Southern Shores, and Kitty Hawk. Vision statements related to land use and development trends include the following (Dare County, 2003):

1. "Manage the growth and development in a manner that preserves the historical, cultural, and natural resources that make Dare County a desirable place to live and visit."

2. "Use existing patterns of village communities as "nodes" of activity and living space in a manner that relates to the vast publicly owned lands and historical landmarks."

3. "Maintain our coastal village atmosphere with an emphasis on residential development and small locally owned commercial establishments."

4. "The preferred pattern of residential development is detached low density homes that are compatible in size and scale with existing patterns of development."

5. "Expand options for housing to meet the diverse needs of the year-round and seasonal employees."

6. “Commercial development should reflect the traditional "coastal village" architecture found throughout the Outer Banks.”

7. “Develop the foundation for an alternative means of transportation that connects the various population nodes for pedestrians and bicycles and provides a means of movement other than traditional reliance on automobiles.”

8. “Use land use planning and zoning techniques to abate the tendency of rapid growth communities to lose their "sense of place" or be homogenized by growth. Such techniques should include size limitations on bulk commercial structures, limited dwelling density and placement of multifamily structures, architectural standards to reflect traditional coastal building design, lighting and landscaping standards to minimize visual blight and light pollution and standards for the display of outdoor advertising and signage.”

The plan includes 74 implementation policies in 39 categories. Several of these policies are relevant to the ICE study area. Natural resource policies related to the protection of wetlands, ocean shoreline and ocean hazard areas, estuarine waters and shoreline emphasize reliance on the requirements of federal and state regulatory programs, including the federal CAMA, the Clean Water Act (CWA), and the National Flood Insurance Program (plan policies 1 to 7, 31, 32). Dare County supports the public’s right to reach and use public trust areas and waters and will manage their use by competing recreational users as needed (plan policies 8 and 9). Dare County supports local, state, and federal agencies to preserve, protect and improve surface water quality, and it encourages the management of water quality using a basin-wide approach that includes inland areas beyond the reach of CAMA regulations (plan policies 12 and 13). The county supports beach nourishment as the means of maintaining ocean beaches in the county and protecting NC 12 from overwash (plan policy 17). The county supports the protection of historic and archaeological resources identified as significant by the NC Department of Cultural Resources (plan policy 29). The county recognizes that stormwater runoff needs to be managed to protect the quality of public trust waters (plan policies 33 and 34).

The plan’s development policies consider public concerns about the lack of on-site parking, excessive noise, and over occupancy of rental recreational housing. They also recognize a lack of affordable housing “that is dedicated or constructed strictly for year-round residents in the community and for the seasonal employees brought to the area by local businesses during the summer months” (plan policies 55 and 56.)

A.2.2 Growth Management

Growth management in Dare County is administered by both the county and the incorporated municipalities within the county. These municipalities are responsible for zoning ordinances within their borders. Dare County is responsible for unincorporated areas. Thus, this section will focus on the growth management strategies of Town of Kitty Hawk, Town of Southern Shores, and Town of Duck as well as Dare County. These communities are fully subdivided and extensively developed. As such, the most

relevant tools and policies relate to the management of redevelopment. The following are some of the growth management tools currently used by these municipalities:

1. Zoning. Zoning is primarily single-family residential. Commercial zoning exists along NC 12 in Duck and along US 158 in Kitty Hawk and Southern Shores.

2. Height Restrictions. Height restrictions vary among the municipalities. Kitty Hawk limits building heights to 35 feet except for hotels in a BH-2 district where five floors and a height of 55 feet is permitted. Duck also generally limits building heights to 35 feet, but allows a height of 52 feet in its R2 Single Family district. Southern Shores limits building heights to 35 feet.

3. Minimum Lot Sizes. Single-family residential lot sizes vary somewhat but are generally 15,000 square feet, if a central water supply is available. The minimum is 20,000 square feet (with septic tank and well) in Duck. Duck allows duplexes on 15,000 to 25,000 square foot lots. Kitty Hawk has a 25,000 square foot minimum for duplexes and allows multi-family residential on lots that include 15,000 square feet for the first unit and 9,520 square feet for each additional unit. In Kitty Hawk, four residential units per acre is the maximum density allowed except for hotels. In Duck, up to five units per acre is the maximum allowed except for hotels. The minimum lot size in Southern Shores is 20,000 square feet for both a single family home and a duplex. Southern Shores generally allows multi-family residential on appropriately zoned lots that include 7,500 square feet for the first unit and 5,151 square feet for each additional unit. Its highest density zoning district allows up to 10 units per acre. Homes can have no more than seven bedrooms with a capacity of 14 people.

4. Land Use Plans. Dare County and each of its incorporated municipalities have land use plans. The plans must be consistent with CAMA objectives.

As development has increased in Dare County, the incorporated municipalities along the Outer Banks have adopted stricter policies to control growth. Some of these include:

- Between 1986 and 1992, Southern Shores reduced the amount of medium- to high-density housing permitted.

- Kitty Hawk has moved from lot-by-lot development to more unified development. Also, it now allows PUDs and PCDs (Planned Commercial Developments).

- The Town of Duck's (incorporated in 2002) current land use plan (Community Planning Collaborative Inc., 2005) indicates the town's intention to undertake new initiates and project to implement the plan, including programs to protect environmental resources. Action items in the plan include: a tree and vegetation protection ordinance, property grading and filling regulations, and a storm water management plan.

Table A-1 compares growth management policies in Currituck County and the three Dare County municipalities in the ICE study area. Currituck County has the most rigorous approach to growth management. The significance of the comparison with Dare County is that the Currituck County Outer Banks is still developing and the Dare County far north is mostly developed. Therefore, a greater amount of the total development that eventually will occur in Currituck County is subject to more stringent land use ordinances than the development that has already occurred in Dare County.

Table A-1. Growth Management Strategies in Currituck County and Dare County Municipalities

Growth Management Strategies ● indicates policies in place	Location			
	Currituck County	Kitty Hawk	Southern Shores	Duck
Height Restrictions	●	●	●	●
Density Requirements	●	●	●	●
Zoning	●	●	●	●
PUDs/Clustering	●	●	●	●
Land Use Plan	●	●	●	●
Unified Development Ordinance	●			
Impact Fees		●[1]		●[2]
Adequate Facilities Ordinance	●			

[1]Beach access
[2]Water

A.3 Town of Duck

The Town of Duck was incorporated on May 1, 2002. It completed its *CAMA Land Use Plan* in February of 2005. The description below is based on the February 2005 plan. The goals found in the plan related to land use and development trends include the following (Community Planning Collaborative Inc., 2005):

1. "Ensure continued development of small, specialty-type shops and the vitality of existing businesses."

2. "Remain aesthetically pleasing while maintaining coastal village image."

3. "Develop and implement development design standards."

4. "Ensure use of Federal properties in a manner consistent with Town growth patterns, character, and image."

5. "Ensure that public systems and services are sized, located, and managed to protect or restore the quality of areas of environmental concern or other fragile areas while providing adequate levels of service to meet the needs of citizens."

6. "Ensure that development and use of resources or preservation of land minimizes direct and secondary environmental impacts, avoids risks to public health, safety, and welfare and is consistent with the capability of the land based on considerations of interactions of natural and manmade features."

7. "Ensure redevelopment is consistent with Town image and land use and development goals."

8. "Continue established single family residential development patterns."

9. "Provide efficient, economical collection and disposal of solid waste."

10. "Ensure comprehensive storm water management."

11. "Ensure a safe, efficient transportation system with NC 12 remaining a two-lane facility and the construction of a mid-Currituck County bridge [sic]."

12. "Maintain, protect, and where possible enhance water quality in all coastal wetlands and estuaries."

Each goal in the Duck land use plan has an associated policy and one or more associated objectives. The plan is described as a guide for land use decision-making. It is viewed as a document that "should be used by the Town's elected and appointed officials and the community as a guide in making decisions about or that affect land use and development." It is described as a guide for developers, town staff reviewing development proposals, and the public. Development proposals and zoning ordinance amendments should be consistent with the plan and "advance the best interests of public health, safety, and general welfare." To accomplish this, the impact of proposals or amendments on the natural environment, important natural resources, the transportation system, the provision of utilities and services, the town economy, important architectural, historical, archaeological, and cultural resources, neighboring development, and community function, character, and attractiveness" should be considered.

A.4 Town of Southern Shores

The Town of Southern Shores was incorporated in 1979. Its land use plan was updated in 1997 and adopted in 1998 (Town of Southern Shores, 1998). Most policies in the plan acknowledge the predominant residential nature of Southern Shores, and the preference and desire to continue this character in the future. Plan policies allow for future infilling

on lots platted years ago. The town relies on the county water system and county septic tank regulations to ensure the public health, welfare, and safety. The resource protection policies, like Dare County's, rely on regulations associated with the federal CAMA, the Clean Water Act, and the National Flood Insurance Program. The town does not permit commercial marinas or floating homes. The town relies on its zoning and subdivision review process as it relates to stormwater and sanitary wastes to address water quality issues. The plan specifically notes that herbicides, pesticides, and fertilizer are associated with the issue of water quality. The plan indicates that the town does not have or want "commercial uses typically associated with the beach." The town "desires to remain a single family residential community." Commercial uses are to serve the town and its goal of remaining a low density detached single-family community. Tourist attractions are discouraged. For storm hazard mitigation, the town relies on the requirements of CAMA, the state building code, and its associated building codes. The town supports the objectives of the Blue Sky Foundation of North Carolina. The mission of this nonprofit foundation is promoting "safe construction, wise land use, disaster mitigation and sustainable development for all the communities of North Carolina" (Blue Sky Foundation, 2007).

The Town of Southern Shores is currently in the process of completing a new CAMA plan for 2008.

A.5 Town of Kitty Hawk

The Town of Kitty Hawk is an historic Outer Banks village that was incorporated in 1981. It completed its *CAMA Land Use Plan* in 2005. Goals found in the plan that relate to land use and development trends are (Community Planning Collaborative Inc., 2004):

- Preserve, protect, and enhance the Atlantic Ocean Shoreline and ensure future generations are able to enjoy its beauty and bounty and can continue to use the beach and water for active and passive recreation and leisure activities.

- Ensure continued commercial development in commercially zoned areas of Kitty Hawk and the continued vitality of existing businesses.

- Remain aesthetically pleasing while maintaining coastal village image.

- Preserve, protect, and enhance the Currituck Sound, Kitty Hawk Bay, and Albemarle Sound shorelines and ensure future generations are able to enjoy their beauty and bounty and can continue to use them for passive and active recreation and leisure activities.

- Ensure Federal properties and programs are used or implemented in a manner consistent with Town growth patterns, character, and image.

- Ensure that public systems and services are sized, located, and managed to protect or restore the quality of areas of environmental concern or other fragile areas while providing adequate levels of service.

- Ensure that development and use of resources or preservation of land minimizes direct and secondary environmental impacts, avoids risks to public health, safety, and welfare and is consistent with the capability of the land based on considerations of interactions of natural and manmade features.

- Conserve and maintain maritime forests, barrier dunes, beaches, wetlands, and other coastal features for their natural storm protection functions and their natural resources giving recognition to public health, safety, and welfare issues.

- Maximize public access opportunities to beaches and public trust waters.

- Ensure a safe, efficient transportation system given State and local finances, topography, geography, and natural systems and surrounding land uses and development.

- Maintain, protect, and where possible enhance water quality in all coastal waters, wetlands, and estuaries.

A.6 RPO and MPO

A.6.1 Rural Planning Organization (RPO)

The purpose of a Rural Transportation Planning Organization is to work cooperatively with the North Carolina Department of Transportation (NCDOT) to plan rural transportation systems and to advise the department on rural transportation policy. RPOs in North Carolina are made up of contiguous areas of three to fifteen counties. They must have at least 50,000 in population according to Office of State Planning. Metropolitan Planning Organizations areas are not to be included. Not all municipalities in a proposed RPO must join the organization but the county must be a member in its RPO.

A RPO serves as a link to an ongoing relationship with NCDOT. It will allow for consistent public involvement. A RPO serves as valuable resource of information regarding transportation issues and provides a unified voice for regional transportation planning. Such a unified voice could encourage economic development throughout the region.

The Albemarle Rural Planning Organization is the RPO for the ICE study area. It encompasses the areas of Camden, Chowan, Currituck, Dare, Gates, Hyde, Pasquotank, Perquimans, Tyrrell, and Washington counties. Goals for the ICE study area come from the Albemarle Rural Planning Organization Project Priorities from 2007-2013. Two goals from the study are relevant:

- Goal 2: Mid-Currituck Bridge (Coinjock to Corolla).
  - Expedite studies.

  - Expedite construction to provide for better and safer transportation to the northern Outer Banks.

- Goal 5: US 158 – widen from Camden Causeway to NC 168.

  - Widen both portions of US 158 to multi-lanes.

A.6.2 Metropolitan Planning Organization (MPO)

Metropolitan Planning Organizations are part of a federal process to conduct local transportation planning in urbanized areas. The federal government requires urbanized areas to establish a planning process that is comprehensive, continuing, and cooperative. The MPO process is required in urbanized areas 50,000 or greater in population in order to receive federal funding for transportation.

The MPO process is a partnership between local and state government to make decisions about transportation planning in urbanized areas and to meet planning requirements established by federal authorizing legislation for transportation funding. The ICE study area includes part of the Hampton Roads MPO.

The Hampton Roads Metropolitan Planning Organization includes representatives from the Cities of Chesapeake, Hampton, Newport News, Norfolk, Poquoson, Portsmouth, Suffolk, Virginia Beach, and Williamsburg, and the Counties of Gloucester, Isle of Wight, James City, and York, as well as the Transportation District Commission of Hampton Roads, Williamsburg Area Transit, the Virginia Department of Transportation, and the Hampton Roads Planning District Commission.

A.7 North Carolina Transportation Goals

The overriding purpose of *Charting a New Direction for NCDOT: North Carolina's Long-Range Statewide Multimodal Transportation Plan* (NCDOT, 2004) is to "establish a long-range blueprint for transportation investment in North Carolina. The statewide transportation plan also provides a balanced picture of the state's transportation challenges and opportunities based on anticipated resources, projected passenger and freight movement needs, and estimated improvement costs. The end result is a preferred North Carolina transportation investment strategy for the next 25 years."

The statewide transportation plan includes the following goals:

1. Mobility – "Provide the infrastructure necessary to optimize mobility and reliability in the transportation of passengers and freight."

2. Maintenance and Preservation – "Protect the public investment in North Carolina's transportation system."

3. Economic Development and Efficiency – "Provide transportation investments to support economic development for existing and new economic activity."

4. Safety – "Promote safety on individual facilities and on a system-wide basis in a cost-effective manner."

5. Modal Options – "Provide a variety of transportation options for personal travel and goods movement."

6. Efficient and Balanced Community Growth and Development – "Encourage the development of growth management mechanisms intended to coordinate infrastructure investment with development."

7. Intermodal Efficiency and Connectivity – "Increase the efficiency of the overall transportation system by facilitating the interconnection of transportation modes."

8. Fiscal Stewardship – "Provide strong fiscal stewardship that maximizes the cost-efficiency of transportation system investment and ensures adequate resources for transportation through traditional and non-traditional sources."

9. Environmental Stewardship – "Maximize compatibility of the transportation system with environmental considerations, as well as with the historic and cultural resources of the state."

10. Coordination – "Provide increased responsibility and continuing cooperation, coordination, and participation with NCDOT's customers: the public, stakeholders, private sector, and local, regional, state, and federal governments."

The Vision Plan contained in the Statewide Transportation Plan shows US 158 as a "boulevard" in need of upgrade from Nags Head in Dare County to the North Carolina/Virginia border. The plan indicates that on a type II boulevard, driveways are allowed but consolidation and/or sharing of driveways is encouraged, as well as limiting access to connecting streets and restricting boulevard access to right-in/right-out if possible. Such a road also includes a median with allowed spacing between crossovers of 2,000 feet (with posted 55 mph speed limit) and 1,200 feet (with posted of 45 mph).

The Vision Map also includes a Mid-Currituck Bridge. Within the project area, NC 12 is shown as an existing thoroughfare. No improvement needs are indicated.

A.8 North Carolina and Regional Resource Agencies

A.8.1 Coastal Area Management Act (CAMA)

The State of North Carolina has established some of its resource protection goals through CAMA, passed in 1974. This act focuses on Areas of Environmental Concern (AECs) and requires land use plans in coastal communities.

The CAMA directs the Coastal Resources Commission to administer a two-tiered program of growth management in 20 coastal counties, including Currituck and Dare. First, the act requires the establishment of a land use plan for each coastal county.

Municipalities within coastal counties may establish land use plans independent from their respective counties. The act provides financial assistance to support coastal communities in developing their land use plans.

Second, CAMA requires permits for development in areas designated as AECs. The commission oversees this permitting process with the aid of local governments. AECs are broadly defined as: the estuarine system, the ocean hazard system, public water supplies, and natural and cultural resources. AECs encompass less than three percent of the land in the twenty coastal counties covered by CAMA, including parts of the Outer Banks.

Land use plans adopted in coastal communities serve as a guide for local development, ordinances, and other local actions, as well as CAMA permits. Land use plans must give specific attention to AECs. As noted, CAMA requires that any development within these areas receive a permit for development. Under the CAMA "no permit shall be issued...which is inconsistent with the approved land use plan for the county in which it is proposed." In addition, no local ordinances may be adopted that are inconsistent with the local land use plans. In areas of the county not defined as AECs, local ordinances are reviewed by the Commission for consistency with the objectives of the CAMA and if inconsistent with the local land use plan, the Commission "shall transmit recommendations for modification to the adopting local government."

The Division of Coastal Management (DCM) published a list of CAMA accomplishments since 1974 (NCDCM, 2008). These CAMA accomplishments are a reflection of the law's original goals. The published accomplishments are the following:

1. "Protecting coastal water quality through requirements for a 30-foot buffer on coastal waterfront property and a new general permit for property owners to use riprap to protect wetlands in estuarine and public trust waters instead of bulkheads, which are not as environmentally friendly.'

2. "Protecting life and property through a ban on seawalls and other hard structures, oceanfront building setbacks, limits on development in dynamic inlet areas have reduced the risks of frequent property damage, long-term erosion mapping."

3. "Strengthening coastal land-use planning with revised guidelines and funding."

4. "Enhancing economies by balancing economic development and environmental protection, expediting CAMA permits, and funding more than more than 280 public access sites along the coast since 1981."

5. "Wetlands conservation planning, including mapping and inventory of wetlands; a functional assessment to rank wetlands according to important functions; policies to protect the most ecologically significant wetlands; and a procedure to identify and rank potential wetland restoration sites."

A.8.2 Coastal Futures Committee

Other North Carolina state objectives were outlined by the Coastal Futures Committee. On July 15, 1993 Governor James B. Hunt, Jr. signed Executive Order 20 establishing the Coastal Futures Committee. The committee was charged with assessing the management of coastal areas, celebrating North Carolina's coastal resources and charting a clear course of action for the future (North Carolina Coastal Futures Committee, 2004). The committee considered one of its most important recommendations to be the following:

> Local land-use plans should consider the cumulative and secondary impacts of growth on communities and on water quality and water supply. For instance, before approving the construction of a new bridge or marina, officials should consider not only the effects on the immediate environment but also the community's ability to deal effectively with the increased need for wastewater treatment and other infrastructure, as well as the estuary's ability to handle the increased wastewater load.

CAMA's 2004 "guidelines for land use plans," allow communities to set goals for environmental sustainability, incorporating cumulative impacts trends. These guidelines also encourage communities to guide development based on an analysis of land suitability, natural systems constraints, and availability of infrastructure and capacity. The community's goals would be based on its unique resources and management needs and will translate into a better-planned and sustainable community with less impact on valuable coastal resources and their important natural functions. (NCDCM, 2009)

In 1999, during the 25th anniversary of CAMA, NCDENR-DCM published a report on the state's progress in meeting the recommendations of the Coastal Futures Committee. A recommendation listed within the main body of the report is of particular significance to the non-road-accessible area of the Outer Banks. It states that "the state should not provide state funds for new development within designated areas of the federal Coastal Barrier Resources System." This statement is indicative of the state's commitment to protecting the northernmost Outer Banks, although no particular activities towards meeting this goal was identified in the report.

A.8.3 Albemarle-Pamlico Estuarine Study Comprehensive Conservation and Management Plan

The Albemarle-Pamlico Estuarine Study (APES) was a cooperative effort sponsored by the NC Department of Environment and Natural Resources and the US Environmental Protection Agency. Four committees guided the work of this six-year project. The committees consist of a diverse group of individuals, including: farmers, foresters, fishermen, environmentalists, developers, business and industry leaders, university researchers, government agencies, and local elected officials. The culmination of their

work is a *Comprehensive Conservation and Management Plan* (Albemarle-Pamlico Estuarine Study, 1994). Its goals are as follows:

1. "Restore, maintain, or enhance water quality in the Albemarle-Pamlico region so that it is fit for fish, wildlife, and recreation."

2. "Conserve and protect vital fish and wildlife habitats, and maintain the natural heritage of the Albemarle-Pamlico region."

3. "Restore or maintain fisheries and provide for their long-term, sustainable use, both commercial and recreational."

4. "Promote responsible stewardship of the natural resources of the Albemarle-Pamlico region."

5. "Implement the Comprehensive Conservation and Management Plan in a way that generates the greatest level of environmental quality while using the most cost-effective and equitable strategies."

All of these goals are relevant to the Mid-Currituck Bridge Study since Currituck County is within the Albemarle-Pamlico region.

A.9 Federal Resource Agencies

Most federal coastal area objectives are contained within the Coastal Zone Management Act of 1972 and the Coastal Barrier Resources Act of 1982. The National Flood Insurance Program and Federal Emergency Management Act are also applicable.

A.9.1 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) was passed by Congress in 1972. This legislation relies on voluntary measures and incentives to encourage federal, state, and local partnerships for coastal protection. This program does not require that states develop a coastal protection program, but it provides two specific incentives to encourage participation. First, it provides financial assistance to establish coastal management programs. Second, it assures states that federal actions in the coastal areas of participating states will be consistent with enforceable policies. Essentially, the CZMA vests considerable authority in the states to implement coastal management programs. In order for federal actions to occur that are not consistent with state policies, the president must determine that the actions are paramount to the interest of the United States. In North Carolina, the CAMA and the State Dredge and Fill Act (in which filling or dredging in estuarine waters, tidelands, marshlands, and state-owned lakes is regulated) make up the bulk of the state's coastal management program.

A.9.2 Coastal Barrier Resources Act

The Coastal Barrier Resources Act (CBRA) of 1982 was established to "minimize the loss of human life, reduce wasteful expenditure of federal revenues, and reduce the damage

to fish and wildlife and other natural resources that can occur when coastal barriers are developed" (US Fish and Wildlife Service, 2009). This legislation establishes the federal government's intent to protect undeveloped portions of the coastal barriers from further development. It does so by withdrawing Federal incentives for development, including federal flood insurance and assistance for infrastructure. This act does not prohibit landowners from developing their property, but it withdraws all federal support from such endeavors (Godschalk, 1984).

The federal government established specific guidelines for defining "undeveloped" stretches of coastal barriers and included these areas within a Coastal Barrier Resources System (CBRS). When established in 1982, this system consisted of 186 coastal barrier units covering approximately 751 miles of coastal barrier resources along the Atlantic and Gulf Coasts (US Fish and Wildlife Service, 2009). These units included areas containing less than one structure per five acres of land. CBRA applies to the non-road-accessible areas of the Currituck County Outer Banks north of the Villages at Ocean Hill development and the Audubon Society's wildlife refuge at the border of Currituck and Dare counties. Figure 3-5 indicates the CBRS areas within the ICE study area.

Prohibition of the issuance of new federal flood insurance associated with CBRA took effect October 1, 1983, and all other prohibitions on federal aid took effect October 18, 1982. Structures covered by federal flood insurance prior to the implementation of CBRA are exempt and existing coverage will extend to subsequent owners (US Department of the Interior, 1982). Eligibility for federal flood insurance and federally insured mortgages, including FHA and VA loans, also was withdrawn.

A.9.3 National Flood Insurance Program/Federal Emergency Management Agency

Another important federal coastal program is the National Flood Insurance Program (NFIP). It was established by Congress in 1968 with passage of the National Flood Insurance Act and is administered by the National Flood Insurance Administration, a component of the Federal Emergency Management Agency. The expressed intent of NFIP is "to mitigate future [flood] damage and provide protection for property owners against potential losses through an insurance mechanism that allows a premium be paid for the protection by those most in need of its protection" (FEMA, 1992).

Participation in NFIP is based on an agreement between local communities and the federal government that states that if a community will implement and enforce measures to reduce future flood risks to new construction in FEMA-designated special flood hazard areas (generally the 100-year floodplain), then the federal government will make flood insurance available as a financial protection against any future loss. Community financial participation is not mandatory. If, however, a community meets the conditions of a flood hazard area and chooses not to participate in NFIP, federal flood insurance is not available and, in the event of a presidentially declared flood disaster, no federal flood assistance can be provided for repair or reconstruction. A participating community must develop a flood management compliance program that meets FEMA criteria; if it does not, that community will be placed on probation and,

eventually, suspended from NFIP. This program is significant primarily for two reasons: no property owners can obtain federal flood insurance in non-participating communities; and participating communities, through wise floodplain management and FEMA-approved construction practices, can reduce flood loss and the high costs associated with flood disasters.

The non-road-accessible areas of the Currituck County Outer Banks where private development can occur are not eligible for NFIP because of their designation as undeveloped under CBRA. Much of this area, however, is not in the 100- year floodplain. The remainder of Currituck County and the Dare County Outer Banks (Nags Head north to Duck) are eligible for NFIP and do participate. Land use regulations in these areas adhere to FEMA standards.

Also under FEMA, when the president declares a disaster area, participating communities are eligible for the following types of assistance:

- Communities receive grants to rebuild community facilities to their pre-disaster condition;
- Homeowners receive grants to restore their primary residences to pre-disaster condition;
- Businesses receive low interest loans for restoration; and
- Residents receive grants to restore their basic personal effects.

Second homes for rent, such as the majority of dwellings on the Outer Banks, are treated as businesses.

All of these benefits are given *after* insurance coverage is paid, including Federal Flood Insurance, and only in the event of a presidential declaration of disaster area.

A.10 Non-Governmental Organizations

A.10.1 BeachHuggers of the Outer Banks

Goals of the organization are focused on beach preservation.

A.10.2 Blue Sky Foundation

The Blue Sky Foundation of North Carolina is a non-profit corporation chartered for the purpose of encouraging hazard resistant construction. The foundation provides information, public education, and professional training which promotes safer construction, wise land use, disaster mitigation, and sustainable development.

A.10.3 Build the Bridge

Build the Bridge-Preserve Our Roads Inc. (BB-PR) includes individuals and businesses, predominately from the communities of Currituck County, Duck, and Southern Shores. BB-PR opposes the widening of NC 12. They believe it would be destructive to the character of the area. They favor building a Mid-Currituck Bridge because they believe it would greatly alleviate traffic problems, provide a much needed hurricane evacuation alternative for the Northern beaches, and eliminate the need to widen NC 12.

A.10.4 Coastal Conservation Association

The stated purpose of the Coastal Conservation Association (CCA) is to advise and educate the public on conservation of marine resources. The objective of CCA is to conserve, promote, and enhance the present and future availability of these coastal resources for the benefit and enjoyment of the general public.

A.10.5 Currituck Chamber of Commerce

The mission of the Currituck Chamber of Commerce is to foster and develop a thriving and sustainable local economy in order to enhance our community's quality of life. The Currituck Chamber of Commerce defines quality of life as: economic opportunity for all; aesthetically pleasing and environmentally sound community; quality schools and education programs; proactive management of livability issues (e.g., traffic congestion, sprawl); and the existence of a large, dynamic, and diverse tax base.

A.10.6 Ducks Unlimited

Ducks Unlimited conserves, restores, and manages wetlands and associated habitats for North America's waterfowl. These habitats also benefit other wildlife and people.

A.10.7 Environment North Carolina

Environment North Carolina is a statewide, citizen-based environmental advocacy organization. Their statement of purpose includes the need for clean air, clean water, and open spaces. This group believes it takes independent research and tough-minded advocacy to win concrete results for our environment, especially when powerful interests stand in the way of environmental progress. The group focuses exclusively on protecting North Carolina's air, water, and open spaces.

A.10.8 NC Coastal Federation

The NC Coastal Federation is committed to “conserving the natural beauty and productivity of our coast so that it remains a great place to live, work and visit is what the NC Coastal Federation is all about.”

A.10.9 Outer Banks Association of Realtors

The Mission of the Outer Banks Association of Realtors is to "continuously enhance the professionalism of our members by providing the resources for education and information, political advocacy for real estate issues and private property rights, and the enforcement of The Realtor [a trademark].”

A.10.10 Outer Banks Home Builders Association

The Outer Banks Home Builders Association, a professional trade organization dedicated to informing, educating, and promoting the members of the building industry. The group's 600 members live and work in the communities they build on the Outer Banks and are committed to building better homes and better lives for their fellow citizens.

A.10.11 Soil and Water Conservation Society

Soil and Water Conservation Society (SWCS) is a nonprofit scientific and educational organization, founded in 1943, that serves as an advocate for conservation professionals and for science-based conservation practice, programs, and policy.

A.10.12 Surfrider Foundation (Outer Banks Chapter)

The Surfrider Foundation is working proactively to promote conservation and responsible coastal management that avoids the creation of coastal hazards or erosion problems. The Surfrider Foundation believes that the construction of new structures (especially those located in relatively high erosion areas or "hot spots") close to a dynamic coastal environment should be avoided.

A.10.13 The American Wild Horse Preservation Campaign

The American Wild Horse Preservation Campaign is supported by a broad-based coalition of public interest groups, environmentalists, humane organizations, and historical societies representing over 10 million supporters. Area of interest for this group is centered in Corolla.

A.10.14 The North Carolina Chapter of the Nature Conservancy

The North Carolina Chapter of the Nature Conservancy is involved in an ongoing effort to protect Currituck Banks.

Appendix B

Protected Species

B. Protected Species

As of February 2011, the US Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) identified 13 federally protected species occurring in Currituck and Dare counties (USFWS, 2011; NMFS, 2011), as shown in Table B-1.

Table B-1. Federally-Protected Species Listed for Currituck and Dare Counties

Scientific Name	Common Name	Federal Status[1]
Canis rufus	Red wolf	E-EXP
Trichechus manatus	West Indian manatee	E
Charadrius melodus	Piping plover	T
Picoides borealis	Red-cockaded woodpecker	E
Sterna dougallii dougallii	Roseate tern	E
Alligator mississippiensis	American alligator	T(S/A)
Chelonia mydas	Green sea turtle	T
Eretmochelys imbricata	Hawksbill sea turtle	E
Lepidochelys kempii	Kemp's ridley sea turtle	E
Dermochelys coriacea	Leatherback sea turtle	E
Caretta caretta	Loggerhead sea turtle	T
Acipenser brevirostrum	Shortnose sturgeon	E
Amaranthus pumilus	Seabeach amaranth	T

Source: USFWS, 2011; NMFS, 2011.

[1] T – Threatened
T(S/A) – Threatened because of similarity of appearance to American crocodile
E – Endangered
E-EXP – Endangered and population is experimental

The red knot (*Calidris canutus*), a type of sandpiper, consists of three subspecies. The *rufa* subspecies was listed as a candidate species for Endangered Species Act protection on September 12, 2006. These species are not protected by federal law, but may be elevated to listed status in the near future. Threats to red knot habitat in North Carolina include beach stabilization (i.e., nourishment), channel relocation, and bulkhead construction. Housing development is also a threat to habitat, but is also a driver for beach stabilization (CZR Incorporated, 2011a; CZR Incorporated, 2011b).