ADMINISTRATIVE ACTION FINAL ENVIRONMENTAL IMPACT STATEMENT

US Department of Transportation

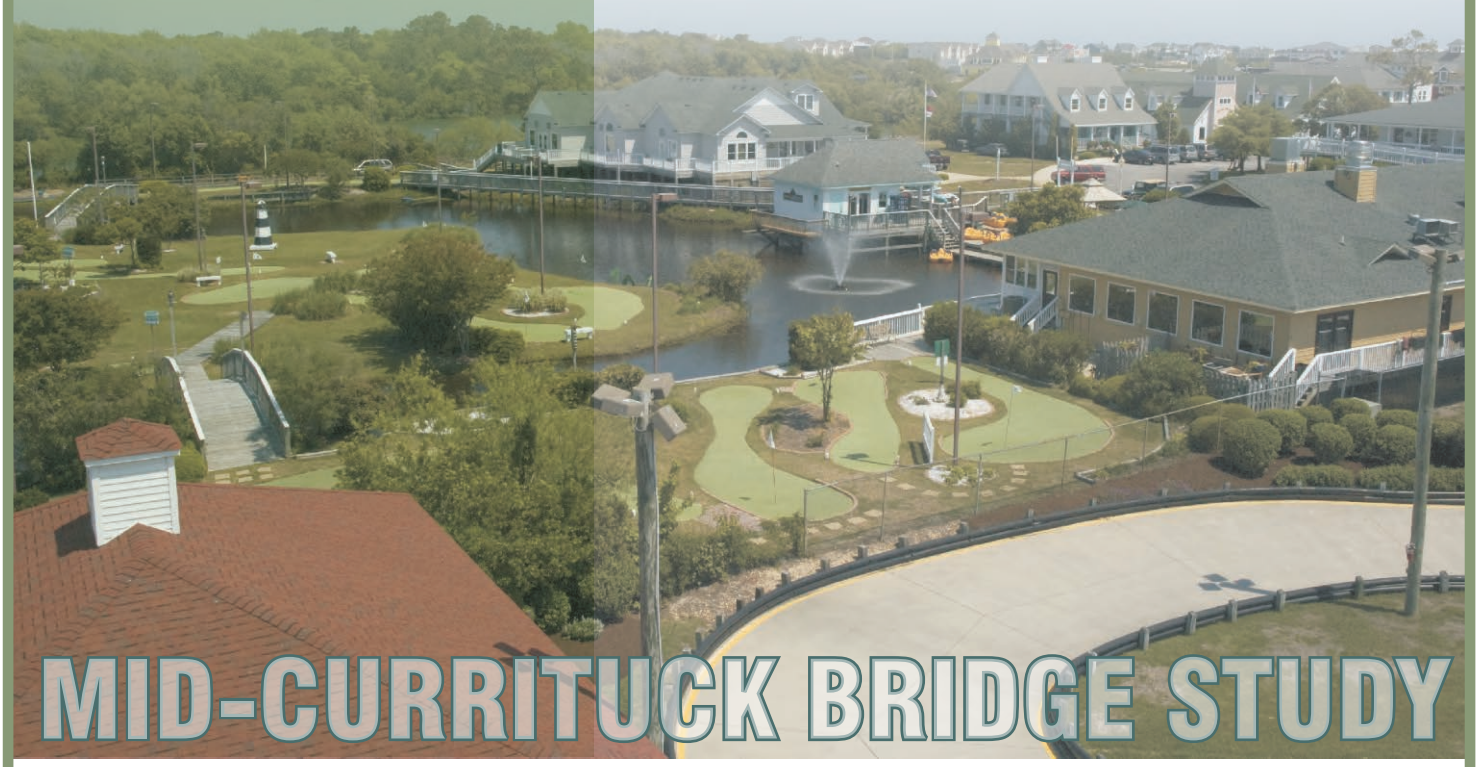
Federal Highway Administration

and

North Carolina Turnpike Authority

a division of the

North Carolina Department of Transportation



MID-CURRITUCK BRIDGE STUDY

NORTH CAROLINA
Turnpike Authority

Submitted Pursuant to the National Environmental Policy Act
42 USC 4332(2)(c)

January 2012

The proposed project calls for transportation improvements in the Currituck Sound area, with focus on consideration of a Mid-Currituck Bridge over Currituck Sound. This Final Environmental Impact Statement (FEIS) documents the purpose of and need for the project; describes existing and projected conditions in the project area; identifies and describes the five Draft Environmental Impact Statement (DEIS) detailed study alternatives, and the Preferred Alternative (a refinement of one of the five DEIS alternatives); and presents an assessment of the direct, indirect, and cumulative impacts of these alternatives. Variations included in the five DEIS alternatives are two hurricane evacuation improvement options and two mainland bridge approach options. The Preferred Alternative includes a single preferred hurricane evacuation improvement and mainland bridge approach.

This FEIS includes all of the sections specified by the President's Council on Environmental Quality in sections 1502.10 to 1502.18 of Title 40 of the *Code of Federal Regulations* (CFR). These sections are presented in a manner that is intended to facilitate the reading and understanding of this document's findings by all readers, including the public, environmental resource and regulatory agency representatives, non-government environmental organizations, and decision-makers. The main body focuses on key findings, including purpose and need, alternatives, and characteristics of the affected environment and environmental consequences. The findings of affected environment and environmental consequences are presented in a single chapter so the reader does not have to shift between chapters to locate findings related to a specific aspect of the environment. Sections not directly related to the project and its impact are included in this FEIS as appendices. A detailed table of contents and summary also are included, as well as a list of project commitments. For readers interested in the details of the studies and activities associated with the preparation of this FEIS, a series of technical reports has been published. They are available to reviewers on the compact disc (CD) that accompanies this FEIS, at public review locations listed in Appendix C as a printed copy, and on the North Carolina Turnpike Authority (NCTA) web site at https://www.ncdot.gov/projects/mid-currituck-bridge/. A list of these reports and their tables of contents are listed in Appendix D of this document.

The following persons may be contacted for additional information concerning this FEIS:

Mr. John F. Sullivan III, P.E.
Federal Highway Administration
310 New Bern Avenue, Suite 410
Raleigh, North Carolina 27601-1418
(919) 856-4346

Ms. Jennifer H. Harris, P.E.
North Carolina Turnpike Authority
1578 Mail Service Center
Raleigh, North Carolina 27699-1578
(919) 707-2700

FHWA-NC-EIS-10-01-F
Federal Highway Administration
North Carolina Division

NORTH CAROLINA
Turnpike Authority

Mid-Currituck Bridge Study
Currituck and Dare Counties, North Carolina

Federal-Aid Project No. BRSTP-000S(494)
WBS Element: 34470.1.TA1
STIP Project No. R-2576

Administrative Action
Final Environmental Impact Statement

Submitted Pursuant to the National Environmental Policy Act
42 USC 4332(2)(c)
US Department of Transportation
Federal Highway Administration
and
North Carolina Turnpike Authority
a division of the
North Carolina Department of Transportation

Cooperating Agencies
US Army Corps of Engineers
US Coast Guard

1.12.2012
Date

Steven D. DeWitt, P.E.
Chief Engineer
North Carolina Turnpike Authority

01/12/2012
Date

John F. Sullivan III, P.E.
Division Administrator
Federal Highway Administration

PAGE INTENTIONALLY LEFT BLANK

NORTH CAROLINA
Turnpike Authority

Mid-Currituck Bridge Study
Currituck and Dare Counties, North Carolina

Federal-Aid Project Number. BRSTP-000S(494)
WBS Element: 34470.1.TA1
STIP Project No. R-2576

Administrative Action
Final Environmental Impact Statement

Submitted Pursuant to the National Environmental Policy Act
42 USC 4332(2)(c)
US Department of Transportation
Federal Highway Administration
and
North Carolina Turnpike Authority
a division of the
North Carolina Department of Transportation

Cooperating Agencies
US Army Corps of Engineers
US Coast Guard

Document prepared by:
Parsons Brinckerhoff in association with:
CZR Incorporated/East Carolina University/Panamerican Consultants/Howard Stein – Hudson, Incorporated/Atkins

1-12-2012
Date

John Page, AICP, CEP
Parsons Brinckerhoff
Project Manager

NATIONAL ASSOCIATION OF ENVIRONMENTAL PROFESSIONALS
JOHN M. PAGE
05286
CERTIFIED ENVIRONMENTAL PROFESSIONAL

Document prepared for:
North Carolina Turnpike Authority

1·12·2012
Date

Jennifer H. Harris, P.E.
North Carolina Turnpike Authority
Director of Planning and Environmental Studies

NORTH CAROLINA PROFESSIONAL SEAL 26972 ENGINEER JENNIFER H HARRIS

PAGE INTENTIONALLY LEFT BLANK

Preface

What is the purpose of a Final Environmental Impact Statement?

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 evaluating proposed transportation improvements in the Currituck Sound area, including consideration of a Mid-Currituck Bridge.

This Final Environmental Impact Statement (FEIS) is an important milestone in the project planning process. The objective of this FEIS is to provide the public and decision-makers with the appropriate and relevant information used to make an informed decision on a Preferred Alternative to select for implementation. This environmental process is intended to provide all interested parties with the opportunity to contribute to the decision-making process.

The development and evaluation of the transportation improvement alternatives assessed in this FEIS was an iterative process that included coordination with public agencies, elected officials, stakeholders, and members of the public. Alternatives were evaluated for environmental impacts (including the human and natural environments), engineering constraints, transportation benefits, and cost. Environmental study findings were initially presented in a March 2010 Draft Environmental Impact Statement (DEIS), which was distributed for government agency and public review.

What does this FEIS include?

The table of contents presents the overall organization of this FEIS and can direct you to the appropriate page numbers in various chapters and sections in the document. Key findings are presented in the summary section. A full discussion of findings is presented in three chapters:

- Chapter 1 – Purpose of and Need for Action describes the transportation improvement needs in the project area and identifies related project objectives.

- Chapter 2 – Alternatives describes the characteristics of the alternatives considered for implementation, the "detailed study alternatives," including the Preferred Alternative. This chapter also summarizes other alternatives considered and the reasons why they were not selected for detailed study. The No-Build Alternative also is described.

- Chapter 3 – Affected Environment and Environmental Consequences describes the existing and forecast future environmental conditions, as well as potential short- and long-term beneficial and adverse effects (if any) of the detailed study alternatives on these conditions. Possible mitigation measures are identified, where appropriate.

Also included with this FEIS are several appendices. Attached to the printed version of this FEIS is a compact disc (CD) that contains this FEIS, as well as the supporting technical documentation, including responses to comments made on the DEIS and methods and assumptions that provided the basis for the technical analyses and findings presented in this FEIS. A list of the technical documentation included on the CD and the table of contents for each document is included in Appendix D.

Printed copies of this FEIS and supporting technical documentation are available for public review at public locations listed in Appendix C. Additional copies of the CD are available from NCTA upon request (see the contact information in the summary of this FEIS). All documentation is posted on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/.

FHWA procedures allow for the preparation of an abbreviated version of the FEIS where the only changes needed in the document are minor and consist of factual corrections and/or an explanation of why the comments received on the DEIS do not warrant further response. FHWA also allows the preparation of a condensed FEIS, which includes only new material and references the DEIS for material that did not change between the DEIS and FEIS. Neither of these approaches was used for this FEIS primarily because notable refinements were made to the Preferred Alternative, including mitigation details, between the DEIS and FEIS. It was believed to be important to present those details and associated changes in impact within the context of the comparison of other alternatives rather than asking the reader to compare two separate documents (DEIS and FEIS) in order to understand the differences.

What happens next?

This FEIS identifies NCTA and FHWA's Preferred Alternative. Agencies or the public may review the findings of this FEIS for 30 days after the availability of the FEIS for public review is published in the *Federal Register*. The public can submit comments in writing to the address at the beginning of the summary. After the review period, FHWA will issue a Record of Decision (ROD) that responds to substantive comments on this FEIS and finalizes its decision on the Selected Alternative. With the release of the ROD, the planning process is complete, and final design, right-of-way acquisition, and construction of the Selected Alternative may begin if a build alternative is selected. NCTA expects to continue to have periodic Citizens Informational Workshops and other public involvement opportunities as the project progresses after the release of the ROD.

Summary

Federal Highway Administration
Administrative Action Environmental Impact Statement

( ) Draft (x) Final ( ) Draft Section 4(f) Evaluation

The proposed project calls for transportation improvements in the Currituck Sound area. The Preferred Alternative is a Mid-Currituck Bridge over Currituck Sound. This Final Environmental Impact Statement (FEIS) documents the purpose of and need for the project; describes existing and projected conditions in the project area; identifies and describes the five DEIS detailed study alternatives, and the Preferred Alternative (a refinement of one of the five DEIS alternatives); and presents an assessment of the direct, indirect, and cumulative impacts of these alternatives. Variations included in the five DEIS alternatives are two hurricane evacuation improvement options and two mainland bridge approach options. The Preferred Alternative includes a single preferred hurricane evacuation improvement and mainland bridge approach.

The following persons may be contacted for additional information concerning this document:

Mr. John F. Sullivan III, P.E.
Federal Highway Administration
310 New Bern Avenue, Suite 410
Raleigh, North Carolina 27601-1418
(919) 856-4346

Ms. Jennifer H. Harris, P.E.
North Carolina Turnpike Authority
1578 Mail Service Center
Raleigh, North Carolina 27699-1578
(919) 707-2700

What is being proposed and where is it?

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 evaluating proposed transportation improvements in the Currituck Sound area. The proposed action is included in NCDOT's approved State Transportation Improvement Program (STIP), the North Carolina Intrastate System, the *North Carolina Strategic Highway Corridors Concept Development Report*, and the *Thoroughfare Plan for Currituck County*. In those plans, the proposed action is defined as a bridge in Currituck County 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 this FEIS include options that involve improvements to the existing road network, both with and without a Mid-Currituck Bridge. The project area encompasses US 158 between its intersection with NC 168 and its intersection with NC 12, and NC 12 from its intersection with US 158 north to where

it terminates in the community of Corolla. The project area is shown on Figure S-1. The Preferred Alternative includes a bridge across Currituck Sound and some improvements to NC 12.

What need would the project meet, and what is the project's purpose?

The proposed project responds to three project area needs:

- The need to substantially improve traffic flow on the project area's thoroughfares (US 158 and NC 12);
- The need to substantially reduce travel time for persons traveling between the Currituck County mainland and the Currituck County Outer Banks; and
- The need to reduce substantially evacuation times from the Outer Banks for residents and visitors who use US 158 and NC 168 as an evacuation route.

Given the needs described above, the purposes of the proposed project are:

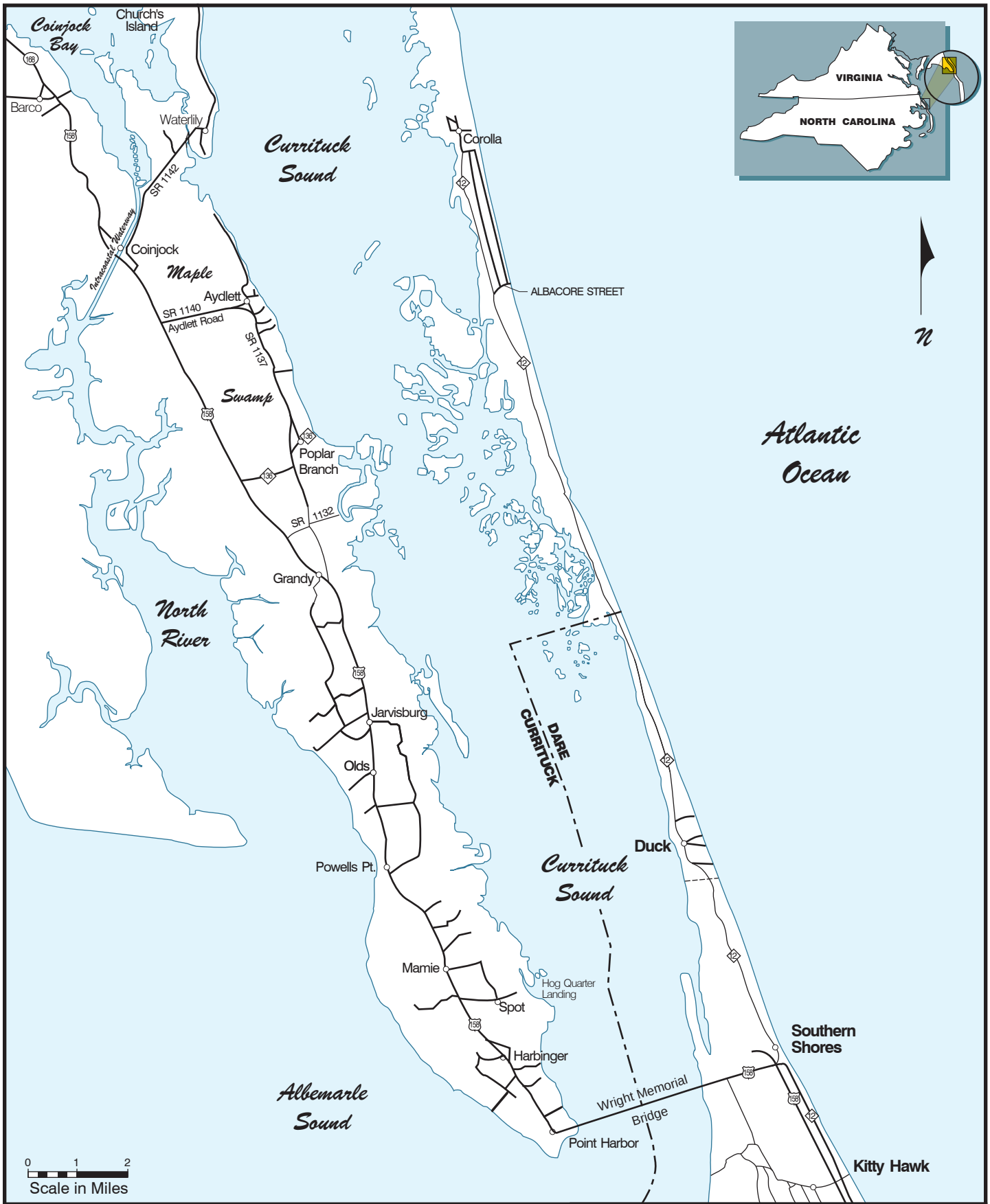
- To substantially improve traffic flow on the project area's thoroughfares. Thoroughfares in the project area are NC 12 and US 158;
- To substantially reduce travel time for persons traveling between the Currituck County mainland and the Currituck County Outer Banks; and
- To reduce substantially hurricane clearance time for residents and visitors who use US 158 and NC 168 during a coastal evacuation.

Purpose and need of the project is discussed in Chapter 1 of this FEIS and in greater detail in the *Statement of Purpose and Need* (Parsons Brinckerhoff, 2008). This report is on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at http://www.ncdot.gov/projects/midcurrituckbridge/.

What alternatives are under consideration and what is the Preferred Alternative?

Five DEIS detailed study alternatives and the Preferred Alternative (a refinement of one of the five DEIS alternatives) are considered for implementation in this FEIS, as well as the No-Build Alternative. The detailed study alternatives are named:

- ER2;
- MCB2/C1 (MCB2 using bridge corridor C1);
- MCB2/C2 (MCB2 using bridge corridor C2);



LEGEND

— - — County Boundaries

Project Area

Figure

S-1

- MCB4/C1 (MCB4 using bridge corridor C1);
- MCB4/C2 (MCB4 using bridge corridor C2); and
- Preferred Alternative.

The Preferred Alternative contains the components of MCB4/C1 with refinements made to help avoid and minimize impacts.

The "ER" in ER2 stands for "Existing Roads." A Mid-Currituck Bridge is not included in this alternative, but only widening existing US 158 and NC 12. The "MCB" stands for Mid-Currituck Bridge. MCB2 and MCB4, as well as the Preferred Alternative, include a Mid-Currituck Bridge and different amounts of improvements to existing US 158 and NC 12. For MCB2 and MCB4, there are two variations of the proposed bridge corridor in terms of its terminus on the Outer Banks. Bridge corridor C1 would connect with NC 12 at an intersection approximately 2 miles north of the Albacore Street retail area, whereas bridge corridor C2 would connect with NC 12 approximately 0.5 mile south of this area. The Preferred Alternative includes the C1 bridge corridor as refined between the DEIS and FEIS to help avoid and minimize impacts. The "C" stands for "Central," as opposed to other corridor possibilities further north (N) and south (S).

For the MCB2 and MCB4 alternatives, two design options also are considered for the mainland approach to the bridge over Currituck Sound (between US 158 and Currituck Sound), Option A and Option B. The design options differ in regards to the location of the toll plaza, whether Maple Swamp is crossed by a bridge or fill, and whether drivers traveling between US 158 and the community of Aydlett would use existing Aydlett Road or the bridge approach road (without paying tolls). No access to and from the Mid-Currituck Bridge would be provided at Aydlett with either option. The Preferred Alternative includes Option A.

The refinements to MCB4/C1 with Option A that are part of the Preferred Alternative are:

- 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 widened sections 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 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).

When MCB2 or MCB4 is discussed in this FEIS without specification of a bridge corridor (C1 or C2), it means that the discussion applies to MCB2 or MCB4 with either corridor. The same is true when MCB2 and MCB4 are discussed in this FEIS without specification of a mainland bridge approach option or a hurricane evacuation option. When impacts differ between the mainland approach road design options (Option A and Option B), the names of the alternatives are augmented with an additional suffix. For example, MCB2 with mainland design Option B and the C1 corridor is referred to as MCB2/B/C1.

For ER2, MCB2/C1, MCB2/C2, MCB4/C1, and MCB4/C2, two hurricane evacuation options are considered. The first option is to add a third outbound lane to US 158 for evacuation use only. The second option is to reverse the existing center turn lane on US 158 to create a third outbound lane during an evacuation. When a third outbound lane is needed on the Wright Memorial Bridge or Knapp (Intracoastal Waterway) Bridge, one existing inbound lane would be reversed. 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 characteristics of these alternatives are described in Section 2.1 of this FEIS.

The No-Build Alternative also is considered. The No-Build Alternative assumes that the proposed project would not be implemented, but includes other reasonably foreseeable improvements contained in NCDOT's 2009 to 2015 STIP. The 2012 to 2018 Draft STIP lists the same projects except for one that is now built.

How were the DEIS alternatives selected for detailed study?

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 study findings, discussions at TEAC meetings, and written comments received from the agencies and public, the DEIS detailed study alternatives were selected. Factors used to screen the potential alternatives included:

- Ability to meet purpose and need and the level of benefit offered in relation to those purposes;
- Ability to improve system efficiency;
- Economic feasibility (cost and funding capacity); and
- Potential impacts on communities and natural resources.

The other road widening and bridge alternatives considered during the screening were:

- ER1, which was identical to ER2 except NC 12 was assumed to be widened to four lanes instead of three lanes from US 158 to Albacore Street;
- MCB1, which was identical to MCB2 except NC 12 was assumed to be widened to four lanes instead of three lanes from US 158 to the Mid-Currituck Bridge terminus on the Outer Banks; and
- MCB3, which was identical to MCB4 except it did not include a third outbound lane on US 158 between the Wright Memorial Bridge and NC 12.

Other alternative concepts also were considered but were not carried forward as detailed study alternatives. These were: (1) shifting rental times; (2) transportation systems management; (3) bus transit; and (4) a ferry service across Currituck Sound as an alternative to a Mid-Currituck Bridge.

Several additional bridge corridors were considered and evaluated. They were C3, C4, C5, and C6, all in the Aydlett area but south of Aydlett Road. Alternatives north of the community of Aydlett and near the Intracoastal Waterway (N1 and N2) and further south in the Poplar Branch area (S) also were considered over the course of alternatives studies.

The alternatives screening study and its findings are presented in detail in the *Alternatives Screening Report* (Parsons Brinckerhoff, 2009). This report is on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/.

What other alternatives were examined and then eliminated from further consideration?

Other alternatives evaluated included three additional road and/or bridge alternatives, lower cost alternatives that attempted to make more efficient use of the available road capacity on US 158 and NC 12 (shifting vacation housing rental times, minor improvements to the road system, and bus transit), ferry alternatives, and multiple Mid-Currituck Bridge corridor alternatives. The alternatives and the reasons why they were not selected for detailed study are presented in Section 2.5. Additional detail can be found in the *Alternatives Screening Report* (Parsons Brinckerhoff, 2009).

What comments or concerns were expressed by the public and environmental resource and regulatory agencies during the selection of the DEIS detailed study alternatives?

Agency and public comments were solicited on multiple occasions during the DEIS alternatives study process. These comments were considered in the development and comparison of alternatives and in the selection of the DEIS detailed study alternatives.

Agency and public comments received during the DEIS alternatives screening process focused on traffic improvement benefits, hurricane evacuation clearance times, capital costs, potential impacts to communities and natural resources, and potential economic impacts. The bridge portion of this project would be a toll facility; the public commented on tolling as a financing tool. The public also commented on pedestrian and bicycle access or accommodations.

Pubic and agency comments associated with selection of the DEIS detailed study alternatives are summarized in the *Alternatives Screening Report* (Parsons Brinckerhoff, 2009). The *Stakeholder Involvement for Draft Environmental Impact Statement Technical Report* (Parsons Brinckerhoff, 2009) also is included on the CD, at public review locations listed in Appendix C, and on the NCTA web site at http://www.ncdot.gov/projects /midcurrituckbridge/. It describes agency and public involvement opportunities during development of the *Statement of Purpose and Need* (Parsons Brinckerhoff, October 2008), and the alternatives screening and their outcomes.

What other transportation projects are proposed in the project area?

The following are additional major transportation improvement projects listed in NCDOT's 2009 to 2015 STIP associated with the network that serves or feeds the project area in Dare, Currituck, and adjoining counties:

R-4457 Convert the existing at-grade intersection of US 158 and NC 12 at Southern Shores to an interchange. The planning and design for this project are currently underway. The project, however, is not funded for either right-of-way acquisition or construction.

R-2545 Widen US 64 to multi-lanes east of Columbia to east of the Alligator River. Planning and design for the project are currently underway, and right-of-way acquisition, mitigation, and structures related work are scheduled for Federal Fiscal Year (FFY) 2012. Construction is unfunded.

R-2544 Widen US 64 to multi-lanes east of the Alligator River to US 264. Right-of-way acquisition is scheduled for FFY 2012. Construction is unfunded. Planning and design are underway.

R-2574 Widen US 158 to multi-lanes east of NC 34 at Belcross in Camden County to NC 168 in Currituck County. The project is not funded for right-of-way acquisition or construction.

R-4429 Upgrade SR 1222 from NC 168 to north of SR 1232 and from SR 1213 to SR 1216. This project is partially complete, and construction is underway for the rest of the project.

Except for R-4457, all of these projects are included in the No-Build Alternative described in Section 2.1.2.6 and shown on Figure 2-13 in Chapter 2. The interchange proposed as R-4457 is not a part of the No-Build Alternative because the interchange is included as a component of detailed study alternatives ER2 and MCB2. The interchange is included in ER2 and MCB2 because an interchange is needed to reach a desirable level of service (LOS) on the summer weekday in 2035. All of these projects are in the 2012 to 2018 Draft STIP except for R-4429, for which construction is now complete.

What are the major differences between the alternatives that are considered important to selecting an alternative for implementation?

Four factors are important to the selection of an alternative for implementation. In order of priority, they are:

1. Effectiveness in meeting the project's purpose and need;

2. Cost and affordability;

3. The ability to meet a variety of state and federal regulatory requirements; and

4. Minimizing impacts to communities, cultural resources, and natural resources.

This section compares the detailed study alternatives, including the Preferred Alternative, from the perspective of these four factors.

How effective would each alternative be in meeting the project's purpose and need?

All of the detailed study alternatives would meet the project's purpose and need to varying degrees. Key differences are:

- MCB2, which includes both a Mid-Currituck Bridge and substantial improvements to existing roads, would have the greatest traffic flow benefits. It would cut congested travel in year 2035 in the project area by 52 percent. MCB4 and the Preferred Alternative would cut congested travel by 39 percent. ER2 would cut congested travel by 22 percent.

- MCB2, MCB4, and the Preferred Alternative with the Mid-Currituck Bridge would offer substantial travel time savings for many travelers between the Currituck County mainland and the Outer Banks. MCB2 would offer the best summer travel time savings overall for those using US 158 and NC 12 via the Wright Memorial Bridge. Even without improvements to existing roads, MCB4 and the Preferred Alternative would offer better travel time savings for those using the Wright Memorial Bridge than ER2 by reducing traffic on US 158 and NC 12 in Dare County.

- The construction of a third outbound lane on US 158 would offer the greatest reductions in hurricane evacuation clearance time with any alternative, bringing the projected 2035 clearance time (in 2035 with 75 percent tourist occupancy) down to 22 hours from 36 hours with the No-Build Alternative. The 22-hour clearance time is 4 hours above the state clearance time standard of 18 hours. Times are also substantially reduced (to 27 hours) when reversing the center lane to serve outbound traffic during the evacuation; however, this reduction is not as much as with a third outbound lane because traffic would also continue to use the lane as a turn lane, thereby slowing travel. A third outbound lane and the associated clearance time reduction could be achieved with any of the detailed study alternatives. Reversing the center turn lane would be practical only with MCB2, MCB4, and the Preferred Alternative.

Additional detail on the travel benefits of the detailed study alternatives, including the Preferred Alternative, is presented in Table 2-3 in Section 2.2.

How much would each alternative cost, and how would those costs be funded?

The total cost (in year of expenditure dollars) for the detailed study alternatives, including the cost of construction, environmental mitigation, bridge drainage treatment, pedestrian and bicycle features (lighted path and parking lots at bridge ends on the Mid-Currituck Bridge, right-of-way, and utility relocation would be:

- ER2: $416.1 to $523.4 million;
- MCB2/A/C1: $884.2 to $1,062.4 million;
- MCB2/B/C1: $800.1 to $970.2 million;
- MCB2/A/C2: $888.1 to $1,065.1 million;
- MCB2/B/C2: $802.4 to $973.5 million;

- MCB4/A/C1: $685.3 to $816.2 million;
- MCB4/B/C1: $600.7 to $724.1 million;
- MCB4/A/C2: $680.3 to $808.6 million;
- MCB4/B/C2: $595.5 to $716.4 million; and
- Preferred Alternative: $502.4 to $594.1 million.

If a Mid-Currituck Bridge is a part of the alternative selected for implementation, it is anticipated that financing the project would involve North Carolina's first venture into the world of Public Private Partnerships (PPP) for major transportation infrastructure. PPPs are formal collaborations between public agencies and private concessionaires that capture the advantages of private sector participation while maintaining public accountability to develop new infrastructure. These partnerships can be an effective way to deliver much needed infrastructure while minimizing costs and risks to the public. A partnering team was selected in December 2008. The services provided by the partner focused on the evaluation of the bridge alternative during the environmental study process and will support the negotiation of a long-term construction, financing, and operating and maintenance agreement. As per the requirements of Title 23 CFR, Section 636.109, the partner did not prepare the DEIS or this FEIS or have any decision-making responsibility with respect to the NEPA process. Additional information on PPP and the procurement of the partnering team is presented in Section 2.3.

NCTA has identified two funding sources available for the Preferred Alternative. The two funding sources are state appropriations from highway user taxes and toll revenues. Using these two funding sources, three financing techniques would be used in combination if the Preferred Alternative is selected for implementation. These techniques are:

1. State appropriation bonds;
2. Toll revenue bonds; and
3. Private equity from the PPP private concessionaire.

If ER2 were selected for implementation, the project would have to be built by NCDOT with traditional highway financing methods rather than by the NCTA financing techniques described above since ER2 has no component that could be funded by these financing techniques. If MCB2 were selected for implementation, the project would need to be built as a joint effort of NCTA and NCDOT, with NCDOT providing funds for components that could not be funded by the financing techniques described above. Based on state law (Session Law 2011-145), state appropriations, or "gap funding," cannot be used to fund ER2 or other significant non-bridge portions of alternatives because the state appropriation funds that could back state appropriation bonds that are allocated to NCTA can only be used to pay financing expenses for a Mid-Currituck

Bridge. If these funds were allocated to NCDOT, they would be subject to the equity formula, which would dilute the effectiveness of the funding.

What state and federal regulatory requirements must be met by the Preferred Alternative?

In addition to NEPA, with its requirements being met by the preparation and release of this FEIS (as well as a future Record of Decision [ROD]), several other environmental laws must be considered. The following paragraphs briefly note those laws and how the Preferred Alternative relates to their requirements.

Section 106 Historic Resource Impacts

Section 106, a provision of the National Historic Preservation Act of 1966, requires federal agencies to consider the effects of their projects on historic properties and to provide the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on those effects. This opportunity to comment is often delegated to a state's State Historic Preservation Office (HPO). This is the case for this project. The HPO has concluded that the Preferred Alternative would have no adverse effect on historic properties in the project area. Following the receipt of comments on this FEIS and the finalization of the selection of a Preferred Alternative, additional archaeological surveys would be conducted on both land and water to identify the presence or absence of additional resources. Also, an assessment would be conducted of the NRHP eligibility of archaeological sites within the APE of the Preferred Alternative if they would be jeopardized by impacts from project construction.

Floodplain Impacts

Protection of floodplains and floodways is required by EO 11988, *Floodplain Management*. The US Department of Transportation Order 5650.2, titled "Floodplain Management and Protection," prescribes policies and procedures for ensuring that proper consideration is given to the avoidance and mitigation of adverse floodplain effects. The Preferred Alternative would involve no significant encroachment on the 100-year floodplain in the project area. Nor would there be a significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or that provides a community's only evacuation route. The Preferred Alternative would not create a significant risk beyond risks associated with development on the Outer Banks and the mainland that exist today. The Preferred Alternative would not have a significant adverse impact on natural and beneficial floodplain values.

Section 404 Jurisdictional Waters Impacts

Waters of the US, including wetlands, are regulated under Sections 401 and 404 of the Clean Water Act (CWA). Section 404 of the CWA regulates the discharge of fill material into waters of the US. The Clean Water Act provides for public notice and review of Section 404 permit applications, as well as review by the US Fish and Wildlife Service (USFWS) and approval by the US Environmental Protection Agency (USEPA). Section 401 requires that the state provide certification that any activity authorized under

Section 404 is in compliance with effluent limits, the state's water quality standards, and any other appropriate requirements of state law.

Applications for US Army Corps of Engineers (USACE) dredge and fill permits under Section 404 must meet mitigation requirements found in the "Memorandum of Agreement (MOA) Between the Environmental Protection Agency and the Department of the Army Concerning the Determination of Mitigation Under the Clean Water Act Section 404(b)(1) Guidelines" (February 1990). This MOA requires the applicant to utilize a sequencing process that includes avoidance of impacts, minimization of impacts, and, finally, compensation of unavoidable impacts to aquatic resource values. Executive Order 11990, *Protection of Wetlands*, also calls for minimizing the destruction, loss, or degradation of wetlands and for enhancing their beneficial values. Of the detailed study alternatives considered, the Preferred Alternative would have the least fill in wetlands based on the area within the slope-stake line (edge of earthwork) plus an additional 25-foot buffer (7.9 acres). Of the alternatives with a Mid-Currituck Bridge, it would involve the least clearing of wetlands at 25.5 acres and the least shading of open water 6 feet deep or less at 8.7 acres. The Preferred Alternative would place no fill in streams.

Steps were taken during project planning before and after the release of the DEIS, and would continue to be taken, to avoid and minimize impacts to jurisdictional resources. Several mitigation opportunities are available.

Coastal Area Management Act Areas of Environmental Concern Impacts

The North Carolina Coastal Resources Commission, through its staff at the North Carolina Department of Environment and Natural Resources, Division of Coastal Management (NCDENR-DCM), regulates the state's Coastal Area Management Act (CAMA), Dredge and Fill Law, and the federal Coastal Zone Management Act of 1972. It issues CAMA permits for development in Areas of Environmental Concern (AEC). Four types of AEC occur within the project area: coastal wetlands, estuarine waters, coastal shorelines, and public trust waters. The shorelines and waters of Currituck Sound, as well as the wetland freshwater marsh communities found within the project area, are all considered AEC under CAMA. This also includes Jean Guite Creek, which is a Primary Nursery Areas (PNA). In addition, Jean Guite Creek, Currituck Sound, and the Atlantic Intracoastal Waterway (AIWW) are considered public trust waters that fall under CAMA jurisdiction. Within the project area, Currituck Sound comprises approximately 3,900 acres, Jean Guite Creek comprises approximately 0.5 acre, and the AIWW approximately 1.9 acres. A CAMA permit for impacts to AEC under jurisdiction of NCDENR-DCM would be required.

Stormwater Impacts

NCTA must and 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 for the additional impervious surface area that would be created by the construction of the Preferred Alternative if it is

selected for implementation. A planned stormwater management plan for minimizing the potential impact of project pollutants is proposed in this FEIS. A final stormwater management plan would be developed in association with the North Carolina Department of Environment and Natural Resources, Division of Water Quality (NCDENR-DWQ), as well as other appropriate state and federal environmental resource and regulatory agencies, during final design and permitting of the Preferred Alternative.

Threatened and Endangered Species Impacts

Section 7 of the Endangered Species Act, Title 16 *United States Code* (USC) Section 1536(a)(2), requires all federal agencies to consult with the National Marine Fisheries Service (NMFS) for marine and anadromous species, or USFWS for freshwater and wildlife species, if they are proposing an "action" that may affect listed species (13 in Dare and Currituck counties) or their designated habitat. There is habitat present for 10 federally protected species in the project area. The biological conclusion for the Preferred Alternative is "May Affect, Not Likely to Adversely Affect" for three of the 11 threatened and endangered species under USFWS jurisdiction for which a biological conclusion is required, and "No Effect" on the other eight species under USFWS jurisdiction for which a biological conclusion is required. The biological conclusion for the Preferred Alternative is "May Affect, Not Likely to Adversely Affect" for four of the six threatened and endangered species under NMFS jurisdiction for which a biological conclusion is required, and "No Effect" on the other two species under NMFS jurisdiction for which a biological conclusion is required. All construction would follow USFWS guidelines for the protection of bald eagles.

Essential Fish Habitat Impacts

The Magnuson-Stevens Fishery Conservation and Management Act (Title 16 USC, Section 1801 *et seq*.) requires the US Secretary of Commerce to develop guidelines assisting regional fisheries management councils in the identification and creation of management and conservation plans for essential fish habitat (EFH). Each council is required to amend existing fisheries management plans (FMPs) to include EFH designations and conservation requirements. The act also requires federal agencies to consult with the Secretary of Commerce on all actions, or proposed actions, authorized, funded, or undertaken by the agency that might adversely affect EFH. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (Title 16 USC, Section 1802(10)).

The Preferred Alternative likely would result in non-substantial short-term and long-term adverse effects to EFH and managed species. There would be no fill or clearing impact to EFH with the Preferred Alternative. Potential impacts of the Preferred Alternative would include:

- Pile impacts resulting in the permanent loss of EFH of 0.1 acre. There would be no clearing impacts to EFH.

- Shading by a Mid-Currituck Bridge of existing submerged aquatic vegetation (SAV) beds, SAV habitat (as defined by the NC 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. A Mid-Currituck Bridge built with the Preferred Alternative would shade a total of 27.8 acres of Currituck Sound.

- Bridge pilings would increase habitat complexity and provide some hard structure that would potentially provide additional habitat for some managed species.

- Temporary impacts would occur during construction, but the aquatic substrate generally would be expected to recover after construction.

- The bridge alternatives would introduce a new source of pollution (via bridge runoff) into Currituck Sound. In addition, pollutants discharged into Currituck Sound near the bridge may dissipate slowly because of poor water circulation and could result in higher sediment pollutant levels and bioaccumulation near the bridge.

Measures to avoid, minimize, and mitigate impacts to EFH from shading, construction, and bridge runoff were refined in association with environmental resource and regulatory agencies between the release of the DEIS and this FEIS and are presented in applicable sections of this FEIS. NCTA would continue to work with environmental resource and regulatory agencies during the permitting process to finalize these measures.

Section 4(f) Resource Impacts

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 archaeological site, by a transportation project is permissible only if there is no feasible and prudent alternative to the use. The Preferred Alternative would not use Section 4(f) resources.

Conformity with Air Quality Plans

USEPA publishes a list of all geographic areas that are in compliance with the National Ambient Air Quality Standards (NAAQS), as well as those areas not in compliance with the NAAQS. The proposed project is in Currituck and Dare counties, which have been determined to comply with the NAAQS. This project is not anticipated to create any adverse effects on the air quality of this geographic area.

Other Federal and State Actions Required for the Proposed Project

The following permits would be required from federal and state agencies for implementation of the Preferred Alternative:

- US Coast Guard Bridge Permit for the Mid-Currituck Bridge component.

- USACE Section 404 Permit for fill in jurisdictional waters, including wetlands.

- The North Carolina Department of Environment and Natural Resources, Division of Land Resources enforces the Sedimentation Pollution Control Act of 1973, which regulates all land-disturbing activities except agriculture and mining.

- NCDENR-DWQ 401 Water Quality Certification for fill in jurisdictional waters, including wetlands.

What environmental impacts are expected with each alternative, and how do the alternatives compare?

This FEIS considers a broad range of potential impacts, including direct impacts to the community, cultural resources, natural resources, other physical characteristics (noise, air quality, energy use, accelerated sea level rise, visual quality, hazardous materials and underground storage tanks, and floodplains), as well as construction impacts and indirect and cumulative effects. The key findings of these assessments, along with descriptions of the existing setting, are contained in Chapter 3 of this FEIS. Detailed discussions of the affected environment and environmental consequences are presented in the technical reports contained on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at http://www.ncdot.gov /projects/midcurrituckbridge/.

In some cases impacts were found to be minor. In other cases, substantial impacts were identified. Table S-1 identifies substantial and other impacts considered important to the selection of an alternative for implementation. The No-Build Alternative would not involve construction of the proposed project and, therefore, would have no direct impacts to the environment. Changes in this table since the DEIS reflect changes made in response to comments, as well correction of some compiling, rounding, and typographical errors found in the process of preparing this FEIS. The latter changes did not affect the conclusions of the impact evaluation and they were not a factor in the selection of the Preferred Alternative.

The key findings that were used in the selection of the Preferred Alternative include travel benefit considerations, community impact considerations, cultural resource impact considerations, natural resource impact considerations, other physical characteristics considerations, and financing and design considerations that are described in Section 2.6 of this FEIS.

Table S-1. Comparison of Key Impacts

	ER2	MCB2/C1		MCB2/C2		MCB4/C1		MCB4/C2		Preferred Alternative
Community Impacts										
Loss of Neighborhood or Community Cohesion										
• Mainland	Minor	Visual barrier to cohesion in Aydlett				Visual barrier to cohesion in Aydlett				
• Outer Banks	Minor	Physically divides Corolla Bay subdivision		None		Physically divides Corolla Bay subdivision		None		Would be in the currently unimproved Phase II of Corolla Bay subdivision, so Phase I would not be divided.
Relocations with and (without) a third outbound lane for hurricane evacuation[1]										
		Option A	**Option B**	**Option A**	**Option B**	**Option A**	**Option B**	**Option A**	**Option B**	
• Residences	6 plus 10 vacation rental units (1 plus 10 vacation rental units)	6 plus 10 vacation rental units (6 plus 10 vacation rental units)	8 plus 10 vacation rental units (8 plus 10 vacation rental units)	6 plus 10 vacation rental units (6 plus 10 vacation rental units)	8 plus 10 vacation rental units (8 plus 10 vacation rental units)	5 (5)	7 (7)	5 (5)	7 (7)	6 (including 1 likely vacation rental unit)
• Businesses	5 (2 with no third outbound lane for hurricane evacuation)	7 (5 with no third outbound lane for hurricane evacuation)		9 (7 with no third outbound lane for hurricane evacuation)		5 (3 with no third outbound lane for hurricane evacuation)		7 (5 with no third outbound lane for hurricane evacuation)		3
• Outdoor Advertising Signs	29 (none with no third outbound lane for hurricane evacuation)	6 (3 with no third outbound lane for hurricane evacuation)	16 (13 with no third outbound lane for hurricane evacuation)	6 (3 with no third outbound lane for hurricane evacuation)	16 (13 with no third outbound lane for hurricane evacuation)	6 (3 with no third outbound lane for hurricane evacuation)	16 (13 with no third outbound lane for hurricane evacuation)	6 (3 with no third outbound lane for hurricane evacuation)	16 (13 with no third outbound lane for hurricane evacuation)	3

[1] The first number indicates the impact assuming the construction of a third outbound lane for hurricane evacuation. The number in parentheses is the impact if improving hurricane evacuation clearance times is accomplished by reversing the existing center turn lane. For the Preferred Alternative, only one number is shown because it assumes reversing the center turn lane is implemented to reduce hurricane evacuation clearance times (i.e., adding a third outbound lane, except for a short distance on US 158 on the Outer Banks, is not part of the Preferred Alternative).

Table S-1 (continued). Comparison of Key Impacts

	ER2	MCB2/C1		MCB2/C2		MCB4/C1		MCB4/C2		Preferred Alternative
		Option A	Option B	Option A	Option B	Option A	Option B	Option A	Option B	
• Gravesites[1]	66 (none with no third outbound lane for hurricane evacuation)	36 (20 with no third out-bound lane for hurricane evacua-tion)	35 (19 with no third out-bound lane for hurricane evacua-tion)	36 (20 with no third out-bound lane for hurricane evacua-tion)	35 (19 with no third out-bound lane for hurricane evacua-tion)	36 (20 with no third out-bound lane for hurricane evacua-tion)	35 (19 with no third out-bound lane for hurricane evacua-tion)	36 (20 with no third outbound lane for hurricane evacua-tion)	35 (19 with no third out-bound lane for hurricane evacua-tion)	20
Land Use Plan Compatibility	Inconsistent in that widening roads are not in land use plans or rejected in land use plans; but bridge is compatible					Generally compati-ble	Incompa-tible because of access to bridge approach in Aydlett	Generally compati-ble	Incompa-tible because of access to bridge approach in Aydlett	Generally compatible
Access Changes										
• Neighborhoods	Turning movements changed on US 158 in Currituck County. On NC 12, four street intersections closed to through traffic but not emergency vehicles. Alternate access exists. Left turns limited at Crown Point and Orion's Way on the Outer Banks with provisions for U-turns.	Same as ER2. Plus, with Option B, Aydlett traffic would use the Mid-Currituck Bridge approach road to travel to and from Aydlett, and Narrow Shore Road would be relocated to pass over a toll plaza. Access road that connects NC 12 to the north end of North Harbor View Drive on the Outer Banks would be closed.		Same as ER2. Plus, with Option B, Aydlett traffic would use the Mid-Currituck Bridge approach road to travel to and from Aydlett, and Narrow Shore Road would be relocated to pass over a toll plaza.		With Option B Aydlett traffic would use the Mid-Currituck Bridge approach road to travel to and from Aydlett, and Narrow Shore Road would be relocated to pass over a toll plaza. Left turns limited at Crown Point and Orion's Way on the Outer Banks with provisions for U-turns. Access road that connects NC 12 to the north end of North Harbor View Drive on the Outer Banks would be closed.		With Option B Aydlett traffic would use the Mid-Currituck Bridge approach road to travel to and from Aydlett, and Narrow Shore Road would be relocated to pass over a toll plaza. Left turns limited at Crown Point and Orion's Way on the Outer Banks with provisions for U-turns.		Frontage roads used to maintain access to US 158 for properties in the US 158 interchange area. Left turns limited at Orion's Way on the Outer Banks with provisions for U-turns. North access road to North Harbor View Drive relocated.

[1] The first number indicates the impact assuming the construction of a third outbound lane for hurricane evacuation. The number in parentheses is the impact if improving hurricane evacuation clearance times is accomplished by reversing the existing center turn lane. For the Preferred Alternative, only one number is shown because it assumes reversing the center turn lane is implemented to reduce hurricane evacuation clearance times (i.e., adding a third outbound lane, except for a short distance on US 158 on the Outer Banks, is not part of the Preferred Alternative).

Table S-1 (continued). Comparison of Key Impacts

	ER2	MCB2/C1		MCB2/C2		MCB4/C1		MCB4/C2		Preferred Alternative
• Business	Substantial changes in business access at the US 158/NC 12 interchange; notable parking loss at Home Depot (40 spaces/ 10 percent).	Substantial changes in business access at the US 158/NC 12 interchange, but less than ER2; substantial changes in business access and 129 parking spaces lost in the Albacore Street area on Outer Banks. With Option B, direct access from US 158 would be lost for a gas station near the end of a frontage road.		Substantial changes in business access at the US 158/NC 12 interchange, but less than ER2. With Option B, direct access from US 158 would be lost for a gas station near the end of a frontage road.		Substantial changes in business access and 129 parking spaces lost in the Albacore Street area on Outer Banks. With Option B, direct access from US 158 would be lost for a gas station near the end of a frontage road.		Minor except with Option B, direct access from US 158 would be lost for a gas station near the end of a frontage road.		Substantial changes in business access and 129 parking spaces lost in the Albacore Street area on Outer Banks.
Environmental Justice	No disproportionately high or adverse direct impacts to minority or low income populations.									
Farmland		**Option A**	**Option B**	**Option A**	**Option B**	**Option A**	**Option B**	**Option A**	**Option B**	
• Prime Soils Used	Less than 2 acres	37 acres	76 acres	37 acres	76 acres	37 acres	76 acres	37 acres	76 acres	37 acres
• State and Locally Important Soils Used	Less than 2 acres	72 acres	41 acres	72 acres	41 acres	72 acres	41 acres	72 acres	41 acres	72 acres
Natural Resource Impacts										
Water Quality Impact	Increased levels of highway runoff with 89.0 acres of increased impervious surface (54.3 acres without construction of a third outbound lane for hurricane evacuation).	Potential for increased turbidity levels during Mid-Currituck Bridge construction; increased levels of bridge and highway runoff with 120.4 to 126.8 acres for Option A and 120.0 to 126.4 acres for Option B of increased impervious surface (115.2 to 121.6 acres for Option A and 114.8 to 121.2 acres for Option B without construction of a third outbound lane for hurricane evacuation).				Potential for increased turbidity levels during Mid-Currituck Bridge construction; increased levels of bridge and highway runoff with 81.0 to 86.6 acres for Option A and 80.6 to 86.2 acres for Option B of increased impervious surface (74.4 to 80.0 acres for Option A and 74.0 to 79.6 acres for Option B without construction of a third outbound lane for hurricane evacuation).				Potential for increased turbidity levels during Mid-Currituck Bridge construction; increased levels of bridge and highway runoff with 71.5 acres of increased impervious surface.
Natural Upland Biotic Communities Impact										
• Fill in Natural and Naturalized Upland Communities[2]	85.3 acres	**Option A** 113.5 acres	**Option B** 121.8 acres	**Option A** 110.1 acres	**Option B** 118.4 acres	**Option A** 44.2 acres	**Option B** 52.5 acres	**Option A** 40.8 acres	**Option B** 49.1 acres	33.6 acres
• Clearing Natural and Naturalized Upland Communities[2]	0.0 acre	2.7 acres	0.5 acre	2.5 acres	0.4 acre	2.7 acres	0.5 acre	2.5 acres	0.4 acre	1.3 acres

[2] Includes mixed pine-hardwood forest, hardwood forest, maritime shrub-grassland, and maritime forest.

Table S-1 (continued). Comparison of Key Impacts

	ER2	MCB2/C1	MCB2/C2	MCB4/C1	MCB4/C2	Preferred Alternative
Land Wildlife Habitat Impact	Least invasive	Removal and alteration of wildlife habitat (both by habitat use and bridging) and habitat edge effects.				
Aquatic Bottom Shaded (water depths ≤ 6 feet)	0.1 acre	12.3 acres	13.3 acres	12.3 acres	13.3 acres	8.7 acres
Water Wildlife Habitat Impact	Minor	Altered light levels and the introduction of piles as a hard substrate in Currituck Sound; localized noise, turbidity, and siltation during construction.				
Submerged Aquatic Vegetation (SAV) Impact						
• Existing SAV Beds Shaded	0.0 acre	4.3 acres	5.5 acres	4.3 acres	5.5 acres	3.8 acres
• Existing Beds and Potential (water depths ≤ 6 feet) SAV Shaded	0.1 acre	12.3 acres	13.3 acres	12.3 acres	13.3 acres	8.7 acres
Wetlands Impacts with and (without) a third outbound lane for hurricane evacuation[3]						
Wetlands within Slope-Stake Line, plus Additional 25-foot Buffer	12.6 (8.6) acres	**Option A** / **Option B**: 21.1 (17.1) acres / 47.1 (43.1) acres	**Option A** / **Option B**: 16.5 (12.5) acres / 42.5 (38.5) acres	**Option A** / **Option B**: 15.4 (10.6) acres / 41.4 (36.6) acres	**Option A** / **Option B**: 10.9 (6.0) acres / 36.9 (32.0) acres	7.9 acres
Total Coastal Area Management Act (CAMA) Wetland Impacts	0.7 acre	0.7 acre	2.2 acres	0.0 acre	1.4 acres	0.0 acre
CAMA Areas of Environmental Concern Affected—with construction of a third outbound lane for hurricane evacuation (without third outbound lane, if different)						
• Fill	0.9 (0.8) acre	0.9 acre	0.9 acre	0.0 acre	0.0 acre	0.0 acre
• Pilings	0.0 acre	0.1 acre	0.2 acre	0.1 acre	0.2 acre	0.1 acre
• Clearing	0.0 acre	0.0 acre	1.5 acres	0.0 acre	1.5 acres	0.0 acre
Essential Fish Habitat (EFH) Affected						
• Fill	1.8 acres	1.8 acres	1.8 acres	0.0 acre	0.0 acre	0.0 acre
• Pilings	0.0 acre	0.1 acre	0.2 acre	0.1 acre	0.2 acre	0.1 acre

[3] The first number indicates the impact assuming the construction of a third outbound lane for hurricane evacuation. The number in parentheses is the impact if improving hurricane evacuation clearance times is accomplished by reversing the existing center turn lane. For the Preferred Alternative, only one number is shown because it assumes reversing the center turn lane is implemented to reduce hurricane evacuation clearance times (i.e., adding a third outbound lane, except for a short distance on US 158 on the Outer Banks, is not part of the Preferred Alternative).

Table S-1 (continued). Comparison of Key Impacts

	ER2	MCB2/C1	MCB2/C2	MCB4/C1	MCB4/C2	Preferred Alternative
• Shading (water depths ≤ 6 feet)	0.1 acre	12.3 acres	13.3 acres	12.3 acres	13.3 acres	8.7 acres
• Shading (SAV habitat)	0.0 acre	4.9 acres	6.5 acres	4.9 acres	6.5 acres	4.8 acres
• Clearing	0.0 acre	0.0 acre	3.2 acres	0.0 acre	3.2 acres	0.0 acre
Threatened and Endangered Species Habitat Affected	"No Effect" on the 11 threatened and endangered species under USFWS jurisdiction for which a biological conclusion is required.	"May Affect, Not Likely to Adversely Affect" three of the 11 threatened and endangered species under USFWS jurisdiction for which a biological conclusion is required. They are the piping plover, West Indian manatee, and loggerhead sea turtle. "No Effect" on the other eight species under USFWS jurisdiction for which a biological conclusion is required. "May Affect, Not Likely to Adversely Affect" four of the six threatened and endangered species under NMFS jurisdiction for which a biological conclusion is required. They are the green sea turtle, Kemp's ridley sea turtle, loggerhead sea turtle, and shortnose sturgeon. "No Effect" on the other two species under NMFS jurisdiction for which a biological conclusion is required.				
Other Physical Features						
Noise Impact Where Consideration of Barriers is Required	None on mainland. Increased noise levels (up to 9 dBA) on NC 12 from US 158 to Albacore Street with pavement closer to homes, particularly in four lane sections where more motor vehicles could travel the speed limit.	None on mainland. Barriers considered for increased noise levels (up to 10 dBA) on NC 12 from US 158 to Mid-Currituck Bridge terminus with pavement closer to homes, particularly in four lane sections where more motor vehicles could travel the speed limit.		None on mainland. Barriers considered for increased noise levels (up to 10 dBA) on NC 12 from Seashell Lane to Mid-Currituck Bridge terminus with four lanes of pavement closer to homes and because more motor vehicles could travel the speed limit.		None on mainland. Barriers considered for increased noise levels (up to 10 dBA) on three sections of NC 12 between Currituck Clubhouse Drive and the Mid-Currituck Bridge terminus with four lanes of pavement closer to homes and because more motor vehicles could travel the speed limit.
Accelerated Sea Level Rise	Existing roads would be affected by sea level rise.	Existing roads would be affected by sea level rise including in the Waterlily Road area of the US 158 interchange. A Mid-Currituck Bridge would be a useful asset in reducing the impact of sea level rise on the project area's road system. Under all sea level rise scenarios considered, the entire barrier island would be inundated at the Dare/Currituck County line, creating a breach in the island and making a Mid-Currituck Bridge the only way off the Currituck County Outer Banks.				

Table S-1 (concluded). Comparison of Key Impacts

	ER2	MCB2/C1	MCB2/C2	MCB4/C1	MCB4/C2	Preferred Alternative
Visual Impact	Interchange introduced into views in Kitty Hawk; changes in views along NC 12 from US 158 to Albacore Street.	Mid-Currituck Bridge features introduced into views along US 158 and in Aydlett (including views of Currituck Sound); would adversely affect views of Currituck Sound from the Corolla Bay subdivision; interchange introduced into views in Kitty Hawk; changes in views along NC 12 from US 158 to bridge terminus.	Mid-Currituck Bridge features introduced into views along US 158 and in Aydlett (including views of Currituck Sound); would adversely affect views from the outdoor recreation area at TimBuck II commercial area; interchange introduced into views in Kitty Hawk; changes in views along NC 12 from US 158 to bridge terminus.	Mid-Currituck Bridge features introduced into views along US 158 and in Aydlett (including views of Currituck Sound); would adversely affect views of Currituck Sound from the Corolla Bay subdivision; changes in views along NC 12 from Seashell Lane to bridge terminus.	Mid-Currituck Bridge features introduced into views along US 158 and in Aydlett (including views of Currituck Sound); would adversely affect views from the outdoor recreation area at TimBuck II commercial area; changes in views along NC 12 from Seashell Lane to bridge terminus.	Mid-Currituck Bridge features introduced into views along US 158 and in Aydlett (including views of Currituck Sound); would adversely affect views of Currituck Sound from adjoining subdivisions; changes in views along NC 12 at three locations - bridge terminus area, Albacore Street area, and Currituck Clubhouse Drive area.
Floodplains	No impact.	No impact except with the use of mainland approach road Option B, which would result in a significant encroachment on the floodplain (as a significant alteration to a water course) by the fill placed in Maple Swamp. If selected, additional studies would be needed to determine how to avoid or minimize the associated maximum 0.2-foot increase in the 100-year storm's water surface elevation just north of the fill.				No impact.
Indirect and Cumulative Effects	Forecast development would be the predominant contributor to cumulative impacts, irrespective of whether a detailed study alternative is implemented. Traffic congestion on NC 12 could act to constrain development on the Outer Banks to 75 percent of maximum build-out compared to 86 percent of maximum build-out forecast in 2035 with no constraint and 70 percent for the No-Build Alternative.	Forecast development would be the predominant contributor to cumulative impacts, irrespective of whether a detailed study alternative is built. The improved accessibility to Currituck County Outer Banks with the bridge would cause the order of future development to change such that development occurs first in Currituck County and later in Dare County. MCB2, MCB4, and the Preferred Alternative do not increase the demand for development but do accommodate the forecast demand for new development of 86 percent build-out in 2035. In contrast, the No-Build Alternative would result in congestion that could act to constrain practical development on the Outer Banks to 70 percent of maximum build-out. In addition, in terms of indirect impacts, the presence of the bridge could result in business development in proximity to the bridge's interchange with US 158 and associated use of farmland and visual change. This development, however, is desired by Currituck County. With MCB2, MCB4, and the Preferred Alternative, day visitor potential demand would increase, which could have some affect in the NC 12 area but likely would have more impact in the unregulated beach-driving area.				

PAGE INTENTIONALLY LEFT BLANK

Mid-Currituck Bridge Study

Currituck and Dare Counties, North Carolina

Federal-Aid Project Number. BRSTP-000S(494)
WBS Element: 34470.1.TA1
STIP Project No. R-2576

Project Commitments

1. NCTA will coordinate with the US Coast Guard to determine appropriate horizontal and vertical navigation clearances for the Preferred Alternative (see Section 2.1.3).

2. NCTA will finalize (in association with environmental resource and regulatory agencies) and implement a stormwater management plan for the Preferred Alternative (see Section 2.1.7.2).

3. NCTA will finalize (in association with environmental resource and regulatory agencies) and implement bridge construction techniques to minimize aquatic resource impacts with the Preferred Alternative, including approaches to minimize impact to SAV habitat and potential SAV habitat (see Section 3.3.4.4).

4. NCTA will use standard details for installed features used to discourage roosting/ perching birds. During final design, NCTA will investigate proven methods of reducing collisions between vehicles operating on the bridge and flying birds and incorporate them as appropriate (see Section 3.3.3.2).

5. NCTA will include bicycle safe rails on the bridge parapet across Currituck Sound (see Section 2.1.11).

6. A Design Noise Study will be prepared to update the FEIS noise analysis based upon the most recent FHWA regulations and NCDOT noise policies and guidance, traffic forecasts, and the final design (see Section 3.4.1.5).

7. NCTA will replace sections of existing multi-use paths that are displaced as a result of NC 12 widening in Currituck County and US 158 widening in Dare County. NCTA also will provide space in the NC 12 right-of-way and complete the grading for future multi-use paths to be provided by others in three locations along the widened sections of NC 12 in Currituck County (see Section 2.1.11).

8. NCTA will purchase land-locked parcels north of Aydlett Road in Maple Swamp and west of US 158 in Great Swamp in addition to public right-of-way. The purchased land (i.e., the land-locked parcels) will be set aside as a conservation area and allowed to retain or return to its natural state (see Section 3.3.6.4).

9. Construction contracts will require compliance with the US Fish and Wildlife Service's (USFWS) 2003 *Guidelines for Avoiding Impacts to the West Indian Manatee: Precautionary Measures for Construction Activities in North Carolina Waters* with the exception of the two guidelines that specify the use of no wake/idle speeds. USFWS agreed to the exceptions.

10. Construction contracts will require compliance with National Marine Fisheries Service's (NMFS) 2006 *Sea Turtle and Smalltooth Sawfish Construction Conditions*. NMFS has indicated that the condition related to no wake/idle speeds will not apply to this project.

11. Construction contracts will require compliance with USFWS guidelines for the protection of eagles contained in their 2007 *National Bald Eagle Management Guidelines.*

The changes in the list of commitments since the DEIS reflect that some DEIS commitments have already been addressed. In addition, some new commitments were noted as expectations or intentions in the body of the DEIS and are in this FEIS. NCTA and FHWA decided to highlight them as Project Commitments in this FEIS. One entirely new commitment (10) was added.

Table of Contents

PREFACE ..... Ý

SUMMARY ..... ÝÐÐ

PROJECT COMMITMENTS ..... ßßÐß

TABLE OF CONTENTS ..... ßßßÐ

LIST OF TABLES ..... ßßßÝÐÐ

LIST OF FIGURES ..... ßßßßÝÐÐÐ

1.0 PURPOSE OF AND NEED FOR ACTION **1-1**

1.1 What do you propose to build and where? **1-1**

1.1.1 We propose to build a bridge across Currituck Sound from the mainland to the Outer Banks. Improvements to existing roads also are considered, both without a bridge and in association with a bridge. 1-1

1.1.2 The project area is in Currituck and Dare counties, North Carolina, and includes two existing thoroughfares, US 158 and NC 12. 1-3

1.2 What needs is the project trying to meet? **1-3**

1.3 What purpose will the project serve? **1-5**

2.0 ALTERNATIVES **2-1**

2.1 Describe the alternatives considered. **2-2**

2.1.1 What alternatives are considered? 2-2

2.1.2 Where would the alternative transportation improvements occur and what would they include? 2-2

2.1.2.1 ER2 2-5

2.1.2.2 MCB2 2-5

2.1.2.3 MCB4 2-10

2.1.2.4 MCB2 and MCB4 Corridor Alternatives and Design Options 2-12

2.1.2.5 Preferred Alternative 2-19

2.1.2.6 No-Build Alternative 2-20

2.1.3 How many lanes would a Mid-Currituck Bridge include, and how tall would the bridge be? 2-20

2.1.4 Why are interchanges included in the detailed study alternatives, including the Preferred Alternative? 2-22

2.1.5 What intersections would have traffic signals? 2-23

2.1.6 How would access to private property and subdivisions be changed? 2-23

2.1.7 What road and bridge drainage provisions would be included in the project? How would stormwater runoff be cleaned? 2-29

2.1.7.1 Stormwater Management for Uplands on the Mainland and Outer Banks 2-30
2.1.7.2 Stormwater Management for Maple Swamp and Currituck Sound 2-31
2.1.7.3 Capturing the First 1.5 Inches of Runoff from Bridges 2-33
2.1.8 Where would additional right-of-way be required to widen existing roads? 2-35
2.1.9 How would bridges be designed to minimize impacts to wetlands on the mainland and Outer Banks? 2-36
2.1.10 Why are hurricane evacuation improvements needed on US 158, and how would they work? 2-36
2.1.10.1 Third Outbound Lane Operations 2-37
2.1.10.2 Reversing Lanes Operations 2-38
2.1.10.3 Reversing Lanes on the Knapp and Wright Memorial Bridges 2-39
2.1.10.4 Observations by Local Emergency Management Officials 2-40
2.1.11 How would the detailed study alternatives accommodate bicyclists and pedestrians? 2-42
2.1.12 How would tolls be collected with a Currituck Sound bridge? 2-44

2.2 Describe how the detailed study alternatives, including the Preferred Alternative, differ in their ability to meet the project's purpose and need 2-44

2.3 Explain how much each detailed study alternative, including the Preferred Alternative, would cost and how it would be paid for 2-46

2.4 Explain how each alternative would be built 2-50
2.4.1 Road and Interchange Construction 2-50
2.4.2 Mid-Currituck Bridge Construction 2-50
2.4.3 Maple Swamp Bridge Construction 2-51
2.4.4 Access and Construction Staging for Construction Materials and Equipment 2-51

2.5 Describe the other alternatives that were considered and explain why they are no longer under consideration 2-52

2.6 For what reasons did you choose the Preferred Alternative? 2-54

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES 3-1

3.1 Community Characteristics and Impacts 3-1
3.1.1 What is the general land use, and what community features are in the project area? 3-2

Table of Contents (continued)

3.1.2 How would neighborhood or community cohesion be affected? 3-7
3.1.2.1 Third Emergency Outbound Lane 3-8
3.1.2.2 US 158 Improvement on the Outer Banks 3-8
3.1.2.3 NC 12 Improvements in Southern Shores and Duck 3-8
3.1.2.4 Mid-Currituck Bridge in Aydlett 3-9
3.1.2.5 Bridge across Currituck Sound 3-9
3.1.2.6 Mid-Currituck Bridge Corridor C1 on the Outer Banks 3-10
3.1.2.7 Mid-Currituck Bridge Corridor C2 on the Outer Banks 3-11
3.1.2.8 No-Build Alternative 3-11
3.1.3 How would quality of life be affected? 3-11
3.1.4 Would any homes, businesses, outdoor advertising signs, or gravesites be relocated? 3-11
3.1.4.1 Relocations 3-11
3.1.4.2 Relocation Assistance for Homes and Businesses 3-13
3.1.4.3 Outdoor Advertising Sign Relocation 3-15
3.1.4.4 Gravesite Relocation 3-15
3.1.5 Would concentrations of low income, minority populations, or limited English proficiency populations suffer disproportionately adverse human health or environmental effects? 3-15
3.1.6 Would the project be compatible with local land use plans? 3-15
3.1.7 How would the existing business community be affected? 3-17
3.1.8 How would access to neighborhoods and communities be changed? 3-19
3.1.9 How would parks, recreation opportunities, and other community services and facilities be affected? 3-19
3.1.10 How would pedestrian and bicycle provisions change? 3-20
3.1.11 Could crime rates increase? 3-22
3.1.12 How would farmlands be affected? 3-23

3.2 Cultural Resources Characteristics and Impacts 3-24
3.2.1 Would historic resources be affected? 3-24
3.2.2 Would archaeological resources be affected? 3-27
3.2.3 Would resources that are protected by the requirements of Section 4(f) of the Department of Transportation Act of 1966 be used? 3-28
3.2.3.1 Three Properties Affected by a Temporary Construction Easement 3-28
3.2.3.2 Samuel McHorney House 3-29
3.2.3.3 Dexter W. Snow House 3-30

Table of Contents (continued)

3.3 Natural Resource Characteristics and Impacts 3-31
3.3.1 How would water resources in the project area be affected? 3-32
3.3.1.1 Water Resources 3-32
3.3.1.2 Classifications of Water Resources 3-32
3.3.1.3 Quality of Water Resources 3-34
3.3.1.4 Impacts to Water Quality 3-35
3.3.2 How would biotic resources be affected? 3-37
3.3.2.1 Biotic Community Types 3-37
3.3.2.2 Rare and Threatened Communities 3-38
3.3.2.3 Natural Heritage Areas 3-38
3.3.2.4 Impacts to Biotic Communities 3-39
3.3.3 How would wildlife on land be affected? 3-47
3.3.3.1 Land Wildlife Characteristics 3-47
3.3.3.2 Impacts to Land Wildlife and Land Wildlife Habitat 3-48
3.3.4 How would aquatic wildlife be affected? 3-50
3.3.4.1 Aquatic Wildlife 3-50
3.3.4.2 Submerged Aquatic Vegetation 3-51
3.3.4.3 Water Habitat Impacts 3-51
3.3.4.4 Impacts from Noise, Turbidity, and Siltation 3-53
3.3.4.5 Commercial Fisheries Impacts 3-54
3.3.4.6 Additional Detail and Information 3-54
3.3.5 How would invasive species be controlled? 3-54
3.3.6 What impacts would occur to waters under the jurisdiction of the US Army Corps of Engineers? 3-55
3.3.6.1 Jurisdictional Features in the Project Area 3-55
3.3.6.2 Impacts to Jurisdictional Features 3-55
3.3.6.3 Clean Water Act and Coastal Area Management Act Permits 3-58
3.3.6.4 Wetland and Stream Mitigation 3-59
3.3.7 Would Coastal Area Management Act Areas of Environmental Concern or essential fish habitat be affected? 3-61
3.3.7.1 Coastal Area Management Act Areas of Environmental Concern 3-61
3.3.7.2 Essential Fish Habitat 3-63
3.3.8 Would habitat used by threatened and endangered species be affected? 3-68
3.3.8.1 Federally-Protected Species 3-69
3.3.8.2 Bald Eagle and Golden Eagle Protection Act 3-69
3.3.8.3 Endangered Species Act Candidate Species 3-71

3.4 Other Physical Characteristics and Impacts 3-71
3.4.1 How would traffic noise levels change? 3-72

Table of Contents (continued)

3.4.1.1 FHWA Noise Abatement Criteria 3-72
3.4.1.2 Sensitive Receptors 3-74
3.4.1.3 Noise Levels and Descriptors 3-75
3.4.1.4 Existing and Predicted Noise Levels 3-75
3.4.1.5 Noise Abatement 3-77
3.4.2 Would air quality be affected? 3-79
3.4.2.1 Conformance with National Ambient Air Quality Standards 3-79
3.4.2.2 Mobile Source Air Toxics 3-80
3.4.3 How would the detailed study alternatives affect energy use? 3-81
3.4.4 How would potential accelerated sea level rise resulting from climate change affect long-term use of the detailed study alternatives? 3-82
3.4.5 How would visual quality be changed? 3-84
3.4.5.1 Characteristics of the Existing Landscape 3-84
3.4.5.2 Visual Impacts 3-86
3.4.6 Are there hazardous materials and underground storage tank sites that could affect the project? 3-89
3.4.7 Would floodplains be affected? 3-91
3.4.7.1 Hydraulic Impacts to Floodplain 3-91
3.4.7.2 Significant Encroachment 3-93

3.5 Construction Impacts 3-95
3.5.1 How would traffic be maintained to minimize the inconvenience to travelers? 3-96
3.5.2 How would air quality be protected during construction? 3-98
3.5.3 How would waste be disposed? 3-98
3.5.4 Would fill have to be obtained to build the detailed study alternatives? 3-99
3.5.5 How would erosion be controlled? 3-100
3.5.6 What construction noise impact would occur? 3-100
3.5.7 Would lighting be used to allow construction at night? 3-101
3.5.8 How would natural resources be protected during construction? 3-101
3.5.9 Would the relocation of utilities cause disruption of service? 3-101

3.6 Indirect and Cumulative Effects 3-101
3.6.1 What procedures did you follow to determine the potential for indirect and cumulative effects? 3-102
3.6.1.1 Study Area 3-103
3.6.1.2 Directions and Goals 3-103
3.6.1.3 Inventory of Notable Features 3-103
3.6.1.4 Impact-Causing Activities 3-105

Table of Contents (concluded)

3.6.1.5 Identify Potential Indirect/Cumulative Effects for Analysis 3-113
3.6.2 What indirect and cumulative effects could be expected? 3-113
3.6.2.1 Land Suitability Analysis for Changed Development Patterns 3-114
3.6.2.2 Indirect Effects 3-116
3.6.2.3 Cumulative Effects 3-118
3.6.2.4 Evaluate Analysis Results 3-122
3.6.3 What are the substantial indirect and cumulative effects and could they be minimized? 3-122

3.7 What is the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity? 3-125

3.8 What resources are committed irreversibly and irretrievably? 3-126

APPENDICES

A. COMMENTS AND COORDINATION A-1

B. LIST OF PREPARERS B-1

C. LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THIS STATEMENT ARE SENT C-1

D. LIST OF TECHNICAL REPORTS AND OTHER SUPPLEMENTAL MATERIALS D-1

E. LISTS OF REFERENCES AND ABBREVIATIONS E-1

List of Tables

Table S-1. Comparison of Key Impacts xxii
Table 2-1. Changes in Access 2-24
Table 2-2. Equipment and Highway Patrol Squads 2-37
Table 2-3. Travel Benefits of Detailed Study Alternatives 2-45
Table 2-4. Cost of the Detailed Study Alternatives 2-47
Table 3-1. Relocations 3-12
Table 3-2. Crime Rates per 100,000 Population 3-22
Table 3-3. Historic Properties and Effects Determination 3-26
Table 3-4. Existing and Proposed Impervious Surface Areas by Detailed Study Alternative 3-36
Table 3-5. Permanent Impacts to Biotic Communities by Detailed Study Alternative for ER2, MCB2/A, and MCB4/A 3-40
Table 3-6. Permanent Impacts to Biotic Communities by Detailed Study Alternative for MCB2/B, MCB4/B, and the Preferred Alternative 3-42
Table 3-7. Temporary Impacts to Biotic Communities by Detailed Study Alternative for ER2, MCB2/A, and MCB4/A 3-44
Table 3-8. Temporary Impacts to Biotic Communities by Detailed Study Alternative for MCB2/B, MCB4/B, and the Preferred Alternative 3-45
Table 3-9. Jurisdictional Impacts by Detailed Study Alternative for ER2, MCB2/A and MCB4/A 3-56
Table 3-10. Jurisdictional Impacts by Detailed Study Alternative for MCB2/B, MCB4/B, and the Preferred Alternative 3-57
Table 3-11. Impacts to CAMA Areas by Detailed Study Alternative 3-62
Table 3-12. Permanent Impacts to Essential Fish Habitat by ER2, MCB2, and MCB4 3-64
Table 3-13. Permanent Impacts to Essential Fish Habitat Areas by the Preferred Alternative 3-65
Table 3-14. Potential Effects on Federally-Protected Species 3-70
Table 3-15. Noise Abatement Criteria 3-73
Table 3-16. Substantial Noise Level Increase (Hourly Equivalent A-Weighted Sound Level (decibels - dBA) 3-74
Table 3-17. Estimated Total Vehicle-Miles Traveled and Congested Vehicle-Miles Traveled in 2035 3-80
Table 3-18. Notable Ecosystem Features 3-105
Table 3-19. Notable Socioeconomic Features 3-106
Table 3-20. Population and Land Calculation Factors 3-119

List of Figures

Figure S-1. Project Area ix
Figure 1-1. Project Area 1-2
Figure 2-1. DEIS Detailed Study Alternatives 2-3
Figure 2-2. Preferred Alternative 2-4
Figure 2-3. US 158 Hurricane Evacuation Lane 2-6
Figure 2-4. US 158 Super-Street and US 158/NC 12 Interchange 2-7
Figure 2-5. NC 12 Three-Lane Widening 2-8
Figure 2-6. NC 12 Four-Lane Widening 2-9
Figure 2-7. Mid-Currituck Bridge Typical Section 2-11
Figure 2-8. Outer Banks Terminus Alternatives 2-13
Figure 2-9. Design Options A and B 2-14
Figure 2-10. US 158/Mid-Currituck Bridge Interchange (Option A) and Waterlily Road Median Acceleration Lane 2-15
Figure 2-11. US 158/Mid-Currituck Bridge Interchange (Option B) 2-16
Figure 2-12. Mid-Currituck Bridge at Aydlett (Option A and Option B) 2-18
Figure 2-13. STIP Projects in the No-Build Alternative 2-21
Figure 2-14. Streets and Landmarks Noted in Table 2-1 2-28
Figure 3-1. Existing Land Use 3-3
Figure 3-2. Project Area Communities 3-4
Figure 3-3. Community Facilities 3-6
Figure 3-4. Historic Properties 3-25
Figure 3-5. Water Bodies and Other Natural Resource-Related Features 3-33
Figure 3-6. SAV Data from 2003, 2006, 2007, and 2010 3-52
Figure 3-7. Representative Views of Landscapes on the Mainland 3-85
Figure 3-8. Representative Views of Landscapes on the Outer Banks 3-87
Figure 3-9. GeoEnvironmental Sites 3-90
Figure 3-10. Floodplains 3-92
Figure 3-11. Indirect and Cumulative Effects Assessment Study Area Boundaries 3-104
Figure 3-12. Currituck County Land Suitability 3-115

1.0 Purpose of and Need for Action

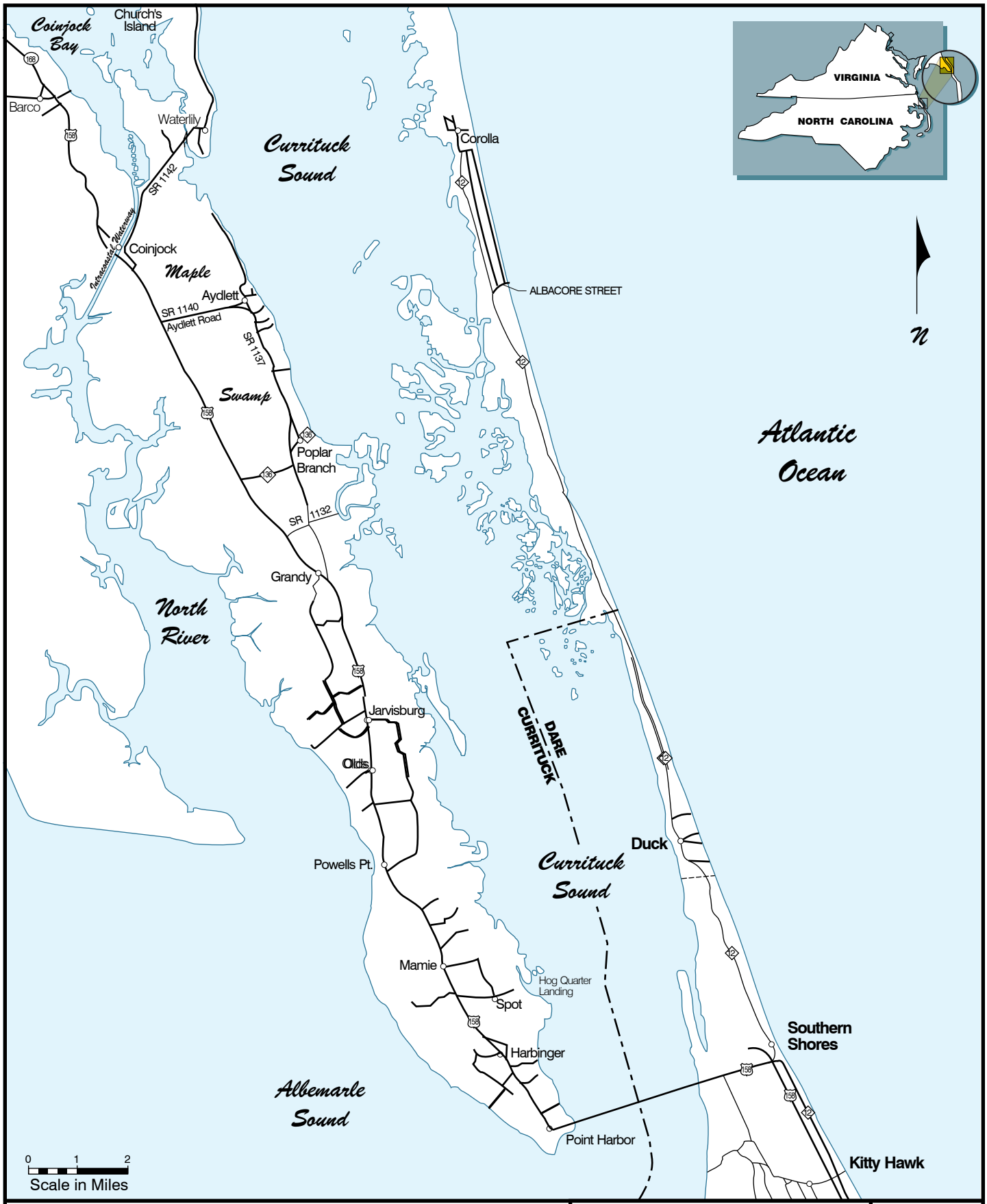
This statement of purpose and need explains why improvements to the transportation system in the project area should be considered and implemented. Additional details related to project purpose and need are contained in a technical report, *Statement of Purpose and Need* (Parsons Brinckerhoff, 2008). The public and environmental resource and regulatory agencies were given the opportunity in April 2008 to review and comment on a draft of this report (see Appendix A). Their comments are summarized in the *Stakeholder Involvement for Draft Environmental Impact Statement Technical Report* (Parsons Brinckerhoff, 2009). These two reports are on the compact disc (CD) that accompanies this Final Environmental Impact Statement (FEIS), at public review locations listed in Appendix C, and on the NCTA web site at http://www.ncdot.gov /projects/midcurrituckbridge/.

1.1 What do you propose to build and where?

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 evaluating proposed transportation improvements in the Currituck Sound area. The project area is shown on Figure 1-1.

1.1.1 We propose to build a bridge across Currituck Sound from the mainland to the Outer Banks. Improvements to existing roads also are considered, both without a bridge and in association with a bridge.

The proposed action is included in NCDOT's *2009 to 2015 State Transportation Improvement Program* (STIP), the 2012 to 2018 Draft STIP, the North Carolina Intrastate System, the *Strategic Highway Corridors Concept Development Repor*t (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. A bridge across Currituck Sound is a part of the Preferred Alternative. When considering the construction of a major transportation investment, it is appropriate to review a range of reasonable alternatives. Thus, the detailed study alternatives evaluated in this FEIS include alternatives that involve improvements to the existing road network. One alternative involves only existing road network improvements. The other four build alternatives involve adding a bridge across Currituck Sound and improving some sections of the existing road network. The No-Build Alternative also is evaluated. These alternatives are described in Chapter 2. Other alternatives that were considered but were not chosen to be assessed in detail are described in Section 2.5, including the reasons why these alternatives were not selected as detailed study alternatives.



LEGEND

— - — County Boundaries

Project Area

Figure

1-1

1.1.2 The project area is in Currituck and Dare counties, North Carolina, and includes two existing thoroughfares, US 158 and NC 12.

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 1-1). 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 in Corolla. 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 south of the proposed Mid-Currituck Bridge.

1.2 What needs is the project trying to meet?

The proposed action responds to three underlying needs in the project area:

- The need to substantially improve traffic flow on the project area's thoroughfares (US 158 and NC 12);
- The need to substantially reduce travel time for persons traveling between the Currituck County mainland and the Currituck County Outer Banks; and
- The need to reduce substantially hurricane evacuation times from the Outer Banks for residents and visitors who use US 158 and NC 168 as an evacuation route.

An improvement is considered substantial as opposed to minor if the improvement is great enough to be largely noticeable to typical users of the transportation system and if the improvement offers some benefit across much of the network, as opposed to offering only a few localized benefits. Alternatives that provide only minor or no improvement, as opposed to substantial improvement, would not meet the above needs.

These needs were identified through an iterative process that included several rounds of agency coordination and public involvement. These needs are based on the following travel conditions and planning activities:

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.

The extent of the existing and expected congestion problems on US 158 and NC 12 in the project area can be summarized as follows:

- In the base year (2006), congestion occurs on almost all of NC 12 in the project area. The worst current congestion occurs in the summer on NC 12 just south of Southern Shores and Duck and on US 158 east of the Wright Memorial Bridge. On both the

summer weekday (2 hours per day) and the summer weekend (7 hours per day) travel demand exceeds the capacity of NC 12 in Southern Shores.

- In the design year (2035), travel demand will exceed the capacity of the road to handle that demand on almost all project area segments of NC 12 and US 158 east of the Wright Memorial Bridge during summer weekday and summer weekend conditions (approximately 29 miles). On the summer weekend, travel demand also will exceed road capacity on all US 158 segments between NC 168 and the eastern end of the Wright Memorial Bridge (an additional approximately 27 miles). When demand exceeds capacity, heavy congestion occurs, and congestion occurs over more hours in the day.

- In 2035, on the summer weekday, on US 158 east of the Wright Memorial Bridge and NC 12 in Southern Shores and parts of Duck, travel demand is expected to be notably greater than the capacity of these roads for 6 to 7 hours per day. Demand is expected to be 81 percent above the capacity of US 158 and as much as 54 percent above the capacity of NC 12. Travel demand is how many vehicles want to travel on a road in an hour. Capacity is the number of vehicles a road can actually carry in an hour. If, for example, a road has the capacity to carry 10,000 vehicles in an hour and demand is 15,400 vehicles in an hour, then demand is 54 percent over capacity.

- In 2035, on the summer weekend, US 158 in Currituck County between NC 168 and the Wright Memorial Bridge will be congested 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 be congested for 15 to 18 hours per day, with demand 117 percent of the capacity of US 158 and as much as 162 percent of the capacity of NC 12.

From the perspective of the thoroughfare network in 2035, the above factors will combine to result in an increase in the annual vehicle-miles of travel under congested conditions on US 158 and NC 12 from 5.4 million (2006) to 66.1 million (2035). Miles of road with travel demand at or exceeding road capacity in the summer is expected to increase from a weighted average (summer weekday versus summer weekend) of 3.9 miles to 22.9 miles between 2006 and 2035. For the same period, the weighted average miles where demand exceeds capacity by more than 30 percent in the summer is also expected to rise from zero to 6.3 miles.

Increasing congestion is causing travel time between the Currituck County mainland and the Currituck County Outer Banks to increase, especially during the summer.

As an example of travel time between the Currituck County mainland and the Currituck County Outer Banks, the 40.9-mile trip between Aydlett Road (SR 1140) at US 158 (on the Currituck County mainland) and Albacore Street (SR 1402) at NC 12 (on the

Currituck County Outer Banks) was evaluated. This trip was selected as a representative trip from the Currituck County mainland to the Currituck County Outer Banks. Not all trips have this origin or destination.

The uncongested travel time for this representative trip, allowing for stops at signalized intersections, is approximately 1 hour. Under base year (2006) conditions, this trip takes approximately 1 hour and 8 minutes on a summer weekday, and approximately 1 hour and 42 minutes on a summer weekend. 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. Increases in travel time would result from increasing peak period congestion. These travel times would be even longer when accidents occur or if back-ups occur at signalized intersections.

Hurricane evacuation times for residents and visitors who use US 158 and NC 168 as a hurricane evacuation route far exceed the state-designated standard of 18 hours.

North Carolina's statewide hurricane evacuation clearance time standard is 18 hours (NC General Statutes § 136-102.7, "Hurricane Evacuation Standard"), which is applied to a Category 3 storm with 75 percent tourist occupancy. Clearance times begin when the first evacuating vehicle enters a roadway segment in a given evacuation corridor and ends when the last vehicle leaving the corridor reaches a point of safety.

The state standard was already exceeded at 27 hours in 2007 for evacuees leaving the Outer Banks via NC 168 and US 158. The 2035 clearance time is forecast to be approximately 36 hours with the No-Build Alternative, which is double the 18-hour standard.

1.3 What purpose will the project serve?

Given the needs described above, the purposes of the proposed action are:

- To substantially improve traffic flow on the project area's thoroughfares. Thoroughfares in the project area are NC 12 and US 158;
- To substantially reduce travel time for persons traveling between the Currituck County mainland and the Currituck County Outer Banks; and
- To reduce substantially hurricane clearance time for residents and visitors who use US 158 and NC 168 during a coastal evacuation.

The definition of "substantial" presented for the needs in Section 1.2 also applies to the three purposes.

2.0 Alternatives

This chapter describes the five DEIS detailed study alternatives and the Preferred Alternative considered. It also describes the No-Build Alternative, as well as other alternatives considered but not selected for detailed study. The reasons why the Preferred Alternative was selected also are discussed. This chapter is divided into the following sections:

- Description of the detailed study alternatives, beginning on page 2-2;
- Description of how the detailed study alternatives differ in their ability to meet the project's purpose and need, beginning on page 2-44;
- Description of the cost of each alternative and how each would be financed, beginning on page 2-46;
- Description of when and how each alternative would be built, beginning on page 2-50;
- Description of other alternatives considered but not selected for detailed study and why they were not selected, beginning on page 2-52; and
- A presentation of the reasons why the Preferred Alternative was selected, beginning on page 2-54.

Five detailed study alternatives were evaluated in the DEIS. They are named:

- ER2;
- MCB2/C1 (MCB2 using bridge corridor C1);
- MCB2/C2 (MCB2 using bridge corridor C2);
- MCB4/C1 (MCB4 using bridge corridor C1); and
- MCB4/C2 (MCB4 using bridge corridor C2).

The Preferred Alternative identified in this FEIS is MCB4/C1 with refinements made to help avoid and minimize impacts.

The "ER" in ER2 stands for "Existing Roads." A Mid-Currituck Bridge is not included in this alternative, but only widening existing US 158 and NC 12. The "MCB" stands for Mid-Currituck Bridge. MCB2 and MCB4 both include a Mid-Currituck Bridge and different amounts of improvements to existing US 158 and NC 12. The bridge components of MCB2 and MCB4 are evaluated with two bridge corridor alternatives (C1 and C2). The preferred bridge corridor, C1 as refined between the DEIS and FEIS to help avoid and minimize impacts, is included in the Preferred Alternative. The "C"

stands for "Central," as opposed to other corridor possibilities further north (N) and south (S).

For all five DEIS alternatives, two hurricane evacuation options are considered. The preferred hurricane evacuation option is included in the Preferred Alternative. For the four MCB2 and MCB4 alternatives, two design options also are under consideration for the mainland approach to the bridge over Currituck Sound (between US 158 and Currituck Sound). The preferred design option is included in the Preferred Alternative.

The information included in this chapter is considered important to understanding the general characteristics of the detailed study alternatives and how they were selected. For readers desiring additional information on a particular topic, items contained on the compact disc (CD) that accompanies this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/ are referenced in the text.

2.1 Describe the alternatives considered.

2.1.1 What alternatives are considered?

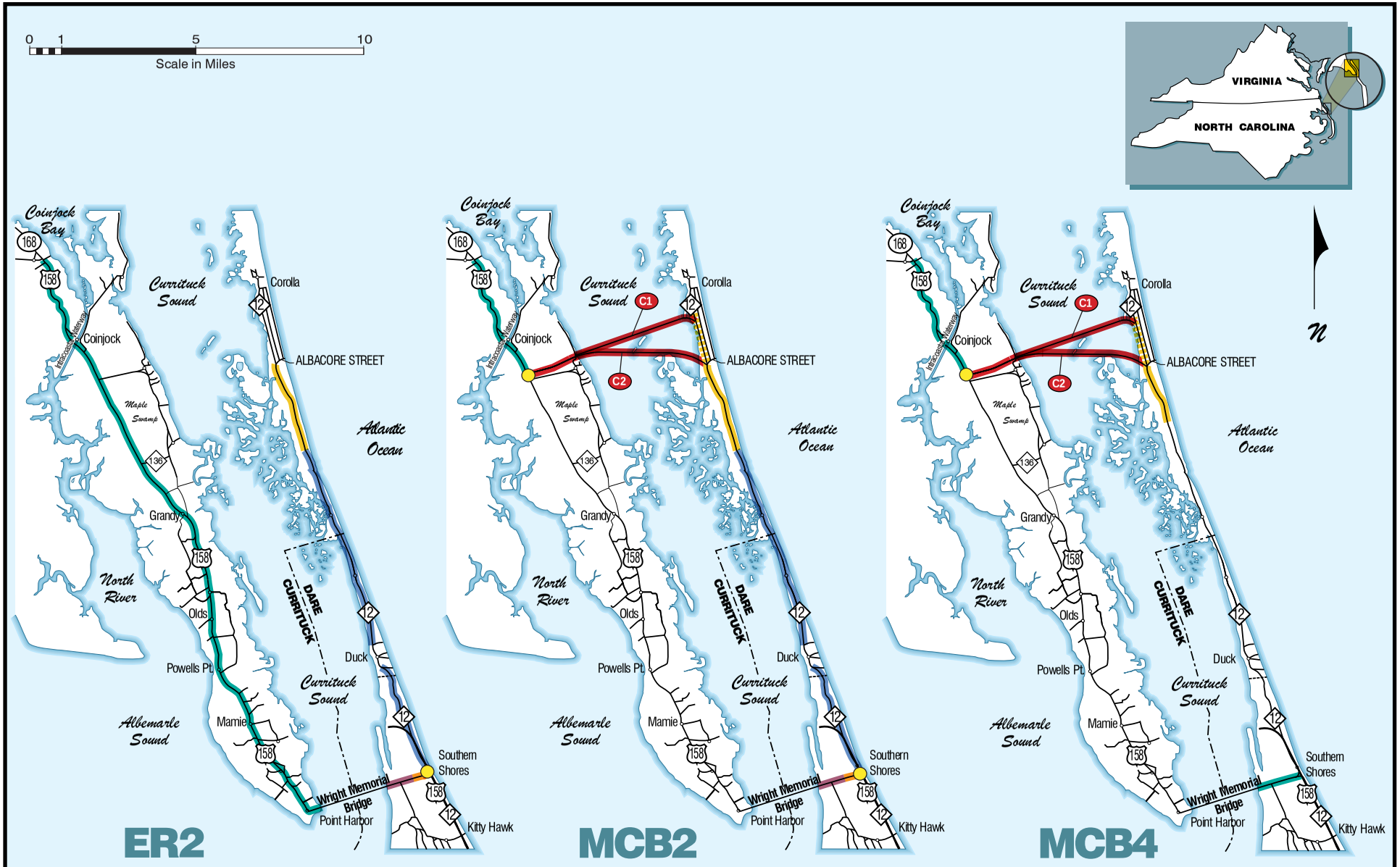
The five DEIS detailed study alternatives are considered in this FEIS. They are named ER2, MCB2/C1, MCB2/C2, MCB4/C1, and MCB4/C2. The No-Build Alternative also is considered. The DEIS detailed study alternatives are shown on Figure 2-1. The alternatives screening process used to determine these detailed study alternatives is described in the *Alternatives Screening Report* (Parsons Brinckerhoff, 2009).

For all five DEIS alternatives, two hurricane evacuation options are considered. For the four MCB2 and MCB4 alternatives, two design options (Option A and Option B) also are considered for the mainland approach to the bridge over Currituck Sound (between US 158 and Currituck Sound). When impacts differ between the mainland approach road design options (Option A and Option B), the names of the alternatives are augmented with an additional suffix. For example, MCB2 with mainland design Option B and the C1 corridor is referred to as MCB2/B/C1.

The Preferred Alternative is MCB4/C1 with refinements made to help avoid and minimize impacts. The Preferred Alternative was selected based on cost and design considerations; travel benefits; community, natural resource, and other impacts; agency comments; and public involvement comments. The Preferred Alternative is illustrated in Figure 2-2. The features included in the Preferred Alternative to help avoid and minimize impacts in a cost-effective manner are described in Section 2.1.2.5.

2.1.2 Where would the alternative transportation improvements occur and what would they include?

The location and key components of the five DEIS detailed study alternatives are shown on Figure 2-1. The following paragraphs describe these alternatives. The CD includes



LEGEND

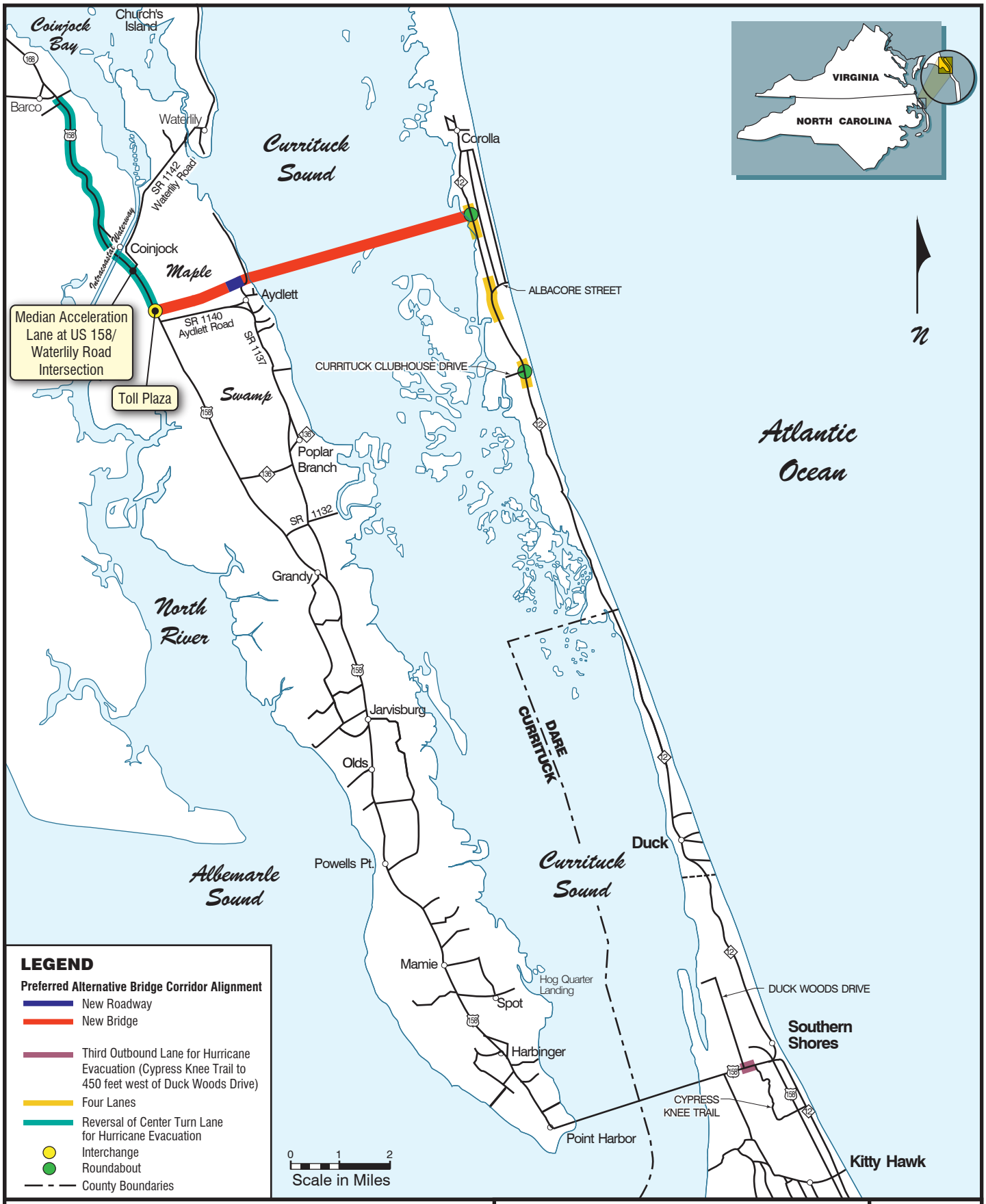
- Eight Lanes (Super-street)
- Six Lanes (Super-street)
- Four Lanes
- Four Lanes (Only with C1)
- Three Lanes
- Mid-Currituck Bridge
- Third Outbound Lane (Contraflow of an existing lane is an option)
- C1 / C2 Bridge Corridor Alternatives
- Interchange

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

DEIS Detailed Study Alternatives

Figure

2-1



Preferred Alternative

Figure
2-2

the combined corridor/design public hearing maps for each of the five DEIS alternatives. These maps were displayed at the public hearings and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/. They present the design features of each DEIS detailed study alternative and were used to assess the impacts of the detailed study alternatives. A list of these maps is included in Appendix D.

2.1.2.1 ER2

ER2 was developed to achieve maximum transportation benefits using the existing roadways, while minimizing impacts to communities along those roads. The basic features of ER2 are:

- Adding for evacuation use only, a third outbound evacuation lane (Figure 2-3) 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 (Figure 2-4) between the Wright Memorial Bridge and Cypress Knee Trail that widens to eight lanes between Cypress Knee Trail and the Home Depot driveway (both locations indicated are just west of the existing US 158/NC 12 intersection);

- Constructing an interchange (Figure 2-4) 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 (which is just south of the existing US 158/NC 12 intersection); and

- Widening NC 12 to three lanes (two travel lanes and a center lane for left turns; Figure 2-5) between US 158 and a point just north of Hunt Club Drive in Currituck County (except for the existing three-lane section in Duck, which will be unchanged) and to four lanes with a median from just north of Hunt Club Drive to Albacore Street (Figure 2-6).

As illustrated on Figure 2-4, the unique characteristic of a super-street 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).

2.1.2.2 MCB2

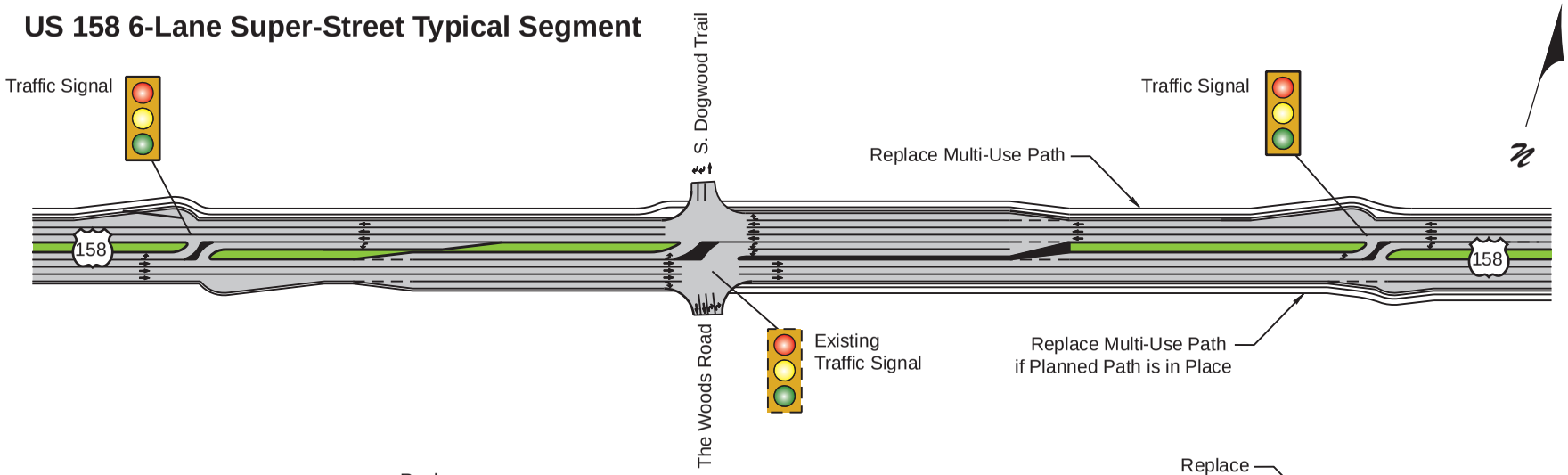
MCB2 involves construction of a Mid-Currituck Bridge, as well as improvements to existing NC 12 and US 158. MCB2 was developed to examine the travel benefits of combining a Mid-Currituck Bridge with substantial NC 12 and US 158 improvements.

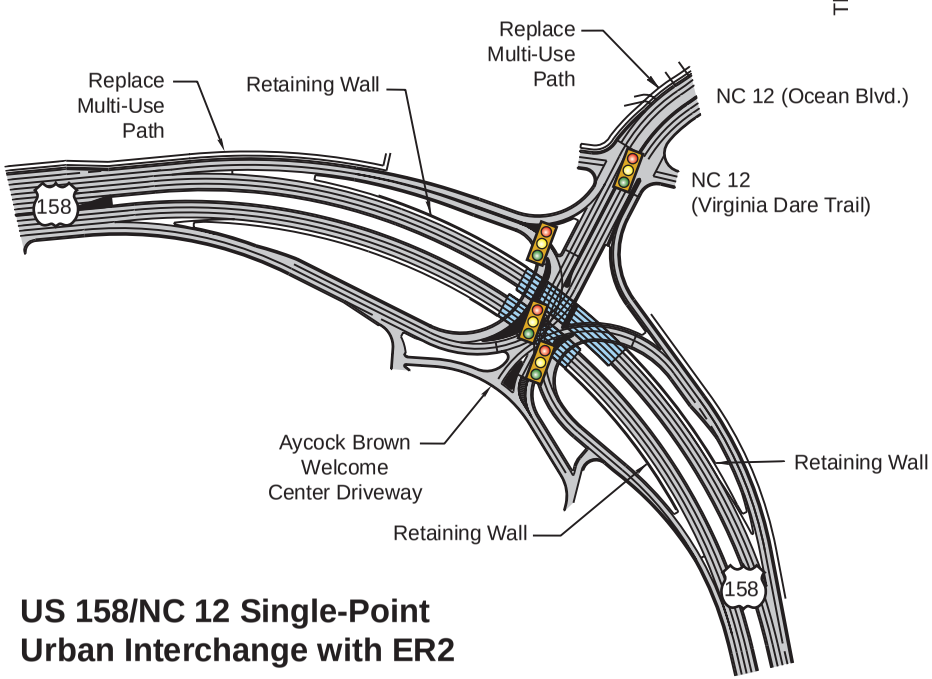
Existing/No-Build Alternative

Photo Simulation

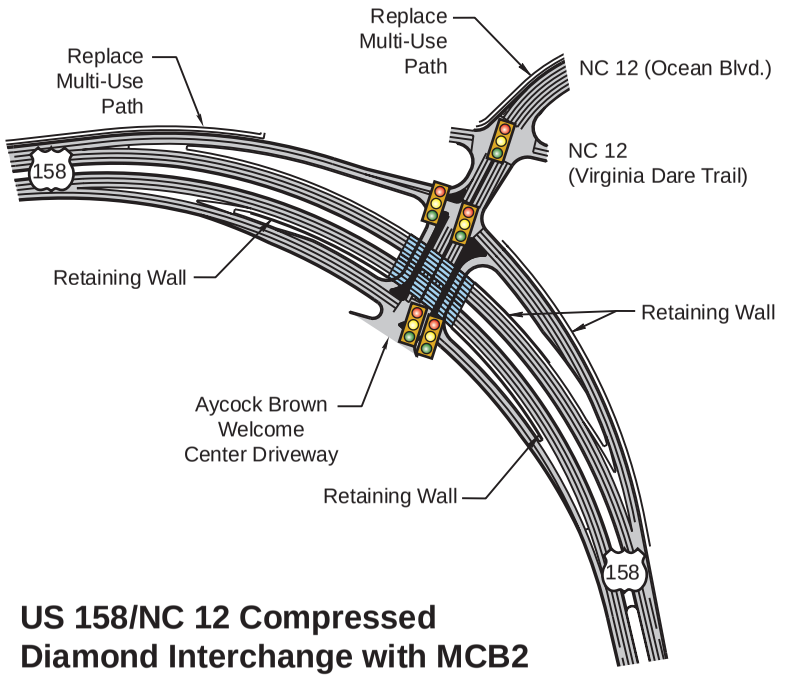
	US 158 Hurricane Evacuation Lane	**Figure** 2-3

US 158 6-Lane Super-Street Typical Segment





US 158/NC 12 Single-Point Urban Interchange with ER2



US 158/NC 12 Compressed Diamond Interchange with MCB2

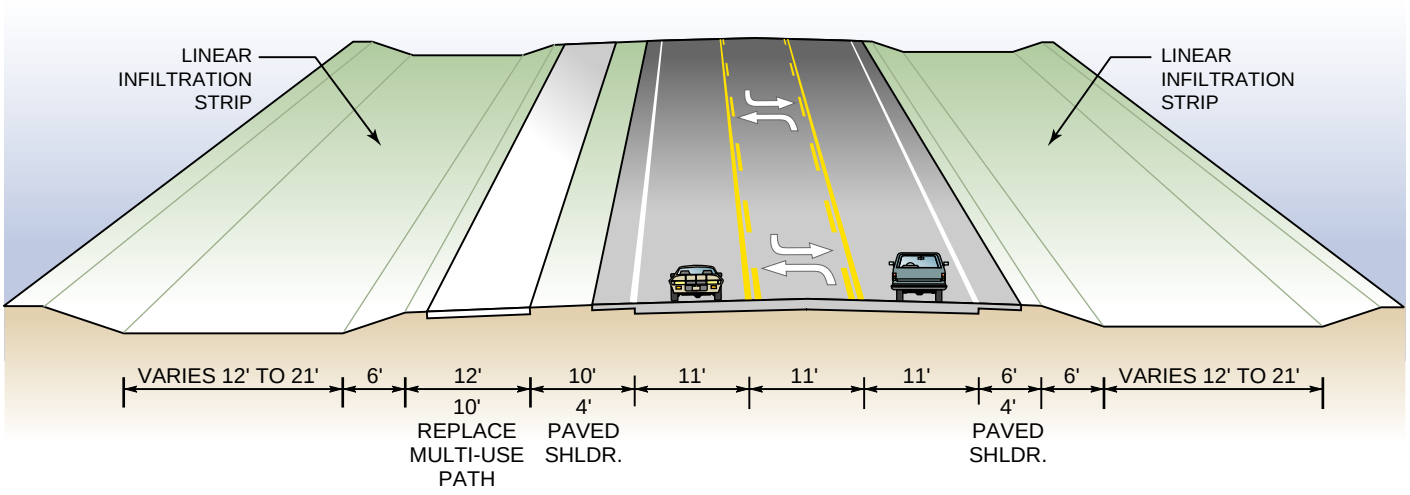
US 158 Super-Street and US 158/NC 12 Interchange

Figure 2-4

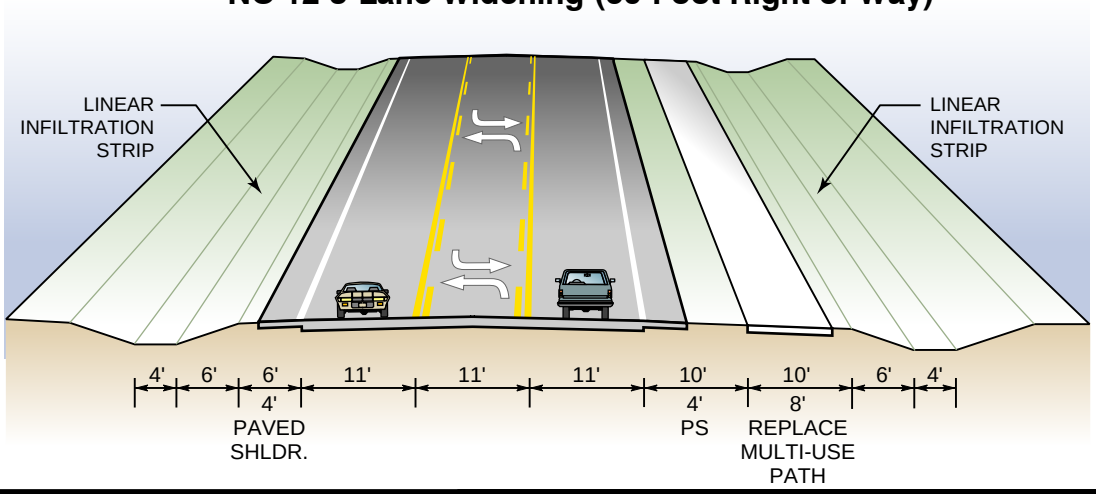
Existing/No-Build Alternative

Photo Simulation

NC 12 3-Lane Widening (90-Foot Right of Way)



NC 12 3-Lane Widening (60-Foot Right of Way)



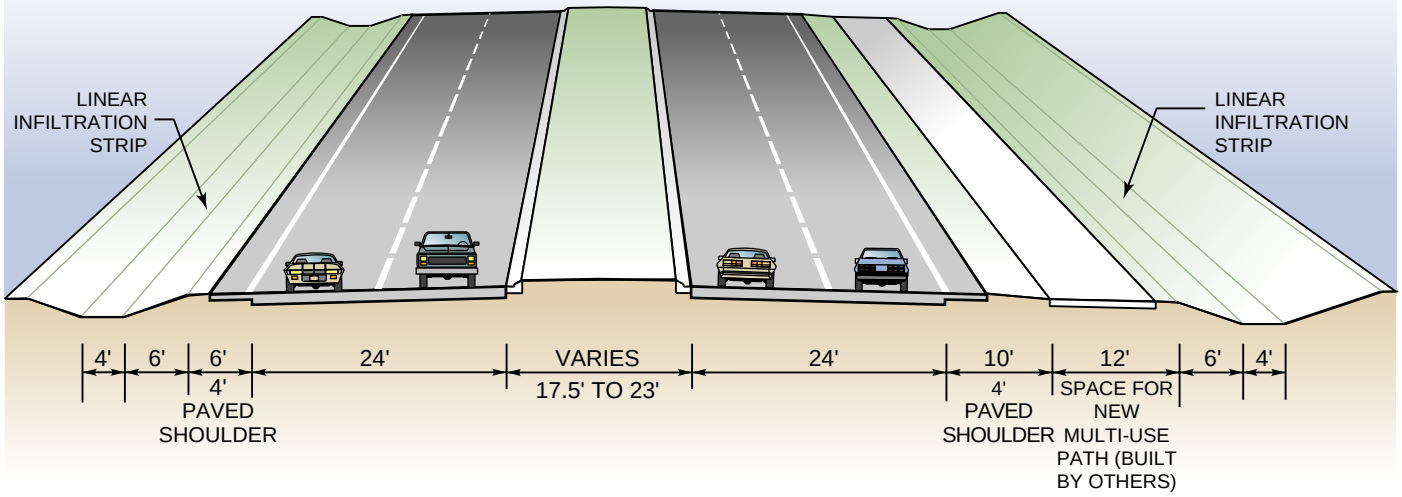
NC 12 Three-Lane Widening

Figure
2-5

Existing/No-Build Alternative

Photo Simulation

NC 12 4-Lane Widening



	NC 12 Four-Lane Widening	**Figure** 2-6

Thus, MCB2 includes the existing road improvements similar to ER2, plus a Mid-Currituck Bridge. The basic features of this alternative are:

- Constructing a 4.7- to 5.3-mile-long two-lane (see Figure 2-7) toll bridge across Currituck Sound, with approach roads, in Currituck County;

- 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 (Figure 2-3) 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 (Figure 2-4) between the Wright Memorial Bridge and Cypress Knee Trail and an eight-lane super-street between Cypress Knee Trail and the Home Depot driveway (both locations indicated are just west of the existing US 158/NC 12 intersection);

- Constructing an interchange (Figure 2-4) 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 (which is just south of the existing US 158/NC 12 intersection); and

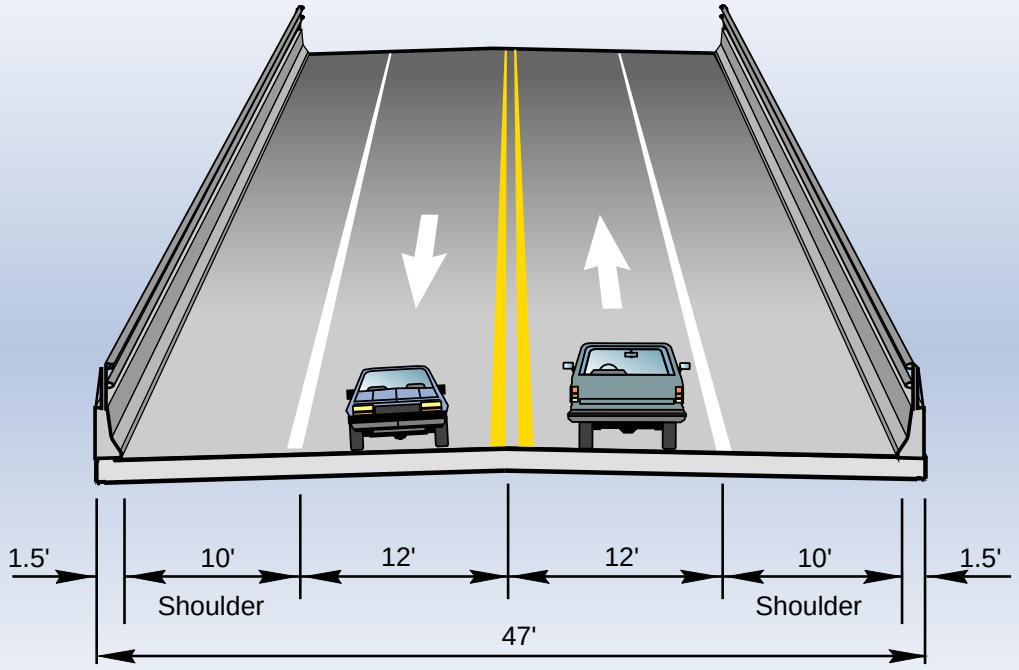
- Widening NC 12 to three lanes (two travel lanes and a center lane for left turns; Figure 2-5) between US 158 and a point just north of Hunt Club Drive in Currituck County (except for the existing three-lane section in Duck, which will be unchanged) and to four lanes with a median from just north of Hunt Club Drive to the NC 12 intersection with the Mid-Currituck Bridge (Figure 2-6).

2.1.2.3 MCB4

MCB4 involves construction of a Mid-Currituck Bridge, as well as limited improvements to existing NC 12 and US 158. MCB4 was considered in order to identify the extent to which network congestion and travel time could be improved, as well as other associated benefits, if only a Mid-Currituck Bridge were built. Limited existing road improvements were added to MCB4 to ensure that southbound traffic stopped at traffic signals on NC 12 would not queue back onto the bridge on the summer weekend. The basic features of this alternative are:

- Constructing a 4.7- to 5.3-mile-long, two-lane toll bridge across Currituck Sound, with approach roads, in Currituck County;

- 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 (Figure 2-3) 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;



Mid-Currituck Bridge Typical Section

	Mid-Currituck Bridge Typical Section	**Figure** 2-7

- 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 to four lanes with a median (Figure 2-6) from Seashell Lane to the NC 12 intersection with the Mid-Currituck Bridge.

2.1.2.4 MCB2 and MCB4 Corridor Alternatives and Design Options

For MCB2 and MCB4, two bridge corridors were evaluated in detail in the DEIS. The locations of the two Outer Banks termini, C1 and C2 (see Figure 2-1 and Figure 2-8), are:

- Corridor C1 on the mainland would be between Aydlett Road (SR 1140) and approximately 500 feet north of the power line that parallels Aydlett Road. On the Outer Banks, C1 would end at the southern end of Phase I of the Corolla Bay subdivision. C1 would connect with NC 12 at an intersection approximately 2 miles north of the Albacore Street retail area. The length of the proposed bridge over Currituck Sound would be approximately 4.7 miles with C1.

- Corridor C2 on the mainland would include the same area as C1 and on the Outer Banks would end near Albacore Street (SR 1402). C2 would connect with NC 12 approximately 0.5 mile south of the Albacore Street retail area. The length of the proposed bridge over Currituck Sound would be approximately 5.3 miles with C2.

For MCB2 and MCB4, two design options (Option A and Option B) also were evaluated in detail in the DEIS for the mainland approach to the bridge over Currituck Sound (between US 158 and Currituck Sound). The options are (see Figure 2-9):

- Option A would place a toll plaza within the US 158 interchange (see Figure 2-10). The mainland approach road to the bridge over Currituck Sound would include a bridge over Maple Swamp. Drivers traveling between US 158 and Aydlett would continue to use Aydlett Road. In Aydlett, the two-lane approach road would pass through Aydlett on fill (approximately 3 to 23 feet high) and bridge Narrow Shore Road.

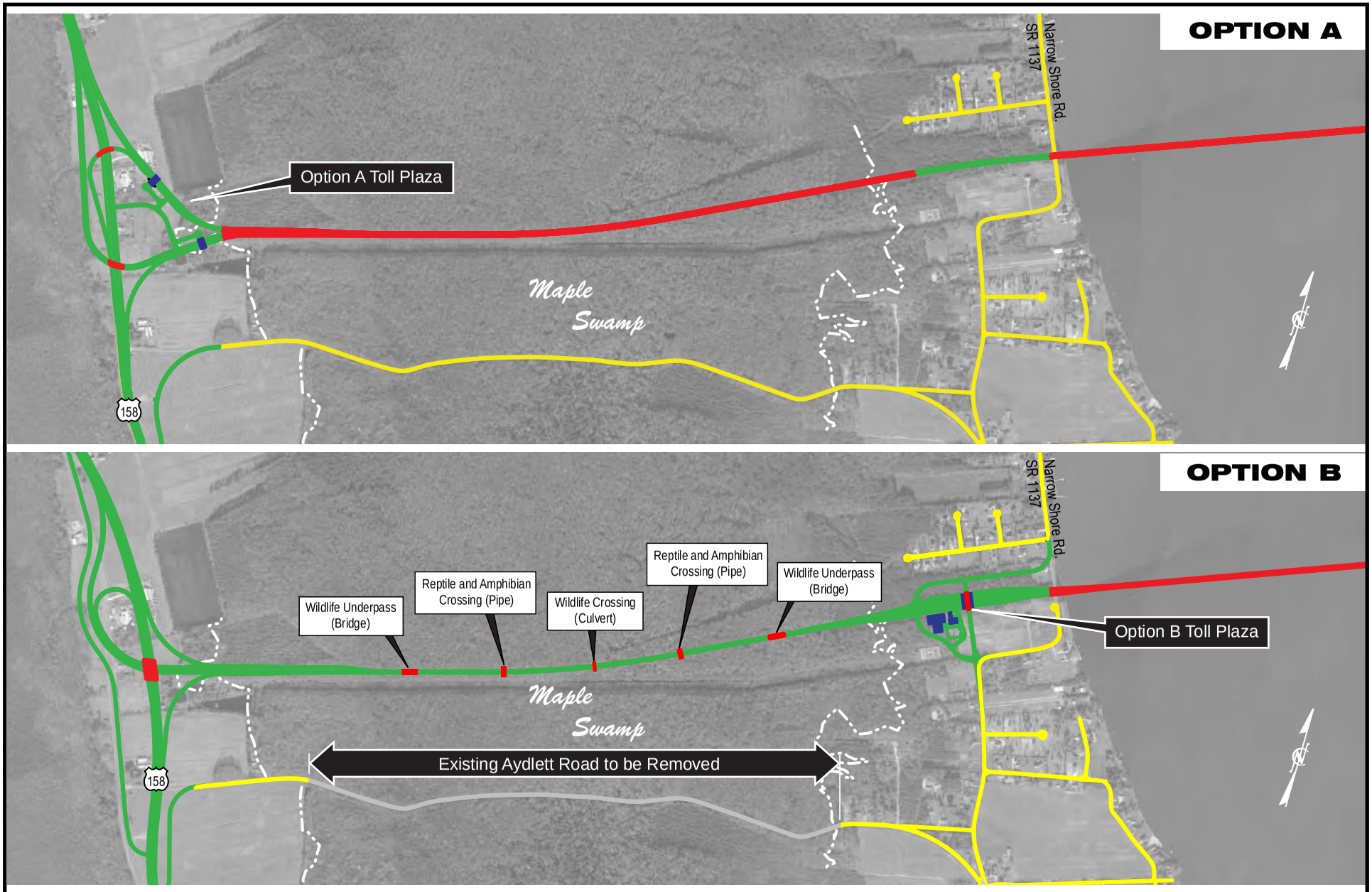
- With Option B, the US 158 interchange would not include the toll plaza (see Figure 2-11). The approach to the bridge over Currituck Sound would be a road placed on fill within Maple Swamp. Wildlife passages would be incorporated into the fill. The preliminary design developed to assess impacts includes five wildlife passages: two bridges with 180-foot spans at the eastern and western sides of the swamp, a 12-foot by 8-foot box culvert at the center of the swamp, and two 43-inch by 68-inch pipes for passage of reptiles and amphibians. Exclusionary fencing along the road also is assumed.

Bridge Corridor C1 Photo Simulation

Bridge Corridor C2 Photo Simulation

Outer Banks
Terminus Alternatives

Figure
2-8



LEGEND

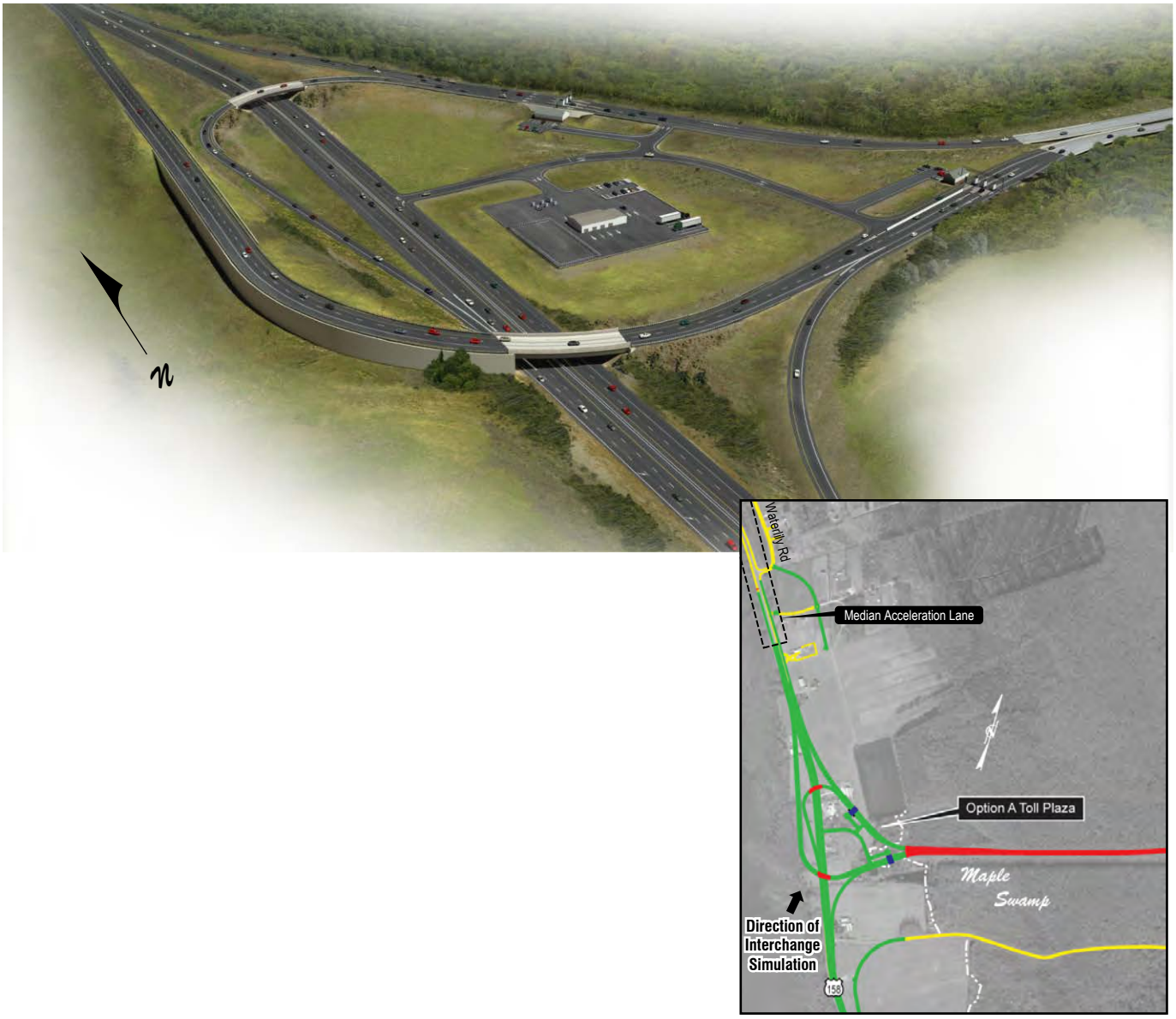
- Existing Road
- Proposed and Improved Existing Road
- Proposed Toll Plaza and Buildings
- Proposed Bridges and Other Structures
- Maple Swamp Boundary

Design Options A and B

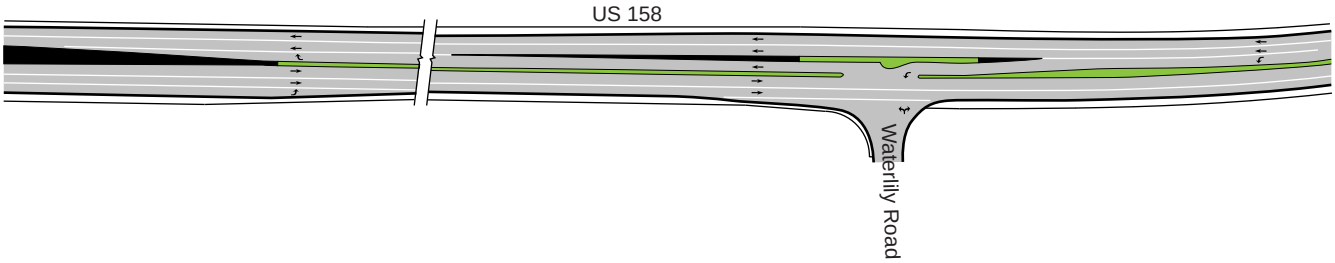
Figure

2-9

US 158/Mid-Currituck Bridge Option A Interchange Simulation



Median Acceleration Lane at Waterlily Road



	US 158/Mid-Currituck Bridge Interchange (Option A) and Waterlily Road Median Acceleration Lane	**Figure** 2-10

US 158/Mid-Currituck Bridge Interchange (Option B)

Figure
2-11

Also with Option B, Aydlett Road would be removed and its right-of-way restored as a wetland. Traffic traveling between US 158 and Aydlett would use the new bridge approach road. Within Aydlett:

- A local connection would be provided between the bridge approach road and the local Aydlett street system.

- The local road system would be reconfigured, including dead-ending Narrow Shore Road at the point where the bridge begins and replacing it with an overpass over the toll plaza and a frontage road parallel to the north side of the toll plaza. The bottom of the bridge span for the overpass would be approximately 25.5 feet above existing ground at its highest point over the toll plaza. The frontage road would be approximately 21 feet above existing ground at its highest point where it would intersect with the overpass.

- The toll plaza would be placed in Aydlett east of the local road 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 in Aydlett.

The characteristics of Option A and Option B in Aydlett are shown on Figure 2-12.

The preliminary designs used for assessing impacts are designed to accommodate forecast travel demand so traffic is not congested during the summer weekday in 2035 with two exceptions:

1. With ER2, three lanes on NC 12 would not eliminate congestion on the summer weekday. However, as discussed in Section 2.5, four lanes in areas of Southern Shores, Duck, and Currituck County where NC 12 has only a 60-foot right-of-way would cause substantial displacement of homes and businesses. Such levels of displacement were not considered prudent or practicable by NCTA or environmental resource and regulatory agencies as discussed in the *Alternatives Screening Report* (Parsons Brinckerhoff, 2009). MCB4, which includes only limited improvements to NC 12, also would not eliminate congestion on NC 12 on the summer weekday. With MCB2, the combination of three lanes and the diversion of traffic to the Mid-Currituck Bridge would eliminate summer weekday congestion in 2035.

2. The Mid-Currituck Bridge interchange at US 158 and its intersection with NC 12 are designed to operate at uncongested levels even on the summer weekend.

Traffic improvements are seldom designed to eliminate completely the worst hours of congestion. Thus, except for the second exception noted above, the detailed study alternatives, including the Preferred Alternative, were not designed to handle all summer weekend congestion in 2035, which will occur only 26 days a year on the 13 summer weekends.

Option A - Aydlett Area Photo Simulation

Option B - Aydlett Area Photo Simulation

Mid-Currituck Bridge at Aydlett (Option A and Option B)

Figure
2-12

2.1.2.5 Preferred Alternative

The Preferred Alternative is MCB4/C1 with Option A (see Figure 2-2) and primarily with reversing the center turn lane on US 158 between the Mid-Currituck Bridge interchange and NC 168 to reduce hurricane evacuation clearance times. The Preferred Alternative also includes several design refinements to help avoid and minimize impacts, in response to government agency and public input and comments. These refinements include:

- Provision of a median acceleration lane at Waterlily Road (see Figure 2-10). 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).

Hurricane evacuation clearance time reduction features include:

- 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.

2.1.2.6 No-Build Alternative

The No-Build Alternative assumes that the proposed project would not be implemented. However, the No-Build Alternative includes the following projects listed in NCDOT's 2009 to 2015 STIP within or near the project area because these projects are considered to be reasonably foreseeable planned improvements (i.e., improvements expected to occur independent of the alternatives being assessed for the proposed project):

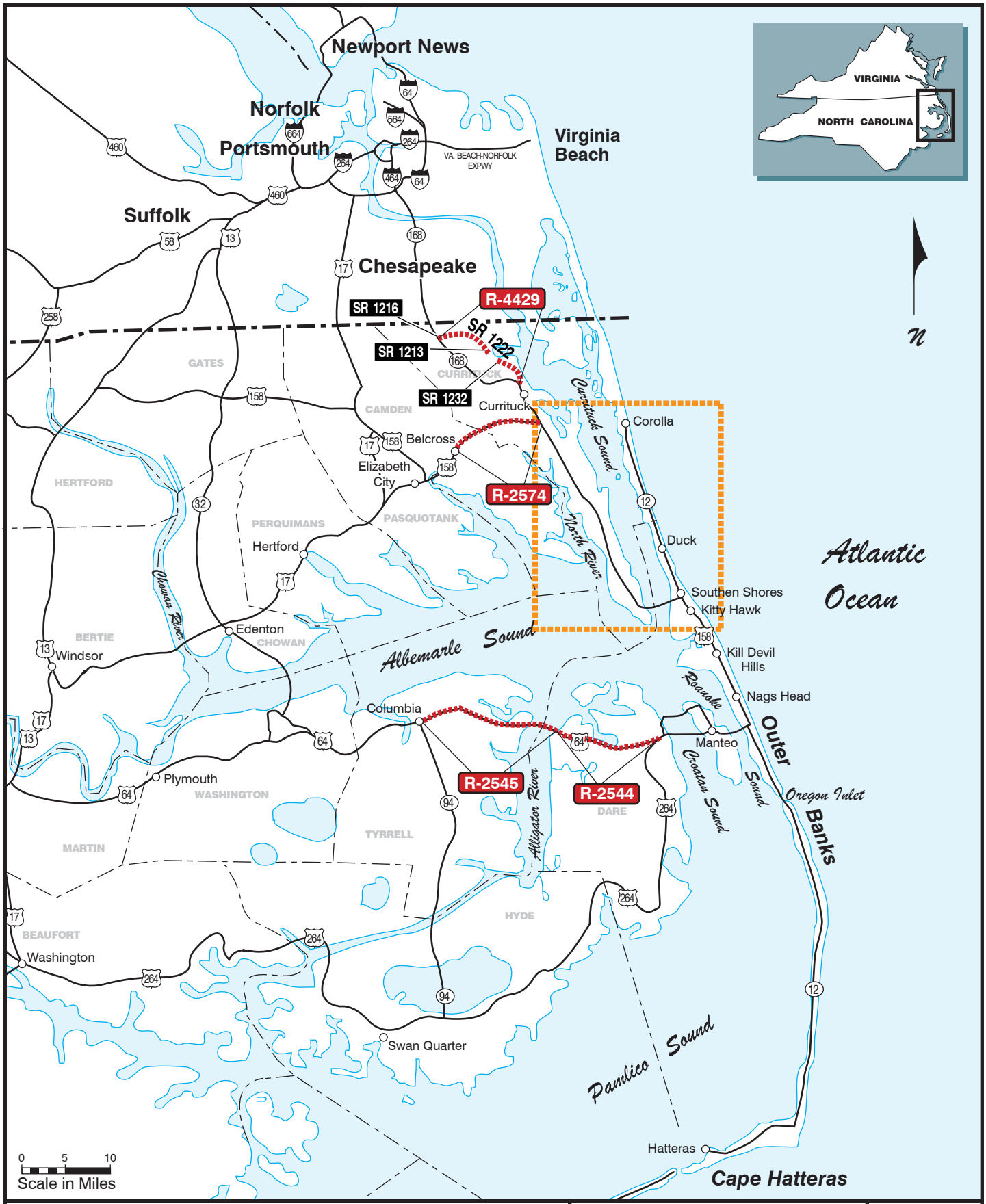
- **Project No. R-2545**—Widen US 64 to multi-lanes from east of Columbia to east of the Alligator River;
- **Project No. R-2544**—Widen US 64 to multi-lanes from east of the Alligator River to US 264;
- **Project No. R-2574** —Widen US 158 to multi-lanes from east of NC 34 at Belcross in Camden County to NC 168 in Currituck County; and
- **Project No. R-4429** —Upgrade SR 1222 from NC 168 to north of SR 1232 and from SR 1213 to SR 1216.

Figure 2-13 shows the locations of these STIP projects.

2.1.3 How many lanes would a Mid-Currituck Bridge include, and how tall would the bridge be?

The preliminary designs for MCB2, MCB4, and the Preferred Alternative assume a two-lane Mid-Currituck Bridge. The typical section for such a bridge is shown on Figure 2-7. The decision to evaluate a two-lane bridge, rather than a four-lane or a three-lane bridge, was based on level of service, travel time, safety, and cost. Bridge lane studies (see the *Alternatives Screening Report;* Parsons Brinkerhoff, 2009) found that the 2035 travel time across a two-lane bridge would be 1.4 minutes greater than a four-lane bridge on the summer weekday at 10.1 minutes. Travel time on a two-lane bridge would be 2.2 minutes greater than with a four-lane bridge on the summer weekend at 11.1 minutes. This difference would not warrant the over $120 million in additional bridge cost for four lanes. A three-lane bridge would provide additional capacity by reversing the center lane during periods of peak demand. This procedure would be needed only on the 26 summer weekend days. The additional capital cost would be $80 million; lane reversing equipment would need to be stored, maintained and require a trained staff. It was found that 1.9 minutes would be saved, a time not substantial enough to warrant the cost and effort required.

Both bridges over Maple Swamp and Currituck Sound, as well as fill across Maple Swamp with mainland approach road Option B, would be above the 100-year Base Flood Elevation or storm surge. At this time, it is assumed that a Mid-Currituck Bridge



LEGEND

- STIP Project Locations
- Mid-Currituck Bridge Project Area

STIP Projects in the No-Build Alternative

Figure

2-13

would have a single navigation span. Additional coordination with the US Coast Guard on this topic will occur after release of the Record of Decision (ROD) (see Project Commitment #1) to determine minimum horizontal and vertical clearances. The navigation span for a Mid-Currituck Bridge is currently assumed to be near the mainland where Currituck Sound tends to be deeper (9 feet), but the final location would be determined in association with the US Coast Guard.

2.1.4 Why are interchanges included in the detailed study alternatives, including the Preferred Alternative?

Two interchanges are included in the detailed study alternatives. MCB2, MCB4, and the Preferred Alternative include an interchange where the Mid-Currituck Bridge and its toll plazas (with Option A) intersect with US 158 (Figure 2-10 and Figure 2-11). ER2 and MCB2 include an interchange at the intersection of US 158 and NC 12 (Figure 2-4).

Interchanges are needed at these locations because forecast year 2035 peak period traffic demand is great enough that, without an interchange, traffic on US 158 would back-up in queues. A signalized intersection was considered at both locations, but 2035 peak period demand is forecast to be great enough that not everyone on US 158 who would want to pass through the intersection could make it through during the time the light is green. When more people arrive at an intersection than can be passed through in a single green light cycle, those who do not get through must wait until the next green light cycle. As each green light cycle passes with demand exceeding green time, the vehicles that are waiting their turn to move through the intersection increase in number, and queues grow until demand drops below the capacity of the intersection.

The US 158/Mid-Currituck Bridge interchange preliminary design for MCB2 and MCB4 is sized to avoid queuing or back-ups from the toll plazas onto US 158, even on the 2035 summer weekend. The interchange configuration used for both Option A and Option B would provide desired capacity and minimize wetland impacts.

The two US 158/NC 12 interchange designs are sized to avoid queuing onto US 158 during the 2035 summer weekday. The US 158/NC 12 interchange with ER2 is designed to handle more traffic than the interchange with MCB2. This is because the Mid-Currituck Bridge associated with MCB2 would reduce traffic demand on US 158 by diverting travelers from US 158 to the Mid-Currituck Bridge. Thus, the US 158/NC 12 interchange would need to handle less traffic. MCB4 and the Preferred Alternative include no interchange because their objective is to improve traffic flow in the project area with a Mid-Currituck Bridge and minimize existing road improvements.

MCB2 uses a compressed diamond interchange, as illustrated on Figure 2-4. It is called a diamond interchange because the combination of US 158 and its ramps form a diamond shape. Traffic signals are used at the ends of each set of ramps. ER2 uses a single point interchange. It is like a diamond except the four ramps are angled to come together at a single traffic signal. More traffic can pass through a single point interchange in one hour than a compressed diamond interchange. In either case, US 158 would pass over the

connection to NC 12 and the Aycock Brown Welcome Center on an elevated structure with a minimum vertical clearance of 15.5 feet. Digging down into the ground to place US 158 under the connection to NC 12 is not feasible. The water table is only a few feet below ground, so a depressed road would easily fill with water. Also, during a storm, the storm surge would fill the depressed road with water, even if pumps were used to pump out rain water, potentially blocking travel during evacuation and then recovery after a storm.

2.1.5 What intersections would have traffic signals?

Existing traffic signals on US 158 and NC 12 generally would be retained at all locations except at a US 158/NC 12 interchange. With the Preferred Alternative, the NC 12/ Currituck Clubhouse Drive signal would be replaced with a roundabout with no signal. Also with the Preferred Alternative, a roundabout with no signal would be placed where a Mid-Currituck Bridge intersects with NC 12. With ER2 and MCB2, traffic signals also would be at U-turn locations on the US 158 super-street. Traffic signals also would be placed at the end of US 158/NC 12 interchange ramps where turns onto NC 12 would occur. With MCB2 and MCB4, traffic signals would be placed where a Mid-Currituck Bridge intersects with NC 12.

2.1.6 How would access to private property and subdivisions be changed?

The changes in local street and driveway access associated with the detailed study alternatives are shown in Table 2-1. The general locations of the streets and landmarks noted in Table 2-1 are shown on Figure 2-14. The least change in local street and driveway access would be with MCB4/C2 because the bridge would terminate at Albacore Street. The capacity improvements that would reduce future congestion on these two thoroughfares (benefiting travelers on those roads) also would introduce changes to local street and driveway connections to those roads.

With Option A (included in the Preferred Alternative), because of the proximity of the US 158/Mid-Currituck Bridge interchange ramps to the Waterlily Road intersection, there would be the potential for merging traffic from the interchange onto US 158 to increase the challenge of turning left into or out of Waterlily Road during peak travel periods. This concern has been addressed in the Preferred Alternative, as described in Section 2.1.2.5. With Option B, the interchange ramp would end approximately 1,800 feet south of Waterlily Road, so there would be no impact to existing conditions at the Waterlily Road intersection.

As illustrated on Figure 2-4, the super-street included on US 158 with ER2 and MCB2 would alter left-turn patterns from side streets. For the NC 12 three-lane design with ER2 and MCB2, some intersections of NC 12 and state-maintained roads would be closed to reduce the number of locations where drivers would slow to make turns. This is only done at subdivisions with more than one state-maintained access point to NC 12.

Table 2-1. Changes in Access

	Applicable Alternative					
	ER2	MCB2/ C1	MCB2/ C2	MCB4/ C1	MCB4/ C2	Preferred Alternative
Mainland, US 158 Frontage Roads: For one house and one business along the eastern side of US 158 just south of Waterlily Road, access to US 158 provided via a frontage road to Waterlily Road instead of direct driveway access to US 158. With Option B only, a frontage road is provided along the western side of US 158 adjacent to the US 158/Mid-Currituck Bridge interchange to provide access to properties in this area that currently have direct access to US 158. Direct access from US 158 would be lost for customers of a gas station near the end of the frontage road. With Option A (including the Preferred Alternative), no upland is available for a frontage road and thus properties west of US 158 that lose their access to US 158 would be purchased.		X	X	X	X	X
Mainland, US 158/Waterlily Road Intersection: With Option A, there would be the potential for merging traffic from the US 158 interchange to wait until just before the intersection to merge into US 158. This would increase the challenge of turning left into or out of Waterlily Road during peak travel periods. This would be mitigated with the Preferred Alternative with a median acceleration lane and other features. With Option B, the interchange ramp would end approximately 1,800 feet south of Waterlily Road, so there would be no impact to existing conditions at the Waterlily Road intersection.		X	X	X	X	X

Table 2-1 (continued). Changes in Access

	Applicable Alternative					
	ER2	MCB2/ C1	MCB2/ C2	MCB4/ C1	MCB4/ C2	Preferred Alternative
Mainland in Aydlett: With Option B, existing Aydlett Road through Maple Swamp removed. Access between US 158 and Aydlett provided from the Mid-Currituck Bridge approach road. Narrow Shore Road altered to pass over the toll plaza, which would be in Aydlett with Option B only. With Option A (including the Preferred Alternative), no changes to Aydlett access or the local street system. No access in Aydlett to and from the Mid-Currituck Bridge with either option.		X	X	X	X	X
Direct access to the Outer Banks (at NC 12) from the mainland (at US 158) via a Mid-Currituck Bridge.		X	X	X	X	X
Outer Banks, US 158 between the Wright Memorial Bridge and NC 12: Left turners from Amandas Avenue, North Croatan Highway, South Dogwood Trail, The Woods Road, Duck Woods Drive, Cypress Knee Trail, Juniper Trail, Wal-Mart Shopping Center, and the Market Place Shopping Center would need to turn right and make a U-turn at a signalized location.	X	X	X			
Outer Banks, US 158 South of NC 12 to Bennett Street: On the eastern side of US 158, the CVS pharmacy would only have access off of NC 12. With ER2, drivers would have to access CVS via NC 12 south of US 158/NC 12 interchange. For two other businesses and residential properties, driveway access to US 158 would be closed, with access only from an alley behind the properties. On the western side of US 158, the Regional Medical Center main access would be closed, with full access being allowed at Grissom Street via Putnam Road.	X	X	X			

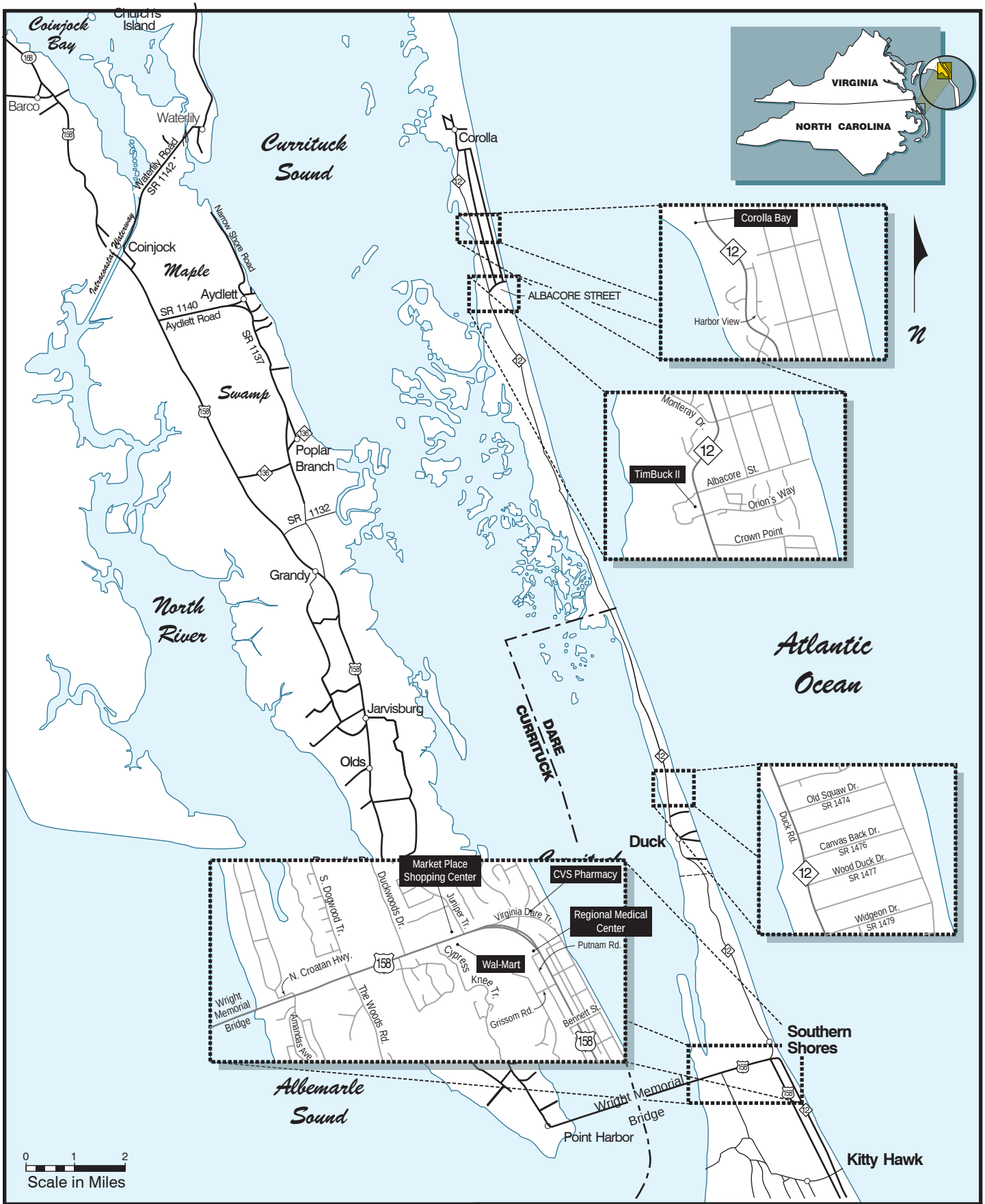
Table 2-1 (continued). Changes in Access

	Applicable Alternative					
	ER2	MCB2/ C1	MCB2/ C2	MCB4/ C1	MCB4/ C2	Preferred Alternative
Outer Banks, NC 12 at US 158: With ER2, from the eastbound off ramp of US 158 to NC 12 northbound, right turns to NC 12 south (Virginia Dare Trail) would be prohibited. Drivers would reach this part of Virginia Dare Trail via NC 12 south of US 158/NC 12 interchange.	X					
Outer Banks, NC 12 in Dare County: Since some subdivisions are served by more than one street, intersections with NC 12 would be closed at Widgeon Drive (SR 1479), Wood Duck Drive (SR 1477), Canvas Back Drive (SR 1476), and Old Squaw Drive (SR 1474) to facilitate NC 12 traffic flow.	X	X	X			
Outer Banks, NC 12 in Currituck County South of Albacore Street: No left turns to or from Crown Point, except with the Preferred Alternative. No left turn from southernmost entrance of TimBuck II to NC 12 with ER2, MCB2/C1, MCB4/C1, and the Preferred Alternative; no left turns to or from southernmost entrance of TimBuck II with MCB2/C2 and MCB4/C2. No left turns from Orion's Way to NC 12. Provisions made for left turners to make U-turns at adjoining intersections.	X	X	X	X	X	X
Outer Banks, NC 12 in Currituck County between Albacore Street and Monteray Drive: Either no left turns from or no left turns to NC 12 from business driveways between Albacore Street and Monteray Drive. Provisions made for left turners to make U-turns at adjoining intersections.		X		X		X

Table 2-1 (concluded). Changes in Access

	Applicable Alternative					
	ER2	MCB2/ C1	MCB2/ C2	MCB4/ C1	MCB4/ C2	Preferred Alternative
Outer Banks, NC 12 in Currituck County between Monteray Drive and Corolla Bay: Corolla Bay subdivision divided with no direct access between the two parts. NC 12 would need to be used to travel between the two parts. The northern intersection of North Harbor View Drive with NC 12 would be closed. The southern intersection would remain open.		X		X		
Outer Banks, NC 12 in Currituck County between Monteray Drive and Corolla Bay: The northern intersection of North Harbor View Drive with NC 12 would be relocated.						X

Note: Access changes on the streets indicated are shown on the public hearing maps and Preferred Alternative preliminary engineering included on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at http://www.ncdot.gov/projects /midcurrituckbridge/.



LEGEND

— - — County Boundaries

Streets and Landmarks Noted in Table 2-1

Figure

2-14

Provisions for emergency vehicles to continue to reach residents through the former intersections would be included. The four-lane preliminary designs for NC 12 with all of the detailed study alternatives, including the Preferred Alternative, include a median with breaks at approximately 1,200-foot intervals, varying somewhat depending on the spacing of existing intersections. The median's limiting of left turns at all but major intersections would greatly reduce traffic interferences associated with drivers stopping in the travel lanes to make left turns. The access changes listed are shown in detail on the public hearing maps and Preferred Alternative preliminary engineering included on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/. At locations where left turns would be prohibited, provisions would be made as needed for those desiring to make left turns to make instead U-turns at nearby intersections before or after a right turn. This is generally accomplished in the form of a widened pavement (U-turn bulb) that would allow most U-turns to be made in a single movement. Opportunities to mitigate access changes further would be considered during final design.

2.1.7 What road and bridge drainage provisions would be included in the project? How would stormwater runoff be cleaned?

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 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 (new built upon area with the Preferred Alternative), about 28 acres would be associated with the bridge over Currituck Sound and 11 acres 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, stormwater wetlands, wet detention basins, rooftop rainwater harvesting, and other traditional roadway Best Management Practices (BMPs), to the maximum extent practicable.

The following paragraphs describe how stormwater would be managed with the Preferred Alternative. Similar approaches, as applicable, would have been used with the other detailed study alternatives, if one of them had been selected as the Preferred Alternative. A final stormwater management plan for minimizing the potential impact

of project pollutants would be developed in association with the North Carolina Department of Environment and Natural Resources, Division of Water Quality (NCDENR-DWQ), as well as other appropriate state and federal environmental resource and regulatory agencies, during final design of the alternative selected for implementation and in the process of obtaining related permits.

2.1.7.1 Stormwater Management for Uplands on the Mainland and Outer Banks

In uplands areas on the mainland and the Outer Banks, stormwater capture and treatment would be through typical roadway BMPs using infiltration trenches and basins. To the maximum extent practicable, all 33 acres of non-bridge additional impervious surface area, plus all 18 acres of existing roadway impervious surface area in the project's construction limits, would have the first 1.5 inches of runoff captured and either treated or used in the project site. Additionally, a rooftop runoff system may be used for buildings and/or toll plaza awnings to capture and use water on site or to infiltrate it. Alternative pavement materials, such as pervious pavements, also may be used in parking areas associated with the toll plaza.

With the Preferred Alternative, there would be no outfalls from NC 12 to Currituck Sound or the Atlantic Ocean. The accommodation of drainage on NC 12 was a focus in developing the preliminary designs along NC 12, both because a wider NC 12 would generate more runoff and because road flooding would continue to occur on NC 12 during storm events without improvement.

NC 12 is in a topographic (rise and fall of the land) depression along much of the roadway within the project area. To the east, the dune area along the coastline forms a ridge line. Similarly, to the west, the land generally rises near Currituck Sound. As a result, NC 12 is in a topographic "bathtub." In addition, there are no streams providing for water discharge, or other outlets for runoff, except in those locations where NC 12 is adjacent to Currituck Sound. Under existing conditions, stormwater runoff makes its way to low areas and eventually infiltrates into the ground. In some places the road itself is the low point, and thus there are parts of NC 12 that experience chronic flooding problems. Other complicating factors include the groundwater elevation, which is near the surface (in some places within 2 feet), and the extensive land development that has occurred along NC 12, particularly in the towns of Southern Shores and Duck.

The preliminary designs for NC 12 with the detailed study alternatives, including the Preferred Alternative, generally use infiltration strategies for the majority of the project, along with a limited number of outfalls to Currituck Sound. Infiltration strategies involve locations for water to be absorbed into the ground rather than be transported to and released into a water body like Currituck Sound. The infiltration strategies would include infiltration basins and linear infiltration strips (roadside ditches). Infiltration basins and linear infiltration strips would remain dry except during and after storms. These volume-based BMPs would be sized to store temporarily the runoff from a 10-year storm. The infiltration strategies closely replicate existing drainage patterns, while improving storage capacity during the infiltration process. The specific approach to be taken varies along the roadway corridor for the NC 12 widening alternatives.

The typical sections shown on Figure 2-5 and Figure 2-6 illustrate the location of proposed linear infiltration BMPs along each side of the road. The wide infiltration strips illustrated on Figure 2-5 are only used in the southern part of Southern Shores (from just north of the US 158 interchange area to Ocean Boulevard). Here the adjoining properties drain to NC 12, and NC 12 is flat. Therefore, the infiltration strips would be up to 21 feet wide on each side of the road to capture and store the water from both NC 12 and the surrounding properties during the infiltration process. Elsewhere, the linear infiltration strips are narrow, as illustrated on Figure 2-6. In Dare County where surrounding properties also drain to the road but NC 12 rises and falls with the terrain, these strips are designed to convey water to low points and new infiltration basins. Most of the basins or ponds could be put on currently vacant property. In Currituck County, development generally drains away from the road, so the infiltration strips only need to accommodate road drainage. Thus, infiltration would generally be accomplished in the strip without water being conveyed to new basins. In most cases, infiltration strips would be placed outside the NC 12 right-of-way in a permanent drainage easement, with the right to maintain the strip purchased from the land owner. The owner would retain all other ownership rights.

2.1.7.2 Stormwater Management for Maple Swamp and Currituck Sound

The stormwater management plan for the Mid-Currituck Bridge with the Preferred Alternative would have the following components:

- Source Control. Source control would be used on the Maple Swamp and Currituck Sound bridges. Source control would be provided by frequent deck cleaning using state of the art, multi-function cleaning equipment that employs mechanical, vacuum, and regenerative air systems. Cleaning would occur weekly during the summer (or other schedule to which the environmental resource and regulatory agencies agree during the permitting process) until the most effective cleaning frequency regime can be determined. Weather dependent cleaning may occur prior to known large rain events such as hurricanes. Source control through deck cleaning would be a contractual element of the agreement between NCTA and the concessionaire operating and maintaining the toll bridge. Failure to comply with contractual terms could result in a financial penalty.

  Modern pavement sweeping and vacuuming technology has been shown to remove effectively upwards of 97.5 percent of materials that cause pollution from the bridge deck (Real World Street Cleaner Pickup Performance Testing, Roger C. Sutherland, PE, Pacific Water Resources, Inc., July 2008). Even when graduated by particle size, this technology removes over 90 percent of the smallest particles and nearly all of the larger particles. Use of this technology prior to a storm event would remove the vast majority of the pollutants from the bridge runoff, thereby substantially improving the water quality of the runoff reaching the sound. Therefore, the sweeping approach is a pre-treatment method.

- Stormwater Capture over SAV Habitat (including Existing Beds) at the Eastern End of the Currituck Sound Bridge. For the bridge over Currituck Sound, the first 1.5

inches of stormwater runoff would be captured from the eastern end of the bridge for a distance of 4,000 feet to prevent direct discharge into the existing SAV habitat (including existing beds) along the eastern shore of the sound. The runoff would be piped to the end of the bridge for treatment to a wet detention basin. The bridge stormwater collection system would be subject to:

- Regular pipe inspections and maintenance (including debris and litter removal); and

- Periodic removal and disposal of accumulated sediments in the wet detention basin.

The remaining length of this 4.7-mile-long bridge would have no stormwater capture and would directly discharge through bridge scuppers into Currituck Sound. According to FHWA research (Design of Bridge Deck Drainage, HEC 21, May 1993), stormwater from bridge scuppers that are 25 feet or greater above the ground has no erosive force. Instead, because of wind and other normal conditions encountered during rain and storm events, this water returns to a state similar to rain. For the bridge over Currituck Sound, the scupper height would be approximately 22 feet above the water, minimizing the impact of discharged stormwater. No impacts to SAV from stormwater concentrations discharging from scuppers would occur because no scuppers would be over SAV habitat (including existing beds) – the stormwater would be collected as previously mentioned. In addition, NCTA would ensure the stability of the sound would not be affected by erosion as a result of stormwater discharge from scuppers during, at minimum, an annual inspection.

- Stormwater Capture at Either End of the Maple Swamp Bridge. The first 1.5 inches of stormwater would be captured for 500 feet on both ends of the Maple Swamp bridge and piped to infiltration basins for treatment. The remaining length of the bridge would have pre-treated discharge (via the frequent deck cleaning) exiting through scuppers 7 to 18 feet above the ground of Maple Swamp. If the energy of the water exiting the scuppers is determined to be a problem, dissipation would be provided either at the pipe outlet or on the ground.

- Water Quality Monitoring and Research. A water quality monitoring program would be conducted as a part of bridge operations. NCTA would monitor the effectiveness of the bridge deck cleaning program so adjustments to the program could be made as needed. The monitoring program would first establish (test) existing water quality levels, including turbidity levels. Research could be supported for better understanding of the effect of bridge deck cleaning and/or the effect of bridge deck stormwater runoff on receiving waters.

- Treatment of Existing Impervious Road Surface Where the Project Improves Those Roads. The water capture and treatment program proposed for the two bridges would result in an uncaptured bridge area of 24 acres on the bridge over Currituck Sound and 10 acres on the bridge over Maple Swamp. Stormwater in these areas would directly discharge into their receiving bodies; however, greater than 90

percent (possibly as high as 97.5 percent) of the pollutants would have already been removed (i.e., pre-treated) through frequent deck cleaning via sweeping and vacuuming.

As indicated above, to the maximum extent practicable, all 33 acres of non-bridge additional impervious surface area, plus all 18 acres of existing roadway impervious surface area in the project's construction limits, would have the first 1.5 inches of runoff captured and either treated or used in the project site. The net effect of this approach would be to offset the 34 acres of uncaptured (yet greater than 90 percent treated) bridge area with the 18 acres of treatment for existing roadway impervious surface area. This results in a net of 16 acres of uncaptured (yet greater than 90 percent treated) new impervious surface area. Traditional bridge collection and stormwater wetland treatment systems are thought to achieve about 85 percent removal of Total Suspended Solids and 40 percent removal of Total Nitrogen and Total Phosphorus. This results in 15 to 60 percent of the pollutants being discharged into receiving waters even with treatment.

NCTA would continue to work with environmental resource and regulatory agencies as the project progresses into final design and permit application to refine this approach.

2.1.7.3 Capturing the First 1.5 Inches of Runoff from Bridges

NC Session Law 2008-211 calls for the capture and treatment of the first 1.5 inches of runoff from impervious surfaces in coastal counties for all new development projects. Although the requirements of NC Session Law 2008-211 do not apply to activities of NCDOT and NCTA, they are regulated in accordance with the provisions of NCDOT's National Pollutant Discharge Elimination System (NPDES) Stormwater Permit (NC Session Law 2008-211, Section 2.d), as indicated above, it is the intent of NCTA to provide at least an equivalent benefit. Two options (Options 1 and 2) for capturing the first 1.5 inches of runoff from the entire length of the Currituck Sound and Maple Swamp bridges were considered in the DEIS by NCTA, but both were found not to be practicable because of the substantial increased costs associated with the bridge designs of these options. The DEIS also included a third option (Option 3) that would capture bridge runoff only over the sensitive coastal marsh on the Outer Banks end of the Currituck Sound Bridge and transport the runoff to off-site treatment sites. As discussed in Section 2.1.7.2, a more extensive version of this option that includes stormwater capture for 4,000 feet at the eastern end of the Currituck Sound Bridge, as well as for 500 feet at both ends of the Maple Swamp Bridge, was included in the Preferred Alternative. The sections below describe the DEIS options for capturing and treating runoff that were not included in the Preferred Alternative (i.e., Options 1 and 2), but DEIS Option 3 is not included below because the Preferred Alternative includes a more extensive version of this option that was already described in Section 2.1.7.2.

Option 1

The first option would involve creating high points on the bridges over Maple Swamp (Option A) and Currituck Sound. This would allow the bridges to drain to the bridge termini via a pipe system where runoff from the bridge deck could be directed to stormwater treatment BMPs, such as stormwater wetlands or wet detention basins. To accomplish this using a uniform minimum 0.3 percent slope, the height of the Currituck Sound bridge's deck would need to be 71 to 79 feet at its highest point, compared to the 23-foot bridge deck height assumed in the preliminary design assessed in this FEIS. A piping system (with pipe sizes ranging from 15 to 24 inches in diameter) would need to be added to the bridges to carry water off the bridge and to the shore.

Stormwater wetlands would need to be constructed to replicate natural wetlands using physical, chemical, and biological processes to treat runoff and provide temporary storage of runoff in shallow pools to support vegetation. They would be approximately 2 acres in total size on the mainland and 2 acres on the Outer Banks. Wet detention basins of approximately 1 acre on the mainland and 1.2 acres on the Outer Banks also would be required.

The installation cost of the collection piping for the bridges over Maple Swamp and Currituck Sound, including the piping and support hardware, could exceed $10 million (in year of expenditure dollars). In addition to the costs for piping and piping support hardware, a substantial bridge cost increase would result because of the taller bridge piers required to achieve the 0.3 percent profile grade. Many of the piers in Currituck Sound would be as much as three times taller. As a result, the substructure costs would be considerably higher with Option 1. Finally, future maintenance of the collection system for this option would be complicated because access to the piping would be difficult.

Option 2

The second option would treat runoff from the bridge deck using filter devices on the bridge itself rather than conveying runoff to the ends of the bridges on the mainland and Outer Banks. The bridge design would need to be modified to allow a minimum longitudinal slope of 0.3 percent so that bridge deck runoff would find its way to the regularly spaced filter units. This would introduce periodic high and low points in the bridge profile, rather than creating a single high point as in the first option.

Catch basins would be required on approximately every other span. These basins would be made of fabricated thin steel plates and would remain partially full of water at all times. As a result, the self-weight of a single basin would be nearly 5,000 pounds. The basins would likely rest on an extension of the bent cap (i.e., the cap on top of the bridge support piles upon which the bridge spans are placed) and be in full view of persons viewing the bridge. Water would be piped to the basins. The catch basins would require routine cleaning, and the filters would require replacement on a regular basis.

Some of the piers would need to be taller with this option, but not to the extent of those used in the first option. Therefore, the structural costs for this option would be less than the first option, but more than with a flat bridge. Aside from the difference in structural costs associated with the height, there also would be an initial cost associated with the installation of the filter system. Based on a delivered cost estimate for 275 catch basins, as well as the cost of the additional structural components that would be required to support the basins, the estimated total cost to install the basins would be approximately $10 million (in year of expenditure dollars). Additionally, future maintenance of the catch basins would be required, including routine cleaning and replacement of the filters (performed every one to three years), as well as an annual inspection and inspection after every major storm. The annual cost of maintaining the catch basins on the bridge (including the cost for inspections, support equipment, personnel, traffic control, etc.) would be approximately $200,000 (in 2009 dollars). These rough cost estimates were based on conversations with a supplier of this system and would change based on a preliminary design and further research.

2.1.8 Where would additional right-of-way be required to widen existing roads?

All of the detailed study alternatives, including the Preferred Alternative, would involve widening existing roads to some extent. Preliminary designs were developed for the super-street on US 158 between the Wright Memorial Bridge and NC 12, the interchange at US 158 and NC 12, and three and four lanes on NC 12, with the intent to minimize the purchase of new right-of-way and the potential impact to adjoining land uses. Additional lanes and provisions for pedestrians and bicyclists generally would be confined to the existing right-of-way. The third outbound lane for hurricane evacuation generally would make use of existing rights-of-way. Some new right-of-way would be purchased:

- At two points along US 158 with ER2 and one point with MCB2 and MCB4, new right-of-way would be purchased with a third outbound lane for hurricane evacuation. In general, a temporary construction easement would be purchased along the full length of US 158, generally both sides of the road south of the Knapp (Intracoastal Waterway) Bridge and generally one side of the road north of the Knapp Bridge.

- At a few points along NC 12 in Dare County with ER2 and MCB2 behind retaining walls and for infiltration basins (see Section 2.1.7.1). In general, a permanent drainage easement would be purchased along NC 12 in both counties as described in Section 2.1.7.1.

- On the south side of US 158 east of the Wright Memorial Bridge with ER2 and MCB2.

- North of the Knapp (Intracoastal Waterway) Bridge to accommodate construction of the third outbound emergency lane with all of the detailed study alternatives except the Preferred Alternative.

- At a few points in the Currituck Clubhouse Drive area, between Albacore Street and Monteray Drive, and just north of North Harbor View with the Preferred Alternative.

As mentioned above, some temporary construction easement would be purchased, giving NCTA the right to disturb private property contained within the easement. The area disturbed would be restored at the end of construction, and the owner would retain all property rights after construction is complete.

The relationship between pavement, multi-use paths, permanent drainage easements, and existing right-of-way is illustrated in the typical sections presented on Figure 2-4 through Figure 2-6. These relationships are shown in detail on the public hearing maps and Preferred Alternative preliminary engineering included on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at http://www.ncdot.gov/projects/midcurrituckbridge/.

2.1.9 How would bridges be designed to minimize impacts to wetlands on the mainland and Outer Banks?

The Option A (included in the Preferred Alternative) preliminary design assumes that wetlands associated with Maple Swamp would be mostly bridged. With Option B, fill would be placed in Maple Swamp, a wetland. Wildlife passages would be incorporated into the fill. Also with Option B, Aydlett Road would be removed and its right-of-way restored to a wetland to mitigate for the fill used to cross Maple Swamp with this option. With both the C1 and C2 alternative Outer Banks termini, wetlands along the sound side of the Outer Banks would be bridged. With the Preferred Alternative, no wetlands along the sound side of the Outer Banks would be affected.

2.1.10 Why are hurricane evacuation improvements needed on US 158, and how would they work?

US 158 between the Wright Memorial Bridge and NC 168 is the controlling road link or bottleneck when it comes to hurricane evacuation (as described in *Statement of Purpose and Need* [Parsons Brinckerhoff, 2008]). The only way to reduce hurricane evacuation clearance times in the project area is to add additional evacuation capacity on US 158.

The locations of hurricane evacuation capacity improvements associated with the detailed study alternatives are shown as green lines on Figure 2-1 and for the Preferred Alternative on Figure 2-2. As noted in Section 2.1.2, these improvements could be done in two ways, adding a third outbound lane for evacuation use or using the existing center turn lane on US 158 for outbound travel during an evacuation. The focus of the Preferred Alternative is the latter approach for the section of US 158 between the Mid-

Currituck Bridge interchange and NC 168. Under either approach to providing additional evacuation capacity on US 158, the inner inbound lane would be reversed to create a third outbound lane at the Knapp (Intracoastal Waterway) Bridge (ER2, MCB2, and MCB4) and the Wright Memorial Bridge (ER2 and MCB4). Because of the high cost, no new lanes would be added to those bridges.

ER2 includes 27 miles of new pavement for a third outbound hurricane evacuation lane or use of the center turn lane (including the Knapp Bridge and Wright Memorial Bridge); MCB2 includes 5 miles of new pavement (including the Knapp Bridge); and MCB4 includes 9 miles of new pavement (including the Knapp Bridge and Wright Memorial Bridge). Also, as noted in Section 2.1.2 and illustrated on Figure 2-1, a Mid-Currituck Bridge (which is a part of the Preferred Alternative) would eliminate the need for additional emergency outbound capacity between the Wright Memorial Bridge and the Mid-Currituck Bridge. This is the case because the Mid-Currituck Bridge would capture a substantial amount of evacuating traffic from the Currituck County Outer Banks, reducing the demands placed on US 158 between the Wright Memorial Bridge and the Mid-Currituck Bridge. This is why MCB2, MCB4, and the Preferred Alternative would require fewer evacuation improvements than ER2. MCB2 would require less improvement specifically for evacuation than MCB4 and the Preferred Alternative because MCB2 includes a super-street east of the Wright Memorial Bridge that would provide additional evacuation capacity.

The addition of a third outbound lane would require a capital investment for the additional pavement. Reversing the existing center turn lane would require an investment in additional personnel during an evacuation and additional equipment to facilitate the evacuation. An estimate of required equipment and police squads with the two options for ER2, MCB2, MCB4, and the Preferred Alternative is shown in Table 2-2.

Table 2-2. Equipment and Highway Patrol Squads

Alternative	Addition of Third Outbound Lane				Reversing Lane Operations			
	Cones	Drums	Changeable Message Signs	Highway Patrol Person-Hours	Cones	Drums	Changeable Message Signs	Highway Patrol Person-Hours
ER2	123	3,923	12	717	123	4,268	13	840
MCB2	167	519	5	57	167	864	6	180
MCB4	167	1,835	12	507	167	2,180	13	630
Preferred Alternative	NA	NA	NA	NA	167	2,180	13	630

NA=Not Applicable

2.1.10.1 Third Outbound Lane Operations

As shown on Figure 2-3, the proposed third outbound lane for hurricane evacuation would be on the right edge of the roadway separated from the two existing outbound

travel lanes by a solid white stripe (indicating that it is not an additional through lane). The hurricane evacuation lane would serve as a paved shoulder during normal traffic operations, and there would be periodic pavement markings indicating that it is for hurricane evacuation use only (a hurricane symbol is being considered as shown on Figure 2-3). In addition, a series of flip signs would be installed to indicate that the hurricane evacuation lane is not for through traffic during normal traffic operations. If required in specific locations where regular parking is found to occur in the lane, "no parking" signs could be added.

During a hurricane evacuation, traffic would be allowed to utilize the paved shoulder as a through lane. The flip signs would be "flipped" to indicate that the third lane should be utilized. In addition to the three outbound evacuation lanes, the two inbound lanes and the existing center turn lane would remain open and fulfill their normal function. Highway patrol and other public safety officials would be needed (as well as cones, variable message signs, and other equipment) at transitions to reverse one inbound lane on the Knapp (Intracoastal Waterway) Bridge, one inbound lane on the Wright Memorial Bridge (see Section 2.1.10.3), and at signalized intersections.

2.1.10.2 Reversing Lanes Operations

With this option for hurricane evacuation, traffic cones or barrels would be placed on the left side of the center turn lane to reserve the lane for outbound traffic. In the inbound direction, a second set of cones would be placed between the two inbound lanes. The outermost inbound lane would remain open to traffic, but the inner lane would serve as a refuge for emergency vehicles or other equipment, as well as provide a buffer between outbound and inbound traffic.

Accomplishing this pattern of lane use would create traffic management challenges. These challenges would be the greatest with ER2 because the lane reversal would occur over a much longer distance (27 miles) than with MCB2 (5 miles), MCB4 (9 miles in two sections), or the Preferred Alternative (5 miles). These challenges would include:

- Although designated for outbound traffic, traffic would still need to turn in and out of the turn lane, slowing and sometimes stopping outbound movements in the turn lane. This is why the clearance time benefits in year 2035 of reversing lanes are less than with adding a third outbound lane (see Section 2.2). In addition, at major intersections (both signalized and possibly high volume unsignalized intersections), highway patrol officers would be required to aggressively control traffic flow and allow for left turning vehicles.

- Compared to the third outbound lane option, the setup and takedown of this approach to evacuation would require higher levels of personnel to distribute and collect the cones, barricades, and other equipment needed to reverse the center turn lane. This could require placing some equipment prior to the official evacuation orders. Timing of the equipment takedown could be problematic for an extensive reversible lane system. Equipment and personnel must be evacuated prior to the onset of gale force winds.

These challenges were considered by local emergency management officials to be important factors in considering using reversing lanes as a hurricane evacuation strategy (see Section 2.1.10.4).

2.1.10.3 Reversing Lanes on the Knapp and Wright Memorial Bridges

Both hurricane evacuation improvement options include the need for reversing one inbound lane on the Knapp (Intracoastal Waterway) Bridge to create the needed emergency roadway capacity. In addition, ER2 and MCB4 would require reversing a southbound lane on the Wright Memorial Bridge. This would not be needed with MCB2 because the combination of the six-lane super-street and the diversion of some evacuating traffic to a Mid-Currituck Bridge would permit the merging of traffic down from three to two outbound lanes east of the Wright Memorial Bridge. Reversing a southbound lane of the Wright Memorial Bridge also is not included in the Preferred Alternative.

Knapp Bridge

At the southern approach to the Knapp Bridge, the two right-most lanes would be directed to the existing two outbound lanes, and the left-most lane would be transitioned over to the inner inbound lane. This transition would require cones, variable message signs, and other equipment in addition to highway patrol and other safety management officials.

On what are normally the inbound lanes, cones (and/or barrels) would be closely spaced along the white dashed stripe to differentiate between outbound and inbound flow. Reduced speed limits would be imposed to reduce the possibility of high-speed head-on collisions. Because of narrow cross-sections on the bridge, highway patrol and tow trucks would be stationed at both ends of the bridge to respond to emergencies.

A similar transition to what occurred on the south end of the bridge would be applied on the north end beyond where an existing barrier separates the two directions of travel. Cones, variable message signs, and other equipment also would be provided in this transition area.

Wright Memorial Bridge

At the southern approach to the Wright Memorial Bridge, traffic would pass through a transition area where the existing lanes are split. The two right lanes would be directed to the existing outbound bridge, and the left-most lane would be transitioned over to the inbound bridge. This transition would require cones, barricades, variable message signs, and other equipment in addition to highway patrol and other safety management officials. Intersections near or within the transition areas would either be closed or manually controlled by the highway patrol.

On what is normally the inbound Wright Memorial Bridge, cones (and/or barrels) would be closely spaced to differentiate between outbound and inbound flow along the white dashed stripe. Like the Knapp Bridge, reduced speed limits would be imposed. Again,

because of narrow cross-sections on the bridge, highway patrol and tow trucks would be stationed at both ends of the bridge to respond to emergencies.

A similar transition to what occurred on the south end of the bridge would be applied on the north end. Instead of splitting the traffic onto different bridges, traffic would be transitioned back into the three outbound evacuation lanes. Cones, barricades, variable message signs, and other equipment again would be provided in the transition area.

2.1.10.4 Observations by Local Emergency Management Officials

Conversations were held with local emergency management officials at meetings on May 8, 2008, and May 11, 2009, to discuss their current evacuation procedures and the hurricane evacuation alternatives. These meetings included representatives from Currituck and Dare counties, NCDOT Division 1, and the NC Highway Patrol. This group had the following observations:

- Some type of contraflow or a third outbound additional lane would be needed sometime in the future, although not necessarily at this time.

- At such time as a third outbound lane is needed, the addition of a third lane for emergency use rather than reversing the center turn lane was their preference.

- The 27-mile lane reversal associated with ER2 would be a massive undertaking that would be beyond what local personnel from the counties, NCDOT, and the Highway Patrol could handle in terms of:

  – Equipment set-up and take-down; and

  – Controlling traffic turning to and from intersecting roads such that turns could be made in a timely manner without disrupting outbound flow.

  Thus, reversing lanes for 27 miles is not a realistic option, leaving for ER2 only adding a third outbound lane as a reasonable strategy for reducing hurricane evacuation times by increasing road capacity along US 158.

- The shorter 5 miles of lane reversal with MCB2 and the Preferred Alternative and 9 miles in two segments with MCB4 could be accomplished and are reasonable strategies for reducing clearance times. However, it would be a challenge logistically in terms of traffic control as it relates to turning traffic and other options would be considered in addition to reversing lanes before making a decision to reverse lanes. Other options might include diverting some evacuees to US 64 (the only other route off of the Outer Banks) or ordering an evacuation earlier than would be preferred.

- Reversing lanes would create a constriction point for inbound travelers, who would then operate in one lane instead of two. This would be the case with both options because they both include reversal of an inbound lane on the Knapp Bridge and/or the Wright Memorial Bridge. The shorter the distance inbound travel would have available only one lane, the less of a potential challenge this would be.

The decision to include reversing the center turn lane on US 158 on the mainland between the Mid-Currituck Bridge interchange and NC 168, along with a small amount of new outbound lane on US 158 on the Outer Banks (see further discussion in the following paragraph), as hurricane evacuation improvements with the Preferred Alternative was made in association with local emergency management officials at a meeting on August 19, 2010. Also, a letter was received from Currituck County Emergency Management on October 7, 2010 (see Appendix F of the *Stakeholder Involvement for Final Environmental Impact Statement Technical Report* [Parsons Brinckerhoff, 2011]), indicating their support of a Mid-Currituck Bridge because it would provide them with the flexibility to re-route traffic when parts of NC 12 become highly congested. According to the letter, during the summer of 2010 as Hurricane Earl approached, it was determined that an evacuation of visitors to the Currituck County Outer Banks would be appropriate. The tourists staying on the Currituck County Outer Banks were compliant with the evacuation order and, although traffic volumes were heavy, traffic was moving adequately until an accident occurred in Duck, which was then compounded by a malfunctioning traffic light. This turned the Currituck County portion of NC 12 into a literal parking lot for several hours and local call centers were overloaded with calls from concerned and angry tourists. As stated in the letter, "While we understand that putting a mid-county bridge in our county will not alleviate all traffic issues and will not be protected from the occasional accident, it does offer us the opportunity to reroute traffic. How can we expect people to continually respond well to our evacuation orders if they must sit on a road with thousands of other vehicles and not move for long periods of time? Many of these people turned around and went back to their rental properties because they naturally assumed the traffic was going to be this way throughout the evacuation route."

Based on input from local emergency management officials, the Preferred Alternative includes adding a short section of third outbound lane. It would involve 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 (see Figure 2-2). 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. There is currently a third outbound lane on US 158 to the west of the NC 12 intersection, but this third lane ends as a right-turn lane at the Cypress Knee Trail/Market Place Shopping Center intersection. Local emergency management officials feel that, with a Mid-Currituck Bridge to divert a substantial amount of evacuating traffic from US 158, extending this third outbound lane in this manner would provide the remaining evacuating traffic on NC 12 southbound with an adequate distance to merge onto US 158 during an evacuation.

2.1.11 How would the detailed study alternatives accommodate bicyclists and pedestrians?

As illustrated on Figure 2-5 and Figure 2-6 for NC 12, existing multi-use paths for bicyclists and pedestrians affected by any of the detailed study alternatives, including the Preferred Alternative, would be replaced in kind, along both US 158 and NC 12. The Town of Kitty Hawk plans to build (it is currently being designed) a multi-use path on the south side of US 158 in Kitty Hawk. This path is assumed to be displaced and replaced with ER2 and MCB2. In Currituck County, along NC 12 between Cadwall Road (i.e., just north of the Dare/Currituck County line) and the end of the project, much of NC 12 does not have an existing multi-use path. Space for a multi-use path in this area is provided in association with the NC 12 widening being considered in that area. With the Preferred Alternative, grading for future multi-use paths to be provided by others would be provided in the following three locations: along the west side of NC 12 from Devil's Bay Road (Corolla Bay subdivision entrance) to north of Ocean Forest Court; along the west side of NC 12 from the south side of the first business driveway north of Monteray Drive to Crown Point Road; and along the east side of NC 12 from Sand Fiddler Trail to south of Currituck Clubhouse Drive (at the point where the widened southern section of NC 12 starts to taper from four lanes to two lanes). Currituck County could provide the funds (or share in the cost per NCDOT pedestrian policy guidelines) to build future multi-use paths in the context of NC 12 widening or choose to build it at a later date.

Existing marked pedestrian crossings of NC 12 in Southern Shores would be restored if NC 12 is widened in Southern Shores. With the Preferred Alternative, marked pedestrian crossings would be provided 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).

It is customary on bridges in North Carolina to assume that bicyclists and pedestrians would use the bridge shoulder. With this in mind, the Mid-Currituck Bridge typical section for all of the detailed study alternatives, including the Preferred Alternative, shown on Figure 2-7 shows a 10-foot-wide shoulder on the bridge and a bicycle-safe rail. Additional provisions for bicyclists and pedestrians also were considered, including:

- Exclusive lane for pedestrians and bicyclists.

  An exclusive lane or multi-use path for pedestrians and bicyclists has been suggested for the bridge. Such a lane could be provided in one of two ways. Both would involve widening the bridge piers and adding up to two additional lines of girders spanning the bridge piers. One option would be an integrated system where the added lane is part of the bridge deck. Essentially, the bridge would be built approximately 12 feet wider to accommodate a 10-foot-wide path and a barrier between the path and the rest of the bridge. A second option would be to mount decking and rails comprised of fiber reinforced recycled plastic lumber on the

additional two lines of girders. Either option would increase bridge costs by approximately 25 percent (approximately $53 to $58 million in year of expenditure dollars) over costs with the typical section shown on Figure 2-7. The cost estimates presented in Section 2.3 for MCB2 and MCB4 include this higher cost.

- Bridge and bridge approach road lighting for pedestrians and bicyclists.

  Lighting the bicycle and pedestrian accommodations also has been suggested. A potential option for lighting the bridge and its approaches appears to be the use of light emitting diode (LED) sources mounted at a low level on the bridge structure (integrated or adjacent to the rail and/or guardrail for lighting the pedestrian accommodations) or on low height poles (approximately 12 to 14 feet) for accommodations adjacent to bridge approach roads. Lighting of this type:

  – Is energy efficient;

  – Offers source variability, including spectral selection, dimming capabilities, and optical control; and

  – Is vibration tolerant and has a good operating life.

  Low-level lighting is desirable because it would not include lighting structures on the bridge, would minimize potential light spill (e.g., lighting trespass, sky glow, and glare) and would minimize associated environmental impacts. Solar power panels could provide power. Such panels should be connected to the electrical grid to provide compensatory power as needed. The least expensive way to connect the panels to the grid would be to place them on the shore of Currituck Sound. At this location, the panels would comprise an area of approximately 6,000 square feet. Construction costs for such a lighting system would be approximately $6 million (in year of expenditure dollars), which includes all hardware, poles, wiring and distribution system. A conventional lighting system using, for example, high pressure sodium lights would cost approximately twice as much.

- Parking lot on the Outer Banks as a starting point for pedestrians and bicyclists using the bridge.

  A parking lot on the Outer Banks to serve those who want to bicycle or walk on the bridge has been suggested. The use of a permeable pavement system has been suggested for the lot. Permeable pavements produce less stormwater runoff and introduce fewer pollutants to the environment, minimizing impacts on water quality. Water falling on the lot would directly infiltrate into the soil. The use of permeable pavement is feasible. Several different designs are feasible, including porous asphalt or concrete, as well as interlocking block pavers (opening for drainage is created as the pavers are placed) or grid pavers (opening for drainage is cast into the paver). Two permeable pavement parking lots that would accommodate 20 to 30 vehicles (excluding the land) would cost approximately $250,000 (in year of expenditure dollars).

An exclusive lane for pedestrians and bicyclists, with associated lighting and parking, also is included in the cost estimate for the Preferred Alternative but could be eliminated if it proves to be cost-prohibitive given the substantial additional cost of these features, combined with limits on the availability of funds to finance the bridge.

2.1.12 How would tolls be collected with a Currituck Sound bridge?

Tolls would be collected by using Electronic Toll Collection (ETC), cash, and credit card. Because of the advantages of time savings and cost savings for users, as well as lower operating costs for NCTA, ETC would be the primary method of collecting tolls, as opposed to tolls collected via cash or credit card at manned toll booths. The principal means of ETC used would involve drivers setting up an account with NCTA and using a transponder/receiver system. A transponder is a small device usually mounted on the windshield of a vehicle. The receiver is mounted over the roadway, and it would electronically collect tolls from a driver's account as their vehicle with the transponder travels under the antenna at the toll plaza. Any discounts applicable to the driver's account would be applied.

NCTA also would work to establish interoperability agreements with other toll authorities in the United States to enable the sharing of tolling accounts and transactions. These agreements would allow other toll authority's transponders to be used for toll payments on a Mid-Currituck Bridge. Toll road users also may have the option of buying project-specific transponders with a specified number of prepaid tolls.

2.2 Describe how the detailed study alternatives, including the Preferred Alternative, differ in their ability to meet the project's purpose and need

All of the detailed study alternatives, including the Preferred Alternative, would meet the project purpose and need to varying degrees, as shown in Table 2-3. Key differences are:

- MCB2, which includes both the Mid-Currituck Bridge and substantial improvements to existing roads, would have the greatest traffic flow benefits and ER2 would have the least;
- MCB2 also would have the greatest travel time benefits because the Mid-Currituck Bridge (which is included in MCB2, MCB4, and the Preferred Alternative), along with the substantial improvements to existing roads, would offer the greatest total travel time savings for many travelers between the Currituck County mainland and its Outer Banks; ER2 would have the least travel time benefits; and
- The construction of a third outbound lane on US 158 would offer the greatest reductions in hurricane evacuation clearance time with any alternative, bringing the 2035 clearance time down to 22 hours, 4 hours above the state clearance time

Table 2-3. Travel Benefits of Detailed Study Alternatives

	No-Build	ER2	MCB2	MCB4 and Preferred Alternative[1]
2035 Traffic Flow Benefits				
Congested Annual Millions of Vehicle-Miles Traveled (VMT)				
• Total Congested VMT (millions)	66.1	51.4	31.4	40.2
• VMT with Traffic Demand at or Above Road Capacity (millions)	60.6	44.4	5.3	17.7
• VMT with Traffic Demand 30 Percent or Above Road Capacity (millions)	15.8	8.9	0.0	4.9
Miles of Road Operating with Traffic Demand at or Above Road Capacity				
• Summer Weekday (SWD)	14.7	5.9	0.0	5.7
• Summer Weekend (SWE)	43.5	39.0	4.8	11.7
• Weighted Average of SWD & SWE	22.9	15.4	1.4	7.4
Miles of Road with Traffic Demand 30 Percent or Above Road Capacity				
• Summer Weekday (SWD)	5.7	3.7	0.0	0.8
• Summer Weekend (SWE)	7.9	5.9	0.0	2.0
• Weighted Average of SWD & SWE	6.3	4.3	0.0	1.1
2035 Travel Time Benefit Aydlett Road to Albacore Street (in minutes)				
Summer Travel Time via Wright Memorial Bridge (weighted average of SWD & SWE)	154	125	86	107
Summer Travel Time via Mid-Currituck Bridge (weighted average of SWD & SWE)	N/A	N/A	11	11
2035 Hurricane Evacuation Benefit				
Clearance Time with US 158 Reversing Center Turn Lane	36 hrs	27 hrs	27 hrs	27 hrs
Clearance Time with US 158 Third Outbound Lane (not included in the Preferred Alternative)		22 hrs	22 hrs	22 hrs

[1]Note that the travel benefits of the Preferred Alternative would likely be slightly lower than with MCB4 because MCB4 assumes a four-lane section on NC 12 between Currituck Clubhouse Drive and the Mid-Currituck Bridge, whereas the Preferred Alternative assumes a four-lane section only at the bridge terminus, the commercial area surrounding Albacore Street, and Currituck Clubhouse Drive. However, widening NC 12 to four lanes at these three locations would account for the majority of delays on NC 12 between Currituck Clubhouse Drive and the bridge.

standard of 18 hours. Times are not reduced as much when reversing the center lane to serve outbound traffic because during the evacuation, traffic would also continue to use it as a turn lane, slowing travel. A third outbound lane and the associated clearance time reduction could be achieved with any of the detailed study alternatives, but it is not included as an option with the Preferred Alternative. Reversing the center turn lane on US 158 would be practical only with MCB2, MCB4, and the Preferred Alternative.

The findings in this section are taken from the *Alternatives Screening Report* (Parsons Brinckerhoff, 2009). Details related to the assessment of traffic flow and travel time benefits, as well as traffic forecasts for 2035, are presented in the *2035 Traffic Alternatives Report* (Parsons Brinckerhoff, 2009). These reports are included on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/.

2.3 Explain how much each detailed study alternative, including the Preferred Alternative, would cost and how it would be paid for

Construction and right-of-way costs for the detailed study alternatives, including the Preferred Alternative, are shown in Table 2-4 in year of expenditure dollars. ER2 would be the least expensive alternative. Of the alternatives with a Mid-Currituck Bridge, MCB4 and the Preferred Alternative (which would involve the fewest improvements to existing roads) would be less costly than MCB2. Mainland approach road Option B would cost approximately $84 to $92 million less than Option A. Costs would be similar between bridge corridors C1 and C2, with C2 costing more than C1. The Preferred Alternative also is the least expensive bridge alternative because, as is indicated in the table, several features assumed in the other bridge estimates were not included in the Preferred Alternative.

A cost estimate review was completed in December 2011 that included individuals from FHWA, NCTA, NCDOT and the project study team to review the cost and schedule estimates for the Preferred Alternative. The objective of the review was to verify the accuracy and reasonableness of the total cost estimate and schedule, and to develop a probability range for the cost estimate that represents the project's current stage of development. The ranges of costs provided in Table 2-4 for the Preferred Alternative, the totals of which closely approximate those developed during the review, were developed by NCTA. The cost estimate review completed in December 2011 yielded an estimate of total project costs ranging from $507.8 million to $588.1 million. This estimate falls within the probable range of costs projected by NCTA.

If a Mid-Currituck Bridge is a part of the alternative selected for implementation, it is anticipated that financing the project would involve North Carolina's first venture into the world of Public Private Partnerships (PPP) for major transportation infrastructure. PPPs are formal collaborations between public agencies and private concessionaires that capture the advantages of private sector participation while maintaining public accountability to develop new infrastructure. These partnerships can be an effective way to deliver much needed infrastructure while minimizing costs and risks to the public. On November 14, 2007, the Board of the NCTA authorized NCTA to seek proposals from private sector firms interested in furthering the development of the Mid-Currituck Bridge project. NCTA chose to use the procurement method known as a "Pre-Development Agreement" for this project. With a Pre-Development Agreement, NCTA

Table 2-4. Cost of the Detailed Study Alternatives

	ER2	MCB2/C1	MCB2/C2	MCB4/C1	MCB4/C2	Preferred Alternative
		With Mainland Approach Road Option A				
Construction Cost (millions)[1]						
• Currituck Sound Bridge	NA	$258.0 to $304.2	$288.4 to $341.2	$258.0 to $304.2	$288.4 to $341.2	$291.4 to $339.1
• Maple Swamp Bridge	NA	$91.9 to $102.3	$91.9 to $102.3	$91.9 to $102.3	$91.9 to $102.3	$74.2 to $86.4
• Other	NA	$350.2 to $417.9	$338.1 to $402.2	$269.4 to $324.5	$256.7 to $309.2	$101.0 to $117.2
Total Construction Cost (millions)	$220.4 to $271.7	$700.1 to $824.4	$718.4 to $845.7	$619.3 to $731.0	$637.0 to $752.7	$466.6 to $542.7
Environmental Mitigation (millions)	$0.2 to $0.3	$0.5 to $0.7	$0.4 to $0.6	$0.3 to $0.4	$0.2 to $0.3	$5.4 to $6.3[2]
Right-of-Way Cost (millions)	$154.0 to $200.4	$160.5 to $208.9	$147.5 to $192.3	$54.2 to $70.6	$33.2 to $43.4	$19.2 to $32.3
Utilities (millions)	$41.5 to $50.9	$23.1 to $28.4	$21.7 to $26.6	$11.4 to $14.1	$9.9 to $12.2	$11.2 to $12.8
TOTAL COST (millions)	**$416.1 to $523.4**	**$884.2 to $1,062.4**	**$888.1 to $1,065.1**	**$685.3 to $816.2**	**$680.3 to $808.6**	**$502.4 to $594.1**
		With Mainland Approach Road Option B				
Construction Cost (millions)[1]						
• Currituck Sound Bridge		$258.0 to $304.2	$288.4 to $341.2	$258.0 to $304.2	$288.4 to $341.2	
• Maple Swamp Bridge		NA	NA	NA	NA	
• Other		$336.4 to $400.0	$323.5 to $385.1	$255.4 to $306.5	$242.2 to $291.3	
Total Construction Cost (millions)		$594.4 to $704.2	$611.9 to $726.3	$513.4 to $610.7	$530.6 to $632.5	
Environmental Mitigation (millions)		$1.0 to $1.4	$0.9 to $1.3	$0.7 to $1.1	$0.7 to $1.0	
Right-of-Way Cost (millions)		$180.4 to $234.8	$166.7 to $217.7	$73.7 to $96.3	$52.6 to $68.7	
Utilities (millions)		$24.3 to $29.9	$23.0 to $28.3	$13.0 to $16.0	$11.6 to $14.2	
TOTAL COST (millions)		**$800.1 to $970.2**	**$802.4 to $973.5**	**$600.7 to $724.1**	**$595.5 to $716.4**	

[1] Except for the Preferred Alternative, construction costs include bridge drainage treatment (Option 2 described in Section 2.1.7.3) and a third outbound lane on US 158 for hurricane evacuation. All alternatives include the cost of pedestrian and bicycle features on the Mid-Currituck Bridge (lighted path and parking lots at bridge ends described in Section 2.1.11). For MCB2 and MCB4, the construction cost is reduced by $13.2 to $15.7 million if reversing the center turn lane is implemented instead of constructing a third outbound lane.

[2] Mitigation costs for the Preferred Alternative are higher than for the other alternatives because advanced mitigation planning has occurred for the Preferred Alternative in coordination with environmental resource and regulatory agencies.

procured a development partner consisting of investors, designers, and construction contractors prior to the completion of project development studies.

In June 2008, NCTA solicited statements of qualifications from teams interested in partnering with NCTA under the Pre-Development Agreement, and a partnering team was selected in December 2008. The services provided by the partner focused on the evaluation of the bridge alternative during the environmental study process and will support the negotiation of a long-term construction, financing, and operating and maintenance agreement in the event a bridge alternative is selected as the Preferred Alternative in the environmental study process. As per the requirements of Title 23 *Code of Federal Regulations* (CFR) Section 636.109, the partner did not prepare the DEIS or this FEIS or have any decision-making responsibility with respect to the NEPA process. The private firm that assisted NCTA and FHWA in the preparation of the DEIS and this FEIS was selected by and subject to the exclusive direction and control of NCTA. The partner could and did provide information to NCTA about the potential project design and possible mitigation actions. The contract with the partner includes termination provisions in the event that the No-Build Alternative or ER2 is selected. NCTA received FHWA concurrence prior to issuing the request for proposal for a partner. The request for proposals informed potential partners of the status of the NEPA process.

NCTA has identified two funding sources available for the Preferred Alternative. The two funding sources are state appropriations from highway user taxes and toll revenues. Using these two funding sources, three financing techniques would be used in combination if the Preferred Alternative is selected for implementation. These sources are:

1. State appropriation bonds.

   Based on the North Carolina "Current Operations and Capital Improvements Appropriations Act of 2011," as ratified by the North Carolina General Assembly on June 11, 2011, the state will appropriate $15,000,000 annually to be used to pay debt service, or related financing expenses, on revenue bonds (e.g., state appropriation revenue bonds, private activity bonds) or notes issued for the construction of the Mid-Currituck Bridge. Effective July 1, 2013, the state appropriation amount will be raised to $28,000,000 annually.

2. Toll revenue bonds.

   The estimated average toll revenues in 2010 dollars for the first ten years would be $21 million per year; the revenues would increase until reaching average toll revenues of $34 million per year during the entire concession period (assumed to be 50 years). All the project operation and maintenance (O&M) costs during the toll collection period would be paid using toll revenues. An average of 30 percent of the revenues would be used to pay the O&M costs each year. The remaining toll revenue during the concession period would be used for debt repayment and payment of the equity return. The toll revenue bonds would be repaid during the

first 40 years and the majority of the private equity would be repaid during the last years of the concession period.

Transportation Infrastructure Finance and Innovation Act (TIFIA) financing (federal government loans) could be used in addition to these bonds.

3. Private equity.

   The PPP approach assumes that a private partner would make a private equity investment to provide additional financing for the project. The amount of this investment would be based on the potential rate of return to the investor over the toll collection period. The private equity investment would be repaid using the toll revenue stream available after the payment of the O&M costs and the debt service of the revenue bonds.

NCTA also has applied for TIFIA financing, which also could be used if NCTA's application were to be successful.

If ER2 were selected for implementation, the project would have to be built by NCDOT with traditional highway financing methods rather than by the NCTA financing techniques described above since ER2 has no component that could be funded by these financing techniques. The Pre-Development Agreement would be dissolved since only motor vehicle and fuel taxes could be used to build ER2. Also, the funds made available by the General Assembly could not be used since there would be no bonds or debt to repay. Based on state law (Session Law 2011-145), state appropriations, or "gap funding," cannot be used to fund ER2 or other significant non-bridge portions of alternatives for the following reasons. *First*, the gap funding is allocated to NCTA. Pursuant to state law (G.S. § 136-89.183), NCTA is only authorized to construct certain projects, including, "A bridge of more than two miles in length going from the mainland to a peninsula bordering the State of Virginia, . . " ER2 does not meet the definition of a bridge and therefore NCTA could not construct ER2. *Second*, the gap funding can only be used to pay debt service or related financing expenses on revenue bonds or notes issued for the construction of the Mid-Currituck Bridge. Again, ER2 does not qualify as the "Mid-Currituck Bridge." *Third*, since NCTA is not authorized to build ER2, if ER2 was to be built, it would have to be built by NCDOT. The gap funding is not available to NCDOT, only NCTA. State law would need to be modified to make the gap funding available for ER2. However, even if NCDOT received the same amount as the gap funding, the additional funds would be subject to the equity formula as defined in state law (G.S. § 136-17.2A). Being subject to the equity formula would dilute the effectiveness of the funding, especially in NCDOT Division 1 where the cost of the Bonner Bridge replacement would likely dominate the funds allocated to Division 1 for a significant period of time, leaving minimal funds available for other projects, such as ER2. Without substantial unencumbered funds, it is unlikely NCDOT would be able to construct ER2.

If MCB2 were selected for implementation, the project would need to be built as a joint effort of NCTA and NCDOT, with NCDOT providing funds for components that could not be funded by the financing techniques described above.

2.4 Explain how each alternative would be built

If MCB4 or the Preferred Alternative were selected for implementation, final design and construction would be expected to begin as soon as possible after issuance of a ROD, the report that ends the planning process. If ER2 were selected as the Preferred Alternative, the project would be implemented by NCDOT with traditional financing, as indicated in Section 2.3. If this were done, it is not known when the project would be implemented because there is no state funding for construction of road improvements in the project area listed in the *2009 to 2015 State Transportation Improvement Program* (STIP) or the 2012 to 2018 Draft STIP. The only component of ER2 listed in the STIP is the interchange at US 158/NC 12, but funds are provided only for planning. If MCB2 were selected for implementation, final design and construction would be expected to begin immediately after issuance of a ROD on the parts that could be funded by the available revenue sources described in Section 2.3 (those parts that MCB2 and the Preferred Alternative share in common). The timing for the implementation of the rest of MCB2 is not known for the same reasons it is not known for ER2; the portions of MCB2 that could not be funded by tolls would require state funding and there is no funding in the STIP for construction of road improvements in the project area.

The currently anticipated approach to building the Preferred Alternative is described in the paragraphs below.

2.4.1 Road and Interchange Construction

Construction of the road and interchange components of the Preferred Alternative, or any of the other detailed study alternatives, would follow typical road building practices. Access to adjoining properties would be maintained during the construction period. Lane closures would be avoided/minimized during peak travel periods.

2.4.2 Mid-Currituck Bridge Construction

NCTA is currently proposing the construction methodologies described below for construction of the bridge over Currituck Sound to minimize construction-related water quality impacts to Currituck Sound and other jurisdictional waters, as practicable. If a Mid-Currituck Bridge is included in the alternative selected for implementation, NCTA would continue to work with environmental resource and regulatory agencies as the project progresses into final design and permit application to refine this approach. Construction methodologies proposed include:

- A combination of work trestle and barges, including:

- An approximately 1,900-foot-long work trestle extending from the western shoreline. Based on the limited presence and sparse coverage of SAV only along the shoreline on the western side of Currituck Sound, an open trestle would not be necessary. This closed surface work trestle is envisioned to be approximately 50 feet wide. Its footprint would allow a parked crane and a small lane to allow necessary materials to pass the crane for loading onto barges. The bridge in this area of the sound would be constructed from the work trestle. The barge method would be used east of the trestle. A barge loading area would be located at the eastern end of the trestle.

- Remaining construction from small, low draft barges for approximately 20,000 feet or 3.8 miles. The barges would be launched from the trestle extending off the shoreline from Narrow Shore Road in Aydlett.

- On the eastern side of the sound, use of temporary construction trestle for approximately 4,500 feet or 0.9 mile (over SAV habitat [including existing beds] = 3,000 feet and over shallow water = 1,500 feet). Bridge erection equipment would operate on the trestle to place the components of the bridge foundation and spans. An open trestle could be used to minimize the shading of SAV habitat during construction. Pans attached to equipment would be used to minimize the potential for petroleum products to leak from equipment into the sound.

- Construction from land for approximately 400 feet.

- Construction duration of 52 months.

- Driving of bridge piles with no jetting (using pressurized water to wash out a hole for a pile to set in).

- The bridge would likely be built beginning at both ends simultaneously. Construction also could begin in a third location, at the eastern-most point of construction from barges.

2.4.3 Maple Swamp Bridge Construction

In Maple Swamp, wooden crane mats, and for some portion a temporary trestle would be used in the cleared right-of-way to distribute the crane loads and provide a suitable platform for erecting the bridge.

2.4.4 Access and Construction Staging for Construction Materials and Equipment

With MCB2, MCB4, and the Preferred Alternative, on the Currituck County mainland, construction materials and equipment would be transported by truck along US 158 and staged in the US 158/Mid-Currituck Bridge project interchange area for most mainland construction. Transport to Currituck Sound of construction materials and equipment for

building the Currituck Sound bridge would be via Aydlett Road (between US 158 and Aydlett only) and Narrow Shore Road. Depending on allowable use of project right-of-way in Maple Swamp, the bridge corridor through Maple Swamp also may for used for access to the Narrow Shore Road area. Such a use, however, could not involve placing fill in wetlands. Construction materials and equipment also would be staged on vacant upland sites along Narrow Shore Road near the western Currituck Sound bridge ending.

On the Outer Banks with all the detailed study alternatives, including the Preferred Alternative, construction materials and equipment would be transported by truck via NC 12 to construction sites. Construction materials and equipment would be staged on vacant upland sites near the NC 12 widening areas and at the eastern endings of the C1 and C2 bridge corridors for the Currituck Sound bridge.

Oversize-overweight loads for certain bridge elements would be transported on US 158, NC 12, Aydlett Road, and Narrow Shore Road. Delivery of these oversize-overweight loads would be required to both sides of Currituck Sound. To ensure minimal traffic disruption, particularly on US 158 and NC 12 during peak travel periods, nighttime or other non-peak period delivery could be made when traffic volumes are at the lowest level if permitted by NCDOT. This would be more expeditious for the bridge construction and would limit traffic interruptions to periods of low travel demand.

2.5 Describe the other alternatives that were considered and explain why they are no longer under consideration

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 Brinkerhoff, 2009) identified the DEIS detailed study alternatives described in Section 2.1. Alternatives were evaluated from the perspective of:

- Ability to meet the purpose and need and level of benefit offered in relation to those purposes;
- Improvement to system efficiency;
- Economic feasibility (cost and funding capacity); and
- Potential impacts on natural resources and communities.

The findings of the *Alternatives Screening Report* are summarized below. A description of the process followed and the specific numerical indications of benefit and environmental impact associated with the findings are included in that report. That report is included on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/.

The other road widening and bridge alternatives considered were:

- ER1, which was identical to ER2 except NC 12 was assumed to be widened to four lanes instead of three lanes from US 158 to Albacore Street;

- MCB1, which was identical to MCB2 except NC 12 was assumed to be widened to four lanes instead of three lanes from US 158 to the Mid-Currituck Bridge terminus on the Outer Banks; and

- MCB3, which was identical to MCB4 except it did not include a third outbound lane on US 158 between the Wright Memorial Bridge and NC 12.

It was decided not to study ER1 and MCB1 in detail because the additional four-lane widening on NC 12 would result in more than 200 total displacements (including over 50 businesses) with these two alternatives.

MCB3 was dropped because it could only achieve a 2035 hurricane evacuation clearance time with construction of a third outbound lane on US 158 of 27 hours compared to 22 hours with the other alternatives. Clearance times with reversal of the center turn lane would be identical for MCB3 and MCB4 (27 hours). Therefore, it was only the third outbound lane option that was relevant to the decision to drop MCB3.

Other alternative concepts also were considered but were not carried forward as detailed study alternatives. These were: (1) shifting rental times; (2) transportation systems management; (3) bus transit; and (4) a ferry service across Currituck Sound as an alternative to a Mid-Currituck Bridge. The first three considered whether there were opportunities to reduce congestion and travel time by:

- Making better use of existing road capacity by shifting peak travel demand (asking property managers to start and end additional vacation home rental times on days other than Saturday and Sunday);

- Making minor improvements to the road system, including optimizing traffic signal timing, improving major intersections, and restricting side-road access where duplicate side roads exist; and

- Providing bus transit.

None of these alternatives was found to make more than a minimal reduction in congestion and travel time; thus, all were eliminated from consideration.

Building a ferry across Currituck Sound was considered as an alternative to a bridge. This alternative was dropped because a ferry would not notably reduce congestion or travel times, would be costly, and would require substantial dredging in Currituck Sound, with resulting impacts to the natural environment.

Several additional bridge corridors were considered and evaluated. The two selected for detailed study (C1 and C2) were the two that appeared to best balance community and

natural resource trade-offs while meeting the objectives of the project. The other corridors considered were C3, C4, C5, and C6, all in the Aydlett area but south of Aydlett Road. Alternatives north of the community of Aydlett and near the Intracoastal Waterway (N1 and N2) and further south in the Poplar Branch area (S) also were considered over the course of alternatives studies.

The No-Build Alternative was retained as a baseline for comparison with the detailed study alternatives. The identification of the No-Build Alternative as the Selected Alternative could be an outcome of this project's decision-making process.

2.6 For what reasons did you choose the Preferred Alternative?

As indicated at the beginning of this chapter and described in Section 2.1.2.5, the Preferred Alternative is MCB4/A/C1 with refinements made to help avoid and minimize impacts. This preference is made taking into account the key findings associated with travel benefits; community, natural resource, and other impacts; public involvement comments; and financing and design considerations.

The Preferred Alternative is only a preference; it is not a final decision. The NEPA process will conclude with a ROD, which will document the Selected Alternative.

MCB4/A/C1 with refinements made to help avoid and minimize impacts is identified as the Preferred Alternative based on the considerations that follow. This list is not in order of importance, but is organized by issues as they are presented in this FEIS. Also, this list does not represent all benefits or impacts of the Preferred Alternative, just those elements that differentiated the Preferred Alternative when compared to the other detailed study alternatives. Quantities associated with the impact considerations are presented in Table S-1 in the Summary and the impact assessments in Chapter 3. Costs are also presented in Section 2.3.

Travel Benefit Considerations

- The Preferred Alternative, as well as MCB4, would provide substantial congestion reduction and travel time benefits while minimizing the widening of NC 12, and also would not require widening of US 158 from the Wright Memorial Bridge to NC 12, or an interchange at the US 158/NC 12 intersection.

- Should additional improvements to NC 12 and US 158 and a US 158/NC 12 interchange (e.g., the components of MCB2 not included in the Preferred Alternative and MCB4) be pursued in the future, they could be built without additional impact over that defined for MCB2. With the Mid-Currituck Bridge included in the Preferred Alternative and MCB4, a future interchange at NC 12 and US 158 would not carry as much traffic (traffic would divert to the Mid-Currituck Bridge), and the interchange configuration would result in fewer community and access impacts than without a Mid-Currituck Bridge (ER2).

Community Impact Considerations

- With the Preferred Alternative, as well as with MCB2 and MCB4, neighborhood and community cohesion impacts would involve the creation of a visual barrier in Aydlett. MCB2 also would interfere with neighborhood cohesion along NC 12. The use of the revised C1 corridor with the Preferred Alternative also would pass through the currently unimproved Phase II of the Corolla Bay subdivision. The use of the original C1 corridor with MCB2 or MCB4 also would physically divide Phase I of the Corolla Bay subdivision. Neighborhood and community cohesion impacts would be minor with ER2.

- The Preferred Alternative, as well as MCB2 and MCB4, are consistent with area land use plans in that they include a Mid-Currituck Bridge. In addition, the Preferred Alternative and MCB4 do not widen NC 12 in Dare County.

- Reducing the amount of NC 12 four-lane widening as described for the Preferred Alternative addresses citizen and local government concerns related to pedestrian crossing of NC 12 (including North Harbor View Drive), greatly reduces the need for infiltration strips within a permanent drainage easement along a widened NC 12, and reduces the potential for community impacts along NC 12 in general.

Cultural Resource Impact Considerations

- The Preferred Alternative with reversing the center turn lane on US 158 to improve hurricane evacuation clearance times would have No Effect or No Adverse Effect on properties listed on or eligible for inclusion in the National Register of Historic Places (NRHP).

Natural Resource Impact Considerations

- The Preferred Alternative would have the least fill in natural upland communities.

- The Preferred Alternative would have no impact on CAMA wetlands. Also, no wetlands on the shoreline of Currituck Sound would be affected.

- With the Preferred Alternative, the increase in impervious surface area (pavement and bridge deck) would be low in contrast to MCB2 and MCB4, although it would be higher than ER2 without a third outbound lane for hurricane evacuation.

- The Preferred Alternative seeks to avoid and minimize impacts to jurisdictional waters, as practicable. Wetland fill impacts, calculated as including the area within 25 feet of the slope-stake line, are estimated to be 7.9 acres. This impact would be higher for all of the other detailed study alternatives, including ER2 at 8.6 acres.

- The construction approach described for the Preferred Alternative in Section 2.4.2 seeks to minimize construction related impacts to Currituck Sound, as practicable.

- The stormwater management plan for the Preferred Alternative described in Section 2.1.7 minimizes impacts to Currituck Sound from bridge runoff, primarily by

removing almost all pollutants from the bridge before they can be suspended by rainwater and flushed off the bridge.

Other Physical Characteristics Considerations

- The Preferred Alternative would have the least number of homes that would experience an adverse noise effect.
- The Mid-Currituck Bridge component of the Preferred Alternative, as well as MCB2 and MCB4, would reduce the impact of accelerated sea level rise on travel on the Outer Banks north of the Dare/Currituck County line.
- The Preferred Alternative, as well as ER2 and MCB2 and MCB4 with design Option A, would result in no impact on the surface water and groundwater hydrology in Maple Swamp or on storm surge elevations.

Financing and Design Considerations

- The Preferred Alternative with the features noted in Section 2.1.2.5 could be financed using the funds that can be raised from the three sources listed in Section 2.3.
- The Preferred Alternative with the features noted in Section 2.1.2.5 would have the fewest changes in current access to residential and business properties.
- With the Preferred Alternative, as with all of the detailed study alternatives that include a Mid-Currituck Bridge, hurricane evacuation improvements would be needed on US 158 only for the 5 miles between the Mid-Currituck Bridge and NC 168, plus for 1,600 feet west of the US 158/NC 12 intersection with the Preferred Alternative only, instead of the 27 miles with ER2, reducing costs and environmental impacts.

3.0 Affected Environment and Environmental Consequences

This chapter describes the findings of the impact assessment conducted for the detailed study alternatives, including the Preferred Alternative. Key characteristics of the affected environment also are described. Additional information on the affected environment and the impacts of the detailed study alternatives, including the Preferred Alternative, is presented in a series of technical reports contained on the compact disc (CD) that accompanies this FEIS, at public review locations listed in Appendix C, and on the North Carolina Turnpike Authority (NCTA) web site at https://www.ncdot.gov/projects/mid-currituck-bridge/. Those technical reports and their tables of contents are presented in Appendix D of this FEIS.

This chapter is divided into the following sections:

- Community Characteristics and Impacts, beginning on page 3-1;
- Cultural Resources Characteristics and Impacts, beginning on page 3-24;
- Natural Resource Characteristics and Impacts, beginning on page 3-31;
- Other Physical Characteristics and Impacts, beginning on page 3-71;
- Construction Impacts, beginning on page 3-95; and
- Indirect and Cumulative Effects, beginning on page 3-101.

The text in italics answers the question posed by the subheading under which it appears, summarizing for the reader the findings of the longer discussion that follows.

3.1 Community Characteristics and Impacts

This section presents the key findings of the community impact assessment conducted for this FEIS. Additional detail is presented in the revised *Community Impact Assessment Technical Report* (Parsons Brinckerhoff, 2011), which is contained on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/. This section discusses the following:

- What is the general land use, and what community features are in the project area?
- How would neighborhood or community cohesion be affected?
- How would quality of life be affected?

- Would any homes, businesses, outdoor advertising signs, or gravesites be relocated?
- Would the project be compatible with local land use plans?
- How would the existing business community be affected?
- How would access to neighborhoods and communities be changed?
- How would parks, recreation opportunities, and other community services and facilities be affected?
- How would pedestrian and bicycle provisions change?
- Could crime rates increase?
- How would farmlands be affected?

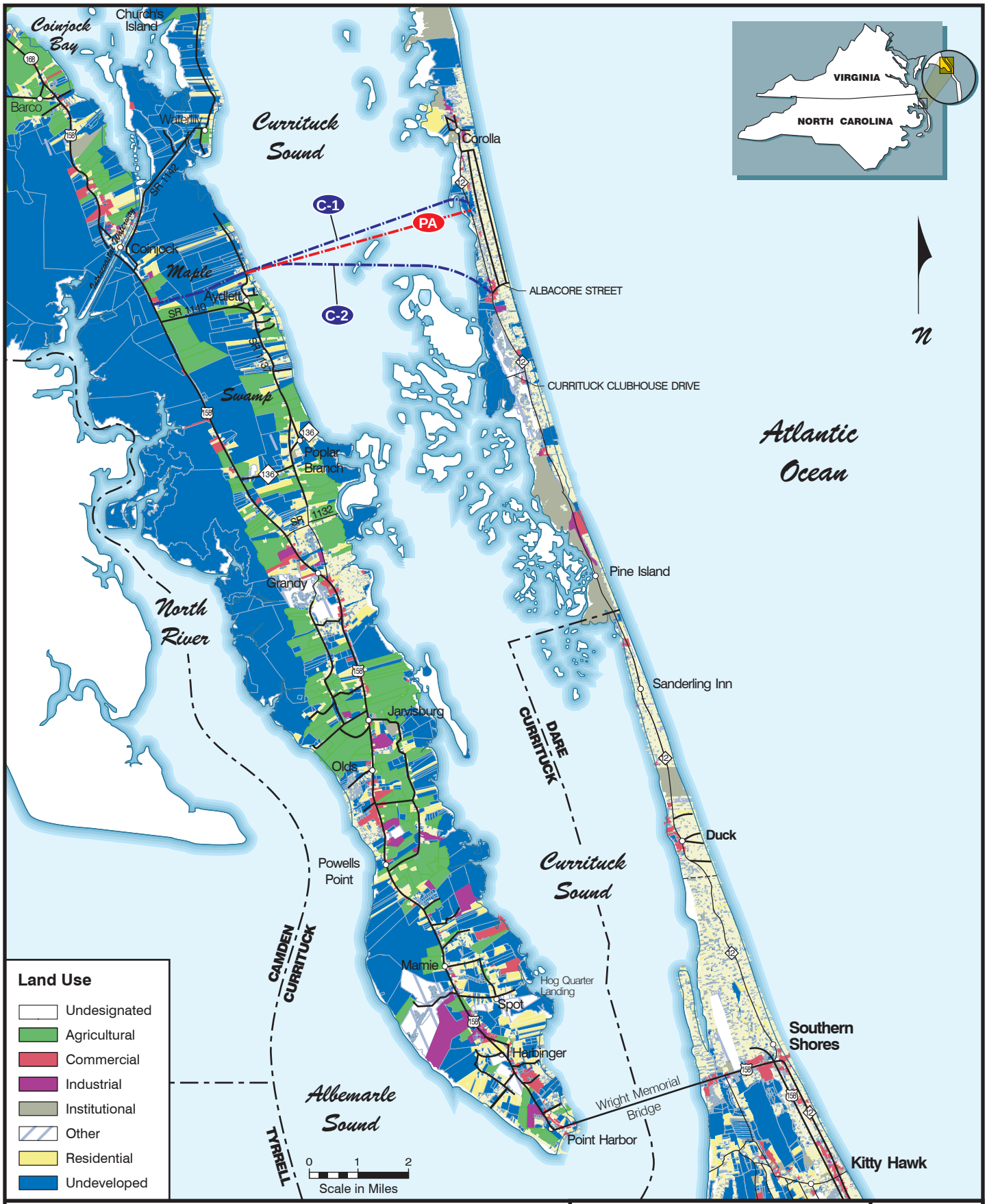
3.1.1 What is the general land use, and what community features are in the project area?

The Direct Community Impact Area (DCIA) includes the communities and neighborhoods that could be directly affected by the proposed project and its detailed study alternatives, including the Preferred Alternative. It encompasses the area within 1,000 feet of the centerline on both sides of US 158 and NC 12 in the project area, as well as the area within 2,500 feet of the centerline on both sides of the two bridge corridors.

Figure 3-1 shows existing land use in the project area. The Currituck County mainland is within a predominantly rural area, with farms, forest, and scattered residences. Service-oriented businesses are in clusters that are scattered along US 158.

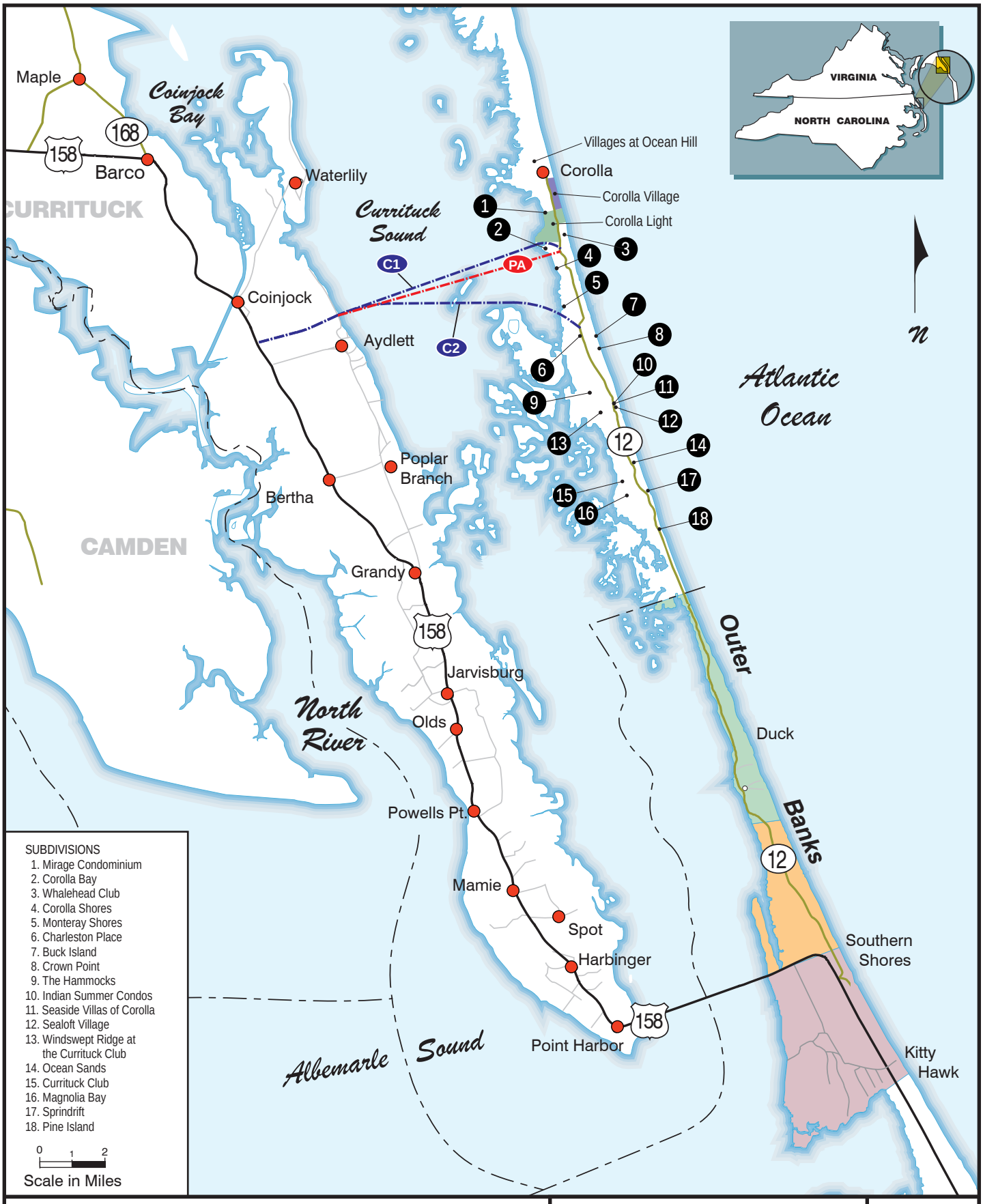
The Outer Banks is a vacation destination oriented to the waters of the Atlantic Ocean and Currituck Sound where the population is substantially greater during the summer season. Vacationers stay in hotel and motel rooms, condominiums, and single-family and multi-family homes. The commercial aspects of the Outer Banks cater to the needs of its vacationers, with restaurants, entertainment, and shops that sell beach-oriented vacation clothing and supplies.

The communities in the project area are shown on Figure 3-2. The primary community of interest on the Currituck County mainland is Aydlett, as a portion of this relatively isolated collection of homes and farms is within the proposed right-of-way of the western approach to the Mid-Currituck Bridge. Aydlett is a shoreline development along Currituck Sound, approximately 2 miles east of US 158, where direct access is generally via just one road, Aydlett Road (SR 1140). Aydlett is within an area that is changing from rural farms to rural residential, with older homes that front Currituck Sound and newer ones being built along roads that are perpendicular to the sound. Community facilities within Aydlett include a post office, clubhouse, and several burial plots and cemeteries.



Existing Land Use

Figure 3-1



Project Area Communities

Figure 3-2

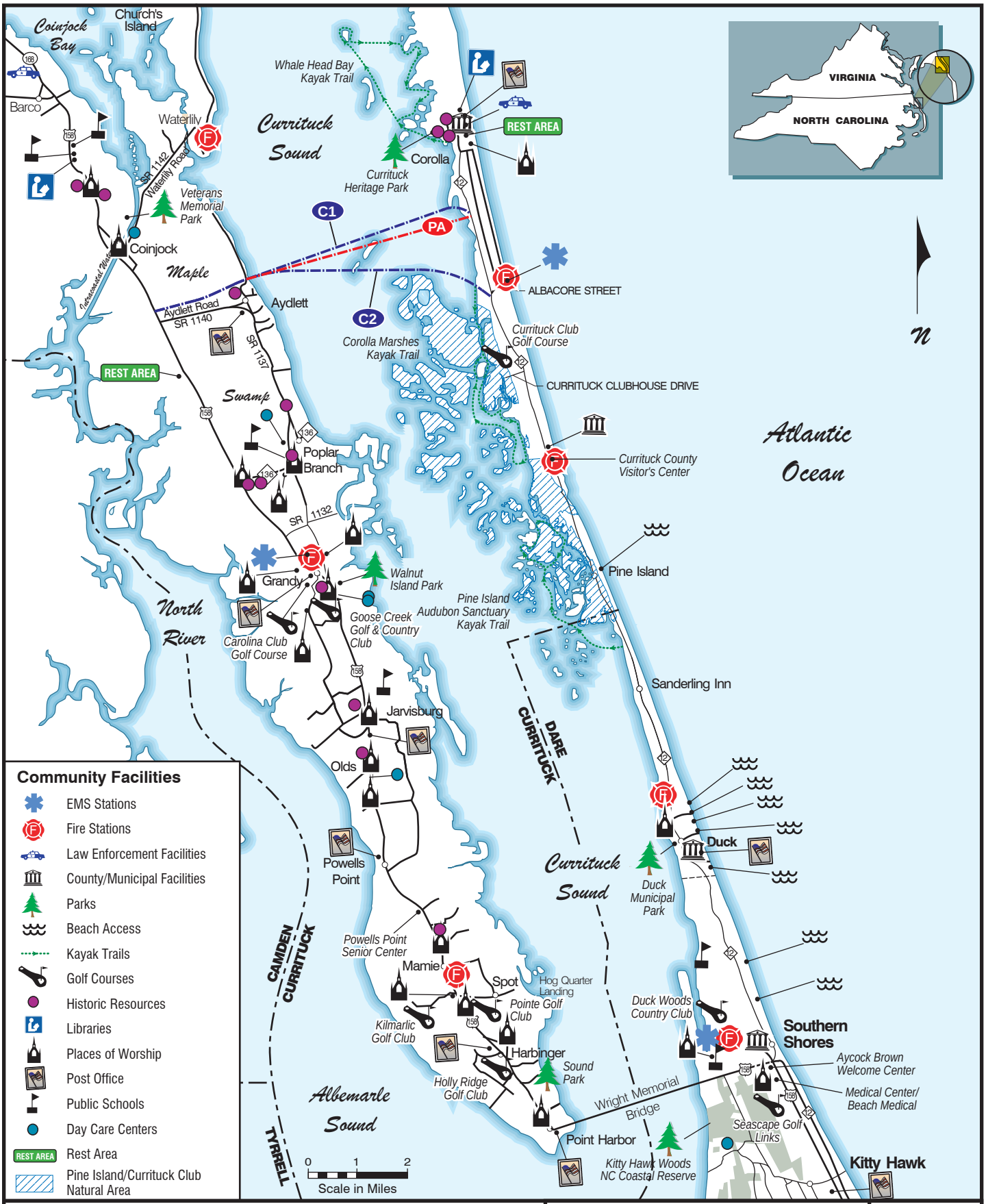
On the mainland in Currituck County, commercial uses scattered along US 158 are characterized by convenience stores, restaurants, tourism shops, and service businesses. Commercial development is concentrated in Coinjock, Grandy, Powells Point, and Point Harbor. On the Outer Banks, commercial uses line US 158 between the Wright Memorial Bridge and NC 12 and include shopping centers, a Wal-Mart, a Home Depot and, near the US 158/NC 12 intersection, hotels and restaurants. A tourist-oriented commercial center that connects to Currituck Sound is at the Duck town center on NC 12. Other commercial development along NC 12 is generally comprised of stand-alone shops and small shopping centers that include restaurants and businesses related to tourist activities (Figure 3-1). The Aycock Brown Welcome Center is at the intersection of US 158 and NC 12.

The Outer Banks north of Dare County are in Currituck County, with similar development and land uses characterized by residential developments of single-family homes, townhomes, and condominiums. There also are resorts and commercial developments comprised of small stand-alone shops and shopping centers with grocery stores and restaurants to serve the tourist population. Larger centers are at Currituck Clubhouse Drive and Albacore Street in Currituck County.

The project area provides services and facilities consistent with an area that is primarily oriented to residential and recreational uses, including schools, churches, community centers, libraries, and post offices, as shown on Figure 3-3.

Public parks on the Currituck County mainland include Veterans Memorial Park on the Intracoastal Waterway in Coinjock, Walnut Island Park in Grandy, and Sound Park in Harbinger (which includes two public boat ramps). There are four public golf courses in the project area on the Currituck County mainland: Carolina Club Golf Course, Kilmarlic Golf Club, Pointe Golf Club, and Holly Ridge Golf Club (see Figure 3-3). Tennis courts at Currituck County High School on US 158 between the Knapp (Intracoastal Waterway) Bridge and NC 168 were built using funds provided under Section 6(f) of the Land and Water Conservation Fund Act. Goose Creek Golf and Country Club is a private golf course near US 158 in Grandy. Public recreation is primarily related to Currituck Sound and the Outer Banks beaches along the Atlantic Ocean. In the project area, Currituck Sound supports a variety of shallow-water recreation opportunities, such as fishing, kayaking, windsurfing, and duck hunting. There is one bird sanctuary in the project area, the Pine Island Audubon Sanctuary. Three kayaking trails in Currituck Sound include Corolla Marshes from TimBuck II (7 miles), Pine Island Audubon Sanctuary from Sanderling (8.5 miles), and Whale Head Bay to Monkey Island (7 miles) (Trails.com web site, May 2009). They also are shown on Figure 3-3.

On the Outer Banks, numerous public accesses are provided to the beaches in Southern Shores, the Town of Duck, and Pine Island. Parks and recreational facilities include two ball fields at the Kitty Hawk Elementary School that are available for public use, Duck Town Commons/Duck Municipal Park along NC 12 on Currituck Sound, and Currituck Heritage Park (which includes a public boat ramp). Seascape Golf Links is a public golf



Community Facilities

Figure 3-3

course near the US 158/NC 12 intersection. There are also two private golf courses on the Outer Banks in the project area: Duck Woods Country Club in Kitty Hawk and Currituck Club Golf Course on NC 12 in Currituck County (see Figure 3-3). Within the Town of Kitty Hawk, Kitty Hawk Woods is a 1,877-acre nature preserve that includes public hiking trails.

There are no sidewalks or bicycle trails along US 158 on the Currituck mainland. On the Outer Banks, sidewalks, multi-use paths, and wide shoulders that are used by pedestrians and cyclists are along NC 12, and a multi-use path parallels NC 12 for much of its length. A multi-use path also is on the north side of US 158, and the town of Kitty Hawk plans a new multi-use path on the south side of US 158 (see *Kitty Hawk 2003-2004 CAMA Core Land Use Plan Update* [Town of Kitty Hawk, 2005]).

There are no public transportation services in the project area. Private transportation services include taxis, limousines, tour/charter service, and a van service that shuttles patrons between the Outer Banks and transportation hubs on the mainland, such as the Norfolk International Airport.

The Currituck County Airport is a general aviation airport in Maple, approximately two miles west of the US 158/NC 168 intersection. It can accommodate small private planes and small corporate jets. Dare County Regional Airport is a general aviation airport in Manteo that can accommodate most regional jets. One publicly owned airstrip for private aircraft is near the project area on the Outer Banks, the First Flight Airstrip next to the Wright Brothers Memorial in Kill Devil Hills. One privately owned airstrip, Pine Island Airport, is within the project area on the Currituck County Outer Banks. This airstrip serves private aircraft and is generally restricted to property owners and guests of the Pine Island community.

Law enforcement and emergency services in the project area are provided by the Currituck County Sheriff's Department, Currituck County Volunteer Fire Department and Emergency Medical Services, Dare County Police and Fire Departments, and the towns of Kitty Hawk, Southern Shores, Duck, and Corolla. The locations of their facilities in the project area are shown on Figure 3-3.

Health care is available at Regional Medical Center, a community hospital just south of the US 158/NC 12 intersection. Nearby Beach Medical specializes in family practice. The Outer Banks Hospital in Nags Head, approximately 8 miles south of the project area, is the only health care facility on the Outer Banks that provides trauma care. In the project area, the Outer Banks has two helipads that can be used to transport people to the mainland for medical care: one in Kitty Hawk and one in Duck.

3.1.2 How would neighborhood or community cohesion be affected?

Neighborhood or community cohesion would be affected in two primary locations with the detailed study alternatives, including the Preferred Alternative: Aydlett on the mainland (with MCB2, MCB4, and the Preferred Alternative) by the creation of a visual barrier and Corolla Bay

on the Outer Banks (with MCB2/C1 and MCB4/C1) by physically dividing Phase I of the subdivision with the bridge. A Mid-Currituck Bridge with MCB2, MCB4, and the Preferred Alternative would provide connectivity between the Currituck County mainland and its Outer Banks. With ER2 and MCB2, pedestrians crossing NC 12 in Southern Shores and at the Sanderling Inn (two locations with notable pedestrian travel) would have to cross three lanes of pavement instead of two. With MCB2/C1 and MCB4/C1, pedestrians traveling between two parts of Monteray Shores would have to cross four lanes of pavement instead of two at NC 12's intersection with North Harbor View Drive. With the Preferred Alternative, pedestrians at this intersection would cross two lanes and a new left turn lane. A marked pedestrian crossing would be provided.

Neighborhood or community cohesion considers whether an alternative would divide the community by a physical barrier that prevents easy travel from one side of a neighborhood or community to another, by a visual barrier that blocks views across the community, or by a discomfort or safety barrier that inhibits passage from one side of a neighborhood or community to another.

3.1.2.1 Third Emergency Outbound Lane

With the DEIS detailed study alternatives, the introduction of a third emergency outbound lane for hurricane evacuation would introduce no barriers to community movement or views, so there would be no potential to isolate or divide existing communities along US 158.

3.1.2.2 US 158 Improvement on the Outer Banks

On the Outer Banks east of the Wright Memorial Bridge, US 158 is a major thoroughfare. US 158 is a neighborhood boundary between the towns of Southern Shores and Kitty Hawk. Thus, widening this section of US 158 with ER2 and MCB2 to a six- to eight-lane super-street and constructing an interchange at US 158 and NC 12 would not affect community cohesion. A third outbound emergency lane in this area with MCB4 and the Preferred Alternative also would not affect community cohesion.

3.1.2.3 NC 12 Improvements in Southern Shores and Duck

In Southern Shores and Duck, NC 12 often acts as a dividing point between neighborhoods. However, there are three locations that see notable pedestrian travel: in the southern half of Southern Shores where people walk across NC 12 to reach the beach, in the Duck commercial area, and in the Sanderling Inn area where inn facilities are on both sides of the road. None of the detailed study alternatives, including the Preferred Alternative, include improvements in the Duck commercial area. In the other two areas, pedestrians crossing a three-lane NC 12 with ER2 and MCB2 would have more pavement to cross and experience more times of day when vehicles can travel the speed limit. However, pedestrian crossing points in these areas would be marked, as they are marked presently.

3.1.2.4 Mid-Currituck Bridge in Aydlett

MCB2, MCB4, and the Preferred Alternative include a Mid-Currituck Bridge. The western bridge approach would pass through the community of Aydlett, which lies along Currituck Sound on the Currituck County mainland. The bridge approach would lie between the northern and southern portions of Aydlett and affect the community visually (see Section 3.4.5), which could affect the perceived cohesion of the community. The visual effects would vary between mainland approach road Option A and Option B. With Option A (included in the Preferred Alternative), the western end of the bridge would bridge Narrow Shore Road (the only road between the northern and southern parts of the community), so access between the two parts of the community would not be affected. With Option B, Narrow Shore Road would be relocated to pass over the toll plaza that would be placed in Aydlett. Like Option A, access between the two parts of the community by motor vehicles, bicycles, and pedestrians would be preserved. Pedestrians and bicyclists would, however, have to walk or cycle to the top of the bridge over the toll plaza, a height of 25.5 feet above existing ground.

Residents of Aydlett have expressed concern about the potential impacts on their way of life related to the presence of a toll plaza in Aydlett and the revised local road system with Option B. Concerns expressed included the potential for drivers to change their minds about using the bridge just before the toll plaza and use roads in the Aydlett community to return to US 158, particularly during periods of high traffic congestion such as a crash on the approach road or the bridge. In this case, these drivers would add traffic to the Aydlett street system and introduce strangers with no business in this rural residential community. The possibility was raised that people might knock on doors seeking to use family bathrooms. Concern also was expressed that, at times of high traffic congestion, emergency vehicles coming from Waterlily to Aydlett and returning to the hospital would be slowed. However, the preliminary design of the Option B toll plaza has adequate traffic capacity during normal peak conditions not to result in queuing from the toll plaza that would block access to and from Aydlett. But this issue could be of concern during unusual traffic situations that may occur, such as a crash on the approach road or the bridge. In addition, the night-time lighting of the toll plaza also was expressed as a concern, particularly as it relates to star gazing hobbyists who recognize Aydlett as an uncommon dark sky location. Finally, citizens also felt that Option B contradicted previous promises that there would be no access between the bridge project and Aydlett. Similar comments were received at the public hearing and during the public comment period for the DEIS.

3.1.2.5 Bridge across Currituck Sound

Currituck Sound serves as a natural barrier between mainland Currituck County and the Outer Banks. With MCB2, MCB4, and the Preferred Alternative, the Mid-Currituck Bridge would remove this barrier and create, instead, a connection between the mainland and Outer Banks. This would result in improving accessibility between the Currituck County mainland and the Outer Banks. It would facilitate travel for service workers, county employees, emergency services, and school children that need to travel between the Currituck County mainland and the Outer Banks.

3.1.2.6 Mid-Currituck Bridge Corridor C1 on the Outer Banks

With MCB2/C1 and MCB4/C1, the Mid-Currituck Bridge would enter the Outer Banks through Phase I of the Corolla Bay subdivision, physically dividing it into two parts and using three residential lots in a subdivided but undeveloped portion. This would alter the planned organization and structure of the new community, affecting its cohesion even before it is completed. The new bridge with these alternatives also would create a visual barrier, as the bridge structure would limit the ability of persons on one side of the community to have clear views of the other side. With the Preferred Alternative, the new bridge would enter the Outer Banks within Phase II of the Corolla Bay subdivision. Phase II currently has no improvements, such as streets or utilities, and has not been legally subdivided.

MCB2/C1 and MCB4/C1 also would affect community cohesion in two ways for a portion of the Monteray Shores community. First, NC 12 would be widened to four lanes at the North Harbor View Drive intersection. An existing subdivision of 34 lots (16 having existing structures as of 2008) along North Harbor View Drive to the east of NC 12 is a part of the Monteray Shores property owner's association and uses the association's recreational facilities on the western side of NC 12. The additional travel lanes and traffic associated with the C1 corridor would make crossing NC 12 by pedestrians to reach the recreational facilities more difficult. Second, these alternatives assume that the northern intersection of North Harbor View Drive and NC 12 would be closed. However, North Harbor View Drive is a private street and its northern and southern halves are maintained by two different property owner's associations (the northern half has 19 additional lots but no structures). The closure of the northern NC 12 intersection would force the traffic from the subdivision at the north end of North Harbor View Drive to use a street maintained by another group of property owners. Both of these concerns are addressed in association with the Preferred Alternative.

With the Preferred Alternative, the Mid-Currituck Bridge corridor would intersect NC 12 at a roundabout, and NC 12 would be widened to four lanes a short distance north to Devil's Bay Road (the entrance to the Corolla Bay subdivision) and south to the southerly intersection of NC 12 and North Harbor View Drive. Thus, the Preferred Alternative also would affect community cohesion for the portion of the Monteray Shores community to the east of NC 12 along North Harbor View Drive. Left turn lanes would be placed at the NC 12/North Harbor View Drive intersection. NC 12, however, would remain two lanes at this intersection. With MCB2/C1 and MCB4/C1, NC 12 was proposed to be four lanes with left turn lanes at this intersection, so the change at this intersection is less with the Preferred Alternative.

With the Preferred Alternative, NC 12 would be two lanes with new left turn lanes at North Harbor View Drive. A signed and marked pedestrian crossing would be provided at North Harbor View Drive. Unlike MCB2/C1 and MCB4/C1, the northern intersection of North Harbor View Drive and NC 12 would be relocated to the south of its current location and not closed.

The roundabout and the relocation of the northern intersection of North Harbor View Drive and NC 12 would result in seven improved (local streets and utilities) lots out of a total of 19 lots being reduced in area in the currently undeveloped subdivision at the north end of North Harbor View Drive. One additional improved (but not built upon) lot would be taken. If the reduction in area of the seven lots precludes their development, they would be purchased in their entirety.

3.1.2.7 Mid-Currituck Bridge Corridor C2 on the Outer Banks

With MCB2/C2 and MCB4/C2, the bridge would enter the Outer Banks south of the TimBuck II commercial area, and NC 12 would be realigned. This alternative would pass through an undeveloped area and not affect community cohesion.

3.1.2.8 No-Build Alternative

With the No-Build Alternative, there is no potential for changes to neighborhood or community cohesion. The benefit of a bridge connecting the Currituck County mainland with its Outer Banks would not be realized with either the No-Build Alternative or ER2.

3.1.3 How would quality of life be affected?

Aside from the community or neighborhood cohesion impacts noted above, quality of life in the community could be affected by noise and visual change. Noise impacts are discussed in Section 3.4.1, and visual impacts are discussed in Section 3.4.5.

3.1.4 Would any homes, businesses, outdoor advertising signs, or gravesites be relocated?

Some homes, businesses, outdoor advertising signs, and gravesites would be relocated with all of the detailed study alternatives, including the Preferred Alternative. The largest number of these relocations would occur when adding a third outbound emergency lane for hurricane evacuation along US 158 compared to reversing the existing center turn lane during an evacuation. The Preferred Alternative would relocate six homes, three businesses, three outdoor advertising signs, and 20 gravesites.

Relocations of homes, businesses, outdoor advertising signs, and gravesites for the detailed study alternatives are presented in Table 3-1. Appendix A of the revised *Community Impact Assessment Technical Report* (Parsons Brinckerhoff, 2011) includes the Relocation Reports.

3.1.4.1 Relocations

On the mainland, the Preferred Alternative would have among the lowest relocations of the detailed study alternatives. Assuming a third outbound lane is built to facilitate hurricane evacuation on the mainland, ER2 would result in the fewest business relocations (two fewer business displacements than MCB2 and MCB4). Outdoor advertising sign and gravesite impacts, however, would be substantially greater with

Table 3-1. Relocations

Location and Alternative	Homes	Businesses	Outdoor Advertising Signs	Gravesites
Currituck County Mainland				
ER2	5 (0)[1]	3 (0)	29 (0)	66 (0)
MCB2/A and MCB4/A	5 (5)	5 (3)	6 (3)	36 (20)
MCB2/B and MCB4/B	7 (7)	5 (3)	16 (13)	35 (19)
Preferred Alternative	5	3	3	20
Outer Banks				
ER2	1 plus 10 vacation rental units	2	0	0
MCB2/C1	1 plus 10 vacation rental units	2	0	0
MCB2/C2	1 plus 10 vacation rental units	3	0	0
MCB4/C1	0	0	0	0
MCB4/C2	0	1	0	0
Preferred Alternative	1 (a likely vacant rental unit)	0	0	0

[1] The number in parentheses is the number of Currituck County mainland relocations that would occur if reversing the center turn lane on US 158 were implemented to reduce hurricane evacuation clearance times rather than constructing a third outbound lane for hurricane evacuation. For the Preferred Alternative, only one number is shown because it assumes reversing the center turn lane is implemented to reduce hurricane evacuation clearance times (i.e., adding a third outbound lane is not part of the Preferred Alternative).

ER2. If the option of using the center turn lane for outbound travel to reduce hurricane evacuation times were chosen, there would be no mainland relocations with ER2. Mainland relocations with MCB2, MCB4, and the Preferred Alternative would be associated with the US 158/Mid-Currituck Bridge interchange. Option B (used with MCB2 and MCB4) would increase residential relocations by two, one in Aydlett and one on US 158. Option B also would result in the same number of business relocations, six more outdoor advertising sign relocations, and one fewer gravesite relocation compared to Option A.

On the Outer Banks, home relocations would occur along NC 12 with ER2 and MCB2 and would be primarily associated with providing drainage detention basins along parts of NC 12 in Dare County. The two business relocations would be associated with the interchange at the intersection of US 158 and NC 12. Also MCB2/C2 and MCB4/C2 would result in one business relocation in Currituck County, a water sports business that relies on the dock extending into Currituck Sound from TimBuck II. Bridge corridor C2 could displace or relocate the dock. Displacements of vacation rental units are noted

separately in Table 3-1 since no permanent residents would need to be relocated. No relocations of homes and businesses would occur on the Outer Banks with MCB4. One home relocation, which is likely a vacant rental unit, would occur on the Outer Banks with the Preferred Alternative. If additional vacation homes are built in Phase I of the Corolla Bay subdivision, through which MCB2/C1 and MCB4/C1 pass, the number of vacation homes displaced could increase for these two alternatives. No outdoor advertising signs or gravesites would be affected on the Outer Banks with any of the detailed study alternatives.

No relocations would occur with the No-Build Alternative.

3.1.4.2 Relocation Assistance for Homes and Businesses

It is the policy of NCTA to ensure that comparable replacement housing will be available prior to the construction of state and federally-assisted projects. Furthermore, the North Carolina Board of Transportation has the following three programs to minimize the inconvenience of relocation:

1. Relocation Assistance Program;

2. Relocation Moving Payments Program; and

3. Relocation Replacement Housing Payments or Rent Supplement Program.

With the Relocation Assistance Program, experienced staff will be available to assist displacees with information such as availability and prices of homes, apartments, or businesses for sale or rent and financing or other housing programs. The Relocation Moving Payments Program, in general, provides for payment of actual moving expenses encountered in relocation.

Where displacement will force an owner or tenant to purchase or rent property of higher cost or to lose a favorable financing arrangement (in cases of ownership), the Relocation Replacement Housing Payments or Rent Supplement Program will compensate up to $22,500 to owners who are eligible and qualify and up to $5,250 to tenants who are eligible and qualify.

The relocation program for the proposed action will be conducted in accordance with the Federal Uniform Relocation Assistance and Real Property Acquisitions Act of 1970 (Public Law 91-646), and the North Carolina Relocation Assistance Act (GS-133-5 through 133-18). The program is designed to provide assistance to displaced persons in relocating to a replacement site in which to live or do business. At least one relocation officer is assigned to each highway project for this purpose.

A relocation officer will determine the needs of the displaced families, individuals, businesses, non-profit organizations, and farm operations for relocation assistance advisory services without regard to race, color, religion, sex, or national origin. The work will be scheduled to allow ample time, prior to displacement, for negotiations and

possession of replacement housing that meets decent, safe, and sanitary standards. The displacees are given at least a 90-day written notice after their property is purchased. Relocation of displaced persons will be offered in areas not generally less desirable in regard to public utilities and commercial facilities. Rent and sale prices of replacement property will be within the financial means of the families and individuals displaced, and will be reasonably accessible to their places of employment. A relocation officer will also assist owners of displaced businesses, non-profit organizations, and farm operations in searching for and moving to replacement property.

All tenant and owner residential occupants who may be displaced would receive an explanation regarding all available options, such as (1) purchase of replacement housing, (2) rental of replacement housing, either private or public, or (3) moving existing owner-occupant housing to another site (if possible). The relocation officer will also supply information concerning other state or federal programs offering assistance to displaced persons and will provide other advisory services as needed in order to minimize hardships to displaced persons in adjusting to a new location.

The Moving Expenses Payment Program is designed to compensate the displacee for the costs of moving personal property from homes, businesses, non-profit organizations, and farm operations acquired for a highway project. Under the Replacement Program for Owners, NCTA will participate in reasonable incidental purchase payments for replacement dwellings, such as attorney's fees, surveys, appraisals, and other closing costs and, if applicable, make a payment for any increased interest expenses for replacement dwellings. Reimbursement to owner-occupants for replacement housing payments, increased interest payments, and incidental purchase expenses may not exceed $22,500 (combined total), except under the Last Resort Housing provision.

A displaced tenant may be eligible to receive payment, not to exceed $5,250, to rent a replacement dwelling or to make a down payment, including incidental expenses, on the purchase of a replacement dwelling. The down payment is based upon what the state determines is required when the rent supplement exceeds $5,250.

It is a policy of the State of North Carolina that no person will be displaced by state or federally-assisted construction projects unless and until comparable replacement housing has been offered or provided to each displacee within a reasonable period of time prior to displacement. No relocation payment received will be considered as income for the purposes of the Internal Revenue Code of 1954 or for the purposes of determining eligibility or the extent of eligibility of any person for assistance under the Social Security Act or any other federal law.

Last Resort Housing is a program used when comparable replacement housing is not available, or when it is unavailable within the displacee's financial means, and the replacement payment exceeds the federal/state legal limitation. The purpose of the program is to allow broad latitudes in methods of implementation by the state so that decent, safe, and sanitary replacement housing can be provided. This program would be implemented, if necessary, as mandated by state law.

3.1.4.3 Outdoor Advertising Sign Relocation

Most signs, including outdoor advertising signs, are classified as personal property. When a sign is in a proposed acquisition area, a moving payment would be made for relocating the physical structure. Payment for value in place also could be made. Like other private lands purchased, payment would be made for the land where the sign is located.

3.1.4.4 Gravesite Relocation

The relocation of gravesites would take place under North Carolina General Statute 65-106, *Removal of Graves*. As required by that law, descendants would be contacted, to the extent possible, prior to moving the graves. The graves would be relocated to a perpetually maintained cemetery.

3.1.5 Would concentrations of low income, minority populations, or limited English proficiency populations suffer disproportionately adverse human health or environmental effects?

There would be no disproportionately high and adverse direct impacts associated with any of the detailed study alternatives, including the Preferred Alternative, to minority populations, low income populations, or limited English proficiency populations.

Based on US census data, field observations, and discussions with local officials, there are no concentrations in the DCIA of minority, low income, and limited English proficiency populations that could be directly affected by construction or operation of the detailed study alternatives. Although there are no concentrations of low income households in the project area that would be directly affected by construction of the detailed study alternatives, there are such persons in Currituck County. MCB2, MCB4, and the Preferred Alternative would create a second means to reach the Outer Banks from Currituck County; however, it would be tolled. With these alternatives, low income households may choose not to pay the toll or use the bridge less frequently. They could, however, continue to use existing roads and would benefit from less congestion on those roads. In addition, mainland low income persons who choose to use the new bridge to the Outer Banks would benefit from reduced travel distances (and associated costs) to many Outer Banks service jobs. There would be no tolls with ER2, and all users would benefit without a direct out-of-pocket cost for their travel. An indirect cost would exist, however, in the form of motor vehicle and fuel taxes.

3.1.6 Would the project be compatible with local land use plans?

The No-Build Alternative and ER2 would be inconsistent with area land use plans in that these alternatives do not include construction of a Mid-Currituck Bridge. ER2 and MCB2 include substantial widening of NC 12; the towns of Southern Shores and Duck specifically reject widening of NC 12 through their communities. The Preferred Alternative would include a Mid-Currituck Bridge and would not widen NC 12 in Southern Shores and Duck.

The North Carolina Coastal Area Management Act (CAMA) requires each of the 20 coastal counties in North Carolina to have a local land use plan that meets guidelines established by the North Carolina Coastal Resources Commission (NCCRC). Further, municipalities within coastal counties may establish land use plans independent from their respective counties. The North Carolina Department of Environment and Natural Resources, Division of Coastal Management (NCDENR-DCM), uses approved plans when making CAMA permit decisions. Proposed development must be consistent with the local land use plan, or NCDENR-DCM will not permit a planned development to be implemented.

The detailed study alternatives, including the Preferred Alternative, would generally be consistent with land use plans of the affected jurisdictions (Currituck County and the Dare County towns of Kitty Hawk, Southern Shores, and Duck). However, they would be inconsistent with some specific provisions, including:

- The No-Build Alternative and ER2 do not include a Mid-Currituck Bridge. A bridge is widely supported and included in the land use plans of the affected jurisdictions.

- The Southern Shores long-range plan specifies a Mid-Currituck Bridge as the means for reducing traffic on NC 12 in their town.

- ER2 and MCB2 would be inconsistent with the Town of Duck land use plan since it opposes NC 12 widening.

- MCB2, MCB4, and the Preferred Alternative would be inconsistent with the Currituck County Land Use Plan, as the western bridge approach traverses a designated "Conservation Area," Maple Swamp. Design Option A (included in the Preferred Alternative) would bridge Maple Swamp, minimizing potential impacts. It is impossible to build a Mid-Currituck Bridge without passing through Maple Swamp.

- MCB2 and MCB4 with design Option B would be inconsistent with Currituck County Transportation Policy TR13, as the location of the toll plaza in Aydlett at the western end of the bridge would enable direct vehicular access between the bridge road across Maple Swamp and Aydlett.

- The US 158/Mid-Currituck Bridge interchange with MCB2, MCB4, and the Preferred Alternative would be placed in Currituck County within an existing "Limited Service Area." The Currituck County land use plan identifies Limited Service as primarily residential development at low densities and conservation. However, the Currituck County land use plan states that its goals include expansion of the county's economic base. The *Economic Development Strategy "Vision Plan," Currituck County, North Carolina, Final Report* (Lane and Jolley, 2008) recommends that to be consistent with the land use plan, bridge-related development should be clustered in the area of the US 158/Mid-Currituck Bridge interchange. Future development could include retail, restaurants, service businesses, and a hotel. There is adequate

developable land along US 158 for this development and as such the US 158/Mid-Currituck Bridge interchange is consistent with county plans.

- MCB2, MCB4, ER2, and the Preferred Alternative do not include widening US 158 to six lanes between NC 168/US 158 and the bridge approach corridor as is called for in the Currituck County thoroughfare plan. However, the improvement of US 158 is not defined as part of the Mid-Currituck Bridge project in the STIP and could be built as part of a future project.

- MCB2, MCB4, ER2, and the Preferred Alternative do not include widening NC 12 to four lanes northward between the Dare/Currituck County line and the Mid-Currituck Bridge as is called for in the Currituck County thoroughfare plan. However, this also is not defined as a part of the Mid-Currituck Bridge project in the STIP.

According to NCDENR-DCM's June 4, 2010, letter commenting on the DEIS, design and mitigation features important to consistency with the Currituck County land use plan relate to protection of Maple Swamp, stormwater management, avoidance of construction of shoreline stabilization measures on Currituck Sound, use of vegetative buffers on the shoreline, relocation of utilities underground, and provision of infrastructure for any potential day visitors. NCDENR-DCM's letter is contained in Appendix B of the *Stakeholder Involvement for Final Environmental Impact Statement Technical Report* (Parsons Brinckerhoff, 2011).

3.1.7 How would the existing business community be affected?

Overall, the business community would not be affected by any of the detailed study alternatives, including the Preferred Alternative, although individual businesses may experience changes in access and, in some locations, changes in parking and visibility. The greatest changes to business access would be in the US 158/NC 12 interchange area with ER2 and MCB2, and in the business area at Albacore Street on the Currituck County Outer Banks with MCB2/C1, MCB4/C1, and the Preferred Alternative. Some businesses would be relocated, as discussed in Section 3.1.4.

With ER2, MCB2, and MCB4, the introduction of a third emergency outbound lane for hurricane evacuation would introduce no barriers to business access or views.

MCB2/B and MCB4/B would change access to a gas station on the western side of US 158 in the US 158/Mid-Currituck Bridge interchange area. It currently has direct access to US 158. These alternatives would place the gas station near the end (4,000 feet) of a long (5,000 feet) frontage road that connects to US 158 at a single point. This change would make it inconvenient for customers to reach the gas station, particularly drive-by customers who would not likely associate the frontage road intersection with the gas station access. The gas station would be displaced with MCB2/A, MCB4/A, and the Preferred Alternative.

On the Outer Banks east of the Wright Memorial Bridge, the super-street and the US 158/NC 12 interchange could affect businesses in several ways. As a result of the

differences in projected traffic, the interchange would be larger with ER2 than with MCB2 and thus have greater impact. A third outbound emergency lane in this area with MCB4 also would not affect businesses. Impacts to businesses with ER2 and MCB2 in this area would include:

- Reduced visibility from US 158 in the interchange area;
- Changes in access as listed in Table 2-1; and
- With ER2 only, displacing approximately 10 percent of the Home Depot parking, making it non-conforming (does not meet current requirements) according to Kitty Hawk development requirements.

No effects on businesses would occur along NC 12 with any of the detailed study alternatives except with the C1 terminus for alternatives MCB2, MCB4, and the Preferred Alternative. Here NC 12 would be widened to four lanes through this business area. Between TimBuck II and Monteray Drive, access to business driveways (except at the Albacore Street intersections) would be altered as listed in Table 2-1.

With ER2, MCB2/C2, and MCB4/C2, changes in business access would be confined to not allowing left turns in or out of the secondary driveway of TimBuck II. Some parking spaces in the southeast corner of TimBuck II would be lost with MCB2/C2 and MCB4/C2.

The access changes described can be viewed in detail on the public hearing maps and Preferred Alternative preliminary engineering contained on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/.

Although access to commercial areas between the Mid-Currituck Bridge and the Wright Memorial Bridge would not be altered, the Mid-Currituck Bridge with MCB2, MCB4, and the Preferred Alternative would divert traffic from this part of US 158. This could result in a loss of business as fewer people drive by. Although traffic is expected to drop 15 to 18 percent following construction of a Mid-Currituck Bridge, reductions in traffic volumes (as compared with the existing volumes) on this part of US 158 would be short-term, as traffic volumes are expected to rise and exceed current volumes by 2035 even with a Mid-Currituck Bridge to divert some traffic. Based on an informal survey conducted in November 2010 of 25 businesses along US 158 south of Aydlett, as well as one on NC 12 in Duck, business managers and owners were evenly divided as to whether the proposed Mid-Currituck Bridge would have a positive or a negative impact on businesses along US 158 south of Aydlett. In general, based on the results of the informal survey, the potential for loss of business depends on the type of business, with tourist-driven businesses likely having greater detrimental impacts than non-tourist-driven businesses. Some businesses may see benefits from lower congestion levels resulting from a Mid-Currituck Bridge, such as businesses that offer deliveries. Appendix D of the revised *Community Impact Assessment Technical Report* (Parsons

Brinckerhoff, 2011) includes a summary of the informal survey of business managers and owners.

3.1.8 How would access to neighborhoods and communities be changed?

Few changes in neighborhood or community access would occur with the detailed study alternatives, including the Preferred Alternative.

The changes that would occur are listed in Table 2-1. No changes would occur along the third outbound hurricane evacuation lane.

With MCB2/A, MCB4/A, and the Preferred Alternative, there would be the potential for merging traffic from the US 158 interchange to wait to merge onto US 158 until just before the intersection of US 158 and Waterlily Road. This would increase the challenge of turning left into or out of Waterlily Road during peak travel periods. This change would be mitigated with the Preferred Alternative by adding a median acceleration lane on US 158 at Waterlily Road (see Figure 2-10). 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. With Option B, the interchange ramp would end approximately 1,800 feet south of Waterlily Road, so there would be no impact to existing conditions at the Waterlily Road intersection.

With MCB2/B and MCB4/B, Aydlett traffic would use the Mid-Currituck Bridge approach road to travel to and from Aydlett instead of Aydlett Road, which would be closed, and Narrow Shore Road would be relocated to pass over a toll plaza (see Figure 2-12). Travel distances to and within Aydlett would be minimally changed by these local street alterations.

With ER2 and MCB2, some local streets along NC 12 would be closed to facilitate NC 12 traffic flow, but only when a subdivision has two state-maintained intersections with NC 12. Provisions would be made so that emergency vehicles could continue to have access by all existing means. With any of the detailed study alternatives, except the Preferred Alternative, left turns to or from Crown Point and Orion's Way, two streets intersecting NC 12 in Currituck County, would be prohibited. With the Preferred Alternative, left turns from Orion's Way would be prohibited.

3.1.9 How would parks, recreation opportunities, and other community services and facilities be affected?

Parks, recreation opportunities, and other community services and facilities (including emergency services) would not be affected by the Preferred Alternative except for three duck blinds near the bridge location. Parks, recreation opportunities, and other community services and facilities (including emergency services) also would not be affected by the other detailed study

alternatives with two exceptions. First, three to four duck blinds near the bridge would be affected with a Mid-Currituck Bridge, depending upon the bridge corridor selected. Second, the platform from where the kayaks are launched for the Corolla Marshes from TimBuck II kayak trail would be removed with MCB2/C2 or MCB4/C2. The remainder of the kayak trail would be unaffected. No parks or recreation facilities built with funds provided under Section 6(f) of the Land and Water Conservation Fund Act would be affected. There would be no use of lands from public parks and recreation facilities to which Section 4(f) of the US Department of Transportation Act applies. The applicability of Section 4(f) to the multi-use paths affected by the Preferred Alternative is discussed in Section 3.1.10.

As noted in the previous section, where a few local street intersections along NC 12 would be closed with ER2 and MCB2 in association with widening NC 12, provisions would be made so that emergency vehicles could continue to have access by all existing means.

The range of a typical shotgun and shell used for hunting migratory waterfowl is 0.25 mile, so duck blinds within this distance of any of the bridge corridors would not be able to remain safely in their current location because there would be a risk of hunters accidently shooting vehicles on the bridge. Based on this minimum distance threshold, MCB2/C1, MCB4/C1, and the Preferred Alternative would displace three private duck blinds on public trust waters. For MCB2/C2 and MCB4/C2, four private duck blinds would be within this distance. The Currituck Game Commission, which issues the duck blind permits, would notify the affected blind holders once construction of the bridge is set to begin. The Game Commission has a number of options in dealing with the affected duck blinds, including moving the blinds, licensing a new location for the blind holder, or, as a last resort, revoking the blind license. All decisions made by the Game Commission can be appealed to district court.

Had MCB2/C2 or MCB4/C2 been selected for implementation, the C2 bridge design would have been revised to miss the platform that is used for launching kayaks for the Corolla Marshes from the TimBuck II trail.

3.1.10 How would pedestrian and bicycle provisions change?

Existing pedestrian and bicycle multi-use paths at the time of construction that are displaced would be replaced with all of the detailed study alternatives, including the Preferred Alternative. The detailed study alternatives do not include the construction of new pedestrian or bicycle multi-use paths, but where NC 12 is widened space would be left along NC 12 for multi-use paths to be built by others. Existing marked pedestrian crossings would be retained or replaced as a part of the detailed study alternatives. With the Preferred Alternative, new marked pedestrian crossings would be built on 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). See Section 2.1.11 for a complete description of pedestrian and bicycle provisions.

The Preferred Alternative would affect two multi-use paths. One is on the west side of NC 12 between Monteray Drive and Ocean Forest Court at Monteray Shores. The other is along US 158 between the US 158/Cypress Knee Trail/Market Place Shopping Center intersection and approximately 450 feet west of the Duck Woods Drive intersection in Dare County.

Neither of the multi-use paths affected by the Preferred Alternative are Section 4(f) resources. Both paths serve both a transportation and a recreation purpose. The path paralleling Monteray Shores can be used by pedestrians and bicyclists to travel to shopping south of Monteray Shores and to travel to the Homeowners Association's recreation complex, which is adjacent to NC 12. The Southern Shores path can be used by pedestrians and bicyclists to travel to shopping from subdivisions north of US 158. Both paths are used for recreation because the Outer Banks is a resort area and walking and bicycling is a common recreation activity.

Despite its use for recreation, the path primarily serving Monteray Shores is not a Section 4(f) resource for the following reasons:

- The multi-use path occupies the rights-of-way of NC 12 (except in a few locations where it is on land owned by the private Monteray Shores Homeowners Association) and is not limited by agreement to any specific location within the right-of-way.

  The right-of-way is owned by NCDOT and the path is maintained by the Monteray Shores Home Owners Association, a private entity. This portion of NC 12, including the path, was built by the developer of Monteray Shores. The right-of-way, including the path and road, was subsequently deeded to NC 12 in 1989 after approval by the NC Board of Transportation on December 30, 1988. The path was not mentioned in the transfer agreement. As such, the path was not built in an existing NC 12 right-of-way under the terms of an encroachment agreement. No subsequent encroachment agreement has been found in NCDOT's archives.

- Adjustments to the multi-use path associated with the Preferred Alternative would not impair the continuity of the path.

  The path would be rebuilt on the same side of NC 12 and serve the same origins and destinations. It would be improved to current NCDOT multi-use path standards, including widening the path to a width of 10 feet and a minimum set-back from NC 12 of 10 feet. The primary difference between the current path and the adjusted path would be that the adjusted path would be straighter.

Despite its use for recreation, the path at Southern Shores is not a Section 4(f) resource for the following reasons:

- The multi-use path occupies the rights-of-way of US 158 and is not limited by agreement to any specific location within the right-of-way except that it was built to serve pedestrians and bicyclists traveling along the north side of US 158.

  The right-of-way is owned by NCDOT and the path is maintained by the Town of Southern Shores under the terms of an encroachment agreement (dated October 17, 1994) with NCDOT. NCDOT built the path, the Town of Southern Shores paid its cost, and the town maintains the path.

- Adjustments to the multi-use path associated with the Preferred Alternative would not impair the continuity of the path.

  Only 1,600 feet of the approximately 1.1-mile-long path between the Southern Shores Town Hall and Dogwood Trail would be affected. The path would be rebuilt essentially in the same location it is today and serve the same origins and destinations. The portion affected would be improved to current NCDOT multi-use path standards, including widening the path to a width of 10 feet. The primary difference between the current path and the adjusted path is the additional 3 feet in width (from the current 7 feet) that would be placed on the north side of the current path.

3.1.11 Could crime rates increase?

Crime rates are not anticipated to increase with any of the detailed study alternatives, including MCB2, MCB4, and the Preferred Alternative, which would provide a direct connection between the mainland and the Currituck County Outer Banks.

Table 3-2 shows crime rates for Currituck County, Dare County, and North Carolina from 1993 to 2007. As shown, crime rates in Currituck County have decreased since 1997 and in Dare County and North Carolina since 1993.

Table 3-2. Crime Rates per 100,000 Population

Year	Currituck County	Dare County	North Carolina
1993	3,337	9,385	5,792
1997	4,056	6,786	5,591
2002	3,047	6,703	4,771
2007	2,453	4,687	4,659

Source: North Carolina State Bureau of Investigation

Bicycle and pedestrian paths are generally along or adjacent to thoroughfares within the Outer Banks and, although not lighted, they would continue to be visible to motor vehicle traffic and/or from homes.

None of the detailed study alternatives is likely to significantly affect the existing patterns of land use or human activities. One concern expressed during citizens meetings was that shorter travel time to the Outer Banks offered by a Mid-Currituck Bridge would make it more convenient for thieves from urbanized areas to burglarize homes during the off season. It is impossible to predict the criminal behavior of certain individuals; however, it may be reasonable to presume that the collection of a toll for use of the Mid-Currituck Bridge would deter thieves from specifically targeting homes on the Outer Banks because of the reduction in travel time created by the bridge. In addition, the fact that the proposed project would use video technology as a part of bridge operations may serve as a further deterrent to thieves who would presumably want to avoid detection. Specifically with regards to thieves from urbanized areas, it seems unlikely that the travel time savings from an urbanized area such as Norfolk, Virginia would be a factor for thieves, since it would take over an hour to reach the Outer Banks regardless of using existing roads or the bridge. For example, the uncongested travel time from Norfolk, Virginia, to Kitty Hawk (the nearest point on the Outer Banks) is approximately 103 minutes. With the Mid-Currituck Bridge, the uncongested travel time from Norfolk, Virginia, to Corolla (the new nearest point on the Outer Banks) via that bridge would be 80 minutes, a 23-minute savings. Thus, none of the detailed study alternatives is anticipated to affect crime rates on the Outer Banks.

3.1.12 How would farmlands be affected?

The greatest impact on farmland would be associated with the US 158/Mid-Currituck Bridge interchange with MCB2, MCB4, and the Preferred Alternative, but that effect would be less than 0.01 percent of all farmland soils in Currituck County.

The US Department of Agriculture, Natural Resource Conservation Service (NRCS), has identified three general categories of important farmland soils—prime, unique, and state and locally important. Prime farmland soils are best suited for producing food, forage, fiber, and oilseed crops. Farmland of state and local importance consists of soils that do not meet all of the requirements for prime farmland because of steepness of slope, permeability, susceptibility to erosion, low available water capacity, or some other soil property. Soils that have a special set of properties unique to producing certain high-value crops meet the requirements for unique farmland.

Most of the farmland soils in the project area exist on the Currituck County mainland. There are no farmland soils of any type on the Outer Banks in Currituck County. Although there are state and locally important farmland soils on the Outer Banks in Dare County, these soil types are present in developed areas and thus are not considered farmland. There are no unique farmland soils in the project area.

ER2 would affect less than 2 acres of prime farmland soils and less than 2 acres of state and locally important farmland soils. MCB2/A, MCB4/A, and the Preferred Alternative each 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 on the mainland. MCB2/B and MCB4/B each would affect

approximately 76 acres of prime farmland soils with its larger use of land in the Aydlett area and 41 acres of state and locally important farmland soils with its smaller US 158/Mid-Currituck Bridge interchange area. According to the NRCS, this is less than 0.01 percent of all farmland soils in Currituck County. With the No-Build Alternative, no farmland would be affected.

The only alternative to using land with farmland soils would be within either developed areas or jurisdictional wetlands, both of which are important to avoid. Therefore, there are no alternative routes or sites available that might reduce the loss of farmland with MCB2, MCB4, or the Preferred Alternative.

In Chapter 106, Article 61 of the North Carolina General Statutes, the North Carolina General Assembly authorized counties to undertake a series of programs to encourage the preservation of farmland. As a result, counties throughout the state of North Carolina have begun to adopt Voluntary Agricultural District Ordinances (VAD) (North Carolina Department of Agriculture and Consumer Services, n.d.). Dare County does not have any Voluntary Agricultural Districts. Currituck County adopted a Voluntary Agricultural Protection District Ordinance in 2001. However, the county does not have any designated Agricultural Districts (Ferrell, 2011).

The revised *Community Impact Assessment Technical Report* (Parsons Brinckerhoff, 2011) provides further detail and includes a copy of the Farmland Conversion Impact Rating form (Form CPA-106).

3.2 Cultural Resources Characteristics and Impacts

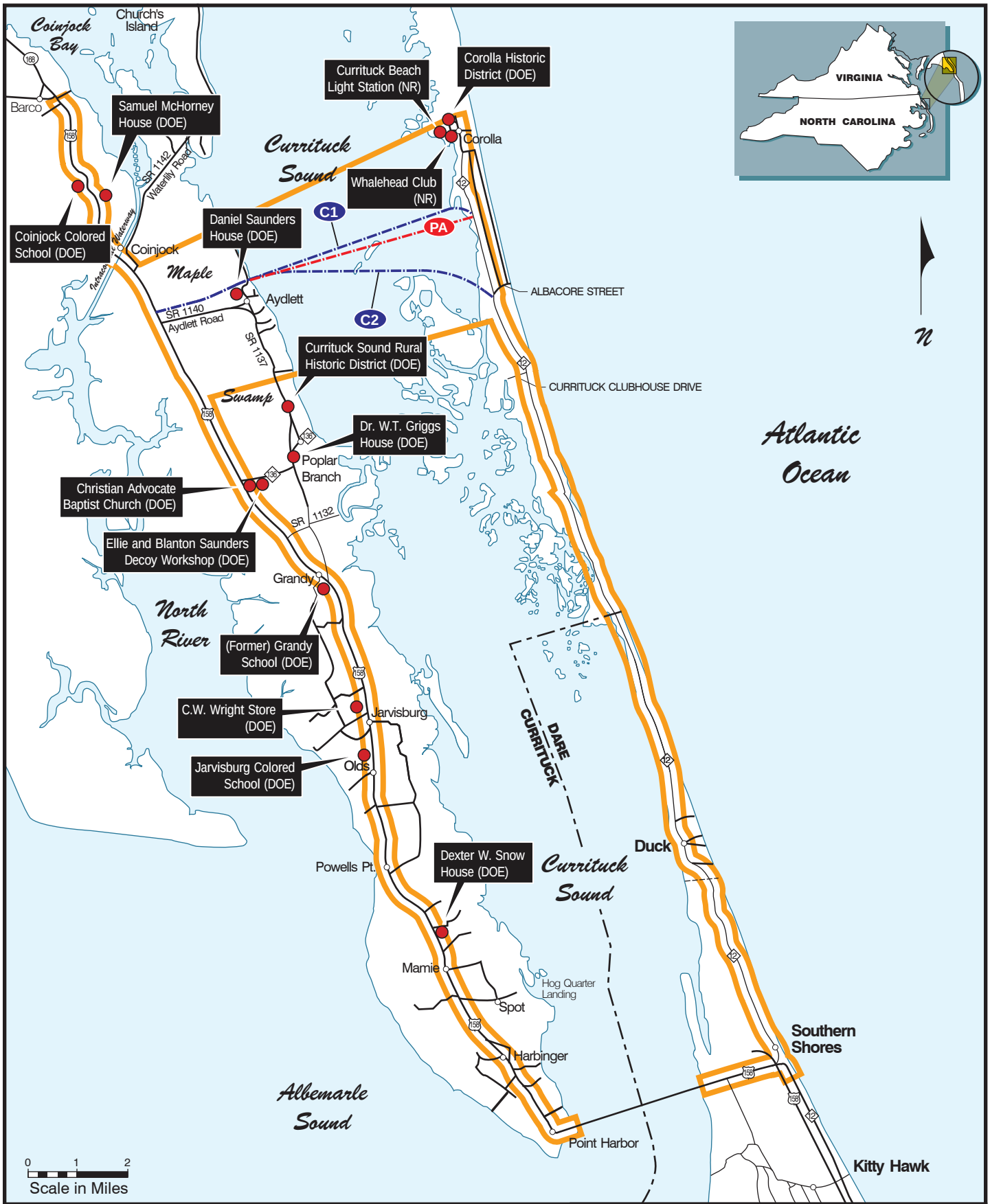
This section considers the impacts of the detailed study alternatives on cultural resources in the project area. It asks:

- Would historic resources be affected?
- Would archaeological resources be affected?
- Would resources that are protected by the requirements of Section 4(f) of the Department of Transportation Act of 1966 be used?

3.2.1 Would historic resources be affected?

In consultation with the State Historic Preservation Office (HPO), it was determined that no adverse effect on historic properties would result from the detailed study alternatives, including the Preferred Alternative.

Surveys for historic resources were conducted in December 2007 and March 2009. The results are documented in two historic resource survey reports (North Carolina Department of Transportation [NCDOT], 2008 and 2009). These reports are included on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/. The historic resource Area of Potential Effects (APE) for the Mid-Currituck Bridge Study is shown on Figure 3-4.



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 3-4

The two surveys identified 36 properties in or near the APE that are older than 50 years and may have some historic significance; however, NCDOT and the HPO agreed that only 14 of these properties in or near the APE are "historic properties" that were already listed in or eligible for inclusion in the National Register of Historic Places (NRHP). Letters associated with that agreement are included on the CD under "Historic Architectural Resources Supplemental Materials" and are posted on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/. The locations of these properties are listed in Table 3-3. They are shown on Figure 3-4.

Table 3-3. Historic Properties and Effects Determination

	ER2	MCB2	MCB4 and Preferred Alternative
Coinjock Colored School (DOE)	No Effect	No Effect	No Effect
Samuel McHorney House (DOE)[1]	No Adverse Effect	No Adverse Effect	No Adverse Effect
Daniel Saunders House (DOE)	No Effect	No Adverse Effect[2]	No Adverse Effect[2]
Currituck Sound Rural Historic District (DOE)	No Effect	No Effect	No Effect
Dr. W. T. Griggs House (DOE)	No Effect	No Effect	No Effect
Ellie and Blanton Saunders Decoy Workshop (DOE)	No Effect	No Effect	No Effect
Christian Advocate Baptist Church (DOE)	No Effect	No Effect	No Effect
(Former) Grandy School (DOE)[1]	No Adverse Effect	No Effect	No Effect
C. W. Wright Store (DOE)[1]	No Adverse Effect	No Effect	No Effect
Jarvisburg Colored School (DOE)[1]	No Adverse Effect	No Effect	No Effect
Dexter W. Snow House (DOE)[1]	No Adverse Effect	No Effect	No Effect
Whalehead Club (NR)	No Effect	No Effect	No Effect
Currituck Beach Light Station (NR)	No Effect	No Effect	No Effect
Corolla Historic District (DOE)	No Effect	No Effect	No Effect

Note: NR=Listed in the NRHP and DOE=Determined eligible for inclusion in the NRHP.

[1]Determinations of No Adverse Effect for these resources only apply with the addition of a third outbound lane for hurricane evacuation along US 158. The finding would be No Effect for reversing the center turn lane during an evacuation since that option would involve no new construction along US 158.

[2]The Daniel Saunders House is the only historic property near mainland approach design Options A and B. The effects determination indicated applies to both options.

On March 24, 2009, and September 15, 2009, representatives of NCTA, NCDOT, the Federal Highway Administration (FHWA), and HPO met to determine whether the detailed study alternatives would have an Adverse Effect on any of the 14 historic properties in or near the APE. The results are presented in Table 3-3 by alternative. None of the detailed study alternatives would have an Adverse Effect on the 14 historic properties. The "Concurrence Forms for Assessment of Historic Resource Effects" signed by NCDOT, FHWA, and representatives from the HPO are included on the CD under "Historic Architectural Resources Supplemental Materials." They also are posted on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/.

3.2.2 Would archaeological resources be affected?

The potential exists for archaeological resources to be affected by the detailed study alternatives, including the Preferred Alternative. Additional studies would be conducted after selection of an alternative for implementation.

Phase I terrestrial and underwater archaeological background studies were conducted for the project (Panamerican Consultants, Inc., 2008 and 2009). These two studies are on the CD included with this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at http://www.ncdot.gov/projects/midcurrituckbridge/. The archaeological APE for the Mid-Currituck Bridge Study encompasses those areas that could be directly disturbed by construction of any of the detailed study alternatives.

Numerous terrestrial archaeological surveys have been conducted in or adjacent to the APE. Surveys of the APE found eight recorded archaeological sites (five prehistoric, two historic, and one multi-component) and 36 old cemeteries. A single reported site and two "old missile test sites" also were noted within the APE. While only a few submerged cultural resources surveys have been conducted within or adjacent to the project area, no underwater sites are listed within the APE. However, there are several notable shipwreck sites adjacent to the APE, and the Currituck Sound portion of the project area has a long maritime history suggesting the possibility of additional sites.

The potential for additional, as yet unidentified, cultural resources sites in the project area is indicated by the presence of known sites within the APE and the extensive and continued use of the area from prehistoric times. Therefore, following the receipt of comments on this FEIS and finalizing the selection of a Preferred Alternative, additional archaeological surveys would be conducted on both land and water to identify the presence or absence of additional resources. Also, an assessment would be conducted of the NRHP eligibility of sites within the APE of the Selected Alternative if they would be jeopardized by impacts from project construction.

The HPO and Office of State Archaeology (OSA) have been consulted throughout project development to provide input on both the timing and methods for the archaeological investigations.

3.2.3 Would resources that are protected by the requirements of Section 4(f) of the Department of Transportation Act of 1966 be used?

The hurricane evacuation option of constructing a third outbound lane on US 158 for evacuating traffic, which is not a part of the Preferred Alternative except for a short distance on the Outer Banks to the west of the NC 12/US 158 intersection, would use land from one or two historic Section 4(f) properties, the Samuel McHorney House (all alternatives) and the Dexter W. Snow House (ER2 only). However, because the impact to both the McHorney House and the Snow House would not adversely affect the activities, features, and attributes that qualify these properties for protection under Section 4(f), FHWA, by publishing the DEIS, requested comments on a proposed finding of de minimis (minimal) impact for both properties for the hurricane evacuation option of constructing a third outbound lane on US 158 for evacuating traffic. No comments were received. A finding of de minimis impact for both properties is not needed for the Preferred Alternative since it does not include a third outbound lane on US 158 and would not affect these properties.

No publicly-owned park, recreation area, or wildlife and/or waterfowl refuge would be affected by any of the detailed study alternatives, including the Preferred Alternative.

Five historic properties determined eligible for inclusion in the NRHP, all located along US 158, were identified as being affected by one or more of the detailed study alternatives as follows:

- For three of these properties, (Former Grandy School, C.W. Wright Store, and Jarvisburg Colored School), a temporary construction easement would be required with ER2 for re-grading the pavement with the hurricane evacuation option of providing a new third outbound lane on US 158 for evacuating traffic.

- For the fourth property, the Dexter W. Snow House, additional right-of-way would be required with ER2 with the hurricane evacuation option of providing a new third outbound lane on US 158.

- For the fifth property, the Samuel McHorney House, additional right-of-way would be required with all of the detailed study alternatives with the hurricane evacuation option of providing a new third outbound lane on US 158.

None of these properties would be affected if reversing the center turn lane on US 158 were chosen as the means to reduce hurricane evacuation times. The HPO has made a determination of no adverse effect for all five properties under Section 106 of the National Historic Preservation Act of 1966. The location of all five properties is shown on Figure 3-4.

3.2.3.1 Three Properties Affected by a Temporary Construction Easement

In the case of the three historic properties affected by a temporary construction easement with a third outbound lane on US 158 (not included in the Preferred Alternative), Section 4(f) does not apply. The temporary occupancy of land is so minimal that it does

not constitute a use within the meaning of Section 4(f) because the following conditions from Title 23 CFR, Section 771.135(p)(7) are satisfied:

1. The duration would be temporary, i.e., less than the time needed for construction of the project, and there would be no change in ownership of the land;

2. The scope of the work would be minor, i.e., both the nature and magnitude of the changes to the Section 4(f) resource would be minimal;

3. There would be no anticipated permanent adverse physical impacts, nor would there be interference with the activities or purpose of the resource, on either a temporary or permanent basis;

4. The land being used would be fully restored, i.e., the resource would be returned to a condition which is at least as good as that which existed prior to the project; and

5. There is a documented agreement with the HPO and FHWA regarding the above conditions.

The agreement noted in item 5 is contained on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and posted on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/.

3.2.3.2 Samuel McHorney House

The Samuel McHorney House is a rare, intact, unaltered example of a two-story, single-pile dwelling. This house is a well-preserved example of a traditional regional form. It is on a 0.92-acre parcel that contains the house and the large trees that surround it. The Samuel McHorney House possesses integrity of location, as it remains at the original site on which it was constructed. The setting has been compromised by modern residential and commercial development directly across US 158. Integrity of design, materials, and workmanship is very much intact, with the only major alteration the loss of porches on the side elevations. The Samuel McHorney House is eligible for NRHP listing under Criterion C (Design/Construction).

At the location of the Samuel McHorney House, there is insufficient right-of-way along US 158 to accommodate the hurricane evacuation option for all of the detailed study alternatives of constructing a third outbound lane for evacuating traffic. The additional right-of-way is not needed when meeting hurricane evacuation needs by using the existing center turn lane as the third outbound evacuation lane, which is the case with the Preferred Alternative. The benefits and limitations of the two options for reducing hurricane evacuation clearance times are discussed in Section 2.1.10.

A third outbound lane for hurricane evacuation would require use of an approximately 8-foot-wide strip along the property frontage (approximately 0.02 acre of right-of-way and easement), which includes a grassed area adjacent to the roadway. The proposed right-of-way line would be approximately 120 feet from the front of the structure. No

trees would be displaced either by the project or the relocation of telephone lines adjacent to the existing right-of-way.

Concurrence was requested and received from the HPO under the requirements of Section 106 of the National Historic Preservation Act of 1966 that the third outbound lane for hurricane evacuation would not adversely affect the activities, features, and attributes that qualify the Samuel McHorney House for protection under Section 4(f). That effects determination is included under "Historic Architectural Resources Supplemental Materials" on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at http://www.ncdot.gov /projects/midcurrituckbridge/. Thus, it appears there were grounds for a finding of *de minimis* (minimal) effect. Section 4(f) property may be used when FHWA determines that the use of the property, including any measure(s) committed to in order to minimize harm (such as any avoidance, minimization, mitigation, or enhancement measures), would have a *de minimis* impact on the property (as defined in Title 23 CFR, Section 774.17). A *de minimis* impact determination under Title 23 CFR, Section 774.3(b) considers the requirement for all possible planning to minimize harm by reducing impacts on the Section 4(f) property to a *de minimis* level (Title 23 CFR, Section 774.117[5]). By publishing the DEIS, FHWA requested comments on the proposed finding of *de minimis* impact for the Samuel McHorney House. None were received. A finding of *de minimis* impact for this property is not needed for the Preferred Alternative since it does not include a third outbound lane on US 158 and would not affect this property.

3.2.3.3 Dexter W. Snow House

Built in 1908 by Currituck carpenter Melton Pugh for a local farmer, the Dexter W. Snow House is a modest two-story frame house with an asymmetrical plan and simple Victorian details. The Dexter W. Snow House was determined eligible for the NRHP in 1989. As a result of the widening of US 158 from Point Harbor to Powell's Point, the house was moved back from the new road 80 feet on the same parcel and placed on a new foundation. The Dexter W. Snow House has been determined eligible for NRHP listing under Criterion C in the area of architecture. It is a good, intact example of a rural farmhouse in Currituck County that dates to the early 1900s. The property has experienced few changes over time. Although the property was moved in 1989, it retains sufficient integrity to remain eligible for the NRHP. The proposed NRHP boundary is 0.8 acre.

At the location of the Dexter W. Snow House, the US 158 right-of-way is approximately 10 feet narrower than at adjoining properties and most of the US 158 right-of-way between the Wright Memorial Bridge and the Knapp (Intracoastal Waterway) Bridge. Thus, there is insufficient right-of-way to accommodate the hurricane evacuation option with ER2 of constructing a third outbound lane on US 158 for evacuating traffic, and the purchase of an additional 10 feet of right-of-way is proposed. The land that would be purchased contains no structures, upper story vegetation, or screening vegetation. The additional width is not needed for ER2 when meeting hurricane evacuation needs by using the existing center turn lane as the third outbound evacuation lane.

Improvements at the Dexter W. Snow Hours are not a part of the Preferred Alternative. The benefits and limitations of the two options for reducing hurricane evacuation clearance times are discussed in Section 2.1.10. In the case of ER2, emergency management officials have indicated that the 27-mile lane reversal associated with ER2 is not a realistic option.

Concurrence was requested and received from the HPO under the requirements of Section 106 of the National Historic Preservation Act of 1966 that the detailed study alternatives would not adversely affect the activities, features, and attributes that qualify the Dexter W. Snow House for protection under Section 4(f). That effects determination is included under "Historic Architectural Resources Supplemental Materials" on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/. Thus, it appears there were grounds for a finding of *de minimis* (minimal) effect. Section 4(f) property may be used when FHWA determines that the use of the property, including any measure(s) committed to in order to minimize harm (such as any avoidance, minimization, mitigation, or enhancement measures), would have a *de minimis* impact on the property (as defined in Title 23 CFR, Section 774.17). A *de minimis* impact determination under Title 23 CFR, Section 774.3(b) considers the requirement for all possible planning to minimize harm by reducing impacts on the Section 4(f) property to a *de minimis* level (Title 23 CFR, Section 774.117[5]). By publishing the DEIS, FHWA requested comments on the proposed finding of *de minimis* impact for the Dexter W. Snow House. None were received. A finding of *de minimis* impact for this property is not needed for the Preferred Alternative since it does not include a third outbound lane on US 158 and would not affect this property.

3.3 Natural Resource Characteristics and Impacts

This section considers the impacts of the detailed study alternatives, including the Preferred Alternative, on natural resources in the project area. It considers:

- How would water resources in the project area be affected?
- How would biotic resources be affected?
- How would wildlife on land be affected?
- How would aquatic wildlife be affected?
- How would invasive species be controlled?
- What impacts would occur to waters under the jurisdiction of the US Army Corps of Engineers?
- Would habitat used by threatened and endangered species be affected?

- Would Coastal Area Management Act Areas of Environmental Concern or essential fish habitat be affected?

Natural characteristics and impacts associated with the detailed study alternatives, including the Preferred Alternative, are described in detail in the revised *Natural Resources Technical Report* (CZR, Incorporated, 2011), which is included on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at http://www.ncdot.gov/projects/midcurrituckbridge/.

3.3.1 How would water resources in the project area be affected?

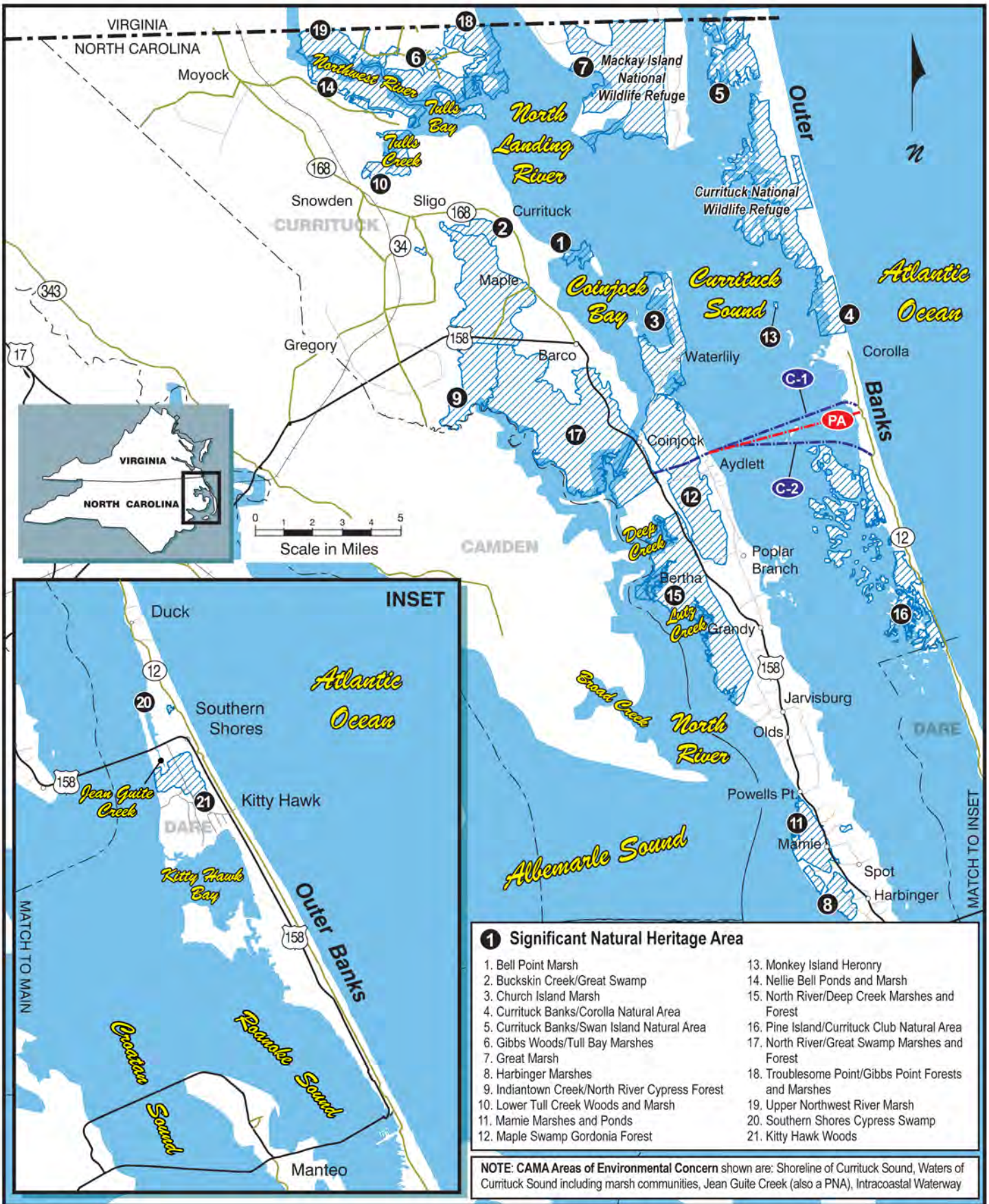
The most notable temporary impact to water quality would be increased turbidity levels produced during construction of the Mid-Currituck Bridge with MCB2, MCB4, and the Preferred Alternative. Permanent impacts to water quality are primarily associated with increased levels of bridge and highway runoff. 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 for the additional impervious surface area created by this project. A stormwater management plan for minimizing the potential impact of project pollutants is proposed in this FEIS and would be finalized in association with NCDENR-DWQ and other state and federal environmental resource and regulatory agencies during final design of the alternative selected for implementation and in the process of obtaining related permits.

3.3.1.1 Water Resources

Surface waters of the project area are found primarily in association with Currituck Sound (see Figure 3-5). The Atlantic Intracoastal Waterway and Jean Guite Creek are the only major drainages present. There are five additional jurisdictional unnamed drainages identified within the project area. These include two canals that connect to Maple Swamp and drain into Great Swamp and Deep Creek (North River), which are along the mainland portion of US 158. Two modified natural streams that drain into Currituck Sound were identified along US 158. There is also a small stream identified within the maritime swamp near the Outer Banks terminus of the C2 bridge corridor. The locations of these seven features are shown in Figure 5 of the revised *Natural Resources Technical Report* (CZR, Incorporated, 2011) on the CD that accompanies this FEIS. There are no NCDENR-DWQ riparian buffer areas currently within the Pasquotank River Basin; therefore, no riparian buffer impacts would occur.

3.3.1.2 Classifications of Water Resources

All waters found within the project area are designated as "SC" under North Carolina's water quality classifications by the North Carolina Department of Environment and Natural Resources–Division of Water Quality (NCDENR-DWQ, 2008). This saltwater classification represents the minimum quality standards applicable to all salt waters. Suitable activities for waters classified SC include "aquatic life propagation and survival, fishing, wildlife and secondary recreation" (NCDENR-DWQ, 2008a).



1 Significant Natural Heritage Area

1. Bell Point Marsh
2. Buckskin Creek/Great Swamp
3. Church Island Marsh
4. Currituck Banks/Corolla Natural Area
5. Currituck Banks/Swan Island Natural Area
6. Gibbs Woods/Tull Bay Marshes
7. Great Marsh
8. Harbinger Marshes
9. Indiantown Creek/North River Cypress Forest
10. Lower Tull Creek Woods and Marsh
11. Mamie Marshes and Ponds
12. Maple Swamp Gordonia Forest
13. Monkey Island Heronry
14. Nellie Bell Ponds and Marsh
15. North River/Deep Creek Marshes and Forest
16. Pine Island/Currituck Club Natural Area
17. North River/Great Swamp Marshes and Forest
18. Troublesome Point/Gibbs Point Forests and Marshes
19. Upper Northwest River Marsh
20. Southern Shores Cypress Swamp
21. Kitty Hawk Woods

NOTE: CAMA Areas of Environmental Concern shown are: Shoreline of Currituck Sound, Waters of Currituck Sound including marsh communities, Jean Guite Creek (also a PNA), Intracoastal Waterway

LEGEND

- DEIS Bridge Corridors
- Preferred Alternative Bridge Corridor
- County Boundaries
- Water Bodies
- Significant Natural Heritage Area

Water Bodies and Other Natural Resource-Related Features

Figure 3-5

Most of Currituck Sound and all waters of the project area are closed to harvesting shellfish for direct marketing purposes or human consumption. There are no water bodies classified as High Quality Waters (HQW), Outstanding Resource Waters (ORW), or Water Supply Watersheds (WS-I, WS-II) within 1.0 mile downstream of the project area.

Primary Nursery Areas (PNAs) are low salinity, state-designated waters in the upper reaches of streams that are used by marine and estuarine fishes and invertebrates during early development. Jean Guite Creek is the only designated PNA in the project area. The lower reaches of streams and bays function as secondary nursery areas but are not officially designated as such.

Anadromous (fish that spawn in freshwater but live mainly in saltwater) Fish Spawning Areas (AFSA) are low salinity, state-designated waters that contain the physical, chemical, and biological attributes necessary for anadromous fish to spawn successfully. No AFSA are crossed by any of the detailed study alternatives.

There is no specific statute or regulation that designates or references the waters of Currituck Sound as subject to a construction moratorium. However, it is assumed that a moratorium could be imposed on the project via a permit condition during the US Army Corps of Engineers (USACE) Section 404 of the Clean Water Act and CAMA permitting review processes in association with in-water work (primarily bottom disturbing) in existing submerged aquatic vegetation (SAV) beds and SAV habitat (including existing beds) as defined by the NC Marine Fisheries Commission (NCMFC). The dates for a likely moratorium would be from February 15 through September 30. The Preferred Alternative would not cross state-designated fish nursery/spawning area (primary, secondary, or anadromous spawning area). The only such area crossed by any alternative is Jean Guite Creek, which is a PNA and would be crossed by the widening of US 158 with ER2 and MCB2, as well as a third outbound lane hurricane evacuation improvement with MCB4.

3.3.1.3 Quality of Water Resources

Water quality of the Albemarle-Pamlico estuarine system is undergoing substantial degradation because of the area's increasing population, changes in agricultural practices, and urbanization and industrialization of the region. Point source pollution within the project area is limited. Local non-point source pollution is typical of developed areas and generally is in the form of stormwater runoff.

Historic and present stressors to Currituck Sound include natural and anthropogenic fluctuations in nutrient loading, turbidity, and salinity (USACE, 2010). Increased development in the watershed has increased the amount of nutrients in runoff into the sound. Bottom disturbing fishing gear, construction of docks/piers/marinas, storms, shoreline erosion, dredging, boating, sedimentation, and runoff have contributed to increased turbidity in the sound. The erosion of some marsh islands in the sound because of wave energy and decreased sediment accretion has increased the wind fetch, creating more wave energy that can re-suspend particles in the water, increasing

turbidity (USACE, 2010). The sound has become more saline since the late 1980s (Caldwell, 2001). Continual increases in the salinity of Currituck Sound could result in shifts in the community structure of aquatic flora and fauna, and possibly increase essential fish habitat (EFH) value for managed species and other estuarine dependent species.

3.3.1.4 Impacts to Water Quality

The most notable temporary impact to water quality would be the increased turbidity levels produced during construction of the Mid-Currituck Bridge with MCB2, MCB4, and the Preferred Alternative. The duration and severity of this impact would vary based on the number of simultaneous construction sites, which is likely to be a minimum of three, and the construction method. Construction methods for a Mid-Currituck Bridge are described in Section 2.4.2. If a Mid-Currituck Bridge is included in the alternative selected for implementation, NCTA would continue to work with environmental resource and regulatory agencies as the project progresses into final design and permit application to refine this approach.

Increased turbidity and sedimentation in Currituck Sound could occur from pile-driving. Increases in turbidity and sedimentation could negatively affect aquatic flora and fauna by depressing light penetration, lowering dissolved oxygen levels, and limiting visibility. Turbidity curtains would be in place to contain particles suspended during pile-driving in SAV habitat (including existing beds) as defined by NCMFC (see Section 3.3.4.2) and when necessary in potential SAV habitat areas of the sound 6 feet deep or less that have a suitable substrate. Driving piles generates less disturbance to the sediment than jetting; therefore, piles would not be jetted. In addition, remaining turbidity impacts from construction would likely diminish soon after construction ceased. Still, it is recognized that as a result of poor water circulation in the sound, some temporary impacts might become permanent if the environment could not recover from the disturbance. NCTA would conduct pre-construction water quality monitoring to establish baseline conditions and post-construction water quality studies to determine if water quality has been degraded by construction activities, as agreed to in a meeting with NCDENR-DWQ on March 21, 2011. If water quality in the project area were deemed substantially degraded because of the project impacts, potential additional mitigation measures would be discussed with NCDENR-DWQ to ensure an environmentally responsible project.

Increased turbidity and sedimentation levels also would temporarily increase as a result of runoff from construction areas on land, until post-construction re-vegetation. Temporary impacts to water quality from this source would be minimized through the use of NCDOT erosion and sedimentation control measures.

Permanent impacts to water quality would be primarily associated with increased levels of bridge and highway runoff, which is considered a non-point source discharge. The effects of runoff are highly site specific. The primary pollutants associated with bridge and highway runoff include particulates, organic compounds, nutrients, and heavy metals. These pollutants accumulate on impervious surfaces and are derived from

automobiles and materials used in construction and maintenance of roadways. These substances have the potential to negatively affect aquatic life by directly or indirectly interfering with various biological processes and cycles.

Pollutants discharged into Currituck Sound from a bridge could dissipate slowly because of poor water circulation, and could result in bioaccumulation and higher sediment pollutant levels than in areas with higher flow and better water circulation. Thermal and turbidity differences in runoff also could affect water quality by depressing oxygen levels and light penetration.

Based solely on the increased amount of impervious surface area (Table 3-4), MCB2 would result in the greatest increase in runoff, whereas ER2 (assuming reversing the

Table 3-4. Existing and Proposed Impervious Surface Areas by Detailed Study Alternative

	ER2 (acres)	MCB2/C1 (acres)	MCB2/C2 (acres)	MCB4/C1 (acres)	MCB4/C2 (acres)	Preferred Alternative
		Option A				
Existing Impervious Surface	290.4	290.4	290.4	290.4	290.4	290.4
Proposed Impervious Surface	379.4 (344.7)	417.2 (412.0)	410.8 (405.6)	377.0 (370.4)	371.4 (364.8)	361.9
Increase in Impervious Surface						
• Road	89.0 (54.3)	87.3 (82.1)	77.8 (72.6)	47.1 (40.5)	38.4 (31.8)	32.9
• Bridge	0.0	39.5	42.6	39.5	42.6	38.6
Total/Percent Increase	89.0/30.6 (54.3/18.7)	126.8/43.7 (121.6/41.9)	120.4/41.5 (115.2/39.7)	86.6/29.8 (80.0/27.5)	81.0/27.9 (74.4/25.6)	71.5/24.6
		Option B				
Existing Impervious Surface		290.4	290.4	290.4	290.4	
Proposed Impervious Surface		416.8 (411.6)	410.4 (405.2)	376.6 (370.0)	371.0 (364.4)	
Increase in Impervious Surface						
• Road		96.8 (91.6)	87.3 (82.1)	56.6 (50.0)	47.9 (41.3)	
• Bridge		29.6	32.7	29.6	32.7	
Total/Percent Increase		126.4/43.5 (121.2/41.7)	120.0/41.3 (114.8/39.5)	86.2/29.7 (79.6/27.4)	80.6/27.8 (74.0/25.5)	

Note: The numbers in parentheses reflect the impact if reversing the center turn lane is used to reduce hurricane evacuation clearance times rather than constructing a third outbound lane. When there is no number in parentheses, the impact would be identical for either hurricane evacuation option. The removal of Aydlett Road (2.8 acres) is factored into Option B impervious surface area calculations.

center turn lane of US 158 for hurricane evacuation) would result in the smallest increase. The Preferred Alternative, MCB4, and ER2 with a third outbound lane on US 158 would have similar increases in impervious surface area with amounts between MCB2 and ER2 (with reversing the center turn lane). The difference between mainland approach road Option A (included in the Preferred Alternative) and Option B in terms of impervious surface would be minimal (0.4 acre). For the road widening portions of the detailed study alternatives, including the Preferred Alternative, infiltration strips and ditches that would transport water to dry infiltration basins would be implemented to treat highway runoff along NC 12. Along US 158, ditches would be used to transport water to existing outfalls.

The stormwater management plan proposed for the Preferred Alternative is described in Section 2.1.7. 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 for the additional impervious surface area created by this project. A final stormwater management plan for minimizing the potential impact of project pollutants would be developed in association with NCDENR-DWQ and other state and federal environmental resource and regulatory agencies during final design of the alternative selected for implementation and in the process of obtaining related permits.

Additional impacts to water quality could occur from single pollution events such as hazardous spill incidents on proposed bridge structures or widened roadways. Impacts to salinity, water supply and wastewater treatment should not result from any of the detailed study alternatives, including the Preferred Alternative.

3.3.2 How would biotic resources be affected?

The detailed study alternatives, including the Preferred Alternative, would affect a variety of natural and naturalized biotic communities. The impact on natural upland communities would be least with the Preferred Alternative. The fill impact on wetlands would be similar with all of the detailed study alternatives except MCB2/B and MCB4/B, which would have the highest wetland fill impact. A Mid-Currituck Bridge would involve shading and clearing impacts in addition to fill impacts. A Mid-Currituck Bridge would affect aquatic bottom and SAV habitat and potential habitat. All of the detailed study alternatives except the Preferred Alternative would cause a minor amount of permanent shading impacts to streams in the project area, but there would be no fill placed in streams. In general, temporary impacts to biotic communities would be greatest with ER2.

3.3.2.1 Biotic Community Types

Twenty-one biotic community types occur within the project area. Of these 21 communities, seven communities are the result of direct human disturbance, including: man-dominated land, agricultural land, pine forest, shrub/scrub, wetland man-dominated land, wetland pine forest, and wetland shrub/scrub. Fourteen communities can be considered to be relatively natural systems: mixed-pine/hardwood forest,

hardwood forest, maritime shrub/grassland, maritime forest, wetland mixed-pine/hardwood forest, wetland hardwood forest, wetland bay forest, wetland swamp forest, wetland maritime shrub/grassland, wetland maritime forest, wetland maritime swamp, wetland freshwater marsh, ponds, and open water. The characteristics and extent of these communities and NCDENR-DWQ wetland rating scores for the wetland communities are described in detail in the revised *Natural Resources Technical Report* (CZR, Incorporated, 2011).

3.3.2.2 Rare and Threatened Communities

Rare and threatened natural community types within the state are identified by the North Carolina Natural Heritage Program (NCNHP) and ranked based on rarity or because of factors making a particular community especially vulnerable to degradation. Rare and threatened natural communities identified within the project area by NCNHP (2008a) are: maritime dry grassland, maritime wet grassland, maritime shrub, maritime swamp forest, maritime evergreen forest, non-riverine wet hardwood forest, non-riverine swamp forest, bay forest, tidal cypress/gum swamp, and tidal freshwater marsh. The characteristics of these communities are described in detail in the revised *Natural Resources Technical Report* (CZR, Incorporated, 2011).

3.3.2.3 Natural Heritage Areas

NCNHP designates Significant Natural Heritage Areas (SNHA). Those in the project area and areas immediately surrounding the project area are shown on Figure 3-5. Three SNHAs are in the project area.

The Pine Island/Currituck Club Natural Area is on the Currituck Outer Banks and in Currituck Sound. It contains an extensive tidal freshwater marsh system along the eastern side of Currituck Sound. This area is given a "C" status, which indicates that it is an outstanding example of this marsh community, though this community may be represented by better examples in the state (NCNHP, 2005). Drainage improvements along NC 12 with ER2 and MCB2 would affect a total of approximately 7.1 acres of the Pine Island/Currituck Club Natural Area along the fringe where it borders NC 12. This impact would consist of approximately 0.4 acre of upland man-dominated land, 4.1 acres of upland maritime shrub/grassland, and 2.6 acres of upland maritime forest. The Preferred Alternative would not affect the Pine Island/Currituck Club Natural Area.

The Maple Swamp Gordonia Forest is an SNHA on the Currituck County mainland in the project area. It is assigned a "B" status, which indicates that it is a statewide significant site that is among the highest quality occurrences in North Carolina. Approximately 494 acres of Maple Swamp that are considered jurisdictional wetland occur within the project area and about 300 acres of that was logged in the past three years, beginning in 2008. The significant features associated with this site include an unusually extensive stand of loblolly bay forest, which may represent the largest stand in the state, and the most northern range of this community. A portion of this forest outside of the project limits was logged in the past three years. MCB2 and MCB4 would pass through Maple Swamp adjacent to an existing powerline corridor. Much of the

proposed right-of-way is in the area that was logged. The bridge corridor, however, was placed so that there would be no use of the area that contained a unique loblolly bay forest found within the swamp until it was logged in 2010. MCB2/A, MCB4/A, and the Preferred Alternative would bridge Maple Swamp. MCB2/B and MCB4/B would place fill in Maple Swamp. Impacts to Maple Swamp are taken into consideration in Sections 3.3.2.4 (Impacts to Biotic Communities), 3.3.3.2 (Impacts to Land Wildlife and Land Wildlife Habitat), 3.3.6.2 (Impacts to Jurisdictional Features), 3.3.6.2 (Impacts to Jurisdictional Features), and 3.4.7 (Would floodplains be affected?).

On the mainland, large portions of the forests and marshes surrounding North River and Deep Creek, including Great Swamp, are recognized by NCNHP as SNHAs. These areas are also assigned a "B" status because of the extensive tidal freshwater marsh areas and what are thought to be natural and/or virgin stands of tidal cypress/gum swamp. All of the detailed study alternatives with a Mid-Currituck Bridge, including the Preferred Alternative, would affect less than 1 acre of Great Swamp along its eastern fringe where it borders US 158. For MCB2/A and MCB4/A, this impact would consist of approximately 0.1 acre of wetland mixed-pine/hardwood forest in the US 158/Waterlily Road intersection area. For MCB2/B and MCB4/B, this impact would consist of a total of approximately 0.6 acre in the US 158/Waterlily Road intersection area, including 0.5 acre of wetland mixed-pine/hardwood forest and 0.1 acre of wetland hardwood forest. For both MCB2 and MCB4 with the addition of a third outbound lane for hurricane evacuation, there would be an additional approximately 0.1 acre of impact to wetland mixed-pine/hardwood forest. The Preferred Alternative also would affect a total of approximately 0.6 acre of Great Swamp in the US 158/Waterlily Road intersection area, consisting of 0.4 acre of wetland hardwood forest, 0.1 acre of wetland mixed-pine/ hardwood forest, and less than 0.1 acre of upland man-dominated land. There would be no impacts to Great Swamp with ER2.

Additional detail on SNHAs is included in the revised *Natural Resources Technical Report* (CZR, Incorporated, 2011).

3.3.2.4 Impacts to Biotic Communities

Permanent impacts to biotic communities include losses because of fill, bridge pilings, shading, drainage easements, and cleared maintenance corridors. Shading from proposed bridge decks would primarily affect open water habitats, including existing and potential SAV habitat. Temporary impacts would result from fill and clearing during construction, but would likely return to natural conditions over time. The estimated amounts of permanent impacts to biotic communities within the project area are shown for each detailed study alternative, including the Preferred Alternative, in Table 3-5 and Table 3-6. The estimated amounts of temporary impacts to biotic communities are shown for each detailed study alternative, including the Preferred Alternative, in Table 3-7 and Table 3-8. Details on specific upland and wetland community types affected are presented in the revised *Natural Resources Technical Report* (CZR, Incorporated, 2011). More specific information on USACE jurisdictional waters impact is presented in Section 3.3.6. Potential impacts to CAMA coastal wetlands are identified in Section 3.3.7.

Table 3-5. Permanent Impacts to Biotic Communities by Detailed Study Alternative for ER2, MCB2/A, and MCB4/A

Biotic Community	ER2 (acres)				MCB2/A/C1 (acres)				MCB2/A/C2 (acres)				MCB4/A/C1 (acres)				MCB4/A/C2 (acres)			
	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing
Upland Impact																				
Upland man-dominated land	35.7 (33.9)	0.0	0.0	0.0	78.0 (76.3)	0.0	0.1	0.1	74.5 (72.8)	0.0	0.2	0.3	49.0 (47.3)	0.0	0.1	0.1	45.5 (43.8)	0.0	0.2	0.3
Upland agricultural land	0.2 (0.0)	0.0	0.0	0.0	16.3 (16.1)	0.0	0.0	0.0	16.3 (16.1)	0.0	0.0	0.0	16.3 (16.1)	0.0	0.0	0.0	16.3 (16.1)	0.0	0.0	0.0
Upland natural or naturalized communities	85.3	0.0	0.0	0.0	113.5	0.0	0.9	2.7	110.1	0.0	1.4	2.6	44.2	0.0	0.9	2.7	40.8	0.0	1.4	2.6
Total upland	121.2 (119.2)	0.0	0.0	0.0	207.7 (205.9)	0.0	1.0	2.8	200.9 (199.0)	0.0	1.6	2.9	109.5 (107.6)	0.0	1.0	2.8	102.6 (100.7)	0.0	1.6	2.9
Wetland Impact[1]																				
Wetland man-dominated land	0.2	0.0	0.0	0.0	1.2	0.0	0.0	0.1	1.2	0.0	0.0	0.1	1.0	0.0	0.0	0.1	1.0	0.0	0.0	0.1
Wetland natural or naturalized communities	4.8 (4.4)	0.0	0.0	0.0	11.7 (11.3)	0.0	10.2	25.0	9.0 (8.6)	0.0	12.5	29.8	7.5 (7.1)	0.0	10.2	25.0	4.9 (4.5)	0.0	12.5	29.8
Total wetland	5.0 (4.6)	0.0	0.0	0.0	12.9 (12.5)	0.0	10.2	25.1	10.2 (9.8)	0.0	12.5	29.9	8.5 (8.1)	0.0	10.2	25.1	5.9 (5.5)	0.0	12.5	29.9

Table 3-5 (concluded). Permanent Impacts to Biotic Communities by Detailed Study Alternative for ER2, MCB2/A, and MCB4/A

Biotic Community	ER2 (acres)				MCB2/A/C1 (acres)				MCB2/A/C2 (acres)				MCB4/A/C1 (acres)				MCB4/A/C2 (acres)			
	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing
Pond Impact	0.3	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Aquatic Bottom Impact (total/≤6 feet deep)	0.1/ 0.1	0.0/ 0.0	0.1/ 0.1	0.0/ 0.0	0.1/ 0.1	0.1/ 0.0	28.1/ 12.3	0.0/ 0.0	0.1/ 0.1	0.1/ 0.0	29.1/ 13.3	0.0/ 0.0	0.0/ 0.0	0.1/ 0.0	28.1/ 12.3	0.0/ 0.0	0.0/ 0.0	0.1 0.0	29.1/ 13.3	0.0/ 0.0
SAV Beds (Existing) Impact	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0	0.0	5.5	0.0	0.0	0.0	4.3	0.0	0.0	0.0	5.5	0.0
Stream Impact																				
Stream (acreage)	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stream (linear feet)	0.0	0.0	36.0	0.0	0.0	0.0	36.0	0.0	0.0	0.0	136.0	0.0	0.0	0.0	18.0	0.0	0.0	0.0	118.0	0.0
TOTAL IMPACT	126.6 (124.2)	0.0	0.2	0.0	221.9 (219.7)	0.1	39.4	27.9	211.4 (209.1)	0.1	43.3	32.8	119.1 (116.8)	0.1	39.3	27.9	108.6 (106.3)	0.1	43.2	32.8

Notes:

- The numbers in parentheses reflect the impact if reversing the center turn lane is used to reduce hurricane evacuation clearance times rather than constructing a third outbound lane. When there is no number in parentheses, the impact would be identical for either hurricane evacuation option. Also, the numbers in this table were rounded to the nearest tenth, so minor rounding error exists when adding the individual numbers to get the totals. The aquatic bottom numbers include the portion of the bottom with existing SAV beds.
- Some impact acreages have been revised since the DEIS. Changes corrected compiling, rounding, and typographical errors. The changes did not affect the conclusions of the biotic communities impact evaluation and were not a factor in the selection of the Preferred Alternative.

[1]The biotic community impacts are based on a preliminary design. Although useful in the context of differentiating potential permanent and temporary impacts of the detailed study alternatives to biotic communities, the wetland fill numbers presented in this table are not considered ideal for evaluating potential fill impacts to USACE jurisdictional resources because the preliminary design is subject to change based on a more detailed terrain model, hydraulic design, and other factors. As such, NCTA uses the edge of earthwork, or slope-stake line plus 25 feet, as a reasonable estimate for potential jurisdictional resource fill impacts. This information is presented in the jurisdictional impact discussion in Section 3.3.6.

Table 3-6. Permanent Impacts to Biotic Communities by Detailed Study Alternative for MCB2/B, MCB4/B, and the Preferred Alternative

Biotic Community	MCB2/B/C1 (acres)				MCB2/B/C2 (acres)				MCB4/B/C1 (acres)				MCB4/B/C2 (acres)				Preferred Alternative			
	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing
Upland Impact																				
Upland man-dominated land	79.2 (77.4)	0.0	0.7	0.0	75.7 (74.0)	0.0	0.7	0.3	50.1 (48.3)	0.0	0.7	0.0	46.6 (44.8)	0.0	0.0	0.3	38.9	0.0	0.1	0.4
Upland agricultural land	35.7 (35.5)	0.0	0.0	0.0	35.7 (35.5)	0.0	0.0	0.0	35.7 (35.5)	0.0	0.0	0.0	35.7 (35.5)	0.0	0.0	0.0	15.3	0.0	0.0	0.0
Upland natural or naturalized communities	121.8	0.0	0.6	0.5	118.4	0.0	0.4	0.4	52.5	0.0	0.6	0.5	49.1	0.0	0.4	0.4	33.6	0.0	0.4	1.3
Total upland	236.7 (234.7)	0.0	1.3	0.5	229.8 (227.9)	0.0	1.1	0.7	138.3 (136.3)	0.0	1.3	0.5	131.4 129.4	0.0	0.4	0.7	87.8	0.0	0.5	1.7
Wetland Impact[1]																				
Wetland man-dominated land	2.4	0.0	0.0	0.0	2.4	0.0	0.0	0.0	2.2	0.0	0.0	0.0	2.2	0.0	0.0	0.0	1.1	0.0	0.0	0.1
Wetland natural or naturalized communities	40.6 (40.1)	0.0	0.5	0.3	37.9 (37.4)	0.0	2.7	5.1	36.4 (35.9)	0.0	0.5	0.3	33.8 (33.3)	0.0	2.7	5.1	5.0	0.0	10.1	25.4
Total wetland	43.0 (42.5)	0.0	0.5	0.3	40.3 (39.8)	0.0	2.7	5.1	38.6 (38.1)	0.0	0.5	0.3	36.0 (35.5)	0.0	2.7	5.1	6.1[2]	0.0	10.1	25.5

Table 3-6 (concluded). Permanent Impacts to Biotic Communities by Detailed Study Alternative for MCB2/B, MCB4/B, and the Preferred Alternative

Biotic Community	MCB2/B/C1 (acres)				MCB2/B/C2 (acres)				MCB4/B/C1 (acres)				MCB4/B/C2 (acres)				Preferred Alternative			
	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing
Pond Impact	1.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aquatic Bottom Impact (total/≤6 feet deep)	0.1/0.1	0.1/ 0.0	28.1/ 12.3	0.0/ 0.0	0.1/0.1	0.1/ 0.0	29.1/ 13.3	0.0/ 0.0	0.0/ 0.0	0.1/ 0.0	28.1/ 12.3	0.0/ 0.0	0.0/ 0.0	0.1/ 0.0	29.1/ 13.3	0.0/ 0.0	0.0/ 0.0	0.1/ 0.0	27.8/ 8.7	0.0/ 0.0
SAV Beds (Existing) Impact	0.0	0.0	4.3	0.0	0.0	0.0	5.5	0.0	0.0	0.0	4.3	0.0	0.0	0.0	5.5	0.0	0.0	0.0	3.8	0.0
Stream Impact																				
Stream (acreage)	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stream (linear feet)	0.0	0.0	36.0	0.0	0.0	0.0	136.0	0.0	0.0	0.0	18.0	0.0	0.0	0.0	118.0	0.0	0.0	0.0	0.0	0.0
TOTAL IMPACT	281.0 (278.5)	0.1	30.0	0.8	270.4 (268.0)	0.1	33.0	5.8	178.0 (175.5)	0.1	29.9	0.8	167.5 (165.0)	0.1	32.2	5.8	93.9	0.1	38.4	27.2

Notes:

- The numbers in parentheses reflect the impact if reversing the center turn lane is used to reduce hurricane evacuation clearance times rather than constructing a third outbound lane. When there is no number in parentheses, the impact would be identical for either hurricane evacuation option. Also, the numbers in this table were rounded to the nearest tenth, so minor rounding error exists when adding the individual numbers to get the totals. The aquatic bottom numbers include the portion of the bottom with existing SAV beds.
- Some impact acreages have been revised since the DEIS. Changes corrected compiling, rounding, and typographical errors. The changes did not affect the conclusions of the biotic communities impact evaluation and were not a factor in the selection of the Preferred Alternative.

[1]The biotic community impacts are based on a preliminary design. Although useful in the context of differentiating potential permanent and temporary impacts of the detailed study alternatives to biotic communities, the wetland fill numbers presented in this table are not considered ideal for evaluating potential fill impacts to USACE jurisdictional resources because the preliminary design is subject to change based on a more detailed terrain model, hydraulic design, and other factors. As such, NCTA uses the edge of earthwork, or slope-stake line plus 25 feet, as a reasonable estimate for potential jurisdictional resource fill impacts. This information is presented in the jurisdictional impact discussion in Section 3.3.6.

[2]The Preferred Alternative includes a median acceleration lane to mitigate impacts to turning safety at Waterlily Road associated with the US 158 interchange. This addition increased the wetland fill impacts associated with the Preferred Alternative by approximately 1.5 acres. The median acceleration lane also would be needed with MCB2/A and MCB4/A, but was not included in the preliminary designs for these alternatives assessed first in the DEIS and now in this FEIS.

Table 3-7. Temporary Impacts to Biotic Communities by Detailed Study Alternative for ER2, MCB2/A, and MCB4/A

Biotic Community	ER2 (acres)	MCB2/A/C1 (acres)	MCB2/A/C2 (acres)	MCB4/A/C1 (acres)	MCB4/A/C2 (acres)
Upland Impacts					
Upland man-dominated land	75.0 (1.7)	7.4 (1.5)	7.9 (2.0)	8.2 (0.0)	8.2 (0.0)
Upland agricultural land	29.9 (0.0)	1.7 (0.0)	1.7 (0.0)	1.7 (0.0)	1.7 (0.0)
Upland natural communities	8.3 (2.5)	0.3 (0.1)	0.3 (0.1)	0.1 (0.0)	0.1 (0.0)
Total upland	113.2 (4.2)	9.4 (1.6)	9.9 (2.1)	10.0 (0.1)	10.0 (0.1)
Wetland Impacts					
Wetland man-dominated land	0.5 (0.0)	0.3 (0.0)	0.3 (0.0)	0.7 (0.0)	0.7 (0.0)
Wetland natural communities	1.7 (0.0)	1.4 (0.0)	1.4 (0.0)	1.4 (0.0)	1.4 (0.0)
Total wetland	2.2 (0.0)	1.7 (0.0)	1.7 (0.0)	2.1 (0.0)	2.1 (0.0)
Pond Impact	0.0	0.0	0.0	0.0	0.0
Open Water Impact	0.1 (0.0)	0.0	0.0	0.0	0.0
SAV Beds (Existing) Impact	0.0	0.0	0.0	0.0	0.0
Aquatic Bottom	0.0	0.0	0.0	0.0	0.0
Stream Impacts					
Stream (acreage)	0.0	0.0	0.0	0.0	0.0
Stream (linear feet)	171.7 (clearing)	0.0	0.0	0.0	0.0
TOTAL IMPACT	115.5 (4.2)	11.1 (1.6)	11.6 (2.1)	12.2 (0.0)	12.2 (0.0)

Note: The numbers in parentheses reflect the impact if reversing the center turn lane is used to reduce hurricane evacuation clearance times rather than constructing a third outbound lane. When there is no number in parentheses, the impact would be identical for either hurricane evacuation option. Also, the numbers in this table were rounded to the nearest tenth, so minor rounding error exists when adding the individual numbers to get the totals.

Table 3-8. Temporary Impacts to Biotic Communities by Detailed Study Alternative for MCB2/B, MCB4/B, and the Preferred Alternative

Biotic Community	MCB2/B/C1 (acres)	MCB2/B/C2 (acres)	MCB4/B/C1 (acres)	MCB4/B/C2 (acres)	Preferred Alternative[1]
Upland Impacts					
Upland man-dominated land	7.9 (1.5)	7.9 (1.5)	8.7 (0.0)	8.7 (0.0)	2.1/0.5
Upland agricultural land	1.8 (0.1)	1.8 (0.1)	1.8 (0.1)	1.8 (0.1)	0.0
Upland natural communities	0.3 (0.2)	0.3 (0.2)	0.2 (0.0)	0.2 (0.0)	0.0/0.6
Total upland	10.0 (1.7)	10.0 (1.7)	10.7 (0.1)	10.7 (0.1)	2.1/1.1
Wetland Impacts					
Wetland man-dominated land	0.3 (0.0)	0.3 (0.0)	0.7 (0.0)	0.7 (0.0)	0.0
Wetland natural communities	1.4 (0.0)	1.4 (0.0)	1.4 (0.0)	1.4 (0.0)	0.0
Total wetland	1.7 (0.0)	1.7 (0.0)	2.2 (0.0)	2.2 (0.0)	0.0
Pond Impact	0.0	0.0	0.0	0.0	0.0
Open Water Impact	0.0	0.0	0.0	0.0	0.0
SAV Beds (Existing) Impact	0.0	0.0	0.0	0.0	0.0
Aquatic Bottom	0.0	0.0	0.0	0.0	0.0
Stream Impacts					
Stream (acreage)	0.0	0.0	0.0	0.0	0.0
Stream (linear feet)	0.0	0.0	0.0	0.0	0.0
TOTAL IMPACT	11.7 (1.7)	11.7 (1.7)	12.9 (0.1)	12.9 (0.1)	2.1/1.1

Notes:

- Temporary impact calculations only include areas contained within temporary construction easements and do not include temporary impacts to the waters of Currituck Sound. The numbers in parentheses reflect the impact if reversing the center turn lane is used to reduce hurricane evacuation clearance times rather than constructing a third outbound lane. When there is no number in parentheses, the impact would be identical for either hurricane evacuation option. Also, the numbers in this table were rounded to the nearest tenth, so minor rounding error exists when adding the individual numbers to get the totals.
- The stream (linear feet) impact for MCB2/B/C1 was incorrectly shown as 171.7 (clearing) linear feet in the DEIS. This was corrected and shows that there would be no stream impacts with MCB2/B/C1. The change did not affect the conclusions of the biotic communities impact evaluation and was not a factor in the selection of the Preferred Alternative.

[1]The number after the slash reflects the area of a permanent utility easement. Impacts in the easement would occur when utilities are relocated and then the impacted features within the easement would be restored. This number reflects a detail added to the preliminary design of the Preferred Alternative that was not included in the impact calculations for the DEIS detailed study alternatives.

The tables reflect changes in the biotic communities because of logging that has occurred in Maple Swamp since the preparation of the assessment included in the DEIS. The proposed bridge would not likely affect the recovery of the forested communities in Maple Swamp outside the bridge corridor because there would be no hydraulic changes in the swamp as a result of the Preferred Alternative.

Table 3-5 and Table 3-6 indicate that:

- The total impact (i.e., fill, pilings, and clearing) on natural upland communities would be least with the Preferred Alternative;

- The fill impact in wetlands would be similar for all of the detailed study alternatives except MCB2/B and MCB4/B. The fill impact on wetlands with Option B would be substantially more than Option A for each MCB alternative;

- A Mid-Currituck Bridge would involve wetlands clearing impacts in addition to fill impacts (with or without construction of a third outbound lane for hurricane evacuation on US 158). The impact would be similar between the detailed study alternatives but least with the Preferred Alternative;

- A Mid-Currituck Bridge would affect aquatic bottom and existing and potential SAV habitat (primarily by shading), with the Preferred Alternative having the least shading impact on existing SAV beds and potential SAV habitat (areas of the sound 6 feet deep or less and have a suitable substrate); and

- No fill would be placed in streams. With a third outbound lane for hurricane evacuation on US 158 over Jean Guite Creek with MCB4, a single piling would be installed in the creek, and the existing bridge over the creek would be widened by 18 feet. With ER2 and MCB2, the bridge over Jean Guite Creek would be widened by 36 feet for the widening of US 158. MCB2/C2 and MCB4/C2 also would result in a small amount of shading over a single stream on the Outer Banks. The Preferred Alternative would not include any alteration of the bridge over Jean Guite Creek and, therefore, would not affect the creek.

Table 3-7 and Table 3-8 indicate that, in general, temporary impacts to biotic communities would be greatest with ER2 with construction of a third outbound lane for hurricane evacuation. These impacts are primarily associated with the third outbound hurricane evacuation lane and are minor for any detailed study alternative without the lane. Temporary impacts to biotic communities with MCB2 and MCB4 would range from 11.1 to 12.9 acres with construction of a third outbound lane for hurricane evacuation. Temporary impacts to biotic communities with the Preferred Alternative would be 3.2 acres.

Openings in forested communities created by vegetation removal would lead to adverse effects including community fragmentation, introduction of shade-intolerant weedy species, and alteration of other environmental factors that affect biotic community dynamics. These "edge effects" would be most prominent in forest and swamp

communities of Maple Swamp and the Outer Banks with MCB2, MCB4, and the Preferred Alternative.

Another effect of the loss of wetland habitat would be the loss of a source of detritus (non-living particulate organic material), which is the basis of several food chains and serves as an energy source for micro-organisms, algae, plants, and small animals in the water and soil (Magee, 1993). MCB2/A, MCB4/A, and the Preferred Alternative would not affect the transport of detrital material through Maple Swamp or to Currituck Sound. MCB2/B and MCB4/B would result in direct loss of a source of detritus as a result of fill in the wetland, but the loss would be mitigated. Transport of detritus within the swamp would still occur through the use of wildlife crossings and hydraulic equalizer pipes.

3.3.3 How would wildlife on land be affected?

Each of the detailed study alternatives, including the Preferred Alternative, would result in the removal of existing vegetative habitats and the displacement of wildlife within the project construction limits. ER2 would be the least invasive to habitat, followed by the Preferred Alternative. Removal and alteration of wildlife habitat would be greatest for MCB2 and MCB4. MCB2/B and MCB4/B would have a greater impact on wildlife than MCB2/A, MCB4/A, and the Preferred Alternative because with MCB2/B and MCB4/B there would be a new road in Maple Swamp rather than a bridge. Although provisions would be made for wildlife passage, the fill would make it more difficult for wildlife to move across the project right-of-way.

3.3.3.1 Land Wildlife Characteristics

The project area encompasses a wide diversity of natural habitat types that support a great diversity of wildlife, including black bears. Many amphibian and reptile species utilize the wetland communities for reproduction and the upland communities for other phases of their lives. Mammalian diversity is generally higher on the mainland compared to the Outer Banks. Most of the wildlife species in the area are not restricted to one habitat type and are known to range through a variety of plant communities, both upland and wetland.

The Mid-Atlantic region of the United States is an extremely important wintering habitat for waterfowl, and Currituck Sound has a long history of attracting large concentrations of wintering waterfowl (North American Waterfowl Management Plan, Plan Committee, 2004). However, there have been substantial declines in waterfowl numbers since the 1980s. The US Fish and Wildlife Service's (USFWS's) mid-winter waterfowl survey data (2001-2009) indicate that the trend of declining waterfowl usage of Currituck Sound is similar to the trend for the entire Outer Banks, except around Pea Island National Wildlife Refuge, which has been generally increasing.

The project area includes habitats used for nesting by a variety of birds. Maritime habitats that normally support nesting of colonial waterbirds are only present on the Outer Banks side of the project area, and no evidence of waterbird colonies was found in this area during field work. Cavity-nesting species potentially occur in bottomland

habitats such as Maple Swamp. No species of passerine neotropical migrants (perching birds from south of the Tropic of Cancer) are listed in the NCNHP list of rare animal occurrences for Currituck County. However, appropriate breeding habitat for rare species such as black-throated green warbler is present in the project area.

3.3.3.2 Impacts to Land Wildlife and Land Wildlife Habitat

Each of the detailed study alternatives, including the Preferred Alternative, would result in the removal of existing vegetative habitats and the displacement of wildlife within the project construction limits. Wildlife species are dependent upon the available resources in the habitats used. Wildlife inhabiting the construction area would either be temporarily displaced, permanently displaced, or lost.

ER2 would be the least invasive to wildlife habitat, since construction would occur in primarily man-dominated areas. Road widening would increase the role of existing roads as impassable barriers that restrict wildlife movement. Roads can potentially isolate populations and prevent genetic exchange by impeding and/or blocking the movement of wildlife searching for new resources and mates in areas other than their own territory. Removal and alteration of wildlife habitat would be greatest for MCB2, MCB4, and the Preferred Alternative as a result of a new traffic corridor across Maple Swamp and a bridge across Currituck Sound. While the wildlife species composition of forest and swamp communities naturally changes over time as habitats mature or are affected by other natural forces, these alternatives are likely to alter the wildlife species composition of the affected forest and swamp communities of Maple Swamp. Species requiring large areas of undisturbed habitat (e.g., black bear) would likely disappear from areas near these corridors, whereas species attracted to edge communities would likely become more common. However, in order to minimize these impacts, the bridge corridors were placed adjacent to a cleared and actively maintained (cleared of trees) utility corridor through Maple Swamp.

With MCB2/A, MCB4/A, and the Preferred Alternative, which include bridging Maple Swamp, the movement of terrestrial wildlife should not be restricted; however, movement of species away from and toward the edge communities of the project corridor could increase competition for limited resources.

MCB2/B and MCB4/B, which include a road on fill through the swamp, would substantially affect the movement of wildlife. Potential effects of roadways on wildlife include: reductions in numbers, habitat, and genetic diversity, and impediments to wildlife migrations and daily travel (Jones, 2008; Cramer and Bissonette, 2009). Road mortalities have been found to significantly affect black bear populations in the southern Appalachians and could substantially reduce or eliminate populations of amphibians (Donaldson, 2005). Wildlife can pass under a bridge much easier and safer than across a road. Provisions for wildlife passage in Maple Swamp were included in MCB2/B and MCB4/B. The preliminary design includes: two bridges with 180-foot spans at the eastern and western sides of the swamp; a 12-foot by 8-foot box culvert at the center of the swamp; and two 43-inch by 68-inch pipes for passage of reptiles and amphibians. Exclusionary fencing along the road also is assumed. The majority of literature on

wildlife crossing structures has found that fencing substantially increases the effectiveness of crossing structures and further reduces the number of wildlife-vehicle collisions. Wildlife need to be funneled to the crossing structures; otherwise, it will be more difficult for them to find the bridge spans or culverts. Option B, however, was not included in the Preferred Alternative.

While all of the detailed study alternatives, including the Preferred Alternative, are near existing road or utility corridors and are under the influence of associated edge effects, these alternatives would amplify those effects. This would be especially detrimental to maritime wildlife habitat on the Outer Banks, where existing habitat is already extremely sparse and fragmented. MCB2, MCB4, and the Preferred Alternative would introduce noise disturbance into Maple Swamp.

With ER2, the road widening portions of MCB2, MCB4, and the Preferred Alternative, and the Maple Swamp fill with mainland approach road Option B, mammals, reptiles, amphibians, and avian species would all continue to be roadkill concerns. Because MCB2, MCB4, and the Preferred Alternative include a new bridge structure across Maple Swamp and Currituck Sound, avian species would be a new roadkill concern. Avian species potentially affected include those that commonly perch on bridges such as gulls, terns, wading birds, pelicans, and possibly some raptors. Substantial bridge mortality has been documented in purple martins (www.purplemartinroost.com), royal terns (Bard et al., 2001), and brown pelicans (Owens and James, 1991). Several species of gulls were commonly observed dead on the Wright Memorial Bridge while conducting field work. NCTA would incorporate features to discourage roosting/perching birds. During final design, NCTA would investigate proven methods of reducing collisions between vehicles operating on the bridge and flying birds and incorporate them as appropriate.

The Mid-Currituck Bridge design used to assess impacts does not include the placement of lights on the bridge across Currituck Sound. The possibility of a bicycle path on the bridge that could include low (i.e., close to the bridge deck) lighting was considered and not included in the Preferred Alternative.

Although the exact effects of the bridge on wintering waterbirds are difficult to quantify, waterfowl and other birds associated with the water/shore can become accustomed to some disturbances and roadways. Large aggregations of waterfowl and shorebirds frequently use areas near and under Bonner Bridge, as well as along and near public roads that traverse through both Pea Island and Lake Mattamuskeet National Wildlife Refuges. 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 substantially alter 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.

Although evidence of wildlife population declines as a result of roadway mortality has persisted for years, the long-term effects of road avoidance resulting from traffic noise have only recently been studied. Traffic noise is a potential threat to an animal's health, reproductive success, physiology, and behavior (Forman and Alexander, 1998; Radle, 2006). Road avoidance because of noise/human activity has been extensively documented for wildlife species such as black bears (Brody and Pelton, 1989), bobcats (Lovallo and Anderson, 1996), wolves (Thurber et al., 1994), and songbirds (Reijnen et al., 1995; Reijnen et al., 1996; Forman and Alexander, 1998). Some species may become habituated to noise disturbances, but many species display reduced nesting and activity near areas of traffic noise (Fernández-Juricic, 2001) and wildlife populations may become isolated as a result of restricted movement (Donaldson, 2005). For example, black bears frequently avoid habitat within 300 feet of roads (Jones, 2008). Even though road noise has a varying effect on wildlife, it seems to affect substantially avian communities that utilize sound in their basic behaviors (Coffin, 2007). Noise levels as low as those found in a library reading room (42 to 48 decibels) have been found to affect negatively some avian species (reviewed in Forman and Alexander, 1998).

A synthesis of studies on the effects of roads on wildlife found that more information is needed on the relation between road noise and wildlife (Kaseloo and Tyson, 2004). Many studies did not quantify noise levels or left out factors such as landscape variables that may have also contributed to wildlife behavior. However, after their analysis of the publications, Kaseloo and Tyson (2004) concluded that traffic noise does have an effect on wildlife. The effect is variable depending on the species and other factors such as surrounding landscape and type of disturbance. It is unclear in many of the studies if noise is a significant effect, predictor variable, or just a contributing factor. Traffic noise has been shown to interrupt aestivation in spadefoot toads and some waterfowl species such as wood ducks did not become habituated to noise but other species such as black ducks, became habituated to noise (Kaseloo and Tyson, 2004).

3.3.4 How would aquatic wildlife be affected?

Fill, pile placement, shading, and clearing would result directly in the permanent loss or alteration of aquatic habitat and the wildlife that live there. Construction operations could result in temporary impacts. Aquatic impacts would be the greatest with MCB2, MCB4, and the Preferred Alternative because they include a Mid-Currituck Bridge.

3.3.4.1 Aquatic Wildlife

Macroinvertebrate populations of Currituck Sound are composed primarily of burrowing amphipods near the shore, but there is a more diverse population in deeper

areas. Currituck Sound has long been recognized as a nationally important area for freshwater recreational fishing. The decline of freshwater fisheries in Currituck Sound has been attributed to the increase in salinity and decrease in SAV during the 1980s. Commercial fishing activities with haul seines and gill nets have also decreased since the 1960s (Borawa et al., 1978). Currituck Sound is an important nursery area for migratory and resident fish.

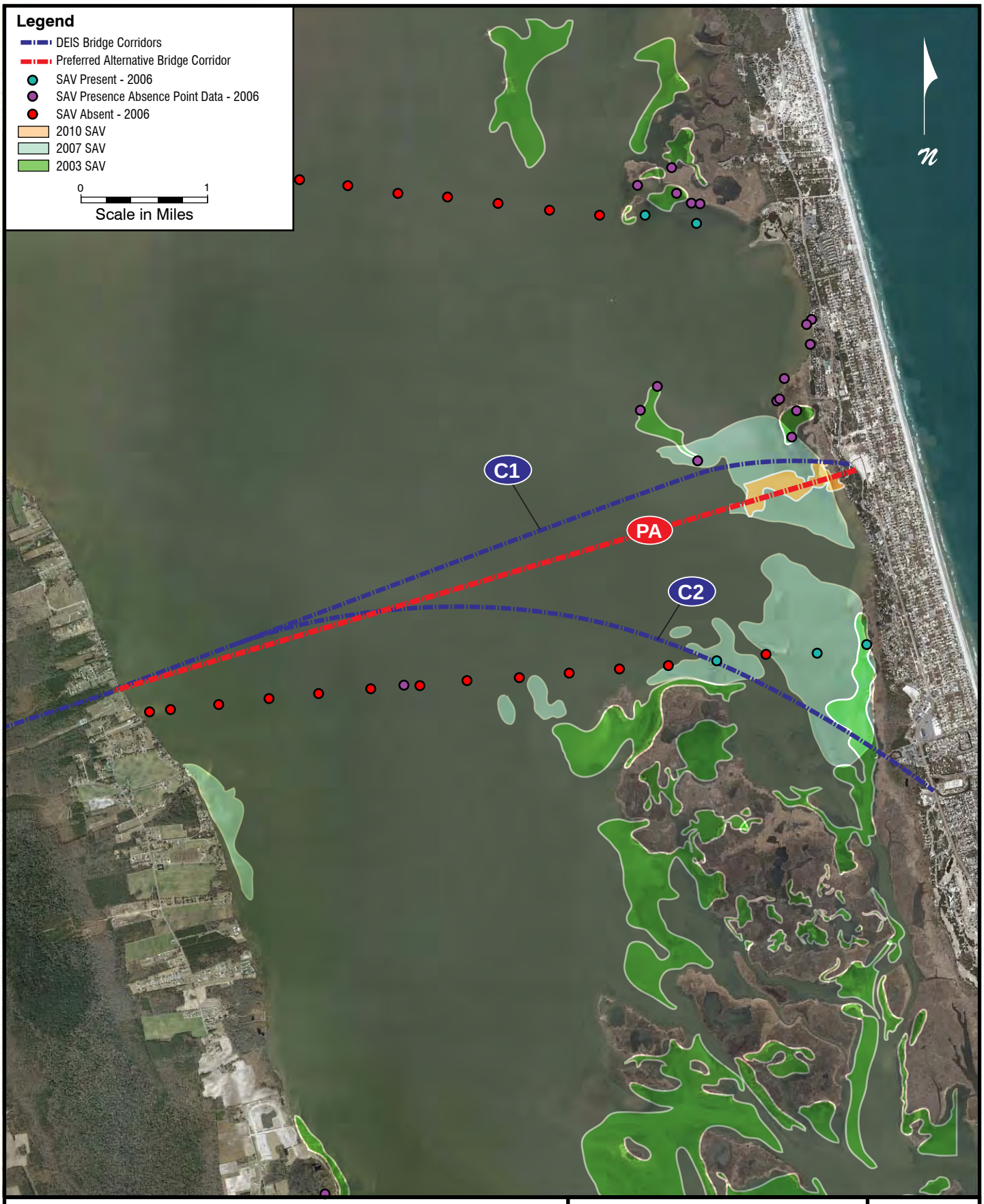
In the past, nursery areas for two anadromous fish species, the blueback herring and alewife, were known to occur within Currituck Sound. Nursery areas for these species, including Whale Head Bay and Sanders Bay, were identified in the sound from 1980 to 1983. The status of the populations of these two species was identified as declining in the sound during 1980 (Copeland and Gray, 1989), and these areas are no longer officially recognized as anadromous fish spawning areas or primary nursery areas.

3.3.4.2 Submerged Aquatic Vegetation

The shallow waters (6 feet deep or less) of Currituck Sound provide habitat and potential habitat for extensive beds of SAV. NCMFC defines SAV habitat as currently vegetated with one or more appropriate (native) SAV species, or has been vegetated by one or more appropriate species within the past 10 annual growing seasons, and meets the average growing conditions needed (water depth of 6 feet or less, average light availability [Secchi depth of 1 foot or more], and limited wave exposure). Survey data from the last 10 annual growing seasons was gathered in 2003, 2006, 2007, and 2010 and is shown in Figure 3-6. These SAV habitats are included within the open water areas of Currituck Sound and on the eastern side of the sound in the project area. In the western portion of Currituck Sound, SAV was only found along the immediate western shoreline and coverage was estimated at less than 10 percent in an area less than 2 acres. For many juvenile and adult fish, the structural complexity of SAV habitat provides refuge from predators. These habitats are also rich in invertebrates and, therefore, serve as important foraging areas. Other SAV roles include stabilization of sediment, nutrient cycling, reduction of wave energy, and provision of organic matter that supports complex food webs (North Carolina Wildlife Resources Commission [NCWRC], 2005). For these reasons, SAV habitat is considered Habitat Areas of Particular Concern (HAPC) for several managed fish species. The distribution and composition of SAV habitat is influenced by several factors; among the most important factors are light, salinity, wave action, and nutrient levels.

3.3.4.3 Water Habitat Impacts

Impacts on aquatic communities are listed in Table 3-5 to Table 3-8. Fill, pile placement, shading, and clearing would result directly in the permanent loss or alteration of aquatic habitat within the project area, as indicated in Table 3-5 and Table 3-6. Aquatic impacts would be the greatest with MCB2, MCB4, and the Preferred Alternative because they include a Mid-Currituck Bridge. Impacts would result primarily from shading. Shading would affect 12.3 to 13.3 acres of aquatic bottom in 6 feet of water or less (potential SAV habitat) with MCB2 and MCB4, 8.7 acres with the Preferred Alternative, and 0.1 acre with ER2. The bridge would shade 3.8 (Preferred Alternative) to 5.5 (bridge corridor C2)



SAV Data from 2003, 2006, 2007 and 2010

Figure

3-6

acres of existing SAV beds. There would also be a piling impact to existing SAV beds as a result of the bridge foundations, but it would be less than 0.1 acre. Altered light levels and the introduction of piles as a hard substrate previously unavailable in the area would result in changes to the existing food web structure. Decreased autotrophic productivity (phytoplankton and aquatic vegetation) resulting from lower light levels could result in a decreased abundance of aquatic vegetative habitat (including SAV), heterotrophic grazers, and predators (zooplankton, benthic invertebrates, and fish). On the other hand, organisms could be attracted to bridge pilings as a reef structure. Additional discussion of SAV (and EFH) impacts and impact mitigation for the Preferred Alternative is presented in Section 3.3.7.2.

Overall, ER2 and the widening components of the detailed study alternatives would result in minor impacts to aquatic habitat. Runoff from active construction areas could result in temporary increases in turbidity, siltation, and sedimentation in aquatic habitat areas, but these affects are expected to be minimal and cease after revegetation.

3.3.4.4 Impacts from Noise, Turbidity, and Siltation

Historic and present stresses to aquatic flora and fauna in Currituck Sound have occurred as a result of increased fishing pressure and practices and natural and anthropogenic fluctuations in nutrient loading, turbidity and salinity (NCDEHNR, 1994; Caldwell, 2001; USACE, 2010), so it is important to NCTA to minimize project-related impacts to the sound so as not to compound existing problems. The proposed construction of the Mid-Currituck Bridge is not anticipated to affect the salinity of Currituck Sound.

Bridge construction associated with MCB2, MCB4, and the Preferred Alternative would take place over Currituck Sound. The over water construction activities associated with these alternatives would produce noise, turbidity, and siltation, thereby creating localized, short-term impacts to aquatic habitat. Noise from open water construction activity would be a temporary, localized disturbance to fish. Construction related noise generated during pile driving could be of sufficient intensity to kill or injure marine organisms (reviewed in Hanson et al., 2004). At the ecosystem level, turbidity would result in a reduction in ecosystem productivity (i.e., ability of the system to produce and export energy) and nursery value by eliminating organisms that cannot readily move, and displacing mobile organisms. For individual organisms, turbidity can impair visual predation success, predator avoidance, and oxygen uptake by clogging respiratory structures. Siltation could generate increased water column turbidity, as well as smother or alter benthic vegetative and animal communities. These impacts likely would be prolonged because of poor water circulation in the sound. Because of the degraded habitat value, most mobile animals would avoid the area of construction for the duration of the construction phase, while non-mobile shellfish, such as clams, could suffer long-term impacts from construction-related siltation. Benthic organisms are expected to recover rapidly after construction ceases, as most soft bottom benthic communities are resilient and likely to re-colonize quickly. NCTA would take practicable measures to minimize turbidity generated during bridge construction.

Construction techniques proposed for use in Mid-Currituck Bridge construction to minimize impacts to aquatic habitat during construction are described in Section 2.4. They include:

- No dredging in any part of Currituck Sound.
- Pile installation using both vibratory and impact hammers, with no jetting of piles.
- Turbidity curtains would be used around piles being driven in SAV habitat (including existing beds), as defined by NCMFC, and potential SAV habitat when necessary.
- No in-water bottom-disturbing activities in SAV habitat (including existing beds), as defined by NCMFC, during a moratorium period from approximately February 15 to September 30, with slight variations possible based on water temperatures.
- Use of an open (i.e., beams only to support a crane) temporary construction trestle over SAV habitat (including existing beds), as defined by NCMFC, on the eastern side of Currituck Sound to minimize shading impacts while the trestle is in place.

Final construction methods for the Preferred Alternative will be selected as part of the permitting process (see Project Commitment #3).

3.3.4.5 Commercial Fisheries Impacts

Ongoing commercial fishing activity exists in the project area. MCB2, MCB4, and the Preferred Alternative should have little impact on commercial fishing operations. However, the presence of a bridge structure across Currituck Sound could disrupt fishing operations by reducing trawling area and restricting net and crab pot deployment.

3.3.4.6 Additional Detail and Information

Additional detail on impacts to aquatic habitat is included in the revised *Natural Resources Technical Report* (CZR, Incorporated, 2011). Additional information on potential impacts to EFH and protected species is included in Section 3.3.7.2. An extensive analysis pertaining to the Preferred Alternative is included in the revised *Essential Fish Habitat Report* (CZR, Incorporated, 2011). Both technical reports are available on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/.

3.3.5 How would invasive species be controlled?

The diversity, abundance and health of natural communities can be negatively affected by the introduction of exotic species. NCTA would follow NCDOT's Best Management Practices (BMPs) for the management of invasive plant species during project construction.

3.3.6 What impacts would occur to waters under the jurisdiction of the US Army Corps of Engineers?

All of the detailed study alternatives, including the Preferred Alternative, would result in placing fill in waters under the jurisdiction of USACE. Fill in jurisdictional areas would be the least for the Preferred Alternative, ER2, and MCB4/A/C2. The largest area of fill in jurisdictional areas would be with MCB2/B and MCB4/B, which include crossing Maple Swamp on fill. Clearing of jurisdictional areas would be greatest with MCB2, MCB4, and the Preferred Alternative because of the Mid-Currituck Bridge. Opportunities for mitigation are available. Efforts have already been made to avoid and minimize impacts to these resources, including project refinements incorporated into the Preferred Alternative. A permit for these impacts would be required.

3.3.6.1 Jurisdictional Features in the Project Area

As described in Section 3.3.1.1, seven jurisdictional streams were identified within the project area. Approximately 4,781 acres of wetlands and waters that are jurisdictional under Section 404 of the Clean Water Act were found in the project area. The majority of this acreage (approximately 3,897 acres) is Currituck Sound. Wetlands occur in 11 communities within the project area: mixed herbaceous (in man-dominated area), disturbed shrub/scrub, mixed-pine/hardwood forest, hardwood forest, bay forest, swamp forest, maritime shrub/grassland, maritime forest, maritime swamp, freshwater marsh, and open-water (includes SAV). These communities are described in the revised *Natural Resources Technical Report* (CZR, Incorporated, 2011). Maps showing delineated streams, wetlands (by type), and other jurisdictional features are included as Figure 5 in the revised *Natural Resources Technical Report* (CZR, Incorporated, 2011) on the CD that accompanies this FEIS. The relationship of delineated streams, wetlands, and other jurisdictional areas to the DEIS detailed study alternatives were shown on the public hearing maps on the CD that accompanied the DEIS. The preliminary engineering plans on the CD that accompanies this FEIS show the relationship of the Preferred Alternative to jurisdictional features.

3.3.6.2 Impacts to Jurisdictional Features

A summary of the jurisdictional impacts that would occur with each of the detailed study alternatives is shown in Table 3-9 and Table 3-10. Temporary impacts to jurisdictional areas include impacts to areas within temporary construction easements that would be disturbed during construction activities, but would return to their natural state after construction is completed. Permanent impacts include fill and piling placement, drainage easements, and permanently cleared areas under proposed bridge structures. Cleared areas would be a permanent impact in that it is expected that they would remain cleared in the long-term. However, stumps would not be removed nor the area grubbed and graded. Therefore, these areas would remain wetlands and the impact would not be considered a permanent fill impact requiring mitigation under Section 404. A separate permanent impact calculation is included that calculates the fill area within the slope-stake line (edge of earth moving during construction), and within wetland areas which includes an additional 25-foot buffer. This calculation is included

Table 3-9. Jurisdictional Impacts by Detailed Study Alternative for ER2, MCB2/A and MCB4/A

	ER2 (acres)	MCB2/A/C1 (acres)	MCB2/A/C2 (acres)	MCB4/A/C1 (acres)	MCB4/A/C2 (acres)
Wetlands					
Fill	5.0 (4.6)	12.8 (12.5)	10.2 (9.8)	8.5 (8.1)	5.9 (5.5)
Pilings	0.0	0.0	0.0	0.0	0.0
Clearing[1]	0.0	25.7	30.6	25.8	30.6
Total Permanent Impacts	5.0 (4.6)	38.5 (38.2)	40.7 (40.3)	34.4 (34.0)	36.5 (36.1)
Temporary	2.1 (0.0)	1.7 (0.0)	1.7 (0.0)	2.1 (0.0)	2.1 (0.0)
Total Wetland Impacts	7.1 (4.6)	40.2 (38.2)	42.4 (40.3)	36.6 (34.0)	38.7 (36.1)
Open Water					
Fill	0.1	0.1	0.1	0.0	0.0
Pilings	0.0	0.1	0.1	0.1	0.1
Clearing	0.0	0.0	0.0	0.0	0.0
Total Permanent Impacts	0.1	0.2	0.2	0.1	0.1
Temporary	0.1 (0.0)	0.0	0.0	0.0	0.0
Total Open Water Impacts	0.2 (0.0)	0.2	0.2	0.1	0.1
Total Stream Impacts (acres/feet)	0.0/171.7 in temporary clearing (0.0/0.0)	0.0/0.0	0.0/0.0	0.0/0.0	0.0/0.0
Total Pond Impacts (Fill)	0.3	1.2	0.2	1.1	0.1
Total Jurisdictional Impacts	7.6 (5.1)	41.6 (39.6)	42.8 (40.7)	37.8 (35.2)	38.9 (36.3)
Wetland within Slope-Stake Line, plus Additional 25-foot buffer					
Total Impact	12.6 (8.6)	21.1 (17.1)	16.5 (12.5)	15.4 (10.6)	10.9 (6.0)

Notes:

- The numbers in parentheses reflect the impact if reversing the center turn lane is used to reduce hurricane evacuation clearance times rather than constructing a third outbound lane. When there is no number in parentheses, the impact would be identical for either hurricane evacuation option. Also, the numbers in this table were rounded to the nearest tenth, so minor rounding error exists when adding the individual numbers to get the totals.
- Some impact acreages have been revised since the DEIS. Changes corrected compiling, rounding, and typographical errors. The changes did not affect the conclusions of the impact evaluation and were not a factor in the selection of the Preferred Alternative.

[1]Cleared areas would be a permanent impact in that it is expected that they would remain cleared in the long-term. However, stumps would not be removed nor the area grubbed and graded. Therefore, these areas would remain wetlands and the impact would not be considered a permanent fill impact requiring mitigation under Section 404.

Table 3-10. Jurisdictional Impacts by Detailed Study Alternative for MCB2/B, MCB4/B, and the Preferred Alternative

	MCB2/B/C1 (acres)	MCB2/B/C2 (acres)	MCB4/B/C1 (acres)	MCB4/B/C2 (acres)	Preferred Alternative (acres)
Wetlands					
Fill	43.0 (42.5)	40.3 (39.8)	38.6 (38.1)	36.0 (35.5)	6.1
Pilings	0.0	0.0	0.0	0.0	0.0
Clearing[1]	0.3	5.1	0.3	5.1	25.5
Total Permanent Impacts	43.3 (42.8)	45.3 (44.9)	38.9 (38.4)	41.1 (40.6)	31.6
Temporary	1.7 (0.0)	1.7 (0.0)	2.1 (0.0)	2.1 (0.0)	0.0
Total Wetland Impacts	45.0 (42.8)	47.0 (44.9)	41.1 (38.4)	43.2 (40.6)	31.6
Open Water					
Fill	0.1	0.1	0.0	0.0	0.0
Pilings	0.1	0.1	0.1	0.1	0.1
Clearing	0.0	0.0	0.0	0.0	0.0
Total Permanent Impacts	0.2	0.2	0.1	0.1	0.1
Temporary	0.0	0.0	0.0	0.0	0.0
Total Open Water Impacts	0.2	0.2	0.1	0.1	0.1
Total Stream Impacts (acres/feet)	0.0/0.0	0.0/0.0	0.0/0.0	0.0/0.0	0.0/0.0
Total Pond Impacts (Fill)	1.2	0.2	1.1	0.1	0.0
Total Jurisdictional Impacts	46.4 (44.2)	47.4 (45.3)	42.3 (39.6)	43.4 (40.8)	31.7
Wetland within Slope-Stake Line, plus Additional 25-foot buffer					
Total Impact	47.1 (43.1)	42.5 (38.5)	41.4 (36.6)	36.9 (32.0)	7.9[2]

Notes:

- The numbers in parentheses reflect the impact if reversing the center turn lane is used to reduce hurricane evacuation clearance times rather than constructing a third outbound lane. When there is no number in parentheses, the impact would be identical for either hurricane evacuation option. Also, the numbers in this table were rounded to the nearest tenth, so minor rounding error exists when adding the individual numbers to get the totals.
- Some impact acreages have been revised since the DEIS. Changes corrected compiling, rounding, and typographical errors. The changes did not affect the conclusions of the impact evaluation and were not a factor in the selection of the Preferred Alternative.

[1]Cleared areas would be a permanent impact in that it is expected that they would remain cleared in the long-term. However, stumps would not be removed nor the area grubbed and graded. Therefore, these areas would remain wetlands and the impact would not be considered a permanent fill impact requiring mitigation under Section 404.

[2]The Preferred Alternative includes a median acceleration lane to mitigate impacts to turning safety at Waterlily Road associated with the US 158 interchange. This addition increased the wetland fill impacts associated with the Preferred Alternative by approximately 1.5 acres. The median acceleration lane also would be needed with MCB2/A and MCB4/A, but was not included in the preliminary designs for these alternatives assessed first in the DEIS and now in this FEIS.

to provide a conservative estimate of impacts to wetlands resulting from topographical changes during construction.

Table 3-9 and Table 3-10 indicate that:

- Fill in wetlands would be the least for ER2, MCB4/A/C2, and the Preferred Alternative. NCTA uses the edge of earthwork or slope-stake line plus 25 feet as a reasonable estimate for potential wetlands resource fill impacts during the evaluation of alternatives in an Environmental Impact Statement. Based on that criterion, the Preferred Alternative would place the least amount of fill in wetlands, 7.9 acres, compared with 8.6 acres with ER2 and 10.6 acres with MCB4/A/C2, assuming no new third outbound lane for hurricane evacuation.

- Fill in wetlands would be substantially higher with MCB2/B and MCB4/B, which would include fill in Maple Swamp instead of the clearing that would occur under Option A in the swamp. Option B is not a part of the Preferred Alternative.

- Clearing of wetlands would be greatest with MCB2 and MCB4 because of the crossing of Maple Swamp.

- Temporary construction easements on US 158 on the mainland with ER2 would result in 171.7 linear feet of temporary clearing impacts to streams.

Also, as shown in Table 3-9, ER2 would involve 171.7 feet in temporary clearing along streams affected by the third outbound lane on US 158. Also, if a third outbound lane is added for hurricane evacuation on US 158 over Jean Guite Creek with MCB4, a single piling would be installed in the creek and the existing bridge over the creek would be widened by 18 feet (shade impact). With ER2 and MCB2, the bridge over Jean Guite Creek would be widened by 36 feet for the widening of US 158 (0.1 acre shade impact). MCB2/C2 and MCB4/C2 also would result in a small amount of shading (0.1 acre over 100 feet) of a single stream on the Outer Banks. The Preferred Alternative would have no effect on streams (see Table 3-5).

3.3.6.3 Clean Water Act and Coastal Area Management Act Permits

An Individual Permit from USACE for the entire project would be required pursuant to Section 404 of the Clean Water Act (Title 33 CFR, Part 323) for discharges of dredge or fill material into Waters of the United States. The Clean Water Act provides for public notice and review of Section 404 permit applications, as well as review by local, state, and federal regulatory agencies.

A Water Quality Certification pursuant to Section 401 of the Clean Water Act would be needed from NCDENR-DWQ. This permit is required in association with the USACE Section 404 permitting process.

A CAMA permit for impacts to Areas of Environmental Concern (AEC) under jurisdiction of NCDENR-DCM would be required.

3.3.6.4 Wetland and Stream Mitigation

Applications for USACE dredge and fill permits under Section 404 must meet mitigation requirements found in the "Memorandum of Agreement (MOA) Between the Environmental Protection Agency and the Department of the Army Concerning the Determination of Mitigation Under the Clean Water Act Section 404(b)(1) Guidelines" (February 1990). This MOA requires the applicant to utilize a sequencing process that includes avoidance of impacts, minimization of impacts, and, finally, compensation of unavoidable impacts to aquatic resource values. Executive Order 11990 requires action to be taken to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. If there is no practicable alternative to construction in wetlands and all practicable measures to minimize harm to wetlands have been provided, compensation of wetland impacts is required.

Avoidance and Minimization

Avoidance and minimization of considerable wetland impacts has already been accounted for in the bridge length designs for the detailed study alternatives that include a Mid-Currituck Bridge and would continue to do so as the project progresses. Additional avoidance and minimization efforts occurred between the DEIS and this FEIS during the refinement of the features of the Preferred Alternative. Substantial wetland impacts in northern Maple Swamp would be avoided by bridging over the swamp (MCB2/A, MCB4/A, and the Preferred Alternative) as opposed to constructing a road on fill (MCB2/B and MCB4/B). With MCB2/B and MCB4/B, impacts of the road on wildlife movements were minimized with wildlife crossing structures. Option B, however, is not included in the Preferred Alternative.

Based on the analysis of landlocked (i.e., land that would no longer have direct highway access) parcels in the DEIS, MCB2/A and MCB4/A also would have resulted in the purchase and preservation (protection from future logging) of approximately 263 acres of land in Maple Swamp (76 percent logged) in addition to the project right-of-way. Approximately 612 acres (58 percent logged) would have been purchased and preserved in Maple Swamp with MCB2/B and MCB4/B. Purchased land for the MCB2 and MCB4 alternatives that is already logged would be given a chance to re-vegetate. For the Preferred Alternative, an access management study completed in May 2011 by the Currituck Development Group recommended that six landlocked parcels, comprising a total of approximately 160 acres, be purchased during right-of-way acquisition. Three of these parcels for the Preferred Alternative are in Maple Swamp to the east of the US 158/Mid-Currituck Bridge interchange and the other three parcels are to the west of the interchange in Great Swamp, and none of them have been logged. The purchased land (assuming successful negotiations with willing sellers) for all of the detailed study alternatives discussed above would be set aside as a conservation area and allowed to retain or return to its natural state. MCB2/B and MCB4/B also would have resulted in 9.1 acres of Aydlett Road right-of-way to be abandoned and restored to its natural state.

A special study was conducted during the development of alternatives to design the US 158/Mid-Currituck Bridge interchange such that wetland impacts would be minimized (see Section 5.1 of the *Alternatives Screening Report* [Parsons Brinckerhoff,

2009]). A special study also was conducted related to the placement of the bridge terminus in the C1 and C2 bridge corridors such that impacts to wetlands and existing and potential SAV habitat could be minimized (see Section 5.3 of the *Alternatives Screening Report* [Parsons Brinckerhoff, 2009]).

The proposed approaches to constructing the Preferred Alternative in Maple Swamp and over Currituck Sound are presented in Section 2.4. In Maple Swamp, wooden crane mats would be used in the cleared right-of-way to distribute the crane loads and provide a suitable platform for erecting the bridge. As indicated in Section 3.3.4.4, over Currituck Sound proposed construction techniques include:

- No dredging in any part of Currituck Sound.
- Pile installation using both vibratory and impact hammers, with no jetting of piles.
- Turbidity curtains would be placed around piles being driven in SAV habitat (including existing beds), as defined by NCMFC, as well as potential SAV habitat when necessary.
- No bottom-disturbing activities in SAV habitat (including existing beds), as defined by NCMFC, during a moratorium period from February 15 to September 30.
- Use of an open (i.e., beams only to support a crane) temporary construction trestle over SAV habitat (including existing beds), as defined by NCMFC, to minimize shading impacts while the trestle is in place.

Final construction methods for the Preferred Alternative will be selected as part of the permitting process (see Project Commitment #3).

Compensatory Mitigation of Impacts

Compensatory mitigation options to offset wetland impacts could include the following: preservation of unique wetland communities; enhancement of existing wetlands; creation of new wetlands; and restoration of wetland areas. Considerations for candidate sites for wetlands mitigation include: proximity to affected wetlands; proximity to the drainage basin of impacted wetlands; topographic and hydrological characteristics; and chance of successful mitigation for lost wetland functions.

In-kind mitigation refers to replacement of a lost wetland with the same wetland type. Out-of-kind mitigation does not require any such similarities between mitigated wetland and affected wetland. Mitigation ratios are negotiable, and US Environmental Protection Agency (USEPA)/USACE guidelines suggest the following ratios (ratio of new wetland acres to the acres of wetland filled) by mitigation type: restoration at 2:1; enhancement at 2:1; preservation at 5:1; and creation at 3:1. Mitigation plans could include restoration of the wetlands on-site and/or the creation of wetland habitat adjacent to or within the construction limits through the use of swales, borrow pit areas, and drainage canals. If on-site mitigation is not acceptable or practical, off-site mitigation could be considered.

NCTA currently proposes the Ballance Farm Wetlands Mitigation Site, which is in Currituck County approximately 5 miles southeast of Moyock, for mitigating the approximately 7.9 acres of wetland fill impact with the Preferred Alternative. The 430-acre property was purchased by NCDOT to mitigate for wetland impacts associated with the widening of NC 168 (STIP Project No. R-2228), as well as for future impacts in the Pasquotank River Basin (Hydrologic Unit Code [HUC] 03010205). The site originally consisted of 297 acres of prior converted agricultural fields, along with existing tidal freshwater marsh and nonriverine forested wetlands.

According to the Ballance Farm Mitigation Plan, implementation of the site was to provide marsh creation, marsh preservation, nonriverine wetland restoration, nonriverine wetland preservation, and upland habitat preservation. After five years of monitoring, the nonriverine wetland restoration portion of the site (including nonriverine forested wetlands) was deemed successful and closed out in 2004. Mitigation credit available from the Ballance Farm Wetlands Mitigation Site could potentially provide for all, or at least a portion of, the mitigation required for impacts to palustrine wetlands for the Preferred Alternative.

3.3.7 Would Coastal Area Management Act Areas of Environmental Concern or essential fish habitat be affected?

The greatest impact to CAMA resources, essential fish habitat, and SAV habitat (including existing beds) or potential SAV habitat (water depths 6 feet or less) would be associated with shading by a Mid-Currituck Bridge. 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.

3.3.7.1 Coastal Area Management Act Areas of Environmental Concern

The North Carolina Coastal Resources Commission, through its staff at NCDENR-DCM, regulates the state's Coastal Area Management Act (CAMA), Dredge and Fill Law, and the federal Coastal Zone Management Act of 1972. NCDENR-DCM issues CAMA permits for development in AECs. Four types of AEC occur within the project area: coastal wetlands, estuarine waters, coastal shorelines, and public trust waters. They also are illustrated on Figure 3-5. The shorelines and waters of Currituck Sound, as well as the marsh communities found within the project area, are all considered AECs under CAMA. This also includes Jean Guite Creek, which is a PNA. In addition, Jean Guite Creek, Currituck Sound, and the Intracoastal Waterway are considered public trust waters that fall under CAMA jurisdiction. Within the project area, Currituck Sound comprises approximately 3,900 acres, Jean Guite Creek comprises approximately 0.5 acre, and the Intracoastal Waterway approximately 1.9 acres. The estuarine shorelines within the project area are considered coastal and not inland shorelines because they fall under joint responsibility of NCDENR-DMF and NCWRC. Coastal shoreline areas include a 75-foot offset from the normal high water level of estuarine waters and a 30-foot offset from the normal high water level of inland public trust waters.

Table 3-11 identifies impacts to CAMA wetlands and AECs by the detailed study alternatives, including the Preferred Alternative. The Preferred Alternative would not

Table 3-11. Impacts to CAMA Areas by Detailed Study Alternative

Type of Impact[1]	ER2 (acres)	MCB2/C1 (acres)	MCB2/C2 (acres)	MCB4/C1 (acres)	MCB4/C2 (acres)	Preferred Alternative (acres)
CAMA Wetlands[2]						
Fill	0.7	0.7	0.7	0.0	0.0	0.0
Pilings	0.0	0.0	0.0	0.0	0.0	0.0
Clearing	0.0	0.0	1.4	0.0	1.4	0.0
Total Permanent Impacts	0.7	0.7	2.2	0.0	0.0	0.0
Temporary	0.0	0.0	0.0	0.0	0.0	0.0
Total Wetland Impacts	0.7	0.7	2.2	0.0	1.4	0.0
CAMA AEC[3]						
Fill	0.9 (0.8)	0.9	0.9	0.0	0.0	0.0
Pilings	0.0	0.1	0.2	0.1	0.2	0.1
Clearing	0.0	0.0	1.5	0.0	1.5	0.0
Total Permanent Impacts	0.9 (0.8)	1.0	2.5	0.1	1.6	0.1
Temporary	0.0	0.0	0.0	0.0	0.0	0.0
Total CAMA AEC Impacts	0.9 (0.8)	1.0	2.5	0.1	1.6	0.1

Notes:

- The numbers in parentheses reflect the impact if reversing the center turn lane is used to reduce hurricane evacuation clearance times rather than constructing a third outbound lane. When there is no number in parentheses, the impact would be identical for either hurricane evacuation option. Also, the numbers in this table were rounded to the nearest tenth, so minor rounding error exists when adding the individual numbers to get the totals.
- The clearing and total wetland impacts for MCB4/C2 were incorrectly shown as 0.0 acres in the DEIS. This has been corrected to show that there would 1.4 acres of clearing and total wetland impacts with MCB4/C2. This correction did not affect the conclusions of the impact evaluation and was not a factor in the selection of the Preferred Alternative.

[1]Coastal shoreline impacts are not included.

[2]Equivalent to the wetland freshwater marsh biotic community.

[3]Includes CAMA wetlands, Currituck Sound, and Jean Guite Creek.

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 Mid-Currituck Bridge with MCB2, MCB4, and the Preferred Alternative would cross coastal shoreline areas on its eastern and western ends. A CAMA major permit would be required for all of the detailed study alternatives.

No CAMA wetlands would be affected by shading with ER2, MCB2/C1, MCB4/C1, or the Preferred Alternative. With bridge corridor C2 for both MCB2 and MCB4, 0.6 acre of CAMA wetland (also a CAMA AEC) would be shaded. This is part of the 1.4 acres indicated as cleared. In terms of shading impacts on CAMA AEC, ER2 and MCB2 would shade 0.1 acre of Jean Guite Creek, and MCB2, MCB4, and the Preferred Alternative would shade 27.8 to 29.1 acres of Currituck Sound.

3.3.7.2 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (Title 16 USC, Section 1801 *et seq.*) requires the US Secretary of Commerce to develop guidelines assisting regional fisheries management councils in the identification and creation of management and conservation plans for EFH. The National Marine Fisheries Service (NMFS), the South Atlantic Fishery Management Council (SAFMC), and the Mid-Atlantic Fishery Management Council (MAFMC) currently manage eight fish species that are known to occur within the project area (MAFMC, 2008; SAFMC, 2008).

These agencies have identified the SAV, intertidal flats, palustrine emergent and forested wetlands, aquatic bed (tidal freshwater), and estuarine water column of Currituck Sound as EFH for these species. However, the palustrine emergent and forested wetlands affected by MCB4/C1 and the Preferred Alternative are not accessible by fish and so are not considered EFH. Jean Guite Creek (a PNA) is also designated as EFH. Information on these habitats is included in the revised *Natural Resources Technical Report* (CZR Incorporated, 2011). Permanent impacts to EFH communities and SAVs are shown in Table 3-12 and Table 3-13. There would be no fill impact to EFH with the Preferred Alternative. The greatest permanent impact to EFH would be associated with shading by a Mid-Currituck Bridge of existing SAV beds, SAV habitat (as defined by 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. (Note that existing beds and potential SAV habitat also are in water 6 feet deep or less that have a suitable substrate.) A Mid-Currituck Bridge built with the Preferred Alternative would shade a total of 27.8 acres of Currituck Sound. SAV also could be affected by stormwater runoff with a Mid-Currituck Bridge, as discussed in Section 3.3.1.4.

Permanent loss or alteration of palustrine emergent and forested areas, SAV, intertidal flats, and tidal freshwater aquatic beds would result directly from shading and pile

Table 3-12. Permanent Impacts to Essential Fish Habitat by ER2, MCB2, and MCB4

Community[1]	ER2 (acres)				MCB2/C1 (acres)				MCB2/C2 (acres)				MCB4/C1 (acres)				MCB4/C2 (acres)			
	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing	Fill	Pilings	Shading	Clearing
Palustrine forested wetland	1.0	0.0	0.0	0.0	1.0	0.0	0.2	0.0	1.0	0.0	0.9	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.8
Palustrine emergent wetland	0.7	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.7	0.0	0.6	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.4
Aquatic bottom (tidal freshwater) (total[2]/≤6 feet)	0.1/ 0.1	0.0/ 0.0	0.1/ 0.1	0.0/ 0.0	0.1/ 0.1	0.1/ 0.0	28.1/ 12.3	0.0/ 0.0	0.1/ 0.1	0.1/ 0.0	29.1/ 13.3	0.0/ 0.0	0.0/ 0.0	0.1/ 0.0	28.1/ 12.3	0.0/ 0.0	0.0/ 0.0	0.1/ 0.0	29.1/ 13.3	0.0/ 0.0
TOTAL EFH IMPACT[3]	1.8	0.0	0.1	0.0	1.8	0.1	28.3	0.0	1.8	0.1	30.6	3.2	0.0	0.1	28.1	0.0	0.0	0.1	30.6	3.2
Primary nursery areas[4] (acres/linear ft)	0.0/ 0.0	0.0/ 0.0	0.0 36.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 36.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 36.0	0.0/ 0.0	0.0/ 0.0	0.0/ 5.0	0.0/ 18.0	0.0/ 0.0	0.0/ 0.0	0.0/ 5.0	0.0/ 18.0	0.0/ 0.0
SAV Communities																				
• SAV beds (existing)	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0	0.0	5.5	0.0	0.0	0.0	4.3	0.0	0.0	0.0	5.5	0.0
• Areas <4 feet deep (potential SAV habitat)	0.1	0.0	0.1	0.0	0.1	0.0	3.1	0.0	0.1	0.0	6.4	0.0	0.0	0.0	3.1	0.0	0.0	0.0	6.4	0.0
• Areas 4 to 6 feet deep (potential SAV habitat)	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.0	0.0	1.4	0.0	0.0	0.0	4.9	0.0	0.0	0.0	1.4	0.0
• Areas >6 feet deep (unsuitable SAV habitat)	0.0	0.0	0.0	0.0	0.0	0.1	15.7	0.0	0.0	0.1	15.8	0.0	0.0	0.1	15.7	0.0	0.0	0.1	15.8	0.0
SAV Habitat[5]	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.0	0.0	6.5	0.0	0.0	0.0	4.9	0.0	0.0	0.0	6.5	0.0

Notes:

- Impacts are the same with and without construction of a third outbound lane on mainland US 158 for hurricane evacuation.
- Some impact acreages have been revised since the DEIS. Changes corrected compiling, rounding, and typographical errors. The changes did not affect the conclusions of the impact evaluation and were not a factor in the selection of the Preferred Alternative.

[1]Communities that have not been mapped include intertidal flats and oyster reef/shell bank.

[2]Includes all SAV sub-categories and is equivalent to estuarine water column (volume not calculated).

[3]Includes palustrine forested wetland, palustrine emergent wetland, and aquatic bottom.

[4]Area in association with Jean Guite Creek (<0.05) and already included in potential SAV habitat totals which are included in Total EFH Impact.

[5]SAV habitat as defined by NCMFC is currently vegetated with one or more appropriate (native) SAV species, or has been vegetated by one or more appropriate species within the past 10 annual growing seasons, and meets the average growing conditions needed (water depth of 6 feet or less, average light availability [Secchi depth of 1 foot or more], and limited wave exposure). Available data for 2000 to 2010 is from 2003, 2006, 2007, and 2010 (see Figure 3-6).

Table 3-13. Permanent Impacts to Essential Fish Habitat Areas by the Preferred Alternative

Community[1]	Fill	Pilings	Shading	Clearing
Palustrine forested wetland (acres)	0.0	0.0	0.0	0.0
Palustrine emergent wetland (acres)	0.0	0.0	0.0	0.0
Aquatic bottom (tidal freshwater) (total[2]/≤6 feet) (acres)	0.0/0.0	0.1/0.0	27.8/8.7	0.0/0.0
TOTAL EFH IMPACT[3] (acres)	0.0	0.1	27.8	0.0
Primary nursery areas[4] (acres/linear feet)	0.0/0.0	0.0/0.0	0.0/0.0	0.0/0.0
SAV Communities				
• SAV beds (existing)[5] (acres)	0.0	0.0	3.8	0.0
• Areas <4 feet deep (potential SAV habitat) (acres)	0.0	0.0	2.0	0.0
• Areas 4 to 6 feet deep (potential SAV habitat) (acres)	0.0	0.0	2.9	0.0
• Areas >6 feet deep (unsuitable SAV habitat) (acres)	0.0	0.1	19.1	0.0
SAV Habitat[6]	0.0	0.0	4.8	0.0

[1]Communities that have not been mapped include intertidal flats and oyster reef/shell bank.
[2] Includes all SAV community sub-categories and is equivalent to estuarine water column (volume not calculated).
[3] Includes palustrine forested wetland, palustrine emergent wetland, and aquatic bottom.
[4]Jean Guite Creek is the only state-designated fish nursery/spawning area (primary, secondary, or anadromous spawning area) in the project area, but it is not crossed by the Preferred Alternative.
[5]Based on Luczkovich, 2010.
[6]SAV habitat as defined by NCMFC is currently vegetated with one or more appropriate (native) SAV species, or has been vegetated by one or more appropriate species within the past 10 annual growing seasons, and meets the average growing conditions needed (water depth of 6 feet or less, average light availability [Secchi depth of 1 foot or more], and limited wave exposure). Available data for 2000 to 2010 is from 2003, 2006, 2007, and 2010 (see Figure 3-6).

placement with the bridge structure associated with MCB2, MCB4/C2, and except for palustrine emergent and forested areas, MCB4/C1 and the Preferred Alternative. The effects of this use are described in Section 3.3.2.4.

In addition, ER2 and MCB2 would involve permanent loss of palustrine emergent and forested areas through the construction of permanent drainage easements along NC 12, and also would result in increased shading of Jean Guite Creek (a PNA and potential

SAV habitat). MCB4 would also result in permanent shading. Bridge widening would only include pile placement within the creek if the hurricane evacuation lane is added with MCB4. The Preferred Alternative would not affect Jean Guite Creek.

The detailed study alternatives, including the Preferred Alternative, likely would result in short-term and long-term adverse effects to EFH and managed species. In general, the detailed study alternatives would not have a substantial long-term adverse impact on EFH or managed species given the small permanent (0.0 to 1.8 acres) and clearing (0.0 to 3.2 acres) impact, as well as the overall small shading impact of the Mid-Currituck Bridge (27.8 to 30.6 acres), compared to the total area of Currituck Sound (97,920 acres). Bridge pilings could provide additional habitat for some managed species. The aquatic substrate generally would be expected to recover after construction.

As indicated above, the greatest permanent impact to EFH would be associated with shading by a Mid-Currituck Bridge over water 6 feet deep or less. NCTA would mitigate permanent impacts to SAV habitat (including existing beds), as defined by NCMFC (see Section 3.3.4.2), resulting from Mid-Currituck Bridge shading and pile placement with the Preferred Alternative. Available options for this mitigation include:

- In-kind restoration in the project area at a suitable site at a 2:1 ratio (if feasible). This restoration activity would follow the currently adopted SAV protocols in North Carolina and best practices from recent successful SAV restoration efforts. These efforts could be performed by others such as Elizabeth City State University or East Carolina University.

- Efforts to improve conditions for SAV propagation and survival within Currituck Sound. This option would involve: protection and establishment of riparian buffers; contribution of funds to promote agricultural BMPs; stormwater management improvement projects; acquisition of properties identified as important for the protection of water quality (as reported in the November 2006 *Countywide Land Parcel Prioritization Strategy for Water Quality Enhancement* [North Carolina Coastal Land Trust, 2006]); and other measures that would reduce the turbidity of water in Currituck Sound.

- Support for SAV research.

- Participation in the Currituck Sound Ecosystem Restoration Project coordinated by USACE.

Efforts to improve conditions for SAV propagation and survival within Currituck Sound, support for SAV research, and participation in the Currituck Sound Ecosystem Restoration Project also are options for mitigating the shading of portions of Currituck Sound in potential SAV habitat (areas of the sound 6 feet deep or less that have a suitable substrate and do not meet NCMFC's definition of SAV habitat.

Regarding potential stormwater runoff impacts, the stormwater management plan proposed for the Preferred Alternative is described in Section 2.1.7. 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 for the additional impervious surface area created by this project. With regard to mitigation of potential impacts to SAV, the first 1.5 inches of stormwater runoff would be captured/treated from the eastern end of the Currituck Sound bridge for a distance of 4,000 feet to prevent direct discharge into SAV habitat (including existing beds) along the eastern shore of the sound, the only location they occur. The runoff would be piped to the end of the bridge for treatment to either a stormwater wetland or a wet detention basin. Source control also would be used. Source control would be provided by frequent deck cleaning using state of the art, multi-function cleaning equipment that employs mechanical, vacuum, and regenerative air systems.

To minimize construction impacts to SAV by in-water work with the Preferred Alternative, NCTA would follow the following protocols to protect SAV habitat (including existing beds):

- No dredging in any part of Currituck Sound.

- No in-water work in SAV habitat (including existing bed) during a moratorium period from February 15 to September 30. In-water work consists of bottom disturbing activities like temporary trestle pile placement and removal and driving of permanent piles. Working above the water, including barge operations (non-bottom disturbing), installation and removal of temporary trestle beams and decking, and installation of Mid-Currituck Bridge pile caps, beams, and decking, would occur up to 365 days a year at the discretion of NCTA.

- Use of an open (i.e., beams only to support a crane) temporary construction trestle to minimize shading impacts while the trestle is in place. Marine industry standard pans would be placed under construction equipment operating on the open trestle to capture any accidental spills of oil and lubricants.

- SAV habitat that meets NCMFC's criteria (including dense SAV beds) has been documented from the eastern side of the sound. In this area of the sound, NCTA would install temporary piling and temporary open work trestle for approximately 4,500 linear feet and would, outside of the moratorium dates, drive piles for both the permanent bridge and the temporary trestle within SAV habitat (including existing beds). Based on the limited presence and sparse coverage of SAV found only along the shoreline in the western portion of Currituck Sound, an open trestle would not be necessary on this side of the sound.

- Turbidity curtains would be used during pile installation (permanent and temporary bridges) and pile removal (temporary bridge). Turbidity curtains would capture any silt from migrating outside the curtain perimeter. These are common and proven turbidity control techniques. Pile installation would be performed both by vibratory and impact hammers, with no jetting of piles.

On the eastern side of Currituck Sound, limiting pile placement to times outside the moratorium period is expected to result in the following construction sequence over SAV habitat (including existing beds) present there:

- Construction Season 1. The October 1 to February 14 non-moratorium window would allow installation of approximately 35 percent of both work trestle and permanent bridge pilings along with deck construction.

- Construction Seasons 2 and 3. During these two seasons, the remaining temporary work trestle and permanent bridge construction would be completed.

- Construction Season 4. During this season, the temporary work trestle would be removed/dismantled.

If surveys following construction operations reveal that additional permanent impacts to SAV beds have occurred, additional permanent impact mitigation would be provided using one or more of the options described in the previous section.

Minimization of potential impacts to potential SAV habitat (areas of the sound 6 feet deep or less and have a suitable substrate) would be accomplished through no dredging anywhere in Currituck Sound, by pile installation using both vibratory and impact hammers, with no jetting of piles, and the use of turbidity curtains during pile installation when necessary.

A more detailed discussion of EFH and the potential for impact is presented in the revised *Essential Fish Habitat Technical Report* (CZR Incorporated, 2011). This report is on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/.

3.3.8 Would habitat used by threatened and endangered species be affected?

There are 13 federally protected species in Dare and Currituck counties; there is habitat present for 10 of them in the project area. The biological conclusion for MCB2, MCB4, and the Preferred Alternative is "May Affect, Not Likely to Adversely Affect" for three of the 11 threatened and endangered species under USFWS jurisdiction for which a biological conclusion is required, and "No Effect" on the other eight species under USFWS jurisdiction for which a biological conclusion is required. The biological conclusion for ER2 is "No Effect" for the 11 threatened and endangered species under USFWS jurisdiction for which a biological conclusion is required. The biological conclusion for MCB2, MCB4, and the Preferred Alternative is "May Affect, Not Likely to Adversely Affect" for four of the six threatened and endangered species under NMFS jurisdiction for which a biological conclusion is required, and "No Effect" on the other two species under NMFS jurisdiction for which a biological conclusion is required. All construction would follow USFWS guidelines for the protection of eagles.

3.3.8.1 Federally-Protected Species

As of January 18, 2011, NMFS and USFWS identified 13 federally-protected species as occurring in Currituck and Dare counties (NMFS, 2011; USFWS, 2011). Six of these species are under the jurisdiction of NMFS and 12 are under the jurisdiction of USFWS. These protected species, along with information on the presence of habitat in the project area and a Biological Conclusion for each species, are listed in Table 3-14. More information is included in the revised *Natural Resources Technical Report* (CZR, Incorporated, 2011).

Construction contracts would require compliance with USFWS's *Guidelines for Avoiding Impacts to the West Indian Manatee: Precautionary Measures for Construction Activities in North Carolina Waters* (USFWS, 2003) and NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions* (NMFS, 2006) with exceptions and clarifications provided by USFWS, and NMFS, respectively. In a letter dated December 2, 2011 addressed to the NMFS and USFWS, NCTA requested relief on conditions related to maintaining a "no wake/idle" speed during construction. In a December 8, 2011 letter USFWS agreed to delete from their requirements for this project the two guidelines that specify the use of no wake/idle speeds. NMFS in an e-mail dated December 16, 2011 agreed that the condition relating to no wake/idle speeds would not apply to this project.

USFWS concurred with the Biological Conclusions for protected species under their jurisdiction in a letter dated July 8, 2011 and formal consultation was not needed. NMFS concurred with the Biological Conclusions for species under their jurisdiction in a letter dated October 18, 2011 and formal consultation was not needed. Consultation has been completed unless a take occurs or new information reveals effects of the action not previously considered, or the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat in a manner or to an extent not previously considered, or if a new species is listed or critical habitat designated that may be affected by the identified action. The Biological Conclusions presented in the DEIS for some of the protected species have been updated in this FEIS as shown in Table 3-14. The updates are based on the findings of a *Biological Assessment* (CZR, Incorporated, 2011) found on the compact disc (CD) that accompanies this FEIS, at public review locations listed in Appendix C as a printed copy, and on the NCTA web site at http://www.ncdot.gov/projects/midcurrituckbridge/.

3.3.8.2 Bald Eagle and Golden Eagle Protection Act

The bald eagle was removed from the endangered species list in 2007, but it remains protected under the Bald Eagle and Golden Eagle Protection Act and the Migratory Bird Treaty. Habitat for nesting bald eagles primarily consists of mature forest in proximity

Table 3-14. Potential Effects on Federally-Protected Species

Scientific Name	Common Name	Federal Status[1]	Habitat Present	Biological Conclusions[2]			
				USFWS Jurisdictional Species		NMFS Jurisdictional Species	Overall Biological Conclusion for Preferred Alternative[3]
				MCB2, MCB4, and Preferred Alternative	ER2	MCB2, MCB4, and Preferred Alternative	
Canis rufus	Red wolf	E-EXP	Yes	No Effect	No Effect	NA	No Effect
Trichechus manatus	West Indian manatee	E	Yes	MA-NLAA	No Effect	NA	MA-NLAA
Charadrius melodus	Piping plover	T	Yes	MA-NLAA	No Effect	NA	MA-NLAA
Picoides borealis	Red-cockaded woodpecker	E	No	No Effect	No Effect	NA	No Effect
Sterna dougallii dougallii	Roseate tern	E	Yes	No Effect	No Effect	NA	No Effect
Alligator mississippiensis	American alligator	T(S/A)	Yes	NA	NA	NA	NA
Chelonia mydas	Green sea turtle	T	Yes	No Effect	No Effect	MA-NLAA	MA-NLAA
Eretmochelys imbricata	Hawksbill sea turtle	E	No	No Effect	No Effect	No Effect	No Effect
Lepidochelys kempii	Kemp's ridley sea turtle	E	Yes	No Effect	No Effect	MA-NLAA	MA-NLAA
Dermochelys coriacea	Leatherback sea turtle	E	No	No Effect	No Effect	No Effect	No Effect
Caretta caretta	Loggerhead sea turtle	T	Yes	MA-NLAA	No Effect	MA-NLAA	MA-NLAA
Acipenser brevirostrum	Shortnose sturgeon	E	Yes	NA	NA	MA-NLAA	MA-NLAA
Amaranthus pumilus	Seabeach amaranth	T	Yes	No Effect	No Effect	NA	No Effect

Source: USFWS, 2011; NMFS 2011.

Note: Determinations of whether or not habitat is present in the project area for the red-cockaded woodpecker, roseate tern, and shortnose sturgeon, as well as the USFWS biological conclusions with MCB2 and MCB4 for the green sea turtle, the Kemp's ridley sea turtle, and the shortnose sturgeon, were revised since the DEIS based on coordination with USFWS and NMFS during completion of the *Biological Assessment* (CZR, Incorporated, 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

[2] MA-NLAA – May Affect, Not Likely to Adversely Affect
NA-Not Applicable; no biological conclusion required

[3] Takes into account the direct and indirect effects of the Preferred Alternative on threatened and endangered species and their habitat. When the biological conclusions for sea turtles differ between USFWS (turtle activity on land) and NMFS (turtle activity in the water), the greater effect is indicated as the overall biological conclusion.

to large bodies of open water for foraging. Large, dominant trees are utilized for nesting sites, typically within 1.0 mile of open water. Suitable nesting habitat exists throughout the area, but primarily in association with the shorelines of Currituck Sound and North River, as well as within Maple Swamp. Surveys conducted by NCWRC show three nests within 2.5 miles of the project area (personal communication, David Allen, NCWRC, February 4, 2009, and January 26, 2011). One bald eagle nest occurs approximately 2.3 miles south of the proposed bridge corridor on the western shore of Currituck Sound, near the Poplar Branch community. This nest was last active in 2007. It is possible the nesting pair built a new nest in the same vicinity in 2008 and may have been active in 2010, but this has not been verified. A second nest is an active nest located approximately 1.8 miles south of the US 158 area in Dare County on the northern side of Kitty Hawk Bay. The third nest is near the Corolla Lighthouse, approximately 2 miles north of the Preferred Alternative's Outer Banks landing site. All construction would follow USFWS guidelines for the protection of bald eagles as described in the *National Bald Eagle Management Guidelines* (USFWS, 2007).

3.3.8.3 Endangered Species Act Candidate Species

Seven species occurring in North Carolina are identified by USFWS as "candidate" species (USFWS, 2011). These species are not protected by federal law, but may be elevated to listed status in the near future. Information on candidate species potentially included in the project area is included in the *Natural Resources Technical Report* (CZR, Incorporated, 2009).

3.4 Other Physical Characteristics and Impacts

This section considers the impacts of the detailed study alternatives, including the Preferred Alternative, on a variety of other physical characteristics of the project area. Section 3.1 addresses community characteristics and impacts. Section 3.2 addresses cultural resources impacts. Section 3.3 addresses natural resources impacts. This section asks:

- How would traffic noise levels change?
- Would air quality be affected?
- How would the detailed study alternatives affect energy use?
- How would potential accelerated sea level rise resulting from climate change affect long-term use of the detailed study alternatives?
- How would visual quality be changed?
- Are there hazardous materials and underground storage tank sites that could affect the project?

- Would floodplains be affected?

3.4.1 How would traffic noise levels change?

Each of the detailed study alternatives would cause some increased noise. The Preferred Alternative would impact the fewest receptors (22). Noise abatement measures would not be cost-effective at sites on the Currituck County mainland (one receptor with the Preferred Alternative). Noise mitigation would be cost-effective at some locations on the Outer Banks (13 of 21 impacted receptors). However, the impacts of barriers on drainage and flooding on the Outer Banks could be substantial.

Sounds exist in the human and natural environment at all times. Some sounds are necessary or desirable for communication or pleasure, some are unnoticed, and some are unwanted or disturbing. Noise is basically defined as unwanted sound. It can be emitted from numerous sources, including airplanes, factories, railroads, power generation plants, trucks, and automobiles. Automobile noise is primarily comprised of noises from engine exhaust, drive train, and tire/roadway interaction. The level of noise generated by roadway traffic depends on the volume of traffic, the speed of traffic, and the number of trucks in the flow of the traffic. Generally, heavier traffic volumes, higher speeds, and larger numbers of trucks increase the loudness of traffic noise.

In addition, there are other more complicated factors that affect the loudness of traffic noise. For example, as a person moves away from a highway, traffic noise levels are reduced by distance, terrain, and natural and human-made obstacles. Traffic noise is not usually a serious problem for people who live more than 500 feet from heavily traveled freeways or more than 100 to 200 feet from lightly traveled roads.

The following sections describe the findings of the noise impact assessment. Additional information is provided in the *Traffic Noise Technical Report* (Parsons Brinckerhoff, 2009) and the *Traffic Noise Technical Report Addendum* (Parsons Brinckerhoff, 2011) on the CD included with this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/.

3.4.1.1 FHWA Noise Abatement Criteria

FHWA has developed noise abatement criteria (NAC) and procedures to be used in the planning and design of highways to determine noise levels at which mitigation should be considered. These NAC and procedures are based on Title 23 CFR, Part 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise*. Table 3-15 provides a summary of the FHWA NAC for various land use activity categories.

FHWA requires that noise abatement measures be considered when future noise levels either approach or exceed the NAC levels shown in Table 3-15, or if there are substantial increases over the ambient noise levels. NCDOT's *Traffic Noise Abatement Policy* (July 13,

Table 3-15. Noise Abatement Criteria
(Hourly Equivalent A-Weighted Sound Level in decibels – dBA)

Activity Category	Activity Criteria[1] $L_{eq}(h)$[2]	Evaluation Location	Description of Activity Category
A	57	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B[3]	67	Exterior	Residential
C[3]	67	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section4(f) sites, schools, television studios, trails, and trail crossings.
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E[3]	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in A-D or F.
F	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	--	--	Undeveloped lands that are not permitted.

Source: NCDOT *Traffic Noise Abatement Policy*, July 13, 2011.

[1]The $L_{eq}(h)$ activity criteria values are for impact determination only, and are not design standards for noise abatement measures.

[2]The equivalent steady-state sound level which in a stated period of time contains the same acoustic energy as the time-varying sound level during the same time period, with $L_{eq}(h)$ being the hourly value of L_{eq}.

[3]Includes undeveloped lands permitted for this activity category.

2011) states that "traffic noise abatement for NCDOT highway projects is warranted and must be considered when traffic noise impacts are created by either of the following two conditions:

1. The predicted traffic noise levels for the design year approach (i.e., reach one decibel less than, for example 66 dBA for land use Activity Category B) or exceed the NAC shown in Table 3-15; or

2. The predicted traffic noise levels for the design year (2035 for this project) substantially exceed existing noise levels. NCDOT definitions for substantial noise level increases are presented in Table 3-16.

Table 3-16. Substantial Noise Level Increase
(Hourly Equivalent A-Weighted Sound Level (decibels - dBA)

Existing Noise Level[1] ($L_{eq}(h)$)	Predicted Design Year Noise Level Increase[2] ($L_{eq}(h)$)
50 or less	15 or more
51	14 or more
52	13 or more
53	12 or more
54	11 or more
55 or more	10 or more

Source: NCDOT *Traffic Noise Abatement Policy*, July 13, 2011.
[1]Loudest hourly equivalent noise level from the combination of natural and mechanical sources and human activity usually present in a particular area.
[2]Predicted hourly equivalent design year traffic noise level minus existing noise level.

Title 23 CFR, Section 772.11(b) states, "In determining traffic noise impacts, a highway agency shall give primary consideration to exterior areas where frequent human use occurs" and Title 23 CFR, Section 772.13(b) states, "In abating traffic noise impacts, a highway agency shall give primary consideration to exterior areas where frequent human use occurs." For this project, identified potentially noise-sensitive receptors were commercial uses, residences, a library, churches, and recreation.

3.4.1.2 Sensitive Receptors

A noise-sensitive site is any property (owner-occupied, rented, or leased) where human activity occurs (typically outdoors) and where a lowered noise level would be of benefit. The noise-sensitive sites adjoining the detailed study alternatives consist mostly of the exterior areas of low density and medium density residential areas. These coincide with the FHWA land use category B where the peak-hour traffic noise level locations were calculated.

The noise impact assessment revealed 1,877 noise-sensitive sites that are either within or in proximity to the detailed study alternatives. Noise-sensitive sites adjacent to US 158 consist of isolated homes adjacent to the roadway right-of-way, commercial properties, a visitor center, churches, and a library. Noise-sensitive sites adjacent to NC 12 include isolated single family homes (adjacent to the roadway right-of-way), single family homes in new and established subdivisions, hotels, apartments, and condominiums.

3.4.1.3 Noise Levels and Descriptors

To assess the existing conditions within the project area, noise measurements were conducted during 2008 near noise-sensitive land uses along the detailed study alternatives. Receptor locations were selected to provide thorough geographic coverage and to be representative of existing and future land uses in the project area, and were used to characterize conditions in the general vicinity of that location.

The most commonly used measure of noise level is the A-weighted sound level (dBA). From many experiments with human listeners, scientists have found that the human ear is more sensitive to midrange frequencies than it is to either low or very high frequencies. At the same sound level, midrange frequencies are therefore heard as louder than low or very high frequencies. This characteristic of the human ear is taken into account by adjusting or weighting the spectrum of the measured sound level for the sensitivity of human hearing. The A-weighted sound level is a measure of sound intensity with frequency characteristics that correspond to human subjective response to weighted noise.

3.4.1.4 Existing and Predicted Noise Levels

To identify sites potentially affected by noise, predicted noise levels for the detailed study alternatives, including the Preferred Alternative, in 2035 were calculated and compared to the existing noise levels and the noise levels predicted in 2035 with the No-Build Alternative. The term "impacted" is defined as the sites that are predicted to experience noise levels that approach or exceed the NAC with the detailed study alternatives.

All predicted noise levels were produced using FHWA's computer prediction model for highway traffic noise – Traffic Noise Model® (TNM) Version 2.5, February 2003.

All noise levels were predicted for the maximum amount of traffic each road could carry traveling the speed limit. When this happens, traffic is at its noisiest. As indicated above, traffic noise is a combination of vehicle type, speed, and the number of vehicles. Thus, even though traffic volumes are greater, congested traffic has lower noise levels because traffic is traveling slower. Thus, in this analysis, it was found that a four-lane NC 12 would be noisier than a two-lane or a three-lane NC 12 because a four-lane road can carry more traffic at the speed limit. Adding lanes to existing roads also puts vehicles closer to sensitive receptors, thereby increasing noise levels at those locations.

With MCB2/B and MCB4/B, two noise analyses were conducted in Aydlett, one with the toll plaza and one without the toll plaza. After 10 to 15 years (i.e., between 2023 and 2028), it is possible that all tolls would be collected electronically with no need for vehicles to stop at a toll plaza. In both cases, noise levels were predicted for the maximum amount of traffic each road could carry traveling the speed limit. Noise associated with traffic slowing and accelerating at the toll plaza was considered. It was found, however, that using the maximum amount of traffic the road could carry traveling the speed limit and assuming that it operated at the speed limit produced the highest noise levels.

The noise analysis found that:

- With the Preferred Alternative, noise is predicted to approach or exceed NAC at one receptor on the Currituck County mainland and 21 receptors on the Outer Banks. This is the lowest impact of any of the detailed study alternatives. The impact on the mainland would be the same as MCB2 and MCB4. On the Outer Banks, the next lowest impact was MCB4/C2, which would impact 83 receptors.

- With ER2, noise is predicted to approach or exceed NAC at 337 sites on the Currituck County mainland and 355 noise-sensitive sites on the Outer Banks.

- With MCB2, noise is predicted to approach or exceed NAC at 27 sites on the Currituck County mainland, 411 sites on the Outer Banks with bridge terminus C1, and 348 sites on the Outer Banks with terminus C2.

- With MCB4, noise is predicted to approach or exceed NAC at 27 sites on the Currituck County mainland, 146 sites on the Outer Banks with bridge terminus C1, and 83 sites on the Outer Banks with terminus C2.

These results would be the same for MCB2 and MCB4 with either Option A or Option B, and in the case of Option B, with or without the toll plaza.

The number shown as approaching or exceeding NAC on the Currituck County mainland is notably higher with ER2 (with the construction of a third outbound emergency lane) than with MCB2 and MCB4. This is because, with ER2, the travel lanes would move closer to surrounding receptors for more than 20 miles with the wider pavement needed to provide for a third outbound emergency lane. This does not mean, however, that noise levels in this area would be notably higher with ER2 and a third outbound emergency lane than with the No-Build Alternative. Since existing noise levels are high and in most cases already exceed the NAC, and because ER2 improvements would offer no additional traffic carrying capacity, predicted build noise levels would not be notably higher. Typically, they would be imperceptibly (no more than 1 dBA) different.

The detailed study alternatives, including the Preferred Alternative, would increase noise levels on the Outer Banks compared to the No-Build Alternative because their wider roads could carry more traffic at the speed limit, and travel lanes would be closer

to noise sensitive receptors. Noise levels on NC 12 would be up to 10 dBA higher than with the No-Build Alternative in areas where the road would be widened to four lanes. The NAC would not be exceeded in the community of Aydlett on the mainland with any of the detailed study alternatives (including the Preferred Alternative), including with a toll plaza in Aydlett (Option B). Option B, however, was not included in the Preferred Alternative. The assessment found noise levels in Aydlett of less than 60 dBA at sensitive receptors with a Mid-Currituck Bridge. No properties in the project area would experience a substantial increase in noise levels over existing levels with any of the detailed study alternatives, including the Preferred Alternative.

3.4.1.5 Noise Abatement

Because noise levels at locations along the study corridor were determined to approach or exceed the NAC for Activity Categories B, C, and E, the feasibility and reasonableness of noise abatement measures were evaluated. These measures included buffer zones, transportation systems management measures, alignment modifications, and noise barriers. Use of a buffer zone, transportation systems management measures, and alignment modifications were found not to be feasible and reasonable, so the study focused on barriers.

Noise barriers reduce noise levels by blocking the sound path between a roadway and noise-sensitive sites. To be effective in reducing traffic-induced noise, a noise barrier must be relatively long, continuous (with no intermittent openings), sufficiently dense, and high enough to provide the necessary reduction in noise levels. For a barrier to be considered feasible and reasonable, it must meet the following criteria:

- Provide a minimum insertion loss (noise reduction) of 5 dBA for at least one impacted receptor.
- Consider adverse impacts created by or upon property access, drainage, topography, utilities, safety, and maintenance requirements.
- Not exceed the maximum allowable base quantity of noise barriers per benefited receptor of 2,500 square feet. Additionally, an incremental increase of 35 square feet shall be added to the base quantity per the average increase in dBA between existing and predicted exterior noise levels of all impacted receptors within each noise sensitive area.
- Evaluate a noise reduction design goal of at least 7 dBA for all front row receptors. At least one benefited front row receptor must achieve this noise reduction design goal to indicate the noise abatement measure effectively reduces traffic noise.
- Solicit viewpoints of the property owners and residents of all benefited receptors.

This is a partial list of the criteria to be considered in determining feasibility and reasonableness. A complete listing of these criteria can be found in NCDOT's *Traffic*

Noise Abatement Policy (July 13, 2011) located in Appendix C of the *Traffic Noise Technical Report Addendum* (Parsons Brinckerhoff, 2011).

Extent of Noise Barrier Benefits

Noise barriers were found to be preliminarily reasonable at a few locations along NC 12 in Dare County and along NC 12 in Currituck County. However, noise barrier feasibility, as well as the noise reduction benefit of noise barriers, was found to be sporadic on the three-lane sections of NC 12 (with ER2 and MCB2) because driveway and street accessibility requirements limited the locations where acoustically effective barriers could feasibly be considered. In this area, 232 receptors would be impacted by traffic noise. Of those 232 receptors, three (one percent) would benefit from noise barriers. Those same barriers would lower noise levels for an additional 11 receptors not impacted.

In the four-lane sections of NC 12 (with all of the detailed study alternatives, including the Preferred Alternative), there are fewer street intersections and driveways, so the benefit of noise barriers would be more pronounced. The Preferred Alternative would impact 22 receptors (21 of which are on the Outer Banks). Of the 22, 13 (59 percent) would benefit from noise barrier construction. Those same noise barriers would lower noise levels for up to 19 additional receptors not impacted. MCB2 or MCB4 with C1 would result in 146 receptors impacted. Of those 146, 111 (76 percent) would benefit from noise barrier construction. Those same noise barriers would lower noise levels for an additional 100 receptors not impacted. With C2, the four-lane section of NC 12 would result in 83 receptors impacted by traffic noise. Of those 83, 67 (81 percent) would benefit from noise barrier construction. Those same noise barriers would lower noise levels for an additional 58 receptors not impacted. The NC 12 noise results for ER2 are similar to those predicted for MCB2/C2.

Drainage and Flooding Impacts of Noise Barriers

Noise barriers could potentially disrupt the drainage patterns along NC 12 in two ways. First, along NC 12 in Dare County and southern Currituck County, the surrounding properties generally drain to the road or sound, so a barrier along NC 12 in that area would block normal drainage from surrounding properties. Second, during severe storms, the walls potentially could be an impediment to flood flow.

Noise Barrier Commitments

NCTA is committed to the construction of feasible and reasonable noise abatement measures at the noise-impacted receptors identified for the Preferred Alternative assuming that it is identified as the Selected Alternative in the ROD, contingent upon the following conditions:

1. Detailed noise analysis updates during the final design process continue to support the opportunity to provide noise barriers at Noise Sensitive Area (NSA) 17, NSA 23, and NSA 26 for the ROD's Selected Alternative and, if identified, additional locations;

2. The outcome of hydraulic studies needed to determine the impact of proposed noise barriers on drainage and flood flows, whether the impact can be mitigated, and what would be required to mitigate it and the associated cost;

3. Viewpoints of the property owners and residents of all benefited receptors would be solicited during the final design process;

4. Safety and engineering aspects (i.e., feasibility) have been reviewed; and

5. Coordination with local officials to identify any new development that has occurred between the date of the *Traffic Noise Technical Report Addendum* (Parsons Brinckerhoff, 2011) and the Date of Public Knowledge (i.e., the Record of Decision). Any such new development would need to be assessed for noise impacts and given consideration for potential noise abatement measures during the final design process.

There is no intent to provide right-of-way fences or walls to mitigate impacts other than those required to mitigate noise or with Option B wildlife passage in Maple Swamp.

3.4.2 Would air quality be affected?

The proposed project is in Currituck and Dare counties, which have been determined to comply with the National Ambient Air Quality Standards (NAAQS) and, therefore, are in attainment. This project is not anticipated to create any adverse effects on the air quality of this attainment area. The detailed study alternatives, including the Preferred Alternative, would reduce regional emissions of mobile source air toxics, with the greatest reduction associated with the reduced vehicle-miles of travel with MCB2 and MCB4.

Air pollution is a general term that refers to one or more chemical substances that degrade the quality of the atmosphere. Individual air pollutants degrade the atmosphere by reducing visibility, damaging property, reducing the productivity or vigor of crops or natural vegetation, or harming human or animal health. When assessing the impact of a proposed transportation project on air quality, compliance with NAAQS for six criteria pollutants and the potential for the project to increase Mobile Source Air Toxics (MSAT) are considered. The six criteria pollutants are: carbon monoxide, nitrogen dioxide, ozone, particulate matter, sulfur dioxide, and lead. Additional information on air quality impacts is included in the *Air Quality Technical Report* (Parsons Brinckerhoff, 2010) on the CD included with this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/.

3.4.2.1 Conformance with National Ambient Air Quality Standards

USEPA publishes a list of all geographic areas that are in compliance with the NAAQS (criteria pollutant levels below their respective standards), as well as those areas not in

compliance with the NAAQS. The designation of an area is made on a pollutant-by-pollutant basis.

The project is in Currituck and Dare counties, which have been determined to comply with the NAAQS. The proposed project is located in an attainment area; therefore, Title 40 CFR, Parts 51 (the NAAQS) and 93 (determination of conformity with a state implementation plan for air quality reduction) are not applicable. USEPA's air quality regulations do not require hotspot analysis of pollutants in attainment areas (and neither does FHWA). This project is not anticipated to create any adverse effects on the air quality of this attainment (geographic) area.

3.4.2.2 Mobile Source Air Toxics

In addition to the criteria pollutants for which there are NAAQS, USEPA also regulates air toxics. Most air toxics originate from human made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories or refineries).

For the detailed study alternatives, including the Preferred Alternative, and the No-Build Alternative, the amount of MSATs emitted would be proportional to the vehicle-miles traveled (VMT), assuming that other variables such as fleet mix are the same for each detailed study alternative. Table 3-17 shows the 2035 estimated total VMT and congested VMT for the detailed study alternatives. The VMT estimated for each of the detailed study alternatives is lower or the same as the No-Build Alternative. As shown in Table 3-17, the bridge alternatives (MCB2, MCB4, and the Preferred Alternative) would reduce total estimated VMT by 12.9 percent in comparison to the 2035 No-Build Alternative, which would lead to a corresponding reduction in associated MSAT

Table 3-17. Estimated Total Vehicle-Miles Traveled and Congested Vehicle-Miles Traveled in 2035

	Total Vehicle-Miles Traveled (millions)	Percent Reduction in Total Vehicle-Miles Traveled from No-Build	Congested Vehicle-Miles Traveled (millions)	Percent Reduction in Congested Vehicle-Miles Traveled from No-Build
Annual Existing (2006)	355.1	—	5.4	—
Annual Future (2035)				
• No-Build	663.9	—	66.1	—
• ER2	663.9	0.0%	51.4	22.2%
• MCB2	578.3	12.9%	31.4	52.5%
• MCB4	578.3	12.9%	40.2	39.2%
• Preferred Alternative	578.3	12.9%	40.2	39.2%

emissions. Estimated VMT would be unchanged with ER2. In the case of the bridge alternatives, the Mid-Currituck Bridge would provide a shorter route to many destinations in the project area. All of the detailed study alternatives, including the Preferred Alternative, would reduce congestion, thereby increasing localized speeds and reducing travel times, with MCB2 reducing congested VMT by 52.5 percent. According to USEPA's Mobile6.2 emissions model, emissions of all of the priority MSATs except for diesel particulate matter decrease as speed increases. However, the extent to which these speed-related emissions decreases will affect overall MSAT levels cannot be reliably projected because of the inherent deficiencies of technical models.

Based on these results, the proposed project is predicted to reduce MSATs in the overall project area in contrast to the No-Build Alternative. MCB2, with both the greatest reduction in total VMT and the greatest reduction in congested VMT, would reduce MSAT emissions the most of the detailed study alternatives.

The widening of NC 12 and US 158 on the Outer Banks contemplated as part of ER2 and MCB2 would have the effect of moving some traffic closer to nearby homes, businesses, and recreational paths. NC 12 and US 158 on the Outer Banks are lined with homes, businesses, and/or recreational paths for their full lengths. The distance of US 158 and NC 12 widening would be approximately 20.3 miles and 18.2 miles for MCB2 with bridge corridors C1 and C2, respectively. The distance of US 158 and NC 12 widening would be approximately 18.3 miles with ER2. The moving of traffic closer to nearby homes would be true for the Mid-Currituck Bridge associated with MCB2, MCB4, and the Preferred Alternative at its termini on the mainland and on the Outer Banks, and as it passes through the community of Aydlett for approximately 1,800 feet. Currently, Aydlett is not adjacent to a thoroughfare. The moving of some traffic closer to nearby homes, businesses, and recreational paths also would be true along the limited widening of NC 12 associated with MCB4 (approximately 4.4 miles with bridge corridor C1 and 2.3 miles with bridge corridor C2) and the Preferred Alternative (approximately 2.6 miles). Therefore, under each detailed study alternative there may be localized areas along US 158, NC 12, and the Mid-Currituck Bridge where ambient concentrations of MSATs could be higher at some receptors than under the No-Build Alternative, but this could be offset as a result of increases in localized speeds and reductions in congestion (which are associated with lower MSAT emissions). In addition, MSAT emissions would be lower in other locations when traffic shifts away from them. For example, a Mid-Currituck Bridge would shift traffic away from US 158 and NC 12 in Dare County. On a regional basis, however, USEPA's vehicle and fuel regulations, coupled with fleet turnover, will, over time, cause substantial MSAT reductions that, in almost all cases, will cause region-wide MSAT levels to be lower than today.

3.4.3 How would the detailed study alternatives affect energy use?

The energy used in constructing, operating, and maintaining one of the detailed study alternatives, including the Preferred Alternative, likely would be greater than simply continuing to operate and maintain existing roads.

With each of the detailed study alternatives, however, there would be a substantial reduction in long-term future traffic operations energy use resulting from a 12.9 percent decrease in millions VMT and reductions in congestion with MCB2, MCB4, and the Preferred Alternative (52.5 percent, 39.2 percent, and 39.2 percent, respectively). ER2 would see reductions in congested VMT only (22.2 percent). The benefit arising from the reduction in future VMT and congested VMT would in part offset the energy used to construct and maintain the detailed study alternatives, including the Preferred Alternative. Differences in energy use related to the construction of the detailed study alternatives are reflected in differences in their cost (Caltrans Transportation Laboratory, July 1983). The higher the cost, the more energy that would be expended. The construction costs of the detailed study alternatives (in this case all costs except right-of-way costs), including differences associated with mainland approach design Option A and Option B, are presented in Table 2-4. The lowest cost alternative is ER2. For MCB2 and MCB4, Option B would be less costly than Option A. Construction cost would be similar between bridge corridors C1 and C2, but C2 would be somewhat more expensive. The Preferred Alternative would require 1.8 times the construction energy use of ER2.

Decreases in potential operating energy use would result from both decreasing millions of VMT and reducing congestion.

Additional detail is presented in the revised *Other Physical Features Technical Report* (Parsons Brinckerhoff, 2011) on the CD included with this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at http://www.ncdot.gov /projects/midcurrituckbridge/.

3.4.4 How would potential accelerated sea level rise resulting from climate change affect long-term use of the detailed study alternatives?

Existing roads would be affected by sea level rise. A Mid-Currituck Bridge would be a useful asset in reducing the impact of sea level rise resulting from climate change on the project area's road system. Under all sea level rise scenarios considered, the entire barrier island would be inundated at the Dare/Currituck County line, creating a breach in the island and making a Mid-Currituck Bridge the only way off the Currituck County Outer Banks.

This assessment considers the potential effect of accelerated sea level rise on the No-Build and detailed study alternatives. Its findings are based on a comparison of the road network in the project area to sea level rise maps prepared for the report: *The Potential Impacts of Global Sea Level Rise on Transportation Infrastructure Phase 1—Final Report: the District of Columbia, Maryland, North Carolina and Virginia* (ICF International, 2008), as well as a comparison of the Preferred Alternative with locations in its corridor at elevations of less than 1 meter.

The ICF International sea level rise study developed a series of North Carolina maps for nine different eustatic (uniformly global) sea level rise scenarios ranging from 6 to 59

centimeters (2.4 to 23.2 inches) between now and year 2100. The sea level rise study used digital elevation models to evaluate the elevation in coastal areas. Tidal surfaces were created to describe the current and future predicted sea water levels. These models were used to identify land and in turn transportation infrastructure that, without protection, would be regularly inundated by the ocean or would be at-risk of periodic inundation as a result of storm surge under each sea level rise scenario. These terms are defined as:

- Regularly inundated: areas that would be permanently under water under a given sea level rise scenario; and

- At-risk: areas that could be temporarily flooded as a result of the storm surge under a given sea level rise scenario.

This assessment used seven of the nine sea level rise maps. The two not used were within a centimeter of other maps and thus were not considered relevant to this assessment.

When considering the various accelerated sea level rise scenarios, it was found that by year 2100 portions of the existing project area road network (including those sections of US 158 and NC 12 improved by the detailed study alternatives) would be inundated (permanently under water for 1.5 to 2.5 miles) or at risk during a storm surge (3.8 to 7.7 miles). Portions of the Mid-Currituck Bridge interchange area with US 158 would be at risk during a storm surge. Areas likely to be inundated along the bridge corridor would be bridged.

It was also found that a Mid-Currituck Bridge would be a useful asset in reducing the impact of sea level rise on the project area's road system. Under all sea level rise scenarios considered, NC 12 would be broken by inundation near the Dare/Currituck County line. The entire barrier island would be inundated at this location, creating a breach in the island. Thus, the bridge would become the only route on and off the Currituck County Outer Banks. ER2 and the road improvements associated with MCB2, MCB4, and the Preferred Alternative would suffer the same levels of inundation and impact from the storm surge as the existing roads that they improve.

Impacts to the Preferred Alternative also were considered with a 1-meter (39.4-inch) sea level rise. The only parts of the Preferred Alternative that would be affected by 1 meter of sea level rise are roadway components on the mainland along US 158 in the Waterlily Road area. They would not, however, be affected within the context of a typical road design life (2035 for this project), and this part of US 158 also would be affected with the No-Build Alternative. When threatened by sea level rise, these roads also would need to be raised in elevation. The same is true for other locations along US 158 in Currituck County that would be affected by sea level rise.

Finally, all components of the detailed study alternatives, including the Preferred Alternative, would likely be replaced before year 2100 and as such would never experience the highest sea level rise. The Mid-Currituck Bridge could stay in service up

to 75 years and would experience most sea level rise between now and 2100. Year 2035 is the project's design year and also reflects the design life of the road components of the detailed study alternatives. The worst-case sea level rise scenario averages an increase of 0.63 centimeter (0.25 inch) per year from 2008 to 2100. If that rise occurred, one would see a 17-centimeter (6.7-inch) rise by 2035, which is similar to the 17.5 centimeters (6.9 inches) data generated by the ICF International study.

Additional detail is presented in the revised *Other Physical Features Technical Report* (Parsons Brinckerhoff, 2011) on the CD included with this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/.

3.4.5 How would visual quality be changed?

Primary visual impacts would be the introduction of Mid-Currituck Bridge features into views along US 158 and in Aydlett (including views of Currituck Sound) with MCB2, MCB4, and the Preferred Alternative. On the Outer Banks, a C1 bridge terminus (a refined location is included in the Preferred Alternative) would adversely affect views of Currituck Sound from the Corolla Bay subdivision and the northern part of Monteray Shores. A C2 bridge terminus would adversely affect views from the outdoor recreation area at TimBuck II. ER2 and MCB2 would introduce an interchange into views in Kitty Hawk. With all of the detailed study alternatives, wider pavement and new drainage features would be introduced along NC 12. This change would be the least with the Preferred Alternative. Roadside vegetation would be lost to provide for the drainage features. This change would be the least extensive with MCB4.

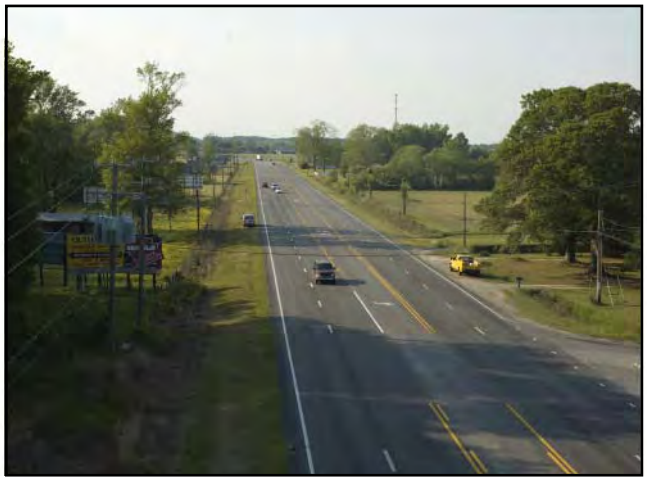
FHWA provides guidance in preparing visual resource discussions and impact assessments in its documents: *Visual Impact Assessment for Highway Projects* (FHWA, 1988) and *Environmental Impact Statement—Visual Impact Discussion* (FHWA, 1990). This guidance was used in preparing this assessment.

3.4.5.1 Characteristics of the Existing Landscape

In the project area, the mainland and Outer Banks are distinctly different in their vegetation coverage, land coverage, and development patterns. The mainland is generally flat, with topographic variances ranging between mean sea level (MSL) and 7 feet above MSL. US 158 is the principal roadway on the mainland and is on top of a long ridge that runs between Barco and the Wright Memorial Bridge. US 158 represents the higher elevations on the mainland. The land uses of agriculture, residential, commercial, and light industrial are primarily along US 158, although some of these land uses also are in the small communities (e.g., Aydlett) located east of US 158. North-to-south oriented deciduous forest-covered swamplands exist within the mainland regional landscape and extend from the back end of the land uses along US 158 to the North River and Currituck Sound. Representative mainland views are shown on Figure 3-7.

The Outer Banks landscape is a peninsula that is bounded on the east by the Atlantic Ocean and on the west by Currituck Sound. The topography of the Outer Banks varies.

2 miles south of the US 158/NC 168 intersection



US 158 at Aydlett Road

Aydlett at the Mid-Currituck Bridge Corridor

0.5 mile south of Walnut Island Boulevard

US 158 at Halls Harbor

Representative Views of Landscapes on the Mainland

Figure

3-7

The area between Kitty Hawk and the Town of Duck has rolling topography as a result of the presence of sand dunes. From the Town of Duck to the community of Corolla, the topography is generally flat, with a few intermittent hills. NC 12 is the principal roadway on the Outer Banks. Other roadways are residential streets to the west and east of NC 12. Land uses on the Outer Banks are largely residential and include single- and multi-family residences and resort type developments. Commercial uses are present in Kitty Hawk, Southern Shores, Duck, and Currituck County. However, Southern Shores, Duck, and Currituck County have far fewer commercial uses than Kitty Hawk, and the amount of commercial uses appears to dwindle as one travels from Kitty Hawk northward along NC 12. Vegetation on the Outer Banks includes: shrubs, ranging in size from 1-foot to 10-feet high; beach and dune type grasses; deciduous trees (mostly in the Town of Duck); and sparse stands of evergreen trees between Duck and Corolla. Representative Outer Banks views are shown on Figure 3-8.

3.4.5.2 Visual Impacts

The visual impact assessment examines how the addition of the features associated with the detailed study alternatives would change the visual character of the project area landscapes, the extent of the change, and whether the change could be considered adverse. No changes to the visual features of the project area would occur with the No-Build Alternative. The introduction of a third outbound emergency lane on US 158 would have minimal visual impact since no new substantial vertical attributes, such as poles or barriers, are proposed with the third lane, although some utility lines would be moved.

On the mainland with MCB2, MCB4, and the Preferred Alternative, the existing landscape would be substantially changed with the introduction of the US 158/Mid-Currituck Bridge interchange along US 158. Existing agricultural features would be lost, and new vertical elements would be introduced. Homes and businesses in this area would be relocated. One home close to Aydlett Road would remain with Option A (included in the Preferred Alternative), and the interchange would be a notable presence and an adverse impact. The interchange is illustrated on Figure 2-10. Option B would displace this home.

With Option A (included in the Preferred Alternative), as the Mid-Currituck Bridge would enter Aydlett from Maple Swamp, it would transition to an earthen berm. The berm would be noticeable from homes south of the berm, and it would replace existing woods. Unless the trees are cut down by the property owners as timber, trees would obscure the berm from homes to the north, except those close to the shore of Currituck Sound.

With Option B, the proposed Mid-Currituck Bridge approach corridor would enter Aydlett near the existing ground elevation. It would include a toll plaza and an elevated realignment of Narrow Shore Road to take it over the toll plaza. These features would replace existing forest views within the community from both north and south of the toll plaza. Drivers on the relocated Narrow Shore Road would have views of the back yards

US 158 east of Wright Memorial Bridge

NC 12 in Southern Shores at Chicahawk Trail

NC 12 in Duck at Thirteenth Street

NC 12 at Sandfiddler Trail

NC 12 in Currituck County 400 feet north of Orion's Way

Corolla Bay planned subdivision in Currituck County

Representative Views of Landscapes on the Outer Banks

Figure

3-8

of homes. The toll plaza would be lighted at night, and those lights would be seen by homes to the south. The nighttime lighting of the toll plaza was expressed as a concern by citizens from Aydlett, particularly as it relates to star gazing hobbyists who recognize Aydlett as an uncommon dark sky location. Light control would be a consideration in developing the final design of a toll plaza in Aydlett. Within 10 to 15 years of bridge opening it is possible that the toll plaza would be narrowed to a two-lane road and the lights removed. Tolls would be collected electronically.

With either Option A (included in the Preferred Alternative) or Option B, the bridge crossing Currituck Sound would be a notable change in the high quality views of Currituck Sound from Aydlett. Essentially, the 180 degree panorama of Currituck Sound would be split, with the bridge becoming a new and substantial human-made element that bisects the view. This adverse impact would be greatest for homes near the bridge where it would be a more dominant presence. The bridge's passage through Aydlett is shown on Figure 2-12.

With ER2 and MCB2, the super-street and associated interchange east of the Wright Memorial Bridge would be introduced into the views of business patrons along US 158, pedestrians and bicyclists on multi-use paths, and motorists on US 158. Principal viewers of the interchange would be users of the Aycock Brown Welcome Center, which would overlook the interchange; businesses near the interchange; a multi-story hotel; and motorists on US 158. The super-street would be the only street of such a large scale on the Outer Banks. The interchange would be the only interchange on the Outer Banks. Although the road and interchange would serve a useful purpose in terms of serving travel demand in this area, neither is what one would expect to see in a beach vacation area like the Outer Banks, with its mostly low density development. The configurations of the super-street and the interchange are shown on Figure 2-4.

With all of the detailed study alternatives, including the Preferred Alternative, wider pavement and new drainage features would be introduced along NC 12. Roadside vegetation would be lost to provide for the drainage features. Although no high quality views would be lost, the overall character of the area along NC 12 would be changed by the loss of vegetation and the wider pavement. Some of the sense of intimacy and isolation associated with this section of NC 12 would be lost with this change. These changes are illustrated on Figure 2-5 and Figure 2-6. These changes would occur for most of the length of NC 12 from US 158 in Dare County to Albacore Street with ER2; for NC 12 from US 158 to the Mid-Currituck Bridge terminus with MCB2; for approximately 2 to 4 miles south of the bridge terminus in Currituck County with MCB4; and for approximately 2.6 miles south of the bridge terminus in Currituck County with the Preferred Alternative.

With the C1 terminus associated with MCB2, MCB4, and the Preferred Alternative, the bridge would be introduced within the panoramic views of Currituck Sound at the planned/developing subdivision of Corolla Bay and the existing subdivision of Monteray Shores. With MCB2 and MCB4, the bridge would have the greatest adverse impact in Corolla Bay, as it would pass through the subdivision, in addition to

obscuring views of Currituck Sound. Once on land, the bridge approach with the Preferred Alternative would remove vegetation between the bridge and the adjoining Corolla Bay and Monteray Shores subdivisions. This would introduce views of the bridge from the subdivisions.

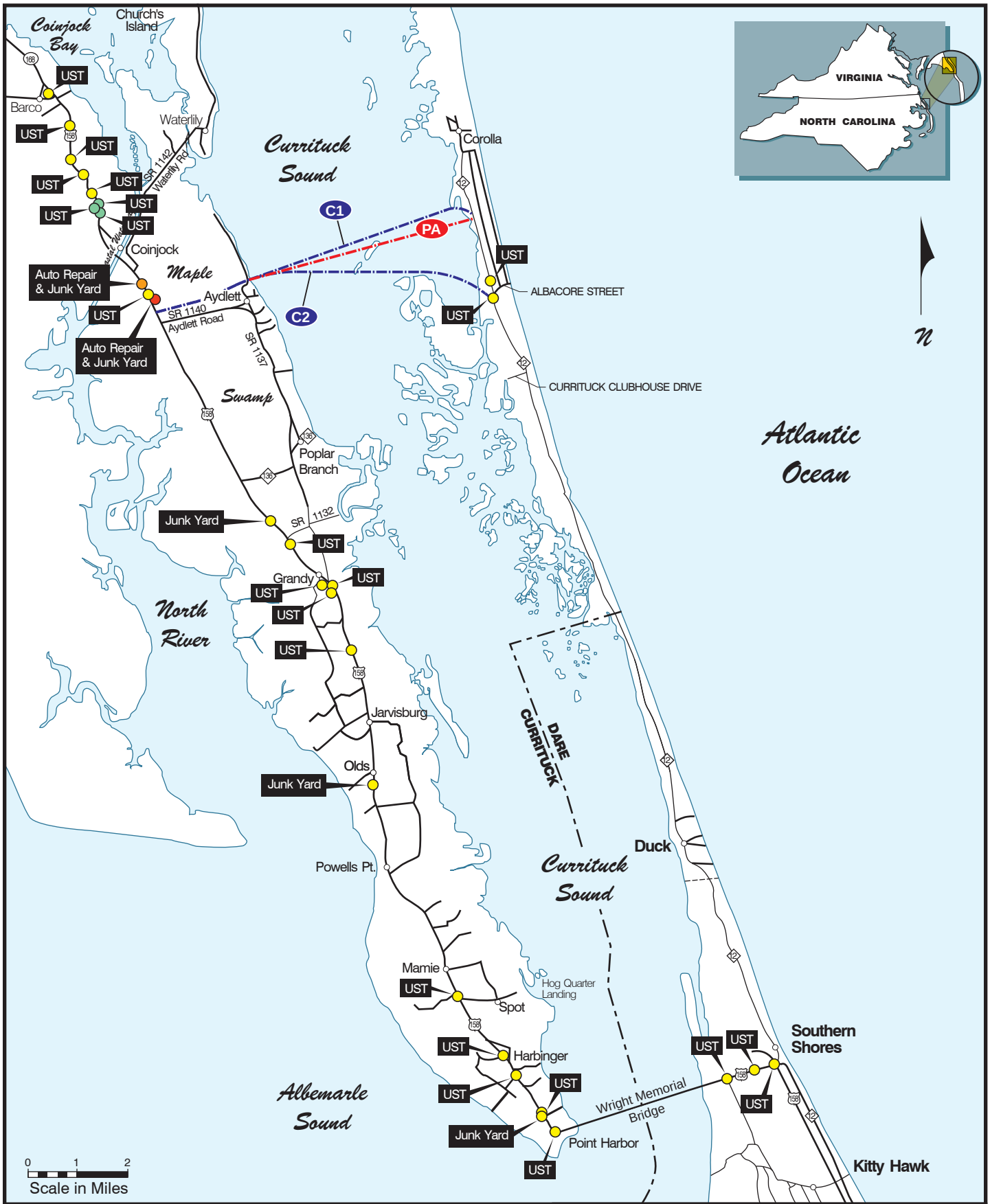
With the C2 terminus for MCB2 and MCB4, a viewing platform in Currituck Sound associated with the TimBuck II development would be displaced, and views of the natural vegetation and the sound from TimBuck II's outdoor recreation area would be replaced by the bridge approaching the shore at a 45-degree angle. This would create an adverse visual impact.

No changes to visual quality in the project area would occur with the No-Build Alternative. Additional detail on the visual impacts is presented in the revised *Other Physical Features Technical Report* (Parsons Brinckerhoff, 2011) on the CD included with this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/.

3.4.6 Are there hazardous materials and underground storage tank sites that could affect the project?

There are 29 potential hazardous material or underground storage tank (UST) sites along the detailed study alternatives. The Preferred Alternative potentially could be affected by five of these sites. The risk of increased project cost or schedule delays resulting from affecting any of these sites ranges from negligible to medium. This risk need not be a factor in choosing an alternative for implementation.

A hazardous material is any item or agent (biological, chemical, or physical) that has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors. Studies identified a total of 29 potential hazardous material or UST sites along the corridors of the detailed study alternatives, including 25 underground storage tank sites and five junk yards (one junk yard is located on one of the 25 underground storage tank sites). The locations of these sites are shown on Figure 3-9. The risk of increased project cost or schedule resulting from affecting any of these sites ranges from negligible to medium. One junk yard is a low to medium risk, and one junk yard is a medium risk. The other 27 sites have a negligible to low or low risk. Assuming reversing the center turn lane is used to improve hurricane evacuation clearance times (as is the case with the Preferred Alternative), all of the detailed study alternatives, except ER2, potentially could be affected by the two low to medium and medium risk sites. In addition, once again assuming reversing the center turn lane is used to improve hurricane evacuation clearance times, MCB2 potentially could be affected by six of the negligible to low or low risk sites, whereas the other detailed study alternatives (including the Preferred Alternative) potentially could be affected by three such sites. With a third outbound lane, ER2 would be affected by 25 negligible to low or low risk sites; MCB2 would be affected by 14 such sites; and MCB4 would be affected by 11 such sites. Detailed soil and groundwater assessments on each of the properties identified (in the current surveys or in the future) would be made after



LEGEND

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

Contamination Sites

- Negligible to Low Impact
- Low Impact
- Low to Medium Impact
- Medium Impact

GeoEnvironmental Sites

Figure 3-9

selection of an alternative for implementation and before right-of-way acquisition. The results would be used to determine any need for remediation of contaminants in the soil or ground water and that need would be taken into consideration during right-of-way acquisition. Additional detail on the potential impacts of hazardous materials and UST sites on the detailed study alternatives, including the Preferred Alternative, is presented in the revised *Other Physical Features Technical Report* (Parsons Brinckerhoff, 2011) on the CD included with this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/.

3.4.7 Would floodplains be affected?

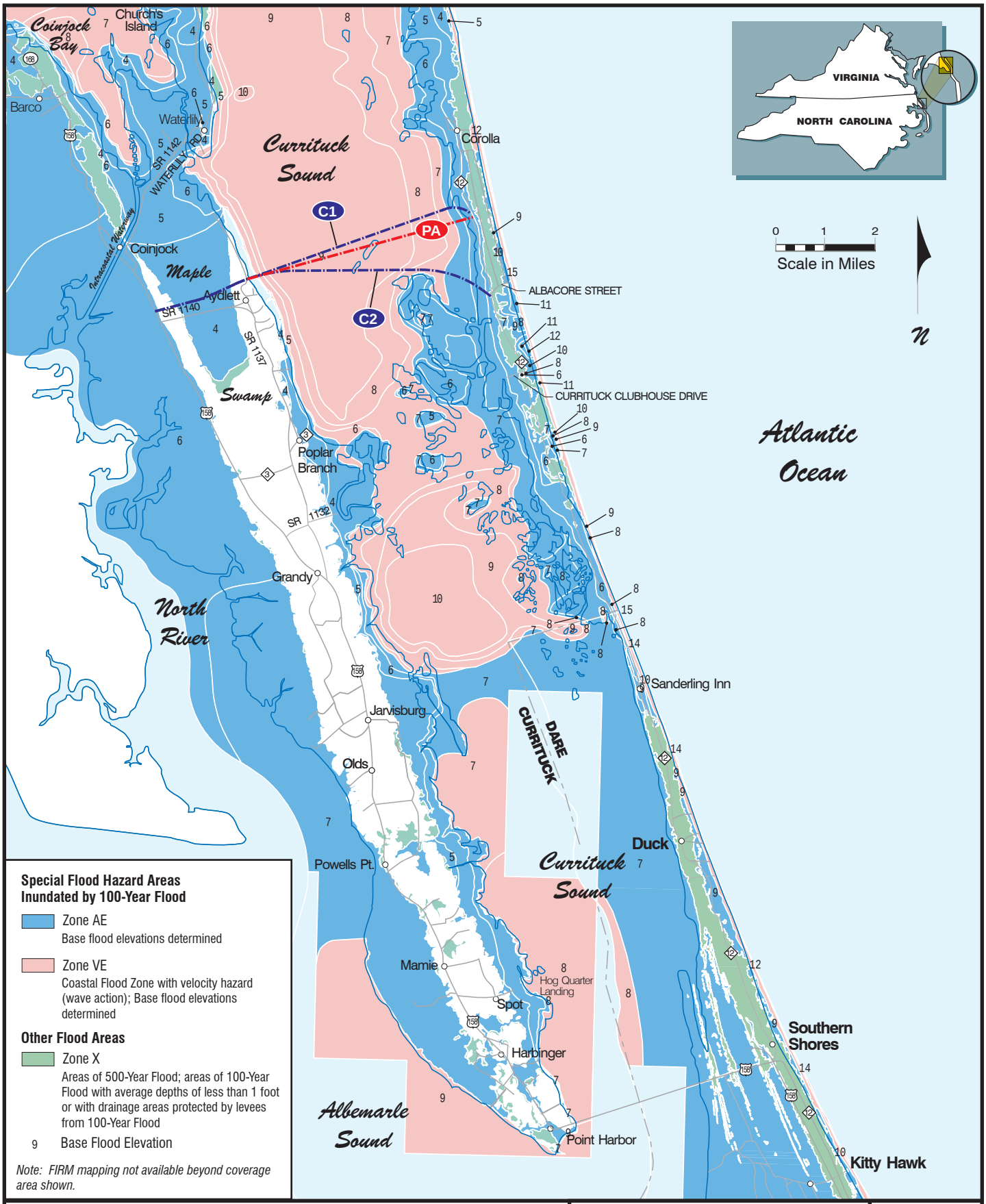
There would be no hydraulic impacts to floodplains in the project area and no significant encroachment on those floodplains with ER2, MCB2/A, MCB4/A, and the Preferred Alternative. Such impacts would occur with MCB2/B and MCB4/B. Option B, however, was not selected for inclusion in the Preferred Alternative.

Floodplains and associated Base Flood Elevations in the project area are shown on Figure 3-10. The floodplains in the project area do not serve the same function as floodplains in non-coastal areas (fluvial or river/stream floodplains with associated stormwater runoff) because water levels in the project area are not dependent on floodplain storage capacity. Rather, the project area is subject to coastal flooding caused by both hurricanes in the summer and fall months and northeasters in the winter and spring, both of which can raise water levels substantially via storm surge. The tidal surge comes into shore with the storm, and then begins to retreat almost immediately once the storm moves on. The only storage that occurs in the project area floodplains is during the brief interval between the surge and the ebb of the storm-induced tide.

3.4.7.1 Hydraulic Impacts to Floodplain

The Mid-Currituck Bridge component of MCB2/A, MCB4/A, and the Preferred Alternative would bridge the two major hydraulic features in the project area, Currituck Sound and Maple Swamp. MCB2/B and MCB4/B would bridge Currituck Sound only except for two 180-foot-long bridges for wildlife passage in Maple Swamp. ER2 would not cross these two features. The Mid-Currituck Bridge would be built above the mapped base flood elevations shown on Figure 3-10. MCB2/A and MCB4/A would encroach on fill for a portion of the total tidally-influenced 100-year floodplain, 9.8 acres on the mainland and 0.6 acre at the C1 Outer Banks terminus of the Mid-Currituck Bridge. The Preferred Alternative also would encroach on fill for a portion of the total tidally-influenced 100-year floodplain, 9.8 acres on the mainland and 0.5 acre at the Outer Banks terminus of the Mid-Currituck Bridge. With MCB2/B and MCB4/B, the mainland number would be 22.1 acres. The proposed widening of the roadways along both the US 158 and NC 12 corridors (with all of the detailed study alternatives, including the Preferred Alternative) would occur at-grade and, therefore, would not result in obstruction or alteration of flood flows or flood elevations.

Since base flood elevations in the project area are the result of tidal surges, neither the increases in runoff because of the expansion of paved surfaces (with all of the detailed study alternatives, including the Preferred Alternative), nor the up to 10.4 acres of fill in



LEGEND

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

Floodplains

Figure

3-10

the 100-year floodplain resulting from bridge construction with MCB2/A and MCB4/A, would have an effect on base flood elevations in the project area. The fill area would be small in relation to the total area affected by the surge.

The fill in Maple Swamp associated with MCB2/B and MCB4/B, however, could obstruct or alter flood flows and elevations and would be considered by Currituck County to be a significant alteration to a water course. MCB2/B and MCB4/B would involve:

- 2.9 acres of fill associated with the western side of the US 158 interchange;
- 19.2 acres of fill associated with the proposed fill in Maple Swamp; and
- 0.6 acre of fill at the C1 Outer Banks terminus of the Mid-Currituck Bridge.

Again, since base flood elevations in the project area are the result of tidal surges, the up to 2.5 acres of fill (excluding that in Maple Swamp) in the 100-year floodplain resulting from bridge construction with MCB2/B and MCB4/B would not have an effect on base flood elevations in the project area. The fill area would be small in relation to the total area affected by the surge.

Hydraulic modeling results revised between the DEIS and this FEIS show that the MCB2/B and MCB4/B fill in Maple Swamp would result in an approximate 0.2-foot increase in the maximum water surface elevation for the 100-year storm at the downstream (north) face of the proposed fill. The 0.2-foot increase would taper to zero change in maximum water surface elevation for the 100-year storm at a point approximately 5,600 feet north of the proposed fill. Based on a visual inspection of available 2-foot contour mapping and satellite images, the area of effect for this rise in water surface elevation includes one residential property (and associated farm buildings) and portions of farm fields along the western edge of the swamp. These properties are east of US 158, between the proposed fill and Young Road. Modeling results also showed that the MCB2/B and MCB4/B fill would result in an approximate 1.3-foot decrease in the maximum water surface elevation for the 100-year storm at the upstream (south) face of the proposed fill. This decrease in water surface elevation would become negligible approximately 5,500 feet south of the proposed fill. Option B was not selected for inclusion in the Preferred Alternative.

3.4.7.2 Significant Encroachment

With respect to floodplain highway encroachment, it is the policy of FHWA "to avoid significant encroachments, where practicable." According to Title 23 CFR, Part 650, Subpart A:

> "*Significant encroachment* shall mean a highway encroachment and any direct support of likely base floodplain development that would involve one or more of the following construction or flood-related impacts:

- A significant potential for interruption or termination of a transportation facility which is needed for emergency vehicles or provides a community's only evacuation route;

- A significant risk; or

- A significant adverse impact on natural and beneficial floodplain values."

ER2, MCB2/A, MCB4/A, and the Preferred Alternative would not involve a significant encroachment on the 100-year floodplain as defined in Title 23 CFR, Part 650, Subpart A (Location and Hydraulic Design of Encroachments on Floodplains). MCB2/B and MCB4/B would involve a significant encroachment since they would be considered a significant alteration to a water course by Currituck County.

Transportation Facility Interruption

There would not be a significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or provides a community's only evacuation route. The Mid-Currituck Bridge associated with MCB2, MCB4, and the Preferred Alternative would lie above the storm surge elevation. The widening of US 158 and NC 12 associated with ER2, MCB2, MCB4, and the Preferred Alternative roadways would be at-grade, the same as with the existing roads. There would be no increase in the risk of transportation facility interruption on those roads. Currituck and Dare counties recognize the risks associated with the storm surge, and each has developed an emergency management program that tracks storms and orders the voluntary evacuation of the entire Outer Banks prior to a storm surge. Dare and Currituck counties also have helicopters to transport patients to area hospitals in the event NC 12 is severed as a result of a storm.

Significant Risk

ER2, MCB2/A, MCB4/A, and the Preferred Alternative would not create a significant risk beyond those associated with development that already exists on the Outer Banks and the mainland. Risks on the Outer Banks and mainland are associated with storms and their consequences. Given the tidal nature of the flooding in the project area, the insignificant footprint of the bridges (Maple Swamp and Currituck Sound bridges) within this very wide floodplain, and the height of the bridges over the floodplain elevations, it is anticipated that the impact of the Mid-Currituck Bridge and, where applicable, associated road widening and interchanges on flood elevations, would be negligible. This conclusion would apply to MCB2/B and MCB4/B, too, except for the potential impact of the fill in Maple Swamp, which as indicated above would be considered by Currituck County to be a significant alteration to a water course. It also would result in an approximate 0.2-foot increase in the maximum water surface elevation for the 100-year storm from the downstream (north) face of the proposed fill. The area of effect for this rise in water surface elevation includes one residential property (and associated farm buildings) and portions of farm fields along the western edge of the swamp.

Impact to Beneficial Floodplain Values

Natural and beneficial floodplain values associated with the project area are:

- The Outer Banks serving as a buffer (therefore flood control) to protect mainland shoreline areas by dampening tidal surges; and
- Wildlife habitat.

ER2, MCB2/A, MCB4/A, and the Preferred Alternative would not have a significant adverse impact on natural and beneficial floodplain values. As noted above, it is anticipated that the impact of these alternatives on flood elevations would be negligible. The bridge component of MCB2/A, MCB4/A, and the Preferred Alternative generally would bridge floodplains and their wildlife habitat. The road widening components would be confined to the existing right-of-way except for infiltration ponds and ditches along NC 12 and generally would pass through areas already disturbed by development.

MCB2/B or MCB4/B, as indicated above, could affect natural and beneficial floodplain values in two different ways: 1) changes in flood flows and elevations for the 100-year storm and 2) anticipated changes to existing groundwater and drainage patterns. Changes associated with the 100-year tidal storm surge include an approximate 0.2-foot increase and 1.3-foot decrease in maximum water surface elevations north and south of the proposed fill, respectively. Hydraulic modeling results for the 10-year tidal surge, however, show no significant impacts to water surface elevations as a result of the proposed fill. There also was negligible response in Maple Swamp (no variation in water surface elevations) during lower storm surge events for existing conditions. This indicates that the wetness of the swamp likely is controlled by the rise and fall of the groundwater table, which is close to the ground surface, rather than tides. The addition of fill proposed for MCB2/B and MCB4/B could result in changes to existing groundwater and drainage patterns in Maple Swamp for non-tidal storm surge situations, which also would affect natural and beneficial floodplain values. Option B was not selected for inclusion in the Preferred Alternative.

3.5 Construction Impacts

This section considers the impacts of the detailed study alternatives that could occur during construction, as follows:

- How would traffic be maintained to minimize the inconvenience to travelers?
- How would air quality be protected during construction?
- How would waste be disposed?
- Would fill have to be obtained to build the detailed study alternatives?

- How would erosion be controlled?
- What construction noise impact would occur?
- Would lighting be used to allow construction at night?
- How would natural resources be protected during construction?
- Would the relocation of utilities cause disruption of service?

The potential characteristics of the construction process for the detailed study alternatives are discussed in Section 2.4. There would be no construction impacts with the No-Build Alternative. Construction associated with the detailed study alternatives would be governed by:

- NCDOT *Standard Specifications for Roads and Structures* (NCDOT, 2006, or current at the time of construction); and
- American Association of State Highway and Transportation Officials (AASHTO) *Standard Specifications for Highway Bridges* (AASHTO, 2002, or current at the time of construction).

Appropriate BMPs applicable to construction and maintenance for protection of surface waters, wetlands, and upland habitat would be used to control erosion, sedimentation, and stormwater runoff. Mechanisms would be put in place to maintain traffic flow; minimize air quality, noise, and construction lighting impacts; manage waste disposal; protect surrounding natural resources; control erosion; and handle any accidental waste spills. Any affected geodetic survey markers in the project area would be properly relocated.

Any major construction project may inconvenience and disturb adjacent residents and businesses. In the case where an existing road is widened or otherwise improved, inconvenience to motorists also can occur. Without proper planning and implementation of controls, traffic disruption, loss of access, dust, noise, burning debris, and utility relocation could adversely affect the comfort and daily life of residents and visitors. Disturbances to the bottom of Currituck Sound, disposal of wastes, lack of erosion control, and damage to trees outside the right-of-way would degrade the quality of the natural environment. In developing and implementing its construction projects, NCTA endeavors to minimize inconveniences and disturbances and would do so if a detailed study alternative were built.

3.5.1 How would traffic be maintained to minimize the inconvenience to travelers?

The construction contractor would be required to meet the traffic maintenance requirements of the NCDOT Standard Specifications for Roads and Structures (NCDOT, 2006, or current at the time of construction). A traffic control plan for each phase of construction would be developed

during final design, and special care would be taken to delineate clearly a safe travelway for traffic. Requirements related to the transport of materials via Aydlett Road, Narrow Shore Road, and NC 12 intended to minimize impacts on Aydlett and the communities along NC 12 would be developed during final design, and the contactor would be contractually obligated to meet these requirements.

Traffic would be maintained on US 158, Aydlett Road (SR 1140), Narrow Shore Road (SR 1137), NC 12, and other local streets throughout construction of any of the detailed study alternatives, including the Preferred Alternative. Emergency vehicles would be able to pass through the construction area. Continuous and safe access would be provided to all adjoining properties, and operations would be conducted so that inconvenience to property owners would be held to a minimum. Traffic generally would not be detoured to other roads. At least one lane in each direction of travel would operate throughout construction on US 158. Two travel lanes would operate on NC 12 throughout construction. Lane closures would not occur during peak travel periods, including the summer weekend when the bulk of the recreational housing on the Outer Banks changes occupants.

Brief periods of delay and disruption that result from construction vehicles operating on US 158, Aydlett Road, Narrow Shore Road, and NC 12 could be encountered by motorists. Most of the bridge components would be brought to the construction site by truck. On the Currituck County mainland, bridge construction materials and equipment would be transported by truck along US 158 and staged in the US 158/Mid-Currituck Bridge interchange area for most mainland construction. US 158 is a five-lane thoroughfare that currently carries truck traffic. Therefore, the impact of additional construction truck traffic on US 158 is not expected to create a substantial impact on US 158 traffic operations, with the possible exception of summer weekend travel.

Transport to Currituck Sound of construction materials and equipment for building the Mid-Currituck Bridge would be via Aydlett Road (between US 158 and Aydlett only) and Narrow Shore Road. Construction materials and equipment would be staged on vacant upland sites along Narrow Shore Road near the western Mid-Currituck Bridge ending. These roads are designed for and generally carry local automobile and light truck traffic. They are two lanes wide and include several sharp curves. They pass through the midst of the community of Aydlett. Narrow Shore Road is the only way in and out of the northern part of Aydlett. Requirements related to the transport of materials intended to minimize impacts on the Aydlett community would be developed during final design, and the contactor would be contractually obligated to meet these requirements. These could include limiting the transport of materials to times of day that would minimize impacts on local motor vehicle movement, as well as providing advance notification of the transport of large bridge components that could briefly block local travel. Depending on the allowable use of project right-of-way in Maple Swamp, the bridge corridor through Maple Swamp also may be used for access to the Narrow Shore Road area as an alternative to Aydlett Road.

On the Outer Banks, construction materials and equipment would be transported by truck via the two-lane NC 12 to construction sites. Construction materials and equipment would be staged on vacant upland sites near the NC 12 widening areas and at the eastern Mid-Currituck Bridge ending. Again, requirements related to the transport of materials intended to minimize impacts to the communities along NC 12 would be developed during final design, and the contactor would be contractually obligated to meet these requirements.

Oversize-overweight loads for certain bridge elements would be transported on US 158, Aydlett Road, Narrow Shore Road, and NC 12. Delivery of these oversize-overweight loads would be required to both sides of Currituck Sound. To ensure minimal traffic disruption, particularly on US 158 and NC 12 during peak travel periods, nighttime or other non-peak period delivery could be made when traffic volumes are at the lowest level if permitted by NCDOT. This would be more expeditious for bridge construction and would limit traffic interruptions to periods of low travel demand. It would, however, generate nighttime noise for the communities along these roads.

3.5.2 How would air quality be protected during construction?

Construction-related air quality effects of the project would be limited to short-term increased fugitive dust (dust in the air) and mobile-source emissions during construction. State and local regulations, as applicable, regarding open air burning, dust control, and other air quality emission reduction controls would be followed.

During construction of any of the detailed study alternatives, including the Preferred Alternative, all materials resulting from clearing and grubbing, demolition, or other operations would be removed from the project site, burned, or otherwise disposed of by the contractor. Any open air burning would be accomplished in accordance with applicable laws, local ordinances, and regulations of the State of North Carolina.

Measures would be taken to reduce dust generated by construction when the control of dust is necessary for the protection and comfort of motorists and area residents. Dust suppression measures could include watering unpaved work areas; temporary and permanent seeding and mulching; covering stockpiled materials; and using covered haul trucks.

To minimize the amount of short-term emissions generated by construction equipment and vehicles, efforts would be made during construction to limit disruption to traffic, especially during peak travel periods, and to minimize construction equipment idling and unnecessary engine use.

3.5.3 How would waste be disposed?

Waste materials, including any toxic or hazardous materials, would be disposed of in accordance with current laws and guidelines. Timber from the woodland areas purchased for right-of-way could be merchandised and sold to lessen the need for disposal or burning of debris.

The disposal of excavated material outside the right-of-way would be the responsibility of the contractor, who would be contractually required to handle and dispose of the materials in accordance with NCDOT *Standard Specifications for Roads and Structures* (NCDOT, 2006, or current at the time of construction) and local, state, and federal laws. When using waste or disposal areas that are not active public waste and disposal sites, the contractor and the owner of the property where waste is to be disposed must jointly submit a Development, Use, and Reclamation Plan to NCTA for each waste or disposal area to be used. This plan must meet specific requirements related to drainage, covering debris with soil, shaping the covered waste into contours that are comparable to and blend in with the existing topography, and erosion control. The covered wastes must be seeded and mulched. Disposal in areas under USACE regulatory jurisdiction is not allowed unless the contractor obtains the required permit. In addition, waste disposal in areas under USACE regulatory jurisdiction would most likely not be authorized, and any such impacts for this type of activity would be considered in the overall impacts for the project.

Any toxic and hazardous materials would be handled and used in accordance with package labels and manufacturers' directions. Wastes would be segregated, labeled, and stored in a manner that would prevent their release into the environment from an accident or spill. The contractor would dispose of these materials and their containers in accordance with applicable state and federal regulations.

In the event of hazardous waste or oil spills, the emergency response procedures established under the North Carolina Oil Pollution and Hazardous Substances Control Act of 1978 would be followed. The Act applies to spills of oil and those chemicals listed in the Federal Clean Water Act, whether on the ground or in water bodies, including off-shore spills.

3.5.4 Would fill have to be obtained to build the detailed study alternatives?

Fill would be required with any of the detailed study alternatives.

It is anticipated that excavation would be minor, primarily associated with accommodating drainage along NC 12 and US 158. The terrain along the alignment of the detailed study alternatives is mostly flat except for a few places in Duck that would be affected with ER2 and MCB2. There would be more fill than excavation, however, primarily associated with interchange ramps and the area between a Maple Swamp Bridge and a Mid-Currituck Bridge. The contractor would select borrow sites and remove the material in accordance with NCDOT practices (see Section 230 of NCDOT standard specifications). No borrow would be taken from wetlands. In placing the fill, all standard construction procedures and measures, including NCDOT *Best Management Practices for Protection of Surface Waters* would be implemented, as applicable, to avoid or minimize environmental impacts.

3.5.5 How would erosion be controlled?

North Carolina Administrative Code Title 15A, Chapter 4, Subchapter B titled "Erosion and Sediment Control," requires approval of a soil erosion control plan before land-disturbing activities can begin. NCTA's contractor would prepare an erosion control plan prior to construction of a detailed study alternative and implement it during construction.

The erosion control plan must identify critical areas subject to severe erosion, limit the size of the area exposed at any one time, limit the time exposed, control water runoff, prevent off-site sedimentation damage, and manage stormwater runoff. Impacts resulting from erosion and sedimentation likely would be kept to a minimum by employing BMPs such as silt check-dams, silt fences, and silt basins. During construction of a detailed study alternative, including the Preferred Alternative, appropriate improvement techniques would be employed, such as prompt establishment of appropriate grass species, sediment barriers, and proper grading of slopes in order to meet the standards set by the Sedimentation Pollution Control Act of 1973, as amended. These practices would include those in conformance with NCDOT *Sediment and Erosion Control Program* and *Best Management Practices for Protection of Surface Waters*.

Permanent erosion control measures would be incorporated into the project at the earliest practicable time and coordinated with temporary measures to ensure economical, effective, and continuous erosion control. Every reasonable precaution would be taken to prevent pollution of water bodies.

3.5.6 What construction noise impact would occur?

Overall, construction noise impacts are expected to be generally minimal because construction noise is relatively short in duration (as it moves along the project reach).

The major construction elements of this project are expected to be earth removal, hauling, grading, and paving, as well as the construction staging activities and transport of materials to staging sites. General construction noise impacts, such as temporary speech interference for passersby and individuals living or working near the project, can be expected, particularly from noise from paving operations and from the earth moving equipment during grading operations. High noise levels of impact pile driving and combustion-engine-powered equipment usually would be the main contributors to bridge construction equipment noise levels. Construction noise impacts are expected to vary depending upon the duration, stage, and location of construction. Furthermore, on land, the transmission loss characteristics of the surrounding wooded areas and other natural and development features would help moderate the effects of intrusive construction noise. Noise impacts to fish are noted in Section 3.3.4.4.

3.5.7 Would lighting be used to allow construction at night?

It is not uncommon in North Carolina to restrict construction to daytime hours in residential areas.

The most critical areas with respect to lighting would be in Aydlett, a full-time quiet residential community, and on the Outer Banks, where sensitivity to construction disturbance would be greatest in the summer tourist season because of the presence of large rental cottages in the area.

3.5.8 How would natural resources be protected during construction?

Protection of the natural resources within the project area would involve implementing a variety of environmental safeguards during all stages of the project, from planning through construction, to protect sensitive natural resources adjoining the construction area.

Appropriate BMPs applicable to construction and maintenance for protection of surface waters, wetlands, and upland habitat would be used to control erosion, sedimentation, and stormwater runoff. Trees outside the construction limits would be protected from construction activities. Additional details on the methods planned to minimize impacts to natural resources during construction are presented in Sections 2.4 and 3.3.4.4 of this FEIS.

3.5.9 Would the relocation of utilities cause disruption of service?

The relocation of utilities would be included in final design plans. NCTA would coordinate construction activities with the appropriate officials to minimize damage or disruption of existing service.

MCB2, MCB4, and the Preferred Alternative would be routed around a power substation in Aydlett. With MCB2, MCB4, and the Preferred Alternative, there is a major powerline in the US 158/Mid-Currituck Bridge interchange area, the corridors parallel a major powerline across Maple Swamp, a major power line is along US 158 east of the Wright Memorial Bridge, and the Mid-Currituck Bridge would pass over an underwater powerline in Currituck Sound. With the Preferred Alternative, powerline towers at four locations would be relocated in the US 158/Mid-Currituck Bridge interchange area, but without service disruption. Local utilities along NC 12 would be relocated when widening NC 12 with minimal or no service disruption. The area required to relocate utilities along NC 12 is included as a permanent utility easement in the preliminary design plans used to assess the impacts of the Preferred Alternative.

3.6 Indirect and Cumulative Effects

The previous sections considered direct impacts, impacts that would be caused by the construction and operation of the project. This section considers impacts that are not directly related to the project, but that could be contributed to by the project.

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 effects 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.

This assessment of indirect and cumulative impacts was prepared in accordance with the *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina* (NCDOT, 2001). The specific methodologies during each step of the indirect and cumulative effects analysis were selected 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. They 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. This section focuses on the key findings of the indirect and cumulative impacts assessment. Additional detail is presented in the revised *Indirect and Cumulative Effects Technical Report* (East Carolina University and Parsons Brinckerhoff, 2011) found on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/.

This discussion addresses the following questions:

- What procedures did you follow to determine the potential for indirect and cumulative effects?
- What indirect and cumulative effects could be expected?
- What are the substantial indirect and cumulative effects and could they be minimized?

3.6.1 What procedures did you follow to determine the potential for indirect and cumulative effects?

The following steps were followed:

- *An indirect and cumulative impacts study area was identified;*
- *The study area's directions and goals were identified;*

- *Notable features were inventoried;*
- *Impact-causing activities were identified; and*
- *Potential indirect and cumulative effects were identified for analysis.*

The sections that follow describe the outcome of these preparatory steps.

3.6.1.1 Study Area

Because communities and ecosystems are connected in a variety of ways, the study area for the indirect and cumulative impacts assessment is larger than that for the direct impact assessment. This study area is shown on Figure 3-11. It encompasses what is believed is the complete area of potential influence of the Mid-Currituck Bridge project, including political and planning boundaries, the commuteshed of area workers, the area where the Mid-Currituck Bridge project might affect future growth and development, and the area where there could be impacts on the natural environment. The inclusion of these areas did not assume that impacts would occur, but rather that the construction of one of the detailed study alternatives would be sufficient to warrant consideration of this wider area.

Time also is a study boundary in an indirect and cumulative impact assessment, both for establishing past trends of development and forecasting future development. The assessment used the early 1970s as the primary starting point for assessing trends in land use change, and the project's 2035 traffic forecasting year as the ending point.

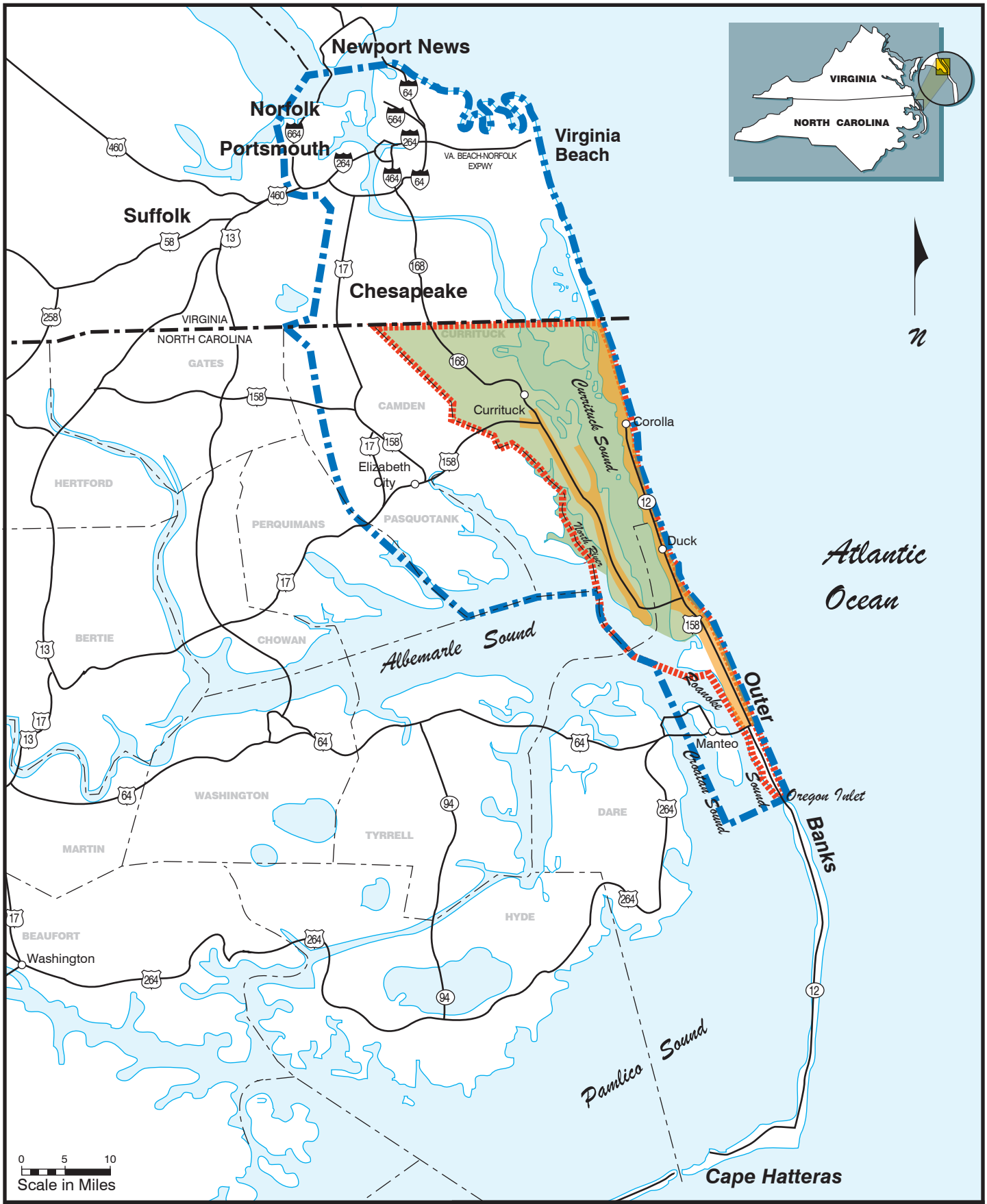
3.6.1.2 Directions and Goals

The study area's directions and goals were identified. Trends in population, housing, and employment were documented. 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. The 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 (Lane and Jolley, 2008). This vision plan did not state goals per se, but did articulate 10 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. The goals of these government and non-government organizations include: social health and well being; economic opportunity; and ecosystem protection.

3.6.1.3 Inventory of Notable Features

Four distinguishable landscapes and waterscapes are of interest in the study area: the Currituck County mainland, North River estuary, Currituck Sound, and the Outer



LEGEND

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

Indirect and Cumulative Effects Assessment Study Area Boundaries

Figure

3-11

Banks. The characteristics of each were considered, the characteristics of key environmental and community elements were described, and notable ecosystem and socioeconomic features were identified. Notable features in the study area are shown in Table 3-18 and Table 3-19.

3.6.1.4 Impact-Causing Activities

In the 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 (Figure 2-13);

Table 3-18. 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
Coastal Marshes	Currituck Sound, North River Estuary
Unconsolidated Estuarine Bottom	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 (AEC)	Currituck County Mainland, North River, Currituck Sound, Outer Banks

Table 3-19. 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

4. Logging in forested areas, including wetlands;

5. Beach driving; and

6. Accelerated sea level rise.

The above activities can alter habitat and ground cover, introduce exotic and invasive flora, alter groundwater recharge and drainage, generate noise, require cuts and fills, fill wetlands or open water, change motor vehicle operating characteristics via new thoroughfares or increased capacity of thoroughfares, and change access, circulation patterns, and travel times to major traffic attractors.

Activities 2 to 6 generally would occur with or without the implementation of one of the detailed study alternatives, including the Preferred Alternative. The proposed project and its detailed study alternatives are under consideration in this FEIS. Those 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 from five perspectives:

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 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?

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

The following sections describe how these questions were answered and why.

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 the region; and
- Other factors that individuals consider in choosing a permanent residence.

An increase in permanent residents on the Outer Banks, should it occur with the detailed study alternatives, could 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. Because there is not likely to be affordable or "workforce" housing on the Outer Banks, the number of workers that could live there irrespective of the changes in access to the Outer Banks is limited. Even with the reductions in travel time associated with a bridge, travel times from the main employment centers of the commuteshed that are in Hampton Roads, Virginia (an area with jobs that have incomes sufficient to live at the beach), would still be too great for a daily commute, especially given closer options like Virginia Beach and Sandbridge, Virginia. The Currituck County mainland is not a significant employment center. Additional factors in reaching the above conclusion were:

- Currently, there are few year-round residents on the Outer Banks. This is evidenced by the fact that 91.2 percent of the Outer Banks property in Currituck County (7,355 of 8,067 parcels) is non-resident owned (derived from 2008 Currituck County tax files).

- The dominant housing types (89 percent) on the Outer Banks are second homes and vacation rental properties and are designed to serve vacationers and not permanent residents.

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

Currently, day visitors to the Currituck Outer Banks comprise a small minority of its visitors. Only 5.6 percent of respondents to a mail-in survey of visitors conducted by the 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 visitors to the Currituck Outer Banks. However, the preferred activities of all visitors to the Currituck 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, and 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 visitors to the Currituck 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 reduce the travel time from Hampton Roads to the Currituck County Outer Banks (156 minutes to 80 minutes under uncongested conditions according to Google Maps in combination with project area travel time studies for the project). 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, Bodie Island, and 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.

Despite these limiting factors, the existence of a Mid-Currituck Bridge 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 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 the one hand, these beaches are only available 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. Direct observation and public comments indicate that already, the summer beaches here become thick with day visitors and weeklong visitors renting in the area. Currently beach driving is unrestricted. Future restrictions by the county could regulate the demand for this activity; however, none are planned at this time.

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

For the NC 12-accessible Outer Banks, there would be no reasonably foreseeable change in the overall type and density of development with implementation of the detailed study alternatives, including the Preferred Alternative, compared to 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 expecting and currently planning for forecast future levels of development.

A potential for a 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. 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 represent 86 percent build-out from Southern Shores to the Virginia Line. The maximum combined build-out in both of these areas (NC 12-accessible and non-road accessible) in terms of homes or hotel rooms is approximately 15,400. Eighty-six percent is 13,200 homes or hotel rooms. With the No-Build Alternative, congestion on NC 12 could be great enough to constrain development in the Outer Banks portion of the larger project area. It is estimated that the No-Build Alternative could create a practical build-out at 70 percent of maximum build-out from the Virginia Line to Southern Shores. A constraint of 70 percent would yield a practical build-out of approximately 10,800 homes or hotel rooms (2,400 units

less than forecast for 2035). It is estimated that ER2 could create a practical build-out at 75 percent of maximum build-out from the Virginia Line to Southern Shores. A constraint of 75 percent would yield a practical build-out of approximately 11,600 homes or hotel rooms (1,600 units less than forecast for 2035). 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.

In 2007, there were approximately 9,000 homes or hotel rooms on the Outer Banks from the Virginia Line to Southern Shores. The number of units forecast for 2035 is 13,200, an increase of 4,200. If one assumes an average growth rate of 150 units per year, the constraint identified for the No-Build Alternative could manifest itself in about 2019; with ER2, it would be 2024. It is also important to note that under both alternatives there would not be a proportionate reduction in new paved roadways because much of the reduction would occur in the non-road area and even the reductions that would be in the NC 12 area are largely serviced by roads that would otherwise exist.

These findings assume that any road can only carry so many motor vehicles an hour. In addition, there are only so many hours that vacationers will want to drive under heavily congested conditions to reach their destinations. Therefore, eventually ever-increasing congestion on a two-lane or three-lane NC 12 could affect the demand for beach housing and, in turn, additions to the supply.

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:

- The road-accessible portion of the Outer Banks is already substantially developed today. As of 2007, the NC 12-accessible communities were nearly all subdivided. There were 12,268 approved residential parcels or hotel rooms of which 8,425, or 69 percent, were developed.

- 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 implementation of these plans are

indicative of the local jurisdictions' commitments 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. 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.

- 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 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 could, however, influence the location of development that occurs first.

- The lack of transportation improvements and associated growing congestion could constrain development under the No-Build Alternative.

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

For the non-paved road-accessible Outer Banks (sometimes referred to as Carova or non-road accessible), there would be no reasonably foreseeable change in the location, rate, or type of development with implementation of the detailed study alternatives compared 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 overcome the influence of travel time savings that the detailed study alternatives would have on development decisions in this area, including the substantial travel time savings associated with the Mid-Currituck Bridge.

The possibility of extreme congestion with the No-Build Alternative constraining development applies here as well, although in this case a bridge also 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.

This finding is based on the following:

- Demand for the unique experience offered by Carova has been a primary reason that development is occurring. Lack of accessibility both makes it attractive and helps limit development.

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

- All new subdivisions in the non-road-accessible area have minimum 3-acre lot sizes. Smaller grandfathered lots exist but may not have acceptable septic conditions.

- 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.

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

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 effects 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 study area. Thus, notable changes in the impact of development associated with this shift are expected only at the western end of 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, compared to the No-Build Alternative and ER2, which do not include a Mid-Currituck Bridge.

Finally, 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 result in people choosing different places to live than if the bridge were not built.

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 were an important determinant 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 would not be 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.

These findings are based on the following:

- 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 exist regardless. The county commissioned an economic development strategy from The UNC Institute for Competitive Economies (Lane and Jolley, 2008). This plan calls for and forecasts development near the US 158/Mid-Currituck Bridge interchange on the mainland.

- Conclusions related to changes in development in the road-accessible Outer Banks do not indicate a net increase in overall business or residential development on the Outer Banks related to 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 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.

3.6.1.5 Identify Potential Indirect/Cumulative Effects for Analysis

Finally, this part of the analysis of indirect and cumulative effects considers how the activities listed in Section 3.6.1.4 would affect the study area's notable socioeconomic and ecosystem features.

3.6.2 What indirect and cumulative effects could be expected?

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). Under the No-Build Alternative and ER2, severe traffic congestion could serve as a practical constraint to planned

development on the Outer Banks. With MCB2, MCB4, and the Preferred Alternative, the potential exists for increased day visitors to the Currituck County Outer Banks. These three 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 such effects would be primarily associated with future growth in Currituck County, irrespective of a detailed study alternative being implemented, including the Preferred Alternative. 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.

This assessment of indirect and cumulative effects had four parts:

1. Assessment of the relationship of reasonably foreseeable changes in land development and use 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 is presented on Figure 3-12. The nature of the reasonably foreseeable changes in land development patterns with the detailed study alternatives is presented in Section 3.6.2.1.

2. Assessment of the effect of changed development and use patterns on the area's notable ecosystem and cultural/socioeconomic features, and their compatibility with local/regional goals, land use plans, and development regulations.

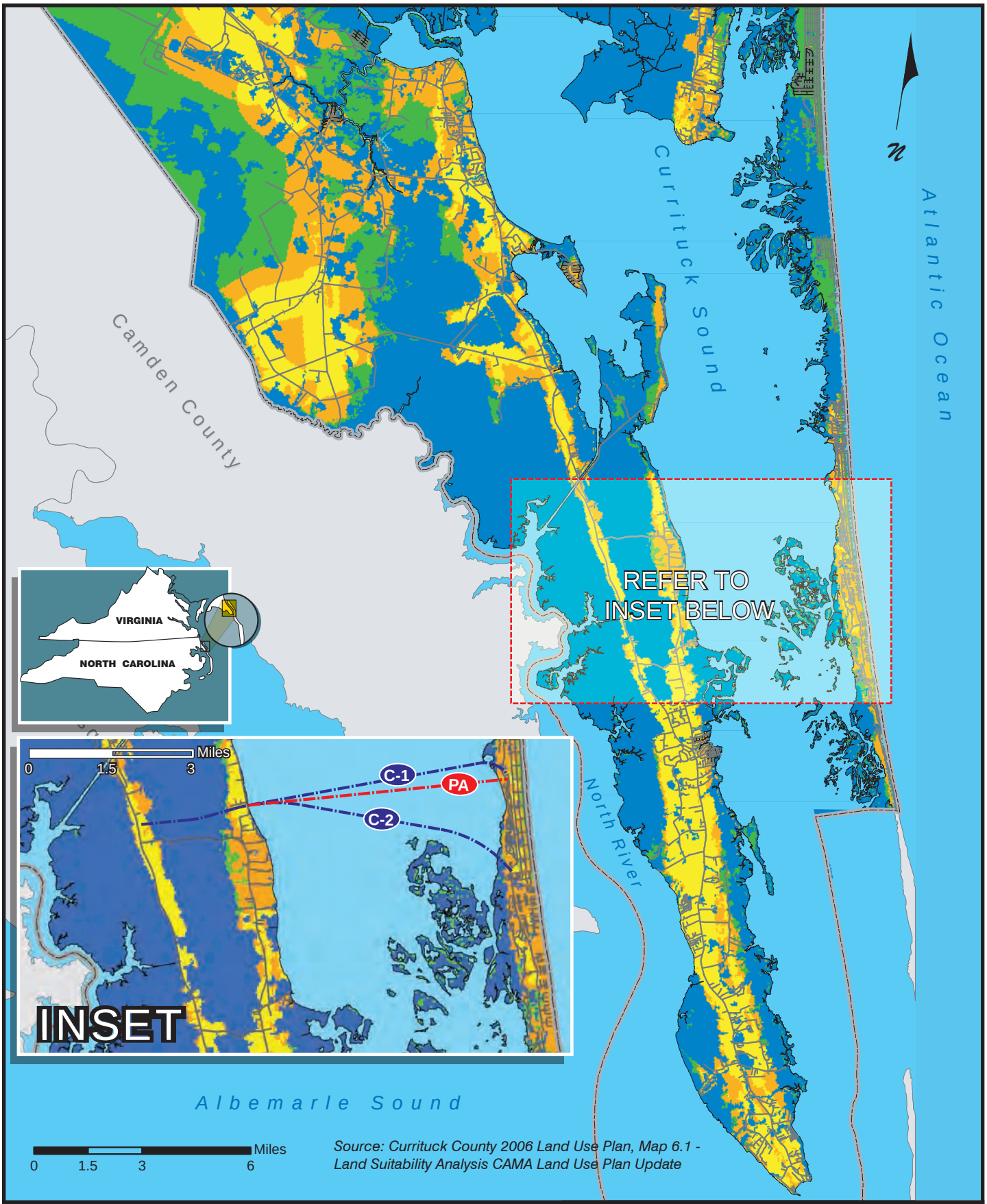
   These indirect impacts are those associated with changes in mainland development patterns as defined by item 1 above and are presented in Section 3.6.2.2.

3. Assessment of the cumulative effects of the detailed study alternatives, project-induced changes, and other activities. These are presented in Section 3.6.2.3 for the same items listed under item 2 above.

4. The extent of uncertainty in assessment results and risk that effects could be different.

3.6.2.1 Land Suitability Analysis for Changed Development Patterns

Section 3.6.1.4 indicates that some commercial development would shift from points elsewhere in the study area to the area around the Mid-Currituck Bridge. The UNC economic study (Lane and Jolley, 2008) indicated the potential for approximately 34 businesses to shift to this area. These businesses would be defined as occurring within an approximately 7.6-square-mile vicinity of the mainland terminus of a Mid-Currituck Bridge. Based on past trends, these businesses could use an average of approximately 2 acres per business, or approximately 68 acres. Sixty-eight acres therefore is considered



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
3-12

in this assessment to represent a reasonably foreseeable order of magnitude estimate of the area that would be affected by the shift of commercial development to the interchange area. An examination of land considered suitable for development in the Currituck County land use plan indicates there is more than adequate suitable land for such development, even within 1 mile of the bridge. Although much of this land is currently in agricultural uses or is undeveloped, all of 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." All of this land is planned to have limited services, which includes public water but relies on on-site septic service.

3.6.2.2 Indirect Effects

The assessment of indirect effects focused on the impact 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. Three notable induced changes associated with MCB2, MCB4, and the Preferred Alternative are:

- A change in the order in which available lots on the NC 12-accessible Outer Banks would develop.
- Approximately 68 acres of business development would likely occur near the US 158/Mid-Currituck Bridge interchange on what is currently agricultural land.
- 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.

Changes that could be caused by the No-Build Alternative or ER2 would be:

- A reduction of the growth in the demand for vacation homes and hotel rooms because of the inconvenience of heavy congestion; and/or
- A reduction in trips per dwelling unit resulting from road user choice (e.g., visitors arriving on a Saturday choosing to stay off the roads on Sunday when other renters arrive) or changes in rental timing (e.g., Realtors offering more rentals with weekday starts).

The assessment concluded that, in general, the indirect effects of these changes would be minimal or low. The change would be compatible with area land use plans, social health and well-being goals, economic opportunity goals, and ecosystem protection goals.

Visual Change

One primary indirect impact would be a visual change associated with the indirect effects of MCB2, MCB4, and the Preferred Alternative, as some existing features would

be lost and new vertical elements would be introduced. As a direct impact, the interchange associated with MCB2, MCB4, and the Preferred Alternative 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 of the businesses would depend upon the appearance requirements that might be imposed by Currituck County. If the development occurred based completely on decisions of individual developers, the result could be a setting with buildings of non-complementary design and a clutter of competing signs. Application by Currituck County of its appearance controls could permit the creation of development that could be an attractive prelude to the developed areas on the Outer Banks. An additional impact of approximately 68 acres of business development would be on US 158 traffic flow if each of the approximately 34 businesses were allowed individual access to US 158, resulting in scattered rather than consolidated turning movements.

A reduction of the growth in the demand for vacation homes and hotel rooms would result in less change in the existing landscapes. However, given the pervasiveness of existing development and that much of the land that would be developed is within existing subdivisions, there would be no notable reduction of visual change on the Outer Banks with ER2 and the No-Build Alternative.

Estuaries/Water Quality

With respect to estuaries and water quality, the area of the induced commercial 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 surface run-off and on-site septic facilities. The 68 acres that are likely to see induced development on the Currituck County 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 surface area coverage of 44 acres. Also, current county regulations require new development to manage run-off from a 10-year storm event, which is approximately a 6-inch rainfall. At the state level, all new development also must comply with NC Session Law 2008-211, which requires new development to capture and treat the first 1.5 inches of runoff from new impervious surfaces.

A potential constraint on the future development rate on the Outer Banks with ER2 and the No-Build Alternative would not be expected to result in an appreciable improvement in surficial water quality. This is because stormwater management in new development is regulated by county and state laws; the buildable beach parcels are on sandy soils; and the reduction in new growth would not be associated with a proportionate reduction in impermeable roadways.

With regard to project-related runoff, NCTA also 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. The law would be met 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 BMPs, to the maximum extent practicable (see Section 2.1.7).

Protected Species

Indirect effects to protected species relate to the potential for increased beach driving. The impacts are taken into consideration in the biological conclusions in Section 3.3.8.1 and in the *Biological Assessment* (CZR, Incorporated, 2011) that is on the compact disc (CD) that accompanies this FEIS, at public review locations listed in Appendix C as a printed copy, and on the NCTA web site at https://www.ncdot.gov/projects/mid-currituck-bridge/. In general, increased beach driving would have "No Effect" on threatened and endangered species. However, the biological conclusion for the loggerhead sea turtle as it relates to their nesting on the beach is "May Affect, Not Likely to Adversely Affect."

Wild Horses

With MCB2, MCB4, and the Preferred Alternative, wild horse habitat in the northern beaches would be affected by increased day visitors to this area. The presence of more bathers increases the chance of horse-human interactions. Also, increased beach traffic increases the likelihood of collisions with the animals.

With ER2 and the No-Build Alternative, potential traffic constraints on the future development rate would proportionately reduce wild horse habitat land use conversion and reduce the trip-generating houses, thereby reducing the future growth of traffic in the wild horse area.

Day Visitors

An increase in the demand of day visitors on the Outer Banks would increase demand on visitor services in the NC 12-accessible communities and on beach driving and access north of NC 12. Beach access and commercial resort activity are consistent with goals in the Currituck County land use plan. At the same time, an increase in resort activity by day visitors would not be universally welcomed by all constituents on the Outer Banks. Induced beach driving would contribute to environmental degradation north of NC 12. However, Currituck County could manage the resort use with small area plans, public beach access and parking plans, and beach driving regulations.

3.6.2.3 Cumulative Effects

Cumulative effects were considered for the detailed study alternatives incorporating: direct impacts; the three induced changes associated with MCB2, MCB4, and the Preferred Alternative; the potential induced changes with the No-Build Alternative and ER2; and other reasonably foreseeable activities in the study area. Potential effects were

evaluated as related to the ecosystem and cultural/socioeconomic features, and their compatibility with local/regional goals, land use plans, and development regulations.

The indirect and cumulative effects study area is a high growth part of North Carolina with a long-term trend towards increased resort, recreational, and commercial development. The cumulative impact assessment found that it was the continuation of current development trends beyond the Currituck County's land use plan's horizon year of 2025 to 2035 that would generally drive the extent of cumulative impacts, irrespective of the implementation of one of the detailed study alternatives or the No-Build Alternative. The exception would be on the Outer Banks with ER2 or the No-Build Alternative, where constraints in the capacity of NC 12 could constrain growth to 75 and 70 percent, respectively, of potential build-out from the Virginia Line to Southern Shores.

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

The Currituck 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 3-20 provides the steps that were used to obtain the extended estimate.

Table 3-20. Population and Land Calculation Factors

Calculation Factor	Result	Source
Difference Between County's 2005 and 2025 Land in Development Estimates	19,118 acres	County land use plan Table 4.9
Difference Between County's 2005 and 2025 Population Estimates	14,300 persons	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 county 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 acres

Based on the trend extrapolation of land to be developed and population growth as shown in Table 3-20, 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.

The potential constraint on Outer Banks development with the No-Build Alternative and ER2 would reduce the number of homes and hotel rooms in 2035 by approximately 1,600 and 2,400 units, respectively, as stated in Section 3.6.1.4. Table 4-7 of the Currituck County land use plan assumes an average acreage per dwelling unit on the Outer Banks of 0.33 acre. If this is applied to the constrained units, the acres developed on the Outer Banks would be approximately 525 to 800 acres less, or approximately 1.6 to 2.4 percent of the 32,988 acres of total development between 2005 and 2035 in Currituck County shown in Table 3-20.

The growth trend assumed in area land use plans with a 2025 horizon year 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 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. This result would occur with all alternatives, including the No-Build Alternative. The detailed study alternatives would not make a substantial contribution to this trend.

On the beaches and dunes north of NC 12, vehicular impacts already degrade the habitat for conservation purposes. With MCB2, MCB4, and the Preferred Alternative, increased potential demand of day visitors would be most realized in this area. This would combine with the trend for increased use of the beach as a road right-of-way for the northern communities and for day visitors to the beach.

For most of the notable features identified in Table 3-18 and Table 3-19, the detailed study alternatives would not notably contribute to cumulative impacts on the resource. Of these, noteworthy natural environmental features impacts would be as follows:

- Estuaries/water quality would be largely affected by the anticipated growth independent of any detailed study alternative. With MCB2, MCB4, and the Preferred Alternative, 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 (up to 126.8 acres of impervious surface) are minor components of the cumulative impacts. With ER2 and the No-Build Alternative, the potential constraint on development rates was not found in Section 3.6.2.2 to lead to a demonstrable improvement in surface water quality. Consequently, the cumulative effects of all future development and actions on surface water quality are not expected to be affected by this potential reduction in

the amount of new development in the future. Public water supplies similarly would be mostly affected by planned development. With any of the bridge alternatives, the location of a forecast approximately 34 businesses on the mainland would exert minor additional water demand there.

- SAV 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 bridge alternatives would shade up to 5.5 acres of existing SAV beds and up to 13.3 acres of SAV habitat and potential SAV habitat.

- Non-coastal wetlands 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 study area.

- Extensive waterbird habitats exist in the indirect and cumulative effects study area. Declining numbers since 1950 suggest environmental stresses to the habitats (USACE, 2010). New development in the study area will convert land uses and introduce increased levels of ambient noise and light. The No-Build Alternative and ER2 would pose the least potential cumulative impact because they would utilize already developed land. MCB2, MCB4, and the Preferred Alternative would contain project-related activities including new bridges through Maple Swamp and Currituck Sound, bisecting waterfowl habitats and introducing vehicles, noise, and light. This could contribute additional stress to the habitats. Other activities include ongoing private development on all landscapes, which is altering habitat; and ongoing beach driving, which is believed to degrade nesting habitat for shore birds. Substantial improvement in the quality of Currituck Sound, including SAV beds, could cause a recovery in waterfowl habitat. The direct project-related impacts from a bridge would be mitigated (see Section 3.3.7.2). Therefore, there would be no substantial impact on waterbirds in the ICE study area.

Noteworthy socioeconomic features experiencing cumulative effects would be as follows:

- Agriculture 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. The detailed study alternatives would affect 109 to 117 acres of prime or state and locally important farmland on the mainland.

- Neighborhoods and village communities and scenic and natural area character would be most affected by 2035 by the extensive development forecast for the 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 or MCB4, 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 presence of the bridge. Also, although within levels that do not require consideration of noise barriers as mitigation, traffic noise from the bridge would be audible in Aydlett.

3.6.2.4 Evaluate Analysis Results

This portion of the analysis examined the assumptions made in the previous steps and considered uncertainty and how that uncertainty could influence the range of indirect and cumulative effects. Refer to the *Indirect and Cumulative Effects Technical Report* (East Carolina University and Parsons Brinckerhoff, 2009) for the findings of this analysis.

3.6.3 What are the substantial indirect and cumulative effects and could they be minimized?

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 minimize impacts associated with the US 158/Mid-Currituck Bridge interchange itself. Minimization of other impacts would be the responsibility of Currituck County.

This final step of the indirect and cumulative effects assessment considered:

- 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 NCTA?
- What is the role of NCTA when mitigation/enhancement measures would not be within its jurisdiction?

NCTA and FHWA believe that the indirect and cumulative effects assessment provides a reasonable basis for informed decision-making.

Substantial undesirable effects were considered to be the indirect visual impact associated with development at the US 158/Mid-Currituck Bridge interchange with MCB2 and MCB4 and the finding that the growth trend assumed in area land use plans

with a 2025 horizon year does not appear to be sustainable to 2035 on the Currituck County mainland.

Practicable avoidance/minimization measures for these impacts include:

- Induced effects minimization

  The extent of the visual impact of new businesses would depend on the appearance requirements that might be imposed by Currituck County. Appearance controls regarding placement of parking, building exteriors, 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 reduced. Its presence and 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 would be expected to be required both by the county and NCDOT.

- Cumulative effects 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 the focus on the type of economic development the county would like to attract in the larger context of land use planning;
  - Creating small area plans to accommodate multiple community goals;
  - Establishing high density village areas and/or clustered mixed-used developments;
  - Continued promotion of conservation subdivision design;
  - Continued promotion of a farmland conservancy and transfer of development rights (if authorized by the North Carolina General Assembly);
  - Consideration of viewsheds and visual elements in land use plans;
  - Advocacy of "low impact development" as a best management practice that would reduce 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 connectivity between valued natural resource features;

- Use of a nuisance vegetation ordinance that would prohibit 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" (Currituck County, 2006). 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, Planning Director, Currituck County, May 2008 and February 2009). Currituck County has the legal authority to regulate and manage driving on its beaches.

NCTA and FHWA generally have no mitigation jurisdiction over indirect and cumulative effects. Within NCTA and/or FHWA jurisdictions are:

- Selecting a Preferred Alternative that meets the project purpose and need while considering: the degree of travel benefit offered, state transportation network efficiency, project affordability, and the manner in which each alternative would avoid, minimize, and have the potential for mitigating environmental impact.

- 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 this FEIS include:

  - Providing no direct access from the bridge to Aydlett, to ensure that 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) or placing fill in Maple Swamp, while 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 where land suitable for development surrounds the interchange to ensure induced development would occur 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 would not reduce the efficiency of public thoroughfares.

The role of NCTA and FHWA when avoidance/minimization measures are not within their jurisdiction includes:

- Guiding future thoroughfare planning in Currituck and Dare counties; and
- Identifying indirect and cumulative impact concerns under the jurisdiction of others in this FEIS.

3.7 What is the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity?

The local short-term impacts and the use of resources for any of the detailed study alternatives, including the Preferred Alternative, would be consistent with the maintenance and enhancement of long-term productivity for Currituck and Dare counties and the State of North Carolina. This conclusion is first reflected in the travel benefits associated with the detailed study alternatives. These benefits vary by alternative, as presented in Table 2-3, and include:

- MCB2, which includes both the Mid-Currituck Bridge and substantial improvements to existing roads, would have the greatest traffic flow benefits, and ER2 would have the least;
- MCB2 also would have the greatest travel time benefits, and ER2 would have the least, with a Mid-Currituck Bridge, which is included in MCB2, MCB4, and the Preferred Alternative, offering substantial travel time savings for many travelers between the Currituck County mainland and its Outer Banks; and
- The construction of a third outbound lane on US 158 would offer the greatest reductions in hurricane evacuation clearance times with any alternative.

Second, from the perspective of area land use and transportation plans, the short-term impacts and use of resources in the construction of MCB4 and the Preferred Alternative would be consistent with the maintenance and enhancement of the long-term productivity of the project area. Those plans consistently call for the construction of a Mid-Currituck Bridge. This finding also would be true for MCB2, but to a lesser extent because MCB2 includes the widening of NC 12 in Dare County, which is not considered desirable according to area plans. Although unfunded, the interchange at US 158 and NC 12 included in ER2 and MCB2 is listed in the 2009 to 2015 STIP, as well as the 2012 to 2018 Draft STIP, and improvements to US 158, such as those included in MCB2, are consistent with the goals of the North Carolina *Strategic Highway Corridors Concept Development Repor*t (NCDOT, 2005), which lists US 158 as a strategic highway corridor.

ER2, because it lacks a Mid-Currituck Bridge, would not be consistent with the maintenance and enhancement of long-term productivity of the project area as defined by area land use and transportation plans.

3.8 What resources are committed irreversibly and irretrievably?

Implementation of any of the detailed study alternatives, including the Preferred Alternative, would involve commitment of a range of natural, physical, human, and fiscal resources. Land used in the construction of any of the detailed study alternatives would be considered an irreversible commitment during the time period that the land is used for a highway and/or bridge facility. However, if a greater need arises for use of the land or if the project is no longer needed, the land could be converted to another use. At present, there is no reason to believe such a conversion ever would be necessary or desirable.

Considerable amounts of fossil fuels, labor, and highway/bridge construction materials (such as asphalt, concrete, and steel) would be expended. Additionally, large amounts of labor and natural resources would be used in the fabrication and preparation of construction materials. These materials generally are not retrievable although asphalt, concrete, and steel are recyclable. These materials are not, however, in short supply, and their use would not have an adverse effect on continued availability of these resources. Any construction also would require a substantial one-time expenditure of funds. In the case of MCB2, MCB4, and the Preferred Alternative, these funds would be retrieved (only in part with MCB2) through tolls charged to users of a Mid-Currituck Bridge.

The commitment of these resources is based on the concept that residents in the immediate area, state, and region, as well as visitors to the area, would benefit by increasing the capacity of the thoroughfare system in the project area, thereby reducing travel time to the Outer Banks and hurricane evacuation clearance times. Such benefits are anticipated to outweigh the commitment of resources.

Appendix A

Comments and Coordination

A. Comments and Coordination

A Final Environmental Impact Statement (FEIS) that addresses the full range of alternatives and issues important to the selection of a Preferred Alternative can be accomplished only in consultation with those who have a stake in the decision. This appendix lists stakeholder involvement activities associated with the Mid-Currituck Bridge Project including:

- The original studies and review from 1994 to 1998;
- Scoping and citizen and agency involvement leading up to the release of the Draft Environmental Impact Statement (DEIS) in March 2010; and
- Citizen and agency comment on the DEIS, as well as agency involvement during the selection of the Preferred Alternative.

The *Stakeholder Involvement for Draft Environmental Impact Statement Technical Memorandum* (Parsons Brinckerhoff, 2009) describes in detail the scoping process, agency coordination process, and public involvement activities, as well as the key issues and pertinent information received through these efforts during preparation of the DEIS. The *Stakeholder Involvement for Final Environmental Impact Statement Technical Memorandum* (Parsons Brinckerhoff, 2011) describes agency involvement activities since the release of the DEIS, agency comments on the DEIS and responses, non-governmental organization comments on the DEIS and responses, and public comments on the DEIS and responses. Both of these technical reports are on the CD that accompanies this FEIS, at public review locations listed in Appendix C, and on the North Carolina Turnpike Authority (NCTA) web site at https://www.ncdot.gov/projects/mid-currituck-bridge. This reports' table of contents is listed in Appendix D.

A.1 1994 to 1998 Mid-Currituck Bridge Studies and Review

The Mid-Currituck Bridge Study began in mid-1994 with an alternatives study. A DEIS evaluating several alternatives for improving access and traffic service to the Currituck County Outer Banks was approved in 1998. The 1995 Notice of Intent (NOI) and the 1998 DEIS were rescinded by the Federal Highway Administration (FHWA) in 2008 (*Federal Register* Vol. 73, No. 107, page 31733). A new NOI was issued soon after (*Federal Register* Vol. 73, No. 116, page 34065).

In association with these earlier studies, two public hearings were held in Aydlett and Corolla in Spring 1998 to allow area citizens an opportunity to comment on the findings presented in the 1998 DEIS.

A.2 2001 to 2009 Scoping and Citizen and Agency Involvement

Scoping is designed to encourage early participation of the public, elected officials, and interested governmental agencies in the decision-making process. The scoping process is intended to be a collaborative and cooperative process considering views from parties who will be affected by or who have an interest in a proposed project. For the Mid-Currituck Bridge Study, the public was involved in scoping through Citizen Informational Workshops and small group meetings. Governmental agencies were involved in the scoping process through National Environmental Policy Act (NEPA)/Section 404 team meetings, Turnpike Environmental Agency Coordination (TEAC) meetings, and local officials meetings. These meetings and the items discussed are presented in Table A-1 and Table A-2.

The NCTA also implemented several other public outreach efforts to keep the public informed about the project and its status. These included newsletters, a toll-free project information line, a web site, and small group meetings.

Additional information on citizen and agency involvement and its outcome prior to release of the DEIS is presented in the *Stakeholder Involvement for Draft Environmental Impact Statement Technical Report* (Parsons Brinckerhoff, 2009).

A.3 Citizen and Agency Comment on the DEIS and Post-DEIS Agency Involvement

Citizen Comment on the DEIS

Three Pre-Hearing Open Houses and three Public Hearings regarding the findings of the DEIS were held on May 18, May 19, and May 20, 2010, as indicated in Table A-3.

In accordance with Title 23 *United States Code* (USC) Section 128, NCTA certifies that a public hearing for the project was held and the social, economic, and environmental impacts, consistency with local community planning goals and objectives, and comments from individuals have been considered in the selection of the Preferred Alternative for the project. A transcript of the public hearing was prepared and forwarded to the FHWA along with the certification.

Public Hearings were held immediately following each of the Pre-Hearing Open Houses. A description of hearing and open house notifications is included in the *Stakeholder Involvement for Final Environmental Impact Statement Technical Memorandum* (Parsons Brinckerhoff, 2011). The DEIS, associated technical reports, and the Public Hearing maps were available on the project web site and at eight public review locations in the project area.

Table A-1. Agency Coordination Meetings

Date	Topics of Discussion
NEPA/Section 404 Merger Team Meetings	
July 12, 2001	Project work plan
August 16, 2001	Project need and environmental issues
May 8, 2002	Statement of Purpose and Need
July 24, 2002	Hurricane evacuation methods
August 20, 2003	Statement of Purpose and Need
Turnpike Environmental Agency Coordination (TEAC) Meetings	
December 15, 2006	Agency coordination plan
January 17, 2007	Project status
April 18, 2007	Statement of Purpose and Need, conceptual alternatives, and alternatives screening criteria
May 23, 2007 & May 31, 2007	Statement of Purpose and Need, conceptual alternatives, and analysis of conceptual alternatives
June 20, 2007	Statement of Purpose and Need, conceptual alternatives, and agency coordination plan
July 10, 2007	Field trip to view the project area's natural and cultural resources
July 18, 2007	Statement of Purpose and Need, conceptual alternatives and their merits, functional design plans for the alternatives, funding constraints, and the North Carolina hurricane evacuation clearance time statute
September 19, 2007	Responses to questions raised at the July 18 meeting and in agency letters; NCTA's recommendation for alternatives to be evaluated in DEIS
November 14, 2007	Results of environmental field studies; an assessment of three potential US 158/Mid-Currituck Bridge interchange configurations and seven potential NC 12 bridge termini locations based on suggestions made by agency representatives at the July 10, 2007 field trip
February 5, 2008	Overview of upcoming Citizens Informational Workshops, Statement of Purpose, and results of Mid-Currituck Bridge study on the number of bridge lanes
April 8, 2008	A draft Statement of Purpose and Need report, a draft Alternatives Screening Report, and public comments from the February 2008 Citizens Informational Workshops
May 6, 2008	Written agency comments on the draft Statement of Purpose and Need report and draft Alternatives Screening Report; and planned NCTA Public Private Partnership Predevelopment Agreement
July 8, 2008	Agreement on components of Statement of Purpose and Need and alternatives to be evaluated in the DEIS; DEIS impact assessment scope
October 7, 2008	Indirect and cumulative impact assessment and detailed study alternative design concepts
June 10, 2009	Discussion of mainland approach road Option B and agreement to assess it in detail in the DEIS.

Table A-2. Citizens and Local Officials Meetings and Request for Comments

Date	Topics of Discussion
Citizens Informational Workshops	
July 15, 21, and 22, 2004	Study requirements, activities, and schedule; and Statement of Purpose and Need.
February 26, 27, and 28, 2008	Mid-Currituck Bridge Study process and components and project concerns and issues.
Public Review of Statement of Purpose and Need and Alternatives Screening Report	
April 2008	On April 7, 2008 the NCTA released a draft Statement of Purpose and Need report and a draft Alternatives Screening Report for the Mid-Currituck Bridge Study. These documents were delivered to project area municipal offices in Currituck, Corolla, Kitty Hawk, Southern Shores, and Duck, and posted on the project web site. Stakeholders were notified of the release of these documents through a postcard mailing and via the project web site. Comments were requested.
Local Officials Meetings	
July 15, 2004 (2 meetings)	Study activities, the planned study area, the traffic flow analysis, and the planned Statement of Purpose and Need.
June 2, 2005	Joint local officials and environmental agencies meeting on project issues and working together
October 26 and 27, 2005	Field trip with discussion of project impact issues
February 26 and 28, 2008	Summary of the study activities, the findings in a draft Statement of Purpose and Need report, and the results of the preliminary alternatives analyses.

Table A-3. Open Houses and Public Hearings

Date	Location	Time	Format
May 18, 2010	Ramada Plaza Nags Head Beach 1701 South Virginia Dare Trail Kill Devil Hills, NC	3:30 - 6:30 pm	Open House
		7:00 - 8:33 pm	Public Hearing
May 19, 2010	Outer Banks Center for Wildlife Education, Currituck Heritage Park on NC 12 Corolla, NC	3:30 - 6:30 pm	Open House
		7:00 - 9:02 pm	Public Hearing
May 20, 2010	Currituck County Center 120 Community Way Barco, NC	3:30 - 6:30 pm	Open House
		7:00 - 8:51 pm	Public Hearing

Total attendance was approximately 386 (based on sign-in sheets) across the three days of Pre-Hearing Open Houses and Public Hearings. Some citizens attended more than one Pre-Hearing Open House and Public Hearing and some citizens opted not to sign in.

Oral comments were delivered and recorded at the three Public Hearings. Written comments included completed comment forms distributed at the Pre-Hearing Open Houses, comment forms received after the Pre-Hearing Open Houses via fax and mail, written statements submitted at the Public Hearings, and comments received via e-mail (most through the project e-mail address: midcurrituck@ncturnpike.org).

Written comments received from citizens were collected between April 5, 2010 and June 7, 2010. The number of comments received by source is shown in Table A-4.

Table A-4. Public Comments Received

Comment Source	Number of Comments Received
Comment Forms	168
• Received in Person at Open Houses	50
• E-mailed, Mailed, or Faxed	118
E-mails, Letters, or Faxes	345
Written Statements Provided at Public Hearing	11
Town Resolutions	3
Oral Comments	70
TOTAL	597

Table A-5 displays the stated preferences and opposition from all comments received by unique individuals via comment sheets, e-mail, letters, and oral presentation. Where an individual stated a preference through multiple channels, their preference is counted once. The stated preferences are more numerous than stated opposition in part because the comment sheet questionnaire emphasized preferences. A notable number of persons favored the No-Build Alternative and a notable number favored MCB4.

Those who preferred the No-Build Alternative were concerned that the project would not be effective in meeting the defined purpose and need, would cause substantial community and natural resource impacts, and, with induced development on the Outer Banks, would change its character and the sense of isolation preferred by its residents and visitors. Those favoring MCB4 did so because of:

- Improved traffic flow, reduced travel time, and hurricane evacuation benefits, as well as perceived greater safety and convenience for motorists, economic benefits, and access to public services.

- Community impacts associated with widening roads with ER2 and MCB2 to obtain needed travel improvements.

Table A-5. Public Alternative Preferences

Stated Preferences	
ER2	14
MCB	132
MCB2	27
MCB4	180
No-Build	64
C1	65
C2	93
Option A	76
Option B	21
Center Lane Reversal for Hurricane Evacuation	113
Addition of Third Outbound Lane for Hurricane Evacuation	29
Stated Opposition	
ER2	40
MCB	50
MCB2	31
MCB4	7
No-Build	0
C1	13
C2	18
Option A	1
Option B	9
Center Lane Reversal for Hurricane Evacuation	1
Addition of Third Outbound Lane for Hurricane Evacuation	4

General opposition to widening NC 12 came particularly from Dare County stakeholders because of potential community impacts. Preferences were divided between the two Outer Banks termini alternatives, C1 and C2. Almost all commenters favored mainland approach design Option A because it would minimize impacts to the community of Aydlett. In terms of hurricane evacuation improvements, commenters favored reversing the center turn lane as a third outbound lane. Many of those who favored the No-Build Alternative also indicated that they did not think hurricane evacuation improvements were needed.

In addition to the comments received expressing preferences for a particular alternative, comments also were received expressing concerns on a broad range of topics related to the project and its potential direct community impacts. These comments included:

- The adequacy of the information in the DEIS related to the general land use and community features in the project area.
- Effects on neighborhood or community cohesion.
- Effects on quality of life.
- Grave site relocation.
- Potential for concentrations of low income, minority, or limited English proficiency populations to suffer disproportionate adverse health or environmental effects.
- Compatibility with local land use plans.
- Effects on the existing business community, including businesses whose access would change or that would be bypassed by bridge traffic.
- Changes in neighborhood and community access.
- Effects on community services, facilities, and recreation opportunities, including potential impacts on boating and duck blinds in Currituck Sound and potential increased beach driving.
- Effects on bicycle and pedestrian movement and provisions on the Outer Banks, and providing bicycle access on the bridge.
- Increased crime rates on the Outer Banks.

A detailed summary of all public comments received, NCTA's responses, and copies of the public hearing transcripts and original written comments received are presented in the *Stakeholder Involvement for Final Environmental Impact Statement Technical Report* (Parsons Brinckerhoff, 2011). Comments from two non-governmental organizations and responses also are included in the technical report. Their primary concerns related to the natural resource impacts of the detailed study alternatives.

Agency Comment on the DEIS

Comments on the DEIS were received from numerous state and federal environmental resource and regulatory agencies, as well as local government. Those providing comments are marked with an asterisk in Appendix C. Original comment letters and responses are contained in the *Stakeholder Involvement for Final Environmental Impact Statement Technical Memorandum* (Parsons Brinckerhoff, 2011). The responses to DEIS

comments are reflected in revisions to the DEIS assessment of impacts that are included in this FEIS.

Post-DEIS Submittal Agency Involvement

Several meetings were held with local government officials and state and federal environmental resource and regulatory agencies after the release of the DEIS, most of which focused on the selection of the Preferred Alternative and refinements being made to further avoid, minimize, and mitigate its impacts. Table A-6 provides a summary of the agency coordination meetings that have occurred since the release of the DEIS. Meeting summaries and complete meeting minutes are included in the *Stakeholder Involvement for Final Environmental Impact Statement Technical Memorandum* (Parsons Brinckerhoff, 2011). Both the responses to DEIS comments and the outcomes of the meetings listed in Table A-6 are reflected in revisions to the DEIS assessment of impacts that are included in this FEIS.

Table A-6. Post-DEIS Submittal Agency Coordination Meetings

Date	Topics of Discussion
Local Officials Meetings	
May 18 and 19, 2010	Local officials were briefed on the DEIS and its findings prior to public hearings on the same days.
July 16, 2010	Coordination with county representatives on issues raised in agency and public comment on the DEIS.
Turnpike Environmental Agency Coordination (TEAC) Meetings	
March 9, 2010	Presentation of an overview of the DEIS format and findings; discussion of construction options in Currituck Sound, including construction moratorium applicability in Currituck Sound; discussion of recent and future public involvement activities and schedule.
August 10, 2010	Discussion of DEIS comments, the Preferred Alternative Identification Information Package (Handout 23 in Appendix B of the *Stakeholder Involvement for Final Environmental Impact Statement Technical Report* [Parsons Brinckerhoff, 2001]), and "practicable" as it relates to project funding.
September 8, 2010	Discussion of bridge stormwater management, bridge construction methodologies, and the practicability of ER2.
November 2, 2010	Discussion of new groundwater and surface water hydrology studies in Maple Swamp and FHWA/NCTA's Preferred Alternative.
January 20, 2011	Further discussion of FHWA/NCTA's Preferred Alternative and refinements made since the November meeting. NCTA indicated that they planned to announce the selection of MCB4/A/C1 with refinements as the Preferred Alternative.

Table A-6 (concluded). Post-DEIS Submittal Agency Coordination Meetings

Date	Topics of Discussion
Other Agency Meetings	
August 19, 2010	Discussion with Currituck and Dare county emergency management officials to solicit input on the hurricane evacuation improvement options presented in the DEIS, as well as on which option to select as the hurricane evacuation clearance time improvement component of the Preferred Alternative.
October 1, 2010 and March 21, 2011	Discussions with the North Carolina Department of Environment and Natural Resources, Division of Water Quality (NCDENR-DWQ) to gain collectively an understanding of what could be reasonable and permitable approaches to stormwater management for a Mid-Currituck Bridge project that employs the best management practices (BMPs) to meet the provisions of NC Session Law 2008-211 to the maximum extent practicable.
April 6, 2011	Continued coordination with the US Army Corps of Engineers (USACE), National Marine Fisheries Service (NMFS), North Carolina Wildlife Resources Commission (NCWRC), NCDENR-DWQ, NCDENR-Division of Coastal Management (DCM), and NCDENR-Division of Marine Fisheries (DMF) on what could be reasonable and permitable approaches to construction of the Mid-Currituck Bridge with the Preferred Alternative that would minimize or mitigate impacts on fisheries and SAV.

Appendix B

List of Preparers

B. List of Preparers

The persons listed below were responsible for preparing the Draft Environmental Impact Statement (DEIS) and this Final Environmental Impact Statement (FEIS).

B.1 Federal Highway Administration

Name and Degree	Responsibility	Experience	Professional Discipline
George Hoops, MS, BS	Major Projects Engineer	18 years in transportation engineering.	Civil Engineer, P.E.

B.2 North Carolina Turnpike Authority

Name and Degree	Responsibility	Experience	Professional Discipline
Steven D. DeWitt, BS	NCTA Chief Engineer	25 years in project development, environmental evaluations and processes, design-build program and project development, contract procurement and administration, and construction processes.	Civil Engineer, P.E.
Jennifer Harris, BS	Director of Planning and Environmental Studies	9 years in transportation, project development, impact analysis, public involvement, and NEPA analysis.	Civil Engineer, P.E.

B.3 North Carolina Department of Transportation

Name and Degree	Responsibility	Experience	Professional Discipline
Ted Devens, BSCE, MCE, CPM	EIS review	24 years in civil, environmental, and transportation engineering	Civil Engineer, P.E.
Mary Alice (Missy) Dickens Pair, BSCE	EIS review	16 years in transportation planning	Staff Engineer Project Development and Environmental Analysis Branch
Dewayne L. Sykes	Roadway Design	34 years in civil engineering and transportation engineering	Civil Engineer, P.E., CPM
Brian Yamamoto, BSCE	EIS review	18 years in transportation planning	Consultant Group Leader (Eastern) for Project Development and Environmental Analysis Branch P.E.

B.4 PB Americas, Inc.

Name and Degree	Responsibility	Experience	Professional Discipline
John M. Page, BS, MUP	Project Manager, Environmental Lead	34 years in land use planning and environmental document preparation	Planner, AICP; Environmental Professional, CEP
Christopher G. Bailey, BS	Structural design and construction engineering	9 years in structural design and construction engineering	Senior Engineer P.E.
Daniel H. Bridges, BS, MS	Project Engineer	15 years in highway design for planning documents and final design plans.	Engineer, P.E.

Name and Degree	Responsibility	Experience	Professional Discipline
Don Brown, BS, MURP	Land-use plans and assessment support	11 years in transportation planning and environmental analysis	Planner, AICP
Matthew Coffin, BS	Noise analysis and noise barrier evaluations	7 years in noise, planning, and GIS	Noise Analyst, GIS
Jason Doughty, BSCE, MSCE	Design-build criteria	10 years in civil and structural engineering	Structural Engineer, P.E.
Michael J. Fendrick, BSCE, MCE	Traffic forecasts and analysis	20 years in civil engineering; traffic and transportation engineering	Civil Engineer, P.E., PTOE
Chin Y. Lien, MS	Water Resources/Water Quality Analysis	27 years in water resources engineering, water quality analysis and ecological restoration	Water Resources Engineer, P.E.
Alice Lovegrove, BE, MS	Air Quality, Energy	21 years in air quality and energy analysis	Environmental Engineer
Ray Magsanoc, BS	Noise analysis and noise barrier evaluations	13 years in noise and environmental planning and permitting	Noise Analyst
Jacob Poling, BS	Noise analysis and noise barrier evaluations	1.5 years in noise analysis	Preferred Alternative Noise Analyst
Eric Misak, BSCE	Design Engineering	23 years in civil engineering	Civil Engineer
Robert Norburn, BSCE, BA	Deputy Project Manager and Deputy Environmental Lead	17 years in transportation planning and environmental document preparation	Transportation Engineer/Planner, EIT
William T. Rice, BS, MA	Indirect and Cumulative Effects, Visual Assessment	16 years in planning	Planner, REA, CEI

Name and Degree	Responsibility	Experience	Professional Discipline
Valerie Robbins, BUPD	Community Impact Assessment	8 years in transportation and environmental planning	Transportation Planner
Albert E. Schaufler, BSCE	Evacuation Plan, NC 12 Reversible Center Lane Alternative & Toll Facility Concepts	40 years in traffic engineering	Traffic and Operations Engineer, Toll Facility Design and Operation
Edward Tadross, BA	Air Quality/Energy	10 years in air quality and energy analysis	Environmental Planner
Carolyn Trindle, BA, MA	Community impacts	26 years in environmental planning	Planner
Han Zhang, BE, MS	Traffic forecasts and analysis	8 years in traffic engineering	Senior Traffic Engineer, P.E.

B.5 CZR Incorporated

Name and Degree	Responsibility	Experience	Professional Discipline
Samuel Cooper, BS, MS	Technical Director, management of natural resources investigations and documentation, including affected environment, environmental consequences, and supporting documents.	18 years in environmental assessment, permitting, and impact analysis	Coastal Ecologist and Technical Director
Julia Kirkland Berger, BA, MS	Document review, oversight of quality control, and assistance with document preparation.	13 years in environmental assessment, permitting, and impact analysis	Senior Environmental Scientist

Name and Degree	Responsibility	Experience	Professional Discipline
Steve Beck, BS	Field task manager for wetland and stream delineations and assessments, aquatic and terrestrial community assessments threatened and endangered species assessment, preparation of the natural resource technical report and essential fish habitat assessment.	3 years in wetland and stream delineation and assessment	Biologist
Mark Grippo, BS, MS	Preparation of the essential fish habitat assessment.	4 years in natural resources assessment and impact analysis	Biologist
T. Travis Brown, BS, MS	Field work and documentation with aquatic and terrestrial community assessments, threatened and endangered species assessment, and preparation of the natural resource technical report.	2 years	Biologist
Lorrie Laliberte Boswell, BS, MS	Research and preparation of the natural resource technical report, essential fish habitat assessment, and EIS data/text. Document reviews.	4 years in natural resources assessment and impact analysis	Biologist
Katharine Braly, BS, MS	Research and preparation of the Biological Assessment (BA).	2 years in natural resources assessment and impact analysis	Biologist

B.6 East Carolina University

Name and Degree	Responsibility	Experience	Professional Discipline
Daniel J. Marcucci, Ph.D., MLA	Natural Resources Inventory, Regional Impacts Analysis, ICE Analysis	17 years in environmental and regional planning, landscape architecture	Assistant Professor, Planning Program AICP
Amy F. Blizzard, Ph.D.	Natural Resources Inventory	18 years in urban and regional planning in coastal communities	Assistant Professor, Planning Program AICP
James W. Kleckley, Ph.D.	Socioeconomic Conditions, Economic Forecasting	30 years in sub-state economic analysis and modeling	Director, Bureau of Business Research,; Research Associate Professor, Department of Finance

B.7 Panamerican Consultants, Inc.

Name and Degree	Responsibility	Experience	Professional Discipline
Andy Lydecker, MA, MS	Cultural Resources Site File Search	12 years in cultural resources management	Archaeologist, RPA
Stephen James, MA	Cultural Resources Site File Search, Report Author	28 years in cultural resources management	Archaeologist, RPA
Ramie Gougeon, Ph.D.	Cultural Resources Report Background	15 years in cultural resources management	Archaeologist, RPA

B.8 Howard Stein – Hudson, Incorporated

Name and Degree	Responsibility	Experience	Professional Discipline
Veronica Bailey-Simmons, BS, MPH	Stakeholder Involvement	9 years in transportation planning and public involvement	Transportation Planner/Public Involvement Specialist
Arnold Bloch, BA, MCE, Ph.D.	Stakeholder Involvement	Over 28 years in transportation planning and public involvement	Principal Transportation Planner
Ryan Walsh, BS, MUP	Stakeholder Involvement	3 years in transportation planning and public involvement	Transportation Planner/Public Involvement Specialist

B.9 PBS&J

Name and Degree	Responsibility	Experience	Professional Discipline
Donald C. Lewis, BA, MSP	Hurricane Evacuation Analysis	29 years in transportation planning/ hurricane evacuation analyses	Planner, AICP

Appendix C

List of Agencies, Organizations, and Persons to Whom Copies of this Statement are Sent

C. List of Agencies, Organizations, and Persons to Whom Copies of this Statement are Sent

The agencies and interest groups listed below were sent a copy of the Draft Environmental Impact Statement (DEIS) and this Final Environmental Impact Statement (FEIS). Those that provided comments on the DEIS are marked with an asterisk. Associated technical reports were enclosed with the DEIS and this FEIS in the form of a CD. Paper copies of the DEIS and this FEIS also were placed at the public review locations listed below. This FEIS and the associated technical reports, public hearing maps, Preferred Alternative design drawings, and FEIS announcements also are available electronically at: https://www.ncdot.gov/projects/mid-currituck-bridge/.

C.1 Federal Agencies

Advisory Council on Historic Preservation

Federal Aviation Administration

Federal Emergency Management Agency

Federal Energy Regulatory Commission

General Services Administration

US Army Corps of Engineers*

US Coast Guard, 5th District

US Department of Agriculture

- Farm Service Agency
- Natural Resources Conservation Service*

US Department of Commerce

- Ecology and Conservation Office
- National Oceanic and Atmospheric Administration – National Marine Fisheries Service*

US Department of Health and Human Services

US Department of Housing and Urban Development

US Department of the Interior

- Office of the Secretary*
- Bureau of Outdoor Recreation
- Fish and Wildlife Service
- Keeper of the National Register
- Office of Environmental Policy and Administration
- US Geological Survey

US Environmental Protection Agency, Region IV (Environmental Review Branch)*

C.2 State Agencies

North Carolina Department of Administration, State Clearinghouse*

North Carolina Department of Agriculture and Consumer Services—Agricultural Service*

North Carolina Department of Crime Control and Public Safety, Division of Emergency Management

North Carolina Department of Cultural Resources, Division of Archives and History*

North Carolina Department of Environment and Natural Resources*

- Division of Air Quality
- Division of Coastal Management*
- Division of Environmental Health*
- Division of Land Resources
- Division of Marine Fisheries*
- Division of Parks and Recreation
- Division of Water Quality*
- Natural Heritage Program*
- Washington Regional Office*

- Washington Regional Office, Aquifer Protection Section*
- Wildlife Resources Commission*

C.3 Local Governments and Agencies

Albemarle Regional Planning and Development Commission (Albemarle Rural Planning Organization)

Area Development Coordination Agency (ADCA)

County of Dare

- Chair, County Commissioners
- County Manager
- Director, Emergency Management
- Superintendent, County Schools

Currituck County

- Chair, County Commissioners
- County Manager
- Coordinator, Emergency Management
- Superintendent, County Schools

Mayor of Duck*

Mayor of Kitty Hawk

Mayor of Nags Head*

Mayor of Southern Shores*

C.4 Non-Governmental Organizations

Nature Conservancy*

Southern Environmental Law Center*

C.5 Local Interest Groups

Build the Bridge—Preserve Our Roads*

Corolla Light Community Association*

Currituck County Chamber of Commerce

Greater Aydlett Civic Organization

Outer Banks Chamber of Commerce

C.6 Public Review Locations

Currituck County Courthouse
Currituck, North Carolina

Corolla Library
Corolla, North Carolina

Currituck County Public Library
Barco, North Carolina

Dare County Library
Kill Devil Hills, North Carolina

Town of Duck Administrative Building
Duck, North Carolina

Kitty Hawk Town Hall
Kitty Hawk, North Carolina

North Carolina Department of Transportation Maintenance Yard Office
Maple, North Carolina

Southern Shores Town Hall
Southern Shores, North Carolina

Appendix D

List of Technical Reports and Other Supplemental Materials

D. List of Technical Reports and Other Supplemental Materials

The technical reports and other supplemental materials listed below are included in the compact disc accompanying the Draft Environmental Impact Statement (DEIS) and this Final Environmental Impact Statement (FEIS). The tables of contents of this material are listed beginning on the page numbers indicated:

- Statement of Purpose and Need D-2
- Alternatives Screening Report D-3
- Air Quality Technical Report D-4
- Biological Assessment D-5
- Community Impact Assessment Technical Report (Revised) D-7
- Essential Fish Habitat Technical Report (Revised) D-11
- Historical Architecture Resources Reports and Supplemental Materials D-12
  - Historic Architectural Resources Report (for MCB4 Area of Potential Effects) D-12
  - Historic Architectural Resources Report Addendum (for Additional ER2 and MCB2 Area of Potential Effects) D-13
  - Historic Architectural Resources Supplemental Materials D-14
- Indirect and Cumulative Effects Technical Report (Revised) D-14
- Natural Resources Technical Report (Revised) D-18
- Other Physical Features Technical Report (Revised) D-20
  - Energy
  - Accelerated Sea Level Rise
  - Visual Quality
  - Hazardous Materials and Underground Storage Tanks
  - Floodplains

- Stakeholder Involvement for Draft Environmental Impact Statement Technical Report D-22
- Stakeholder Involvement for Final Environmental Impact Statement Technical Report D-23
- Traffic Noise Technical Report D-26
- Traffic Noise Technical Report Addendum D-28
- 2035 Traffic Alternatives Report D-28
- Public Hearing Maps D-30
- Preferred Alternative's Preliminary Design Drawings D-31

Printed copies are provided at public review locations. The technical reports include additional documentation of the studies and impact assessments that resulted in the findings presented in the DEIS and this FEIS. The public hearing maps and the Preferred Alternative's preliminary design drawings show the preliminary designs for the detailed study alternatives used in the assessment of impacts.

D.1 Statement of Purpose and Need

1.0 PURPOSE OF AND NEED FOR ACTION 1

1.1 Project Area 1

1.2 Project Needs 1

1.3 Project Purpose 6

1.4 Project Description 7
1.4.1 Setting and Land Use 7
1.4.2 Project History 8

1.5 System Linkage 11
1.5.1 Existing Road Network 11
1.5.2 Sidewalks, Bicycles Routes, and Pedestrian Movements 12
1.5.3 Modal Interrelationships 13

1.6 Social and Economic Conditions 14
1.6.1 Permanent Population Growth 14
1.6.2 Housing Growth 14
1.6.3 Recreational Facilities 15
1.6.4 Land Use Plans 15

1.7 Transportation Planning 16
1.7.1 Overview of the Thoroughfare Planning Process 16
1.7.2 Currituck and Dare County Thoroughfare Planning 16

1.7.3 Other Proposed Road Improvements 17
1.7.4 North Carolina Strategic Highway Corridor System 17
1.7.5 North Carolina Intrastate System 22

1.8 Transportation Network and Operating Characteristics 23
1.8.1 Roadway Characteristics and Posted Speeds 23
1.8.2 Traffic Volumes 25
1.8.3 Level of Service and Congestion 25

1.9 Travel Time 38

1.10 Hurricane Clearance Time 39

D.2 Alternatives Screening Report

1.0 NO-BUILD ALTERNATIVE 1

2.0 PROJECT CONCEPT SCREENING 2

2.1 Road and Bridge Alternatives 2
2.1.1 Development of Road and Bridge Alternatives 4
2.1.2 Evaluation of Road and Bridge Alternatives 22

2.2 Additional Alternatives Considered and Eliminated 37
2.2.1 Shifting Rental Times 37
2.2.2 Transportation Systems Management (TSM) 39
2.2.3 Bus Transit 40
2.2.4 Ferry Alternatives 42

2.3 Agency and Public Comments 49
2.3.1 Agency Comments 49
2.3.2 Public Comments 51

3.0 BRIDGE CORRIDOR SCREENING 53

3.1 Bridge Corridor Alternatives 55
3.1.1 Development of Bridge Corridor Alternatives 55
3.1.2 Evaluation of Bridge Corridor Alternatives 59

3.2 Additional Alternatives Considered and Eliminated 61
3.2.1 Assessment of N1, N2, and S Corridors 61
3.2.2 Far North and South Corridors 64

3.3 Agency and Public Comments 65
3.3.1 Agency Comments 65
3.3.2 Public Comments 66

4.0 DETAILED STUDY ALTERNATIVES 66

5.0 CORRIDOR C1 AND C2 ALIGNMENT REFINEMENTS 69

5.1 Refinements to Western Terminus (US 158 / Mid-Currituck Bridge Interchange) 70

5.2 Maple Swamp Alignment 70

5.3 Refinements to the Outer Banks Termini 73

5.4 Agency and Public Comments 76

5.4.1 Agency Comments 76

5.4.2 Public Comments 76

6.0 MAINLAND APPROACH ROAD OPTION B 77

D.3 Air Quality Technical Report

1.0 INTRODUCTION AND SUMMARY 1

1.1 Summary of Impacts 1

1.2 Project Description 3

2.0 AFFECTED ENVIRONMENT 7

2.1 Clean Air Act Amendments of 1990 7

2.2 Local Air Quality Regulations 7

2.3 National Ambient Air Quality Standards 8

2.4 Mobile Source Air Toxics 8

3.0 ENVIRONMENTAL CONSEQUENCES 11

3.1 Regional and Microscale Analyses 11

3.2 Mobile Source Air Toxics 11

3.2.1 Analysis 12

3.2.2 Information that is Unavailable or Incomplete 15

3.2.2.1 Emissions 15

3.2.2.2 Dispersion 16

3.2.2.3 Exposure Levels and Health Effects 16

3.3 Construction Impacts 17

3.3.1 Open Air Burning 17

3.3.2 Dust Control 17

3.3.3 Mobile Source Emissions 18

3.4 Transportation Conformity 18

4.0 REFERENCES 19

EXECUTIVE SUMMARY ..... **vii**

Overview of Project Action ..... **vii**

Location of the Action Area ..... **vii**

Timeframe ..... **viii**

Summary of Effects ..... **viii**

1.0 PROJECT OVERVIEW **1**

1.1 Federal Nexus **1**

1.2 Project Description **2**

1.3 Project Area and Setting **5**

1.4 Consultation History **5**

2.0 FEDERALLY PROPOSED AND LISTED SPECIES AND DESIGNATED CRITICAL HABITAT **9**

2.1 Mammals **9**

2.1.1 Red Wolf (Canis rufus) 9

2.1.2 West Indian Manatee (Trichechus manatus) 10

2.2 Birds **10**

2.2.1 Piping Plover (Charadrius melodus) 10

2.2.2 Red-cockaded Woodpecker (Picoides borealis) 10

2.2.3 Roseate Tern (Sterna dougallii) 11

2.3 Reptiles **11**

2.3.1 American Alligator (Alligator mississippiensis) 11

2.3.2 Hawksbill Sea Turtle (Eretmochelys imbricata) 11

2.3.3 Leatherback Sea Turtle (Dermochelys coriacea) 12

2.3.4 Green Sea Turtle (Chelonia mydas) 12

2.3.5 Loggerhead Sea Turtle (Caretta caretta) 12

2.3.6 Kemp's Ridley Sea Turtle (Lepidochelys kempii) 13

2.4 Fish—Shortnose Sturgeon (Acipenser brevirostrum) **14**

2.5 Vascular Plants—Seabeach Amaranth (Amaranthus pumilus) **14**

3.0 ENVIRONMENTAL BASELINE **15**

3.1 Water Resource Classification **15**

3.2 Water Quality **16**

3.3 Aquatic Wildlife **16**

3.4 Essential Fish Habitat (EFH) **17**

3.5 Submerged Aquatic Vegetation 17

3.6 Floodplains 19

3.7 Beach and Dune 19

4.0 PROJECT DETAILS 22

4.1 Construction 22
4.1.1 Project Timeline and Sequencing 22
4.1.2 Site Preparation 22
4.1.3 Construction Access and Staging 22
4.1.4 In-Water Work 23
4.1.5 Potential Impacts on Water Quality and Aquatic Habitat 25
4.1.6 Post-Project Site Restoration 26

4.2 Operations 26
4.2.1 Stormwater Management 28
4.2.2 Shading 30

4.3 Maintenance 30

5.0 PROJECT ACTION AREA 32

5.1 Project Action Area 32

5.2 Limits of the Action Area 32
5.2.1 Right-of-Way and Permanent and Temporary Easement plus 500 Feet 32
5.2.2 Mid-Currituck Bridge 33
5.2.3 Additional Action Area Associated with Indirect Impacts 34

6.0 EFFECTS ANALYSIS 35

6.1 Direct Effects 35

6.2 Indirect Effects 36
6.2.1 Altered Predator-Prey Relationships 39
6.2.2 Long-Term Habitat Alteration 39
6.2.3 Indirect Land Use Impacts 40

6.3 Interrelated and Interdependent Actions and Activities 40

6.4 Cumulative Effects 41
6.4.1 Water Quality in Currituck Sound 42
6.4.2 Beach Driving 42

6.5 Conservation Measures 43
6.5.1 Species in Currituck Sound 43
6.5.2 Beach Driving 44

7.0 EFFECT DETERMINATIONS 45

7.1 Effect Determination for Listed Species 45

7.1.1 No Effect or Not Applicable Determinations for Listed Species 45
7.1.2 May Affect, Not Likely to Adversely Affect Determinations for Listed Species 49
7.1.3 May Affect, Likely to Adversely Affect Determinations for Listed Species 55

7.2 Effect Determinations for Proposed Species—Atlantic Sturgeon 55
7.2.1 Background 55
7.2.2 Reasons for Decline 56
7.2.3 Determination 56

7.3 Effect Determination for Critical Habitat 57
7.3.1 Effect Determination for Designated Critical Habitat 57
7.3.2 Effect Determinations for Proposed Critical Habitat 57

7.4 Making Overall Effect Determinations 57

7.5 Candidate Species—Red knot (Calidris canutus rufa) 59

8.0 REFERENCES 60

8.1 Publications and Technical Reports 60

8.2 Web Sites 63

8.3 Personal Communication 64

APPENDIX A: ESSENTIAL FISH HABITAT A-1

APPENDIX B: DETAILED LISTED SPECIES INFORMATION B-1

APPENDIX C: CONSULTATION HISTORY C-1

D.5 Community Impact Assessment Technical Report (Revised)

1.0 SUMMARY 1-1

1.1 Key Community Characteristics 1-3

1.2 Public Involvement and Issues Raised 1-6
1.2.1 July 2004 Workshops 1-7
1.2.2 February 2008 Workshops 1-8
1.2.3 Public Review of Statement of Purpose and Need and Alternatives Screening Report 1-10
1.2.4 Small Group Meetings 1-12
1.2.5 Public Hearings, Open Houses, and Public Review 1-13

1.3 Key Potential Impacts 1-15

1.4 Findings and Recommendations 1-21

2.0 PROJECT DESCRIPTION 2-1

2.1 Communities within the Project Area 2-1

2.2 Project Purpose and Need 2-2

2.3 Detailed Study Alternatives 2-2

2.4 No-Build Alternative 2-9

2.5 Project Schedule 2-10

2.6 Functional Classifications 2-10

2.7 Typical Sections 2-11

3.0 METHODOLOGY 3-1

4.0 STUDY AREA DESCRIPTIONS 4-1

4.1 Direct Community Impact Area 4-1

4.2 Demographic Area 4-3

5.0 COMMUNITY CHARACTERISTICS 5-1

5.1 Community Characteristics Overview 5-1

5.1.1 Currituck County-Mainland 5-1

5.1.2 Dare County Outer Banks 5-1

5.1.3 Currituck County-Outer Banks 5-4

5.2 Population Characteristics 5-4

5.3 Housing Characteristics 5-10

5.4 Employment Characteristics 5-13

5.5 Community Resources – Facilities 5-15

5.5.1 Educational Facilities 5-15

5.5.2 Parks and Recreation Facilities 5-18

5.5.3 Post Offices 5-21

5.5.4 Places of Worship and Cemeteries 5-21

5.5.5 Commercial Centers or Nodes 5-21

5.5.6 Health Centers and Hospitals 5-22

5.5.7 Historic Resources 5-22

5.6 Community Resources - Infrastructure 5-23

5.6.1 Pedestrian Routes, Sidewalks, and Bicycle Routes 5-23

5.6.2 Automobile Routes 5-24

5.6.3 Rail, Transit, and Airports 5-25

5.6.4 Water and Utilities 5-26

5.7 Community Resources – Natural 5-27

5.7.1 Farmland 5-27

5.7.2 Open Space 5-28

5.7.3 Water Supply Watershed Protection 5-28
5.7.4 Wild and Scenic Rivers/Water Bodies 5-29
5.7.5 Coastal Barrier Resources System 5-30

5.8 Crime, Safety and Emergency Services 5-30
5.8.1 Crime and Safety Issues 5-30
5.8.2 Police and Fire 5-32
5.8.3 Emergency Medical and Rescue Services 5-33

5.9 Plans and Regulations 5-33
5.9.1 Coastal Area Management Act (CAMA) 5-33
5.9.2 Currituck County Plans 5-34
5.9.3 Dare County Plans 5-36
5.9.4 Thoroughfare Plans 5-38
5.9.5 Other Proposed Road Improvements 5-39

6.0 COMMUNITY IMPACT ANALYSIS 6-1

6.1 Community Impact Assessment Overview 6-1

6.2 Physical, Social, and Psychological Aspects 6-2
6.2.1 Community Stability and Neighborhood Cohesion 6-2
6.2.2 Visual and Aesthetic Impacts 6-16
6.2.3 Relocations 6-19

6.3 Consistency with Land Use Plans 6-21
6.3.1 ER2 6-22
6.3.2 MCB2 6-23
6.3.3 MCB4 6-24
6.3.4 Preferred Alternative 6-25

6.4 Transportation Access 6-26
6.4.1 Neighborhood Access 6-30
6.4.2 Commercial Access and Parking 6-34
6.4.3 Pedestrian and Bicycle Access 6-39
6.4.4 The Americans with Disabilities Act 6-41
6.4.5 Public Transit 6-42

6.5 Consistency with Thoroughfare Plans 6-42
6.5.1 ER2 6-42
6.5.2 MCB2 6-43
6.5.3 MCB4 6-43
6.5.4 Preferred Alternative 6-44

6.6 Safety 6-44
6.6.1 Pedestrian and Bicycle Safety 6-44
6.6.2 Emergency Response 6-46
6.6.3 Public Safety 6-49

6.7 Farmland Impacts 6-50
6.7.1 ER2 6-50

6.7.2 MCB2 6-51
6.7.3 MCB4 6-52
6.7.4 Preferred Alternative 6-52

6.8 Impacts to Water Resources 6-52

6.9 Environmental Justice 6-53
6.9.1 Environmental Justice Regulations 6-53
6.9.2 Potential Impact 6-53

6.10 Recreation Opportunities and Resources 6-57
6.10.1 ER2 6-57
6.10.2 MCB2 6-58
6.10.3 MCB4 6-59
6.10.4 Preferred Alternative 6-59

7.0 CIA CONCLUSIONS 7-1

7.1 ER2 7-1
7.1.1 Benefits 7-1
7.1.2 Impacts 7-1

7.2 MCB2 7-2
7.2.1 Benefits 7-2
7.2.2 Impacts 7-2

7.3 MCB4 7-5
7.3.1 Benefits 7-5
7.3.2 Impacts 7-5

7.4 Preferred Alternative 7-7
7.4.1 Benefits 7-7
7.4.2 Impacts 7-7

8.0 MITIGATION, ENHANCEMENT, AND RECOMMENDATIONS 8-1

9.0 REFERENCES 9-1

9.1 Publications and Technical Reports 9-1

9.2 Personal Communications 9-3

9.3 Web Sites 9-4

APPENDIX A: RELOCATION REPORTS A-1

APPENDIX B: FORM CPA-106 ..... B-1

APPENDIX C: CORRESPONDENCE C-1

APPENDIX D: US 158 BUSINESS SURVEY RESULTS D-1

D.6 Essential Fish Habitat Technical Report (Revised)

1.0 INTRODUCTION 1

2.0 PROJECT AREA 2

3.0 PROJECT DESCRIPTION 5

3.1 Preferred Alternative 5

3.2 Mid-Currituck Bridge Construction 7

3.3 Stormwater Management 8

3.3.1 Stormwater Management for Uplands on the Mainland and the Outer Banks 9

3.3.2 Stormwater Management for Maple Swamp and Currituck Sound 10

4.0 ESSENTIAL FISH HABITAT 13

4.1 Habitat Elements 13

4.1.1 Submerged Aquatic Vegetation (SAV) 15

4.1.2 Oyster Reef and Shell Bank 18

4.1.3 Intertidal Flats 18

4.1.4 Palustrine Emergent Wetlands 19

4.1.5 Palustrine Forested Wetlands 19

4.1.6 Aquatic Bed (Tidal Freshwater) 19

4.1.7 Estuarine Water Column 19

4.1.8 Primary Nursery Areas 20

4.2 Managed Species 20

4.2.1 SAFMC and MAFMC Managed Species 20

4.2.2 ASMFC Managed Species 26

4.2.3 NCDENR-DMF Managed Species 26

5.0 POTENTIAL IMPACTS TO EFH 28

5.1 Short-Term and Temporary Impacts 29

5.2 Permanent and Long-Term Impacts 33

5.2.1 Water Quality 35

5.2.2 Water Flow 35

5.2.3 Bridge Shading 36

5.2.4 Discussion of Potential Long-Term Impacts 37

5.3 Potential Impacts to Individual Species 41

5.3.1 Black Sea Bass (*Centropristis striata*) 41

5.3.2 Bluefish (*Pomatomus saltatrix*) 41

5.3.3 Butterfish (*Peprilus triacanthus*) 44

5.3.4 Summer Flounder (*Paralichthys dentatus*) 44

5.3.5 Penaeid Shrimp (*Penaeus* sp.) 45

5.3.6 Red Grouper (*Epinephelus morio*) 45
5.3.7 Atlantic Spadefish (*Chaetodipterus faber*) 46
5.3.8 Spanish Mackerel (*Scomberomorus maculatus*) 46
5.3.9 Additional Species 47

6.0 FINDINGS AND CONCLUSION 49

6.1 Findings 49

6.2 Conclusion 50

7.0 REFERENCES/LITERATURE CITED 52

7.1 Publications and Technical Reports 52

7.2 Personal Communications 57

7.3 Web Sites 57

D.7 Historical Architecture Resources Reports and Supplemental Materials

Historic Architectural Resources Report (for MCB4 Area of Potential Effects)

PROJECT DESCRIPTION 1

PROJECT PURPOSE AND NEED 1

PROJECT SETTING AND LAND USE 2

PROJECT HISTORY 2

ALTERNATIVES UNDER CONSIDERATION 4

METHODOLOGY 4

SUMMARY OF FINDINGS 6

HISTORIC AND ARCHITECTURAL OVERVIEW OF CURRITUCK COUNTY 8

PROPERTIES LISTED IN OR PREVIOUSLY DETERMINED ELIGIBLE (DOE) FOR LISTING IN THE NATIONAL REGISTER OF HISTORIC PLACES 9

Property 1: Currituck Beach Lighthouse (CK 1) 9

Property 2: Whalehead Club (CK 5) 11

Property 3: Corolla Historic District (CK 97) 13

Property 4: Christian Advocate Baptist Church (CK 98) 15

Property 5: Ellie and Blanton Saunders Decoy Workshop (CK 99) **17**

Property 6: Dr. W. T. Griggs House (CK 103) **19**

Property 7: Currituck Sound Rural Historic District **21**

Property 8: Daniel Saunders House **23**

PROPERTIES RE-EVALUATED IN THIS REPORT AND RECOMMENDED NOT ELIGIBLE FOR THE NATIONAL REGISTER OF HISTORIC PLACES **25**

Property 9: Baum House (CK 100) **25**

Property 10: Currituck Shooting Club (CK 9) **25**

PROPERTIES EVALUATED IN THE REPORT AND RECOMMENDED ELIGIBLE FOR THE NATIONAL REGISTER OF HISTORIC PLACES **26**

Property 11: Samuel McHorney House **26**

Property 12: Coinjock Colored School **33**

PROPERTIES EVALUATED IN THE REPORT AND RECOMMENDED NOT ELIGIBLE FOR THE NATIONAL REGISTER OF HISTORIC PLACES **42**

Property 13: House, 4451 Caratoke Highway **42**

Property 14: Boswood-Morris House **46**

Property 15: Center Chapel AME Zion Church **50**

BIBLIOGRAPHY **54**

APPENDICES

I. HPO Correspondence **56**

II. Properties Determined Not Eligible for the National Register of Historic Places Through HPO Concurrence on 7 January 2008 ..... **59**

III. Representative Photographs of Shed-roof Dormer Bungalows In Currituck County **63**

Historic Architectural Resources Report Addendum (for Additional ER2 and MCB2 Area of Potential Effects)

PROJECT DESCRIPTION **1**

ALTERNATIVES UNDER CONSIDERATION **3**

METHODOLOGY **6**

SUMMARY OF FINDINGS **7**

PROPERTIES LISTED IN OR PREVIOUSLY DETERMINED ELIGIBLE (DOE) FOR LISTING IN THE NATIONAL REGISTER OF HISTORIC PLACES 9

Property A: (Former) Grandy School (CK 40), 6470 Caratoke Highway 9

Property B: Jarvisburg Colored School (CK 55), 7302 Caratoke Highway 11

Property C: Dexter W. Snow House (CK 81), 8055 Caratoke Highway 13

Property D: Christian Advocate Baptist Church (CK 98), 5855 Caratoke Highway 15

Property E: C.W. Wright Store (CK 315), 7054 Caratoke Highway 17

BIBLIOGRAPHY 19

Historic Architectural Resources Supplemental Materials

MAY 20, 2009 MEMORANDUM FROM THE NC DEPARTMENT OF CULTURAL RESOURCES AFFIRMING HISTORIC ARCHITECTURAL RESOURCE SURVEY FINDINGS 2

SEPTEMBER 15, 2009 MEMORANDUM FROM THE NC DEPARTMENT OF CULTURAL RESOURCES AFFIRMING ARCHAEOLOGICAL RESOURCE SURVEY FINDINGS 4

SEPTEMBER 15, 2009 CONCURRENCE FORM FOR THE HISTORIC ARCHITECTURAL ASSESSMENT OF EFFECTS 5

D.8 Indirect and Cumulative Effects Technical Report (Revised)

LIST OF ABBREVIATIONS IX

PREFACE XI

SUMMARY XXI

1.0 DEFINITION OF INDIRECT AND CUMULATIVE EFFECTS ASSESSMENT STUDY AREA BOUNDARIES 1

1.1 Spatial Boundaries 1

1.1.1 Political/Planning Boundaries 1

1.1.2 Commuteshed 3

1.1.3 Growth/Development Study Area 3

1.1.4 Habitat/Water Quality Study Area 4

1.2 Timeframe 5

2.0 INDIRECT/CUMULATIVE EFFECTS STUDY AREA DIRECTIONS AND GOALS 2-1

2.1 Local and Regional Growth Trends 2-1
2.1.1 Population 2-1
2.1.2 Housing 2-4
2.1.3 Employment 2-6

2.2 Local/Regional Goals 2-8
2.2.1 Agencies and Organizations with Stated Goals 2-8
2.2.2 Social Health and Well Being Goals 2-8
2.2.3 Economic Opportunity Goals 2-11
2.2.4 Ecosystem Protection Goals 2-12

2.3 Land Use Plans 2-13
2.3.1 Currituck County 2-13
2.3.2 Dare County 2-18
2.3.3 Local Plans' Consistency with AEC Protection 2-22

3.0 INVENTORY OF NOTABLE FEATURES 3-1

3.1 Landscape and Waterscape Inventory 3-1
3.1.1 Currituck County Mainland 3-1
3.1.2 North River Estuary 3-3
3.1.3 Currituck Sound 3-3
3.1.4 Outer Banks 3-3

3.2 Notable Features Inventory 3-3

3.3 Environmental Elements 3-3
3.3.1 Geologic Landform 3-3
3.3.2 Water Resources 3-6
3.3.3 Living Resources 3-11
3.3.4 Landscape Structure 3-18

3.4 Cultural and Socioeconomic Conditions 3-20
3.4.1 Physical 3-20
3.4.2 Economic 3-28
3.4.3 Social 3-31

4.0 IMPACT-CAUSING ACTIVITIES 4-1

4.1 Encroachment-Alteration Effects (Project and Other Actions) 4-4
4.1.1 Modification of Regime 4-4
4.1.2 Land Transformation and Construction 4-5
4.1.3 Resource Extraction 4-6
4.1.4 Land Alteration 4-6
4.1.5 Changes in Traffic and Access Alteration 4-6

4.2 Access-Alteration Effects (Project-Induced Growth) 4-9
4.2.1 Potential to Increase Permanent Residents on the Outer Banks 4-11

4.2.2 Potential for Increase in the Number of Day Trips to the Outer Banks 4-15
4.2.3 Potential for Development Location, Rate, or Type in the Road-Accessible Outer Banks to Change 4-19
4.2.4 Potential for Development Location, Rate, or Type on the Non Road-Accessible Outer Banks to Change 4-26
4.2.5 Potential for Development Location, Rate, or Type in Mainland Currituck County to Change 4-31

5.0 POTENTIAL INDIRECT/CUMULATIVE EFFECTS FOR ANALYSIS 5-1

6.0 ANALYZE INDIRECT/CUMULATIVE EFFECTS 6-1

6.1 Land Suitability Analysis for Changed Development Patterns 6-1
6.1.1 Land Available for Development into 2035 Horizon Year 6-2
6.1.2 Land Available for Development near the Mid-Currituck Bridge 6-3

6.2 Indirect Effects 6-5
6.2.1 Effects of Induced Change on Notable Landscape and Waterscape Features 6-6
6.2.2 Effects of Induced Change on Notable Environmental Elements 6-7
6.2.3 Effects of Induced Change on Notable Cultural and Socioeconomic Conditions 6-12
6.2.4 Compatibility of Induced Change with Local/Regional Goals 6-14
6.2.5 Compatibility of Induced Change with Land Use Plans and Development Regulations 6-18

6.3 Cumulative Effects 6-19
6.3.1 Cumulative Effects on Notable Landscape and Waterscape Features 6-22
6.3.2 Cumulative Effects on Notable Environmental Elements 6-25
6.3.3 Cumulative Effects on Notable Socioeconomic Features 6-33
6.3.4 Compatibility with Local/Regional Goals 6-37
6.3.5 Compatibility with Land Use Plans and Development Regulations 6-42

7.0 EVALUATION OF ANALYSIS RESULTS 7-1

7.1 Cumulative Development and Land Availability 7-2

7.2 Development near the Mid-Currituck Bridge 7-5

7.3 Potential Impacts of Permanent Resident Increase on the Outer Banks 7-5

7.4 Potential Impacts of Increased Amounts of Day Visitors on the Outer Banks 7-6

7.5 Potential Impacts of Increased Demand for Residences on the Non-Road Accessible Outer Banks 7-7

8.0 ASSESS CONSEQUENCES AND APPROPRIATE AVOIDANCE/MINIMIZATION STRATEGIES 8-1

8.1 Reasonable Basis for Informed Decision-Making 8-1

8.2 Substantial Negative Effects 8-2
8.2.1 Indirect Effects 8-2
8.2.2 Cumulative Effects 8-2

8.3 Practicable Avoidance/Minimization Measures 8-3
8.3.1 Indirect Effects Avoidance/Minimization 8-3
8.3.2 Cumulative Effects Avoidance/Minimization 8-3

8.4 Transportation Agency Jurisdiction Related to Avoidance/ Minimization Measures 8-4

8.5 Transportation Agencies' Roles When Avoidance/Minimization Measures Are Not within Their Jurisdictions 8-5

9.0 REFERENCES 9-1

APPENDICES

A. STATED GOALS OF AGENCIES AND STAKEHOLDER GROUPS 1

A.1 Currituck County 1
A.1.1 Land Use Planning Goals 1
A.1.2 Unified Development Ordinance 3
A.1.3 Planned Unit Developments/Planned Residential Developments 5
A.1.4 General Regulations 6
A.1.5 Other Planning Regulations 6
A.1.6 Currituck Farmland Preservation Ordinance 7
A.1.7 Economic Development Strategy "Vision Plan" for Currituck County, North Carolina 7

A.2 Dare County 8
A.2.1 Land Use Plan 8
A.2.2 Growth Management 9

A.3 Town of Duck 11

A.4 Town of Southern Shores 12

A.5 Town of Kitty Hawk 13

A.6 RPO and MPO 14
A.6.1 Rural Planning Organization (RPO) 14

A.6.2 Metropolitan Planning Organization (MPO) 15

A.7 North Carolina Transportation Goals 15

A.8 North Carolina and Regional Resource Agencies 16
A.8.1 Coastal Area Management Act (CAMA) 16
A.8.2 Coastal Futures Committee 18
A.8.3 Albemarle-Pamlico Estuarine Study Comprehensive Conservation and Management Plan 18

A.9 Federal Resource Agencies 19
A.9.1 Coastal Zone Management Act 19
A.9.2 Coastal Barrier Resources Act 19
A.9.3 National Flood Insurance Program/Federal Emergency Management Agency 20

A.10 Non-Governmental Organizations 21
A.10.1 BeachHuggers of the Outer Banks 21
A.10.2 Blue Sky Foundation 21
A.10.3 Build the Bridge 22
A.10.4 Coastal Conservation Association 22
A.10.5 Currituck Chamber of Commerce 22
A.10.6 Ducks Unlimited 22
A.10.7 Environment North Carolina 22
A.10.8 NC Coastal Federation 22
A.10.9 Outer Banks Association of Realtors 22
A.10.10 Outer Banks Home Builders Association 23
A.10.11 Soil and Water Conservation Society 23
A.10.12 Surfrider Foundation (Outer Banks Chapter) 23
A.10.13 The American Wild Horse Preservation Campaign 23
A.10.14 The North Carolina Chapter of the Nature Conservancy 23

B. PROTECTED SPECIES B-1

D.9 Natural Resources Technical Report (Revised)

1.0 INTRODUCTION 1-1

1.1 DEIS Detailed Study Alternatives 1-2

1.2 Preferred Alternative 1-4

1.3 Mid-Currituck Bridge Construction 1-5

1.4 Maple Swamp Bridge Construction 1-6

1.5 Access and Construction Staging for Construction Materials and Equipment 1-7

1.6 Stormwater Management 1-7

1.6.1 Stormwater Management for Uplands on the Mainland and the Outer Banks 1-8
1.6.2 Stormwater Management for Maple Swamp and Currituck Sound 1-9

2.0 METHODOLOGY AND QUALIFICATIONS 2-1

3.0 PHYSICAL RESOURCES 3-1

3.1 Soils 3-1

3.2 Water Resources 3-1
3.2.1 Surface Waters 3-1
3.2.2 Water Use Classification 3-6
3.2.3 Impacts to Water Quality 3-7

4.0 BIOTIC RESOURCES 4-1

4.1 Terrestrial Communities 4-1
4.1.1 Terrestrial Habitat 4-1
4.1.2 Impacts to Terrestrial Habitat 4-14
4.1.3 Terrestrial Wildlife 4-29
4.1.4 Impacts to Terrestrial Wildlife 4-35

4.2 Aquatic Communities and Wildlife 4-40
4.2.1 Aquatic Communities 4-40
4.2.2 Aquatic Wildlife 4-42
4.2.3 Impacts to Aquatic Communities and Aquatic Wildlife 4-44

4.3 Invasive Species 4-49

5.0 JURISDICTIONAL ISSUES 5-1

5.1 Clean Water Act Waters of the US 5-1
5.1.1 Characteristics 5-1
5.1.2 Impacts 5-9

5.2 Clean Water Act Permits 5-12

5.3 Construction Moratorium 5-12

5.4 North Carolina River Basin Buffer Rules 5-12

5.5 Rivers and Harbors Act Section 10 Navigable Waters 5-13

5.6 Wetland and Stream Mitigation 5-13
5.6.1 Avoidance and Minimization 5-13
5.6.2 Compensatory Mitigation of Impacts 5-14

5.7 Endangered Species Act Protected Species 5-16

5.8 Bald Eagle and Golden Eagle Protection Act 5-29

5.9 Endangered Species Act Candidate Species 5-30

5.10 Coastal Zone Issues 5-31

5.10.1 Coastal Area Management Act Areas of Environmental Concern 5-31

5.10.2 Essential Fish Habitat (EFH) 5-33

6.0 LITERATURE CITED 6-1

6.1 Publications and Technical Reports 6-1

6.2 Web Sites 6-8

6.3 Personal Communications 6-11

APPENDICES

Appendix A. Figures A-1

Appendix B. Lists of Plant and Animal Species Found in the Vicinity of the Project Area and/or Referenced in the Report B-1

Appendix C. Wetland and Stream Forms C-1

Appendix D. Qualifications of Additional Contributors D-1

Appendix E. Conceptual Mitigation Plan E-1

D.10 Other Physical Features Technical Report (Revised)

1.0 INTRODUCTION AND SUMMARY 1-1

1.1 Project Description 1-3

1.1.1 DEIS Detailed Study Alternatives 1-3

1.1.2 Preferred Alternative 1-7

1.2 Summary of Impacts 1-9

1.2.1 Energy 1-9

1.2.2 Accelerated Sea Level Rise 1-9

1.2.3 Visual Quality 1-10

1.2.4 Hazardous Materials and Underground Storage Tanks (UST) 1-13

1.2.5 Floodplains 1-13

2.0 ENERGY 2-1

3.0 ACCELERATED SEA LEVEL RISE RESULTING FROM CLIMATE CHANGE 3-1

3.1 Findings Based on Sea Level Rise Maps 3-1

3.2 Findings Based on 1 Meter of Sea Level Rise 3-5

4.0 VISUAL QUALITY 4-1

4.1 Visual Resource Assessment Parameters and Criteria 4-1

4.2 Existing Project Area Visual Resources 4-2
4.2.1 Regional Landscapes 4-2
4.2.2 Landscape Units 4-3
4.2.3 Visually Sensitive Locations 4-7

4.3 Visual Impacts 4-19
4.3.1 Barco/Intracoastal Landscape Unit as Represented by VSL1 4-19
4.3.2 Barco/Intracoastal Landscape Unit as Represented by VSL2 4-19
4.3.3 Intracoastal/Grandy Landscape Unit as Represented by VSL3 4-19
4.3.4 Aydlett Landscape Unit as Represented by VSL4 and VSL5 4-21
4.3.5 Intracoastal/Grandy Landscape Unit as Represented by VSL6 4-27
4.3.6 Grandy/Point Harbor Landscape Unit as Represented by VSL7 4-27
4.3.7 Grandy/Point Harbor Landscape Unit as Represented by VSL8 4-27
4.3.8 Wright Memorial Bridge Landscape Unit as Represented by VSL9 4-27
4.3.9 Kitty Hawk/Duck Landscape Unit as Represented by VSL10 4-29
4.3.10 Kitty Hawk/Duck Landscape Unit as Represented by VSL11 4-29
4.3.11 Duck Landscape Unit as Represented by VSL12 4-29
4.3.12 Duck/Corolla Landscape Unit as Represented by VSL13 4-32
4.3.13 Duck/Corolla Landscape Unit as Represented by VSL14 4-33
4.3.14 Duck/Corolla Landscape Unit as Represented by VSL15 4-35

4.4 Mitigation 4-37

5.0 HAZARDOUS MATERIALS AND UNDERGROUND STORAGE TANKS ... 5-1

6.0 FLOODPLAINS 6-1

6.1 Mid-Currituck Bridge Encroachment on the Floodplain (MCB2, MCB4, and the Preferred Alternative) 6-3

6.2 NC 12 and US 158 Encroachment on the Floodplain (ER2, MCB2, MCB4, and the Preferred Alternative) 6-4

6.3 Hydraulic Analyses 6-4

6.4 Hydraulic Impacts to Floodplain 6-5

6.5 Significant Encroachment 6-6
6.5.1 Transportation Facility Interruption 6-7
6.5.2 Significant Risk 6-7
6.5.3 Impact to Beneficial Floodplain Values 6-8

7.0 REFERENCES 7-1

APPENDICES

Appendix A: Sea Level Rise Maps A-1

Appendix B: Hazardous Materials Reports B-1

D.11 Stakeholder Involvement for Draft Environmental Impact Statement Technical Report

1.0 1994 TO 1998 MID-CURRITUCK BRIDGE STUDIES AND REVIEW 1

2.0 SCOPING AND AGENCY COORDINATION 2

2.1 NEPA/Section 404 Merger Team Meetings 2

2.1.1 July 12, 2001 Meeting 4
2.1.2 August 16, 2001 Meeting 4
2.1.3 May 8, 2002 Meeting 5
2.1.4 July 24, 2002 Meetings 5
2.1.5 August 20, 2003 Meeting 5

2.2 Turnpike Environmental Agency Coordination (TEAC) Meetings 6

2.2.1 December 15, 2006 Meeting 6
2.2.2 January 17, 2007 Meeting 6
2.2.3 April 18, 2007 Meeting 6
2.2.4 May 23, 2007 Meeting 7
2.2.5 May 31, 2007 Meeting 8
2.2.6 June 20, 2007 Meeting 8
2.2.7 July 10, 2007 Field Trip 9
2.2.8 July 18, 2007 Meeting 10
2.2.9 September 19, 2007 Meeting 10
2.2.10 November 14, 2007 Meeting 11
2.2.11 February 5, 2008 Meeting 12
2.2.12 April 8, 2008 Meeting 12
2.2.13 May 6, 2008 Meeting 12
2.2.14 July 8, 2008 Meeting 13
2.2.15 October 7, 2008 Meeting 13
2.2.16 June 10, 2009 Meeting 14

2.3 Agency Coordination on Technical Documents 15

2.3.1 Statement of Purpose and Need 15
2.3.2 Alternatives Screening Report 16

3.0 CITIZEN AND LOCAL OFFICIALS INVOLVEMENT 17

3.1 Citizens Informational Workshops and Public Review of Project-Related Reports 17

3.1.1 July 2004 Citizens Informational Workshops 18

3.1.2 February 2008 Citizens Informational Workshops 18
3.1.3 Public Review of Statement of Purpose and Need and Alternatives Screening Report 19

3.2 Local Officials Meetings 22
3.2.1 July 15, 2004 Local Officials Meetings 22
3.2.2 June 2, 2005 Joint Local Officials and Environmental Agencies Meeting 22
3.2.3 October 26 and 27, 2005 Local Officials Field Trip 23
3.2.4 February 26 and 28, 2008 Local Officials Meetings 23

3.3 Local Government Resolutions and Comments 23
3.3.1 The Albemarle Commission 23
3.3.2 Currituck County 24
3.3.3 Town of Duck 24
3.3.4 Town of Nags Head 24
3.3.5 Town of Southern Shores 24

4.0 OTHER PUBLIC OUTREACH 25

4.1 Newsletters 25
4.1.1 Summer 2004 Newsletter 25
4.1.2 October 2008 Newsletter 25

4.2 Toll-Free Project Information Line 25

4.3 Web Site 26

4.4 Small Group Meetings 26
4.4.1 March 27, 2002 Meeting 26
4.4.2 July 18, 2002 Meeting 27
4.4.3 March 31, 2004 Meeting 27
4.4.4 October 12, 2009 Meeting 28

APPENDICES

A. State and Federal Agency Involvement Materials A-1

B. Citizens and Local Officials Involvement Materials B-1

D.12 Stakeholder Involvement for Final Environmental Impact Statement Technical Report

1.0 AGENCY INVOLVEMENT 1-1

1.1 Local Officials Meetings 1-1

1.2 Turnpike Environmental Agency Coordination (TEAC) Meetings 1-3
1.2.1 March 9, 2010 Meeting 1-4
1.2.2 August 10, 2010 Meeting 1-4

1.2.3 September 8, 2010 Meeting 1-5
1.2.4 November 2, 2010 Meeting 1-5
1.2.5 January 20, 2011 Meeting 1-7

1.3 North Carolina Department of Environment and Natural Resources—Division of Water Quality Meetings 1-8

1.4 Agency Meeting to Discuss Submerged Aquatic Vegetation Impacts and Construction Moratoriums for the Preferred Alternative 1-10

1.5 Emergency Management Officials Meeting 1-12

2.0 AGENCY COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT AND RESPONSES 2-1

2.1 Federal Agencies 2-1
2.1.1 US Army Corps of Engineers—June 7, 2010 2-1
2.1.2 US Department of Agriculture—Natural Resources Conservation Service—April 6, 2010 2-10
2.1.3 US Department of Commerce—National Oceanic and Atmospheric Administration, National Marine Fisheries Service—June 4, 2010 2-11
2.1.4 US Department of the Interior—Office of the Secretary—May 25, 2010 2-20
2.1.5 US Environmental Protection Agency—June 4, 2010 2-33

2.2 State Agencies 2-48
2.2.1 North Carolina Department of Agriculture and Consumer Services—Agricultural Services—April 27, 2010 2-48
2.2.2 North Carolina Department of Cultural Resources—State Historic Preservation Office—April 16, 2010 2-49
2.2.3 North Carolina Department of Environment and Natural Resources—General—June 10, 2010 2-50
2.2.4 North Carolina Department of Environment and Natural Resources—Division of Coastal Management—June 4, 2010 2-50
2.2.5 North Carolina Department of Environment and Natural Resources—Division of Environmental Health—April 8, 2010 2-60
2.2.6 North Carolina Department of Environment and Natural Resources—Division of Marine Fisheries—May 14, 2010 2-60
2.2.7 North Carolina Department of Environment and Natural Resources—Division of Water Quality 2-63
2.2.8 North Carolina Department of Environment and Natural Resources—Natural Heritage Program—May 26, 2010 2-80
2.2.9 North Carolina Department of Environment and Natural Resources—Washington Regional Office—May 27, 2010 2-81
2.2.10 North Carolina Department of Environment and Natural Resources—Washington Regional Office, Aquifer Protection Section—April 19, 2010 2-81

2.2.11 North Carolina Department of Environment and Natural Resources—Wildlife Resources Commission—May 21, 2010 2-82

2.3 Local Government 2-85
2.3.1 Town of Duck—May 21, 2010 2-85
2.3.2 Town of Nags Head—May 20, 2010 2-88
2.3.3 Town of Southern Shores—May 5, 2010 2-88

3.0 NON-GOVERNMENTAL ORGANIZATION COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT AND RESPONSES 3-1

3.1 Southern Environmental Law Center 3-1

3.2 Nature Conservancy 3-31

4.0 PUBLIC COMMENTS AND RESPONSES ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT 4-1

4.1 Public Review Summary 4-1
4.1.1 Open Houses and Public Hearings 4-1
4.1.2 Attendance 4-2
4.1.3 Comments 4-2
4.1.4 Public Preferences 4-2
4.1.5 Range of Public Comment 4-4

4.2 Purpose and Need 4-7
4.2.1 General 4-7
4.2.2 Improving Traffic Flow 4-8
4.2.3 Improving Travel Time 4-10
4.2.4 Reducing Hurricane Clearance Times 4-11
4.2.5 Other 4-13

4.3 Alternatives 4-14
4.3.1 Widening Existing Roads 4-14
4.3.2 NC 12 Drainage Improvements 4-16
4.3.3 Mid-Currituck Bridge 4-17
4.3.4 Hurricane Evacuation Improvements 4-19
4.3.5 Other Alternatives 4-21
4.3.6 Accommodation of Bicyclists and Pedestrians 4-25
4.3.7 Bridge Cost and Financing 4-26
4.3.8 Other 4-30

4.4 Affected Environment and Environmental Consequences 4-31
4.4.1 Community Impacts 4-31
4.4.2 Natural Resource Impacts 4-38
4.4.3 Other Physical Impacts 4-43
4.4.4 Construction Impacts 4-46
4.4.5 Indirect and Cumulative Effects 4-46

4.4.6 Relationship between Local Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity 4-60
4.4.7 Irreversible and Irretrievable Commitment of Resources 4-60

4.5 Other Comments 4-61
4.5.1 Requests for Specific Information or Outreach 4-61
4.5.2 Decision-Making Process 4-62
4.5.3 Past Permits 4-63

APPENDIX A: AGENCY INVOLVEMENT MATERIALS A-1

APPENDIX B: AGENCY COMMENTS ON THE DEIS B-1

APPENDIX C: NON-GOVERNMENTAL ORGANIZATION COMMENTS ON THE DEIS C-1

APPENDIX D: PUBLIC COMMENTS ON THE DEIS D-1

APPENDIX E: PUBLIC HEARING TRANSCRIPTS E-1

APPENDIX F: PUBLIC HEARING-RELATED MATERIALS F-1

D.13 Traffic Noise Technical Report

1.0 INTRODUCTION AND SUMMARY 1-1
1.1 Summary of Impacts 1-1
1.2 Project Description 1-4

2.0 TRAFFIC NOISE ANALYSIS 2-1
2.1 Noise Abatement Criteria 2-3
2.2 Noise-Sensitive Receptors 2-4
2.3 Noise Model 2-15
2.4 Traffic Data 2-17
2.5 Measured Noise Levels 2-18
2.6 Predicted Noise Levels 2-21

3.0 EVALUATION OF NOISE ABATEMENT ALTERNATIVES 3-1
3.1 Vegetative Buffer 3-1
3.2 Transportation Systems Management Measures 3-2
3.3 Alignment Modifications 3-2

3.4 Noise Barriers 3-3
3.4.1 NSA 11 3-4
3.4.2 NSA 17 3-5
3.4.3 NSA 18 3-7
3.4.4 NSA 19 3-8
3.4.5 NSA 21 3-9
3.4.6 NSA 23 3-10
3.4.7 NSA 25 3-13
3.4.8 NSA 26 3-14

4.0 CONSTRUCTION NOISE 4-1

5.0 PUBLIC COORDINATION 5-1

5.1 Coordination with Local Officials 5-1

5.2 Public Involvement 5-1

6.0 CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER STUDY 6-1

6.1 Analytical Results 6-1
6.1.1 NSA 11 6-1
6.1.2 NSA 17 6-2
6.1.3 NSA 18 6-2
6.1.4 NSA 19 6-3
6.1.5 NSA 21 6-3
6.1.6 NSA 23 6-3
6.1.7 NSA 25 6-4
6.1.8 NSA 26 6-4

6.2 Other Factors in Noise Barrier Reasonableness 6-4
6.2.1 Extent of Noise Barrier Benefit 6-5
6.2.2 Visual 6-5
6.2.3 Drainage and Flooding 6-6

6.3 Recommendations for Further Study 6-6

7.0 REFERENCES 7-1

APPENDICES

A. Plan Sheets with Noise Study Data A-1

B. Traffic Data B-1

C. Existing, No-Build, and Detailed Study Alternative (Build) Predicted Noise Level Data C-1

D. NCDOT Traffic Noise Abatement Policy D-1

D.14 Traffic Noise Technical Report Addendum

1.0 INTRODUCTION AND SUMMARY 1-1

1.1 Summary of Impacts 1-3

1.2 Project Description 1-5

1.2.1 DEIS Detailed Study Alternatives 1-6

1.2.2 Preferred Alternative 1-9

1.2.3 Noise Assessment 1-11

2.0 TRAFFIC NOISE ANALYSIS 2-1

2.1 Noise Abatement Criteria 2-1

2.2 Noise-Sensitive Receptors 2-3

2.3 Predicted Noise Levels 2-4

3.0 EVALUATION OF NOISE ABATEMENT ALTERNATIVES 3-1

3.1 NSA 17 3-2

3.1.1 Barrier 17B 3-3

3.1.2 Barriers 17C and 17D 3-3

3.2 NSA 23 3-5

3.2.1 Barrier 23A 3-6

3.2.2 Barrier 23C 3-6

3.3 NSA 26 3-8

4.0 CONSTRUCTION NOISE 4-1

5.0 PUBLIC COORDINATION 5-1

6.0 CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER STUDY 6-1

7.0 REFERENCES 7-1

D.15 2035 Traffic Alternatives Report

1.0 INTRODUCTION 1

1.1 Chronology of Traffic Studies 1

1.2 Alternatives Under Consideration 3

1.2.1 Existing Road Improvement (ER) Alternatives 3

1.2.2 Mid-Currituck Bridge (MCB) Alternatives 5

1.2.3 Non-Roadway Alternatives 9

2.0 TRAFFIC FORECASTS 10

2.1 2006 Existing Conditions 10

2.2 2035 Traffic Forecasts 12

2.3 Peak Hour Traffic Forecast 18
2.3.1 Peaking Characteristics of Roadway Network 18
2.3.2 Computation of Peak Hour Traffic Forecasts – Roadway Links 19
2.3.3 Computation of Peak Hour Traffic Forecasts – Intersection Turn Movements 20

3.0 ROADWAY LEVEL OF SERVICE ANALYSIS FOR BUILD ALTERNATIVES 21

3.1 Methodology 21

3.2 Roadway Level of Service Peak Hour Thresholds 23
3.2.1 NC 12 23
3.2.2 US 158 26
3.2.3 Mid-Currituck Bridge 27

3.3 Roadway Level of Service Findings by Section 28
3.3.1 US 158 from Barco to the Wright Memorial Bridge 29
3.3.2 US 158 from East of Wright Memorial Bridge to South of NC 12 31
3.3.3 NC 12 in Dare and Currituck Counties 34
3.3.4 Mid-Currituck Bridge 38

3.4 Roadway Level of Service Findings by Alternative 41
3.4.1 No-Build and Existing Roads(ER) Alternatives 52
3.4.2 Mid-Currituck Bridge (MCB) Alternatives 52

4.0 NETWORK CONGESTION MEASURES 54

4.1 Miles of Congested Roadway 54

4.2 Duration of Congestion 55

4.3 Vehicle Miles Traveled – Total & Congested 56
4.3.1 Methodology 56
4.3.2 Findings 56

4.4 Travel Time 58
4.4.1 Methodology 58
4.4.2 Travel Time Findings 59

5.0 POTENTIAL EFFECTS OF NON-ROADWAY STRATEGIES 62

5.1 Low Capital Investment and Operational Alternatives 62
5.1.1 Shift Rental Times Alternative 62
5.1.2 Transportation Systems Management (TSM) Alternative 63
5.1.3 Bus Transit Alternative 65

5.2 Ferry Alternatives 68
5.2.1 Ferry Service Assumptions 69

5.2.2 Ferry Traffic Forecasts 69

5.3 Network Congestion Measures 71
5.3.1 Miles of Congested Roadway 71
5.3.2 Vehicle Miles Traveled – Total & Congested 72
5.3.3 Travel Time 72

6.0 CONCLUSIONS 75

6.1 Primary Findings and Comparison of Alternatives 75
6.1.1 Traffic Forecasts (See Section 2) 75
6.1.2 Capacity and Level of Service (See Section 3) 77
6.1.3 Network Measures of Effectiveness (See Section 3.4.1) 78
6.1.4 Non-Roadway Improvement Alternatives (See Section 5) 79

6.2 Additional Studies 79

D.16 Public Hearing Maps

KEY MAPS

ER2

MCB2/C1

MCB2/C2

MCB4/C1

MCB4/C2

US 158 HURRICANE EVACUATION THIRD OUTBOUND EMERGENCY LANE MAPS

Sheet 1—ER2

Sheet 2—ER2

Sheet 3—ER2

Sheet 4—ER2

Sheet 5—ER2

Sheet 5—ER2

Sheet 7—ER2, MCB2, and MCB4

MID-CURRITUCK BRIDGE MAPS

Sheet 8A—MCB2 and MCB4 (Option A)

Sheet 8B—MCB2 and MCB4 (Option A)

Sheet 9—MCB2/C1 and MCB4/C1

Sheet 10—MCB2/C2 and MCB4/C2

NC 12 CORRIDOR MAPS

Sheet 11—ER2, MCB2, and MCB4

Sheet 12—ER2, MCB2, and MCB4

Sheet 13—ER2 and MCB2

Sheet 14—ER2 and MCB2

Sheet 15—ER2 and MCB2

US 158 CORRIDOR MAPS

Sheet 16—ER2 and MCB2

Sheet 16A—MCB4

D.17 Preferred Alternative's Preliminary Design Drawings

SCROLL 1 OF 6

SCROLL 2 OF 6

SCROLL 3 OF 6

SCROLL 4 OF 6

SCROLL 5 OF 6

SCROLL 6 OF 6

Appendix E

List of References and Abbreviations

E. Lists of References and Abbreviations

E.1 List of References – Publications and Technical Reports

American Association of State Highway and Transportation Officials. 2002. *Standard Specifications for Highway Bridges.* American Association of State Highway and Transportation Officials, Washington, DC.

Bard, A. M., H. T. Smith, T. V. Harber, G. W. Stewart, J. S. Weske, M. M. Browne, and S. D. Emslie. 2001. *International conference on ecology and transportation*. Keystone, Colorado.

Borawa, J. C., J. H. Kerby, M. T. Huish, and A. W. Mullis. 1978. "Currituck Sound Fish Populations Before and After Infestation by Eurasian Water-milfoil." *Proc. An. Conf. S.E. Assoc. Fish and Wildl. Agencies*.

Brody, A. J. and M. R. Pelton. 1989. "Effects of roads on black bear movements in western North Carolina." *Wildlife Society Bulletin*, 17: 5-10.

Caldwell, W. S. 2001. *Hydrologic and Salinity Characteristics of Currituck Sound and Selected Tributaries in North Carolina and Virginia, 1998-1999*. US Geological Survey, Water-Resources Investigations Report 01-4097.

Caltrans Transportation Laboratory. July 1983. *Energy and Transportation Systems*. Prepared for the Federal Highway Administration.

Currituck Development Group (CDG). May 2011. *Access Management Report (Preliminary Service Road Study), Based on Potential Route(s) for the Mid-Currituck Bridge Project.* Prepared for the North Carolina Turnpike Authority.

Chapman, B. R. and R. J. Howard. 1984. *Great Egret*. US Fish and Wildlife Service Habitat Suitability Index Models. FWS/OBS-82/10.78. 23 pp.

Coffin, A. W. 2007. "From roadkill to road ecology: a review of the ecological effects of roads." *Journal of Transport Geography*, 15: 396-406.

Copeland, B. J. and J. Gray. 1989. "The Albemarle-Pamlico Estuarine System. A summary of the preliminary status and trends report of the Albemarle-Pamlico Estuarine Study." *Albemarle-Pamlico Estuarine Study Report 89-13B*.

Cramer, P. C. and J. A. Bissonette. 2009. "Transportation Ecology and Wildlife Passages: The State of the Practice and Science of Making Roads Better for Wildlife." *TR News*, May/June (No. 262), pp. 12-19.

Currituck County. November 2006. *Currituck County Land Use Plan*. Currituck County, North Carolina.

Currituck County. 2008. *Unified Development Ordinance*. Currituck County, North Carolina.

CZR Incorporated. 2011. *Biological Assessment*. State Project No. 6.049002T, STIP No. R-2576, Currituck County, Dare County.

CZR Incorporated. 2009, Revised 2011. *Essential Fish Habitat Technical Report*. State Project No. 6.049002T, STIP No. R-2576, Currituck County, Dare County.

CZR Incorporated. 2009, Revised 2011. *Natural Resources Technical Report*. State Project No. 6.049002T, STIP No. R-2576, Currituck County, Dare County.

Donaldson, B. M. 2005. "The Use of Highway Underpasses by Large Mammals in Virginia and Factors Influencing Their Effectiveness." Virginia Transportation Research Council. *Final Report for VTRC 06-R2*. 34 pp.

East Carolina University and Parsons Brinckerhoff. 2009, Revised 2011. *Indirect and Cumulative Effects Technical Report*. State Project No. 6.049002T, STIP No. R-2576, Currituck County, Dare County.

Erwin, M. E., J. E. Spendelow, P. H. Geissler, and B. K. Williams. 1987. "Relationships between nesting populations of wading birds and habitat features along the Atlantic coast." In W.R. Whitman and W.H. Meredith (eds): *Waterfowl and wetlands symposium; proceedings of a symposium on waterfowl and wetland management in the coastal zone of the Atlantic flyway*. Delaware Department of Natural Resources and Environmental Control, Dover, Delaware. 552 pp.

Erwin, M .E. and J. E. Spendelow. 1991. *Colonial wading birds; herons and egrets*. Pp. 19-1 through 19-14 in S.L. Funderburk, S.J. Jordan, J.A. Mihursky, and D. Riley (eds.) Habitat Requirements for Chesapeake Bay Living Resources. Habitat Objectives Workgroup, Chesapeake Bay Research Consortium, Inc. Solomons, Maryland.

Ewing, R. 2008. "Highway-induced development: Results for metropolitan areas." Transportation Research Record 2067(12):101.

Federal Highway Administration. 1988. *Visual Impact Assessment for Highway Projects.* Office of Environmental Policy, Washington, D.C.

Federal Highway Administration. 1990. *Environmental Impact Statement--Visual Impact Discussion*. Office of Environmental Policy, Washington, D.C.

Federal Highway Administration. 1993. *Design of Bridge Deck Drainage*, HEC 21.

Fernández-Juricic, E. J., M. D. Jimenez, and E. Lucas. 2001. "Alert distance as an alternative measure of bird tolerance to human disturbance: implications for park design." *Environmental Conservation* 28:263-269.

Forman, R. T. T. and L. E. Alexander. 1998. "Roads and their major ecological effects." *Annual Review of Ecology and Systematics*, 29: 207-231.

Grinols, E., D. Mustard, and M. Staha. 2009. "How Do Visitors Affect Crime?" Available: http://ssrn.com/abstract=1368447. Accessed: April 2011.

Hanson, J., M. Helvey, and R. Strach. 2004. *Non-Fishing Impacts to Essential Fish Habitat and Recommended Conservation Measures*. National Marine Fisheries Service (NOAA Fisheries), Version 1. Southwest Region, Long Beach, California.

ICF International. August 2008. *The Potential Impacts of Global Sea Level Rise on Transportation Infrastructure Phase 1—Final Report: the District of Columbia, Maryland, North Carolina and Virginia.* Prepared for the US DOT Center for Climate Change and Environmental Forecasting, Washington, D.C.

Jones, E. R. 2008. "The Effectiveness of Wildlife Crossing Structures for Black Bears in Madison County, North Carolina." Master's thesis, NC State University.

Kaseloo, P. A. and K. O. Tyson. September 2004. "Synthesis of Noise Effects on Wildlife Populations." Publication No. FHWA-HEP-06-016. Prepared for FHWA.

Kitty Hawk, Town of. April 2005. *Kitty Hawk 2003-2004 CAMA Core Land Use Plan Update.* Kitty Hawk, North Carolina.

Lane, B. and J. Jolley. November 2008. *Economic Development Strategy "Vision Plan," Currituck County, North Carolina, Final Report.* The University of North Carolina at Chapel Hill. Chapel Hill, North Carolina

Lovallo, M. J. and E. M. Anderson. 1996. "Bobcat movements and home ranges relative to roads in Wisconsin." *Wildlife Society Bulletin*, 24: 71-76.

Luczkovich, J. J. 2010. *Survey of the Submerged Aquatic Vegetation in the Proposed Alignment for the Mid-Currituck Bridge*. A report to the North Carolina Turnpike Authority.

Magee, P. A. 1993. *Detrital Accumulation and Processing in Wetlands*. USFWS Waterfowl Management Handbook. University of Nebraska-Lincoln.

National Marine Fisheries Service. March 2006. "Sea Turtle and Sawfish Construction Conditions."

North American Waterfowl Management Plan, Plan Committee. 2004. *North American Waterfowl Management Plan 2004. Implementation Framework: Strengthening the*

Biological Foundation. Canadian Wildlife Service, US Fish and Wildlife Service. Secretaria de Medio Ambiente y Recursos Naturales.

North Carolina Coastal Land Trust. November 2006. *Countywide Land Parcel Prioritization Strategy for Water Quality Enhancement*. Wilmington, North Carolina.

North Carolina Department of Agriculture and Consumer Services. N.d. *North Carolina Agricultural Districts*. Raleigh, North Carolina.

North Carolina Department of Environment, Health, and Natural Resources. 1994. *Currituck Sound Outstanding Resource Water Evaluation.* Division of Environmental Management, Water Quality Section (Now the NC Department of Environment and Natural Resources, Division of Water Quality). Unpublished Report.

North Carolina Department of Transportation. 1999. *Thoroughfare Plan for Currituck County.* Raleigh, North Carolina.

North Carolina Department of Transportation. 2001. *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina*. Prepared by The Louis Berger Group Inc., Cary, North Carolina.

North Carolina Department of Transportation. October 2005. *Strategic Highway Corridors Concept Development Report.* Raleigh, North Carolina.

North Carolina Department of Transportation. 2006. *Standard Specifications for Roads and Structures*. Raleigh, North Carolina.

North Carolina Department of Transportation. 2008. *2009 to 2015 State Transportation Improvement Program*. Raleigh, North Carolina.

North Carolina Department of Transportation. 2008. *Historic Architectural Resources Report: Mid-Currituck Bridge Project.*

North Carolina Department of Transportation. 2009. *Historic Architectural Resources Report Addendum: Mid-Currituck Bridge Project.*

North Carolina Department of Transportation. 2010. *2012 to 2018 Draft State Transportation Improvement Program*. Raleigh, North Carolina.

North Carolina Natural Heritage Program. 2005. Biennial Protection Plan: List of Significant Natural Heritage Areas.

North Carolina Watershed Restoration Program. 2002. *Watershed Restoration Plan for the Pasquotank River Basin.* NCDENR-DWQ.

Owens, L. K. and R. W. James. 1991. *Mitigation of traffic mortality of endangered brown pelicans on coastal bridges*. Transportation Research Record No. 1312, Energy and Environmental Issues, pp. 3-12.

Panamerican Consultants, Inc. September 2008. *Phase I Terrestrial and Underwater Archaeological Background Study: Mid-Currituck Bridge Project*. Federal Project No. BRS-000S(36), State Project No. 6.049002T, STIP No. R-2576, Currituck County, Dare County.

Panamerican Consultants, Inc. 2009. *Phase I Terrestrial and Underwater Archaeological Background Study, Mid-Currituck Bridge Study*. Federal Project No. BRS-000S(36), State Project No. 6.049002T, STIP No. R-2576, Currituck County, Dare County.

Parsons Brinckerhoff. October 2008. *Statement of Purpose and Need*. State Project No. 6.049002T, STIP No. R-2576, Currituck County, Dare County.

Parsons Brinckerhoff. 2008, Revised 2009. *2035 Traffic Alternatives Report*. State Project No. 6.049002T, STIP No. R-2576, Currituck County, Dare County.

Parsons Brinckerhoff. 2009. *2035 Detailed Study Alternatives Traffic Capacity Report*. State Project No. 6.049002T, STIP No. R-2576, Currituck County, Dare County.

Parsons Brinckerhoff. 2009. *Alternatives Screening Report*. State Project No. 6.049002T, STIP No. R-2576, Currituck County, Dare County.

Parsons Brinckerhoff. 2009, Revised 2011. *Community Impact Assessment Technical Report*. State Project No. 6.049002T, STIP No. R-2576, Currituck County, Dare County.

Parsons Brinckerhoff. 2009, Revised 2011. *Other Physical Features Technical Report*. State Project No. 6.049002T, STIP No. R-2576, Currituck County, Dare County.

Parsons Brinckerhoff. 2009. *Stakeholder Involvement for Draft Environmental Impact Statement Technical Report*. State Project No. 6.049002T, STIP No. R-2576, Currituck County, Dare County.

Parsons Brinckerhoff. 2009. *Traffic Noise Technical Report*. State Project No. 6.049002T, STIP No. R-2576, Currituck County, Dare County.

Parsons Brinckerhoff. 2010. *Air Quality Technical Report*. State Project No. 6.049002T, STIP No. R-2576, Currituck County, Dare County.

Parsons Brinckerhoff. 2010. *Mid-Currituck Bridge Project, Preliminary Assessment of Maple Swamp Groundwater System*. State Project No. 6.049002T, STIP No. R-2576, Currituck County, Dare County.

Parsons Brinckerhoff. 2011. *Stakeholder Involvement for Final Environmental Impact Statement Technical Report*. State Project No. 6.049002T, STIP No. R-2576, Currituck County, Dare County.

Parsons Brinckerhoff. 2011. *Traffic Noise Technical Report Addendum*. State Project No. 6.049002T, STIP No. R-2576, Currituck County, Dare County.

Radle, A. L. 2006. *The effect of noise on wildlife: a literature review*. World Forum for Acoustic Ecology (Master's Thesis), Oregon University.

Randall Travel Marketing, Inc. 2007. *Currituck County Comprehensive Tourism Research and Strategic Plan*.

Reed, J., Y. Le, and M. Littlejohn. 2002. *Cape Hatteras Visitor Study, Summer 2002: Visitor Services Project, Report 136A.*

Reijnen, R., R. Foppen, and H. Meeuwsen. 1996. "The effects of traffic on the density of breeding birds in Dutch agricultural grasslands." *Biological Conservation*, 75: 255-260.

Reijnen, R., R. Foppen, C.T. Braak, and J. Thissen. 1995. "The effects of car traffic on breeding bird populations in woodland III: reduction of density in relation to the proximity of main roads." *The Journal of Applied Ecology*, 32: 187-202.

Thurber, J. M., R. O. Peterson, T. D. Drummer, and S. A. Thomasma. 1994. "Gray wolf response to refuge boundaries and roads in Alaska." *Wildlife Society Bulletin*, 22: 61-67.

US Army Corps of Engineers. 2010. *Currituck Sound Feasibility Scoping Meeting Report*. Available: http://www.saw.usace.army.mil/Currituck /index2.htm. Accessed: February 23, 2011.

US Fish and Wildlife Service. 2003. *Guidelines for Avoiding Impacts to the West Indian Manatee: Precautionary Measures for Construction Activities in North Carolina Waters*. Raleigh Field Office, Raleigh, North Carolina.

US Fish and Wildlife Service. 2001 to 2009. *Mid-Winter Waterfowl Surveys*. Available: https://migbirdapps.fws.gov/. Accessed: January 14, 2011.

US Fish and Wildlife Service. 2007. *National Bald Eagle Management Guidelines*.

E.2 List of References – Personal Communication

Allen, David. Coastal Wildlife Diversity Supervisor, North Carolina Wildlife Resources Commission. February 4, 2009 and January 26, 2011.

Ferrell, Kim. District Administrator, Soil and Water Conservation, Currituck County, North Carolina. January 6, 2011.

Woody, Ben. Currituck County Planning Director, Currituck County, North Carolina. May 2008 and February 2009.

E.3 List of References – Web Sites

Carolina Bird Club. 1988. Available: http://www.carolinabirdclub.org/chat/issues /1988/v52n3briefs_summer_1987.pdf. Accessed: January 2011.

Mid-Atlantic Fishery Management Council. 2008. Fishery Management Plans. Available: http://www.mafmc.org/mid-atlantic/fmp/fmp.htm. Accessed: December and January, 2009.

National Marine Fisheries Service. 2011. Office of Protected Species, NOAA Fisheries. Available: http://www.nmfs.noaa.gov/pr/species/.

North Carolina Wildlife Resources Commission. 2005. North Carolina Wildlife Action Plan. Raleigh, North Carolina. Available: http://www.ncwildlife.org/pg07 _WildlifeSpeciesCon/pg7c1_3.htm. Accessed: May 29, 2008.

North Carolina Wildlife Resources Commission. 2008. 2007-2008 Annual Report. Raleigh, North Carolina. Available: http://www.ncwildlife.org/Wildlife _Species_Con/documents/AnnualProgramReportWDinWM07-08.pdf. Accessed: April 2011.

South Atlantic Fishery Management Council. 2008. Fishery Management Plans. Available: http://www.safmc.net/Library/ FisheryManagementPlansAmendments/tabid/395/Default.aspx. Accessed: December and January, 2009.

Trails.com. 2009. Kayaking Trail Guides. Available: http://www.trails.com/. Accessed: May, 2009.

US Fish and Wildlife Service. 2011. Threatened and Endangered Species in North Carolina. Available: http://www.fws.gov/nc%2Des/es/countyfr.html. Accessed: May 7 and December 8, 2008, February 25, 2009, and January 18, 2011.

US Fish and Wildlife Service. 2002. Snowy Egret Model. Available: http://www.fws .gov/r5gomp/gom/habitatstudy/metadata2/snowy_egret_model.htm. Accessed: April 2011.

E.4 List of Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ACHP	Advisory Council on Historic Preservation
AEC	Areas of Environmental Concern
AFSA	Anadromous Fish Spawning Areas
AICP	American Institute of Certified Planners
APE	Area of Potential Effects
BMP	Best Management Practice
CAMA	Coastal Area Management Act
CD	Compact Disc
CFR	Code of Federal Regulations
CWA	Clean Water Act
dBA	A-weighted Sound Level in Decibels
DCIA	Direct Community Impact Area
DEIS	Draft Environmental Impact Statement
DOE	Determination of Eligibility
EFH	Essential Fish Habitat
ER	Existing Road
FEIS	Final Environmental Impact Statement
FFY	Federal Fiscal Year
FMP	Fisheries Management Plan
FHWA	Federal Highway Administration
GS	General Statute
HAPC	Habitat Area of Particular Concern

HEC	Hydraulic Engineering Circular
HPO	State Historic Preservation Office
HQW	High Quality Waters
HUC	High Unit Cost Grant Program
L_{eq}(h)	Hourly Equivalent Sound Level
LED	Light Emitting Diode
LOS	Level of Service
MAFMC	Mid-Atlantic Fishery Management Council
MCB	Mid-Currituck Bridge
MOA	Memorandum of Agreement
MSAT	Mobile Source Air Toxics
MSL	Mean Sea Level
NAAQS	National Ambient Air Quality Standards
NAC	Noise Abatement Criteria
NCCRC	North Carolina Coastal Resources Commission
NCDENR	North Carolina Department of Environment and Natural Resources
NCDENR-DCM	North Carolina Department of Environment and Natural Resources – Division of Coastal Management
NCDENR-DMF	North Carolina Department of Environment and Natural Resources – Division of Marine Fisheries
NCDENR-DWQ	North Carolina Department of Environment and Natural Resources – Division of Water Quality
NCDOT	North Carolina Department of Transportation
NCNHP	North Carolina Natural Heritage Program
NCTA	North Carolina Turnpike Authority

NCWRC	North Carolina Wildlife Resources Commission
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
NR	National Register
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
O&M	Operation and Maintenance
ORW	Outstanding Resource Waters
P.E.	Professional Engineer
PNA	Primary Nursery Areas
PPP	Public Private Partnerships
ROD	Record of Decision
SAFMC	South Atlantic Fishery Management Council
SAV	Submerged Aquatic Vegetation
SNHA	Significant Natural Heritage Area
SR	Secondary Road
STIP	State Transportation Improvement Program
SWD	Summer Weekday
SWE	Summer Weekend
TEAC	Turnpike Environmental Agency Coordination
TIFIA	Transportation Infrastructure Finance and Innovation Act
TNM	Traffic Noise Model®
UNC	University of North Carolina

USACE	US Army Corps of Engineers
USC	United States Code
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UST	Underground Storage Tank
VAD	Voluntary Agricultural District
VMT	Vehicle-Miles Traveled
WBS	Work Breakdown Structure
WS	Water Supply Watershed